

LIVE SHOW LIGHTING CONTROL  
EPCOT CENTER  
December 14, 1981

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SPECIFICATIONS  
TITLE

SPECIFICATIONS  
LIVE SHOW LIGHTING AND CONTROL SYSTEM  
DESIGNED BY ELECTRONIC THEATRE CONTROLS, INC.  
FOR EPCOT CENTER

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Electronic Theatre Controls, Inc.  
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- APPENDIX 1 - AMP Catalog No. 73-204 Circular Plastic Connectors
- APPENDIX 2 - T&B Ansley Product Cut Sheet BLUE MACS "D" connector
- APPENDIX 3 - Amphenol Product Cut Sheet UHF Coaxial Connectors

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REFERENCE DRAWINGS

Sheet No.	Sheet Title	Latest Rev. No.	Date
LSLC-001	Live Show Lighting Control System System Architecture	-	12/14/81
LSLC-025	Live Show Lighting Control System Console Panel Layout	-	12/14/81
LSLC-035	Live Show Lighting Control System Remote Focus Unit Panel Layout	-	12/14/81

PART 1.00 - TECHNICAL SPECIFICATIONS

1.01 DESCRIPTION

- A. The intent of this Section is to describe the technical specifications, both electrical and mechanical, for the LIVE SHOW LIGHTING CONTROL SYSTEM for EPCOT CENTER that is being designed and produced by Electronic Theatre Controls, Inc.

1.02 ARCHITECTURE - GENERAL

- A. The system shall consist of three separate assemblies:  
-Main Frame  
-Console  
-Remote Focus Unit

Each assembly will have its own processor and communications between the assemblies will be EIA RS-422 standard serial transmissions over Owner Provided cabling (Ref. Drawing LSLC-001).

- B. The main processor for the system will be contained within the Console and will be responsible for fade calculations as well as the other control functions described in Part 2.00 of this document. This processor will transmit the levels for 224 dimmer outputs to the Main Frame. The maximum distance between the Console and the Main Frame is 4000'.
- C. The processor in the Main Frame will control the digital to analog conversions as well as the analog to digital conversions required to 'read back' the levels from an Owner Provided manual control board. There will also be an un-programmed RS-422 interface in the Main Frame.
- D. The Processor in the Remote Focus Unit will also communicate to the Console processor and will decode and transmit operator commands from a remote location. There will be interface connections for the Remote Focus Unit on both the Main Frame and the Console with the maximum distance between the Unit and the Console of 4000'.

1.03 DETAILED HARDWARE SPECIFICATIONS

A. Main Frame

1. Electrical

a. Processor

The processor will be an 8-bit Z-80 CPU on a STD bus card (Mostek MDX-CPU2-4).

-EPROM program storage

-RAM

b. Serial Interfaces

One dual port RS-422 serial interface card (Mostek MDX-422N).

-RS-422 synchronous interface to the Console at a transmission rate of 57.6 to 76.8 KBaud.

-RS-422 un-programmed port.

c. Dimmer Output

Analog control circuitry for 224 dimmers.

-32 dimmers per STD card (ETC IO-03).

- 0-24 VDC @ 5 MA. per output.

d. Analog Input

Analog input from 224 channel Owner Provided manual controller.

-32 dimmers per card

- 0-10 VDC input

d. Power Supply

Redundant DC power supplies

e. AC Power Requirements and Circuit Protection

10 A input with RF filtering and circuit breaker

-120 VAC @ 10 A max.

-10A push to reset circuit breaker

(Potter & Brumfield P/N W58XB1A4A-10)

-RF line filter

(Corcom P/N 10KV1)

2. Connectors

a. Console Interface

Panel mounted receptacle

-Amp Circular Plastic Connector Series 1 reverse sex square flanged receptacle 14 contacts with 12 used

(Amp P/N 206043-1)

- Solder tab gold-plated socket contacts (Amp P/N 202237-1) or;  
Crimp connect gold-plated socket contacts (Amp P/N 66183-1)

Mating connector (for Owner Provided cable)

- Amp Circular Plastic Connector Series 1 reverse sex plug (Amp P/N 206044-1)
- Solder tab gold-plated pin contacts (Amp P/N 202236-1) or;  
Crimp connect gold-plated pin contacts (Amp P/N 66182-1)
- Standard Cable Clamp (Amp P/N 206070-1)

b. Remote Focus Unit Interface

Panel mounted receptacle

- Amp Circular Plastic Connector Series 1 standard sex square flanged receptacle 9 contacts with 6 used. (Amp P/N 206486-1)
- Solder tab gold-plated pin contacts (Amp P/N 66570-3) or;  
Crimp connect gold-plated pin contacts (Amp P/N 1-66507-2)

Mating connector (for Owner Provided cable)

- Amp Circular Plastic Connector Series 1 standard sex plug (Amp P/N 206485-1)
- Solder tab gold-plated socket contacts (Amp P/N 66569) or;  
Crimp connect gold-plated socket contacts (Amp P/N 1-66505-2)
- Flexible Cable Boot (Amp P/N 207489-1) and;  
Internal Cable Clamp (Amp P/N 207490-1)

c. Dimmer Control Interface

Panel mount socket connector (7 connectors)

- 37 contact "D" type mass terminated connector (TB Ansley P/N 609-37S)

Mating Connector (for Owner Provided cabling)

- 37 pin "D" type plug (TRW)

- d. Manual Controller Interface
    - Panel mount socket connector (7 connectors)
      - 37 contact "D" type mass terminated connector (TB Ansley P/N 609-37S)
    - Mating Connector (for Owner Provided cabling)
      - 37 pin "D" type plug (TRW)
  - e. AC Power Input
    - Line cord with grounded straight bladed connector
      - 6'6" 16 AWG 3 wire type SJT with molded NEMA 5-15P plug (Belden P/N 17614C)
3. Mechanical
- a. Card Cage
    - 16 Slot STD bus card cage
      - Terminated bus with remoted PBReset switch (Mostek MDCC-16)
  - b. Enclosure
    - Rack mountable enclosure
      - 7" vertical panel height
      - 30" max depth
      - Fan cooled
      - Connectors on back of enclosure
      - Card cage accessed from front
- B. Console
- 1. Electrical
    - a. Processor
      - The processor will be an 8-bit Z-80 CPU on a STD bus card (Mostek MDX-CPU2-4).
        - EPROM program storage
    - b. RAM
      - The system shall contain at least 48 K bytes of dynamic random access memory on two STD bus cards (MDX-DRAM-32-4).
    - c. RS-422 Serial Interfaces
      - Two dual port RS-422 serial interface cards (Mostek MDX-422N).
        - RS-422 synchronous interface to the Main Frame at a transmission rate of 57.6 to 76.8 KBaud.
        - RS-422 asynchronous interface to an Owner Provided printer.

- RS-422 asynchronous interface to the DEC TU58 tape drive at a transmission rate of 38.4 KBaud.
- RS-422 asynchronous interface to the Remote Focus Unit at a transmission rate of 300 to 19.2 KBaud.
- d. CRT Controllers  
Two STD bus monochrome CRT controller cards (Matrox STD-ALPHA)
  - RS-170 Video output
  - 80 characters X 24 lines
- e. ETC Serial MUX  
TTL level serial multiplexer 16 I/O lines
  - Serial interface to Fader Module
  - Serial interface to Operator Keyboard
- f. DEC TU-58AB Tape Drive  
Cassette tape storage unit
  - System will load contents of RAM onto tape after one (1) minute power failure.
- g. Fader Module  
Automatic Fader control module (ETC P/N PI-05)
  - Z80 processor
  - EPROM program storage
  - TTL serial interface to the ETC Serial MUX
  - Four 51 segment LED bargraphs
  - Four 51 contact membrane touch switches
  - Six discrete membrane switches with indicator LEDs
  - Eight discrete LED indicators
- h. Operator Keyboard  
Main Operator interface for setting and recalling cues and interface to Manual Fader Module.
  - Z80 processor
  - EPROM program storage
  - TTL serial interface to the ETC Serial MUX
  - 49 discrete membrane switches
  - 32 discrete LED indicators
  - 3 four digit LED displays, 1 three digit LED display

- One 51 contact membrane touch switch
  - One linear Potentiometer
  - Interface to Manual Fader Module
  - i. Manual Fader Module  
Manual fader control module with twenty-four Submasters with illuminated Bump switches and one Split Dipless Crossfader.
    - Interface to Operator Keyboard
    - Twenty-six linear slide potentiometers
    - Twenty-eight discrete membrane switches
    - Twenty-eight discrete LED indicators
  - j. Power Supplies  
DC power supplies for logic
    - Battery Back-up
  - k. AC Power Requirements and Circuit Protection  
15 A input with RF filtering and circuit breaker
    - 120 VAC @ 15 A max.
    - 15 A push to reset circuit breaker  
(Potter & Brumfield P/N W58XB1A4A-15)
    - RF line filter  
(Corcom P/N 15KV1)
2. Connectors
- a. Main Frame Interface  
Panel mounted receptacle
    - Amp Circular Plastic Connector Series 1 reverse sex square flanged receptacle 14 contacts with 12 used  
(Amp P/N 206043-1)
    - Solder tab gold-plated socket contacts  
(Amp P/N 202237-1) or;  
Crimp connect gold-plated socket contacts (Amp P/N 66183-1)
  - Mating connector (for Owner Provided cable)
    - Amp Circular Plastic Connector Series 1 reverse sex plug  
(Amp P/N 206044-1)
    - Solder tab gold-plated pin contacts  
(Amp P/N 202236-1) or;  
Crimp connect gold-plated pin contacts  
(Amp P/N 66182-1)
    - Standard Cable Clamp  
(Amp P/N 206070-1)

b. Remote Focus Unit Interface

Panel mounted receptacle

-Amp Circular Plastic Connector Series 2  
standard sex square flanged receptacle  
9 contacts with 6 used.

(Amp P/N 206486-1)

-Solder tab gold-plated pin contacts  
(Amp P/N 66570-3) or;

Crimp connect gold-plated pin contacts  
(Amp P/N 1-66507-2)

Mating connector (for Owner Provided cable)

-Amp Circular Plastic Connector Series 2  
standard sex plug

(Amp P/N 206485-1)

-Solder tab gold-plated socket contacts  
(Amp P/N 66569) or;

Crimp connect gold-plated socket  
contacts (Amp P/N 1-66505-2)

-Flexible Cable Boot

(Amp P/N 207489-1) and;

Internal Cable Clamp

(Amp P/N 207490-1)

c. CRT Interfaces

Two UHF type coaxial connectors for CRT  
outputs.

-SO-239 Panel mount receptacle

(Amphenol P/N 83-1R)

Mating connector for Owner Provided cabling.

-SO-239 plug for RG/58 cable

(Amphenol P/N 83-58SP)

d. Printer Interface

Panel mount socket connector

-9 contact "D" type socket connector

(TB Ansley P/N 609-9S)

e. AC Input

Line cord with grounded straight bladed  
connector

-6'6" 14 AWG 3 wire type SJT with  
molded NEMA 5-15P plug

(Belden P/N 17616C)

- f. AC outputs for CRTs  
Duplex straight grounded straight blade receptacle  
-(Hubbell P/N 5242)
- 3. Mechanical
  - a. Card Cage  
Twelve slot STD bus card cage  
-Terminated bus (Mostek P/N MDCC-12)
  - b. Operator Panel  
The membrane switch panel with slide potentiometers (Ref. Drawing LSLC-025)
    - 83 switches
    - 5 membrane touch bar switches
    - 27 slide potentiometers
  - c. Enclosure  
A Console enclosure to provide protection to all circuitry and components.
- C. Remote Focus Unit
  - 1. Electrical
    - a. Processor  
8-bit processor to decode switches, drive displays
    - b. Serial Interface  
RS-422 asynchronous serial interface to console at a transmission rate of 300 to 19.2 Kbaud
    - c. Power Requirements  
DC Power supplied over control cable from either the Main Frame or Console
  - 2. Connector
    - a. Console interface cable  
10' interface cable
      - 3 twisted pair 24 AWG overall shield cable (Belden P/N 9503)Connector (for Owner Provided cable)
      - Amp Circular Plastic Connector Series 2A standard sex plug (Amp P/N 206485-1)
      - Solder tab gold-plated socket contacts (Amp P/N 66569) or;  
Crimp connect gold-plated socket contacts (Amp P/N 1-66505-2)

- Flexible Cable Boot  
(Amp P/N 207489-1) and;  
Internal Cable Clamp  
(Amp P/N 207490-1)

Panel mounted receptacle

- Amp Circular Plastic Connector Series  
2A standard sex square flanged  
receptacle 9 contacts with 6 used.  
(Amp P/N 206486-1)
- Solder tab gold-plated pin contacts  
(Amp P/N 66570-3) or;  
Crimp connect gold-plated pin contacts  
(Amp P/N 1-66507-2)

b. Owner Provided Extention Cable (typical)  
Connector: Remote Focus Unit end

- Amp Circular Plastic Connector Series  
2A standard sex free hanging receptacle  
9 contacts with 6 used.  
(Amp P/N 206486-2)
- Solder tab gold-plated pin contacts  
(Amp P/N 66570-3) or;  
Crimp connect gold-plated pin contacts  
(Amp P/N 1-66507-2)

Cable

- 3 twisted pair 24 AWG overall shield  
cable (Belden P/N 9503)

Connector: Console end

- Amp Circular Plastic Connector Series  
2A standard sex plug  
(Amp P/N 206485-1)
- Solder tab gold-plated socket contacts  
(Amp P/N 66569) or;  
Crimp connect gold-plated socket  
contacts (Amp P/N 1-66505-2)
- Flexible Cable Boot  
(Amp P/N 207489-1) and;  
Internal Cable Clamp  
(Amp P/N 207490-1)

3. Mechanical

- a. Keypad  
(Ref. Drawing LSLC-035)
- b. Enclosure

PART 2.00 - OPERATION

2.01 DESCRIPTION

- A. The intent of this Section is to describe the operation of the LIVE SHOW LIGHTING CONTROL SYSTEM for EPCOT CENTER that is being produced by Electronic Theatre Controls, Inc.
- B. This Section describes each function of the system individually. An asterisk "\*" following the function name indicates that there is an illuminated indicator associated with the switch.

2.02 KEYPAD - GENERAL

The KEYPAD is used to select numbers for CHANNEL CONTROL FUNCTIONS, CUE CONTROL FUNCTIONS, etc. There is a 4 digit seven segment display above the KEYPAD that displays the number selected. This display rolls so that the last entered digit appears in the least significant location.

- A. 0-9 KEYPAD  
Ten switches that are used for numerical entry.
- B. + SWITCH  
A switch that increments the number in the KEYPAD DISPLAY by one or .1 if KEYPAD is in INSERT mode.
- C. - SWITCH  
A switch that decrements the number in the KEYPAD DISPLAY by one or .1 if KEYPAD is in INSERT mode.
- D. . SWITCH  
A decimal point switch for entry of inserted CUES and fractional fade rates.
- E. CE (CLEAR ENTRY)  
A switch that clears any numerical entry in the KEYPAD DISPLAY when depressed. This function will not remove the KEYPAD from its assignment to a control function.
- F. ENTER  
This switch is used to terminate any entry of information from the KEYPAD and to verify certain actions.

2.03 CHANNEL CONTROL FUNCTIONS - GENERAL

The following control functions are used to control channels, groups of channels and CUES (in the manner of WRITING BY CUE). The modification of a channel by either the AT switch or the LEVEL TOUCH BAR will not affect the level of that channel in any other fader but the level of that channel given by these controls will pile on to the other levels produced by the faders.

- A. WRITE BY CUE \*  
This switch assigns the KEYPAD to the function of selecting a CUE for control of the LEVEL TOUCH BAR or the AT function. The number of the CUE selected by the KEYPAD will be mimicked in the display above this switch.
- B. WRITE BY CHANNEL \*  
This switch assigns the KEYPAD to the function of selecting channels for control by the LEVEL TOUCH BAR and the functions below. The channel number (or the last channel number of a group) selected by the KEYPAD will be displayed on the display above this switch.
- C. AND \*  
This switch allows additional channels that are not in numerical order to be assigned to the LEVEL TOUCH BAR.
- D. THRU \*  
This switch allows groups of channels to be assigned to the LEVEL TOUCH BAR when those groups are in numerical sequence. There is no need to enter the lowest number of a group of channels first, e.g. '5 THRU 10' is the same as '10 THRU 5'
- E. AT \*  
This switch allows the level of selected channels to be entered digitally with the KEYPAD. The entered level will appear in the KEYPAD DISPLAY but the change in level will not be made until the ENTER switch is depressed. When the new level is entered, it will appear in the level display above the LEVEL TOUCH BAR. ALL channels selected at the time will be set to the same level.
- F. LEVEL TOUCH BAR  
The level touch bar is a membrane touch switch that is used to manually alter the levels of channels and CUES assigned by the KEYPAD by the SELECT CHANNEL and SELECT CUE functions.

2.04 CUE FUNCTIONS - GENERAL

The following functions are used to construct and modify a CUE after it has been selected. Note that the functions entered in composing and modifying a CUE are entered in the buffer only until RECORD is activated thus transferring the information to the RAM. A CUE may be modified and then activated on a TIMED FADER without recording if it is left intact in the buffer.

- A. SELECT CUE \*  
This switch dedicates the KEYPAD to selecting CUES for composing and altering. CUES may be inserted between integer numbered cues by depressing the "." (decimal point) switch on the KEYPAD and the entering of an additional number.
- B. SUBROUTINE \*  
If a CUE number is selected that has not got any recorded information, depressing this switch will cause the display to change to the SUBROUTINE mode where the information is displayed in text format. A SUBROUTINE CUE may only be written in BLIND display mode and this switch will automatically put the system into that mode.
- C. RISE TIME \*  
This switch allows the assigning of upfade times for the fade going into the CUE selected in the TIMED FADERS or in the case of the selected CUE being assigned to a SUBMASTER, the rise time will affect the rate at which the CUE fades up when a BUMP SWITCH is depressed.
- D. DECAY TIME \*  
This switch allows the assigning of the downfade time for channels decreasing in intensity in the TIMED FADERS or in the case of the CUE being assigned to a SUBMASTER, the decay time will affect the rate at which the selected CUE fades out after a BUMP SWITCH is released.
- E. CLEAR CUE  
This switch clears the contents of the buffer for the selected CUE. This is to "clear the slate" before writing a new CUE. Note that the clearing of the buffer will not change the levels in RAM for the CUE until the RECORD is hit, thus allowing the old information to be recalled by reselecting the CUE number with the KEYPAD.

F. ASSIGN FADER \*

This allows the CUE to be automatically assigned to a SUBMASTER when the show is loaded off of the tape and to specify the type of automatic fade if the fade is assigned to the automatic faders. This switch will create a message which will read:

WHICH FADER DO YOU WANT CUE 25 ASSIGNED TO (Select 1-24 for SUBMASTERS or 0 for AUTOMATIC FADERS, then ENTER)?

In the case that 0 is entered, a further message will read:

WHAT TYPE OF AUTOMATIC FADE DO YOU WANT FOR CUE 25?

SELECT: 1 FOR CROSSFADE      2 FOR PLUS FADE      3 FOR FADE OUT  
Press ENTER.

