

UNCLASSIFIED

AD NUMBER

AD856774

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

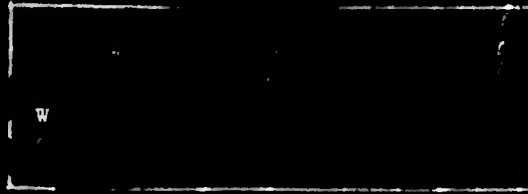
Distribution authorized to U.S. Gov't. agencies only; Administrative/Operational Use; 26 SEP 1968. Other requests shall be referred to Space and Missile Systems Organization, Los Angeles, CA.

AUTHORITY

SAMSO per DTIC form 55

THIS PAGE IS UNCLASSIFIED

STDR B5-10-8



OPERATION and SERVICE MANUAL

AD856774

**GEMINI B/MOL/L/V
ELECTRICAL
INTERFACE
SUBSTITUTE**

58E040504

Prepared for the

United States Air Force

by

MCDONNELL

STDR B5-10-8

DATE 26 SEPTEMBER 1968

3
OPERATION AND SERVICE MANUAL

FOR

EACH TRANSMISSION OF ~~TELETYPE~~ ^{GEMINI B/MOL/L/V}
THE AGENCIES OF THE US GOVERNMENT MUST HAVE
PRIOR APPROVAL OF THE OFFICE OF INFORMATION
(EMDA), SPACE & MISSILE SYSTEMS ORGANIZATION,
AT UNIT P.O., LOS ANGELES, CA 90045
~~582040504~~

AD856774

PROJECT GEMINI B

AUG 20 1969

SUBMITTED UNDER Contract No. F04695-67-C-0023

P.O. Box 516 Saint Louis, Missouri 63166

MCDONNELL DOUGLAS



CORPORATION

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: Latest PCN incorporated is _____
dated _____.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 51, CONSISTING OF THE FOLLOWING:

PAGE NO.	REVISION	DATED
Title		Original
i thru vi		Original
1-1 thru 1-11		Original
1-12 blank		Original
2-1		Original
2-2 blank		Original
3-1		Original
3-2 blank		Original
4-1 thru 4-9		Original
4-10 blank		Original
5-1 thru 5-7		Original
5-8 blank		Original
6-1 thru 6-3		Original
6-4 blank		Original
6-5 thru 6-10		Original

DOCUMENT STATUS INDEX

NOTE: This document has been updated to incorporate the following:

- 58EO40504 - G/B to TIIIM Electrical Interface Substitute Assy
EO Seq. 1
- 58DO42021 - G/B to TIIIM Electrical Substitute Control and Monitor
Panel Assembly
- 58DO42022 - G/B to TIIIM Electrical Substitute Analog Monitor Panel
Assembly - DCN Seq. B
- 58DO42027 - G/B to TIIIM Electrical Substitute Digital Data Output
Panel Assembly
- 58DO42023 - G/B to TIIIM Electrical Substitute Cabinet Assembly -
DCN Seq. A

MCDONNELL

INTRODUCTION

The purpose of this ~~Space Technical Data Report~~ (STDR) is to familiarize personnel with the operation and service of the Gemini B/MOL/L/V Electrical Interface Substitute, 58E040504. This STDR describes the console, associated panels and their functions. The console is used to electrically simulate the Gemini B Spacecraft when performing functional tests on the Gemini B/MOL Launch Vehicle.

MCDONNELL

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
	INTRODUCTION	iii
I	DESCRIPTION	1-1
	1.1 Description	1-1
	1.2 Related Equipment	1-9
	1.3 Facility Requirements	1-9
II	TEST EQUIPMENT AND SPECIAL TOOLS	2-1
	2.1 Test Equipment	2-1
	2.2 Special Tools	2-1
III	PREPARATION FOR USE, SHIPMENT AND STORAGE	3-1
	3.1 Preparation For Use	3-1
	3.2 Preparation For Shipment	3-1
	3.3 Preparation For Storage	3-1
IV	OPERATION	4-1
	4.1 Functions of Controls and Indicators	4-1
	4.2 Pre-Operational Validation	4-6
	4.3 Operation	4-7
V	PREVENTIVE MAINTENANCE AND CALIBRATION	5-1
	5.1 Preventive Maintenance	5-1
	5.2 Calibration	5-2
VI	LIST OF SUBASSEMBLIES AND DIAGRAMS	6-1
	6.1 List of Subassemblies	6-1
	6.2 Diagrams	6-2

MCDONNELL

LIST OF ILLUSTRATIONS

<u>FIGURE</u>	<u>TITLE</u>	<u>PAGE</u>
1-1	Gemini B/MOL/L/V Electrical Interface Substitute (58E040504) . .	vi
1-2	Digital Voltmeter (Y593440A/3443A)	1-3
1-3	Analog Monitor Panel (58D042022-1)	1-4
1-4	Control and Monitor Panel (58D042021-1)	1-6
1-5	PCM Simulator (2790-01-6-04-M4)	1-8
1-6	Blower Assembly (R2DB350A)	1-10
6-1	Wheel Diagram (Local Operation)	6-3
6-2	Wheel Diagram (Remote Operation)	6-5
6-3	Cabinet Cabling Diagram	6-6
6-4	Analog Monitor Panel Schematic	6-8
6-5	Control and Monitor Panel Schematic	6-9
6-6	Digital Data Output Panel Schematic	6-10

LIST OF TABLES

<u>TABLE</u>	<u>TITLE</u>	<u>PAGE</u>
4-1	Analog Monitor Panel Component Functions	4-1
4-2	Control and Monitor Panel Component Functions	4-3
4-3	Cable Entry Panel Control Functions	4-5
5-1	Preventive Maintenance Requirements	5-1
5-2	Signal Voltage to Indicator Scale Specifications	5-2
5-3	Signal Voltage and Scale Correlation Specifications (Stage 1) .	5-3
5-4	Signal Voltage and Scale Correlation Specifications (Stage 2) .	5-3
5-5	Signal Voltage to Indicator Scale Specifications	5-4
6-1	List of Subassemblies	6-1

MCDONNELL

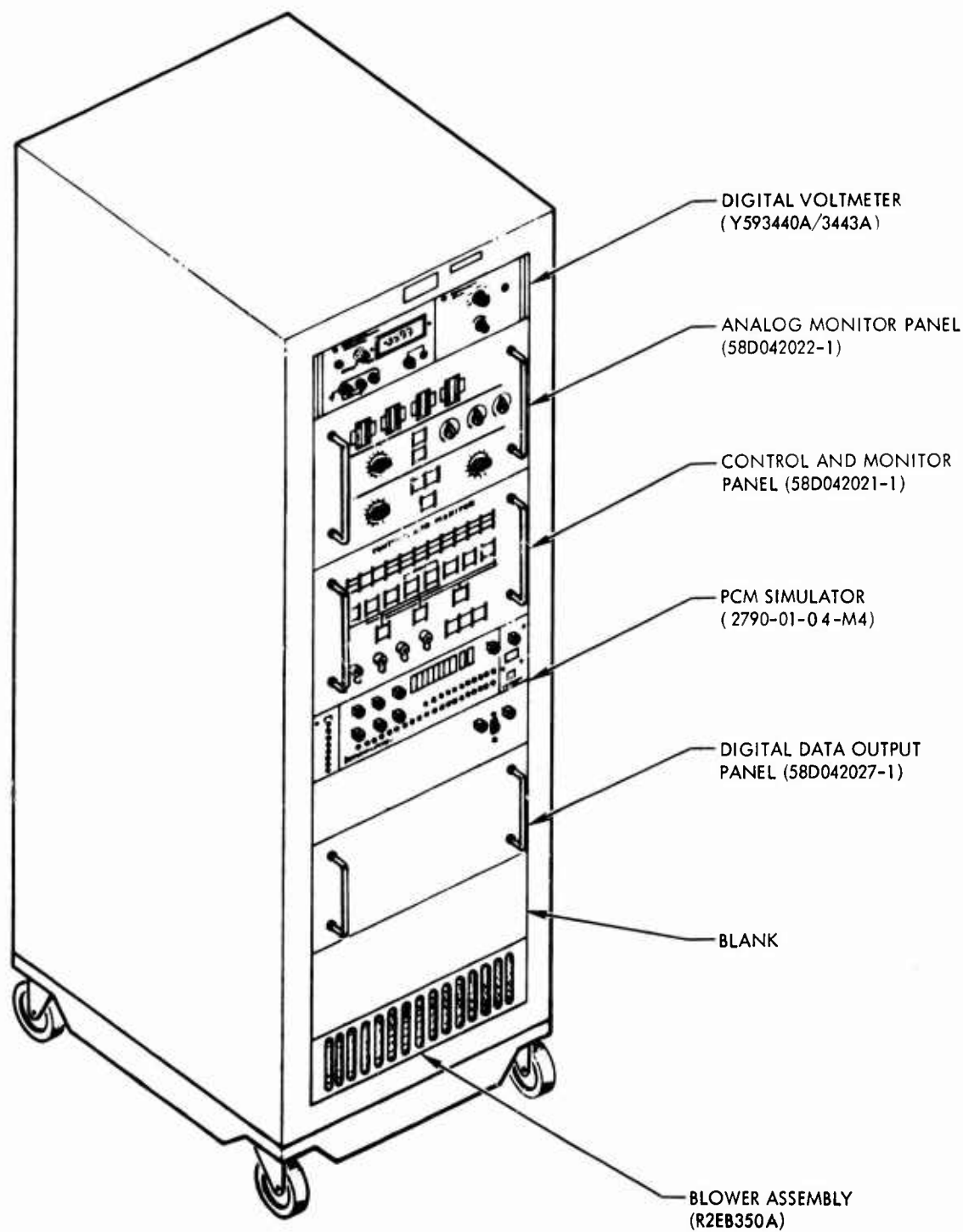


Figure 1-1 Gemini B/MOL/L/V Electrical Interface Substitute (58E040504)

MCDONNELL

SECTION I
DESCRIPTION

1.1 DESCRIPTION

The Gemini B/MOL/L/V Electrical Interface Substitute, 58E040504 (Figure 1-1), is designed for electrically checking the Titan IIIM Launch Vehicle without the presence of the Gemini B Spacecraft. The substitute generates and monitors Gemini B and launch vehicle interface signals. Signals simulated by the substitute are Gemini B Electrical Power and Guidance and Control Systems signals. These signals are applied to and commanded by the launch vehicle Combined Systems Test Simulator Set (CSTSS).

There are two modes of operation of the substitute. In the LOCAL mode of operation signals generated by the substitute are initiated manually by panel mounted switches and potentiometers. In the REMOTE mode of operation the substitute generated signals are initiated by bi-level commands from the CSTSS.

Monitoring of launch vehicle bi-level (ON-OFF) generated signals is provided by indicator lights, digital voltmeter and launch vehicle AGE event recorders. Launch vehicle generated analog signals are monitored by meters, digital voltmeter, and launch vehicle AGE analog recorders.

The Gemini B/MOL/L/V Electrical Interface Substitute is an upright console consisting of a single bay. The console is approximately 6 feet high, 2 feet wide and 1.5 feet deep and caster mounted for ease

MCDONNELL

1.1 DESCRIPTION (Continued)

of movement. A door at the rear of the cabinet provides access to the cabinet wiring and panels. A cable entry panel on the rear of the cabinet provides connections for input power and interface cabling.

The following paragraphs describe the individual subassemblies comprising the substitute. Refer to Figure 6-1, Section VI for the cabinet cabling diagram.

1.1.1 DIGITAL VOLTMETER (Y593440A/3443A)

The Hewlett-Packard Model 3440A Digital Voltmeter (Figure 1-2), equipped with a 3443A plug-in unit, provides a digital display of selected interface signals. These signals are selected by the DVM SELECT switches on the Analog Monitor Panel.

The unit provides a four digit presentation of 0-99.99 mv to 0-999.9 volts, and indicates polarity automatically. The unit also has a self-check capability. For additional information refer to the applicable Hewlett-Packard operating and service manual.

