SUPPLEMENTARY CENTRAL PULSE DISTRIBUTOR PROCEDURES FOR REMOVING AND RESTORING POWER NO. 2 AND NO. 2B ELECTRONIC SWITCHING SYSTEMS

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1. GENERAL

1.01 This section describes and explains the method of operation and the limitations of the various power options used in the supplementary central pulse distributor (SCPD). These control circuits consist of the controller power, peripheral unit answer bus (PUAB) power, and the +24 volts to +6 volts converter power.

1.02 This section is reissued to cover the No. 2B Electronic Switching System (ESS). Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The SCPD frame (Fig. 1) is a peripheral unit intended to supplement the 512 output points of the local central pulse distributor (CPD). The two controllers are located at the top of the SCPD frame with the control panel mounted directly below the controllers. The matrix units are below the control panel, and the +24 volts to +6 volts converter power supply unit is mounted in the lower section of the frame. The converter unit (Fig. 2) contains two +24 volts to +6 volts dc-to-dc converters with control and alarm relays. The converters furnish the +6 volts power required for the circuit packs located in the controller unit.

1.04 Communication from a control unit (CU) to a controller (Fig. 3) is via the peripheral unit address bus (PUAB). CU 0 can communicate to either controller but only via PUAB 0; likewise, CU 1 can access either controller but only via PUAB 1. Since the power control circuit allows removal of power from the controller, PUAB cable receivers (CR), or both, through manual, automatic, or program means, it is important that the maintenance personnel understand the effect of this action on the system.

1.05 In order to facilitate the understanding of the SCPD power controls, this document is divided into the following categories:

- Controller Power
- Bus Power
- Converter Power
- Interlocks
- Ferrod Status.

