

Digital Control Unit for HAM-IV and T-2X

Model DCU-1/ DCU-1X
Instruction Manual



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CHAPTER 1 INSTALLATION AND OPERATION

Section 1. Components of the DCU-1 "Pathfinder" Digital Control Unit

General Description

The DCU-1 "Pathfinder" digital control unit features 6 memory presets, automatic brake delay (8 seconds), automatic motor slowdown (last 5 degrees), automatic motor control on startup, programmable center of rotation, full circle analog display of current and target bearings, digital display of current and target bearings, automatic display blanking of target bearings, automatic display blanking (30 minutes), RS-232 control with passthrough, and an 8 pin socket for the control cable.

Your existing rotator unit (HAM IV, T2X, or compatible) must be connected to the control unit with an 8-wire cable. You may use your existing cable, you may assemble your own cable from the information supplied in this manual, or you may purchase pre-assembled

The DCU-1 "Pathfinder" digital control unit consists of the following main components:

PN 870804 DCU-1 Control Unit Assembly

PN 870805 Parts Pack DCU-1 (120 VAC)

PN 870843 Parts Pack DCU-1 (220 VAC)

Section 2. DCU-1 Digital Control Unit

DCU-1 Digital Control Unit Specifications:

Size

8.5"x4.3"x9.0" (W x H x D)
(21.6 x 11.0 x 22.8 cm)

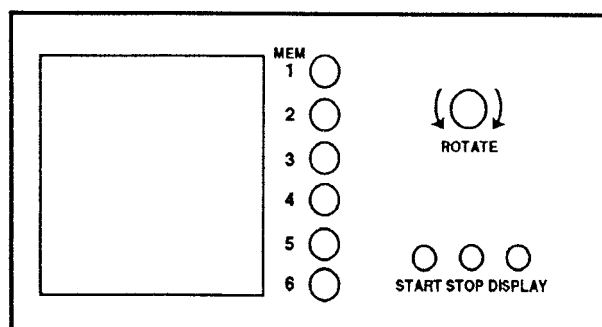
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Figure 1
Front View

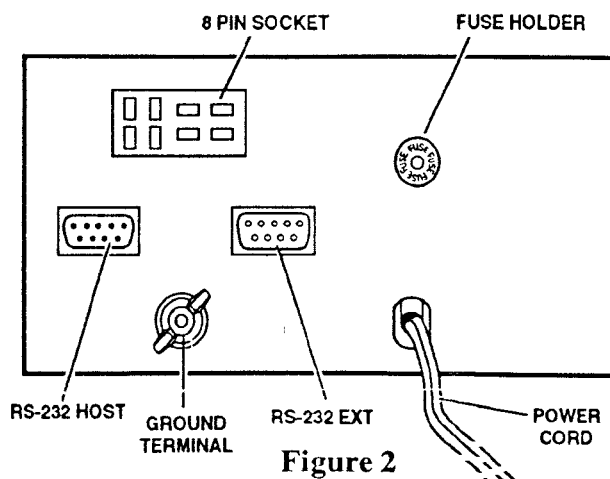


Figure 2
Back View

Section 3. Precautions

Metal towers must be grounded properly at the tower location before the DCU-1 "Pathfinder" is connected to the rotator. This is to minimize electrical hazard and the possibility of lightning damage. DO NOT bury bare aluminum wires or stakes in the ground. Use copper or copper-clad ground stakes. The service entrance ground should be checked. The household convenience outlet should be the 3-prong type (grounded back to the service entrance). Connect a ground wire to the DCU-1 ground terminal.

The DCU-1 Control Unit is not weatherproof and must be located in a house or other protected location. The DCU-1 should not be exposed to temperatures over 130°F!

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The DCU-1 "Pathfinder" digital control unit has been carefully designed and manufactured to give many years of trouble-free service when carefully and professionally installed. It consists of the strongest and best commercially available components.