1.1.2 ANALOG MONITOR PANEL (58D042022-1)

The Analog Monitor Panel (Figure 1-3) monitors various launch vehicle analog pressure signals and velocity and attitude comparison signals. Meters monitoring these signals are located on the panel face. The panel is also capable of generating attitude error signals to the launch vehicle. The attitude error signals, with the substitute in the LOCAL mode of operation, are generated by first adjusting the

MCDONNELL

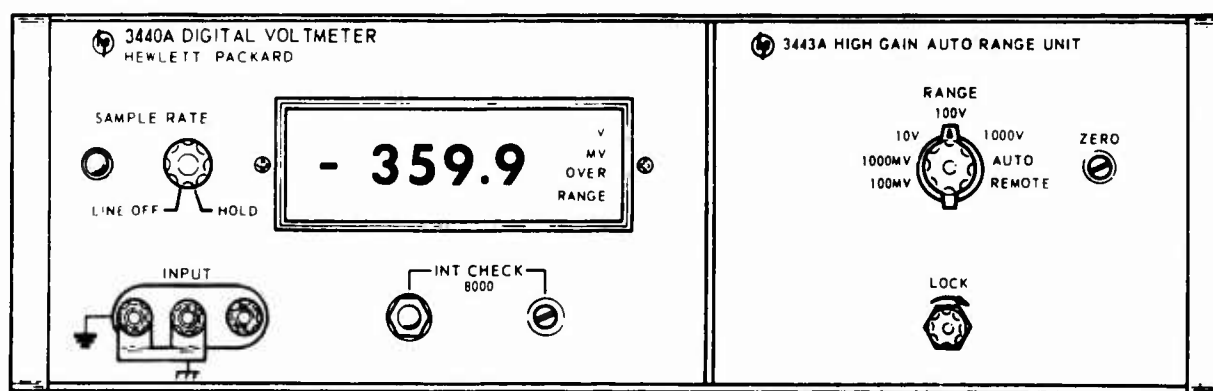
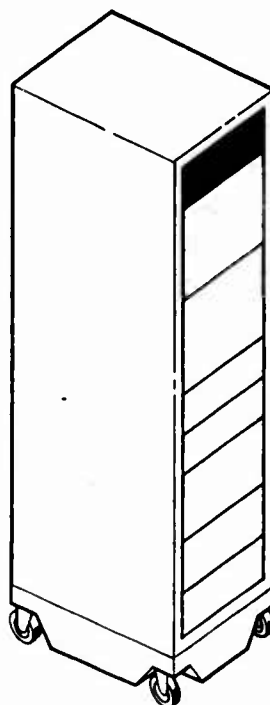


Figure 1-2 Digital Voltmeter (Y593440A/3443A)

MCDONNELL

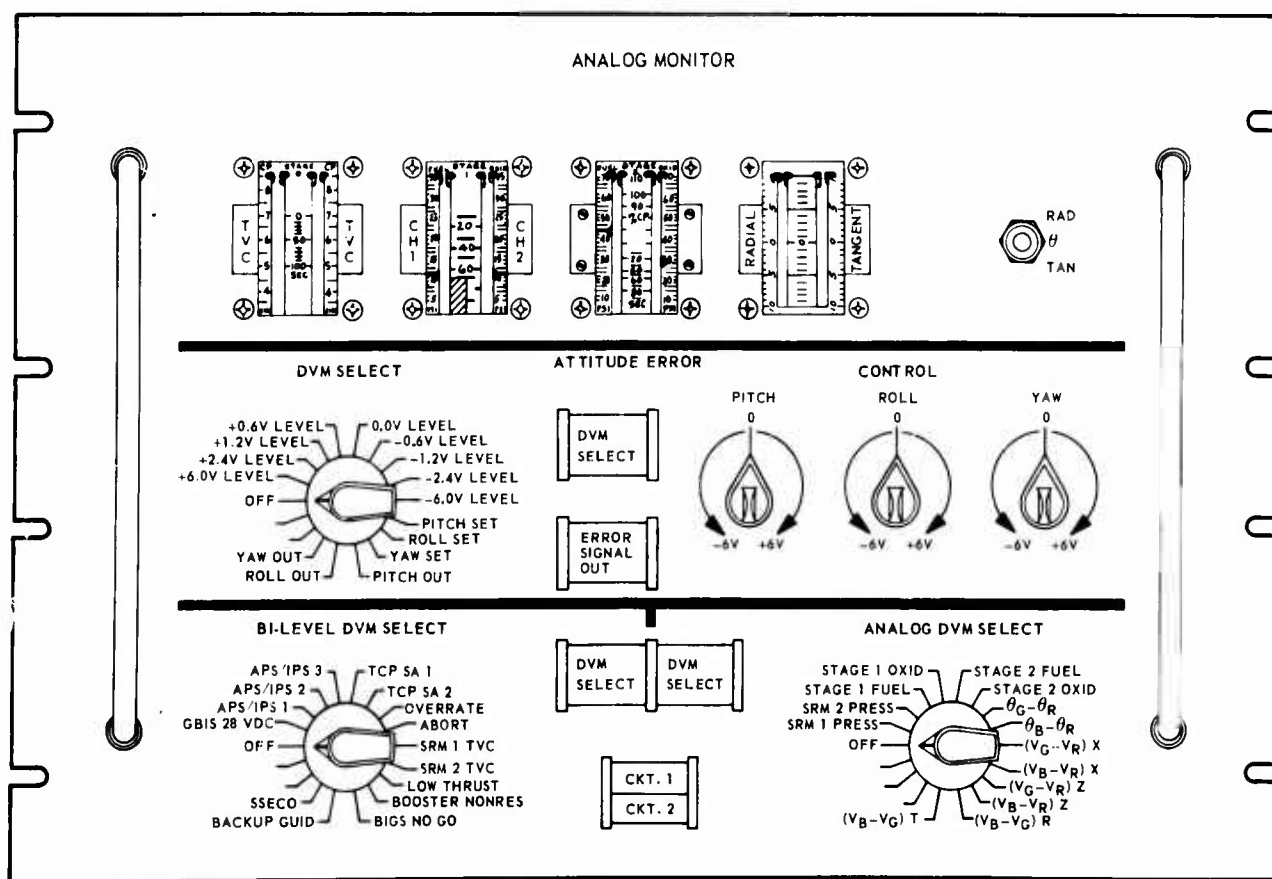
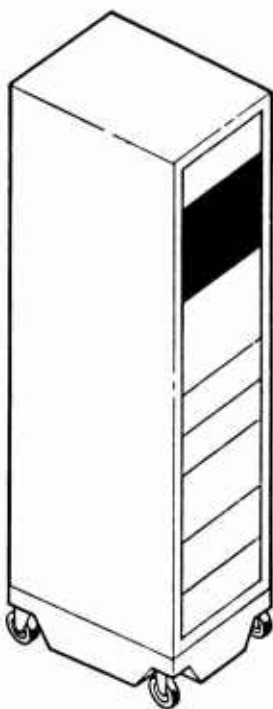


Figure 1-3 Analog Monitor Panel (58D042022-1)

MCDONNELL

1.1.2 ANALOG MONITOR PANEL (58DO42022-1) (Continued)

PITCH, ROLL and YAW error signal control knobs for the desired voltage. This attitude error signal is monitored on the Digital Voltmeter when the DVM SELECT switch is in the PITCH SET, ROLL SET, or YAW SET positions. During the attitude error signal set-up procedure the actual attitude error signals at the substitute-launch vehicle interface are at the zero volt level and will remain so until the ERROR SIGNAL OUT switch is depressed. When the ERROR SIGNAL OUT switch is depressed for the first time after the LOCAL POWER switch (located on Control and Monitor Panel) is depressed, the attitude error signal as previously set up will be transferred to the substitute-launch vehicle interface. Depressing the ERROR SIGNAL OUT switch the second time returns the attitude error signal at the interface to the zero volt level. In the REMOTE mode of operation the substitute supplies attitude error signals when it receives a steering error test command from the CSTSS. The attitude error signals are preset voltage levels applied to the pitch, yaw, and roll channels. The output voltage will not change until it receives the next CSTSS steering error test command. The substitute provides the capability to preset the individual attitude error signal steps to any one of the following nine voltage levels: +6.0 vdc, +2.4 vdc, +1.2 vdc, +0.6 vdc, 0 vdc, -0.6 vdc, -1.2 vdc, -2.4 vdc, or -6.0 vdc.

Ten distinct attitude error signal steps are provided by the substitute. Each step is preset to one of the above mentioned voltage levels by

MCDONNELL

1.1.2 ANALOG MONITOR PANEL (58DO42022-1) (Continued)

programming a matrix board for each of the pitch, yaw, and roll channels. The matrix boards are located at the rear of the panel assembly. Refer to Table 4-1, Section IV for panel control and indicator functions and to Figure 6-2, Section VI for the panel schematic.

1.1.3 CONTROL AND MONITOR PANEL (58DO42021-1)

The Control and Monitor Panel (Figure 1-4) contains controls and indicators that provide and monitor simulated spacecraft functions. Three controls select launch vehicle voltage busses and these voltages are applied to panel busses. Other controls with relay switching capabilities route the voltages back to the launch vehicle as command signals. Launch vehicle signals coming into the panel are monitored by lights, simulating spacecraft light indicators. Most signals are routed to the Analog Monitor Panel for monitoring on the Digital Voltmeter.

The Control and Monitor Panel also controls the application of input power to the console blower and panel assemblies. A more detailed explanation of the panel controls and indicators is given in Table 4-2, Section IV. Refer to Figure 6-3, Section VI for a panel schematic.

1.1.4 PCM SIMULATOR (2790-01-6-04-M4)

The EMR PCM Simulator (Figure 1-5) is used to simulate the Gemini B Digital Computer. Digital data is programmed into the unit by controls on the simulator front panel. The unit supplies this digital data to the Guidance Interface Adapter which is part of the Digital Data Output Panel. Digital data can be transferred from the simulator

MCDONNELL

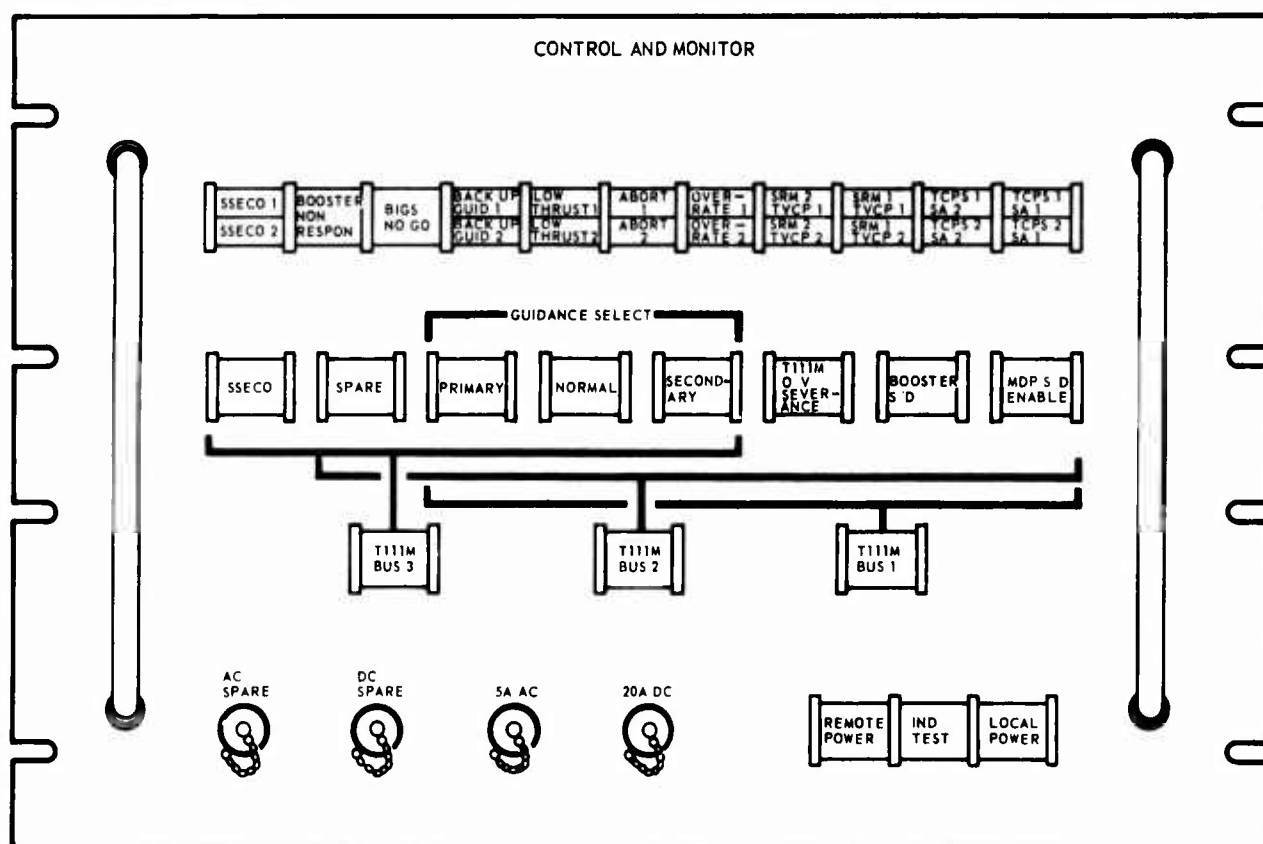
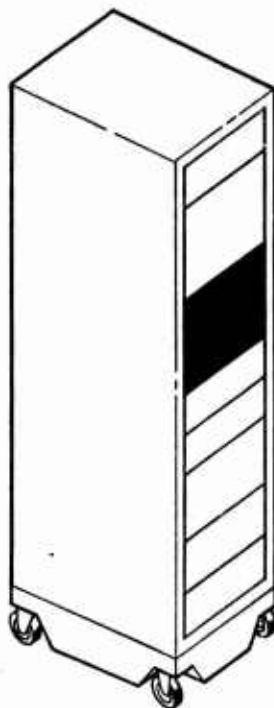