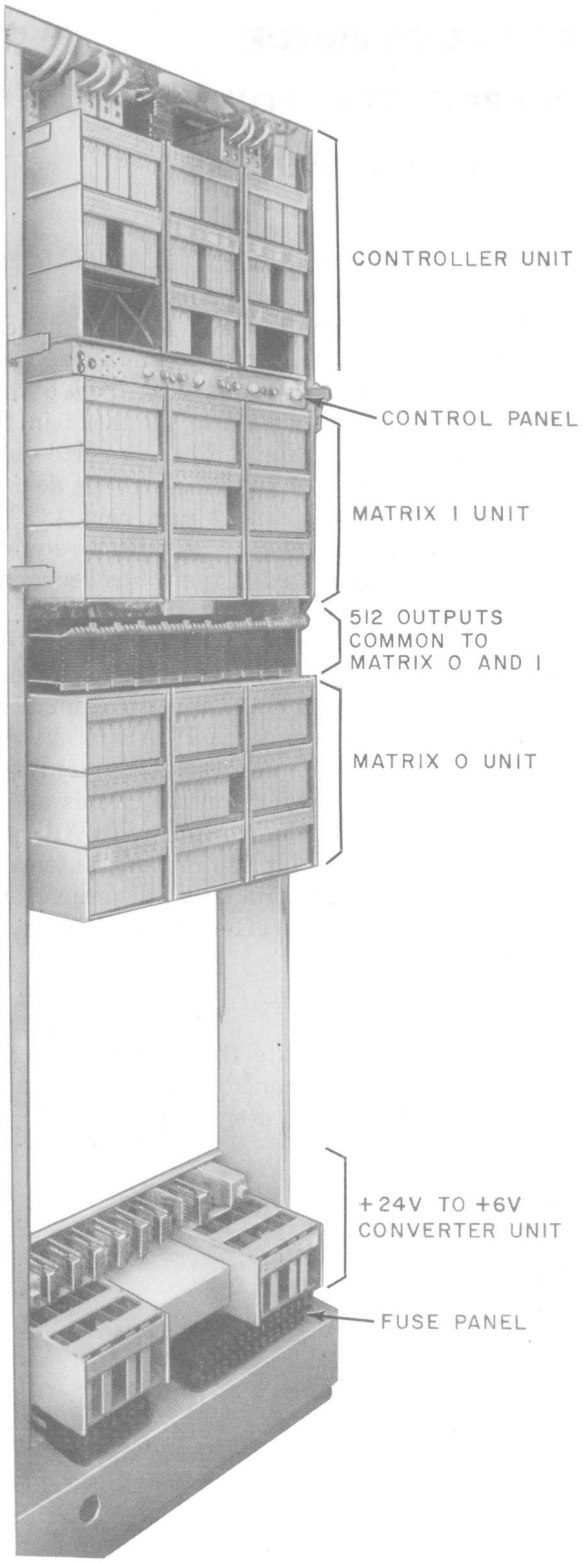

Fig. 1—Supplementary Central Pulse Distributor Frame

2. CONTROLLER POWER

A. Removing and Restoring Controller Power

2.01 Table A is a general controller status table. Controller power can be removed or restored by manual or program action. If removed by the manual method, the duplicate controller is locked up by hardware interlock thus preventing its power from being removed by program or manual action. However, if removed by program, the duplicate controller's power can be manually removed. This action would then restore power to the former controller and prevent a situation in which both controllers are unpowered simultaneously.

> ***Note:*** To manually remove power from a controller in order to restore the duplicate controller is not recommended. This action should be taken only in an emergency situation in which the off-line controller cannot be restored by program action.

2.02 Various indicators inform maintenance personnel of the controller's power status via lamp displays and TTY output messages. If a circuit defect is located in the controller and its power is removed in order to repair the malfunction, care must be exercised to prevent the good controller from having its power accidently remove. Therefore, the conditions and restrictions listed in Table A should be adhered to.

2.03 On Table B notice that manual power removal, but not programmed power removal, causes the OFF NOR and PWR OFF lamps on the control panel (Fig. 4) to become lighted. Also, the manual ferrods are still saturated when the power removal is accomplished by the programmed method.

2.04 The SCPD CONTROL keys (Fig. 4) are the manual power-off for the controllers. These keys are used to control controller power on/off and have no effect on the associated bus receivers or power supply.

2.05 The system always recognizes one of the controllers as the preferred controller to be on-line. In order to prevent a trouble in the off-line controller from being undetected for lengthy periods of time, the system is programmed to alternate the controllers automatically every 24 hours. Thus, one controller is preferred on even days and the other is preferred on odd days.

