Manual for the

Multiple Control Unit MCU

In combination with Turntable TT, (Turn Device TD) and Antenna Mast AM

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1) General Instructions and Precautions

Before this device is applied with power:
Ground it properly through the protective conductor of the power cable to a power source provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the device, or disconnection of the protective earth terminal could result in personal injury.

The electrical installation of this product must be accomplished by an individual who is authorized to so do by the appropriate local authority. The installation must be in compliance with local electrical safety codes.

Only qualified personnel are allowed to operate or service this equipment.

Before making service, contact maturo GmbH
Service or modifications of the device by yourself may void your warranty.
If you attempt to service the unit by yourself, disconnect all electrical power before starting. There are voltages at many points in the components which could, if contacted, cause personal injury. Only trained service personnel are allowed to perform adjustments and/or service procedures upon this device. Capacitors inside this instrument may still be charged even when instrument is disconnected from its power source.

Stay clear of moving components during the operation of the device.
Do not operate the device while somebody is close to moving parts.

The protection of the **area of risk** at site is part of the operator.

Read this manual completely before starting installation. This equipment must be installed and operated only by qualified personnel.

Regularly inspect all equipment and conduct scheduled maintenance in accordance with the factory recommendations provided. Only use replacement parts and fasteners ordered directly from the factory.

Information presented enclosed is subject to change as product enhancements are made regularly.
Every effort has been made to ensure that the information in this manual is accurate. However, no liability or guarantee is assumed for the up-to-dateness, correctness and completeness of the information provided herein.
Pictures included are for illustration purposes only and do not represent all possible configurations.

2) Technical Data of Controller MCU

The new developed **M**ultiple **C**ontrol **U**nit **MCU** is suited for the operation of up to four devices with multiple axis of motion. Those devices can be any combinations of antenna masts, turntables, cable guide rails or any other positioning equipment.
This controller MCU permits the operation in manual, semi-automatic and remote control mode via IEEE 488.2 (GPIB bus) of multiple devices simultaneously.

Technical Data

|	
Data interface	IEEE 488.2 (GPIB-Bus)
Device interface	CAN-Bus via fibre optic cable
Transfer rate	100 baud
With 4 device connectors	
Display	4 x 40 characters
Voltage	208-240 VAC, 50/60 Hz, single phase
Current consumption approx.	20W
Fuse	T 125mA, 250V
Size (W X D)	19" Rack mount (427 x 300 mm)
Height	2 HE (87 mm)
Temperature range	5°C - 40°C
Total weight	5 kg
Accessories	1.5 m power supply cable Service manual

The multiple control unit MCU works with HP, R&S, and etc. software. The IEEE 488 (GPIB) is available as an interface device.

3) Connecting devices to MCU with fibre optic cables

1. Connect "IN" at MCU with "OUT" of first device, prefer the red line. Connect "OUT" at MCU with "IN" of first device, prefer the black line. If your device is prepared for a HCU (Hand Control Unit), you have to connect the MCU to the port named "MCU".

2. Repeat step 1 with all other devices.

3. Power on all devices and wait for 30 seconds.

4. Connect the power cable and switch on the power
   Attention: Power Consumption: 208-240V, 50/60 Hz, 16A

5. Power on the MCU. While booting the following is shown:
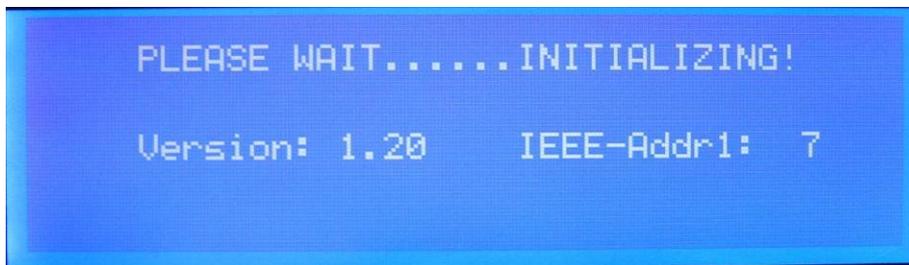
6. When the MCU is ready for working the following MAINSCREEN is shown:
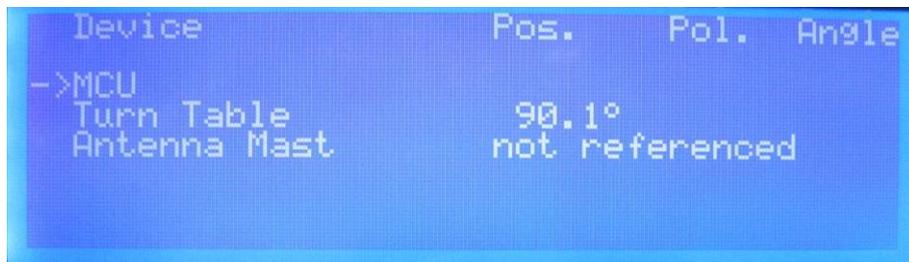
   In this example the main screen shows the MCU itself, a referenced Turntable and a non-referenced Antenna Mast.

