

**Model 8860
Antenna Tracking Controller**

Installation and Maintenance Manual

**Manual Part No. 42S053
Revision H – April 2006**

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SAFETY SUMMARY

Notice

Any service, adjustment, maintenance, or repair of this product must be performed only by authorized technical service personnel.

Prior to installation and use of this product review all safety markings and instructions. When safety precautions or important information is presented in this manual, the information will normally be presented just prior to the point where the hazard is likely to be encountered.

The following symbols are used throughout this manual to bring attention to practices, procedures, and conditions important to the safety of the operator and equipment or to obtaining desirable results from the equipment.



WARNING

This symbol warns of electrical shock hazards to personnel. Failure to comply with the instructions of such a warning may result in severe injury or death resulting from electrical shock.



WARNING

This symbol warns of non-electrical hazards to personnel. Failure to comply with the instructions of such a warning may result in severe injury or death.



CAUTION

This symbol warns of hazards to equipment. Failure to comply with the instructions of such a caution may result in damage or destruction of equipment.



GROUNDING REQUIRED

This symbol is used to bring attention to installation grounding requirements.

NOTE

Notes are used to provide clarification, or to alert the reader of possible erroneous results, which may occur if a procedure is not followed as written.

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Chapter 1

General Information

1.1 Introduction

This manual contains information needed to properly install and maintain the Model 8860 Antenna Tracking Controller. Chapters 1 through 4 contain information pertaining to Model 8860 on a unit level. Chapters 5 and 6 contain information on the front and rear subassemblies within the Model 8860. As of March 2006, the Model 8860 is UL safety approved and certified to FCC Part 15, Subpart B for conducted and radiated emissions.

All warnings and cautions should be reviewed before any procedures are performed. Failure to do so may result in personal injury or equipment damage. ViaSat makes every effort to ensure that the information contained herein is correct and complete.

NOTE: USE OF THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE PROTECTION PROVIDED BY THE EQUIPMENT.

1.2 Unit Description

The Model 8860 provides the operator interface for the antenna control system. The unit contains softkeys, a keypad, and display to enable operator control of the antenna pointing angle (see Figure 1-1). The controller is a microprocessor-controlled unit that outputs antenna commands to the Model 8861A/8862 Antenna Position Controller. With Model 8860, the operator can control and monitor antenna movement either from the front panel of the unit or remotely using the Earth Station Controller via the SAbus port.

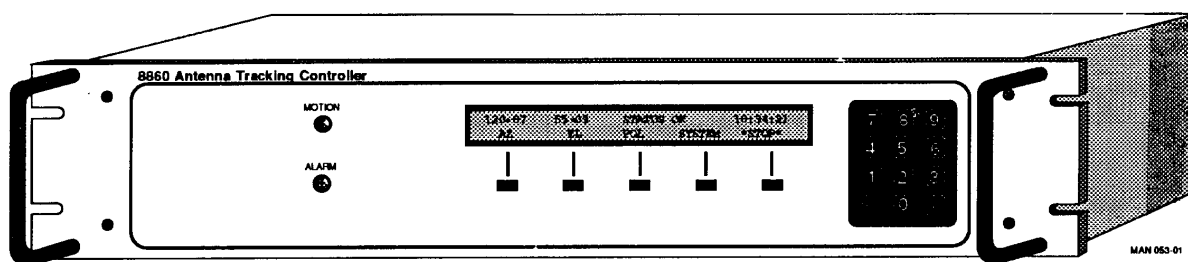


Figure 1-1. Model 8860 Antenna Tracking Controller

1.2.1 Antenna Control System Theory

The microprocessor, which controls the operation of the Model 8860, is located within the front panel control board (see Figure 1-2). The front panel control board receives operator information from the keypad assembly and outputs status messages to the display assembly. Earth Station Controller commands are transferred to the front panel control board via the rear panel subassembly. The front panel control board contains softkeys which select data to be changed or updated using the keypad assembly. The front panel control board also contains an alarm indicator which indicates a possible failure in the antenna control system and a motion indicator which comes on whenever the antenna is being driven.

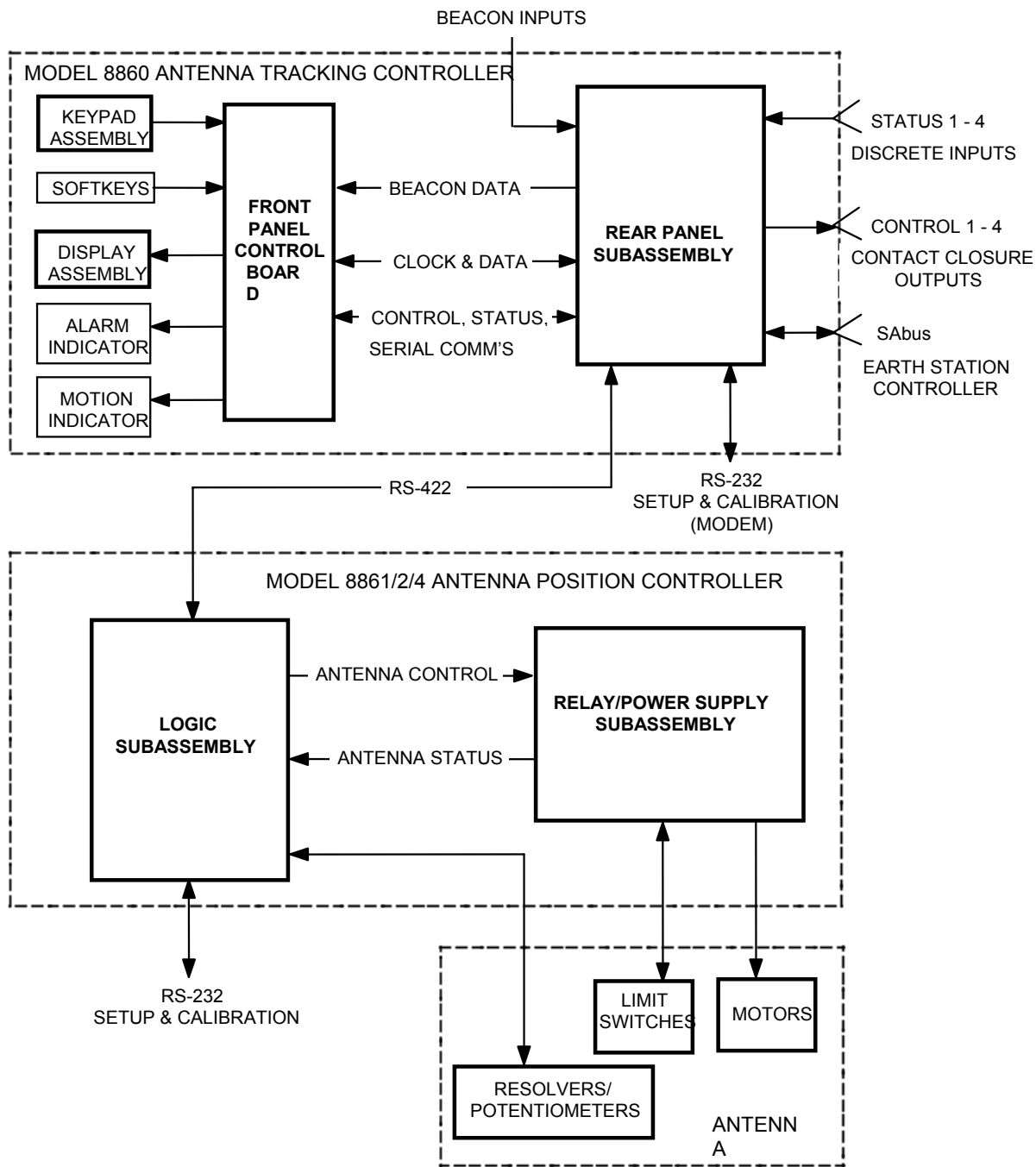
Operator commands are processed and transferred via the rear panel subassembly to the Model 8861A/8862 Antenna Position Controller using the RS-422 port. Within the Model 8861A/8862 Antenna Position Controller, the logic subassembly converts the RS-422 port data into antenna drive command signals. These signals are applied to the relay/power supply subassembly which provides the power output signals to drive the antenna motors.

Antenna resolvers/potentiometers provide antenna position data back to the logic subassembly, which converts it to RS-422 data. The logic subassembly then transfers the data, via the rear panel, to the microprocessor within the front panel control board. The antenna position can be viewed on the display assembly.

NOTE

While the antenna is being driven, the motion indicator will be on. The motion indicator will go off when the antenna reaches the commanded position.

If the antenna is driven into an electrical limit, the limit switches will engage. Then, an electrical signal is transmitted back to the logic subassembly where it is converted to RS-422 data. The logic subassembly then transfers the signal back to the microprocessor within the front panel control board. The operator is informed of the problem by status messages of the display. If there is an alarm or fault in the Model 8860 or Model 8861A/8862, the alarm light will be on. By using the softkeys and display, the operator can identify the fault.



MAN 053-02

Figure 1-2. Antenna Control System Block Diagram

The rear panel subassembly contains an RS-232 port for setup and calibration of the antenna control system. Beacon inputs are applied to the rear panel, converted to digital data, and transferred to the front panel control board for processing antenna pointing angle corrections. Four discrete inputs provide auxiliary status inputs from external equipment. Four contact closure outputs provide auxiliary control outputs for external circuitry.

1.2.2 Front Panel Control Board

Using commands received via the softkeys, keypad or via the rear panel Earth Station Controller input, the front panel microprocessor (processor, U1) issues operational control signals to all other circuits and subassemblies (see Figure 1-3). The processor uses data lines D0 through D15 and address lines A1 through A23 to control and communicate with all other circuits within the front panel control board. The beacon/discrete interface and communication interface circuits provide communication channels with the rear panel subassembly using clock, data, discrete, and serial communication lines.

Based on operator input, the processor generates antenna commands which are transferred to the Model 8861A/8862 Antenna Position Controller via the antenna control circuitry within the rear panel. Serial data is used to communicate between the communication interface and antenna control circuits. An RS-422 (serial data) is used to communicate between the Model 8860 and the logic assembly within the Model 8861A/8862 Antenna Position Controller. Antenna status and position data are transferred back to the processor using the same circuits.

NOTE

The front panel control board circuits are described in more detail in Chapter 5, Front Panel Control Board, of this manual.

1.2.3 Rear Panel Subassembly

The rear panel subassembly provides the Model 8860 with the required interfaces to external equipment. Using operator selection commands from the front panel processor, the requested beacon input is selected in the rear panel subassembly U10 circuit. The analog beacon input is then converted to digital data and transferred to the front panel for antenna position processing.

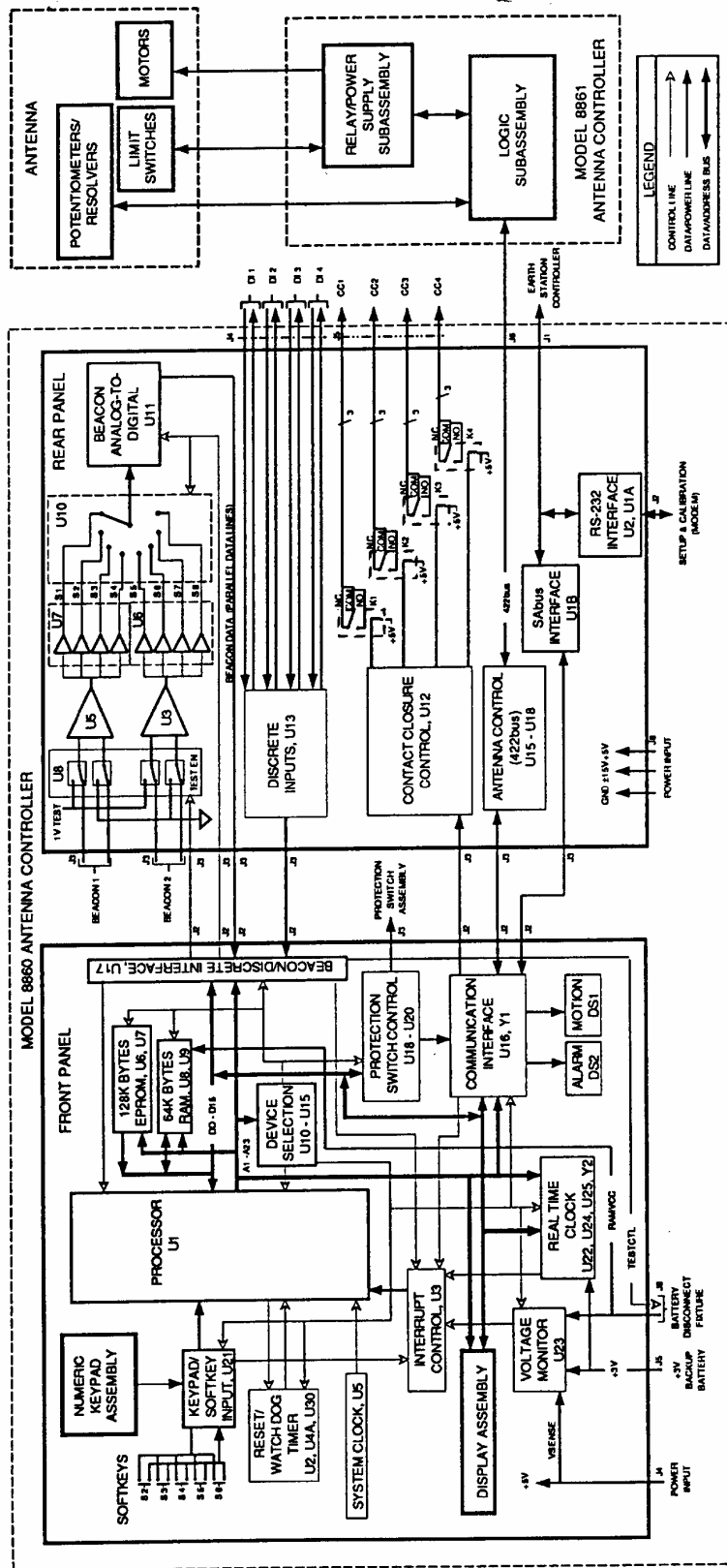


Figure 1-3. Model 8860 Detailed Block Diagram

The rear panel contains circuitry for four opto-isolated input discrete signals, which are transferred to the front panel for viewing or available via SAbus command. Under control of the front panel processor, the contact closure circuitry and relays provide four output control signals to external equipment. The rear panel subassembly also contains the circuitry to drive the RS-422 port for antenna control, SAbus for communication with the Earth Station Controller, and RS-232 interface for setup and full antenna system control.

NOTE

The rear panel subassembly circuits are described in more detail in Chapter 6, Rear Panel Subassembly, of this manual.

1.3 Specifications



Table 1-1. Model 8860 Technical Specifications	
Function/Item	Specification
Mechanical and Environmental	
Size	3.5" H X 19" W X 9" D, approximate
Temperature range	0° to 50°C Operational
Humidity	0 to 95% Non-condensing
Mechanical and Environmental	
Certifications, Domestic USA	 ETL Listed Conforms to UL61010-1 2 nd Edition FCC Part 15B
Certifications, International	

Table 1-1. Model 8860 Technical Specifications	
Function/Item	Specification
Electrical	
Input Power AC	100 - 240VAC, 47-63 Hz, universal input 0.5 amps Max input current
Circuit Protection, Fuse AC	1 Amp SB @ 230VAC 2 Amp SB @ 115VAC
Host Communication Link	One serial port, either EARTH STATION CONTROLLER (SAbus) connector directly or RS-232 via MODEM connector for remote systems
Antenna Communication Link	One serial port, RS-422
Beacon Inputs	Two differential inputs, $\pm 12V$ dc
Auxiliary +5VA +5VB Discrete Inputs Contact Closures	50 mA, maximum 50 mA, maximum Four TTL level opto-isolated input pairs Four - one form C, UL rated 1 Amp, 30V dc
RAM Battery, Lithium	10 year lifetime, maximum
Transient Protection	Optically isolated, gas tube and avalanche diode on outdoor communication link
Operator Controls and Indicators	
Display	LCD, 2 line by 40 character
Softkeys	Five below display
LEDs	Motion, Alarm
Keypad	12 button, 0-9, H (home), P (previous)
Power Switch	Two position (ON/OFF)
Modes of Operation	
Position Controls Local Remote	Via softkeys, keypad, and display Via SAbus, Modem

Chapter 2

Installation

2.1 Introduction

This chapter contains procedures for unpacking, installing, and setup of the Model 8860 Antenna Tracking Controller. General safety precautions and procedures are also described.