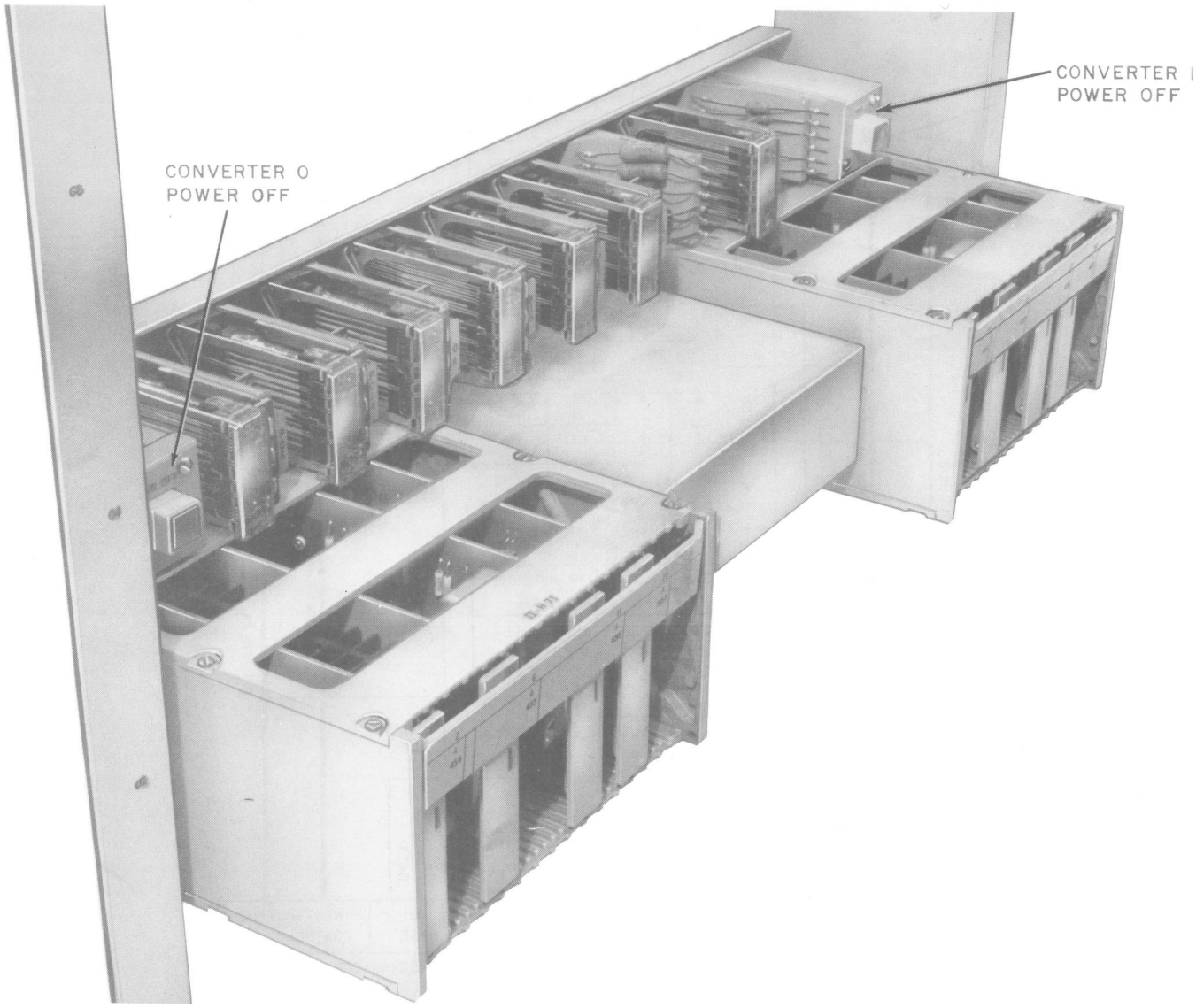

Fig. 2—SCPD +24V to +6V Converters

POWER REMOVAL AND RESTORAL PROCEDURE

2.06 To remove power from a controller and restore power to a controller the following procedures should be performed.

Note: Before removing power from a controller, insure that the duplicate controller is in good working order and is on-line. Refer to TTY Input Message Manual (IM-2H200) for TTY message to put appropriate controller on-line and to run a diagnostic check on the on-line controller.

STEP	ACTION	VERIFICATION
1	At maintenance TTY, type in— M DS:RMV:fg h-.	System response: tt MR DS RMV fg h-