Section 4. Installation

Precautions

1. Unbalanced weight: Weight should be as closely balanced as possible. Unbalanced weight in an antenna creates a bending moment of force which is concentrated on the mast at the point where it is clamped to the rotator.
2. Wind Pressure: Balanced wind pressure against the antenna system produces a bending force on the mast which can cause the same stresses as unbalanced weight. To minimize these forces, a thrust bearing should be used where possible, the antenna should be as close to the top of the tower as possible and the rotator shelf should be as low as possible.
3. Unbalanced Wind: If the antenna has unequal wind areas and element spacings on each side of the mast attachment point, it could produce torque on the support mast. This is similar to the principle of a weather vane. If the unbalance is high enough or the wind velocity is high enough, this could prevent rotation or could damage the limit switches. To minimize this effect, the antenna should be designed for minimum mast torque or "torque compensators" added to produce minimum mast torque.
4. Mast Binding: If the antenna support mast binds within the tower due to ice accumulation or other reasons, this could prevent rotation.
5. Extreme Cold: If the ambient temperature is at or below -30 degrees F, this could prevent rotation. Older HAM-M, II, III or IV and older T2X units may be sluggish at temperatures less than 0 degrees F.

The DCU-1 checks for rotator movement upon pressing "START", and if no movement is detected within 8 seconds, it will stop trying to rotate.

Section 5. Wiring and Check-Out

Wiring and Check-Out

1. Write down the colors of the wires attached to your existing rotator control unit:

Terminal No.	Color
1	
2	
3	
4	
5	
6	
7	
8	

Table 1

2. Disconnect the wires from your existing control unit. Attach these to the 8-pin connector to the same numbered pins.

CAUTION:

The new connector is numbered differently than the terminal strip. Pay close attention to the pin numbers! You may wish to check your wiring by measuring the rotator resistances as shown in Section 9, Table 5.

3. If this is a new installation, assemble the rotator cable as shown in Figure 3, or purchase a pre-assembled cable. Temporarily attach the mounting screws to the bottom of the rotor unit. These will be used to support the rotator during bench-testing.

NOTE: The specifications call for heavier gauge wire in two locations. Leads #1 and #2 must be heavier gauge and less total lead resistance.

CAUTION: Shorts between terminals or grounded leads may damage the rotator. Check the numbered pins on each connector with an Ohmmeter! Pin 1 is connected to pin 1, etc.

4. With the rotator sitting in the upright position (either on the bench or on the tower) and connected to the control unit by the 8-wire cable, plug the control unit power cord into a receptacle. At this time, the rotator brake wedge may momentarily release and re-engage. This is normal.

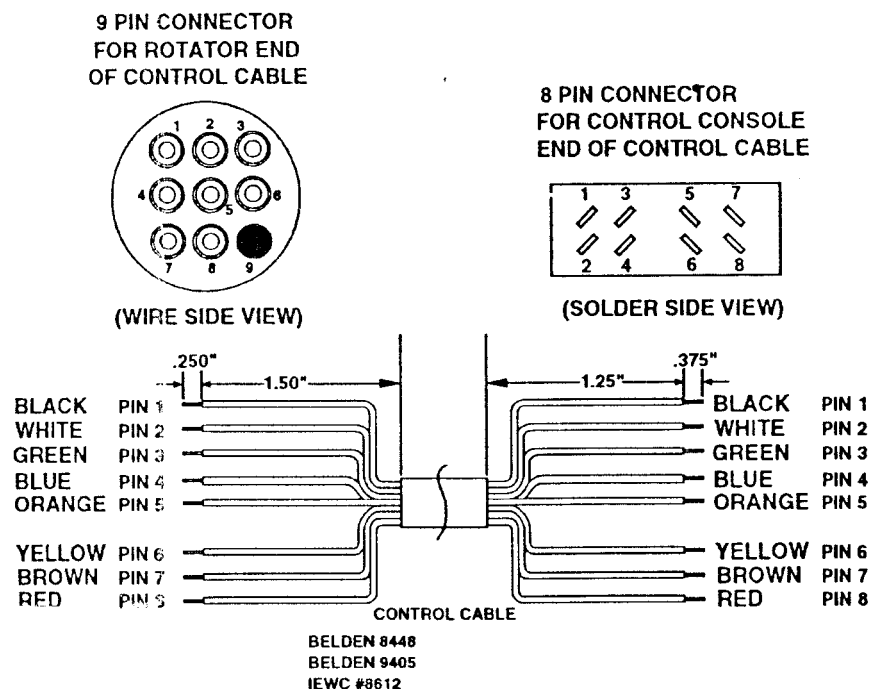


Figure 3 Control Cable Connector
Attachments 1-5

Maximum Length Terminals	Gauge for 1 & 2	Gauge for Terminals 3-8
125' (38 m)	#18 (1.19 mm)	#20 (.97 mm)
200' (61 m)	#16 (1.42 mm)	#18 (1.19 mm)
300' (91 m)	#14 (1.75 mm)	#16 (1.42 mm)
Recommended		
Belden 8448		
Belden 9405		
IEWC #8612		

Table 2

5. The DCU-1 display should look similar to the display shown in Figure 4. The numeric display in the lower left corner indicates the current bearing of your rotator. The numeric display in the lower right corner indicates the target bearing. If both displays read a steady "000", disconnect your control cable and check the cable wiring with an ohmmeter. See Section 9, "Checking the Rotator Resistances from the Ground". Proceed if the cable checks OK.

