

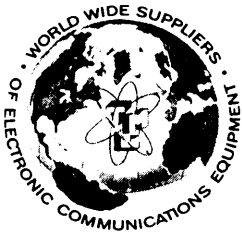


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Technical Manual
for
Bridging Speaker Panel
Model BSP-7

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS



ERRATA
Publication 210715-7
Dated July 1997

Page 5 Para 2.2.1 Add "Primary power is 115/230VAC when internal power supply is installed."

Page 8 Para 4.2 Add "DS2A (green) is an activity delay LED circuit that provides an adjustable ON signal to allow the operator time to visually identify an active channel."

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment - except electron tubes, semi-conductor devices, fuses, lamps, batteries, and articles made of glass or other fragile or expendable materials - purchased hereunder to be free from defect in workmanship and materials under normal use and service, when used for the purposes for which the same is designed, for a period of ONE YEAR from the date of delivery FOB factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, FOB factory, which may fail within the stated warranty period, provided:

- Any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction;
- The defect is not the result of damage incurred in shipment from or to the factory;
- The equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise; and
- Any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

At TMC's option, any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid and the TMC RETURN AUTHORIZATION number clearly marked on the package. Electron tube warranty claims should be made directly to the manufacturer of such tubes since tubes furnished by TMC bear only the manufacturer's warranty.

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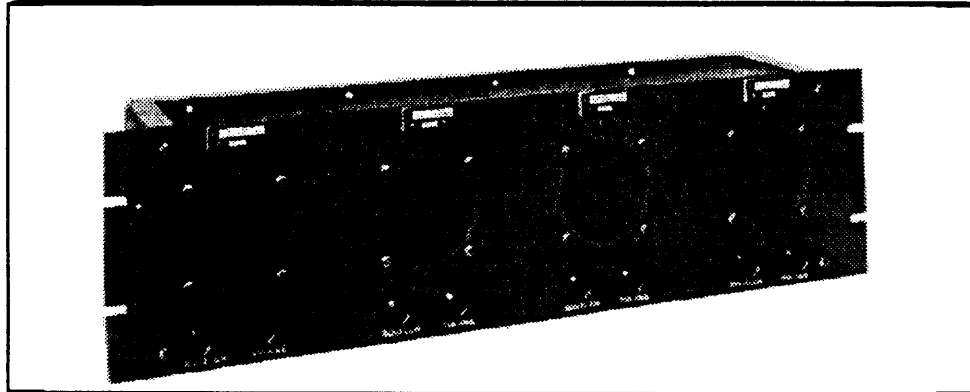
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The designation "BSP" is used herein to refer interchangeably to all BSP-7 models. Any variations to this convention are noted.

BSP-7 Series



Model BSP-7-4/S

Models in BSP-7 Series:

| | |
|---------|---------------------------------------|
| BSP-7-1 | Bridging Speaker Panel, One-Channel |
| BSP-7-2 | Bridging Speaker Panel, Two-Channel |
| BSP-7-3 | Bridging Speaker Panel, Three-Channel |
| BSP-7-4 | Bridging Speaker Panel, Four-Channel |

Section 1 - General Description

1.1 Functional Description

1.1.1 Overview

The BSP Series of Bridging Speaker Panels provide high-quality monitoring of voice circuits without disturbing line levels or balance. Up to four channels may be monitored on one panel, each channel with its own loudspeaker, volume control and optional channel activity lamp. This simple, but effective method of dynamically monitoring audio channels may be used with any make of receiver with an audio output impedance of 600 ohms (balanced).

1.1.2 Major Assemblies

The BSP units are totally solid state and modular. Each channel monitored is provided with its own loudspeaker, audio amplifier assembly, and volume control. If one channel is lost due to a malfunction in one assembly, the other channels are not affected and in fact can easily be switched in to bypass the defective module. An added advantage of this design is that crosstalk or interaction between audio lines, caused by operating the BSP when receiver circuits are monitored simultaneously, is held to an absolute minimum.

1.1.3 Controls and Indicators

All operator controls and indicators are located on the front panel with audio connections made conveniently to terminal strips at the rear of each module. Primary operating voltages are applied individually to each module via screw-type terminal blocks mounted to the rear panel.

1.1.4 Input/Output Characteristics

Since each module is calibrated at the factory prior to shipment, the BSP unit can be installed immediately upon receipt at the site. No further adjustments are required. Optional audio jacks, mounted on the front panel, can be provided to mute each speaker and provide a measure of privacy to the operator.

1.1.5 Remote Operation

Remote audio monitoring of discrete channels is easily handled by extending 600-ohm balanced lines from each module to the remote control site. Under these conditions, consideration should be given to balancing or equalizing the audio lines to prevent unwanted distortion in the received audio. This is particularly important if low speed data is being passed over the audio channels and monitored by the BSP.