Figure 1-4 Control and Monitor Panel (58D042021-1)

MCDONNELL

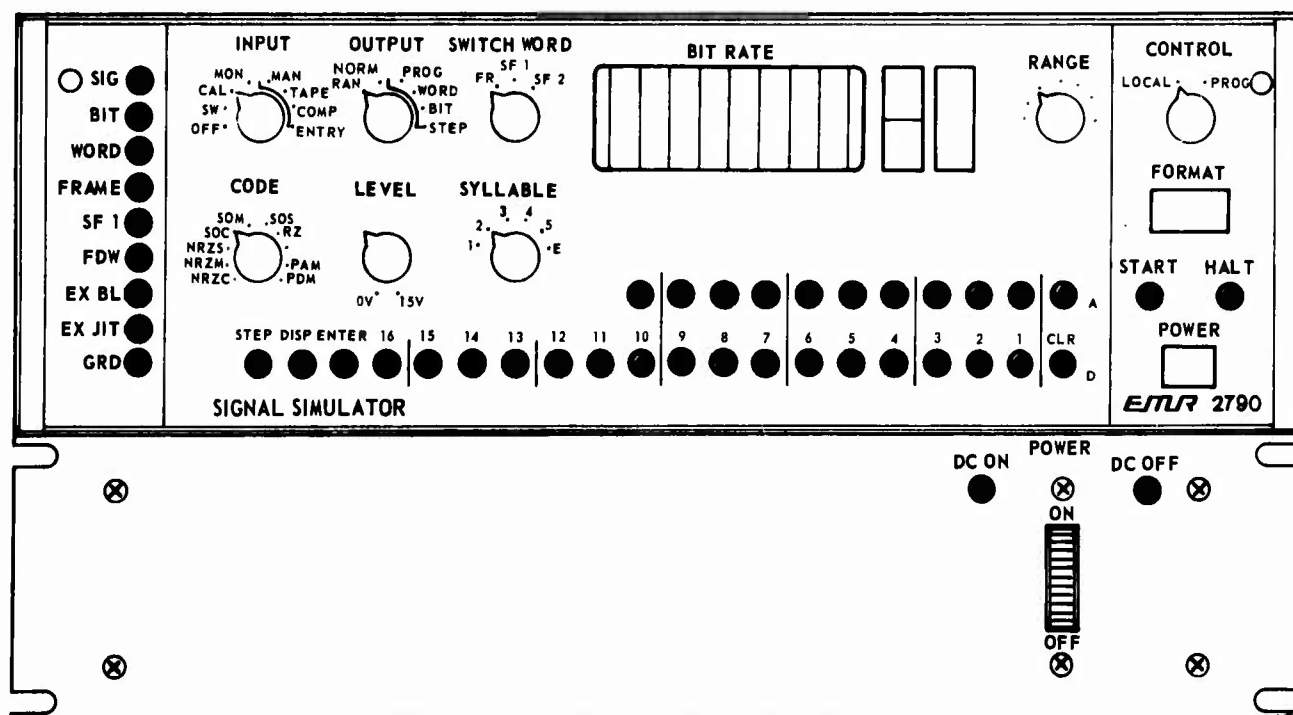


Figure 1-5 PCM Simulator (2790-01-04-M4)

MCDONNELL

1.1.4 PCM SIMULATOR (2790-01-6-04-M4) (Continued)

locally by front panel controls or remotely by commands from other launch vehicle AGE. For additional information refer to the applicable EMR instruction manual along with the 2790M-4 configuration supplement, EMR 16021 drawing, and EMR 16022 wire list. To program the simulator to provide the simulated computer computation cycle for local mode of operation see the wheel diagram, Figure 6-5. For remote operation the simulator is programmed for one word of the computer computation cycle. See Figure 6-6 for the program wheel diagram.

1.1.5 DIGITAL DATA OUTPUT PANEL (58D042027-1)

The Digital Data Output Panel is a plain front panel containing the Guidance Interface Adapter. The Guidance Interface Adapter receives signals from the PCM Simulator which substitutes for the Gemini B Digital Computer. These signals are ground isolated and conditioned by the Guidance Interface Adapter before being sent to the launch vehicle. The above signals are dc analog steering error signals, digital (velocity, attitude, and time) data, shift pulses and data ready discretes.

1.1.6 BLOWER ASSEMBLY (R2EB350A)

The Blower Assembly (Figure 1-6) provides cooling air for the equipment contained in the cabinet. The incoming air is passed through a permanent type dust filter which is located on the front panel. Blower power is controlled by the LOCAL POWER switch on the Control and Monitor Panel. For additional information refer to the McLean Engineering Laboratories Instruction Manual for the R2EB350A Blower.

MCDONNELL

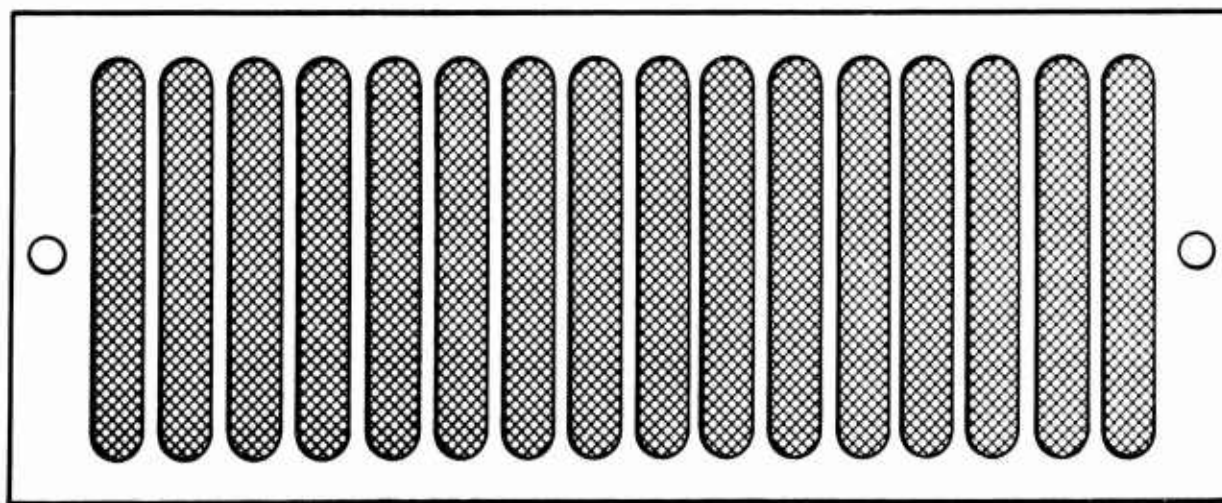
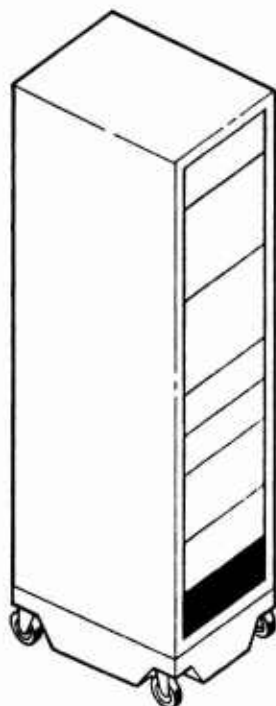


Figure 1-6 Blower Assembly (R2EB350A)

MCDONNELL

1.2 RELATED EQUIPMENT

The Gemini B/MOL/L/V Electrical Interface Substitute requires the Combined Systems Test Simulator Set (CSTSS), CEI-F09D01 for normal operation.

1.3 FACILITY REQUIREMENTS

The power requirements for the Gemini B/MOL/L/V Electrical Interface Substitute are as follows:

- (a) 115 vac, 60 cps, single-phase regulated power.
- (b) 115 vac, 60 cps, single-phase unregulated power.
- (c) 28 vdc

MCDONNELL

SECTION II

TEST EQUIPMENT AND SPECIAL TOOLS

2.1 TEST EQUIPMENT

Standard laboratory test equipment is required for calibration and maintenance of the Gemini B/MOL/L/V Electrical Interface Substitute.

2.2 SPECIAL TOOLS

No special tools are required for maintenance or testing of the Gemini B/MOL/L/V Electrical Interface Substitute.

MCDONNELL

SECTION III

PREPARATION FOR USE, SHIPMENT AND STORAGE

3.1 PREPARATION FOR USE

The following procedure shall be performed before initial use, after prolonged storage, and after major repair or modification.

- (a) Perform a visual inspection of the cabinet and panels.
- (b) Calibrate the cabinet mounted equipment by performing the procedures of Paragraph 5.2.2.
- (c) Perform an acceptance test of the cabinet equipment in accordance with ATP 58D900193.

3.2 PREPARATION FOR SHIPMENT

Refer to MIL-E-17555 for preparation instructions.

3.3 PREPARATION FOR STORAGE

Refer to MIL-E-17555 for preparation instructions.

MCDONNELL

SECTION IV

OPERATION

4.1 FUNCTIONS OF CONTROLS AND INDICATORS

4.1.1 COMMERCIAL EQUIPMENT

Refer to the applicable Hewlett-Packard and Electro-Mechanical Research instruction manuals for the control and indicator functions of the Digital Voltmeter and PCM Simulator.

4.1.2 ANALOG MONITOR PANEL

The function of the Analog Monitor Panel (Figure 1-3) controls and indicators is explained in Table 4-1.

COMPONENT	FUNCTION
STAGE 0 CP meter	Monitors analog signals from the Solid Rocket Motor Head (SRM) Head End Pressure Sensors in launch vehicle.
STAGE 1 FUEL/OXID meter	Monitors analog signals from the stage 1 fuel tank and oxidizer tank pressure sensors.
STAGE 2 FUEL/OXID meter	Monitors analog signals from the stage 2 fuel tank and oxidizer tank pressure sensors. Also monitors analog signals from the stage 2 thrust chamber pressure sensors through signal switching in the launch vehicle.
RADIAL, TANGENT lights and Guidance Comparator Indicator (G.C.I.)	Monitors tangential and radial GIGS (Gemini Inertial Guidance System) and BIGS (Booster Inertial Guidance System) comparison velocity on the two outside scales. After SSECO these scales display tangential and radial velocity to be gained. One inside scale displays the comparison of BIGS and ARS (Attitude Reference System) velocity along the roll and yaw axis and attitude in pitch

Table 4-1 Analog Monitor Panel Component Functions

MCDONNELL

4.1.2 ANALOG MONITOR PANEL (Continued)

COMPONENT	FUNCTION
RADIAL, TANGENT lights and Guidance Comparator Indicator (G.C.I.)	(Continued) plane. The other inside scale displays the comparison of GIGS and ARS velocity along the roll and yaw axis and attitude in pitch plane. Lights, when illuminated, indicate signals are tangential or radial. No light illumination indicates signals are pitch attitude signals.
RAD, TAN switch	S5 Selects radial, tangential and pitch at- titude signals for application to Guid- ance Comparator Indicator.
DVM SELECT switch	S7 Selects steering error commands and pre- set pitch, yaw and roll error signals for readout on the DVM.
DVM SELECT switch/indicator	S4, DS4 Applies signals selected by switch S7 to the DVM. Illuminates when actuated.
ERROR SIGNAL OUT switch/indicator	S1, DS1 Applies steering error signals to launch vehicle and Guidance Interface Adapter. Illuminates when actuated.
PITCH, ROLL, YAW controls	R16, R18, R19 Manually controls plus and minus pitch, roll and yaw steering error signals.
BI-LEVEL DVM SELECT switch	S6 Selects bi-level signals from the launch vehicle for readout on DVM.
DVM SELECT switch/indicator	S3, DS3 Applies signals selected by switch S6 to the DVM. Illuminates when actuated.
DVM SELECT switch/indicator	S8, DS5 Applies signals selected by switch S9 to the DVM. Illuminates when actuated.
CKT. 1, CKT. 2 switch/indicator	S2, DS2 Selects signals from deck A or deck B of switch S6 for application to DVM by switch/indicator S3, DS3. The selected signals are redundant and this switch distinguishes between them.
ANALOG DVM SELECT switch	S9 Selects analog signals from the launch vehicle for readout on DVM.