The unit is thoroughly inspected and carefully packed before shipment. At the time of shipment, the carrier assumes responsibility for its safe delivery; therefore, do not return damaged units to ViaSat. Instead, file a claim with the carrier as noted in the paragraphs following the initial unpacking procedure given below:

1. Inspect shipping carton for visible damage.
2. Open the shipping carton.
3. Remove all packing material.
4. Inspect unit for visible damage.
5. Using packing list, check for missing items (see paragraph 2.4, How To Inventory Equipment Received).

2.2 What to do About Visible Loss or Damage

Make a note of any loss or evidence of external damage on the freight bill or receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

2.3 What to do About Concealed Damage

Concealed damage means damage which does not become apparent until the unit has been unpacked. The contents may be damaged in transit due to rough handling, even though the carton may not show external damage. If you discover damage after unpacking the unit, make a written request for inspection by the carrier's agent within 15 days of the delivery date, then file a claim with the carrier since such damage is the carrier's responsibility. If

you follow these instructions carefully, ViaSat guarantees its full support of your claims to protect you against loss from concealed damage.

2.4 How to Inventory Equipment Received

Check off each item received against that list on the packing slip included with the shipment, and verify that this list matches the purchase order. If any items are missing, please notify ViaSat. For a current list of telephone and email contact information please refer to the Contact Information section of the ViaSat internet site (www.viasat.com/sgs/support/).

2.5 How to Return Equipment

ViaSat makes every reasonable effort to ensure that all items arrive safely and in working order. When equipment is received, which is not in working order, return the equipment to the factory for repair or replacement. Return the equipment according to the following procedure. This procedure will apply whenever equipment is returned for warranty or other services.

1. Notify ViaSat of the problem and request a Return Material Authorization (RMA) number and shipping instructions.
2. Tag or identify defective equipment and note defect and circumstances, if any. If known, reference sales order, purchase order, and date equipment was received.
3. Reship equipment in original shipping container or use a strong shipping container to protect equipment during shipment.
4. Package equipment using shock-absorbing material around all sides of equipment.
5. Seal container securely and mark outside of container FRAGILE. Also, place the RMA number on the outside of the container using a permanent marker.

2.6 General Electrical Safety Summary

These are general electrical safety precautions that are not related to any specific procedure. These are recommended precautions that personnel must understand and apply.

WARNING

Avoid shorting circuits when using metal tools. Some circuits have high current capability which, when shorted, will flash and may cause burns and/or eye injury.

Remove all jewelry and exposed metal objects from body and clothing before performing maintenance, adjustments, and/or troubleshooting. Before working inside the equipment, remove all power, unless power is required to perform procedures. Do not replace parts with power on.

Servicing this equipment may require working with protective covers removed and ac power connected. Extreme caution must be exercised during these procedures.

Death or severe injury may result if personnel fail to observe safety precautions.

2.7 Resuscitation

Personnel working with or near hazardous chemicals or voltages should be familiar with modern methods of resuscitation.

2.8 Use Safety Approved Equipment

When cleaners are being applied, approved explosion-proof lights, blowers, and other equipment shall be used. Ensure that fire-fighting equipment is readily available and in working order. Keep cleaners in special polyethylene bottles or in safety cans and in minimum quantities. Discard soiled cloths into safety cans.

2.9 Rear Panel Connections

Installation of the Model 8860 Antenna Tracking Controller includes making the necessary power and signal connections appropriate to the system. The connections available are located on the rear panel, as shown in Figure 2-1. These are described in Table 2-1.

Table 2-1. Model 8860 Rear Panel Connections

Control/Indicator	Function																										
ANTENNA	<p>The ANTENNA connector provides a port for controlling Model 8861A Antenna Position Controller operation using the RS-422 interface. The ANTENNA connector is optically isolated from the other circuitry. The serial port supports baud rates of 9600 or 19200.</p> <p>The pin out identifications for the ANTENNA connector are shown below:</p> <table border="0"> <thead> <tr> <th align="left"><u>Pin Number</u></th> <th align="left"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>Shield</td></tr> <tr><td>2</td><td>+TXD (Transmit Data)</td></tr> <tr><td>3</td><td>-TXD (Transmit Data)</td></tr> <tr><td>4</td><td>IGND (Internal Ground)</td></tr> <tr><td>5</td><td>+RXD (Receive Data)</td></tr> <tr><td>6</td><td>-RXD (Receive Data)</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	Shield	2	+TXD (Transmit Data)	3	-TXD (Transmit Data)	4	IGND (Internal Ground)	5	+RXD (Receive Data)	6	-RXD (Receive Data)												
<u>Pin Number</u>	<u>Function</u>																										
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2	+TXD (Transmit Data)																										
3	-TXD (Transmit Data)																										
4	IGND (Internal Ground)																										
5	+RXD (Receive Data)																										
6	-RXD (Receive Data)																										
REMOTE CONTACT CLOSURE	<p>The REMOTE CONTACT CLOSURE connections provide a means of outputting four control signals from form-C contact closures.</p> <p>The pin out identifications for the REMOTE CONTACT CLOSURE connections are shown below:</p> <table border="0"> <thead> <tr> <th align="left"><u>Pin Number</u></th> <th align="left"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>CC1 NC</td></tr> <tr><td>2</td><td>CC1 COM</td></tr> <tr><td>3</td><td>CC1 NO</td></tr> <tr><td>4</td><td>CC2 NC</td></tr> <tr><td>5</td><td>CC2 COM</td></tr> <tr><td>6</td><td>CC2 NO</td></tr> <tr><td>7</td><td>CC3 NC</td></tr> <tr><td>8</td><td>CC3 COM</td></tr> <tr><td>9</td><td>CC3 NO</td></tr> <tr><td>10</td><td>CC4 NC</td></tr> <tr><td>11</td><td>CC4 COM</td></tr> <tr><td>12</td><td>CC4 NO</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	CC1 NC	2	CC1 COM	3	CC1 NO	4	CC2 NC	5	CC2 COM	6	CC2 NO	7	CC3 NC	8	CC3 COM	9	CC3 NO	10	CC4 NC	11	CC4 COM	12	CC4 NO
<u>Pin Number</u>	<u>Function</u>																										
1	CC1 NC																										
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6	CC2 NO																										
7	CC3 NC																										
8	CC3 COM																										
9	CC3 NO																										
10	CC4 NC																										
11	CC4 COM																										
12	CC4 NO																										
REMOTE DISCRETE INPUT	<p>The REMOTE DISCRETE INPUT connections provide a means of inputting four general purpose status signals which are opto-isolated TTL level inputs.</p>																										

Table 2-1. Model 8860 Rear Panel Connections																											
Control/Indicator	Function																										
	<p>The pin out identifications for the REMOTE DISCRETE INPUT connections are shown below:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;"><u>Pin Number</u></th> <th style="text-align: left;"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>+5V dc (50 mA maximum)</td></tr> <tr><td>2</td><td>+DI1</td></tr> <tr><td>3</td><td>-DI1</td></tr> <tr><td>4</td><td>+DI2</td></tr> <tr><td>5</td><td>-DI2</td></tr> <tr><td>6</td><td>COM A (Internal ground)</td></tr> <tr><td>7</td><td>COM B (Internal ground)</td></tr> <tr><td>8</td><td>+DI3</td></tr> <tr><td>9</td><td>-DI3</td></tr> <tr><td>10</td><td>+DI4</td></tr> <tr><td>11</td><td>-DI4</td></tr> <tr><td>12</td><td>+5V dc (50 mA maximum)</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	+5V dc (50 mA maximum)	2	+DI1	3	-DI1	4	+DI2	5	-DI2	6	COM A (Internal ground)	7	COM B (Internal ground)	8	+DI3	9	-DI3	10	+DI4	11	-DI4	12	+5V dc (50 mA maximum)
<u>Pin Number</u>	<u>Function</u>																										
1	+5V dc (50 mA maximum)																										
2	+DI1																										
3	-DI1																										
4	+DI2																										
5	-DI2																										
6	COM A (Internal ground)																										
7	COM B (Internal ground)																										
8	+DI3																										
9	-DI3																										
10	+DI4																										
11	-DI4																										
12	+5V dc (50 mA maximum)																										
BEACON INPUT	<p>The BEACON INPUT connections allow two differential beacon inputs. The operator can select the type of beacon transmitter and the appropriate input (1 or 2) for processing. Typical connections are at the (+) and (-) terminals.</p> <p>The pin out identifications for the BEACON INPUT connections are shown below:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;"><u>Pin Number</u></th> <th style="text-align: left;"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>Beacon 1 (+)</td></tr> <tr><td>2</td><td>Ground</td></tr> <tr><td>3</td><td>Beacon 1 (-)</td></tr> <tr><td>4</td><td>Beacon 2 (+)</td></tr> <tr><td>5</td><td>Ground</td></tr> <tr><td>6</td><td>Beacon 2 (-)</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	Beacon 1 (+)	2	Ground	3	Beacon 1 (-)	4	Beacon 2 (+)	5	Ground	6	Beacon 2 (-)												
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2	Ground																										
3	Beacon 1 (-)																										
4	Beacon 2 (+)																										
5	Ground																										
6	Beacon 2 (-)																										
EARTH STATION CONTROLLER	<p>The EARTH STATION CONTROLLER connector, which is the default mode of operation, provides the port for remote terminal operation using the SAbus interface. The SAbus address and baud rate can be set on the front panel (see Chapter 3). The serial ports support baud rates of 1200, 2400, and 9600.</p>																										

Table 2-1. Model 8860 Rear Panel Connections																					
Control/Indicator	Function																				
	<p>The pin out identifications for the EARTH STATION CONTROLLER connector are shown below:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;"><u>Pin Number</u></th> <th style="text-align: left;"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>Shield</td></tr> <tr><td>2</td><td>SRR (Secondary Receiver Ready)</td></tr> <tr><td>3</td><td>+RXDATA (Receive Data)</td></tr> <tr><td>4</td><td>+TXDATA (Transmit Data)</td></tr> <tr><td>5</td><td>GND</td></tr> <tr><td>6</td><td>-TXDATA (Transmit Data)</td></tr> <tr><td>7</td><td>SRS</td></tr> <tr><td>8</td><td>SCS</td></tr> <tr><td>9</td><td>-RXDATA (Receive Data)</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	Shield	2	SRR (Secondary Receiver Ready)	3	+RXDATA (Receive Data)	4	+TXDATA (Transmit Data)	5	GND	6	-TXDATA (Transmit Data)	7	SRS	8	SCS	9	-RXDATA (Receive Data)
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4	+TXDATA (Transmit Data)																				
5	GND																				
6	-TXDATA (Transmit Data)																				
7	SRS																				
8	SCS																				
9	-RXDATA (Receive Data)																				
MODEM	<p>The RS-232 MODEM is primarily for antenna calibration. It enables the Model 8860 Antenna Tracking Controller to communicate with a PC direct or via a modem for setup and full antenna system control. (Pins 1 and 4 must be jumpered by the external cable to use this connector.)</p> <p style="text-align: center;">NOTE</p> <p>This connector uses RS-232 levels with SAbus protocol (7 bits, one stop bit, and even parity). The default mode of operation is the SAbus through the EARTH STATION CONTROLLER connector. This serial port supports baud rates of 1200, 9600, and 19200.</p> <p>The pin out identifications for the MODEM connector are shown below:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;"><u>Pin Number</u></th> <th style="text-align: left;"><u>Function</u></th> </tr> </thead> <tbody> <tr><td>1</td><td>DCD</td></tr> <tr><td>2</td><td>RX</td></tr> <tr><td>3</td><td>TX</td></tr> <tr><td>4</td><td>DTR</td></tr> <tr><td>5</td><td>GND</td></tr> <tr><td>7</td><td>RTS (Not Supported)</td></tr> <tr><td>8</td><td>CTS (Not Supported)</td></tr> </tbody> </table>	<u>Pin Number</u>	<u>Function</u>	1	DCD	2	RX	3	TX	4	DTR	5	GND	7	RTS (Not Supported)	8	CTS (Not Supported)				
<u>Pin Number</u>	<u>Function</u>																				
1	DCD																				
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7	RTS (Not Supported)																				
8	CTS (Not Supported)																				
J1	<p>The power connector, J1, is a three-prong connector located adjacent to the Slo-Blo fuse. Power requirements are 115V ac at two amps or 230V ac at one amp.</p>																				

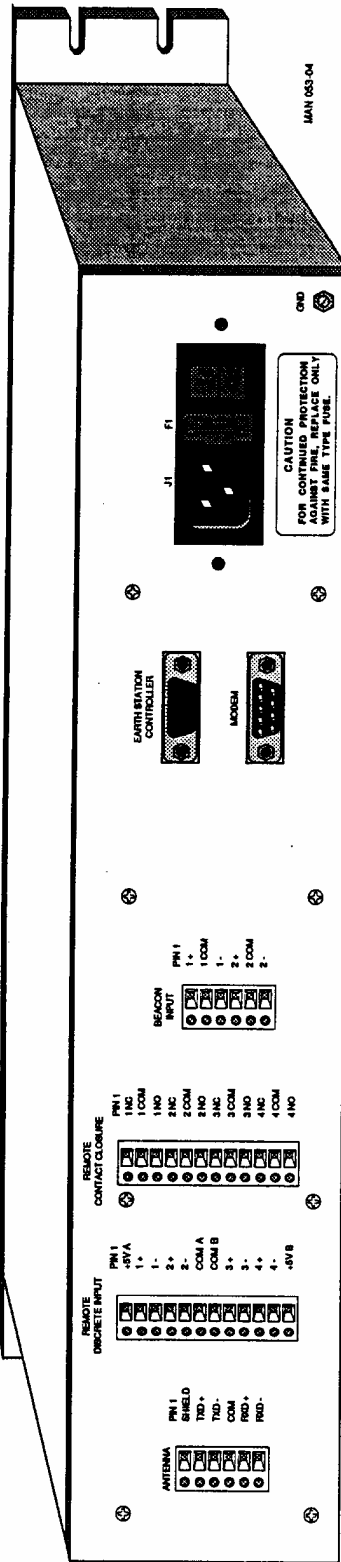


Figure 2-1. Model 8860 Rear Panel Connections

2.10 Model 8860 Installation

Installation of the Model 8860 Antenna Tracking Controller requires mounting the unit into a rack assembly and connecting signal and power cables to the rear panel. The following paragraphs contain instructions to install the Model 8860 Antenna Tracking Controller.

CAUTION

Model 8860 Antenna Tracking Controller requires bracket or rack slide support when the unit is installed in the rack assembly. Failure to have adequate support for the unit may result in structural damage to the unit.

2.10.1 Rack Assembly Installation

Install the Model 8860 Antenna Tracking Controller in a standard 19-inch wide, 24-inch deep rack. Brackets or rack slides must support the unit. It is not recommended the unit be installed such that it is supported only by the front panel.

The two brackets (part number E054881) are installed on each side of the rack assembly using eight #10-3/4 inch long screws (E077744), eight nuts (E175005), eight #10 flat washers (E073275), and eight #10 split washers (E073273). After the two brackets are mounted, adjust the brackets so that the unit rests on the brackets. The unit can now be safely installed into the rack assembly.

The optional rack slide assembly (part number E169148) available for the unit is manufactured to EIA/Universal RETMA standards and is compatible with any 24-inch EIA/Universal RETMA enclosed rack. The slide assembly is equipped with front disconnect and locknut as standard features. A Phillips-head screwdriver and a flat-bladed screwdriver are all the tools required for installation.

To install the right slide, proceed as follows and refer to Figure 2-2:

1. Extend slide to full length and disconnect chassis member from the rack member by tripping the lock release lever.
2. Attach chassis member to chassis using two 8-32 x 1/4L panhead screws so that the lock release lever faces the front of the chassis. Use care not to strip the threads in the chassis side panel.

