

INSTRUCTION BOOK  
FOR  
THE DIPLOMAT  
GATES 994 6377 002 TEN CHANNEL TRANSISTOR CONSOLE

IB #888-0938-001  
9/13/63

Gates Radio Company  
Quincy, Illinois

## MAINTENANCE SUPPLEMENT

### Attenuator Cleaning Instructions

1. Use lint free cloth or Kem-Wipes when cleaning or lubricating attenuators. Use each cloth once and discard.
2. Use denatured alcohol as a cleaning agent.

**WARNING:** *DO NOT use carbon tetrachloride.  
It causes noise and the fumes may  
cause injury to personnel.*

3. Use a soft clean pencil eraser to remove spots or noisy areas not cleaned in Step 2.
4. Lubricate with a pure, high grade vaseline.
5. Clean and lubricate each control on a regular schedule. This function should be performed every 50,000 cycles of operation or every three months, whichever occurs first.

## ADDENDUM

**CAUTION** — To prevent severe ground loops, all wiring connected to this console must be free from ground connections in the source and load equipment (microphones, turntables, tape players, recorders, speakers, etc.). An ohmmeter check is necessary to be certain that each wire is not grounded before connecting it to the console. If any source or load equipment has a grounded connection wire, an isolating transformer must be used between that equipment and the console.

A final ohmmeter check is recommended: After all system connections are made, temporarily disconnect the station ground from the console and measure the resistance (ohms) from the console ground stud to the station ground. A very high resistance is normal — a low reading indicates a ground loop. All ground loops must be eliminated before operating the console. Be sure to re-attach the station ground to the console after testing.

ADDENDA SHEET

    Ambassador, Diplomat,  
Executive & President Consoles

Power Supply Wiring - (Removal from Console)

Should it be necessary to remove the power supply assembly from the Console for test or repair, re-connect as shown with correct numbered wires replaced in the proper location.

CAUTION: Recheck the wiring before applying power because a wiring error may destroy the power supply and void its Guarantee.

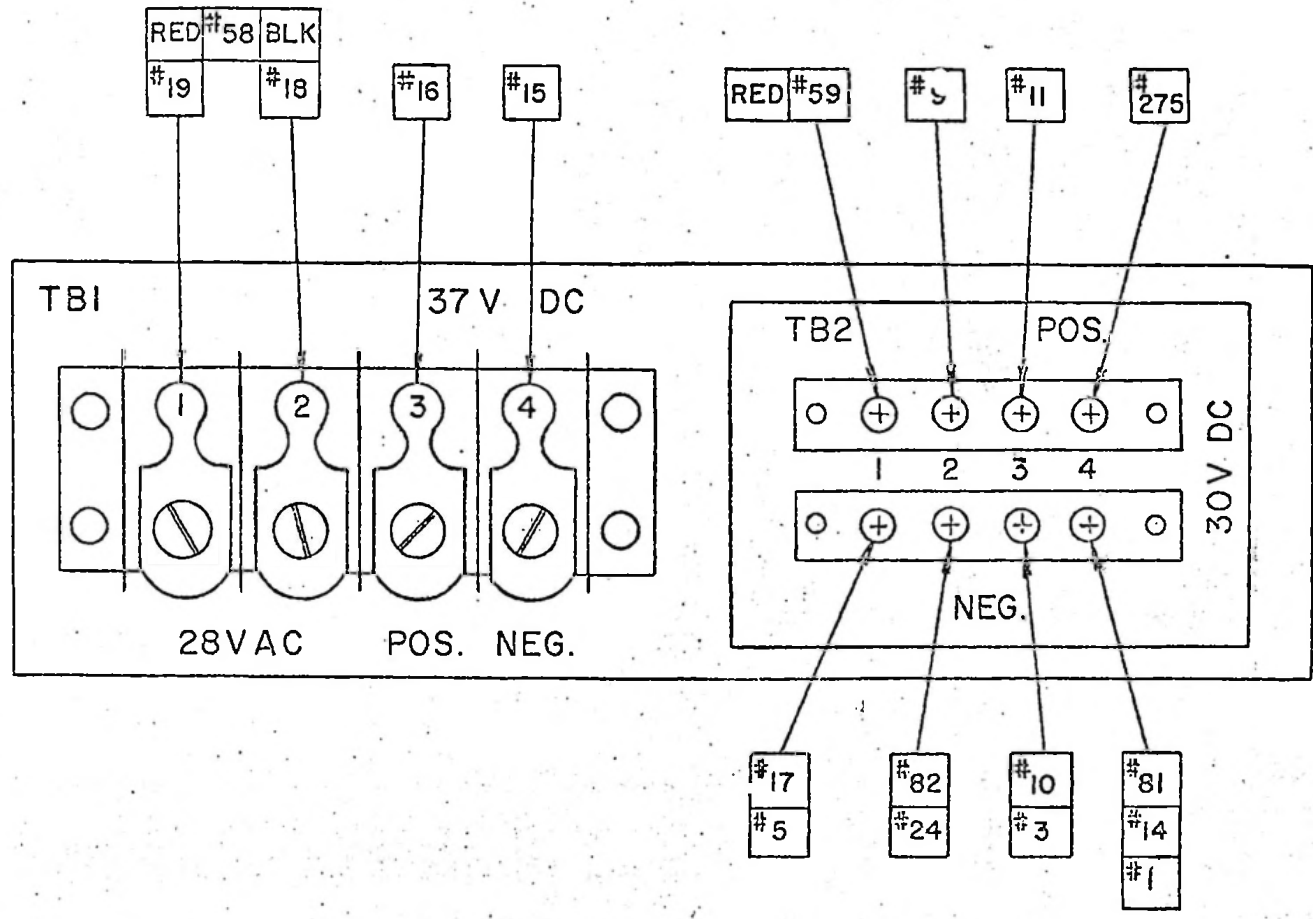
See Drawings:

~~Ambassador Console #814 2811 001~~  
Diplomat Console #814 2813 001  
Executive Console #814 2812 001  
President Console #814 2814 001

4/9/65

Gates Radio Company  
Quincy, Illinois

# DIPLOMAT



WIRE COLOR  
 GREY # 275  
 SHIELDED # 58, # 59  
 RED-ALL OTHERS

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842 3695 001 - Functional Block Diagram	
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813 9115 001 - Monitor Speaker Connections	
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842 3485 001 - Schematic, M6205 Regulated Power Supply	

INSTRUCTION BOOKS:

M-5700A Transistorized Program Amplifier  
M-6034 Transistorized Console Preamp  
M-6035 Transistorized Cue-Intercom Amplifier  
M-6108 Transistorized Monitor Amplifier  
Replacing Component Parts (Gates has a printed sheet  
furnished on request, no charge)

## SPECIFICATIONS

### GAIN:

Remote/Network to Line Out:	56 DB $\pm$ 2 DB
Remote/Network to Speaker:	58 DB minimum
Microphone Input to Line Output:	104 DB $\pm$ 2 DB
Turntable Input to Line Output:	56 DB $\pm$ 2 DB
Microphone Input to Speaker Output:	106 DB minimum.
Turntable Input to Speaker Output:	58 DB minimum.

