

**TM-106-6-90**

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**TECHNICAL MANUAL**

**INSTALLATION MANUAL**  
**OMEGA-TEK**  
**EXPANDER CARD MK \_\_\_\_\_**  
**with MK-70 Board.**



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## DOUBLE COUNTS ON AUTOMATIC SCORING AFTER SWEEP REVERSE CYCLE

In some cases during a sweep reverse cycle (i.e. gutter ball or 7-10 pickoff) a double miss may be entered into Magic Score or Accuscore. This is caused by double triggering of the APS start switch actuated by the sweep. This switch is located at the front of the pinspotter and is positioned to actuate when the sweep drops. When the sweep reverses, there is some degree of overtravel when the sweep reaches zero. The Expander Card compensates for this by momentarily energizing the sweep in the forward direction about  $\frac{1}{2}$  second after the end of the sweep reverse cycle. If the APS start switch is not carefully adjusted, this can cause an additional count to be entered into Magic Score or Accuscore. This count will be entered as a miss.

If this occurs, carefully inspect and adjust all APS start switches to insure that a normal sweep reverse cycle will not actuate the APS start switch. There should be enough adjustment in the existing brackets to correct any difficulty.

## SOLID STATE START SWITCHES

There are a variety of solid state start switches for the table and sweep motors on the market. Some of these require a special wiring procedure for use with AMF MP chassis. This same wiring procedure should be used for the OMEGA-TEK Expander Card. If the sweep reverse cycle on the OMEGA-TEK board does not work and you have solid state motor start switches AND THE SWEEP REVERSE MODULE RELAY IS ENERGIZING BUT THE MOTOR FAILS TO RUN IN REVERSE, then it may be necessary to consult the manufacturer of the solid state switch to obtain wiring instructions for correct use with the AMF MP chassis. The maker of the switch should also be reported to OMEGA-TEK for our reference.

## INTRODUCTION

The OMEGA-TEK Expander Card provides a low cost alternative for pinspotters equipped with OMEGA-TEK MK series single board conversions to obtain sweep reversal on gutter ball or 7-10 pickoff, short strike cycle, bypass of table cable and optional diagnostic outputs, when used in conjunction with AMF automatic scoring. In addition an LED on the Expander Card monitors system power, clock, and data.

The Expander may be removed at any time and chassis will revert to normal operation.

NOTE: FOR OPERATION WITH EXPANDER CARD REMOVED, CABLE FROM C1 TO EXPANDER MUST BE TERMINATED WITH SHORTING PLUG PROVIDED OR SWEEP WILL NOT RUN.

Optional analyzer decodes APS or Accucam signal and displays pinfall.

All installation is via push on terminals and no wiring changes are required.

OMEGA-TEK will update any MK series board to the MK-70 level for use with Expander as well as numerous other improvements and give the entire package a lifetime warranty.

## EXPANDER CARD OPERATING DESCRIPTION

The Expander Card is a serial to parallel decoder and sequential controller used in conjunction with AMF automatic scoring and the Omega-Tek MK-70 EC board to generate all features normally found in the MP chassis. These include elimination of first revolution of table on a strike cycle, sweep reversal on a gutter ball or 7-10 pickoff, bypass of gripper inputs for pindication.

Expander inputs are as follows:

Clock from scoring system.

Data from scoring system.

Offspot, TA-2, SB, SA, SC (L), Inst, Foul, 2nd ball.

Expander outputs are as follows:

Gripper drivers pins 1-10.

Sweep Reverse, Sweep Run.

Table Inhibit.

Offspot, TA-2, SB, SC (L).

Note that Offspot, TA-2, SB, and SC (L) are both inputs and outputs.

On a strike cycle the expander works as follows:

Data from the scoring system is decoded (see timing diagram for scoring data) is conditioned by U4 and U5 and sent to U6 and U7 for serial to parallel conversion. These outputs are labeled on the schematic as to pin and pin count and will match up with each bit of the serial data. In the case of a strike all bits will be zero. This data goes directly to U20A, U20B, U21A, U21B, U22A to the gripper inputs on the MK-70 board.

The decoded pin count goes directly to the sequential controller U19.

If no inhibits are present from the OS, Foul, Inst, 2nd ball, or Table Running, the strike sequence is started. The sequence is started by the arrival of the start and stop pulses at U11-1,2. This generates a pulse that is ORed with an output from the sequential controller. This sets latch U17 and starts counter U19 which generates 16 discrete addresses that in conjunction with other address inputs generates the correct sequence for the short strike cycle. In addition, SB must be at 66-186 to start the sequence.

Output TA-2 is closed U23A and Table Run is inhibited. This sets the strike. At 186 of sweep the TA-2 and Table Run inhibit return to the normal state.

Note: Defective or intermittant SB can cause the sweep to stop at 270 guard with strike light and first ball light on.

The counter will have the above output for 16 counts about 6.5 sec or until SB reaches 186. Reset of counter is via carry bit. Remainder of cycle is normal operation.

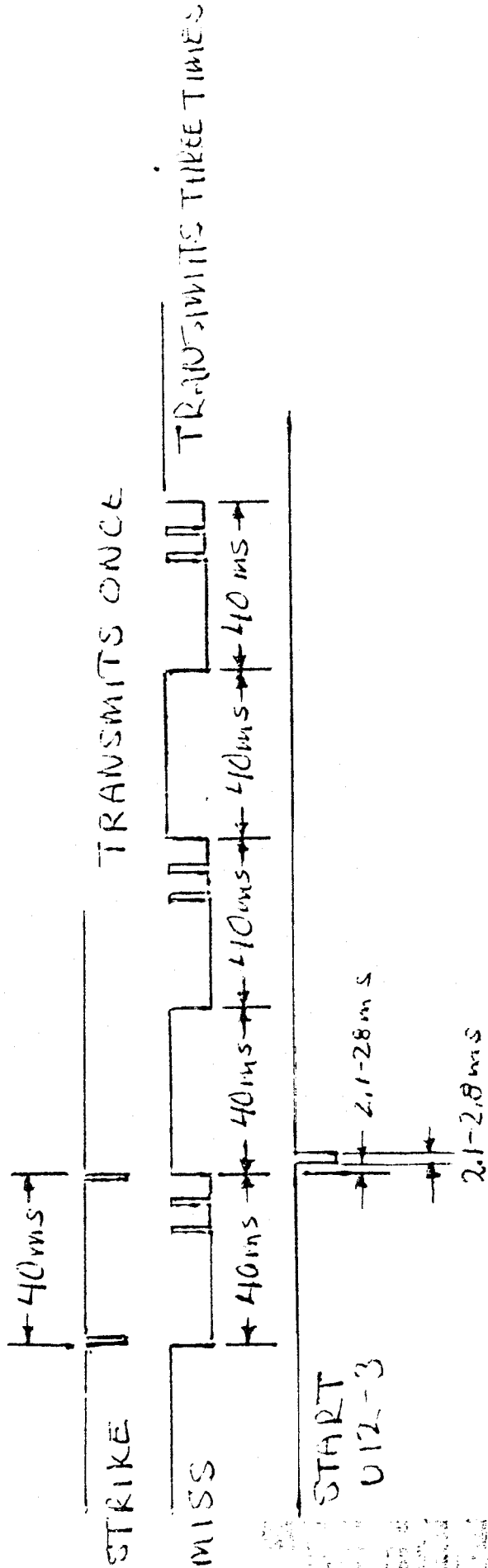
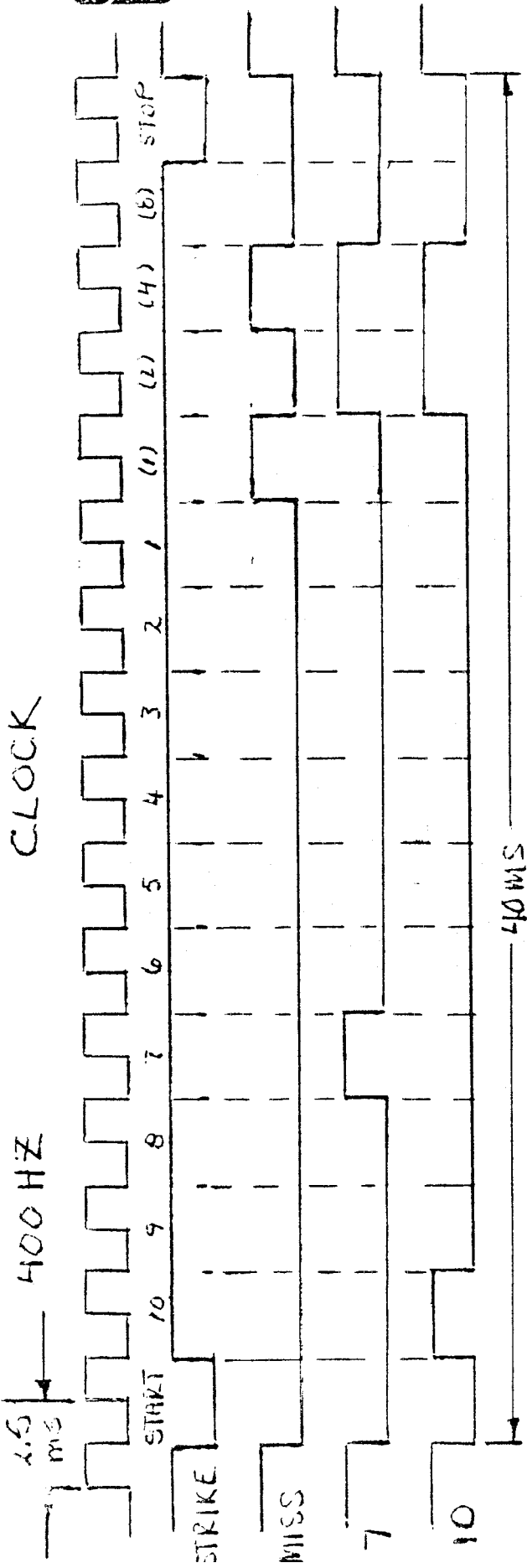
On a gutter ball or 7-10 pickoff the sequence is as follows:

Data is decoded and sent to grippers as above. The pin count and ANDed 7-10 pin to sequential controller initiate the following sequence:

1. Set OS
2. Set TA-2, inhibit table run.
3. Close sweep rev. relay
4. Set SB and run sweep via connection to MK-70 board.
5. Hold this until sweep activates SA.
6. Stop sweep.
7. Open sweep rev relay.
8. Reset OS
9. Set SC.
10. Reset SC, pindication comes on.
11. Reset TA-2, SB.