7. With "UP" and "DOWN" you can navigate the arrow "->" from one device to another and to the MCU.

4) Menu of MCU

1. Navigate the arrow "->" to the MCU and press "ENTER". Now there is a double arrow "=>" in front of the MCU. The double arrow "=>" always marks the chosen device / MCU.

2. Press "MENU". The menu screen opens.

   With "UP" and "DOWN" you can navigate the arrow.

3. In the menu item "information" the serial number of the controller is shown.

4. If you want to change the display contrast, go to "display contrast" with the arrow and press "ENTER".

5. Change the contrast by pressing "UP" or "DOWN". When finished press "ENTER" to confirm, then "EXIT". You are back in the MAINSCREEN again.

6. For changing the IEEE-address of MCU repeat steps 3.1, 3.2 and 3.3, but choose "IEEE-address".

7. Change the address with "UP" or "DOWN" and confirm with "ENTER". Quit with "EXIT", the MAINSCREEN is shown again.

5) Moving a Turntable (Turn Device)

1. Navigate the arrow in the MAINSCREEN with "UP" or "DOWN" to the Turntable (Turn Device) and press "ENTER". The double arrow marks him now as chosen device.

2. Press "REFERENCE",

Then "ENTER". The Turntable (Turn Device) is now slowly moving to his reference point, normally +90°.

3. When referencing is finished you will be able to move the Turntable (Turn Device) manually or with entering a new position
Note: You must make a reference process if the Turntable (Turn Device) shows "not referenced", you also can do this when he is at a defined position.

4. Press "CW" and hold it, the Turntable (Turn Device) will move clockwise, but only up to his maximum limit, normally +400°. Press "CCW" and hold it, the Turntable (Turn Device) will move counter-clockwise, but only up to his minimum limit, normally -200°.

5. To move to a defined position press "ENTER",

Input the new position

```
Device              Pos.     Pol.   Angle

MCU
=>Turn Table           90.1°
  Antenna Mast       not referenced


  new value            360°
```

And press "ENTER" again. The Turntable (Turn Device) will move to his new position.

```
Device              Pos.     Pol.    Angle

MCU
=>Turn Table           277.2°
  Antenna Mast       not referenced


  new value            360.0°
```

```
Device              Pos.     Pol.    Angle

MCU
=>Turn Table           360.0°
  Antenna Mast       not referenced
```

6. With pressing, "STOP" while the Turntable (Turn Device) is moving he will brake and stop then.

6) Menu of Turntable (Turn Device)

1. When a Turntable (Turn Device) is chosen (double arrow =>) by pressing "MENU" you will enter the Turntable (Turn Device) menu. With "UP" and "DOWN" you can navigate to the individual points.

```
------------------ DEVICE MENU ------------------



-> information
   movement limits
   Positioning speed
```

2. Navigate to "information" and press "ENTER". The device type, the serial number and the firmware version is shown.

```
------------ DEVICE INFORMATION ------------

device type                    0x400

serial number             471070108

firmware version              11.10
```

You cannot make any changes there.
Press "EXIT" and you will be back in the MAINSCREEN.