Table 4-1 Analog Monitor Panel Component Functions
(Continued)**MCDONNELL**

4.1.3 CONTROL AND MONITOR PANEL

The function of the Control and Monitor panel (Figure 1-4) controls and indicators are explained in Table 4-2.

COMPONENT		FUNCTION
SSECO 1, SSECO 2 indicator	DS24	When illuminated indicates receipt of SSECO signals from launch vehicle.
BOOSTER NON RESPON indicator	DS23	When illuminated indicates receipt of Booster NON RESPON signal from launch vehicle.
BIGS NO GO indicator	DS22	When illuminated indicates receipt of Booster Inertial Guidance System NO-GO signal from launch vehicle.
BACK UP GUID 1 BACK UP GUID 2 indicator	DS21	When illuminated indicates receipt of back up guidance signals from launch vehicle.
LOW THRUST 1 LOW THRUST 2 indicator	DS20	When illuminated indicates receipt of low thrust signals from launch vehicle.
ABORT 1 ABORT 2 indicator	DS19	When illuminated indicates receipt of abort signals from launch vehicle.
OVERATE 1 OVERATE 2 indicator	DS18	When illuminated indicates receipt of overate signals from launch vehicle.
SRM2, TVCP1 SRM1, TVCP2 indicator	DS17	When illuminated indicates receipt of signals from thrust vector control pressure switches in launch vehicle.
SRM1, TVCP1 SRM2, TVCP2 indicator	DS16	Same as DS17. Monitors certain thrust vector control pressure switches in launch vehicle.
TCPS1, SA2 TCPS2, SA2 indicator	DS15	When illuminated indicates receipt of signals from thrust chamber pressure switches in launch vehicle.
TCPS1, SA1 TCPS2, SA1 indicator	DS14	Same as DS15. Monitors certain thrust chamber pressure switches in launch vehicle.

Table 4-2 Control and Monitor Panel Component Functions

MCDONNELL

4.1.3 CONTROL AND MONITOR PANEL (Continued)

COMPONENT		FUNCTION
SSECO switch/ indicator	S12, DS13	When actuated applies launch vehicle power as engine shutdown signal to launch vehicle. Illuminates when actuated.
DESTRUCT INHIBIT switch/ indicator	S14, DS25	When actuated applies launch vehicle power as destruct inhibit signal to launch vehicle. Illuminates when actuated.
GUIDANCE SELECT		
PRIMARY switch/ indicator	S11/ DS12	When actuated applies launch vehicle power as primary guidance signal to launch vehicle.
NORMAL switch/ indicator	S10/ DS11	When actuated opens relays selected by the primary and secondary switch/indicators. Cuts off guidance signals to launch vehicle. Illuminates when guidance signal relays are open.
SECONDARY switch/ indicator	S9, DS10	When actuated applies launch vehicle power as secondary guidance signal to launch vehicle. Illuminates when actuated.
TIIM/OV SEVERANCE switch/indicator	S8, DS9	When actuated applies launch vehicle power as TIIM/Orbiting Vehicle severance command signals to launch vehicle. Illuminates when actuated.
BOOSTER S/D switch/indicator	S7, DS8	When actuated removes launch vehicle power from booster shutdown command lines and switches the power to the Malfunction Detection System (MDS) shutdown enable lines. Illuminates when actuated.
MDS S/D ENABLE switch/indicator	S6, DS7	When actuated, applies launch vehicle power as MDS shutdown enable signal to launch vehicle. Illuminates when actuated.
TIIM BUS 3 switch/indicator	S5, DS6	When actuated applies launch vehicle Bus 3 power to TB15 in panel for distribution. Illuminates when actuated.

Table 4-2 Control and Monitor Panel Component Functions
(Continued)**MCDONNELL**

4.1.3 CONTROL AND MONITOR PANEL (Continued)

COMPONENT		FUNCTION
TIIM BUS 2 switch/indicator	S4, DS5	When actuated applies launch vehicle Bus 2 power to TB14 in panel for distribution. Illuminates when actuated.
TIIM BUS 1 switch/indicator	S3, DS4	When actuated applies launch vehicle Bus 1 power to TB13 in panel for distribution. Illuminates when actuated.
REMOTE POWER indicator	DS3	Indicates remote command power is applied to the simulator through the GBIS IN PLACE switch S1, located on cable entry panel at back of the Substitutes cabinet.
IND TEST switch/indicator	S2, DS2	When actuated, operates relays that apply power to illuminate all panel indicators for a lamp check.
LOCAL POWER switch/indicator	S1, DS1	When actuated allows input power to be applied to the substitute.
GBQ, MANNED switch	S13	Located at back of panel. In GBQ position, relay coils are connected to (abort) signal lines from the launch vehicle for signal loading.
AC SPARE fuse and holder		Spare fuse to replace F2 as required.
DC SPARE fuse and holder		Spare fuse to replace F1 as required.
5A AC fuse and holder	F2	Provides protection for 115 vac regulated power input circuit.
20A DC fuse and holder	F1	Provides protection for 28 vdc power input circuit.

Table 4-2 Control and Monitor Panel Component Functions (Continued)

4.1.4 CABLE ENTRY PANEL

The functions of the panel controls and indicators are explained in Table 4-3.

MCDONNELL

4.1.4 CABLE ENTRY PANEL (Continued)

COMPONENT		FUNCTION
GBIS IN PLACE switch	S1	Supplies signal path for launch vehicle indicating the substitute is properly connected for testing. Also supplies a signal path for launch vehicle remote command power (28 vdc). This signal activates relays in the substitute allowing for remote control of the substitute functions.
5A fuse and holder	F1	Provides protection for the substitute blower circuit.

Table 4-3 Cable Entry Panel Control Functions

4.2 PRE-OPERATIONAL VALIDATION

The following pre-operational validation is to be performed prior to each usage of the Gemini B/MOL/L/V Electrical Interface Substitute 58E040504.

NOTE

Whenever the specified results cannot be obtained, or if a malfunction is indicated, the substitute is not to be used until corrective measures have been completed.

4.2.1 EQUIPMENT REQUIRED

The Combined System Test Simulator Set (CSTSS), CEL-F09D01 must be operating to supply input power to the substitute.

4.2.2 SET-UP

- (a) Inspect the Gemini B/MOL/L/V Electrical Interface Substitute cabinet and cabinet components for obvious physical damage.

MCDONNELL

4.2.2 SET-UP (Continued)

- (b) Verify that inter-cabinet wiring cables and/or power input cables are properly connected to the substitute cabinet (See Figure 6-1).
- (c) Verify that current calibration stickers are attached to the Digital Voltmeter and PCM Simulator panels.
- (d) Activate the Combined System Test Simulator Set (CSTSS) to supply input power to the substitute.

4.2.3 PROCEDURE

- (a) Depress the LOCAL POWER switch located on the Control and Monitor panel, to ON. Verify that the switch illuminates.
- (b) Verify that the blower operates when the LOCAL POWER switch is depressed.
- (c) Depress the INDICATOR TEST switch, located on the Control and Monitor panel, and verify that all Control and Monitor and Analog Monitor Panel indicator lamps are illuminated.
- (d) Position the POWER switch on the Digital Voltmeter to ON. Verify that the POWER indicator illuminates and the unit is operative.
- (e) Depress the POWER switch on the PCM Simulator to ON. Verify that the switch illuminates and the unit is operative.
- (f) Depress the LOCAL POWER switch, located on the Control and Monitor panel, to OFF (extinguished) condition.

4.3 OPERATION

The following procedures provide instructions for starting and stopping the equipment. For operating procedures for the Gemini B/MOL/L/V Electrical Interface Substitute refer to the applicable test procedures.

MCDONNELL

4.3.1 EQUIPMENT REQUIRED

The Combined System Test Simulator Set (CSTSS), CE1-F09D01 must be operating to supply input power to the substitute. Optional commercial equipment may be used for monitoring panel test points, etc.

4.3.2 SET-UP

- (a) Connect the launch vehicle interface wiring to the cabinet cable entry panel in accordance with the applicable test procedures.
- (b) Activate the Combined System Test Simulator Set (CSTSS) and other equipment as required by the applicable test procedures.

4.3.3 POWER-UP

- (a) Depress the LOCAL POWER switch, located on the Control and Monitor Panel, to ON (illuminated) condition.

NOTE

The remaining controls on the cabinet panels and commercial equipment will be positioned as required by the applicable test procedures.

4.3.4 SHUTDOWN

- (a) Depress the LOCAL POWER switch on the Control and Monitor Panel to OFF (extinguished) condition.
- (b) Return all the remaining panel switches and cabinet mounted commercial equipment POWER switches to their OFF positions.

MCDONNELL

4.3.5 **EMERGENCY SHUTDOWN**

Depress the LOCAL POWER switch on the Control and Monitor Panel to OFF
(extinguished) condition.

MCDONNELL

SECTION V

PREVENTIVE MAINTENANCE AND CALIBRATION

5.1 PREVENTIVE MAINTENANCE

The preventive maintenance requirements for the Gemini B/MOL/L/V Electrical Interface Substitute are specified in the AGE Preventive Maintenance Requirements Summary (Product Support Report P.S. 339). Table 5-1 lists the items identified in the maintenance summary and the type of maintenance required. A reference is provided for items requiring specific maintenance procedures.

ITEM	TYPE MAINTENANCE	REFERENCE
Cabinet	Visual Inspection	
Blower air filter	Clean	Paragraph 5.1.1
Digital Voltmeter	Calibration	Paragraph 5.2.2.2
Analog Monitor Panel	Calibration	Paragraph 5.2.2.3

Table 5-1 Preventive Maintenance Requirements

5.1.1 CLEANING

- (a) Wash blower air filter with water, dry and recoat with Filter Coat 411, Research Products Corporation.

NOTE

Access to the blower filter is obtained by removing the grille from the front of the blower assembly.

MCDONNELL

5.2 CALIBRATION

5.2.1 FREQUENCY OF CALIBRATION

The Gemini B/MOL/L/V Electrical Interface Substitute shall be calibrated at intervals specified in the AGE Preventive Maintenance Requirements Summary (Product Support Report P.S. 339), after replacement of components, or in the event of a malfunction.

5.2.2 CALIBRATION PROCEDURES

The following calibration procedures are provided to ensure that the Gemini B/MOL/L/V Electrical Interface Substitute meets specified requirements.

5.2.2.1 Equipment Required

The equipment required for calibrating the cabinet components is standard laboratory test equipment or equipment defined in the applicable manufacturers instruction manuals.

5.2.2.2 Digital Voltmeter Calibration

Calibrate the Digital Voltmeter, Hewlett-Packard Y593440A/3443A in accordance with the applicable manufacturers instruction manual.

5.2.2.3 Analog Monitor Panel Calibration

5.2.2.3.1 Calibrate the Analog Monitor Panel Stage "0" Launch Vehicle Indicator, 52-81708-5 using standard laboratory procedure to the specifications shown in Table 5-2.

MCDONNELL

5.2.2.3.1 (Continued)

SIGNAL VDC	CP	CENTER SCALE (SECONDS)
0.75	850	0 AT 700
1.50	700	50 AT 600
2.50	500	100 AT 500
3.25	350	

Table 5-2 Signal Voltage to Indicator Scale Specifications (Stage 1)

5.2.2.3.2 Calibrate the Analog Monitor Panel Stage "I" Launch Vehicle Indicator, 52-81708-7 using standard laboratory procedure to the specifications in Table 5-3.

SIGNAL VOLTAGE TO INDICATOR SCALE		SCALE CORRELATION	
SIGNAL VDC	FUEL AND OXID. SCALE	TIME/SEC	PRESS/PSI
1.50	35	10	25.0
2.00	30	20	22.5
2.50	25	30	20.0
3.00	20	40	17.5
3.50	15	50	15.0
4.00	10	60	12.5
4.50	5	70	10.0
		80	8.0
		90	6.0

Table 5-3 Signal Voltage and Scale Correlation Specifications (Stage 2)

5.2.2.3.3 Calibrate the Analog Monitor Panel Stage "II" Launch Vehicle Indicator, 52-81708-9 using standard laboratory procedure to the specifications in Table 5-4.