Completion of the sequence results in second ball with pindication.

Any other combination of pins is decoded and set to gripper drivers without any special sequence. Note that each time APS is cycled this information is stored in memory and sent to grippers. Pin count on second ball is stored in memory. Power failure erases memory or updating of data changes output to grippers.



## EXPANDER CARD INSTALLATION INSTRUCTIONS

1. Disconnect Russell Stoll plug.
2. Insure sufficient lighting is available or move chassis to well lit work area.
3. Remove OMEGA-TEK MK Board from chassis.
4. Remove PC-3 adapter from chassis.
5. Check PC-4, PC-3, PC-1, and PC-5 card connectors to insure no broken connectors or bent pins.
6. Inspect C1 plug for evidence of overheating and renew pins and connectors as required.
7. Install new PC-3 jumper in PC-3 connector with fingers facing rear of chassis (toward mask plug).
8. Route wire from PC-3 jumper to 12V lug adjacent PC-5 connector. Connect faston to lug and carefully route wire as shown in Fig. 1 to avoid interference when PC-5 jumper is reinstalled.
9. Reinstall OMEGA-TEK MK-70 Expander Compatible board with expander harness attached as shown in Fig. 2. Observe polarization on connectors and P.C. Board when installing harness.
10. Install the Expander card in the P.C. 1 connector.
11. Prior to seating card in connector, attach the 15 position cable from the MK-70 board to the connector on the solder side of the Expander card. Observe correct polarization. See Fig. 7.
12. Locate the five wire connector assy.(red, black, white, orange, green) and plug the polarized six position connector into the mating socket on the upper left corner of the Expander. See Fig. 7.
13. Locate the terminals on the ends of the red, black, white, orange and green wires on the above harness and plug into unused positions in the C1 chassis connector as shown in Fig. 4.

Black	C1-18-JJ
Red	C1-17-DD
Orange	C1-26-BB
White	C1-27-FF
Green	'Sweep' Contactor Coil Terminal 6 (yellow)

14. Locate 4 loose piece wires with sockets on one end and fastons or faston splices on other end and install in C1-HARNESS Connector as shown in Fig. 5.

Black	C1-18-JJ	to	TSA-3	Faston Term.
Red	C1-17-DD	to	TSA-2	Faston Term.
Orange	C1-26-BB	to	Sweep Motor Plug	SMP-Z
White	C1-27-FF	to	Sweep Motor Plug	SMP Y

15. Remove short section of wireway cover that contains Russell Stoll receptacle. Do not disconnect wiring.

16. Locate terminals TSA-2 and TSA-3 in uncovered section of wireway.

17. Remove the wire from TSA-2 going to the sweep motor cable term. Z. (This wire is usually red or orange, but may vary.)

18. Locate the orange wire previously installed at C1-26-BB and connect via AMP faston splice to the motor wire removed from TSA-2 in 17 above.

19. Remove the wire from TSA-3 going to the sweep motor cable term Y. (This wire is usually white, but may vary.)

20. Locate white wire previously installed at C1-27-FF and connect via AMP faston splice to the motor wire removed from TSA-3 in 19 above.

21. Connect red wire from C1-17-DD to TSA-2.

22. Connect black wire from C1-18-JJ to TSA-3.

23. Connections should now be as shown in Fig. 6.

24. Locate 3 conductor cable and route from chassis to scoring system. For APS systems with transducers in kickback, assemble and route cable as shown in Fig. 3.

25. Connect terminated end of cable to scoring system per Fig. 8A.

26. For Accusonic systems with array under pit light connect as shown in Fig. 8B or 8C.

27. For Accucam systems connect as shown in Fig. 8D.

For Qubica Fig 8E, Steltronic Fig 8F, Twelve Strike Fig 8G.

28. Reinstall chassis on pinspotter and fish expander end of cable through opening between Mask and BPP plugs at rear of chassis and connect as shown in Fig. 7.

29. Apply power to chassis and scoring system. Red LED on upper right corner of Expander should light. This indicates power to



systems, APS clock is running, and data line is inactive.

30. Clear pins from deck and cycle pinspotter. Sweep should run to guard, Strike light should come on, and table should spot pins.

31. With full set of pins (or either the 7 or 10 missing), cycle pinspotter. Sweep should run to guard and go back up after time delay. Machine goes to 2nd ball and pin lamps come on.

CYCLE MUST BE INITIATED BY ACTIVATING START SWITCH ON CUSHION PLANK IN ORDER TO ACTIVATE PINSSENSOR OR ACCUCAM. B.E. CYCLE WILL NOT ACTIVATE PINSSENSOR.

32. Note that there are four small LED's located near the center right of the Expander card labeled 8-4-2-1 from top to bottom. Adding the indicated value of each LED after transmission of pin count will result in the number of pins still standing:

Miss-10 pins standing	8 and 2 LED's on.
Strike	No LED's on.
Any single pin down	8 and 1 LED's on.
Any two pins down	8 LED on. etc.

Observe that data will change about 2.5 sec after sweep reaches 66° on both first and second ball cycle. Turning power off and back on will clear data from Expander.

33. Note that there is a two position jumper near the center of the board. In the top position shown Expander pinfall outputs are in parallel with gripper inputs. Boards are shipped with the jumper in this position.

This is for use with the table cable left in place. In this position the Expander will bypass broken or intermittant wiring on grippers and display correct pinfall on mask. Shorted table wiring to ground will prevent strike cycle and must be corrected.

In the event of pin sensor malfunction the system will automatically revert to the table cable. It may be necessary to clear last data from Expander by turning power on and off.

Top of Board



Jumper in position for use with table cable.

34. With the jumper in the lower position the table cable may be removed. In the event of pin sensor malfunction the 2 pin gripper is held electronically closed by the Expander to prevent false strike cycle. The pin sensor must be repaired or the table cable reinstalled in the event of a problem.

Top of Board



Jumper in optional position for use with table cable removed.

The no pindication Expander has a single 4 wire cable attached to the reverse side of the expander with a single plug that connects to the 10 POSITION ROW OF PINS on the reverse side of the MK-70.

This plug is polarized such that the 4 wires in the plug are positioned toward to top of the MK-70 board when installed. The polarizing inserts are positioned toward the bottom of the MK-70 when correctly installed.

## MK-70 EXPANDER NO PINDICATION

The no pindication expander is intended for use with no pindiction masks. It may be used with either pindicator or no pindicator MK-70 boards.

All gripper outputs from the expander are eliminated except for one (gripper input 1) which functions as a strike/no strike input to gripper 1 of the MK-70 board. During a 1st ball cycle, if strike data is received from the scoring system, the gripper 1 output from the expander remains open and the MK-70 can perform a strike cycle. If any other pin combination is received from the scoring system, the output for gripper 1 closes to ground and a strike is not performed. Short strike cycle and sweep reverse on gutter ball function as with a pindicator board.

If no data is received from the scoring system due to failure or use of Reset Pins Only switch the gripper 1 is held closed during the time the table runs to prevent spotting with pins in the grippers. It is assumed that the table cable is disconnected.

If the table cable remains connected, the 1 pin gripper will be held closed in the event of any pin combination, scoring system failure or RPO use. This means that a strike cycle will not be possible if the scoring system fails or the RPO is used. If it is desired to go back to the table cable operation, the jumper must be in the top position. In the top position the table cable controls all gripper inputs. The short strike cycle and sweep reverse work as usual.

See manual for location and positioning of the yellow jumper on the expander.