NOTE: After approximately 30 seconds of inactivity, the target digital and analog displays will blank (disappear). After 30 minutes of inactivity, the entire display will blank. Push the "DISPLAY" button to return normal display.

6. If the current bearing display shows a number between "000" and "359", then proceed. Twist the knob marked with the two (2) arrows "(o)". The target bearing display should change along with the inner circle tick mark. Using the knob, select a target bearing at least 30 degrees from the current bearing. Push the "START" button. The brake in the rotator should release, the rotator will turn a few degrees in the opposite direction, reverse direction, then turn to the target bearing. During the last 5 degrees, the rotator will slow down to half speed, then stop on or close to the target bearing. The brake solenoid will "hum" for 8 seconds, then the brake will engage. During rotation, the outer circle tick mark will move to the new bearing. If operation does not work as described, immediately unplug the unit from the AC line and check cable wiring!

7. You may wish to repeat step 6 to confirm operation over a wide range of bearings. If the "STOP" button is depressed during rotation, rotation will stop and the brake will engage 8 seconds later. If the operation is consistent, proceed to the next step.

S. Determine the mechanical center of rotation at this time. For example, if you rotate from East to West through South, then South (180 degrees) is your center of rotation. If you wish to change your center of rotation, you must loosen the mast-to-rotator clamps and reposition the direction of your antenna. This should be done before disconnecting your old control, however it can be done after calibration of the DCU-1.

The center of rotation can be selected as any bearing between "000" and "359". Press "DISPLAY" and hold until the letters "CAL" appear in the center of the display. The rotator should automatically turn to the mechanical center of rotation. When it has reached this position, the letters "SET" should appear in the center of the display. Twist the knob until the desired center of rotation is displayed in the lower right corner.

Press the "START" button and hold until the rotator starts to turn. The rotator will automatically find both limit switches and set up the calibration for the center of rotation you selected. During this time, the letters "EPC" will be displayed for "End Point Calibration". When this process is finished, the "EPC" **will** disappear, and the rotator is ready for use. If you wish, you may re-calibrate the rotator system at any time.

9. You may set the memory presets at this time or at any time after the rotator system has been installed. To store a bearing into a memory location, select a target bearing with the knob then press and hold the appropriate memory location button until the letters "PRE" light up. The memory presets are stored in non-volatile memory, and will stay in memory even if the power is disconnected for a long period of time. You may use previously stored memory presets and the knob to select new bearings.

10. If this is a new installation, rotate the system to the center of rotation. You are now ready to install the rotator system in your tower or on your mast. Refer to the instructions in your rotator manual for complete installation information.

