

MCU1 INSTALLATION & MAINTENANCE MANUAL



**BRADSHAW
COMMUNICATION
SYSTEMS**

MODEL MCU1 MOTOR CONTROL UNIT INSTALLATION & MAINTENANCE MANUAL

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INTRODUCTION

A. MANUAL PURPOSE

This manual contains installation and maintenance instructions for the Bradshaw Communication Systems MCU1 Motor Control Unit. The instructions herein are provided for personnel responsible for installing and maintaining the MCU1. A nameplate label located on the inside cover door of the MCU1 identifies the units' model number, part number, revision, and serial number. The serial number is used by Bradshaw Communication Systems (BCS) to identify the units' particular configuration of options.

This manual does not provide information pertaining to the operation of the MCU1. Information pertaining to operation of the MCU1 is found only in the MCU1 Operators Manual. It is required that a installation and/or service technician have a thorough understanding of the operation of the MCU1 prior to any attempts to install or service the unit. Any required internal repairs to the MCU1 should be referred to qualified service personnel.

B. MANUAL ORGANIZATION

This manual is organized into the following three sections:

“Introduction” – This section provides manual purpose, manual organization, required installation/ setup equipment, unit specifications, and customer support information.

“MCU1 Installation” – This section provides safety precautions, typical system configuration, MCU1 Mounting, and interface wiring information.

“MCU1 Maintenance” – This section provides information pertaining to preventative maintenance and troubleshooting of the MCU1.

C. REQUIRED INSTALLATION / SETUP TOOLS & EQUIPMENT

1 EACH	Medium Phillips Screwdriver
1 EACH	Medium Flat-blade Screwdriver
1 EACH	Adjustable Wrench
1 EACH	Socket Wrench Set
1 EACH	Multi-meter (capable of direct current voltage measurement)
MISC.	Multi-meter Test Leads

D. UNIT SPECIFICATIONS


Dimensions:	27" (67.3cm) high x 24" (61.0cm) wide x 9" (23.7cm) deep
Weight:	50 LBS (23 Kg)
Power Requirements:	3 Phase Power - Voltage & Current Dependent on Motor Sizes
Environmental:	-40° to 50°Celsius (-40° to 122° Fahrenheit) Operational 100% Relative Humidity
Enclosure:	Wall Mounted Weatherproof NEMA 4 Steel Enclosure
Enclosure Finish:	Severe Duty Paint
Enclosure Color:	White

E. CUSTOMER SUPPORT

Customer support, replacement parts, and repair are available 8AM – 5PM EST M-F by contacting Bradshaw Communication Systems at 770-844-9704 or by fax at 770-886-0205.

MCU1 INSTALLATION

A. SAFETY PRECAUTIONS

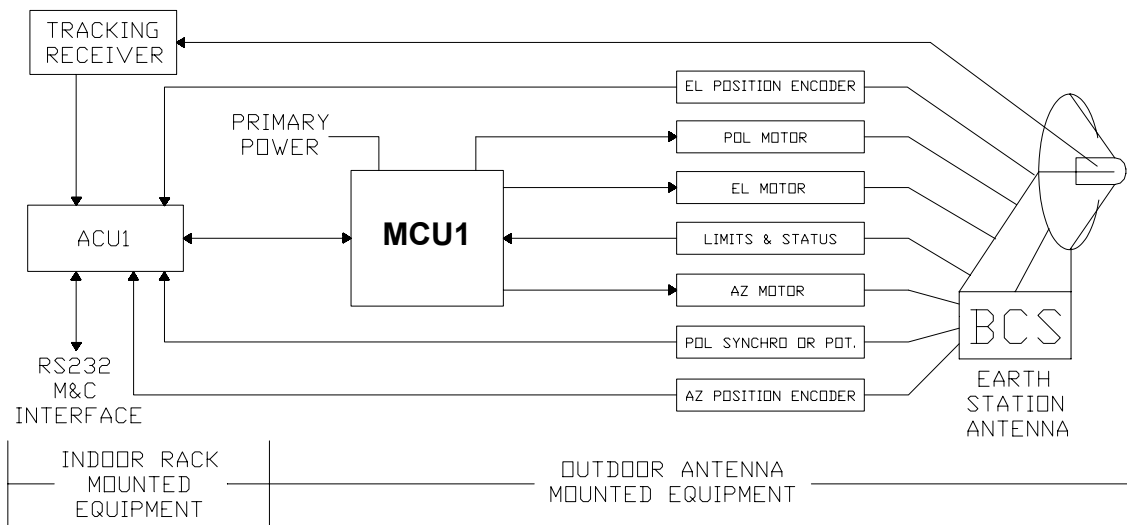


Lethal voltages are present inside the MCU1. Emergency Stop switches and other interlocks will disable the system, but do not disconnect the MCU1 from primary power. Refer all troubleshooting and repair to qualified service personnel. The MCU1 contains no operator serviceable parts.

