ESA-10 CONSOLE MANUAL

REVISION SCHEDULE

Revision Number -- Number 1

Effective Date -- July 1, 1984

Serial Numbers Effected -- Number 10021 On

Revisions This Change -- Mic Pre-Amp -- Schematic
Mic Pre-Amp -- PC Layout
Mic Pre-Amp -- Parts List
Control Board -- Parts List
Input Mother Board -- Parts List
Line Amp Mother Board -- Schematic
Line Amp Mother Board -- Schematic
Line Amp Mother Board -- Parts List
Cue Amp -- Schematic
Cue Amp -- PC Layout
Cue Amp -- Parts List
Bar Graph Meter -- Schematic
Bar Graph Meter -- PC Layout
Bar Graph Meter -- Parts List
Auxiliary Selector Control -- Schematic

Additions This Change -- Revision Schedule
RFI Shielding (Engineering Notes)
Remote Start Interface (Engineering Notes)

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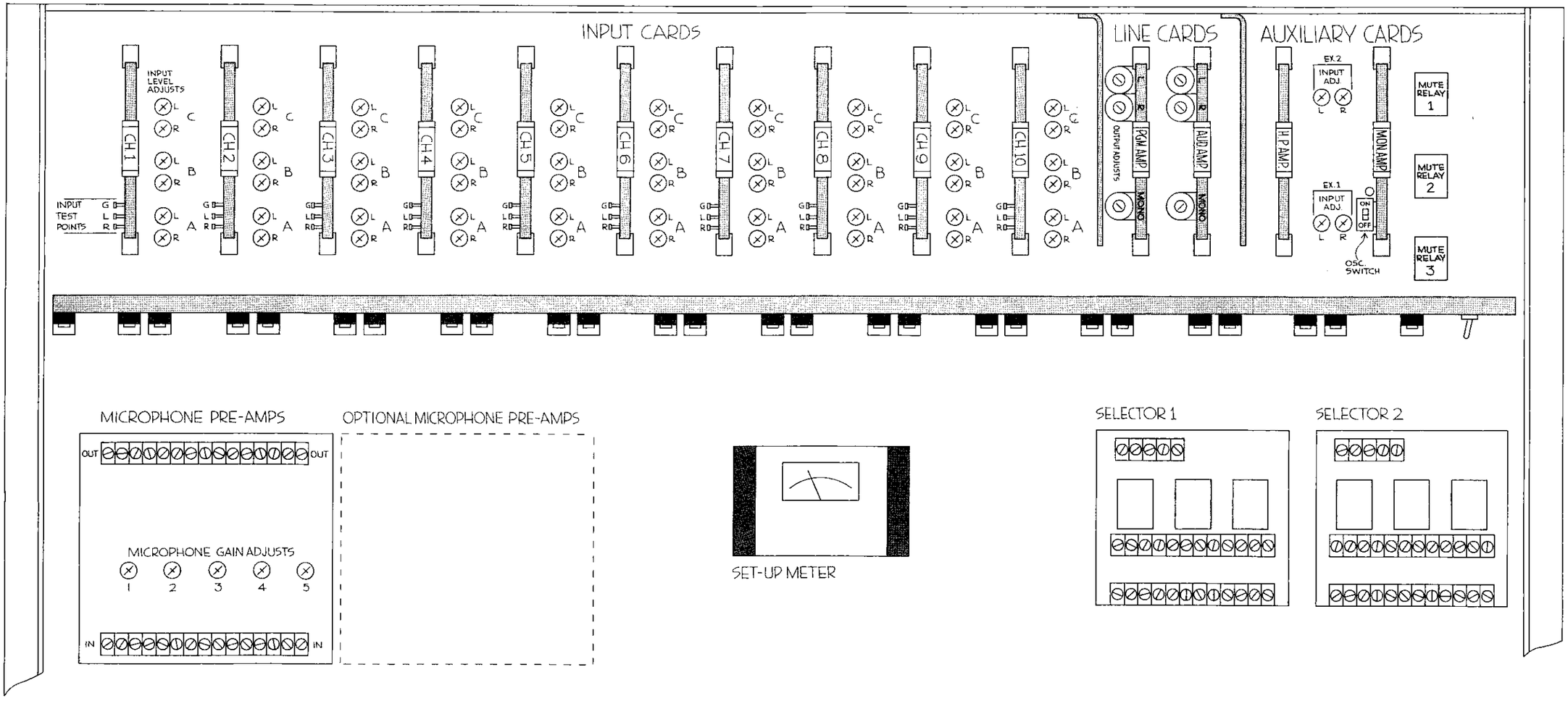
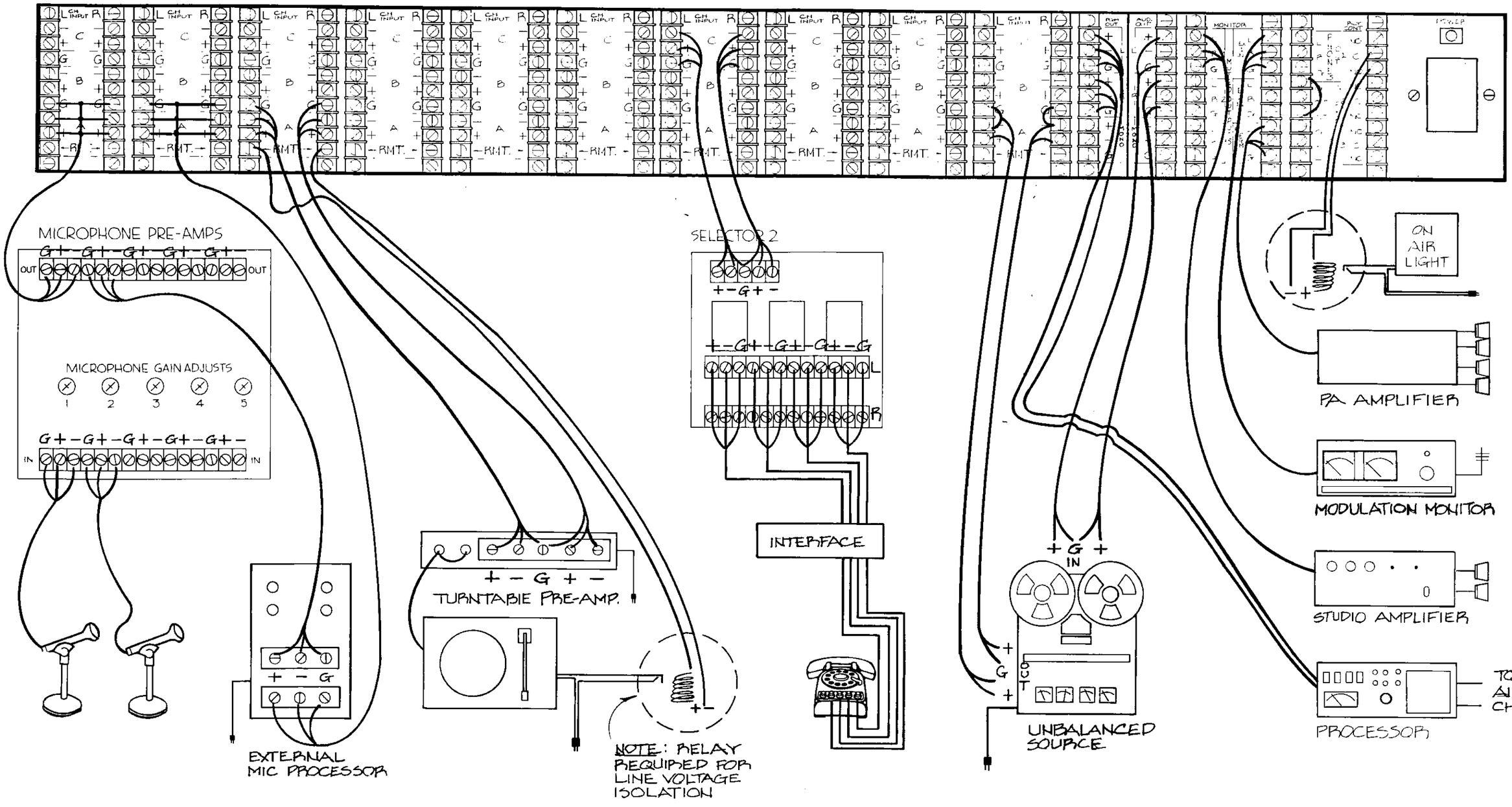
Internal Control Layout