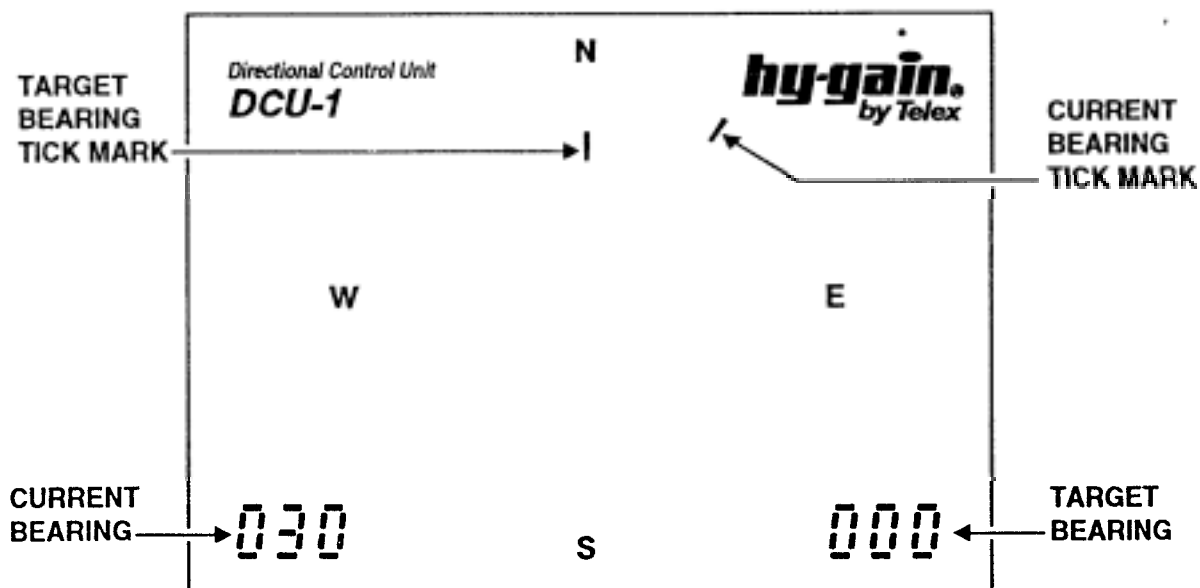


Figure 4
DCU-1 Display

Section 6. Operation of DCU-1 Control

Operation of DCU-1 Control Unit

Precautions:

1. Thermal Protection: If the rotator fails to turn after 4 or 5 minutes of continuous operation, the thermal switch has come into play. This protective device in the transformer assembly automatically shuts off power if the transformer becomes too hot. It will automatically reset after approximately 10 minutes.
2. Display Protection: The gas-plasma display will be turned off during periods of inactivity to extend its useful life. After approximately 30 seconds of inactivity, the target digital and analog displays will blank (disappear). After 30 minutes of inactivity, the entire display will blank. Push the "DISPLAY" button to return normal display.
3. Brake Wedge Protection: The brake wedge will only engage after waiting eight seconds after removing power from the motor. This allows large antenna systems to coast to a complete stop before engaging the brake. Even if the "STOP" button is pressed, the system will still wait eight (8) seconds before dropping the brake. The brake will immediately engage if AC power is disconnected from the control unit.

CAUTION:

Do not reverse rotation direction during rotation!

This will cause the system to hang with the brake released. Pressing "STOP" will reset the system.

Normal Operation

The numeric display in the lower left corner and the outer circle tick mark always indicates the current bearing of your rotator. The numeric display in the lower right corner and the inner circle tick mark indicates the target bearing. This display is also used during calibration to select the center of rotation. The center alpha-numeric display is used during the calibrate routine and to indicate memory preset selections. The tick marks may fluctuate between two marks if the rotator is moving in the wind and the digital bearing ends with "2" or "T".

To move the rotator to a new bearing, either the knob, memory presets, or a combination of these may be used to select the new bearing. To start rotation to this new bearing, press "START". The brake in the rotator will release, the rotator will turn a few degrees in the opposite direction, reverse direction, then turn to the target bearing. During the last 5 degrees, the rotator will slow down to half speed, then stop on or close to the target bearing. The brake solenoid will stay on for 8 seconds, then the brake will engage. During rotation, the outer circle tick mark will move to the new bearing.

If the "STOP" button is pressed during rotation, rotation will stop and the brake will engage 8 seconds later.

To store a bearing into a memory location, select a target bearing with the knob then press and hold the appropriate memory location button until the letters "PRE" light up. You may use previously stored memory presets and the knob to select new bearings to store.

NOTE: The rotator may end up a few degrees off the desired target bearing. This is because the brake wedge locks into place every five (5) degrees. This should not cause any problems in most HF and VHF installations.

Computer Operation

The DCU-1 may be controlled from your computer via a RS-232 cable connection. The rear panel has two (2) RS-232 connectors. The connector marked "HOST" is a DB9 female connector and should be directly connected to the host computer. Do not use a null-modem connection. The connector marked "EXT" is a DB9 male connector and should be connected to other ham equipment such as a modem, TNC, or radio interface unit. If the "EXT" connector is not attached to other equipment, it should be terminated with the supplied plug. The supplied termination plug shorts DTR,DSR and DCD (Pins 1,4,6) together and RTS and CTS (Pins 7 and 8) together.