B. INTRODUCTION

Typical System Configuration

The MCU1 is designed to allow automatic control via an Antenna Control Unit (ACU1) or local manual positioning of an earth station antenna. Operators may use the controls on the MCU1 to provide control at the antenna structure. The MCU1 is normally only a part of the complete antenna control system, however, the MCU1 has all controls necessary to allow positioning of the earth station antenna. This redundancy is extremely useful in the unlikely event of an Antenna Control Unit failure or if local positioning is required for antenna maintenance or other. A typical antenna control system configuration using the MCU1 is depicted in Figure 1. Note that the addition of the motors and limit switches are all that is required to allow local positioning of the earth station antenna.



TYPICAL SYSTEM CONFIGURATION
FIGURE 1

The ACU1 is the main system component and contains the control logic electronics to generate motor drive commands. The motor control commands are produced in response to inputs from the position encoders, limit and status switches, front panel controls, and R.F. signal receiving equipment. Control may also be accomplished via the RS-232 monitor & control port.

The angular position of each axis is reported by synchro based position encoders that are mounted on their corresponding axes of the earth station antenna. The signal from these position encoders is converted in the ACU1 to provide an angular display on the front panel display as well as being used for automatic positioning modes.

For automatic satellite tracking operation (Steptrack), a D.C. signal proportional to signal strength is connected to the ACU1. This signal is then used by the ACU1 to optimize the antenna position when in Steptrack mode.

The ACU1 is connected to the MCU1, which produces the high voltage required to start and stop the earth station antennas' motors. Each axis has a motor (or possibly two depending upon

configuration) which allow electrical control of the mechanical movement of each antenna axis. In some system configurations two motors (or dual speed) motors are employed allowing two-speed control of each antenna axis. In these two-speed configurations the MCU1 is used in conjunction with a second, separate motor control unit to allow control of the additional motors (or secondary high-speed motor windings). The MCU1 allows for simultaneous control of all three axis motors if equipped with the polarization option as well.

If the earth station antenna being controlled by the ACU1 has a linearly polarized feed, the ACU1 polarization option is employed. This option allows the ACU1 to receive a signal from an additional position encoder (either a synchro transmitter or potentiometer depending upon configuration) and to control an additional motor. By adding the additional position encoder and motor the ACU1 can remotely control the rotation of the earth station antenna polarization feed horn.

The ACU1 is generally rack mounted and located in the control room area, while the position encoders, limit switches, MCU1, and motors are generally located on the earth station antenna structure. The R.F. tracking equipment is generally located in the control room area with the ACU1.

C. MCU1 MOUNTING

The MCU1 design provides for mounting the unit via four tabs. Two tabs at the top of the unit and two at the bottom. Standard 3/8 inch hardware may be used for mounting to the appropriate mounting location. Due to the variety of antennae the MCU1 may be used with, mounting specific instructions cannot be provided. For unit mounting and dimensional data assistance, please contact Bradshaw Communication Systems.

D. INTERFACE WIRING CHARTS

1. Termination Notes

NOTE 1: Limit switch contacts must be closed for a non-limit condition. All limit switch contacts must be isolated.

NOTE 2: Jumpers are installed on TB-6 to "jumper" the auxiliary Azimuth, Elevation, & Polarization Interlock connections as well as the auxiliary Emergency Stop connection. These jumpers may be removed to allow the insertion of additional safety interlock switches as required. The switches must be normally closed and may be connected in series to provide multiple interlock points as required.

2. MCU1 to Azimuth Track Motor

Azimuth Track Motor Cable

FROM MCU1 (Terminal Block #10 Screws) TO AZIMUTH TRACK MOTOR (Wire Leads)

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB4-5	#10 Ring Terminal		MOTOR L1	Wire-Nut		Motor Phase A
TB4-6	#10 Ring Terminal		MOTOR L2	Wire-Nut		Motor Phase B
TB4-7	#10 Ring Terminal		MOTOR L3	Wire-Nut		Motor Phase C
TB4-12	#10 Ring Terminal		MOTOR CASE	#10 Ring Terminal		Safety Ground

3. MCU1 to Elevation Track Motor

Elevation Track Motor Cable

FROM MCU1 (Terminal Block #10 Screws) TO ELEVATION TRACK MOTOR (Wire Leads)