G. DUP

This function allows CUE to be duplicated as a new CUE number.

2.05 SUBROUTINE FUNCTIONS - GENERAL

The following functions are used to construct and modify a SUBROUTINE after it has been selected.

A. UP CURSOR

This switch moves the editing cursor up through the SUBROUTINE text.

B. DOWN CURSOR

This switch moves the editing cursor down through the SUBROUTINE text.

C. CUE SELECT \*

This allows CUES to be selected for action for a SUBROUTINE. It will create a line of text such as:

CROSS FADE CUE \_\_\_\_\_ to \_\_\_\_\_% in \_\_\_:\_\_\_ up and \_\_\_:\_\_\_ down

D. DELAY \*

This switch allows a delay or wait period to be inserted between steps of the cue such as:

Delay \_\_\_:\_\_\_

The delay period will start at the beginning of the step before the DELAY step.

D. LOOP \*

When this command is entered at the end of the SUBROUTINE text it will automatically restart the cue at the beginning of the cue text and indicate how many times it should repeat the sequence. A default mode of infinite loops can be performed by not specifying the number of repeats. An example is:

Loop to beginning \_\_\_\_\_ times.

E. REVERSE \*

This command, when placed at the end of the SUBROUTINE, will reverse the order of the cue text automatically until it reaches the beginning of the cue and then will start the cue in the original order. The number of reverses can be entered (a default mode of infinite reverses will can be performed by not specifying the number of times). Example:

Reverse \_\_\_\_\_ times.

F. INSERT LINE \*

This switch will insert a new SUBROUTINE function above of the cursor. When depressed, a line space appears with the cursor at the head. A new function can be selected.

G. DELETE LINE

This switch removes the line of text, that the cursor is on, from the selected SUBROUTINE.

2.06 DISPLAY FUNCTIONS - GENERAL

These functions dedicate the right CRT monitor to display and print information in various formats. The variable displays will occur on the right CRT and the fixed FADER STATUS DISPLAY will be on the left CRT.

A. FADER STATUS DISPLAY

This display provides information pertinent to the playback of CUES on the system. Information resembling a cue sheet will indicate the next ten CUES and include brief descriptions of the CUES. The level of all faders, the CUE assigned or loaded into them, and the fade progress of the TIMED FADERS will also be displayed (Figure 1).

B. STAGE DISPLAY

This mode displays the current level of the ninety-six control channels as they affect the stage. Any changes made through the operator's keyboard will be made to the levels on stage when in this mode. RECORD will store the levels as displayed on the CRT in the CUE selected (Figure 2).

C. BLIND DISPLAY \*

This mode displays the channel levels in the CUE presently selected by the KEYPAD or the information contained in the selected CUE (Figure 3). A CUE can be made into a SUBROUTINE in this display mode (see SUBROUTINE above) and this will cause the display to have another format (Figure 4). This display mode is used for 'blind plotting' of a show. Changes made to recorded information will not affect the levels or actions on-stage. A CUE that has been altered in this manner can be stored permanently by the RECORD switch or can be activated onstage from the buffer without affecting the recorded information to test set-ups. The information will remain in the buffer until a new CUE is selected by the KEYPAD.

D. FADER DISPLAY \*

This display indicates the status and output of any fader. This switch, when depressed, will cause a message on the right CRT (Figure 5) that asks:

WHICH FADER DO YOU WANT DISPLAYED?

SELECT: 1-24=SUBMASTERS 25=AUTO FADERS 26=CROSSFADERS +ENTER

The status and levels of channels under control of the selected fader will then be displayed (Figure 6). Once displayed, the levels of the channels can be recorded in a CUE.

E. MANUAL DISPLAY \*

This display indicates the levels of the ninety-six control channels as currently set by an Owner Provided manual lighting controller (Figure 6). Since there will be softpatch equivalent in the manual system, the system takes the first dimmer in its own softpatch for a channel and assumes the level seen as the level for the channel.

F. CHANNEL SCAN DISPLAY \*

A display of one channel (the channel currently selected by the KEYPAD) in one-hundred CUES (the set of CUES will be the hundred in which the selected CUE is

contained). Once the levels have been displayed, they can be modified in one CUE or a group of CUES by the selection of the CUE(s) on the KEYPAD utilizing the AND and THRU switches and their levels changed with the AT switch or the LEVEL TOUCH BAR (Figure 7). New levels may then be stored with the RECORD function. A scan of the next set of one hundred CUES can be displayed by depressing this switch again.

G. SOFTPATCH DISPLAY \*

This display indicates the assignment of the two hundred twenty-four dimmers in the ninety-six channels (Figure 8). When in this mode, the softpatch can be modified using a menu system.

H. PRINT \*

This display will allow the contents of the screen to be printed on an owner supplied printer. When depressed this switch will put a question on the right CRT asking:

WHICH DISPLAY DO YOU WANT TO PRINT? (ENTER for current display or  
SELECT:     1 for STAGE           2 for BLIND           3 for FADER  
             4 for MANUAL       5 for CHANSCAN       6 for STATUS  
then ENTER).

The operator will then depress a display mode or enter for the page that is displayed on the right CRT currently. The system will then either print the display, or in the case of the PRESET display being selected, ask:

What is the last CUE you wish printed (starting at the selected CUE)?

When a number is selected, the operator will get the message:

Press ENTER to start print.

2.07 FILE CONTROLS - GENERAL

These functions control the memorizing, storage and playback of cues.

A. RECORD \*

This switch transfers information currently in the temporary buffer to the RAM and replaces information in the RAM with the new information.

- B. SEQUENCE \*  
This switch determines whether the system will automatically sequence through the CUES or not. If the system is not in SEQUENCE mode, the operator must select the next CUE individually.
- C. CLEAR SYSTEM \*  
This switch when depressed simultaneously with the RECORD switch will create a message on the left CRT which says:

You are about to clear the contents of the system (which could be catastrophic). If you do indeed wish to clear the system, press ENTER. If you do not want to clear the system press CE.

- D. TO TAPE \*  
This switch is used to load a show from the RAM to the tape. The show that is loaded to the tape will be cleared from the RAM upon completion. When the switch is depressed, a message will appear on the left CRT which says:

You are now loading SHOW #1 to the tape.

- E. FROM TAPE \*  
This switch loads a show from the tape to the RAM. A message will appear in the RAM at th time, a message will say:

What Show do you wish to load (select number and press ENTER)?

## 2.08 GRAND MASTER - GENERAL

The GRAND MASTER potentiometer and BLACKOUT switch provide means to reduce or totally remove the output of the system. These actions are taken without affecting the status of the fades in the system.

- A. BLACK OUT \*  
This alternate action switch zeros the output of the system when activated.
- B. GRAND MASTER  
This potentiometer allows the output of the system to be reduced or completely zeroed.

## 2.09 SUBMASTERS - GENERAL

The SUBMASTERS are a set of 24 manual faders which pile on to each other individually as well as to all the other faders in the system. A cue may be assigned to any of the faders as well as a group of channels. In the case of a group of channels being assigned when the group does not have a cue number assigned to it, the group will take up one memory location and be identified by the SUBMASTER number. Each SUBMASTER shall consist of:

- A. POT (24 EACH NUMBERED 1-24)  
A linear slide potentiometer to set the level of the SUBMASTER.
- B. BUMP SWITCH (24 EACH NUMBERED 1-24) \*  
A momentary switch which will bring the assigned contents of the SUBMASTER to full intensity. In the case of a CUE that has recorded RISE and DECAY times being assigned to SUBMASTER, when the BUMP switch is depressed that CUE will start to rise to full at the recorded rate. Assuming that the BUMP switch is held longer than the rise time the CUE will reach full and decay at the recorded rate when the switch is released. If the BUMP switch is released prior to the CUE reaching full intensity, the CUE will decay from that point at the recorded DECAY rate. If no rates are recorded, the bump action will be instantaneous.

The BUMP switch has an LED indicator which lights when the SUBMASTER has been assigned.

The level of each SUBMASTER as well as its assignment will be displayed on the left CRT.

## 2.10 SPLIT DIPLESS CROSS FADER - GENERAL

This fader is another form of manual fader that allows cross fades between cues. It consists of two opposing pots that each have the following controls:

- A. POT  
A linear slide potentiometer to adjust the level of the CUE loaded into the fader.
- B. LOAD SWITCH \*  
A switch that loads the selected CUE into the fader.

C. CLEAR SWITCH

A switch that clears the fader of the CUE loaded into it. If the fader is at a level greater than 0, the output of the fader for that CUE will be cancelled.

2.11 AUTOMATIC FADERS - GENERAL

The AUTOMATIC FADERS are arranged in two pairs. These two pairs are "last action" faders, meaning that a channel will always go to the last level that is given for it. The final output of the AUTOMATIC FADERS will then pile on to the other faders in the system.

There will be two modes of operation for the AUTOMATIC FADERS. The first controls fades for normal CUES and the second controls fades for SUBROUTINES.

Each pair of faders consists of two membrane TOUCH BARS and a GO, HOLD, and CLEAR FADER SWITCH switch. The functions of the TOUCH BARS differs between the two operating modes of the system and these different modes are indicated with illuminated legends RATE and LEVEL. The GO, HOLD, and CLEAR FADER switches perform the same function in either case.

A. GO \*

When depressed, this switch will load the NEXT CUE into the AUTOMATIC FADER pair. The fade rates will be set as recorded and the CUE will commence.

B. HOLD \*

During an active fade on the AUTOMATIC FADER pair, depressing this switch will stop the CUE but the CUE will still be loaded into the fader. The cue can be resumed at the same point by depressing the GO switch again or cancelled, leaving the channels at their current levels by depressing HOLD a second time. When a CUE is stopped using this function, the indicator lights on the GO and HOLD switches will blink alternately.

C. CLEAR FADERS \*

This switch will clear the fader pair of any CUE loaded into it. This will zero any channel levels created by the fader pair instantly.

D. CUE OPERATING MODE

In the case that a simple CUE (containing only channel level information and fade rates) is initiated on an AUTOMATIC FADER pair, the function of the TOUCH BARS will be to set and allow modification of the RISE and DECAY times associated with that CUE. The RATE indicators for both faders in the pair will be illuminated. When the CUE is started, the BARGRAPHS will indicate the rates that are recorded with the CUE with the left-hand BARGRAPH indicating the RISE TIME and the right-hand BARGRAPH the DECAY TIME. With the TOUCH BARS these rates may be modified by the operator.

There are three types of fades that are assigned through the ASSIGN FADER function (Section 2.04.F.). These three types are:

1. CROSS FADE

All channel levels currently produced by these AUTOMATIC FADERS will be replaced by the levels recorded in the NEXT CUE.

2. PLUS FADE

Only channels with new information in the NEXT CUE will change in intensity. All other levels produced by the AUTOMATIC FADERS will remain the same.

3. FADE OUT

All channels under the control of the AUTOMATIC FADERS will fade to 0%.

E. SUBROUTINE OPERATING MODE

When a SUBROUTINE CUE is initiated on an AUTOMATIC FADER pair, the left-hand TOUCH BAR and BARGRAPH will act as a master level device for the SUBROUTINE with the LEVEL indicator illuminated. When the CUE is started, the level will be set automatically at 100% and can be modified by the operator, the level can be brought to 0% while the CUE is still running.

The right-hand TOUCH BAR and BARGRAPH act as the rate control device for the SUBROUTINE and the RATE indicator will be illuminated. The BARGRAPH will show a pattern which will not be moving if the rates have not been modified. If the rates are reduced (slowed down) the pattern will move downward on the BARGRAPH increasing with the amount of modification. As the rates are increased (sped up) the pattern will move upward on the BARGRAPH.

## 2.12 REMOTE FOCUS UNIT - GENERAL

The Remote Focus Unit (RFU) will execute certain functions of the System from distances up to 4000' from the console.

### A. REMOTE FOCUS UNIT INITIALIZATION

When the RFU is connected to the System turned on, a message will appear on the CRT asking:

A REMOTE FOCUS UNIT IS ON, DO YOU WISH TO TRANSFER CONTROL TO IT?  
PRESS: ENTER TO TRANSFER, CE NOT TO TRANSFER

If ENTER is pressed, the RFU will take control of the System and the Console will be disabled. This condition will remain until the RFU ceases sending transmissions to the Console Processor.

If CE is pressed, the Console will remain in control of the System and the message will disappear. In this case, the RFU can only be enabled by recycling the power on the RFU, thus making the same message appear.

### B. KEYPAD

See PART 2.02.A thru F.

### C. AND

See PART 2.03.C.

### D. THRU

See PART 2.03.D.

### E. AT

See PART 2.03.E.

### F. GO FADE

See PART 2.11.A.

### G. HOLD

See PART 2.11.B.

### H. SELECT CUE

See PART 2.04.A.

### I. SELECT CHANNEL

See PART 2.03.B.

- J. UP CURSOR  
This switch allows the intensity of a channel or group of channels under the control of the RFU to be raised.
- K. DOWN CURSOR  
This switch allows the intensity of a channel or group of channels under the control of the RFU to be lowered.
- L. CUE/CHANNEL DISPLAY  
A four digit seven segment display to indicate the selected CUE or channel.
- M. LEVEL DISPLAY  
A two digit seven segment display to indicate the level of the selected channel or group of channels.
- N. PROGRESS DISPLAY  
Two two digit seven segment displays to indicate the progress of a fade.

C		1	AUTO CROSS FADE	00:05 RISE	00:10 DECAY
U	NEXT CUE	2	SUBMASTER 3	00:05 RISE	00:15 DECAY
E		2.1	MANUAL CROSS FADE		
		3	MANUAL CROSS FADE		
S		4	AUTO PLUS FADE	00:10 RISE	00:10 DECAY
H		5	AUTO SUBROUTINE	5 STEPS	
E		6	MANUAL CROSS FADE		
E		7	MANUAL CROSS FADE		
T		8	AUTO SUBROUTINE	30 STEPS	INFINITE REVERSE
		10	AUTO PLUS FADE	05:00 RISE	10:00 DECAY

MANUAL CROSS FADERS			AUTOMATIC FADERS			
X FADER	Y FADER		A FADER	B FADER	C FADER	D FADER
80%	20%		75%	HOLD	LEVEL FF	RATE NORM
CUE			10:10	20:20	STEP 10:CUE	8 TO 100%
20.4	CLEAR		CUE 113.5	CUE 113.5	SUBROUTINE	128.9

SUBMAST	13	14	15	16	17	18	19	20	21	22	23	24
LEVEL	75%	80%	85%	90%	95%	FF						FF
CUE	23.5	114	12.5	18	156							118

SUBMAST	1	2	3	4	5	6	7	8	9	10	11	12
LEVEL	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%
CUE	125.5	126	2	13	145	8.5	20.5	13.3	CHA	CHA	20.5	80.7

Figure 1  
 STATUS DISPLAY

STAGE DISPLAY												GRAND MASTER AT 100%							
<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
10	20	33	45	56	FF	78	65		44	56	89	90				25	25	25	25
<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>	<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>40</u>
02	44	67	56	56	56	48	39				66	53	54	88	FF	FF	FF	FF	FF
<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>49</u>	<u>50</u>	<u>51</u>	<u>52</u>	<u>53</u>	<u>54</u>	<u>55</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>	<u>60</u>
33	33	54	65	68								85	85	90	FF	FF	FF		
<u>61</u>	<u>62</u>	<u>63</u>	<u>64</u>	<u>65</u>	<u>66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>	<u>78</u>	<u>79</u>	<u>80</u>
				FF	FF	FF	FF	FF	FF	80	80	90	90	99	99	99	45	45	
<u>81</u>	<u>82</u>	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>				
FF	FF	FF	34	33	34	90	80	90	99				FF	FF	FF				

\*\*\*Press ENTER to Assign Intensities\*\*\*

NEXT CUE	*128				CUES		CHANNEL:	1, 5 THRU 15, 23
RISE TIME	99:50				LEFT			THRU 84
DECAY TIME	:04				125		AT:	80%
FADER	AUTO XFADE							

Figure 2  
 STAGE DISPLAY

CUE 128				BLIND DISPLAY										GRAND MASTER AT 100%					
<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
10	20	33	45	56	FF	78	65		44	56	89	90				25	25	25	25
<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>	<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>40</u>
02	44	67	56	56	56	48	39				66	53	54	88	FF	FF	FF	FF	FF
<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>49</u>	<u>50</u>	<u>51</u>	<u>52</u>	<u>53</u>	<u>54</u>	<u>55</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>	<u>60</u>
33	33	54	65	68								85	85	90	FF	FF	FF		
<u>61</u>	<u>62</u>	<u>63</u>	<u>64</u>	<u>65</u>	<u>66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>	<u>78</u>	<u>79</u>	<u>80</u>
				FF	FF	FF	FF	FF	FF	80	80	90	90	99	99	99	45	45	
<u>81</u>	<u>82</u>	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>				
FF	FF	FF	34	33	34	90	80	90	99				FF	FF	FF				

\*\*\*Press ENTER to Assign Intensities\*\*\*

NEXT CUE	123.1		BLIND		CUES		CHANNEL:	1, 5 THRU 15, 23
RISE TIME	99:50		EDIT		LEFT			THRU 84
DECAY TIME	:04		CUE		125		AT:	80%
FADER	AUTO XFADE		128					

Figure 3  
 BLIND DISPLAY OF CUE

CUE 5            SUBROUTINE            BLIND DISPLAY            GRAND MASTER AT 100%

1. CUE 003 AT 75% IN 00:10 RISE 00:10 DECAY  
2. DELAY 00:05  
3. CUE 095 AT FF IN 00:05 RISE 00:20 DECAY  
4. DELAY 00:10  
5. CUE 005 AT 89% IN   :   RISE

---

NEXT CUE	123.1		BLIND		CUES		EDITING LINE: 5
RISE TIME	99:50		EDIT		LEFT		ENTER RISE TIME
DECAY TIME	:04		CUE		125		
FADER	AUTO XFADE		5				

Figure 4  
BLIND DISPLAY OF SUBROUTINE

SELECT FADER	FADER DISPLAY	GRAND MASTER AT 100%
<u>01</u> <u>02</u> <u>03</u> <u>04</u> <u>05</u> <u>06</u> <u>07</u> <u>08</u> <u>09</u> <u>10</u> <u>11</u> <u>12</u> <u>13</u> <u>14</u> <u>15</u> <u>16</u> <u>17</u> <u>18</u> <u>19</u> <u>20</u>		
<u>21</u> <u>22</u> <u>23</u> <u>24</u> <u>25</u> <u>26</u> <u>27</u> <u>28</u> <u>29</u> <u>30</u> <u>31</u> <u>32</u> <u>33</u> <u>34</u> <u>35</u> <u>36</u> <u>37</u> <u>38</u> <u>39</u> <u>40</u>		
<u>41</u> <u>42</u> <u>43</u> <u>44</u> <u>45</u> <u>46</u> <u>47</u> <u>48</u> <u>49</u> <u>50</u> <u>51</u> <u>52</u> <u>53</u> <u>54</u> <u>55</u> <u>56</u> <u>57</u> <u>58</u> <u>59</u> <u>60</u>		
<u>61</u> <u>62</u> <u>63</u> <u>64</u> <u>65</u> <u>66</u> <u>67</u> <u>68</u> <u>69</u> <u>70</u> <u>71</u> <u>72</u> <u>73</u> <u>74</u> <u>75</u> <u>76</u> <u>77</u> <u>78</u> <u>79</u> <u>80</u>		
<u>81</u> <u>82</u> <u>83</u> <u>84</u> <u>85</u> <u>86</u> <u>87</u> <u>88</u> <u>89</u> <u>90</u> <u>91</u> <u>92</u> <u>93</u> <u>94</u> <u>95</u> <u>96</u>		