### FREQUENCY RESPONSE: (1 KC Reference)

$\pm$ 1.0 DB from 30 to 15,000 cps in all regular program circuits.

$\pm$ 2 DB from 30 to 15,000 cps in all emergency program circuits.

$\pm$ 1.5 DB from 30 to 15,000 cps in all monitoring speaker circuits.

### HARMONIC DISTORTION:

0.5% maximum, 30 to 15,000 cps @ +8 DBM output on all program lines.

0.5% maximum, 50 to 15,000 cps @ +18 DBM output on all program lines.

1.0% maximum, 50 to 15,000 cps @ +39 DBM (8 watts) output on all monitoring speaker outputs.

### I.M. DISTORTION:

0.5% maximum (40/7000 cps @ 4:1) @ +8 DBM equivalent sine wave output on all regular program circuits, 1.5% maximum @ +18 DBM out.

1.0% maximum @ +39 DBM equivalent sine wave output on all monitoring speaker outputs.

### NOISE:

-122 DBM relative input noise on microphone channels.

-75 DBM relative input noise on turntable channels.

### CROSSTALK:

Below noise level in all program channels.

### CHANNELS:

10 Monophonic



may be easily found. The engineering staff is urged to become acquainted with all sections so that they can advise other groups in the best performance, as well as being able to keep the console in top operating condition.

### INSTALLATION

All the packing material, including any shipping frames and platforms, should be carefully removed prior to the installation of the M6377A Control Console. The removable items include:

- 3 - 994 6034 001 Transistor Preamplifiers. ✓
- 2 - 994 5700 001 Transistor Program Amplifiers. ✓
- 1 - 994 6035 001 Transistor Cue-Intercom Amplifier. ✓
- 1 - 826 9445 001 Phone Jack Plate. ✓
- 1 - 472 0429 000 Power Transformer. ✓
- 1 - 646 0379 000 Group of Knob Decals. ✓
- 1 - 888 0938 001 Instruction Manual. ✓

If any of the items listed above are missing, search all of the packing material again to determine if they have been overlooked. If still missing, contact the Gates Radio Company for instructions.

SIZE: The M6377A Console is 53-1/2" long, 11-3/8" high and 17-3/8" deep.

With the plug-in amplifiers removed, place the console on the control desk in the final operating position. Determine the routing of the interconnecting cables into the cabinet and the method of connecting the cables to the control desk. The conduit and/or duct layout should also be considered in the planning of the interconnecting cable runs. If the cables are to come up through the surface of the desk, mark the cable access holes (in the console base) on the desk top so they may be accurately drilled after removal of the cabinet.

In some cases, it is preferred to elevate the console cabinet sufficiently to permit the cables to lay between the desk top and the console base, making a right angle turn with the cables to enter the cabinet. The cables are then dressed off the rear of the desk and generally a protective cover is installed down the rear of the desk.

In either type of installation, the console should be fastened securely to the control desk after the wiring is complete. This is facilitated by the holes in the center of several of the large dimples in the cabinet base. The wiring adjacent to the mounting holes should be fully protected during the securing operation.

### AMBIENT TEMPERATURES

The transistor amplifiers and the power supply used in the console have been designed for reliable operation at temperatures up to

## INTRODUCTION

The Gates "Diplomat" ten channel control console is a monophonic companion to the popular "Executive" stereo control console. Performance, features and styling are identical except that all mixing channels are monophonic. The well planned control functions insure maximum versatility and performance for those requiring the best in monophonic operation.

This console provides for the mixing, cueing and monitoring of a variety of program sources including microphones, turntables, tape recorders, remote pickups and networks. Separate "Program" and "Audition" outputs are provided to allow two channel operation. Separate programs may be carried on AM and FM, or recording may be done through the audition channel while normal programming is continued on the program channel. Provisions are included for the addition of a third program output channel if desired. This output can be fed from either the program or audition channels and would provide even greater versatility.

Complete details on the operation of this console may be found in the section of this book entitled OPERATION.

The console is completely transistorized and self-contained except for the earphone jack panel and the power transformer which has been placed externally to minimize hum pickup in the console.

Breaking and jumpering of all major circuits allows full use of normalling jack fields, with all connections brought out to terminal blocks for ease of installation and future circuit checking. Three speaker muting and warning light relays are wired with provisions included for the use of a fourth relay.

Compensation of signal levels by the use of fixed pads throughout the console minimizes the necessity of readjusting gain controls when switching from one circuit to another.

The cue-intercom system provides cueing of turntable and tape sources as well as intercom facilities between the control room and each of the studios as well as the remote lines. The cue-intercom system is interlocked with the speaker muting relays so that cueing and intercom signals cannot inadvertently get on the air.

This introduction has touched on some of the more important points of the console to give general information without excessive details. Those concerned with the daily operation should study the section labeled OPERATION. The installation crew should study their section before actually starting the work. Each section is broken down to cover different phases so that unnecessary confusion may be eliminated and the answer to any particular question

INPUTS:

6 mics, 4 turntables, 4 tapes, 4 remotes, 1 network and 1 high level auxiliary input.

OUTPUTS:

Program 1, program 3, 3 speaker lines with muting (plus one optional), 1 speaker line without muting 2 studio intercom speaker lines and 2 phone jacks.

TOTAL TRANSISTORS:

2N1307	2
2N422	5
2N1414	26
2N214	4
2N1183	6
2N1225	1
2N1539	<u>4</u>
Total	48

SIZE:

53½" long, 11-3/8" high, 17-3/8" deep.  
Net weight 96 lbs.

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55°C. or 131°F. No special ventilation is required. However, prolonged sine wave testing (especially in the monitor amplifier) should be avoided to allow heat, built up in the power output transistors, to be dissipated. See the instruction books provided at the end of this manual for more information.

### CABLE AND CONDUIT LAYOUT

Cable and conduit layout is of utmost importance in the studio installation. Good results, with a minimum of noise and cross-talk, require careful planning and construction. A system hastily installed, without thorough planning, invariably results in continuous trouble until rebuilt.