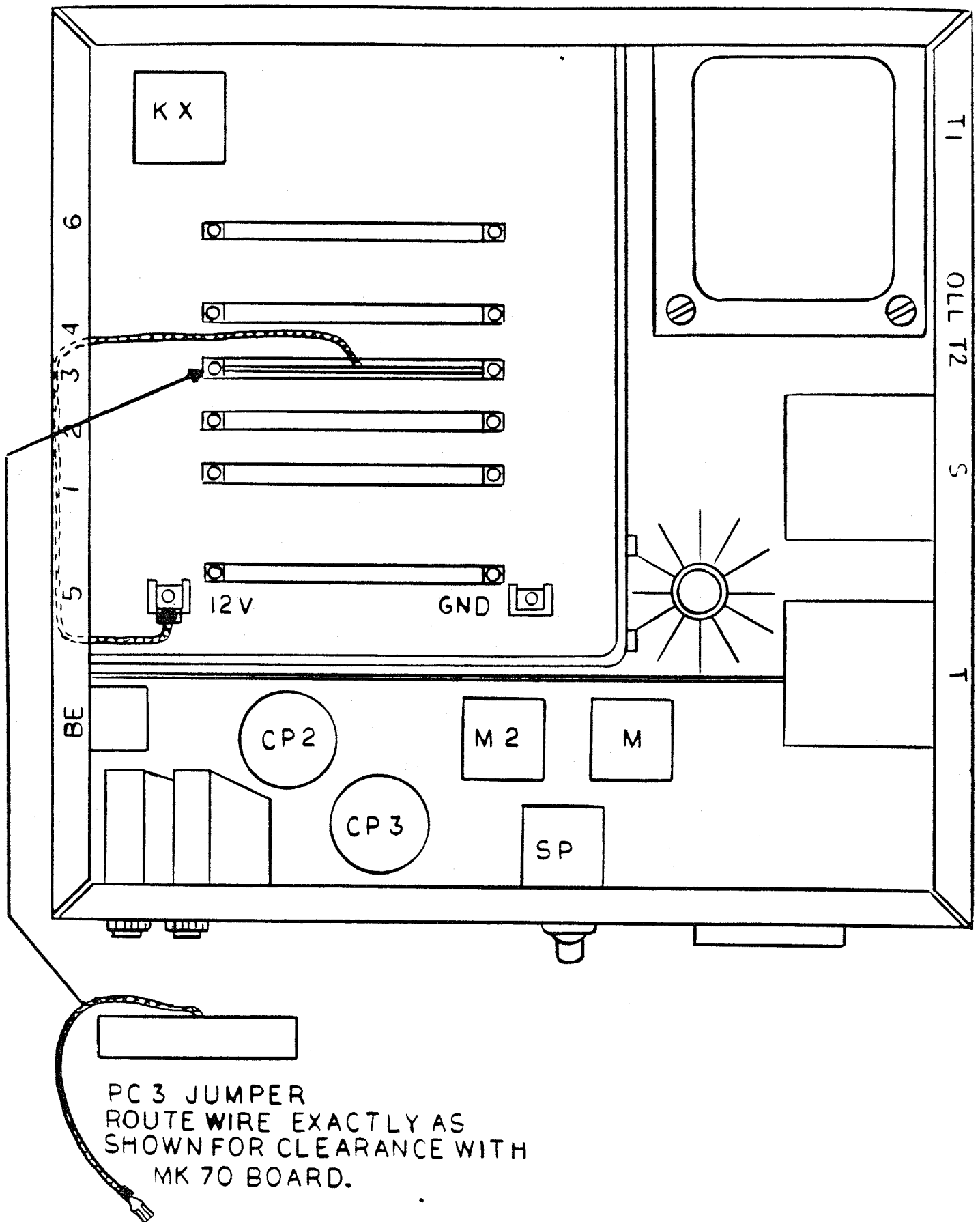
## INHIBIT LED INDICATOR

All expanders are now equipped with an additional LED indicator in the lower right hand portion of the Expander board. This indicator will light if any of the following inputs are present:

1. Foul
2. Instructomat
3. Off Spot
4. 2nd ball
5. Table running (time delay elapsed).

Presence of any of the inputs will inhibit the short strike cycle and sweep reverse cycle from the expander. The pinspotter will run a normal 1st ball or strike cycle. This indicator should be off when data is received from the scoring on 1st ball with sweep at 66°.

The LED will flash momentarily on power up to indicate reset is working.



PC 3 JUMPER  
 ROUTE WIRE EXACTLY AS  
 SHOWN FOR CLEARANCE WITH  
 MK 70 BOARD.

NOTE: IF DURING A STRIKE CYCLE WITH EXPANDER IN USE THE PINSPOTTER STOPS WITH SWEEP AT 270° \*GUARD, NO TABLE RUN OR SPOTTING, AND WITH BOTH FIRST BALL AND STRIKE LIGHTS ON, ADJUST SB AND REPLACE THE RETURN SPRING ON THE CAM LEVER. IF THE PROBLEM STILL OCCURS, REPLACE SB SWITCH.

NOTE: IF THE PINSPOTTER FAILS TO RUN A STRIKE CYCLE WITH THE EXPANDER INSTALLED AND THE SWEEP RUNS THROUGH AND RETURNS TO ZERO WITH TABLE RUN AND THE PINSPOTTER GOES TO SECOND BALL, THEN THERE IS A SHORT FROM ONE OF THE GRIPPERS OR TABLE CABLE WIRES TO GROUND. CHECK WIRING AND GRIPPERS. IF THERE IS PINDICATION ON THE MASK, THE GROUNDED GRIPPER SHOULD BE INDICATED.

NOTE: FOR OPERATION WITH EXPANDER CARD REMOVED, CABLE FROM C1 TO EXPANDER MUST BE TERMINATED WITH SHORTING PLUG PROVIDED OR SWEEP WILL NOT RUN.

NOTE: FOR USE IN INSTALLATIONS THAT HAVE CHASSIS MOUNTED SWEEP REVERSE RELAY INSTALL EXPANDER AND CONNECT CABLE FROM SWEEP REVERSE RELAY TO 8 POSITION CONNECTOR WITH RED DOT IN LOWER RIGHT SIDE OF EXPANDER. ALL OTHER CONNECTIONS ARE AS DESCRIBED IN MANUAL.

REMOVE RELAY FROM EXPANDER BOARD TO REDUCE UNNECESSARY POWER CONSUMPTION IF EXTERNAL RELAY IS USED.

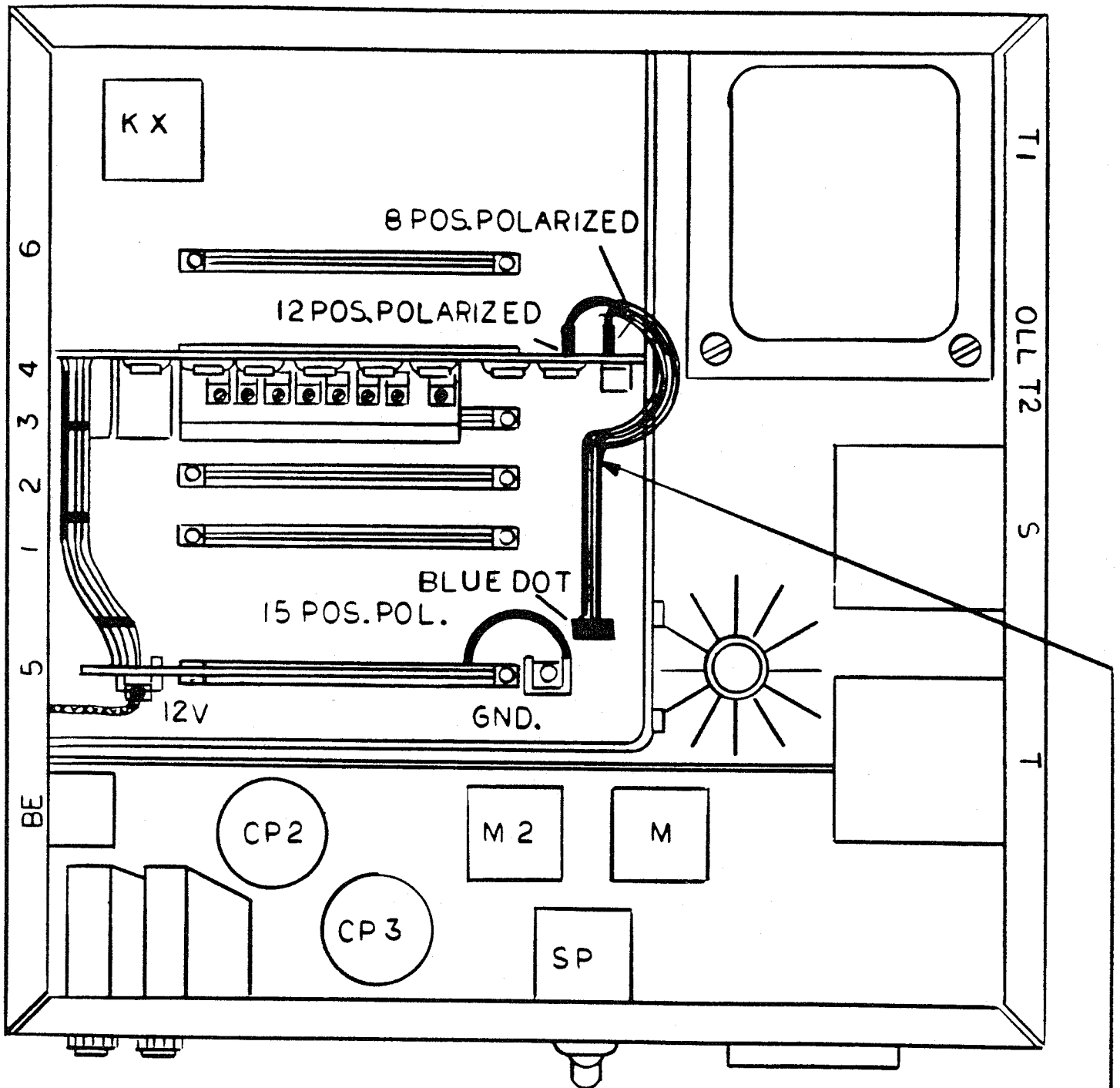
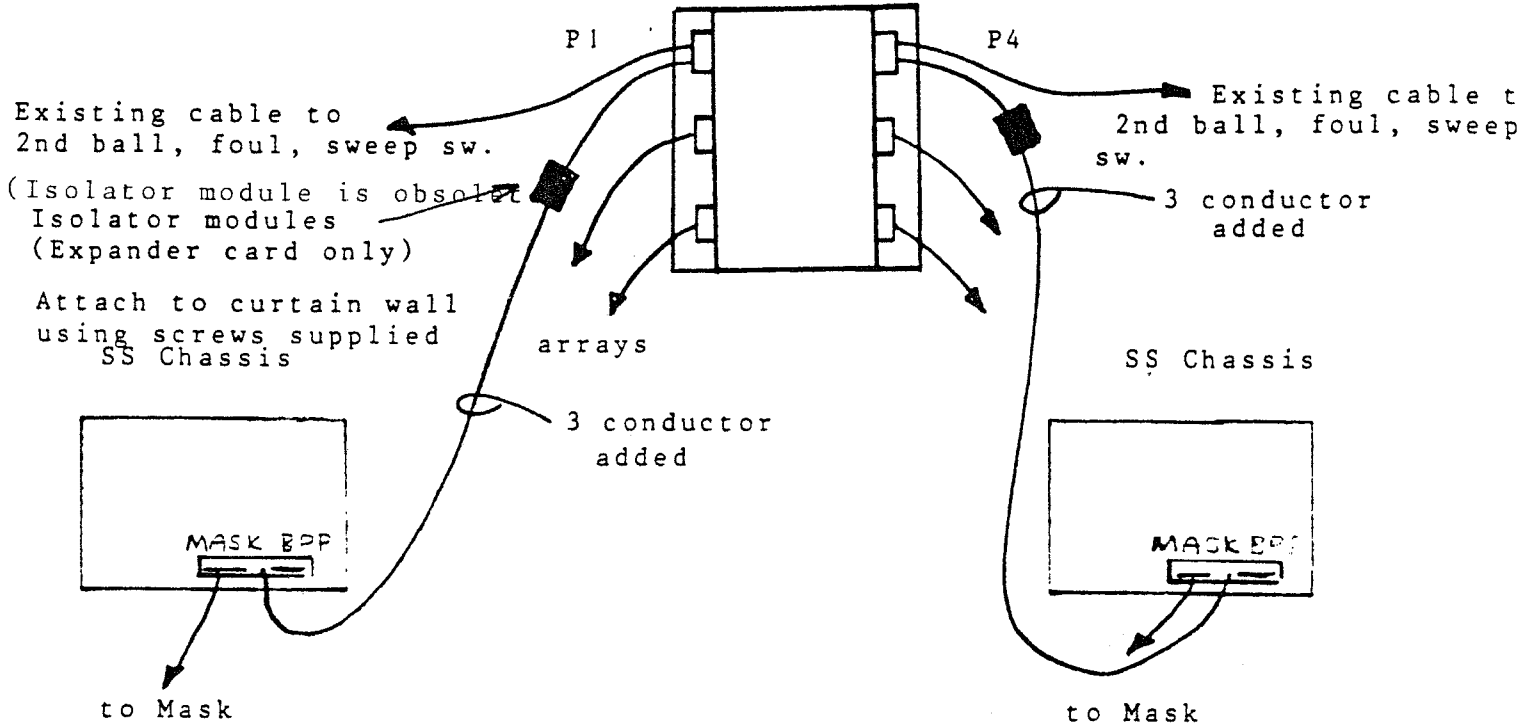