MCDONNELL

5.2.2.3.3 (Continued)

SIGNAL VOLTAGE TO INDICATOR SCALE				SCALE CORRELATION	
SIGNAL VDC	FUEL AND OXID SCALE	SIG VDC	STAGE 2 C.P. SCALE	TIME/SEC	PRESS/PSI
0.33	70		FULL SCALE	10	32
1.00	60	0.43	110	20	29.5
1.67	50	0.85	100	30	27
2.33	40	1.26	90	40	24
3.00	30	1.68	80	50	22
3.66	20	2.10	70	60	20
4.33	10	2.52	60	70	17
				80	14
				90	11

Table 5-4 Signal Voltage and Scale Correlation Specifications

- 5.2.2.3.4 Calibrate the Analog Monitor Panel Guidance Comparator Indicator, 52-81708-11 using standard laboratory procedure to the specifications in Table 5-5.

SIGNAL VDC	SCALE
0	+10
0.909	+5
1.818	0
2.727	-5
3.636	-10

Table 5-5 Signal Voltage to Indicator Scale Specifications

MCDONNELL

5.2.2.4 Altitude Error Step Level Calibration

- (a) Position DVM SELECT switch (S7) to +6.0 V LEVEL. Depress DVM SELECT (S4) and adjust potentiometer R17 (located at rear of panel) for $+6.000 \pm .005$ VDC on digital voltmeter.

NOTE

DVM SELECT (S4) must be depressed for digital voltmeter indication when making potentiometer adjustments. Potentiometers are located at rear of panel.

- (b) Position DVM SELECT switch (S7) to +2.4 V LEVEL. Adjust potentiometer R22 for $+2.400 \pm .005$ vdc on digital voltmeter.
- (c) Position DVM SELECT switch (S7) to +1.2 V LEVEL. Adjust potentiometer R24 for $+1.200 \pm .005$ vdc on digital voltmeter.
- (d) Position DVM SELECT switch (S7) to +0.6 V LEVEL. Adjust potentiometer R25 for $+0.600 \pm .005$ vdc on digital voltmeter.
- (e) Position DVM SELECT switch (S7) to -6.0 V LEVEL. Adjust potentiometer R30 for $-6.000 \pm .005$ vdc on digital voltmeter.
- (f) Position DVM SELECT switch (S7) to -2.4 V LEVEL. Adjust potentiometer R28 for $-2.400 \pm .005$ vdc on digital voltmeter.
- (g) Position DVM SELECT switch (S7) to -1.2 V LEVEL. Adjust potentiometer R27 for $-1.200 \pm .005$ vdc on digital voltmeter.
- (h) Position DVM SELECT switch (S7) to -0.6 V LEVEL. Adjust potentiometer R26 for $-0.600 \pm .005$ vdc on digital voltmeter.
- (i) Position DVM SELECT switch (S7) to 0.0 V LEVEL. Verify digital voltmeter indicates $0.000 \pm .005$ vdc.

MCDONNELL

5.2.2.5 Amplifier Potentiometer Calibration

5.2.2.5.1 Pitch Amplifier Adjust

- (a) Position PITCH CONTROL on panel to +6 V (full cw).
- (b) Position DVM SELECT switch (S7) to PITCH SET.
- (c) Depress DVM SELECT (S4) and adjust potentiometer on amplifier 3 (located at rear of panel) for $+6.000 \pm .005$ vdc reading on digital voltmeter.
- (d) Position PITCH CONTROL on panel to -6V (full ccw).
- (e) Depress DVM SELECT (S4) and verify $-6.000 \pm .010$ vdc reading on digital voltmeter.

5.2.2.5.2 Roll Amplifier Adjust

- (a) Position ROLL CONTROL on panel to +6 V (full cw).
- (b) Position DVM SELECT switch (S7) to ROLL SET.
- (c) Depress DVM SELECT (S4) and adjust potentiometer on amplifier 2 (located at rear of panel) for $+6.000 \pm .005$ vdc reading on digital voltmeter.
- (d) Position ROLL CONTROL on panel to -6 V (full ccw).
- (e) Depress DVM SELECT (S4) and verify $-6.000 \pm .010$ vdc reading on digital voltmeter.

5.2.2.5.3 YAW Amplifier Adjust

- (a) Position YAW CONTROL on panel to +6 V (full cw).
- (b) Position DVM SELECT switch (S7) to YAW SET.
- (c) Depress DVM SELECT (S4) and adjust potentiometer on amplifier 1 (located at rear of panel) for $+6.000 \pm .005$ vdc reading on digital voltmeter.

MCDONNELL

5.2.2.5.3 YAW Amplifier Adjust (Continued)

- (d) Position YAW CONTROL on panel to -6 V (full ccw).
- (e) Depress DVM SELECT (S4) and verify $-6.000 \pm .010$ vdc reading on digital voltmeter.

MCDONNELL

SECTION VI

LIST OF SUBASSEMBLIES AND DIAGRAMS

6.1 LIST OF SUBASSEMBLIES

Table 6-1 is a list of subassemblies for the Gemini B/MOL/L/V Electrical Interface Substitute (58E040504).

PART NUMBER	NOMENCLATURE/MANUFACTURER
58D042022-1	Analog Monitor Panel
R2EB350A	Blower Assembly (McLean Engineering Lab.)
58D042023-3	Cable Assembly
58D042023-5	Cable Assembly
58D042023-7	Cable Assembly
58D042023-9	Cable Assembly
58D042023-11	Cable Assembly
58D042023-13	Cable Assembly
58D042023-15	Cable Assembly
58D042023-17	Cable Assembly
58D042023-19	Cable Assembly
58D042023-21	Cable Assembly
58D042023-23	Cable Assembly
58D042023-25	Cable Assembly
58D042021-1	Control and Monitor Panel
58D042027-1	Digital Data Output Panel
Y593440A/3443A	Digital Voltmeter (Hewlett-Packard)

Table 6-1 List of Subassemblies

MCDONNELL

6.1 LIST OF SUBASSEMBLIES (Continued)

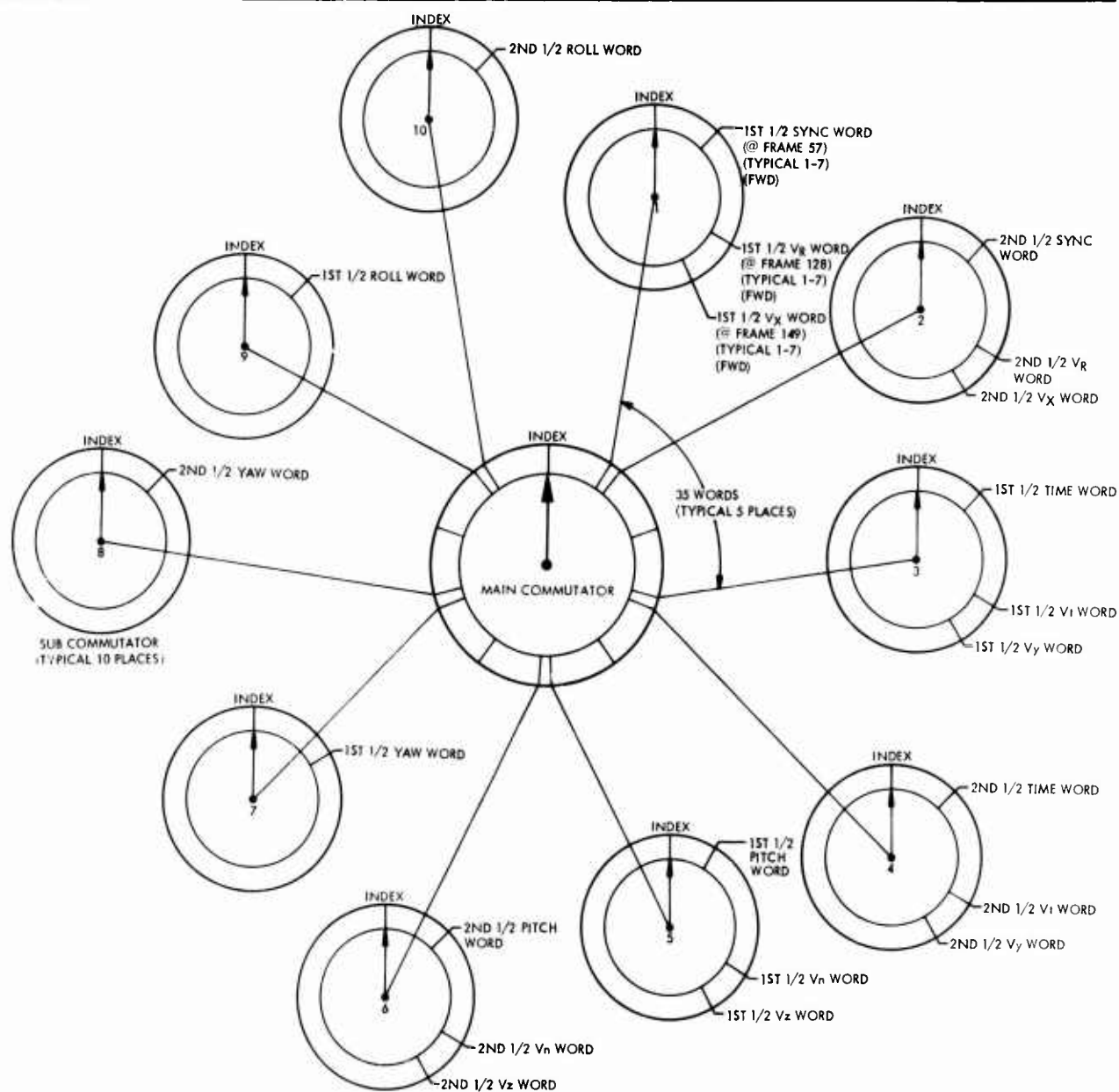
PART NUMBER	NOMENCLATURE/MANUFACTURER
2790-01-6-04-M4	PCM Simulator (EMR)
58D042023-27	Wiring Assembly

Table 6-1 List of Subassemblies (Continued)

6.2 DIAGRAMS

Figure 6-1 is the substitute cabling diagram showing the cabinet cabling between panels and external connectors. Figures 6-2, 6-3 and 6-4 are schematic diagrams of the panels contained in the cabinet. Figures 6-5 and 6-6 are wheel diagrams giving information for programming the PCM Simulator.

MCDONNELL

**NOTE**

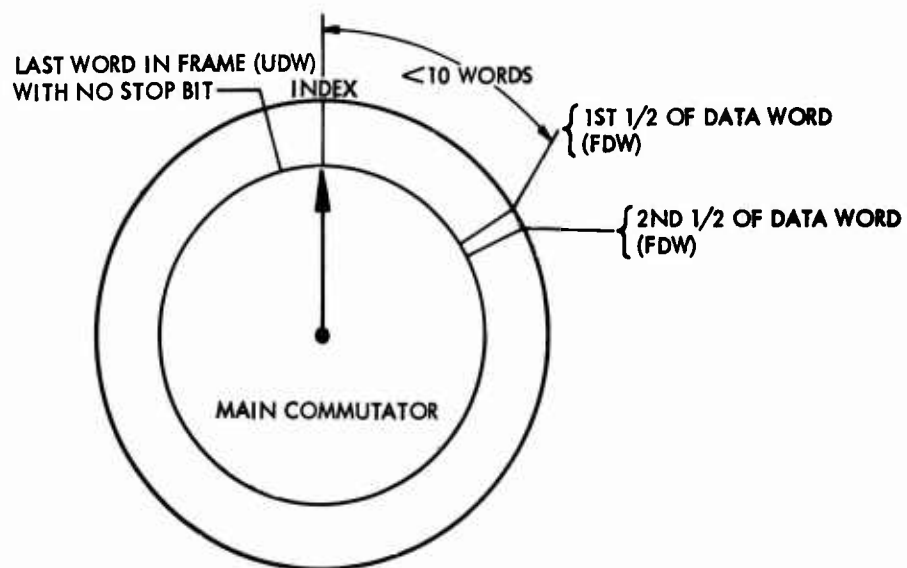
1. FDW - FLAG DATA WORD

LEGEND

MAIN COMMUTATOR	SUB COMMUTATOR
10 BITS/WORD 20 μ SEC/WORD 175 WORDS/FRAME 3.5 MSEC/FRAME	256 FRAMES PER SUB-FRAME

Figure 6-1 Wheel Diagram (Local Operation)