\*\*\* SELECT FADER NUMBER TO DISPLAY \*\*\*  
(1-24 for Submasters, 25 for Cross Fader, or 26 for Auto Fader)

---

NEXT CUE	123.1			CUES		FADER:
RISE TIME	99:50			LEFT		
DECAY TIME	:04			125		
FADER	AUTO XFADE					

Figure 5  
FADER DISPLAY BEFORE FADER SELECTION

SUBMASTER 24 AT 100%								FADER DISPLAY								GRAND MASTER AT 100%							
<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>				
10	20	33	45	56	FF	78	65		44	56	89	90				25	25	25	25				
<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>	<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>40</u>				
02	44	67	56	56	56	48	39				66	53	54	88	FF	FF	FF	FF	FF				
<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>49</u>	<u>50</u>	<u>51</u>	<u>52</u>	<u>53</u>	<u>54</u>	<u>55</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>	<u>60</u>				
33	33	54	65	68								85	85	90	FF	FF	FF						
<u>61</u>	<u>62</u>	<u>63</u>	<u>64</u>	<u>65</u>	<u>66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>	<u>78</u>	<u>79</u>	<u>80</u>				
				FF	FF	FF	FF	FF	FF	80	80	90	90	99	99	99	45	45					
<u>81</u>	<u>82</u>	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>								
FF	FF	FF	34	33	34	90	80	90	99				FF	FF	FF								

---

NEXT CUE	123.1				CUES		SUBMASTER: 24
RISE TIME	99:50				LEFT		CUE: 118
DECAY TIME	:04				125		AT: 100%
FADER	AUTO XFADE						

Figure 6  
 FADER DISPLAY

MANUAL DISPLAY										GRAND MASTER AT 100%									
<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>
10	20	33	45	56	FF	78	65		44	56	89	90				25	25	25	25
<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>	<u>32</u>	<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>40</u>
02	44	67	56	56	56	48	39				66	53	54	88	FF	FF	FF	FF	FF
<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>49</u>	<u>50</u>	<u>51</u>	<u>52</u>	<u>53</u>	<u>54</u>	<u>55</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>	<u>60</u>
33	33	54	65	68								85	85	90	FF	FF	FF		
<u>61</u>	<u>62</u>	<u>63</u>	<u>64</u>	<u>65</u>	<u>66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>	<u>72</u>	<u>73</u>	<u>74</u>	<u>75</u>	<u>76</u>	<u>77</u>	<u>78</u>	<u>79</u>	<u>80</u>
				FF	FF	FF	FF	FF	FF	80	80	90	90	99	99	99	45	45	
<u>81</u>	<u>82</u>	<u>83</u>	<u>84</u>	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>				
FF	FF	FF	34	33	34	90	80	90	99				FF	FF	FF				

\*\*\*DISPLAY OF MANUAL CONTROL BOARD\*\*\*

---

NEXT CUE	128			CUES	
RISE TIME	99:50			LEFT	
DECAY TIME	:04			125	
FADER	AUTO XFADE				

Figure 6  
 MANUAL DISPLAY



SOFTPATCH DISPLAY

CHANNEL	DIMMERS
1	1, 5 THRU 10, 12, 20, 45 THRU 80, 113
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

\*\*\*ENTER DIMMER NUMBERS\*\*\*

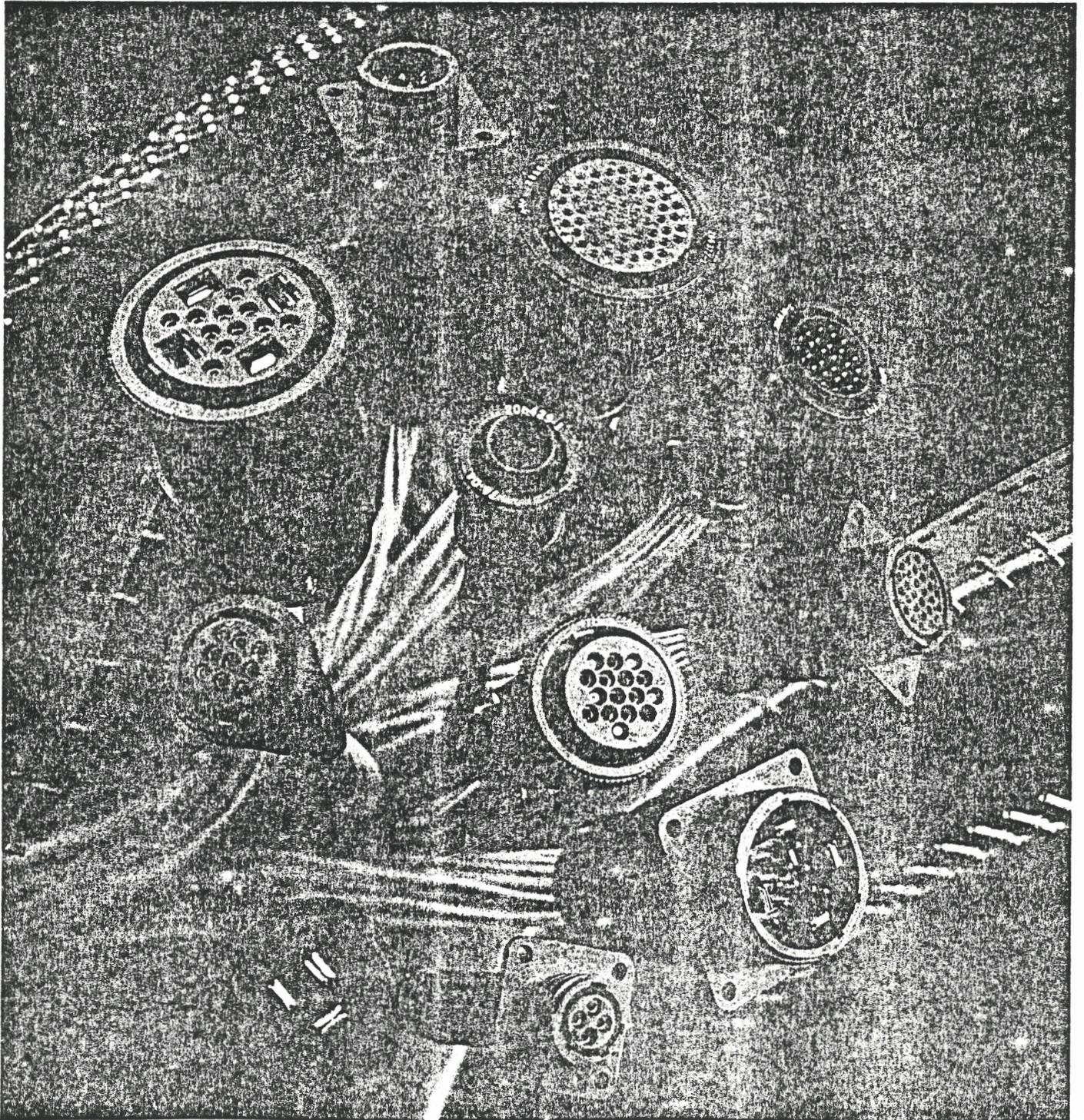
Figure 8  
SOFTPATCH DISPLAY

LIVE SHOW LIGHTING CONTROL  
EPCOT CENTER  
December 14, 1981

PAGE 1  
SPECIFICATIONS  
APPENDIX 1

AMP Catalog No. 73-204 Circular Plastic Connectors  
Pages 9-149 thru 9-177

## AMP Circular Plastic Connectors (A Multimate Product)



# General Information

## Introduction

AMP Circular Plastic Connectors are molded plugs and receptacles that house pin and socket contacts. These versatile connectors provide substantial savings in both weight and cost through the use of plastic shells and a wide variety of hand and machine terminated contacts. Circular plastic connectors are available in a wide range of shell sizes, densities, and configurations, and offer many options to extend their usefulness. All connectors are supplied unloaded, except for the Class F feed-through receptacle and the solder cup and posted contact connectors in which contacts are furnished preloaded. Many connectors are available in both standard sex (receptacles that accept pins and plugs that accept sockets) and reverse sex (receptacles that accept sockets and plugs that accept pins).

## Table of Contents

### Dimensioning:

All dimensions in inches and millimetres. Values in brackets are metric equivalents. Metric symbols used are:  
mm<sup>2</sup> (square millimetre)  
C (Celsius)

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

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## Three Series of Circular Plastic Connectors are available

■ **Series 1** circular plastic connectors are standard density connectors. These connectors use size 16 contacts; are available in four shell sizes — 11, 13, 17 and 23; and are supplied as Class A for normal unsealed applications and as Class F for pressure bulkhead feed-through applications. AMP supplies four contact types in size 16 for the circular plastic connector, including screw-machined and precision formed contacts. Subminiature coaxial contacts, solder tab contacts and a wide range of posted contacts are available. Many connector arrangements are available in reverse sex configurations.

■ **Series 2** circular plastic connectors are high density connectors. These connectors use size 20 contacts; are available in three shell sizes — 11, 17 and 23; and are supplied as Class A for normal

unsealed applications and as Class F for pressure bulkhead feed-through applications. AMP supplies two contact types in size 20 for the Series 2 circular plastic connector, including screw-machined contacts, precision formed contacts with and without insulation support, snap-in solder cup contacts and a posted version for point-to-point wiring. Many connector arrangements are available in reverse sex configurations.

■ **Series 3** circular plastic connectors are power density connectors. These connectors use Type XII contacts which can carry up to 35 amperes and are available in two shell sizes\*— 17 and 23. Type XII contacts accept wire from #16 through 8 AWG [1.25 through 8 mm<sup>2</sup>] and are available in loose piece, and in strip form for automatic machine application. Reverse sex connector arrangements are available.

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## Features

### Dimensioning:

All dimensions in inches and millimetres.  
Values in brackets are metric equivalents.

### Housing Features

AMP circular plastic connectors are designed for use in commercial applications such as automotive, aircraft, instrumentation, computer,

■ All plastic construction . . . up to 50% lighter than comparable metal cylindrical connectors.

■ Recognized under  Component Program of Underwriters Laboratories Inc. for 250-volt service—made of UL recognized, high grade thermoplastic, File No. E 28476

■ CSA certified,  File No. LR 16455

■ Quick connect/disconnect capability with thread assist, positive detent coupling.

■ Built-in pin and socket protection.

■ 5-key polarization for proper mating of connector halves.

■ Three connector series to handle different interconnection needs:

- Series 1 for standard density applications
- Series 2 for high density applications
- Series 3 for power density applications

■ Wide choice of contacts:

**Series 1 (size 16 contacts)**

Type II (screw-machined)  
#32-16 AWG [0.03 — 1.4 mm<sup>2</sup>]  
Type III+ (precision formed)  
#30-16 AWG [0.05 — 1.4 mm<sup>2</sup>]  
Solder and Posted versions  
Type VI (precision formed)  
#28-16 AWG [0.08 — 1.4 mm<sup>2</sup>]

Subminiature COAXICON contacts (precision formed)  
For coaxial cable, shielded, double braid and twisted pair leads

**Series 2 (size 20 contacts)**

Type 20 DF (precision formed)

and peripheral equipment. These connectors offer many advanced design features which assure their high performance characteristics.

■ Shell sizes 11, 13, 17 and 23.

■ Available in panel or chassis mounting versions (with and without jaw nut), and in free hanging versions.

■ Special connector configurations are available to cover applications in which different density contacts are mixed, and for applications in which coaxial cable is mixed with other type contacts. Contact your local Sales Engineer or AMP Incorporated for more information.

■ Optional cable clamps available in standard and large versions for all connector series.

■ Optional keying plugs available for all connector series.

■ Optional rubber boots, peripheral seals and cable entry seals available for Series 1 and Series 3 connectors to provide splashproof protection.

■ Optional sealing caps available for Series 1 and Series 2 receptacles (shell sizes 11, 17 and 23).

#28-20 AWG [0.08 — 0.6 mm<sup>2</sup>]  
(with and without insulation support)

Solder and Posted versions

Type 20 DM (screw-machined)

#24-20 AWG [0.2 — 0.6 mm<sup>2</sup>]

**Series 3 (power contacts)**

Type XII (precision formed)

#16-8 AWG [1.25 — 8 mm<sup>2</sup>]

■ Precision formed contacts are made from high conductivity brass or copper stock, with gold or tin plating.

■ Machine applied terminations for volume production with uniform reliability and lowest applied cost.

### Contact Features

## Performance Characteristics

For detailed information on the performance of circular plastic connectors and contacts, request:

**AMP Product Specification No. 108-10024** (Circular Plastic Connectors)

**AMP Product Specification No. 108-10028** (Contacts)

Test Description	Procedure	Requirements
Maintenance Aging	Contacts removed and reinserted 10 times using applicable tools	No damage
Contact Retention	Axial load applied to contact to displace to the rear of the connector	Contacts remain in place
Dielectric Withstanding Voltage (MIL-STD-1344, Method 3001)	Connectors subjected to 1500 volts rms at sea level	No breakdown or flashover
Thermal Shock	Unmated connectors subjected to five cycles of temperature change ( $-55^{\circ}\text{C}$ & $+105^{\circ}\text{C}$ )	No damage
Vibration (MIL-STD-202, Method 204, Test Condition B)	Connectors vibrated (wired and mated). Contacts wired in series with 100 milliamperes flowing during the test	No damage or loosening of parts. No interruption of electrical continuity longer than 10 microseconds
Physical Shock (MIL-STD-202, Method 213A, Test Condition A)	Connectors shocked 50 G (wired and mated). Contacts wired in series with 100 milliamperes flowing during the test	No damage or loosening of parts. No interruption of electrical continuity longer than 10 microseconds
Durability	Connectors mated and unmated 200 times with tin plated contacts, and 500 times with gold plated contacts	No damage
Corrosion (Salt Spray) (MIL-STD-202, Method 101, Test Condition B)	Mated connectors subjected to 5% salt spray for 48 hours	No damage
Temperature Life	Mated connectors subjected to a temperature of $+105^{\circ}\text{C}$ for 200 hours	No damage
Insulation Resistance (MIL-STD-1344, Method 3003)	Measurement made between adjacent contacts with connector unmated	5000 megohms at $25^{\circ}\text{C}$ minimum
Humidity (MIL-STD-202, Method 103, Test Condition B)	Mated connectors subjected to 10 days moisture test	Minimum insulation resistance of 100 megohms

## Choosing Connectors and Accessories

This section provides a quick reference to this catalog in order to help you locate one particular connector/contact combination from the broad selection currently available. Part numbers of the various connector components are looked-up after components have been selected.

To assure proper selection and ordering of components, customers should consider the following factors regarding their particular application.

**1. Determine number of wires and wire size** necessary for your application.

**2. Determine the connector series.** Based on required packaging density and current carrying requirements, choose: Series 1 for normal packaging density; Series 2 for high density; and Series 3 for higher currents. Posted contacts are available for Series 1 and Series 2 connectors only.

**3. Determine the connector class.** If application requires pressure bulkhead connection, choose class F. Otherwise, choose class A.

**4. Determine arrangement number.** Available contact arrangements are shown in the Contact Arrangement

Section under the appropriate Series heading.

**5. Determine the contact type.** This decision will be based on the reliability and cost requirements of your application, the availability of contact types and sizes, and your existing in-plant capabilities. Posted contacts are available for Series 1 and Series 2 connectors only.

**6. Determine shell style and sex.** Available styles are shown on the appropriate Component Dimension pages, and part numbers are shown in the Part Number Guide. Except for connectors with shell size 13 and the pressure bulkhead feed-through receptacles, each style can be obtained to accept either sockets or pins in either plug or receptacle half. Normally the line side of the circuit requires the "enclosed" socket contact.

**7. Select applicable accessories.** Part numbers for cable clamps, rubber boots with seals, and sealing caps are listed in the Part Number Guide. Part numbers for keying plugs are listed in the Contact Specifications under the appropriate Series heading.

**8. Determine part numbers.** Contacts are listed by series number and contact type. Housings and accessories are listed in the Part Number Guide.

# Part Number Guide

### Dimensioning:

All dimensions in inches and millimetres. Values in brackets are metric equivalents.

## Connectors

**Material:** UL recognized, 94V-1 rated, heat stabilized, fire resistant, self extinguishing thermoplastic; Color, black.

These quick-reference charts list part numbers of all connector configurations and accessories, except the special versions which are presented on pages 9-178 thru 178F. The referenced catalog page numbers indicate the locations of detailed engineering information. For simplicity, the "9-" prefix has been eliminated from all page numbers listed in the charts.

Series Class	Arrangement No.	Sex <sup>1</sup>	Receptacles		Plugs <sup>2</sup>		Feed-Thru Receptacle		
			Square Flanged	Free Hanging	Standard Lettering	Reverse Lettering	With Jam Nut	Without Jam Nut	
1-A (pp. 170, 170A)	11-4	Std.	206061-1	206153-1	206060-1	---	---	---	
		Rev.	206430-1	206430-2	206429-1	---	---	---	
	13-9	Std.	206705-1	206705-2	206708-1	---	---	---	
		Rev.	---	---	---	---	---	---	
	17-14	Std.	---	---	---	---	---	---	
		Rev.	206043-1	206043-3	206044-1	---	---	---	
	17-16	Std.	206036-1	206036-3	206037-1	---	---	---	
		Rev.	---	---	---	---	---	---	
	23-24	Std.	206838-1	206838-2	206837-1	---	---	---	
		Rev.	---	---	---	---	---	---	
	23-37	Std.	206151-1	206151-2	206150-1	---	---	---	
		Rev.	206306-1	206306-2	206305-1	---	---	---	
1-F (pp. 170, 170A)	11-4	Std.	---	---	206517-1	206516-1	---	206518-2 <sup>3</sup>	
		Rev.	---	---	---	---	---	206518-1 <sup>4</sup>	
	17-16	Std.	---	---	206553-1	206554-1	---	206552-1 <sup>3</sup>	
		Rev.	---	---	---	---	---	206552-2 <sup>4</sup>	
	23-37	Std.	---	---	206369-1	206370-1	---	207201-1 <sup>3</sup> 207364-1 <sup>5</sup>	
		Rev.	---	---	---	---	---	207201-2 <sup>4</sup> 207364-2 <sup>4</sup>	
2-A (pp. 172, 172A)	11-8	Std.	205841-1	205841-2	205838-1	---	---	---	
		Rev.	206433-1	206433-2	206434-1	---	---	---	
	11-9	Std.	206486-1	206486-2	206485-1	---	---	---	
		Rev.	---	---	---	---	---	---	
	17-28	Std.	205840-3	206152-1	205839-3	---	---	---	
		Rev.	206038-1	206038-2	206039-1	---	---	---	
	23-57	Std.	---	---	---	---	---	---	
		Rev.	206438-1	206438-2	206437-1	---	---	---	
	23-63	Std.	205843-1	205843-2	205842-1	---	---	---	
		Rev.	---	---	---	---	---	---	
	2-F (pp. 172, 172A)	11-8	Std.	---	---	206459-1	206460-1	---	206458-1 <sup>3</sup>
			Rev.	---	---	---	---	---	206458-2 <sup>4</sup>
17-28		Std.	---	---	206125-1	206126-1	---	206127-1	
		Rev.	---	---	---	---	---	---	
23-63		Std.	---	---	206377-1	206378-1	---	207200-1 <sup>3</sup> 207363-1 <sup>5</sup>	
		Rev.	---	---	---	---	---	207200-2 <sup>4</sup> 207363-2 <sup>4</sup>	
3-A (p. 174)	17-3	Std.	206036-2	206207-1	206037-2	---	---	---	
		Rev.	206425-1	206425-2	206426-1	---	---	---	
	23-7	Std.	206137-1	206137-2	206136-1	---	---	---	
		Rev.	206227-1	206227-2	206226-1	---	---	---	

<sup>1</sup>Standard sex: pin contacts in receptacle housings, socket contacts in plug housings.  
<sup>2</sup>Reverse sex: socket contacts in receptacle housings, pin contacts in plug housings.  
<sup>3</sup>Replacement coupling rings are available for the following shell sizes: 11 — 206089-1, 13 — 206707-1, 17 — 205958-1, 23 — 206251-1.  
<sup>4</sup>Receptacle with gold-over-nickel plated pin contacts.  
<sup>5</sup>Receptacle with tin plated pin contacts.  
<sup>6</sup>Jam nut style receptacle with gold-over-nickel plated pin contacts.  
<sup>7</sup>Jam nut style receptacle with tin plated pin contacts.  
**Note:** A complete feed-thru assembly requires:  
a. One plug with normally marked cavity identification.  
b. One feed-thru receptacle.  
c. One plug with reverse-marked cavity identification.

