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DRIVING INSTRUCTIONS

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The five-element array involves large structures driven by powerful motors spread out over a considerable area. Normal operation includes the interaction of several people with the whole system. Consequently a procedure for safe operation must be followed. One person must assume the responsibility for operation at any time.

The control room is the focal point for all operations. Any use or service on the array needs to begin in the control room with the proper procedures which will be given below. The standard quiescent conditions are:

1. All antennas stowed.
2. All controls switched to Control Room and antennas in Use position.
3. Power on at all antennas (manual disconnect switches on).
4. Automatic stow lock air supply ready.
5. Contactor boxes, ground boxes and delay shelter locked.
6. Log book on operating consol.
7. Power toggle switches on dec. control and RA control panels are switched to ON, pilot light on.

Refer to the appropriate figure for locations and arrangements mentioned below.

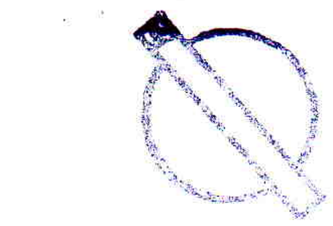
Operational Procedures:

I. Normal use

A. Carry out procedures on Control Room Driving Check List [Fig. 5]

B. Antenna driving instructions

1. To Exit Stow: Manually unstow each antenna. (All STOW lights should be lit to start and all MERIDIAN lights should be on.) Place all S_4's in STOW position. Depress S drive button until antenna passes thru N boundary as indicated by the yellow N-boundary light coming on momentarily. (When first depressed there is a slight delay while the automatic stow latch retracts before driving starts.) The STOW light goes out, the declination readout will indicate motion of the antenna and the declination drive motor current meter will be indicating. Repeat for other antennas.



[5 ea S_4
Dec. Readout Panel]

2. To Drive to a Desired Declination when Unstowed:

a. Determine desired readout setting

b. Set PRESET DECLINATION thumbwheel switch to N > 9000. (To disable this feature)

c. Switch S_4 in SLEW position.

d. Depress S or N pushbutton as desired. (To go to smaller readout settings drive S.) Antenna will drive in direction chosen. Depress STOP button as desired setting is approached. Switch S_4 to INCH, S_{10} to NORMAL and depress S and N buttons as needed to set desired readout value.

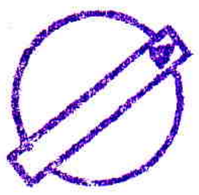
[S_{10}
Dec. Readout Panel]

e. In some cases the pulsed inch mode is useful to set declination. To use this feature in the INCH mode, set S_{10} to PULSE. When the N and S buttons are depressed . regular short pulses are applied to the corresponding contactor and hence the motor is inched in a somewhat controlled fashion.

f. To use the preset declination feature (the read-out counters and the electrical impulse counters should correspond.), set the desired number in the PRESET DECLINATION thumbwheel switch and slew in the desired direction. The drive motion will stop individually as the antenna readouts (and impulse counters) coincide with the preset number. This operation takes place with S_4 in the SLEW mode and it is necessary to leave the SLEW position at least momentarily to release the coincidence stop circuit.

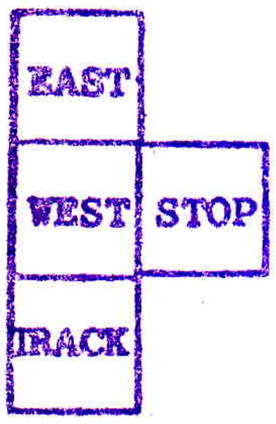
3. To Enter Stow: All antennas must be on the meridian and S_4 on the RA control panel in MERIDIAN SET position. Meridian lights should be on. Drive antennas north in SLEW mode until they stop at N boundary. Switch S_4 to STOW and manually drive N until motor stops and STOW light comes on. Antenna is now stowed. The N limit light will also be on.

4. Driving in Hour Angle: Four modes of operation exist for hour angle motion. These are selected by switch S_4 on the RA control panel. (The antennas must be unstowed.) Except in the case of corrections all antennas operate together.



S_4
RA Control Panel

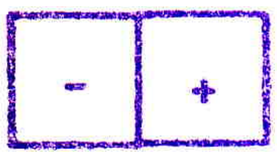
a. Slewing east or west is done with the switch S_4 in the SLEW position. The push button labeled EAST or WEST is used to start the desired direction of motion. The STOP push button stops hour angle motion in all modes.