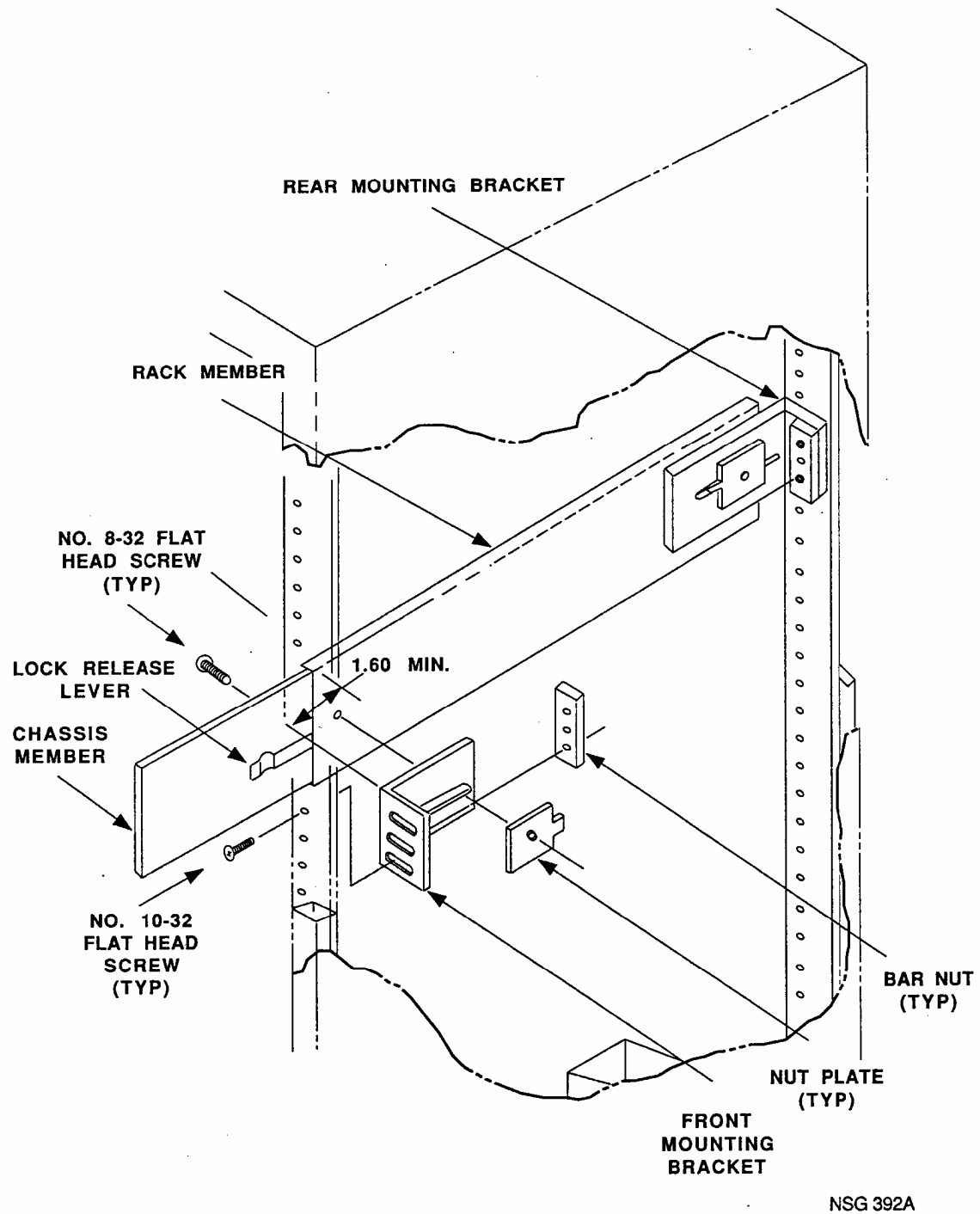


Figure 2-2. Rack Slide Installation

3. Attach front mounting bracket and rear mounting bracket to rack member using two 8-32 flathead screws and two 5652 nut plates. The front mounting bracket should protrude at least 1.6 inches from the rack member. Mount brackets loosely to permit final adjustment to rack.
4. Attach rack member and brackets to rack assembly using four 10-32 flathead screws and two 5641 nut bars. Leave screws loose to allow adjustment after chassis is inserted.
5. Adjust mounting brackets to overall rack length and tighten bracket-slide interconnecting screws.

Install the left slide in accordance with the procedures for right slide installation.

To mount the unit in the rack assembly, proceed as follows:

1. Insert the unit into rack assembly engaging chassis and rack members of the slide.
2. Adjust positioning, if necessary, to ensure free travel of the chassis.
3. Tighten screws mounting the slides into the rack assembly.

2.10.2 Connecting Signal Cables

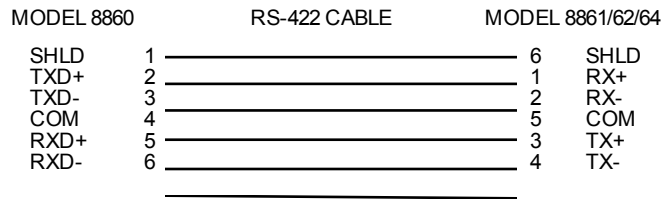
Perform the following steps to connect the signal cables to the Model 8860 Antenna Tracking Controller (see Figure 2-1 and 2-3).

1. Connect Model 8861A/8862 Antenna Position Controller RS-422 cable to ANTENNA connections.
2. If required, connect PC or modem using RS-232 cable to the MODEM connector.
3. If required, connect beacon inputs to BEACON INPUT connections.

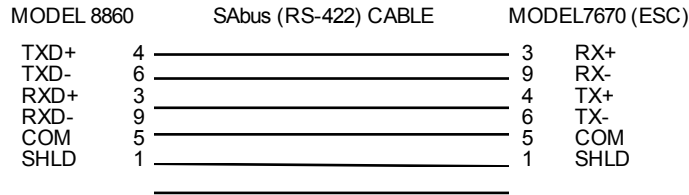
NOTE

The beacon inputs are sensed by a differential amplifier. For optimum performance and noise immunity, both the + and - beacon inputs should be connected to a signal source or signal ground. Neither side should be left floating.

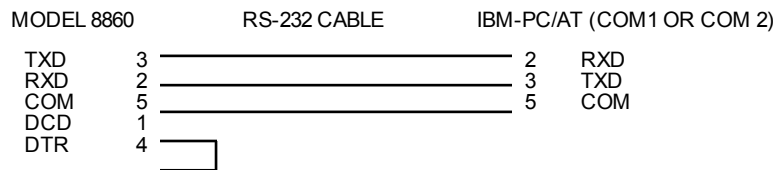
For a beacon or video receiver with a negative slope output voltage, reverse pins 1 and 3 on the Model 8860. Refer to the instruction manual for the beacon receiver.



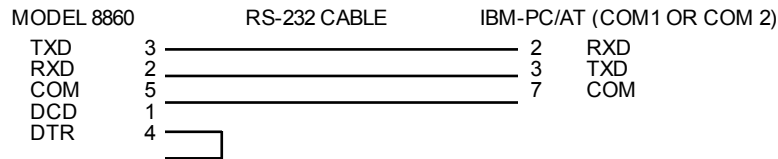
MODEL 8860 (ANTENNA CONNECTOR) TO MODEL 8861/62/64 (REMOTE CONNECTOR) CABLE



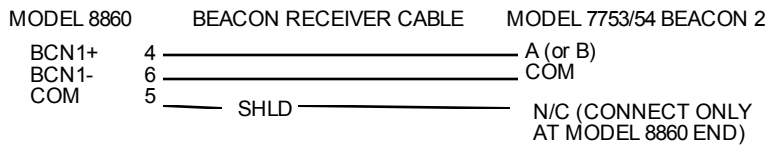
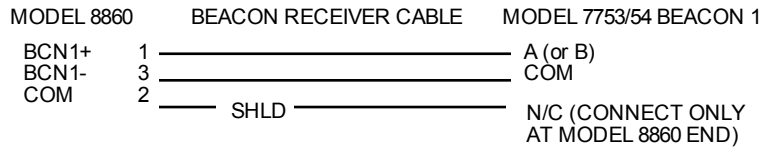
MODEL 8860 (ESC CONNECTOR) TO MODEL7670 (THROUGH SAbus STRIP) CABLE



MODEL 8860 (MODEM CONNECTOR) TO PC (9-PIN CONNECTOR) CABLE



MODEL 8860 (MODEM CONNECTOR) TO PC (25-PIN CONNECTOR) CABLE



MODEL 8860 (BEACON CONNECTOR) TO MODEL 7753/54 BEACON RECEIVER CABLE

MAN 053-10

Figure 2-3. Signal Interface Cables

4. If required, connect any discrete inputs to the REMOTE DISCRETE INPUT connections.

At the rear panel of the 8860 are 4-optically isolated inputs to be used as a general purpose contact closer interface. These inputs operate in conjunction with the +5V A/B and COM A/B terminals located on the same terminal block. Limit the +5V to 50ma max current consumption. The status can be observed on the front panel display however no customization is available. They are better suited for use with an M&C computer connected to the Earth Station Controller connector.

5. If required, connect any discrete outputs to the REMOTE CONTACT CLOSURE connections.

At the rear panel of the 8860 are four, form-C relay outputs for general purpose contact control of external equipment. Each output provides a relay common (COM), a normally open (NO) and normally closed (NC) contact. The status can be observed on the front panel display however no customization is available. They are better suited for use with an M&C computer connected to the Earth Station Controller connector.

6. If required, connect Earth Station Controller SAbus cable to the EARTH STATION CONTROLLER connector.

WARNING

Death or severe injury may result if the equipment is not properly grounded. Make sure the power cable is plugged into an outlet which provides a grounding connection. Ensure that the cable is securely plugged into the rear of the controller, and that the power line is suitable for the power requirements before powering up the unit.

2.10.3 Connecting Power Cable

When using ac input power unit, the power supply automatically adjusts for 115 or 230V ac input. An optional -24V dc power supply unit can be purchased which provides the operating power using -24V dc input power. A power line filter is located on the rear panel of the controller and provides the J1 receptacle for the power cable and an on/off switch.

Connect power cord (supplied with unit) between rear panel power receptacle and applicable power outlet. The fuse is located under a pop up panel, released from inside receptacle area.

Upon initial power-up, the battery for memory backup is enabled. If power application to the unit does not work, check the internal fuse in the power line filter to ensure it is in working order.

2.11 Setup

Refer to operation chapter within the Model 8860 Antenna Tracking Controller Operation manual 557660.

Be sure to clear the 8860 memory when the unit is powered up the first time by holding down the middle softkey while turning on power. Continue to hold the key until prompted for a YES or NO answer, then press YES.

Chapter 3

Front Panel Operation

3.1 Introduction

This chapter includes an explanation of controls and indicators for the front panel. Rear panel connections are provided with a description in Chapter 2 of this manual. The complete operational information necessary to understand and operate the Model 8860 Antenna Tracking Controller is contained in manual 557660.

3.2 Front Panel Controls and Indicators

The Model 8860 Antenna Tracking Controller is operated using controls and indicators on the front panel. These include the keypad, the softkeys, the liquid crystal display (LCD) display, and ALARM indicator. These are shown in Figure 1-1.

3.2.1 Keypad

The keypad is used to enter specific angles, satellite names and other data required for configuration and operation. The H (home) key resets the software to the initial menu and the P (previous) key returns to the previous menu. The P and H keys can also be used to cancel any numeric entry at any point during the entry sequence. All parameter values can be modified by direct keypad entry.

3.2.2 LCD Display

The LCD display provides information on the selections available at any menu level, current settings for receiver parameters, and certain status and alarm indications. There are always two lines available on the display. The top line may be status data or it may be a cursor allowing the user to input data or identifier information. It can also display optional functions available for tuning operations. The bottom line will show selections or parameter values available using the softkeys. The selections are entered or the values changed by pressing the softkey directly below the function listed on the bottom line.

3.2.3 Softkeys

The five softkeys are the primary controls for the receiver. Each softkey selects a specific function which is displayed above the softkey on the LCD lower display line. Once the desired function is selected, each softkey provides inputs related to that function. These can be specific values displayed on the LCD or values that can be stepped through when up and down arrows are shown on the LCD lower display line. The function of the softkey depends on the function being displayed on the LCD lower display line. These displays are illustrated and explained in manual 557660.

3.2.4 Alarm Indicator

The alarm indicator will come on (red) whenever an alarm signal is detected. Using the softkeys, the operator can select faults or message log to identify which antenna system alarm is activated.

3.2.5 Motion Indicator

The motion indicator will come on whenever the antenna is being driven in any axis. Antenna movement can be commanded by the Model 8860 Antenna Tracking Controller, locally by the Model 8861A/8862 Antenna Position Controller, or remotely by the Earth Station Controller.

3.2.6 Reset

Newer Model 8860 Antenna Tracking Controllers that include Front panel PWB assembly part number 512913 or 1002660 may be reset from the front panel by pressing the left and middle softkeys simultaneously. Older units require that power be cycled off then back on to reset. Units manufactured since fourth quarter 1994 contain the new PWB assembly. The front panel reset does not clear the contents of non-volatile RAM. Memory may only be cleared by the procedure described in Chapter 2 of this manual.

Chapter 4

Maintenance

4.1 Introduction

This chapter provides guidelines for general maintenance and troubleshooting of the Model 8860 Antenna Tracking Controller. The design precludes any user repair. Maintenance should be limited to specific level adjustments and subassembly or circuit board assembly replacement.

4.2 Failure Indication and Remedy

Model 8860 will display general system status messages on the front panel display's home menu. Table 4-1 identifies the system status messages and the most probable remedy for a failure. The calibration software can also be used to help diagnose failures.

The 8860 firmware generates a message log that is viewable from the front panel. For a description of these log messages, refer to the appendix in the 8860 Operation manual 557660.

Detailed failure messages are available on two menu lists by pressing SYSTEM function key, then REPORT function key and then selecting the appropriate fault log. Table 4-2 identifies the detailed failure messages when FAULTS function key is pressed and Table 4-3 identifies the failure messages when LIM ALM function key is pressed. In each list, the most probable failure indication is presented adjacent to the failure message.

If the remedy listed in Tables 4-1, 4-2, and 4-3 does not remedy the failure, please refer to the Contact Information section of the ViaSat web site, <http://www.viasat.com>. Select Products and Technologies, Satellite Ground Systems and Contact Us. Note that you must have an RMA number before returning your unit for repair.

Table 4-1. Home Menu System Status Messages	
Indication	Comments/Remedy
STANDBY	When this is displayed, no failure messages are active; the system is fully operational and not tracking.
ANTN COMM LOST	This indicates that communication between Model 8860 and Model 8861A/8862 has been lost. Check SAbus setup Check wiring and connections Check Model 8861A/8862 Check Model 8860 rear panel subassembly
ANT SUMMARY ALARM	This fault indicates that a Model 8861A/8862 fault has been received. Check for individual fault messages by pressing SETUP, SITE, then 8861A/8862 function keys. Table 4-2 presents all possible fault messages and remedies.
AZ AT LIMIT	This indicates that azimuth axis has reached a limit. Check for appropriate limit by pressing SETUP, SITE, then LIMIT function keys. Table 4-3 presents all possible limits and remedies.
EL AT LIMIT	This indicates that the elevation axis has reached a limit. Check for the appropriate limit by pressing SETUP, SITE, then LIMIT function keys. Table 4-3 presents all possible limits and remedies.
FD1 AT LIMIT	This indicates that the feed 1 axis has reached a limit. Check for the appropriate limit by pressing SETUP, SITE, then LIMIT function keys. Table 4-3 presents all possible limits and remedies.
FD2 AT LIMIT	This indicates that the feed 2 axis has reached a limit. Check for the appropriate limit by pressing SETUP, SITE, then LIMIT function keys. Table 4-3 presents all possible limits and remedies.
ANT IN LOCAL MODE	This message reports that the LOCAL/REMOTE switch on the Model 8861A/8862, or 8864 is placed to the LOCAL position and communications is stopped.
ANT POSITN LOCKED	The antenna position has been locked, preventing any antenna motion. To unlock, use the OTHER front panel menu.

