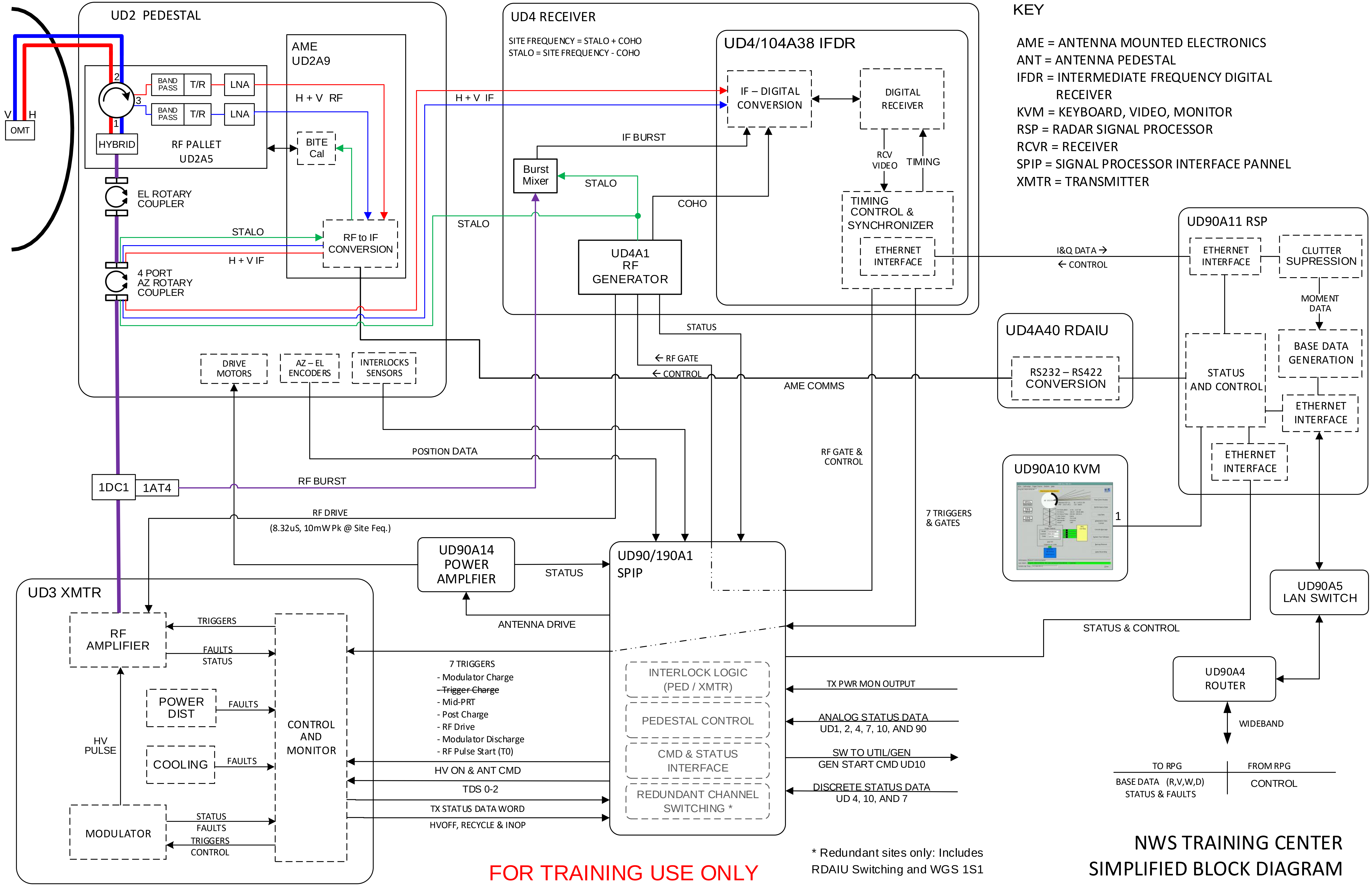
NWSTC WSR-88D Webinar

Subject: Hardware Changes on SPIP and Pedestal.

Start Time: 9:00am CT

Duration: Approximately 3hrs



KEY

AME = ANTENNA MOUNTED ELECTRONICS
ANT = ANTENNA PEDESTAL
IFDR = INTERMEDIATE FREQUENCY DIGITAL RECEIVER
KVM = KEYBOARD, VIDEO, MONITOR
RSP = RADAR SIGNAL PROCESSOR
RCVR = RECEIVER
SPIP = SIGNAL PROCESSOR INTERFACE PANNEL
XMTR = TRANSMITTER

* Redundant sites only: Includes RDAIU Switching and WGS 1S1

FOR TRAINING USE ONLY

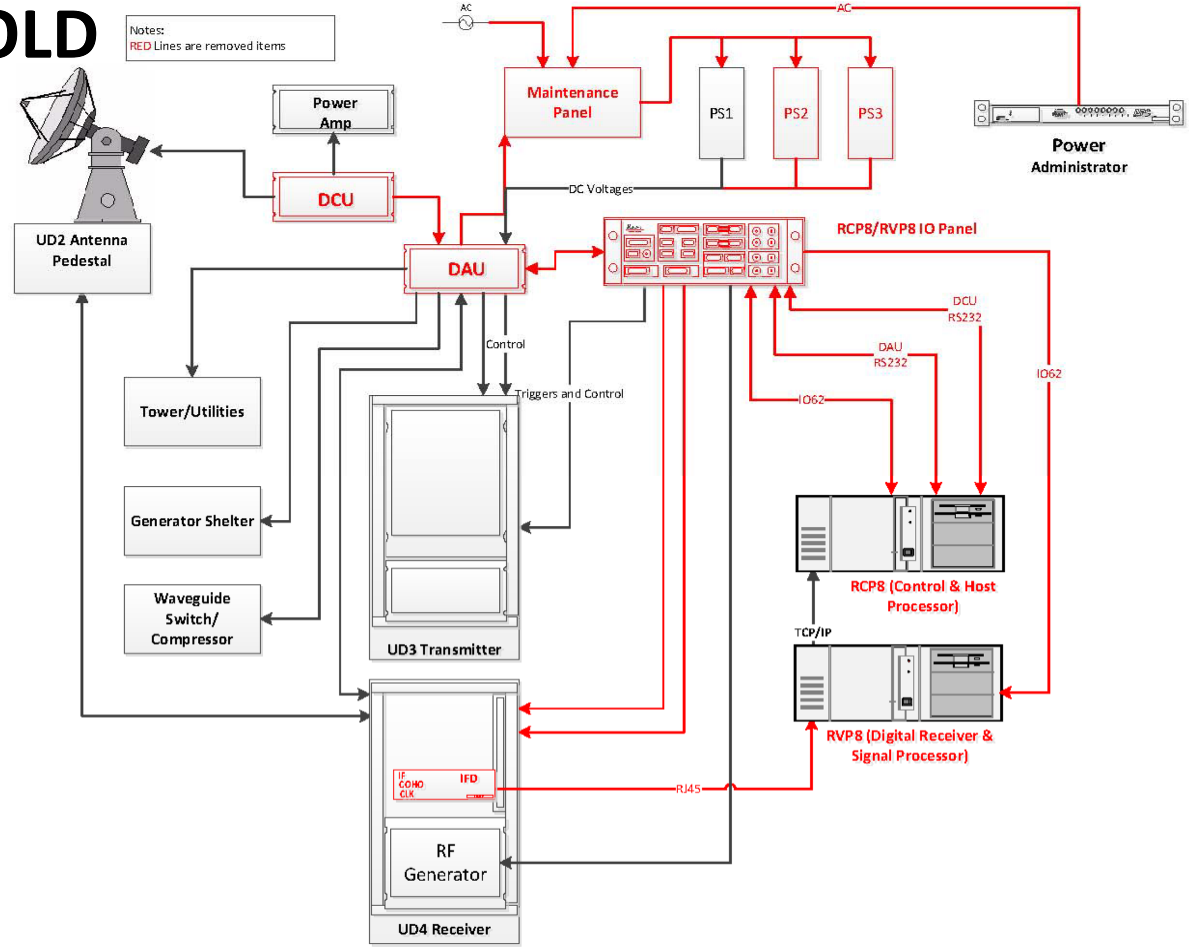
NWS TRAINING CENTER
SIMPLIFIED BLOCK DIAGRAM

SimplifiedBlock_20200828b.vsd

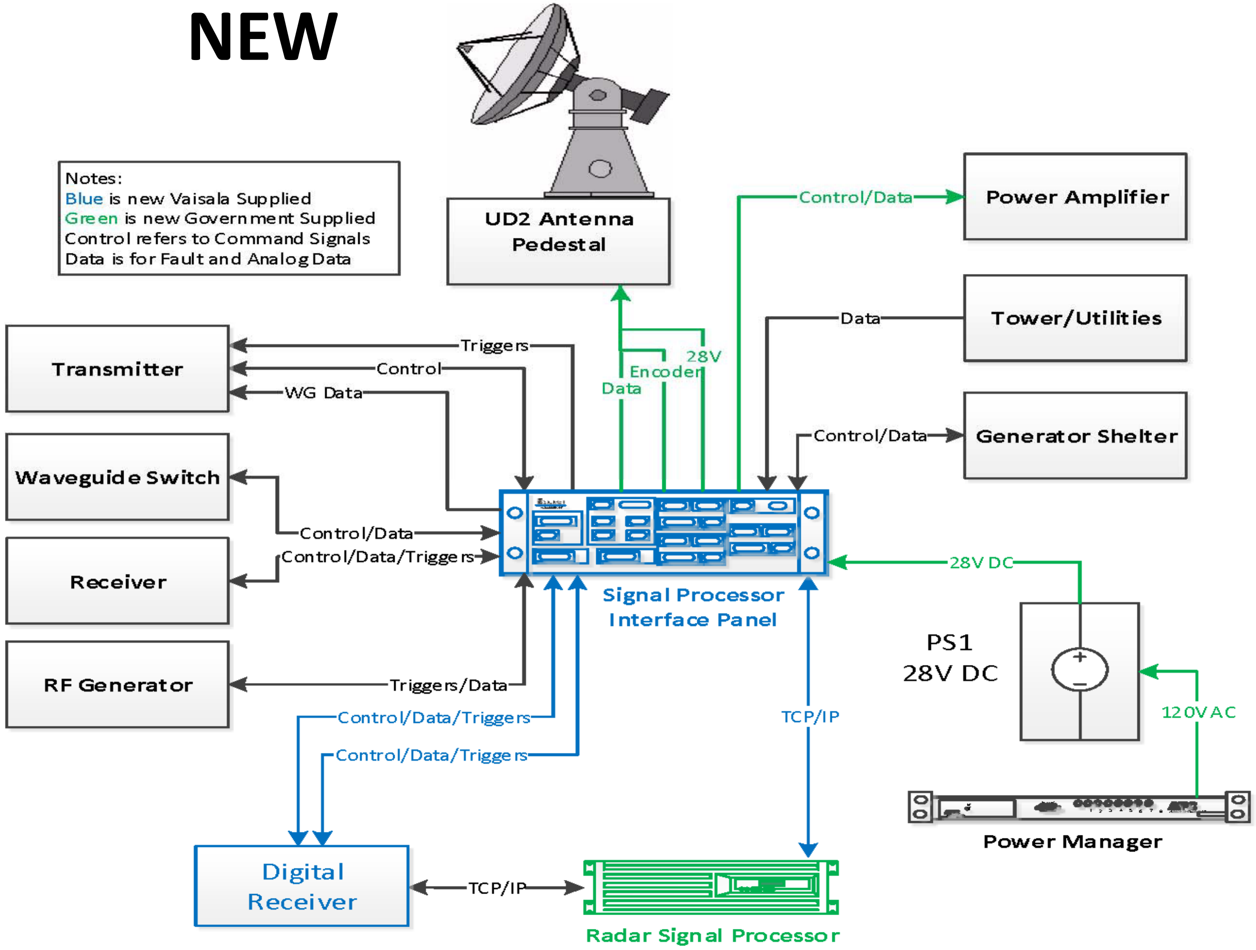
WSR88D SPIP & Pedestal Hardware Changes

Over the past few years the WSR88D radar has gone through several modifications, part of the SLEP program that started 4 years ago.

OLD

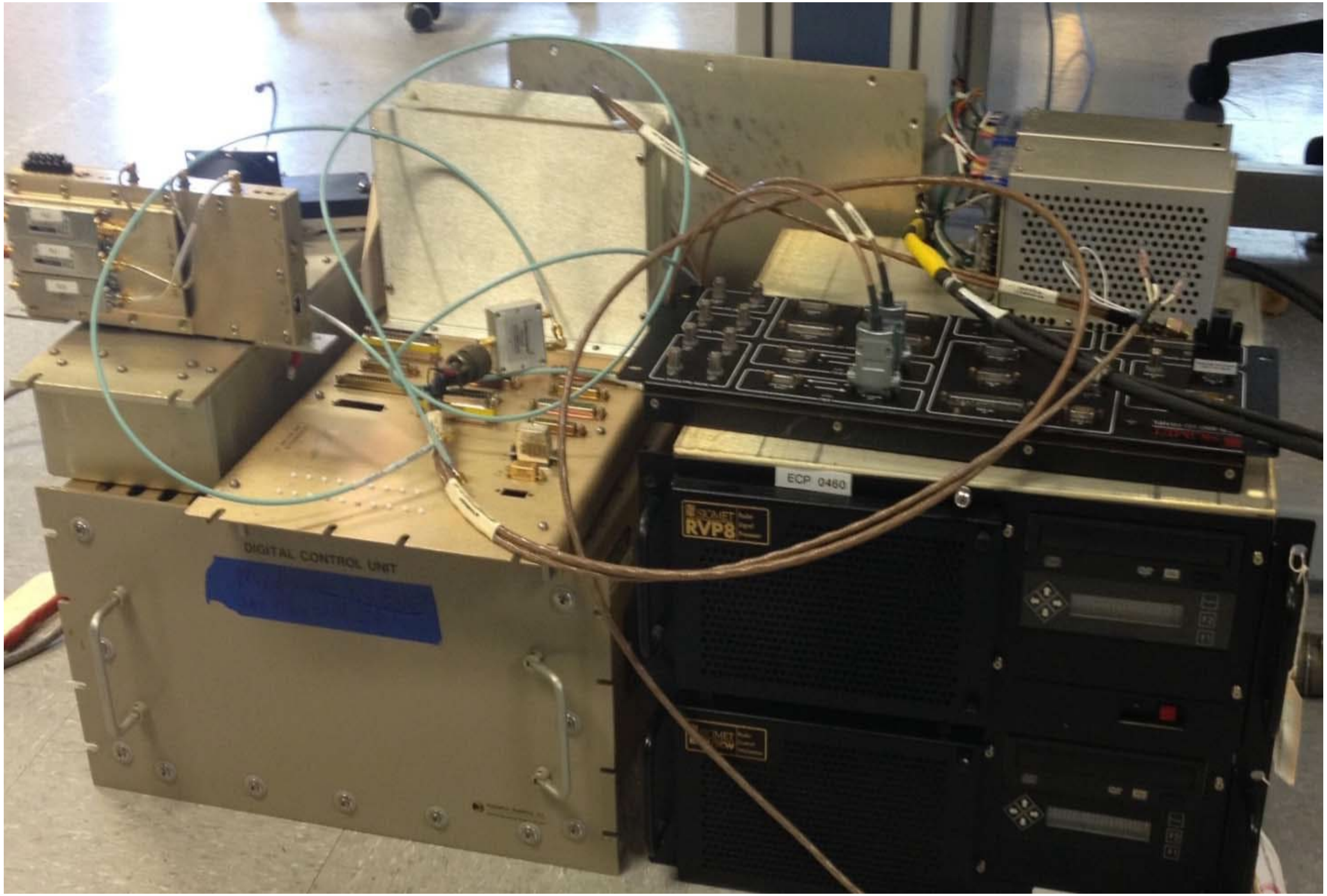


NEW

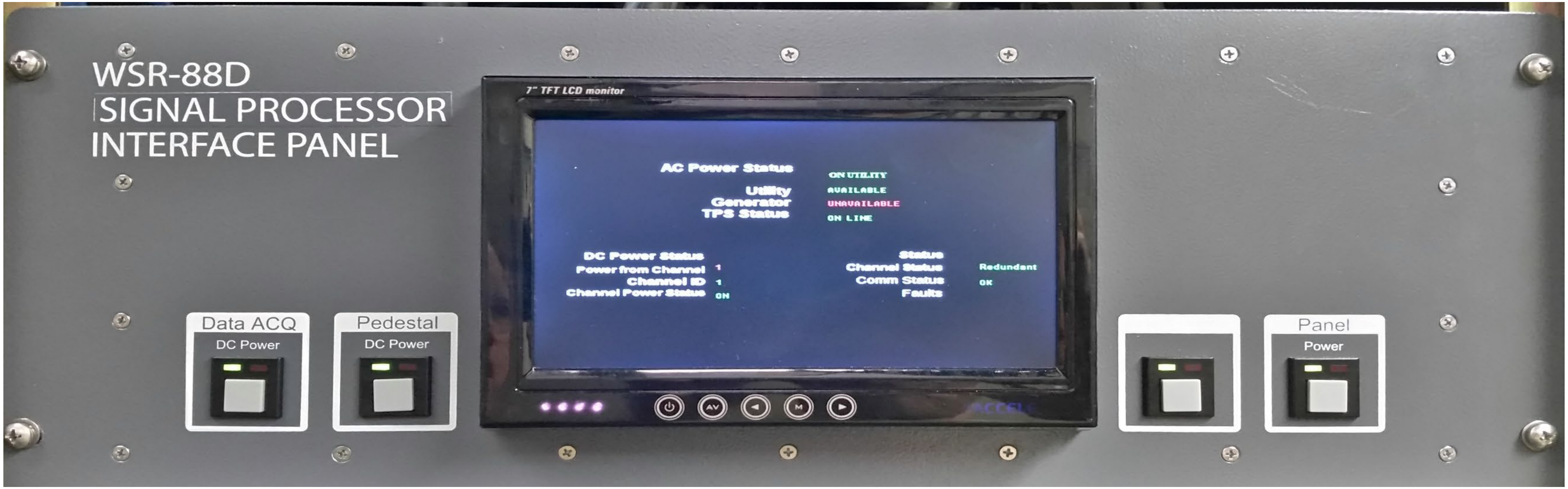


SPIP replaced all these parts

- IO Panel
- DCU
- DAU
- Maintenance Panel
- PS2
- PS3



Signal Processor Interface Panel



SPIP

SECTION 5.7 RDASC/SPIP INTERFACE

5.7.1 INTRODUCTION.

This section discusses the RDASC interface functions of the data acquisition interface at the functional block diagram level. The data acquisition interface functions and reference diagrams discussed in this section are listed as follows:

- Figure FO5-8 Signal Processor Interface Panel Functional Block Diagram
- Figure FO5-9 Signal Processor Interface Panel Signal Flow Diagram
- Figure FO5-13 RDA Status and Control Interface Functional Block Diagram
- Figure FO5-14 RDASC/SPIP Command Data Interface Functional Block Diagram
- Figure FO5-15 Redundant RDASC/SPIP Command Data Interface Functional Block Dia-gram
- Figure FO5-16 SPIP/RDASC Status Data Interface Functional Flow Diagram
- Figure FO5-17 Generator Discrete Status Data Monitoring (Onan/Kohler) Functional Flow Diagram
- Figure FO5-18 RDA Discrete Status Data Monitoring Functional Flow Diagram
- Figure FO5-19 RDA Surge Suppression Assembly Interconnect Diagram
- Figure FO5-20 Single Channel Analog Status Data Monitoring Flow Functional Block Diagram
- Figure FO5-21 Redundant Analog Status Data Monitoring Functional Block Diagram

These functions are discussed in the following paragraphs. On-line performance monitoring and off-line diagnostic testing and are discussed in paragraphs 5.8.3 and 5.8.4, respectively.

NOTE

> This section refers to the RDADP as UD90, the Receiver Cabinet as UD4, the Transmitter as UD3, and the Waveguide Pressurization Unit as UD6. Unless otherwise specified, the information also applies to redundant systems UD190, UD104, UD103, and UD106.

5.7.1.1 Data Acquisition Interface Overview. The data acquisition interface function is a full duplex communication link between Radar Signal Processor (RSP) 90A11 and Signal Processor Interface Panel (SPIP) 90A1. Fault alarms and status data from the transmitter, antenna/pedestal positioning and status electronics, microwave system, receiver, RDA environmental sensors, and RDA tower/utilities are processed through this link. The data may be in one of three forms: analog, parallel binary words, or discrete status BITs. All this data is packaged in Remote Procedure Calls (RPCs) and sent via a TCP/IP Gigabit Ethernet link to the RSP. The RSP sends antenna/pedestal positioning (servo), transmitter, auxiliary power system, and -- in redundant scenarios -- channel change commands to the SPIP via the same link.

5.7.1.2 Purpose. This interface provides the means of transmitting status and Built-in-Test (BIT) information from the SPIP to the RSP, and of transmitting commands and requests for data to the SPIP from the RSP. The status and BIT information is data gathered by the SPIP from the transmitter, receiver, tower/utilities, antenna/pedestal positioning and status electronics, and various RDA power supply voltages.

5.7.1.3 Interface Description. The interface is a Gigabit Ethernet link using TCP/IP protocols to share information between the RSP and the SPIP. A client/server model is utilized (the SPIP is the server and the RSP is the client) and communication is achieved using RPCs. The SPIP and RSP are connected directly to one another via a CAT5e cable configured for Gigabit Ethernet communications.

5.7.2 DATA ACQUISITION INTERFACE FUNCTIONAL DESCRIPTION.

The data acquisition interface function (containing the SPIP) links the RSP to various functions of the RDA. The interface (Figure FO5-13) contains the following functions:

- RDASC/SPIP command data interface
- SPIP/RDASC status data interface
- Discrete status data monitoring
- Analog status data monitoring

5.7.2.1 RDASC/SPIP Command Data Interface. The RDASC/SPIP command data interface is a dedicated TCP/IP Gigabit Ethernet link between the RSP and the SPIP. The commands from the RSP via the SPIP are used to control operation of the antenna/pedestal positioning and status electronics, transmitter, operation of the SPIP, and tower/utilities. The RSP communicates with the SPIP using "set" and "get" RPCs (i.e., command and data). Table 5-4 specifies the commands sent to the various systems in the RDA from the RSP via the SPIP. The table also lists the RPCs used to transmit the commands to the SPIP. Command RPCs (i.e., "set" RPCs) send several long words (32-bit) to the SPIP with the MSB hard-coded to be "1". Refer to Figure FO5-14 for command flow. Also refer to Figure FO5-9 for the various SPIP jack and pins referenced.