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB5-1	#10 Ring Terminal		MOTOR L1	Wire-Nut		Motor Phase A
TB5-2	#10 Ring Terminal		MOTOR L2	Wire-Nut		Motor Phase B
TB5-3	#10 Ring Terminal		MOTOR L3	Wire-Nut		Motor Phase C
TB5-12	#10 Ring Terminal		MOTOR CASE	#10 Ring Terminal		Safety Ground

4. MCU1 to Polarization Motor (Optional)

Polarization Motor Cable

FROM MCU1 (Terminal Block #10 Screws) TO POLARIZATION MOTOR (Wire Leads)

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB5-11	#10 Ring Terminal		MOTOR COMMON	Wire-Nut		Common (Phase A)
TB5-8	#10 Ring Terminal		MOTOR NEUTRAL	Wire-Nut		Neutral
TB5-9	#10 Ring Terminal		MOTOR FORWARD	Wire-Nut		Forward
TB5-10	#10 Ring Terminal		MOTOR REVERSE	Wire-Nut		Reverse
TB5-12	#10 Ring Terminal		MOTOR CASE	#10 Ring Terminal		Safety Ground

5. MCU1 to Azimuth Limit Switch/s

Azimuth Limit Switch/s Cable

FROM MCU1 (Terminal Block #6 Screws)			TO AZIMUTH LIMIT SWITCH/S (#6 Screws)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB6-7	#6 Ring Terminal		CLOCKWISE N.C.	#6 Ring Terminal	NOTE 1	CW Status
TB6-8	#6 Ring Terminal		CLOCKWISE COMMON	#6 Ring Terminal	NOTE 1	CW Return
TB6-5	#6 Ring Terminal		COUNTER-CLOCKWISE N.C.	#6 Ring Terminal	NOTE 1	CCW Status
TB6-6	#6 Ring Terminal		COUNTER-CLOCKWISE COMMON	#6 Ring Terminal	NOTE1	CCW Return

6. MCU1 to Elevation Limit Switch/s

Elevation Limit Switch/s Cable

FROM MCU1 (Terminal Block #6 Screws)			TO ELEVATION LIMIT SWITCH/S (#6 Screws)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB6-13	#6 Ring Terminal		UP N.C.	#6 Ring Terminal	NOTE 1	UP Status
TB6-14	#6 Ring Terminal		UP COMMON	#6 Ring Terminal	NOTE 1	UP Return
TB6-11	#6 Ring Terminal		DOWN N.C.	#6 Ring Terminal	NOTE 1	DOWN Status
TB6-12	#6 Ring Terminal		DOWN COMMON	#6 Ring Terminal	NOTE1	DOWN Return

7. MCU1 to Polarization Limit Switch/s (Optional)

Polarization Limit Switch/s Cable

FROM MCU1 (Terminal Block #6 Screws)			TO POLARIZATION LIMIT SWITCH/S (#6 Screws)			
TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB6-17	#6 Ring Terminal		CLOCKWISE +12V			CW Limit Supply
TB6-25	#6 Ring Terminal		CLOCKWISE GROUND			CW Limit Ground
TB6-18	#6 Ring Terminal		CLOCKWISE RETURN			CW Limit Return
TB6-19	#6 Ring Terminal		COUNTER-CLOCKWISE +12V			CCW Limit Supply
TB6-25	#6 Ring Terminal		COUNTER-CLOCKWISE GROUND			CCW Limit Ground
TB6-20	#6 Ring Terminal		COUNTER-CLOCKWISE RETURN			CCW Limit Return

8. MCU1 to Auxiliary Emergency Stop Limit Switch/s (Optional)

Auxiliary Emergency Stop Limit Switch/s Cable

FROM MCU1 (Terminal Block #6 Screws) TO EMERGENCY STOP LIMIT SWITCH/S (#6 Screws)

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB6-1	#6 Ring Terminal	NOTE 2	STOP SWITCH N.C.			Emergency Stop (N.C.)
TB6-2	#6 Ring Terminal	NOTE 2	STOP SWITCH COMMON			Emergency Stop (COM)

9. MCU1 to MCU2 Slew Speed Controller (Optional)

MCU1 to MCU2 Cable

FROM MCU1 (Terminal Block #6 Screws) TO MCU2 SLEW CONTROLLER (#6 Screws)

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB4-8	#6 Ring Terminal		TB4-1	#6 Ring Terminal		CW Slew Command
TB4-9	#6 Ring Terminal		TB4-2	#6 Ring Terminal		CCW Slew Command
TB5-4	#6 Ring Terminal		TB4-3	#6 Ring Terminal		UP Slew Command
TB5-5	#6 Ring Terminal		TB4-4	#6 Ring Terminal		Down Slew Command
TB6-21	#6 Ring Terminal		TB4-12	#6 Ring Terminal		Azimuth Horn +
TB6-22	#6 Ring Terminal		TB4-14	#6 Ring Terminal		Azimuth Horn -
TB6-23	#6 Ring Terminal		TB4-13	#6 Ring Terminal		Elevation Horn +
TB6-24	#6 Ring Terminal		TB4-15	#6 Ring Terminal		Elevation Horn -