Table 4-2. Active Faults Menu Messages

Failure Indication	Comments/Remedy
----start----	This is the message at the beginning of the fault listing.
MOTION INHIBIT	Antenna fails to respond when commanded to move. Check antenna axis for freedom of movement Check wiring and connections Check Model 8861A/8862 (see manual 557660)
EXTERNAL FAULT INPUT	Indicates an alarm status on an input of the Model 8861A/8862 (see manual 557660).
RELAY/PWR SUPPLY FLT	The relay/power supply subassembly within Model 8861A/8862 indicates a fault. Refer to manual 557660.
R/D CONVERTER FAILED	The logic subassembly resolver to digital converter within Model 8861A/8862 indicates a failure. Refer to manual 557660.
A/D CONVERTER FAILED	The logic subassembly analog to digital converter within Model 8861A/8862 indicates a failure. Refer to manual 557660.
UNDER TEMPERATURE	Model 8861A/8862 temperature is lower than operating limits (motor controls shut down at 40°C). Check Model 8861A/8862 heaters. Refer to manual 557660.
OVER TEMPERATURE	Model 8861A/8862 temperature is greater than operating limits (motor controls shut down at +60°C). Check Model 8861A/8862 heaters. Refer to manual 557660.
INTERNAL EEPROM FLT	The logic subassembly processor EEPROM within Model 8861A/8862 indicates a failure. Refer to manual 557660.
AZ OVERLOAD ALARM	Azimuth axis indicates an overload condition. Check axis for freedom of movement Check motor and wiring
AZ BACKWARD OP ALARM	This indicates that the azimuth axis is being driven in the opposite direction than commanded. Using a PC or earth station controller, refer to manual 1008111 and perform static calibration checks.

Table 4-2. Active Faults Menu Messages

Failure Indication	Comments/Remedy
AZ LOWER LIMIT FAULT	The azimuth lower limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
AZ UPPER LIMIT FAULT	The azimuth upper limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
AZ MOTION FAULT	Azimuth axis fails to move when commanded. Check motor and wiring Check Model 8861A/8862 (see manual 557660)
AZ RELAY FAULT	Model 8861A/8862 azimuth axis relay, K1, indicates a failure. Check relay. Refer to manual 557660.
EL OVERLOAD ALARM	Elevation axis indicates an overload condition. Check axis for freedom of movement Check motor and wiring
EL BACKWARD OP ALARM	This indicates that the elevation axis is being driven in the opposite direction than commanded. Using a PC or earth station controller, refer to manual 1008111 and perform static calibration checks.
EL LOWER LIMIT FAULT	The elevation lower limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
EL UPPER LIMIT FAULT	The elevation upper limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.

Table 4-2. Active Faults Menu Messages

Failure Indication	Comments/Remedy
EL MOTION FAULT	Elevation axis fails to move when commanded. Check motor and wiring Check Model 8861A (see manual 557660)
EL RELAY FAULT	Model 8861A elevation axis relay, K2, indicates a failure. Check relay. Refer to manual 557660.
FD1 OVERLOAD ALARM	Feed 1 axis indicates an overload condition. Check axis for freedom of movement Check motor and wiring
FD1 BACKWARD OP FLT	This indicates that the feed 1 axis is being driven in the opposite direction than commanded. Using a PC or earth station controller, refer to manual 1008111 and perform static calibration checks.
FD1 LOWER LIMIT FLT	The feed 1 lower limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 UPPER LIMIT FLT	The feed 1 upper limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 MOTION FAULT	Feed 1 axis fails to move when commanded. Check motor and wiring Check Model 8861A/8862 (see manual 557660)
FD1 RELAY FAULT	Model 8861A/8862 feed 1 axis relay indicates a failure. Check relay/power supply subassembly. Refer to manual 557660.
FD2 OVERLOAD ALARM	Feed 2 axis indicates an overload condition. Check axis for freedom of movement Check motor and wiring
FD2 BACKWARD OP FLT	This indicates that the feed 2 axis is being driven in the opposite direction than commanded. Using a PC or earth station controller, refer to manual 1008111 and perform static calibration checks.

Table 4-2. Active Faults Menu Messages

Failure Indication	Comments/Remedy
FD2 LOWER LIMIT FLT	The feed 2 lower limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD2 UPPER LIMIT FLT	The feed 2 upper limit indicates a failure. Check azimuth lower limit switch wiring. Refer to the appropriate antenna electrical installation manual for wiring information. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD2 MOTION FAULT	Feed 2 axis fails to move when commanded. Check motor and wiring Check Model 8861A/8862 (see manual 557660)
FD2 RELAY FAULT	Model 8861A/8862 feed 2 axis relay indicates a failure. Check relay/power supply subassembly. Refer to manual 557660.
EMERGENCY STOP FLT	This message may be displayed when Model 8862 or 8864 Antenna Position Controllers are used in the system. The message indicates that an antenna emergency stop switch has been activated or a secondary limit switch has been engaged. (Secondary limit switches are used on 16M or 18M antennas only.)
PHASE LOSS/REVERSAL	This message may be displayed when Model 8862 or 8864 Antenna Position Controllers are used in the system. This message indicates that three-phase power is reversed or one of the phases is missing. (A phase reversal or fault will also cause an Emergency Stop Fault.)
EL VSPD DRIVE FAULT	This message may be displayed when Model 8862 or 8864 Antenna Position Controllers are used in the system. This failure message indicates that the Model 8862 or 8864 variable speed inverter drive for elevation has detected a failure (i.e., over current, over voltage, etc.)

Table 4-2. Active Faults Menu Messages

Failure Indication	Comments/Remedy
AZ VSPD DRIVE FAULT	This message may be displayed when Model 8862 or 8864 Antenna Position Controllers are used in the system. This failure message indicates that the Model 8862 or 8864 variable speed inverter drive for azimuth has detected a failure (i.e., over current, over voltage, etc.)
----end----	This is the message at the end of the fault listing.

Table 4-3. Limit Alarms Menu Messages

Failure Indication	Comments/Remedy
----start----	This is the message at the beginning of the fault listing.
AZ UPPER HARD LIMIT	Antenna has reached azimuth upper electrical limit. Drive antenna in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
AZ LOWER HARD LIMIT	Antenna has reached azimuth lower electrical limit. Drive antenna in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
AZ UPPER SOFT LIMIT	Antenna has reached azimuth upper software limit. Drive antenna in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
AZ LOWER SOFT LIMIT	Antenna has reached azimuth lower software limit. Drive antenna in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
EL UPPER HARD LIMIT	Antenna has reached elevation upper electrical limit. Drive antenna in downward direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.

Table 4-3. Limit Alarms Menu Messages

Failure Indication	Comments/Remedy
EL LOWER HARD LIMIT	Antenna has reached elevation lower electrical limit. Drive antenna in upward direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
EL UPPER SOFT LIMIT	Antenna has reached elevation upper software limit. Drive antenna in downward direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
EL LOWER SOFT LIMIT	Antenna has reached elevation lower software limit. Drive antenna in upward direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 UPPER HARD LIMIT	Feed 1 has reached upper electrical limit. Drive feed in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 LOWER HARD LIMIT	Feed 1 has reached lower electrical limit. Drive feed in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 UPPER SOFT LIMIT	Feed 1 has reached upper software limit. Drive feed in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD1 LOWER SOFT LIMIT	Feed 1 has reached lower software limit. Drive feed in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD2 UPPER HARD LIMIT	Feed 2 has reached upper electrical limit. Drive feed in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.

Table 4-3. Limit Alarms Menu Messages

Failure Indication	Comments/Remedy
FD2 LOWER HARD LIMIT	Feed 2 has reached lower electrical limit. Drive feed in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD2 UPPER SOFT LIMIT	Feed 2 has reached upper software limit. Drive feed in lower (decreasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
FD2 LOWER SOFT LIMIT	Feed 2 has reached lower software limit. Drive feed in upper (increasing) direction to remove limit fault. Using a PC or earth station controller, refer to manual 1008111 and perform limit switch checks.
---end---	This is the message at the end of the fault listing.

4.3 Applicable Technical Drawings

The following list contains all technical drawings required for maintenance and repair of the Model 8860 chassis and associated components. Further breakdown of the front panel control board and rear panel subassembly are contained in the following sections. The following list is given in the order the drawings appear on the following pages.

Part No.	Rev.	Title
455343	A	Model 8860 Interconnect Diagram, AC Version
456045	-	Model 8860 Interconnect Diagram, DC Version
455341	Y	Model 8860 Assembly Diagram, AC Version
456041	L	Model 8860 Assembly Diagram, 24V DC Version