Equipment Interconnections



LEVEL REFERENCE GUIDE

	Input Impedance	Int Level Adj.	Nominal Level	Max Level	Bal-anced
line inputs	10k	yes	0 dbm	+30 dbm	yes
line inputs (gain straps out)	10k	yes	-20 dbm	+30 dbm	yes
mic inputs	236	yes	-50 dbv	-25 dbv	yes
external inputs	4.7k	yes	1 V	30 V	no

	Output Impedance	Int Level Adj.	Nominal Level	Max Level	Bal-anced
program outputs	200	yes	+8 dbm	+25 dbm	yes
audition outputs	200	yes	+8 dbm	+25 dbm	yes
mono inputs	200	yes	+8 dbm	+25 dbm	yes
mic pre-amp output	200	yes	0 dbm	+25 dbm	yes
monitor outputs	330	muted	1 V	10V RMS	no
fixed program out.	10k	no	1 V	10V RMS	no
headphones	47		load dependent	12V .4W	no

	Maximum Voltage	Maximum Current	Maximum Wattage
remote start contacts	50 VDC	300 MA	10W
muting contacts	48 VDC	1 AMP	24W

INSTALLATION AND WIRING

10.00 Console Placement

Because neither ventilation, nor access to the rear is required, the console may be placed in any convenient operating position. Opening the lid provides access to all operational components and connection points. The lid requires no rear clearance.

10.01 The console mounts on any sturdy table, with no large table cut-outs required. After placing the console to determine proper location, mark the cable slots through the chassis bottom plate on the table surface. The slots include up to four oval holes for input and output wiring, one rectangular hole for the power supply cable and several round holes, which can be used, if desired, for mic and external input cables. After drilling holes, replace the console in position and secure with two screws through the two holes provided in the front of the chassis bottom plate.

10.02 Power Supply

All console operating voltages are provided by an external rack mounted supply, which can also be placed on a shelf or floor near the console. Ten feet of connectorized cable is provided. Longer lengths, up to 20 feet total, may be added or ordered from the factory.

10.03 The unit contains five supplies which operate different console functions. These are:

Clock Supply	14 VDC and 14 VAC for the clock and timer.
B Supply	±18 VDC for the main audio section.
C Supply	±12 VDC (unregulated) for the muting relays and cue amp.
D Supply	+6.25 VDC for audio and digital control circuits.
M Supply	+3.8 VDC (factory set) for the LED meters.

10-04 Power supply front panel fuses protect B, C, D, and M voltages as well as both the switched and unswitched AC line inputs. LED lamps, wired after the fuses, indicate supply status.

10-05 The internal console on/off swich activates a relay in the power supply which controls all voltages except the clock supply. The clock and timer keep running, and hold their time sets if the console is turned off. A toggle switch inside the power supply activates the on/off relay for service when the supply is not connected to the console.

10-06 If the studio is not run full time, and the console is de-activated by switching the AC supply, a separate, full-time AC circuit may be provided to power the clock and timer . Wire the AC cable through the hole provided in the rear of the power supply box. Break the jumpers between terminals 1 and 5 and terminals 2 and 3 on the rear terminal strip and connect the AC line to terminals 1 and 2. Refer to parts layout drawing #PPW-2 for a pictorial of these connections.

10-07 For RFI protection, and to minimize ground loops, a single point ground system is employed in the console wiring. This ground is reference for all audio circuits and is tied to both console and power supply chassis. It can be accessed at the stud on the rear of the power supply and should be tied from this point only to the station ground.

10-08 Mic Inputs

The console employs a unique and simple method of connecting mics directly to any console input, or through external processing equipment. This is accomplished by wiring mic level lines first to one of the five balanced mic pre-amp inputs (an additional 5 are available as an option) on the mic pre-amp board on the left side of the console chassis base. These pre-amplifiers boost the mic signals to line level outputs. The balanced outputs are then manually wired to any console input in the same manner as other line-level inputs. No terminating resistor is required when wiring a mic pre-amp output directly to a console line input.

To isolate mic and line level cables, mic lines should be brought into the console through the designated hole, located in front of the mic pre-amp.

10-09 Because the mic pre-amp outputs are balanced and at line level, they can be wired through patch panels or external processing equipment before being connected to a console input.

10-10 Stereo mic sources can be created by using two of the available mic pre-amps. Single mic sources can be wired to feed both left and right channels by simply parallelling the mic pre-amp output into a channel left and right input.

10-11 Line Level Sources

Balanced line level inputs are wired to any of the 30 console inputs. Unbalanced sources may require that the - and G terminals be strapped together on that particular input. The console utilizes active balanced circuitry which may require a different approach to system grounding than you are currently utilizing. Consult the section titled "Active Balanced Circuitry" in the "Engineering Notes" section of the manual for more information. Note that for mono souces, the left and right inputs must be connected together. This will not load down a source since they are 10k inputs.

10-12 Auxiliary Switchers

Two banks of auxiliary 4 position switchers are provided for additional signal routing control. These passive, bi-directional, relay controlled, circuits are located on the right side of the console chassis base, and controlled by push buttons on the console surface. Inputs and outputs must be manually wired to the appropriate sources.

10-13 A switcher can be used as an input selector by wiring up to four sources to the input side of the circuit board and connecting the common to any console input. One typical application would be to select between four phone lines, while utilizing only one console input. It is not recommended that mic level signals be applied to these switchers.

10-14 A switcher can be used as an output director by wiring up to four feeds to the input side of the switcher board and connecting the common to the input of a tape machine or other send. One typical application would be to switch a tape recorder input between "program", "audition" and other external inputs.

10-15 External Inputs

Two stereo, high impedance, unbalanced external inputs are provided for signal monitoring. These inputs provide a load of no less than 4.7k ohms. Both inputs can be displayed on the auxiliary meter and selected as sources on the main monitoring circuit. Only external input #1 can be monitored in the headphones. These inputs are intended mainly as air-signal monitors, to be connected to the output of a modulation monitor, or other receiver. Level trims for these inputs are located by the monitor plug-in card.

10-16 Internal Oscillator

A 1000 Hz tone is included as a test source and signal generator. Its output is balanced, and the level, while adjustable, is factory set to give .78V rms into a bridging load. The oscillator circuitry, level control and on/off switch are located on the monitor plug in ciruit board.

