Original Operating Instructions

CT0500, CO3000

Contents

1 Compact Table CT0500

1.1 General

1.1.1 Safety

These instructions are intended for users with previous technical knowledge in the field of vehicle testing technology.

The machine has been constructed according to current state-of-the-art principles and valid regulations. Special attention has been given to the safety of the user. The machine complies with Machinery Directive, harmonized standards, European standards or the corresponding national standards. This is confirmed by a manufacturer's declaration.

It is forbidden to start up the machine until it has been ensured that the machine or plant in which it has been installed complies with the regulations in the Machine Directive, the harmonized standards, European standards or the corresponding national standards.

The following regulations apply:

- relevant accident prevention regulations
- generally accepted safety regulations
- directives
- other applicable standards
- national regulations

1.1.2 Significance of the Instruction Manual

The instruction manual belongs to the machine and must be kept readily accessible until the machine is discarded and also must be handed over to owners or borrowers if the machine is sold or lent.

It is unavoidable that there are still a few risks for persons and property associated with this machine. Therefore, every person who works with this machine and is involved with transport, installation, operation, maintenance and repair of the machine must be trained and be aware of the possible dangers. The instructions, in particular safety instructions, must be carefully read, understood and followed.

No knowledge or inadequate knowledge of the instruction manual voids the liability of innco systems GmbH for any claims. The operator is therefore recommended to have written confirmation of staff training.

1.1.3 Authorized Use

The machine is exclusively designed for vehicle and component testing technology. Any application other than specified or one going beyond the mentioned data in this document is unauthorized. The manufacturer is not liable for damages resulting from such applications. The user alone has to bear the risk. Also the user is responsible for the specific application of use.

1.1.4 The Operator's Obligations

In accordance with the Machine Directive, the harmonized standards, European standards or the corresponding national standards the operator is obliged to instruct, in particular with regard to safety, staff who are involved with assembly, operation, maintenance, repair or disassembly of the machine. In accordance with the Machine Directive, the harmonized standards, European standards or the corresponding national standards the operator is also obliged to check the machine before initial start-up and after repairs and any malfunctioning.

1.1.5 Operating Personnel

The machine is designed according to state-of-the-art technology and is in line with applicable safety regulations. However, the general risks of personal injury or damage to property connected with the use of such machinery cannot be completely eliminated Therefore the units may only be assembled and operated by competent and qualified personnel and only be used for the authorized application.

Therefore a careful study of the operation manual is to be made before attempting to use or service the machine, and particular attention is to be paid to the safety instructions.

Work to be performed on electrical parts, such as:

- installation of limit switches
- mounting of drives

may only be carried out by qualified electricians.

1.1.6 Notes and Signs for Risks and Danger Zones

The machine is designed to be safe. However, should there be any remaining risks for persons or property, the user must indicate these risks by the use of signs or written instructions on procedures.

1.1.7 Modifications and Alterations to the Machine

It is not permitted to make any alterations to the safety features or design of the machine without our consent. innco systems GmbH declines any responsibility in case of such alterations. Wearing and spare parts may only be replaced after consultation with our service technicians or by them personally.

It is not permitted to disassemble or disconnect any safety or protection device. When using special accessories, the assembly instructions of the manufacturer must be observed.

The following regulations must be complied with:

- the relevant regulations for the prevention of accidents

- generally recognized safety regulations
- national regulations

1.1.8 Warranty

The warranty conditions are stated in this documentation. Any claims for warranty is voided if

- the machine has not be used in accordance with its intended use,
- the instructions stated in this instruction manual have not been followed,
- the machine has been modified without the manufacturer's permission,
- screws sealed with locking enamel have been unscrewed.

The manufacturer is only liable if original spare parts have been used for maintenance and repair work.

1.2 Description

The **CT0500** is a compact and inexpensive turntable for test objects up to 75 kg (165 lbs.). It is dismountable and easy to transport. The options for the automatic control are a controller CO3000 or directly a PC via RS232 or USB. The CT will be delivered with small demo software written in Virtual Basic, C++ or LabView, if ordered with PC controll option.

The IEEE 488 (GPIB) bus, when operated with the CO2000 Controller, or IEEE 488 (GPIB) & TCP/IP (LAN) interface, when operated by CO3000 Controller provides an additional control option for all functions.

1.3 Technical Data

Diameter	500mmm
Max. Load	75kg
Max. Height	188mm
Material of Carrier Plate	Kömacel, PVC-border-ring
Min. rotating speed	1U / 120sec $\hat{=}$ 0.5U / min
Max. rotating speed	1U / 30sec $\hat{=}$ 2.0U / min
Positioning accuracy	+/- 1°
Min. rotating angle	-200° (alt. -20°)
Max. rotating angle	+200° (alt. +380°)
Control method	Polymer optical fibres (POF)
Motor	electronic EC motor, 150W
Drive unit	Shielded and radio interference suppressed
Max. current consumption	1.6A
Voltage	110-230V AC / 50-60HZ