## Accessories

Shell Size	Cable Clamps <sup>1</sup> (p. 176)		Rubber Boot <sup>2</sup> (p. 176A)	Peripheral (p. 177)	Seals			Back-Shell Extender (p. 176A)	Panel Mount Adaptor <sup>5</sup> (p. 176A)	Flexible Strain Relief (p. 177A)	
	Standard	Large			Cap (p. 177)	Cable Entry (p. 177)	Jacketed Cable (p. 177A)			Boot	Grip
11	206062-1	206358-1	206304-1	206403-1	206903-1	54010-1	---	---	---	207489-1	207490-1
13	206966-1	207008-1	---	206403-4	---	54123-1	---	---	---	---	---
17	206070-1	206322-1	206398-1	206403-2	207445-1	54011-1	---	---	---	207241-1	207387-1 207387-2
23	206138-1	206512-1	207053-1	206403-3	207446-1 <sup>3</sup>	54012-1	207052-1	207055-1	207299-4	---	---
			207053-2		207446-2 <sup>4</sup>		207052-2				
			---		---		207052-3				

<sup>1</sup>Part numbers listed above are for cable clamps individually packaged. For additional part numbers of cable clamps bulk packaged in various quantities, see page 9-176.  
<sup>2</sup>Rubber sealing boots are for use on Series 1 and Series 3 connectors only. They serve as a splash guard, not an environmental seal.  
<sup>3</sup>Sealing cap for use on Series 1 and Series 3 receptacle connectors only.  
<sup>4</sup>Sealing cap for use on Series 2 receptacle connectors only.  
<sup>5</sup>Panel mount adaptor for use on plug connectors only.  
**Note:** Part numbers of keying plugs are listed with the contact information under the appropriate Series heading

**Dimensioning:**

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

## Series 1 Contact Specifications (Continued)

Wire Size Range <sup>1</sup>		Ins. Dia. Range	Contact Finish	Strip Form Contact No. <sup>3</sup>		Loose Piece Contact No.		Hand Tool No.			
				Pin	Socket	Pin	Socket				
30-26	0.05-0.15	.070-.100 1.78-2.54	Gold/Nickel <sup>2</sup>	—	—	—	66483-1	90277-1 or 90282-1			
			Gold/Nickel <sup>2</sup>	66425-5	66424-5	66429-1	66428-1	90277-1 or 90066			
			Tin	66425-6	66424-6	66429-2	66428-2				
			Gold/Nickel <sup>2</sup>	66425-7	66424-7	66429-3	66428-3				
			Sel. Gold/Nickel <sup>4</sup>	66425-8	66424-8	66429-4	66428-4				
			Gold/Nickel <sup>2</sup>	66393-5	66394-5	66406-1	66405-1	90277-1 or 90225-2			
		Tin	66393-6	66394-6	66406-2	66405-2					
		26-24	0.12-0.2	.035-.055 0.89-1.4	Gold/Nickel <sup>2</sup>	66106-5	66108-5	66107-1	66109-1	90277-1 or 90066	
					Tin	66106-6	66108-6	66107-2	66109-2		
					Gold/Nickel <sup>2</sup>	66106-7	66108-7	66107-3	66109-3		
					Sel. Gold/Nickel <sup>4</sup>	66106-8	66108-8	66107-4	66109-4		
					Gold/Nickel <sup>2</sup>	66102-6	66104-6	66103-1	66105-1	90277-1, 90066 or 90067	
Tin	66102-7				66104-7	66103-2	66105-2				
24-20	0.2-0.6			.040-.080 1.02-2.03	Gold/Nickel <sup>2</sup>	66102-8	66104-8	66103-3	66105-3	90277-1, 90066 or 90067	
					Sel. Gold/Nickel <sup>4</sup>	66102-9	66104-9	66103-4	66105-4		
					Tin	66332-5	66331-5	66400-1	66399-1		90277-1, 90067-2 or 90225-2
					Gold/Nickel <sup>2</sup>	66332-6	66331-6	66400-2	66399-2		
					Gold/Nickel <sup>2</sup>	66332-7	66331-7	66400-3	66399-3	90331-1	
					Sel. Gold/Nickel <sup>4</sup>	66332-8	66331-8	66400-4	66399-4		
		18-16	0.8-1.4	.080-.100 2.03-2.54	Gold/Nickel <sup>2</sup>	66564-5	66563-5	66566-1	66565-1	90277-1, 90067, 90208-1 or 90067-2	
					Tin	66564-6	66563-6	66566-2	66565-2		
					Gold/Nickel <sup>2</sup>	66564-7	66563-7	66566-3	66565-3		
					Sel. Gold/Nickel <sup>4</sup>	66564-8	66563-8	66566-4	66565-4		
					Gold/Nickel <sup>2</sup>	66098-6	66100-6	66099-1	66101-1	90277-1, 90067, 90208-1 or 90067-2	
					Tin	66098-7	66100-7	66099-2	66101-2		
18-14	0.8-2			.110-.150 2.79-3.81	Gold/Nickel <sup>2</sup>	66098-8	66100-8	66099-3	66101-3	90277-1, 90067, 90208-1 or 90067-2	
					Sel. Gold/Nickel <sup>4</sup>	66098-9	66100-9	66099-4	66101-4		
					Tin	66597-1	66598-1	66602-1	66601-1	90310-1	
					Sel. Gold/Nickel <sup>4</sup>	66597-2	66598-2	66602-2	66601-2		

<sup>1</sup>Wire strip length — .156 [3.96] (all wire sizes).

<sup>2</sup>.000030 [0.00076] gold over .000050 [0.00127] nickel.

<sup>3</sup>.000015 [0.00038] gold over .000050 [0.00127] nickel.

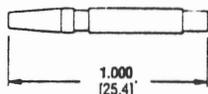
<sup>4</sup>Gold flash over .000050 [0.00127] nickel on entire contact, with .000030 [0.00076] selective gold plating on contact area

<sup>5</sup>Contacts reeled for AMP miniature applicator and AMP-O-MATIC side-feed stripper/crimper machine.

Insertion Tool Part No. — 91002-1 (for insulation diameters .070 [1.78] or less).

Extraction Tool Part No. — 305183

### Type III+ Contacts, Solder Version



#### Series I Keying Plug (for Type II, III+ and VI Contacts)

For use in socket cavities only. Plug is installed taper-end first into front of connector.

Part No. — 200821-1

**Solder Tab**

**Pin**

**Solder Type**  
(with preformed wire barrel/insulation support)

**Socket**

Contact size — 16  
Pin diameter — .062 [1.57]

Test current — 13 amperes\*  
Spring material — stainless steel

\*Refer to contact current carrying capability information (page 9-160).

Wire Size Range <sup>1</sup>		Contact Finish	Loose Piece Contact No.	
AWG	[mm <sup>2</sup> ]		Pin	Socket
26-20	0.12-0.6	Gold/Nickel <sup>2</sup>	66182-1	66183-1
18-16	0.8-1.4		66180-1	66181-1
Solder Tab	—		202236-1	202237-1
		Tin	202236-2	202237-2

<sup>1</sup>Wire strip length — .156 [3.96] (all wire sizes).

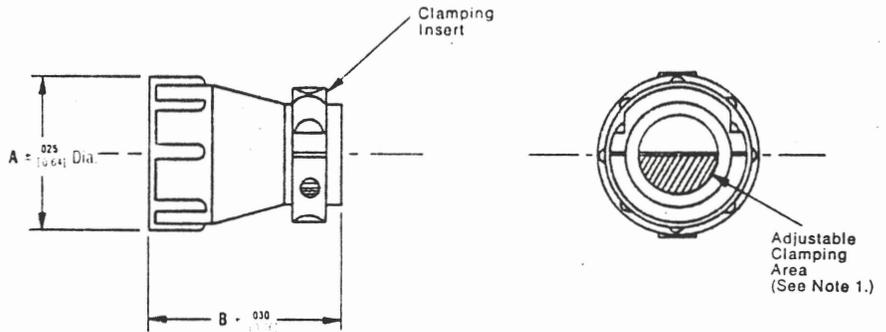
<sup>2</sup>.000030 [0.00076] gold over .000050 [0.00127] nickel.

# Accessories

## Dimensioning:

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Charts contain dimensions in inches over millimetres.

## Cable Clamp



**Material:** UL listed, 94V-1 rated, heat stabilized, fire resistant, self-extinguishing thermoplastic; Color, black

### Standard Size

Shell Size	Dimensions		Cable O. D. (Max.)	Adjustment Range (Sq. In.)	Part Number	
	A	B			Individually Packaged	Bulk Packaged*
11	.825	1.250	.329	.004-.055	206062-1	206062-2 (400)
	20.96	31.75	8.33	2.58-35.48		
13	.966	1.400	.453	.010-.161	206966-1	206966-2 (200)
	24.54	35.56	11.51	6.45-103.87		
17	1.131	1.400	.453	.010-.161	206070-1	206070-3 (200)
	28.73	35.56	11.51	6.45-103.87		
23	1.600	1.555	.703	.083-.390	206138-1	206138-2 (100)
	40.64	39.5	17.86	53.55-251.61		

### Large Size

Shell Size	Dimensions		Cable O. D. (Max.)	Adjustment Range (Sq. In.)	Part Number	
	A	B			Individually Packaged	Bulk Packaged*
11	.825	1.450	.453	.010-.161	206358-1	206358-2 (200)
	20.96	36.83	11.51	6.45-103.87		
13	1.131	1.655	.703	.083-.390	207008-1	207008-2 (100)
	28.73	42.04	17.86	53.55-251.61		
17	1.131	1.655	.703	.083-.390	206322-1	206322-2 (100)
	28.73	42.04	17.86	53.55-251.61		
23	1.600	1.655	1.125	.261-.571	206512-1	206512-2 (75)
	40.64	42.04	28.58	168.39-333.55		

\*Numbers in parentheses specify, in multiples, the minimum quantity of parts to be ordered

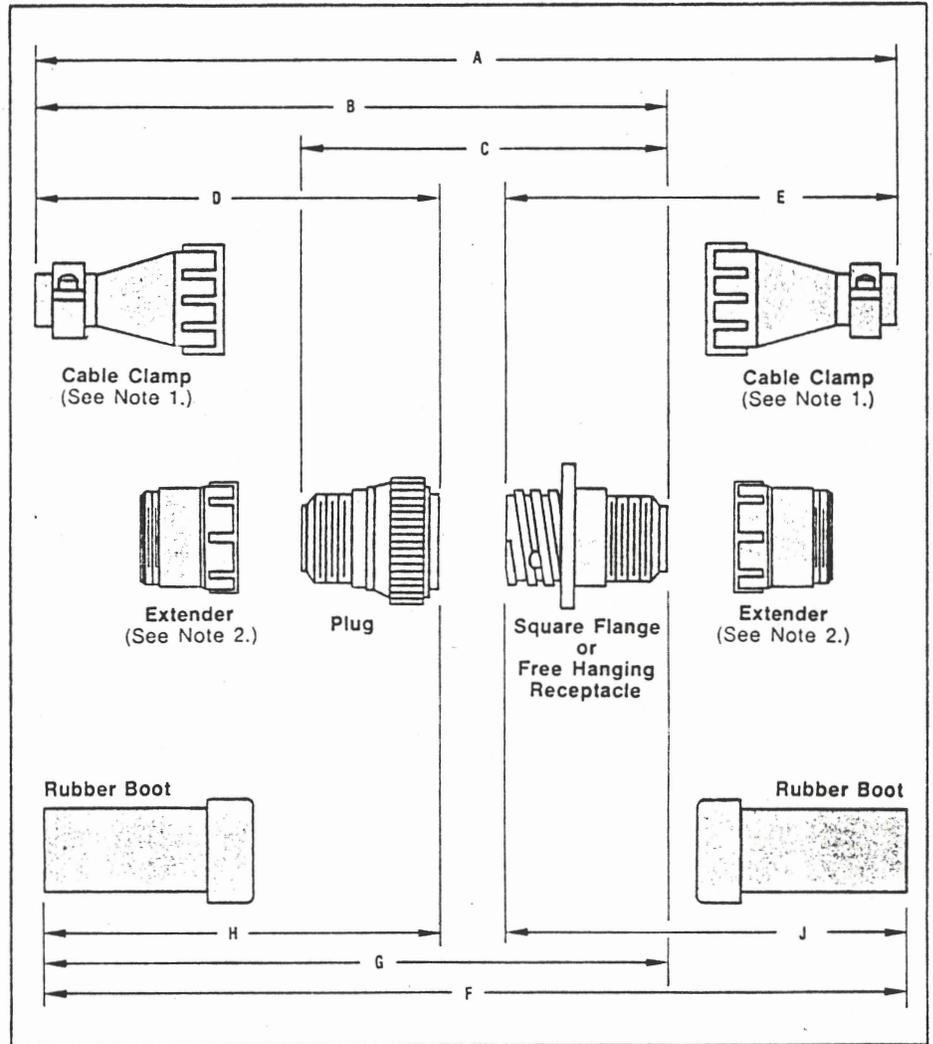
- Notes:**
1. Clamping area is adjustable by changing clamping inserts. For size 11 cable clamps (standard size), 3 inserts are supplied with each assembly; for all other cable clamps, 4 are supplied with each assembly.
  2. Components for all cable clamps are packaged unassembled. This includes the cable clamp, two screws and the clamping inserts.
  3. Cable clamps can be threaded directly onto plugs and receptacles, or onto back-shell extenders (page 9-176A).

# Series 1 Mated Dimensions

**Dimensioning:**

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

## Class A Connectors



Arrangement No.	Sex	Dimensions									
		A Max.	B Max.	C Max.	D Max.	E Max.	F Max.	G Max.	H Max.	J Max.	
11-4	Rev.	4.340	3.170	2.000	2.531	2.281	4.860	3.430	2.795	2.539	
	Std.	110.24	80.52	50.8	64.29	57.94					123.45
13-9	Std.	—	—	2.000	—	—	—	—	—	—	
17-14	Rev.	4.750	3.375	2.000	2.750	2.484	4.860	3.430	3.785	2.539	
	Std.	120.65	85.73	50.8	69.85	63.1					123.45
17-16	Std.	4.750	3.375	2.000	2.484	2.750	4.860	3.430	2.524	2.785	
	Std.	120.65	85.73	50.8	63.1	69.85					123.45
23-24*	Std.	4.750	3.375	2.000	2.484	2.750	—	—	—	—	
23-37	Rev.	4.750	3.375	2.000	2.750	2.484	—	—	—	—	
	Std.	120.65	85.73	50.8	69.85	63.1					69.85

\*Plug and receptacle accept Type II, III + or VI contacts for insulation diameters up to .140 [3.57].  
**Notes:** 1. Dimensions A, B, D and E apply to "large size" cable clamps (page 9-176).  
 2. Add 1.200 [30.48] (max.) to dimensions A, B, D and E when extenders are used. Extenders can be used only with cable clamps.

**Dimensioning:**

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

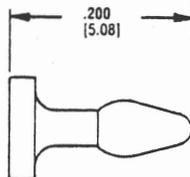
**Introduction**

AMP supplies two contact types in size 20 for the Series 2 circular plastic connector: Type 20 DM (screw-machined); and Type 20 DF (precision formed), with and without insulation support, a solder version, and a posted version for point-to-point wiring.

**Type 20 Contacts**

Type 20 contacts are designed for applications that require high density circuit packaging. These miniature contacts are available for terminating wire sizes #28-24 AWG [0.08-0.2 mm<sup>2</sup>] and #24-20 AWG [0.2-0.6 mm<sup>2</sup>]. They feature an economical single-piece design and can be terminated to wire using either hand crimping tools or automatic machines.

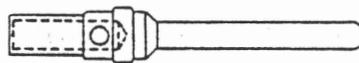
Both pins and sockets can be installed in connector housings and removed with one simple insertion/extraction tool. Because the contacts employ the rear release system for loading and retention, insertion and extraction of contacts is accomplished from the rear of connector housings.



**Series 2 Keying Plug**  
(for Type 20 DM and 20 DF contacts)

For use in socket cavities only. Plug is installed, taper-end first into front of connector.

Part No. — 206509-1

**Series 2 Contact Specifications****Type 20 DM Contacts (Screw-Machined)**

Pin  
(M24308/11-1)



Socket  
(M24308/10-1)

Contact size — 20  
Pin diameter — .040 [1.02]  
Test current — 7.5 amperes\*  
Material: Pin — copper alloy per QQ-B-626  
Socket — beryllium copper per QQ-C-530  
Socket sleeve — passivated stainless steel  
Finish — .000050 [0.00127] gold over .000100 [0.00254] copper; gold plated per MIL-G-45204, copper plated per MIL-C-14550

\*Refer to contact current carrying capability information (page 9-160).

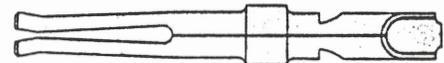
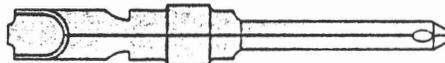
Wire Size Range <sup>1</sup>	Wire Size [mm <sup>2</sup> ]	Ins. Dia. Range (Max.)	Tape Mounted Contact No. <sup>2</sup>		Loose Piece Contact No.		Hand Crimping Tool	
			Pin	Socket	Pin	Socket	Tool No.	Positioner No.
24-20	0.2-0.6	.068 1.73	205089-2	205090-2	205089-1	205090-1	M22520/2-01	M22520/2-08

<sup>1</sup>Wire strip length — .156 [3.96] (all wire sizes).

