User Manual

DF COMMANDER MK2

Software for the remote control, monitoring and integration of radio direction finding systems





Edited by:

RHOTHETA Elektronik GmbH Kemmelpark Dr.-Ingeborg-Haeckel-Str. 2 82418 Murnau Germany

Phone: +49 8841 4879 - 0 Fax: +49 8841 4879 - 15

Internet: <u>www.rhotheta.de</u> Email: <u>email@rhotheta.de</u>

Copyright © RHOTHETA Elektronik GmbH All rights reserved

- Issue: 2023/03/30 [Rev 3.00]
- Document-ID: 12-9-3-4-00005-3-1-61

Note

The manufacturer reserves the right to make changes to the product described herein at any time without prior notice.

<u>Contents</u>

1	Ove	erview	5
	1.1	Server Application	6
	1.2	Client Application	6
	1.3	Application Pages	6
2	Sta	rt and End the Programm	8
	2.1	Start / Restart	8
	2.2	Command Line Parameters	8
	2.3	Exit the Program	9
3	Cor	nfiguration	
	3.1	General Setup	11
		3.1.1 Configuration Files	11
		3.1.2 Server Name / Client Name	14 14
		3.1.4 Frequency Color Assignment	14
		3.1.5 Favorite Frequency List Setup	15
	3.2	Map Settings	16
	3.3	Configuration of a DF System	18
		3.3.1 System Configuration	
		3.3.2 GPS Configuration	20 22
		3.3.4 Channel Configuration	
		3.3.5 Checking the Configuration	34
	3.4	Triangulator	
		3.4.1 Configuration	
		3.4.3 Sector Blanking	
	3.5	Server Setup (only for "DF Commander MK2 Server" Application)	49
	3.6	Remote Servers Setup	52
		3.6.1 Configuration of Remote Server	
		3.6.2 Checking the Configuration	54 57
	37	Self Bearing Suppression	60
	0.1		
4	518	tus Displays	
5	Μοι	nitoring Page	69
	5.1	General Status Monitoring	69
	5.2	System Details	70
	5.3	71	
6	Bea	aring Page	73
7	Мар	p Page	
Q	<u> </u>	SPAS-SARSAT Scan & Decode / Marine Scan	77
0			

12	Note	es	. 85
11	Abb	reviations	. 84
	10.4	Licensing	83
	10.3	Installation in Linux	82
	10.2	Installation in Windows	82
	10.1	Minimum PC and Network Requirements	81
10	Inst	allation	. 81
9	Lim	itations	. 80
	8.3	COSPAS-SARSAT Files	79
	8.2	COSPAS-SARSAT Decode	77
	0.1		
	81	COSPAS-SARSAT Scan / Marine Scan	77

1 Overview

The DF Commander MK2 software enables remote control and monitoring of radio direction finding systems (DF Systems). In addition to displaying the bearing results on various electronic maps, the software can calculate and display cross bearings at different frequencies.



Figure 1: VTS application overview



Figure 2: ATC application overview

1.1 Server Application

Bearings, cross bearing results and status information of radio direction finding systems are made available via an integrated TCP server in the "DF Commander MK2 Server" application. DF systems can also be set and controlled via the same server. Thus, the "DF Commander MK2 Server" can be understood as a service module, which enables a simple integration of radio direction finder systems into modern VTS and ATC network architectures. By using a standardized radio direction finder protocol in JSON format, further protocol

conversions can be implemented very easily.

The corresponding protocol is described in the document "Radio Direction Finder Standard JSON Protocol".



Figure 3: DF service

When starting/restarting the server application, in opposition to the client application, the settings are read from the configuration files and the corresponding systems are commanded according to the settings read.

Up to 99 clients can be connected to the DF Commander MK2 server and their IP-addresses will be shown in the "Connected Clients" list.

1.2 Client Application

In the "DF Commander MK2 Client" application, there is no local TCP/IP server available to connect to, but the same information about DF systems, bearings, cross bearing results, etc. is available, proceesed and shown via graphical user interface.