FIG. 2

POLARIZED EXPANDER  
 CABLE CONNECTS TO  
 REVERSE SIDE OF  
 MODIFIED MK70. ROUTE  
 OVER MK70.

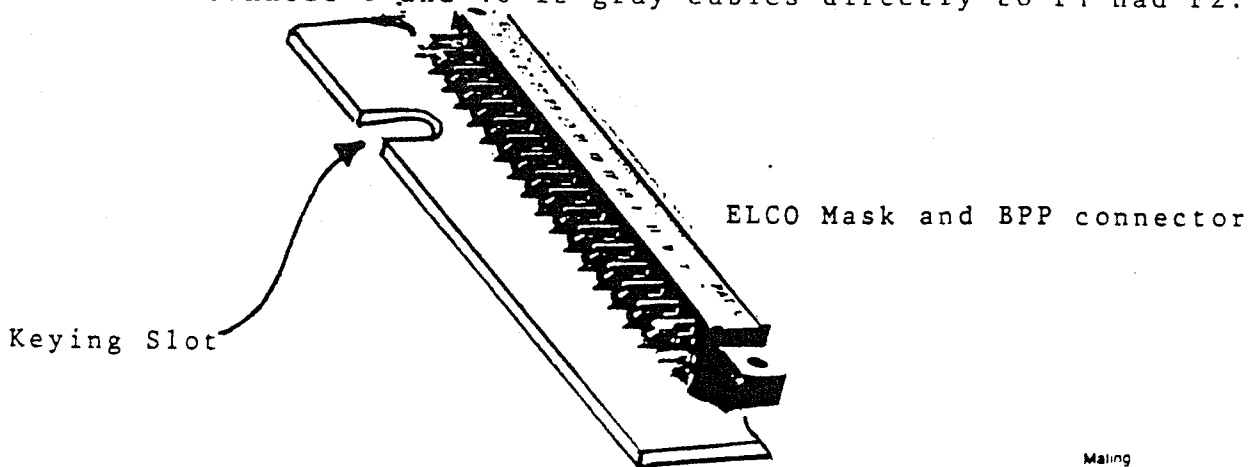
FIG. 3

Accoustic Pin Sensor Chassis

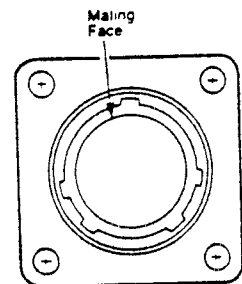


See Fig 8A for connections to APS chassis.

NOTE: Isolator module shown in Fig 3 is obsolete.  
Connect 8 and 10 ft gray cables directly to P1 and P2.



AMP C-23 Mask and BPP connector



CI PLUG ON CHASSIS  
(FRONT VIEW)

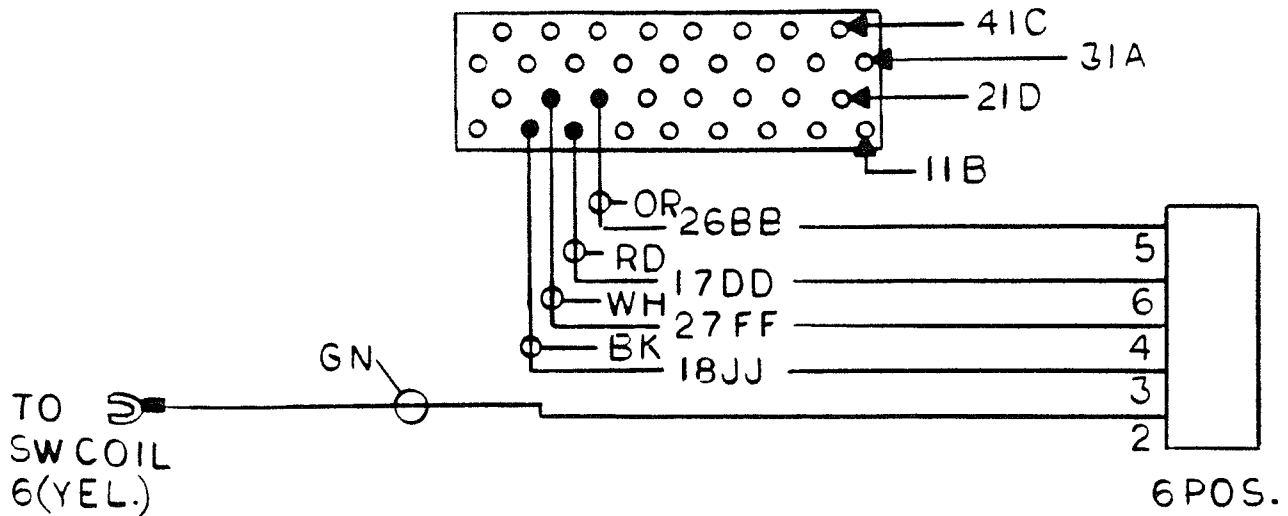


FIG. 4.

CI PLUG ON HARNESS  
(REAR VIEW)

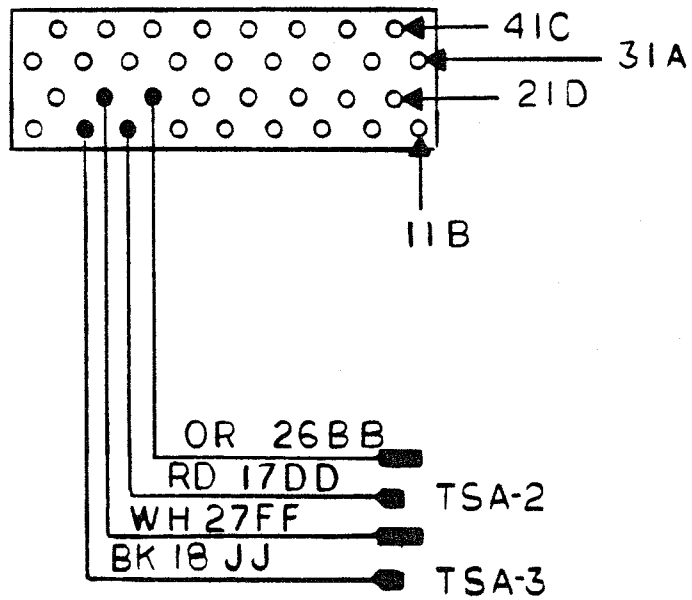
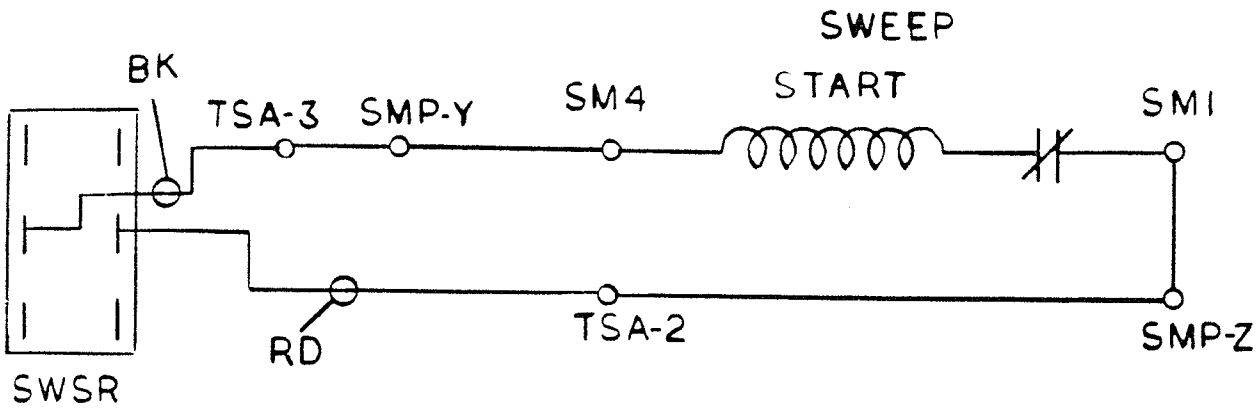