The cable which is attached to the computer and to the DCU-1 should have a DB9 male connector at one end and either a DB9 female or DB25 female connector at the other end. The connections should be straight through, e.g. pin 1 to pin 1, pin 2 to pin 2, etc if both ends have 9 pin connectors. If a DB25 female connector is used to attach to the computer's COM1 or COM2 port, use the wiring guide shown in Figure 5. You may also purchase a pre - assembled cable from Hy-Gain to connect your computer to the DCU-1. Order either DCU-9P or DCU-25P cable assemblies.

Signal Name	DB9 pin	DB25 pin
DCD Data Carrier Detect 1	8	
RX Receive Data	2	3
TX Transmit Data 3	2	
DTR Data Terminal Ready	4	20
GND Signal Ground 5	7	
DSR Data Set Ready 6	6	
RTS Request to Send 7	4	
CTS Clear to Send	8	5
RI Ring Indicator 9	22	

Figure 5
Wiring Guide

Command:

Result:

API***;

Sets Target Bearing in DCU-

(***is a three digit number between 000 and 359)

AM 1;

Starts Rotation to Target Bearing

Figure 6
Command Set

A sample BASIC program is shown in Figure 7 which can be used to control operation of the DCU-1. Other software vendors may also include the ability to directly control the DCU-1 from within a logging or rig control program.

The commands are similar to those used by Kenwood in controlling radio operations. A summary of unique commands is shown in Figure 6. The COM port should be used at 4800 baud with no parity, 8 data bits, 1 stop bit and ASCII mode. This is usually shown as "4800,N,8,1,ASC".

After a command is sent to the DCU-1, all other motor and brake operation is automatic. There are no provisions at this time to send current bearing information back to the computer.

You may wish to check with our Customer Service Dept. from time to time in order to obtain the latest firmware upgrades.

```

10 CLS
   PRINT " "
   PRINT "                               HY-GAIN DCU-1  ROTATOR CONTROL"
   PRINT "                               REV. 1.5   12-02-94"
   PRINT " "
   PRINT " "
   PRINT " "
   INPUT "                               Press 'Enter' to continue:  ",Z$
   CLS
20 INPUT " Choose either COM1 or COM2: (Enter 1 or 2) ",COMPT
   IF COMPT < 1.5 THEN 30 ELSE 40
30 OPEN "COM1:4800,N,8,1,ASC" FOR OUTPUT AS #1
   PRINT #1,";"
   PRINT " "
   PRINT " Opening COM1 at 4800 baud "
   PRINT " "
   INPUT " Press 'Enter' to continue:  ",Z$
   GOTO 60
40 OPEN "COM2:4800,N,8,1,ASC" FOR OUTPUT AS #1
   PRINT #1,";"
   PRINT " "
   PRINT " Opening COM2 at 4800 baud "
   PRINT " "
   INPUT " Press 'Enter' to continue:  ",Z$
   GOTO 60
50 PRINT " "
   PRINT " ERROR - Enter Destination between 0 and 359 degrees "
   PRINT " "
   INPUT " Press 'Enter' to continue:  ",Z$
60 CLS
   PRINT #1,";"
   PRINT " "
   PRINT " North = 0, East = 90, South = 180, West = 270, ... "
   PRINT " Enter '999' to exit program "
   INPUT " Enter Destination Bearing ( 0 - 359 ): ",DEST
   IF DEST >= 999 THEN 500
   IF DEST < 0 THEN 50
   IF DEST > 360.5 THEN 50
   IF DEST > 359.5 AND DEST < 360.5 THEN DEST = 0
   PRINT " "
   PRINT " Destination Bearing = ";DEST;" Degrees "
   DEST=DEST+1000
   PRINT #1, USING "AP####";DEST
100 PRINT " "
   INPUT " Press 'Enter' to execute rotation:  ",Z$
   PRINT #1,";"
   PRINT #1,"AM1;"
   PRINT " ROTATING !"
   PRINT " "
   PRINT " Wait for brake to engage before entering new destination."
   PRINT " "
   INPUT " Press 'Enter' to continue:  ",Z$
   GOTO 60
500 CLOSE #1
   END

```

Figure 7
Sample Program

Section 7. Troubleshooting

Troubleshooting

CAUTION: This unit has been thoroughly tested and cycled before shipment. Follow the connector wiring carefully between the rotator and the DCU-1 control box. Pin #1 must attach to Pin #1, etc... Incorrect wiring will burn out the rotator potentiometer and void the warranty.