The client application is used for indication and controlling of the DF systems that are directly connected to it (local systems). In addition, the client application can process and display the data from the remote servers.

The client cannot enforce the DF systems configuration at start/restart of the application. Besides the folding menu, that will be described below, the following pages can be selected in the upper bar of the DF Commander MK2 (server as well as client application):

1.3 Application Pages



Figure 4: "Pages"

<u>MAP</u>

The Map page allows the display of direction finding systems with corresponding information on the electronic map. The following can be illustrated:

- Bearing results as LOBs (lines of bearing) within the Bearing Cones
- Cross bearing results as position on the map and as text field in the triangulation window
- Module to control the map
- Module to display additional data on DF systems, triangulations, COSPAS-SARSAT lists

BEARING

The Bearing page allows displaying of DF results and signal levels of selected DF channels on a compass rose. This view is used to support the navigators and the technical system monitoring.

MONITORING

The Monitoring page allows observing of the general statuses (of systems, triangulators and servers) as well as the observing of all configured DF channels at a glance. The configured elements are displayed in two different perspectives (tabs) as list views.

Settings cannot be made on this page. The focus of the presented views is solely on technical system monitoring.

<u>SETUP</u>

The Setup page is used for the entire configuration (see chapter 3).

Folding Menu

DF Commander MK2 User Manual and DF Standard JSON Protocol can be viewed and downloaded from the folding menu.

The "About" window provides license agreement information and allows entering a new license key if a new key is required (e.g., after the demo version has expired or to add new options to the software).

2 Start and End the Program

2.1 Start / Restart

After the installation, the program starts the graphical user interface (GUI) when doubleclicking on the exe file.

To start the program on Linux, start.sh must be called up on the command line.

Using the GUI simplifies the licensing and configuration process of radio direction systems.

After the configuration of the DF systems is complete and saved (s. 3.1.1 Configuration Files, EXPORT ALL or SAVE AS DEFAULT), the application can be restarted with or without a system tray, with or without a GUI.

If some DF system settings (e.g., frequency setting in a DF channel) are currently not applicable, the corresponding message appears.

2.2 Command Line Parameters

This chapter describes the command line parameters which affect the operation mode of the application.

The following parameter can be passed to the application when calling DF Commander MK2 from the command line or using scripts.

-t, --show-systray

This parameter starts the application with the grafical user interface. Additionally the control of the application is available from the system tray.

Closing the application window just moves the application into background. The grafical user interface can be restored from the system tray.



Figure 5: DF Commander MK2 with system tray

-g, --no-gui

This parameter starts the application (server application only) without graphical user interface. It can not be restored from the system tray. For quiting the application please use the task manager or commands for stopping the prozesses of your operationg system.

-n, --config-name <name>

This parameter starts the application using different configuration file location specified by <name>. This allows to run multiple instances of the application with different configurations.

Here is the exmple of starting three server with different configurations on Linux without GUI:

```
./DFCommanderMK2-Server -n "../Config1" -g
./DFCommanderMK2-Server -n "../Config2" -g
./DFCommanderMK2-Server -n "../Config3" -g
```

The recommended approach doing this includes the configuration of server using grafical interface first and then restarting the application without a GUI.

NOTE:

Other existing command line parameters are intended for internal use or trouble shooting.

2.3 Exit the Program

If the program is running with GUI, it can be simply closed by clicking on the close symbol ("x") of the window in the upper right corner.

If the program is running without a GUI, you can use the task manager or end the process in a console, command prompt ("Ctrl + C") or terminal accordingly.

3 Configuration

This chapter describes the system configuration which can be performed in the following steps on the SETUP page:

- General settings
- Configuration of DF system(s)
- Configuration of triangulator(s)
- Map settings
- DF service settings (for DF Commander MK2 Server application only)
- Remote servers settings
- Self-bearing suppression settings

GENERAL DF SYSTEMS TRIANGULATOR MAP LOCAL SERVER

REMOTE SERVERS SBS

As result, bearings and cross bearings are visible in the map view and accessible via the server interface.