First, the matter of signal levels: Cables should generally be divided into three groups, low level cables may include levels from -60 DBM to -20 DBM. Medium level cables may include levels from -20 DBM to +14 DBM. The high level cable may include levels from +14 DBM to +40 DBM. AC power wiring should be run in separate cables.

Whenever possible, do not run any of the four cables listed in a conduit along with cables of different level classification. If two or more cables must be run in a common conduit, never exceed a difference of 40 db in level between the highest and the lowest level in either cable. Use high quality shielded twisted pair for all audio wiring, such as Gates catalog number 1261. For all microphone wiring and long medium level cable and conduit runs the use of rubber, plastic or cloth covered shielded pairs eliminates multiple ground loops and the resultant noise problems. Gates catalog number 8440 microphone cable is recommended.

In parallel cable runs of different levels, the most important aid is physical isolation. Up to six inch spacing is preferred. If there is not room for this isolation, do not lace all of the wires in the same cables. Keep the cables laced separately for the different level classifications even if two or more must lay together. This will give much better isolation than when formed into one cable. The deviations from the preferred methods must not be taken lightly. Use them only as a last resort, not just for convenience.

Terminal layout is arranged in the console to allow adequate separation of cables up to the point of connecting to the terminal blocks. Low level microphone cables connect on the left to TB1. Medium level cables connect in the center to TB3. High level cables connect to TB4 and (in the rear) to TB6. Intercom wiring connections are brought out to TB6 since these are auxiliary circuits which may vary in level from -50 DB to +28 DBM. The speaker output cables are high level and should not be run with low level cables.

Conduit generally affords enough shielding so that different levels in separate conduit presents no isolation problem even

without spacing them apart. Microphone level conduit and speaker level conduit can probably run along together with no crosstalk. However, if practical, it is advisable to maintain physical separation and add to the safety of the installation. Power circuits, especially those with high current, should not be in close proximity with program carrying conduit; electro-magnetic shielding is poor in most conduit.

### GROUNDING CIRCUITS

Grounding circuits, like cable layout and most systems work methods, are unpredictable to a certain extent. Therefore, no hard and fast rules apply 100% of the time. In this section it is attempted to cover the things to avoid and to present generally accepted practices that always give good results, or allow good results to be obtained with minor modification. Entirely different approaches have been used, some with good results, but unless you are an expert on the subject, most are risky.

The console grounding system is based on the one point ground. Different circuit grounds are insulated from the chassis and other grounds except at one point, where they all join together and go to earth ground. This system prevents multiple ground loops with the resulting hum pickup from circulating currents and RF pickup and regeneration.

External circuits connected in the console should not destroy this system. Microphone circuits are not grounded in the console. The shields should not be grounded externally except after noise checks. They may then be grounded if better results are obtained. Turntable and tape inputs are unbalanced and the common side is grounded. If the inputs are unbalanced, the common side should connect to the back row of the terminal blocks (1B, 2B, 3B, etc.). If the input circuit is grounded external to the console, the ground should be lifted if possible to prevent ground loops. If the ground cannot be removed, or if the circuit impedance will not match the 600 ohm input, a matching transformer should be used. Order Gates A-21 line matching and isolation transformer.

Thus, a safe rule to follow is: Do not ground either side of external circuits. Generally, the shields of the cables should ground at the console only. They may be connected to the ground terminals in the console. There may be exceptions to this rule, especially on microphone input circuits, so the shield grounds should be wired in such a manner that they can be lifted in the console and grounded at the other end. Again, this is part of the test procedure to obtain lowest noise.

If patch panel facilities are used, special consideration of circuit grounding is necessary. Look in the section marked MODIFICATION FOR EXTRA FACILITIES for instructions.

## BALANCED AND UNBALANCED LINES

If a circuit is ungrounded, it is considered balanced to ground. If one side is grounded it is unbalanced. If the circuit is center-tap grounded with a pad or coil it is balanced to ground. Refer to the third paragraph under GROUNDING CIRCUITS for determining proper classification. Twisted shielded pairs should be used for all circuits whether they are balanced or unbalanced. Cancellation of noise and crosstalk pickup is approximately the same for either when the one point ground system is used.

If it is necessary to connect a balanced line to an unbalanced line, or the opposite, an isolation transformer should be used between them. The transformer must have good balance, an electrostatic shield, and magnetic shielding sufficient to reduce the hum pickup at least 65 DB below the signal level. Impedance taps on primary and secondary are important to properly match both circuits. The Gates Radio Company's general catalog lists these transformers. Balanced lines require balanced pads and attenuators, unbalanced lines require unbalanced ones. Mixing them generally results in poor noise, frequency response or other poor operation.

## CIRCUIT IMPEDANCES

The microphone inputs are factory connected for 150 ohms. These are balanced inputs. The impedance can be changed to 50 ohms balanced by changing the connections of the input transformer on the preamp board. See the preamp instruction book included at the back of this book for more information on this change.

The turntable and tape inputs, net input to channel 9 and the high level input to channel 10 are 600 ohms unbalanced. These impedances cannot be changed in the console and if other impedances are desired, a matching pad or an isolation transformer must be used. If a matching pad is used it should be unbalanced and its common side connected to the common or grounded side of the inputs.

The remote input lines are 600 ohm balanced circuits. The impedance can be changed by changing taps on T1, the matching transformer in this channel. As connected, to 1 and 3, the impedance is 600 ohms. Connect to 1 and 2 for 150/200 ohms and to 2 and 3 for 30/50 ohms.

## INSTALLATION - WIRING

### POWER CONNECTIONS

A 117 VAC circuit should be connected to terminals 1 and 3 on the power transformer. Terminals 1 and 2 should be used if local AC line voltage is low (105-110 V.) and terminals 1 and 4 should be used where the AC voltage is high (120 to 125 V.).

The three 28 V. secondary windings of the power transformer, terminals 5 and 6, 7 and 8, 9 and 10 should be connected to terminal block 8, terminals 1 and 2, 3 and 4, 5 and 6.

117 VAC for the warning lights should be connected to terminals 1 and 2 of terminal block 7. Studio A warning lights connect to terminals 3 and 4 of terminal block 7. 117 VAC will appear at these terminals when channel one lever switch is placed in program or audition positions. Lights connected to these terminals should, therefore, be in the same studio as microphones connected to channel 1 inputs. Studio B warning lights should be connected to terminals 5 and 6. These lights will be on when channel 2 lever switch is in program or audition position and should be in the same studio as microphones connected to channel 2 inputs. Control room warning lights, activated by lever switch 3 should be connected to terminals 7 and 8 of terminal block 7. Terminals 9 and 10 are wired for use with a fourth relay. See the section on modifications for more information. Warning light circuits should not be grounded at any point and should not draw more than 2 amps of current. Drawing 813 7289 001 shows the above connections in detail.