1.4 Drawing

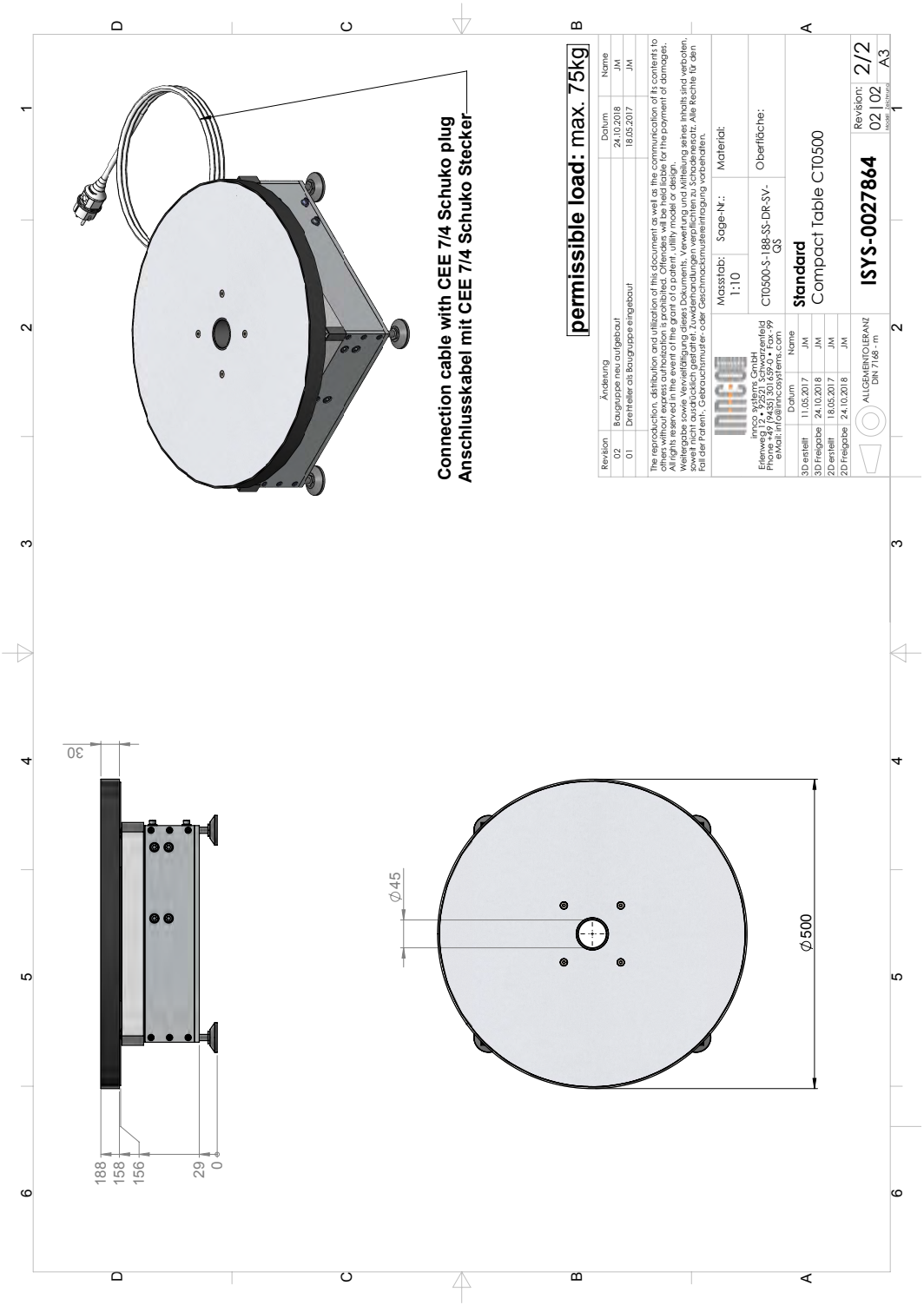


Figure 1.1: CT0500

1.5 Wiring Diagram

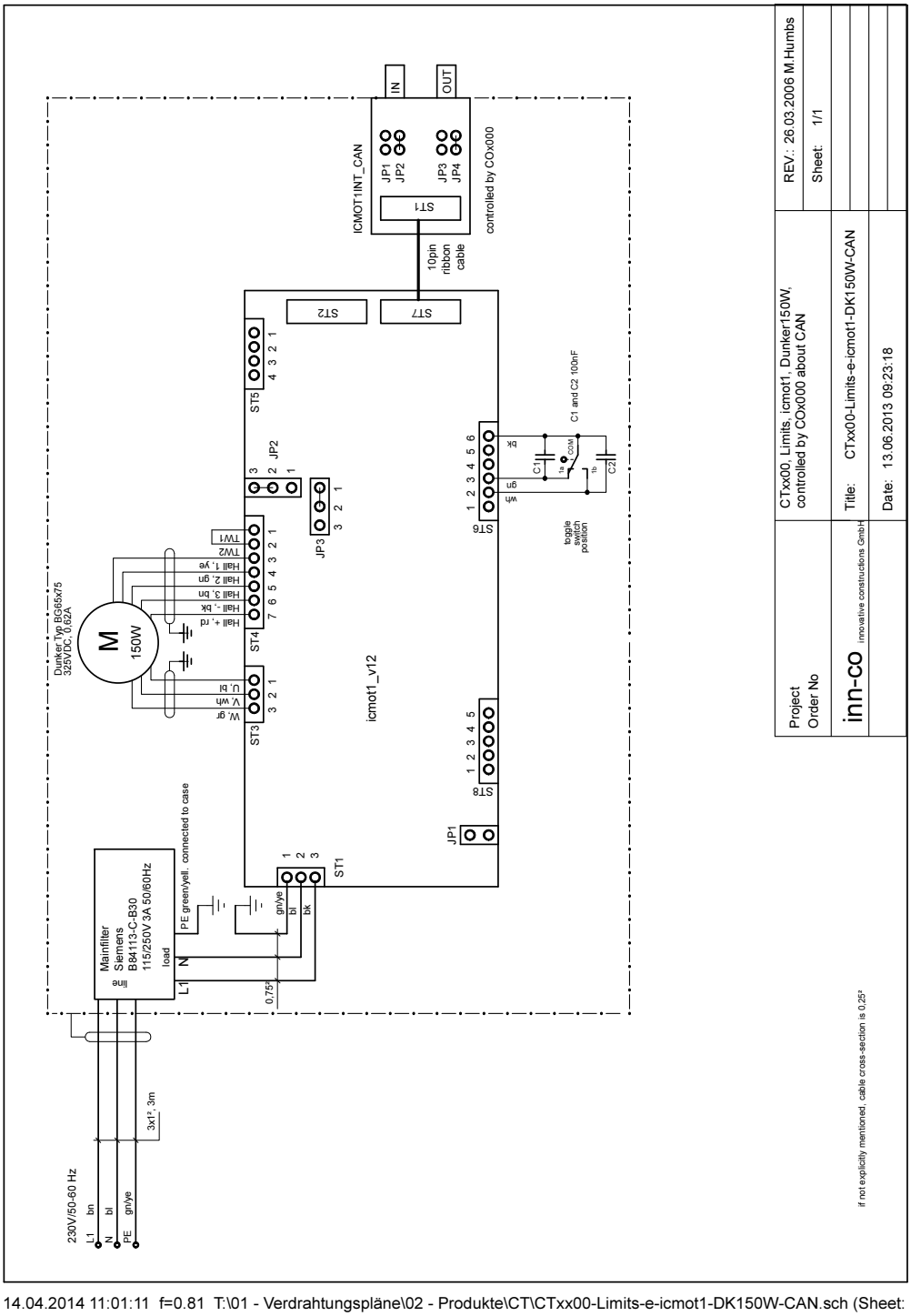


Figure 1.2: Wiring Diagram

1.6 Motor

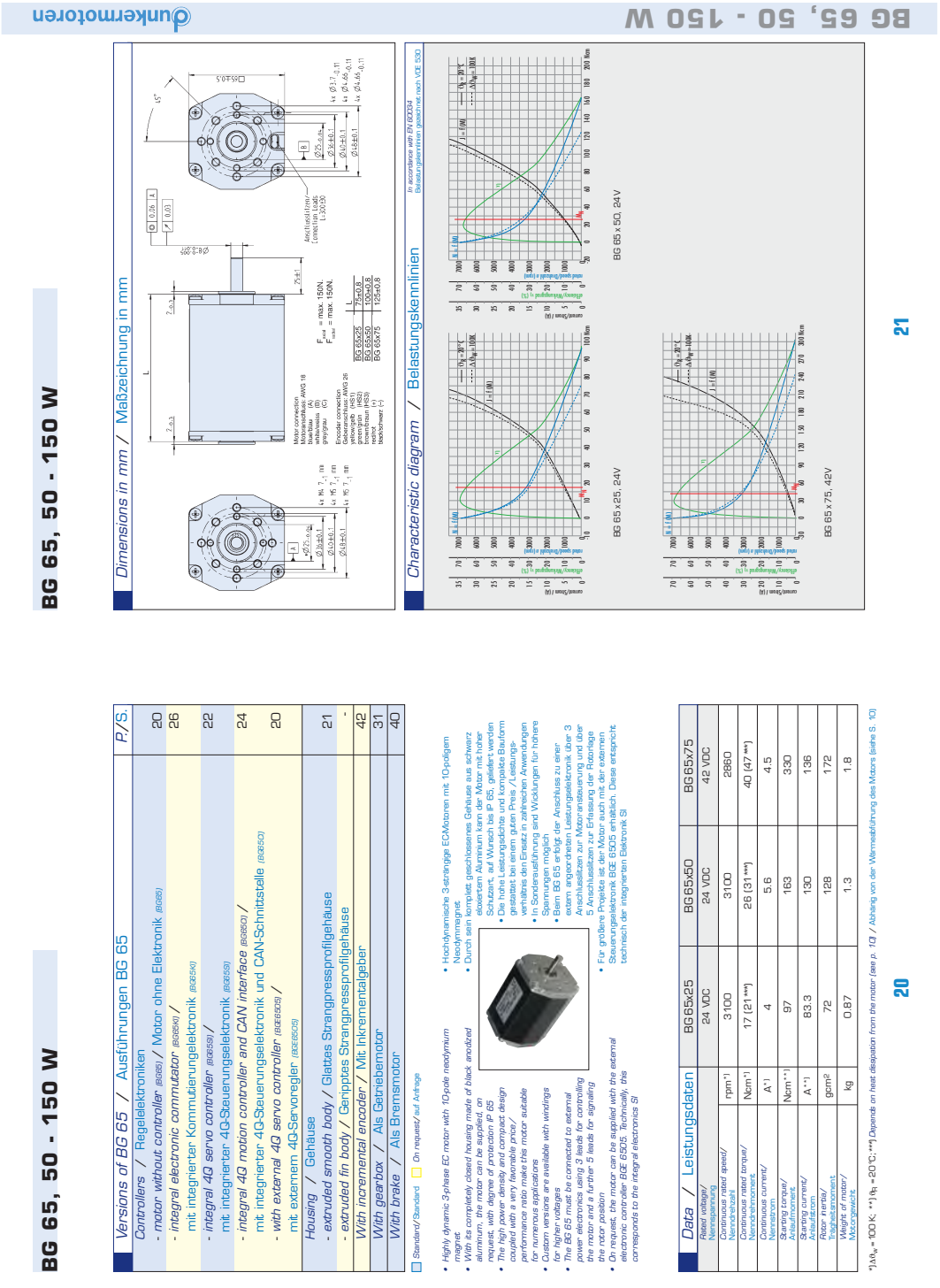


Figure 1.3: Motor

2 Controller CO3000

2.1 Brief Description

The digital controller CO3000 is suited for the operation of antenna masts, turntables, slide bars and other positioning equipment of innco and innco-systems.
It is operable in manual, semi-automatic and remote control mode.
The "Quick Move" buttons and the "Menu Wheel" enable an intuitive and quick operation.
A 7” display provides clear and precise information for each device.

2.2 Technical Data

Data interface	IEEE488 / LAN
Device interface	4-port CAN-Bus via duplex optical fiber
Transfer rate	500kBit/s
Display	7” TFT 800x480 pixel
Voltage	100-240V AC (50/60Hz)
Approx. current consumption	20W
Fuse	T 1,25A / 250V
Size	3HE 19” Rack mount (427mm x 134mm x 300mm)
Approx. weight	3kg
Min. temperature	5°C
Max. temperature	40°C
Last Digit Serial-No. = P	Polymeric-cable Type 980/1000μm 660nm
Last Digit Serial-No. = G	Glass-cable Type 50/125μm 850nm

2.3 Control Elements

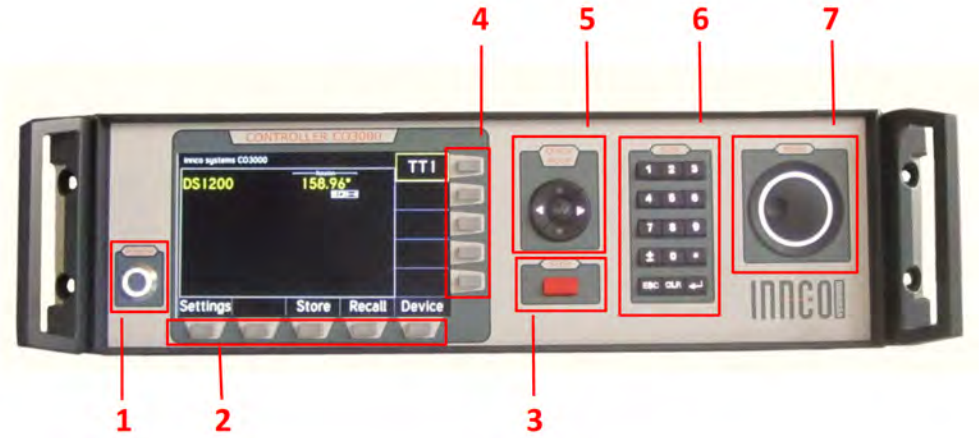


Figure 2.1: Front

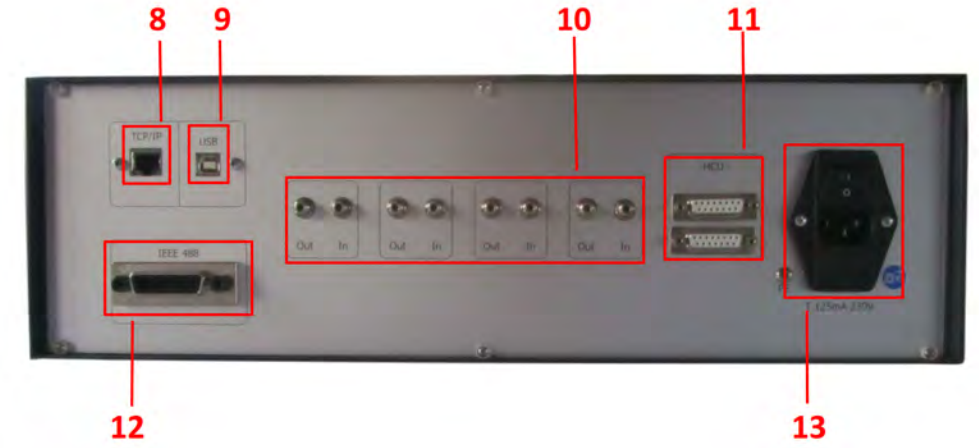


Figure 2.2: Back

1 - Power switch	8 - LAN (TCP/IP) port
2 - Horizontal softkeys	9 - USB port
3 - STOP button	10 - Fiberoptic CAN interface
4 - Vertical softkeys	11 - HCU interface (optional)
5 - Quick move buttons	12 - GPIB (IEEE 488) interface
6 - Data keypad	13 - Main switch / Power socket
7 - Menu wheel	

2.4 Operational Controls

The buttons are lit when you can use them.

Figure 2.3: Quick Move Buttons

The **"Quick Move"** buttons let you navigate left/right or up/down. You can also use these buttons to move the active device.
Other than that, the polarization (horizontal/vertical) can be switched by using the **"H/V"**-button.

Figure 2.4: Data Keypad

Use the data keypad for direct input of numerical values.
When a menu item is selected, there is no need to push the enter button - just start typing.
Lower keys:

- **"ESC"** exit active menu
- **"CLR"** delete last typed character
- **"Enter"** confirm input value

Figure 2.5: Menu Wheel

The Menu Wheel is used to navigate through the menu by turning it clockwise or counter-clockwise. Pressing the wheel has the same effect as the *"Enter"* button.
When a Tilt-Mast is connected, it switches between height and elevation input mode on main display.

Also, the menu wheel is used to move the active device. By turning the wheel, the active device increases or decreases it´s current position. The turning speed will affect the movement speed of the device. This will be indicated by the following graphics:

Figure 2.6: Speed indicator

Control elements which are able to be used will be displayed directly beneath the menu item.

Figure 2.7: **"Data Keypad"** or **"Menu Wheel"** | Up/Down | H/V | Left/Right (**"Quick Move"**)

To abort any running process or to stop the movement of a unit, please press the **"Stop"** Button.

Figure 2.8: Stop Button

ATTENTION: This stopping procedure is NOT an emergency stop!

2.5 Power On/Off

First, connect the power cable to the power socket.
Then, move the main switch into 'I'-position (ON).

Figure 2.9: Main Switch / Power Socket

Press the **"Power"** button once, to turn on the controller.

Figure 2.10: Power Button

Press and hold the **"Power"** button for 3 seconds, to shut off the controller.

2.6 Initialization

By pressing the **"Power"** button, the following screen will be shown.

Figure 2.11: Initialization Screen

During this time all devices which are currently connected to the CAN-bus will be detected and initialized.

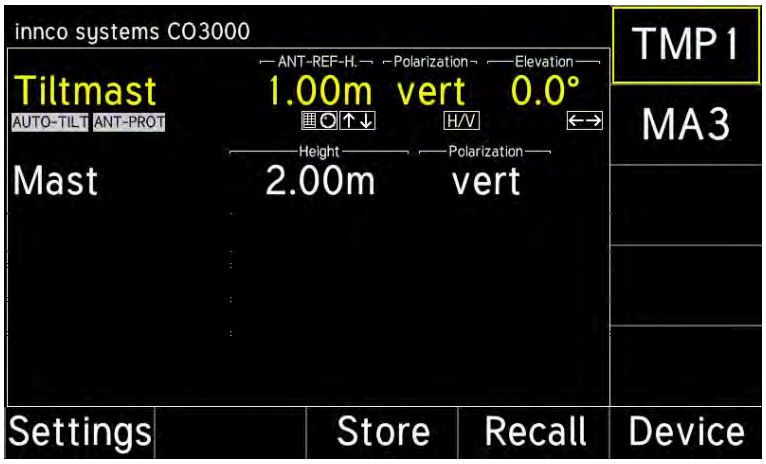


Figure 2.12: Main Display

All connected devices will be shown in the main display and are ready to be used (provided they have been referenced) - see chapter 2.8.

2.7 Activating Devices

The device in the first line is automatically activated.

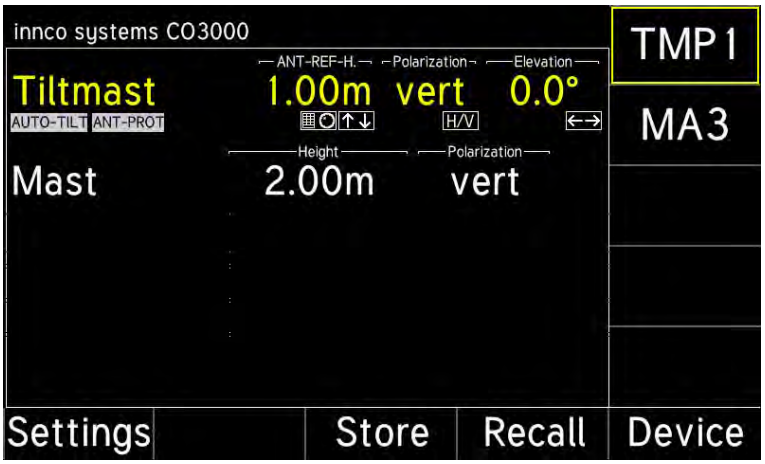


Figure 2.13: Activating; Main Display

To select an other device, press the vertical softkey next to the device name.
The selected device will be shown in yellow.

2.8 Referencing Devices

Before operating, each device must be referenced. Referencing can be done any time.
In case the device has not been referenced, *"NOT REFERENCED"* will be shown in the display.

Figure 2.14: Referencing; Main Display

Please reference devices in the following cases by pressing the **"Ref."** softkey.

- A device has been connected to the controller for the first time
- The movement of a device has been interrupted (e.g. power loss, emergency stop)
- An error has occurred at a device (e.g. activated limit switch)

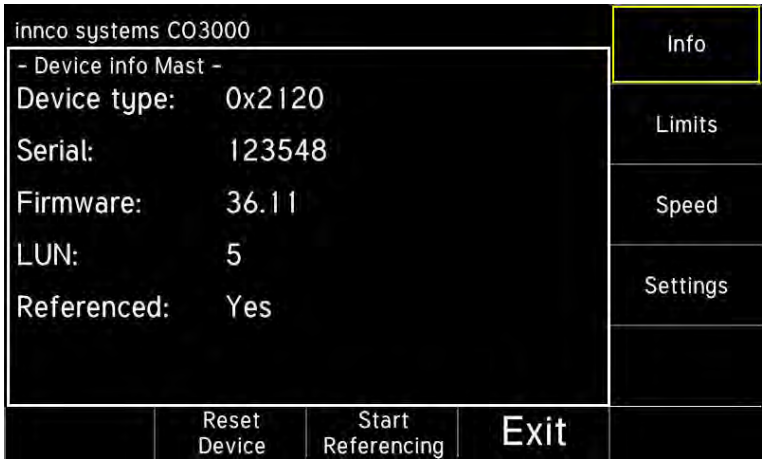


Figure 2.15: Referencing Device

Press the **"Device"** softkey and then the **"Start Referencing"** softkey
if you need to reference a device once more.

Press the **"Exit"** softkey to leave the setup and return to main display.

2.9 Settings

By pressing the **"Settings"** softkey, the following screen will be shown.

