User Guide

Radiotheodolite RT20 and DigiCORA® Sounding System MW41

VAISALA

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1. About This Document

1.1 Version Information

This document provides information on how to perform a sounding with Radiotheodolite RT20 and DigiCORA Sounding System MW41.

Table 1   Document Versions

Document Code	Date	Description
M212085EN-A	February 2018	First version of this document.

1.2 Related Manuals

Table 2   Related Manuals

Document Code	Name
-	*Vaisala DigiCORA Sounding System MW41 On-line Help*, embedded in MW41 sounding software user interface
M211429EN	*Vaisala DigiCORA Sounding System MW41 Getting Started Guide*
M211952EN	*Vaisala Radiosonde RS41-D User Guide*

1.3 Documentation Conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

	Tip gives information for using the product more efficiently.

	Lists tools needed to perform the task.

	Indicates that you need to take some notes during the task.

1.4 Trademarks

DigiCORA® is a registered trademark of Vaisala Oyj.

2. Product Overview

2.1 Introduction to DigiCORA MW41 and Radiotheodolite RT20

A basic Radio Direction Wind Finding (RDF) wind finding system consists of:

- Radiothedolite RT20
- Sounding workstation
- Power distribution unit (RPC)
- Power supply, for example, a vehicle battery

The sounding workstation, power unit and printer are installed in a shelter where the RDF units are stored during transportation.

> This document applies only to soundings in RDF mode, performing a sounding with RT20. For instructions on performing soundings in GPS mode, see MW41 online help, embedded in the MW41 sounding system software user interface.

2.2 Safety

This product has been type-tested for safety. Note the following precautions:

> **WARNING!** RT20 might move at high speed. Do not stand near the antenna when it rotates. The safe distance is 3 meters from the antenna.

> **WARNING!** Take great care when using the RT20 optical telescope. RT20 might move suddenly and with high speed.

> **WARNING!** Only licensed experts may install electrical components. They must adhere to local and state legislation and regulations.

2.2.1 ESD Protection

Electrostatic Discharge (ESD) can damage electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects in the equipment housing.

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

2.3 Regulatory Compliances

RT20 conforms to the requirements of:
- EMC directive 2004/108/EC
- Machinery directive 2006/42/EC

3. Operation

3.1 Standard RT20 Sounding Procedure

The numbered list below states the steps and tasks included in a standard sounding procedure with RT20. Detailed operating instructions are given in the same order in the sections below.

> **i** The list below introduces standard sounding procedure tasks in a sounding with RT20. The tasks vary according to the sounding system configuration.

1. Power up the system.
2. Align RT20.
3. Start the sounding preparations.
4. Enter station data and front direction angle.
5. Set the frequency and termination settings.
6. Set RT20 in AUTO tracking mode.
7. Release the radiosonde balloon.
8. Monitor the sounding.
9. End the sounding.

3.2 Getting Started

▶ 1. Make sure that the RT20 Hand Terminal RTH21 is connected to the RT20 elevation unit RTE21 and check the leveling of the antenna.

2. Check that the needed peripherals are properly connected.

3. Switch the power supply on and power up the MW41 computer.

3.2.1 Connecting and Configuring RT20 and MW41

Sounding with Radiotheodolite RT20 requires that RT20 is enabled in MW41 system settings. By default, RT20 is disabled.

▶ 1. Connect the serial cable from Power Unit RP20 to the MW41 computer serial port.

2. Click the MW41 icon and log in as soundingadmin. The table below shows the default usernames and passwords for MW41.

Table 3   MW41 Default Users and Passwords

Username	Password	Role
soundingoperator	Operator123	Sounding operator
soundingmanager	Manager123	Sounding manager
soundingadmin	Admin123	Sounding administrator

To maintain sufficient level of security, it is highly recommended to change the default passwords when the system is configured.

3. In **Administration > Devices and System > RT20**, enable RT20 status.

4. Select the serial port.

5. Set the default frequency.

6. Click **Save**.

Figure 1   Configuring RT20 in MW41

3.2.2 Aligning RT20

1. Drive the antenna to zero position with the hand terminal (El=90 Az=0 deg).

2. The antenna is now pointing to a certain direction. Determine the true bearing of that direction, taking the local magnetic declination into account.

3. Write down the true bearing, that is, the antenna's front direction angle. If the radiotheodolite has been installed on soft or uneven ground, the ground may yield under the antenna legs and the leveling must be corrected.
You can use the RTK111 Compass Assembly of the radiotheodolite to determine the antenna's front direction angle.
   - Check the measurements on the compass and write down the value of the angle displayed on Hand Terminal RTH21.
   - Add the declination value of the sounding location to the measurement of the compass according to the geographic zone.

If the radiotheodolite has been installed on soft or uneven ground, the ground may yield under the antenna legs and the leveling must be corrected.