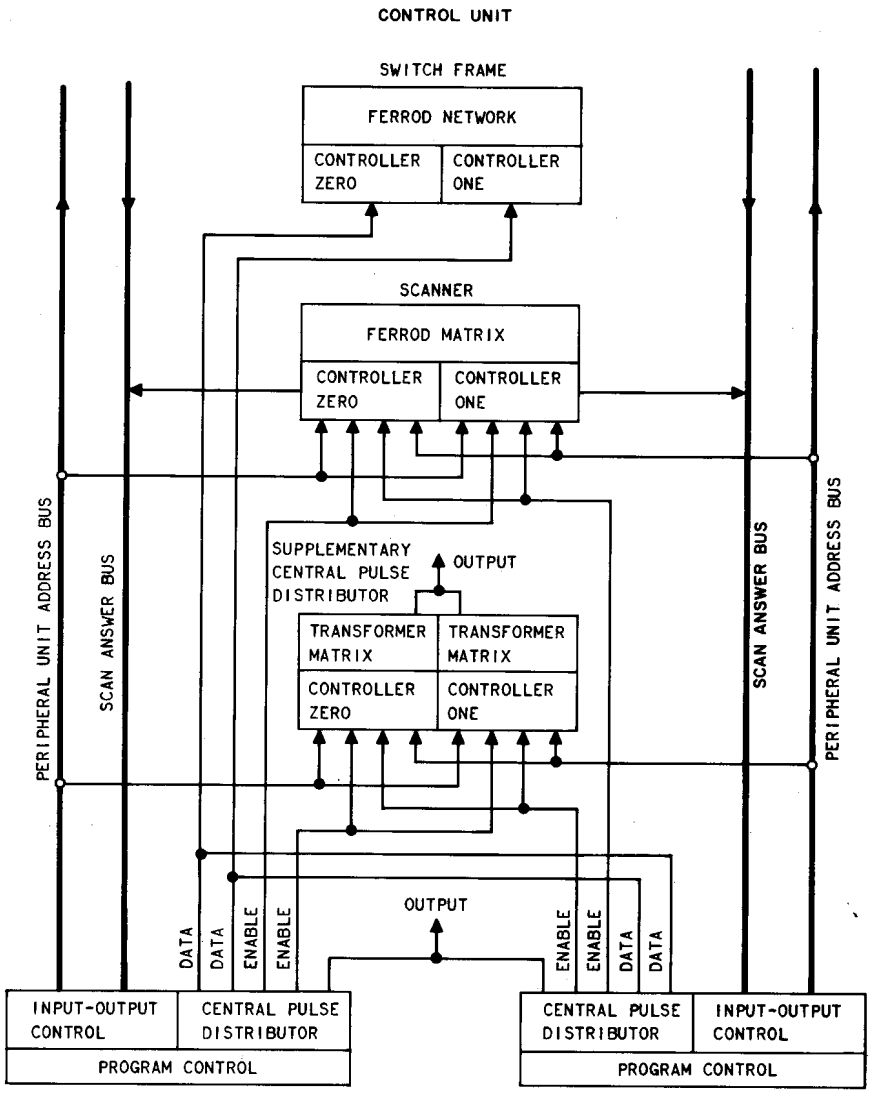

Fig. 3—SCPD Power Control—Block Diagram

STEP	ACTION	VERIFICATION
	fg = SCPD frame number (01-07) h = Controller (0 or 1).	(Refer to output message manual.) At System Status Panel— MISC lamp lighted. At SCPD control panel (Fig. 4)— OS-0 or OS-1 lamp lighted. OS = Out-of-service.
2	At SCPD control panel— Depress SCPD CONTROL OFF-0 or OFF-1 key.	At SCPD control panel— OFF NOR lamp lighted. PWR OFF lamp lighted.

TABLE A

CONTROLLER STATUS TABLE

CONDITION	RESTRICTION
Controller 0 Power Manually Removed	Cannot remove Controller 1 power manually. *Cannot remove Controller 1 power via program.
Controller 1 Power Manually Removed	Cannot remove Controller 0 power manually. *Cannot remove Controller 0 power via program.
Controller 0 Power Removed by Program	Cannot remove Controller 1 power via program. **If Controller 1 power is manually removed, Controller 0 power will be automatically reapplied.
Controller 1 Power Removed by Program	Cannot remove Controller 0 power via program. **If Controller 0 power is manually removed, Controller 1 power will be automatically reapplied.

* When out-of-service lamp for one controller is on, no attempt to remove duplicate controller power should be attempted.

** This could produce a condition in which the active controller is defective since it was originally removed from service due to some malfunction. Thus the user must guard against restoral of a controller via this method.

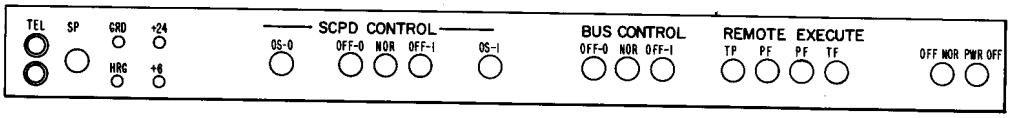

Fig. 4—SCPD Control Panel

TABLE B

CONTROLLER POWER REMOVAL RESTRICTIONS

CONDITION	CONTROLLER 0	CONTROLLER 1	*CONTROLLER FERRODS MANUAL SC(00) 0	MANUAL SC(03) 1	PROGRAM SC(01) 0	PROGRAM SC(04) 1	LAMP STATUS OUT OF SERVICE 0	OUT OF SERVICE 1	OFF NOR	PWR OFF
Normal Power On	X	X	X	X	X	X				
Manual Power Off Controller 0		X		X		X	X		X	X
Manual Power Off Controller 1	X		X		X			X	X	X
Program Power Off Controller 0		X	X	X		X	X			
Program Power Off Controller 1	X		X	X	X			X		
	X=Power On		X=Saturated				X=Lamp On			

*There are manual and program ferrods associated with each controller.

STEP	ACTION	VERIFICATION
	Note: Insure depressed key agrees with controller that has been removed from service.	
3	Perform desired work or repair on controller that is out of service.	
4	At SCPD control panel— Depress SCPD CONTROL NOR key.	At SCPD control panel— OFF NOR lamp extinguished. PWR OFF lamp extinguished.