3. Go to the Turntable (Turn Device) menu again as explained in 6.1; navigate to "movement limits" and press, "ENTER". The first two lines are the hardware limits, normally +400° and -200°. You cannot change these hardware limits.

```
------------------ DEVICE MENU ------------------



   information
-> movement limits
   Positioning speed
```

4. Standard for the user limits is "no".

```
-------------- LIMITS SETUP --------------

hardware limit maximum          400.0°
hardware limit minimum         -200.0°

user limit maximum                  no
user limit minimum                  no
```

You can type in user limits and confirm with "ENTER". With "UP" and "DOWN" you can navigate between user limit maximum and minimum.

5. To delete a user limit navigate to the according, input a higher (or lower) limit and confirm with "ENTER". Repeat this with the second user limit. Press "EXIT" to go back to the MAINSCREN.

6. Go to the Turntable (Turn Device) menu again as explained in 6.1; navigate to "positioning speed" and press, "ENTER". You will see the possible minimal and maximal speed.
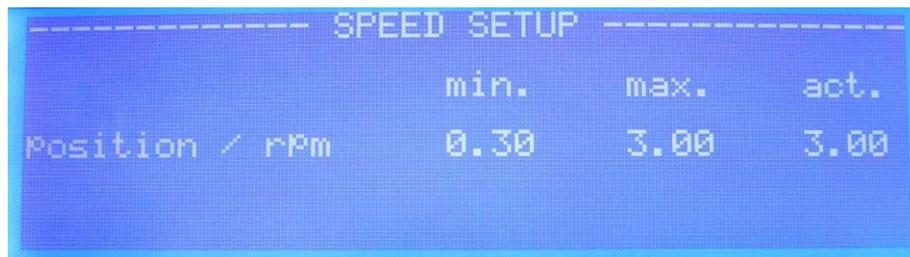
```
------------ SPEED SETUP ------------
                     min.      max.      act.

Position / rPm       0.30      3.00      3.00
```

You can change the actual speed by type in a value and confirm with "ENTER".
Press "EXIT" to go back to the MAINSCREEN.

7) Moving an Antenna Mast

1. Navigate the arrow in the MAINSCREEN with "UP" or "DOWN" to the Antenna Mast and press "ENTER". The double arrow marks him now as chosen device.

2. Press "REFERENCE",

   Then "ENTER".
   The Antenna Mast is now slowly moving to his reference points, 1.00 m and vertical.

3. When referencing is finished

   You will be able to change the polarization and to move up and down manually or with entering a new height.
   Note: You must make a reference process if the Antenna Mast shows "not referenced", you also can do this when he is at a defined positions.

4. By pressing "HOR" or VER" you can change the polarization.

5. Press "UP" and hold it, the Antenna Mast will move up, but only up to his maximum limit, for example 4.00m. Press "DOWN" and hold it, the Antenna Mast will move down, but only to his minimum limit 1.00m.

6. To move to a defined height press "ENTER",

Input the new height

And press "ENTER" again. The Antenna Mast will move to his new height.

7. With pressing, "STOP" while the Antenna Mast is changing his height he will brake and stop then.

8) Menu of Antenna Mast

1. When an Antenna Mast is chosen (double arrow =>) by pressing "MENU" you will enter the Antenna Mast menu. With "UP" and "DOWN" you can navigate to the individual points.

```
------------------ DEVICE MENU ------------------



   information
-> movement limits
   Positioning speed
```

2. Navigate to "information" and press "ENTER". The device type, the serial number and the firmware version is shown.

```
------------- DEVICE INFORMATION -------------

  device type              0x2100

  serial number          291070108

  firmware version          11.11
```

You cannot make any changes there.
Press "EXIT" and you will be back in the MAINSCREEN.

3. Go to the Antenna Mast menu again as explained in 8.1; navigate to "movement limits" and press, "ENTER".

4. Navigate to "height lower limits" and press, "ENTER". You will see the "hardware limit minimum" on 1.00 m; you cannot change this hardware limit.