3.3 Starting Sounding with Ground Check

For detailed information on preparing the radiosonde for the sounding, see the corresponding radiosonde user guide.

For further information on the sounding procedure, see also *Vaisala DigiCORA Sounding System MW41 On-line Help*, embedded in the MW41 sounding software user interface.

1. Open the radiosonde package and remove the foil bag.

> ℹ️ When RS41 is prepared outdoors with Ground Check Device MWH322, Vaisala recommends that the radiosonde is prepared in its cardboard package to provide extra protection for the radiosonde sensor. Remove the foil bag before the preparations.

2. Place the radiosonde on the ground check device. If you are preparing the radiosonde in the cardboard box, check the markings on the cardboard box and the ground check device for the correct placement of the radiosonde.

3. The radiosonde is switched on automatically. When using MWH322, make sure the radiosonde is properly attached with the strap before continuing. To interrupt the sounding preparations at this point, remove the strap and the radiosonde.

> ℹ️ When the outside temperature exceeds +40°C, the maximum time for RS41-D preparations with the radiosonde switched on is 15 minutes.

4. The sounding software automatically detects the radiosonde and begins the preparations. During the radiosonde pre-flight preparation phase, several steps are carried out. These consist of ground check procedures for sensors, as well as optional features for setting the radiosonde inflight operation parameters, such as a timer for turning the radiosonde power off after a desired time.

5. Radiosonde reconditioning starts.

6. In MW41, enter the front direction angle value.

7. If needed, tune the radiosonde frequency by clicking the **Change** button.

8. At this point, you can also set a termination trigger. See Setting Termination Triggers (page 12).

9. The sounding software goes through reconditioning and ground checking. The status is clearly indicated with a progress bar. During the ground check, the following preparation steps are performed for the radiosonde:
   - T check: The radiosonde performs an in-built functional temperature check.
   - Reconditioning: Preparation of humidity sensor.
   - Cooling after reconditioning
   - U check: The radiosonde performs a physical zero humidity check.
   - Stabilizing
   - Ground check
   - Updating radiosonde: The parameters and ground check results are updated to the radiosonde.

10. When the message `Preparation is completed` appears, remove the radiosonde from the ground check device.

11. When the radiosonde telemetry has been received and the radiosonde is ready for release, the message `Radiosonde Ready for Release` appears.

12. When the radiosonde LED light changes from blinking to steady green, the radiosonde is ready for release.

3.3.1 Setting Termination Triggers

When preparing the radiosonde with a ground check unit, you can set triggers to terminate the sounding calculations. The triggers switch the radiosonde transmitter off at a certain point of the sounding.

Note that the possibility to set termination triggers is defined in the MW41 Administration section.

▶
1. The following triggers are available for a sounding with RS41-D:
   - `Switch off radiosonde transmitter at`: Time after balloon release (minutes).
   - `Raw data continues after termination`: This trigger defines that after the balloon has burst and the sounding has terminated, EDT calculation is finished, but raw data is still received.

   Termination trigger `Height` is not available in RT20 soundings.

When the criteria set as the termination trigger for the radiosonde has been met, the sounding terminates with reason `Radiosonde termination condition met`.

3.4 Starting Sounding with No Ground Check

You can also perform a sounding with MW41 and RT20 by entering a frequency that radiosonde RS41-D is transmitting, without performing a ground check. There are two alternatives:

1. Both RT20 and SPS311 are connected and enabled, see step 1 below.
2. RT20 is enabled and SPS311 is disabled, see step 2 below.

▶ 1. If both RT20 and SPS311 are connected and enabled in MW41 system settings:
- Select **Radiotheodolite** in the frequency display in **Sounding > Radiosonde Selection**.
- Enter frequency and front direction angle.
- Click **Refresh** to update the spectrum and **Start** to start the sounding.

2. When RT20 is enabled and SPS311 is disabled:.
- Enter frequency and front direction angle in the frequency display in **Sounding > Radiosonde Selection**.
- Click **Refresh** to update the spectrum and **Start** to start the sounding.

3.5 Preparing for the Release

For more detailed information on the preparing the radiosonde and the balloon, see the appropriate radiosonde user guide.

▶ 1. Prepare the radiosonde and the radiosonde balloon.

2. If you are using radiosonde RS41-D, straighten the RS41-D antenna.

> **i** The RS41-D antenna is bent for packing purposes. Straighten the antenna before the release.
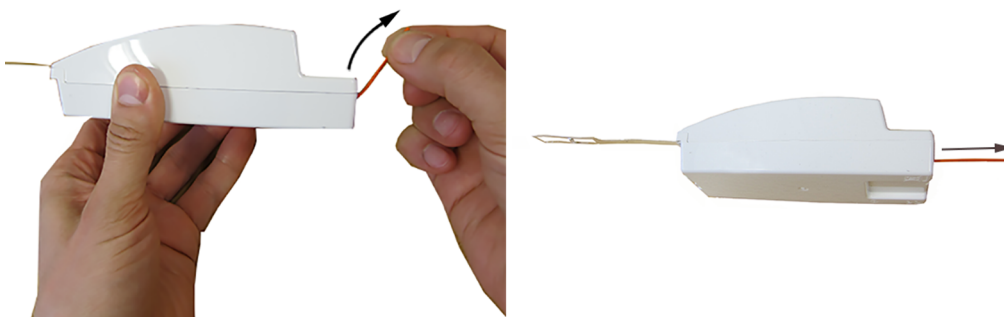
3. Attach the radiosonde to the balloon and set the radiotheodolite in AUTO tracking mode before releasing the balloon.