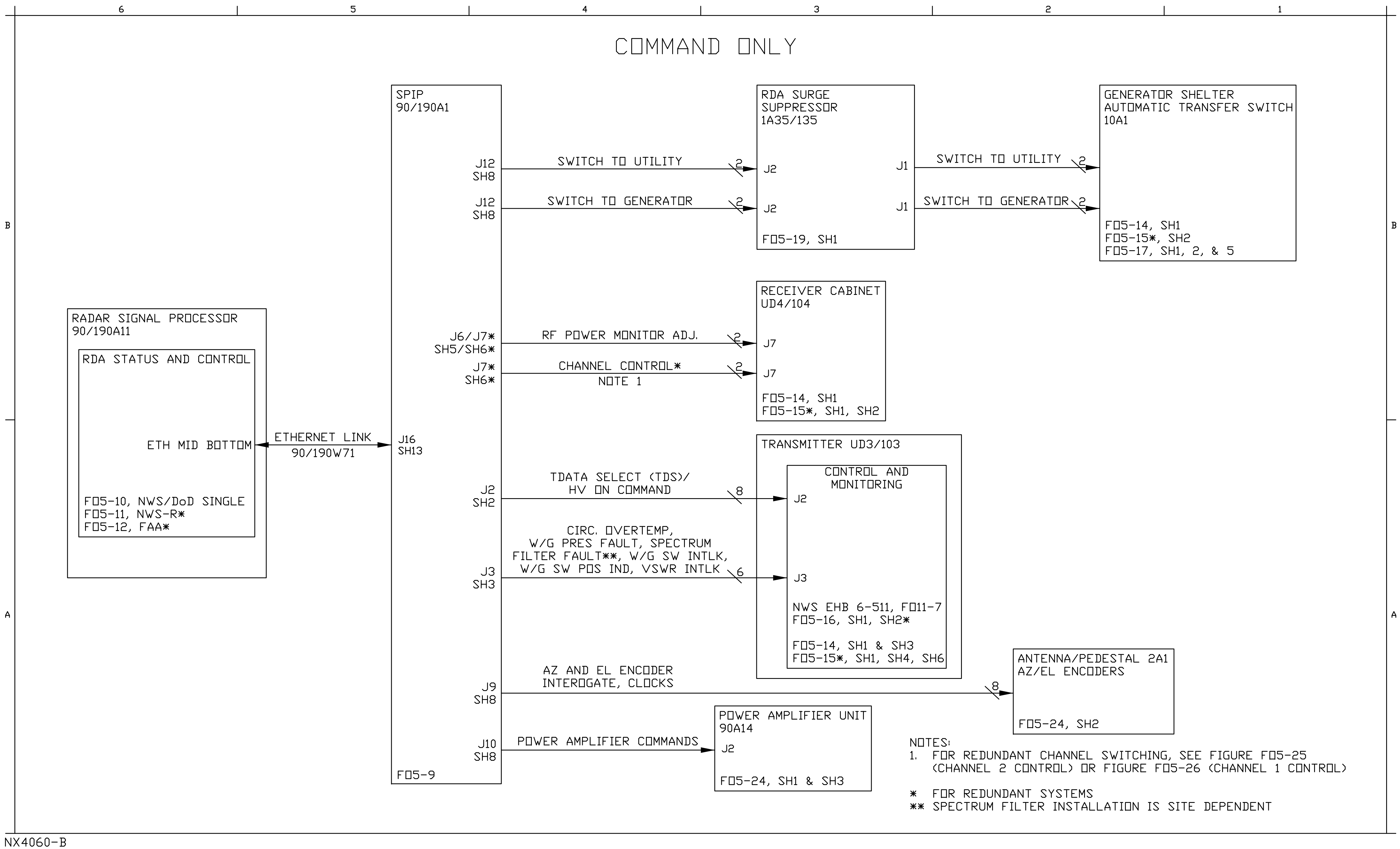


Figure FO5-13. RDA Status and Control Interface Functional Block Diagram (Sheet 2 of 2)

Table 5-4. RSP-to-SPIP Commands

COMMAND	ALARM	CODE	CONFIGURATION	DESTINATION	SPIP PINS	OUTPUT
Pedestal Power Button	SPIP PED POWER BUTTON OFF	258	All	SPIP	N/A	LED Indicator Green: ON LED Indicator Red: OFF
Data ACQ Power Button	SPIP DAQ POWER BUTTON OFF	257	All	SPIP	N/A	LED Indicator Green: ON LED Indicator Red: OFF
SPIP J2 Transmitter Status/Commands						
High Voltage On	XMTR HV SWITCH FAILURE	96	All	Transmitter	J2-17 ref. to J2-35	0V: Off +5V: On
SPIP J3 Transmitter/WG Interlocks						
Circulator Overtemp	N/A	N/A	All	Transmitter	J3-2 ref. to J3-8	0V: Fault +28V: OK
Antenna Position Indicator	N/A	N/A	All	Transmitter	J3-3 ref. to J3-8	0V: Fault +15V: OK
Spectrum Filter/Pressure Fault	N/A	N/A	All	Transmitter	J3-4 ref. to J3-8	0V: Fault +15V: OK
Waveguide Pressure Fault	N/A	N/A	All	Transmitter	J3-5 ref. to J3-8	0V: Fault +15V: OK
Waveguide Switch Transitioning	N/A	N/A	All	Transmitter	J3-6 ref. to J3-8	0V: Fault +15V: OK
VSWR Circuitry	N/A	N/A	All	Transmitter	J3-7 ref. to J3-8	0V: Fault +15V: OK
SPIP J4 WG Switch						
Waveguide Switch to Antenna[1]	N/A	N/A	All	Microwave Distribution	J4-1/9 ref. to J4-2/10	0V: Dummy Load +28V: Antenna
Antenna Command	N/A	N/A	All	Microwave Distribution	J4-12 ref. to J4-2/10	0V: Dummy Load +5V: Antenna
SPIP J6 Single Channel Receiver						
Power Monitor Adjustment	XMTR POWER BITE FAIL	88	All	Receiver	J6-24 ref. to J6-27	Voltage between -5V and +5V

1. Requires jumpers between pins J4-4 and J4-11/13 (WG SW Transition Interlock); and J11-9 and J11-42 (Radome Hatch SW #1) before SPIP allows command. Not required if using breakout boards.

Table 5-4. RSP-to-SPIP Commands - Continued

COMMAND	ALARM	CODE	CONFIGURATION	DESTINATION	SPIP PINS	OUTPUT
SPIP J7 Redundant Receiver						
Channel Command[2]	CHANNEL CONTROL FAILURE - RDAIU SWITCH MISMATCH	555	Redundant	Receiver	J7-16/17 ref. to J7-35/36	0V: Channel 1 +15V: Channel 2
Power Monitor Adjustment	XMTR POWER METER ZERO OUT OF LIMIT	87	All	Receiver	J7-24 ref. to J7-27	Voltage between -5V and +5V
SPIP J10 Power Amplifier						
Servo Power[3]	N/A	N/A	All	PAU	J10-2 ref. to J10-25	OPEN: Servo Power Off CLOSED: Servo Power On
Elevation Servo Amp Inhibit[4]	ELEVATION AMPLIFIER INHIBIT	300	All	PAU	J10-4 ref. to J10-19	0V: Inhibits Servo Amp +5V: No Action
Azimuth Servo Amp Inhibit[5]	AZIMUTH AMPLIFIER INHIBIT	315	All	PAU	J10-3 ref. to J10-19	0V: Inhibits Servo Amp +5V: No Action
Elevation Servo Amp Drive[6]	RCP EL CONTROL UNRESPONSIVE	358	All	PAU	J10-14 ref. to J10-15	Voltage between -10V and +10V
Azimuth Servo Amp Drive[6]	RCP AZ CONTROL UNRESPONSIVE	357	All	PAU	J10-12 ref. to J10-13	Voltage between -10V and +10V
SPIP J12 Generator Shelter						
Switch to Generator[7]	COMMANDED POWER SWITCH FAILED	177	All	Auxiliary Power	J12-9 ref. to J12-42	OPEN: No selection CLOSED: Selects Gen. Power
Switch to Utility[8]	COMMANDED POWER SWITCH FAILED	177	All	Auxiliary Power	J12-26 ref. to J12-10	OPEN: No selection CLOSED: Selects Utility Power

1. Requires jumpers between pins J4-4 and J4-11/13 (WG SW Transition Interlock); and J11-9 and J11-42 (Radome Hatch SW #1) before SPIP allows command. Not required if using breakout boards.
2. Requires redundant SPIP in default configuration. See **SECTION 5.12**. Only output from Channel 2.
3. Requires Radome Hatch closed and Pedestal Safety Switch in "PWR ON" position. To test with only SPIP, requires jumper between J11-9 and J11-42 (Radome Hatch SW #1); and jumper between J8-22 and J8-23 (Pedestal Interlock).
4. Requires the following:
   - Elevation Handwheel engaged (J8-12 ref. to J8-33)
   - Elevation Stow Pin engaged (J8-11 ref. to J8-33)
   - All elevation limit switches not activated (J8-6, 7, 8, 9 ref. to J8-33)

   To force an inhibit signal, remove 90W41-P1 from SPIP J8.
5. Requires the following:
   - Azimuth Handwheel engaged (J8-2 ref. to J8-33)
   - Azimuth Stow Pin engaged (J8-5 ref. to J8-33)

   To force an inhibit signal, remove 90W41-P1 from SPIP J8.
6. Requires a breakout board to test.
7. Requires ATS to be in Utility (closed contacts or short between SPIP J12-5 and J12-38).
8. Requires ATS to be in Generator (open contacts or open between SPIP J12-5 and J12-38).

The SPIP receives status signals from sensors and devices in the RDA and passes them to the RDASC computer (RSP).

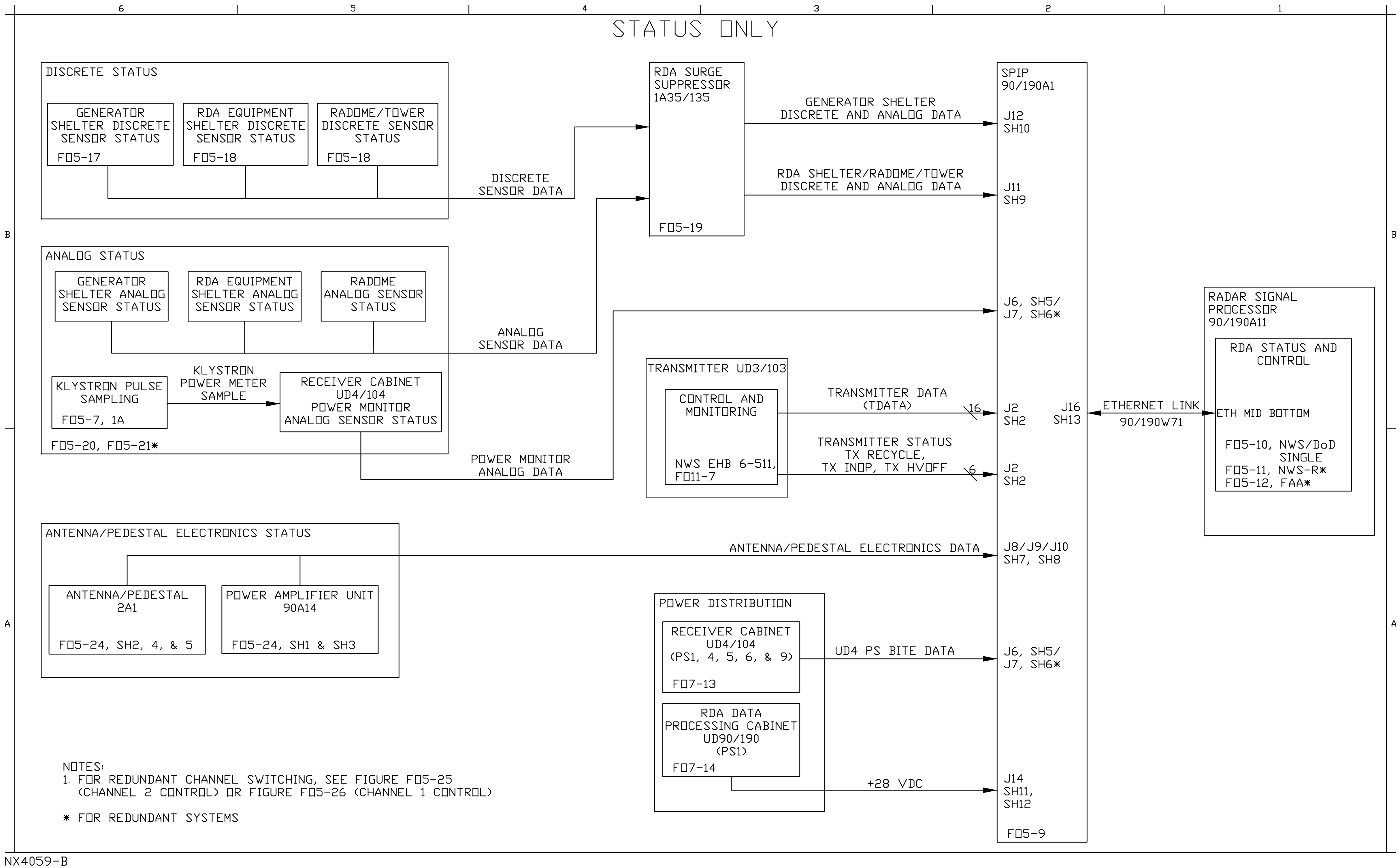


Figure FO5-13. RDA Status and Control Interface Functional Block Diagram (Sheet 1 of 2)

Table 5-5. SPIP-to-RSP Status

SIGNAL	ALARM NAME	ALARM CODE	FIGURE FO/ TABLE REF	SIGNAL TYPE	SPIP PINS	PMD STATUS
SPIP Auto-Config Channel Assignment	N/A	N/A		3.3V Logic****	N/A	0V: Chan. 1 3.3V: Chan. 2
SPIP Pedestal Power Button	See Table 5-4		FO5-9, Sheet 12 Table 6-2 (PED)			
SPIP Data ACQ Power Button	See Table 5-4		FO5-9, Sheet 12 Table 6-2 (PED)			
SPIP J2 Transmitter Status/Commands						
Transmitter Recycle	XMTR RECYCLING	97	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	J2-13 ref. to J2-31	0V: Normal +5V: Recycling
Transmitter Inoperable	XMTR INOPERATIVE	98	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	J2-14 ref. to J2-32	0V: OK +5V: Inoperable
Transmitter High Voltage Status	N/A	N/A	FO5-9, Sheet 2	RS422 TTL	J2-15 ref. to J2-33	0V: On +5V: Off
Filament Power Supply Status	FILAMENT POWER SUPPLY OFF	40	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: On +5V: Off
Klystron Preheat (Warmup)	N/A	N/A	FO5-9, Sheet 2	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: Normal +5V: Preheat
Transmitter Available	XMTR UNAVAILABLE	46	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: Yes +5V: No
Waveguide Switch Position	WAVEGUIDE SWITCH FAILURE	43	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: Antenna +5V: Dummy Load
WG/PFN Transition Interlock	WAVEGUIDE/PFN TRANSFER INTERLOCK	44	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: OK +5V: Open
Control Status	XMTR IN MAINTENANCE MODE	45	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: No +5V: Yes
Transmitter Status	XMTR MAINTENANCE REQUIRED	62	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: No +5V: Required
PFN Switch Position	PFN/PW SWITCH FAILURE	47	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: Short Pulse +5V: Long Pulse
PS6 (+5V)	XMTR +5VDC POWER SUPPLY 6 FAIL	48	FO5-9, Sheet 2 Table 6-3 (XMT)	RS422 TTL	TDATA (J2-5 thru 12 ref. to J2-23 thru J2-30)	0V: OK +5V: Fail

Table 5-5. SPIP-to-RSP Status - Continued

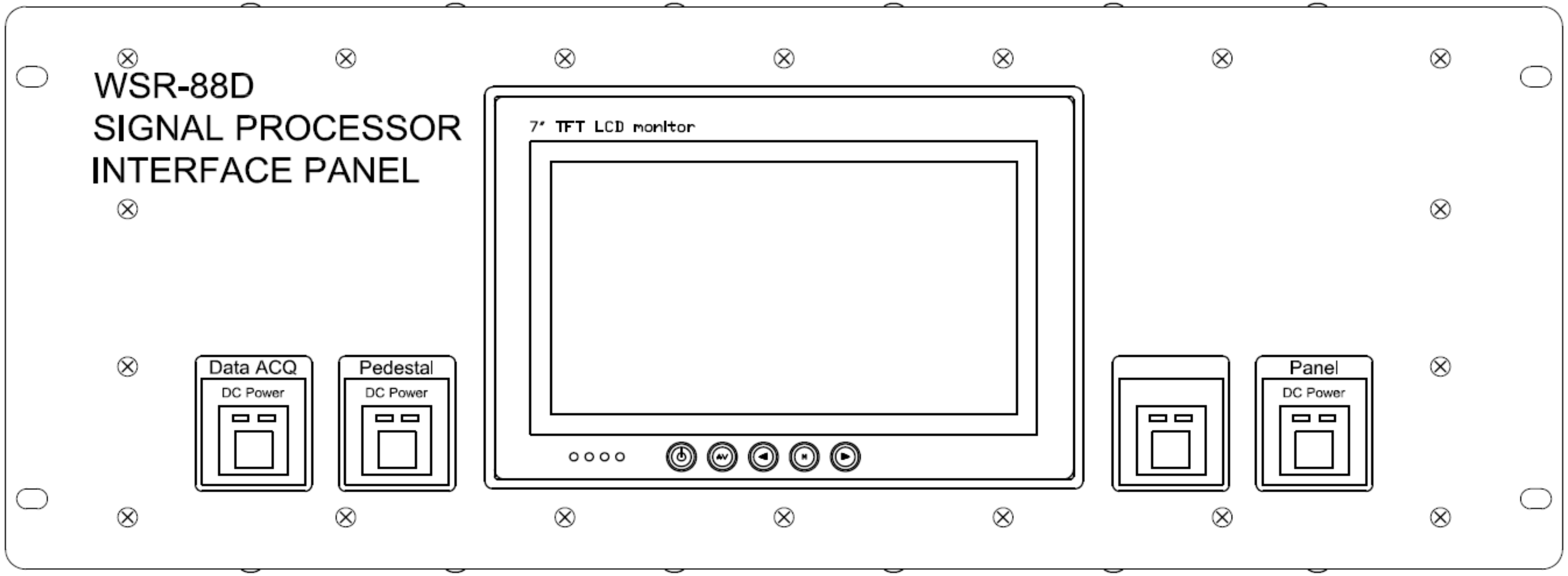
SIGNAL	ALARM NAME	ALARM CODE	FIGURE FO/ TABLE REF	SIGNAL TYPE	SPIP PINS	PMD STATUS
SPIP J4 WG Switch						
Waveguide Switch Transition Interlock	N/A	N/A		Open/+5V	J4-4 ref. to J4-11/13	Open: Transitioning +5V: OK
Waveguide Switch Dummy Load Position Indicator	N/A	N/A		Open/+5V	J4-5 ref. to J4-11/13	Open: Antenna +5V: Dummy Load
Waveguide Switch Antenna Position Indicator	N/A	N/A		Open/+5V	J4-6 ref. to J4-11/13	Open: Dummy Load +5V: Antenna
SPIP J6 Single Channel Receiver						
SPIP +15V	SPIP +15V POWER SUPPLY FAIL	254	FO5-9, Sheet 5 Table 6-5 (CTR)	Digitized Voltage	J6-4 ref. to J6-5	Range: 0 – 15V Resolution: 0.015V
SPIP -15V	SPIP -15V POWER SUPPLY FAIL	256	FO5-9, Sheet 5 Table 6-5 (CTR)	Digitized Voltage	J6-23 ref. to J6-5	Range: 0 – -15V Resolution: -0.015V
Receiver PS1 Fault (±18V)	RCVR ±18V POWER SUPPLY 1 FAIL	365	FO5-9, Sheet 5 Table 6-4 (RCV)	Open/0V TTL-open-collector	J6-9 ref. to J6-32	Open: Fail 0V: OK
Receiver PS4 Fault (-9V)	RCVR -9V POWER SUPPLY 4 FAIL	366	FO5-9, Sheet 5 Table 6-4 (RCV)	Open/0V TTL-open-collector	J6-29 ref. to J6-32	Open: Fail 0V: OK
Receiver PS5 Fault (+5V)	RCVR +5V POWER SUPPLY 5 FAIL	364	FO5-9, Sheet 5 Table 6-4 (RCV)	Open/0V TTL-open-collector	J6-11 ref. to J6-32	Open: Fail 0V: OK
Receiver PS6 Fault (+9V)	RCVR +9V POWER SUPPLY 6 FAIL	367	FO5-9, Sheet 5 Table 6-4 (RCV)	Open/0V TTL-open-collector	J6-30 ref. to J-32	Open: Fail 0V: OK
Receiver PS9 Fault (+5V RDAIU)	SINGLE CHANNEL RDAIU +5V POWER SUPPLY 9 FAIL	368	FO5-9, Sheet 5 Table 6-4 (RCV)	Open/0V TTL-open-collector	J6-13 ref. to J6-32	Open: Fail 0V: OK
Transmitter RF Power	XMTR POWER METER ZERO OUT OF LIMIT	87	FO5-9, Sheet 2 Table 6-3 (XMT)	Analog	J6-6 ref. to J6-25	Range: 0 – 100 mV Resolution: 0.1 mV
SPIP J7 Redundant Receiver						
SPIP +15V	SPIP +15V POWER SUPPLY FAIL	254	FO5-9, Sheet 5 Table 6-5 (CTR)	Digitized Voltage	J7-4 ref. to J7-5	Range: 0 – 15V Resolution: 0.015V
SPIP -15V	SPIP -15V POWER SUPPLY FAIL	256	FO5-9, Sheet 5 Table 6-5 (CTR)	Digitized Voltage	J7-23 ref. to J7-5	Range: 0 – -15V Resolution: -0.015V

Table 5-5. SPIP-to-RSP Status - Continued

SIGNAL	ALARM NAME	ALARM CODE	FIGURE FO/ TABLE REF	SIGNAL TYPE	SPIP PINS	PMD STATUS
Transmitter Air Filter	XMTR FILTER DIRTY	154	FO5-9, Sheet 9 Table 6-8 (UTL)	Open/Closed	J11-35 ref. to J11-40	Open: OK Closed: Dirty
Security System Fault	SECURITY SYSTEM EQUIPMENT FAILURE	145	FO5-9, Sheet 9 Table 6-8 (UTL)	Open/Closed	J11-39 ref. to J11-40	Open: OK Closed: Fail
RDA Shelter Door***	N/A	N/A	FO5-9, Sheet 9	Open/Closed	J11-48 ref. to J11-32	Open: Door Open Closed: Door Closed
Transmitter Exhaust Air Temperature	XMTR EXHAUST AIR TEMP EXTREME	173	FO5-9, Sheet 9 Table 6-8 (UTL)	Analog	J11-12 ref. to J11-40	Range: -10 – 60 deg C Resolution: 0.07 deg C
A/C #1 Air Filter	AC UNIT #1 FILTER DIRTY	152	FO5-9, Sheet 9 Table 6-8 (UTL)	Open/Closed	J11-1 ref. to J11-40	Open: OK Closed: Dirty
A/C #2 Air Filter	AC UNIT #2 FILTER DIRTY	153	FO5-9, Sheet 9 Table 6-8 (UTL)	Open/Closed	J11-18 ref. to J11-40	Open: OK Closed: Dirty
Fire Detection System Trouble	EQUIP SHELTER FIRE DETECTION SYSTEM FAULT	131	FO5-9, Sheet 9 Table 6-8 (UTL)	Open/Closed	J11-3 ref. to J11-40	Open: Fail Closed: OK
Radome Temperature	RADOME AIR TEMP EXTREME	174	FO5-9, Sheet 9 Table 6-8 (UTL)	Analog	J11-14 ref. to J11-40	Range: -50 – 50 deg C Resolution: 0.1 deg C
Equipment Shelter Temperature	EQUIPMENT SHELTER TEMP EXTREME	171	FO5-9, Sheet 9 Table 6-8 (UTL)	Analog	J11-27 ref. to J11-40	Range: 0 – 50 deg C Resolution: 0.05 deg C
AC #1 Discharge Temperature	AC UNIT#1 DISCHARGE TEMP EXTREME	172	FO5-9, Sheet 9 Table 6-8 (UTL)	Analog	J11-29 ref. to J11-40	Range: 0 – 50 deg C Resolution: 0.05 deg C
AC #2 Discharge Temperature	AC UNIT #2 DISCHARGE TEMP EXTREME	184	FO5-9, Sheet 9 Table 6-8 (UTL)	Analog	J11-46 ref. to J11-40	Range: 0 – 50 deg C Resolution: 0.05 deg C
External Ambient Temperature	N/A	N/A	FO5-9, Sheet 9	Analog	J11-44 ref. to J11-40	Range: -50 – 50 deg C Resolution: 0.1 deg C
SPIP J12 Generator						
ATS Power Selection	POWER SYSTEM MISMATCH	137	FO5-9, Sheet 10 Table 6-8 (UTL)	Open/Closed	J12-5 ref. to J12-38	Open: Generator Closed: Utility
Generator Select Switch	GENERATOR AUTO/RUN/OFF SWITCH NOT AUTO	128	FO5-9, Sheet 10 Table 6-8 (UTL)	Open/Closed	J12-7 ref. to J12-40	Open: Auto Closed: Manual
TPS	TPS IS OFF-LINE	126	FO5-9, Sheet 10 Table 6-8 (UTL)	Open/Closed	J12-11 ref. to J12-27	Open: Off Closed: OK

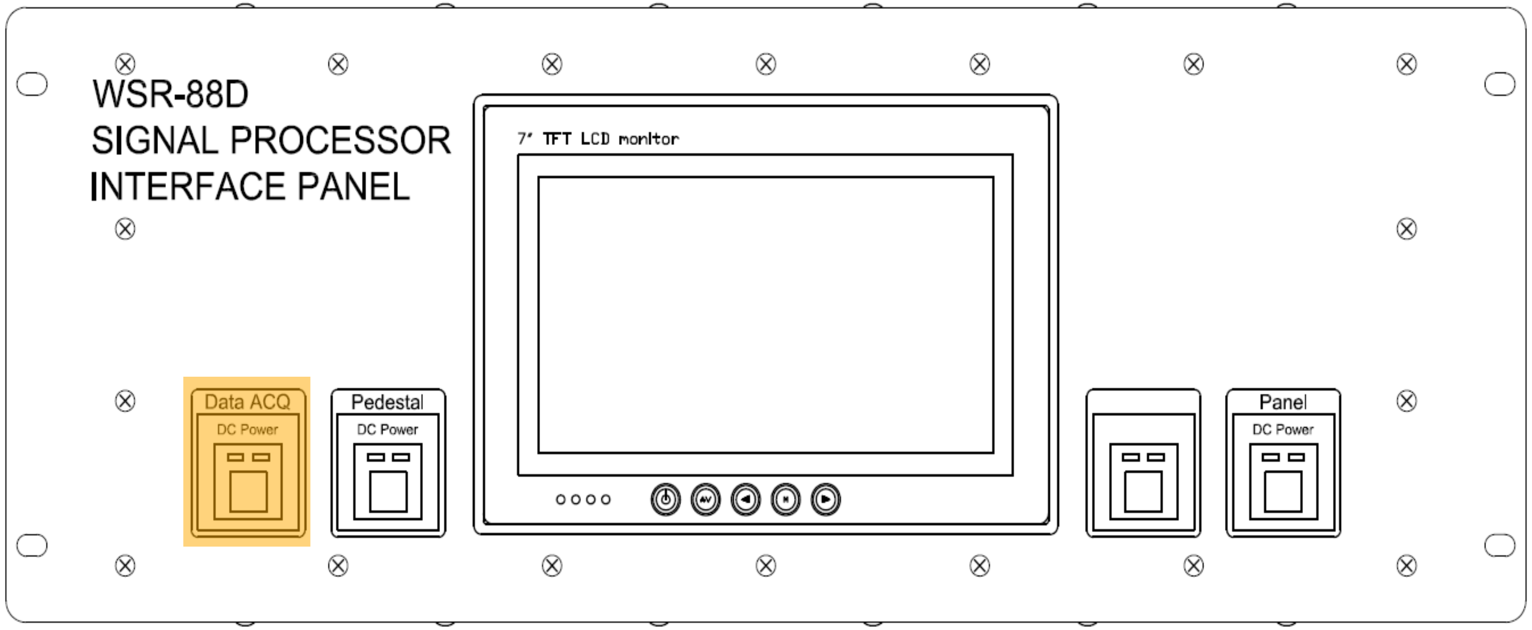
SPIP Front Panel

- **4 Power Buttons**
  - DAQ Power
  - Pedestal Power
  - Future Use
  - Main Power
- **Display**
  - 7 inch VGA