### STUDIO INTERCOM WIRING

When connecting the studio intercom units, the wiring should be kept separated from program circuits. Connect the Studio A unit to terminal block 6, terminals 5A and 5B. The Studio B unit should connect to terminals 7A and 7B on terminal block 6. These circuits should not be grounded.

### MONITOR SPEAKERS

All speaker wiring is high level and must be run in separate conduit away from low level program circuits. Monitoring is provided to all studios as well as external lobby speakers. 45/50 to 6/8 ohm speaker matching transformers should be used. Gates 478 0291 speaker transformers are satisfactory. The relay deck has 47 ohm back loading resistors across the lines when the speakers are muted. Do not parallel speakers across the monitor outputs without using the matching transformers just mentioned since serious damage to the monitor amplifiers will result if they are operated with a load of less than 4 ohms.

Speakers connect as follows to terminal block 6 -

<u>Speaker</u>	<u>Terminal</u>
Studio A	8A - 8B
Studio B	10A - 10B
Control Room	12A - 12B
Lobby	18A - 18B

The Studio A speaker will mute when channel 1 lever switch is in program or audition position. The Studio B speaker will mute when channel 2 lever switch is operated and the control room speaker is muted when channel 3 lever switch is operated.  
SPEAKER CIRCUITS MUST NOT BE GROUNDED EXTERNALLY.

External monitor inputs, if used, should connect to TB5, 2A-2B.

## MICROPHONE INPUT CONNECTIONS

Each microphone channel has provisions for two microphone inputs. Switching between microphones is done on the front panel.

Channel 1: With S41 in "Mic 1" position, the console is set up for broadcasting from the microphone connected to the first input on terminal block 1. Moving S41 to "Mic 2" position, switches microphones connected to terminal 3 into the channel 1 preamp. S12, the mono-stereo switch is not used in this console and may be used as a utility switch. Reference to the functional block diagram, drawing 842-3695-001, will help clarify these functions. Channel 1 microphones should be located in the same studio as the speakers that are connected to mute when the channel 1 lever switch is operated.

Channel 1 microphone connections are made to terminal block 1 as follows -

<u>Microphone</u>	<u>Terminal</u>
1	1A - 1B
2	3A - 3B

The microphone inputs are balanced 150 ohm and the external circuit should not be grounded.

(See Instruction Book for the preamps for information on changing the impedance to 30/50 ohms.) (See section on GROUNDING CIRCUITS for installation techniques.)

Microphone arrangements for channel 2 are the same as for channel 1. The switching function of S42 is the same as S41, as explained above. S13 is not used. The functional diagram drawing 842 3695 001 shows these functions. Channel 2 microphones should be in the same studio as the speakers connected to mute when the channel 2 lever key is operated.

Microphone connections to channel 2 are as follows -

<u>Microphone</u>	<u>Terminal Block 1</u>
3	5A - 5B
4	7A - 7B

Switch S11 performs the same function as S41 & S42 as explained under Chan.1. Channel 3 microphones should be in the same studio as the speakers connected to mute when the channel 3 lever switch is operated. S14 is not used.

Connections should be made as follows -

<u>Microphone</u>	<u>Terminal Block 1</u>
5	9A - 9B
6	11A - 11B



Drawing 813 9116 001 shows the above microphone connections.

### TURNTABLE INPUTS

Provision is made for four turntable inputs, each of which can be switched to mixers 4 or 5. Turntable inputs are medium level (-20 DBM) 600 ohm unbalanced. If the output of turntable preamp is unbalanced, the common side should be connected to the common side of the input terminals (Row B) on terminal block 3. Inputs to the turntable channels should not be grounded externally. Isolation transformers may be used if necessary to isolate external grounds or to connect inputs that should not be grounded to the unbalanced turntable inputs.

Turntable inputs connect to terminal block 3 as follows -

<u>Turntable</u>	<u>Terminals</u>
1	1A - 1B
2	3A - 3B
3	5A - 5B
4	7A - 7B

See the section on OPERATION for details on switching functions.

### TAPE INPUTS

Four tape inputs are provided, switchable between channels 6 and 7. These are "medium-level" 600 ohm balanced inputs.

Connections are made to terminal block 3 as follows -

<u>Tape</u>	<u>Terminal</u>
1	9A - 9B
2	11A - 11B
3	13A - 13B
4	15A - 15B

Although the console is intended to handle 4 turntables and 4 tapes, more than this number of turntables may be used by connecting to tape inputs and switching them into mixers 6 and 7. Of course, one or more of the tape inputs must be sacrificed. In the same manner, more than 4 tape inputs can be obtained by using turntable inputs and bringing the additional tapes into mixers 4 and 5. In this case, one or more turntable inputs will be sacrificed. Of course, not all the tape or turntable inputs need be used.

### REMOTE INPUTS

Provision is made for the connection of 4 remote lines to mixer 8. These are "medium-level" 600 ohm balanced monophonic inputs. Connections for these inputs are located on terminal block 3 as follows -

Remote LineTerminals

1	17A - 17B
2	18A - 18B
3	19A - 19B
4	20A - 20B

It is suggested that, rather than connect the remote lines directly to the console, they be brought out to jacks in the station patch panel to allow a greater versatility in programming. External circuits should not be grounded. The input level of these lines should be about -20 DBM. This allows the use of isolation pads or equalizers and still have sufficient gain for proper operation.

NETWORK INPUT

A 600 ohm network input is provided with mixing accomplished through mixer 9. The network line should be connected to TB5, terminals 17A and 17B.

NEMO INPUT

Channel 10 is a high level channel provided for auxiliary use. Input connection should be made to TB5, 19A and 19B.

LINE OUTPUT CONNECTIONS

The level of these lines will be +8 DBM and they should be routed carefully to prevent crosstalk back into low level input circuits. Connect output line 1 to TB4 terminals 13A-13B. Output line 3 connects to TB4 terminals 15A - 15B. These are 600 ohm balanced outputs.

EARPHONE CONNECTIONS

The earphone jacks for both the cue-intercom system and the line monitoring circuits are mounted externally on a jack panel. The panel should be mounted in a convenient location in the control room and shielded twisted pair should be used to connect to the console. Drawing 813 9114 001 shows the complete wiring details necessary for proper installation.

OPERATION

The arrangement of panel controls gives maximum versatility to console operation while keeping actual operating as simple as possible. Control functions are explained in the following sections. In all cases, reference to the block diagram of the console, drawing 842 3695 001 will help clarify these functions.