> ✋ **WARNING!** RT20 might move at high speed when set in AUTO tracking mode. Do not stand near the antenna when it rotates. The safe distance is 3 meters from the antenna.

4. The sounding begins automatically after the launch. The message `Sounding in Progress` and the sounding data are displayed.

5. The surface observations values window opens. Depending on the system configuration, the surface observation values are automatically obtained from the radiosonde or from the AWS. You can also set the values manually before or after the release.

You can return to the preparation phase at any time before the radiosonde is launched. Restart the preparation by replacing the radiosonde on the ground check device. The sounding system automatically returns to the preparation phase and you can edit the frequency, termination settings, and front direction angle values.

3.6 Monitoring RT20 Sounding

▶ 1. Check that the RT20 antenna follows the radiosonde. The antenna moves stepwise. After each elevation and/or azimuth correction, the radiosonde should be visible through the RT20 optical telescope.

> ✋ **WARNING!** Take great care when using the RT20 optical telescope. RT20 might move suddenly and with high speed.

2. If the antenna tracks but the radiosonde is not visible through the optical telescope:

   a. Point the antenna manually to the radiosonde using the direction keys on Hand Terminal RTH21. The direction keys are active before the launch and two minutes after the balloon has been released. Automatic tracking mode is automatically resumed when the direction keys are released.

   b. Check if the radiosonde is now visible through the optical telescope. If not, point the antenna again.

3. If the antenna does not track, tune the receiver with the hand terminal:

   a. Press the **AUTO/MANUAL** key.

   b. Press the **ENTER** key.

   c. Press the **TELEM.** key.

   d. Press the **SCAN** key.

4. When the frequency is correct and stars appear on the display:

    a. Press the **TRACK** key.

    b. Point the antenna to the radiosonde using the direction keys.

    c. Press the **AUTO/MANUAL** key.

    d. Press the **ENTER** key.

5. During the sounding, MW41 displays information on RT20.

In addition to showing the azimuth and elevation angles, the Radiotheodolite tab shows the following information:
- Front Direction Angle indicates the true bearing where the antenna points after commanding to zero position.
- Tilt F-B / L-R shows the inclination angle (alignment difference from vertical) of the radiotheodolite pole.
- Mode indicates whether the radiotheodolite is in automatic or manual mode.

For more information on monitoring sounding data and creating sounding messages, see *Vaisala DigiCORA Sounding System MW41 On-line Help*, embedded in the MW41 sounding software.

3.7 Ending RT20 Sounding

When terminating the sounding, you must set RT20 to manual tracking mode.

1. Press the **MANUAL** key on the hand terminal.

2. Press the **ENTER** key on the hand terminal. If RT20 is left in the same location for a
    longer period of time without being dismantled, turn the antenna's elevation angle to
    approximately 90° to decrease wind resistance.
    If the antenna is dismantled after the sounding, turn the antenna's elevation angle to
    approximately two or three degrees. This makes it easier to detach and set up the
    antenna elements.

3. Switch off RT20 power supply.

Appendix A. Using RT20 Hand Terminal RTH21

A.1 Introduction to RTH21

> **WARNING!** RT20 might move at high speed. Do not stand near the antenna when it rotates. The safe distance is 3 meters from the antenna.

Hand Terminal RTH21 is a microprocessor-based device with a membrane keypad and Liquid Crystal Display (LCD) for controlling the radio and motor drivers of the antenna. With the hand terminal it is possible, for example, to find the radiosonde signal, choose the radiosonde signal tracking mode (Track or AFC), and scan the signal. You can also set the antenna to track manually or automatically, drive the antenna manually, monitor mechanical angles, and monitor PTU.