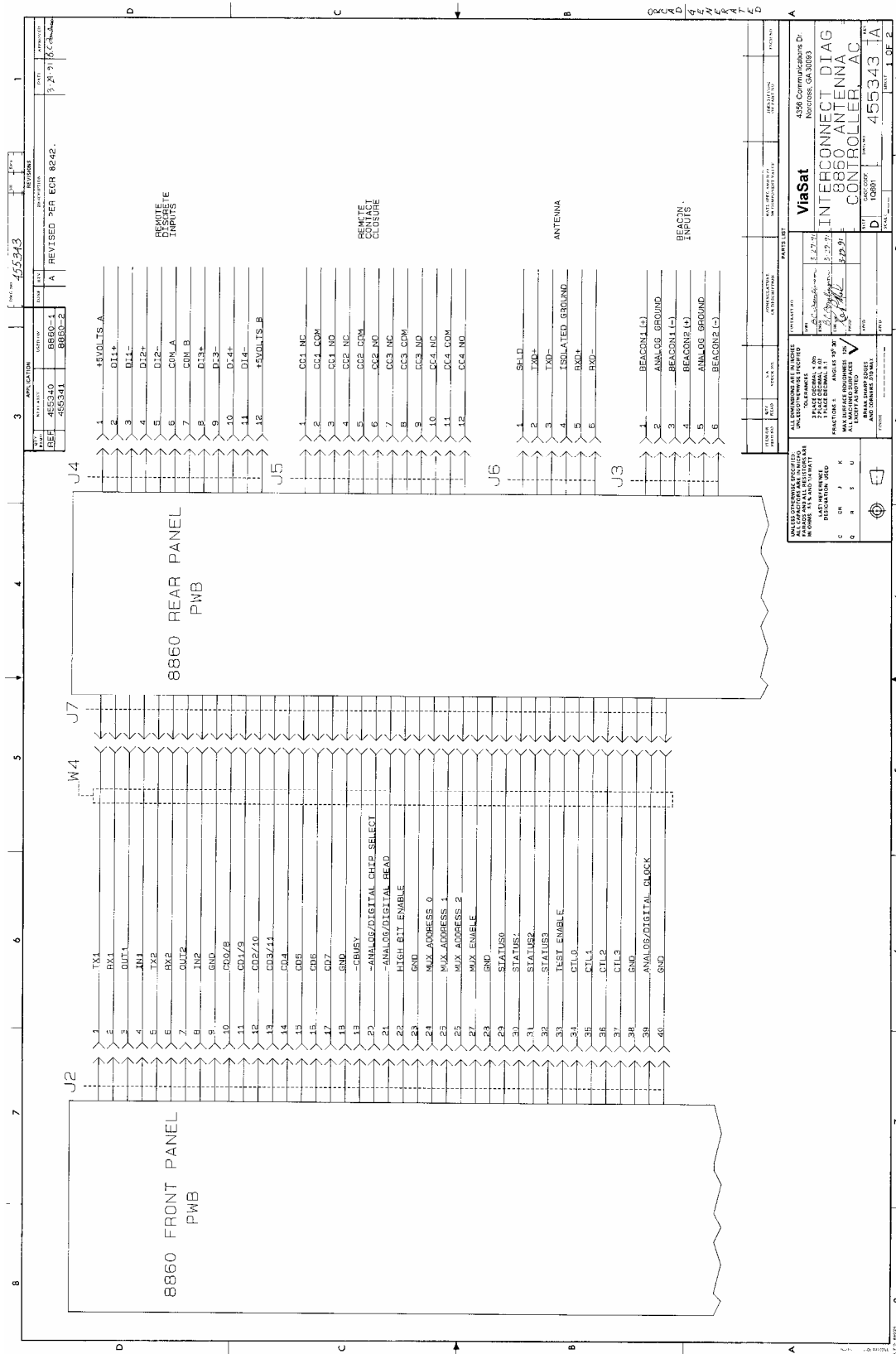


Figure 4-1. Model 8860 Interconnect Diagram, AC Version (Sheet 1 of 2), 455343

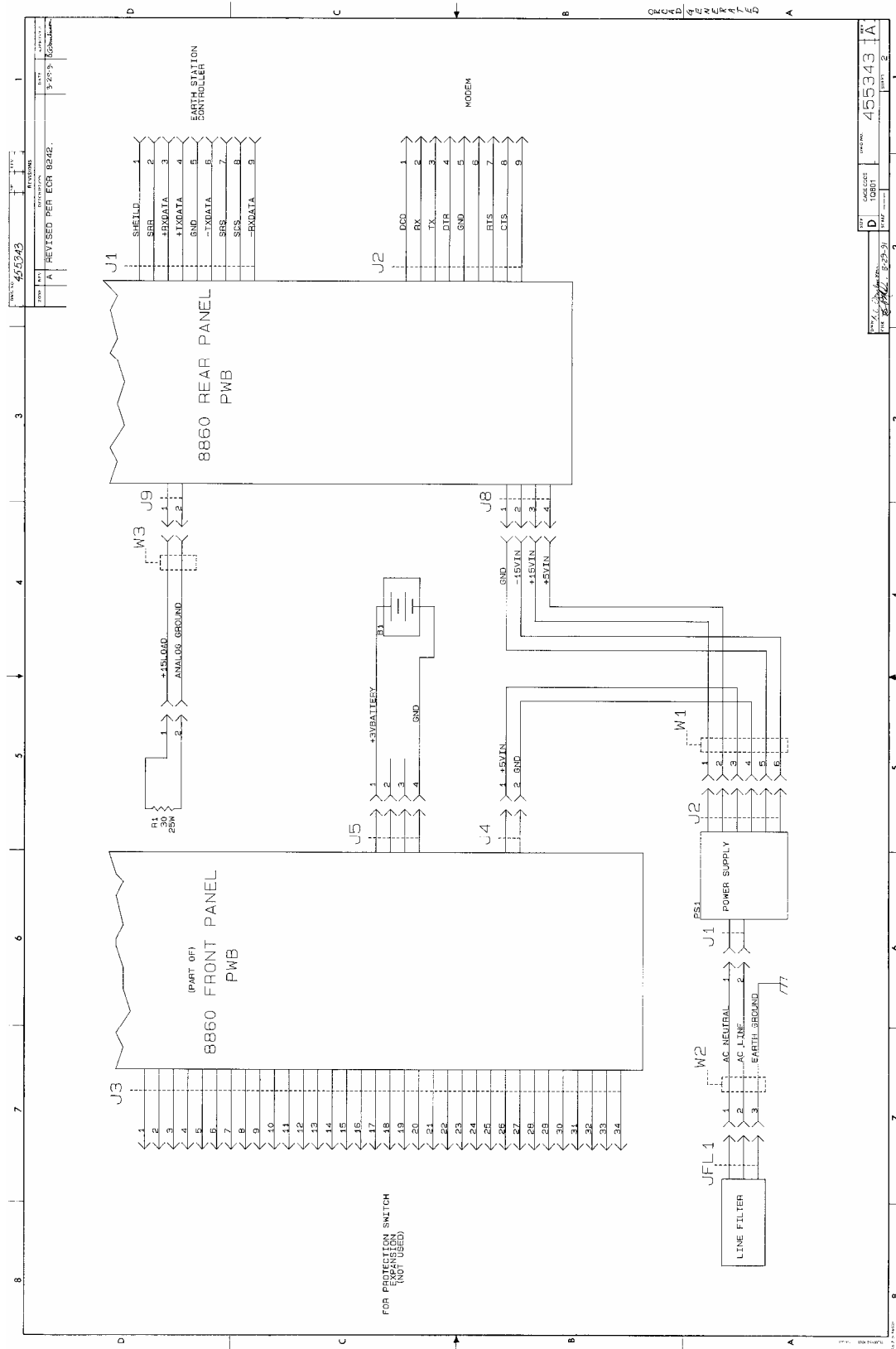


Figure 4-1. Model 8860 Interconnect Diagram, AC Version (Sheet 2 of 2), 455343

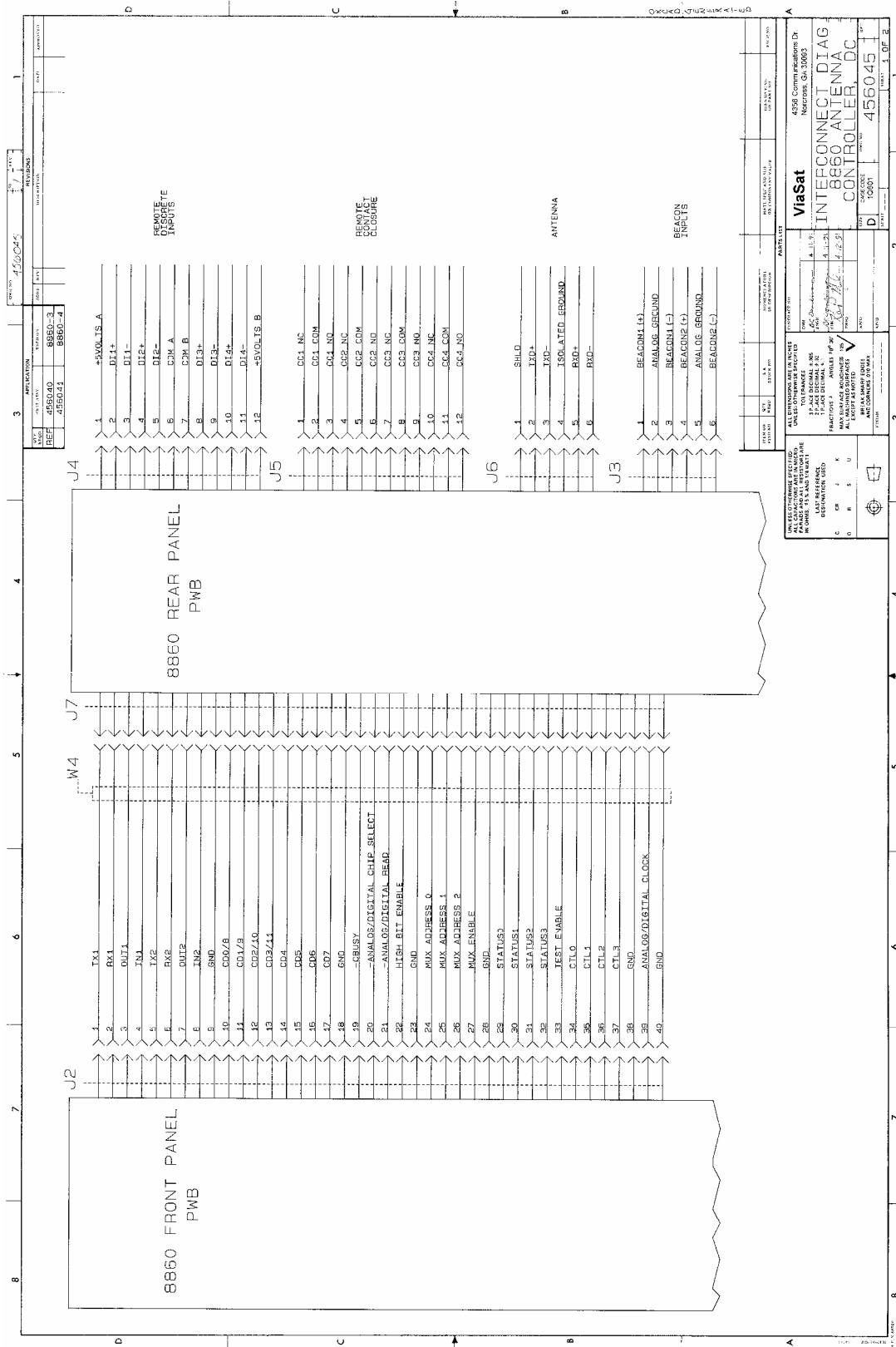


Figure 4-2. Model 8860 Interconnect Diagram, DC Version (Sheet 1 of 2), 456045

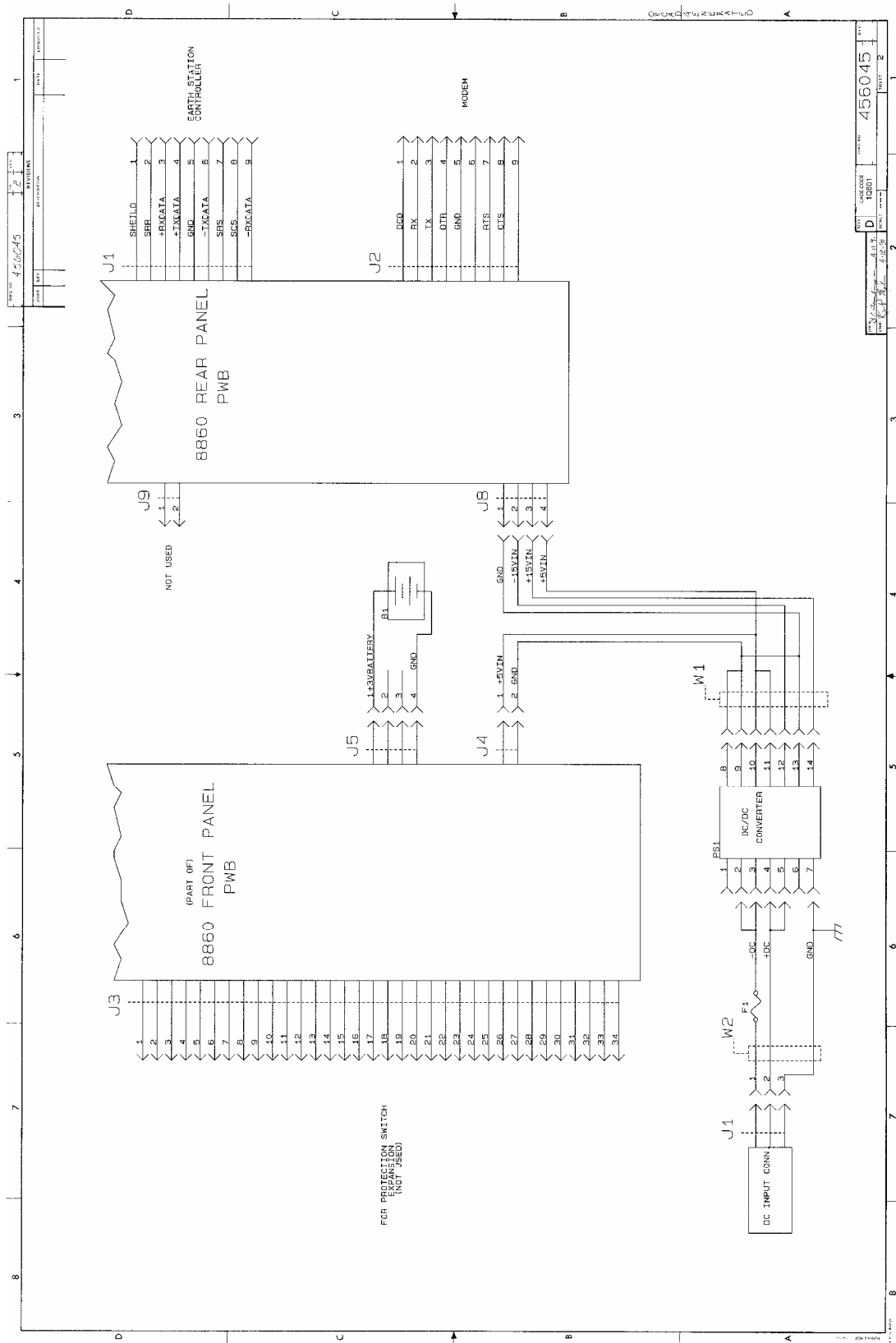


Figure 4-2. Model 8860 Interconnect Diagram, DC Version (Sheet 2 of 2), 456045

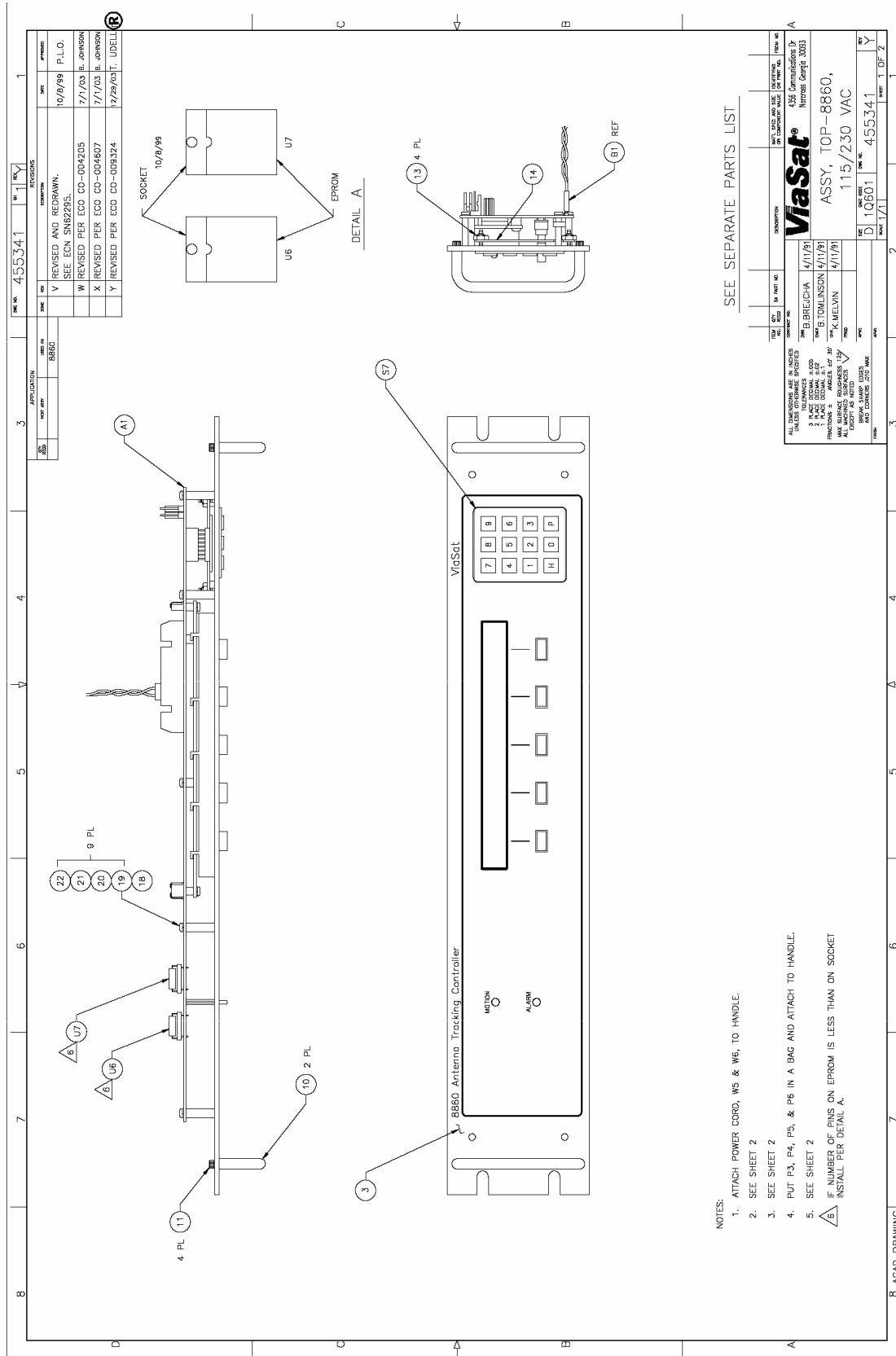


Figure 4-3. Model 8860 Assembly Diagram, AC Version (Sheet 1 of 4), 455341

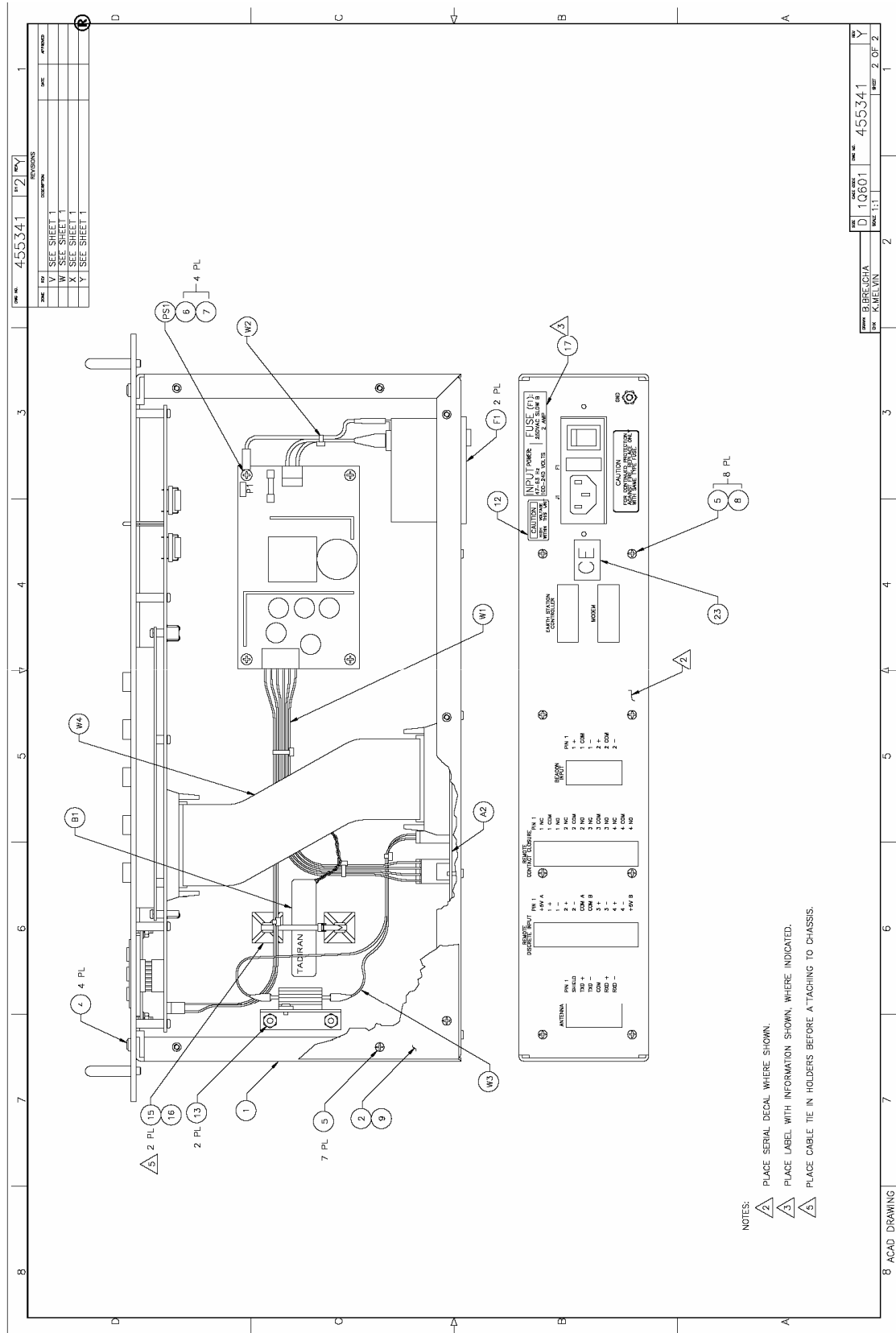


Figure 4-3. Model 8860 Assembly Diagram, AC Version (Sheet 2 of 4), 455341

Organization: 70
Explosion Level: 1

ViaSat Reference Designator Report

Item: 455341
TOP ASSY, 8860, 115/230 VAC, P/L

Report Date: 12-JAN-2004 09:44
Page: 1

Revision: Y Date: 2004/01/1 09:40



Level	Ref Des	Ref Des	Comments	Item	Item	Rev	Description	Quantity	UOM	Typ	Code	Item	Supply Type
1	440	517637	0	KIT,SHIP	0			1	EAC	SA	Make	Phantom	Phantom
1	360	455379	0	ASSY,CABLE-AC INPUT,8860	0			1	EAC	SA	Make	Phantom	Phantom
1	310	455299	0	ASSY,POWER RESISTOR	0			1	EAC	SA	Make	Phantom	Phantom
1	390	1008532	001	ASSY, FWB - FRONT PANEL 8860, TESTED	0			1	EAC	SA	Make	Phantom	Phantom Push
1	380	480484	0	LABEL, INPUT POWER/FUSE-8885	0			1	EAC	SA	Make	Bulk	Phantom
1	530	456059	0	DOC PKG, SFTWR-SATL STM, V1.0	0			1	EAC	REF	Buy	Bulk	Push
1	490	455342	0	REF &NOM, TOP ASSY 8860	0			1	EAC	REF	Buy	Bulk	Push
1	520	455345	D	TEST PROC TOP ASSY 8860	0			1	EAC	REF	Buy	Bulk	Push
1	510	455344	0	TEST SPEC, TOP ASSY 8860	0			1	EAC	REF	Buy	Bulk	Push
1	70	75128	0	WASHER NO. 6 FLAT NYLON .312 OD .047THK	0			9	EAC	RAW	Buy	Push	Push
1	100	86080	0	WASHER NO. 4 FLAT SHLDRD NYLON .140 OD	0			9	EAC	RAW	Buy	Push	Push
1	240	285797	A	PLATE,KEYPAD MTG	0			1	EAC	RAW	Buy	Push	Push
1	370	456042	0	PANEL,FRONT-W/LENS,8860	0			1	EAC	RAW	Buy	Push	Push
1	10	71499	0	NUT FLEXLOC 6-32 THIN HEX ZINC PL STL	0			6	EAC	RAW	Buy	Push	Push
1	300	455291	0	COVER, TOP-ANT. CONTRLR, 8860	0			1	EAC	RAW	Buy	Push	Push
1	290	455290	D	CHASSIS-ANT CONTRLR, IEU, 8860	0			1	EAC	RAW	Buy	Push	Push
1	280	557660	B	MANUAL, OPERATIONS-MODEL 8860 FIRMR 5.0	0			1	EAC	RAW	Buy	Push	Push
1	270	425053	F	MAN. -8860 ANT. CONT. INSTALLATION & MAINT.	0			1	EAC	RAW	Buy	Push	Push
1	480	578825	B	CE COMPLIANCE DECLARATIONS (ANT PRODUCTS)	0			1	EAC	RAW	Buy	Bulk	Bulk
1	540	512914	0	SFTWR DOC PKG-V1.0D,8860 FACTORY TEST	0			1	EAC	REF	Buy	Bulk	Bulk
1	500	455343	0	INTCONN D'AG-ANT CONT, AC, 8860	0			1	EAC	REF	Buy	Bulk	Push
1	170	178720	A	HANDLE BLK ALUM 1/4 OD 3 IN.	0			2	EAC	RAW	Buy	Push	Push
1	50	72372	A	SCREW 6-32 X 1/2 SOC CAP SST	0			4	EAC	RAW	Buy	Push	Push
1	130	132439	B	LABEL HIGH VOLTAGE 1/2-IN. X 1-IN.	0			1	EAC	RAW	Make	Bulk	Phantom
1	110	87296	A	MOUNT, CABLE TIE, .75 SO, 4 WAY,ADHESIVE BACKED,WHI	0			2	EAC	RAW	Buy	Push	Push
1	230	179816	A	CABLE TIE 8.0 IN. LONG - RED N	0			1	EAC	RAW	Buy	Push	Push
1	90	84819	96	ADHESIVE NUT LOCK LCKNG-RTNG 50 CC BOT	0			.001	EAC	OPS	Buy	Bulk	Bulk
1	30	72327	A	SCREW 4-40 X 3/8 PAN HD,SST	0			9	EAC	RAW	Buy	Push	Push
1	60	73266	A	WASHER-NO. 4-.125 .250 .022 AUS SST	0			9	EAC	RAW	Buy	Push	Push
1	470	538414	C	LABEL, CE MARK	0			1	EAC	RAW	Buy	Bulk	Push
1	160	175285	A	SCREW 6-32 X 3/8 BLACK HEAD	0			4	EAC	RAW	Buy	Push	Push
1	20	72319	A	SCREW 4-40 X 5/16 PAN HD,SST	0			15	EAC	RAW	Buy	Push	Push

Figure 4-3. Model 8860 Assembly Diagram, AC Version (Sheet 3 of 4), 455341