The DCU-1 "Pathfinder" control unit is designed to be used ONLY with Hy-Gain HAM-IV (type) and T2X rotator systems. Do not try to use this control on other systems!

Problem	Possible Cause
Antenna Bearing doesn't match display	Mast slipped in rotator clamp Antenna slipped on mast DCU-1 Calibration not performed
Current Bearing changes randomly or does not change at all	Potentiometer broken or burned-up Shorts or opens in control cable Extremely high RF field near rotator DCU-1 MPU or A/D failure Tower or DCU-1 not grounded
Antenna Bearing changes by itself	Brake wedge failure DCU-1 MPU failure
Current Bearing changes +/- less than 3 degrees	Antenna rocking in high winds Potentiometer dirty or poor connection High RF field near rotator Long (200') control cable
Rotator unable to reach target bearing	Temperature less than -30 degrees F Broken teeth in gears Shorts or opens in control cable Thermal cut-out in power transformer Mast binding in tower Old motor-start capacitor High winds, high wind area Control cable wire size too small DCU-1 MPU failure
Rotator slow to reach target bearing	Temperature between -30 and 0 degrees F Broken teeth in gears Mast binding in tower Old motor-start capacitor High winds, high wind area

Table 3

Ground Wires

Most operational difficulties with rotators are traceable to broken, shorted, grounded or miswired control cables. Time spent on assembling, routing and protecting the control cable will lead to a long trouble-free rotator life.

Unintentional grounds on cable leads can burn out the line fuse in the DCU-1 control box or burn out the potentiometer in the rotator. If pin #3 or pin #7 is grounded, it shorts out part of the potentiometer so that as rotation progresses to the other end, the full DC voltage is applied across a decreasing portion until current becomes so high that the potentiometer or the voltage regulator burns cut. Note also that any grounds may put an overload on the power transformer which could cause the line fuse to blow.

Antenna Motion

Frequently the slight motion of the antenna array in gusts of wind is due more to the natural flexing of the elements and mast than to actual play in the rotator mechanism. A slight amount of "play" is built into the rotator to avoid binding due to environmental changes.

If the antenna actually rotates in high winds, this is usually just the mast slipping in the rotator or the antenna slipping on the mast. For large antennas, it is often necessary to drill a 5/16" hole through the rotator clamping plate and mast and pin them together with the bolt provided. Also, if possible, pin the antenna to the mast with appropriate hardware. If slipping is suspected, return the rotator to an end of rotation limit and visually check antenna alignment.

Lack of Power

If the antenna rotation is slow or sluggish or hard to start, check for proper voltages on pins #2,5, and 6. (See Table 4) If the voltages are correct, the 130 - 156 MFD capacitor may be old. If your unit is more than 5 years old, try replacing this capacitor. Also, if your cable run is over 200 feet, make sure that you are using the proper wire size. See Table 2. For cable runs over 300 feet, you may wish to move the motor capacitor to the tower. This allows you to run only 6 wires from the control to the rotator, so that you can reduce wire resistance by doubling up wires or using

If the electrical circuit is working, then check for mechanical problems. Look for mast binding or thrust bearing misalignment if you have experienced strong winds recently. If the temperature is less than -30 deg. F (-34 deg. C), the rotator will be very sluggish or may not run at all! This is normal. Do not try to rotate with the DCU-1 control if temperatures are below -30 deg. F ! Older models of HAM-M, 11, 111, IV and T2X rotators may be very sluggish at temperatures less than 0 degrees F.

Checking the Control Unit Voltages

To check the control unit voltages, first remove the rotator control cable from the DCU-1 control box, then plug the line cord into a 110 VAC outlet. Set the target bearing at least 10 degrees from the current bearing. Press "START" to check voltages on pins 2, 5, and 6. Check for the following voltages on the 8 pin connector:

NOTE:

You have 8 seconds after pressing "START" to make each measurement. The DCU-1 checks for movement, and after 8 seconds without movement, it stops trying to rotate. You may wish to make your meter connections with alligator clips, then press "START" when you are ready to read the meter.