Lighted Push Buttons
RA Control Panel

b. Tracking at the sidereal rate is done with the mode switch S_4 in the TRACK position. Depressing the button marked TRACK starts the tracking of all antennas. The STOP switch stops tracking.

c. Correction: Individual antennas may be adjusted in the hour angle coordinate by using the corresponding buttons labeled "+" and "-" on the RA readout panel while the antennas are tracking. Depressing the "+" button stops the track motor, while depressing the "-" button stops the track motor and starts the correct motor. (The correct motor is an induction motor whose speed is approximately twice that of the track motor.)



5 ea.
Lighted Push Buttons
RA Readout Panel

d. Driving to the Meridian: For convenience the antennas can be set to the meridian in an automatic fashion. Select the Meridian Set position of S_4 and start slewing towards the meridian with either the EAST or WEST buttons. As each antenna reaches the meridian it will stop automatically and its MERIDIAN light will come on. When all antennas are on the meridian the dummy meridian light also lights. A stowing operation would normally use this mode.

e. Auto-track Operation: The final mode selectable by S_4 is AUTO-TRACK. This mode allows one to start the antennas slewing to a chosen right ascension using the EAST or WEST buttons and have the antennas stop at the desired right ascension which has been entered into the thumbwheel switch on the Decitrak readout panel just above the RA readout panel. After a short delay the track motors start and all antennas begin tracking the desired right ascension position. After this mode has been used the auto-stop circuit must be released by pushing the OFF push button alongside the thumbwheel switch before slewing can take place during a subsequent use of this mode.

C. Procedures if Boundary Switches are Actuated:

The boundary switches prevent antenna motion beyond a predesignated boundary. These function to stop all antennas whenever any antenna activates a boundary switch.* Recovery from this condition requires driving in a direction away from the boundary and subsequently resetting the limit circuitry by pushing P_7 the LIMIT RESET button on the declination control panel. (Motion away from the boundary is always possible but after moving away it is necessary to use the LIMIT RESET button before motion back towards that boundary can occur.)

LIMIT RESET

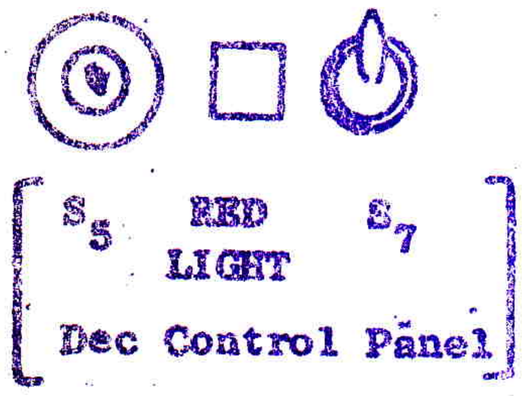
[Dec. Control Panel]

*Remember we have five boundary zones, i.e., North, East, Southeast, Southwest, and West. The North boundary acts independently on each antenna. The other four operate with the all stop feature. The Southeast and Southwest boundaries can be approached by either declination or hour angle motion and leaving the boundary can be accomplished by both motions. Near the southern horizon the boundary is effectively one South boundary, and hour angle motion will be unimportant compared to declination motion.

II. Special Procedures

A. Danger-zone operation

There is a small zone of operation possible beyond the boundaries. Operation within this zone is reserved for special uses and requires unusual caution. Special considerations govern the use of this feature.



1. Danger-zone entry switches: On both the declination (S_5) and right ascension (S_2) control panels is a key operated switch. Actuation of this switch bypasses the boundary switches of the appropriate drive system and allows the antenna to be driven past the boundaries into the danger-zone and up to the limits. However, it is necessary to hold down the spring loaded switch S_7 on the dec. control panel to drive in declination and a similar switch S_6 on the RA control panel for hour angle motion. In danger zone to drive in HA requires both key switches to be on; to drive in dec., only the dec. key switch need be on. In any case, only one of the S_7 switches need be on at one time.

B. Emergency Stop:

A large red button on the RA readout panel labeled EMERGENCY STOP actuates a remote contactor in the delay shelter to remove all power from the antennas in emergency situations. To return power to the array it is necessary to go to the delay shelter and press the ON button on the contactor itself. Since this is an emergency procedure it is necessary to follow a very cautious course before turning on the power. If you did not turn it off you must obtain clearance from all involved people before turning it on.