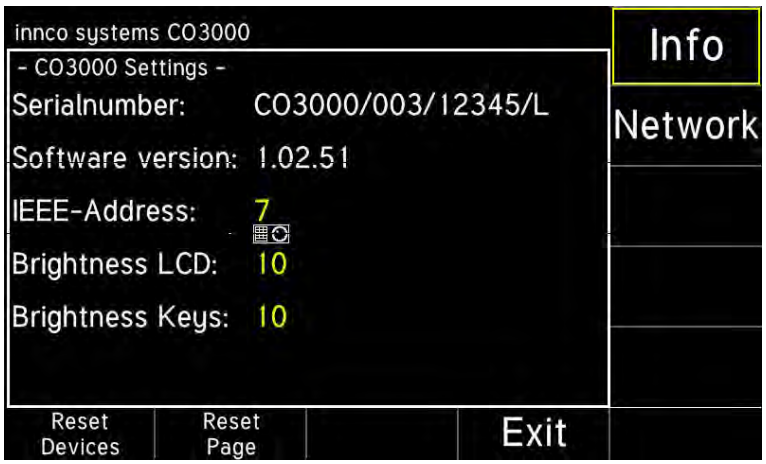


Figure 2.16: Info

The **"Info"** softkey shows the *"Serialnumber"* and the *"Software version"* - they cannot be changed.

"IEEE-Address" lets you set the desired IEEE-Address number.
"Brightness LCD" will change the brightness of the display.
"Brightness Keys" will change the brightness of the keys.

Press the **"Exit"** softkey to leave the setup and return to main display.

2.10 Network Settings

By pressing the **"Network"** softkey, the following screen will be shown.

Figure 2.17: Network

"Mode" changes from "DHCP" to "Static".
"IP Address" lets you change the IP address of the controller.
"Netmask" lets you change the netmask of the controller.
"Gateway" lets you change the gateway of the controller.
"Port" lets you change the network port of the controller.
"Hostname" sets the name of the controller, which is shown in the network.

The **"Reset Page"** softkey resets the values on the active page to default settings.
The **"Reset Devices"** softkey resets the values of every referenced device to default settings.

Press the **"Exit"** softkey to leave the setup and return to main display.

2.11 Device Limits

By pressing the **"Device"** softkey on the main display and then the **"Limits"** softkey, the following screen will be shown.

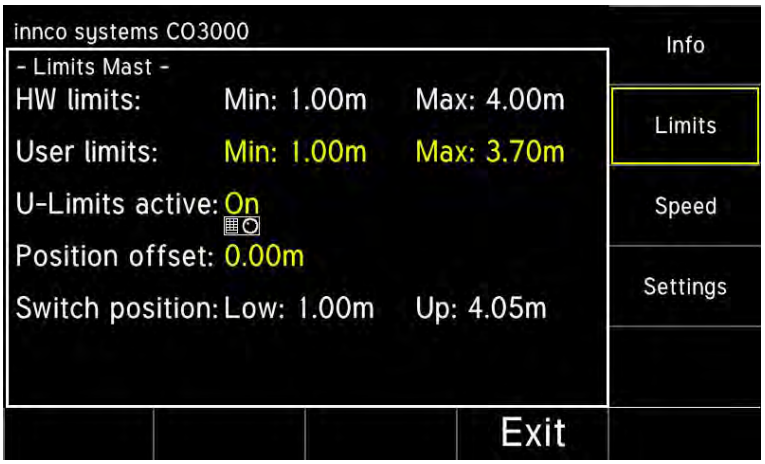


Figure 2.18: Limits

The min. and max. hardware limits are fixed in the device and can not be changed.
Within these hardware limits the user can set additional limits (user limits)
If there are no hardware limits, only the user limits will be shown.

"User limits" changes the limits, within the device will be able to move.
"U-Limits active" activates or deactivates the limit settings. Switch to "On" or "Off".
"Position offset" lets you insert an offset value.

ATTENTION: User limits are not considered during referencing!

Press the **"Exit"** softkey to leave the setup and return to main display.

2.12 Device Speed

By pressing the **"Device"** softkey on the main display and then the **"Speed"** softkey, the following screen will be shown.

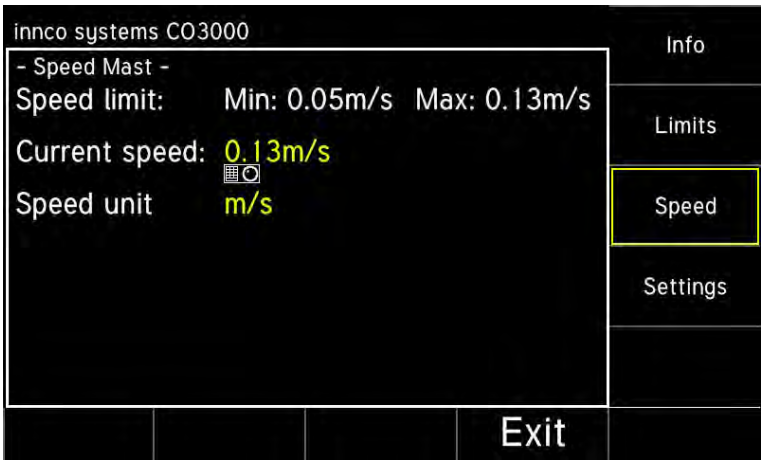


Figure 2.19: Speed

"Current speed" lets you set the movement speed.
"Speed unit" allows you to change the unit of measurement (mm/s, cm/s, m/s, inch/s)

Press the **"Exit"** softkey to leave the setup and return to main display.

2.13 Device Settings

By pressing the **"Device"** softkey on the main display and then the **"Settings"** softkey, the following screen will be shown.

Figure 2.20: Device Settings

"Name" lets you rename the device individually.
"Position unit" allows you to change the unit of measurement (mm, cm, m, inch).
"Mode" changes from "Step" to "Continuous".
"Stepwidth" specifies the step distance wich is run when in "Step" mode.
"Decimal place" sets the number of decimal places shown on the results.
"Rounding" lets you round the results. Switch to "On" or "Off".

Press the **"Exit"** softkey to leave the setup and return to main display.

2.14 Positioning

Use the data keypad or the menu wheel to input a target position.
While the device is moving, a new position can be entered.
The device will stop and move to the new position.

2.15 Store Positions

By pressing the **"Store"** softkey on the main display, the following screen will be shown.

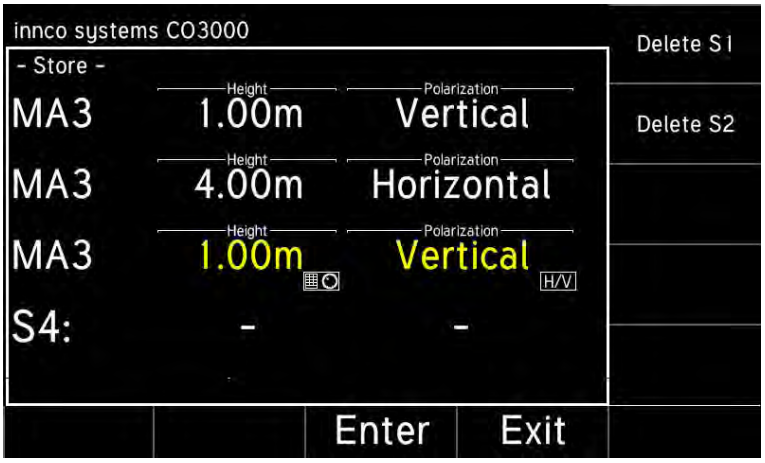


Figure 2.21: Store Position

To store the position, just enter the position you would like to save, using the data keypad (up to 4 positioins are storeable)
Please confirm the input values, using the **"Enter"** softkey,
otherwise the position will not be saved.

Saved positions will be shown on the right (Delete S1, Delete S2, ...)
Press the **"Delete ..."** softkey to delete a saved position from the memory.

Press the **"Exit"** softkey to leave the menu and return to main display.

2.16 Recall Positions

By pressing the **"Recall"** softkey on the main display, the following screen will be shown.

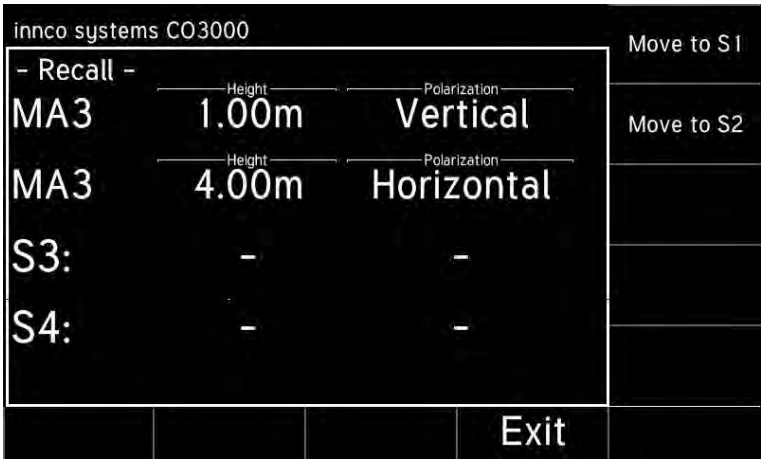


Figure 2.22: Recall Stored Position

Press the **"Move to ..."** softkey to recall the saved position from the active device.
The device will immediately move to the restored position.

Press the **"Exit"** softkey to leave the menu and return to main display.

ATTENTION: The recall operation will be canceled if not completed!

2.17 Tiltmast Settings

The tiltmast positioner is a combination of minimum two devices:

- mast with up/down and hor./vert. movement (polarization)
- + elevation unit with tilt up/down movement

or (optional)

- mast + elevation unit (as above)
- + slider with forwards/backwards movement

The device is able to automatically correct the antenna elevation.
This occurs in relation to:

- object height
- antenna height
- antenna length
- measurement distance

When a mast with "Auto-Tilt" function is connected, the following screen will be shown.

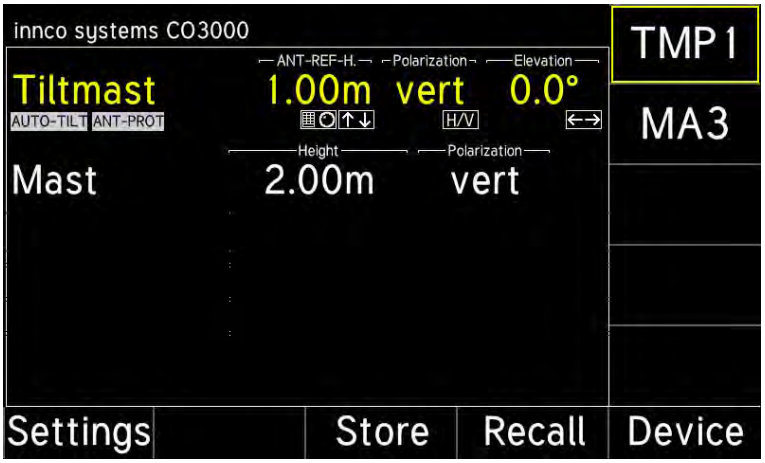


Figure 2.23: Main Display

Notes below the device name indicate, whether the respective function is activated.
e.g. *"AUTO-TILT"* or/and *"ANT-PROT"* will be shown when active.

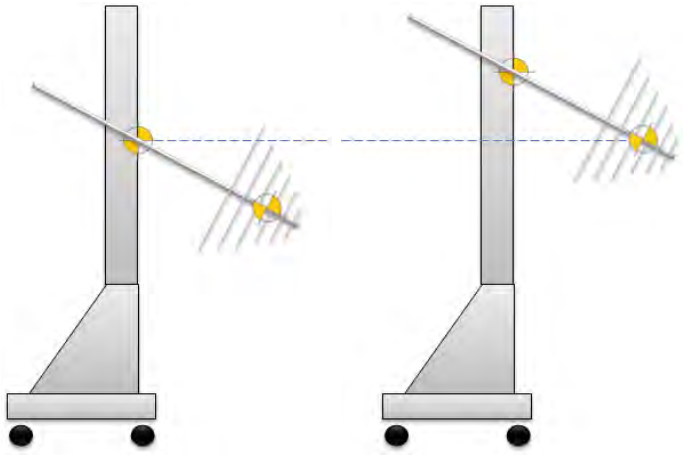
First, the actual height is shown.
Above, you can see wether *"ANT-REF-H."* or *"MAST-HEIGHT"* is activated.
Second, the actual polarization is shown. (hor./vert.)
Third, the actual degree of elevation is shown.

By pressing the **"H/V"** button, the polarization axis will be switched.

Pressing the Menu Wheel lets you switch between height and elevation.

2.18 Auto-Tilt

There are two types of measurement.



Mast Height and Antenna Reference Height

When the system is set to "MAST HEIGHT", the inserted height value will relate to the mast basket reference mark.
When set to "ANT-REF-HEIGHT", the inserted height value will relate to the antenna reference mark.

Please consider this while setting up and configuring the Tilt-Mast.

2.19 Auto-Tilt Settings

By pressing the **"Device"** softkey in the main menu and then the **"Auto-Tilt"** softkey, the following screen will be shown.

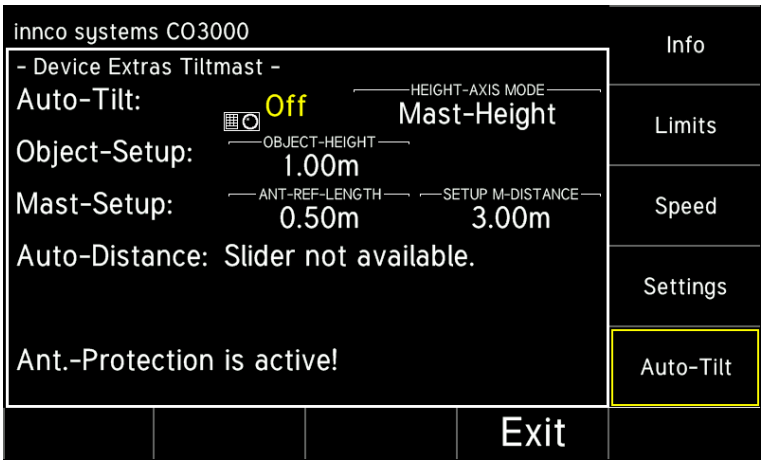


Figure 2.24: Auto-Tilt Off

To enable the *"Auto-Tilt"* function, it needs to be switched to "On" first.