NOTE:

Basically, all menus are structured in such a way that the current settings are displayed on the left. On the right, however, new values can be entered or selected. Press "< SET < " to apply the new settings. After setting they should appear accordingly in the left area.

3.1 General Setup

The first step is to make general settings. The individual aspects are described in sequence.

000 DF Commander MK2 - Client					– 🗆 X
≡ мар	BEARING MONITO	RING SE	TUP	General Status OK	11:21:58 15 Feb 2023
GENERAL	General Setup				
DF SYSTEMS	Configuration Files				
TRIANGULATORS	Location Path: C:\Users\lena.zverev\AppData\L	.ocal\DFCommand	erMK2Client	OPEN DIREC	TORY
МАР	IMPORT IMPO		XPORT	SAVE I	
REMOTE SERVERS					
SBS	Client Name Current Client Name:			New Client Name	
	DFCommanderMK2Client				
	GPS Format				
	Current GPS Format: Degrees and Decimal Minutes (D	PM)			
	Frequency Color Assignment				
	Frequency List:			Add New Frequency [MHz]:	
	156.800 MHz		REMOVE		
	156.025 MHz 121.500 MHz				
	Favorite Frequency List Setup				
	Frequency List: 121.500 MHz			Add New Frequency [MHz]:	
	156.800 MHz / Chn: 16 156.025 MHz / Chn: 60 Ship		REMOVE		

Figure 6: General setup Client Application

3.1.1 Configuration Files

The configuration files of the systems are located in the specified path and can be accessed directly by pressing the "OPEN DIRECTORY" button.

1	DFCommanderMK2Server	26.10.2022 11:21	Dateiordner	
រា	BearingPageConfig.json	07.02.2023 13:12	JSON File	1 KB
រា	BearingPageConfigDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	DfContainer.json	08.02.2023 13:22	JSON File	13 KB
រា	DfContainerDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	FavoriteFrequencyList.json	04.04.2022 14:43	JSON File	1 KB
រា	FavoriteFrequencyListDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	FrequencyColors.json	02.02.2023 16:10	JSON File	1 KB
រា	FrequencyColorsDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	frequencyLimits.json	04.04.2022 14:43	JSON File	1 KB
រា	frequencyLimitsDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	GeneralSettings.json	06.02.2023 11:32	JSON File	1 KB
រា	GeneralSettingsDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	ProxyContainerDefault.json	26.10.2022 11:21	JSON File	0 KB
រា	SelfBearingSuppression.json	07.02.2023 13:10	JSON File	2 KB
រា	SelfBearingSuppressionDefault.json	28.12.2022 17:53	JSON File	2 KB
រា	Server.json	07.02.2023 13:10	JSON File	1 KB
រា	ServerDefault.json	26.10.2022 11:21	JSON File	1 KB
រា	Triangulator.json	07.02.2023 13:12	JSON File	1 KB
រា	TriangulatorDefault.json	26.10.2022 11:21	JSON File	1 KB

Figure 7: Configuration files (Server application)

The composition of the configuration files is different for the "DF Commander MK2 Server" and "DF Commander MK2 Client" applications.

If these files are deleted, they are created again by restarting the program. In this case, the settings and contents correspond to the configuration stored in the program code. DF systems and channels are not initially created.

Each functional unit has two configuration files, each in JSON format. One of them is the work file, in which the current changes are stored by the application. In the other file, however, only the basic settings are stored.

If the work files are deleted, restarting the program will recreate the work files. The settings are taken from the default configuration files.