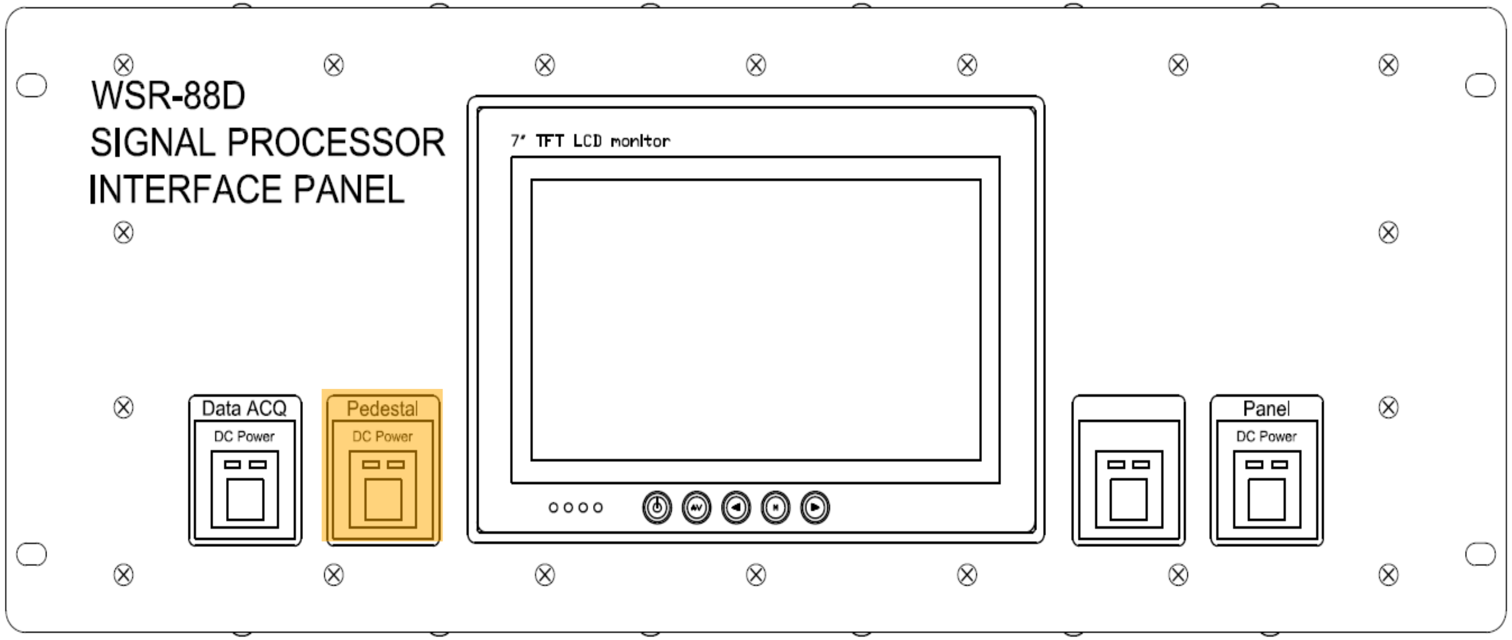
SPIP Power Buttons

- **DAQ Power**
  - Power goes to J3, J4, J6, J7, J11, J12
  - HW/SW Controlled
    - STS Control
  - Front Button Toggles Power



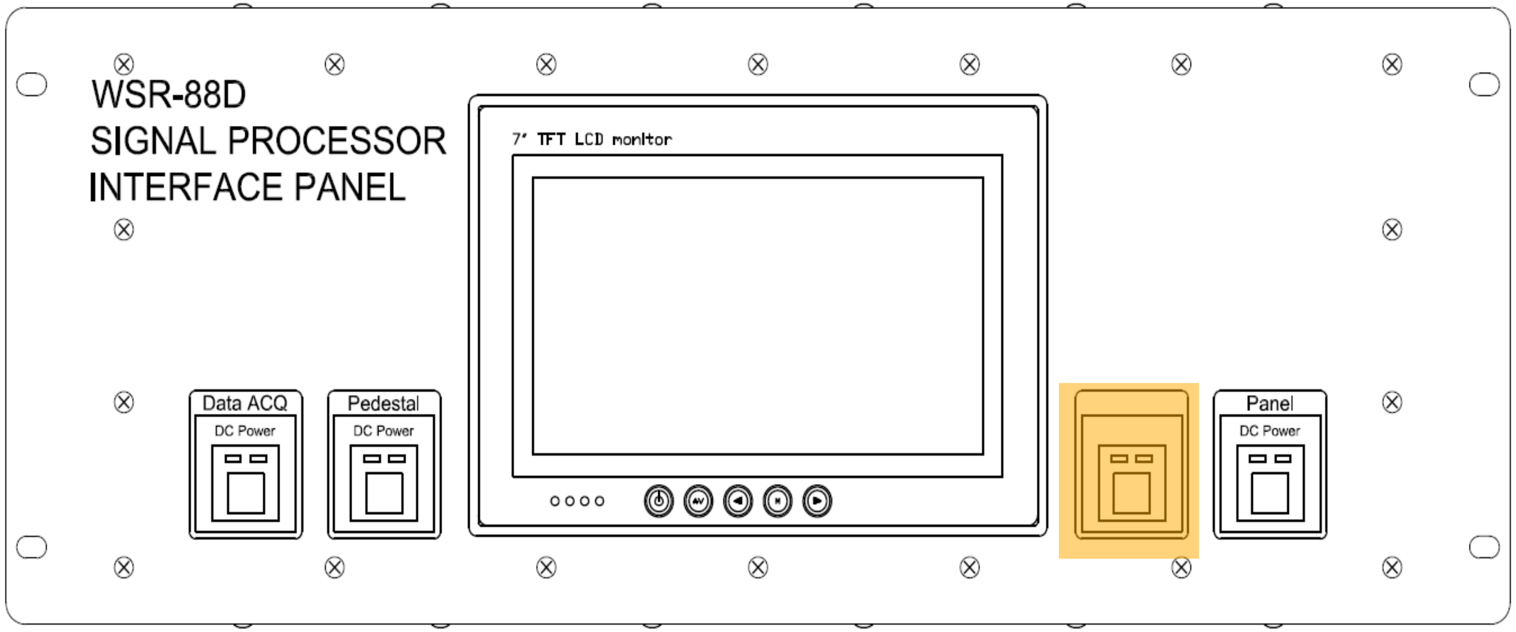
SPIP Power Buttons

- **Ped Power**
  - Powers Pedestal
  - Power goes to J9, J10, J15
    - J8 only uses internal voltage for sensing
  - HW/SW Controlled
    - STS Control



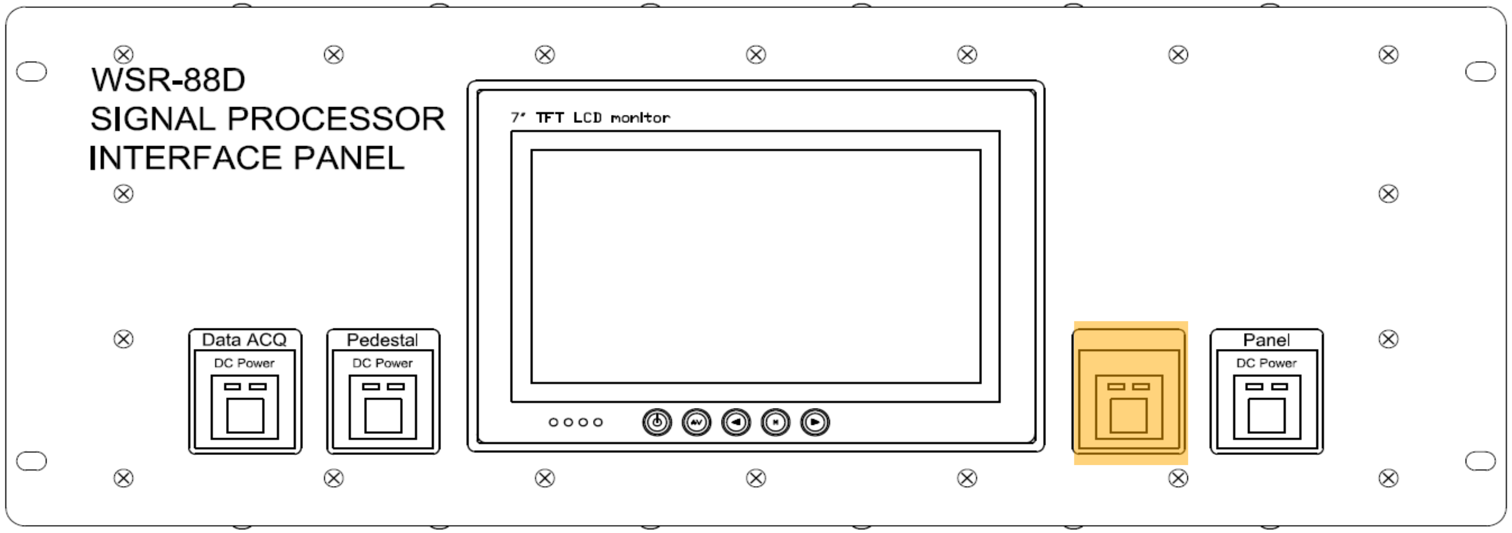
SPIP No Label Buttons

- **Future Use**
  - Originally a “Sleep” button
  - HW/SW Toggle Button
  - Can Sleep from software
    - Sleep is low power state
    - SPIP keeps ethernet comms but nothing else



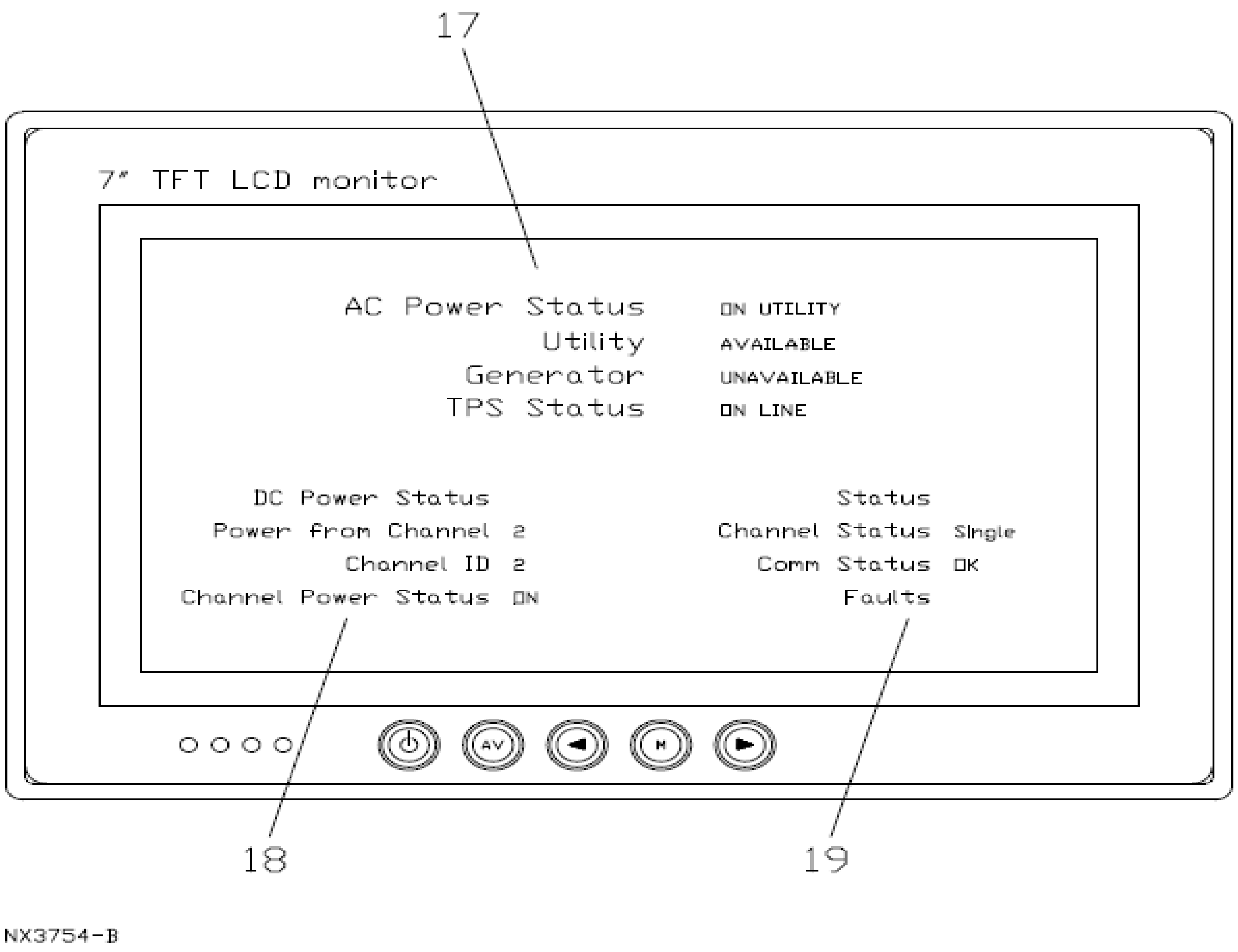
SPIP Power Buttons

- **Main Power**
  - Controls +28V to SPIP
  - PS1 primary +28V source
    - Redundant:
  - There is always 3.3V internal when +28V present for main power circuitry
  - HW only button
  - SPIP always powers ON when +28V initially applied
    - Either local PS1 or redundant PS1 via SPIP

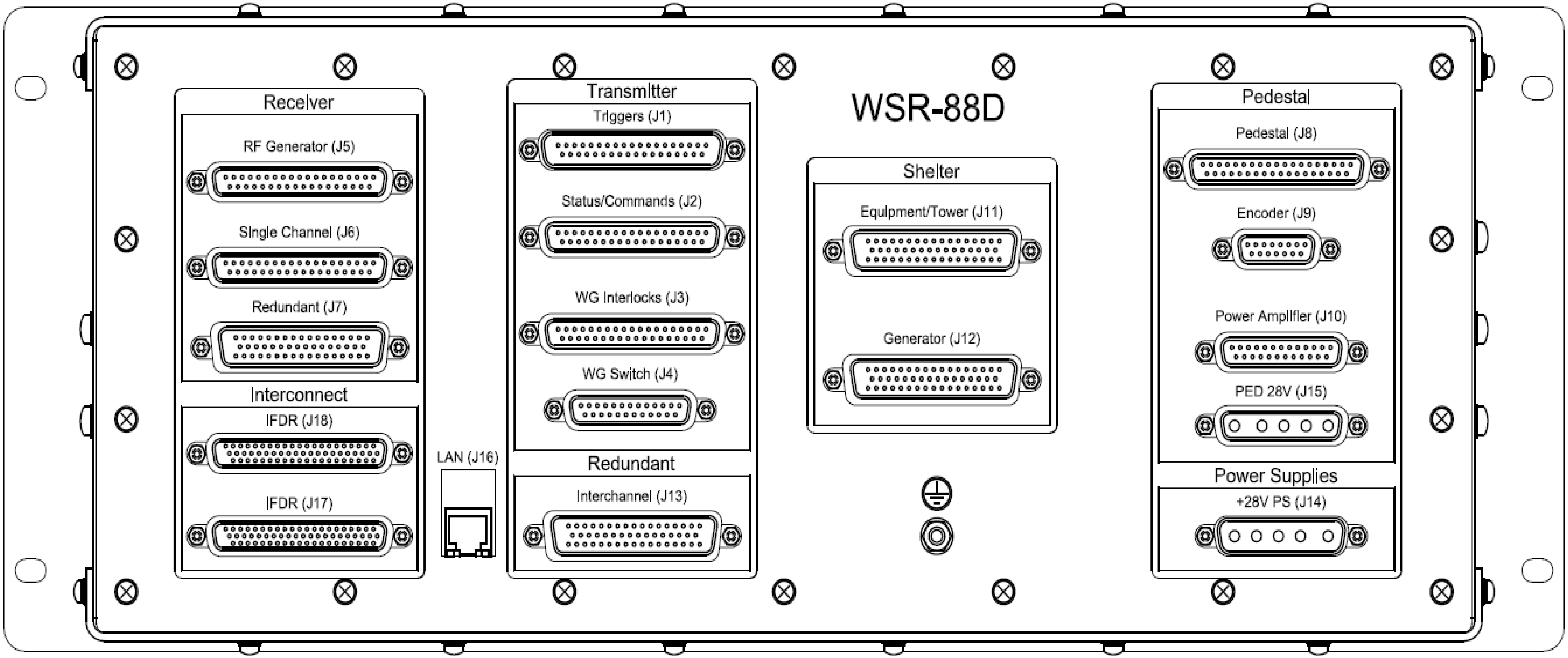


SPIP Display

- VGA Panel
- Touch buttons on Display
- Shows basic site information
- Power Status
- Channel Status
- Configuration



Back Panel Cable Connections



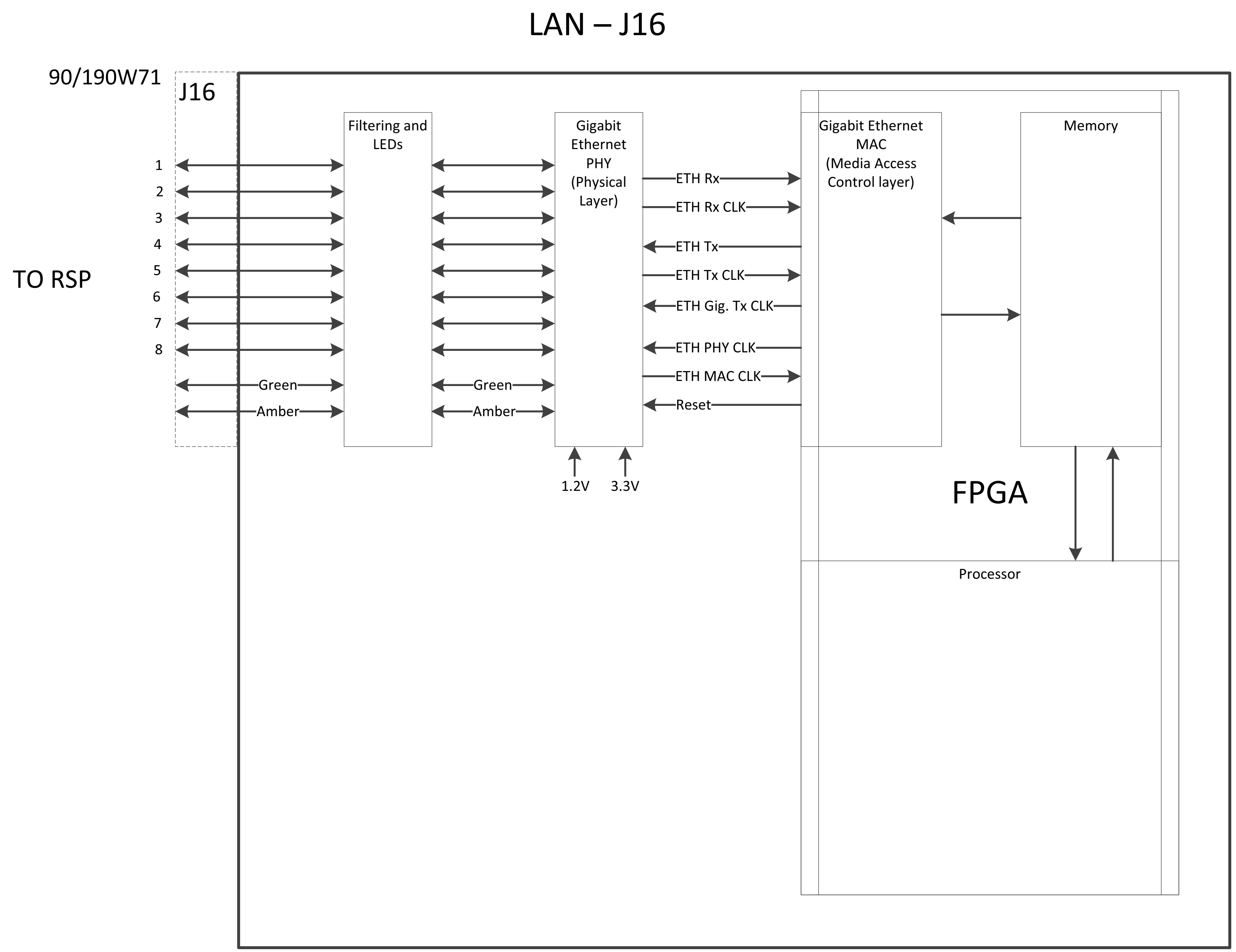


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 13 of 15)

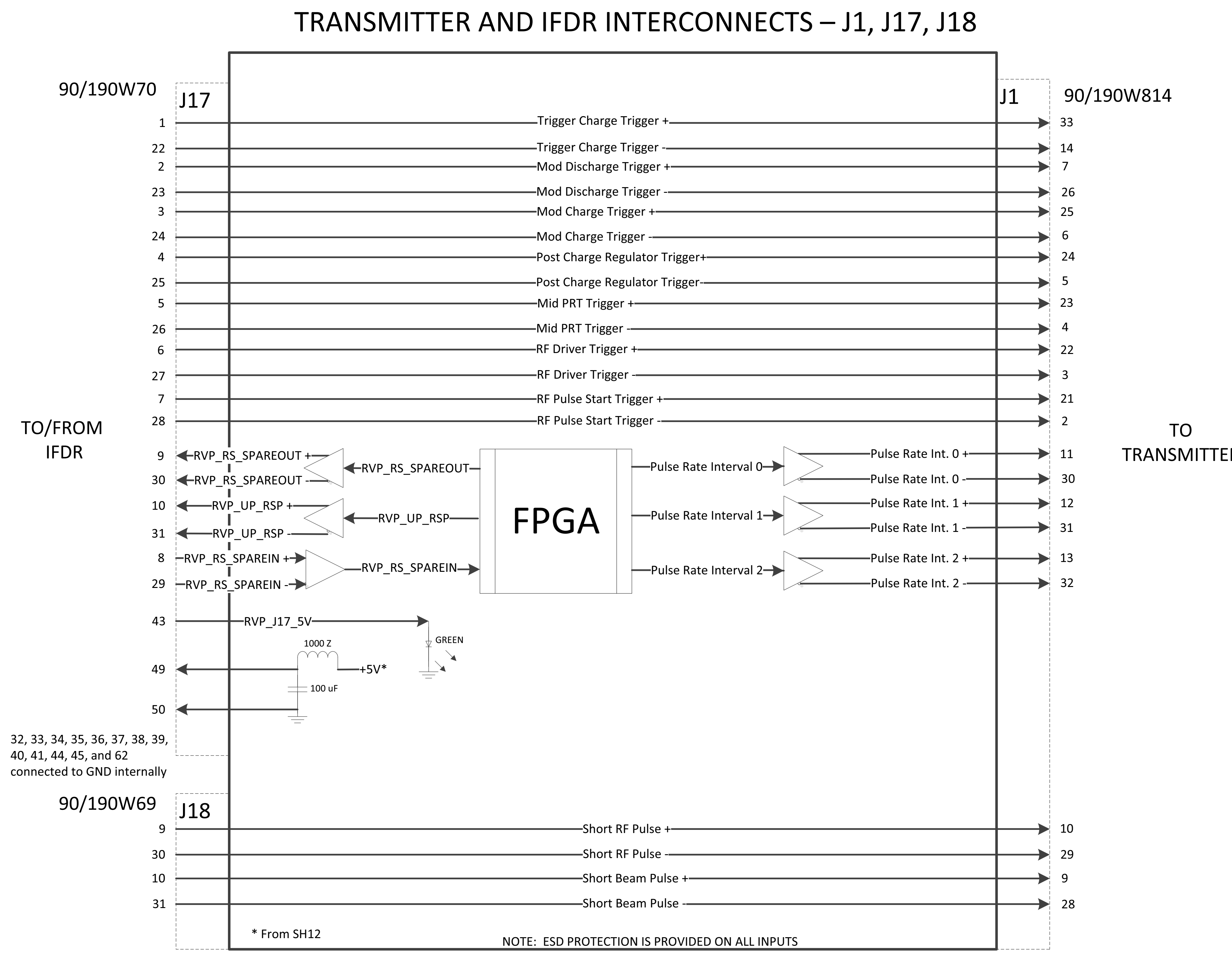


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 1 of 15)