MCDONNELL



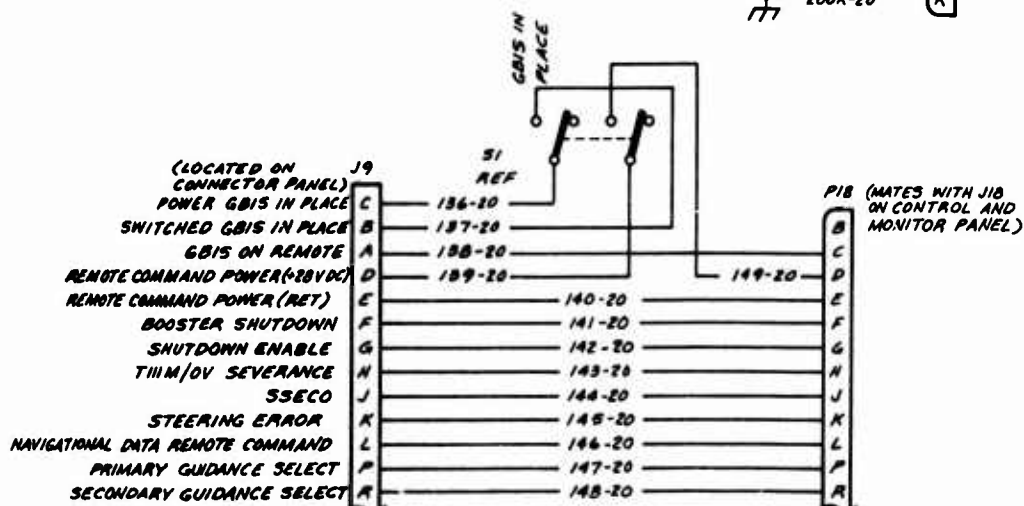
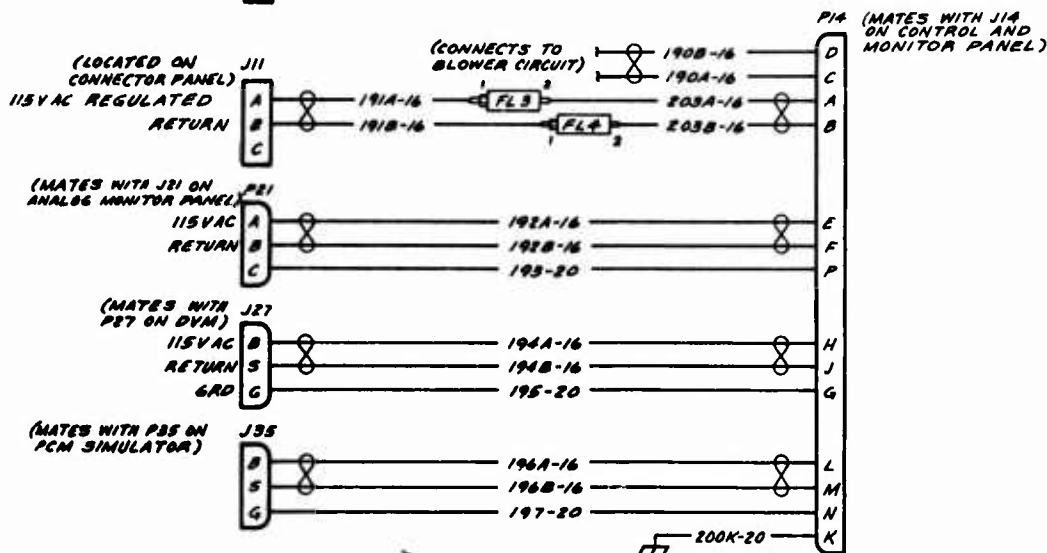
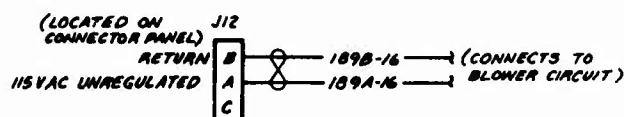
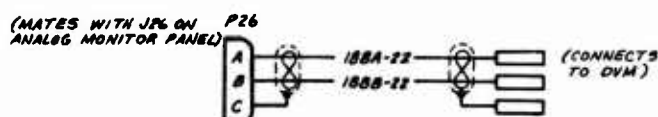
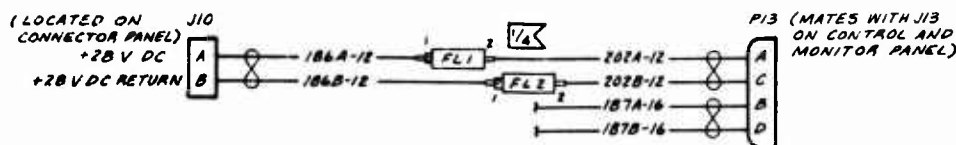
LEGEND
MAIN COMMUTATOR
10 BITS/WORD
20MSEC/WORD
500 WORDS/FRAME
10 MSEC/FRAME

NOTES

1. UDW - UNIQUE DATA WORD
2. FDW - FLAG DATA WORD
3. NO SUB COMMUTATORS

Figure 6-2 Wheel Diagram (Remote Operation)

MCDONNELL



(MATES WITH J15 ON CONTROL AND MONITOR PANEL) P15

+28V DC SWITCHED

RETURN

NAVIGATIONAL DATA REMOTE COMMAND

REMOTE COMMAND POWER RETURN

+28V DC

RETURN

LAMP TEST

(+28V DC) REMOTE COMMAND POWER

ERROR SIGNAL

THIM APS/IPS BUS 1

THIM APS/IPS BUS 2

THIM APS BUS 3

THIM APS/IPS BUS 1

APS/IPS RETURN BUS

STAGE I THRUST CHAMBER PRESS 1 SA1

STAGE I THRUST CHAMBER PRESS 1 SA2

STAGE I THRUST CHAMBER PRESS 2 SA1

STAGE I THRUST CHAMBER PRESS 2 SA2

SRM 1 TVC PRESS SW 1

SRM 1 TVC PRESS SW 2

SRM 2 TVC PRESS SW 1

SRM 2 TVC PRESS SW 2

ABORT 1

ABORT 2

OVERRATE 1

OVERRATE 2

LOW THRUST 1

LOW THRUST 2

BACKUP GUIDANCE 1

BACKUP GUIDANCE 2

BOOSTER NON-RESPONSIVE

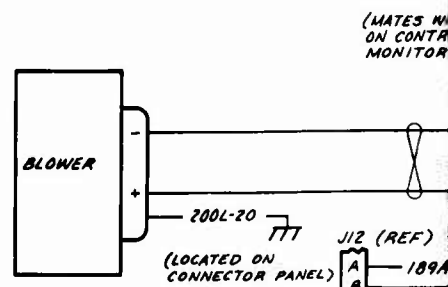
BIGS NO-GO

SSECO 2

SSECO 1

+28V DC SWITCHED

REMOTE COMMAND POWER RETURN



(MATES WITH J12 ON CONTROL AND MONITOR PANEL)

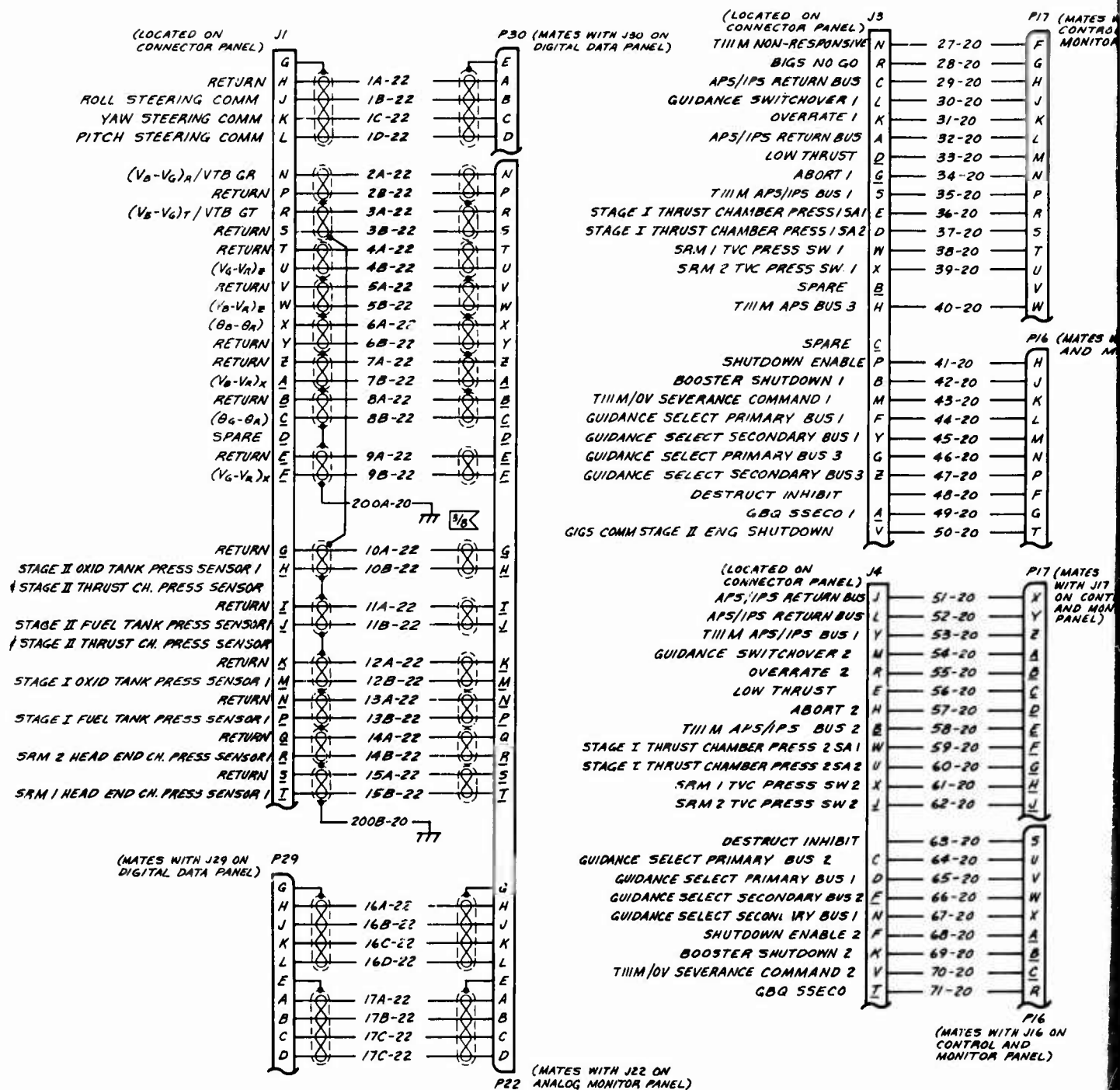


Figure 6-3 Cabinet Cabling Diagram (Sheet 2 of 2)

MCDONNELL

(LOCATED ON CONNECTOR PANEL) J5

P31 (MATE WITH J31 ON DIGITAL DATA PANEL)

P17 (MATES WITH J17 ON CONTROL AND MONITOR PANEL)
ROLL STEERING COMM
YAW STEERING COMM
PITCH STEERING COMM

RETURN
(V_B-V_A)_R/VTB G_T
RETURN
(V_B-V_G)_T/VTB G_T
RETURN
RETURN
(V_G-V_A)₂
RETURN
(V_B-V_A)₂
RETURN
(θ_B-θ_A)
RETURN
RETURN
(V_B-V_A)_X
RETURN
(θ_G-θ_A)

P16 (MATES WITH J16 ON CONTROL AND MONITOR PANEL)

STAGE II OXID TANK PRESS SENSOR 1
STAGE II THRUST CH PRESS SENSOR
RETURN
STAGE II FUEL TANK PRESS SENSOR 1
STAGE II THRUST CH PRESS SENSOR
RETURN
STAGE I OXID TANK PRESS SENSOR 1
RETURN

P17 (MATES WITH J17 ON CONTROL AND MONITOR PANEL)
STAGE I FUEL TANK PRESS SENSOR 1
RETURN
SRM 2 HEAD END CH. PRESS SENSOR 1
RETURN
SRM 1 HEAD END CH. PRESS SENSOR 1

P16 (MATES WITH J16 ON CONTROL AND MONITOR PANEL)

(LOCATED ON CONNECTOR PANEL) J6
RETURN
STAGE II OXID TANK PRESS SENSOR 2
RETURN
STAGE II FUEL TANK PRESS SENSOR 2
RETURN
STAGE I OXID TANK PRESS SENSOR 2
RETURN
STAGE I FUEL TANK PRESS SENSOR 2
RETURN
SRM 2 HEAD END CH. PRESS SENSOR 2
RETURN
SRM 1 HEAD END CH. PRESS SENSOR 2