FIG. 5





EXISTING WIRING

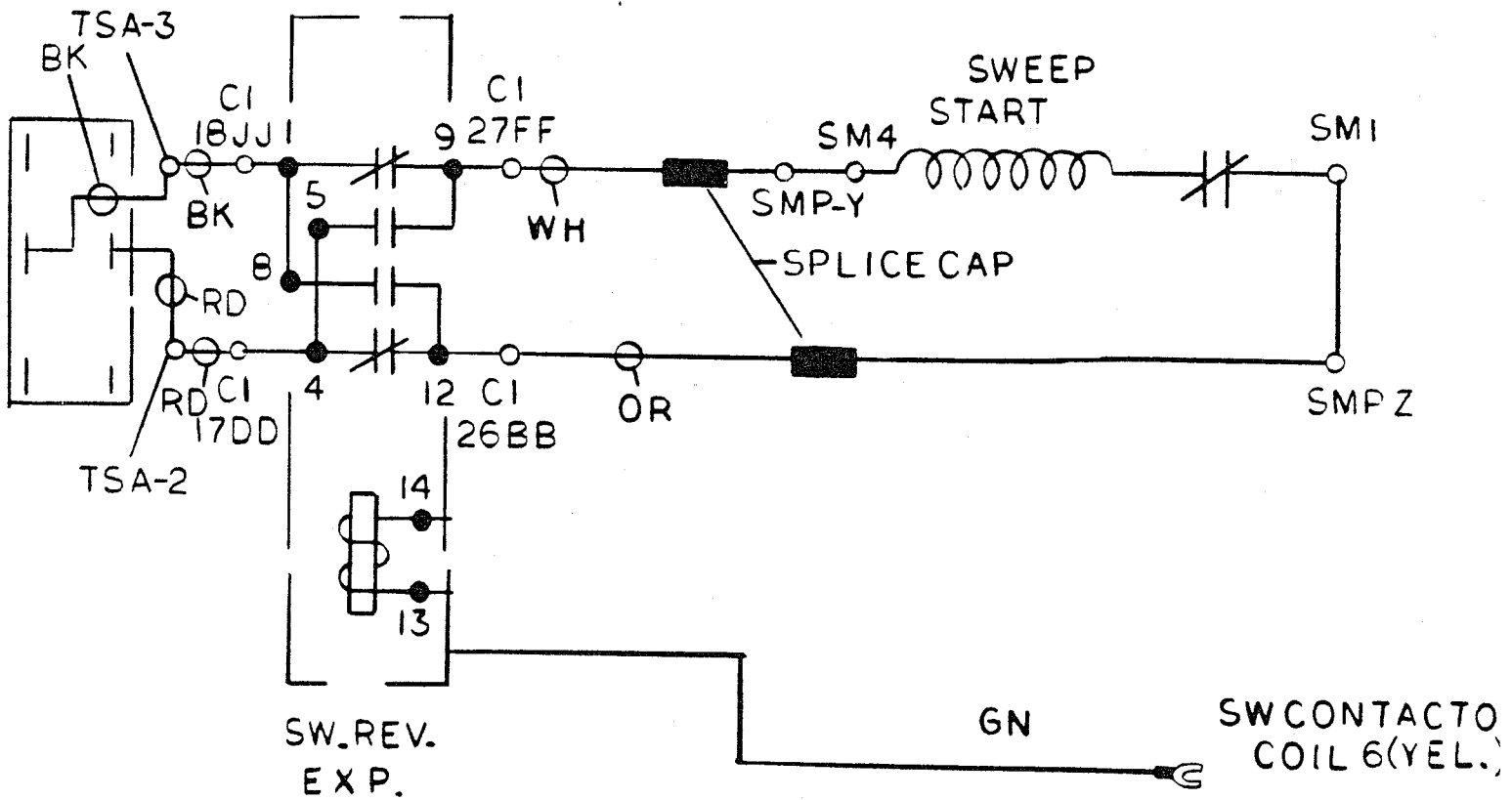


FIG. 6

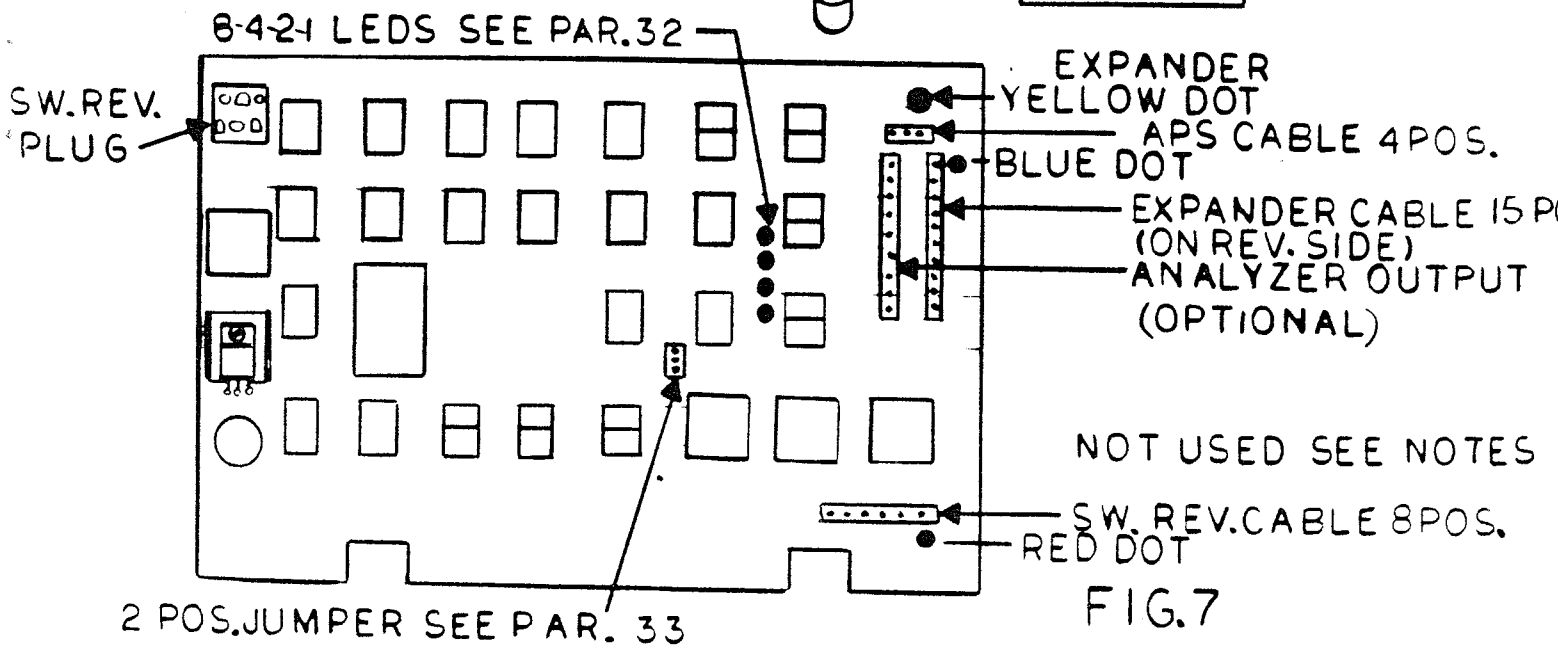
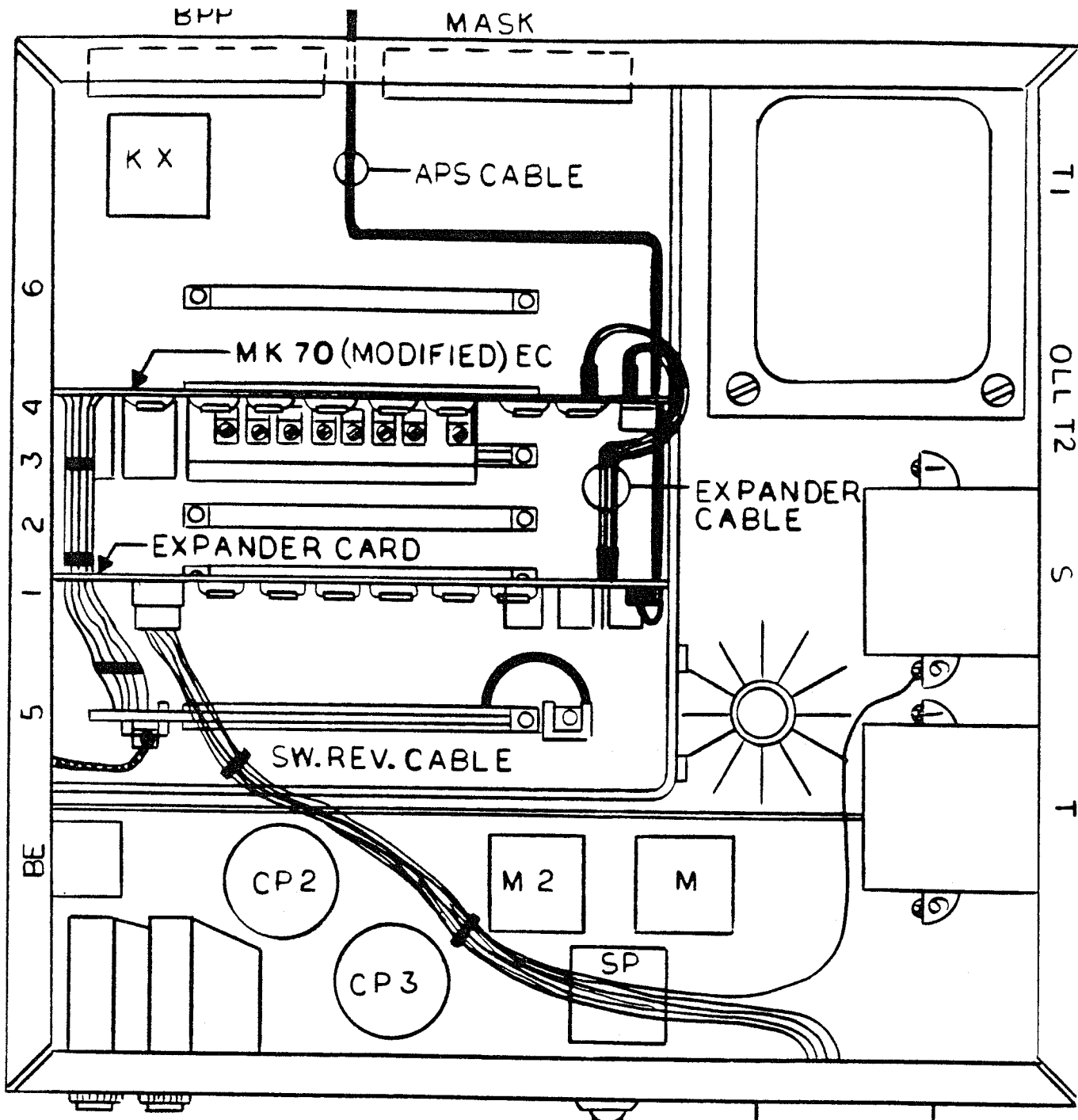
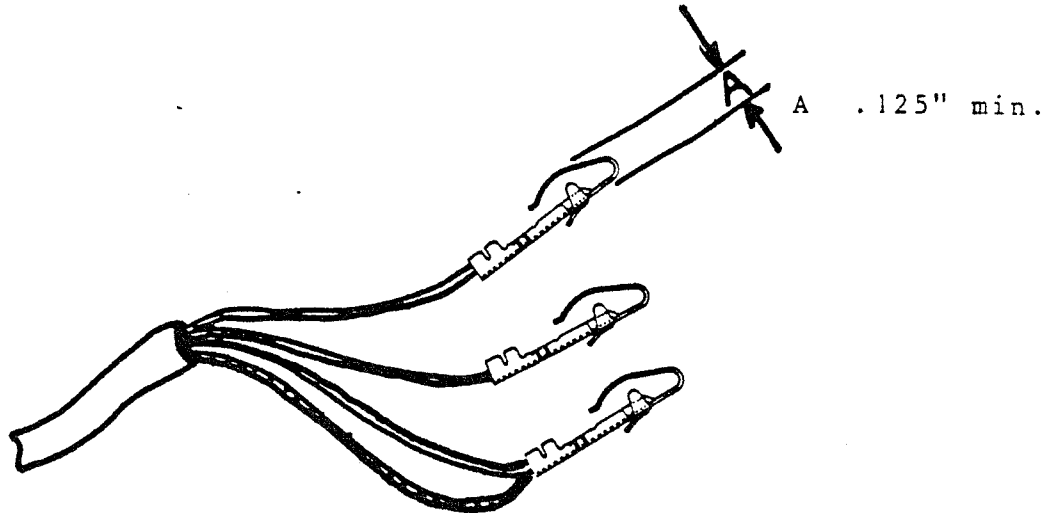