1.2 Physical Description

1.2.1 Equipment Mounting

Several sub-assemblies are mounted to a U-chassis which is bolted securely to a single 19-inch aluminum alloy panel. These sub-assemblies perform the functions of amplification, impedance matching and line sensing. They are physically arranged to simplify any required troubleshooting or repair. The majority of the components used in the assemblies are discrete, although extensive use is made of integrated circuits in the design. All non-power assemblies in the BSP are mounted on printed circuits cards which can be accessed directly from the front panel for servicing.

Four modules can be configured for each panel - providing a compact, economical package suitable for both commercial and military service. Based on the number of channels monitored, the speakers are sized to the panel spacing.

1.2.2 Semiconductor Complement

A list of a semiconductors used in the BSP-7 are listed in Table 1.1.

Table 1.1 - Semiconductor Complement

| | | |
|-----------------------|---------|----------|
| CE Amplifier | CK2305 | 2N711 |
| CE Amplifier | CK10671 | 2N3904 |
| Operational Amplifier | CK2305 | MC17416P |
| Operational Amplifier | CK10671 | CA3020 |
| Squelch Gate | CK10671 | 2N3906 |
| Diode Gate | CK2305 | 1N645 |
| +12-volt Zener Diode | CK10671 | 1N3018A |

1.3 Technical Specifications

Input Impedance 600 ohms balanced; Optional: 80,000 ohms, ungrounded
Speaker Impedance 3.2 ohms
Rear Panel Connection Standard terminal block
Power Gain 36dB (1 Watt for -6dB input); Front panel volume control
Frequency Response 200 to 7500Hz, +/-2dB
Hum Level -40dBm at 1 Watt
Distortion Less than 2% with 1 Watt at 400Hz
Input Power +12vdc at 1.0A; 45ma no-signal/200ma full-signal
Cooling Convection
Speaker Size 3 inches (7.6cm)
Components Solid state
Construction Aluminum alloy with external stainless-steel hardware
Dimensions (Overall) 5.25H x 19W x 5D inches
Weight BSP-7-1: 3 lbs; BSP-7-2: 6 lbs; BSP-7-3: 9 lbs; BSP-7-4 (12lbs)
Environmental Operating 0° to +50°C; 95% R.H.

Ordering Information

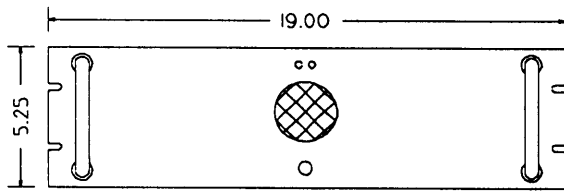
| | |
|---------|--------------------|
| BSP-7-1 | One-channel unit |
| BSP-7-2 | Two-channel Unit |
| BSP-7-3 | Three-channel Unit |
| BSP-7-4 | Four-channel unit |

Options (each channel):

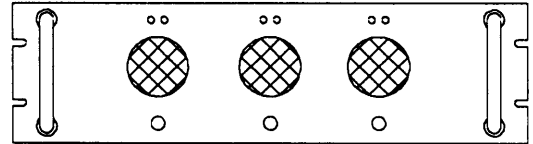
| | |
|----|----------------------------|
| /A | Audio input jack |
| /B | 600-ohm balanced input |
| /S | Activity/standby indicator |

1.4 BSP Product Group

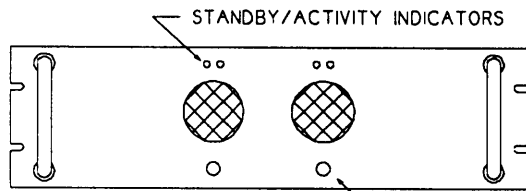
| | |
|---------|---------------------------------------|
| BSP-1 | Bridging Speaker Panel, One-channel |
| BSP-2 | Bridging Speaker Panel, Two-channel |
| BSP-3 | Bridging Speaker Panel, Three-channel |
| BSP-7-1 | Bridging Speaker Panel, One-channel |
| BSP-7-2 | Bridging Speaker Panel, Two-channel |
| BSP-7-3 | Bridging Speaker Panel, Three-channel |
| BSP-7-4 | Bridging Speaker Panel, Four-channel |



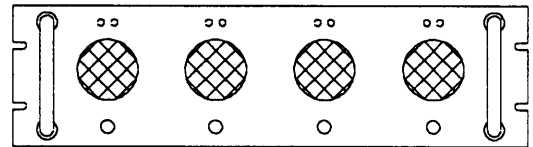
Model BSP-7-1/S



Model BSP-7-3/S



Model BSP-7-2/S



Model BSP-7-4/S

Figure 1.1 - Outline Drawing, BSP Series

Section 2 - Installation

2.1 Initial Inspection

2.1.1 General

Every BSP undergoes a thorough testing and calibration prior to shipment. Upon receipt of the unit, check the packing case and its contents for obvious damage. Unpack the equipment carefully to reduce the risk of damage and to avoid misplacing any parts shipped as loose items.