5. Standard for the user limit is "no".

```
------------------ LIMITS SETUP ------------------

hardware limit minimum            1.00m


user limit minimum                 no
```
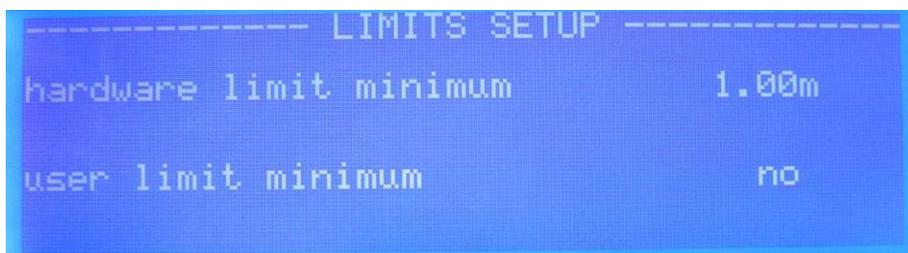
You can type in a user limit and confirm with "ENTER". To delete the user limit type in a value lower then 1, e.g. 0, and confirm with "ENTER".
Press "EXIT" and you will be back in the MAINSCREEN.

6. Repeat point 8.1 and 8.3; navigate to "height upper limit" and press, "ENTER". Here you can set a user limit absolute and one for vertical. See point G5 how to set or delete user limits

```
---------------- LIMITS SETUP ----------------

hardware limit maximum              4.00m


user limit max. absolute            no
user limit max. vert. Polar.        no
```

7. Repeat point 8.1, navigate to "positioning speed" and confirm with "ENTER". You will see the possible minimal and maximal speed.

```
--------------- SPEED SETUP ---------------

                    min.      max.      act.

height / m/s        0.050     0.200     0.200
```

You can change the actual speed by type in a value and confirm with "ENTER".
Press "EXIT" to go back to the MAINSCREEN.

9) Trouble Shooting for Controller MCU

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If there are problems with the controller, please always carry out the following first:

1. Check power supply – <u>must</u> be between 110V and 240V

2. Check both fuses at the backside of the controller

3. Check user limits and remove the limits, if not in use (see manual for controller)

4. Check fibre optic cables and connections (if possible change cables from a different device and check)

5. Use a short cable for connection directly to the device in the chamber

6. Disconnect the power supply of the device and the controller for approx. 1 minute; reconnect the power supply and carry out referencing

Fault	Probable Cause	Suggested Remedy
Display does not light up	• LCD display not connected properly or display has malfunction	• Check all connectors of the display
Display lights up but no text is shown	• Wrong adjustment of the display contrast	• Check display contrast in the menu
Problems with IEEE interface to software	• Wrong software installed • Malfunction at the connector	• Update of software • Change of IEEE-connector

Please contact our service department by:
Phone: +49 9606 9239130
Or by
Email: service@maturo-gmbh.de

When contacting maturo, please always provide the serial number of the products.

Warranty Statement

Maturo GmbH, hereinafter referred as maturo, warrants that our standard products are free from defect in materials and workmanship for a period of one year from date of shipment, if maintenance is done regularly. Standard maturo products include the following:

- Antenna Mast and Stands

- Turntables and Turn Devices

- Cable guide rails

- Controllers

- Dynamometers for the automotive industry

If the Buyer notifies the Seller of a defect within the warranty period, the Seller will, at the Seller's option, either repair and/or replace those products that prove to be defective.

There will be no charge for warranty services performed at the location maturo designates. The customer must, however, prepay inbound shipping costs and any duties or taxes. Maturo will pay outbound shipping cost for a carrier of maturo's choice, exclusive of any duties or taxes. If maturo determines that warranty service can only be performed at the customer's location, the customer will not be charged for maturo's travel related costs.

This warranty does not apply for:

- Improper storage of our products outside our area of influence,

- Errors during installation, commissioning or operation,

- Wear and tear during normal operations,

- Unqualified maintenance works,

- The application of unsuitable equipment and materials,

- The results of repair works or other activities undertaken on our products, which have not been expressly approved by us.

- Consumable items such as fuses, batteries, etc.

- Products which have been operated outside the specifications

Note: Please always contact maturo before shipping equipment to us.