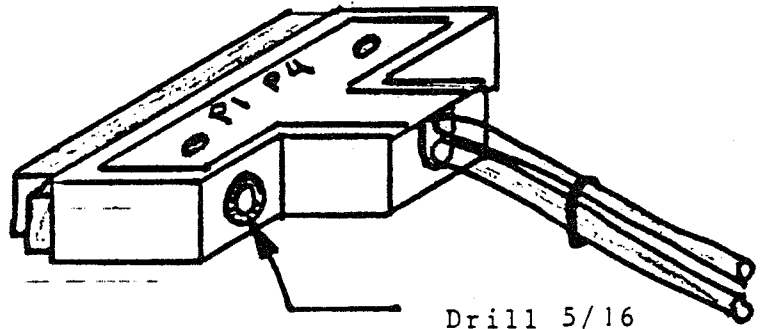
FIG. 7

FIG. 8A



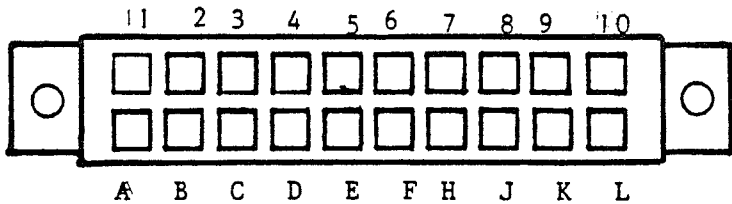
CAUTION

Insure terminals have not been damaged in shipment. Insure that contact face (A) is of sufficient height to make contact with P.C. Board connector prior to installing in housing.



Drill 5/16  
hole and install rubber  
grommet.

AMP Leaf  
(Rear View P1, P4)



Connector 583723-1 AMP

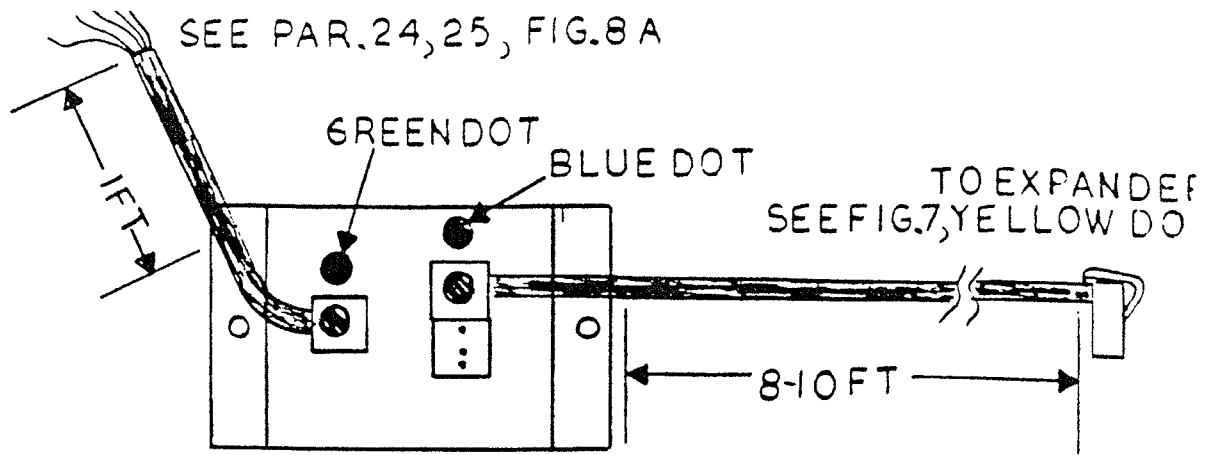
Term 42840-3 AMP

Black 7

White 8

Green F

Red H } Obsolete  
Green J }  
Shield C }

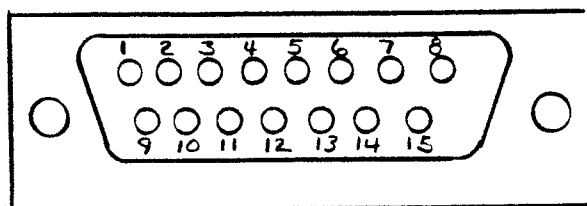


FOR APS CHASSIS ONLY  
NOT USED ON OTHER MODELS

These connections are obsolete. See Fig 8A.

FIG. 8B

AMP D STYLE  
(REAR VIEW CABLE END)

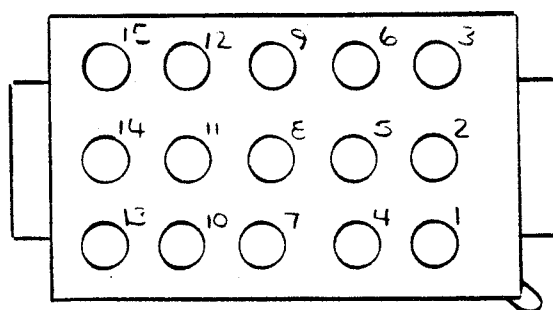


CONNECTOR AMP 205205-1  
SOCKET TERMINAL AMP 745253-6

BK 8  
WH 7  
GN 15

FIG. 8C

AMP UNIVERSAL MATE-N-LOK  
(REAR VIEW CABLE END)