Example:

DfContainer.json – Contains the current settings of the DF systems DfContainerDefault.json – Contains default settings of the DF systems

- 1. DF systems are set as required. The settings are initially located in the work file: DfContainer.json.
- 2. Now these settings are to be defined as a fallback level. This is made possible by manually saving the file DfContainer.json as DfContainerDefault.json .
- 3. If it becomes necessary to load the settings of DfContainerDefault.json , the current working file DfContainer.json must be deleted and the program restarted.

The DF Commander MK2 software provides buttons on the General Setup page for easier handling of the configuration files.

IMPORT CONFIGURATION

This button allows importing the configuration files from any directory of your PC.

If the selected directory contains only one or several applicable configuration files, only these are applied for the new configuration, the rest of the settings remains unchanged. If no configuration files are in the selected directory, or they are damaged, the software produces a corresponding warning.

A restart of the DF Commander is required to implement the new configuration.

IMPORT DEFAULT CONFIGURATION

The default configuration is replaced by the new default configuration from the imported configuration files. The default files are merely replaced and stored, but the configuration is not applied and no restart of the application is required. To apply the imported default configuration use "Load from default" button explicitly.

EXPORT ALL

Copies all configuration files from the specified DF Commander MK2 directory to any other directory. The files are simply stored in the selected directory. The restart of the application is not required.

SAVE AS DEFAULT

All working configuration performed in the application can be converted to the new default configuration. This can then be applied when there is a need to revert to the same settings instead of using the mainly empty configuration that is created when the application is first started.

LOAD FROM DEFAULT

Applies the configuration according to the data stored in the default configuration files. This requires the restart of the application.

Example of a use case "Local system functional test after repair":

A functional test of a DF system, which requires a different configuration, is needed on site (local system) while the DF system is already being remotely controlled and monitored by a remote server (monitoring center). The operator of the remote server is informed about the test so that he does not change the settings during the execution.

- 1. The working configuration of the system is saved by using "SAVE AS DEFAULT".
- 2. Then the new test configuration is accomplished.
- 3. The functional test is performed.
- 4. The test configuration is exported by using "EXPORT ALL" to a specified directory (e.g. "Test Setup"), if another test with the same configuration on e.g. a second system is needed.
- 5. After the test is finished, the previous working configuration is reloaded by using "LOAD FROM DEFAULT".

Example of a use case "Regular tests on local system":

If e.g., functional tests with the same test configuration are necessary time and again, the procedure could be:

- 1. The steps from the previous example are performed at the first test.
- If the test setup is required again (the regular test is pending), the working configuration is first exported to another directory (e.g. "Working Configuration") with "EXPORT ALL".
- 3. The test setup can now be loaded from the corresponding directory ("Test Setup") with "IMPORT CONFIGURATION".
- 4. After the test, the working configuration is restored from the corresponding directory with "IMPORT CONFIGURATION".
- 5. In this way, you can switch between these two configurations at any time.

3.1.2 Server Name / Client Name

The Server Name is used to identify the present local server in the applications that use its data. Thus, this name will appear in the list of remote servers under SETUP / REMOTE SERVERS of other "DF Commander MK2 Server" or "DF Commander MK2 Client" application when they connect to the present server.

The Client Name is only visible in the "DF Commander Client" application itself, since a remote connection to the client cannot be established.

3.1.3 GPS Format

This setting allows the positions to be displayed in different formats.





Example:

Decimal Degrees (D): Degrees and Decimal Minutes (DM): Degrees Minutes Seconds (DMS): 54.300252°N 11.528357°E 54°18.842'N 11°32.125'E 54°16'47.79"N 11°32'16.51"E

3.1.4 Frequency Color Assignment

In this area, different colors are assigned to different frequencies. This makes it easier to distinguish bearing results from cross bearing results on the map. The frequency in MHz is entered in the right field. Then press the "< ADD <" key. The "REMOVE" button deletes the selected frequency from the list.

Frequency Color Assignment									
		Add New Frequency [MHz]:							
	< ADD <								
	REMOVE								
		< ADD < REMOVE							

Figure 9: Frequency Color Assignment

3.1.5 Favorite Frequency List Setup

The favorite frequency list is set in this area. The frequency in MHz is entered in the right field. Then press the "ADD" key. The "REMOVE" button deletes the selected frequency from the list.