EG Konformitätserklärung gemäß EMV-Richtlinie 2004/108/EG
Declaration of Conformity in accordance with EMC guideline 2004/108/EC

Hiermit wird erklärt, dass das Produkt:
We hereby declare that the product:

Produktbezeichnung: *Product:*	Controller MCU
Seriennummer: *Serial number:*	MCU/xxx/xxxxxxx
Baujahr: *Year:*	2015
Hersteller: *Manufacturer:*	maturo GmbH, Am Kalvarienberg 24, 92536 Pfreimd

mit den Vorschriften folgender Europäischer Richtlinien übereinstimmt:
has been manufactured according to the regulations of the following European directives:

- 2004/108/EG   Elektromagnetische Verträglichkeit – EMV-Richtlinie
- 2004/108/EC   Electromagnetic compatibility – EMC directive

- 2006/95/EG   Niederspannungsrichtlinie
- 2006/95/EC   The Low Voltage Directive

Grundlagen dafür sind folgende harmonisierte Normen:
Basis for that are the following harmonized standards:

- EN 55022:2010   Class B
- EN 61000-4-2:2009   Level 2/3
- EN 61000-4-3:2006 + A1:2008 + A2:2010 Level 2
- EN 61000-4-4:2004 + A1:2010   Level 2
- EN 61010-1:2010   Safety requirements for electrical equipment for
                                         measurement, control and laboratory use.

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Pfreimd, den 20.02.2013

Gerhard Strehl, Managing Director

Firmenstempel *Company stamp*	Ort und Datum der Ausstellung Place and date of issue	Name, rechtsverbindliche Unterschrift Name and signature of authorised person

GPIB commands for the Multiple Control Unit MCU

For
Antenna Mast
Turntable TT &Turn Devices TD

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Chapter 1:

Chapter 1: GPIB-Bus commands for Antenna Masts

General information

- All outputs through the GPIB-Bus are five characters long, followed by Line Feed (0AH). Missing positions are filled with blanks (20H).
- All values are transferred in CM.
- Negative values are not allowed.
- The commands, values and units must be transferred in capital letters and separated by blanks.
- No more than 32 characters may be sent in one transmission.
- The Line Feed or the EOI can be used as an end character (CR will be ignored).

Registers

The GPIB-Bus interface of the control device has several registers available. By transmitting the register name, the register is made the current register. If the device is addressed as TALKER, it outputs the contents of the register set.
If a value has been loaded previously with LD, it is accepted into the next following register.

Input Registers

These registers can be assigned a value with the LD command. They can be readout when the register name is received and the control unit is then addressed as TALKER.

UL - Upper Limit (General)
        Cannot exceed the maximum height and must not be smaller than the minimum height.

UV - Upper Limit for vertical polarization
        Cannot exceed the "Upper Limit".

LL - Lower Limit
        Cannot exceed the minimum height and must not be larger than the maximum height.

NP - Next Position
        Set point for the GO command.

Output Registers

These registers are only for readout of information.

CP - Current Position

BU - Busy Motor status
        0: Motor is off
        1: Motor is on

The BU register indicates if the motor and thereby also the mast is currently moving.
For mechanical reasons, the motor cannot start immediately after the receipt of a start command.
Therefore it is necessary to wait until the mast moves (BU = 1), before it is possible to enquire with BU whether the previous command has been completed. If the mast is already located in the desired position when a GO command is received, BU will nevertheless be set on 1 for approx. 0.5 sec.

Commands to Load the Registers

LD nnn CM -   Load the value nnn into the register following.

Commands to Control the Mast

UP   -   Moves the mast basket up until the upper limit is reached or a STOP
command
               (ST) is received.

DN   -   Moves the mast basket down until the lower limit is reached or a STOP
               command (ST) is received.

GO   -   Moves the mast basket to the position, which is in the set point register (NP).

P?   -   Current polarization of the antenna.
               0: Horizontal polarisation
               1: Vertical polarisation

PV   -   Sets the antenna to vertical polarization.

PH   -   Sets the antenna to horizontal polarization.

Chapter 2: GPIB-Bus commands for Turntables & Turn Devices

General information

- All outputs through the GPIB-Bus are five characters long, followed by Line Feed (0AH). Missing positions are filled with blanks (20H).
- All values are transferred in DG.
- The commands, values and units must be transferred in capital letters and separated by blanks.
- No more than 32 characters may be sent in one transmission.
- The Line Feed or the EOI can be used as an end character (CR will be ignored).