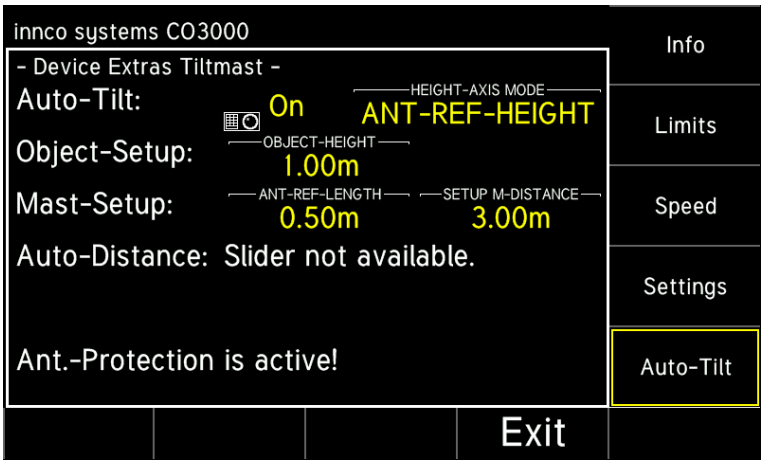


Figure 2.25: Auto-Tilt On

"Auto-Tilt" lets you activate/deactivate the elevation correction. Switch to "On" or "Off".
"HEIGHT-AXIS MODE" indicates which measurement type is being used.
"Object-Setup" lets you choose the height of the object to be measured.
"Mast-Setup" set *"ANT-REF-LENGTH"* and *"SETUP M-DISTANCE"* as shown on next page.
> it is preferred to set the "SETUP M-DISTANCE" directly after referencing a device.
"Auto-Distance" will show if a "Slider" has been connected or not.

2.20 Setup Drawing

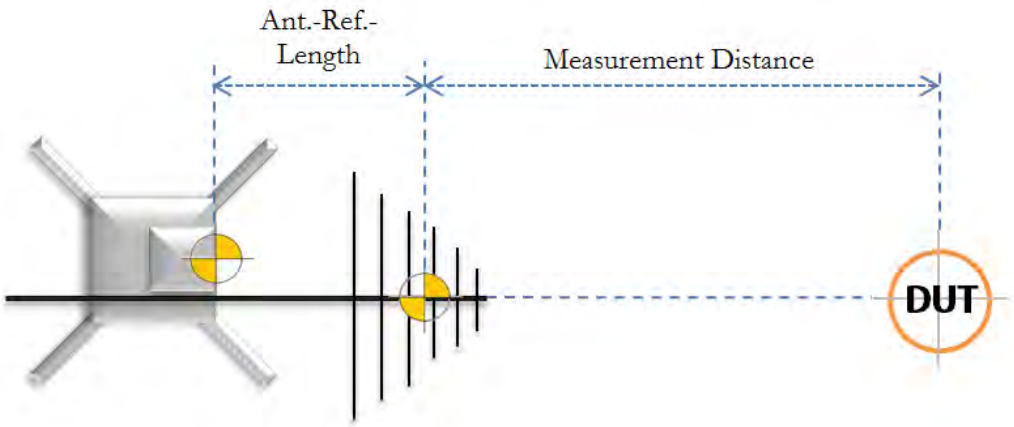


Figure 2.26: Setup Drawing

If there is *no* slider connected, the *'SETUP M-DISTANCE'* is the same as Measurement Distance. The mast will have to be moved manually into position or the antenna
will have to be moved to the correct position, using the polarisation-tube.

ATTENTION:
Moving the antenna will change the Ant.-Ref.-Length! If necessary, adjust!

For operation *with* slider, please use the Slider Setup manual.

2.21 Limits Axis

The display shows the active axis on the top in green.

Figure 2.27: Limits Tiltmast

Change the active axis by pressing the **"Change Axis"** softkey or the **"H/V"** button.

"User limits" changes the limits, within the device will be able to move.
"U-Limits active" activates or deactivates the limit settings. Switch to "On" or "Off".
"Position offset" lets you insert an offset value.
"Tilt Ant. Protection" lets you set the minimum height, when at maximum tilt angle, to protect the mounted antenna. Switch to "On" or "Off".

Press the **"Exit"** softkey to leave the menu and return to main display.

2.22 Limits Tiltmast

By pressing the **"Limits"** softkey, the following screen will be shown.

Figure 2.28: Limits Tiltmast

The min. and max. hardware limits are fixed in the device and can not be changed.
Within these hardware limits the user can set additional limits (user limits)
If there are no hardware limits, only the user limits will be shown.

ATTENTION:
User Limits are always referenced to the Mast Height - not to the Ant-Ref-Height!

"User limits" changes the limits, within the device will be able to move.
"U-Limits active" activates or deactivates the limit settings. Switch to "On" or "Off".
"Position offset" lets you insert an offset value.
"Tilt Ant. Protection" lets you set the max. tilt-angle, when at 1m height,
to protect the mounted antenna. Switch to "On" or "Off".

2.23 VSWR Settings

The VSWR positioner is a combination of two devices:

- The slide with left and right movement
- The turn unit with corrective rotation left and right (automatic correction is optional)

Figure 2.29:

The device is able to correct the antenna direction according to the antenna distance to DUT and the slider center position.
The mentioned parameters can be adjusted in the "Extras" of the device settings.

By pressing the **"Device"** softkey in the main menu and then the **"Extras"** softkey, the following screen will be shown.

Figure 2.30: VSWR Position

"Auto-Azimuth" enables the direction correction. Switch to "On" or "Off".
"Centre position" set the centre position of the slider. (Reference for the 0° position)
"Distance to DUT" will affect the correction angle according to the following drawing.

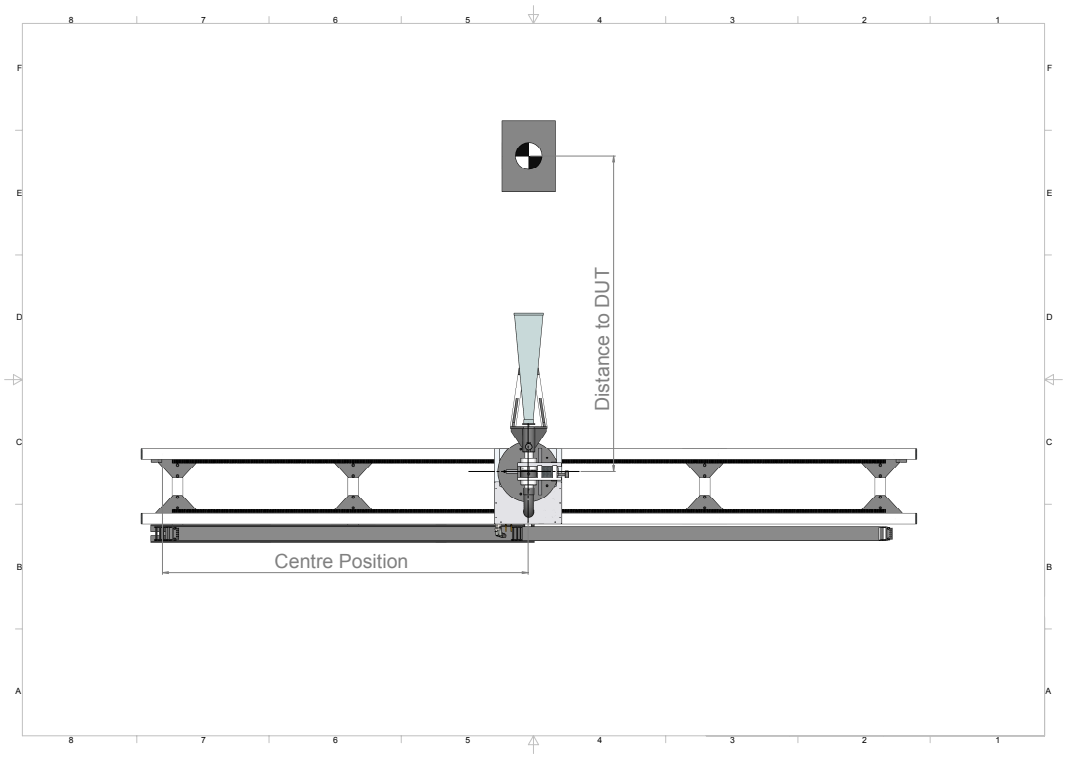


Figure 2.31: VSWR Setup

2.24 Software Update

If new software is available, it can be downloaded from our homepage or will be provided by our service team.
For the update it is necessary to connect the CO3000 to a computer.

ATTENTION: Do not use a USB hub!

Connect the CO3000 USB port on the rear panel with a USB cable (Type A to Type B) directly to a free USB port on the PC.

Windows will now load the USB driver for the CO3000.
No user interaction will be required.

If the CO3000 is connected to the PC for the first time, a short message on the task bar will appear, that the device is now ready to use.
Now the controller can be updated by starting the program "Updater.exe".

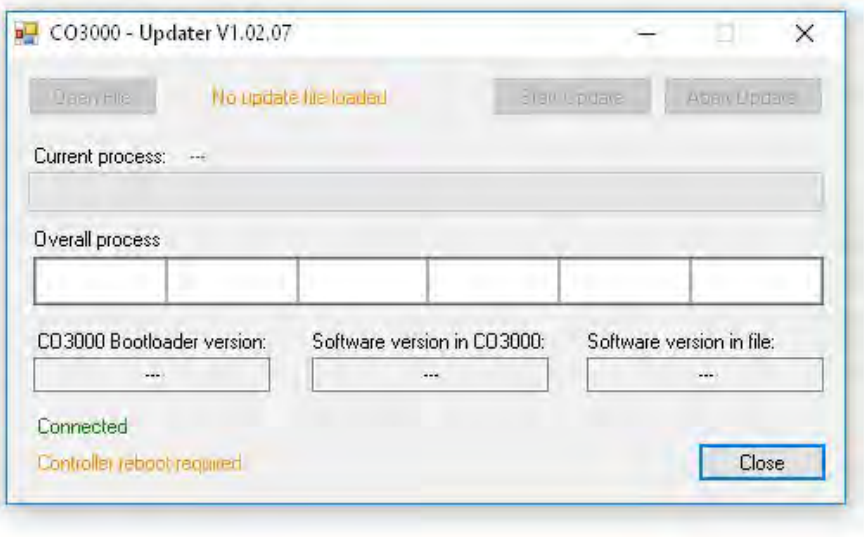


Figure 2.32: Update Start

The update program shows: *"Connected"* and *"Controller Reboot required"*.
Please reboot the controller now. (Power off, then power on).

During reboot, the following screen will be shown on the controller.

Figure 2.33: Update Mode Controller

After rebooting, the message *"Controller Reboot required"* will change to *"Ready to Update"*.

Figure 2.34: Update Process

Please click *"Open File"* and choose the provided update file (*.CO3000 file type)
Now click *"Start Update"* to start update process.
The update process can take up to 10 minutes.

ATTENTION: Do not switch off or disconnect the controller during this time!

After a successful update, the following screen will be shown.

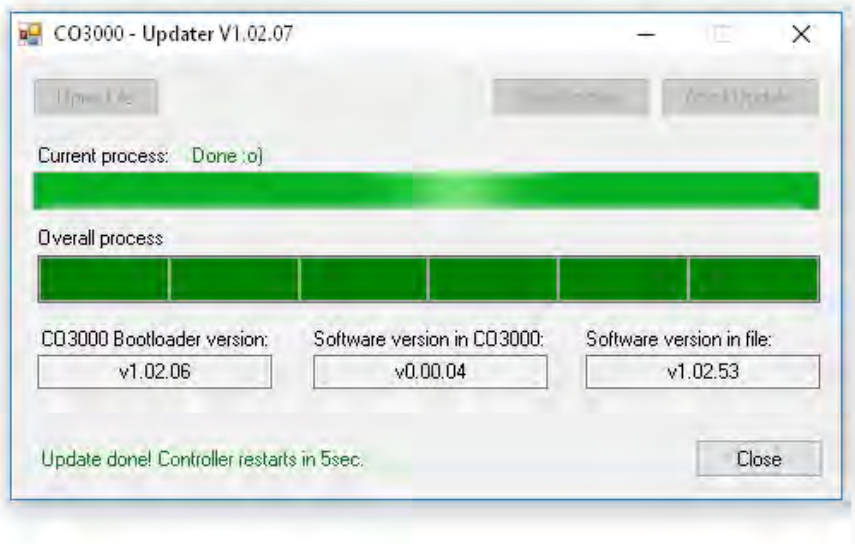


Figure 2.35: Update Done

The update software can now be closed and the USB cable disconnected.
The controller will reboot automatically and is ready to use.

3 Slider Setup

3.1 Brief Description

The slider is an additional unit to the antenna mast with auto-tilt function.
A toothed bar, mounted to the floor and a drive unit, mounted to the mast are the main components.
How to set up the toothed bar and the antenna mast is described in this manual.

3.2 Antenna Polarization

Please follow the steps as shown below. If necessary, take the controller manual at hand.