MICROPHONE SELECTOR SWITCHES

On the upper left side of the panel, above channel mixers 1, 2 and 3, are three pairs of switches. These switches perform

identical functions for each channel. The microphone selector switch is used to switch between two microphones in each studio. Whichever microphone is selected can be switched to either the program or audition bus by placing the mixer key to the right or left. See the section on LINE INPUT SWITCHING for correct setup of program and audition amplifiers. The mono-stereo switches in mixers 1, 2 and 3 are not used in this console and can be used for utility switches.

#### TURNTABLE SWITCHING

The four turntable switches, above mixers 4 and 5, select the desired input to each mixer. When the channel switches, above mixer 4, are in the "OFF" position, turntable inputs are normalled through to the mixer 5 switches. When any of the switches in channel 4 are switched "ON", the turntable input will appear at the output of mixer 4. Moving the channel 4 mixer key to the right will bring up the turntable input on the program bus, while moving the mixer key to the left will switch the signal to the audition bus. Moving the desired turntable input switch to the "ON" position, above mixer 5, will switch the desired turntable input into this mixer. Switching is arranged so that a turntable cannot be switched into mixer 5, if it is already switched into mixer 4. This prevents loading the turntable output by paralleling it into two console inputs. Cueing facilities are provided for by turning either turntable mixer fader fully counterclockwise. This connects the turntable inputs to the cue-intercom amp. Cueing can be accomplished by using the panel mounted speaker or headphones (plugged into the cue phone jack). The operation of the cue-intercom system is covered in a later section.

#### TAPE INPUT SWITCHING

Mixers 6 and 7, located to the right of the VU meters are identical in operation to the turntable inputs discussed above. Four inputs can be switched to either mixers 6 or 7. Outputs of mixers 6 and 7 can be switched to "program" or "audition" busses. Cueing facilities are provided by turning mixer 6 or 7 fully counterclockwise, thus, connecting the mixer to the cue intercom system.

#### REMOTE INPUT SWITCHING

Four lever switches, located above mixer 8, control four remote inputs. The remote switches provide talkback and cueing facilities to the remote operator. In the center position, they receive program cue signal from the monitoring amplifier. The level is adjusted to approximately +8 VU. This signal is fed back to the remote operator to allow him to start his program at the proper time. The lower position is the "mix" position and connects the remote program into the program or audition bus through mixer 8. The upper position of the switches have a terminating load for the remote lines and allow over-ride and talkback functions. See the section CUE-INTERCOM SYSTEM

for explanation of these functions. The remote lines are not tied together when any or all of the remote keys are in the talkback position. There is sufficient isolation between them even with the over-ride tie-in on all lines.

A typical sequence of operation for a remote line will be: Before air time, the studio operator would place the appropriate remote line switch in the "TB" position, and the cue-intercom input selector switch to the "remote" position. When the remote operator arrives at the broadcast site, he would call in on the remote line. The studio operator would hear his call and be able to talk back via the cue-intercom system. After preliminary instructions, the remote input switch would be placed in the "cue" position. When the remote operator receives his cue the remote input switch is moved to the "mix" position and the remote signal is brought up on mixer 8. An alternate method of operation, before contact is established with remote operator, is to place the appropriate remote input switch in the "mix" position and the channel 8 mixer in the "cue" position. This allows the remote operator to call in and be heard regardless of the position of the cue-intercom input selector. After the call is heard, the remote switch is placed in the "TB" position and the cue-intercom input selector to the "remote" position and the above procedure is followed.

#### NETWORK INPUT

The network input is connected directly to mixer 9 and is put in use by placing the mixer key to the program or audition position and turning up the mixer gain control. Preview monitoring of the network is provided by turning the mixer control fully counterclockwise into the "cue" position. Network can then be monitored with the "cue input" switch in any position. If it is desired to monitor the network with the mixer turned up ready for use, the "cue" input switch should be turned to the "net" position allowing the network to be heard in the cue-intercom system.

#### NEMO INPUT

Channel 10 is an auxiliary channel with the input connected directly into the mixer. Cueing is available by turning the mixer fully counterclockwise.

#### MONITOR INPUT SELECTOR AND LEVEL

The monitor input selector is located on the lower center of the panel. Input switching allows monitoring of program, audition or an external signal source. The gain of the monitor amplifier is controlled by the gain control located to the left of the monitor input selector.

## LINE AMP INPUT SELECTORS

The inputs to line amplifier 3 are selected by the switch in the upper right corner of the panel. Line amp 1 is fed from the program bus at all times.

If it is desired to feed the same program to lines 1 and 3 simultaneously, the line amp 3 input switch should be placed in the upper or "PGM" position. In this position, the signal on the left program bus will appear at both line 1 and 3 outputs. Placing the line amp 3 input switch in the center or "Aud" position switches line amp 3 input to the audition bus. This enables the console to be operated as a dual channel console with line 1 being fed from the program bus and line 3 being fed from the audition bus.

## MASTER GAIN CONTROLS

The gain controls for line amps 1 and 3 are located on the upper right side of the panel.

Signal levels in the console are adjusted with the input channel mixers so that control should not need adjustment after being initially set to match the output levels of lines 1 and 3.

## CUE-INTERCOM SYSTEM

Controls for the cue-intercom amplifier are located below the VU meter.

The top control is the gain control, and controls the level for both the "talk" and "listen" functions. Below the level control is the cue-intercom input selector switch, which has 6 positions. In the "net" position, the network line can be monitored. Talkback is not possible in the network position. The remote 1, 2, 3 and 4 positions tie the cue-intercom amp to the 1, 2, 3 or 4 remote lines. For talkback facilities, the intercom selector is switched to the desired remote line and the appropriate remote

input switch is placed in the "TB" position. The incoming remote signal line will then be heard in the panel mounted speaker. When the control room operator desires to talk out on the remote line, he simply pushes the red "talk" button in the center of the panel and speaks into the panel speaker. "ST1" and "ST2" positions allow listening and talkback into studios 1 and 2 if intercom units have been installed in them.

Levels are adjusted so that normal listening volume will provide sufficient gain for talkback purposes. The system is quite sensitive and does not require shouting or placing your mouth near the speaker.

Turntable and tape cueing circuits are connected directly to the input of the cue-intercom amp and may be used regardless of the position of the cue-intercom input selector.

The intercom speaker on the console is set up to mute when the channel 3 lever key is operated. This muting does not disable the "cue phone" jack, so it is still possible to cue a record by monitoring the cue circuit with headphones. This jack is labeled "cue". The intercom speaker is interlocked with the headphone jack so that this speaker is muted whenever a phone plug is inserted in the "cue" jack.