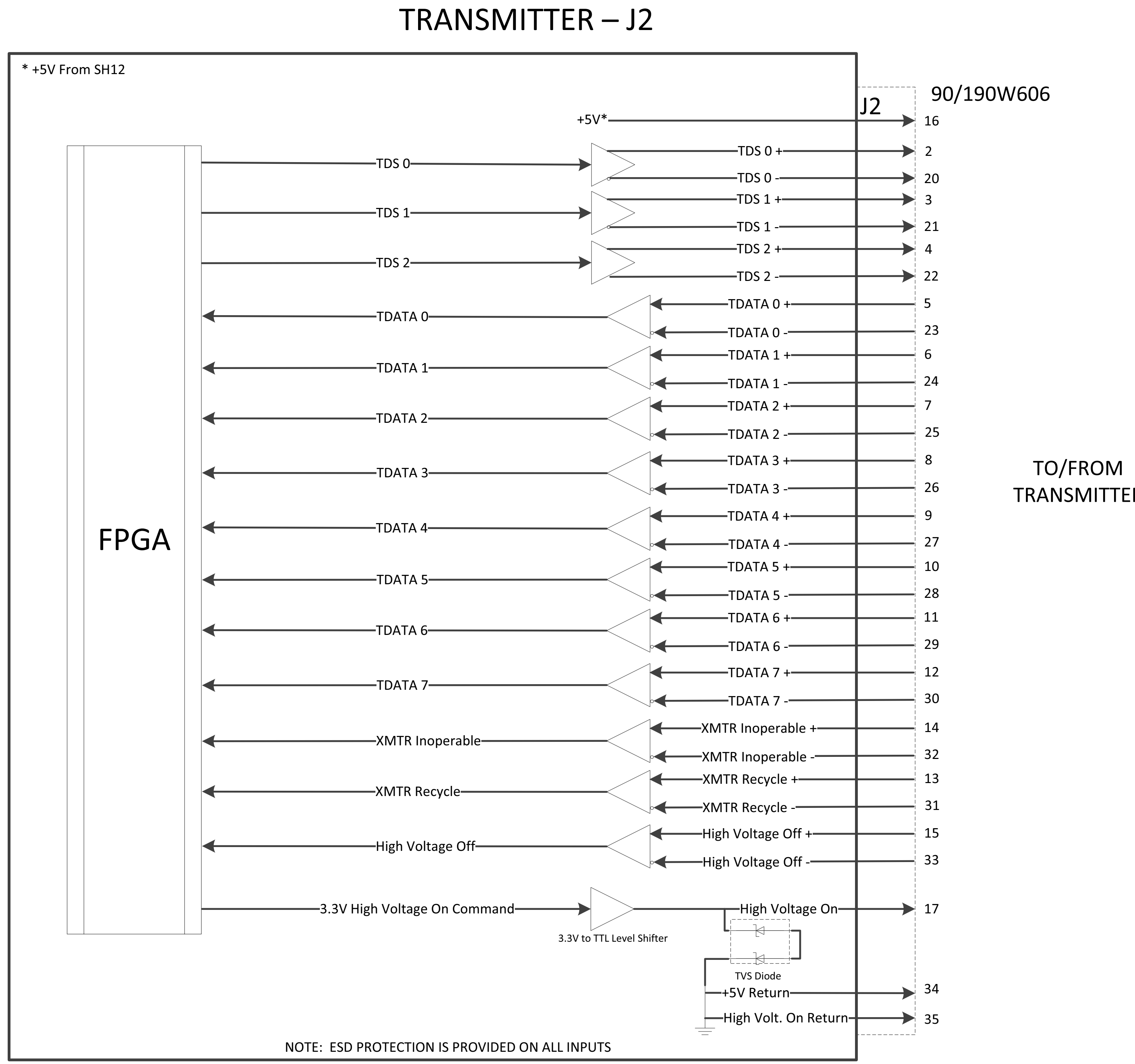


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 2 of 15)

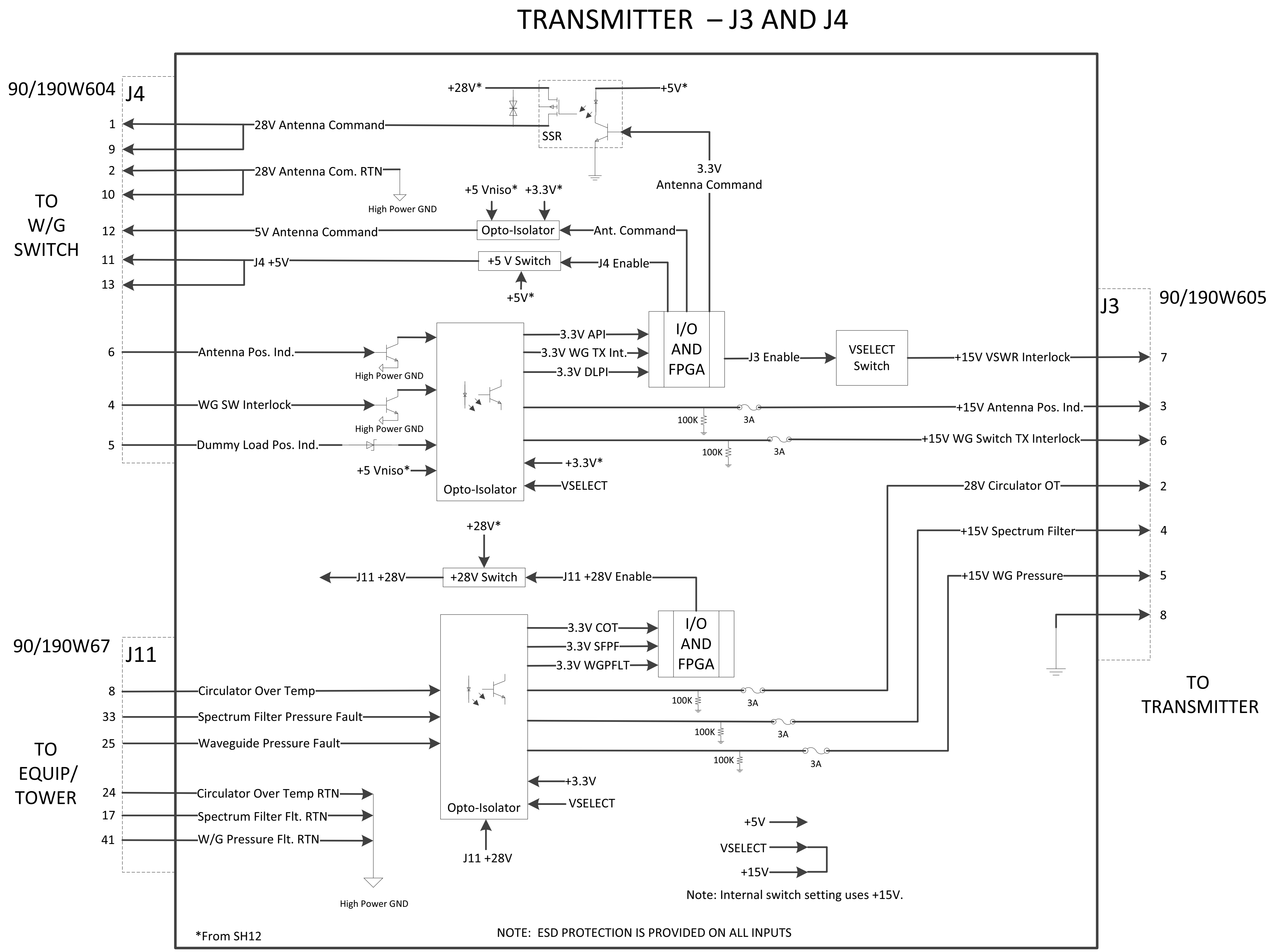
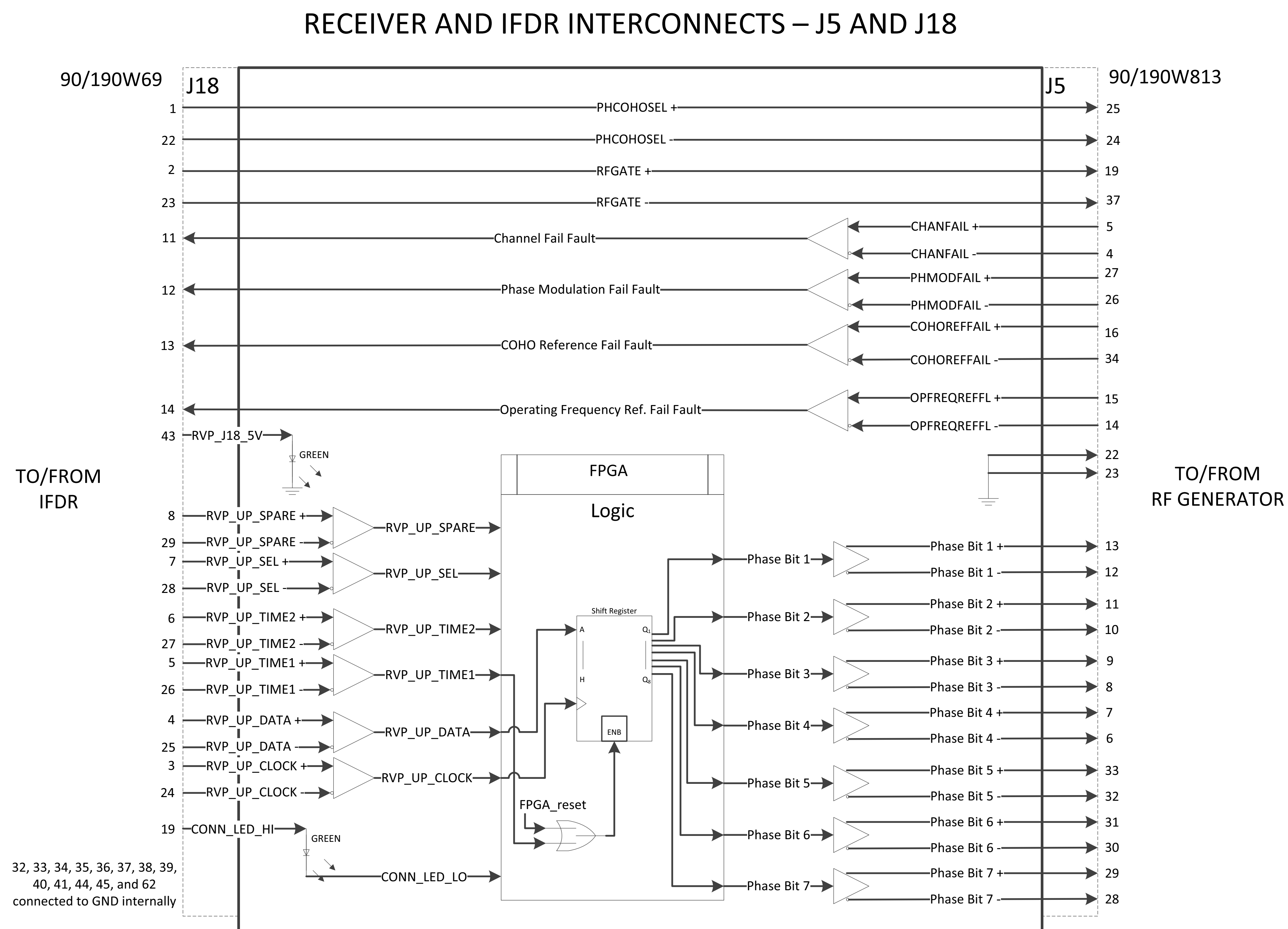


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 3 of 15)



NOTE:
J5 PHCOHOSEL+ and RFGATE + outputs connected to 1.0K pulldown resistor to GND.
J5 PHCOHOSEL- and RFGATE- outputs connected to 1K pullup resistor to +5V.
ESD PROTECTION IS PROVIDED ON ALL INPUTS

Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 4 of 15)

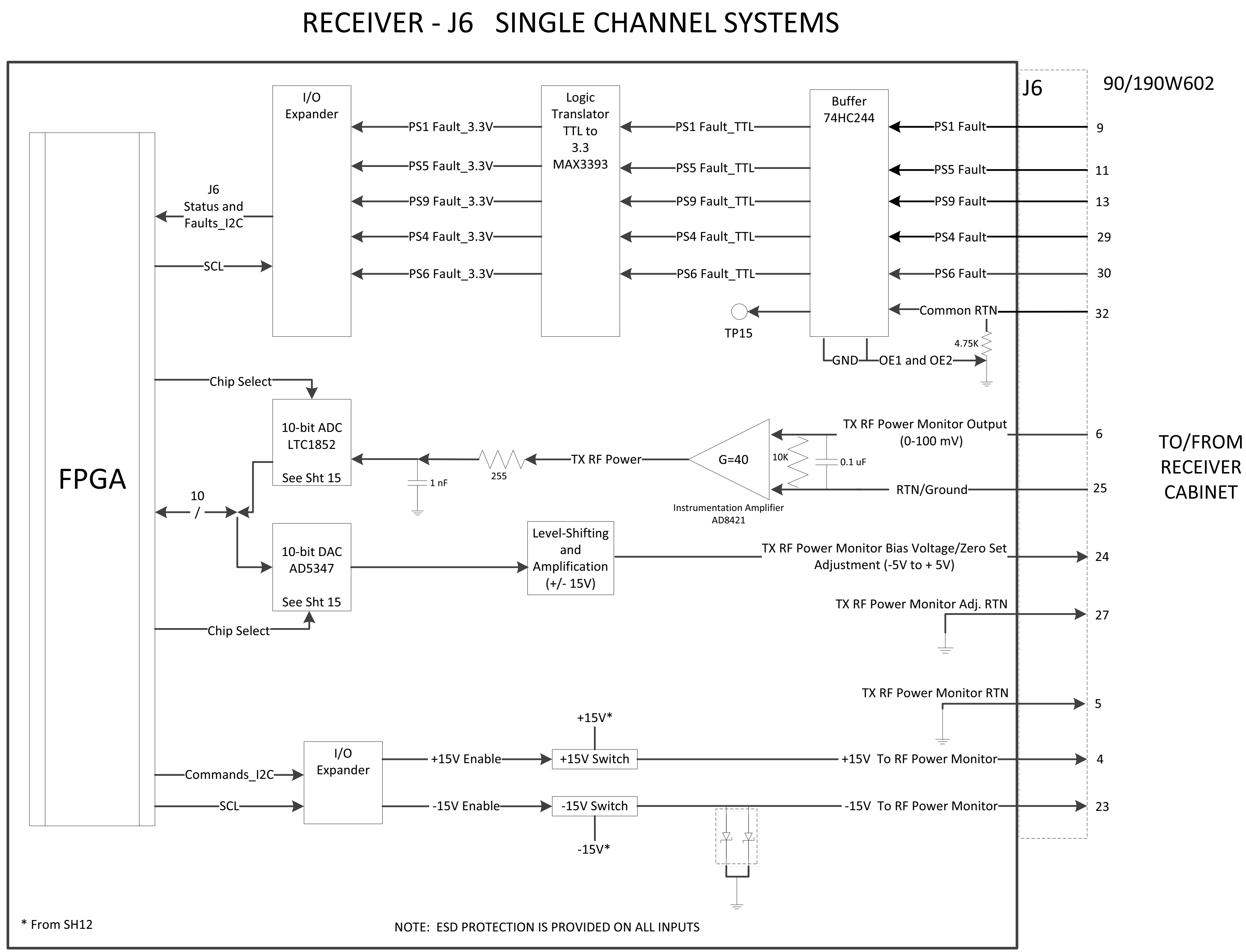


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 5 of 15)

RECEIVER - J7 REDUNDANT CHANNEL SYSTEMS

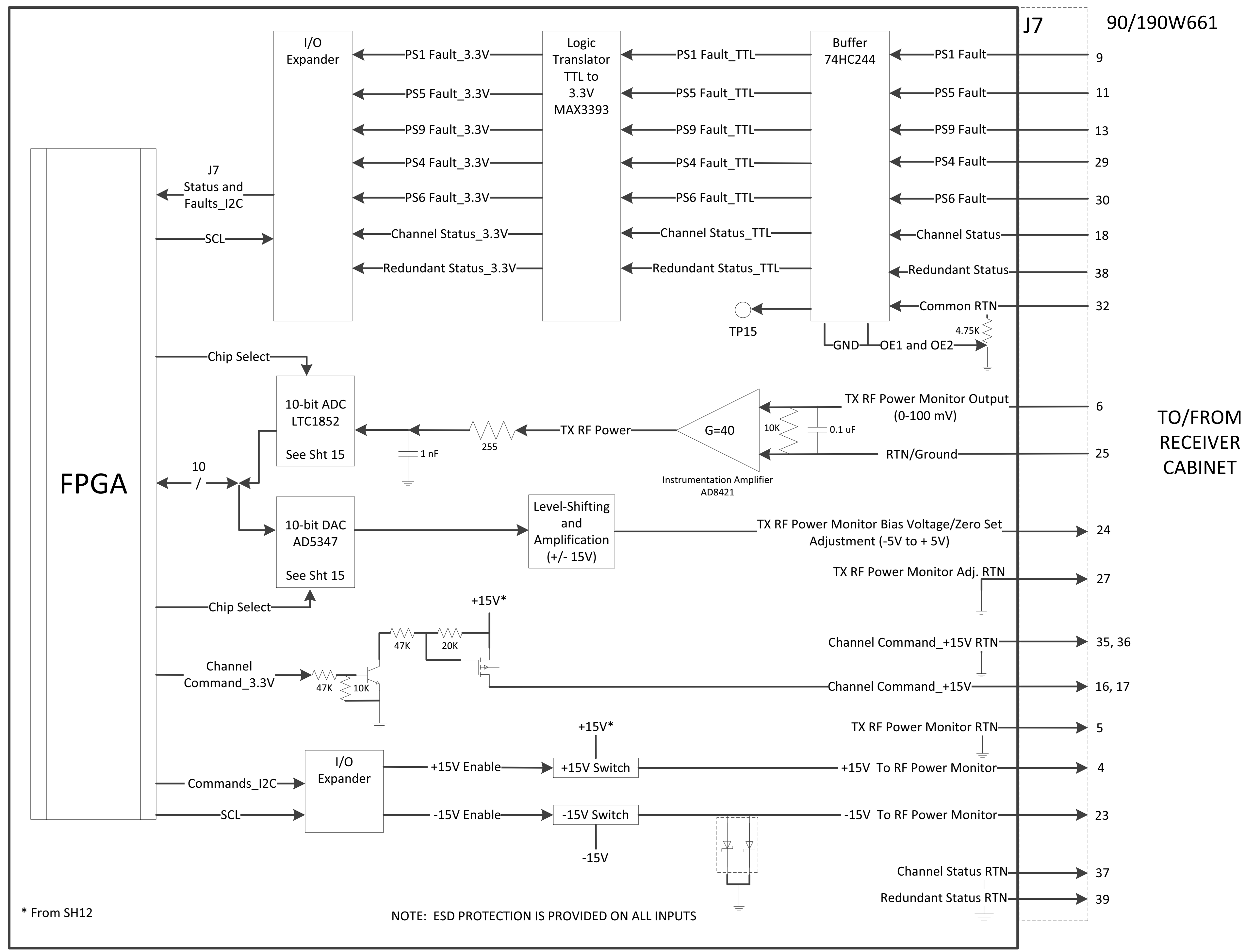


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 6 of 15)

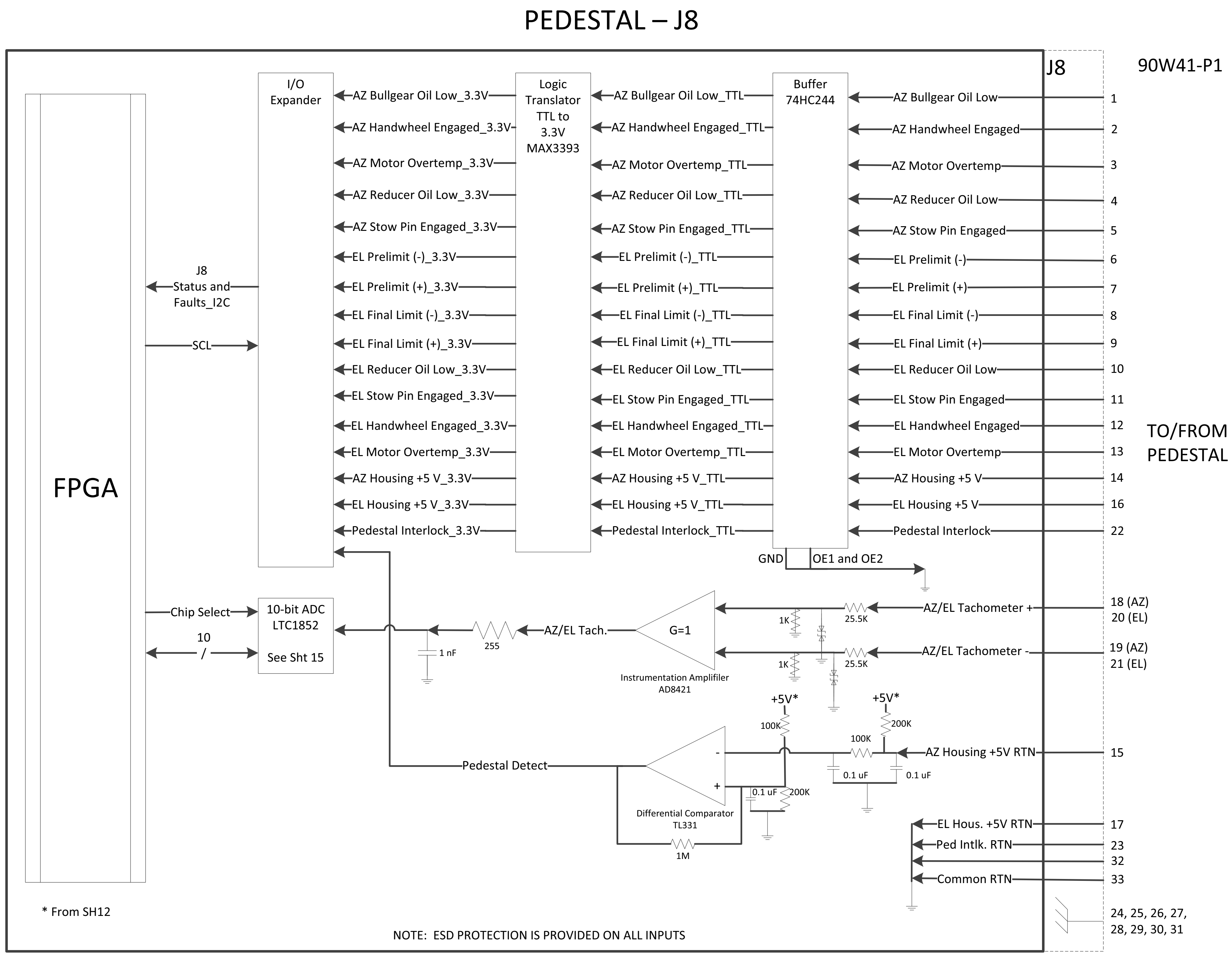


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 7 of 15)

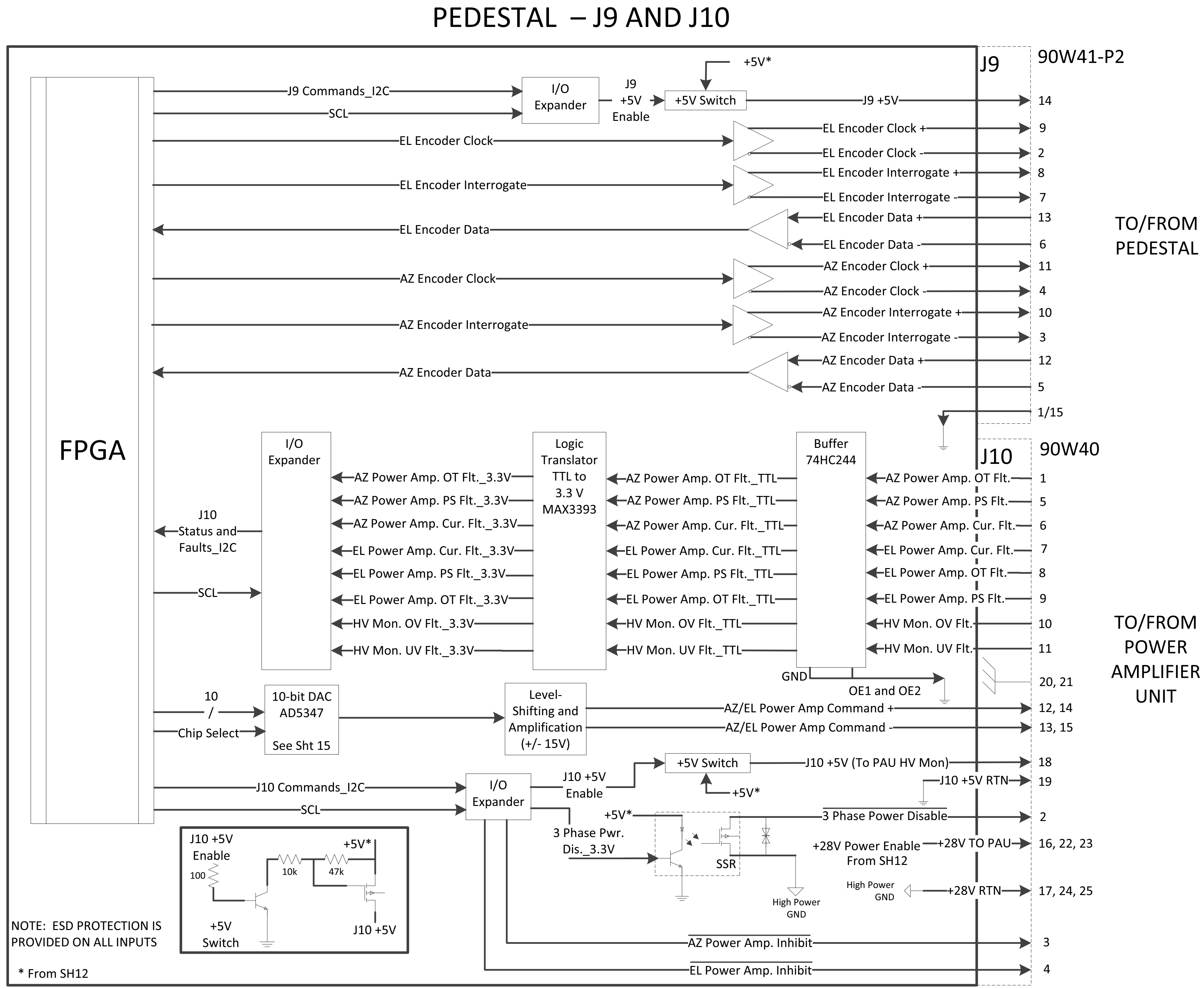


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 8 of 15)