2.1.2 Damage By Carrier

With respect to equipment damage for which the carrier is liable, TMC will assist in describing methods of repair as well as furnishing replacement parts.

2.2 Electrical Installation

2.2.1 Primary Power

The BSP is wired at the factory for +12-volt DC operation. It is the user's responsibility to provide the required conversion from a standard 115/230-volt AC or other suitable external power source.

2.2.2 External Connections

The following external connections must be made to the BSP after it has been installed in an equipment rack:

Power - Connect primary power to the unit via the screw-type terminal block mounted on the rear panel. There is one terminal block for each speaker assembly, beginning with TB101. No internal power bus is provided.

Outputs - Connect the outputs of the BSP to the associated receivers via the terminal board TB101 on the rear panel of each amplifier assembly. The audio input circuit is 600-ohm balanced (excepting on 80K-ohm unbalanced units) across terminals 4 and 6 with terminal 5 center-tapped and terminal 7 grounded.

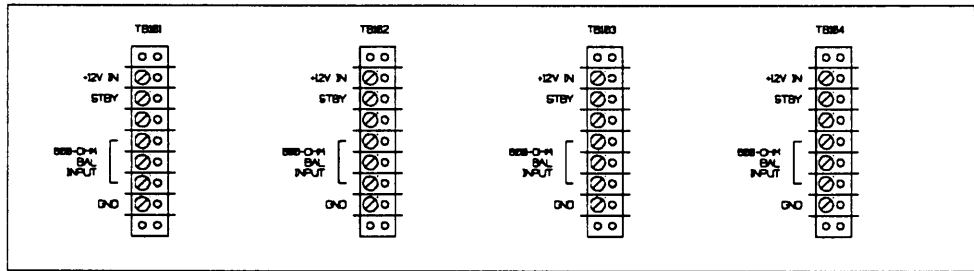


Figure 2.1 - Rear Panel Connections (BSP-7-4)

2.2.3 Clearance Requirements

The BSP equipment should be located in such a way that sufficient clearance is obtained at the rear of the unit for making all audio and power connections. The front panel controls should also be within easy reach of an operator. The solid state design of the BSP reduces heat problems, allowing "stacking" of BSP units, one above the other, in the same rack. To reduce the effects of prolonged heat in confined spaces, the equipment cabinet should be fitted for forced air cooling or the speaker panels should be separated vertically by sufficient space to allow dissipation of the heat into the operating area.

2.3 Performance Check

2.3.1 General

When the appropriate audio and power connections have been made to the BSP, turn the front-panel rotary switch to the ON position (clockwise). The BSP-7 is ready for immediate use. No further checks are required.

Table 2.1 - Loose Items Supplied

| | | |
|------------------|----------|--------|
| Technical Manual | 210715-7 | 1 each |
|------------------|----------|--------|

Section 3 - Operation

3.1 General

3.1.1 Controls

The only operating controls are the volume controls on the front panel. With these controls, the individual audio levels can be adjusted to a comfortable level. The BSP-7-1 has one control, the BSP-7-2 has two, the BSP-7-3 has three and the BSP-7-4 has four.

3.1.2 Procedures

After connecting the communication receivers and power, and turning on the volume switch, no further operating procedures are required. The BSP is now fully operational without further adjustment.

Table 3.1 Controls and Indicators

| | |
|------------------|---|
| Audio Volume | Controls audio level output from associated speaker |
| Activity/Standby | Indicates status of audio in each channel monitored |

Section 4 - Principles of Operation

4.1 General

Each BSP-7 section consists of two assemblies: an audio amplifier/squelch and an optional activity/standby indicator. The following describes one channel.

4.2 Circuit Description

The input line voltage is routed directly to both the amplifier and the indicator circuits simultaneously.

On the amplifier board A10699, audio input signals are applied via terminal board TB101 to the operational amplifier U1. The output is then applied via a center-tapped matching transformer (balanced) to the 3-ohm speaker mounted to the front panel. AGC and SQUELCH voltages are applied to transistor gate Q1. As the SQUELCH voltage increases, collector voltage decreases forcing the collector voltage of common emitter amplifier Q2 to ground. This grounds the output of U1, eliminating any audio to the speaker.

Activity/Standby Indicator board A5864 monitors the audio signal level at the output of the op-amp U1 on A10699. A positive voltage at the input of inverter Z1 produces an amplified and positive (Pin 6) output which is applied to the base of common-emitter amplifier Q1. This forward biases Q1 to saturation, bringing the collector to ground, and allowing current to flow through the LED DS1. The inverted output at Pin 7 cuts Q2 off, disabling the standby LED DS2.