Registers

The GPIB-Bus interface of the control device has several registers available. By transmitting the register name, the register is made the current register. If the device is addressed as TALKER, it outputs the contents of the register set.
If a value has been loaded previously with LD, it is accepted into the next following register.

Input Registers

These registers can be assigned a value with the LD command. They can be readout when the register name is received and the control unit is then addressed as TALKER.

WL - Wise Limit cannot be larger than 400°.

CL - Counter-clockwise Limit cannot be smaller than -200°.

NP - Next Position. Set point for the GO command.

SP - Speed, valid numbers are 1 to 8.

Output Registers

These registers are only for readout of information.

CP - Current Position

BU - Busy Motor status
         0: Motor is off
         1: Motor is on

The BU register indicates if the motor and thereby also the turntable or turn device are currently moving.

For mechanical reasons, the motor cannot start immediately after the receipt of a start command.

Therefore it is necessary to wait until the turntable moves (BU = 1), before it is possible to enquire with BU whether the previous command has been completed. If the mast is already located in the desired position when a GO command is received, BU will nevertheless be set on 1 for approx. 0.5 sec.

Commands to Load the Registers

LD nnn DG -   Load the value nnn into the register following.

Commands to Control the Turntable or Turn Device

CW   -   Moves the table clockwise until the limit is reached
               or a STOP command (ST) is send.

CC   -   Moves the turntable or turn device counter-clockwise until the limit is
               reached or a STOP command (ST) is send.

GO   -   Moves the turntable or turn device to the position which is in the set
               point register (NP).

ST   -   Stops the movement of the turntable or turn device.

Chapter 3: Error Messages

E – P   Power is sent after a loss of mains power

E – S   Syntax is sent when an invalid command is received

E – V   Value is sent when a value does not lie within the valid limits

E – D   Device is sent when the device no longer reacts, meaning that the motor does not move in spite of the control. It is also sent if the addressed device does not exist.

Chapter 4: General programming of the GPIB-BUS at MCU

Addressing the several devices

If several devices are connected to the MCU, the controllable device needs to be addressed.

For example (One Antenna Mast and one Turntable)
"LD 0 DV"   for the Antenna Mast
"LD 1 DV"   for the Turntable.
This applies for setting a new position and for readout of the actual position of a device!

Speed setting of a device

You can set speed 1 to 8 with the SP-Register. To change the speed of the turntable, make the following two steps:
Select the Turntable "LD 1 DV"
Write "LD 5 SP" sets the speed to five. The speed depends on the maximum speed of the device.

For example the maximum speed of the turntable is 2.0 U/min
(2.0 ÷ 8) * 5 = 1.25 U/min is the new speed

The maximum speed of each device can be readout in the device-menu of the MCU.

Note: The polarisation speed of the antenna mast cannot be change!

Go to a new position

For setting a new position of the turntable make the following two steps:
Select the Turntable "LD 1 DV"
Write the command "LD 180.0 DG NP GO" (the turntable moves to 180 degree)

With the commands "CC" and "CW" it is possible to move the turntable to minimum and maximum limit.
"CC" – Turntable moves to minimum limit (e.g.: -200 degree)
"CW" – Turntable moves to maximum limit (e.g.: +400 degree)

For stopping the turntable make the following two steps:
Select the turntable "LD 1 DV"
Write the command "ST"

For setting a new position of the antenna mast follow the same steps:
Except: Select the antenna mast with writing "LD 0 DV"
Write the command "LD 300.0 CM NP GO" (the antenna mast moves to 3.0 meter)
For polarization of the antenna mast write "PV" and "PH".

Readout the actual position of the device:

Select the device by writing "LD x DV". (x = 0 => Antenna Mast and x = 1 => Turntable)
Write   "CP" (set the Pointer to the CP-Register)
Readout of six Bytes (applies to antenna mast and turntable)

For polarization readout select the antenna mast
Write "P?" and readout the position

In general all registers can be readout in the same way.
E.g.: WL and the CL Register

Device address	Device
0	(Compact) Antenna Mast 1 or Antenna Stand
1	Turntable 1 (TT)
2	Cable Guide Rail (CGR) or Field Probe Positioner (FPP)
3	Turn Device (TD)
4	(Compact) Antenna Mast 2 or Antenna Stand
5	Turntable 2 (TT)

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Notes