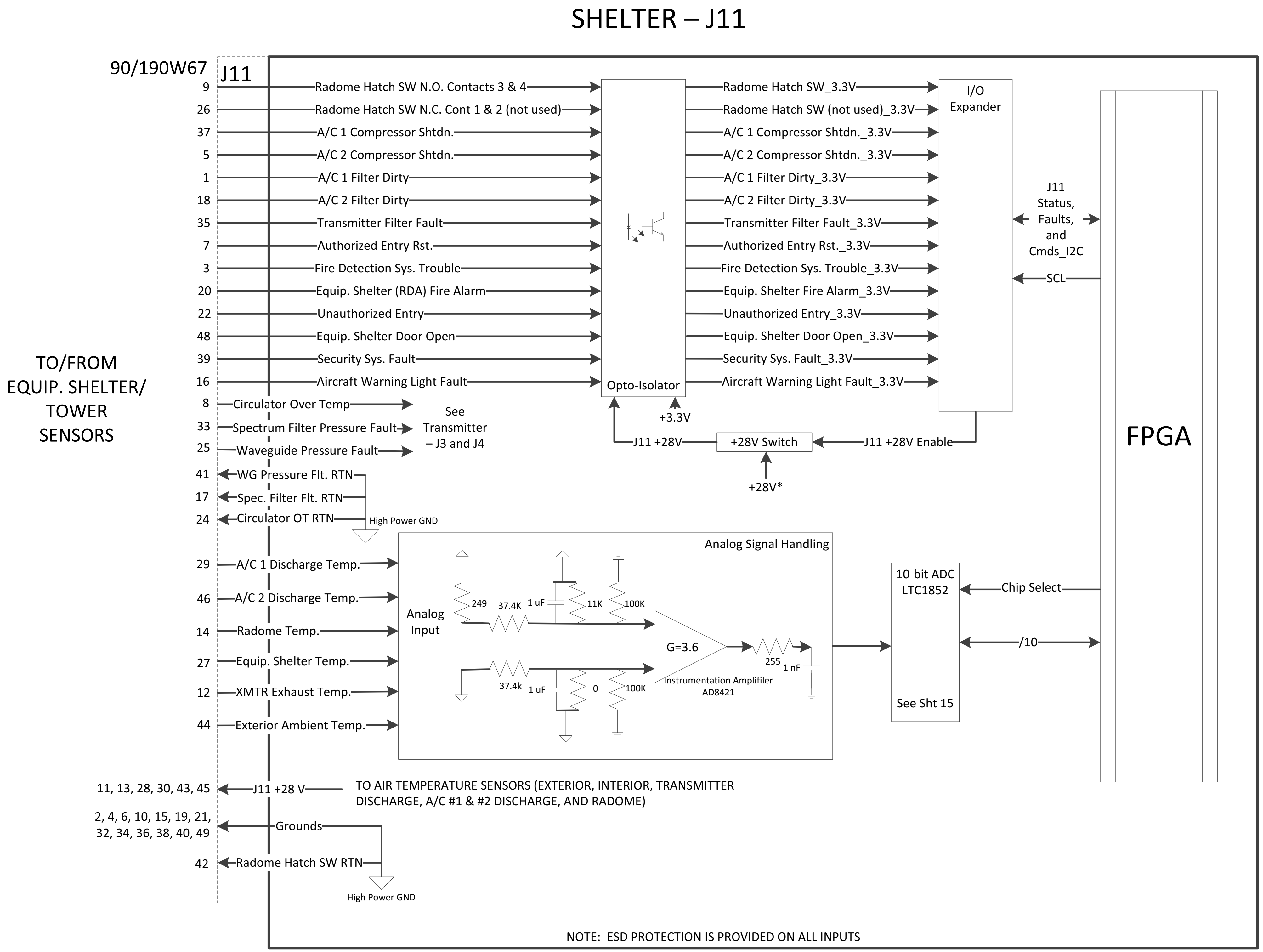


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 9 of 15)

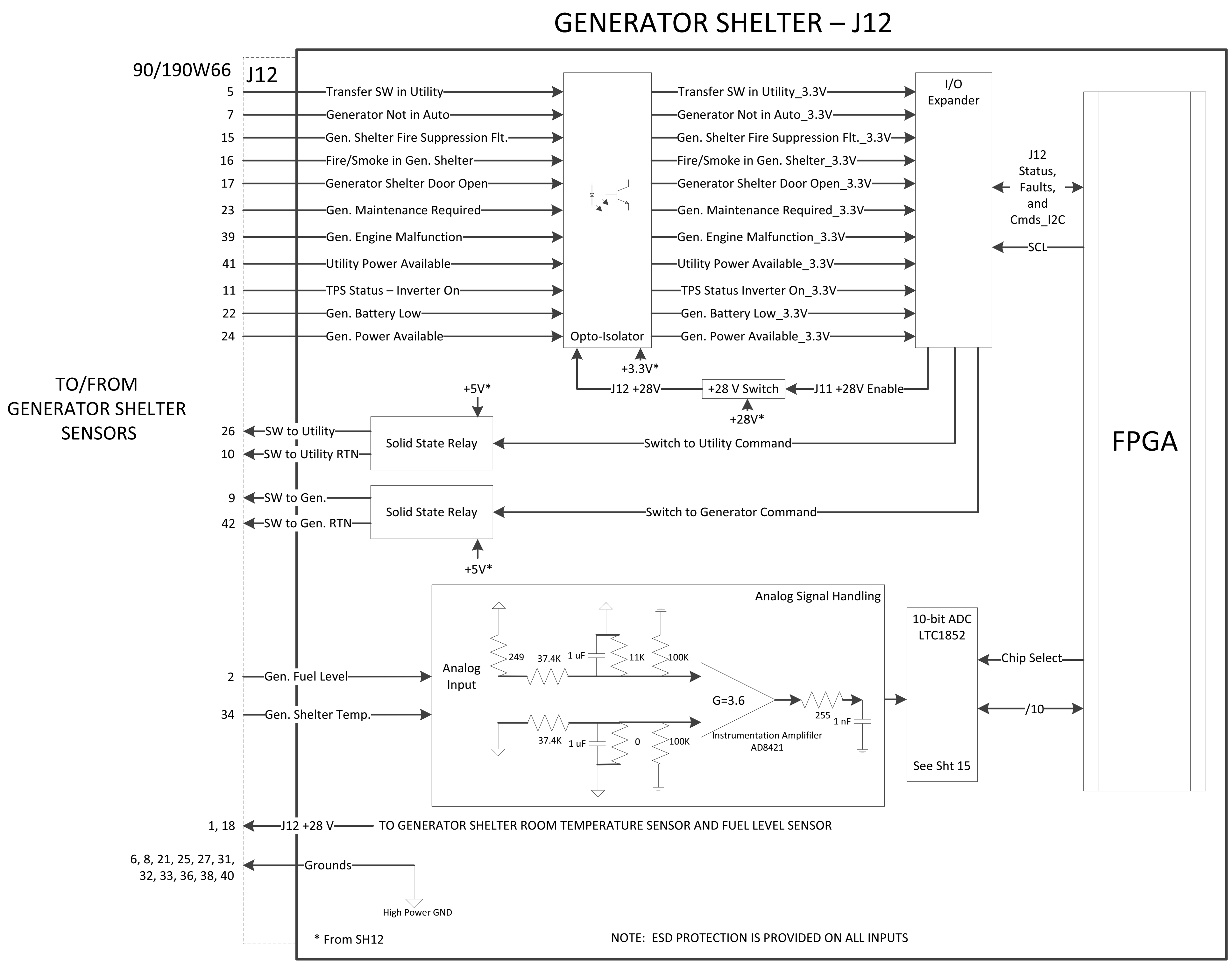


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 10 of 15)

REDUNDANT COMMS – J13 AND J14

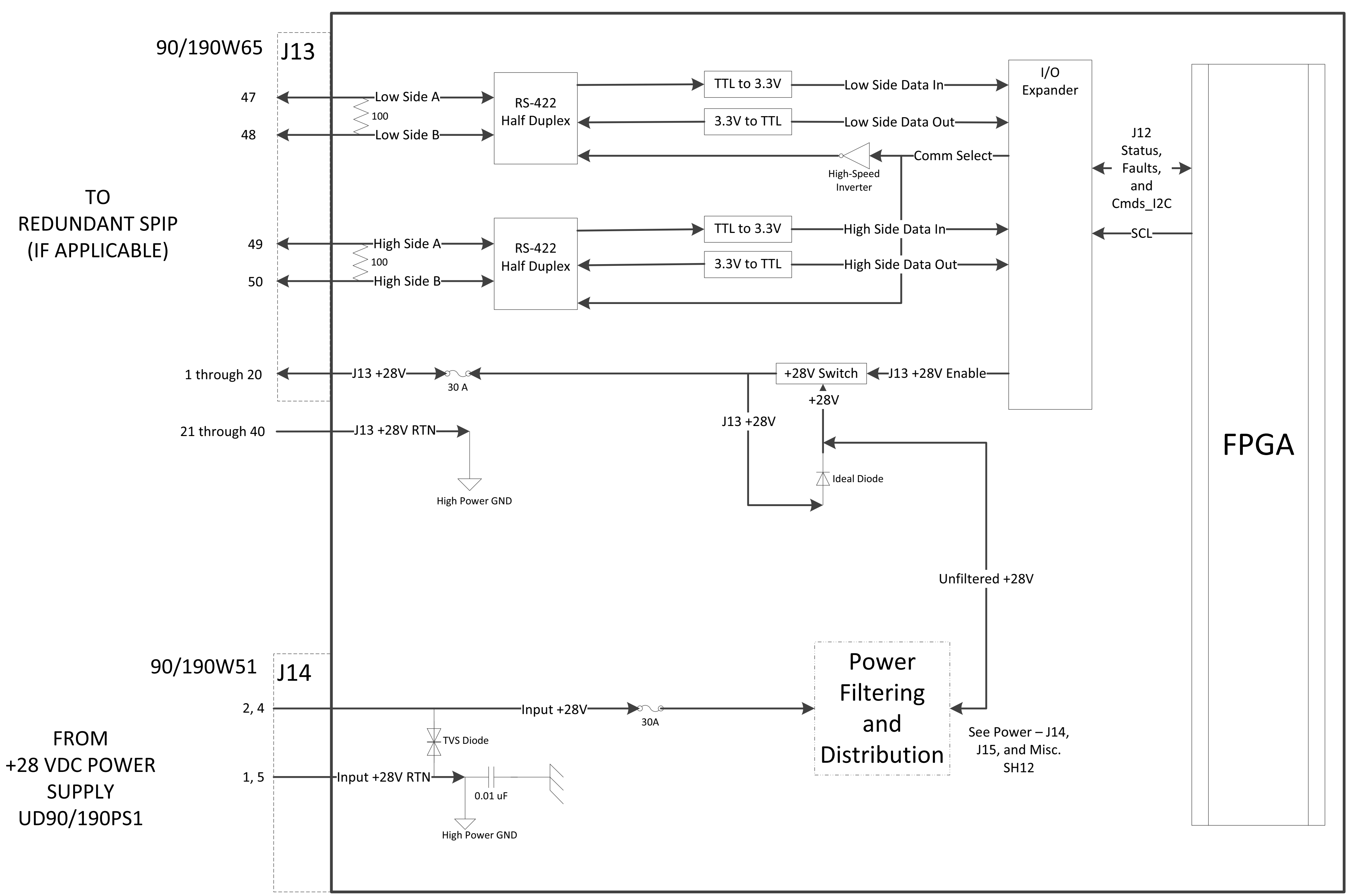


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 11 of 15)

POWER – J14, J15, AND MISCELLANEOUS

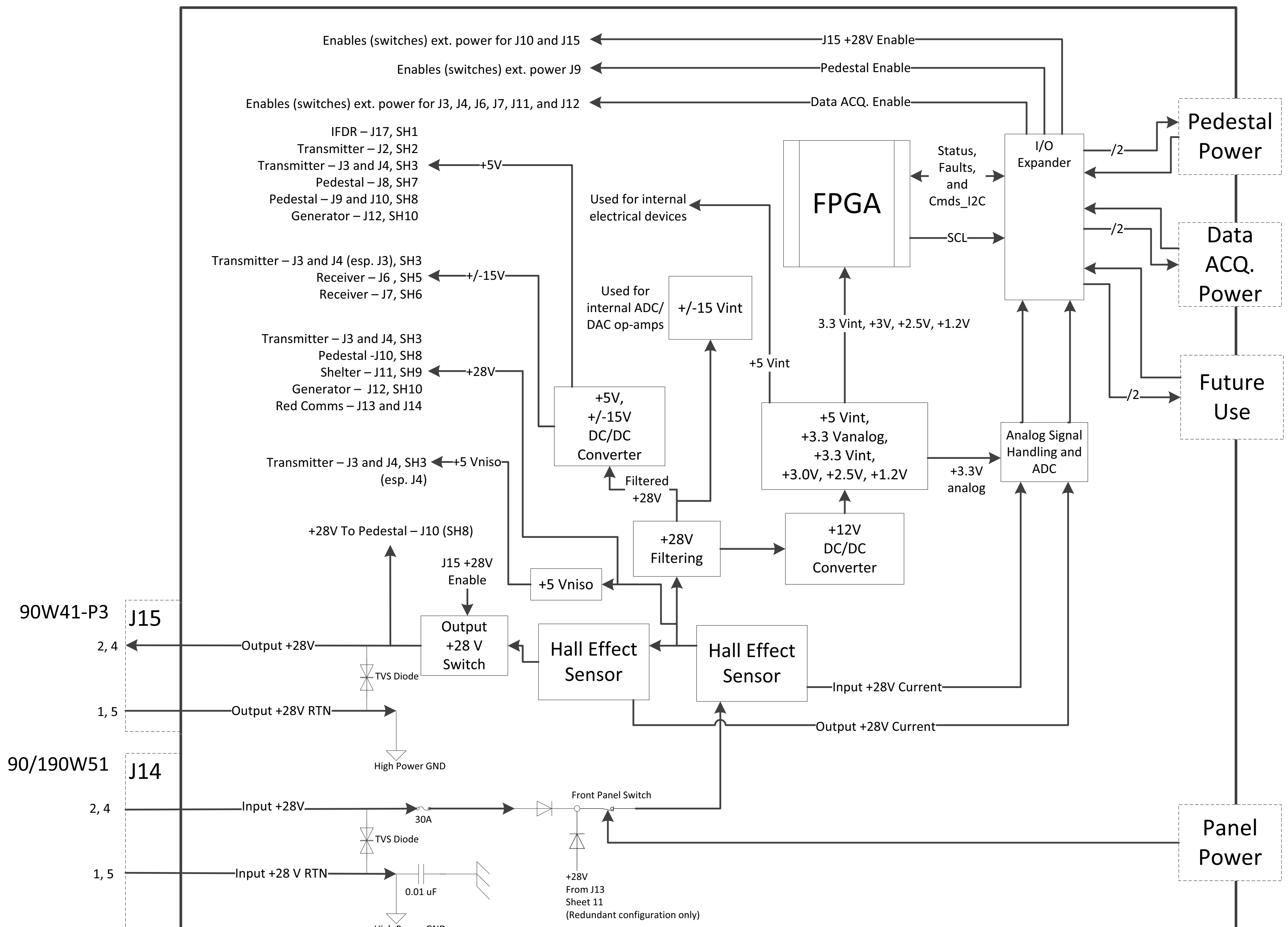


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 12 of 15)

DISPLAY AND INDICATORS

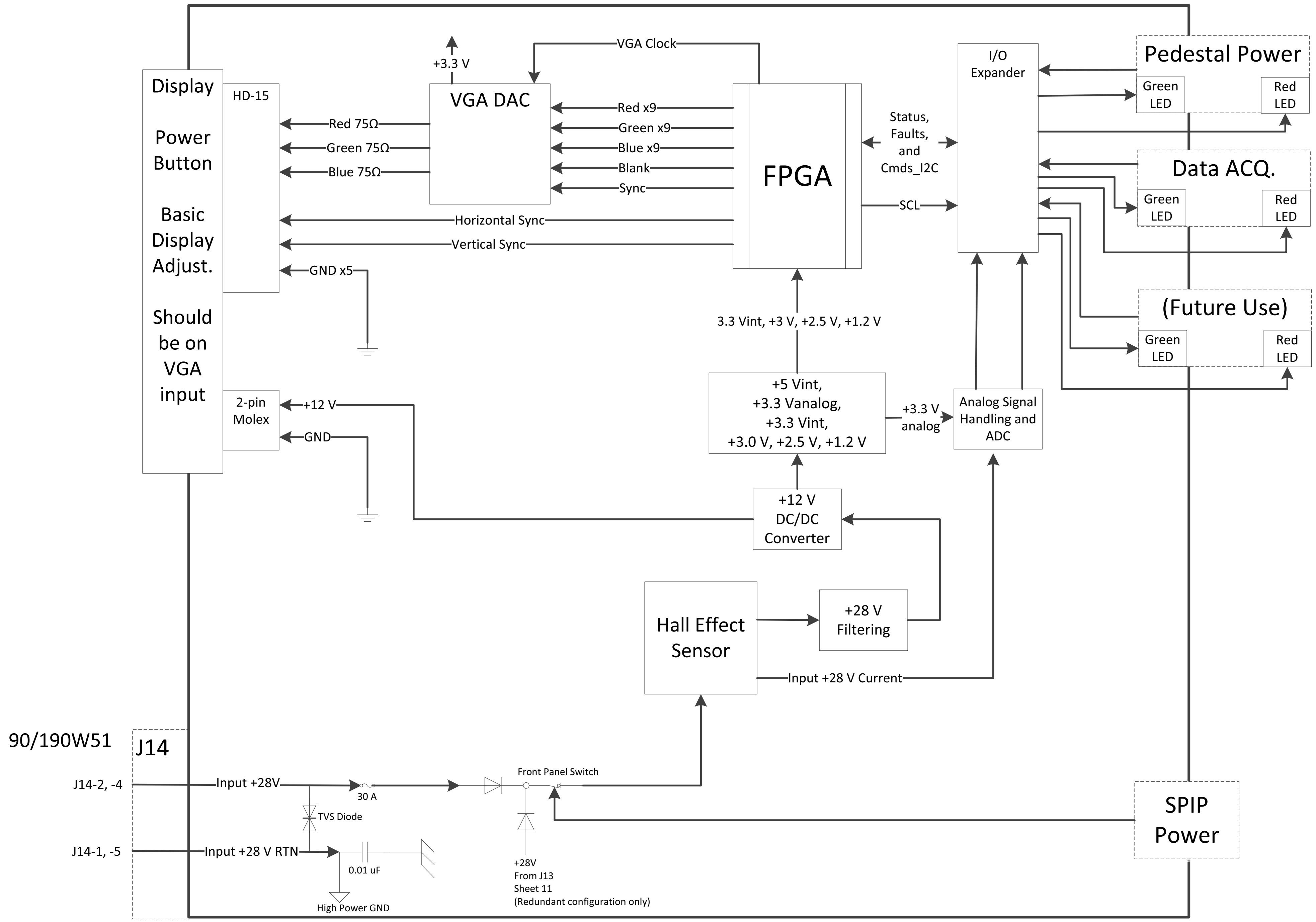


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 14 of 15)

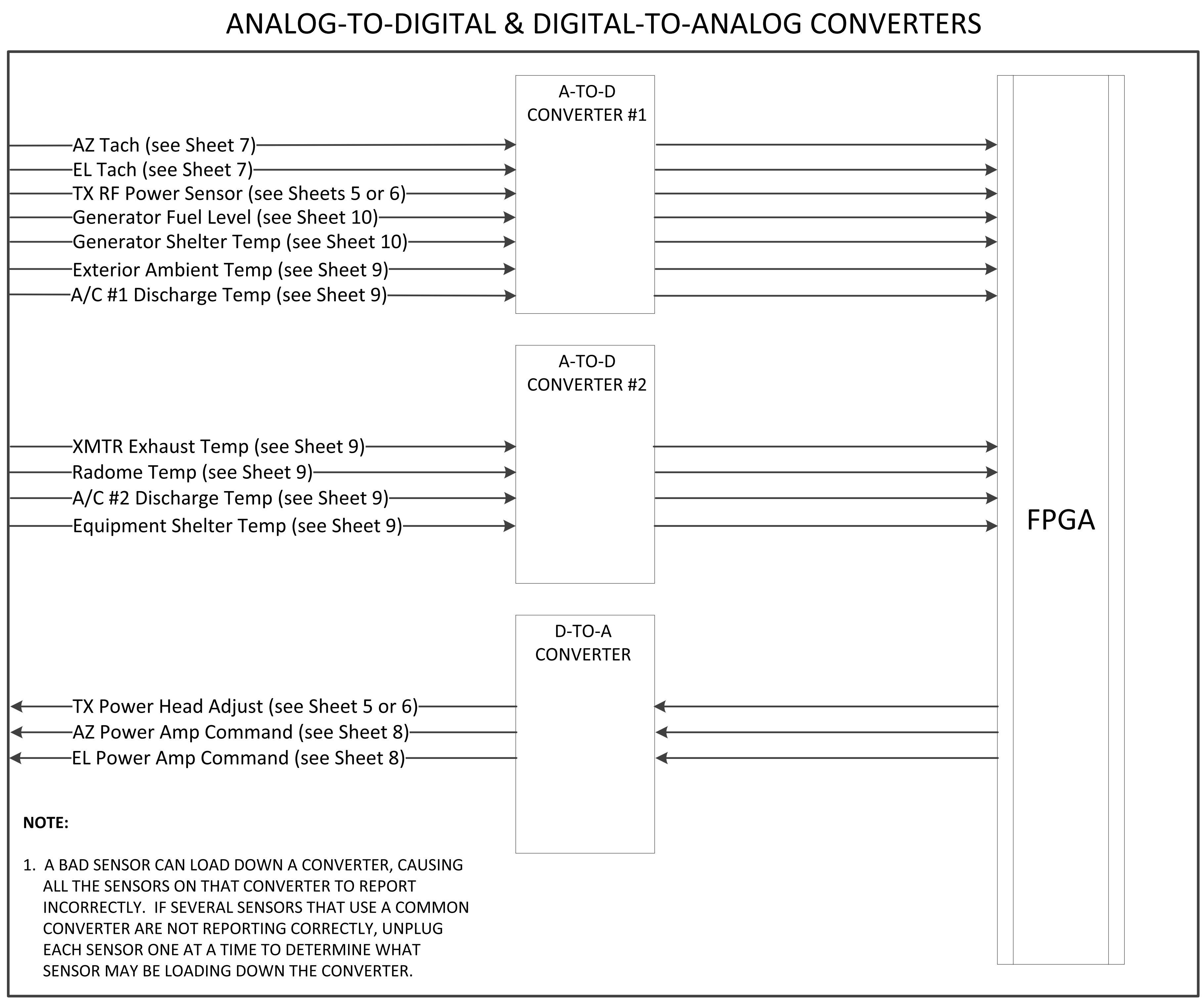


Figure FO5-9. Signal Processor Interface Panel Signal Flow Diagram (Sheet 15 of 15)