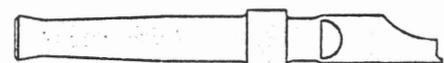
<sup>2</sup>Contacts reeled for use in AMP-TAPEMATIC Stripper/Crimper Machine.

Insertion/Extraction Tool Part No. 91067-2 (MS 18278-1) is used to install and remove both pins and sockets.

Note: All Type 20 DM contacts conform to Military Specification MIL-C-24308.

**Type 20 DF Contacts, Snap-In Solder Cup Version (Precision Formed)**

Pin



Socket

Contact size — 20  
Pin diameter — .040 [1.02]  
Test current — 7.5 amperes\*  
Material: Pin — brass per MIL-C-50  
Socket — phosphor bronze per QQ-B-750  
Finish: Pin — gold flash over .000050 [0.00127] nickel on entire contact, with .000030 [0.00076] selective gold plating on mating end for length of .175/.150 [4.45/3.81].  
Socket — gold flash over .000050 [0.00127] nickel on entire contact, with .000030 [0.00076] selective gold plating for length of .150/.100 [3.81/2.54] from mating end (gold plated per MIL-G-45204, nickel plated per QQ-N-290)  
Wire size — 18 AWG [0.8-0.9 mm<sup>2</sup>] max.  
Part Numbers: Pin — 66570-3 (loose piece)  
Socket — 66569-3 (loose piece)

\*Refer to contact current carrying capability information (page 9-160).

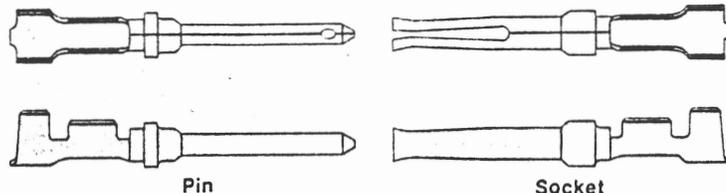
Insertion/Extraction Tool Part No. 91067-2 is used to install and remove both pins and sockets.

## Series 2 Contact Specifications (Continued)

### Dimensioning:

- All dimensions in inches and millimetres. Values in brackets are metric equivalents.
- Charts contain dimensions in inches over millimetres.

### Type 20 DF Contacts with Insulation Support (Precision Formed)



**Contact size — 20**  
**Pin diameter — .040 [1.02]**  
**Test current — 7.5 amperes \***  
**Material: Pin — brass per MIL-C-50**  
**Socket — phosphor bronze per QQ-B-750**  
**Finish — gold over copper, selective gold over nickel or gold flash over nickel (gold plated per MIL-G-45204, copper plated per MIL-C-14550, nickel plated per QQ-N-290)**

\*Refer to contact current carrying capability information (page 9-160).

Wire Size Range <sup>1</sup>	Ins. Dia. (Max.)	Finish	Strip Form Contact No. <sup>3</sup>		Loose Piece Contact No.		Hand Tool No.
			Pin	Socket	Pin	Socket	
28-24 0.08-0.2	.040 1.02	Gold/Copper <sup>2</sup>	66507-2	66505-2	66507-8	66505-8	90302-1
		Sel. Gold/Nickel <sup>2</sup>	66507-3	66505-3	66507-9	66505-9	
		Gold Flash/Nickel <sup>4</sup>	66507-4	66505-4	1-66507-0	1-66505-0	
24-20 0.2-0.6	.060 1.52	Gold/Copper <sup>2</sup>	66506-2	66504-2	66506-8	66504-8	
		Sel. Gold/Nickel <sup>2</sup>	66506-3	66504-3	66506-9	66504-9	
		Gold Flash/Nickel <sup>4</sup>	66506-4	66504-4	1-66506-0	1-66504-0	

<sup>1</sup>Wire and strip length — .110 [2.8] (all wire sizes).

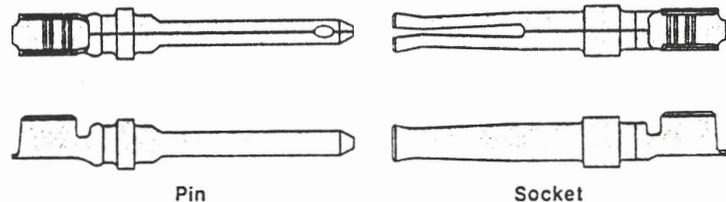
<sup>2</sup>.000050 [0.00127] gold over .000100 [0.00254] copper.

<sup>3</sup>Gold flash over .000050 [0.00127] nickel on entire contact, with .000030 [0.00076] selective gold plating on mating end to length of .150 [3.81] max.

<sup>4</sup>Gold flash over .000030 [0.00076] nickel.

<sup>5</sup>Contacts reeled for AMP miniature applicator and AMP-O-MATIC side-feed stripper/crimper machine. Insertion/Extraction Tool Part No. 91067-2 is used to install and remove all crimp-type contacts.

### Type 20 DF Contacts without Insulation Support (Precision Formed)



**Contact size — 20**  
**Pin diameter — .040 [1.02]**  
**Test current — 7.5 amperes \***  
**Material: Pin — brass per MIL-C-50**  
**Socket — phosphor bronze per QQ-B-750**  
**Finish — selective gold over nickel or gold flash over nickel (gold plated per MIL-G-45204, nickel plated per QQ-N-290)**

\*Refer to contact current carrying capability information (page 9-160).

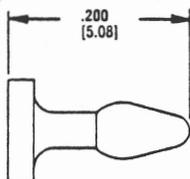
Wire Size Range <sup>1</sup>	Ins. Dia. (Max.)	Finish	Strip Form Contact No. <sup>4</sup>		Loose Piece Contact No.		Hand Tool No.
			Pin	Socket	Pin	Socket	
28-24 0.08-0.2	.068 1.73	Sel. Gold/Nickel <sup>2</sup>	205310-2	205311-3	205310-8	205311-9	90265-1
		Gold Flash/Nickel <sup>2</sup>	205310-4	205311-4	1-205310-0	1-205311-0	
24-20 0.2-0.6	.068 1.73	Sel. Gold/Nickel <sup>2</sup>	205202-2	205201-3	205202-4	205201-5	
		Gold Flash/Nickel <sup>2</sup>	205202-6	205201-6	205202-7	205201-7	

<sup>1</sup>Wire strip length — .110 [2.8] (all wire sizes).

<sup>2</sup>Gold flash over .000030 [0.00076] nickel on entire contact, with .000030 [0.00076] selective gold plating on mating end for length of .275/.250 [6.99/6.35].

<sup>3</sup>Gold flash over .000030 [0.00076] nickel.

<sup>4</sup>Contacts reeled for AMP miniature applicator and AMP-O-MATIC side-feed stripper/crimper machine. Insertion/Extraction Tool Part No. 91067-2 is used to install and remove all crimp-type contacts.



**Series 2 Keying Plug (for Type 20 DM and 20 DF contacts)**

For use in socket cavities only. Plug is installed taper-end first into front of connector.

Part No. — 206509-1

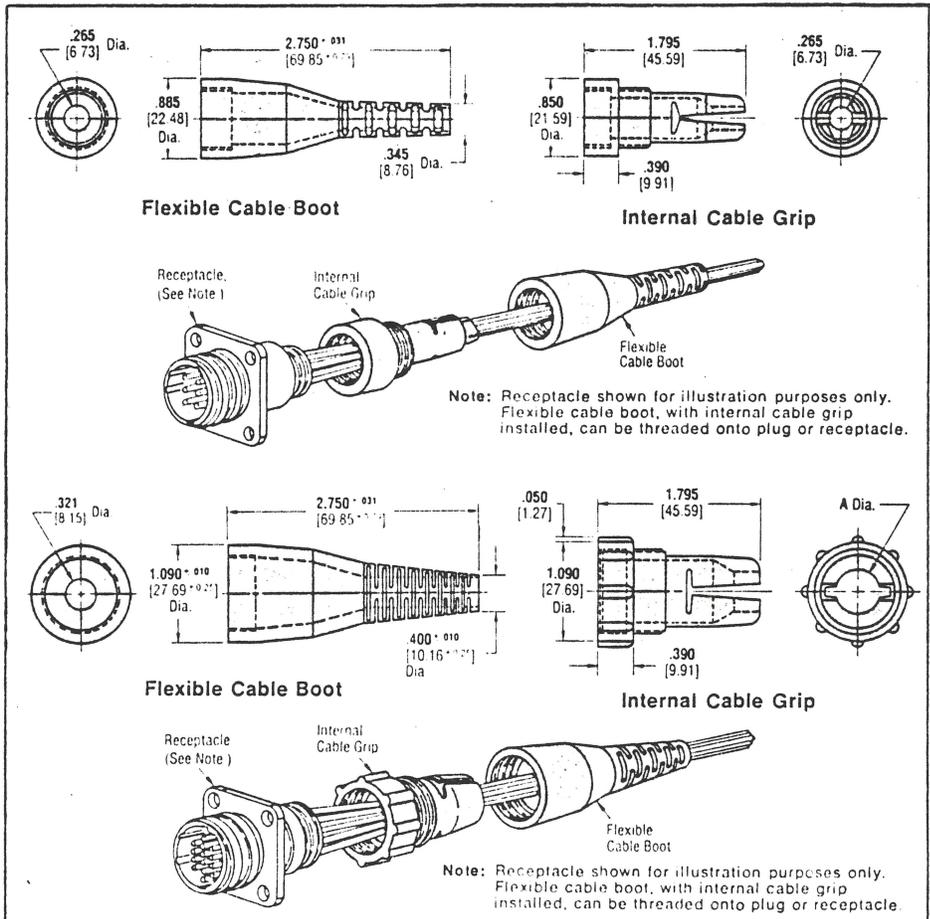
## Accessories (Continued)

### Dimensioning:

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

### Flexible Cable Boot and Internal Cable Grip (for Shell Size 11 Only)

**Material:** Thermoplastic; Color, black  
**Cable Range:** .150-.250 [3.81-6.35]  
**Part Numbers:**  
 207489-1 (Cable Boot)  
 207490-1 (Cable Grip)

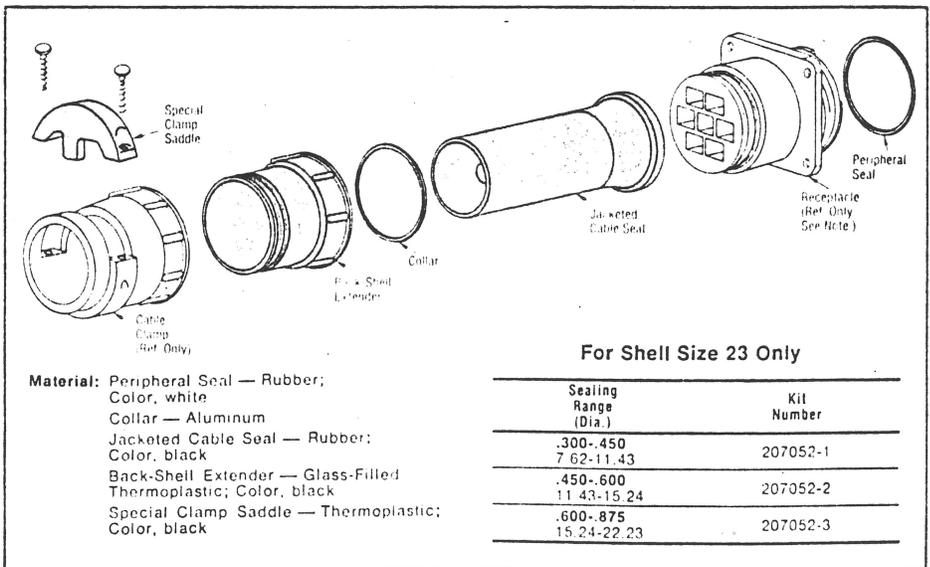


### Flexible Cable Boot and Internal Cable Grip (for Shell Size 17 Only)

**Material:** Thermoplastic; Color, black  
**Part Numbers:**  
 207241-1 (Cable Boot)  
 207387-1 (Cable Grip) — for cable range of .200-.250 [5.08-6.35], A dia. = .325 [8.26]  
 207387-2 (Cable Grip) — for cable range of .250-.300 [6.35-7.62], A dia. = .385 [9.78]

### Jacketed Cable Seal

- Note:** Jacketed cable seals must be used with cable clamps and can be used on plugs or receptacles. Cable clamps are to be purchased separately, refer to page 9-176. Each jacketed cable seal is comprised of:
- One Peripheral Seal — to be discarded if kit is used on plug. Additional seals may be ordered, refer to page 9-177.
  - One Collar (provides bearing surface for back-shell extender)
  - One Jacketed Cable Seal
  - One Back-Shell Extender — Additional extenders may be ordered, refer to page 9-176A.
  - One Special Clamp Saddle — to be used in lieu of clamp saddle supplied with cable clamp.



#### For Shell Size 23 Only

**Material:** Peripheral Seal — Rubber;  
 Color, white  
 Collar — Aluminum  
 Jacketed Cable Seal — Rubber;  
 Color, black  
 Back-Shell Extender — Glass-Filled  
 Thermoplastic; Color, black  
 Special Clamp Saddle — Thermoplastic;  
 Color, black

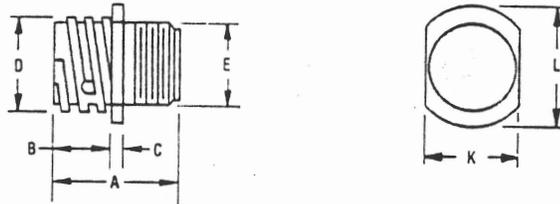
Sealing Range (Dia.)	Kit Number
.300-.450	207052-1
7.62-11.43	207052-2
.450-.600	207052-3
11.43-15.24	
.600-.875	
15.24-22.23	

## Series 2 Component Dimensions (Continued)

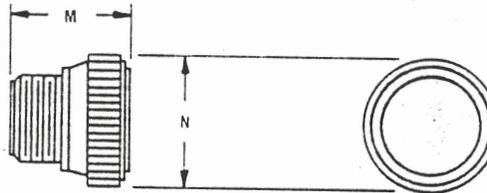
**Dimensioning:**

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

### Free Hanging Receptacle (Class A)



### Plug (Class A and F)



Arrangement No.	Dimensions														
	A Max.	B ± .015 0.38	C ± .005 0.13	D ± .010 0.25	E	F ± .010 0.25	G ± .015 0.38	H	J	K Max.	L Max.	M Max.	N Max.	P Max.	Q ± .015 0.38
11-8,	.800	.420	.094	.688	.625	.844	1.125	.125	.850	.812	.928	.800	.940	1.035	.188
11-9	20.32	10.67	2.39	17.48	15.88	21.44	28.58	3.18	21.59	20.63	23.58	20.32	23.88	26.29	4.78
17-28	.800	.420	.094	1.050	.938	1.125	1.435	.150	1.156	1.156	1.305	.800	1.310	1.040	.188
	20.32	10.67	2.39	26.67	23.83	28.58	36.45	3.81	29.36	29.37	33.15	20.32	33.28	26.42	4.78
23-57,	.920	.420	.156	1.438	1.375	1.438	1.750	.150	1.610	1.495	1.728	.910	1.745	1.668	.156
23-63	23.37	10.67	3.96	36.53	34.92	36.53	44.45	3.81	40.89	37.98	43.9	23.12	44.33	42.37	3.96
23-63°	—	.826	—	1.438	—	1.438	1.750	.150	1.610	—	—	—	—	1.668	.156
		20.98		36.53		36.53	44.45	3.81	40.89					42.37	3.96

\*Jam nut style receptacle only, with or without jam nut.

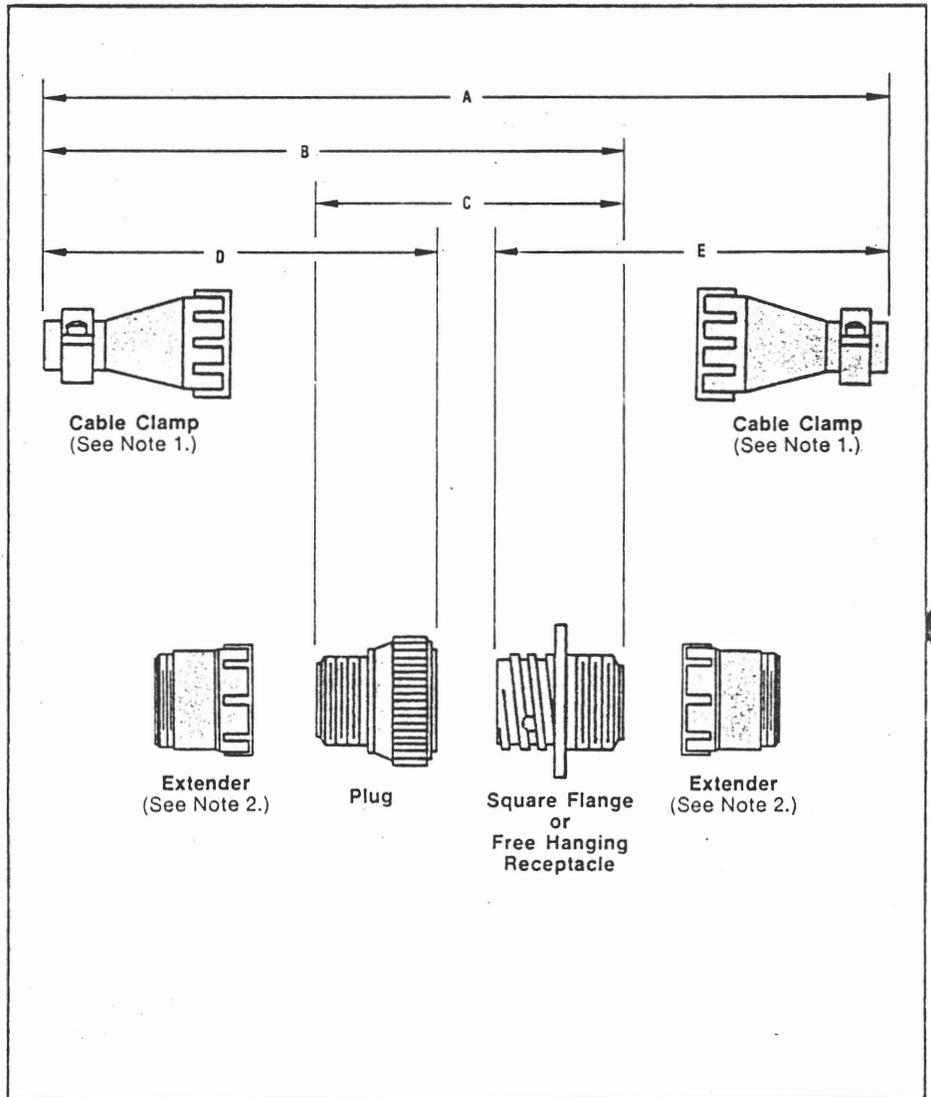
- Notes:**
1. All dimensions apply to both standard and reverse sex for class A connectors. Class F connectors in reverse sex are not available.
  2. Mated dimensions of various combinations of connector configurations and accessories are provided on pages 9-173 and 173A.