Favorite Frequency List Setup		
Frequency List:		Add New Frequency [MHz]:
121.500 MHz	< ADD <	
156.800 MHz / Chn: 16		
156.025 MHz / Chn: 60 Ship	REMOVE	

Figure 10: Favorite Frequency List setup

3.2 Map Settings

If the PC / server is connected to the Internet, the map tiles are automatically downloaded from public servers and persistently stored in the cache.

If the computer is offline, the tiles can be loaded into the cache manually. For this purpose, a special ZIP file with the desired area is prepared and provided by RHOTHETA. This file can be loaded by pressing the "INSTALL" button.

Depending on the size of the file, the selection dialog (especially with Windows) may be blocked for a while. Copying can also take some time. A corresponding "Busy Indicator" is displayed.

00 DF Commander MI	K2 - Client							- 🗆	I X
_		DEADING	MONITODING	OFTUD			General Status	20:42:	:22
=	MAP	BEARING	MONITORING	SETUP			ОК	30 Mar 2	2023
GENERA	L	Map Setup							
DF SYSTE	MS	Offline maps							
TRANCINA	TODO								
TRIANGULA	TORS	INSTAL							
ΜΔΡ		Man Format							
L I I I									
		Current MAP Format:							
REMOTE SER	VERS	OpenSeaMap			< SET <	OpenSeaMap			
SBS		Color Themes							
		Current Panel Theme:							
		LightMode			< SET <				
		Current MAP Theme:							
		LightMode			< SET <				
		Download Behavio	r						
		Download Behavior:							
		Online Mode			< SET <				
		Map / Marble File L	ocations						
		Marble Data Path:							
		C:/Users/lena.zvere	v/DFCommanderMK2-C	Client\data					
		Marble Local Path:							
		C:/Users/lena.zvere	v/AppData/Local/.marb	le/data					
		Marble System Path:							
		C:/Users/lena.zvere	v/DFCommanderMK2-C	Client\data					
		Marble Plugin Local Pa	th:						
		C:/Users/lena.zvere	v/AppData/Local/.marb	le/plugins					
		Marble Plugin System	Path:						
		C:/Users/lena.zvere	v/DFCommanderMK2-C	Client\plugins					

Figure 11: MAP SETUP

Furthermore, different map formats can be set. The following map formats are possible:

- OpenStreetMap Vector
- OpenStreetMap
- OpenSeaMap

- OpenFlightMap

Other formats are also possible on request. The map theme can be set up. The "Light Mode" and "Dark Mode" are available.

Finally, the download behavior can be controlled by selecting the "Online Mode" or "Offline Mode".

"Map / Marble File Locations" is an information field and does not require any settings. The paths to the map material and to the plugins are displayed here. This information can be relevant for possible troubleshooting.

3.3 Configuration of a DF System

This chapter shows how to set up a DF system with one direction finding channel. The configuration of several systems and channels is done in the same manner.

DF Commander MK2 - Client				- 🗆 ×
≡ мар	BEARING MONITOR	NG SETUP	General Status OK	14:28:09 27 Feb 2023
GENERAL	DF Systems			
DF SYSTEMS	Server Location:	DF Channels		
TRIANGULATORS	CREATE DELETE			
МАР				
REMOTE SERVERS				
SBS				

Figure 12: Empty system list

Go to the "SETUP" page, then "DF SYSTEMS" and press "CREATE".

This creates a new DF System entity. The DF system is initially not configured and therefore not able to generate bearing results. For this reason, the corresponding indicator LEDs as well as the "General Status" LED show an error.



Figure 13: New DF system

In the following, the system will be configured step by step by calling up the corresponding dialogs (see buttons in the figure above) from left to right, which is described in the following chapters in the same order.