Report Date: 12-JAN-2004 09:44
Page: 2



ViaSat Reference Designator Report

Organization: 70
Explosion Level: 1

Revision: Y Date: 2004/01/1 09:40

Item: 455341 TOP ASSY, 8860, 115/230 VAC, P/L

Components		Ref	Item	Rev	Description	Quantity	UOM	Typ	Code	Supply Type
Level	Des	Des	Seq							Item
1	6	40	72367	96	SCREW 6-32 X 1/2 PAN HD,SST	4	EAC	RAW	Buy	Push
1	7	150	174555	96	WASHER NO. 6 LOCK, SPLIT, SST	4	EAC	RAW	Buy	Push
1	8	140	174554	A	WASHER NO. 4 LOCK, SPLIT, SST	8	EAC	RAW	Buy	Push
1	9	120	132438	B	LABEL HIGH VOLTAGE 2-IN. X 4-IN.	1	EAC	SA	Buy	Push
1	A	410	517622	D	ASSY,PWB- REAR PANEL, 8860	1	EAC	SA	Buy	Phantom
1	B	220	179761	A	BATTERY LITHIUM 3.6V SQ W/PLUG	1	EAC	RAW	Buy	Push
1	F	180	178821	A	FUSE 2 AMP 250V 5X20MM SLOW	2	EAC	RAW	Buy	Push
1	P	190	179169	A	CONN MISC HEADR TO WIRE 6-COND	1	EAC	RAW	Buy	Push
1	P	200	179173	A	CONN MISC HEADR TO WIRE 12-CON	1	EAC	RAW	Buy	Push
1	P	200	179173	A	CONN MISC HEADR TO WIRE 12-CON	1	EAC	RAW	Buy	Push
1	P	190	179169	A	CONN MISC HEADR TO WIRE 6-COND	1	EAC	RAW	Buy	Push
1	PS	210	179638	A	PWR SUPPLY THREE +15V2A -15V.35A +5V3A	1	EAC	RAW	Buy	Push
1	S	250	285804	A	KEYPAD-FRONT PANEL,W/LGND,7530	1	EAC	RAW	Buy	Push
1	U	450	726178-0006	A	EPR0M-U6, FIRMWARE V6.0 ODD, 8860	1	EAC	SA	Make	Push
1	U	450	726178-0007	A	EPR0M-U7, FIRMWARE V6.0 EVEN, 8860	1	EAC	SA	Make	Push
1	W	340	455359	B	ASSY,CABLE-PWR SPLY,AC,8860	1	EAC	FG	Make	Push
1	W	350	455360	A	ASSY,CABLE-LOGIC 8860	1	EAC	FG	Buy	Push
1	W	80	82801	96	CORD SET 3-WIRE #18 125V 7 1/2-FT W/FEN	1	EAC	RAW	Buy	Push
1	W	260	363599	0	ASSY,CABLE-230V POWER,NO PLUG	1	EAC	RAW	Make	Phantom

***** End of Report *****

Figure 4-3. Model 8860 Assembly Diagram, AC Version (Sheet 4 of 4), 455341

5.2.1 Operator Input, Interrupt, and Display Operation

When the operator presses a softkey or enters data on the numeric keypad assembly, the information is encoded by the keypad/ softkey input circuit, U21. Upon receiving the information, the keypad/softkey input circuit generates an interrupt signal to the interrupt control circuit, U3. The interrupt control circuit assigns priorities to the interrupts as noted below (level 1 is the highest priority interrupt and level 5 is lowest priority interrupt):

<u>Interrupt</u>	<u>Level</u>
Voltage Monitor	1
Communication Interface	2
Real-Time Clock	3
Beacon/Discrete Interface (counter/timer)	4
Keypad/Softkey Input	5

NOTE

The interrupt name corresponds to the name of circuit that generates the interrupt.

Upon receiving the keypad/softkey input interrupt, the processor reads the information stored in U21 via the data bus to determine the operator-initiated command. The processor then performs the required operation and transmits the appropriate data to the display assembly using the data bus, D0 through D15, and address bus A1 through A23.

The display assembly is a 40-character LCD display controller. The address and data bus connects directly to this slower device (memory mapped I/O). Data transfers use the DTACK control line (see Figure 5-2) to insert the needed wait cycles. Both the display assembly and the keypad assembly are mounted directly to the front panel control board.

Units manufactured beginning fourth quarter 1994 allow the following conditions be triggered from the front panel by pressing two softkeys simultaneously. Keys are numbered from the left beginning with S1.

<u>Condition</u>	<u>Press Keys</u>
Reset	S1 & S3
Int. Req. 7	S2 & S3
Int. Req. 2	S4 & S3
Int. Req. 1	S5 & S3