The output of the oscillator appears on the main connector bulkhead. It can be permanently wired into any console input, wired to a patch panel, or used only during set up and test.

10-17 Program and Audition Outputs

Both output circuits provide identical stereo performance. Connections, located on the main connector bulkhead, are available for balanced, left and right channel outputs, and a summed mono feed. Level controls, located on the program and audition plug-in cards, attenuate all output levels. Outputs are low impedance, line level, but can

operate into any load greater than 600 ohms. If connected to unbalanced feeds, do not tie the "-" and "G" screws together. Rather, connect the source to the "+" and "G" terminals and leave the "-" terminal unused. For more information on active balanced circuits, see the pages titled "Active Balanced Circuitry", in the "Engineering Notes" section of this manual.

If it is necessary to use an output transformer, a Jensen 123-CL from Jensen Transformers in Hollywood, CA, is suggested.

10-18 An unbalanced, high impedance, isolated output is available for the program channel only. This "fixed program" output is intended for connection to the station PA amplfier, telephone music-on-hold or other source that needs an air signal feed. This souce must have its own input attenuator, since the feed does not have a dedicated trim pot, and should have a source inpedance of greater than 5k ohms.

10-19 Muting Relays

Three internal relays can be randomly assigned to activate when any console input is switched on. A relay will energize if its buss has been strapped to a particular input switch at the control card (see the "Programming" section for connection information), if that input button has been depressed, and if the channel is in the "on" position.

Each three pole relay has a factory wired monitor send switched through two sets of contacts. Mute buss 1 also controls muting of the cue speaker, and is therefore intended to be activated by the input(s) assigned to the control room mic(s).

10-20 Auxiliary Relay Contacts

One set of normally closed and normally open contacts are brought out to the connector bulkhead for each of the three muting relays.

These contacts can be utilized to control on-air lights and speaker muting circuits. 110V AC circuits should be isolated through an outboard relay and not connected directly to these contacts.

10-21 Remote Start Contacts

A set of normally open relay contacts appear below the input connections for each channel. These contacts close when the channel is activated only if input "A" for that channel is selected. They can be utilized to automatically, remotely activate any machine whose output is connected to an "A" console input.

The contacts can be programmed to provide momentary or holding operation. Refer to the "Programming" section for more information.

The contacts are rated at 300 MA, at 50V (10 watts maximum).

10-22 Monitor Outputs

The console contains no internal monitor amplifier. Three, unbalanced, stereo monitor sends are provided - each switched by one of the console muting circuits. These sends follow the monitor selector switch on the console front panel. The front panel volume control affects #1 output only.

Individually muted sends may be wired to separate amplifiers for studios where live mics are used. An alternative to separate amplifiers is to keep one send unmuted and switch speaker feeds with the auxiliary muting relay contacts provided.

10-23 Headphones

An internal headphone amplifier provides drive for high impedance and 8 ohm phones. Input source selection is via front panel push-buttons.

A trim pot on the headphone plug-in card, sets the nominal operating level.

10-24 Cue Circuitry

An internal cue amplifier and speaker are mounted on the console front panel. Any input can be switched to the cue circuit via the detent position of the channel fader, channel cue switch, or channel on/off switch. Consult the "Programming" sections for details on activating individual or combinations of these cue-control options.

An external, 8 ohm, cue speaker may be connected to the cue "G" and "out" terminals on the connector bulkhead. When doing so, disconnect the jumper to the internal cue speaker terminal. Do not attempt to operate two cue speakers simultaneously.

CALIBRATION AND LEVEL SET

12.00 The ESA-10 console is equipped to allow the user to precisely measure and control every important operating signal level. By accessing each individual input and output and setting optimum operating levels, it is possible to maximize the console headroom, signal to noise ratio, and minimize distortion components. Each of the following console set-up procedures should be done carefully.

12.01 Set-Up Meter

The internal set-up meter is provided to facilitate level set-up by providing a level reference for console performance. Calibrated test equipment can be substituted for even greater accuracy.

The meter has true VU ballistics and is calibrated so that 0 VU = 2V RMS, the ideal attenuator drive level in the ESA-10. The meter can be used with test tones or program material. When using program material, the meter should average 0 VU with occasional +3 peaks.

The meter can be used to check and calibrate individual channel inputs by clipping onto the input card test points, to check mic levels at the output of the mic pre-amp card, or to check and trim output levels by clipping onto various output connectors.

12.02 Line Level Inputs Calibration

Connect the test meter to the "G" and right or left test point of the input card being calibrated.

The front panel slide attenuators do not affect level at the test points, however, the channel front panel on/off switch must be on.

Select the input being calibrated on the corresponding front panel input push buttons.

Repeat the calibration procedures described in the following paragraphs with the test meter clipped to the other input stereo channel, to each input, and to every console channel.

12.03 Nominal input level is .78V RMS. With the input trim pots wide open (fully CW) a .78V RMS input signal will cause 0 VU reading on the set-up meter. Sources with output levels of approximately .78V RMS, and containing their own output attenuators, should be connected to inputs with the trim pots fully CW and adjusted at the source to give 0 db reading on the set-up meter.

Sources with outputs higher than .78V RMS and no individual output gain adjust should be connected to a console input and the console input trim pot adjusted CCW to provide 0 db on the set-up meter.

12.04 For sources with outputs lower than .78V RMS, the gain of the card can be increased by 20 db by cutting the 4 gain straps for that individual card. Refer to illustration 12A, at the end of this section, for the location of these straps on the foil side of each plug-in input card. This increases

sensitivity for all three inputs connected to that channel. Follow the same procedure outlined above for adjusting individual input levels. The nominal input sensitivity of the input card with the gain strap cut is .078V RMS.

12.05 Mic Level Input Calibration

Mic level signals must first be brought through a mic pre-amp for amplification to line level (consult the "Installation" section for more information).

12.06 When connecting mics to inputs with normal gain (gain straps in place), connect the test meter as described above and set the channel input gain trims for minimum attenuation (fully CW). Then adjust the corresponding mic pre-amp attenuator for 0 VU reading on the set-up meter.

12.07 When connecting mics to input channels with increased gain (gain straps out) the mic pre-amp output should first be established at approximately .78V RMS. Input trim pots should then be adjusted for 0 VU on the set-up meter.

12.08 If the mic pre-amp output is to be "looped through" external processing equipment, adjust the mic pre-amp input attenuator for the proper input level for that piece of equipment.

12.09 Output Level Adjustment

To preserve console headroom, an output level of +8 dbm into 600 ohms, or 2V RMS is suggested. To calibrate the output level, connect the set-up meter to the Program or Audition, left, right or mono output. Using a properly pre-calibrated input with the front panel slide attenuator set to the -15 db mark, adjust the line amp plug in card trim pots to

set 0 VU on the test meter. While this adjustment is being made, make sure that the output is terminated into the load it will be feeding, as output loading will effect the level. If a level other than +8 dbm is desired, adjust trim pots to that level.

12.10 LED Meter Calibration

Each console meter has three adjustments, which should be made using a tone generator after all other console level adjustments have been completed. Refer to illustration 12B, at the end of this section, for the location of all of the variable meter controls on the rear of each meter.

12.11 To set meter sensitivity, connect the internal tone generator (or other sine wave source) to a console left and right input with channel attenuator set at the -15 db mark. Use a calibrated meter to determine that the line outputs are at the desired level. Set the meter response mode switch for VU.