## Series 2 Mated Dimensions

### Dimensioning:

1. All dimensions in inches and millimetres. Values in brackets are metric equivalents.
2. Chart contains dimensions in inches over millimetres.

### Class A Connectors



Arrangement No.	Dimensions				
	A Max.	B Max.	C Max.	D Max.	E Max.
11-8,	3.672	2.484	1.300	1.984	1.984
11-9	93.27	63.1	33.02	50.4	50.4
17-28	4.094	2.688	1.300	2.188	2.188
	103.99	69.28	33.02	55.58	55.58
23-57,	4.328	2.938	1.531	2.320	2.320
23-63	109.94	74.63	38.89	58.93	58.93

**Notes:**

1. Dimensions A, B, D and E apply to "large size" cable clamps (page 9-176).
2. Add 1.200 [30.48] (max.) to dimensions A, B, D and E when extenders are used. Extenders can be used only with cable clamps.
3. All dimensions apply to both standard and reverse sex for class A connectors. Class F connectors in reverse sex are not available.

LIVE SHOW LIGHTING CONTROL  
EPCOT CENTER  
December 14, 1981

PAGE 1  
SPECIFICATIONS  
APPENDIX 2

Amphenol Catalog F122-00058 Amphenol industrial line connectors  
Pages 12 thru 15

# UHF coaxial connectors

Amphenol UHF connectors are low cost, general purpose units designed to operate satisfactorily up to 500 MHz. They have a peak voltage rating of 500 volts.

Two sizes of UHF connectors are available: standard 5/8-24 mating threads and 1-20 threaded coupling. They do not intermate.

## SPECIFICATIONS\*

### ELECTRICAL

Impedance	Non-constant.
Frequency range	0-500 MHz.
Voltage rating	500 volts peak.

### ENVIRONMENTAL

Normal limits	Mica-filled phenolic insulators: -67° to 300°F (-55° to 149°C). Copolymer of styrene and polystyrene: -67° to 185°F (-55° to 85°C). TFE insulators: -67° to 390°F (-55° to 199°C)
Weatherproof	Except as noted, all series UHF are non-weatherproof.

### MATERIAL

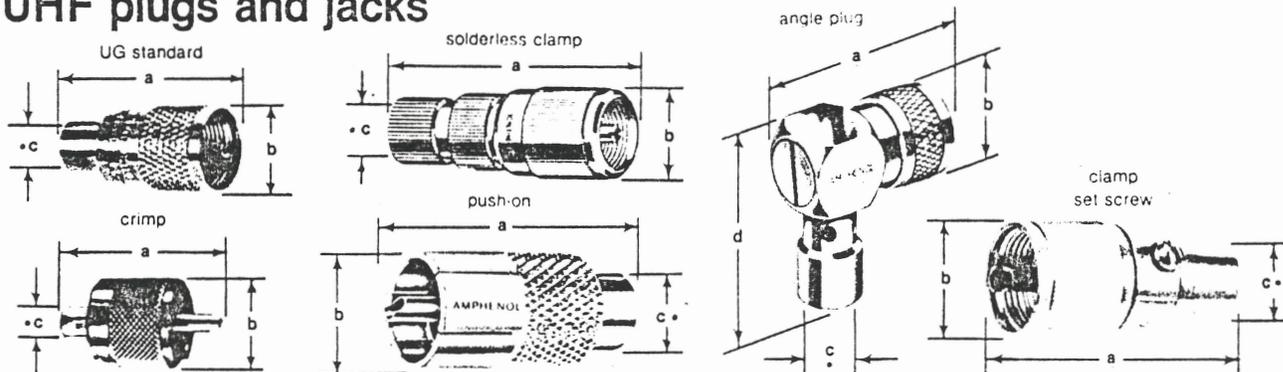
Contacts	Male: brass, silver plated. Female: beryllium copper, silver plated.
Bodies	Brass or die cast zinc.
Other metal parts	Brass
Plating	ASTROplate* and silver.
Insulators	TFE, copolymer of styrene, polystyrene, mica-filled phenolic and or, PBT polyester or equal.

\*These characteristics are typical and may not apply to all connectors.

### MECHANICAL

Mating	Standard size: 5/8-24 threaded coupling Push-on plug mates with any standard size threaded receptacle. Large size: 1-20 threaded coupling
Cable affixment	Braid solder, solderless clamp, set screw clamp and crimp.

## UHF plugs and jacks



NON-CONSTANT IMPEDANCE • MALE CONTACTS • NON-WEATHERPROOF • MICA-FILLED PHENOLIC INSULATION OR EQUAL

## STRAIGHT PLUGS

Cable RG-/U	Cable Termination	Dimensions, inches (millimeters)				Tool Data Die Set P/N	Construction Notes	Military Number	Amphenol Part Number
		a	b	c	d				
8	Crimp-Crimp	1 1/8 (35.7)	1/2 (19.1)	—	—	227-952 227-1355*	Economy Formed Metal Body/ Short Cplg Nut	—	83-8DCP
8,11,149,213	Braid Crimp	1 1/2 (38.3)	1/2 (19.1)	418 (10.4)	—	227-1221-23*	Solder Contact	—	83-8SP
8,9,11,13,63, 87,149,213, 214,216,225	UG Standard	1 1/2 (38.1)	1/2 (19.1)	444 (11.2)	—	—	TFE Insulation	PL 529	*83-1SP-1050
	UG Standard	1 1/2 (38.1)	1 1/8 (17.5)	437 (11.1)	—	—	TFE Insulation	PL 259	83-822
	Clamp Set Screw	1 3/4 (39.7)	2 1/8 (18.3)	444 (11.2)	—	—	—	PL 259A	83-ISP N
	Clamp Set Screw	1 3/4 (39.7)	1 1/2 (20.6)	450 (11.4)	—	—	TFE Insulation	PL 259A	83-756
	Solderless Clamp	1 3/4 (42.5)	1/2 (19.1)	444 (11.2)	—	—	—	—	83-851
	UG Standard	1 1/2 (38.1)	2 1/8 (18.3)	444 (11.2)	—	—	Push-on Mating	—	83-5SP

□ U.S. patent 4,053,200

• accommodates cable diameter  
\* use with tool handle P/N 227-944

□ use with semi-automatic pneumatic bench tool P/N 227-945  
\* for silver plated body order 83-1SP

## UHF plugs and jacks

## STRAIGHT PLUGS continued

Cable RG-/U	Cable Termination	Dimensions, inches (millimeters)				Tool Data Die Set P/N	Construction Notes	Military Number	Amphenol Part Number
		a	b	c	d				
11, 149	Solderless Clamp	1 <sup>1</sup> / <sub>4</sub> (42.5)	3/4(19.1)	.437(11.1)	—	—	Solderless Contact	—	83-850
34	UG Standard	1 <sup>1</sup> / <sub>4</sub> (30.2)	1 <sup>1</sup> / <sub>4</sub> (28.6)	.625(15.9)	—	—	Large Body, Weatherproof	UG-358	83-21SP
58	FCP Clamp	1 <sup>1</sup> / <sub>4</sub> (27.0)	3/4(19.1)	—	—	—	No Special Tools Or Soldering	—	83-58FCP□
	Crimp-Crimp	1 <sup>1</sup> / <sub>4</sub> (34.9)	3/4(19.1)	.245(6.2)	—	227-947 ☆ 227-1242 ★	Standard Const./ Long Cplg. Nut	—	83-58SCP
	Crimp-Crimp	1 <sup>1</sup> / <sub>2</sub> (35.7)	3/4(19.1)	.245(6.2)	—	227-951 ☆ 227-1350 ★	Economy Formed Metal Body/ Short Cplg. Nut	—	83-58DCP-2
	FCP Clamp	1 <sup>1</sup> / <sub>4</sub> (28.2)	3/4(11.1)	—	—	—	No Special Tools Required Mini UHF	—	81-103
59	Crimp-Crimp	1 <sup>1</sup> / <sub>2</sub> (35.7)	3/4(19.1)	.262(6.7)	—	227-1358 ★ 227-948 ☆	Economy Formed Metal Body/ Short Cplg. Nut	—	83-59DCP
59,62	FCP CLAMP	1 <sup>1</sup> / <sub>4</sub> (27.0)	3/4(19.1)	—	—	—	No Special Tools Or Soldering	—	83-59FCP
58,141	Braid Crimp	1 <sup>1</sup> / <sub>4</sub> (33.3)	3/4(19.1)	.206(5.3)	—	227-1221-11/ CAV A ★	Solder Contact	—	83-58SP
	Clamp Set Screw	1 <sup>1</sup> / <sub>4</sub> (39.7)	3/4(18.3)	.214(5.5)	—	—	—	UG-203	83-776
59,62,140 210	Braid Crimp	1 <sup>1</sup> / <sub>4</sub> (33.3)	3/4(19.1)	.251(6.4)	—	227-1221-13/ CAV A ★	Solder Contact	—	83-59SP
59,62,71 140,210	UG Standard	1 <sup>1</sup> / <sub>4</sub> (42.9)	3/4(19.8)	.257(6.6)	—	—	—	UG-111	83-750

## ANGLE

8,9,11,13,63, 87,149,213 214,218,225	UG Standard	1 <sup>1</sup> / <sub>4</sub> (34.9)	3/4(19.1)	.444(11.2)	1 <sup>3</sup> / <sub>4</sub> (39.3)	—	TEF Insulation	—	83-67
	UG Standard	1 <sup>1</sup> / <sub>4</sub> (34.9)	3/4(19.1)	.444(11.2)	1 <sup>3</sup> / <sub>4</sub> (39.3)	—	Polystyrene Ins.	—	83-59

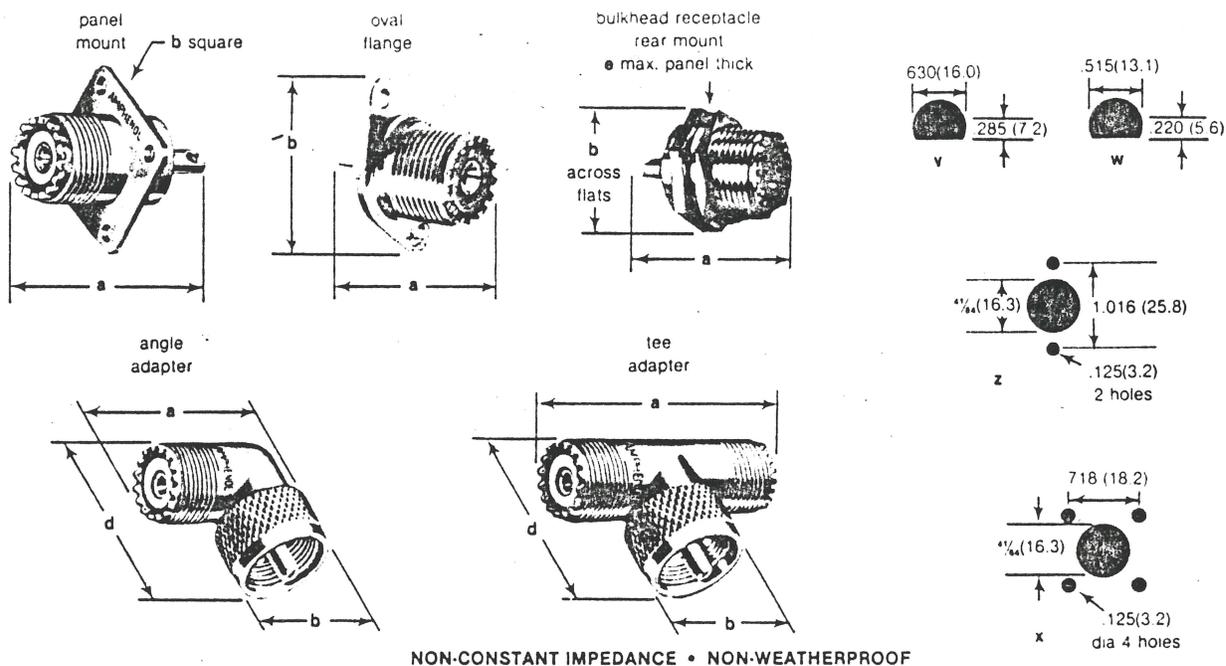
## STRAIGHT JACK

58	FCP Clamp	1.5(40.0)	.64(16.3)	—	—	—	No Special Tools Or Soldering	—	83-58 FCJ□
	FCP Clamp	1 <sup>1</sup> / <sub>2</sub> (32.6)	3/4(7.9)	—	—	—	No Special Tools Required Mini UHF	—	81-104

□ U.S. patent 4,053,200

• accommodates cable diameter  
★ use with tool handle P/N 227-944☆ use with semi-automatic  
pneumatic bench tool P/N 227-945

## UHF receptacles and adapters



### PANEL RECEPTACLES • .125" (3.2mm) dia. flange holes • female contacts • mica-filled phenolic insulation

Description	Dimensions, inches (millimeters)				MTG. Hole	Military Number	Amphenol Number
	a	b	d	e			
Standard Type	1 1/8 (27.0)	1 (25.4)	—	—	X	SO-239	83-1R
Polystyrene Insulation	1 1/8 (27.0)	1 (25.4)	—	—	X	SO-239	83-1RTY
TFE Insulation	1 1/8 (27.0)	1 (25.4)	—	—	X	SO-239A	83-798
Pressurized/Ceramic Ins.	1 1/8 (30.2)	1 (25.4)	—	—	X	—	83-716
Special/Oval Flange	1 1/8 (27.0)	1 3/16 (32.9)	—	—	Z	—	83-876

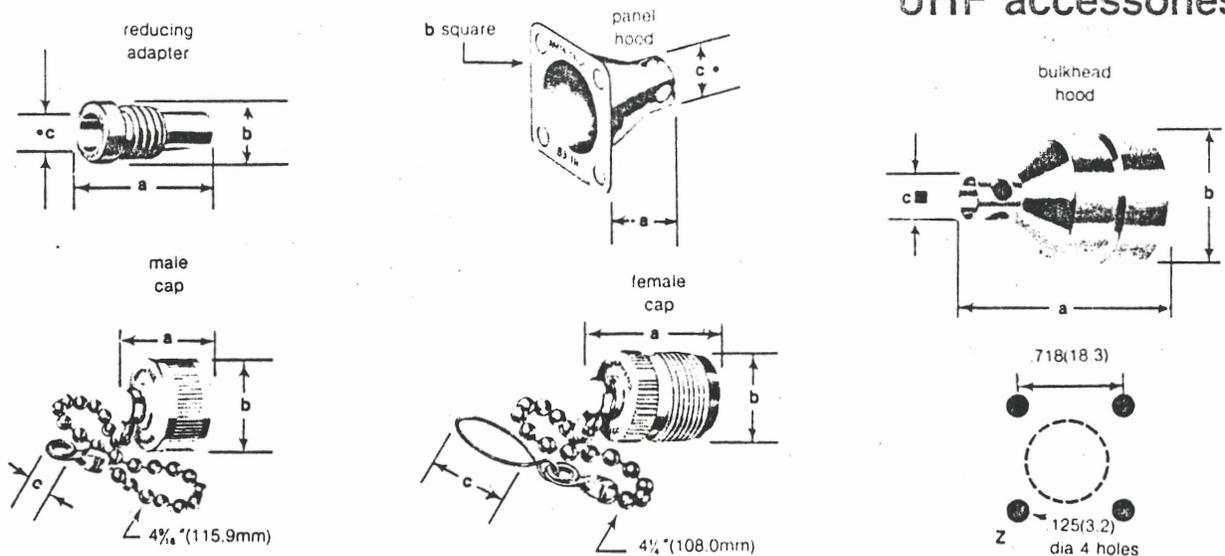
### BULKHEAD RECEPTACLES • female contacts

Front Mount/Copolymer of Styrene and TFE Ins.	1 1/8 (27.8)	3/8 (14.3)	—	.156 (4.0)	W	—	83-875
Front Mount/Mica-Filled Phenolic Ins.	1 1/8 (27.8)	3/8 (14.3)	—	.156 (4.0)	W	—	83-875-1002
Rear Mount/Mica-Filled Phenolic Ins.	1 1/8 (27.0)	3/8 (19.1)	—	.093 (2.4)	V	—	83-878
Rear Mount/Pressurized/Copolymer of Styrene Ins.	1 1/8 (35.7)	3/8 (22.2)	—	.515 (13.1)	1/8 (16.3) dia.	UG-266	4575

### ADAPTERS • polystyrene insulation

Straight/Jack-Jack	1 1/8 (28.6)	3/8 (15.9)	—	—	—	PL-258	83-1J
Straight Jack/Plug	1.5 (38.1)	.750 (19.1)	—	—	—	—	83-5SPA
Straight/Jack-Jack/TFE Ins.	1 1/8 (28.6)	3/8 (15.9)	—	—	—	—	11850
Straight/Plug-Plug	1 1/8 (33.3)	3/8 (19.8)	—	—	—	—	83-877
Bulkhead/Jack-Jack	2 (50.8)	3/8 (15.9)	—	.890 (22.6)	1/8 (16.3) dia.	UG-363	83-1F
Bulkhead/Jack-Jack/Copolymer of Styrene Ins.	1 1/8 (34.9)	3/8 (15.9)	—	.281 (7.1)	1/8 (16.3) dia.	UG-224	29500
Angle/Jack-Plug	1 1/8 (32.5)	3/8 (19.1)	1 1/8 (30.2)	—	—	UG-646	83-1AP
Angle/Plug-Jack	1 1/8 (31.0)	3/8 (19.1)	1 1/8 (27.0)	—	—	M-359A	83-58
Tee/Jack-Plug-Jack	1 1/8 (41.3)	3/8 (19.1)	1 1/8 (30.6)	—	—	M-358	83-1T

## UHF accessories

**REDUCING ADAPTERS** • for p/n 83-1SP, 83-59, 83-67, 83-750, 83-822, 83-850, 83-851

Description	Dimensions, Inches (millimeters)			MTG. Hole	Military Number	Amphenol Number
	a	b	c			
RG-55, 58, 141, 142 Cable (Except 55A)	1(25.4)	1/2(11.1)	209(5.3)	—	UG-175	83-185
RG-59, 62, 71, 140, 210 Cable	1(25.4)	1/2(11.1)	257(6.5)	—	UG-176	85-168

**HOODS** • for use with cables indicated and panel receptacles p/n 83-1R, 83-1RTY, 83-716, 83-798

RG-8, 10, 11, 12, 63, 79, 115, 149, 213, 215 Cable	1/2(19.1)	1(25.4)	345(8.8)	Z	UG-106	83-1H
RG-8, 9, 10, 11, 12, 63, 79, 87, 115, 149, 213, 215, Cable	1/2(22.2)	1(25.4)	360(9.1)	Z	UG-372	83-1HP
RG-58, 141 Cable	1/2(19.1)	1(25.4)	155(3.9)	Z	UG-177	83-765
RG-58, 141 Cable Cadmium Plating	1/2(19.1)	1(25.4)	155(3.9)	Z	—	83-765-1001
RG-58, 141 Cable	1/2(22.2)	1(25.4)	156(4.0)	Z	—	83-786