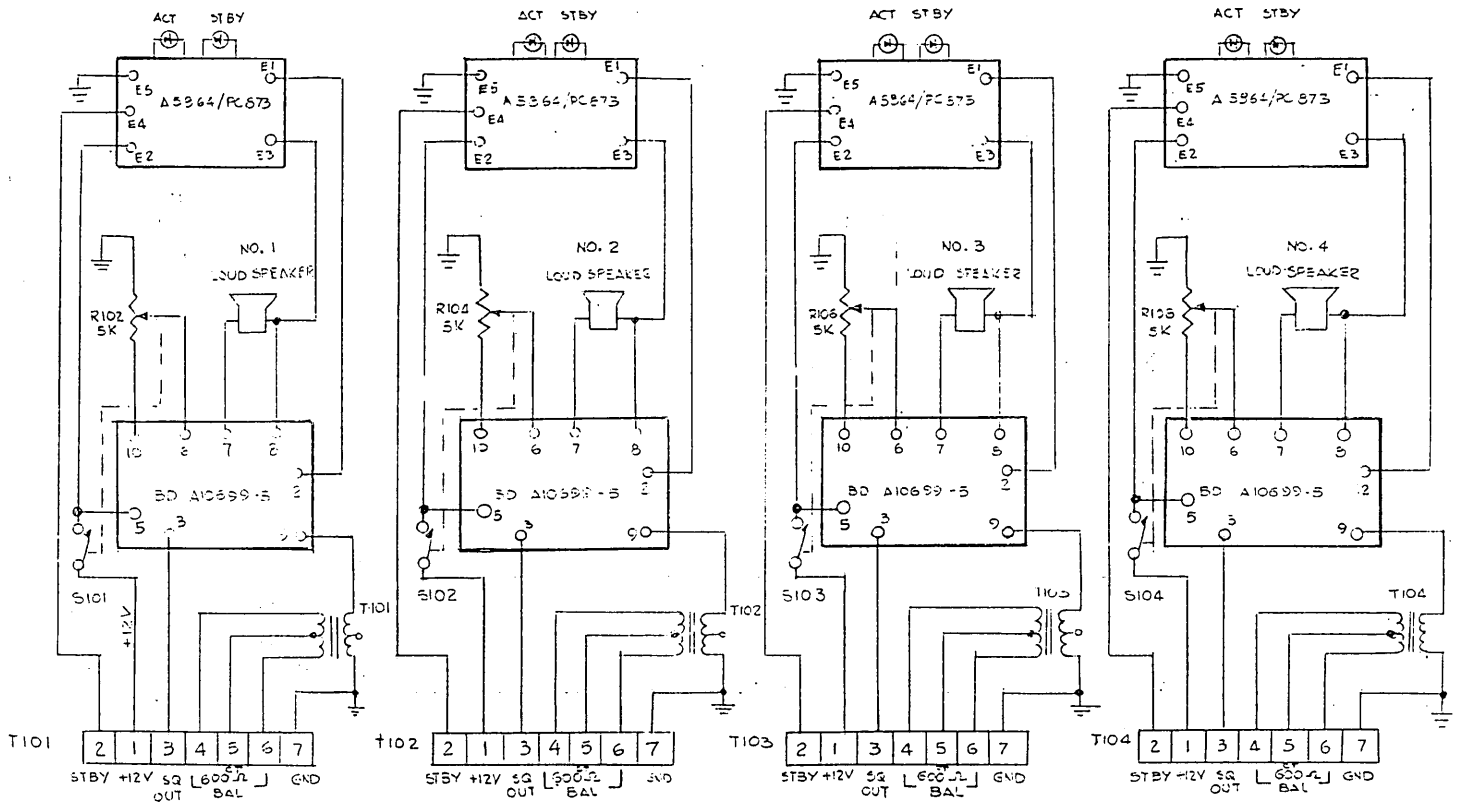


Figure 4.1 - Block Diagram

Section 5 - Maintenance

5.1 General

The amplifier subassembly is installed as a unit and should a malfunction occur, the entire subassembly can be replaced. On the first indication of trouble, check the line fuses, volume control and loudspeaker before replacing the amplifier subassembly. First check the volume control for an open or short circuit. Next, examine the speaker for a broken cone or loose connections. A continuity check of the voice coil will reveal whether it is open or short-circuited.

5.2 Preventive Maintenance

5.2.1 General Cleaning Methods

Preventive maintenance for the BSP consists of routine functions such as visual inspection and cleaning. Periodic cleaning is recommended as dust may build up on components, reducing the efficiency of the coupler unit and possibly causing circuit failure. To facilitate cleaning the unit, use a vacuum cleaner or a low-pressure filtered compressed-air supply.

5.2.2 Visual Check and Adjustment

A simple visual check of the unit when it is opened up for servicing or cleaning with often reveal potential trouble spots and thereby reduce downtime due to component failure. Signs of trouble may be found in discoloration, warped printed circuit boards and damaged wiring or cables. Any deteriorating component should be replaced immediately. All hardware should be checked for tightness during preventive maintenance inspections.

5.3 Troubleshooting

The gain of the amplifier subassembly can be measured using the following test set-up. Refer to Figure 7.1.