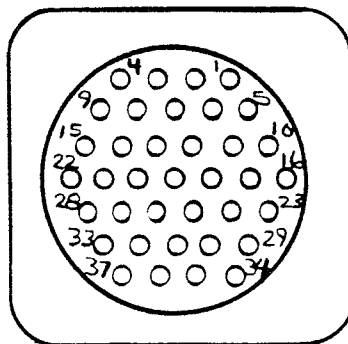


CONNECTOR AMP 350736-1  
PIN TERMINAL 350690-1 AMP

BK 9  
WH 7  
GN 10

FIG. 8D

AMP C 23  
REAR VIEW CABLE END

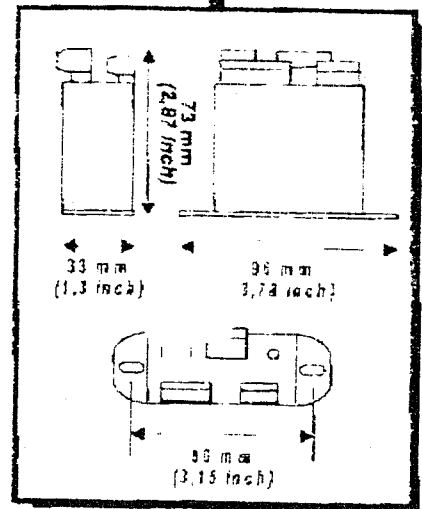
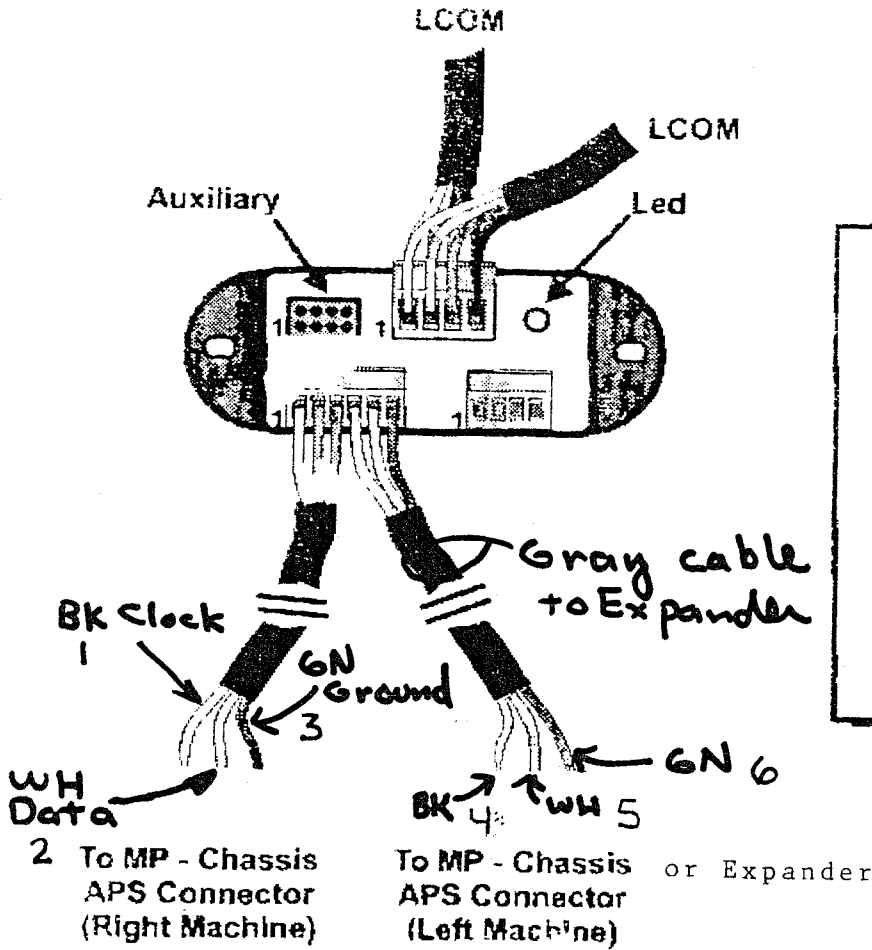


PIN TERMINAL 66593-1 AMP

WH 13  
BK 14  
GN 15

A  
A P

# AMF 8270 MP CHASSIS or EXPANDER




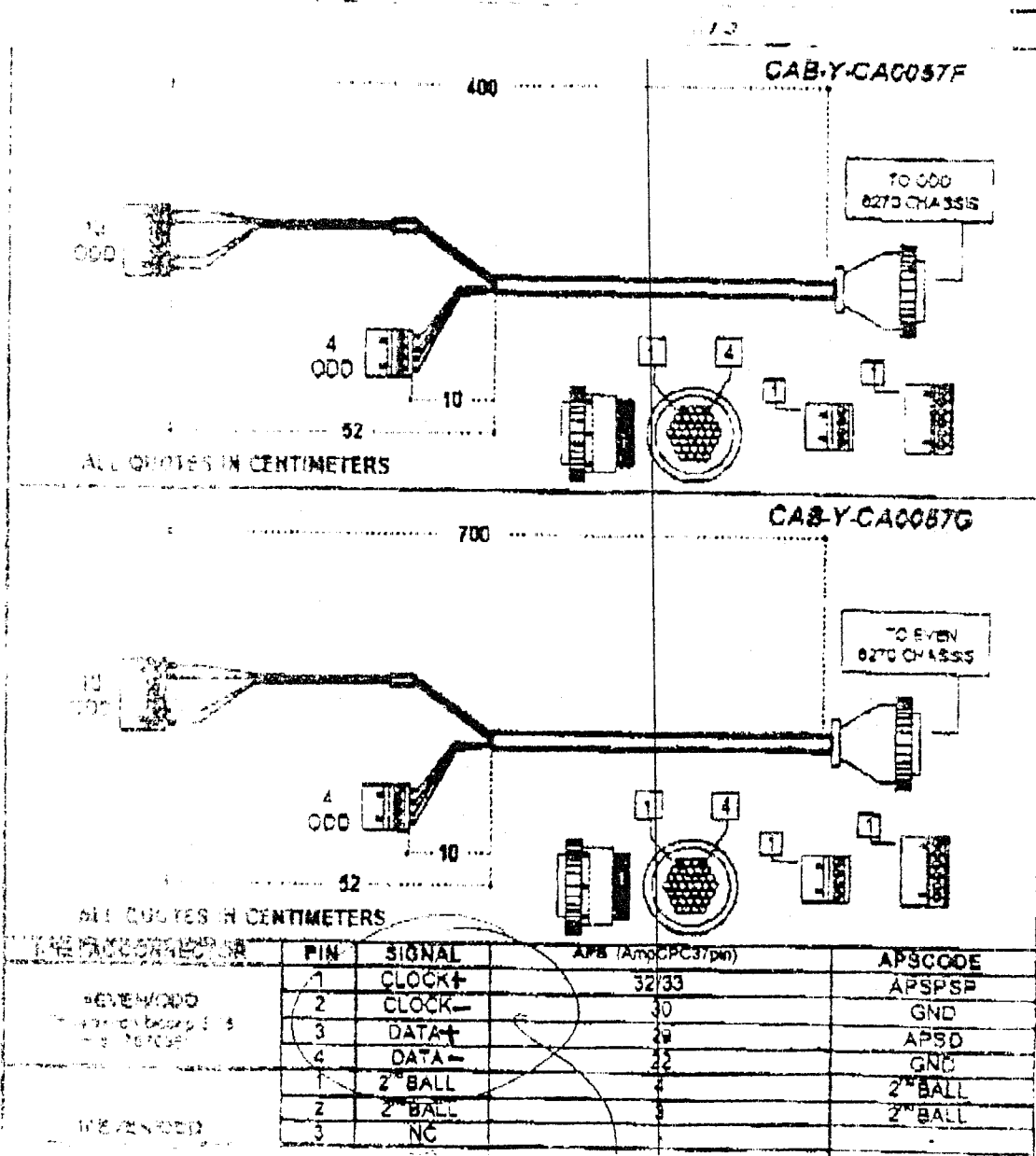
 SWITCH OFF THE PINSETTER DURING INSTALLATION AND MAINTENANCE

FIG 8F

OMEGA-TEK EXPANDEER TO STELTRONIC SCORING



Black to Clock +  
 White to Data +  
 Gray Expander Cable Green to Clock and Data -  
 (jumper together)

1. Plug the printer port cable into the computer motherboard. There is only one place that will accept the Header connector of that size. Make sure you align the colored edge of the ribbon cable to the #1 on the motherboard near the connector.
2. Find a place for the box. Use the two sided tape to affix it inside the computer case.
3. Pop out a blank slot on the computer case and install the 9pin expansion slot.
4. Run the included 120' cable from the pedestal to the pinsetters to the area under the down sweep.
5. Run the two smaller cables from the downsweep area to each pinsetter.
6. On the 9 pin connector at the computer, solder the 3 pair wire to it using this color pattern:

9 pin	Desc	Color
1	Clock (odd) Gnd Data	Red
2		Green
3		White
6	Clock (even) Gnd Data	Black
7		Blue
8		Brown

Omega-Tek

→ Black

→ Green

→ White

→ Black

→ Green

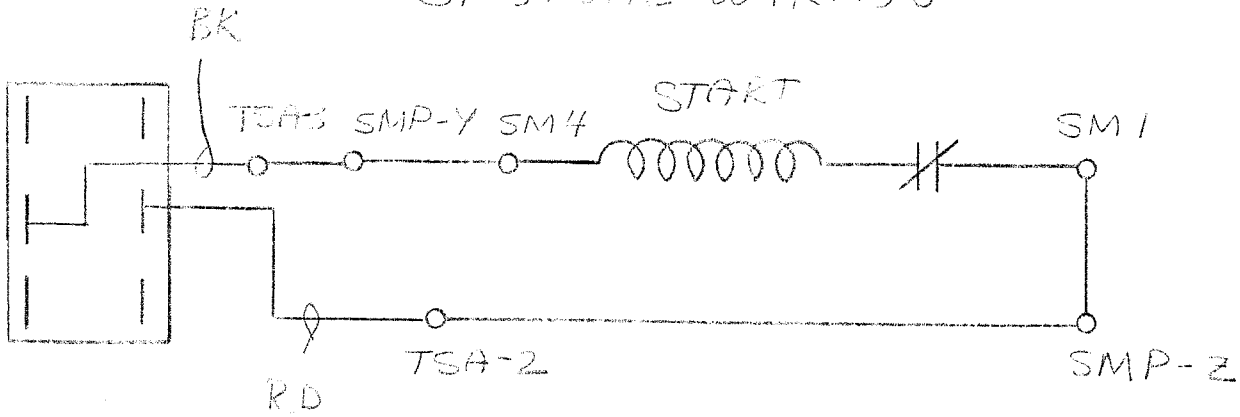
→ White

Set camera timing to  $\approx$  5 sec.