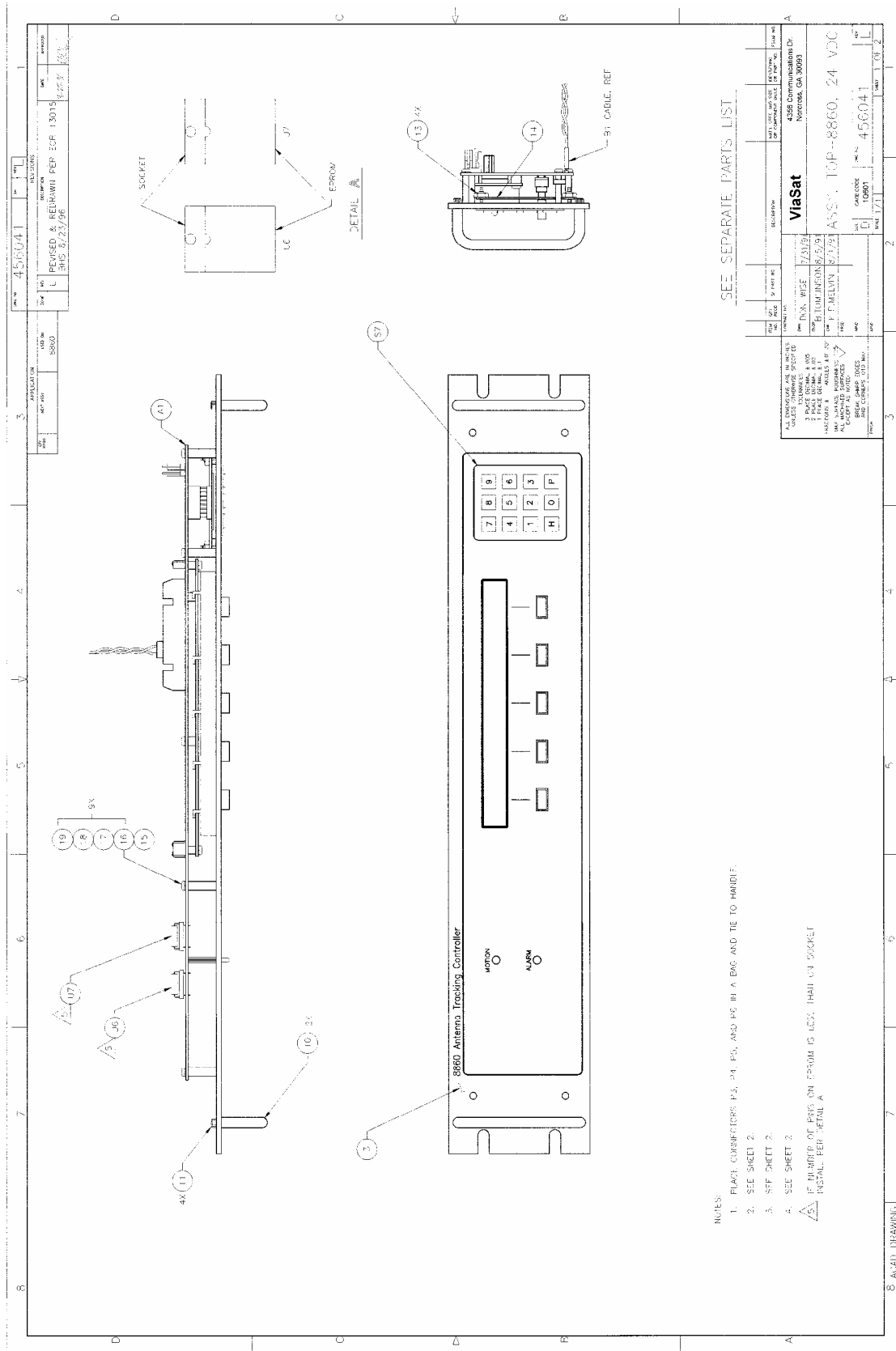


Figure 4-4. Model 8860 Assembly Diagram, 24V DC Version (Sheet 1 of 4), 456041

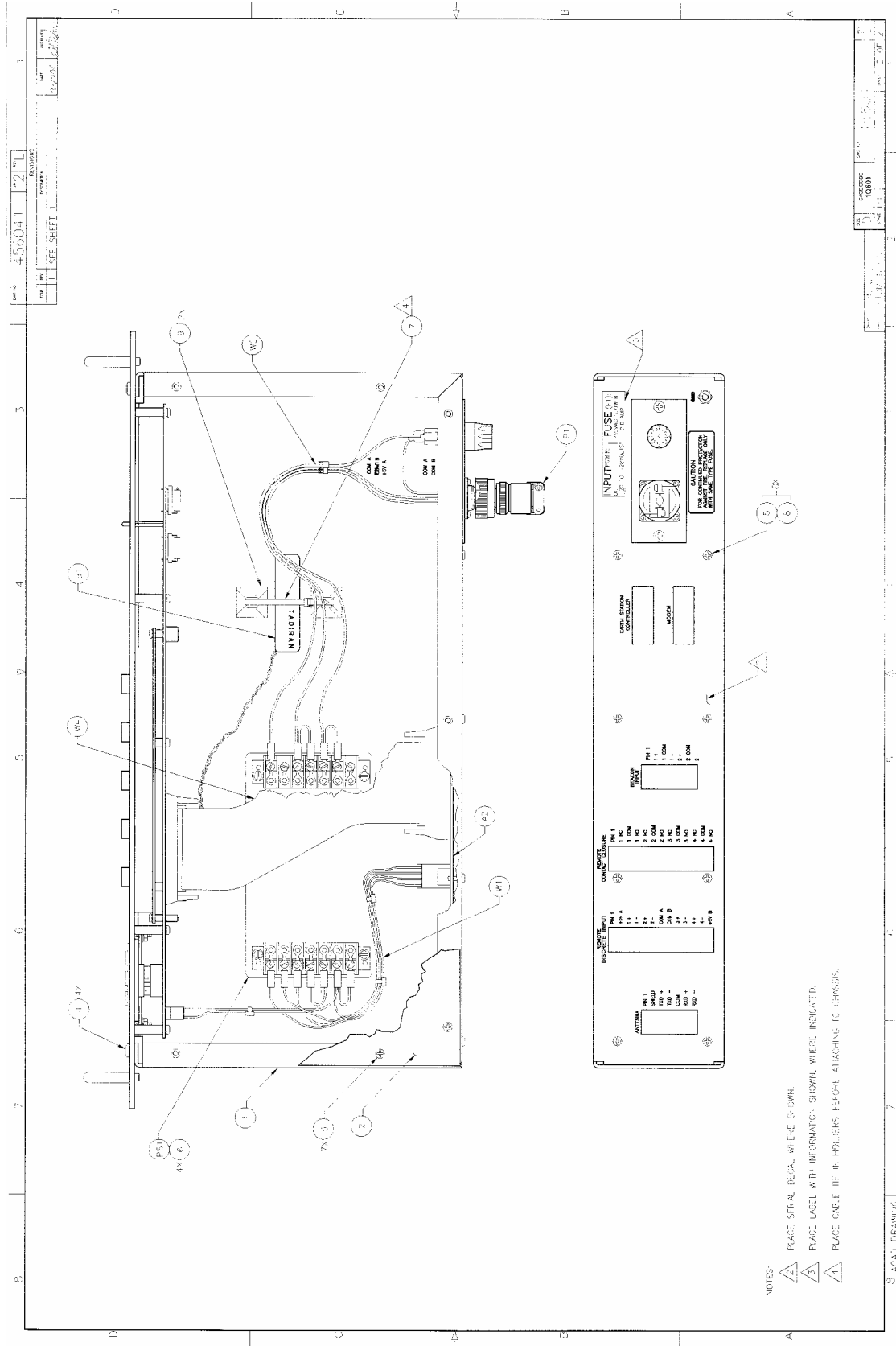


Figure 4-4. Model 8860 Assembly Diagram, 24V DC Version (Sheet 2 of 4), 456041

Assembly	Plant	REF DES	Revision L	Material Group	16ANTCONT	Profit Center	16ANTCONT	Valid From
456041	60	DES	number	Description	16ANTCONT	Center	16ANTCONT	08-26-96
		Item						
1		370 517637		KIT, SHIP				
2		220 42S053		MAN.-8860 ANT.CONT.INSTALLATION & MAINT.				
3		230 42S300		MANUAL OPERATION-MODEL 8860 FIRMWR 4.0 0				
4		240 455290		CHASSIS-ANT CONTRLR IEU 8860				
5		250 455291		COVER, TOP-ANT CONTRLR 8860				
6		310 456042		PANEL, FRONT-W/LENS, 8860				
7		130 175285		SCREW 6-32 X 3/8 BLACK HEAD				
8		20 72319		SCREW 4-40 X 3/8 F HD, 100 DEG, SST				
9		190 179816		CABLE TIE B.0 IN. LONG - RED N				
10		120 174554		WASHER NO. 4 LOCK, SPLIT, SST				
11		110 87296		CABLE TIE MOUNT ADHESIVE BACKED				
12		140 178720		HANDLE BLK ALUM 1/4 OD 3 IN.				
13		40 72372		SCREW 6-32 X 1/2 SOC CAP SST				
14		10 71499		NUT FLEXLOC 6-32 THIN HEX CAD PL STL				
15		200 285797		PLATE KEYPAD MTG				
16		90 84819		ADHESIVE NUT LOCK LCKNG-RTNG 50 CC BOT				
17		100 86080		WASHER NO. 4 FLAT SHLDRD NYLON .140 OD				
18		60 75128		WASHER NO. 6 FLAT NYLON .512 OD .047THK				
19		50 73266		WASHER NO. 4 -.125 .250 .022 AUS SST				
A	1	320 512913		ASSY, PMB - FRONT PANEL, 8860				
B	1	340 517622		ASSY, PMB - REAR PANEL, 8860				
P	1	180 179761		BATTERY LITHIUM 3.6V SQ W/PLUG				
P	3	80 84338		CONNECTR 3106A 10SL 3S				
P	4	150 179169		CONN MISC HEADR TO WIRE 6-COND				
P	5	160 179173		CONN MISC HEADR TO WIRE 12-CON				
P	6	150 179173		CONN MISC HEADR TO WIRE 12-CON				
PS	1	150 179169		CONN MISC HEADR TO WIRE 6-COND				
S	7	170 179684		CONVERTER VLTG 18-36VDC TO +-15V1A+5V5A				
U	6	210 285804		KEYPAD-FRONT PANEL, W/LGND, 7530				
U	7	350 517626		IC, EPROM - U6 (ODD), V4.0, 8860				
W	1	360 517627		IC, EPROM - U7 (EVEN), V4.0, 8860				
W	2	290 455346		ASSY, CABLE-PWR SPLY, DC, 8860				
W	4	260 455339		ASSY, CABLE-DC INPUT, 8860				
W	4	300 455360		ASSY, CABLE-LOGIC 8860				

Figure 4-4. Model 8860 Assembly Diagram, 24V DC Version (Sheet 3 of 4), 456041

Chapter 5

Front Panel Control Board

5.1 Introduction

This chapter provides detailed information pertaining to the front panel control board. The front panel control board consists of a 68000 16-bit microprocessor, softkeys, and the circuitry necessary to provide operator interface and control of the antenna position. The microprocessor controls all of the antenna control operations.

5.2 Description

Commands generated within the microprocessor (processor, U1) are decoded in the device selection circuit, U10 through U15 (see Figure 5-1). The output of the device selection circuit controls the selection of each circuit within the front panel control board so that the processor, U1, can selectively communicate with each device or circuit.

The processor uses up to 256 Kbytes of stored program data in the erasable programmable read-only memory (EPROM), U6 and U7. Using the firmware, or program stored on the EPROMs, the processor executes operator commands and provides antenna position control and satellite tracking. The firmware is written or "burned" into the EPROMs at the factory, and is upgraded the field by replacing the EPROMS. The board is jumper selectable for up to 2M bytes of EPROM for future expansion; however, additional memory requires new address decoder ICs. The processor uses up to 256 Kbytes of data storage in the static random access memory (RAM), U8 and U9. 256 Kbytes is the maximum RAM available for this board.

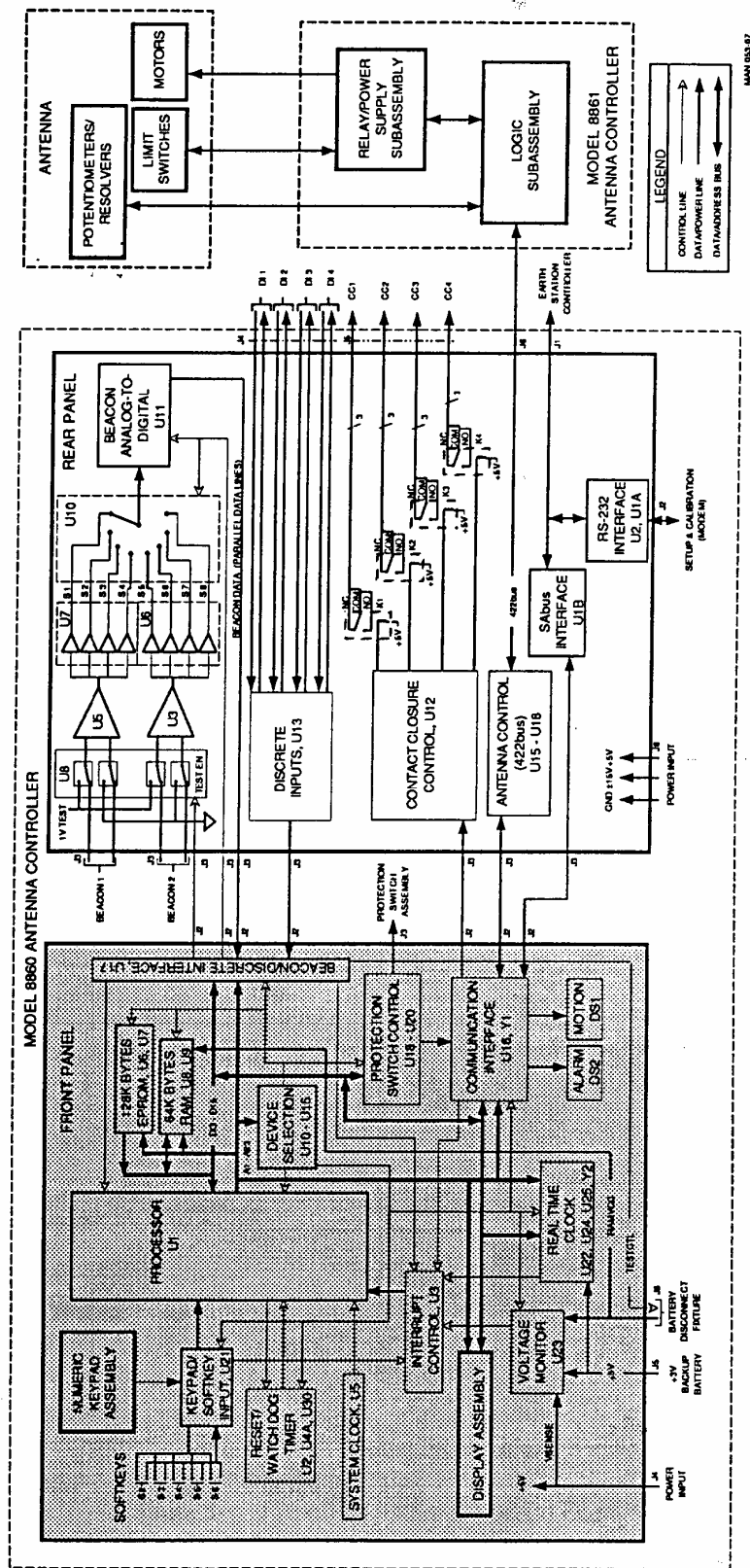


Figure 5-1. Front Panel Control Board Block Diagram

Older units use front panel PWB assembly 455338, which does not have the above capability. Otherwise, operation of the two board assemblies is identical to the user.

5.2.2 Interface Operation

The processor interfaces with the rear panel subassembly using two interface circuits: the beacon/discrete interface, U17, and the communication interface, U16. The beacon/discrete interface circuit issues the appropriate control signals (generated from the processor) and receives data from the beacon analog-to-digital circuit and discrete data from the discrete opto-isolated inputs circuit. After receiving the data, the beacon/discrete interface circuit generates an interrupt signal to inform the processor that the data is ready to be read and processed.

The communication interface circuit, U16 and Y1, provides the required clock and data signals to enable the processor to communicate with other equipment. Oscillator Y1 provides the data transfer clock signal to circuit U16 (see Figure 5-2). Using this data transfer clock signal, circuit U16 generates data transfer rates of 1200, 2400, 9600, and 19200 bits-per-second based on operator input commands received via the processor. The data signals supports all of the standard asynchronous parameters (e.g., stop bit size, number of data bits, etc). Using the clock and data signals, the communication interface circuit sends and receives data to the rear panel subassembly which provides the RS-422 (ANTENNA port), SAbus (EARTH STATION CONTROLLER port), and RS-232 MODEM port) drivers.

Under processor control, the communication interface circuit provides four output control signals to the contact closure control circuit, which controls the contacts on four relays. The processor also uses the communication interface circuit to light the motion indicator, DS1, whenever the antenna is being driven and light the alarm indicator, DS2, whenever a malfunction is detected within the antenna control system.

5.2.3 Control Circuits

Upon power-up, the reset/watchdog timer circuit, U2, U4A, and U30, provides a 100 milli-second reset pulse to reset the processor. After reset, the processor uses an overlay reset memory map which allows the processor to boot up and obtain the stack pointer and reset vector from the EPROM circuit. This initiates the processing operation. The reset circuitry also monitors the +5V supply and resets the processor if that supply falls below 4.5V.

The reset/watchdog timer circuit uses watchdog timer circuitry to reset the processor if it is not strobed regularly by the output control line from the processor. The time-out period is between 0.5 and 2 seconds.

The system clock, U5, provides an 8 MHz clock signal to the processor and other front panel control board circuits. This is the master clock signal for the Model 8860 Antenna Tracking Controller.

The voltage monitor circuit, U23, monitors the +5V input power. If the voltage monitor circuit senses a loss of +5V power, the circuit will issue an interrupt to the interrupt control circuit. This interrupt has the highest priority and informs the processor of the potential power loss. The processor then enters a routine to save the data being processed so that data will not be lost during a power failure.

The real time clock circuit, U22, U24, U25, and Y2, uses a crystal time source (Y2) to provide an accuracy of ± 30 ppm. This circuit provides the time-of-day and date to memory mapped registers and has the capability to generate an interrupt to the processor at a given time and date. The circuit uses battery backup to ensure time is not lost during power failures.

5.3 Applicable Technical Drawings

The following list contains all technical drawings required for maintenance and repair of the front panel control board.

Part No.	Rev.	Title
512913-5001	B	Front Panel Control Board Assembly Diagram
1002664	001	Front Panel Control Board Assembly Diagram