10. MCU1 to Primary Input Power

Primary Input Power Cable

FROM MCU1 (Terminal Block #10 Screws) TO PRIMARY INPUT POWER

TERMINATION	TYPE	NOTES	TERMINATION	TYPE	NOTES	FUNCTION
TB4-1	#10 Ring Terminal		PHASE A			Phase A
TB4-2	#10 Ring Terminal		PHASE B			Phase B
TB4-3	#10 Ring Terminal		PHASE C			Phase C
TB4-4	#10 Ring Terminal		NEUTRAL			Neutral
TB4-12	#10 Ring Terminal		SAFETY GROUND			Safety Ground

E. INSTALLATION INSTRUCTIONS

1. Wiring/Pre Power-up Verification

Prior to application of power, verify the following:

- a. Proper input voltage and wiring.
- b. Use a multi-meter on ohm scale to verify high impedance between each motor connection and safety ground. This step is crucial to avoid damage to the MCU1.
- c. Continuity check all wiring to ensure proper wiring per the installation wiring charts.

2. Limit Switch Testing

- a. Turn control power on and track motor power off.
- b. Emergency Stop Switch/s must be in the normal operation position.
- c. Set the ACU/LOCAL Switch to the LOCAL position and set the SLEW/NORMAL Switch (2 speed systems only) to the NORMAL position.
- d. Using the Local Axis Jog Switch for Azimuth, command the CW direction. Verify relay K18 activates.
- e. Manually activate the CW Limit Switch while monitoring the relay K18. Verify relay K18 deactivates when the CW Limit Switch is activated while commanding the CW direction using the Local Axis Jog Switch.
- f. Repeat Steps a. through e. for the remaining axis directions as follows:

Direction	Relay
Azimuth CCW	K17
Elevation UP	K23
Elevation DOWN	K22
Polarization CW	K7
Polarization CCW	K6

3. Motor Phasing

- a. Turn the Azimuth Local Axis Jog Switch to the center (OFF) position.
- b. Switch the Azimuth Motor Power Circuit Breaker to the “up” (ON) position.
- c. Switch the Azimuth Local Axis Jog Switch to the CW position. The antenna should rotate in the CW direction. If not, turn off all power to the MCU1 and switch any two motor wires to change phasing to obtain the proper direction of rotation.
- d. Repeat Step c. for the remaining axes and directions as follows:

- Azimuth CCW
- Elevation UP
- Elevation DOWN
- ⊗ Polarization CW
- ⊗ Polarization CCW

- ⊗ Switch forward and reverse motor leads to change polarization motor rotation.
- e. Verify proper limit operation by driving into each limit. The MCU1 should be able to drive out of each limit, but not further into the limit.

MCU1 MAINTENANCE

A. MAINTENANCE

At six-month intervals, inspect the interior of the MCU1 for excessive dust, dirt, and/or moisture. Remove any such accumulations with a damp cloth only after ensuring all input power has been removed.

Replace the corrosion inhibitor (or place desiccant packets inside the bottom of the MCU1) once a year. Replace more often if the unit is opened frequently or if the MCU1 is located in a heavy humidity environment.

B. TROUBLESHOOTING

In the event a motor does not turn in the proper direction, reverse any two phases at the motor to obtain proper rotation. If a limit switch does not properly stop antenna motion in a given direction, reverse the limit switch wiring to ensure proper antenna motion direction to proper limit switch orientation.

If the antenna does not respond to Local Axis Jog commands, verify the following:

1. Proper input power is applied
2. Power Circuit Breaker is in the "up" (ON) position
3. ACU/LOCAL Switch is in the "LOCAL" position
4. All Motor Power Circuit Breakers are in the "up" (ON) position
5. MCU1 power supply fuse is not "blown" (replace with 3 AMP fuse if blown)
6. Emergency Stop Switch/s is not depressed (pull to reset)

If the antenna does not respond to ACU1 commands, verify the following:

1. Proper MCU1 input power is applied
2. Power Circuit Breaker is in the "up" (ON) position
3. ACU/LOCAL Switch is in the "ACU" position
4. All Motor Power Circuit Breakers are in the "up" (ON) position
5. MCU1 power supply fuse is not "blown" (replace with 3 AMP fuse if blown)
6. Emergency Stop Switch/s is not depressed (pull to reset)