- Connect an audio signal generator to terminals 4 and 7 on TB101. Connect a VTVM to pins 7 and 8 of A10699. Turn the volume control fully counterclockwise.
- Set output of the signal generator for a -6dBm at 1000Hz (1kHz). Adjust the VOL control for a gain of 36dB +/-3dB (1 watt) on the VTVM.
- Check the frequency response between 200Hz and 7000Hz. It should not drop more than 3dB.
- Set the output of the signal generator for a -6dBm output at 400Hz. Adjust the VOL control for a gain of 35dB +/-3dB on the VTVM.
- Connect a distortion meter to pins 7 and 8 of A10699. The distortion should not exceed two percent (2%).

5.4 Repair

5.4.1 General Method

Repair work generally consists of replacing the defective component. The following cautions should be observed:

- Make sure the replacement component is an exact duplicate of the defective one. This is particularly important in the amplifier modules.
- Place any new component in the same location as the component it replaces. The dressing of any wire runs should not be altered.
- Observe standard practice when replacing semiconductor components by using a low-wattage soldering iron and appropriate heat-sink tools.
- Avoid damage to the printed circuit wiring when handling or repairing amplifier and regulator modules.

Section 6 - Parts Lists

IMPORTANT NOTE

Reference designations are assigned to identify all electrical parts of the equipment. These designations, called symbols, are used for marking the equipment (usually adjacent to the part they identify) and are included on drawings, schematic diagrams and the parts list. The first character(s) of a symbol - normally one or two letters, or one number plus one letter - indicate the kind of part (generic group), such as resistor, capacitor, transistor, etc. The number following differentiates between parts of the same generic group and is normally indexed sequentially; omitted numbers are noted on the diagrams. Sockets associated with a particular plug-in device - such as transistor, integrated circuit, fuse - are identified by a symbol which includes the reference designation of the plug-in device. For example, the socket for fuse F101 is designated XF101.

When ordering replacement parts, specify the TMC part number. This part number is cross-referenced to the symbol number on the parts list and on the associated schematic diagram. If the TMC part number is known, the model number of the equipment is useful but not essential since TMC utilizes identical parts that are common to many different types of equipment. If only the symbol number is known then specify the part number of the assembly on which it is mounted.

Item Material Listing

| Item/Part Number | Rev | Description | Qty | Notes |
|------------------|-----|--------------------------------|-----|-------------|
| A5864 | | Printed Circuit Board Assembly | | |
| 1N34A | | Diode, Germanium | 1EA | CR1 |
| 1N645 | | Semiconductor Device, Diode | 1EA | CR2 |
| 2N1711 | | Transistor, Silicon | 4EA | Q1/2/3/4 |
| BI132 | | Lamp, Incandescent | 2EA | DS1/2 |
| CC131-44 | | Capacitor, Fixed, Ceramic | 3EA | C1/2/3 |
| MC1741CP | | Amplifier | 1EA | Z1 |
| PC873 | | Printed Circuit Board | 1EA | |
| RC07GF680J | | Resistor, Fixed, Composition | 1EA | R8 |
| RC07GF562J | | Resistor, Fixed, Composition | 1EA | R9 |
| RC07GF102J | | Resistor, Fixed, Composition | 4EA | R5/10/12/14 |
| RC07GF203J | | Resistor, Fixed, Composition | 1EA | R3 |
| RC07GF122J | | Resistor, Fixed, Composition | 1EA | R2 |
| RC07GF103J | | Resistor, Fixed, Composition | 2EA | R6/7 |
| RC07GF472J | | Resistor, Fixed, Composition | 1EA | R11 |
| RC32GF561J | | Resistor, Fixed, Composition | 2EA | R4/13 |
| RV124-1K | | Resistor, Variable, Comp. | 1EA | R1 |

Item Material Listing

| Item/Part Number | Rev | Description | Qty | Notes |
|------------------|-----|--------------------------------|-----|-------|
| BSP-7-4/S | | Bridging Speaker Panel | | |
| A10699-5 | | Printed Circuit Board Assembly | 4EA | |
| A5864 | | Printed Circuit Board Assembly | 4EA | |
| CK2304 | | Schematic, Diagram | 1EA | |
| CK2304 | | Schematic, Diagram | 1EA | |
| HA102-2BN | | Handle | 2EA | |
| HP540 | | Nameplate | 1EA | |
| LS106 | | Loudspeaker | 4EA | |
| MP127-3FD | | Knob | 4EA | |
| MS7214/LD3168 | | Panel, Front | 1EA | |
| MS7215-1 | | Panel, Side Chassis | 1EA | |
| MS7215-2 | | Panel, Side Chassis | 1EA | |
| MS7216/LD3169 | | Panel, Rear | 1EA | |
| MS7218 | | Bracket, Mtg, PC Board | 4EA | |
| MS7219 | | Grille | 4EA | |
| RV4NBYS50SA | | Resistor, Variable | 4EA | |
| TF267-3B | | Transformer | 4EA | |
| TM100-7 | | Terminal Board, Barrier | 4EA | |