STEP	ACTION	VERIFICATION
5	At maintenance TTY, type in— M DS:RST:fg h-. (Refer to input message manual.)	System response: tt MR DS DGN fg h- ATP tt MR DS RST fg h-. (Refer to output message manual.) MISC lamp on System Status Panel extinguished. OS-0 or OS-1 lamp on SCPD frame extinguished.

3. BUS POWER

3.01 The bus power control is only available via manual action and, when operated, restricts SCPD access to one PUAB and, therefore, one control unit.

> ***Note:*** Bus power should only be removed for repair or modification to the cable receivers or their associated circuitry.

3.02 The bus power control is manually interlocked to prevent dual PUAB access removal and is further interlocked to override the key operation if the duplicate +24 volt to +6 volt converter has produced an over/under-voltage alarm condition or has been manually unpowered. This is done to avoid frame outage due to incorrect control panel operation as well as automatic failure of the supply.

3.03 Table C illustrates the "bus" operation status to manual and automatic power conditions. The associated PUAB is off when either a bus or a converter is off or if a converter shows an over/under-voltage. The Bus OFF NOR lamp lights only when either Bus 0 or Bus 1 is off or when either SCPD controller 0 or controller 1 is off. The controller out-of-service (OS-0 or OS-1) lamps light when the appropriate controller is off. It does not light when a converter over/under-voltage is present or when power is off in a converter either manually or automatically.

POWER REMOVAL AND RESTORAL PROCEDURE

3.04 To remove power from BUS 0 or BUS 1 (CR circuit pack) and to restore power to BUS 0 or BUS 1, the following procedures should be performed.

> ***Note:*** Insure that bus power to be removed is always in agreement with the CU that is off-line (e.g., CU 0 and BUS POWER 0). If not in agreement, then the CU must be switched. See Input Message Manual (IM-2H200) for appropriate input message to switch CUs.

STEP	ACTION	VERIFICATION
1	At maintenance TTY— For No. 2 ESS offices type in: M CU:RMV! For No. 2B ESS offices type in: RMV:CU!	At System Status Panel for off-line CU— OUT-OF-SERVICE lamp lighted.
2	At SCPD control panel— Operate BUS CONTROL OFF-0 or OFF-1 key. ***Note:*** Insure correct BUS-OFF key is operated.	At SCPD control panel— OFF NOR lamp lighted. PWR OFF lamp lighted.
3	Perform desired work or repair on appropriate cable receiver bus.	
4	At SCPD control panel— Restore power by operating BUS CONTROL NOR key.	At SCPD control panel— OFF NOR lamp extinguished. PWR OFF lamp extinguished.

TABLE C

BUS POWER STATUS

CONDITION	PUAB		LAMP STATUS ON CONTROL PANEL					
				OUT OF SERVICE			CONVERTER	
	0	1	OFF NOR	0	1	PWR OFF	0	1
Bus Normal	X	X						
Bus 0 Off		X	X			X		
Bus 1 Off	X		X			X		
Converter 0 Off		X		X		X	X	
Converter 1 Off	X				X	X		X
Converter 0 Over/Under - Voltage		X						
Converter 1 Over/Under - Voltage	X							

X=Power On

X=Lamp On

STEP	ACTION	VERIFICATION
5	At maintenance TTY— For No. 2 ESS offices type in: M CU:RST!	At System Status Panel for off-line CU— OUT-OF-SERVICE lamp extinguished. STANDBY lamp lighted. RUN lamp lighted. TTY printout: tt MI CU SYN (Refer to OM-2H200.)
	For No. 2B ESS offices type in: RST:CU!	

4. CONVERTER POWER

4.01 The duplicated +24 volt to +6 volt converter (Fig. 2) is responsible for all the +6 volts output for the controllers and the PUAB circuitry in the SCPD frame. Power for the converter can be manually removed using the PWR OFF key located on each side of the converter unit. Removing power from a converter would disable the associated controller and PUAB circuit. If an over/under-voltage condition is detected with one converter out-of-service, the duplicate converter will disconnect from the SCPD leaving the SCPD with no converter power. The disconnect mode, though automatically originated (+6 volt output level exceeding +7 volts), is only recoverable manually by removing and then reapplying converter power.