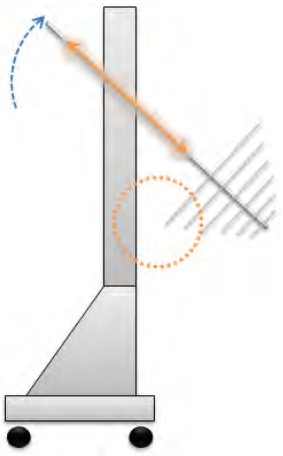


Figure 3.1: Polarization Tube

- Bring the mast basket into the maximum tilt position
- Make sure, the antenna is in vertical position
- Mount the adaptor and the antenna to the polarization tube
- Adjust the polarization tube, to ensure the antenna does not collide with the mast

> If this is not possible, adjust the maximum tilt-angle in the controller's "User Limits" settings.

- Make sure, the polarization tube is tightened firmly

3.3 Toothed Bar Setup

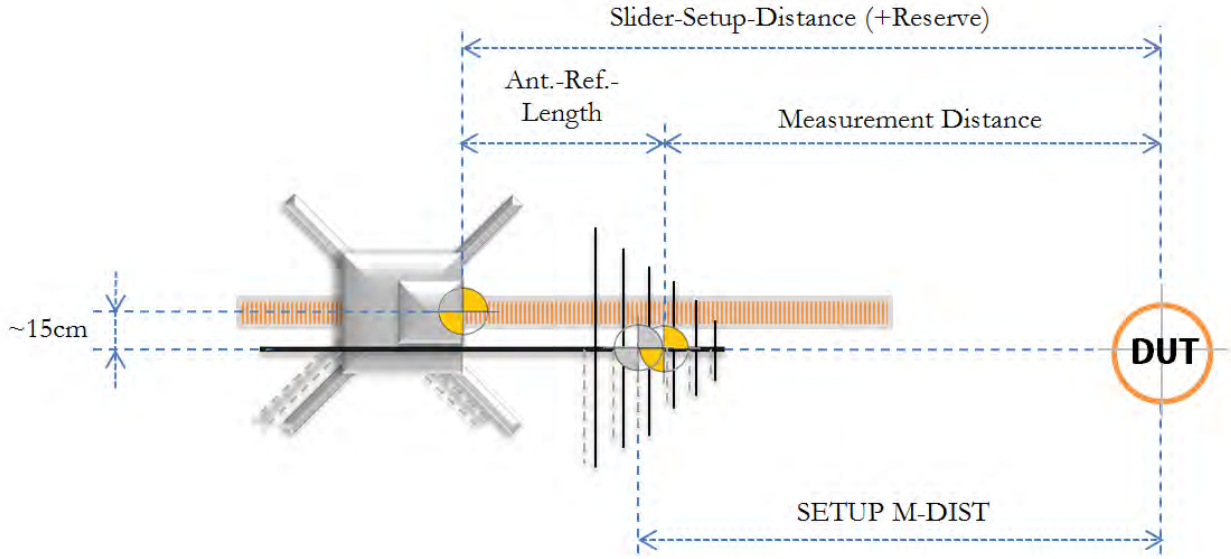
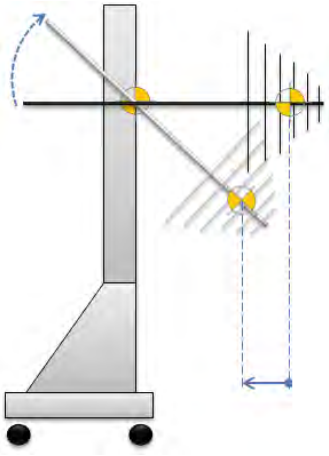


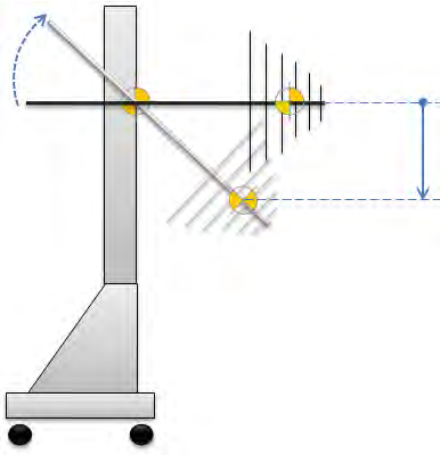
Figure 3.2: Setup

- Bring the antenna into 0° position (horizontal)
- Add the Ant.-Ref.-Length, the Measurement Distance and a little reserve (approx. 2-3cm) This will be your *'Slider-Setup-Distance'*
- Mark the floor at the calculated Distance from the DUT
- Place the toothed bar on the floor, so the mark on the floor matches the mark on the bar
- Make sure, the direction of the bar's mark is pointing towards the DUT
- Fix the bar to the floor (screw or tape)
- Place the mast(-drive) on top of the toothed bar
- Reference the mast as described in the CO3000 manual
- After referencing, measure the *'SETUP M-DIST'* and insert it in the controller

3.4 Correction Modes



Distance Correction



Height Correction

To correct differences in distance, the slider will move forward or backward.
To correct differences in height, the mast basket will move up or down.

4

Remote Control CO3000 for Innco Systems devices

Document version: **v2.10**
Date: **2016-06-28**
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Valid from CO3000 SW Version: **v1.02.60**

Document-History

Version	Date	Author	Changes	CO3000 Version
v1.0	2012-08-22	TW	Initial version	v1.01.02
v1.1	2013-01-31	TW	Changes GPIB index DS & CT	v1.01.10
v1.2	2013-04-16	TW	Gantry device added, Correction axis documentation of XYZ-Positioner	v1.02.01
v1.3	2013-10-04	TW	Compound device added. Mast-Rotator added	v1.02.08
v1.4	2014-05-20	TW	New speed command NSP added	v1.02.11
v1.5	2014-07-28	TW	Tiltmast (TMP) added Tiltmast-Slider (TMS) added	v1.02.12
v1.6	2015-05-06	TS	VSWR-Compound added	v1.02.25
v1.7	2015-05-18	TS	Updated Tiltmast (TMP)	v1.02.26
v1.8	2015-06-30	TS	Added FSM Compound	v1.02.33
v1.9	2015-10-05	TS	Added STATUS command, see 3.1 General Commands	v1.02.37
v1.10	2015-11-30	TS	New Commands for - Tiltmast (TMP) Antenna-Protection - Tiltmast (TMP) Auto-Tilt - Tiltmast (TMP+TMS) Auto-Distance - VSWR-Compout Auto-Azimuth - Gantry Antenna-Compensation	v1.02.38
v2.00	2016-06-07	TS	Tiltmast (TMP): Reworked Auto-Tilt	v1.02.50
v2.10	2016-06-28	TS	Tiltmast (TMP): Reworked Auto-Distance	v1.02.60

Table of Content

1 General

1.1 Terminology

- IEEE488: External Parallel Data Bus
- GPIB: General Purpose Interface Bus, or General Purpose Instrumentation Bus
- EOI: End Or Identify
- Listener GPIB condition of the device's ability to receive messages
- Talker GPIB condition of the device's ability to receive messages
- LF: Line Feed
- LAN: Local Area Network, Network Connection
- TCP/IP: Transmission Control Protocol / Internet Protocol, used by the LAN
- Subnet Contiguous partial network within a LAN network
- Hostname Unique name of a computer in the network
- DHCP Dynamic Host Configuration Protocol, automatic IP address assignment
- HTTP Hyper Text Transfer Protocol, Protocol for Websites
- Socket Connection for exchanging data in networks and procedures
- Network mask Bitmask for setting up subnets in a network
- Gateway Protocol implementer for communicating via Internet

1.2 Other Terminology

- nnn Floating point number, up to one decimal place, negative and positive
  - e.g.: 0, 1, 0.0, 0.1, -100.5, 42.3
- ppp Floating point number, up to one decimal place, only positive
  - e.g.: 0, 1, 0.0, 0.1, 100.5, 42.3
- iii Integernumber
  - e.g.: 0, 1, 123, -456

2 Remote System

2.1 Basic Information

Using a GPIB or LAN connection, the CO3000 can be triggered and used to control devices connected to it. The commands used for this are coded in simple, readable character strings. The following applies to all connections:

- Character set: ASCII 8Bit
- All incoming and outgoing communications are completed with LineFeed “LF” (0x0A)
  - for IEEE488, LF and/or EOI can be used
- Maximum length of incoming character string: 64 bytes, including LF
- Maximum length of outgoing character string: 64 bytes, including LF
- All characters must be transmitted in capital letters. The separator is a space (0x20)
- All commands sent to the CO3000 are confirmed with a return value for each
  - Each command can however also be answered with an error message.

2.2 Connecting via GPIB

2.2.1 Connection

To connect remotely via GPIB, the PC must have a GPIB interface. There are several suppliers for suitable add-on cards or USB adaptors, e.g. National and Agilent. You will need an IEEE-488 cable to connect it with.

The CO3000 is delivered with the default GPIB address 7. This can be changed in the controller’s settings.

2.2.2 Communication

Communication runs on the GPIB standard. To receive commands, the CO3000 must be addressed as a listener and to send the return value it must be addressed as a talker. Return values can be read several times.

Return values are available for reading immediately after being received and decoded.

2.3 Connection via Network (LAN / Ethernet)

The CO3000 can be operated in a normal TCP/IP network. It has no website. It is not possible to run it via an internet browser!

2.3.1 Connection

The controller can be connected to a PC or switch by using a normal network cable (not crossover!) in the network socket in the back of the CO3000.

2.3.2 Settings

	DHCP mode (Preset)	Static mode (Example)
Hostname	CO3000	CO3000
IP address	Automatic	192.168.0.42
Network mask	Automatic	255.255.255.0
Gateway	Automatic	192.168.0.1
Port	5025	5025

The CO3000 is delivered with the DHCP activated. If a static address is desired, this can be set on the CO3000.

In its original setting, the hostname “CO3000” is preset. If you are operating several controllers on the same subnet, the hostnames must be unique. Depending on the DHCP server you are using on the network, various negative effects can occur on the network if several network-capable devices use the same hostname. The hostname can be changed in the CO3000 settings.

The settings for the gateway are irrelevant in most cases, because the CO3000 does not make an Internet connection.

2.3.3 Communication

No additional protocols such as HTTP are used. Sockets can be used for communication. The commands can be written directly to the previously opened socket and the return values read from it. When communicating via LAN, please note that unlike GPIB it is not possible to read a return value from the CO3000 several times. A return value can only be read if a command has been sent to the CO3000.

After receiving and decoding the command, the CO3000 will immediately send the return value to the invoker. Depending on the network, it may take some time to receive the return value (> 100ms).

2.4 Addressing Devices

Each axis of a device is assigned an address between 0 and 15. If an address is already occupied by a device, newly added devices will be assigned a higher address.

An exception to this address assignment is the polarisation axis of the mast devices. The polarisation is described by itself in the sections under each device.

Example of numerical addressing:

- Mast selection : **LD 0 DV**
- Selecting a rotary table DT2: **LD 5 DV**
- Selecting an X-axis of an XYZ positioner: **LD 4 DV**

In addition to numerical addressing, a device can also be triggered via a named address. This has the advantage that a device can have a unique name in the remote system and be triggered by this name even if a newly added device could change the numerical address.

Device names can be given out using the *OPT? Command. See 3.1. General Commands und 4.1.Opt Command

Named Addresses:

- Mast selection: **LD MA1 DV**
- Selecting a rotary table DT2: **LD DT2 DV**
- Selecting an X-axis of an XYZ positioner: **LD X1 DV**

2.5 Error messages

All entries are confirmed with a return value. In case of an error, one of the four error codes is returned.

"**E - P**"	Power:	Is sent after a loss of the power supply.
"**E - S**"	Syntax:	Is sent when there was an error in the command.
"**E - V**"	Value:	Is sent when a value is not within the limits.
"**E - D**"	Device:	Is sent hen a device fails to react for a long time. This means that the motor is not moving. Is also sent when the addressed device does not exist.

3 Remote Commands

Important: Each command sent to the controller is confirmed with a return value. The return values listed in the tables below are the values returned in case of success. In case of error, the error codes listed under 2.4. Error Messages may be given at any command.

3.1 General Commands

General Commands		
Command	Return	Description
ES	1	Emergency Stop Stops all movements of all connected devices
LO	1	Log Out, leave remote-modus. Any currently executed device movement will be completed.
****IDN?***	***inncoCO3000/aaa/bbb***	Returns the identification string aaa: Serial number, variable character string length bbb: CO3000 Version number, variable character string length
****OPT?***	Depends on device. Without devices: **0,0,0,0,0,0,0,0,** **0,0,0,0,0,0,0,0**	Returns the named addresses of the connected devices. The numerical address is derived from the index of named addresses. Example with Mast, Rotary Table and XYZ Positioner: "**MA1,DT1,0,0,X1,0,0,0,Y1,0,0,0,Z1,0,0,0**" - Mast MA1 has the address 0 (Index 0) - Rotary Table DT1 has the address 1 (Index 1) - Addresses of XYZ_Axes: 4, 8 and 12 (Index 4,8,12)
LD xxxn ***DV***	xxxn (see above)	Load one axis of one device and enter remote-modus, Addressing by name Examples (compare with example of *OPT? above) LD MA1 DV LD DT1 DV LD X1 DV LD Y1 DV LD Z1 DV
LD d ***DV***	d	Lode one axis of one device and enter remote-modus, Addressing by index Index d starts at 0 (see *OPT? above) Examples (compare with example of *OPT? above) LD 0 DV LD 1 DV LD 4 DV LD 8 DV LD 12 DV
STATUS d ***?*** ***STATUS*** n ***?***	x, b, nnn EE - or - x, b, ppp EE - or - x, b, nnn EE, pp - or - x, b, nnn EE, pp	Query the status of the device and axis. Can use numerical addressing (d) or name addressing (n). d: Numerical address of the device x: Name of the device b: Busy status of the device (***0***=stopped ***1***=moving) nnn, ppp: The current position of the device EE: Unit, can be ***CM*** (Centimetre) or ***DG*** (Degree) pp: Polarisation ***PV***, ***PH***, or ***P-*** (moving) Example: STATUS MA1 ?