The hand terminal electronics are housed in an EMI/EMP-shielded, robust metal enclosure. Connection to the antenna pedestal is made through a shielded spiral cable. The terminal communicates with other units via Arcnet Local Area Network (LAN). The dimensions of the unit are 96 x 160 x 35 mm.
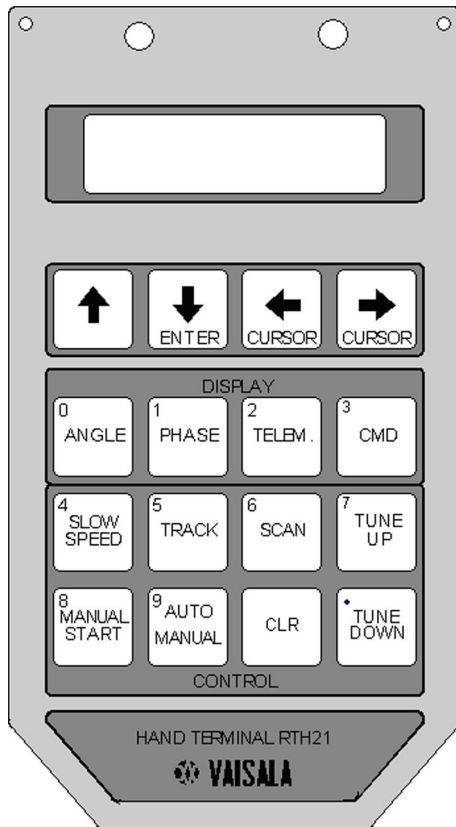
The hand terminal has two interfaces to the RT20, the display, and the keypad. With the keypad you can monitor and command the RT20 in the following three modes:

- **ANGLE** mode: The terminal displays the mechanical angles of RT20.
- **PHASE** mode: The terminal displays the phase differences of RT20.
- **TELEM.** mode: The terminal displays the status of the receiver. You can command the receiver using **SCAN**, **TRACK**, **TUNE UP**, and **TUNE DOWN** keys.

Select the modes with the **ANGLE**, **PHASE**, and **TELEM.** keys. The **CMD** key has a special function depending on the current mode. The display mode is shown on the upper right corner of the LCD display.

The display module is a dot matrix LCD with a capacity of 2 lines x 16 characters. It is equipped with a LED backlight and contrast control.

A.2 Keypad

The membrane switch keypad is divided into two groups of keys. The lower group, containing control and display keys, is arranged to a 3-row x 4-column matrix, whereas the upper group consists of arrow keys that are single switches. For EMI/EMP protection, the top side of the keypad is covered by a grounded metal layer, and the display window has a thin gold layer, connected to the metal housing of the terminal.
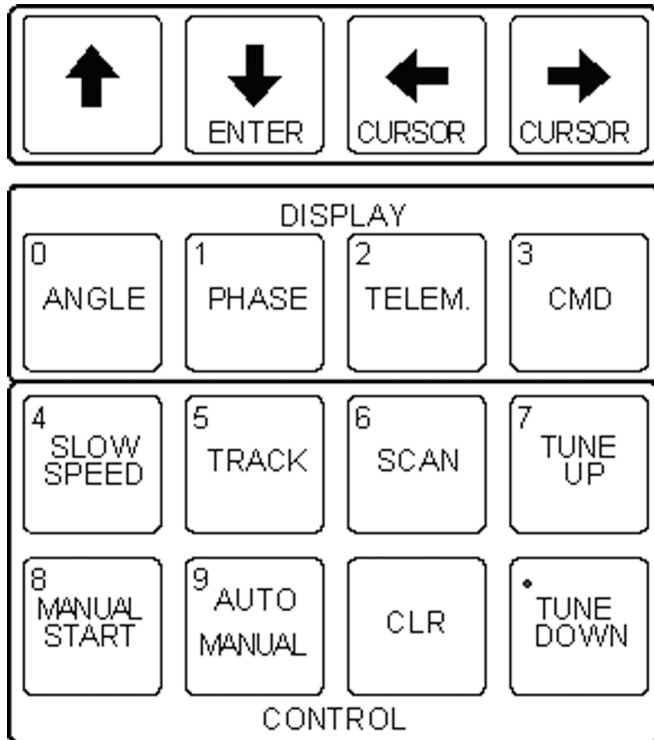
A.2.1 Cursor Keys

The cursor keys ↑ ↓ ← → have two functions according to the mode selected, manual or command mode.

A.2.1.1 Manual Tracking Mode

When the manual tracking mode is selected, you can drive the antenna up or down and clockwise or counterclockwise (cw/ccw) with the cursor keys. If you press the **Slow Speed** key simultaneously with the cursor key, the antenna moves very slowly.

A.2.1.2 Command Mode

When the command mode is selected (**CMD** is pressed), you can move the cursor on the display from left to right, or from right to left. In this mode the **DOWN** (↓) key serves as the **ENTER** key.

A.2.2 Display Keys

Display keys such as **ANGLE**, **PHASE**, and **TELEM.**, change the mode of the display. The function of the **CMD** key is determined by the current display mode. Receiver (**TELEM.**) keys, **TRACK**, **SCAN**, **TUNE UP**, and **TUNE DOWN** keys, are active only when the **Telem.** display mode is selected.

- **TRACK** key sets the Track mode to **ON** or **OFF** state.

> ℹ️ When the track mode is set OFF, the receiver automatically sets the AFC ON.