C. Emergency Stow:

This feature is not present and all controls intended for its use are not to be used. Leave S_3 (EMERG, NORM) in NORM position.

D. Mechanical Interference Protection between PRIMO, SECUNDO and TERTIO.

Since the three closely spaced antennas can physically touch in some positions a sensing circuit has been installed to stop all antenna motion if the antennas approach a condition where this could occur. If either PRIMO or TERTIO is on the opposite side of the meridian from SECUNDO the circuit stops the drives. To recover from this condition it is necessary to locally drive SECUNDO back to the meridian using the special push button (INT) provided at the SECUNDO contactor box.

CAUTION: You must select the proper direction to drive.

E. Driving Selected Antennas.

An option of selecting antennas to be driven in hour angle is provided by HA drive select switches on the HA DRIVE SELECT panel. A toggle switch for each antenna can be thrown to remove that antenna from the number to be driven. (Notice the switches have a center off position which is not used and is labeled NULL.) The pilot light above each switch indicates the disconnect switch at that antenna is on and that power is available at the antenna.

CAUTION: If an antenna is not "on the meridian" the HA DRIVE SELECT switches will not stop tracking or correcting motions on that antenna. This can cause trouble if an antenna is being used locally but does not have the proper switches in the ANT position.

This feature will be modified to select and control all antenna motions.

III. Local Driving

A. Go to control room and clear the local driving requirement with the operator and/or switch the Hour Angle Select switch for the involved antennas off.

B. Follow the Local Driving Checklist posted in the contactor box.

C. Normal Local Use:

The local control consists of controls for declination and a set for hour angle motion. In particular a separate stop button is used for each function. Be sure you are using the switch or switches associated with the motion you intend to use.

1. To Exit Stow: Select INCH position of declination Slew/Inch switch. Press S button until antenna clears N boundary.

2. To Drive in Declination: Switch to SLEW if desired and drive into position at which point use the STOP button to stop the declination motor. Small motions can be accomplished in the INCH mode using short punches of the drive button for the desired direction.

3. To Enter Stow: The antenna must be "on the meridian"* and the Meridian Set/Use switch S_4 in the MERIDIAN SET

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*An antenna is considered to be "on the meridian" when its meridian switch has its arm in the corresponding hole on the hour angle wheel. This may differ slightly from having the antenna's beam pointed to the true meridian, which in turn may differ slightly from having the antenna's hour angle readout indicating h = 0.

position. Drive to the N boundary where motion stops. Now depress the LOCAL STOW button and the N dec. drive pushbutton and motion will continue into the automatic stow lock. When the stowed position is reached the drive stops and the LOCAL STOW button lights. At this point, return the Meridian Set/Use swtich to the USE position.

Rem: several different switches are all called "S_4" in the course of this Glint. Could that be changed?

4. To Enter Service Position: Antenna must be on the meridian and S_4 in the USE position. Drive S to the boundary position. This position allows the service tower to be moved into place. Switch S_4 to MERIDIAN SET which allows further motion south. With the help of a second person drive S into the desired location. Great care is needed since no protection is present to prevent driving into the service tower, etc.

5. To Leave Service Position: Drive N in two stages to remove the service tower and return the antenna to normal use.

6. To Drive in Hour Angle: Antenna must be unstowed. Then select slew or track/correct functions with S_2. EAST, WEST and STOP pushbuttons are used for slew. TRACK, CORRECT and STOP pushbuttons are available for these two motions.

7. To Drive to Meridian: Place S_4 in MERIDIAN SET position and S_2 in the SLEW position. Start the antenna driving towards the meridian and motion will stop when the meridian is reached. Visual checking of the meridian switch can confirm the location of the antenna on the meridian.

D. Boundary Switch Considerations.

No indicating lights are present locally for boundary switch actuations. The "all stop" function is operative during local driving so that if more than one antenna is involved it will be stopped as well. This fact makes it important to coordinate with other operators. A LIMIT RESET button P_8 is provided locally to reset the system after a boundary has been reached and cleared. Note that if an antenna is in local (ANTENNA) mode, in MERIDIAN SET mode, and on the meridian, then its SE and SW boundaries are disabled; this includes disabling of the all-stop feature for these boundaries on that antenna.