General commands (work on selected device and axis)		
Command	Return	Description
ST	1	Stops currently selected axis movement Does not leave remote-modus
LD nnn EE RR ***LD*** ppp EE RR ***LD*** iii EE RR	Depends on EE and RR	Load command, loads a value to a register LD: Load nnn, ppp, iii assigned register values EE: Unit, valid character string: - ***CM*** (Centimetre) - ***DG*** (Degree) - ***INT*** (Integer) RR: Register, valid registers are described in each device Example: LD 350 CM UL LD 123 CM NP
LD s ***SP***	s	Sets the speed of the currently selected axis. Valid values for s: ***1-8***, ***1***: minimum speed ***8***: maximum speed Example: LD 4 SP
LD ppp ***NSP***	ppp	Sets the speed of the currently selected axis. In cm/s or degree/s
LD nnn ***CM NP*** ***LD*** ppp ***CM NP*** ***LD*** nnn ***DG NP*** ***LD*** ppp ***DG NP***	1	New Position, Register is loaded using ***LD*** - see devices Example: LD 123 CM NP
GO	1	Moves the axis to the value in register ***NP***
LD nnn ***CM NP GO*** ***LD*** ppp ***CM NP GO*** ***LD*** nnn ***DG NP GO*** ***LD*** ppp ***DG NP GO***		Load New Position and move the axis to this position Example: LD 123 CM NP GO
BU	0 or 1	***BU*** = 1: Motor on***; BU*** = 0: Motor off This register shows if one of the motors is currently moving. For mechanical reasons, the motor cannot implement the movement immediately after the start command. It is therefore necessary to wait until the mast starts moving before you can use ***BU*** to check if the last command is complete. Even if the mast has already reached its target ***BU*** will still remain at the value 1 for approx. 0.5 seconds.
HO	1	Starts referencing for the selected device. All axis of the device are referenced.

3.2 Mast (MA), Minimast (MM)

3.2.1 General

- Supported devices
  - Mast (MA): 0x21..
  - Minimast (MM): 0x23..
- All values are transmitted in ***CM*** (cm).
- Negative values are not possible.

3.2.2 Register

Addressing		
Command	Return value	Description
LD d ***DV***	d	Load X-axis mast, numerical addressing Valid values for d: ***0, 4, 8, 12***
LD MAd ***DV*** ***LD MM***d ***DV***	Index of MAd/MMd from ****OPT?*** return	Load X-axis mast, named addressing Valid values for d: ***1, 2, 3, ..***

Read commands		
Command	Return value	Description
CP	ppp	ppp: Current Position in cm
BU	0 or 1	Motor Operation Status 0: Motor is off 1: Motor is on
MP	ppp	ppp: Mast position in cm Changes the address to the X-axis of the mast. All following commands will relate to the X-axis of the mast.
P?	0 or 1	Polarisation, 0: horizontal, 1: vertical
UL	ppp	ppp: Upper Limit X-axis in cm
LL	ppp	ppp: Lower Limit X-axis in cm
SP	1 to 8	Current Speed X-axis
NSP	ppp	Current speed X-axis in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit to ppp cm This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM LL***	ppp	Sets lower limit to ppp cm This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for X-axis Valid values for s: **1-8**
LD ppp ***NSP***	ppp	Sets new speed for X-axis in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the mast basket upwards until the upper limit is reached or the command STOP(***ST***) is sent.
DN	1	Moves the mast basket downwards until the lower limit is reached or the command STOP(***ST***) is sent.
PV	1	Polarise vertical
PH	1	Polarise horizontal
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position)
GO	1	Move the mast basket according to ***NP***

3.3 Twinmast (TW: TWX, TWZ), Tiltmast (TM: TMX, TMZ)

3.3.1 General

- Supported devices
  - Twinmast (TW): 0x2A.
  - Tiltmast (TM): 0x28.., 0x29..
- All values are transmitted in *CM* (cm) or DG (degrees).
- Negative values are not possible.

3.3.2 Register

Addressing		
Command	Return value	Description
LD x ***DV***	x	Load X-axis Twinmast/Tiltmast, numerical addressing Valid values for x: **0, 3, 6, 9, 12, 15**
LD z ***DV***	z	Load Z-axis Twin/Tilt-Mast, numerical addressing Valid values for y: **3, 6, 9, 12, 15**
LD TWXd ***DV*** ***LD* TWZ**d ***DV*** ***LD* TMX**d ***DV*** ***LD* TMZ**d ***DV***	Index of TWXd, TWZd,.. from ****OPT?*** return	Load X-axis Twinmast (TW) Load Z-axis Twinmast (TW) Load X-axis Tiltmast (TM) Load Z-axis Tiltmast (TM) Valid values for d: **1, 2, 3, ...**

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the X-Axis in cm
TA	ppp	ppp: Current position of Z-Axis (Swing) in degree
BU	0 or 1	Motor Operational Status 0: Motor is off 1: Motor is on
MP	ppp	ppp: Mast position of X-Axis in cm Changes the address to the X-Axis of the Mast. All following commands will relate to the X-Axis of the Mast.
P?	0 or 1	Polarisation, 0: horizontal, 1: vertical
UL	ppp	ppp: Upper Limit X-Axis in cm
LL	ppp	ppp: Lower Limit X-Axis in cm
TL	ppp	ppp: Swing Limit of Z-Axis in degrees Maximum deviation from the horizontal position in degrees downwards and upwards.
SP	1 to 8	Speed of the current axis
NSP	ppp	Speed of the current axis. X-axis in cm/s, Z-axis in Degree/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit of X-Axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM LL***	ppp	Sets lower limit of X-Axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD ppp ***DG TL***	ppp	Sets swing limit of the Z-Axis to ppp degrees Swing Limit: Maximum deviation of the horizontal position in degrees upwards and downwards. ppp must not exceed the hardware limits of the Z-Axis.
LD s ***SP***	s	Sets new speed for the currently selected axis: X or Z Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. X-axis in cm/s, Z-Axis in degree/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the mast basket (X-Axis) upwards until the upper limit is reached
DN	1	Moves the mast basket (X-Axis) downwards until the lower limit is reached
PV	1	Polarise vertical
PH	1	Polarise horizontal
TF	1	Swings downwards until the swing arm's lower limit is reached
TU	1	Swings upwards until the swing arm's upper limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), X-Axis must be previously selected!
LD ppp ***DG NP***	1	Load ppp Grad in Register ***NP*** (New Position) Z-Axis must be previously selected!
GO	1	Moves the selected axis to NP

3.4 Rotary table (DT), Rotary unit (DE), Rotary disc (DS), Compact table (CT), Mast rotator (MR)

3.4.1 General

- Supported devices
  - Rotary table (DT): 0x1A.., 0x1B..0x19.., 0x18..
  - Rotary unit (DE): 0x01.., 0x48..
  - Rotary disc (DS): 0x04..
  - Compact table (CT): 0x0400
  - Mast rotator (MR) 0x0450
- All values are transmitted in ***DG*** (degrees).

3.4.2 Register

Addressing		
Command	Return Value	Description
LD d ***DV***	d	Load Table, numerical addressing - Rotary table d: ***1, 5, 9, 13*** - Rotary unit d: ***3, 7, 11, 14*** - Rotary disc d: ***1, 5, 9, 13*** - Compact table d: ***1, 5, 9, 13*** - Mast rotator d***: 1, 5, 9, 13***
LD DTd ***DV*** ***LD DE***d ***DV*** ***LD DS***d ***DV*** ***LD CT***d ***DV*** ***LD MR***d ***DV***	Index of DTd, DEd,.. from ****OPT?*** return	Load Table, named addressing Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	nnn	nnn: Current Position in Grad
BU	0 or 1	Motor Operational Status, Return: 0: Motor is off 1: Motor is on
TP	nnn	nnn: Table position in degrees Changes the address to the table. All following commands will relate to the table.
WL	nnn	nnn: Limit in clockwise degrees
CL	nnn	nnn: Limit in anticlockwise degrees
SP	1 to 8	Current speed
NSP	ppp	Current speed in Degree/s

Write Commands		
Command	Return Value	Description
LD nnn ***DG WL***	nnn	Sets clockwise limit to nnn degrees This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD nnn ***DG CL***	nnn	Sets anticlockwise limit to nnn degrees This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for the device Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the device in degree/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
CW	1	Moves the table clockwise until the limit is reached
CC	1	Moves the table anticlockwise until the limit is reached
LD nnn ***DG NP***	1	Load nnn degrees in Register ***NP*** (New Position)
GO	1	Move the table to ***NP***

3.5 XYZ-Positioner (XYZ: X, Y, Z)

3.5.1 General

- Supported devices
  - XYZ-Positioner (XYZ): 0xA0..
- All values are transmitted in ***CM*** (cm)
- Negative values are not possible
- Each axis of the positioner is controlled individually. Only one axis can be moved at a time. As long as ***BU***=1, no new command will be carried out.

3.5.2 Register

Addressing		
Command	Return Value	Description
LD x ***DV***	x	Load X-Axis, numerical addressing Valid values for x: ***4***
LD y ***DV***	x	Load Y-Axis, numerical addressing Valid values for y: ***8***
LD z ***DV***	z	Load Z-Axis, numerical addressing Valid values for z: ***12***
LD Xd ***DV*** ***LD Y***d ***DV*** ***LD Z***d ***DV***	Index of Xd, Yd, Zd from ****OPT?*** return	Load X-Axis Load Y-Axis Load Z-Axis Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the current axis in cm
MP	ppp	ppp: Position of the X-Axis in cm Changes the address to the X-Axis of the positioner. All following commands will relate to the X-Axis of the positioner
BU	0 or 1	Motor Operational Status, current axis 0: Motor is off 1: Motor is on
UL	ppp:	ppp: Upper limit, current axis, in cm
LL	ppp:	ppp: Lower limit, current axis, in cm
SP	1 to 8	Speed of current axis
NSP	ppp	Speed of the current axis. X-axis in cm/s, Y-axis in cm/s, Z-axis in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit of the current axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM LL***	ppp	Sets lower limit of the current axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for the currently selected axis: X or Z Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. X-axis in cm/s, Y-axis in cm/s, Z-Axis in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in positive direction until the upper limit is reached
DN	1	Moves the current axis in negative direction until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), Applies to current axis
GO	1	Moves the current axis to ***NP***

3.6 Field probe mast (FSM: FX, FY)

3.6.1 General

- Supported devices
  - Field probe mast (FSM): 0x58..
- All values are transmitted in ***CM*** (cm)
- For the X-Axis, only positive values are possible
- For the Y-Axis, positive and negative values are possible

3.6.2 Register

Addressing		
Command	Return Value	Description
LD x **DV**	x	Load X-Axis, numerical addressing Valid values for x: **0, 4, 8**
LD y **DV**	y	Load Y-Axis, numerical addressing Valid values for y: **4, 8, 12**
LD *FX*d **DV** **LD *FY***d **DV**	Index of FXd, FYd from ****OPT?*** return	Load X-Axis Load Y-Axis Valid values for d: **1, 2, 3, ...**

Read Commands		
Command	Return Value	Description
CP	ppp nnn	ppp at X-Axis nnn at Y-Axis Current position of the current axis in cm
MP	ppp	ppp: Position of the X-Axis in cm Changes the address to the X-Axis of the field probe mast. All following commands will relate to the X-Axis of the field probe mast.
BU	0 or 1	Motor Operational Status, current axis 0: Motor is off 1: Motor is on
UL	ppp nnn	ppp at X-Axis nnn at Y-Axis Upper limit of current axis in cm
LL	ppp nnn	ppp at X-Axis nnn at Y-Axis Lower limit of current axis in cm
SP	1 to 8	Speed of current axis
NSP	ppp	Speed of the current axis. X-axis in cm/s, Y-axis in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL*** ***LD*** nnn ***CM UL***	ppp nnn	ppp at X-Axis nnn at Y-Axis Sets upper limit of the current axis to the value in cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM LL*** ***LD*** nnn ***CM LL***	ppp nnn	ppp at X-Axis nnn at Y-Axis Sets lower limit of the current axis to the value in cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for the currently selected axis: X or Y Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. X-axis in cm/s, Y-Axis in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in a positive direction until the upper limit is reached
DN	1	Moves the current axis in a negative direction until the lower limit is reached
LD ppp ***CM NP*** ***LD*** nnn ***CM NP***	1	ppp at X-Axis nnn at Y-Axis Load the value in cm in Register ***NP*** (New Position), Applies to current axis
GO	1	Moves the current axis to ***NP***

3.7 Slidebar (KMS)

3.7.1 General

- Supported devices
  - Cable measurement section/Slidebar: 0x4000, 0x4010
- All values are transmitted in ***CM*** (Centimetres)
- Negative values are not possible

3.7.2 Register and Commands

Addressing		
Command	Return Value	Description
LD d ***DV***	d	Load Slidebar, numerical addressing Valid values for d: ***2, 6, 10, 14***
LD KMSd ***DV***	Index of MKSd from ****OPT?*** return	Load Slidebar, named addressing Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current Position in cm
BU	0 or 1	Motor Operational Status, return: 0: Motor is off 1: Motor is on
GP	ppp	ppp: Glider Position in cm Changes the address to the Slidebar. All following commands will relate to the Slidebar.
FL	ppp	ppp: Upper Limit in cm
BL	ppp	ppp: Lower Limit in cm
SP	1 to 8	Current speed
NSP	ppp	Current speed in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM BL***	ppp	Sets upper limit to ppp cm This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM FL***	ppp	Sets lower limit to ppp cm This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for the device Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the device in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
BA	1	Moves the cable measurement section in a positive direction until the upper limit is reached.
FO	1	Moves the cable measurement section downwards until its lower limit is reached.
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position)
GO	1	Moves the cable measurement section to ***NP***

3.8 Mast Positioner (MP)

3.8.1 General

- Supported devices
  - Mast Positioner (MP): 0x4020
- Negative values are not possible.