- **SCAN**. If the receiver is in Scan OFF state, pressing this key starts the receiver to scan the signal until it is found.
- **TUNE UP**. The receiver starts tuning up when this key is pressed.
- **TUNE DOWN**. The receiver starts tuning down when this key is pressed.

The figure below shows RTH21 waiting for operator action.

```
For MANUAL mode
press (10)    ENTER
```
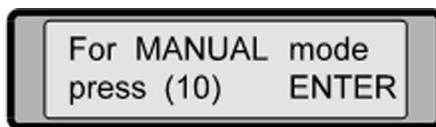
A.2.3 Manual Start Key

The **MANUAL START** key is active only when the angle or phase display is active.

When this key is pressed, the hand terminal menu for **Manual Start** command activation is shown for 20 seconds. Within these 20 seconds, you must press the **ENTER** key to activate the **Manual Start** command.

If you do not press the **ENTER** key within 20 seconds, the RTH21 display returns to the previous display mode without activating the **Manual Start** command.

You can also clear the **Manual start** mode menu by pressing the **CLR** key.

```
Manual START
press (10)    ENTER
```

A.2.4 AUTO/MANUAL Key

When the **AUTO/MANUAL** key is pressed, the hand terminal menu for changing the tracking mode is shown for 20 seconds. Within these 20 seconds, you must press the **ENTER** key to select the **Auto/Manual tracking** mode shown in the display.

If you do not press the **ENTER** key during the 20 seconds, or if you press the **CLR** key, the hand terminal display returns to the previous display mode and the tracking mode remains unchanged.

The current tracking mode is shown on the LCD display when the Angle or Phase mode is selected. For details, see Angle Display Mode (page 21) and Phase Display Mode (page 21).

```
For AUTO mode
press (10)    ENTER
```
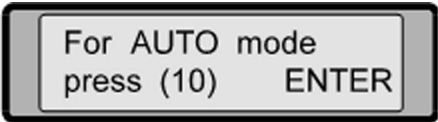
A.2.5 CLR (Clear) Key

The **CLR** key's function is determined by the current display.

A.3 Angle and Phase Display Modes

A.3.1 Angle Display Mode

The Angle display mode is the default mode after power-on. This mode displays the mechanical azimuth and elevation angles of the antenna. It also shows the tracking mode of the RT20 (auto/manual). The azimuth angle is always displayed in positive figures.

```
AZ=  359.00     Angle
EL=   -10.00     Auto
```

```
AZ=  359.00     Angle
EL=   -10.00     Man.
```
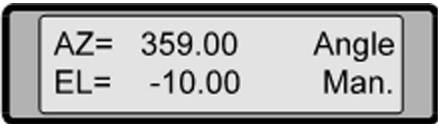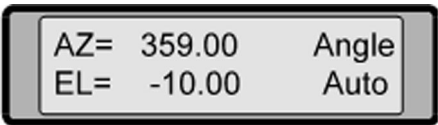
When tracking manually, the antenna is controlled with the RTH21 direction keys.

A.3.2 Phase Display Mode

You can monitor the phase difference and signal strength difference of the radiosonde signal by pressing the **PHASE** key. This mode displays the azimuth and elevation phase differences between the reference and azimuth antennas as well as between the reference and elevation antennas. The phase difference is shown as electrical degrees. The signal amplitudes are shown as percentage of the reference signal. Normally they are between 95 and 105. This display mode also shows the RT20 tracking mode (auto/manual).

```
AZ=  -30    100   Pha.
EL=   20     90   Aut.
```

```
AZ=  -30      100  Pha.
EL=   20       90  Man.
```
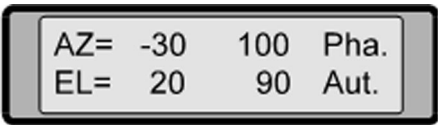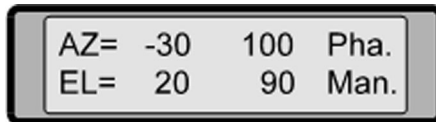
With the phase display, use the direction keys on the hand terminal to manually control the antenna.

A.3.3 Speed Change

When RT20 is in manual mode, you can drive the antenna in azimuth and elevation directions with the direction keys (↑ ↓ ← →) in all three modes, that is, Angle, Phase, and Telem. mode.

The default speed of the antenna is about 15 deg./sec. You can change the speed using the additional command **Speed**. You can slow down the antenna movement by pressing the direction and **SLOW SPEED** keys simultaneously. The speed is then 5 deg./sec. You can press or release the **SLOW SPEED** key at any time when the direction key is pressed. The antenna control processor slows down or accelerates the speed of the antenna automatically according to the key combination.

A.3.4 Automatic Tracking Override

In the auto tracking mode, the direction keys are not active during the sounding, except before the launch and two minutes after the radiosonde release. During this period, it is possible to manually override the automatic tracking using the direction keys. After the direction keys are released, the automatic tracking will immediately resume automatically.