IV. Service

The operator is to be informed of any service activity taking place on the array and the required entries made in the log book.

V. Things to be Done

1. Label "+" and "-" correction buttons on RA readout panel.
2. Provide a single key switch to allow operation of the array.
3. (a) Provide 5 key switches and appropriate relays to implement a complete individual antenna select panel to replace the current HA select switch panel.

(b) Install matching key switches in each collector box for local driving. (The individual RA DRIVE SELECT switch inside will be off and the key removed and used to actuate the local drive function.)

4. Write up a procedure for setting readouts, dec. impulse counters, sidereal motor shaft, dummy antenna, etc.

5. Collect ideas for revision of readout system.

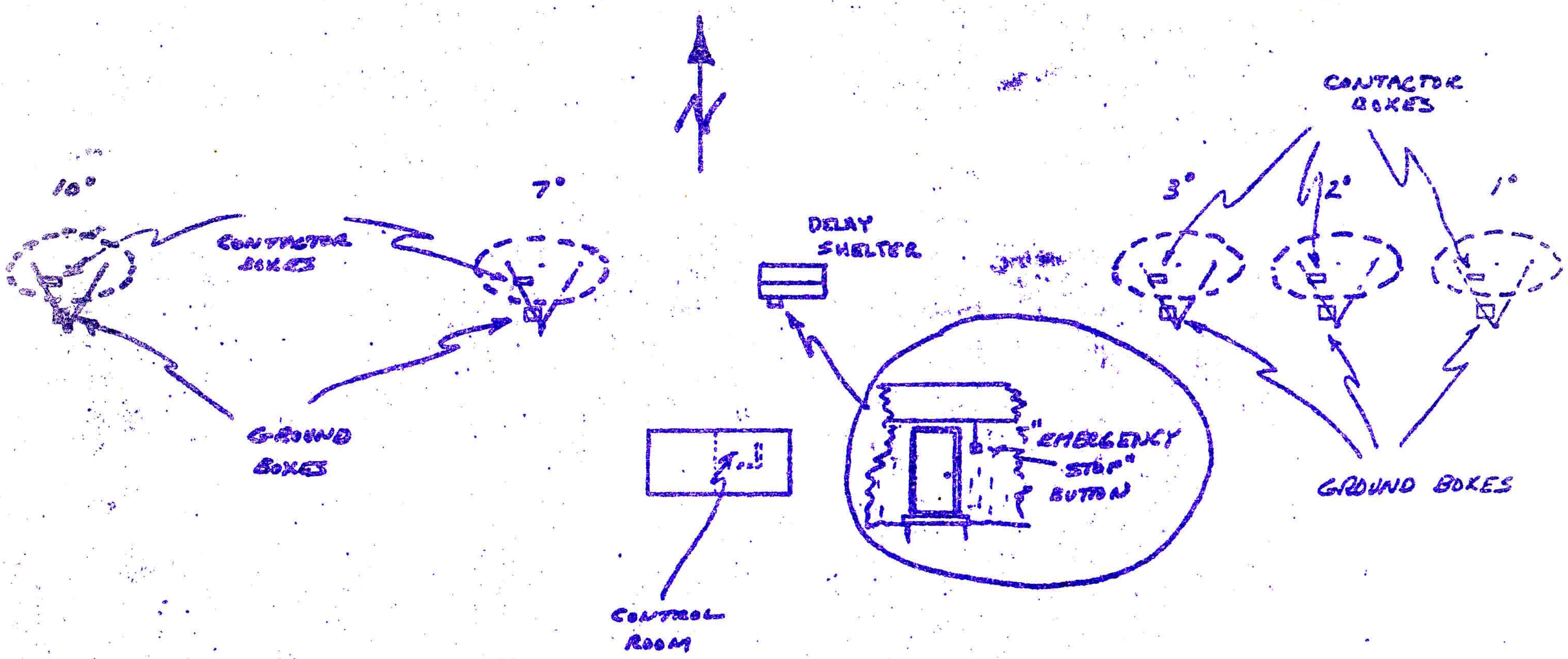
6. Post check list and safety rules.