The studio intercom speakers are muted with the regular speaker muting relays so that it is impossible to talkback to a studio when there is a live microphone in it. These relays operate when the microphone channel is switched to either the program bus or the audition bus. This interlocking feature makes it impossible to disturb the program and the console operator may use the intercom system without concern.

#### VU METER SWITCH

VU meter 1 is not switched but is connected permanently across the output of line 1. VU meter 2 is switched by the control directly beneath it. It may be used to monitor the level of output lines 1 or 3, as well as the incoming network line. For monitoring, the network should be connected to TB4 terminals 16A - 16B, this should be a balanced input. A utility position is also furnished to allow the panel mounted meter to monitor an external circuit. Connect desired external circuit to TB4 - 17A- 17B. The meters are set to read 0 VU with an input level of +14 DBM. With the 6 DB isolation pads in the output of each line this setting gives the standard +8 DBM level in the outgoing lines. This level can be changed by changing the pads on the rear of each meter. These pads are marked AT21 and AT23 on the schematic, drawing 852 5905 001.

#### HEADPHONE JACKS

The headphone jack labeled "line" is provided for headphone monitoring of all output program circuits. Phones can be switched to the desired circuit by the switch labeled "phones".

The "Util." and AL2 position is not used. Switch positions marked "AL1" and "AL3" provide monitoring of the outputs of line amplifiers 1, and 3 respectively. The "network" position allows monitoring the incoming network line. The network should be tied to TB4, terminals 16A - 16B. The jack labeled "cue" allows monitoring the cue-intercom system with headphones if desired. See the section on the CUE-INTERCOM SYSTEM for more information.

### PRINCIPLES AND THEORY OF OPERATION

This section is included to give the engineer a better understanding of some of the more unusual features of the console. The very obvious methods of operation will not be covered, since they are common knowledge, or have been covered in previous sections of this instruction book.

### TRANSISTOR AMPLIFIER CIRCUITRY

Complete details on the various amplifiers used in the console will be found in the individual instruction books included in the back of this manual. However, a word here about the circuitry will aid in explaining overall console setup. The pre-amps, monitor booster amps, cue-intercom amp and the monitor amps, have transformerless output circuits. Grounding of external wiring is critical for best noise figures and to avoid crosstalk, especially in the high gain cue-intercom amp. If modifications are made on the console, care should be exercised to insure that unwanted grounds do not enter the picture. Under no circumstances should the monitor speaker wiring be grounded externally.

### CUE-INTERCOM SYSTEM

Reference to the schematic, drawing 837 9345 001, of the cue-intercom amplifier; and to drawing 852 5905 001, the overall console schematic for the wiring of this system; will aid in understanding the operation of the cue-intercom system.

An interstage volume control, remotely mounted on the front panel, helps reduce noise at normal operating levels.

The incoming remote lines normally operate with a signal level of up to +8 VU. This level is padded down, to a level sufficiently low to prevent overloading the cue amplifier, when listening to the remote lines. These pads consist of the 620 ohm resistor across the input of each remote line and the 5100 ohm resistors in series with each side of the line. These pads are built up on S38, the cue-intercom input selector switch, located on the front panel. These pads also give isolation between lines when more than one line is switched into the cue amp.

The maximum gain of this amplifier is approximately 90 db. Since the input and output of the amplifier comes in close

proximity at the talk-listen relay (K5), wire dress is very important here. The grounding of the cue-intercom system is also very critical. Do not allow any part of the external speaker or other system to be grounded. They are grounded in the console. Shielding of all external speaker lines is necessary to prevent hum and possible regeneration.

The frequency response of the amplifier is rolled off severely on both ends of the spectrum to provide the best compromise of cueing and intercom functions. Do not attempt to alter it without taking all of the circuit requirements into consideration.

### SIMULTANEOUS FEED TO LINE AMP 3

The line amplifier input switch allows switching the output of line amp 1 into line amp 3. Pads AT12 and AT14 adjust the signal level to a level comparable to those appearing at the other positions of the line input switches. The absolute output level of line amp 3 will depend upon the relative gain control settings of both line amps. For example, pads AT12 and AT14 have a total loss of 65 DB. If both line amps are set to have a gain of 65 DB, a -55 DBM signal applied to the input of AL1 will appear at the output at a +10 DBM level. After passing through the pads it will appear at the input of AL3 at a -55 DB level. AL3 has the same gain as AL1 so it will appear at output of AL3 at +10 DBM also. However, if the amplifiers are set for different amounts of gain, the signal will not be the same at both outputs. A signal amplified 70 DB for example, will be padded down only 65 DB and again amplified 70 DB, so the output of AL3 will be 10 DB higher than the output of AL1. Pads AT12 and AT14 are adjusted to give equal levels at the outputs of all line amps, when input switches are in "PGM" position, with normal operating levels. Pads AT12 and AT14 can be adjusted, if necessary, to better suit the local requirements.

### MIXING SYSTEM

The mixing system consists of a ten channel mixer, utilizing ladder type controls connected in a parallel, minimum loss type, mixing circuit.

### VU METER AND ISOLATION PADS

The two VU meters are set up to read "zero" when signal level of +8 VU is being fed into the program line. Isolation pads are placed in each output line to isolate the console circuits from the various telephone line reactances.

### MUTING RELAYS

The relays are connected to mute the studio speakers and connect a 47 ohm load in place of the speakers. The relays also energize the proper warning light in the studio, and mute the



intercom speaker to prevent intercom use in a studio with a live microphone.

Provision is included for the use of a fourth relay, if needed. Connections to this relay are made on TB6 and TB7. See section on MODIFICATIONS for complete details.

#### SPEAKER MATCHING TRANSFORMERS

All house monitor speakers should have matching transformers. These should be 45/50 ohms to voice coil. The output impedance of the monitor amplifiers is 4 to 16 ohms (8 ohms nominal). The parallel combination of the speakers should fall in this range. The 47 ohm back loading resistors, mounted on the relay deck, prevent the load from changing when the speakers are muted.

#### REGULATED POWER SUPPLY AND POWER TRANSFORMER

The power supply has two DC outputs. A -37 V. unregulated output for the meter lamps, and a -30 V regulated supply for all other circuits. Transistors XQ4, XQ5 and XQ6 amplify any change in output voltage. This sensing signal is then fed to XQ2, which in turn controls the voltage drop across XQ1. XQ1 is in series with the output and maintains a constant voltage with varying load and power line. Zener diodes CR9, CR10 and CR11 provide reference levels for the voltage sensing amplifier.