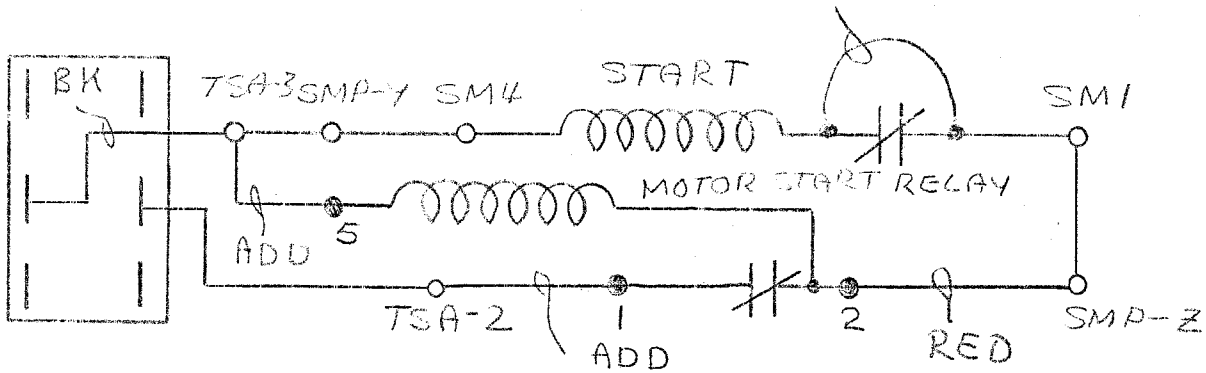
EXPANDER WIRING FOR USE WITH EXTERNAL RELAY TYPE  
MOTOR START WINDING SWITCH (GE Type Switch)

ORIGINAL WIRING



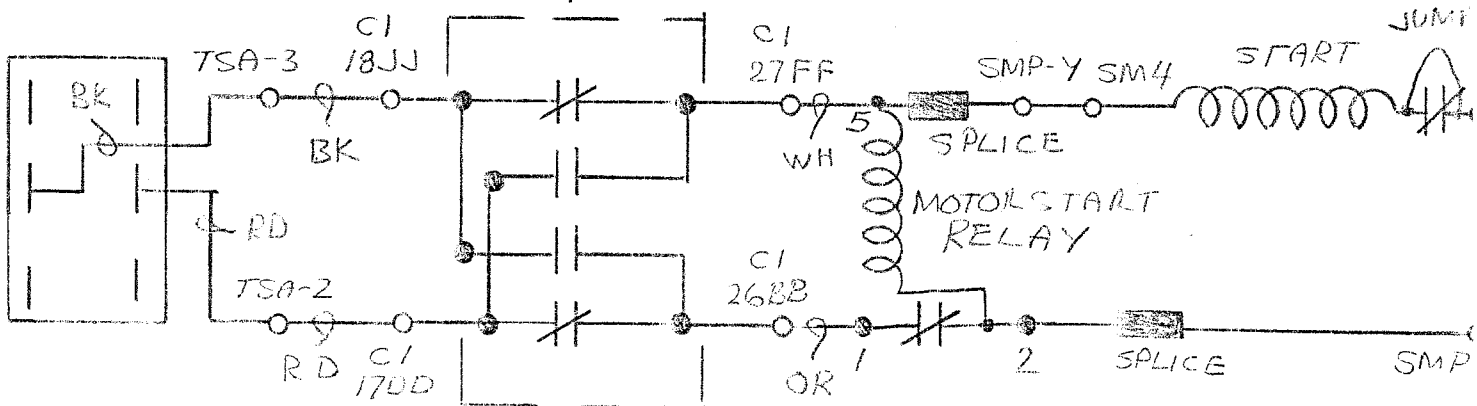
STD. WIRING

JUMPER MOTOR SWITCH

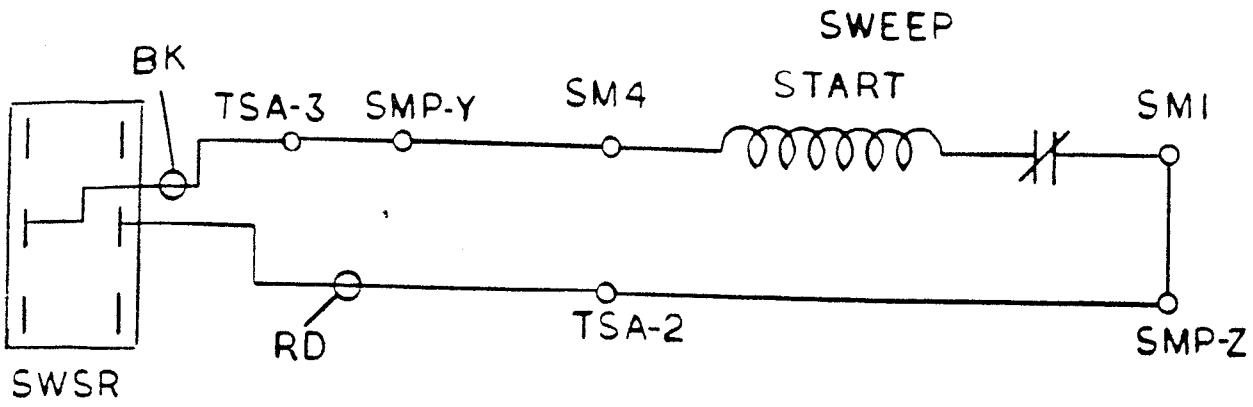


MP WIRING

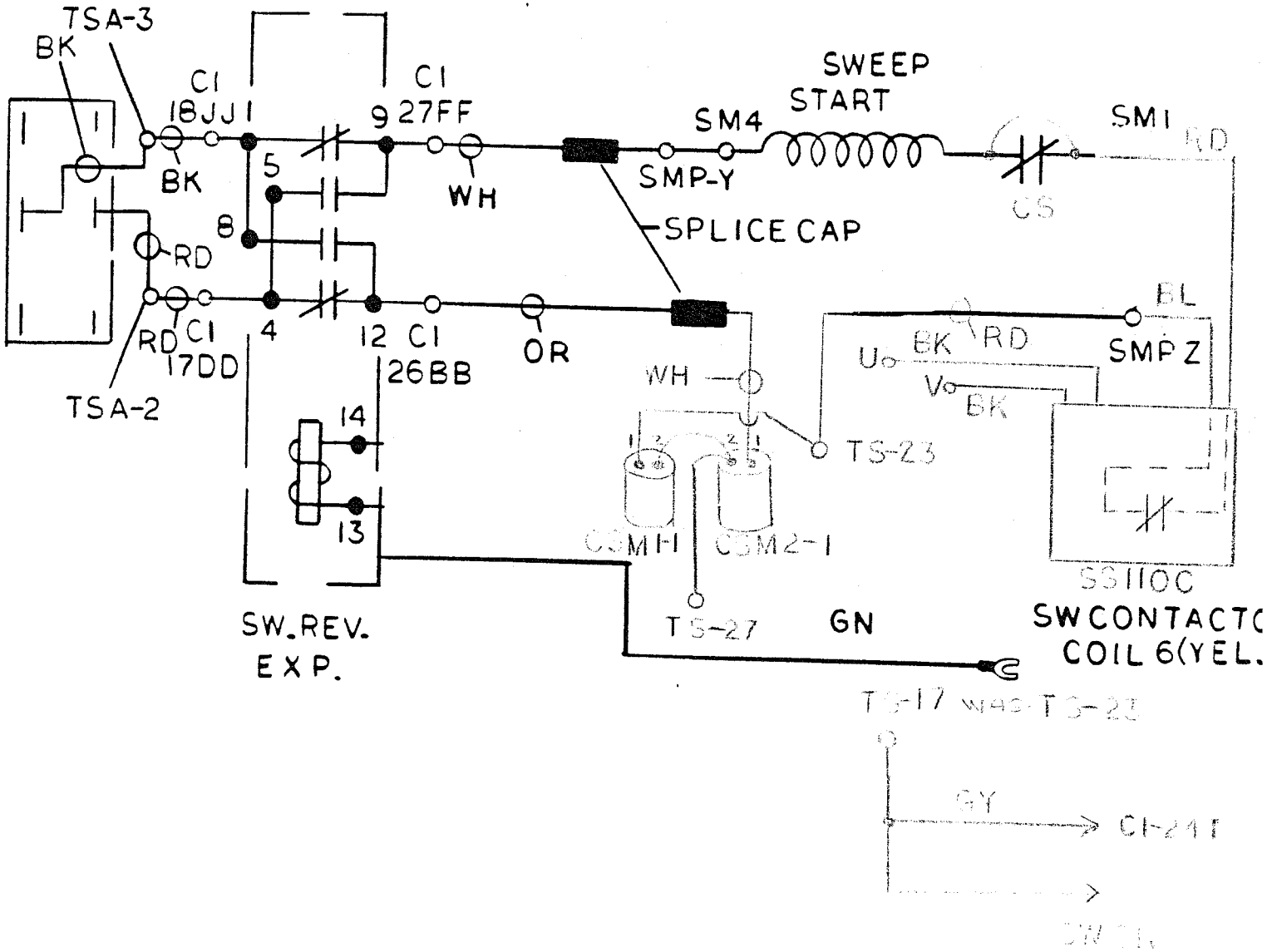
RELAY ON EXPANDER



SEE FIG 6 FOR  
STANDARD EXP WIRING  
WITHOUT JUMPER MOTOR SWITCH.



EXISTING WIRING



Cybernetics start switch used with Omega-Tek Expander with sweep reverse restored.

Instructions for 785-000-000-T  
with MP or Expander  
Sweep Motor

1. Locate RED wire from Z of sweep motor plug. Place onto #2 of start relay.
2. Be sure machine is wired in the following manner:
  - A. TSE 2 - BLACK wire from sweep reverse switch.  
Wire from 18JJ of C1 block. (Black)
  - B. TSA 2 - RED wire from sweep reverse switch.  
Wire from 17 DD of C1 block. (Red)
  - C. TSE 1 - Wire to #1 of start relay.  
Wire from 26BB of C1 block. (Orange)
  - D. TSA 3 - ORANGE wire from Y of sweep motor plug.  
Wire to #5 of start relay.  
Wire from 27FF of C1 block. (White)

ALTERNATE SWEEP WIRING  
FOR REAR IN CHANNEL.

## QubicaAMF Q-Vision Camera Wiring for Expanders

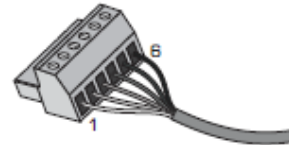
MP CONNECTIONS			
Phoenix	Colours	37-PIN AMP	SIGNALS
1	← White →	EVEN MACHINE 32+33	CLK
2	← Brown →	29	DATA
3	← Green →	30	GND
4	← Yellow →	ODD MACHINE 32+33	CLK
5	← Gray →	29	DATA
6	← Pink →	30	GND

### EVEN

1. Black
2. White
3. Green

### ODD

4. Black
5. White
6. Green



Small green 6-pin phoenix connector on front of board.