Pin #'s	Ambient State	Press "START" (see note)
1-2	0	30 VAC
1-5	0	30 VAC (for CW rotation to target)
1-6	0	30 VAC (for CCW rotation to target)
4-8	0	0
3-7	+ 5.0 VDC	+ 5.0 VDC

Table 4

Checking the Rotator Resistances from the ground

You may possibly avoid bringing the rotator down from the tower by making electrical resistance checks on the control cable. Disconnect the control cable from the control box. Check for the following resistances:

Description	Pin #'s	Approximate Resistance (ohms)
Brake Solenoid	1-2	0.75 + cable resistance
1/2 Motor Winding	1-8	2.5 + cable resistance
1/2 Motor Winding	1-4	2.5 + cable resistance
1/2 Motor Winding + switch	1-6	2.5 + cable resistance
Entire Motor	4-8	4.5 + cable resistance
Right Limit Switch	5-8	0 + cable resistance
Left Limit Switch	4-6	0 + cable resistance
Entire Pot	3-7	500 + cable resistance
Pot Arm to + End	1 - 3	0 to 500 (0 at full CCW)
Pot Arm to - End	1-7	0 to 500 (500 at full CCW)

Table 5

The block diagram illustrates the system architecture. At the center is the **MPU PIC 18C57**. It is connected to a **GAS PLASMA DISPLAY** via a **CATHODE DRIVER HV5222** and an **ANODE DRIVER HV6810**. The cathode driver is connected to the display's cathodes and to power sources **+80**, **-100**, **-105**, **VSS**, and **VDD**. The anode driver is connected to the display's anodes (labeled **ANODE 1-9**) and to **VSS** and **VDD**. The MPU is also connected to a **ROTARY ENCODER** and **PUSH BUTTON SWITCHES**. A **XTAL 18M432** crystal is connected to the MPU. The MPU's I/O pins are labeled on the left: **GND**, **DATA 1**, **DATA 2**, **DATA 3**, **DATA 4**, **CTB**, **CLOCK**, **DATA**, **SPARE**, and **GND**.

Front Panel PCB

The schematic diagram for the Front Panel PCB illustrates the following components and connections:

- Power Section:**
 - PCB POWER SUPPLY:** Provides +40V ANODE SUPPLY, -400V CATHODE DRIVER, -100V CATHODE SUPPLY, and a COMMON VSS.
 - ROTATOR POWER SUPPLY:** Receives A.C. MAINS through a FUSE and provides power to the first ALTERNISTOR (TRIAC).
 - ALTERNISTOR (TRIAC):** Two units are shown. The first is powered by the ROTATOR POWER SUPPLY. The second is powered by the first ALTERNISTOR and provides output to the 8 PIN CONNECTOR (BRAKE, CCW, CW, CAP, CAP, COMMON, POT CW, POT CCW).
- Control and Logic Section:**
 - OPTOISOLATORS:** Two units, MOC3183 (2) and MOC3052 (1), receive input from the 8 PIN CONNECTOR and provide output to the second ALTERNISTOR.
 - U100 (MPU 180C47):** Microprocessor Unit with XTAL 180K32 and various data and address lines.
 - U108 (MEMORY 93LC56):** Memory unit connected to the MPU.
 - U110 (A/D LTC1206):** Analog-to-Digital converter connected to the MPU.
 - U111 (RS232 LT-1181A):** RS232 interface unit connected to the MPU and external connectors.
- Connectors:**
 - 8 PIN CONNECTOR:** Provides inputs for BRAKE, CCW, CW, CAP, CAP, COMMON, POT CW, and POT CCW.
 - D CONNECTOR 9 PIN MALE (EXT):** External data connector.
 - D CONNECTOR 9 PIN FEMALE (HOST):** Host data connector.