You can change the tracking mode using **AUTO/MANUAL** key as explained in AUTO/MANUAL Key (page 20).

A.3.5 Tune Display Mode

Select the tune display mode by pressing the **TELEM.** key. With this display mode, you can monitor and control the 1680 MHz receiver. This display mode shows the radiosonde frequency (**Frq**) and the signal strength of the received signal (**ST**). It also shows the current commands of the receiver, such as Track, Scan, AFC, or Tune.

```
Frq=  1680.3      Telem
ST=   *****       Track
```

Figure 2   Receiver Tracks Signal on Whole Frequency Band

```
Frq=  1680.3    Telem
ST=   ******    AFC
```

Figure 3   Receiver Control Mode AFC is ON

```
Frq=  1680.3    Telem
ST=             Scan
```
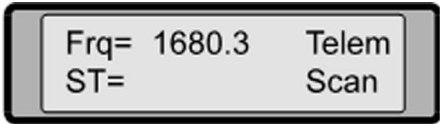
Figure 4   Receiver Scans for Signal

The following display is shown if the **TUNE UP/TUNE DOWN** key has been pressed from the sounding workstation console or from the hand terminal. The display does not show which of the commands, TUNE UP or DOWN, is pending.

```
Frq=  1680.3    Telem
ST=             Tune
```
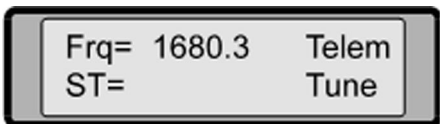
Figure 5   Tune Display with TUNE UP/DOWN Command Pending

A.3.6 Command Display Mode

When the hand terminal is in Angle, Phase, or Telem. mode, you can change the mode to the command mode by pressing the **CMD** key. In the command mode, several additional commands are available. With the additional commands you can, for example, monitor the raw PTU, change the intensity of the display backlight, and command the receiver processor.

To return to the main modes (Angle, Phase or Telem.), press the **CLR** key.

Because the hand terminal has many commands in the command mode and all the commands cannot be displayed at the same time, the command menus are divided into submenus. Select the submenu by choosing the option **More** in the main menu and pressing the **ENTER** key.

The figure below shows the main command menu of the Angle and Phase modes.

H	o	m	e		T	i	l	t		B	L		P	T	U
L	i	g	h	t		B	e	e	p			M	O	R	E

Figure 6   Display when CMD Key is Pressed First Time

Home in the upper left corner is flashing, indicating that if **ENTER** key is pressed, this command is selected. Pressing the ➜ key stops **Home** from flashing and the next command (**Tilt**) begins to flash instead, and so on. The ➜ key moves the flashing point forward ⬅ and the key moves it backwards. When the **MORE** command is reached, the flashing point moves back to the starting point (**Home**) only with the ⬅ key. When **MORE** has been selected and there are no more submenus, the main menu will be displayed again.

S	p	e	e	d		C	o	n	t	r	a	s	t		
C	a	l	i	b	r	a	t	e				M	O	R	E

Figure 7   Submenu of Angle or Phase CMD Main Menu

G	o	P	o	s		S	e	t	H	o	m	e			
S	e	t	Z	e	r	o	A	z				M	O	R	E

Figure 8   Submenu of Angle or Phase CMD Main Menu

A.3.6.1 Displaying Additional Commands of the Angle and Phase Modes

Press the **CMD** key with the display in Angle or Phase mode to make the additional commands accessible. The main and submenus are shown in Command Display Mode (page 23).

A.3.6.1.1 Antenna Home Position Command

With the **Home** command you can drive the antenna to home position, which has been stored previously in the non-volatile memory of RT20.

When the **Home** command is selected, RTH21 displays a confirmation menu for the actual driving. The default selection is **No**. Change the selection with the cursor keys ⬅ or ➜. Accept the selection with the **ENTER** ⬇ key .

D	r	i	v	e		h	o	m	e		p	O	s	.	
			Y	e	s		N	o				S	e	l	

Activating the **Yes** selection with the **ENTER** key immediately starts automatic driving to home position. You can monitor the angles during the driving with RTH21 in Angle mode. If you select **No**, no action is taken.

> **WARNING!** When you select Yes and accept it with the **ENTER** key, the antenna immediately turns to home position.

> The command Antenna Home Position is allowed only when the RT is in MANUAL mode.

A.3.6.1.2 Tilt Angles Monitoring

With the **Tilt** command you can monitor the current values of the Front/Back (**F/B** in the display) and Left/Right (**L/R** in the display) tilt sensor values in degrees from vertical. Tilt directions towards front (antenna side) and left (from the back view) produce negative readings, and tilt directions towards back and right produce positive readings.

If RT20 is not equipped with optional tilt sensors, Tilt monitoring shows near zero readings for both values.