Item Material Listing

| Item/Part Number | Rev | Description | Qty | Notes |
|------------------|-----|--------------------------------|------|----------|
| A10699-5 | | Printed Circuit Board Assembly | | |
| 1N3018A | | Diode, Zener | 1EA | CR1 |
| 2N3904 | | Transistor | 4EA | Q2/3/4/5 |
| 2N3906 | | Transistor, Silicon, PNP | 1EA | Q1 |
| A10699-4 | | Printed Circuit Board | 1EA | |
| BS100 | | Solder, Tin Alloy | 1LOT | |
| CC10011-3 | | Capacitor, Fixed, Ceramic | 1EA | C2 |
| CC10011-8 | | Capacitor, Fixed, Ceramic | 2EA | C1/4 |
| CC10011-10 | | Capacitor, Fixed, Ceramic | 1EA | C6 |
| CE105-1-15 | | Capacitor, Electrolytic | 1EA | C3 |
| CE105-2-15 | | Capacitor, Electrolytic | | N/R |
| CE105-30-15 | | Capacitor, Electrolytic | 1EA | C5 |
| CK10671 | | Schematic, Diagram | 1EA | |
| HD10002-7 | | Heat Sink | 1EA | |
| NW-CA3020 | | Integrated Circuit | 1EA | U1 |
| RC20GF103J | | Resistor, Fixed, Composition | 2EA | R5/9 |
| RC20GF152J | | Resistor, Fixed, Composition | 1EA | R4 |
| RC20GF153J | | Resistor, Fixed, Composition | 1EA | R3 |
| RC20GF273J | | Resistor, Fixed, Composition | 2EA | R6/7 |
| RC20GF514J | | Resistor, Fixed, Composition | 1EA | R2 |
| RC32GF330J | | Resistor, Fixed, Composition | 1EA | R1 |
| TE127-2 | | Terminal, Stud | 10EA | |
| TF10047 | | Transformer | 1EA | T1 |