Figure 9
Control PCB and External Components

Section 9. DCU-1 Control Unit Replacement Parts

Part No.	Description	Qty
870804	DCU-1 Assembly, 120 V.....	1
870842	DCU-1 Assembly, 220 V.....	1
1034403	Fuse 3 Amp 3 AG (120 VAC)	1
(710053)	Fuse i AMP 5 x 20 mm (220 VAC)	1
1056300	Fuse Holder (120 VAC).....	1
(710054)	Fuse Holder 5/20 mm (220 VAC).....	1
105632051	6-32 x 5/16 screw.....	2
150078	Front overlay, printed.....	1
150624-3	Label, „TELEX"	1
171131	Spacer, transformer assy.	4
350979	Clip, capacitor.....	1
450431	Strain Relief (120 VAC).....	1
(450403)	Strain Relief (220 VAC)	1
450433	Hole plug (110 VAC only)	1
450614	Filter Display, printed	1
470677	Backing plate, switch.....	3
46002 RD	Connector, 2 pin, red.....	2
47138P2	Contact, connector	4
500157	Screw, 10-24 x 2"	4
500326	Screw, 4-40 x 5/16 ".....	7
5022500	Terminal, solder.....	1
506325	Screw, 1/4"-20 x 3/4"	1
5086100	Power Cord (120 VAC)	1
(5079800)	Power Cord (220 VAC)	1
5112400	Flat Washer. 128 I.D.....	1
5113100	Nut, 6-32, hex	5
5141100	Rotator Housing, Top cover.....	1
5141200	Rotator Housing, bottom cover.....	1
5151501	Capacitor 130-156 MFD.....	1
5152700	Bumper (rubber feet).....	4
520057	Screw, 6-32 x 3/8", (black)	8
53432116	Knob.....	1
53433015	Knob-cap.....	1
550029	Wing nut, 1/4"-20,	1
554071	Nut, 10-24, hex	8
556960	Nut, 1/4"-20, hex	1
567110	Lockwasher, 1/4", internal,	2
567120	Flat washer, 1/4"	2
567125	Lock washer, No. 10, internal.....	8
640076	Socket, 8 pin (Part of 870849 Wire Assembly)	1
640084	Cable Assembly, 10 wire, 7 inch	1
640085	Cable Assembly, 6 wire, 7 inch	1
810138	Key pad, 3 button.....	3
51401-031	Screw, 4-40 x 1/4", socket head.....	3

DCU-1 Control Unit Replacement Parts List (continued)

Part No.	Description	Qty
870806	Transformer Assembly, (120 VAC).....	1
1073501	Transformer Assembly, (220 VAC).....	1
870807	PCB Assembly, front panel.....	1
870808	PCB Assembly, control.....	1
8800102114	Connector D, 9 pin, male (Part of 870848 Wire Assembly)	1
8800102132	Connector D, 9 pin, female (Part of 870848 Wire Assembly)	1
8800102463	Hardware, D Connector	2
880394	Chassis, Assembly	1

DCU-1 Parts Pack, 120V, 870805

Part No.	Description	Qty
1034403	Fuse, 3 AMP, 3 AG.....	2
640077	Plug, 8 pin	1
870844	DCU Termination Assembly	1

DCU-1 Parts Pack, 220V, 870843

Part No.	Description	Qty
710053	Fuse, 1 AMP, 5 x 20 mm	2
640077	Plug, 8 pin	1
870844	DCU Termination Assembly (plug).....	1

Section 10. How to Get Factory Service

If service is required, the unit must be packed securely and sent prepaid to:

copy of your sales receipt. For out-of-warranty units, call the Warranty Service Department for prices.

For units that are in warranty, no charge will be made for any repair work required. Include a

Hy-gain

308 Industrial Park
Starkville, MS 39759 USA Ph:
 (662) 323-9538 FAX: (662) 323-6551

The price includes rebuilding the unit, replacing all defective and/or worn parts, and return freight charges. Hy-Gain reserves the right to change prices at its option. When returning items for repair, a check or money order for the repair charges must be included. Be sure to include your name, address, zip code, and telephone number. Also, give a brief description of the problem.

hy-gain® LIMITED WARRANTY

Hy-Gain Warrants to the original owner of this product, if manufactured by **Hy-Gain** and purchased from an authorized dealer or directly from **Hy-Gain** to be free from defects in material and workmanship for a period of 12 months for rotator products and 24 months for antenna products from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of-purchase to **Hy-Gain** at the time of warranty service. **Hy-Gain** shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.
2. **Hy-Gain** agrees to repair or replace at **Hy-Gain's** option without charge to the original owner any defective product under warranty, provided the product is returned postage prepaid to **Hy-Gain** with a personal check, cashiers check, or money order for \$8.00 covering postage and handling.
3. Under no circumstances is **Hy-Gain** liable for consequential damages to person or property by the use of any **Hy-Gain** products.
4. Out-of-warranty Service: **Hy-Gain** will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
5. This warranty is given in lieu of any other warranty expressed or implied.
6. **Hy-Gain** reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
7. All **Hy-Gain** products to be serviced in-warranty or out-of-warranty should be addressed to hy-gain, 308 Industrial Park Road, Mississippi 39759, USA and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
8. This warranty gives you specific rights, and you may also have other rights which vary from state to state.