> Use the **Angle**, **Phase**, or **Telem.** keys to return from tilt display mode. The **CLR** key does not return to the normal mode.

A.3.6.1.3 Setting the Keyboard Back Light

With the **BL** command, you can change the intensity of the keyboard back light.

- Use the cursor keys ← → or to increase or decrease the light intensity.
- Accept the desired setting by pressing the **ENTER** (⬇) key. Use the **CLR** key to return without changing the setting.

U	s	e		c	u	r	s	o	r				C	M	D
k	e	y	s											B	L

If you accept the desired setting with the **ENTER** key, the following menu requests you to save this setting as the new default setting:

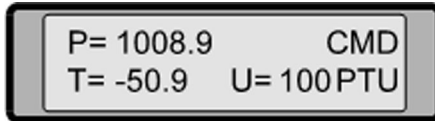| S	a	v	e		i	n	t	e	n	s	i	t	y	.	
				Y	e	s		N	o				S	e	l

The default selection is **No**.

Change the selection with cursor keys ← or →. Accept the selection with the **ENTER** key.

Use the **Yes** selection to save the setting as the new default value to be used this time and later. Use the **No** selection to use the new setting only this time.

A.3.6.1.4 PTU Command Display Monitoring

With the **PTU** command you can monitor the current values of the PTU data (pressure, temperature, and humidity). This data is monitored directly from the receiver processor.

```
P= 1008.9         CMD
T= -50.9   U= 100 PTU
```

The **CLR** key does not enable return from the PTU display mode to the normal mode. To return to the normal display mode, press the **ANGLE**, **PHASE**, or **TELEM.** keys.

A.3.6.1.5 Setting the Keyboard Light

With the **Light** command, you can change the intensity of the RTH21 keyboard light.

- Use the cursor keys ← or → to increase or decrease the light intensity.
- Accept the desired setting by pressing the **ENTER** key ↓.
- Use the **CLR** key to return without changing the setting.

U	s	e		c	u	r	s	o	r			C	M	D
k	e	y	s										B	L

Figure 9   Setting the Keyboard Light

- If you accept the desired setting with the **ENTER** key, the following menu requests you to save or not to save this setting as the new default setting to the non-volatile memory.

S	a	v	e		i	n	t	e	n	s	i	t	y	.	
				Y	e	s		N	o				S	e	l

Figure 10   Saving the Keyboard Light Setting

The default selection is **No**.
- Change the selection with the cursor keys. Accept the selection with the **ENTER** key.
- Use the **Yes** selection to save the setting as the new default value to be used this time and later, use the **No** selection to use the new setting only this time.

A.3.6.1.6 Using RTH21 Keyboard Beep Command

By selecting the **Beep** command, you can enable or disable the RTH21 keyboard beep. When enabled, the unit responds to a keystroke with a short audible beep.

When you select the **Beep** command, the following menu is shown.

- The current beep mode is flashing. Use the cursor keys ← or → to enable (**Yes**) or to disable (**No**) the keyboard beep.
- The selected beep setting is accepted and stored by pressing the **ENTER** key (↓) key.
- Use the **CLR** key to return.

A.3.6.1.7 Manual Driving Speed Command

Change the speed of the antenna by selecting the **Speed** command when the antenna is controlled with the hand terminal. The display flashes the current speed which can be changed with the cursor keys ← or →.

The **ENTER** key enables the following selections:

- **Slow** speed is about 5 deg./sec.
- **Normal** speed is about 15 deg./sec.
- **Max.** speed is about 30 deg./sec.

> ℹ️ When you press the **Slow Speed** key simultaneously with the cursor key, the antenna driving speed is about 5 deg./sec.

```
Speed    Slow     CMD
Normal   Max.     Sel
```

A.3.6.1.8 Using Display Contrast Command

By selecting the **Contr** command, you can adjust the contrast of the LCD display. By default, the hand terminal selects the contrast automatically using the temperature of the display. If you want to select the contrast manually, first change the Auto contrast mode to **Manual** mode.

- To do this, select **Manu** from the menu shown in the figure below. The display flashes the current choice of contrast control mode and you can change it with the cursor keys (← →).

```
Contrast          CMD
Manu  Auto        Sel
```

Figure 11   Display Contrast Control Display

- Press the **ENTER** key to accept the selection. When the manual LCD contrast control is selected, the terminal requests you to select the contrast, displaying the following menu.

Figure 12   Selecting Contrast Manually

- Change the display contrast manually with the cursor keys. The new contrast value can be seen from the display.
- Press the **ENTER** key to accept. The new contrast value is not saved permanently by the hand terminal.
- To get back to Auto Display Contrast Control, select the **Contr** command, followed by its submenu (**MORE**) and **Auto**.