3.3.1 System Configuration

Press "SYSTEM SETUP" to open the following dialog:

010 DF System Setup)				_		×
General System St	tatus						
General System Status General DF System Settings Unique System ID: 91131bb9-51be-42b5-929f-2ff93153c2eb System Name: undefined Time (UTC): Source: 2023-02-27T16:43:32.235Z							
General DF Syster	n Settings						
Unique System ID: 91131bb9-51be-	-42b5-929f-2ff93153c2	eb					
System Name: undefined			< SET <	System Name:			
Time (UTC): 2023-02-27T16	:43:32.235Z	Source: Local Machine	< SET <				•
Valid Bearing Sect	or						
Valid TRUE Bearing	g Minimum:		< SET <	New Valid TRUE Bearing Minimum:			
Valid TRUE Bearing 360	g Maximum:		< SET <	New Valid TRUE Bearing Maximum:			
						CLOS	SE

Figure 14: System Setup dialog

Enter a system name (e.g. DF STABERHUK).

The system name is used to assign the system in all displays and status data transmitted via the interface (server). Furthermore, each DF system is assigned a unique system ID.

Set the source for the reference time and press "< SET <".

The bearing values are subsequently provided with the set reference time. This time is also important for logging events (e.g. changes to the system or important error messages).

Two sources are available:

- Local Machine the time is used by the local computer running DF Commander MK2. If necessary, the computer / server can be synchronized with an appropriate time source via the NTP protocol.
- GPS the reference time is taken from a GPS device. For this purpose, a GPS device must be configured (see next chapter).

A valid bearing angle sector can be defined in the "Valid Bearing Sector" area in order to hide certain sectors. The DF system then only works in the defined range. The setting is made clockwise from minimum to maximum. For example, a setting from 270° to 45° means that the DF system accepts the TRUE bearing values from 270° west via 0° north to 45° as valid. The figure below shows the representation of the valid bearing sector on the map by the green circle segment.



Figure 15: Valid bearing sector

Bearing values that are outside of this range are not displayed, are not evaluated by other modules such as Triangulator and are not passed on via the protocol.

3.3.2 GPS Configuration

000 DF Commander MK2 - Client		-	
≡ мар	BEARING MONITORI	NG SETUP General Status 10 ERROR 11	
GENERAL	DF Systems	DF System Info	
DF SYSTEMS	Server Location:	System GPS Antenna	
TRIANGULATORS	ALL TREATE DELETE	System Message:	
МАР	DF STABERHUK	System Name: DF STABERHUK Radio Horizon: undefined Antenna Orientation: 0.00° (Tr	rue North)
REMOTE SERVERS		System UTC: 2023-03-01T09:56:53.249Z(Local Machine) Exp. Transmitter Height: 0.00 m Antenna Correction: Position: undefined Altitude: undefined Variation:	undefined undefined
SBS		Position Source: Manual Input Course over Ground: undefined Speed over Ground: True Heading: 0.00° Magnetic Heading: undefined Antenna Type: RT-	undefined 1000-ATC
		SYSTEM SETUP GPS SETUP ANTENNA SETUP ADD CHANNEL DELETE CHANNEL	

Figure 16: GPS Setup button

Press "GPS SETUP" to enter the settings of the GPS device.

	\times
New Po	rt:
ON	OFF
CL	.OSE
	New Po ON CL

Figure 17: GPS Device setup

If the DF system used is not a mobile system, but is fixed in one place and the reference time is taken from the local machine, the GPS device can remain switched off. Press "OFF" if the status is not shown as OFF.

The GPS device must be configured, however, if you either want to

- determine the GPS position of the antenna using a GPS device, or
- equate the orientation (heading) of the antenna to the course over ground (COG), or
- determine the reference time of the system by means of a GPS device.

The prerequisite for this is that a GPS device can send the common GPS sentences in an NMEA-0183 format via a network interface. This can be achieved by having an RS-232 / RS-422 device send its data via a serial to LAN converter (e.g. MOXA NPort device). If the prerequisite is fulfilled, only a TCP/IP connection must be established.