3.8.2 Register

Addressing		
Command	Return Value	Description
LD d **DV**	d	Load X-Axis, numerical addressing Valid values for d: **2, 6, 10, 14**
LD MPd **DV**	Index of MPd from ***OPT?*** return	Load X-Axis Valid values for d: **1, 2, 3, ...**

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current Position in cm
BU	0 or 1	Motor Operational Status, return: 0: Motor is off 1: Motor is on
GP	ppp	ppp: Mast Positioner Position in cm Changes the address to the MP. All following commands will relate to the MP.
FL	ppp	ppp: Upper Limit in cm
BL	ppp	ppp: Lower Limit in cm
SP	1 to 8	Current speed
NSP	ppp	Current speed in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM BL***	ppp	Sets upper limit to ppp cm This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM FL***	ppp	Sets lower limit to ppp cm This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for MP Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the MP in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
BA	1	Moves the MP in a positive direction until the upper limit is reached
FO	1	Moves the MP downwards until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position)
GO	1	Moves the MP to ***NP***

3.9 VSWR Compound (VSWR: VS, VSA)

3.9.1 General

CO3000 Display shows: ***VSWR***n

with n = the number of the VSWR, starting with 1 (e.g. VSWR1 or VSWR2)

A VSWR compound is comprised of two devices:

- ***VS***n = X-Axis (Device type: 0x4044)
- ***VSA***n = Azimuth (Device type: 0x0451)

- All values are transmitted in ***CM*** (centimeter) or ***DG*** (degrees).
- Negative values are not possible for ***CM***.

3.9.2 Register

Addressing		
Command	Return Value	Description
LD x ***DV***	x	Load X-Axis, numerical addressing Valid values for x: ***2, 6, 10***
LD a ***DV***	a	Load Azimuth-Axis, numerical addressing Valid values for a: ***6, 10, 14***
LD VSn ***DV***	x	Load X-Axis of VSWRn Valid values for n: ***1, 2, 3, …***
LD VSAn ***DV***	a	Load Azimuth-Axis of VSWRn Valid values for n: ***1, 2, 3, …***

Return value of ***OPT?** command deterimnes values for x and a
(Position of return value, starting with 0).

Example of return value for ***OPT?** command:
0,0,VS1,0,0,0,VSA1,0,0,0,VS2,0,0,0,VSA2,0

Here x=2 for VS1, a=6 for VSA1, x=10 for VS2, a=14 for VSA2

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current Position in cm
BU	0 or 1	Motor Operational Status, Return: 0: Motor is off 1: Motor is on
GP	ppp	ppp: VSWR Position in cm Changes the address to VSWR. All following commands will relate to the VSWR.
FL	ppp	ppp: Upper Limit in cm (X-axis)
BL	ppp	ppp: Lower Limit in cm (X-axis)
WL	nnn	nnn: Limit in clockwise degrees (Azimuth-axis)
CL	nnn	nnn: Limit in anticlockwise degrees (Azimuth-axis)
SP	1 to 8	Current speed (index)
NSP	ppp	Current speed (numerical value) in cm/s for X-axis in degree/s for azimuth-axis

Write Commands		
Command	Return Value	Description
LD ppp ***CM BL***	ppp	Sets Upper Limit to ppp cm (X-axis) This must not be greater than the hardware limits and should not be less than the device's lower limit.
LD ppp ***CM FL***	ppp	Sets Lower Limit to ppp cm (X-axis) This must not be less than the hardware limits and should not be greater than the device's upper limit.
LD nnn ***DG WL***	nnn	Sets clockwise limit to nnn degrees (Azimuth-axis) This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD nnn ***DG CL***	nnn	Sets anticlockwise limit to nnn degrees (Azimuth-axis) This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed (index) Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed (numerical value) in cm/s for X-axis in degree/s for azimuth-axis

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
BA	1	Moves until the upper limit is reached (positive direction) (X-Axis)
FO	1	Moves until the lower limit is reached (X-Axis)
CW	1	Moves clockwise until the limit is reached (Azimuth-Axis)
CC	1	Moves anticlockwise until the limit is reached (Azimuth-Axis)
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position) (X-Axis)
LD nnn ***DG NP***	1	Load nnn degrees in Register ***NP*** (New Position) (Azimuth-Axis)
GO	1	Moves the selected axis to ***NP***

3.10 VSWR Positioner (VSWR)

3.10.1 General

- Supported devices
  - VSWR Positioner (VSWR): 0x4030
- Negative values are not possible.

3.10.2 Register

Addressing		
Command	Return Value	Description
LD d ***DV***	d	Load X-Axis, numerical addressing Valid values for d: ***2, 6, 10, 14***
LD VSd ***DV***	Index of CSd from ****OPT?*** return	Load X-Axis Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current Position in cm
BU	0 or 1	Motor Operational Status, Return: 0: Motor is off 1: Motor is on
GP	ppp	ppp: VSWR Position in cm Changes the address to VSWR. All following commands will relate to the VSWR.
FL	ppp	ppp: Upper Limit in cm
BL	ppp	ppp: Lower Limit in cm
SP	1 to 8	Current speed
NSP	ppp	Current speed in cm/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM BL***	ppp	Sets Upper Limit to ppp cm This must not be greater than the hardware limits and should not be less than the device's lower limit.
LD ppp ***CM FL***	ppp	Sets Lower Limit to ppp cm This must not be less than the hardware limits and should not be greater than the device's upper limit.
LD s ***SP***	s	Sets new speed for VSWR Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for VSWR in cm/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
BA	1	Moves the VSWR in a positive direction until the upper limit is reached
FO	1	Moves the VSWR downwards until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position)
GO	1	Moves the VSWR to ***NP***

3.11 Antenna stand (AS)

3.11.1 General

- Supported devices
  - Antenna stand (AS): 0x60..
- The X-Axis is used here for polarisation!
- Can only change polarisation

3.11.2 Register

Addressing		
Command	Return Value	Description
LD d ***DV***	d	Load X-Axis, numerical addressing Valid values for d: ***0, 4, 8, 12***
LD ASd ***DV***	Index of ASd from ****OPT?*** return	Load X-axis (here for polarisation) Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
BU	0 or 1	Motor Operational Status of current axis 0: Motor is off 1: Motor is on
P?	0 or 1	Polarisation, 0: horizontal, 1: vertical

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
PV	1	Polarises vertically
PH	1	Polarises horizontally

3.12 Gantry with Polarisation (GAP)

3.12.1 General

- Supported devices
  - Gantry with Polarisation (GAP): 0x5080 - 0x50FF
- All values are transmitted in ***CM*** (cm) or ***DG*** (Degree)

3.12.2 Register

Addressing		
Command	Return Value	Description
LD h ***DV***	h	Load Height axis, numerical addressing Valid values for h: ***4***
LD s ***DV***	s	Load Swing axis, numerical addressing Valid values for s: ***8***
LD p ***DV***	p	Load Polarisation axis, numerical addressing Valid values for p: ***12***
LD GAPHd ***DV*** ***LD GAPS***d ***DV*** ***LD GAPP***d ***DV***	Index of GAPHd, GAPSd, GAPPd from ****OPT?*** return	Load Height-Axis Load Swing-Axis Load Polarisation-Axis Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the current axis in cm or degree
MP	ppp	ppp: Position of the Height-Axis in cm Changes the address to the Height-Axis of the gantry. All following commands will relate to the Height-Axis
BU	0 or 1	Motor Operational Status 0: Motor is off 1: Motor is on
UL	ppp:	ppp: Upper limit, current axis, in cm or degree
LL	ppp:	ppp: Lower limit, current axis, in cm or degree
SP	1 to 8	Speed of current axis
NSP	ppp	Speed of the current axis. Height-Axis in cm/s, Swing-Axis in degree/s, Swing-Axis in degree/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit of the current axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid, when Height is addressed.
LD ppp ***DG UL***	ppp	Sets upper limit of the current axis to ppp degree. ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid, when Swing or Polarisation is addressed.
LD ppp ***CM LL***	ppp	Sets lower limit of the current axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid, when Height is addressed.
LD ppp ***DG LL***	ppp	Sets lower limit of the current axis to ppp degree ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit.Only valid, when Swing or Polarisation is addressed.
LD s ***SP***	s	Sets new speed for the currently selected axis: Height, Swing or Polarisation Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. Height-axis in cm/s, Swing-Axis in degree/s, Polarisation-Axis in degree/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in positive direction until the upper limit is reached
DN	1	Moves the current axis in negative direction until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), Applies to current axis. Only valid, when Height is addressed.
LD ppp ***DG NP***	1	Load ppp degree in Register ***NP*** (New Position), Applies to current axis. Only valid, when Swing or Polarisation is addressed.
GO	1	Moves the current axis to ***NP***

3.13 Gantry without Polarisation (GA)

3.13.1 General

- Supported devices
  - Gantry without Polarisation (GA): 0x5100
- All values are transmitted in ***CM*** (cm) or ***DG*** (Degree)

3.13.2 Register

Addressing		
Command	Return Value	Description
LD h ***DV***	h	Load Height axis, numerical addressing Valid values for h: ***4***
LD s ***DV***	s	Load Swing axis, numerical addressing Valid values for s: ***8***
LD GAPHd ***DV*** ***LD GAPS***d ***DV***	Index of GAPHd, GAPSd from ****OPT?*** return	Load Height axis Load Swing axis Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the current axis in cm or degree
MP	ppp	ppp: Position of the Height axis in cm Changes the address to the Height axis of the gantry. All following commands will relate to the Height axis
BU	0 or 1	Motor Operational Status 0: Motor is off 1: Motor is on
UL	ppp:	ppp: Upper limit, current axis, in cm or degree
LL	ppp:	ppp: Lower limit, current axis, in cm or degree
SP	1 to 8	Speed of current axis
NSP	ppp	Speed of the current axis. Height-Axis in cm/s, Swing-Axis in degree/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit of the current axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid, when Height is addressed.
LD ppp ***DG UL***	ppp	Sets upper limit of the current axis to ppp degree. ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid, when Swing is addressed.
LD ppp ***CM LL***	ppp	Sets lower limit of the current axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid, when Height is addressed.
LD ppp ***DG LL***	ppp	Sets lower limit of the current axis to ppp degree ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit.Only valid, when Swing is addressed.
LD s ***SP***	s	Sets new speed for the currently selected axis: Height, Swing or Polarisation Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. Height-axis in cm/s, Swing-Axis in degree/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in positive direction until the upper limit is reached
DN	1	Moves the current axis in negative direction until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), Applies to current axis. Only valid, when Height is addressed.
LD ppp ***DG NP***	1	Load ppp degree in Register ***NP*** (New Position), Applies to current axis. Only valid, when Swing is addressed.
GO	1	Moves the current axis to ***NP***

3.14 Compound Device Mast (CD: CDH, CDP, CDE)

3.14.1 General

- Supported devices
  - Compound_Device
  - combined with three devices:
    - Device for Height (***CDH***): 0x4040
    - Device for Polarisation (***CDP***) 0x6040
    - Device for Elevation (***CDE***) 0x0440

- All values are transmitted in ***CM*** (cm) and ***DG*** (degree)
- Negative values are not possible
- Each axis of the positioner is controlled individually. Only one axis can be moved at a time. As long as ***BU***=1, no new command will be carried out.

3.14.2 Register

Addressing		
Command	Return Value	Description
LD h ***DV***	h	Load Height-Axis, numerical addressing Valid values for x: ***4***
LD p ***DV***	p	Load Polarisation-Axis, numerical addressing Valid values for y: ***8***
LD e ***DV***	e	Load Elevation-Axis, numerical addressing Valid values for z: ***12***
LD CDHd ***DV*** ***LD CDP***d ***DV*** ***LD CDE***d ***DV***	Index of CDHd, CDPd, CDEd from ****OPT?*** return	Load Height-Axis Load Polarisation-Axis Load Elevation-Axis Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the current axis in cm or degree (Only for Height and Elevation)
TA	ppp	ppp: Current position of Elevations axis in degree
P?	0 oder 1	Polarisation, 0: horizontal, 1: vertical
MP	ppp	ppp: Position of the Height-Axis in cm Changes the address to the Height-Axis of the compound. All following commands will relate to the Height-Axis of the compound
BU	0 or 1	Motor Operational Status, current axis 0: Motor is off 1: Motor is on
UL	ppp:	ppp: Upper limit, current axis, in cm/degree (Only for Height and Elevation)
LL	ppp:	ppp: Lower limit, current axis, in cm/degree (Only for Height and Elevation)

Read Commands		
SP	1 to 8	Speed of current axis. (Only for Height and Elevation)
NSP	ppp	Speed of the current axis. (Only for Height and Elevation) Height-Axis in cm/s, Elevation-Axis in degree/s

Write Commands		
Command	Return Value	Description
LD ppp ***CM UL***	ppp	Sets upper limit of the height axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid when height is addressed.
LD ppp ***DG UL***	ppp	Sets upper limit of the elevation axis to ppp degree ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid when elevation is addressed.
LD ppp ***CM LL***	ppp	Sets lower limit of the height axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid when height is addressed.
LD ppp ***DG LL***	ppp	Sets lower limit of the elevation axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid when elevation is addressed.
LD s ***SP***	s	Sets new speed for the currently selected axis: Height or Elevation Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. Height-axis in cm/s, Elevation-Axis in degree/s

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in positive direction until the upper limit is reached
DN	1	Moves the current axis in negative direction until the lower limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), Applies to current axis
GO	1	Moves the current axis to ***NP***
PV	1	Set polarisation vertical
PH	1	Set polarisation horizontal

3.15 Tiltmast (TMP: TMPM, TMPE)

3.15.1 General

- Supported devices
  - combined from two devices:
    - Device for Height/Polarisation (***TMPM***): 0x2341
    - Device for Elevation (***TMPE***) 0x0141

- All values are transmitted in ***CM*** (cm), ***DG*** (degree) or ***INT*** (integer)
- Each axis of the Tiltmast is controlled individually. Only one axis can be moved at a time. As long as ***BU***=1, no new command will be carried out.