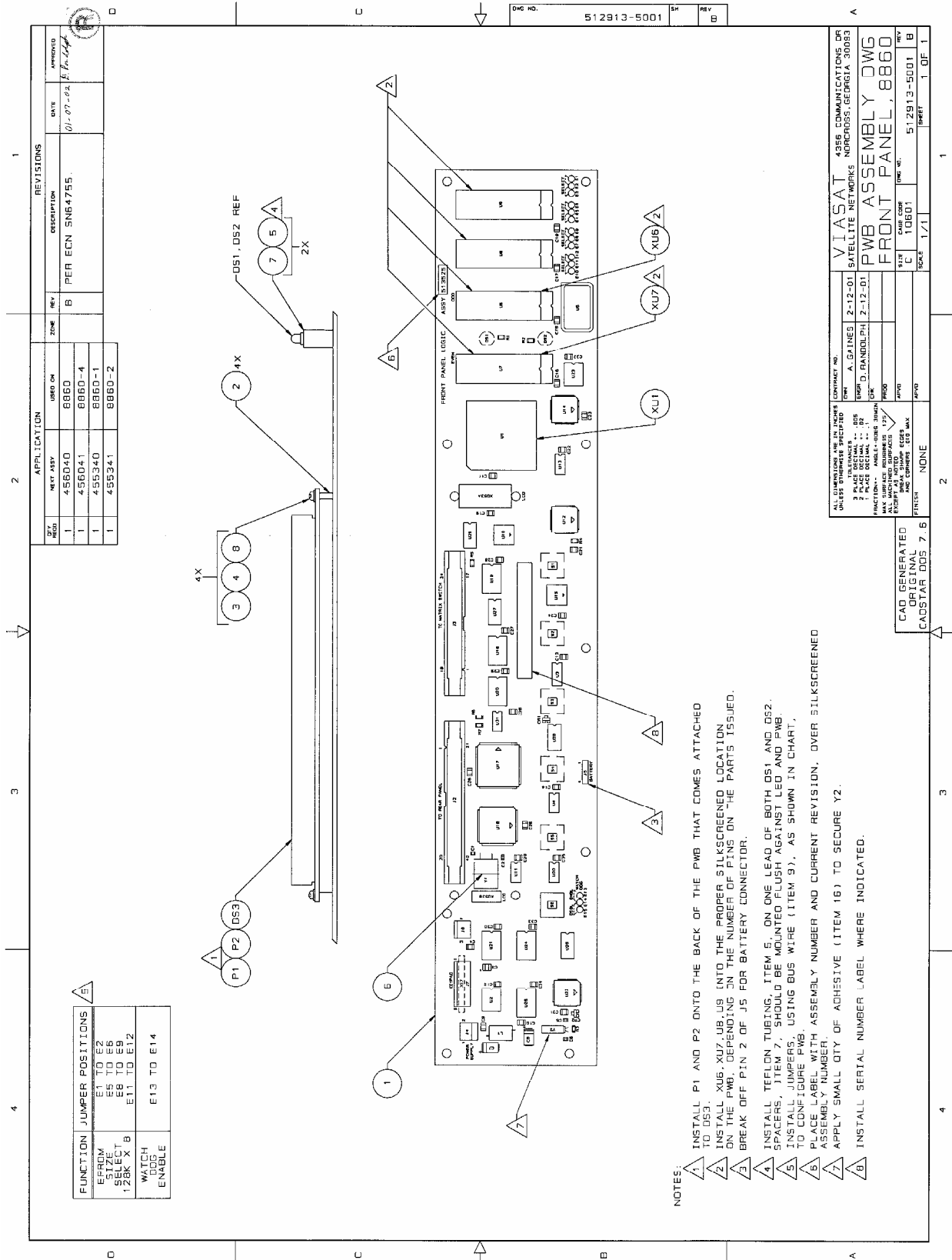


Figure 5-2. Front Panel Control Board Assembly Diagram, 512913-5001B

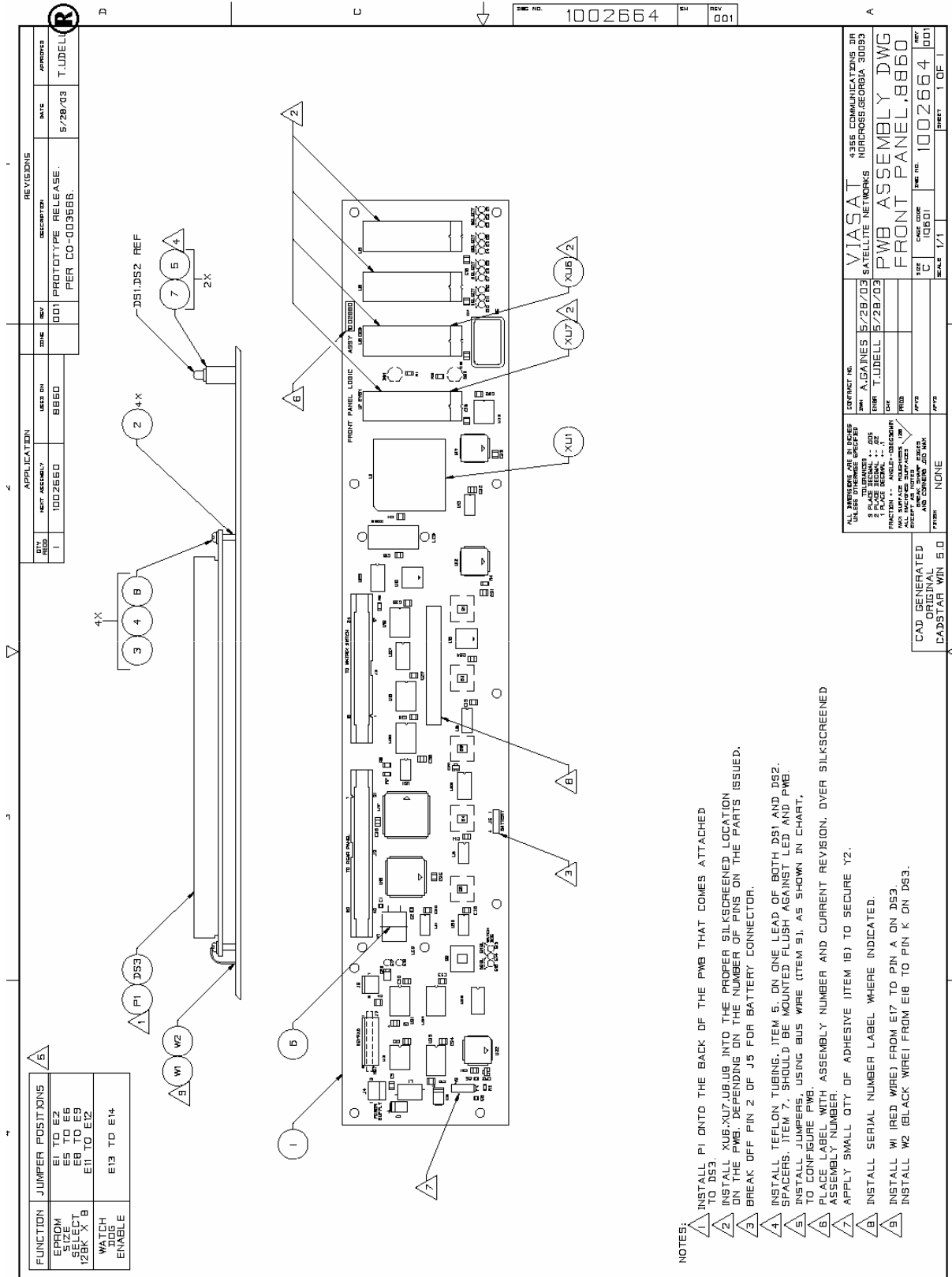


Figure 5-3. Front Panel Control Board Assembly Diagram, 1002664

Chapter 6

Rear Panel Subassembly

6.1 Introduction

This chapter provides detailed information pertaining to the rear panel subassembly. The rear panel subassembly consists of an analog-to-digital converter, relays, bus drivers, and other circuitry necessary to provide an interface between the front panel control board and external equipment. The front panel control board processor controls all rear panel subassembly operations.

6.2 Description

The rear panel subassembly provides three major functions: beacon data conversion, contact closure I/O and serial communication interface. The data is transferred to and from the front panel and external equipment under control of the processor in the front panel control board. All external equipment connections are made on the rear panel subassembly.

6.2.1 Beacon Data Conversion

The beacon data conversion function provides analog-to-digital (ADC) conversion of input analog beacon data. This rear panel function provides 12-bit resolution with a typical conversion time of 100 microseconds or less. The front panel processor interfaces with the beacon data conversion function using a parallel bus (BEACON DATA line, see Figure 6-1) composed of clock, data, and ADC select lines. There are a total of 12 BEACON DATA lines, 8 data lines, and 4 control lines.

Analog beacon data from beacon 1 and/or beacon 2 enters the rear panel and is applied to test circuit U8. When commanded from the front panel processor, this circuit selects a 1V test signal for an operational check of the beacon data conversion function. The operator can initiate this test from the front panel or from the Earth Station Controller. Upon initiating the test, the processor compares the test conversion data with data stored on the front panel EPROM to ensure the beacon data conversion function is operating properly.

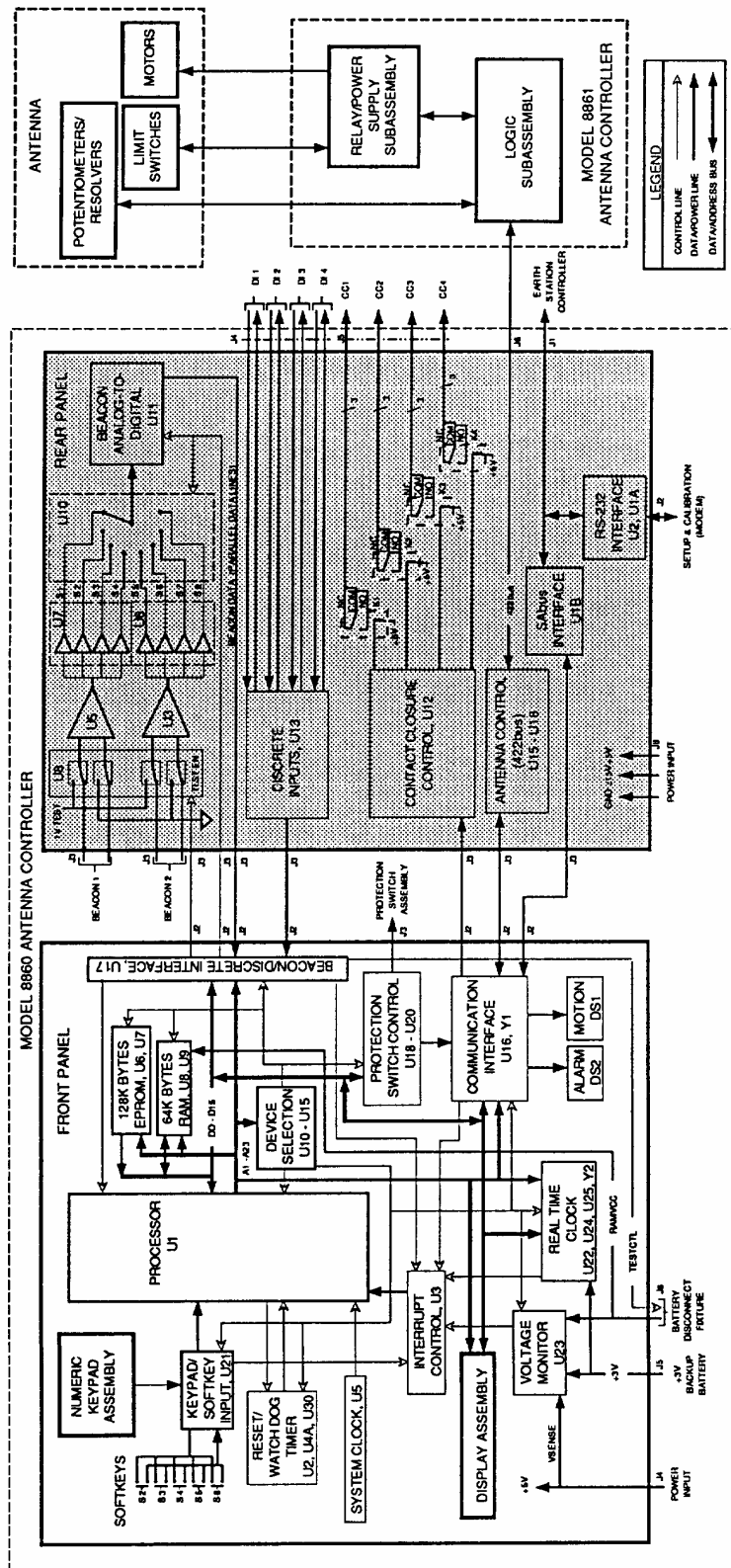


Figure 6-1. Rear Panel Subassembly Block Diagram

The analog beacon data is converted to a single-ended signal by amplifier U3 or U5 and separated into four signals for each range of beacon input signal levels. Amplifier network U6 and U7 provides the appropriate amplification requirements for the selected type of beacon receiver. There are four different ranges of signal levels, which can be received from a beacon receiver.

The following list identifies the different ranges of signal levels and the corresponding switch position of eight to one multiplexer, U10, required to select the signal range.

<u>Input</u>	<u>Switch</u>	<u>Input Level Range</u>
Beacon 1	S1	-12V to +12V
	S2	-3V to +3V
	S3	0V to +12V
	S4	0V to +6V
Beacon 2	S5	-12V to +12V
	S6	-3V to +3V
	S7	0V to +12V
	S8	0V to +6V

The desired beacon and required signal range can be selected by the operator on the front panel or from the Earth Station Controller. After operator selection is made, the front panel processor selects the desired signal in U10. The selected signal is applied to beacon analog-to-digital circuit, U11, where the analog signal is converted to digital data. The digital beacon data is transferred to the front panel as parallel digital data.

6.2.2 Input/Output Discretes

The rear panel subassembly receives four input discretes, DI 1 through DI 4. These input discretes are applied to opto-isolated TTL level inputs in the discrete opto-isolated inputs circuit, U13. The discrete signals are then applied to the front panel for processing.

The rear panel provides four contact closure outputs. The front panel processor generates four output discretes to the contact closure control circuit, U12. When this circuit receives an active (high level) discrete, it energizes the appropriate relay. All three relay contacts are applied to the rear panel. The contacts as they appear in Figure 6-1 are: normally closed (NC), common (COM), and normally open (NO).

6.2.3 Serial Communication Interface

The serial communication interface function provides the drivers for the RS-422 (ANTENNA port), SAbus (EARTH STATION CONTROLLER port), and RS-232 (MODEM port) interface. The serial ports support baud rates of 1200, 2400, 9600, and 19200 baud. The baud rates are operator selected on the front panel.

The antenna control (RS-422) circuit, U15 through U18, provides the RS-422 drivers for the communication channel with Model 8861A/8862 Antenna Position Controller. The antenna control (RS-422) circuit is physically isolated from the other rear panel circuitry. Opto-coupler U6 (Figure 6-2) provides data transfer and dc/dc converter bridge, U7, provides 300V of dc power isolation. The circuit is protected against transient overvoltages at the connector to outdoors with the use of both avalanche diodes, CR19 through CR22, and gas tube V1.

The SAbus interface circuit, U1, provides the SAbus drivers for the communication channel with the Earth Station Controller. The RS-232 interface circuit, U2, provides the communication channel for setup and full antenna system control.

Rear panel assembly 517622 replaces 455358 and provides improved transient protection, noise immunity, and eliminates electrical adjustment of the antenna communications channel. Operationally, the board has not changed, and is completely compatible with earlier 8860 units.

6.3 Applicable Technical Drawings

The following list contains all technical drawings required for maintenance and repair of the rear panel subassembly

Part No.	Rev.	Title
517622-5001	A	Rear Panel Assembly Diagram

Appendix A

Tracking System Information

A.1 Introduction

The following paragraphs provide tracking system level information. This information may be when installing and troubleshooting the system.

A.2 System Start-up and Troubleshooting

For the antenna tracking system to operate successfully, all of the major components must be installed and operating correctly.

1. The Antenna Position Controller (8861A/8862) must be correctly wired and calibrated. The Limit Switch Resolver (LSR) packages must be correctly installed and adjusted and must be free of binding or backlash. The antenna actuators must operate smoothly with no binding or loose hardware (couplings, pins, etc.). In order to generate correct data in the satellite table, the site coordinates must be accurately determined and entered into the calibration program. Refer to the appropriate installation and calibration manuals for more information.
2. The communication link between the 8860 and the Position Controller must be wired correctly and tested for link integrity. If a com link problem is suspected, use an oscilloscope and check the differential signal levels. They should be measured and each side of each pair should be approximately 2 V p-p.
3. The RF front end of the system must be installed correctly and tested for proper performance. In particular, for Ku-band systems, the subreflector must be adjusted by pattern measurement - setting the subreflector to a nominal value per the manual is NOT adequate. The LNA/LNB mounting must be tight with no significant twisting or binding of the IFL cables. Power supplied to LNA/LNBs should be stable and at the correct voltage. For the correct signal levels and LNA/LNB supply voltages, refer to the system-level design documentation.
4. The RF input to beacon/video receivers used for tracking must be at the designed level and have an acceptable signal/signal plus noise ratio. In particular, the receiver input must not be overloaded by a strong satellite beacon signal as this will cause erroneous tracking performance. For the correct signal levels, refer to the system-level design documentation.

5. The beacon/video receiver must be set to the correct frequency and output gradient (0.5 to 1.0 V/dB highly recommended). The receiver output calibration should be checked by placing a step attenuator in front of its input. Refer to the beacon receiver manual for more information.
6. The receiver must be wired correctly to the 8860 beacon input. Note that the 8860 inputs are differential and both the + and - terminals must be connected. The COM terminal would be used for a shield but connected only at one end of the cable.
7. The satellite table must be loaded into the 8860 from the computer used for calibration. Global parameters such as local time, site coordinates, beacon gradient and threshold must be set. Refer to the calibration manual, 1008111 for this table loading procedure.
8. Prior to attempting tracking operation, the position repeatability of the system must be measured. The error on a single axis should not exceed approximately 0.2 dB, subject to beacon noise/modulation level and spectrum analyzer resolution.
9. To begin tracking, the antenna must be peaked on the desired satellite and the desired tracking mode entered into the 8860. During the initial 24 hour period, the complete system must not be disturbed (particularly the receiver frequency) as this may caused the 8860 to acquire erroneous position data. The use of a strip chart recorder connected to the beacon level signal is strongly recommended as this will aid in troubleshooting.

A.3 Repeatability Test

Most tracking problems can be traced to poor positioning repeatability problems. A repeatability problem exists whenever an antenna does not reliably point to the commanded position.

To verify proper pointing repeatability, perform the following procedure. Note that some antenna repeatability problems have occurred at certain look angles but not at others so it may be necessary to test the antenna using more than one satellite. Intermittent problems may require that the following test be repeated several times. Also note that repeatability behavior varies from one axis to another.

1. Secure an appropriate satellite signal strength meter. This can be a spectrum analyzer, a beacon receiver, or video receiver.
2. Manually peak the antenna azimuth, elevation, and polarization on a stationary satellite.
3. Record the signal strength, the azimuth, and elevation. (Record all readings on the attached form. Make additional copies as necessary.)

4. Move the azimuth axis up 0.5° . Record the signal strength reading and the azimuth and elevation.
5. Command the antenna back to the original position by entering the desired azimuth and elevation angles on the 8860 front panel.
6. Record the signal strength, the azimuth, and elevation readings. (The system should return to the original position. A repeatability problem is present when the azimuth and elevation readouts indicate the correct position but the signal strength does not return to the peak reading within approximately ± 0.2 dB. In some extreme cases the system may not even indicate the commanded angles after moving.)
7. Repeat steps 4, 5, and 6 but move the azimuth axis down 0.5° .
8. Repeat steps 4, 5, and 6 but move the elevation axis up 0.5° .
9. Repeat steps 4, 5, and 6 but move the elevation axis down 0.5° .
10. Repeat steps 4, 5, and 6 but move the polarization axis up 0.05° .
11. Repeat steps 4, 5, and 6 but move the polarization axis up 0.05° .
12. Repeat steps 4, 5, and 6 but move the elevation axis up 0.05° .
13. Repeat steps 4, 5, and 6 but move the elevation axis down 0.05° .

The tracking software cannot operate unless the antenna is properly pointed to the commanded position within $\pm 0.01^\circ$ and/or ± 0.2 dB (approximately). (The precision of antenna control systems varies somewhat. Typically, larger antennas are more precise.)

If the azimuth or elevation axis fails to pass the repeatability test, verify proper installation/operation of the following system components:

1. Check that the LSR package hardware is tight.
2. Check that the LSR external coupling is properly aligned and not bent.
3. Check for binding inside of the LSR package.
4. Check the LSR wiring shield connections and grounding per the electrical installation manual.
5. Check antenna-mounted RF hardware for loose fit and check all cable connections.
6. Check that the axis actuator does not have excessive play.
7. Use the Calibration software to optimize the axis parameters.

Repeatability Test Worksheet

Antenna Size _____ Frequency: C-band___ Ku-band___

Date: _____ Time: _____

Move	Signal Strength	Azimuth	Elevation
Initial Position			
AZ Up 0.5°			
Return to Initial Position			
AZ Down 0.5°			
Return to Initial Position			
EL Up 0.5°			
Return to Initial Position			
EL Down 0.5°			
Return to Initial Position			
AZ Up 0.05°			
Return to Initial Position			
AZ Down 0.05°			
Return to Initial Position			
EL Up 0.05°			
Return to Initial Position			
EL Down 0.05°			
Return to Initial Position			