Overload protection is provided by XQ3 and the associated circuitry. Maximum current out of the power supply is limited to approximately 600 ma. R12 provides for adjusting the output voltage over a small range, to allow for zener diode voltage tolerances. When installing the console, this voltage should be checked and if necessary, R12 readjusted to give -30 volts at the output + and - bus. The console power transformer is designed to mount externally. This prevents the high hum field, surrounding the power transformer, from inducing a high hum level into the low level console circuits. Independent 28 volt windings are necessary to provide complete isolation between the monitor amplifier and the main console power supply.

#### MAINTENANCE

One of the great advantages in the use of transistors is the long life expectancy of semiconductor devices. In this console, high quality components, conservatively rated, have been combined with the latest circuit techniques to give maximum dependability with a minimum of emergency maintenance. However, even the finest equipment may become erratic or inoperative if not properly cared for. We strongly recommend that the station engineer plan a routine preventive maintenance schedule and make every effort to faithfully follow it.

#### VOLTAGE MEASUREMENTS

Average voltage readings are given on the schematic diagrams of the various amplifiers. It is recommended that, after the console is installed and operating satisfactorily, these readings

be checked and recorded on the schematic. This will provide the station engineer with a record of the actual voltage readings in his installation, using his meter. If trouble later develops, he will then be better able to judge whether or not a particular circuit is operating properly since he will have available a record of the various readings of his particular equipment. DC readings were taken with a 20,000 ohm/volt meter as indicated on the schematic. RLS signal voltages are shown in parenthesis and must be measured with a vacuum tube voltmeter. If a VTVM is used to measure DC voltages, slightly higher readings may be obtained.

### MECHANICAL COMPONENTS

The channel mixers are step type low impedance attenuators. If sealed types are used, they require no maintenance. If unsealed types are used, they require cleaning about four times a year in the average location. A well air conditioned room would allow longer periods between cleaning them. A very dusty location would require more frequent cleaning. The attenuator contacts should be cleaned and lubricated by using Davenol (sometimes called Daven Oil). A soft, lint-free cloth should be used to remove the dirty accumulation from the contact surfaces. Davenol is inexpensive and may be purchased from the Gates Radio Company.

The relays, and the channel lever keys, were selected for long-life and trouble-free service. The contacts are self-wiping and everyday use will keep these contacts burnished. The contacts on the keys and relays that receive infrequent use can be cleaned by operating the equipment several times; thus, periodic operation of unused equipment will keep the contacts clean. In case of stubborn trouble, use a contact burnishing tool (Gates TM-1). Abrasive papers, files and grease solvents should never be used on these contacts. Grease or oil should not be used on relay or key contacts. This would make them collect dust, get gummy and cause contact burning and possible failure.

The Centralab lever keys have excellent wiping action and will probably not require any cleaning. If one of these keys is damaged, it is better to replace it than to attempt to repair it. Use the parts list for the description, if it is necessary to order a new one.

### MODIFICATIONS

In the design and construction of the equipment we have tried to provide a console which would give most installations adequate operating facilities. Realizing, however, that some users may require facilities that are not common, we have included in this section information about possible modifications which can be made on the console. Plan your modification carefully and allot sufficient time to complete it so that it will be well executed and will not be a source of trouble.

## PATCH PANEL FACILITIES

All of the important internal circuits of the console are terminated and jumpered on the main terminal board. These jumpers may be removed and normalling jacks wired in place of them. This would permit patching around sections of the console, feeding the console signal to other equipment and feeding signals into selected sections of the console. Of course, any of the inputs or outputs may normal through patch panels before connecting to the external connections. The proper use of patch panels will make the difference between a very versatile and a rather restricted installation. On the other hand, if patch panel facilities are not required, their elimination will reduce the number of possible operational errors. The station engineer must weigh all of the factors carefully and act accordingly.

If patch panels are used, they must be wired correctly. They should be wired so that the polarity of the circuits are phased properly in normalling and patching operations. The patch panel should not introduce grounds in any of the circuits. Circuits that need ground will have them as explained in the section labeled GROUND CIRCUITS under INSTALLATION.

Circuits of more than 40 DB difference in level should be separated in the patch panels. It is recommended that the jacks be segregated into low level, medium level and high level groups and all wiring attached to the different groups be cabled separately. The cables must have sufficient physical separation to prevent crosstalk as explained in INSTALLATION. If the circuits on the patch panel were located in a progressive order, as located in the console or system, patching would be much easier.

## MUTING RELAYS

The fourth muting relay may be wired to mute with the operation of channels 1, 2 or 3 when the lever key is actuated.

The "hot" side of the relay coil appears at terminal 4B on TB6. For operation with S1 (channel 1), connect 4B to 1B on TB6. For operation with S2, connect 4B to 2B on TB6. For operation with S3, connect 4B to 3B on TB6. With the fourth relay, warning light connections (1 amp max. load) can be made to terminals 9 and 10 on TB7. Monitor speaker connections may be made on TB6: "Left" spkr. - Terminals 14A-14B. The speaker will mute, and the warning lights will operate simultaneously with the other relay already connected to the channel key selected. The fourth relay (as well as the other three relays) may also be wired to operate with external switching, if desired.

Simply connect terminal 4B to one side of the switch and run a lead from the regulated "+30 volt bus" on the power supply to the other switch contact. Muting of relays 1, 2 and 3 may be changed, if desired. The "hot" side of relay coils 1, 2 and 3 appear on TB6, terminals 1A, 2A and 3A, respectively. Muting voltage from channel switches S1, S2 and S3 appear on TB6,

terminals 1B, 2B and 3B respectively. To change relay operation, remove the factory installed jumpers and connect the desired relay coil terminal to the desired channel switch terminal. For example, if it is desired to operate relay 3 from channel 1 key switch, jumper TB6-3A to TB6-1B.

#### WARRANTY

The Gates Warranty, gladly supplied in detail on request, generously covers all materials when returned to the Gates factory for inspection, transportation paid. Certain moving parts and tubes are guaranteed usually on an hourly basis and that of the manufacturer's guarantee. This warranty does not extend to free service in the field, but this service is available at a modest cost, where required.