Pedestal Hardware

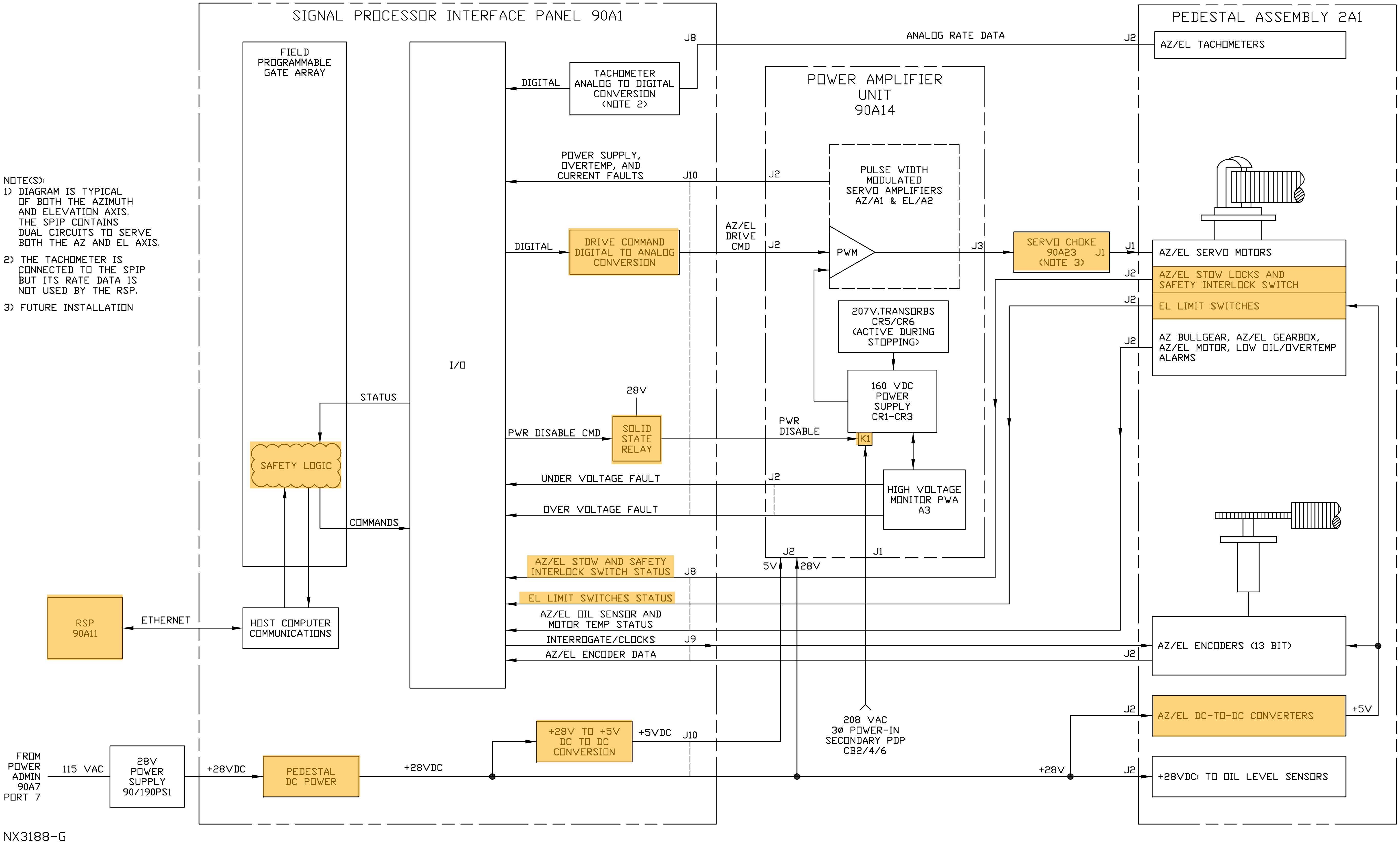


Figure 2-11. Pedestal System Functional Flow Diagram (Sheet 1 of 2)

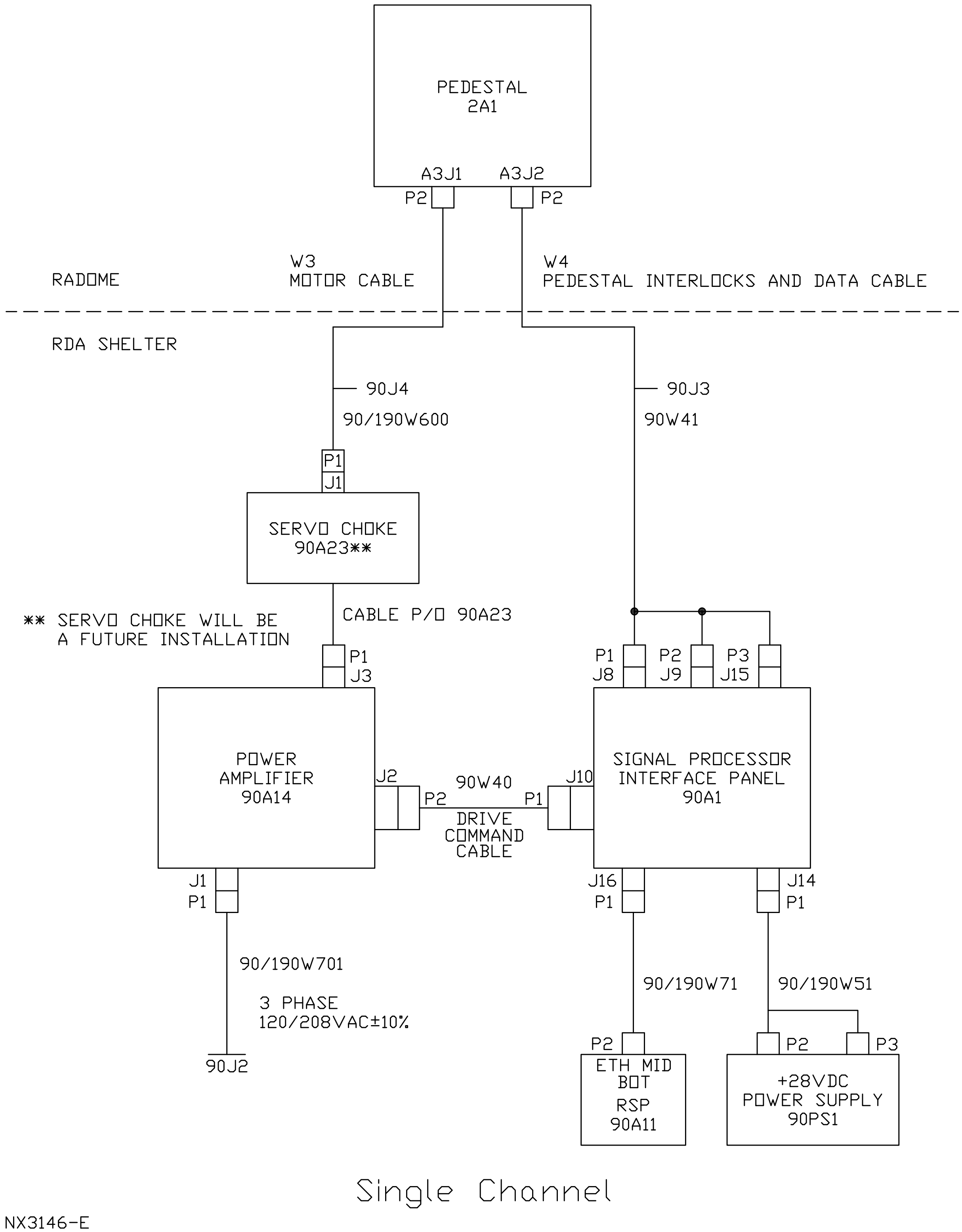


Figure 1-8. Pedestal System Interconnecting Diagram (Single Channel)

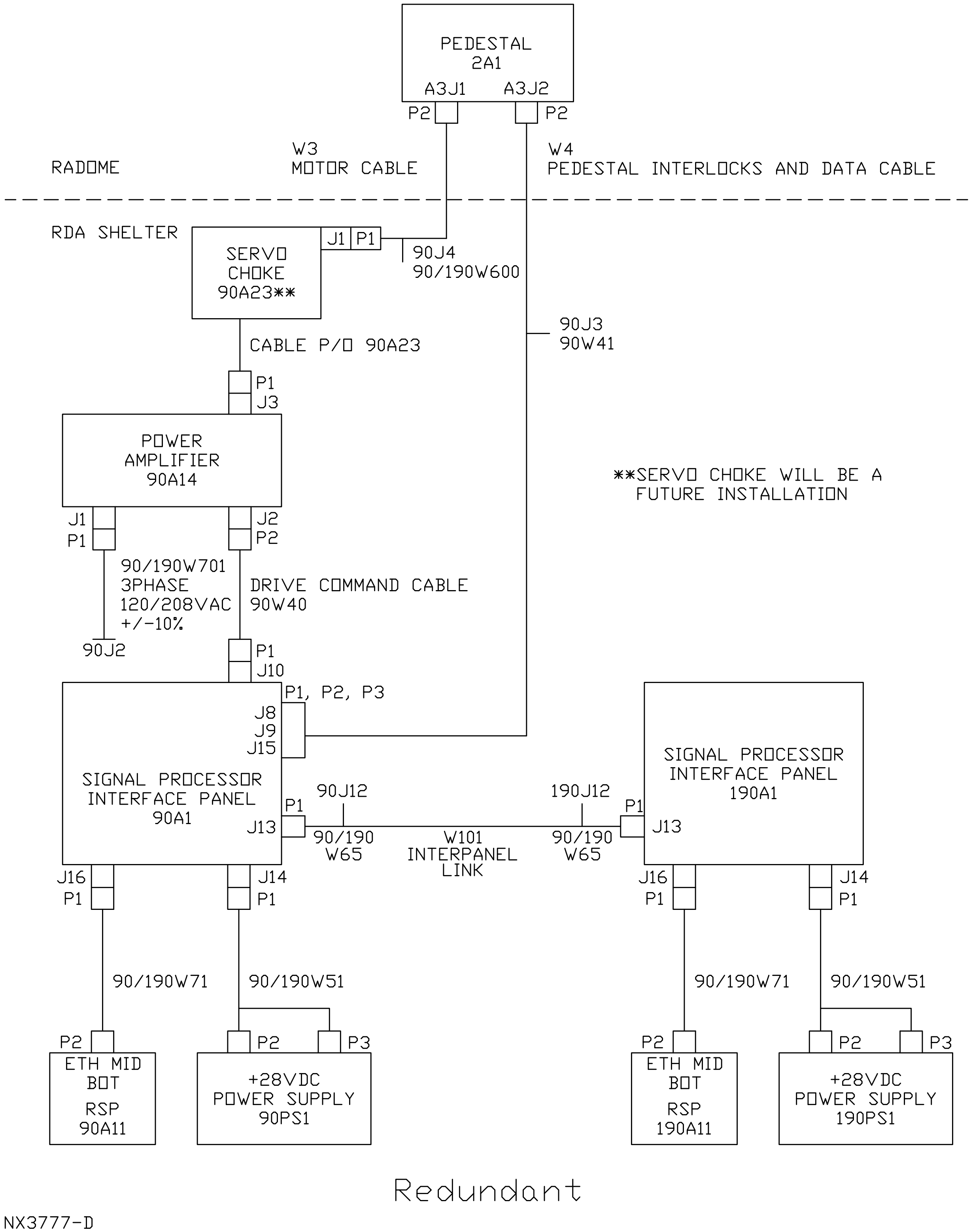


Figure 1-9. Pedestal System Interconnecting Diagram (Redundant Systems)

Pedestal functional flow

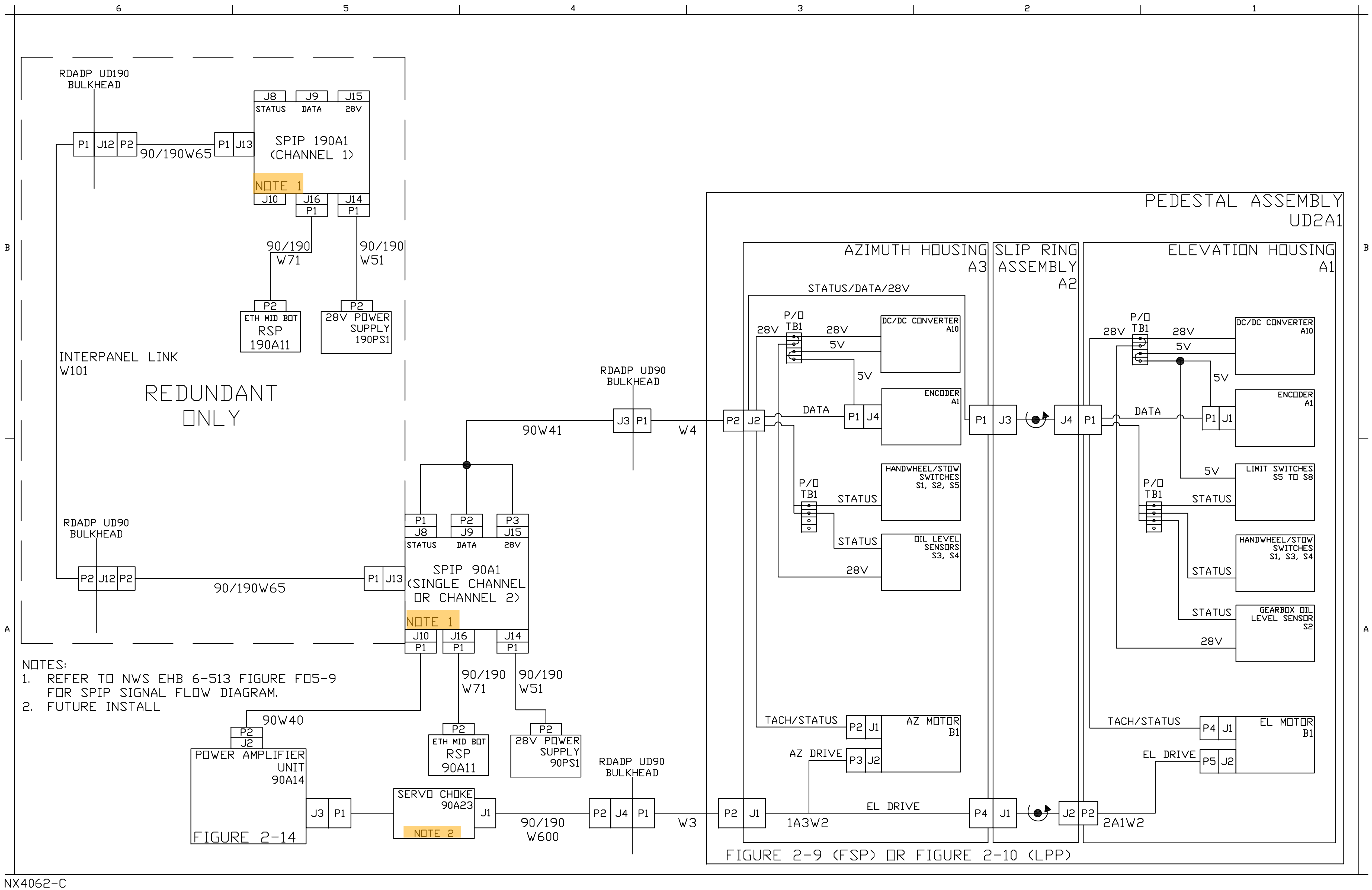


Figure 2-11. Pedestal System Functional Flow Diagram (Sheet 2 of 2)

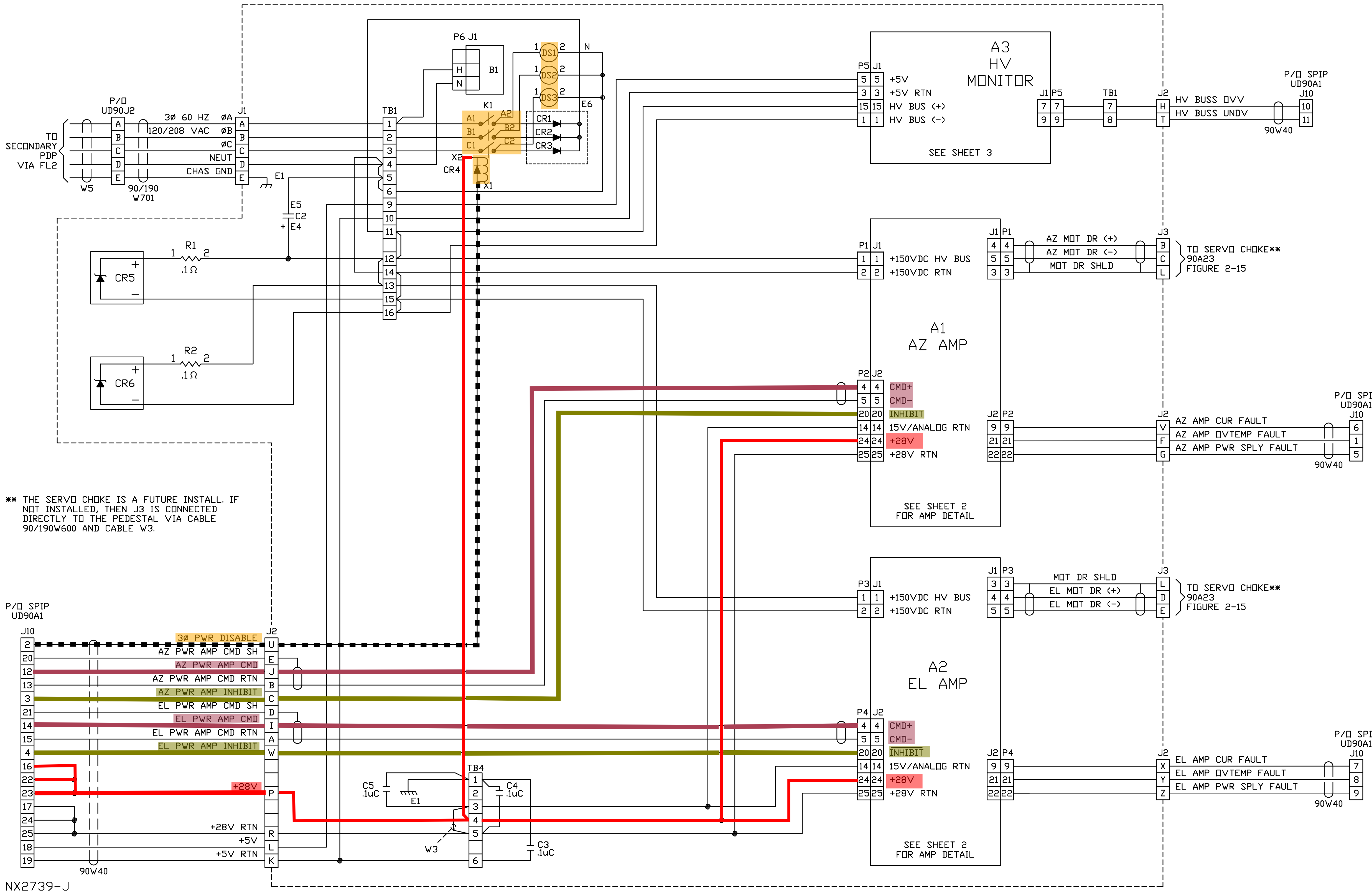
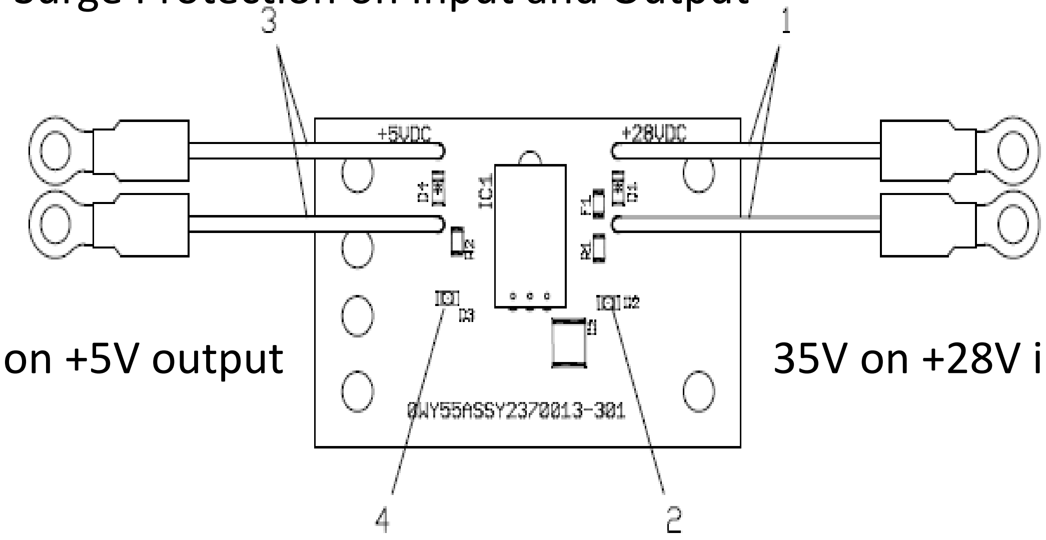


Figure 2-14. Power Amplifier Unit UD90A14 Interconnection Diagram (Sheet 1 of 3)

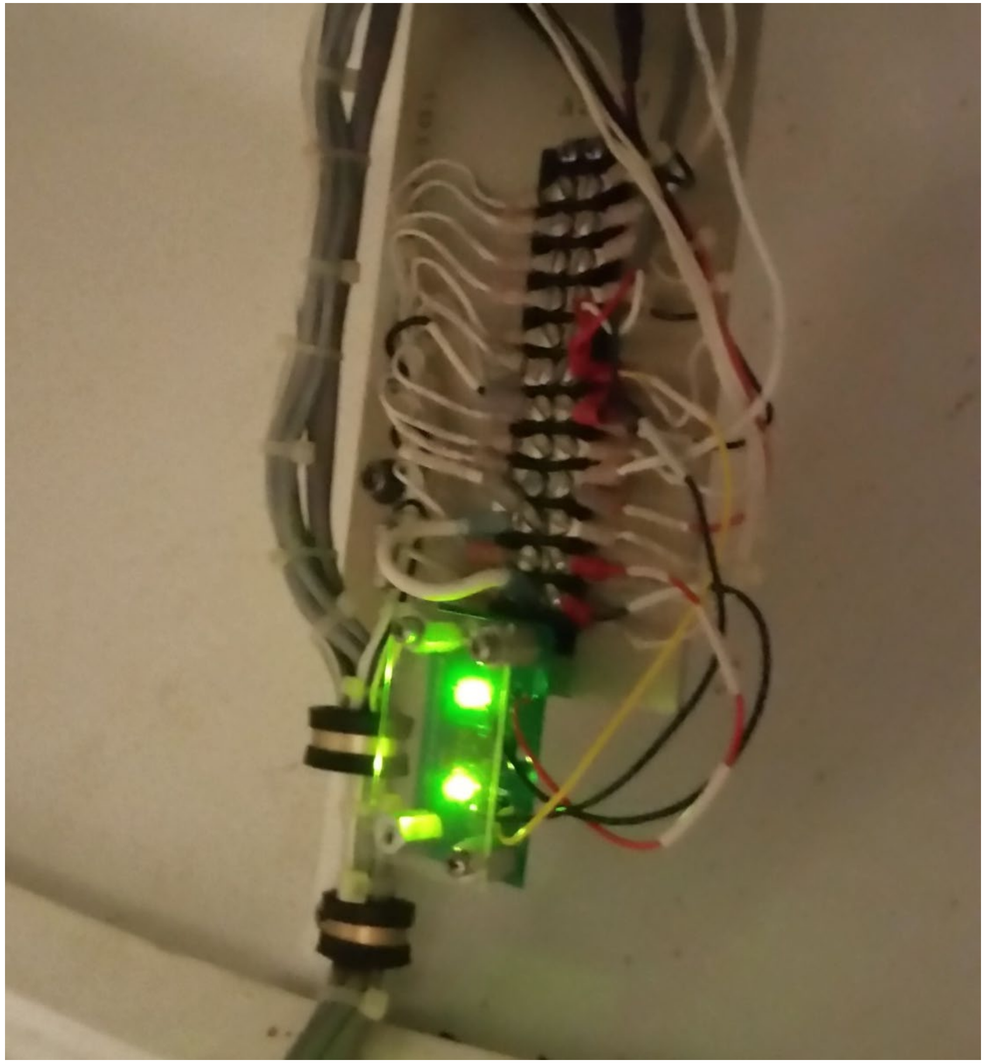
Encoder DC/DC Converter Board

- Converts 28V DC to 5V DC
- One in Azimuth housing, one in Elevation housing
- Provides 5V to Encoders and Limit Switches
- 2 green LED Lights for operation
- A sample of the encoder's 5V is sent back to the SPIP for status.
- Surge Protection on Input and Output