(MATES WITH J25 ON ANALOG MONITOR PANEL) P25

87A-22
87B-22
88A-20
88B-20
89A-22
89B-22
90A-22
90B-22
91A-22
91B-22
92A-20
92B-20

(LOCATED ON CONNECTOR PANEL) J7

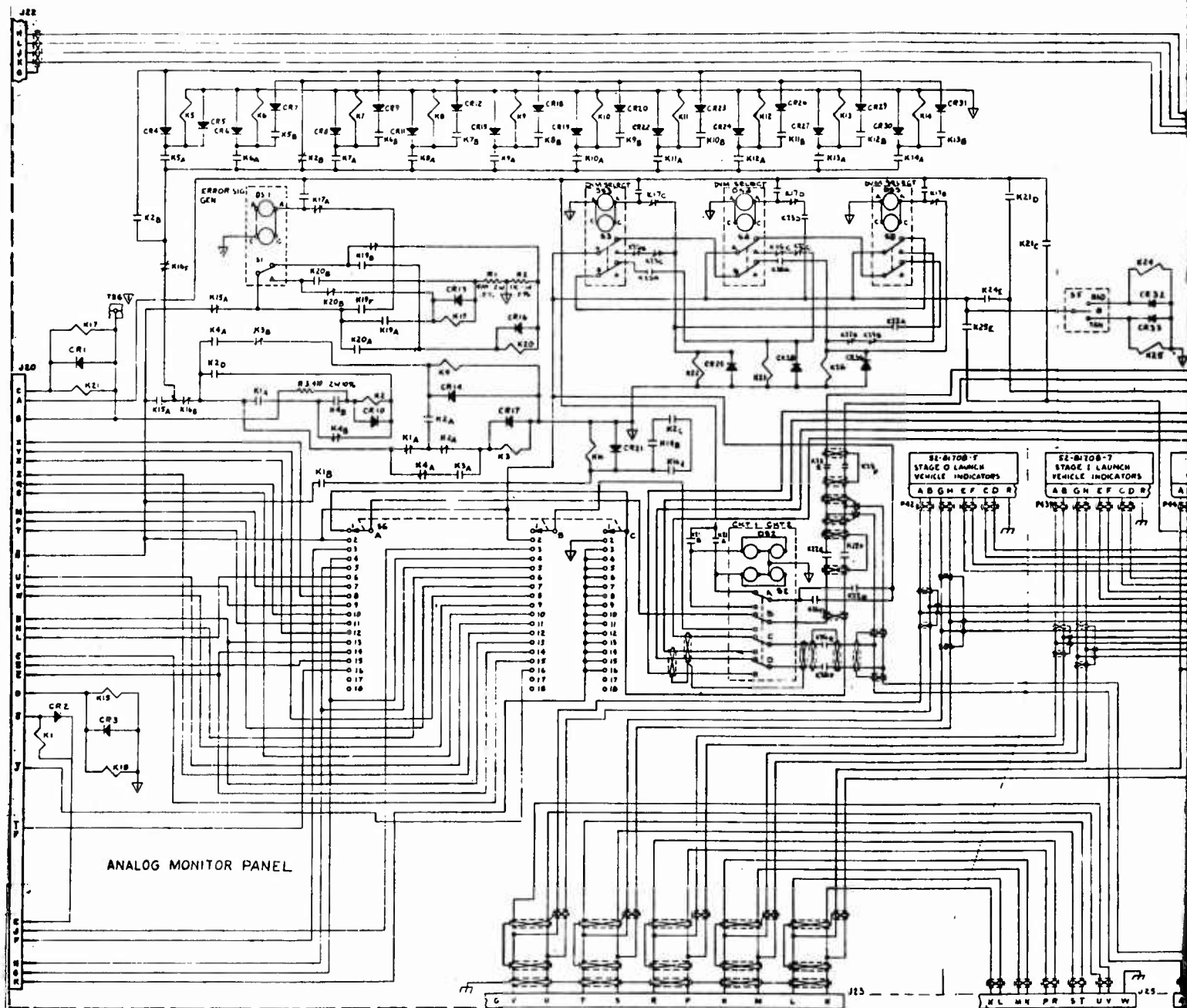
11M NON-RESPONSIVE
L STRUCT INHIBIT
APS/IPS RETURN BUS
GUIDANCE SWITCHOVER 1
OVERRATE 1
APS/IPS RETURN BUS
LOW THRUST
ABORT 1
SHUTDOWN ENABLE 1
BOOSTER SHUTDOWN 1
THIM APS/IPS BUS 1
THIM O/V SEVERANCE COMMAND 1
STAGE I THRUST CHAMBER PRESS 1 SA
STAGE I THRUST CHAMBER PRESS 1 SA 2
SRM 1 TVC PRESS SW 1
SRM 2 TVC PRESS SW 1
GBQ SSEC0 1
GUIDANCE SELECT PRIM BUS 1
SPARE
GUIDANCE SELECT SEC BUS 1
GUIDANCE SELECT PRIM BUS 3
THIM APS BUS 3
SPARE
GUIDANCE SELECT SEC BUS 3
BIGS NO-GO
GIGS COMM STAGE II ENG SHUTDOWN

APS/IPS RETURN BUS
APS/IPS RETURN BUS
THIM APS/IPS BUS 1
GUIDANCE SELECT PRIM BUS 2
GUIDANCE SELECT SEC BUS 2
GUIDANCE SWITCHOVER 2
OVERRATE 2
LOW THRUST
ABORT 2
SHUTDOWN ENABLE
BOOSTER SHUTDOWN 2
THIM APS/IPS BUS 2
THIM O/V SEVERANCE COMMAND 2
STAGE I THRUST CHAMBER PRESS 2 SA
STAGE I THRUST CHAMBER PRESS 2 SA 2
SRM 1 TVC PRESS SW 2
SRM 2 TVC PRESS SW 2
GBQ SSEC0
DESTRUCT INHIBIT

(LOCATED ON CONNECTOR PANEL) J8

(MATES WITH J19 ON CONTROL AND MONITOR PANEL) P19

93-20
94-20
95-20
96-20
97-20
98-20
99-20
100-20
101-20
102-20
103-20
104-20
105-20
106-20
107-20
108-20
109-20
110-20
111-20
112-20
113-20
114-20
115-20
116-20
117-20
118-20
119-20
120-20
121-20
122-20
123-20
124-20
125-20
126-20
127-20
128-20
129-20
130-20
131-20
132-20
133-20
134-20
135-20