7. Affix graphs of HA vs. counter reading and Dec vs. counter reading on front panels.

Relevant Documents:

Glints: No. 325 - Declination Readout
No. 326 - Hour Angle and Right Ascension Readout
No. 309 - The Mercury Switches
No. 383 - Array Limit Switches

Drawings: SRA-628 - Common Line Reset Connection Diagram
RA- - Mechanical Interference Diagram
RD-627 - Array Limit Switch Schematic
RB-686 - RA Drive/Antenna
RB-687 - Declination Drive
RB-688 - RA Drive Control



LOCATION OF VARIOUS ARRAY ITEMS

FIG. 1

(WILD & TEMP. RECORDING IN SEPARATE RACK BEHIND MAIN RACKS.)

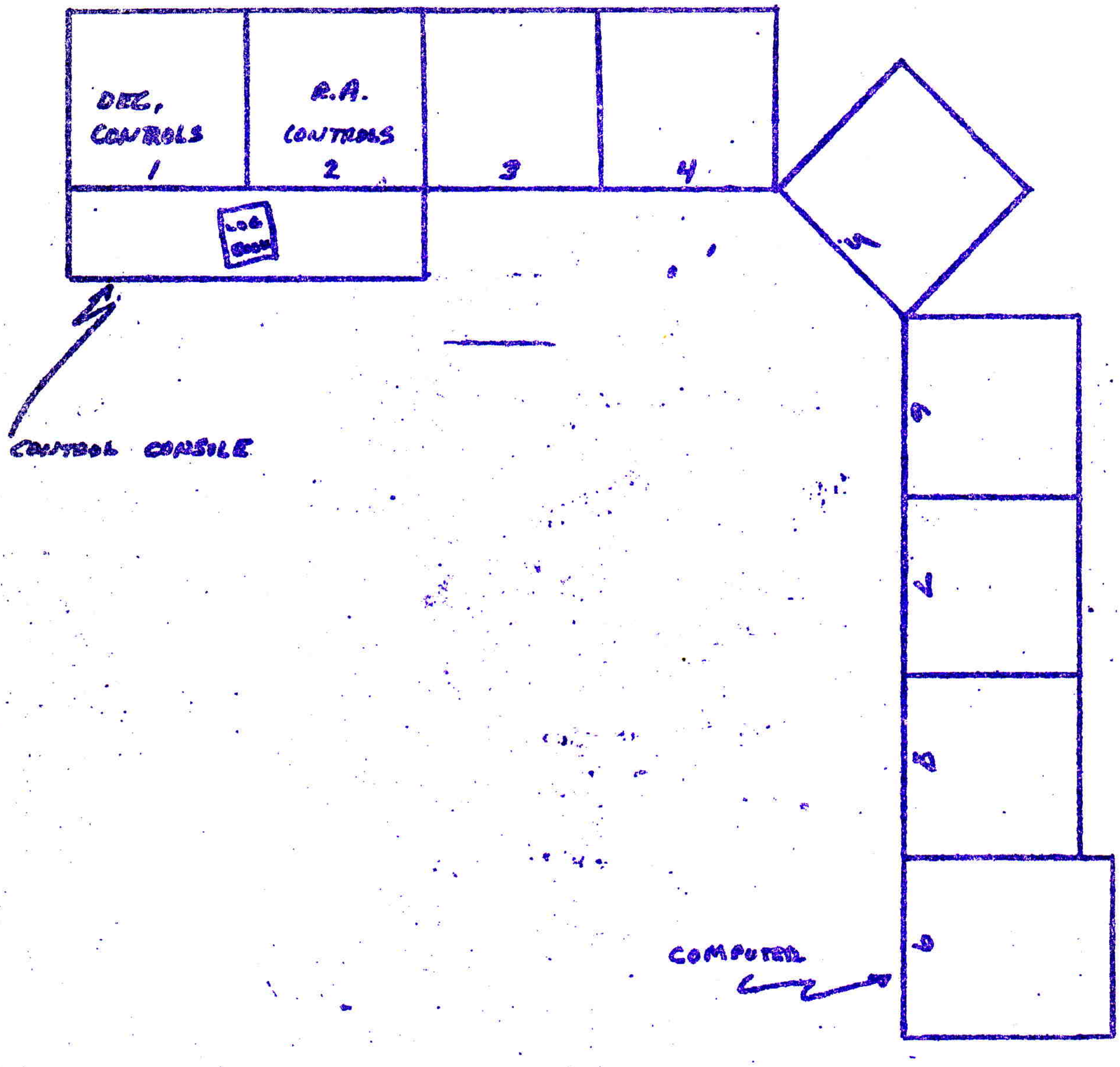


Fig. 2. CONTROL ROOM RACK PLAN

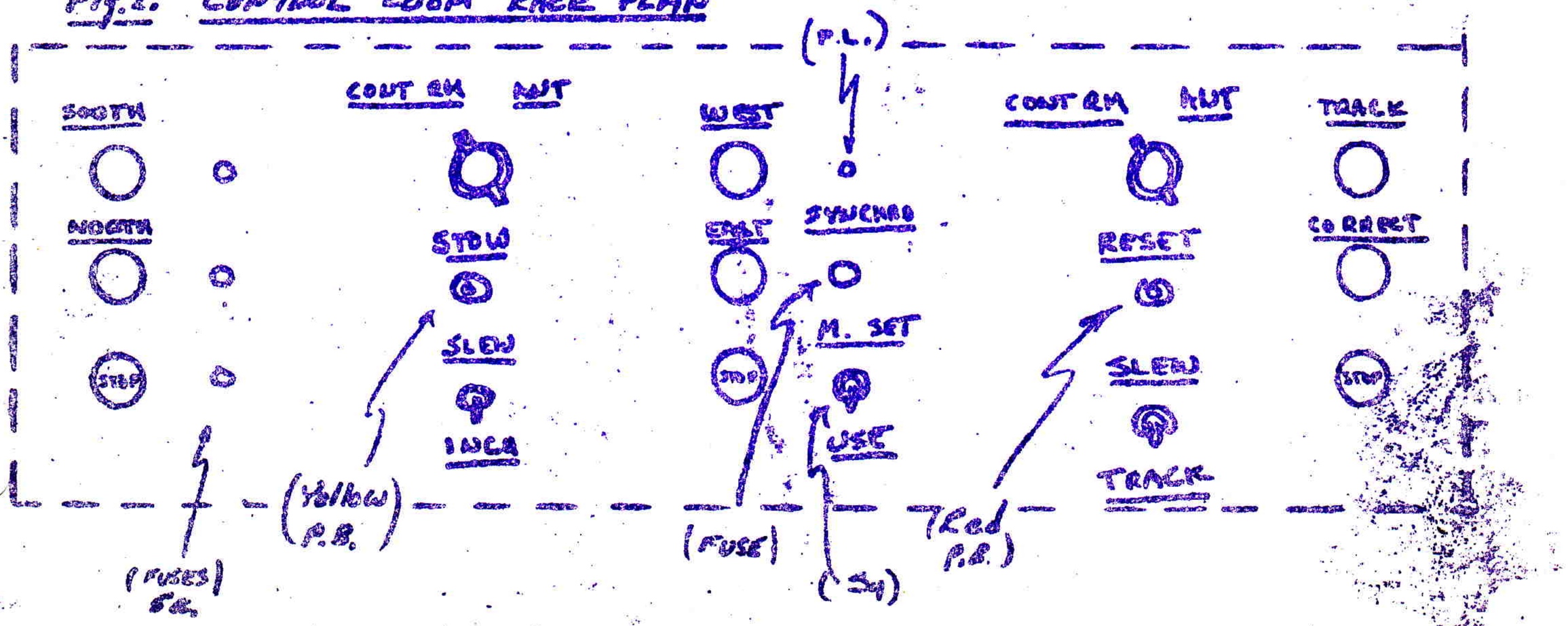


Fig. 3. Typical LOCAL CONTROL PANEL.