Adjust the left and right sensitivity controls to light the last yellow LED, for 0 VU reading.

12.12 To set the peak flasher, first determine what level above 0 db you want the flasher to indicate. This will depend on overall system headroom, and/or processing. However, between 10 db and 14 db is generally practical. Increase the tone level by this amount, as indicated on the external meter monitoring output level. The bar graph meter should "peg".

Set the peak indicator threshold control to just light the peak indicator LED on the back of the meter. This LED is provided because unlike the peak lamp on the front of the meter, it has no holding function - enabling more accurate calibration.

12.13 To operate the meter in the peak mode, select peak on the response mode switch and follow the same calibration procedure. However, sensitivity controls should be adjusted with the tone set at the peak output level of the desired nominal output level. Otherwise, meters will be overly sensitive, and "peg" continuously. It is suggested that the peak flasher be adjusted to illuminate at this same peak level.

12.14 The auxiliary meter should be calibrated as described above, using the mono outputs from the program and audition line amps. Use a tone for calibration, monitoring the mono outputs from the program and audition circuits.

This calibration should be completed prior to setting external monitor input levels.

12.15 External Input Trims

Trim pots located next to the plug-in monitor card set left and right levels for the external monitor inputs.

The minimum suggested input level is .5V RMS nominal and, while no meter test points are provided, these inputs can be displayed on the auxiliary meter for level calibration.

12.16 Headphone Level Trims

A trim pot on the rear of the headphone plug-in card sets the nominal operating level of the front panel headphone volume control.

To adjust this setting, select a music input and display it at 0 VU level on the LED meter display. Set the front panel headphone volume control at 12:00 and monitor the signal on the standard station phones. Set the trim pot for a moderate monitoring level.

Illustration 12-A

Gain strap locations

input plug-in boards, foil side

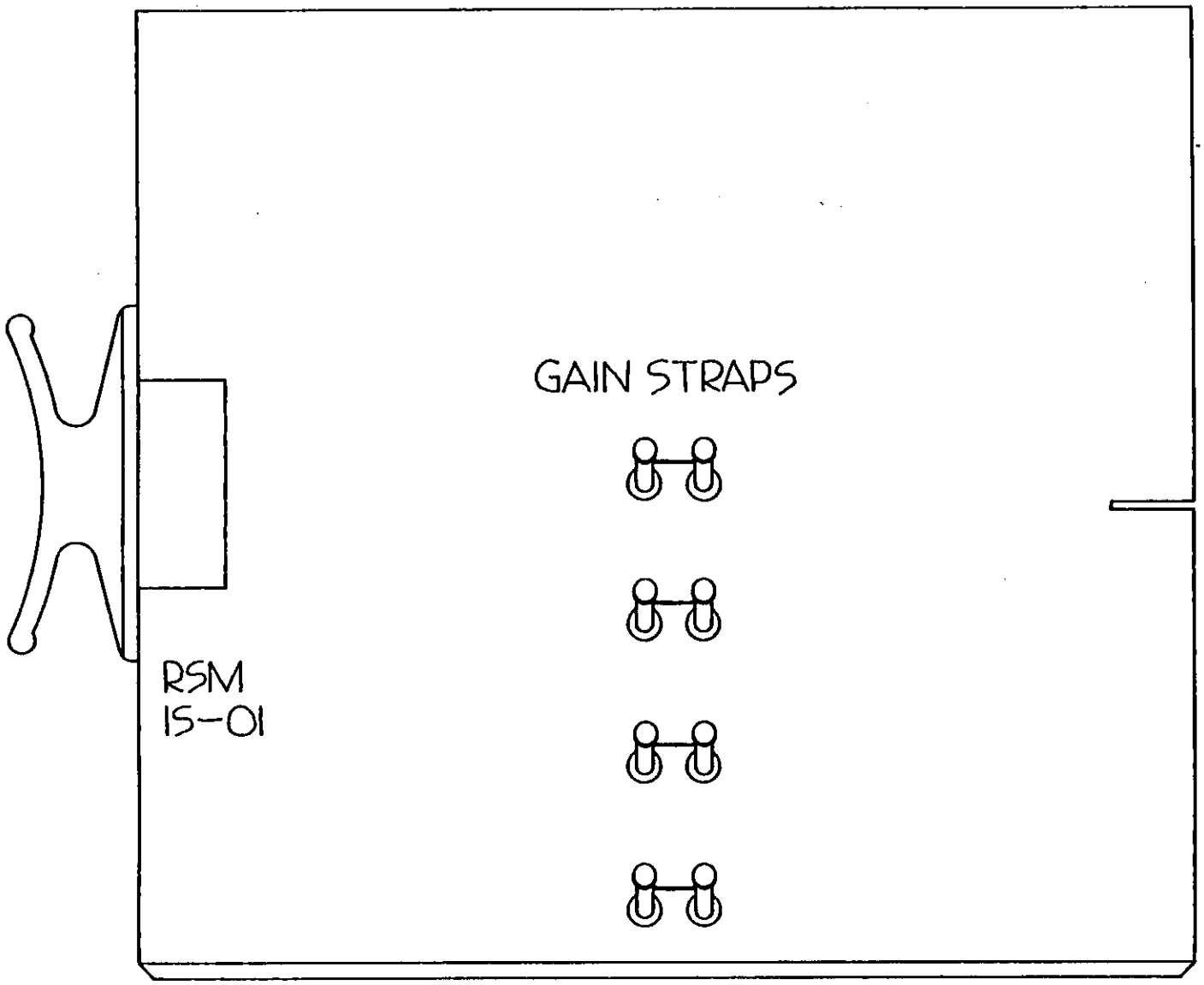
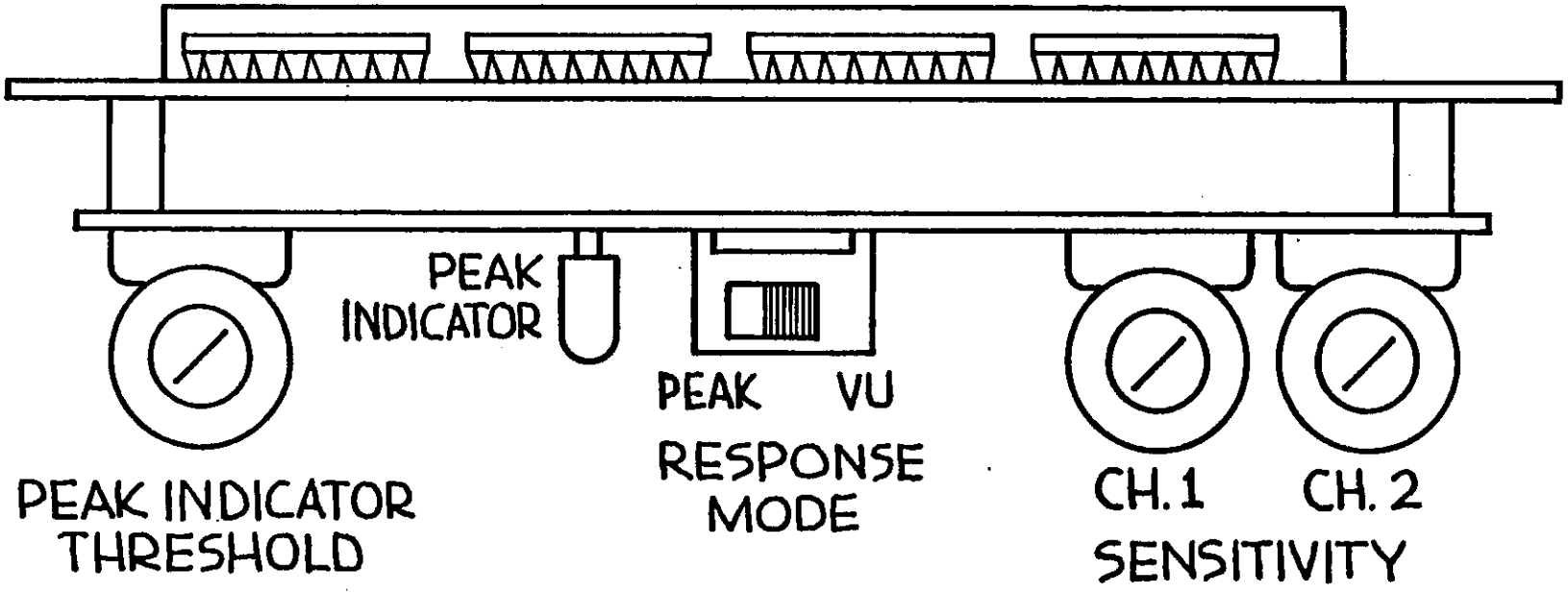