B. Converter Power Interlocks

4.02 Two interlocks are built into the converter to prevent both converters from being removed from service or to prevent removing one converter while the duplicate controller is unpowered. The interlocks under certain conditions do not provide protection either electrically or automatically. For example, if converter circuit 0 has an over-voltage condition, it is possible to manually remove power

from converter circuit 1, which would effectively remove power from the frame.

Note: Over- or under-voltage can be detected only by ferrod operation. This function is included in system diagnostics, and printout information is all that is available in an over/under-voltage condition.

4.03 The converter PWR OFF keys should ***only*** be operated in recovering from an over- or under-voltage or in repairing the converter itself. In recovering from an over/under-voltage, the controller power is removed prior to the removal of the power supply to allow for a sequenced removal of power. In restoring power, the sequence should be reversed; that is, application of converter power followed by the application of controller power. This power sequencing is desirable because there exists some danger of accidently sending an execute pulse during power removal/application processes due to power transients. These transients are minimized by disabling the execute pulser while removing or restoring power to its control logic. Since the output stage of the pulser is operated on +24 volts, while the control logic is almost exclusively +6 volts, these transients can best be avoided by removing +24 volts before +6 volts and restoring +24 volts after +6 volts.

4.04 Table D lists the operation sequence desired in applying power to avoid any system transients. It also lists the required relay operation to achieve the desired power condition. If it should be necessary to remove power from a controller which has been program quarantined, operate only the associated converter PWR OFF key. Converter power should only be removed to aid in converter repair. To repair controller or PUAB problems, remove the respective controller or bus power.

4.05 The PWR OFF lamp on the control panel excludes the program quarantine condition in order to make it compatible with other peripheral unit frames. The PWR OFF lamp will light if any of the following conditions occur:

- Bus 0 Off
- Bus 1 Off
- Fuse Alarm
- Converter 0 Off
- Converter 1 Off
- Controller 0 Off
- Controller 1 Off.

4.06 The PWR OFF lamp on the control panel will not light if any of the following conditions occur:

- Program Quarantine
- Over-Voltage
- Under-Voltage.

POWER REMOVAL AND RESTORAL PROCEDURE

4.07 To remove power from a converter and restore power to a converter, the following procedure should be performed.

Note: Before removing power from a converter unit, insure that the duplicate controller is in good working order and is on-line. Extreme care should be exercised at this time to insure that the units to be taken out-of-service are in agreement. (CU 0 with converter 0 and visa versa.)

Refer to input message manual if there is a need to switch CUs in order to remove appropriate CU from service or if there is a need to switch controller in order to take the appropriate controller out-of-service.

STEP	ACTION	VERIFICATION
1	At maintenance TTY— For No. 2 ESS offices type in: M CU:RMV! For No. 2B ESS offices type in: RMV:CU!	At System Status Panel for off-line CU— OUT-OF-SERVICE lamp lighted.

TABLE D

CONVERTER POWER SEQUENCE

CONDITION	ACTION	POWER RELAYS				LAMP STATUS			
						CONTROL PANEL			
		HV	A	P24	P6	OFF NOR	PWR OFF	OUT OF SERVICE	CONVERTER PWR OFF
A. Normal On	None	X		X	X				
B. *Remove Converter Power	1. Operate the SCPD controller off key associated with converter.	X X X		X	X X	X X X	 X X	 X	
	2. Operate the converter PWR OFF key.					X	X	X	X
C. Over-Voltage			X	X	X				
D. Recovery from over-voltage	1. Operate the appropriate SCPD controller off key.		X X X	X	X X	X X X	 X X	 X	
	2. Operate the appropriate converter PWR OFF key.					X	X	X	X
		X=Relay Energized				X=Lamp On			

*Reverse this sequence of actions to restore power.

Note: During an over-voltage condition, do not remove the wrong power supply or the SCPD frame will be disabled.

STEP	ACTION	VERIFICATION
2	At maintenance TTY type in— M DS:RMV:fg h-! fg = SCPD frame number (01-07) h = Controller (0 or 1).	At System Status Panel— MISC lamp lighted. At SCPD control panel— OS-0 or OS-1 lamp lighted. OS = Out-of-service.