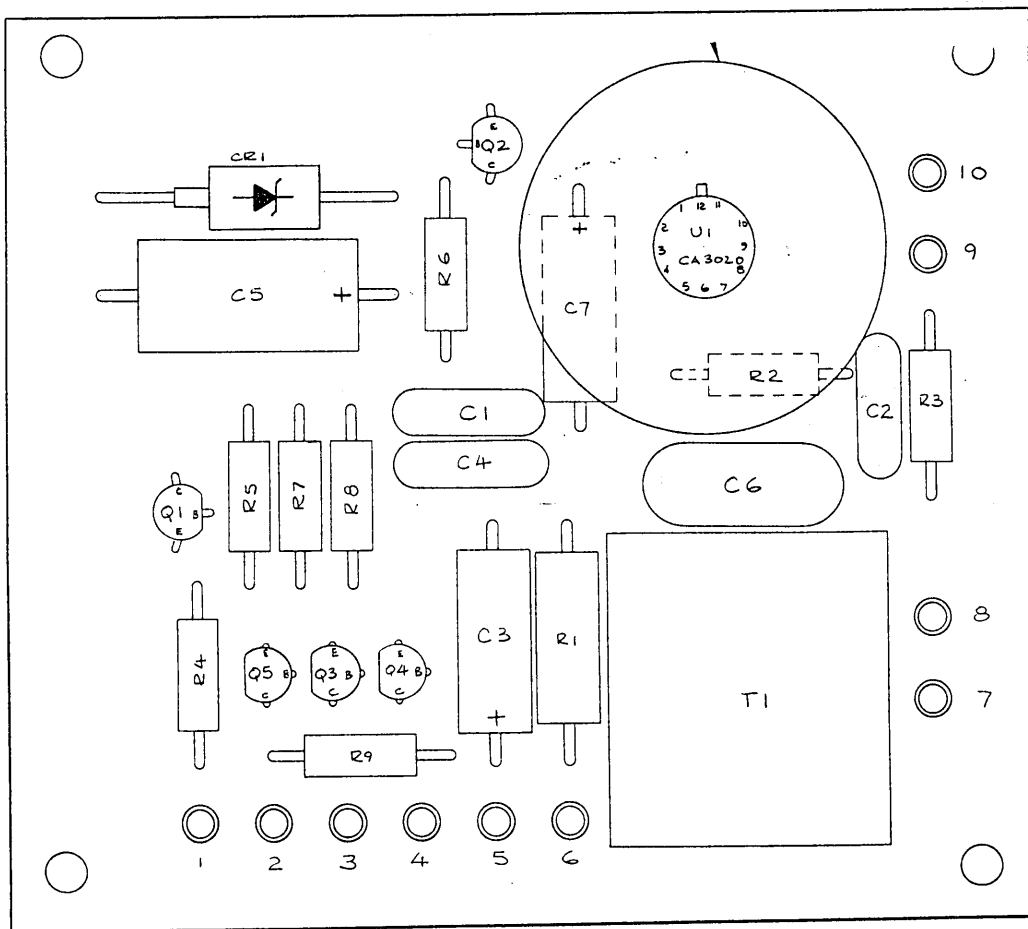
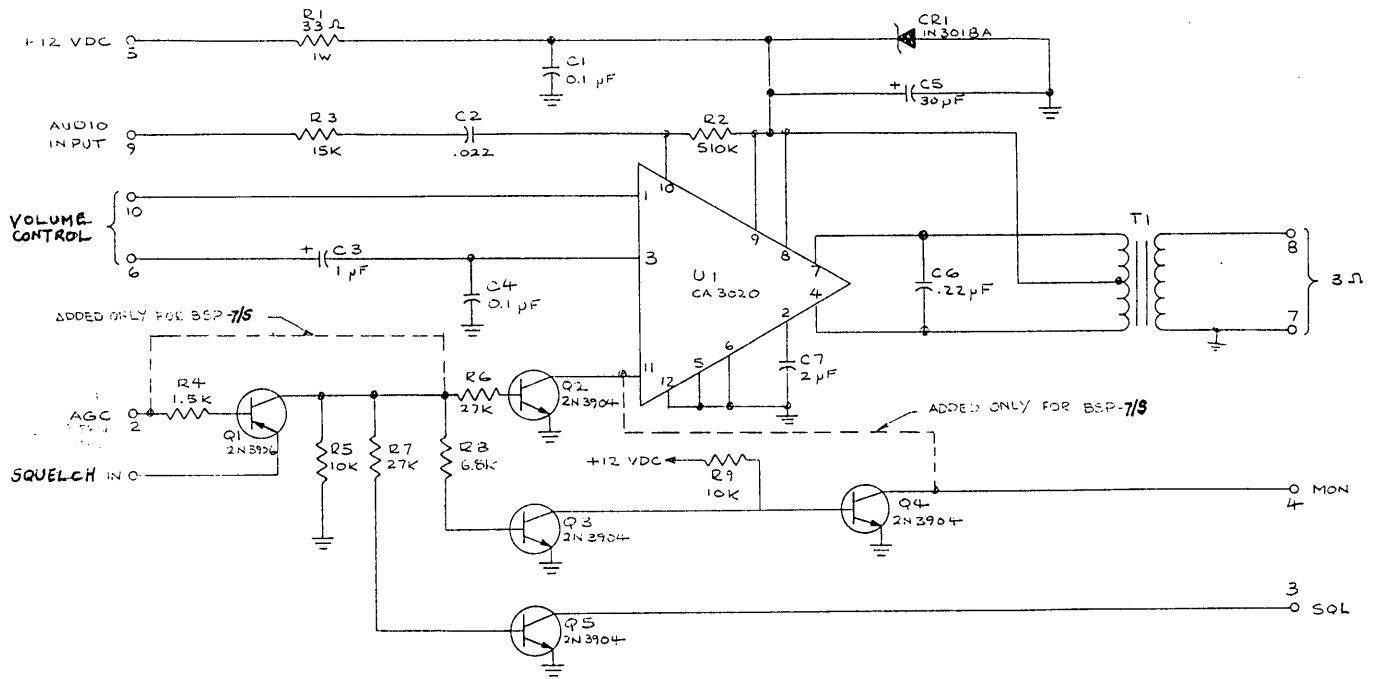