Illustration 12-B

Bar graph meter control locations



FUNCTION PROGRAMMING

14.00 The ESA-10 console allows user selection of several control options in the cue, muting and remote control functions of the console. These options are activated by installing various "option straps" between pins located on the control circuit boards, mounted behind each channel fader. Options must be individually programmed for each channel, on that channel's control board.

Choice of channel operating options will depend on operator preference, and input equipment interface requirements.

14.01 Muting Busses

Three muting relays are supplied internally to the console. Consult the paragraph on "Muting Relays" in the "Installation and Wiring" section for function information.

To assign muting busses to console input:

1 - Refer to illustration 14A at the end of this section.
2 - Connect and solder "option straps" for buss 1, 2, or 3 pins to input A, B, or C pins for each channel.

Important Notes:

1 - Busses can be strapped to any number of console inputs.
2 - Buss #1 mutes the cue speaker, and is therefore intended to mute control room monitors.
3 - Mute relays are activated when the strapped input is selected and the channel is turned on.
4 - The console is shipped with no muting straps in place.

14.02 Cue Mode Selection

Three modes are available at each channel to activate the cue channel. They are:

1 - Cue on Detent - activated when the slider is brought down into the cue position. This is the "traditional" method for getting into cue.

2 - Cue in Place - activated whenever the cue button is depressed. This allows cueing of the source without disturbing its pre-set fader level.

3 - Auto Cue - activated when the channel is switched off. This is useful for cueing remote controlled equipment like turntables. In this mode, the source, when turned off by the console, is automatically put into cue, then back into program when switched back on.

To assign cue modes to each channel:

1 - Refer to illustration 14B at the end of this section.
2 - Connect no option straps for cue on detent.
3 - Strap pins 1 and 2 for cue in place.
4 - Strap pins 2 and 3 for auto cue and cue on detent.

Important Notes

1 - The cue button must be down for any cue modes to activate.
2 - Cue is exclusive of program and audition.
3 - The cue button will light only when the cue circuit is actually activated.
4 - Channel remote starts remain operative in cue.

5- If cue is activated and the channel is left on, the on switch will flash to indicate that the channel is "hot" and will return to on when cue is de-activated.

6 - The console is shipped with no straps installed (cue-on detent active for each channel).

14.03 Timer Auto-Reset

The internal console up-timer can function as an event timer, automatically triggered by channel-on switches. In this mode, the timer will indicate the time elapsed for the most recent source activated. The automatic reset function is armed when the timer switch is in the "auto" position. An LED on the timer face lights to confirm that the timer is in the auto mode.

The console is shipped with no timer auto-reset functions activated.

To activate the auto-reset timer function for a channel:

1 - Refer to illustration 14B at the end of this section.

2 - Connect a strap between the two timer reset pins.

14.04 Remote Start Function

On/off switching for each channel activates a remote control relay which can be connected to the A input source for remote control. Consult the paragraph on "Remote Control" in the manual "Installation and Wiring" section for additional functional information.

The remote control relay can be strapped to function in three ways. Refer to illustration 14B at the end of this section for the location of programming straps on the foil side of each control card.

1 - With no straps in place, the contacts will close momentarily when the channel goes from off to on. This function is useful when controlling cart machines.

2 - With straps from pins 2 to 3, the contacts will close momentarily when the channel goes from on to off and again when the channel goes from off to on. This function is useful when controlling equipment with internal on/off flipflops, such as Technics turntables.

3 - With straps from pin 1 to 2, the contacts will stay closed whenever the channel is on. This function is useful when controlling sources with no internal logic, such as most rim-drive turntables.

Important Notes

1 - For options 1 and 2 above, contact action will occur only when the channel is changing status. Repeated pushing of either button will not activate the contacts more than once.

2 - The remote start relays activate only when the "A" input is selected. "A" sources will not be false triggered when airing B or C inputs.

3 - The console is shipped with no straps in place (contacts close momentarily when the channel goes from off to on).

14.05 Clock Operation

To accurately synchronize the console clock to the station time standard:

1 - Refer to illustration 14C at the end of this section.
2 - Use a pointed object to depress buttons through the clock-set holes.
3 - Depress the stop button.
4 - Depress fast, then slow buttons to set the clock slightly ahead of real time.
5 - When set time exactly coincides with real time, depress start.

Important Notes

1 - The clock and timer will continue to run if the console power switch is turned off.

2 - Consult the "Power Supply" paragraph in the manual "Installation and Wiring" section to wire clock and timer power independently, which will allow switching of console main power without affecting clock settings.

3 - The console is shipped for clock 12 hour format operation. Consult P.C. layout drawing #CLK-1 in the manual "Parts List" section for conversion to 24 hour format operation.