**HOOD** • threaded for mounting on bulkhead receptacles p/n 4575

RG-55, 59, 140, 142, 223 Cable 1/4-24 Mounting Threads	1(25.4)	1/2(17.5)	201(5.1)	—	MX-539	5375
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**CAPS** • weatherproof

Male	1/2(11.9)	1/2(19.1)	.130(3.3)	—	—	83-1AC
Female	1/2(17.5)	1/2(15.9)	562(14.3)	—	—	83-1BC

**COUPLING RING**

Converts 83-1SP Plug to Push-On Mating	1.062(27)	.750(19.1)	578(14.7)	—	—	83-693
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**PIN PLUG ADAPTER**

UHF Connector to Motorola Type Pin Plug	1.632(41.707)	.650(16.5)	—	—	—	83-10
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**LIGHTNING ARRESTOR**

—	2 1/8(71.4)	1/2(19.1)	—	—	—	83-23
---	-------------	-----------	---	---	---	-------

**DUMMY LOAD**

UHF Plug - Resistor Load - 51 ohm 2 watts	1 1/2(38.1)	1/2(17.5)	—	—	—	83-887
UHF Plug - Lamp Load	2 1/4(57.15)	1/2(17.5)	—	—	—	83-888

**ANTENNA SWITCH**

CB Switch - 2 Way - UHF	2 1/4(61.9)	—	—	—	—	83-2SW
CB Switch - 3 Way - UHF	2 1/4(61.9)	—	—	—	—	83-3SW

- accommodates cable diameter
- accommodates braid diameter

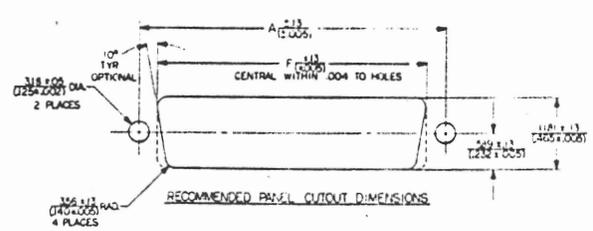
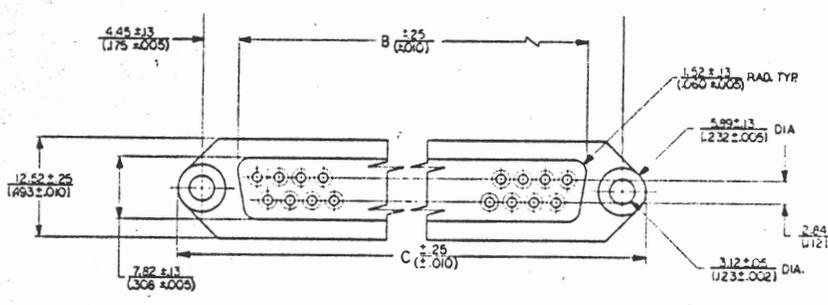
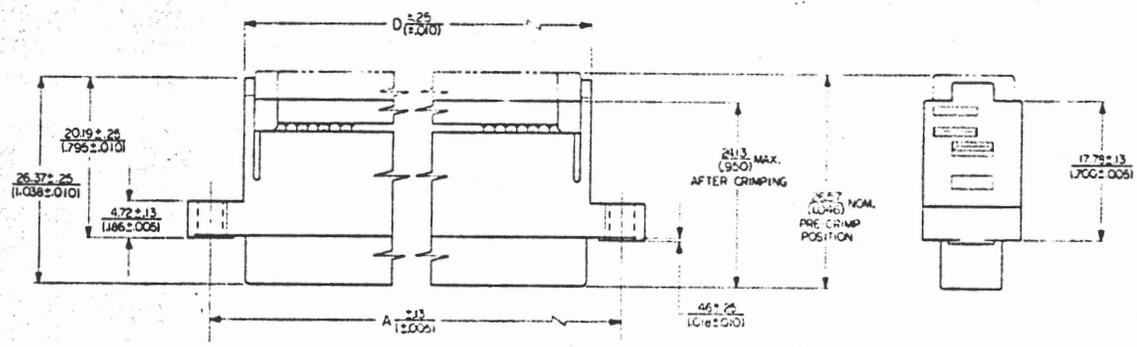
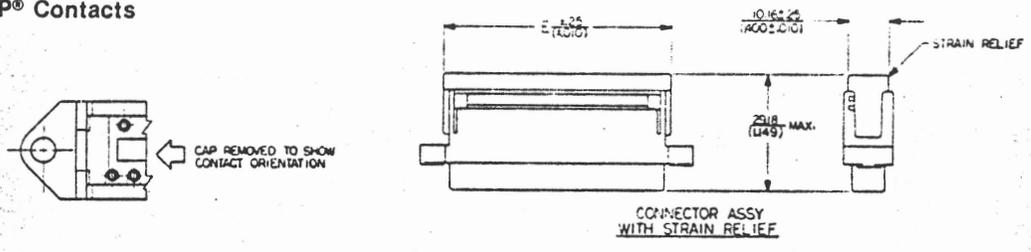
LIVE SHOW LIGHTING CONTROL  
EPCOT CENTER  
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SPECIFICATIONS  
APPENDIX 3

T&B Ansley Catalog No. -Bm1 Blue Macs  
Pages 56, 57

# BLUE MACS® "D" Connectors

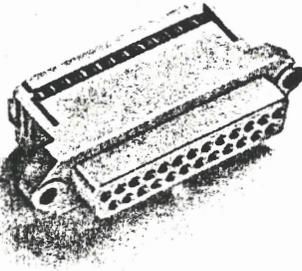
**"D" Socket Connector**  
 U.S. PATENT #3,990,767  
 Feature patented TULIP® Contacts



DIMENSIONS ARE SHOWN IN  $\frac{\text{MM}}{\text{INCHES}}$  / MM (INCHES)

# BLUE MACS® "D" Connectors

CATALOG NO.	NO. OF POS.	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F
609-9S	9	24.99 (.984)	16.05 (.632)	30.89 (1.216)	16.23 (.639)	18.95 (.746)	19.46 (.766)
609-15S	15	33.32 (1.312)	24.36 (.959)	39.22 (1.544)	24.54 (.966)	27.25 (1.073)	27.76 (1.093)
609-25S	25	47.04 (1.852)	38.20 (1.504)	52.93 (2.084)	38.38 (1.511)	41.02 (1.615)	41.61 (1.638)
609-37S	37	63.50 (2.500)	54.61 (2.150)	69.39 (2.732)	54.99 (2.165)	57.61 (2.268)	58.09 (2.287)



"D" Connectors with socket contacts are designed for I/O applications utilizing standard 1.27mm (.050") pitch cable. This connector

series can be mass terminated to all types of 28 or 30 AWG Jacketed Cable for U.L. listed external inter-connection of electronic equipment. The use of backshell strain reliefs are recommended when "D" Connectors are terminated to Jacketed Cable in inter-cabinet disconnect applications.

"D" Connectors can also be mass terminated to standard 28 or 30 AWG round conductor cable for intra-cabinet applications. A strain relief for use with round conductor cable comes standard with this connector series.

PHYSICAL PROPERTIES	
INSULATION MATERIAL	GLASS REINFORCED THERMOPLASTIC RATED 94V-0
COLOR	CUSTOM BLUE
CONTACT MATERIAL	BERYLLIUM COPPER
CONTACT PLATING	30- $\mu$ Au OVER Ni
ELECTRICAL PROPERTIES	
CURRENT RATING	0 AMPS
INSULATION RESISTANCE	$\geq 1 \times 10^9$ OHMS
DIELECTRIC STRENGTH	$\geq 500$ VDC (SEA LEVEL)
ENVIRONMENTAL PROPERTIES	
TEMPERATURE RATING	-55°C TO 105°C

### Installation Tools:

779-2100 Hand Tool with 779-2166 Die

779-3100 Bench Press with 779-3131 Platen and 779-3166 Base Plate.

## PART 1.00 - OPERATION

### 1.01 GENERAL

- A. The intent of this section is to describe the operation of the LIVE SHOW LIGHTING CONTROL SYSTEM produced by Electronic Theatre Controls, Inc.
- B. In this section, each function and control is described in technical detail as to how it will affect the system. An asterisk "\*" following the function name indicates that there is an illuminated indicator associated with the switch.

### 1.02 KEYPAD - GENERAL

The KEYPAD is used to select numbers for CHANNEL CONTROL FUNCTIONS, CUE CONTROL FUNCTIONS, etc. There is a 4 digit seven segment display above the KEYPAD that displays the number selected. This display rolls so that the last entered digit appears in the right-most location.

- A. 0-9 KEYPAD  
Ten switches that are used for numerical entry.
- B. + SWITCH  
A switch that increments the number in the KEYPAD DISPLAY to the next applicable number.
- C. - SWITCH  
A switch that decrements the number in the KEYPAD DISPLAY to the next applicable number.
- D. . SWITCH  
A decimal point switch for entry of inserted CUES and fractional fade rates.
- E. CLEAR ENTRY  
A switch that clears any numerical entry in the KEYPAD DISPLAY when depressed. This function will not remove the KEYPAD from its assignment to a control function.
- F. ENTER  
This switch is used to terminate any entry of information from the KEYPAD and to verify certain actions.

The following control functions are used to control channels, groups of channels and CUES (in the manner of WRITING BY CUE). The modification of a channel by either the AT switch or the LEVEL TOUCH BAR will not affect the level of that channel in any recorded level information, but any change that is made will determine the output of the system until the channel(s) is released from control of the KEYPAD using the RELEASE switch (see Section 1.06.B. Stage Display).

All channels under control of the KEYPAD will be indicated on the CHANNEL DISPLAY by reverse video.

- A. WRITE BY CUE \*
- This switch assigns the KEYPAD to the function of selecting a CUE for control of the LEVEL TOUCH BAR or the AT function. The following message will appear:

\*\*\* SELECT CUE TO WRITE BY \*\*\*

The number of the CUE selected by the KEYPAD will be mimicked in the display above this switch. When a CUE is selected for control in this manner, the AT function and the LEVEL TOUCH BAR will set the channels recorded in the CUE to their proportional levels.

- B. WRITE BY CHANNEL \*
- This switch assigns the KEYPAD to the function of selecting channels for control by the LEVEL TOUCH BAR and the functions below. The following message will appear:

\*\*\* SELECT CHANNELS TO WRITE BY \*\*\*

The channel number (or the last channel number of a group) selected by the KEYPAD will be displayed on the display above this switch.

- C. AND \*
- This switch allows additional channels that are not in numerical order to be selected for level modification.
- D. THRU \*
- This switch allows groups of channels to be for level modification when the channels are in numerical sequence. There is no need to enter the lowest number of a group of channels first, e.g. '5 THRU 10' is the same as '10 THRU 5'

E. AT \*

This switch allows the level of selected channels to be entered digitally with the KEYPAD. The following message will appear:

\*\*\* ENTER INTENSITY \*\*\*

The entered level will appear in the KEYPAD DISPLAY but the change in level will not be made until the ENTER switch is depressed. When the new level is entered, it will appear in the level display above the LEVEL TOUCH BAR. All channels selected at the time will be set to the same level.

In the case of a CUE being selected, setting it to a level using the AT function will set the channels to a percentage of their recorded levels.

F. AT FULL \*

This switch will select a level for the assigned channels. The following message will appear:

\*\*\* ENTER INTENSITY \*\*\*

The ENTER switch must be depressed to enter the information.

G. LEVEL TOUCH BAR

The level touch bar is a membrane touch switch that is used to manually alter the levels of channels and CUES assigned by the KEYPAD by the SELECT CHANNEL and SELECT CUE functions.

The LEVEL TOUCH BAR will set the selected channels or CUE to the level it is touched at e.g. touching the LEVEL TOUCH BAR in the middle will set the levels to 50%.

1.04 CUE FUNCTIONS - GENERAL

The following functions are used to construct and modify a CUE after it has been selected. Note that the changes made in composing and modifying a CUE are entered in the buffer only until RECORD is activated thus transferring the information to the CUE.

A. SELECT CUE \*

This switch dedicates the KEYPAD to selecting CUES for composing and altering. The following message will appear:

\*\*\*SELECT CUE NUMBER \*\*\*

CUES may be inserted between whole numbered CUES by depressing the "." (decimal point) switch on the KEYPAD and the entering of an additional number.

B. SUBROUTINE \*

Depressing the SUBROUTINE switch will change a CUE from the normal format of 96 channel levels into a master CUE that controls twenty four step multi-part fades. A subroutine is displayed in a text format consisting of CUES that are already in existence. A SUBROUTINE CUE may only be written in BLIND display mode and this switch will activate the SUBROUTINE FUNCTIONS (See Section 1.05).

C. RISE TIME \*

This switch allows the assigning of upfade times for the fade going into the CUE selected in the TIMED FADERS or in the case of writing into a SUBMASTER in FADER display mode, the rise time will affect the rate at which the submaster fades up when a BUMP SWITCH is depressed. The following message will appear:

\*\*\* ENTER RISE TIME \*\*\*

Rise times of .1 second to 59.9 seconds and 1:00 minutes to 59:59 minutes may be entered.

D. DECAY TIME \*

This switch allows the assigning of the downfade time for channels decreasing in intensity in the TIMED FADERS or in the case of writing into a SUBMASTER, the decay time will affect the rate at which the selected SUBMASTER fades out after a BUMP SWITCH is released. The following message will appear:

\*\*\* ENTER DECAY TIME \*\*\*

The same range of decay times as rise times may be entered.

E. CLEAR CUE

This switch clears the contents of the buffer for the selected CUE. This is to "clear the slate" before writing a new CUE. The following message will appear:

\*\*\* TO DELETE CUE, PRESS "RECORD" \*\*\*  
\*\*\* TO ABORT, PRESS "CLEAR ENTRY" \*\*\*

Note that the clearing of the buffer will not change the levels recorded for the CUE until RECORD is hit, thus allowing the old information to be recalled by reselecting the CUE number with the KEYPAD.

F. FADE TYPE

This switch allows the type of fade to be specified if the CUE is to be used on an AUTO FADER. The following message will appear:

\*\*\* ENTER FADE TYPE \*\*\*

(1 =AUTO CROSSFADE, 2 =AUTO PLUSFADE, 3=AUTO MINUSFADE, 4 =MANUAL)

The appropriate number should be selected and then ENTER is depressed to complete this function.

NOTE: See Section 1.11.E. for detailed fade descriptions.

G. DUP

This function allows CUE to be duplicated as a new CUE number. The following message will appear:

\*\*\* ENTER "1" TO DUPLICATE FROM A CUE \*\*\*

\*\*\* ENTER "2" TO DUPLICATE FROM A SUBMASTER \*\*\*

The appropriate entry should be made and ENTER depressed. The following message will appear:

\*\*\* ENTER NUMBER OF CUE TO DUPLICATE FROM \*\*\*

or

\*\*\* ENTER NUMBER OF SUBMASTER TO DUPLICATE FROM \*\*\*

After the selection and ENTERing of the appropriate number, the following message will appear:

\*\*\* ENTER NUMBER OF CUE TO DUPLICATE TO \*\*\*

When the CUE number is selected and ENTER is depressed, the duplication will be complete.

H. SEQUENCE \*

When the SEQUENCE switch is depressed, the CUE SHEET will appear on the STATUS DISPLAY MONITOR that shows the currently selected CUE as the NEXT CUE and the next nine CUES, including their RISE and DECAY times. This CUE SHEET will sequence to the next recorded CUE every time that a CUE is assigned to the CROSSFADER or either of the AUTO FADERS.

During the time that the system is in SEQUENCE mode, CUES can be called up for modification on stage and in BLIND mode.

NOTE: When SEQUENCE mode is terminated (by a second depression of the switch) the Cues may be selected manually for activation in a fader.

1.05 SUBROUTINE FUNCTIONS - GENERAL

The following functions are used to construct and modify a SUBROUTINE after it has been selected.

- A. UP CURSOR  
This switch moves the editing cursor up through the SUBROUTINE text.
- B. DOWN CURSOR  
This switch moves the editing cursor down through the SUBROUTINE text.
- C. CUE SELECT \*  
This allows CUES to be selected for action in a SUBROUTINE CUE. This function will create this line text:

01. \_\_\_ FADE CUE 0 TO 00% IN 00:00.0 RISE AND 00:00.0 DECAY

And the following message will appear:

\*\*\* ENTER TYPE OF FADE \*\*\*  
(1 FOR CROSSFADE, 2 FOR PLUSFADE, 3 FOR MINUSFADE)

The appropriate fade is selected and ENTER is depressed. Depressing ENTER without selecting a type will default to CROSSFADE. The line of text will now read (for example):

01. CROSSFADE CUE 0 TO 00% IN 00:00.0 RISE AND 00:00.0 DECAY

And the following message will appear:

\*\*\* ENTER CUE NUMBER TO FADE \*\*\*

The appropriate CUE is selected and ENTER is depressed. The line of text will now read (for example):

01. CROSSFADE CUE 1 TO 00% IN 00:00.0 RISE AND 00:00.0 DECAY

And the following message will appear:

\*\*\* ENTER INTENSITY \*\*\*

The appropriate LEVEL is selected and ENTER is depressed. The line of text will now read (for example):

01. CROSSFADE CUE 1 TO 100% IN 00:00.0 RISE AND 00:00.0 DECAY

And the following message will appear:

**\*\*\* ENTER RISE TIME \*\*\***

The appropriate RISE TIME is selected and ENTER is depressed. The line of text will now read (for example):

01. CROSSFADE CUE 1 TO 100% IN 00:10.0 RISE AND 00:00.0 DECAY

And the following message will appear:

**\*\*\* ENTER DECAY TIME \*\*\***

The appropriate DECAY TIME is selected and ENTER is depressed. The line of text will now read (for example):

01. CROSSFADE CUE 1 TO 100% IN 00:10.0 RISE AND 00:20.0 DECAY

This step is now complete, and the cursor will advance to the next line for the entering of the next step.

D. DELAY \*

This switch allows a delay or wait period to be inserted between the activation of CUES. The delay period will start at the beginning of the step before the DELAY step. This function will create a line of text:

02. DELAY 00:00:0

And the following message will appear:

**\*\*\* ENTER DELAY TIME \*\*\***

The delay period will scroll in from the right side and depressing ENTER will complete the function.

NOTE: The final step of any SUBROUTINE CUE must be a wait that is long enough for any fades in the CUE to be completed.

E. LOOP \*

When this command is entered in a SUBROUTINE text it will automatically restart the CUE at the beginning of the CUE text and indicate how many times it should repeat the sequence. This function will create a line of text:

03. LOOP TO BEGINNING 00 TIMES

And the following message will appear:

```
*** ENTER NUMBER OF LOOPS TO BEGINNING ***  
    (ENTER 0 FOR INFINITE LOOPS)
```

A default mode of infinite loops can be performed by not specifying the number of repeats, which appears as 00 times.

If a number of times is specified, the SUBROUTINE will execute the LOOP that many times and then pass by the LOOP command and complete the rest of the SUBROUTINE, this allows a LOOP to be entered in the middle of a SUBROUTINE CUE.