A.3.6.1.9 Calibration Command

When you select **Calibrate**, the following submenu appears. You can now calibrate either the elevation synchro or the phase measurement system. Each RT20 has been calibrated at the factory before delivery, so there is normally no need for calibration.

| E | l | | s | y | n | c | h | r | o | | | C | M | D |
| P | h | a | s | e | | | | | | | | S | e | l |

Figure 13   Calibrate Menu Submenu

A.3.6.1.10 Driving the Antenna to the Desired Position

The hand terminal can command the control processor to drive the antenna's azimuth and elevation to desired positions (that is, angles) by selecting the **Pos.Selection** command.

First, the terminal requests the azimuth angle and then the elevation angle. Next, the terminal commands the control processor to drive the antenna to the chosen position. The display mode is changed to the angle mode by the terminal.

When the **Pos.Selection** command is selected, a display shown below appears, requesting you to give the angle values. Enter the angles with the number keys.

After you press the number, the cursor moves to the right and the previous cursor position shows the entered number. Pressing the backspace key ← moves the cursor to the left and the number is deleted. Accept the values with the **ENTER** key. Cancel the whole command with the **CLR** key and the terminal returns to the previous display mode. If the number you entered is out of the acceptable bounds, the terminal displays an error message `Number out of bounds`. This message is shown for a few seconds, after which you can key in the correct number.

> ✋ **WARNING!** When you have typed the elevation angle and pressed the **ENTER** key, the antenna immediately turns to the desired position.

> ℹ The **Pos.Selection** command is allowed only when RT20 is in manual mode.

Figure 14   RTH21 Requests Elevation Direction Position

A.3.6.1.11 Using SetHome Position Command

With the **SetHome** command you can store the desired antenna's home position in the non-volatile memory of RT20.

- To set the **Home** position, first drive the antenna to the desired home position and select **SetHome** from the command menu. The RTH21 displays a confirmation menu for the actual saving.
- Use the cursor keys ←or → to change the default **No** selection to **Yes**. Press the **ENTER** key to accept the selection.

S	e	t		h	o	m	e		p	o	s	.			
				Y	e	s		N	o				S	e	l

Figure 15   SetHome Confirmation Menu

The message `saving OK` is shown to indicate the completed operation. Press any key to return.

A.3.6.1.12 Using Set Zero Azimuth (SetZeroAz) Command

With the **SetZeroAz** command, you can store the desired antenna azimuth direction as zero in the non-volatile memory of RT20.

- To set the zero azimuth direction, drive the antenna to the desired azimuth direction and select SetZeroAz from the command menu. RTH21 displays a confirmation menu for the actual saving.
- Use the cursor keys ⬅ ➡ to change the default **No** selection to **Yes** and press the **ENTER** key to accept the selection.
- The message `saving OK` is shown to indicate the completed operation. Press any key to return.

S	e	t		z	e	r	o		az	.					
				Y	e	s		N	o				S	e	l

Figure 16   SetZeroAz Confirmation Menu

A.3.7 Additional Commands of the Telem. Mode

When the **CMD** key is pressed while the display is in **Telem.** mode, the operator can give other receiver commands, such as AFC ON/OFF, set receiver frequency, or find signal. The Telem. command menu has no submenus.

Figure 17   Telem. Mode Main Menu

A.3.7.1 AFC Command Display Mode

When you select the **AFC** command, you can see the state of the AFC on the display and you can change it.

The display flashes the current AFC state, **ON**, or **OFF**. The flashing text (selection indicator) can be changed from **ON** to **OFF** state or vice versa with the cursor keys ⬅ ➡. The current selection is sent to the receiver processor by pressing the **ENTER** key ⬇ .

Now the new **AFC** mode is selected and the display returns to normal mode. If the terminal is in AFC command display mode and you press the **CLR** key, the AFC stays in the previous state and the display returns to normal mode.

Figure 18   AFC ON/OFF Command Display

A.3.7.2 Set Receiver Frequency Command Display Mode

You can command the receiver processor to any frequency at 1680 +/- 20 MHz band by selecting **Freq** in the main **Telem.** menu. The display after the **Freq** selection is shown in the figure below. The cursor in the display requests you to press the number keys.

Figure 19   Set Receiver Frequency Command Display

After you have pressed the first number, the cursor moves to the right and the previous cursor position shows the entered number. Pressing the ← key, acting here as backspace, moves the cursor to the left and the number is deleted. Accept the entered value by pressing the **ENTER** key ⬇. Cancel the whole command with the **CLR** key and the hand terminal returns to the previous display mode.

If the value you entered is not within the acceptable bounds, the terminal displays an error message `Number out of bounds`. This text is shown for a few seconds after which you can correct the value.

For example, key in `1680.8`, `1680`, or `1680`. and press **ENTER**.

A.3.7.3 Find Signal Command Display Mode

Selecting the **Find** command in the hand terminal makes the receiver processor find the signal of maximum strength. If the signal is found, the AFC control is set to **AFC ON** state. This command has no special display.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical Support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information:

- Product name, model, and serial number
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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