STEP	ACTION	VERIFICATION
3	At SCPD control panel— Depress SCPD CONTROL OFF-0 or OFF-1 key. ***Note:*** Insure depressed key agrees with controller that has been removed from service.	At SCPD control panel OFF NOR lamp lighted. PWR OFF lamp lighted.
4	At SCPD converter unit— Depress PWF OFF (0 or 1) key. ***Note:*** Converter unit 0 is the lower left unit in the SCPD frame. Converter 1 is the lower right unit.	At converter unit (0 or 1)— PWR OFF lamp lighted.
5	Perform desired work or repair on appropriate converter unit.	
6	At SCPD converter unit— Depress PWR OFF (0 or 1) key.	At converter unit (0 or 1)— PWR OFF lamp extinguished.
7	At SCPD control panel— Depress SCPD CONTROL NOR key.	At SCPD control panel— OFF NOR lamp extinguished. PWR OFF lamp extinguished.
8	At maintenance TTY, type in— M DS:RST:fg h-! (Refer to input message manual.)	System response: tt MR DS DGN fg h- ATP tt MR DS RST fg h- (Refer to output message manual.) At SCPD control panel— OS-0 or OS-1 lamp extinguished. At System Status Panel— MISC lamp extinguished.
9	At maintenance TTY— For No. 2 ESS offices type in: M CU:RST! For No. 2B ESS offices type in: RST:CU!	At System Status Panel— OUT-OF-SERVICE lamp extinguished. STANDBY lamp lighted. RUN lamp lighted. TTY printout: tt MI CU SYN (Refer to output message manual.)

5. POWER INTERLOCKS

5.01 The power circuit interlock is designed to prevent various illegal manual operations from occurring. The guide shown in Table E indicates the restrictions and allowable user operations in all modes of operation.

5.02 The interlock circuitry will prevent power removal from either power supply, if the duplicate power supply is unpowered or if the

TABLE E

ROLE OF INTERLOCKS

CONDITION	INTERLOCK	COMMENTS
Converter Off	A. Cannot remove power from duplicate power converter. B. Cannot quarantine duplicate controller if converter that is off also has its associated controller off. C. Cannot remove power from duplicate bus receivers.	Do not take any action against "active" controller-bus-power supply without noting restriction B.
Controller is in Quarantine Mode	A. Cannot remove power from duplicate power supply. B. Cannot quarantine duplicate controller.	Can remove bus power.
Converter Over/Under-Voltage	A. Cannot quarantine other controller. B. Cannot remove bus power from duplicate bus receivers.	Since this condition is not manually prohibited, during an over/under-voltage the duplicate controller/bus must not be unpowered. Do not remove power from duplicate converter.
Bus Power Off	A. Cannot remove other bus power. B. Over/under-voltage to other converter will restore this bus power. C. Duplicate converter off (manually) will restore this bus.	Can remove any controller or converter.

duplicate controller is unpowered either by quarantine mode or an over/under-voltage condition.

6. POWER FERROD STATUS

6.01 The SCPD utilizes three power status ferrods. These ferrods monitor the Manual Controller ON/OFF, Program Controller ON/OFF, and the Over/Under-Voltage status of the converter. The manual ferrod refers to the manual removal or application of the controller from the SCPD control panel. The program ferrod refers to the controller power status that is accessible by program, and the ferrod refers to the converter voltage status. Table F is a detailed table for all conditions.

TABLE F

POWER STATUS FERRODS

MANUAL CONTROLLER	PROGRAM CONTROLLER	CONVERTER OVER/UNDER VOLTAGE	STATUS	COMMENTS
0	0	0	Over/under voltage	If over-voltage, the controller PUAB associated with converter is out of service.
0	0	1	Normal power-on condition	
0	1	0	Multiple Condition	Over/under converter alarm with controller in quarantine mode.
0	1	1	Program Quarantine	Controller removed from service by program.
1	0	0	Malfunction	Over/under alarm and controller removed manually *but* controller circuit remains powered.
1	0	1	Malfunction	Controller removed but controller circuit remains powered.
1	1	0	Possible step in recovering from over voltage	Controller off manually and over/under voltage indication.
1	1	1	Controller removed from service manually	Manual quarantine.