7V on +5V output

35V on +28V input



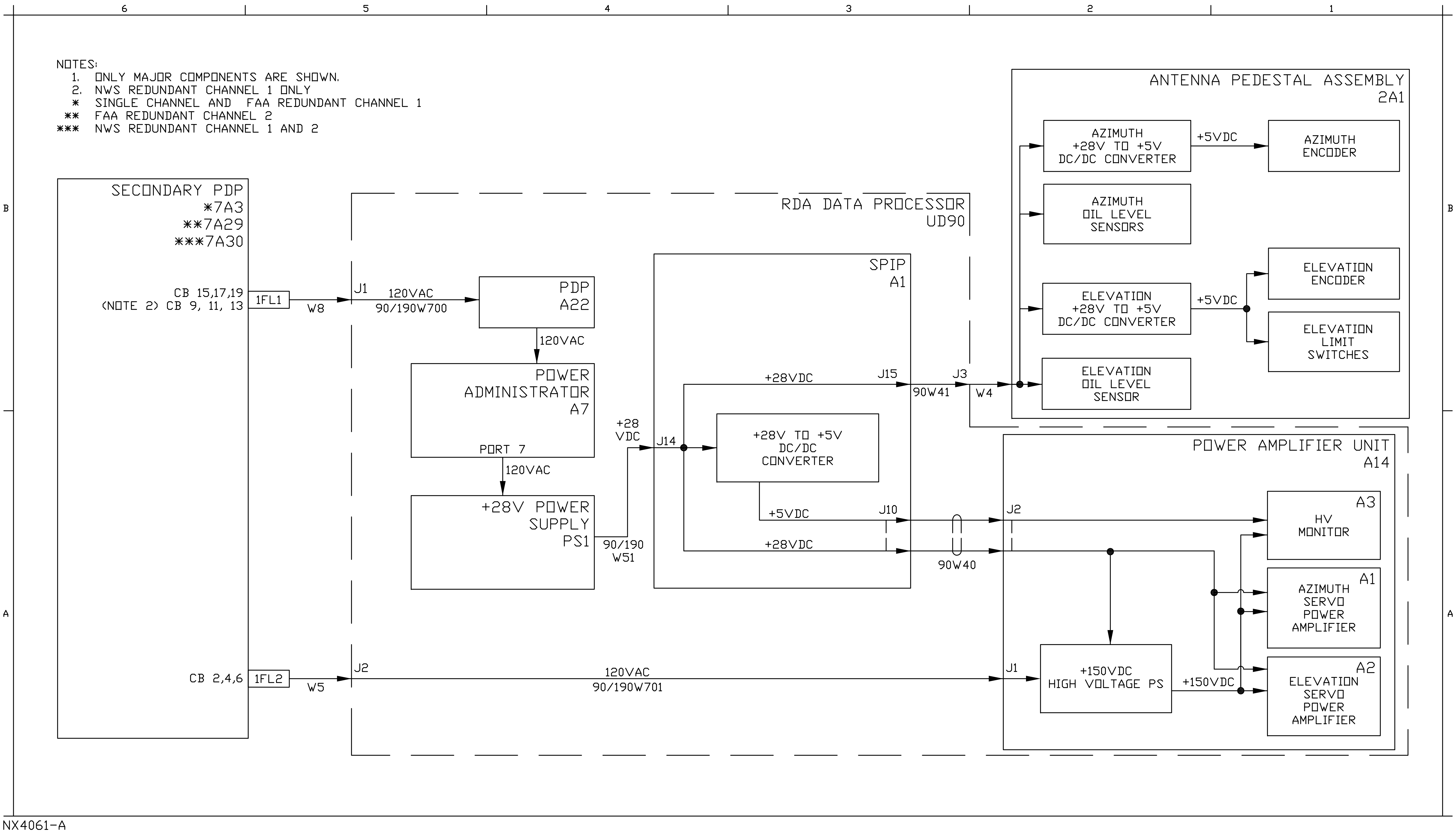
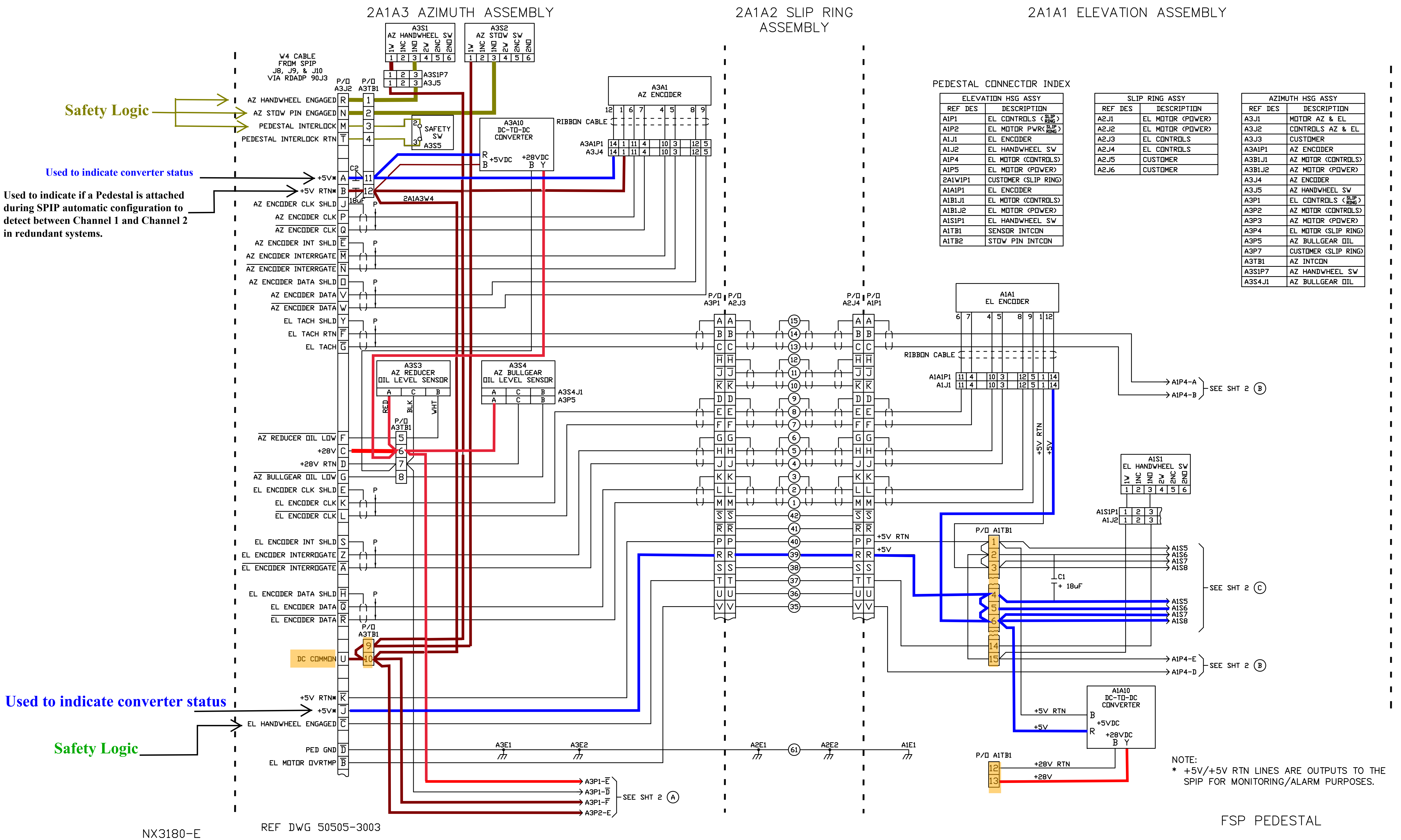


Figure 2-12. Pedestal Power Distribution Diagram



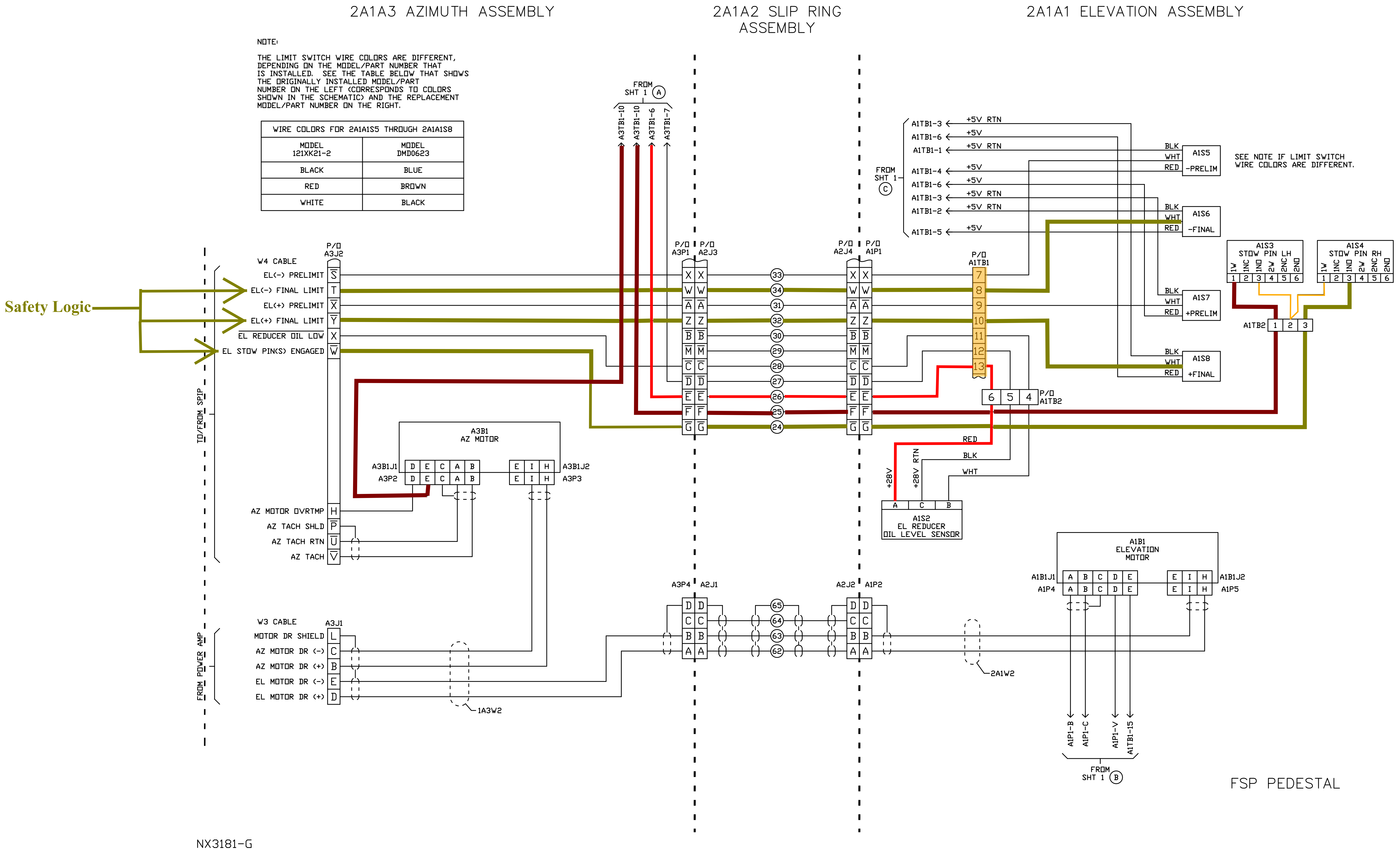
PEDESTAL CONNECTOR INDEX

ELEVATION HSG ASSY	
REF DES	DESCRIPTION
A1P1	EL CONTROLS (SLIP RING)
A1P2	EL MOTOR PWR(SLIP RING)
A1J1	EL ENCODER
A1J2	EL HANDWHEEL SW
A1P4	EL MOTOR (CONTROLS)
A1P5	EL MOTOR (POWER)
2A1W1P1	CUSTOMER (SLIP RING)
A1A1P1	EL ENCODER
A1B1J1	EL MOTOR (CONTROLS)
A1B1J2	EL MOTOR (POWER)
A1S1P1	EL HANDWHEEL SW
A1TB1	SENSOR INTCON
A1TB2	STOW PIN INTCON

SLIP RING ASSY	
REF DES	DESCRIPTION
A2J1	EL MOTOR (POWER)
A2J2	EL MOTOR (POWER)
A2J3	EL CONTROLS
A2J4	EL CONTROLS
A2J5	CUSTOMER
A2J6	CUSTOMER

AZIMUTH HSG ASSY	
REF DES	DESCRIPTION
A3J1	MOTOR AZ & EL
A3J2	CONTROLS AZ & EL
A3J3	CUSTOMER
A3A1P1	AZ ENCODER
A3B1J1	AZ MOTOR (CONTROLS)
A3B1J2	AZ MOTOR (POWER)
A3J4	AZ ENCODER
A3J5	AZ HANDWHEEL SW
A3P1	EL CONTROLS (SLIP RING)
A3P2	AZ MOTOR (CONTROLS)
A3P3	AZ MOTOR (POWER)
A3P4	EL MOTOR (SLIP RING)
A3P5	AZ BULLGEAR OIL
A3P7	CUSTOMER (SLIP RING)
A3TB1	AZ INTCON
A3S1P7	AZ HANDWHEEL SW
A3S4J1	AZ BULLGEAR OIL

Figure 2-9. Schematic Diagram, Pedestal Assembly (FSP) (Sheet 1 of 3)



NOTE:

THE LIMIT SWITCH WIRE COLORS ARE DIFFERENT, DEPENDING ON THE MODEL/PART NUMBER THAT IS INSTALLED. SEE THE TABLE BELOW THAT SHOWS THE ORIGINALLY INSTALLED MODEL/PART NUMBER ON THE LEFT (CORRESPONDS TO COLORS SHOWN IN THE SCHEMATIC) AND THE REPLACEMENT MODEL/PART NUMBER ON THE RIGHT.

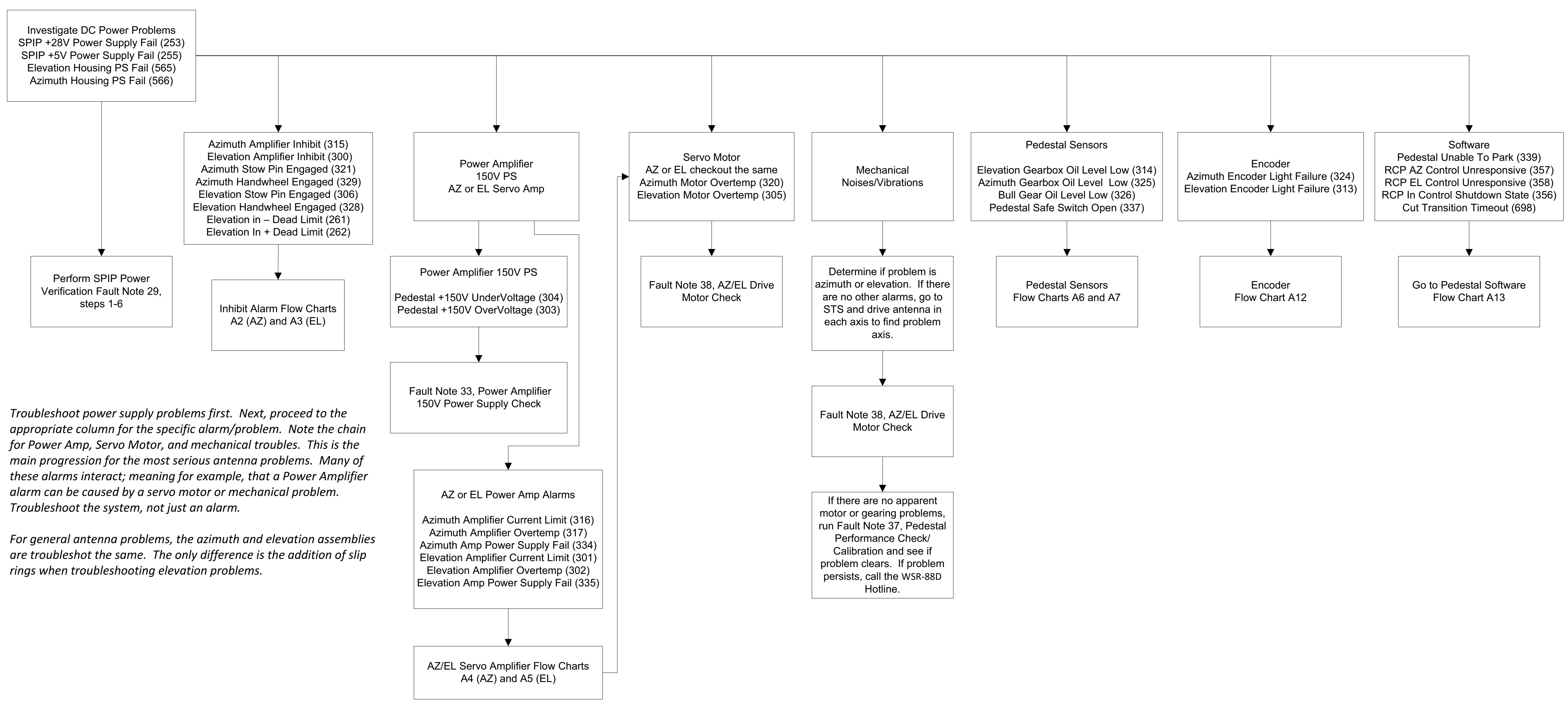
WIRE COLORS FOR 2A1A1S5 THROUGH 2A1A1S8	
MODEL 121XK21-2	MODEL DMD0623
BLACK	BLUE
RED	BROWN
WHITE	BLACK

Figure 2-9. Schematic Diagram, Pedestal Assembly (FSP) (Sheet 2 of 3)

Antenna Troubleshooting Order Of Precedence

Note:

This flowchart provides a fundamental order in which various Antenna Alarms and faults should be resolved. Most alarms have basic troubleshooting in Alarm Table 6-2 (Ped Alarms). Many antenna problems have multiple alarms associated with them, often alarms that appear unassociated with the primary cause. Several antenna problems do not have associated alarms; those symptoms are noted where appropriate.



Troubleshoot power supply problems first. Next, proceed to the appropriate column for the specific alarm/problem. Note the chain for Power Amp, Servo Motor, and mechanical troubles. This is the main progression for the most serious antenna problems. Many of these alarms interact; meaning for example, that a Power Amplifier alarm can be caused by a servo motor or mechanical problem. Troubleshoot the system, not just an alarm.

For general antenna problems, the azimuth and elevation assemblies are troubleshot the same. The only difference is the addition of slip rings when troubleshooting elevation problems.

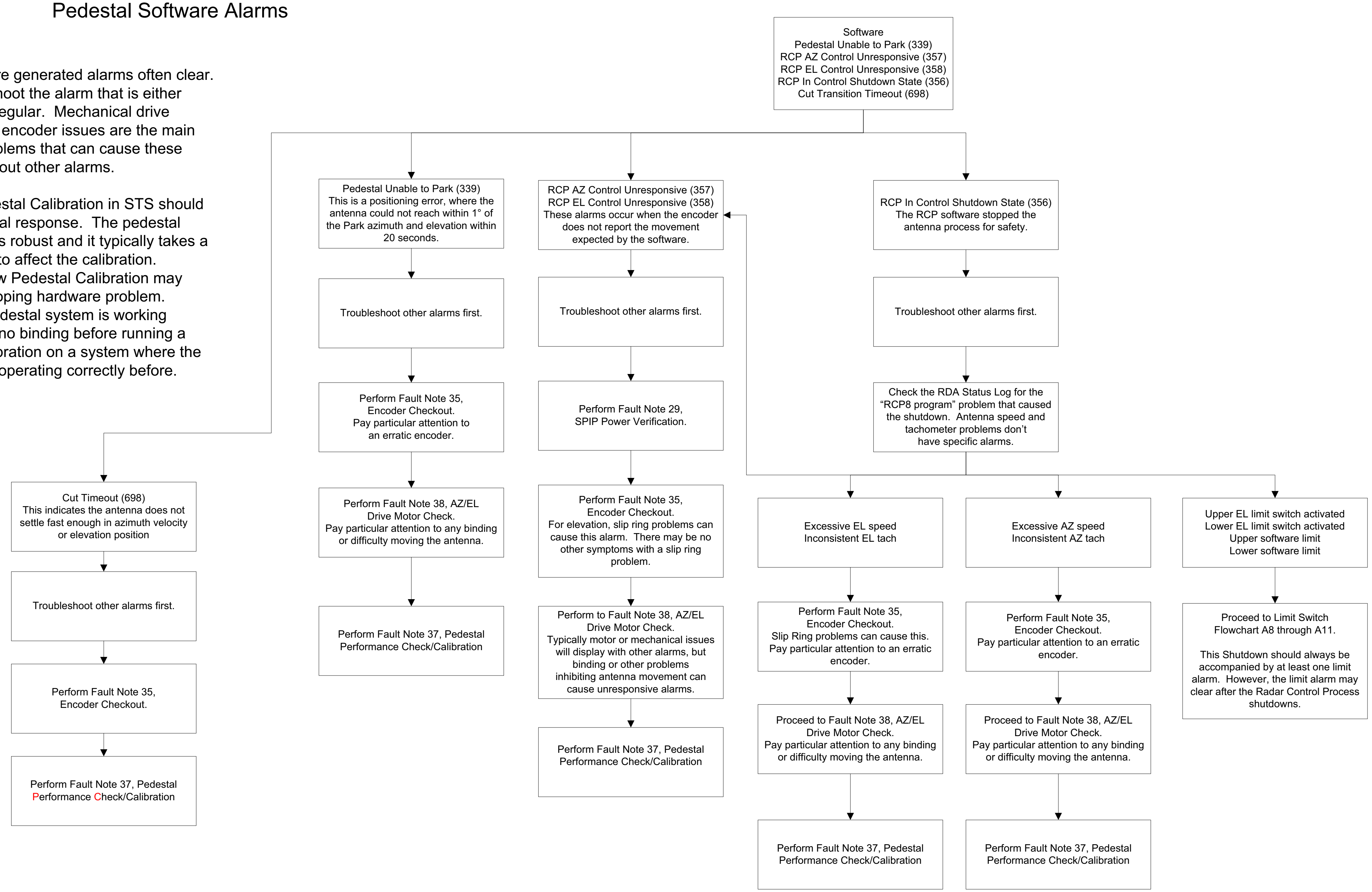
A1

Figure FO6-2. Antenna Fault Isolation Flowchart (Sheet 1 of 13)

Pedestal Software Alarms

These software generated alarms often clear. Only troubleshoot the alarm that is either persistent or regular. Mechanical drive problems and encoder issues are the main hardware problems that can cause these problems without other alarms.

Running Pedestal Calibration in STS should not be a normal response. The pedestal drive system is robust and it typically takes a large change to affect the calibration. Running a new Pedestal Calibration may mask a developing hardware problem. Ensure the pedestal system is working correctly with no binding before running a Pedestal Calibration on a system where the pedestal was operating correctly before.



A13

Figure FO6-2. Antenna Fault Isolation Flowchart (Sheet 13 of 13)

㊲	PEDESTAL PERFORMANCE CHECK/CALIBRATION
Step	**Operator Action**
1	At the Main RDA HCI, place the system in Standby. `Standby` displays in the `State:` field. **NOTE** At NWS sites, the following task requires coordination with personnel at the WFO. DoD and FAA sites can perform this task at the RPG inside RDA shelter. Disabling AVSET when testing the pedestal calibration will ensure a full VCP will run.
2	If AVSET is already disabled, skip to step 3, otherwise, complete this step. At the MSCF or RPG HCI, disable AVSET by clicking on the **AVSET Enable** button, and then click **Yes** at the `Warning Popup` window.
3	Perform the following steps at the Main RDA HCI to assess azimuth or elevation drive performance: a. Click on the **System Test Software** button. Then click **Yes** on the `Confirm Maintenance Mode` pop-up window. The `System Test Software` window opens. b. On the menu bar of the `System Test Software` window, click **Diagnostics ▸ Pedestal...** to open the `Pedestal Diagnostics` window. c. In the `Pedestal Diagnostics` window, click **None**, select **4** (Velocity/Acceleration Test), and then click **Run**. Note any errors. d. In the `Pedestal Diagnostics` window, click **Close**. e. Close the `System Test Software` window by clicking **File** then **Exit** and **Yes** to confirm. Click **OK** on the `Elapsed Time` pop-up window. f. At the Main RDA HCI Command Menu Bar, select **RDA ▸ Select Local VCP** to open the `Select Local VCP` window. g. In the `Select Local VCP` window, select **Precipitation - 12**, then click **Apply** and **Yes** to confirm. Close the window.

h. At the Main RDA HCI Command Menu Bar, select **RDA ▸ Operate State** to place the radar into operate mode.

NOTE

If pedestal performance appears to operate normally after a major antenna drive component replacement, then a pedestal calibration is not advised. Carefully observe the radar for antenna drive related alarms such as Elevation limit alarms and Radial Data Lost alarms. These alarms indicate the antenna movements are not indicative with the commands from the RSP, in which case, a pedestal calibration may be required.

i. Observe the radar for at least one VCP, including retrace to the next VCP, and look for abnormal pedestal functions such as:

On the HCI:
At the Elevation angle display field (i.e., EL: 0.88/0.88), compare the actual elevation angle to the commanded elevation angle. Look for dithering (seen as actual angle values oscillating above and below the commanded angle) or any other discrepancy. A brief overshoot is acceptable when transitioning between elevation angles.

Alarms:
CUT TRANSITION TIMEOUT (698)
ELEVATION - NORMAL LIMIT (311)
ELEVATION + NORMAL LIMIT (310)
RADIAL DATA LOST (396)

In the RDA Status Log:
Pedestal elevation position error
Azimuth rate fault

These are not alarms, but the condition can cause RCP AZ CONTROL UNRESPONSIVE (357) or RCP EL CONTROL UNRESPONSIVE (358) alarms, or even the RCP IN CONTROL SHUTDOWN STATE (356) alarm.

j. If the radar is operating normally in VCP 12, then return the radar to normal operation per step 3. If any related alarms or anomalies occurred during the Pedestal Diagnostics (step 3c) or Local VCP operations (step 3i), then perform a Pedestal Calibration in the appropriate azimuth or elevation axis per step 4.

4	Perform the following steps at the Main RDA HCI to perform a pedestal calibration routine: **CAUTION** Use caution when performing a pedestal calibration routine. Calibrating a normally functioning pedestal drive system may introduce calibration errors. If pedestal performance appears to operate normally after a major antenna drive component replacement, then a pedestal calibration is not advised. a. At the Main RDA HCI Command Bar, select **RDA ▸ Standby State** to place the radar into standby mode. b. Before performing the Pedestal Calibration, make a backup of adaptation data to the removable hard drive per Table 4-48, steps 2 thru 4 and 12 thru 15 in case the original pedestal calibration adaptation data values (a036 through a052) need to be restored after updating adaptation data with the new Pedestal Calibration values (step f). c. Click on the **System Test Software** button. Then click **Yes** on the `Confirm Maintenance Mode` pop-up window. The `System Test Software` window opens. d. On the menu bar of the `System Test Software` window, click **Calibration ▸ Pedestal Calibration** to open the `Pedestal Calibration` window. e. At the `Pedestal Calibration` window, perform the following steps: **NOTES** It is not necessary to always run all subtests. For example, if assessing issues with an elevation Cut Transition Timeout (Alarm 698), only run the Elevation Axis subtest. The Moment of Inertia subtest is rarely selected and is used for when major components on the antenna are changed or if there are repeated instances of Excessive Velocity alarms in azimuth or elevation.