F. REVERSE \*

This command, when placed in a SUBROUTINE, will reverse the order of the CUE text automatically until it reaches the beginning of the CUE and then will start the CUE in the original order. This function will create a line of text:

04. REVERSE 00 TIMES

And the following message will appear:

```
*** ENTER NUMBER OF REVERSES ***  
    (ENTER 0 FOR INFINITE REVERSES)
```

The number of reverses can be entered (a default mode of infinite reverses will can be performed by not specifying the number of times).

If a number of times is specified, the SUBROUTINE will execute the REVERSE that many times and then pass by the REVERSE command and complete the rest of the SUBROUTINE, this allows a REVERSE to be entered in the middle of a SUBROUTINE CUE.

G. MENU \*

This function is not implemented at this time.

H. DELETE LINE

This switch removes the line of text, that the cursor is on, from the selected SUBROUTINE.

These functions dedicate the right CRT monitor to display and print information in various formats. The variable displays will occur on the right CRT and the fixed FADER STATUS DISPLAY will be on the left CRT.

A. FADER STATUS DISPLAY

This display provides information pertinent to the playback of CUES on the system. Information resembling a CUE SHEET will indicate the next ten CUES and include brief descriptions of the CUES. The level of all faders, the CUE assigned or loaded into them, and the fade progress of the TIMED FADERS will also be displayed (Figure 1).

B. STAGE DISPLAY

This mode displays the current level of the ninety-six control channels as they affect the stage. Any changes made through the operator's keyboard will be made to the levels on stage when in this mode.

Once a channel or channels are under control of the KEYPAD in STAGE DISPLAY mode, changes in the level by the AT switch or LEVEL TOUCH BAR will be reflected onstage regardless of the levels for the channel(s) caused by any fader. All channels that have been modified in the stage mode will remain "captured" by and their levels controlled by the KEYPAD until the RELEASE switch is depressed.

If another display mode is selected while the channel(s) is still under control of the KEYPAD (i.e. BLIND DISPLAY to change levels in the affected CUES) the channel(s) will remain at the set levels until STAGE DISPLAY is reselected and the channel(s) are released from control of the KEYPAD at which point they will revert to the levels caused by the faders.

RECORD will store the levels as displayed on the CRT in the CUE selected (Figure 2).

C. BLIND DISPLAY \*

This mode displays the channel levels in the CUE presently selected by the KEYPAD (Figure 3).

This display mode is used for 'blind plotting' of a show. Changes made to recorded information will not affect the levels or actions on-stage. A CUE that has been altered in this manner can be stored permanently by the RECORD function.

The information will remain in the buffer until a new CUE is selected by the KEYPAD.

A CUE can be made into a SUBROUTINE in this display mode (see SUBROUTINE above) and this will cause the display to show another format (Figure 4).

D. FADER DISPLAY \*

This display indicates the status and output of any fader. This switch, when depressed, will cause a message on the right CRT (Figure 5) that asks:

\*\*\* SELECT FADER NUMBER \*\*\*

(1-24 FOR SUBMASTERS, 25 FOR CROSSFADER, 26 FOR AB FADER, 27 FOR CD FADER)

The status and levels of channels under control of the selected fader will then be displayed (Figure 6).

In the case of a SUBMASTER being displayed, the levels shown will be the full recorded levels for the 96 channels. The channels may be set to different levels and recorded into the displayed SUBMASTER. The RISE and DECAY times for the bump switches may also be entered in this mode.

In the case of the CROSSFADER or TIMED FADERS being displayed, the levels indicate the current output of the displayed fader.

E. MANUAL DISPLAY \*

This display indicates the levels of the ninety-six control channels as currently set by a manual lighting controller and allows those levels to be recorded as a CUE. When this display mode is entered the message appears:

\*\*\* TO READ BACK MANUAL BOARD, PRESS "ENTER" \*\*\*  
(READBACK MODE WILL BLACKOUT THIS SYSTEM'S OUTPUT)

NOTE: Since there is a softpatch in this system, the system takes the first dimmer in its own softpatch for a channel and assumes the level seen as the level for the channel.

F. CHANNEL SCAN DISPLAY \*

A display of one channel (the channel currently selected by the KEYPAD) in all of the recorded CUES. The level for the selected channel in each CUE will appear under the CUE number. If more CUES are recorded that can be displayed on the monitor, a second depression of the CHANNEL SCAN switch will display the next group. When the CHANNEL SCAN switch is depressed, a message will appear:

\*\*\* SELECT CHANNEL TO BE SCANNED \*\*\*

Once the levels have been displayed, they can be modified in one CUE or a group of CUES by using the KEYPAD in SELECT CUE mode and then utilizing the AND and THRU switches. The following message will appear:

**\*\*\* SELECT CUES TO BE MODIFIED \*\*\***

Their levels changed with the AT function or the LEVEL TOUCH BAR. A message will appear:

**\*\*\* ENTER INTENSITY \*\*\***

New levels may then be stored with the RECORD function.

NOTE: The levels for a channel can only be recorded into CUES that are already recorded. Thus selecting to modify a channel in CUES 1 THRU 100 will not create any new CUES within that block.

**G. SOFTPATCH DISPLAY \***

This display indicates the assignment of the two hundred twenty-four dimmers in the ninety-six channels (Figure 8). The channel number will appear followed by all of the dimmers assigned to it. Subsequent dimmers are displayed by additional depressions of the SOFTPATCH display switch.

NOTE: A dimmer may be patched to only one channel at a time. Assigning a dimmer that is already patched to another channel will remove it from the original channel.

When in this mode, the softpatch can be modified. A message will appear:

**\*\*\* ENTER DIMMER NUMBERS \*\*\***

Dimmers to be patched into a channel are selected first (using the AND and THRU functions) and the ENTER is depressed. A message appears:

**\*\*\* TO ASSIGN DIMMERS, SELECT CHANNEL # (1-96) THEN PRESS "ENTER" \*\*\***  
**\*\*\* TO DELETE DIMMERS, SELECT "0" THEN PRESS "ENTER" \*\*\***

Selecting the channel number and then depressing ENTER will store the new patch and return the point of selecting dimmer numbers.

When the system is powered up, or CLEAR SYSTEM is executed, a default softpatch will be entered. This patch has dimmers 1-96 in channels 1-96, dimmers 97-192 in channels 1-96, and dimmers 193-224 in channels 1-32.

H. PRINT \*

This function will allow the contents of any display mode on the right CRT to be printed on an owner supplied printer. The system will then either print the selected display, or in the case of the BLIND display being selected, ask:

\*\*\* ENTER LAST CUE TO BE PRINTED \*\*\*

When the last CUE to be printed is selected, and ENTER is depressed the system will continue to print until the selected CUE is printed.

NOTE: Changing display modes during a PRINT will stop that print.

1.07 FILE CONTROLS - GENERAL

These functions control the memorizing, storage and playback of CUES.

A. RECORD \*

This switch transfers information currently in the temporary buffer to the RAM and replaces information in the RAM with the new information. A message will appear:

\*\*\* TO RECORD, PRESS "ENTER" \*\*\*  
\*\*\* TO ABORT, PRESS "CLEAR ENTRY" \*\*\*

Depressing ENTER will complete the RECORD function, thus making the change to the CUE. Depressing CLEAR ENTRY will abort the RECORD function and not make any change to the recorded information in the CUE.

B. CLEAR SYSTEM \*

This switch when depressed will create the message:

\*\*\* TO CLEAR SYSTEM, PRESS "ENTER" \*\*\*  
\*\*\* TO ABORT, PRESS "CLEAR ENTRY" \*\*\*

Depressing ENTER will complete the CLEAR SYSTEM function, thus erasing all of the CUE information in the system's memory and returning the softpatch to the default setting. Depressing CLEAR ENTRY will abort the CLEAR SYSTEM function and return to the previous display mode.

D. FROM TAPE \*

This function will cause the system to retrieve the directory of the tape that is inserted into the the tape drive. A message will appear:

\*\*\* TO READ FROM TAPE, SELECT SHOW # (1-5) THEN PRESS "ENTER" \*\*\*  
\*\*\* TO ABORT, PRESS "CLEAR ENTRY" \*\*\*

SHOW 1: RECORDED  
SHOW 2: RECORDED  
SHOW 3: RECORDED  
SHOW 4: NOT RECORDED  
SHOW 5: NOT RECORDED

A show consists of 200 CUES, a softpatch and the 24 SUBMASTER assignments. Selecting a recorded show number and depressing the ENTER switch will start the system loading a show from the tape into the working memory. A message will appear:

"FROM TAPE"  
IN PROGRESS

SHOW 1: RECORDED  
SHOW 2: RECORDED  
SHOW 3: RECORDED  
SHOW 4: NOT RECORDED  
SHOW 5: NOT RECORDED

NOTE: During FROM TAPE operations, all fades in progress at the time will be halted for the duration of the tape function. The output of the system to the dimmers will be frozen at their current levels on the activation of the FROM TAPE function. The fades will continue at the completion of this function.

E. TO TAPE \*

This function will cause the system to retrieve the directory of the tape that is inserted into the the tape drive. A message will appear:

\*\*\* TO RECORD ONTO TAPE, SELECT SHOW # (1-5) THEN PRESS "ENTER" \*\*\*  
\*\*\* TO ABORT, PRESS "CLEAR ENTRY" \*\*\*

SHOW 1: RECORDED  
SHOW 2: RECORDED  
SHOW 3: RECORDED  
SHOW 4: NOT RECORDED  
SHOW 5: NOT RECORDED

A SHOW NUMBER is selected as the destination of the information that is contained in the console memory at

the time and ENTER is depressed to initiate the transfer of information to the tape. The levels will remain in the memory of the console, the TO TAPE function duplicates the information without erasing it from memory. When ENTER is depressed, a message appears:

**"TO TAPE"  
IN PROGRESS**

SHOW 1:	RECORDED
SHOW 2:	RECORDED
SHOW 3:	RECORDED
SHOW 4:	NOT RECORDED
SHOW 5:	NOT RECORDED

NOTE: During TO TAPE operations, all fades in progress at the time will be halted for the duration of the tape function. The output of the system to the dimmers will be frozen at their current levels on the activation of the TO TAPE function. The fades will continue at the completion of this function.

NOTE: "TAPE ERROR" messages will occur from the following causes:

- Tape cassette is "write protected"
- Tape cassette is not inserted in drive unit
- Tape drive unit is not functioning properly

## 1.08 GRAND MASTER - GENERAL

The GRAND MASTER potentiometer and BLACKOUT switch provide means to reduce or totally remove the output of the system. These actions are taken without affecting the status of the fades in the system.

### A. BLACK OUT \*

This alternate action switch zeros the output of the system when activated. The levels indicated in the STAGE display mode will remain at their normal intensities, but the effect of a STAGE RECORD will be to record the levels at 0%. The word BLACKOUT will appear black on a light background (reverse video) on the CHANNEL DISPLAY MONITOR as long as the BLACKOUT switch is activated.

### B. GRAND MASTER

This potentiometer allows the output of the system to be reduced or completely zeroed. The level of the GRAND MASTER is displayed on the CHANNEL DISPLAY MONITOR. Any time that the level of the GRAND MASTER is below 100%, the level is indicated in reverse video.

## 1.09

### SUBMASTERS - GENERAL

The SUBMASTERS are a set of 24 manual faders which pile on to each other individually as well as to all the other faders in the system. Any of the 96 control channels may be assigned to any of the SUBMASTER. The levels of the channels can be proportional, with the recorded levels affected by the level of the SUBMASTER. The contents of a SUBMASTER may be displayed and recorded in FADER DISPLAY MODE (see Section 1.06.D.)

The RISE and DECAY times that are associated with the BUMP switches are displayed and recorded in FADER DISPLAY MODE.

The level of the submaster, whether set by the potentiometer or the BUMP switch, is displayed on the STATUS DISPLAY MONITOR under the SUBMASTER number.

- A. FADER (24 EACH NUMBERED 1-24)  
A linear slide potentiometer to set the level of the SUBMASTER.
- B. BUMP SWITCH (24 EACH NUMBERED 1-24) \*  
A momentary switch which will bring the assigned contents of the SUBMASTER to full intensity. When the BUMP switch is depressed its level will start to rise to full at the recorded rate. Assuming that the BUMP switch is held longer than the recorded RISE time, the level will reach full and decay in the recorded DECAY time when the switch is released. If the BUMP switch is released prior to the CUE reaching full intensity, the CUE will decay from that point at the recorded DECAY rate. If no rates are recorded, the bump action will be instantaneous.

The BUMP switch has an LED indicator which lights when the SUBMASTER has any levels recorded into it.

## 1.10

### CROSS FADERS - GENERAL

The CROSS FADERS are configured as separate pile on faders that allow split, dipless fades to be performed. Different CUES may be assigned to the X and the Y faders. A fade between these CUES may be performed in which levels staying the same or increasing in intensity will not show a "dip" in their levels.

The current position of the CROSS FADERS as well as the CUE assignments are indicated on the STATUS DISPLAY MONITOR.

- A. FADER  
Each CROSS FADER has a linear slide potentiometer to adjust the level of the CUE loaded into the fader. The two faders are reversed such that when the X fader is at a level of 100%, the Y fader is at a level of 0%. This allows the CROSS FADERS to be used to simply fade between CUES. The output of the CROSS FADERS piles on to the outputs of the other faders of the system.

Since each CROSS FADER has a separate potentiometer, lead lag fades may be performed.

- B. LOAD SWITCH \*  
A switch that loads the selected CUE into the fader. If the system is in SEQUENCE mode, the NEXT CUE indicated in the CUE SHEET will be assigned to the fader.
- C. CLEAR SWITCH  
A switch that clears the fader of the CUE loaded into it.

#### 1.11 AUTO FADERS - GENERAL

The AUTO FADERS are arranged in two pairs. These two pairs are "last action" faders, meaning that a channel will always go to the last level that is given for it. The final output of the AUTO FADERS piles on to the other faders in the system.

There are two modes of operation for the AUTO FADERS. The first controls fades for normal CUES and the second controls fades for SUBROUTINES.

- A. GO \*  
When depressed, this switch will load the NEXT CUE into the AUTO FADER pair. The fade times will be set as recorded and the recorded CUE will be initiated in the AUTO FADER.

- B. HOLD \*  
Depressing the HOLD switch when a fade is active in an AUTO FADER will freeze any fades which are in progress at the time, at their current levels.

The CUES will still be loaded into the AUTO FADER and the fades can be resumed by depressing the GO switch; the fades will continue from the point that they were held.

The fades can be left at the point that they were held by depressing the HOLD button a second time, in this case the levels that the fades were producing will remain as the output of the fader. Another CUE can be initiated at this point in the AUTO FADER.

- C. **CLEAR \***  
This switch will clear the fader pair of any CUE or CUES that are loaded into it. All of the output from the AUTO FADER will be cancelled.
- D. **FADE OUT**  
This function will initiate a fade to zero for all channels in the AUTO FADER. When this fade is complete, the AUTO FADER will be cleared of any CUES and the CLEAR switch will be illuminated. The fade time for the fade is the same as the DECAY time for the last CUE initiated in the AUTO FADER.
- E. **CUE OPERATING MODE**  
When a simple CUE (containing only channel level information and fade times) is initiated on an AUTO FADER pair with the GO switch, the left bargraph in the pair will indicate the progress of the up-fade portion of the fade, the TOUCH BAR acts as a manual override for this portion of the fade. Depressing the TOUCH BAR below the indicated fade progress on the bargraph will hold the fade at the level that it has reached and the fade can then be advanced manually. The progress of this part of the fade will follow the position of the override on the touch bar.

The right bargraph and touch bar perform the same function for the down-fade portion of the fade. This feature allows both the up-fade and the down-fade progress to be modified independantly.

There are three types of fades that can be performed by the AUTO FADERS using simple level only CUES. These are determined by the information recorded in the CUE that is entered using the FADE TYPE function (see Section 1.04.F.). The fades will cause the following results in the AUTO FADER when a CUE is initiated.

1. **CROSS FADE**  
All channel levels currently produced by these AUTO FADERS will be replaced by the levels recorded in the NEXT CUE.
2. **PLUS FADE**  
Only channels with new non-zero levels in the NEXT CUE will change in intensity. All other levels produced by the AUTO FADERS will remain the same. Using this type of fade, it is possible to do infinite "fade within fade" CUES, initiating different CUES with different starting and ending times in an AUTO FADER.

### 3. MINUS FADE

Initiating a MINUS FADE in an AUTO FADER will take any channels that are recorded at levels greater than 0 in the CUE and fade them to 0% in the AUTO FADER.

## F. SUBROUTINE OPERATING MODE

When a SUBROUTINE CUE is initiated on an AUTO FADER pair, The controls and displays will be automatically configured in a mode to allow the control of the level and rates of the fades in the SUBROUTINE.

The left-hand TOUCH BAR and BARGRAPH will act as a master level control for the SUBROUTINE. When a SUBROUTINE CUE is initiated, the level will be set automatically at 100% and can be modified at any time during the course of the SUBROUTINE.

The right-hand TOUCH BAR and BARGRAPH act as the rate control device for the SUBROUTINE. When the SUBROUTINE is initiated, The bargraph will be set in the middle of its range, indicating that the fades are running at the normal rates. By depressing the TOUCH BAR, the rates can be doubled, set to instantaneous, cut in half and halted. Modification of the rate will change both the fade times and any delay times that are recorded in the SUBROUTINE that is running in the AUTO FADER.

The STATUS DISPLAY MONITOR will indicate the step that the SUBROUTINE is executing as well as the rate and level that the AUTO FADER is set to.

## 1.12 BATTERY BACK-UP FUNCTION

### A. DESCRIPTION

The Console contains a battery back-up power supply which will keep the system fully functional for a period of 5 minutes. The Back-up system will automatically activate when a failure of the AC input to the system is detected, or in the case of failure of the primary power supply circuit.

One minute after the power failure is detected, the system will automatically activate the TO TAPE function (see Section 1.07.D.). The show that is contained in the console will be recorded in the last show location on the tape that was loaded from.

After this function is complete, the system will remain fully operational for a total of five minutes and then shut itself down.

The batteries will recharge when AC power is restored to the Console.

### 1.13 REMOTE FOCUS UNIT - GENERAL

The Remote Focus Unit (RFU) will execute certain functions of the system from distances up to 4000' from the console.

- A. REMOTE FOCUS UNIT INITIALIZATION  
When the RFU is connected to the system, the OPERATOR PANEL of the console will become inoperable. Certain functions provided by this portion of the console will be duplicated by the REMOTE FOCUS UNIT.
- B. KEYPAD  
See PART 1.02.A. thru G.
- C. CHANNEL CONTROL FUNCTIONS  
See PART 1.03.A thru F.
- D. LEVEL DISPLAY  
A two digit seven segment display to indicate the level of the selected channel or group of channels.
- E. CUE/CHANNEL DISPLAY  
A four digit seven segment display to indicate the selected CUE or channel. The display functions the same as the KEYPAD DISPLAY.
- F. GO  
This switch will allow any recorded CUES to be initiated on the AB AUTO FADER.
- G. HOLD  
This switch will perform the same function as the AB AUTO FADER HOLD switch.
- H. SELECT CUE  
This switch allows the selection of a CUE to be initiated in a fade by the GO function.  
See PART 1.03.B.
- I. PROGRESS DISPLAY  
Two two-digit seven segment displays to indicate the progress of a fade.