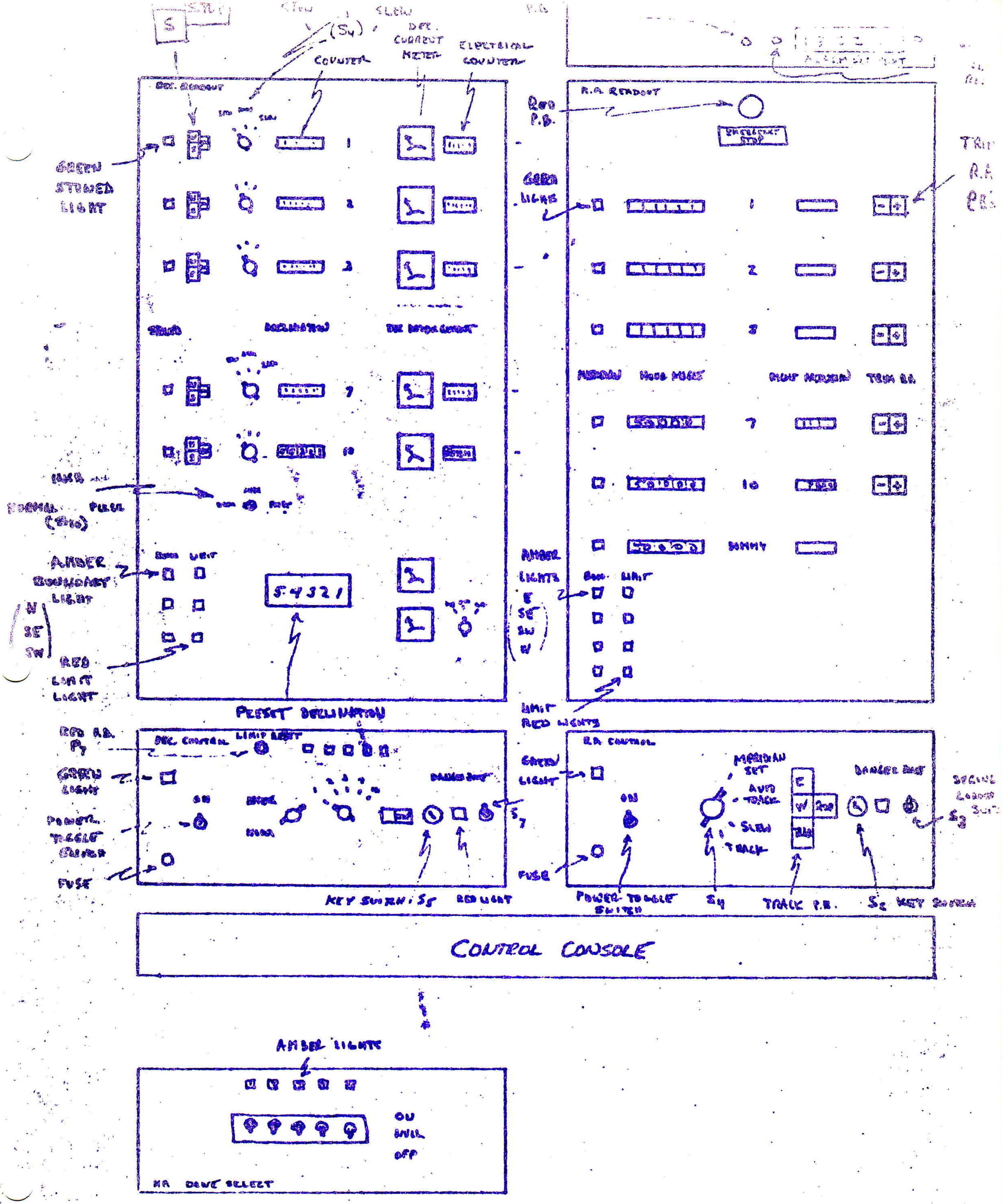


FIG. 4. CONTROL AND READOUT PANELS

CONTROL ROOM DRIVING CHECKLIST

BEFORE DRIVING:

1. WALK AROUND CHECK

   -- FOCUS-ROAD CHAINS IN PLACE

   -- NO OBSTACLES WITHIN CHAINED-OFF AREAS

   -- ANTENNAS FULLY STOWED OR SET TO LOCAL.

2. ALL PERSONNEL ON SITE INFORMED OF YOUR INTENDED USE.

3. PREDICTED WIND SPEED < 30 MPH PEAK.

4. INTERCOM ON (CHANNEL 6).

5. AT NIGHT" ANTENNA LIGHTS ON.

6. LOG SIGN-ON COMPLETED AND LOG CHECKED FOR:

   -- NOTES FROM PREVIOUS OPERATORS

   -- VERIFICATION OF WEEKLY MAINTENANCE.

7. H.A. DRIVE SELECT SWITCHES CORRECTLY SET.

WHEN FINISHED:

1. ALL ANTENNAS FULLY STOWED.

2. H.A. FUNCTION SWITCH TO "SLEW".

3. H.A. DRIVE SELECT SWITCHES ALL OFF.

4. ANTENNA LIGHTS OFF.

5. LOG ENTRY COMPLETE.

FIG. 5