A

DATE 26 SEPTEMBER 1968

ST

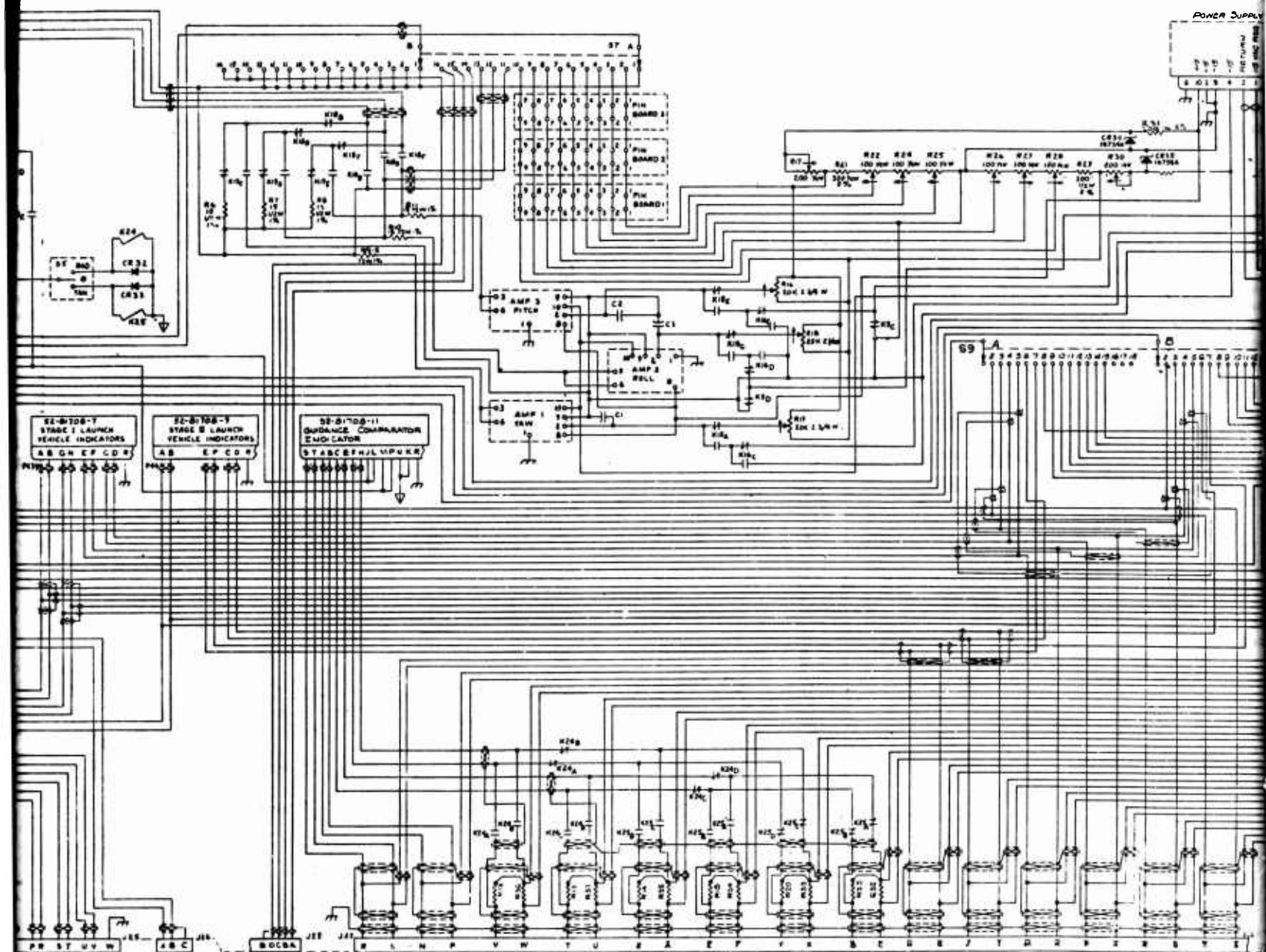


Figure 6

B

M

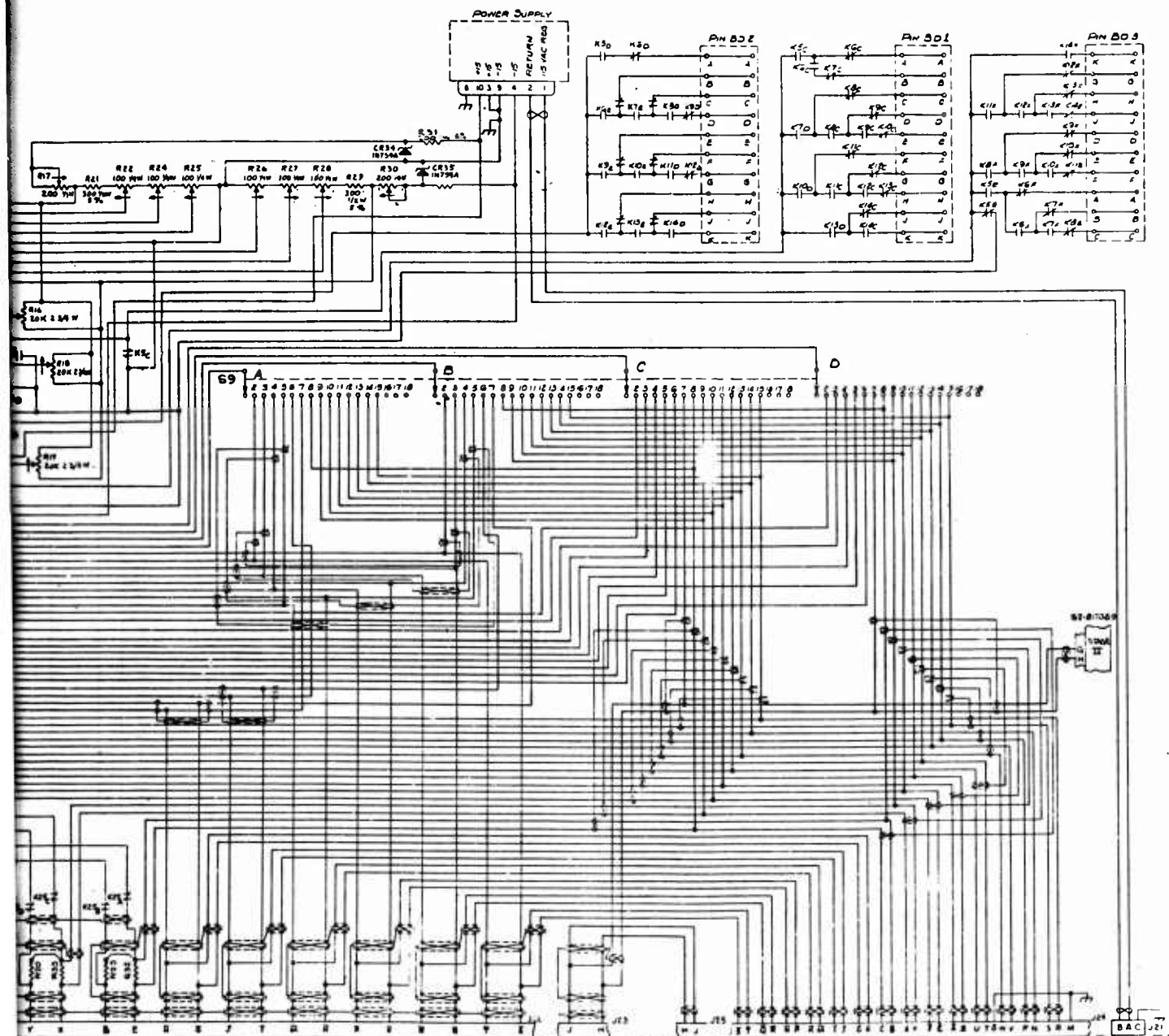


Figure 6-4 Analog Monitor Panel Schematic

MCDONNELL

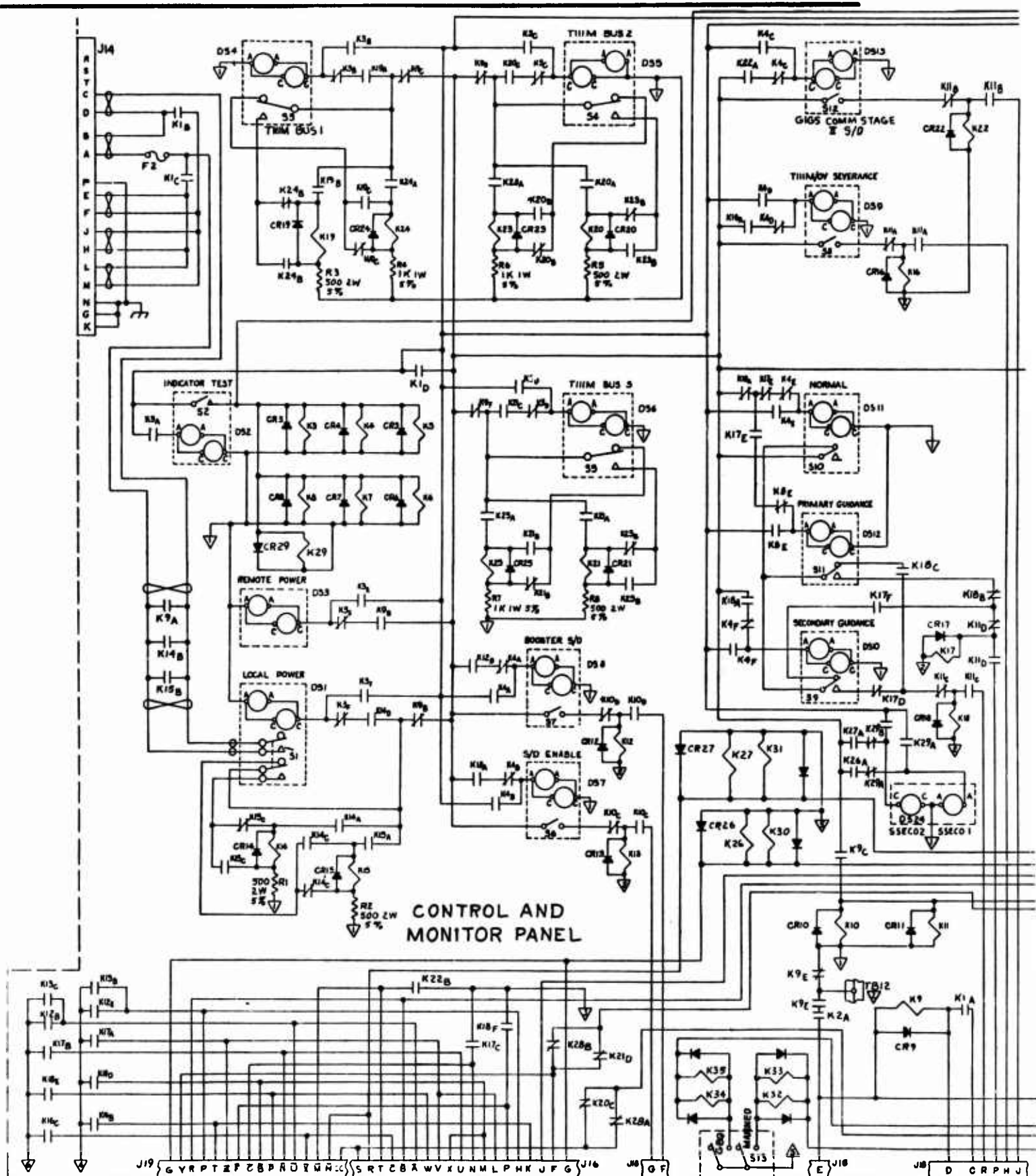
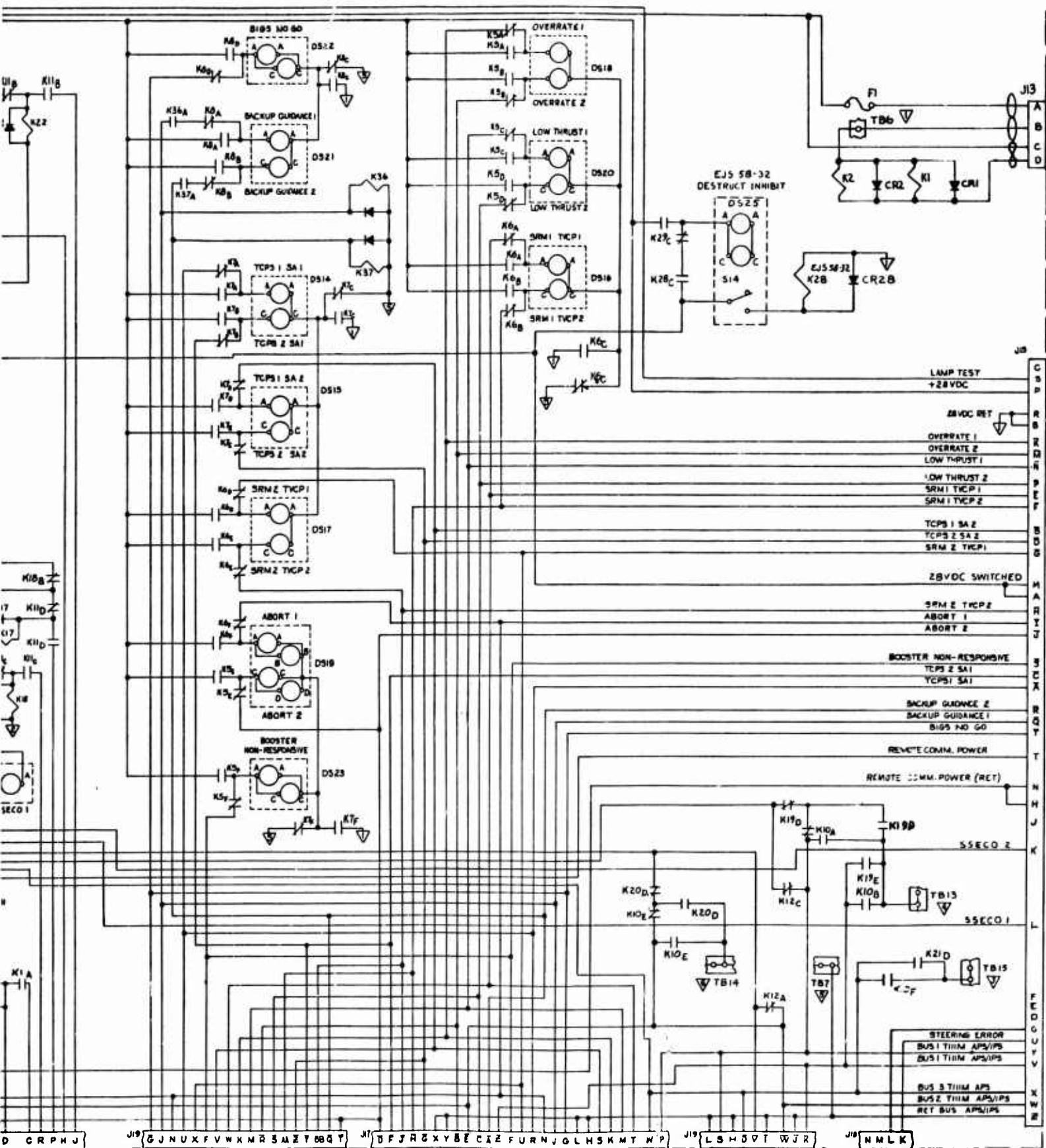
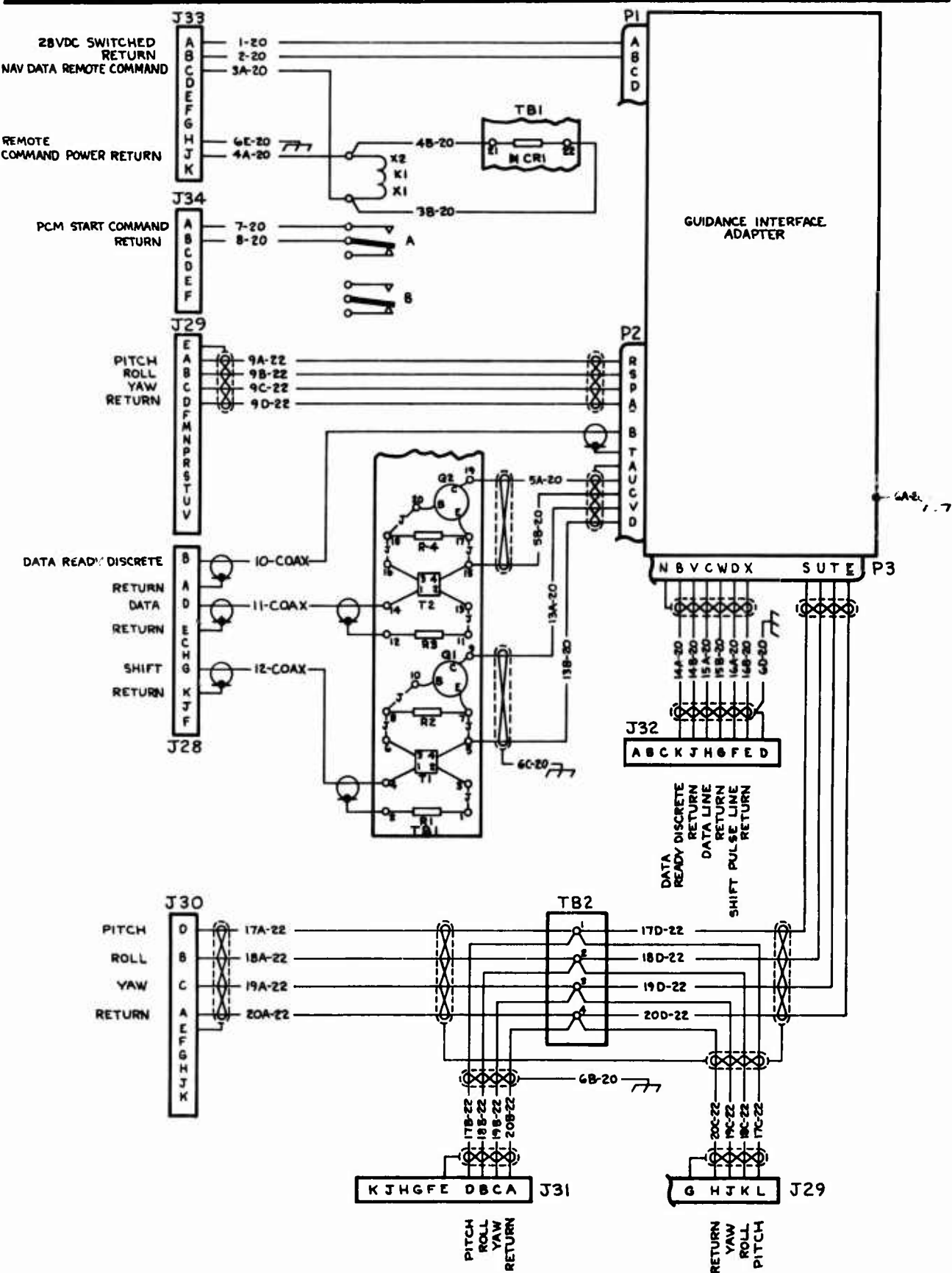


Figure 6-5 Control and Monitor Panel Schematic

A

MCDONNELL





MCDONNELL