NOTES - Continued

Pedestal Calibration should only be started from baseline adaptation data for specific troubleshooting. It should **not** be started from baseline every time Pedestal Calibration is executed or it will hinder the tuning process. For example, if Pedestal Calibration was performed with failing hardware that generated higher than normal values, it may need to start from baseline after the hardware issues are corrected. If hardware failed but the Pedestal Calibration values were not updated with the failing hardware, do not select to start from baseline adaptation data.

If Pedestal Calibration is started from baseline adaptation data, a second Pedestal Calibration may need to be started with the `Start from Baseline Adaptation Data` box unchecked.

(1) Select the applicable subtest(s).

(2) Click **Run**. After approximately 10 to 20 minutes, the calibration routine completes and will display the current and new results in a `Pedestal Calibration Results` window.

f. In the `Pedestal Calibration Results` window, review the data in the Current and New columns. If specific values are within certain ranges as listed in Table 1, click the **Update Adaptation Data** button. Then click **Yes** at the `Please Confirm` pop-up window.

This updates the Adaptation Data related to Pedestal Calibration, a036 through a052, with new values from the selected subtest(s). Key parameters outside of the normal range indicate that hardware assessment is needed. Running Pedestal Calibration again (or the specific subtest) can help confirm repeatable response from hardware motion.

NOTE

As shown in Table 1, each parameter type fits within a general range on a healthy system. Hardware issues can/may cause these specific parameters to be outside of the general ranges. The other parameters not shown (i.e., Elevation Interval Slopes [a046 through a048), Elevation Droop Angle (a049), Azimuth/Elevation Moment of Inertia (a051/a052)] have less critical ranges in terms of assessing potential hardware issues.

Table 1. Pedestal Calibration Adaptation Data General Ranges

Azimuth Parameter Type	Adaptation Data Numbers	Expected Range
Positive and Negative Sustaining Drives	a036/a037	Between -5.0 and +5.0
Positive and Negative Drive Slopes	a038/a039	Between 0.100 and 1.000
Velocity Feedback Slope	a040	Between 3.000 and 7.000
Elevation Parameter Type	**Adaptation Data Numbers**	**Expected Range**
Positive and Negative Sustaining Drives	a041/a042	Between -5.0 and +5.0
Positive and Negative Drive Slopes	a043/a044	Between 0.100 and 1.000
Velocity Feedback Slope	a045	Between 1.500 and 6.000
Droop Drive	a050	Between 0.00 and 5.50

g. In the `Pedestal Calibration` window, click **Close**.

h. Close `System Test Software` window by clicking **File** then **Exit** and **Yes** to confirm. Click **OK** on the `Elapsed Time` pop-up window. At the Main RDA HCI Command Menu Bar, click **RDA ▸ Restart RDASC**, then click **Yes** to confirm.

i. Login to the Main RDA HCI: Click **Log In**, then click **Yes** in the `Warning` window, then enter *username* and *password*.

j. At the Main RDA HCI Command Menu Bar, select **RDA ▸ Request Control**.

k. Repeat step 3 to reassess azimuth or elevation drive performance.

l. Create a backup CD and backup to the removable drive per Table 4-48.

m. At redundant sites, transfer the updated adaptation data values (a036 through a052) to the other channel by performing the following steps:

(1) At the RDA HCI Command Menu Bar, click on **Channel**.

(2) In the `Channel` menu, click on **Sync Pedcal/Suncheck Data**.

(3) In the `Confirm Pedcal/Suncheck Data Sync` pop-up window, click **Yes**.

	(4) The new values are automatically applied to adaptation data, so it is not necessary to use the Restart RDASC command. n. At redundant sites, create a backup CD and backup to the removable drive for the other channel per Table 4-48.
5	Return to normal operations.
㊳	**AZ/EL DRIVE MOTOR CHECK**
	This procedure checks the Azimuth and Elevation drive motors for proper operation. The AZ/EL drive motors receive up to 4 kW peak electrical power per axis to provide precise positioning of the antenna. A Digital Voltmeter is required to perform these procedures.
Step	**Operator Action**
1	At the Main RDA HCI Command Menu Bar, click **RDA ►Standby State**. `Standby` displays in the `State:` field.
2	At SPIP 90A1, press the Panel Power button to **OFF**. The panel LED's and display turn off.
3	In the RDA shelter, at the applicable Secondary PDP (7A3 Single Channel; 7A29/CP-2 FAA Systems; or 7A30 NWS Redundant Systems), set circuit breaker CB2, 4, 6 (ganged) PEDESTAL MOTOR POWER to **OFF**. Use Panduit part number PSL-CB circuit breaker lockout device.
4	Disconnect cable 90/190W600P1 from Power Amplifier Unit 90A14J3.
5	**AZ/EL Motor Resistance Checks (RDA SHELTER)** a. Measure resistance on the P1 end of cable of 90/190W600 using Table 1 below:

Table 1

Measurement	Azimuth	Elevation	Expected Result
Drive Windings	Pin B to Pin C	Pin D to Pin E	Normal: 0 - 10 Ohms (short)
Winding to Case	Pin B to Pin L	Pin D to Pin L	Normal: >5 Meg Ohms or open (OL)
Winding to Case	Pin C to Pin L	Pin E to Pin L	Normal: >5 Meg Ohms or open (OL)

8.3.3.2.1 Subtest 1: LAN Switch. This subtest checks the communication of the RSP with the LAN Switch.

8.3.3.2.2 Subtest 2: Router. This subtest checks the communication of the RSP with the Router.

8.3.3.2.3 Subtest 3: GPS. This subtest checks the communication of the RSP with the GPS.

8.3.3.2.4 Subtest 4: Console Server. This subtest checks the communication of the RSP with the Console Server.

8.3.3.2.5 Subtest 5: Channel Communications. This subtest is only available on a redundant system. It checks the communication of the RSP with the other channel's LAN Switch and RSP.

8.3.3.3 Power Diagnostics. The `Power Diagnostics` window (see Figure 8-20) is used to run subtests that check the power subsystem in the RDA cabinets.

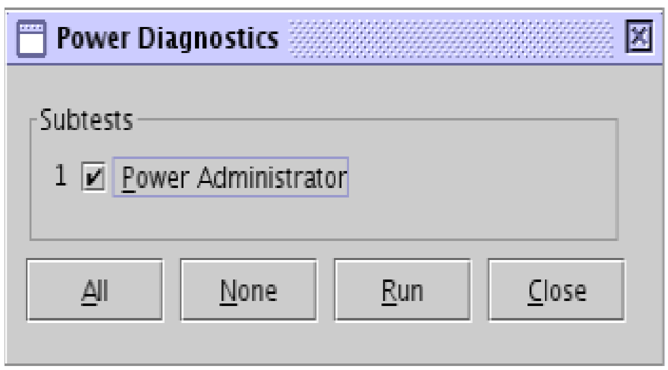


Figure 8-20. Power Diagnostics Window

8.3.3.3.1 Subtest 1: Power Administrator. This subtest checks the communication between the RSP and the Power Administrator. It also receives data on the Power Administrator status.

8.3.3.4 Pedestal Diagnostics. The `Pedestal Diagnostics` window (see Figure 8-21) is used to run subtests that test the pedestal status.

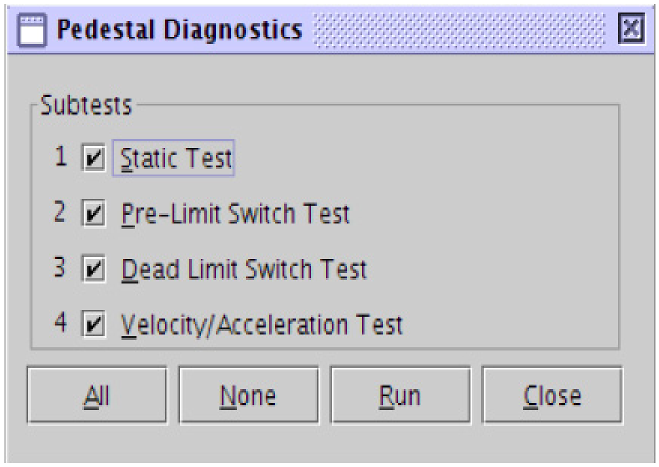


Figure 8-21. Pedestal Diagnostics Window

8.3.3.4.1 <u>Subtest 1: Static Test</u>. This subtest runs a static pedestal BIT test to verify the operational status of the pedestal before moving the pedestal position. It checks the status of the limit switches, hand-wheel switches, gear box and azimuth reservoir oil levels, safety switch, radome hatch switch, stow pins, and the azimuth and elevation DC-to-DC converters.

8.3.3.4.2 <u>Subtest 2: Pre-Limit Switch Test</u>. This subtest will command the antenna to move into an elevation pre-limit condition (upper and lower) and test the ability to move out of the pre-limit condition. When the subtest is complete, it displays the expected angle measurements for the upper and lower pre-limit switches and the actual measured angle in the `Pre-Limit Switch Test Results` window as shown in Figure 8-22.

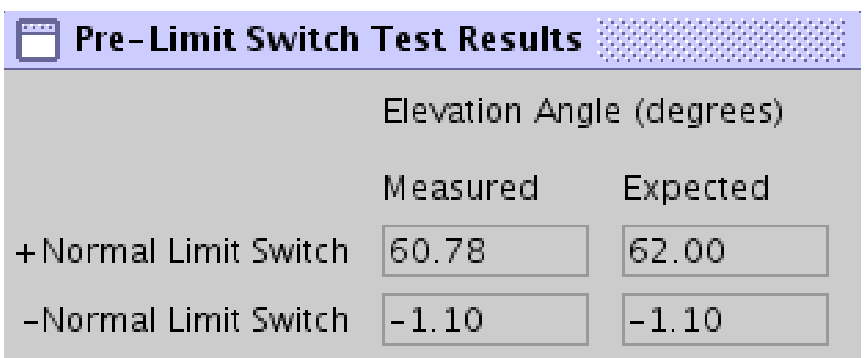


Figure 8-22. Pre-Limit Switch Test Results Window

8.3.3.4.3 <u>Subtest 3: Dead-Limit Switch Test</u>. This subtest will command the antenna to move into an elevation final (dead)-limit condition (upper and lower) and test the ability to move out of the dead-limit condition. This test can only be run from the local RDA HCI in case the technician may need to manually push the antenna out of the dead-limit condition. When the subtest is complete, it displays the expected angle measurements for the upper and lower dead limit switches and the actual measured angle in the `Dead Limit Switch Test Results` windows as shown in Figure 8-23.

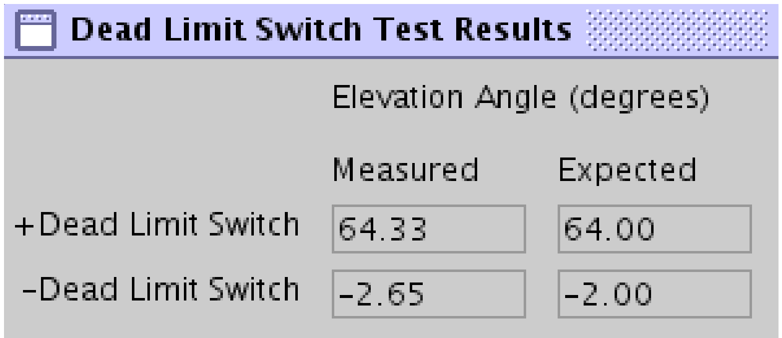


Figure 8-23. Dead Limit Switch Test Results Window

8.3.3.4.4 Subtest 4: Velocity/Acceleration Test. This subtest tests the safety limits of velocity and acceleration in azimuth and elevation. When the subtest is complete, it displays the results of the velocity and acceleration tests in degrees per second in the `Velocity/Acceleration Test Results` window as shown in Figure 8-24.

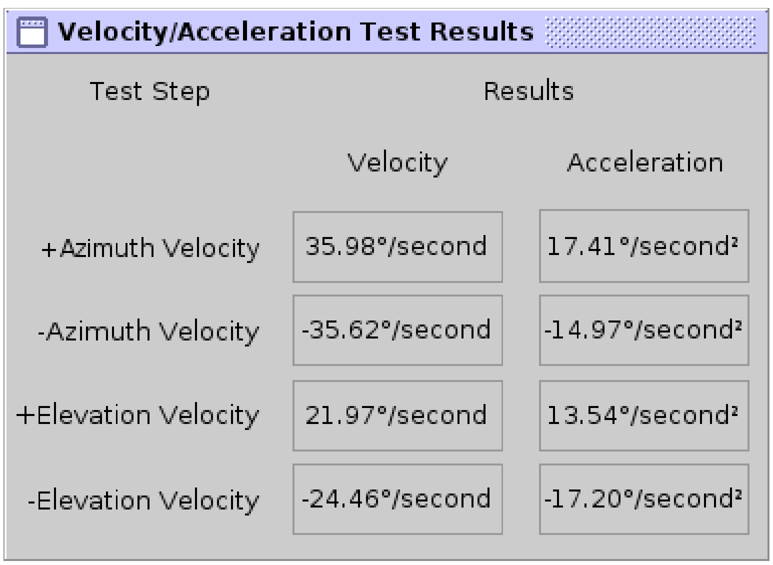


Figure 8-24. Velocity/Acceleration Test Results Window

8.3.3.5 Signal Processor Diagnostics. The `Signal Processor Diagnostics` window (see Figure 8-25) is used to run subtests that check the communications between the RSP and IFDR and the DSP data busses. It can also check the diagnostic register A of the DSP.

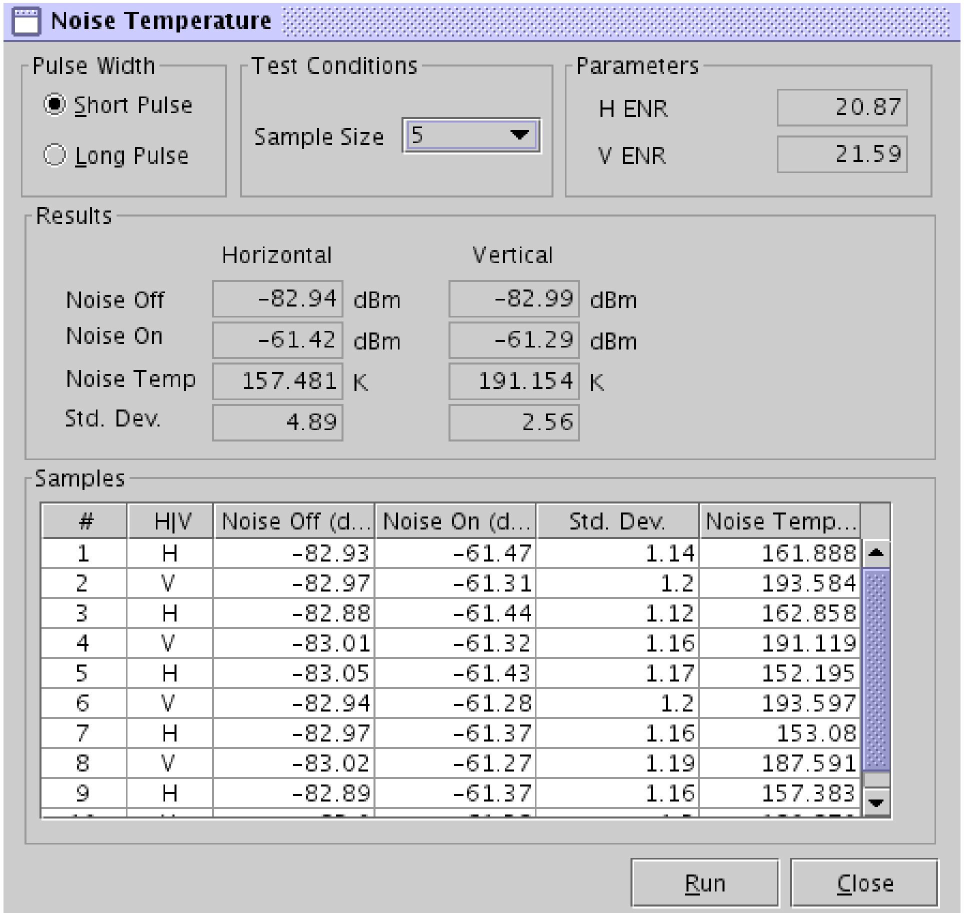


Figure 8-45. Noise Temperature Window

8.4.8 PEDESTAL CALIBRATION.

The `Pedestal Calibration` window (see Figure 8-46) is used to run a calibration routine that executes three subtests: Moment of Inertia, Azimuth Axis, and Elevation Axis. Each subtest can be selected to run together or individually, if desired, and will tune the RDA pedestal control software to match the specific performance characteristics of the pedestal system. During the calibration, the selected subtests make several intricate measurements of pedestal performance while stepping through a range of pedestal control parameters to find the best adjustment combination among interactive parameters. The goal of this routine is to optimize the pedestal performance while minimizing position over/undershooting and dithering. The type of measurement a subtest is performing at the current time will be displayed in the `Status` area and can repeat several times during the run of a particular subtest. In addition to the three subtests, the user has the option to start the pedestal calibration routine from saved baseline adaptation data values by clicking on the check box option `Start from Baseline Adaptation Data`. This option is used for specific troubleshooting and is usually not selected. A detailed description of each subtest are described in the following paragraphs.

The Moment of Inertia subtest independently assesses the motion of both antenna axes to calculate moment of inertia values used for the other subtests. The Moment of Inertia rarely changes and is not executed as often as the Azimuth and Elevation subtests. Modifying the antenna balance/weight or the pedestal may require this subtest to be performed.

The Azimuth Axis subtest is proportioned into the following types of adjustments: Feedback, Drive/Slope, and adjustments for each. The Feedback portion sets an initial guess at the velocity feedback slope. Proper feedback settings assist in getting to a requested velocity and/or position without too much over/undershoot and can help maintain a constant value (with minimal dither around the requested value). The Drive/Slope portion tests how much sustaining drive voltage is needed to overcome friction and an associated slope to maintain a requested velocity. Each measurement is calculated and adjusted multiple times to fine-tune the parameters because the parameter impacts on overall pedestal performance are linked.

The Elevation Axis subtest measures similar parameters as measured in the Azimuth Axis subtest (Feedback, Drive/Slope) plus additional tests for antenna motion balance compensation (Droop Settings) and position slope tuning (Pservo Slope). The Droop Setting moves the antenna to different elevation positions and determines the difference in pointing accuracy to estimate a compensation value for antenna drift during rotation. The Pservo Slope values adjust the drive voltage based on how far away the commanded position is compared to the desired position. There are three intervals of the elevation position slope test; one for nearby elevations, one for moderately distant elevations, and one for elevations a great distance away.

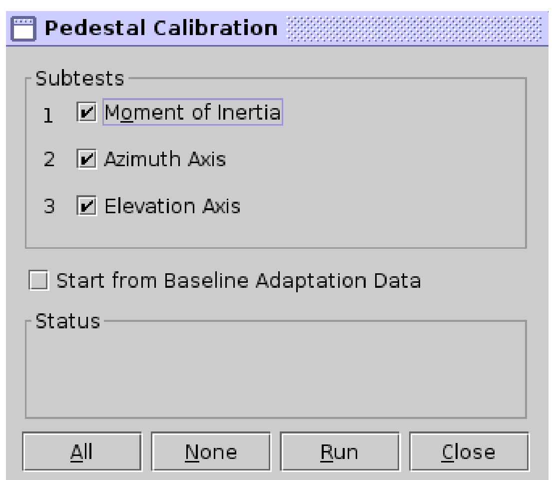


Figure 8-46. Pedestal Calibration Window

After approximately 10 to 20 minutes, the pedestal calibration completes and will display the current and new results in the `Pedestal Calibration Results` window (see Figure 8-47 and Figure 8-48). If the user chooses to update Adaptation Data items associated with the pedestal calibration, a036 through a052, with these new values, click on the **Update Adaptation Data** button. Only the adaptation data parameters from the selected subtest(s) will be updated. If the routine fails when multiple subtests are selected, it will provide the option to update adaptation data of the passing subtests. If a particular subtest fails, try running only the failed subtest again. Failures beyond this may require WSR-88D Hotline assistance. As a general rule, this routine should only be run and the new results updated if certain alarms (i.e., Cut Transition Timeout or Radial Data Lost) are being set routinely. To evaluate the system, the technician should refer to NWS EHB 6-513, Fault Note 37.

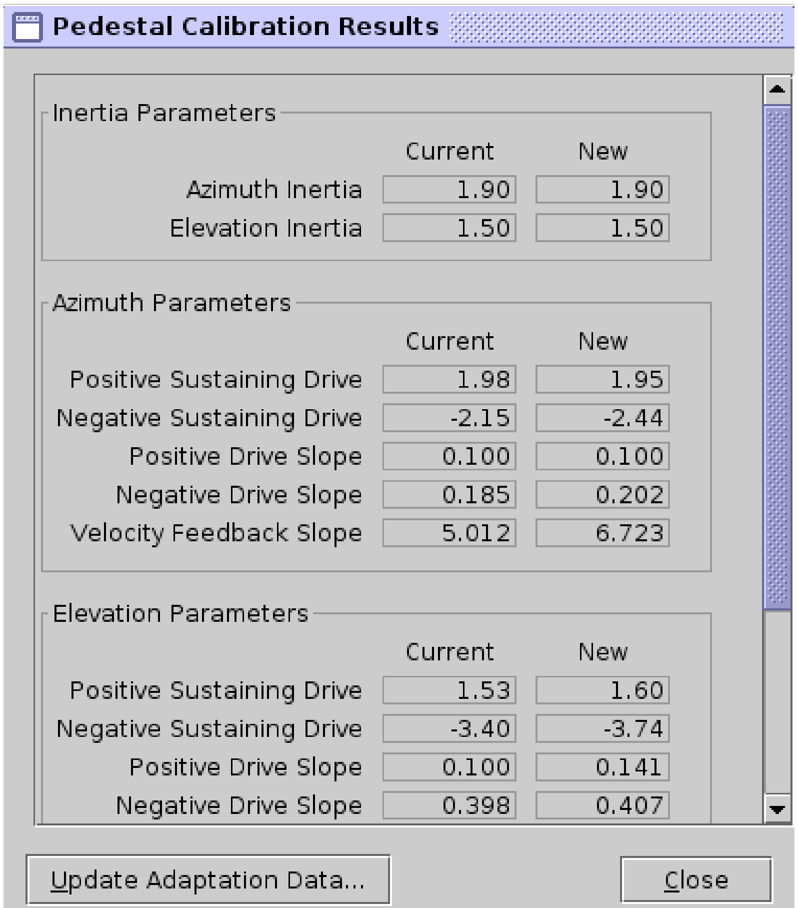


Figure 8-47. Pedestal Calibration Results Window (Upper Half)

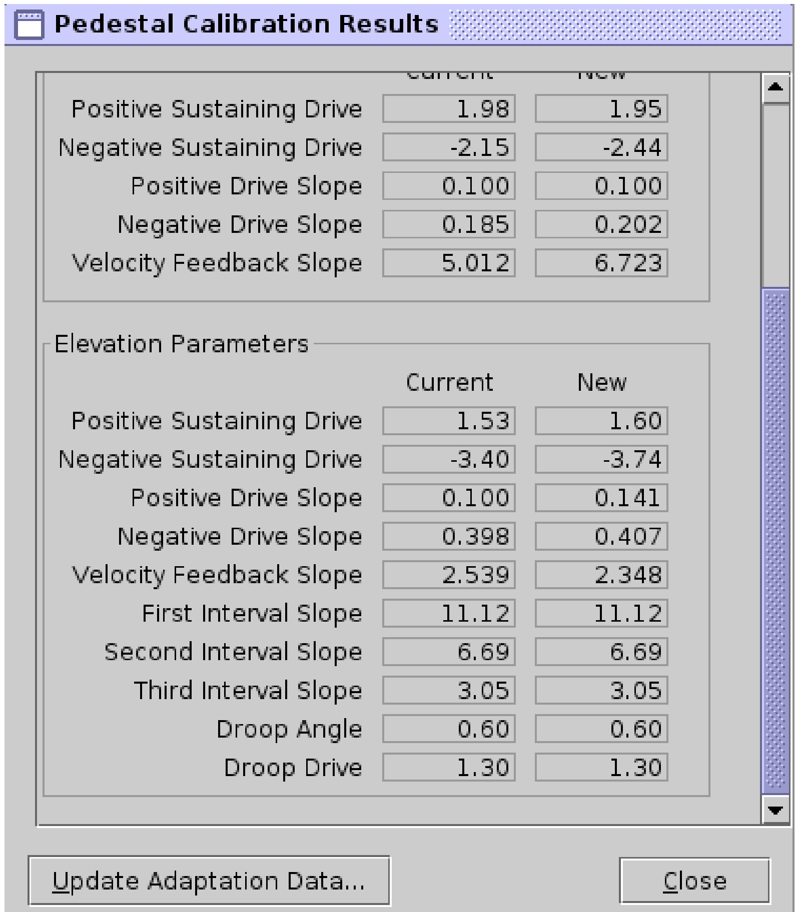


Figure 8-48. Pedestal Calibration Results Window (Lower Half)

Pedestal Software Reset

In the event the Radar Control Program becomes unresponsive and shuts down, the RCP Status field will change to Shutdown, Dead, or Dead Ang.

This is a safety feature that occurs when antenna movement as reported by the encoders doesn't match the commanded position.

To recover from one of these states, the program can be reset by clicking on the **RESET** button.

To prevent the Radar Control program from becoming unresponsive when performing select mainte-nance procedures, click on the **Manual Maintenance** button. This option is only useful in pedestal maintenance procedures where the processor needs to stay active while the antenna encoders report movement, such as during the encoder alignment.