3.15.2 Register

Addressing		
Command	Return Value	Description
LD h ***DV***	h	Load Height-Axis, numerical addressing Valid values for h: ***0, 3, 6, 9, 12, 15***
LD e ***DV***	e	Load Elevation-Axis, numerical addressing Valid values for e: ***3, 6, 9, 12, 15***
LD TMPMd ***DV*** ***LD*** **TMP*E***d ***DV***	Index of TMPMd, TMPEd from ****OPT?*** return	Load Height-Axis Load Elevation-Axis Valid values for d: ***1, 2, 3, ...***

Control Commands		
Command	Return Value	Description
ST	1	Stops all movements in all connected devices
UP	1	Moves the current axis in positive direction until the upper limit is reached
DN	1	Moves the current axis in negative direction until the lower limit is reached
TF	1	Swings downwards until the lower elevation limit is reached
TU	1	Swings upwards until the upper elevation limit is reached
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position), Applies to current axis. Only valid when height is addressed. †
LD ppp ***DG NP***	1	Load ppp degree in Register ***NP*** (New Position), Applies to current axis. Only valid when elevation is addressed.
GO	1	Moves the current axis to ***NP***
PV	1	Set polarisation vertical
PH	1	Set polarisation horizontal

† Height-axis is switchable between Antenna-Reference-Height and Mast-Height (see ATMH)
‡ Value is mast-height

Read Commands		
Command	Return Value	Description
CP	ppp	ppp: Current position of the current axis in cm or degree (Only for Height and Elevation)
TA	ppp	ppp: Current position of Elevations axis in degree
P?	0 oder 1	Polarisation, 0: horizontal, 1: vertical
MP	ppp	ppp: Position of the Height-Axis in cm Changes to the Height-Axis. All following commands will relate to the Height-Axis †
BU	0 or 1	Motor Operational Status, current axis 0: Motor is off 1: Motor is on
UL	ppp:	ppp: Upper limit, current axis, in cm/degree (Only for Height and Elevation)
LL	ppp:	ppp: Lower limit, current axis, in cm/degree (Only for Height and Elevation)
SP	1 to 8	Speed of current axis. (Only for Height and Elevation)
NSP	ppp	Speed of the current axis. (Only for Height and Elevation) Height-Axis in cm/s, Elevation-Axis in degree/s

† Height-axis is switchable between Antenna-Reference-Height and Mast-Height (see ATMH)
‡ Value is mast-height

Write Commands		
Command	Returns	Description
LD ppp ***CM UL***	ppp	Sets upper limit of the height axis to ppp cm ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid when height is addressed. ‡
LD ppp ***DG UL***	ppp	Sets upper limit of the elevation axis to ppp degree ppp must not be greater than the hardware limits and should not be less than the hardware's lower device limit. Only valid when elevation is addressed.
LD ppp ***CM LL***	ppp	Sets lower limit of the height axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid when height is addressed. ‡
LD ppp ***DG LL***	ppp	Sets lower limit of the elevation axis to ppp cm ppp must not be less than the hardware limits and should not be greater than the hardware's upper device limit. Only valid when elevation is addressed.
LD ppp ***DG TL***	ppp	Sets limit of the Elevation-Axis to ppp degrees Elevation Limit: Maximum deviation of the horizontal position in degrees upwards and downwards. ppp must not exceed the hardware limits of the Elevation-Axis.
LD s ***SP***	s	Sets new speed for the currently selected axis: Height or Elevation Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the currently selected axis. Height-axis in cm/s, Elevation-Axis in degree/s

† Height-axis is switchable between Antenna-Reference-Height and Mast-Height (see ATMH)
‡ Value is mast-height

Write Commands Antenna-Protection		
Command	Returns	Description
LD ppp ***CM APH***	ppp	Set Antenna-Protection Height to ppp cm Should not be bigger than upper, and not smaller than lower hardware-limit of height axis ‡
LD ppp ***DG APT***	ppp	Set Antenna-Protection Tilt to ppp degree Should not be bigger than upper, and not smaller than lower hardware-limit of tilt axis
LD iii ***INT AP***	iii	Switch Antenna-Protection off LD 0 INT AP Switch Antenna-Protection on: LD 1 INT AP

† Height-axis is switchable between Antenna-Reference-Height and Mast-Height (see ATMH)
‡ Value is mast-height

Write Commands AUTO-TILT		
Command	Returns	Description
LD iii ***INT AT***	iii	Switch AUTO-TILT off: LD 0 INT AT Warning: This disables AUTO-DISTANCE as well Switch AUTO-TILT on: LD 1 INT AT Warning: AUTO-TILT is only applied if the height-axis is moved
LD iii ***INT ATMH***	iii	Switch modus between Mast-Height and Antenna-Reference-Height Set to Antenna-Reference-Height (default) LD 0 INT ATMH Warning: Only active if AUTO-TILT is switch on. Set to Mast-Height LD 1 INT ATMH
LD ppp ***CM DZ***	ppp	Object-Setup: Object-Height Use this to set the Object-Height in cm.
LD ppp ***CM ARP***	ppp	Mast-Setup: Antenna-Reference-Point (ARP) Use this to set the Antenna-Reference-Length, the distance from the antenna-pivot-point to the antenna-reference-point in cm.
LD ppp ***CM DYMD***	ppp	Mast-Setup distance (SETUP M-DISTANCE) Sets distance between Antenna-Reference-Point and Object in cm. Attention: With regards to the SETUP M-DISTANCE please refer to the device-manual on how to properly setup the mast.

Write Commands AUTO-DISTANCE (only TMP in combination with TMS, commands have to be sent to TMPE or TMPM device)		
Command	Returns	Description
LD ppp ***CM MD***	ppp	Set the measurement distance to ppp cm If AUTO-DISTANCE is switched on, then the measurement distance will be used for the next GO command of the height axis (if possible) Warning: Both AUTO-TILT and AUTO-DISTANCE must be switched on, and all values for AUTO-TILT must be set. Alternatively the Measurement-Distance can be set in the TMS (see ADSP)
LD iii ***INT AD***	iii	Switch AUTO-DISTANCE of LD 0 INT AD Schaltet AUTO-DISTANCE on LD 1 INT AD Warning: AUTO-TILT must be switched on as well!
LD iii ***INT ADSP***	iii	Switch between Measuring-Distance and Slider-Position Switch to Measuring-Distance (default) LD 0 INT ADSP Switch to Slider-Position LD 1 INT ADSP

3.16 Tiltmast Slider (TMS), Tiltmast-Positioner Extension

3.16.1 General

- Supported devices
  - Tiltmast Slider: 0x4041
- All values are transmitted in ***CM*** (Centimetres)
- Negative values are not possible

3.16.2 Register and Commands

Addressing		
Command	Return Value	Description
LD d ***DV***	d	Load Slider, numerical addressing Valid values for d: ***2, 6, 10, 14***
LD **T*MS***d ***DV***	Index of TMSd from ****OPT?*** return	Load Slider, named addressing Valid values for d: ***1, 2, 3, ...***

Read Commands		
Command	Returns	Description
CP	ppp	ppp: Current Position in cm †
BU	0 or 1	Motor Operational Status, return: 0: Motor is off 1: Motor is on
GP	ppp	ppp: Position in cm † Changes the address to the Tiltmast Slider. All following commands will relate to the Tiltmast Slider.
FL	ppp	ppp: Upper Limit in cm ‡
BL	ppp	ppp: Lower Limit in cm ‡
SP	1 to 8	Current speed
NSP	ppp	Current speed in cm/s

Write Commands		
Command	Returns	Description
LD ppp ***CM BL***	ppp	Sets upper limit to ppp cm ‡ This must not be greater than the hardware limits and should not be less than the hardware's lower device limit.
LD ppp ***CM FL***	ppp	Sets lower limit to ppp cm ‡ This must not be less than the hardware limits and should not be greater than the hardware's upper device limit.
LD s ***SP***	s	Sets new speed for the device Valid values for s: ***1-8***
LD ppp ***NSP***	ppp	Sets new speed for the device in cm/s

Control Commands		
Command	Returns	Description
ST	1	Stops all movements in all connected devices
BA	1	Moves the tiltmast slider in a positive direction (commonly towards the object) until the limit is reached.
FO	1	Moves the tilstmast slider in negative direction (commonly away from the object) until the limit is reached.
LD ppp ***CM NP***	1	Load ppp cm in Register ***NP*** (New Position) †
GO	1	Moves the tiltmast slider to ***NP*** †

† Axis is switchable between Measurement-Distance and Slider-Position (see ADSP at TMP)
‡ Value relates to Slider-Position

4 Examples

4.1 *OPT? Command

Sent Command	Answer from CO3000
***OPT?**	**MA1,DT1,0,0,X1,0,0,0,Y1,0,0,0,Z1,0,0,0**
	// Meaning: Mast, rotary table and XYZ-Pos. Are connected
LD DT1 DV	**1** // Same effects as LD 1 DV
LD Z1 DV	**12** // Load Z-axis of the XYZ Positioner

Note:
If two devices of the same type are attached to the CO3000, the devices are numbered in order. This number remains even if the device is later disconnected from the CO3000.

Example: two masts MA1, MA2; a rotary table DS1

1. MA1, MA2 and DS1 are attached to the CO3000

Sent Command	Answer from CO3000
***OPT?**	**MA1,0,0,DS1,MA2,0,0,0,0,0,0,0,0,0,0**

2. MA1 is removed, MA2 and DS1 remain attached to the CO3000

Sent Command	Answer from CO3000
***OPT?**	**MA2,0,0,DS1,0,0,0,0,0,0,0,0,0,0,0**

4.2 Addressing (LD n DV, LD d DV)

Sent Command	Answer from CO3000
LD DT3 DV	**5** // Loading rotary table No.3 was successful, Rotary table is
	// on Index 5. i.e. it can also be loaded with LD 5 DV
	// Index 1 is already occupied.
LD 5 DV	**5** // Equivalent to LD DT3 DV

4.3 Reading current position (CP)

Sent Command	Answer from CO3000
LD X1 DV	**4** // Load XYZ-Pos, X-Axis
CP	**123.4** // Current Position at 123,4cm
LD Y1 DV	**8** // Load XYZ-Pos. Y-Axis
CP	**42.0** // Current Position at 42,0cm
LD Z1 DV	**12** // Load XYZ-Pos, Z-Axis
CP	**31.4** // Current Position at 31,4cm

4.4 Moving axes (NP, GO, UP, ...)

Move the X-Axis of a mast

Sent Command	Answer from CO3000	
LD MA1 DV	**1**	// Load Mast1
UP	**1**	// Move Mast MA1 to Limit (UL)
BU	**1**	// 1: Mast moves
		// repeat BU
BU	**0**	// 0: Mast has reached Limit UL

Move rotary table to NP (New Position)

Sent Command	Answer from CO3000	
LD DT1 DV	**1**	//
LD 99.1 DG NP GO	**1**	// Move rotary table to position 99.1 degrees
BU	**1**	// 1: Rotary table moves
		// repeat BU
BU	**0**	// 0: Rotary table has reached NP
CP	**99.1**	// Rotary table is at 99.1 degrees

Commands can also be written separately.

Sent Command	Answer from CO3000	
LD 120 DG	**120**	// Load 120.0 degrees into the unit register “Degrees”
NP	**1**	// Load 120.0 degrees into the NP Register
GO	**1**	// Move the current axis to 120.0 degrees
BU	**1**	// 1: Rotary table moves
		// repeat BU
BU	**0**	// 0: Rotary table has reached NP
CP	**120.0**	// Rotary table is at 120 degrees

4.5 Error messages

Sent Command	Answer from CO3000	
LD DT2 DV	**E - D**	// Error, rotary table DT2 does not exist
LD DT1 DV	**1**	// Rotary table DT1 successfully loaded
LD 150 CM NP GO	**E - V**	// Wrong value. CM not allowed for rotary table
LD1DV	**E - S**	// Wrong Syntax, spaces are missing
LD FOO	**E - S**	// Wrong Syntax, FOO unknown
FOO 1 DV	**E - S**	// Wrong Syntax, FOO unknown
LD 99,2 CM	**E - S**	// Wrong Syntax, commas not allowed

4.6 Setting a Register

In this example, the lower user limit is being changed.

Sent Command	Answer from CO3000	
LD DT1 DV	**1**	// Load rotary table DT1
WL	**400**	// Read upper limit -> 400 degrees
CL	**-200**	// Read lower limit -> -200 degrees
LD -150 DG CL	**-150**	// Sets lower limit to -150 degrees (User limit)
CL	**-150**	// Read lower limit -> -150 degrees

4.7 Polarisation

Sent Command	Answer from CO3000	
LD MA1 DV	**1**	// Load Mast MA1 via named addressing
P?	**1**	// Read polarisation 1: Polarisation is horizontal
PV	**1**	// Polarise to vertical
BU	**1**	// Motor is running for polarisation
		// repeat BU
BU	**0**	// Polarisation is complete