Illustration 14-A

Muting strap locations

control boards, component side

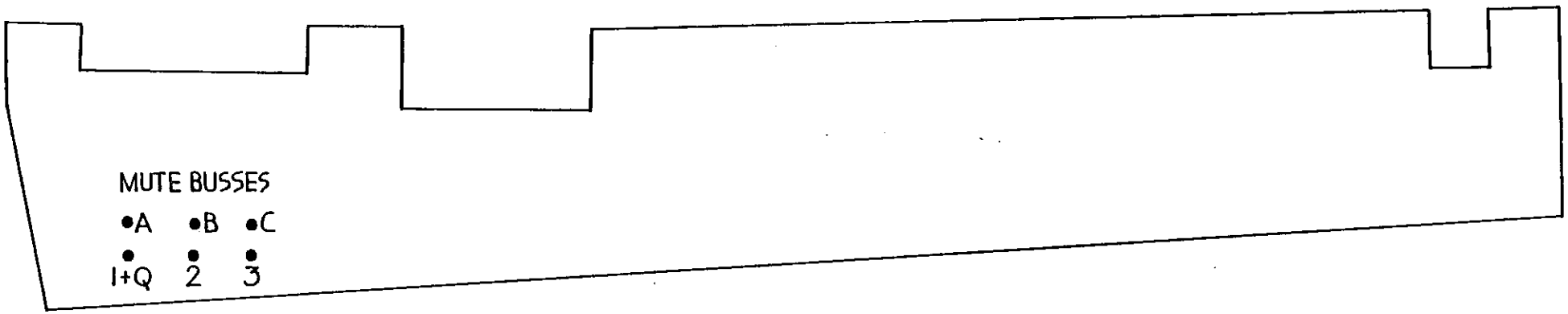


Illustration 14-B

Cue, Timer, Remote Control strap locations

control boards, foil side

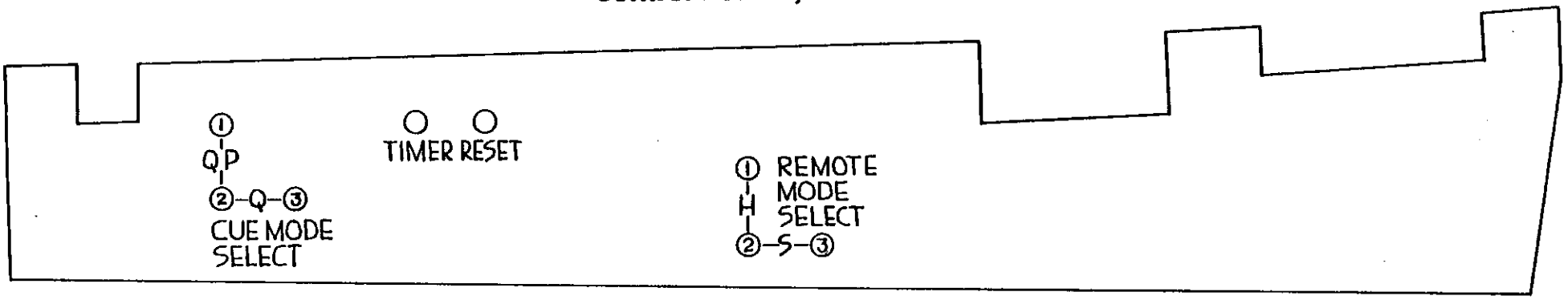
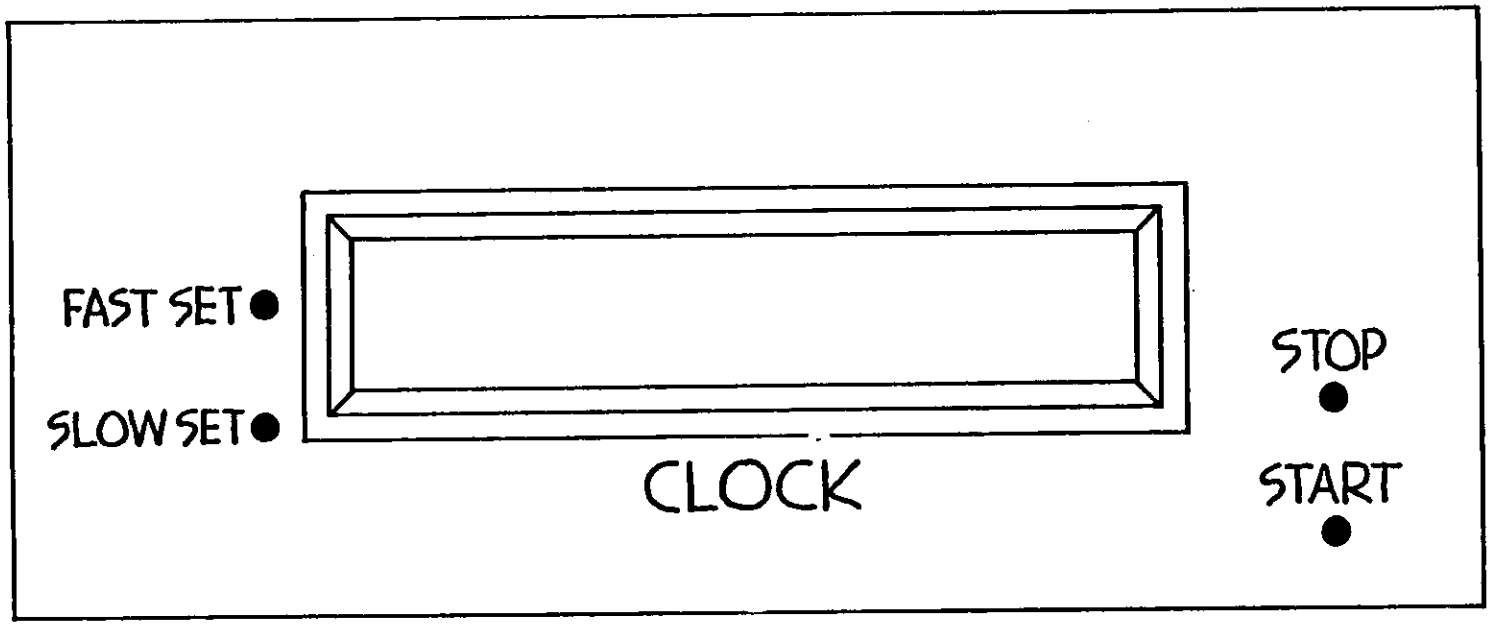


Illustration 14-C

Clock control locations

front panel clock holes



OPERATION

16.00 The ESA-10 has been designed to offer the greatest combination of user flexibility and operating ease. Obviously, the console should be installed and operated in accordance with station format, personnel habits and engineering principles.

The following sections suggest some operational possibilities which were considered in the console design.

16.01 Input Assignment

Commonly used sources, should be assigned to "A" inputs. These inputs can be remote started, and this helps distribute main sources across the board for smooth transitions.

Colored slider knobs are available from Radio Systems in red, blue, yellow, green and white. These can be used to create color coded input groups such as faders 1, 2, and 3 colored white for mics, 4 and 5 green for turntables, 6 and 7 blue for cart machines, etc.

A complete set of pre-printed input switch labels are included to title every input and auxiliary input switch with the name of the audio source.

16.02 Mic Use

Mic channels should always be activated with the slider down, and then potted up to avoid a sudden "room rush" of background sound.

Caution should be taken to leave the cue button in the off position on a channel where a control room mic input is selected. This is because muting circuitry is activated only when the channel is on, and feedback can result if a control room mic is put into cue with the channel in the off mode.

If additional, unused mic pre-amps remain, they can be utilized by installing mic connectors in air or other studios, and wiring these inputs through the mic pre-amps to unused C inputs, or patchpanel positions.

16.03 Channel Switching

On/off switches at the bottom of each attenuator provide three functions. First, they activate channel audio, routing signal to the program and audition channels. Second, they activate remote start relays when the A inputs are selected. Thirdly, the off button can be strapped to automatically place the channel in cue when it is turned off.

Because of the function of these buttons, sliders need not be moved when changing from one audio source to another.

16.04 Cue Circuitry

The cue pushbutton at the base of each pot arms the cue function. Cue can then be activated in one of three ways which is individually programmable for each channel.

16.05 Cue on Detent is the traditional method of activating the cue circuit when the fader is brought fully down. Cue will then activate if the cue button has been pushed and the lamp in the button will illuminate. If the channel has been left switched on, the on lamp will flash to indicate that the channel is "hot" and that the audio will be routed to program or audition when the fader is brought up.