## 994 6377 002 TEN CHANNEL TRANSISTOR CONSOLE

PARTS LIST

<u>Symbol No.</u>	<u>Gates Stock No.</u>	<u>Description</u>
A1,A2,A3,A4	396 0120 000	Lamp, 28 V.
AP1,AP3,AP5	994 6034 001	Booster Transistor, Printed Wiring Preamplifier, Plug-in
ALL,AL3	994 5700 001	Transistorized Program Amplifier, Plug-in
AM1	994 6108 002	Transistorized Monitor Amplifier
AQ1	994 6035 001	Transistorized Cueing Amplifier, Plug-in
AT1,AT2,AT3	554 0012 000	Dual Attenuator, 600/600
AT4,AT5,AT6, AT7,AT8, AT9,AT10	554 0024 000	Dual Attenuator, 600/600 w/Cue
AT12	914 2272 001	"U" Pad Assy. 34 DB, 15K/300
AT14	913 5918 002	"U" Pad Assy. 5400/150, 35 DB
AT19,AT20	913 5922 001	"U" Pad Assy. 7200/600
AT21	913 6031 002	VU Pad Assembly
AT23	913 6031 001	VU Pad Assembly, 600/600, 6 DB
AT25	913 6033 001	"H" Pad, 600/600, 6 DB
C1,C2,C3,C4	506 0005 000	Cap., .1 uf., 200 V.
CR1,CR2, CR3,CR4	384 0018 000	Diode Rectifier
J1	612 0279 000	Cue Jack
J2	612 0279 000	Line Jack
K1,K2,K3,K4	572 0126 000	Relay, 24 V. DC
K5	574 0103 000	Relay
LS1	722 0009 000	Speaker, 45 ohm, 3"
M1,M2	915 2745 001	VU Meter, Model 1349 "B" Scale (Mod.)
PS1	994 6205 001	Console Power Supply
R2,R14,R26, R40,R53,R68, R81,R91, R146,R155	540 0042 000	Resistor, 510 ohm, 1/2 W. 5%

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<u>Symbol No.</u>	<u>Gates Stock No.</u>	<u>Description</u>
R3, R5, R15, R17, R27, R29, R41, R43, R54, R56, R69, R71, R82, R84, R92, R94, R147, R148, R156, R158	540 0051 000	Resistor, 1200 ohm, 1/2W. 5%
R4, R16, R28, R37, R42, R43, R50, R55, R61, R63, R65, R70, R76, R78, R83, R93, R107, R108, R110, R113, R116, R119, R141, R157	540 0044 000	Resistor, 620 ohm, 1/2W. 5%
R95	540 0032 000	Resistor, 200 ohm, 1/2W. 5%
R96, R97, R100	550 0236 000	Master Control, 2500 ohm
R101, R102, R104	540 0018 000	Resistor, 51 ohm, 1/2W. 5%
R103	540 0039 000	Resistor, 390 ohm, 1/2W. 5%
R105	550 0215 000	Control, 10K ohm
R106, R109, R111, R112, R114, R115, R117, R118, R142, R143	540 0066 000	Resistor, 5100 ohm, 1/2W. 5%
R120, R122, R124, R126	540 0579 000	Resistor, 47 ohm, 2W. 5% (Part of relay board)
R137, R138	540 0059 000	Resistor, 2700 ohm, 1/2W. 5%
S1, S2, S3, S4, S5, S6, S7, S8, S9, S10	602 0047 000	Lever Key, Series 4803, Pos. 1 Locking, 1A, 1B, 1D Left and Right - Pos 2 Locking, 1A, 1B, 1D Left and Right
S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S30, S41, S42	602 0007 000	Lever Switch
S31, S32, S33, S34, S36, S37	602 0005 000	Lever Switch

<u>Symbol No.</u>	<u>Gates Stock No.</u>	<u>Description</u>
S35	914 8732 001	Mon. Selector Switch (Mod.)
S38	914 8731 001	Intercom Selector Switch (Mod.)
S39,S40	914 8733 001	VU2 & Phone Selector Switch (Mod.)
S43	604 0230 000	Pushbutton Switch, SPST, N.O.
T1	478 0009 000	Audio Transformer A21
T2,T4	478 0230 000	Speaker Transformer - A-36283
T3	478 0231 000	Speaker Transformer - A-36792
T11	472 0429 000	Power Transformer - A-36766
TB1,TB2,TB3, TB4,TB5,TB6	614 0434 000	Terminal Block, 20 pair
TB7	614 0054 000	Terminal Board
TB8	614 0050 000	Terminal Board
XA1,XA2, XA3,XA4	406 0317 000	Pilot Light Socket
XK5	404 0160 000	Relay Socket

PARTS LIST

M6205 TRANSISTOR  
REGULATED POWER SUPPLY

<u>Symbol No.</u>	<u>Gates Stock No.</u>	<u>Description</u>
C1, C2	522 0268 000	Cap., 20 uf., 100(W)V.
C3	524 0104 000	Cap., 1000 uf., 50 V.
C4	506 0005 000	Cap., .1 uf., 200 V.
C5	522 0297 000	Cap., 250 uf., 50(W)V.
C6	522 0321 000	Cap., 500 uf., 50 V.
C7	522 0394 000	Cap., 100 uF., 50 V.
C8	516 0054 000	Cap., .001 uF., 1 kV.
CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR12	384 0062 000	Silicon Rectifier, X5A2
CR8, CR9, CR10, CR11	386 0019 000	Zener Diode
F1	398 0056 000	Fuse, 1.5 amp. Slo-Blo
F2	398 0017 000	Fuse, 1 amp., 250 V.
Q1, Q3	380 0016 000	Transistor, 2N1539
Q2, Q6	380 0014 000	Germanium Transistor, 2N1414
Q4	380 0018 000	Transistor, 2N1307
Q5	380 0011 000	Transistor, 2N214
R1, R5, R8, R11	540 0073 000	Res., 10K ohm, 1/2 W. 5%
R2	540 0066 000	Res., 5100 ohm, 1/2 W. 5%
R3	542 1119 000	Res., .75 ohm, 2 W. 5%
R4	540 0623 000	Res., 3300 ohm, 2 W. 5%
R6, R7, R9	540 0071 000	Res., 8200 ohm, 1/2 W. 5%
R10	540 0059 000	Res., 2700 ohm, 1/2 W. 5%
R12	550 0350 000	Potentiometer, 2K ohm, 1/4 W. 30%
R13	540 0058 000	Res., 2400 ohm, 1/2 W. 5%
R14	540 0570 000	Res., 20 ohm, 2 W. 5%
R15	540 0065 000	Res., 4700 ohm, 1/2W. 5%
TB1	614 0112 000	Terminal Board
TB2	614 0513 000	Terminal Strip
XCR8, XCR9, XCR10, XCR11, XQ2, XQ4, XQ5, XQ6	404 0066 000	Socket
XF1, XF2	402 0023 000	Fuse Holder
XQ1, XQ3	404 0294 000	Transistor Mtg. Kit