Figure 7.2 - Amplifier/Squelch

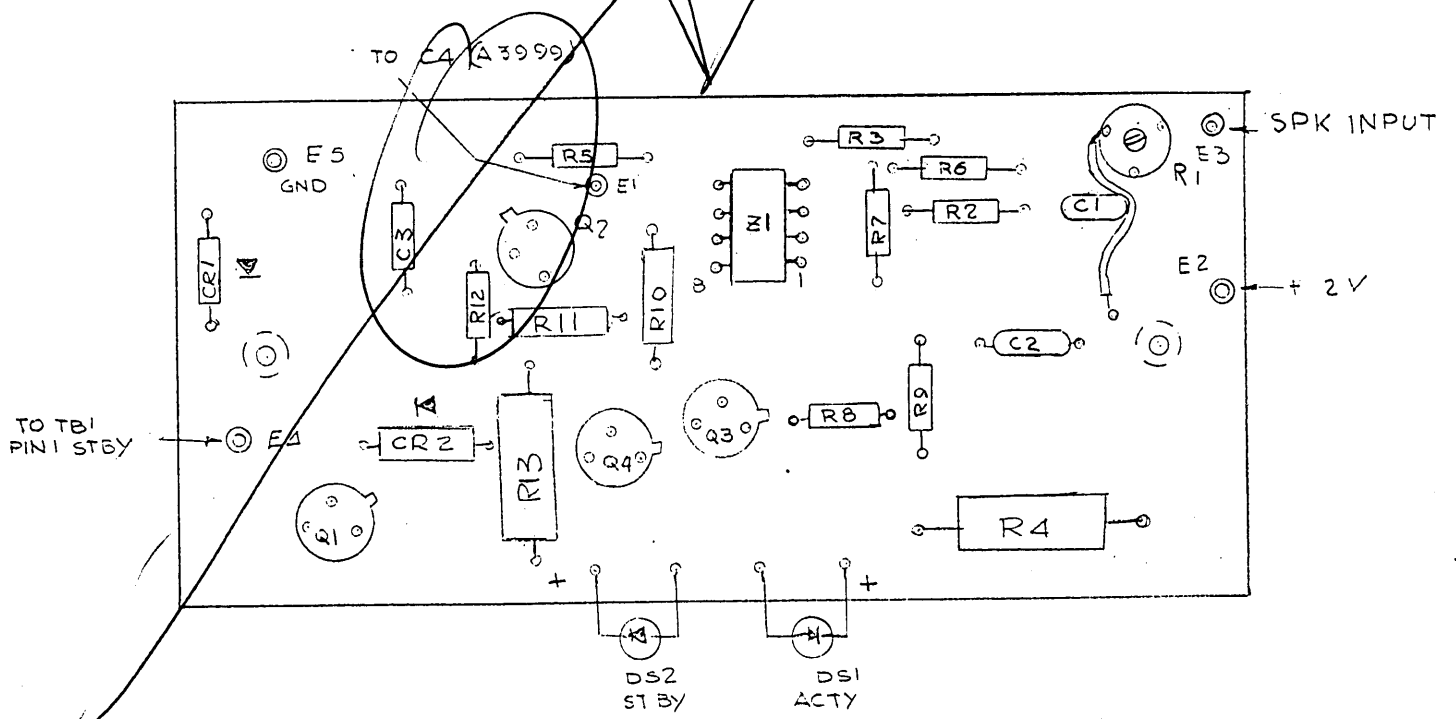
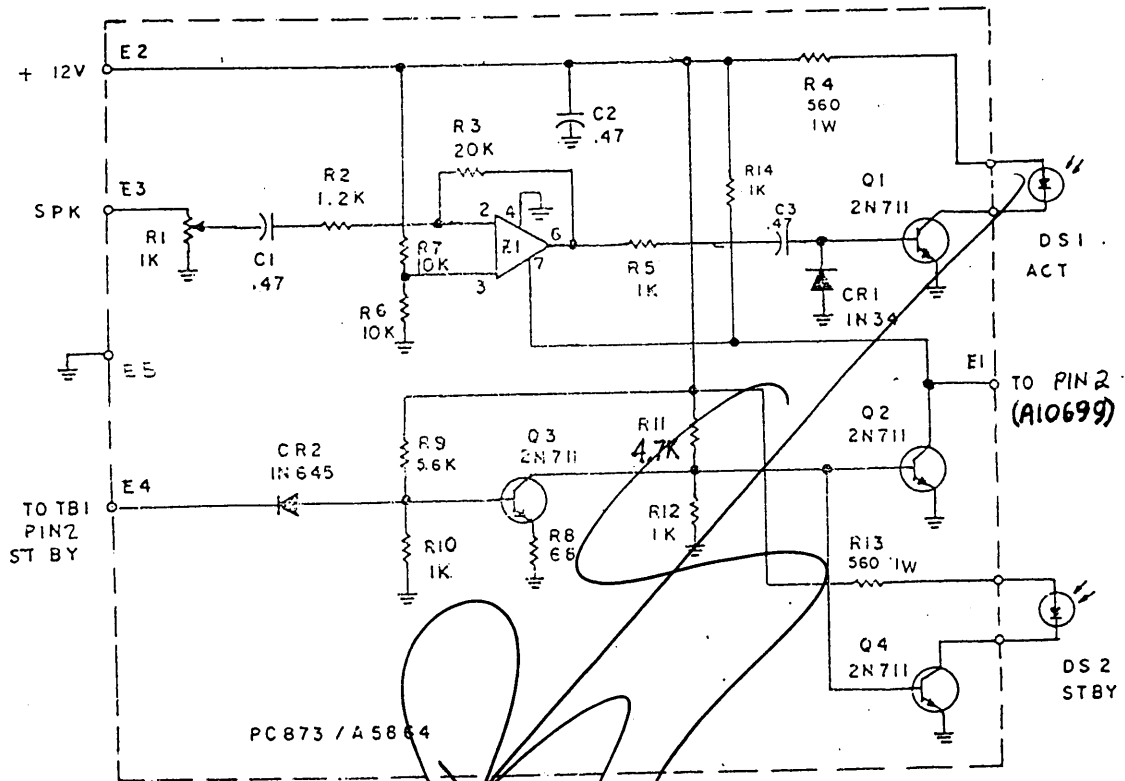


Figure 7.1 - Standby/Activity Indicator