16.06 Cue in Place routes the audio to the cue channel whenever the cue button is pushed, regardless of attenuator position. This is useful for monitoring audio, such as listening for a network cue, without disturbing attenuator settings. Since cue is an exclusive function, audio is switched off the program and audition channels when the cue button is pushed and then restored to these main channels when the cue button is pushed again.

16.07 Auto-Cue is available as a special operating convenience which is especially applicable to turntable use. In this mode, when the cue button is depressed, cue is activated whenever the channel is switched off. When used with a turntable, the channel would be switched off after a cut had aired. This will automatically stop the turntable and place the channel in cue. The record could then be changed and cued up. To air this new cut, simply depress the channel-on button. The turntable will start and the audio will be switched back into program or auditon. The channel attenuator is never touched.

Auto-cue can be set to operate in conjunction with cue-on-detent.

16.08 Output Routing

Program and audition busses illustrate identical stereo performance and each provides mono mix-down outputs. Audition can be utilized to feed a separate, or back-up audio chain or to preview or record material.

16.09 Specific outputs can be routed to program and audition simultaneously to create a "mix-minus" feed, especially useful for studio "foldback" monitoring and talk show applications.

"Foldback" monitoring usually implies the creation of a monitor feed minus the studio mic inputs. This allow live monitors in a studio where mics are in use. To set up foldback monitoring, route all but the mic inputs to the audition and program channels. Route the studio mics to the program channel only. Feed the studio monitors with audition signal and the air chain with program signal.

Talk show hybrid telephone patches frequently require a return feed to the caller that does not contain his own voice. To accomplish this, the host should be routed to program and audition and the caller to program only. The audition channel should then be fed back to the telephone hybrid and program audio used to feed the air chain.

16.10 Monitor select switches on the right hand side of the console allow the studio speakers to monitor program, audition, and two external inputs. All monitor sends follow these switches.

The headphones have their own selector which routes program, audition, external input #1, and cue to the phones.

16.11 Monitor and headphone volume controls are also located on the console right hand side. The monitor volume controls only monitor #1, usually assigned to the control room speakers.

The headphone circuit has an internal volume trim on the headphone card to set nominal listening levels.

16.12 Two auxiliary switcher rows are provided for discretionary use. They can be wired as input selectors to expand any console channel by three additional inputs. For instance, a switcher might be assigned to select between four phone lines. The output of the switcher is then wired to any console input which must be selected to activate the switcher.

16.13 A switcher can also be wired as an output director. In this case, various console outputs such as program, audition and other outputs are connected to the switcher input. The output of the switcher is then wired to a source such as a tape machine. The tape machine input can then be switched between these various feeds.

16.14 The bar graph meters have been specifically manufactured to provide an attractive and clear graphic representation of the audio signal. Color changes dramatically show when the audio is approaching or has reached upper levels. The peak indicator segment at the far right can be programmed to show when the audio has reached the upper limit of signal handling capability. Left and right channels are displayed in the same viewing frame for operator convenience.

16.15 Meters can be internally programmed to display peak or VU balistics. VU movement approximates the average signal level and peak response shows the instantaneous signal peaks, an important consideration in signal processing and dynamic range.

Different meters can be set up for both types of response to view these display options simultaneously.

16.16 The auxiliary meter is switchable between mono and external signals. Displaying the program and audition mono signals provides a convenient phase check. Out-of-phase signals show a mono display of reduced signal level as compared to the stereo display.

External signals, such as the air feed, can be selected to provide a visual check on these inputs.

16.17 The timer, on the right hand side of the console turret, is a six digit up-counter that displays events lasting up to 9:59:59. It can function as a manual timer by leaving the "auto" switch in the down position and using the stop/start/reset buttons.

The timer is also wired to function as an automatic event timer when the "auto" switch is in the up position. In this case, the timer will automatically reset and start to count up whenever a channel, internally strapped for this option, is cycled from off to on. In this way, the timer will always display the elapsed time of the last event initiated, such as the time progressed on a record cut or cart tape.

Normally, turntable and tape channels are user strapped for this option and mic and auxiliary channels are not.

16.18 The left side of the console turret houses a time-of-day clock. It can be user selected for 12 or 24 hour time display. The clock can also be provided with separate power, to hold its setting if console main power is interrupted.

Holes on the right and left side of the clock face access time-set and clock run and stop switches which are used to exactly synchronize the clock to station time.

THEORY OF OPERATION

18.01 Power Supply Circuit Description

The power supply consists of five supplies, each providing separate voltage levels to operate different console functions. The control/clock supply provides 14VDC and 14VAC to run the clock and timer. It also provides power for relay RL 1 which operates the main supplies. The control/clock supply is on as long as the power supply is plugged in. This keeps the clocks running if the power is turned off by the power switch in the console. It is possible to connect a separate line cord for the control/clock supply if the console is to be turned off from a main breaker. This avoids having to reset the clocks each day. When the connection between the console and power supply is disconnected, the main supply is turned off. This can be defeated by turning on the service power switch inside the power supply

The B supply provides +18V for the main audio sections. IC101 and IC102 are the respective voltage regulators. The B supply ground is called the analog ground and is the reference ground for the audio circuits. The shield of the supply cable and the chassis of both units are tied to this ground.

The C supply is unregulated at +12V. It supplies power for the mute relays and cue amp and has a separate ground return from the console but shares the B ground at the supply.

The D supply is used for the control circuits in the audio chain and the digital level controls. IC103 is an adjustable regulator with VR2 as the control element. VR2 is adjusted so the D+ voltage at the console is 6.25V.

The bar graph meter supply M, uses a discrete regulator IC1, Q1, Q2, with remote sense. The remote sense compensates for line loss to the console. VR1 adjusts the M supply so the M+ voltage at the console is sufficient to saturate the bar graph drivers with varying LED on-voltages.

To maintain supply isolation, four different ground returns are used, T & M (timer and meter) D, C and B (analog).

LED indicators for the B, C, D and M supplies are on the output side of the fuses. Should a fuse blow, the LED will go out but the supply may still be OK.

NOTE: Due to the remote sense circuitry of the M supply, the LED will remain lit at lower intensity, if the M supply fuse blows, and the supply is still operating.

18.02 Input Stage Circuit Description

The inputs are of the active balanced type and provide a minimum load of 10k ohms. Each input has a pot (VR1 > VR6) which is used to optimize the input levels.

Input switching is accomplished by IC1 and IC5, differential 4 pole CMOS switches. These feed the input pre-amps, IC2 and IC6, which have two gain settings, +15 db and +35 db. The output of each pre-amp appears at a test point so levels can be monitored and set.

To control attenuation, two CMOS digital step attenuators are used in parallel, one for each channel. The fader control acts as a pot whose output voltage drives the control processor. The processor converts the fader voltage into digital codes. The attenuator chips use the codes to attenuate the input voltages in a series of steps from 1 to 40. Each step is 1.5 db for a total of 60 db. At the extreme bottom end of the fader, the attenuators shut off completely. The data busses for the attenuators are in parallel so that the left to right matching is a function of chip accuracy which is about 1/4 db. IC4 and IC7 are low noise unity gain op-amps which convert the input signal current from the attenuators into signal voltage.

IC9 and IC10 are buss select switches. These are identical to the input chips, operated backwards.

All control signals come from the control board through a 14 conductor ribbon cable.

18.03 Control Board Circuit Description

The control board generates all control signals for its corresponging input board. Signals for remote start, timer reset and muting circuits also originate here.

Input selection is accomplished by a two wire digital code from the input select switch. Q6 turns on and off with the ON/OFF switch to operate the input select CMOS switches simultaneously with the buss select CMOS switches for better off isolation.

The ON/OFF switches are momentary, hall effect types operating a NAND latch for bounceless switching.

Buss select, cue select and ON/OFF are accomplished by the buss select switch chips on the input card. A three wire digital code performs this operation. When cue is selected, diodes D2 and D3 bypass any buss switch or ON/OFF latch condition to select cue. Q5 and D1 set the attenuator control voltage to provide audio signal level when in cue.

Q1 is driven by the latch output for ON/OFF control. Q8 is driven from the same point to control muting through the input select switch. The remote start/stop function is also controlled by Q8 through input A select to Q9 and Q10.

Timer reset is a momentary pull to ground by Q7, which is capacitively coupled through an inverter to the ON/OFF latch.

Q2 turns on when the channel is off. If the "Q" terminals are jumpered and SW3, the cue switch, is closed, the channel will go into cue at that time. Q4, a programmable unijunction transistor, oscillates at about 1 Hz. Q3 is pulsed by this oscillator and robs drive from Q12 causing the ON light to flash if the latch is in the ON state and the channel is in cue.

18.04 Mic Pre-Amp Circuit Description

The mic pre-amp is unique in that it does not use a transformer input. Q1, a very low noise differential pair, combined with IC1, form a semi-discrete op-amp.

IC2 is an inverter with a gain control element R6. IC3 inverts the output of IC2 to supply the second side of the differential ouput.

The output is capable of driving a 600 ohm load to +23 dbm.

18.05 Line Amp Circuit Description

The line amp card uses low noise, unity gain stable op-amps as input stages. These are the main mix-buss amplifiers, IC1 and IC5. For best performance, these are operated at a gain of 1. IC2 and IC6 are the main gain amps for the left and right channels, operating at +25 db. The gain trimpots, VR1 and VR2 allow proper adjustment of the line output levels.

IC2 and IC6 provide the positive side of the differential output through isolation resistors and bypass capacitors. IC3 and IC7 are phase invertors which drive the negative side of the output in a similiar fashion.

IC4 and IC8 are differential amps which provide auxiliary feed for meters, monitors, and headphones. Since IC4 and IC8 look at the output side of the isolation resistors, they will reflect any voltage drop across them due to loading and thereby accurately reflect the actual line output.

R33 and R34 provide a resistive mix of the left and right channels. VR3 is the mono gain trim. IC9, IC10, and IC11 operate in a like manner for the mono output.

All the output stages are 5534s and are capable of driving the line directly. Output blocking capacitors keep any offset from the output and any external DC from getting back in.

18.06 Monitor Amp Circuit Description

The DC control scheme for switching and level control is identical to that in the headphone amp. IC2 and IC4 are fixed gain amps driving the #2 and #3 muted outputs through 330 ohm resistors. IC3 and IC5 are used as voltage controlled inverters. The LDRs control the gain of the stage for volume control.

The monitor amp card also contains the test oscillator circuit. IC6 has two RC networks in a positive feedback path to cause oscillation. VR3 is the output level control and functions by controlling negative feedback. VR2 also controls negative feedback and is adjusted to keep the output from clipping with VR3 set at maximum output. IC7 inverts the output of IC6 to form the negative half of the balanced source. The oscillator can deliver a 1000 Hz signal into 600 ohms at +23 dbm at acceptable low distortion levels.

18.07 Cue Amp Circuit Description

The cue amp uses a dual power op-amp for both input and output functions. The input half functions as the summing amp for the cue mix buss. The output of IC1 provides signal to the headphones. Relay RL1 shorts the input of the output section for muting.

The output of IC1 will drive an 8 ohm speaker directly. R10 and C6 provide high frequency loading for stability.

18.08 Headphone Amp Circuit Description

The headphone amp utilizes DC control for both switching and level control. A three wire digital code operates IC1, a CMOS switch. DC control of level is accomplished by LED coupled, light dependent resistors, (LDR).

The current through LDR1 and LDR2 is controlled by adjustable current source Q5. As the current increases the cell resistance decreases, increasing the gain of IC2 and IC3, the headphone amps. LDR1 and LDR2 are matched to give good left to right tracking. VR1 is used to trim the current of Q5, thereby adjusting the gain for any given front panel level control setting.

IC2 and IC3 are used as drivers for current boosters Q1, Q2, Q3 and Q4. The output of these stages is decoupled by R18 and R24. These resistors compensate for different headphone impedances. Headphones between 8 ohms and 600 ohms will give approximately the same volume level for a given control setting.

18.09 Bar Graph Meter Circuit Description

These meters are designed to provide the optimum in signal monitoring for a broadcast console.

Circuit board VM2 performs signal processing for both channel displays. IC201 and IC202 are input amplifiers and precision full wave rectifiers. One section of each quad IC is a DC amplifier to provide proper drive signal to the bar graph drivers.

SW1 selects the detector mode for VU or peak displays.

IC203 is a comparator which looks simultaneously at left and right signals and will trigger the peak flasher when either level exceeds the set level. D209 indicates peaks before the holding circuit to enable more precise setting of the peak.

Board VM1 is the display and driver board. The driver chips are operated in the bar mode with their reference ladders connected in series. Each ladder is shunted by a precision resistor for maximum accuracy. JC109 provides on-card regulation of the reference ladder source voltage.

The voltage feeding the LEDs is approximately 3.75 volts and is regulated in the supply to avoid flashing.

The four display packages contain 40 segments but only 38 are utilized. The display closely simulates the standard VU meter scale.

While this meter is accurate, because it is not analog, there is quantizing error. Therefore, it is not intended as a lab measurement device.

18.10 Clock and Timer Circuit Description

Both the clock and timer use a CMOS clock chip to provide time counting, logic and multiplexing functions.

IC2, a NAND latch, provide start and stop logic interfacing. In the timer, IC2 also resets the timer at 9:59:59 to zero.

The CMOS clock chip, IC1, cannot drive LED displays without output transistors. Therefore, there is a digit driver for each digit chip and a segment driver for each like segment of all digit chips. The multiplexing function of IC1 keeps all this in order for a proper display.

MAINTENANCE AND TROUBLE SHOOTING

20.0 There is no required maintenance for the ESA-10. All pots (except cue level) and switches handle DC only and therefore will not become "noisy". A very dirty pot will skip levels erratically. Normal cleaning agents may be used to clean the pots.

Painted surfaces should be cleaned with a warm damp cloth with mild detergent. Avoid any solvents that might attack plastic switches or meter and clock lenses.

Vacuuming or blowing dirt off of circuit boards occasionally is also recommended.

20.1 The ESA-10 is designed for ease of repair should it become necessary. All active components, except those on the cue amp board, are either on plug-in sockets or on easily removable P.C. cards. Since the electronics for each channel are identical, the simplest and most logical approach to trouble shooting is exchanging parts, boards, and cables to determine the defective part.

20.2 Much of the audio control circuitry for the ESA-10 console is sophisticated and factory repair is recommended for problems in circuit boards that defy basic repair attempts. For this reason, a simple and liberal factory exchange program has been instituted for defective boards. Consult the warranty information sheet for details.

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