Press "ON", enter the IP address in the "New IP" field and the TCP port in the "New Port" field and press "CONNECT". The result must now look like this:

()(() GPS Dev	ice Setu	up						_		×
GPS Device Setu	up:									
Status: Current IP: Current Port:				New IP:		New	Port:			
ОК	тср Т		DATA	DEV	127.0.0.1	3000		127.0.0.1		
Device Message	2:									
ОК							CONNECT	DISCONNECT	10	N OFF
										CLOSE

Figure 18: GPS device setup connection established

In the event of an error see Chapter 4 Status Displays.

3.3.3 Configuration of the Antenna Properties

00 DF Commander MK2 - Client			- 🗆 ×
≡ мар	BEARING MONITORI	ING SETUP General Status ERROR	
GENERAL	DF Systems	DF System Info	
DF SYSTEMS	Server Location:	System GP5 Antenna ERROR OFF ERROR	
TRIANGULATORS	CREATE DELETE	System Message: Antenna is in error statel No DF Channels configured!	
МАР	DF STABERHUK	System Name: DF STABERHUK Radio Horizon: undefined Antenna Orientation: 0.00	° (True North)
REMOTE SERVERS		System UTC: 2023-03-01T09:56:53.2492(Local Machine) Exp. Transmitter Height: 0.00 m Antenna Correction: Position: undefined Altitude: undefined Variation:	undefined undefined
SBS		Position Source: Manual Input Course over Ground: undefined Speed over Ground: True Heading: 0.00° Magnetic Heading: undefined Antenna Type: I	undefined RT-1000-ATC
		SYSTEM SETUP GPS SETUP ANTENNA SETUP ADD CHANNEL DELETE CHANNEL	

Figure 19: Antenna setup button

Press "ANTENNA SETUP". The following window opens.

010 Antenna Device Setup				- 🗆 🗙			
Antenna System Status							
Antenna Status Antenna Status Messag	e: tate!						
Antenna Setup							
Antenna Type:							
RT-1000-ATC		< SET <	RT-1000-ATC				
Mechanical Correction:			Mechanical Correction [-180+180°]:				
undefined		< SET <					
Upside Down:							
Up		< SET <	UP				
Orientation:	Mode:						
0.00°	True North	< SET <	True North				
Variation:	Source:		Variation [xx.xx° E or W]:				
undefined	Manual Input	< SET <		Manual Input 🔻			
Position:	Source:		Position [Latitude, Longitude]:				
undefined	Manual Input	< SET <		Manual Input 🔻			
Altitude [m]:	Source:		Altitude [m]:	Manual Instate			
	Manual Input	< SET <	Even and Transmitter Unight Fach	Manual Input 🔻			
Expected Transmitter Height [m]:			Expected Transmitter Height [m]:				
Standard Daviation:			Stepdard Deviation (v. v. ⁹)				
3 00°							
Additional Attenuation [dB]:			Additional Attenuation [dB]:				
0.00 dB		< SET <					
				CLOSE			

Figure 20: Antenna setup (not configured)

Initially, the antenna is in an error state because there are not enough parameters set to take bearings. For this reason, the corresponding DF system is also in the error state.

Then all parameters must be set one after the other. Finally, the antenna must display the status OK.

NOTE:

Basically, the menu is structured in such a way that the current settings are displayed on the left. On the right, however, new values can be entered or selected. Press "< SET < " to apply the new settings. After setting they should appear accordingly in the left area.

Antenna Type:

Select the type of antenna used and press "< SET <".

With this selection, the system knows the most important antenna characteristics such as antenna gain. This allows the field strength in $dB\mu V/m$ of the incoming wave fields to be determined.

Mechanical Correction

Set the correction value for the mechanical offset.

Assuming that during the measurement of the direction finding system it was determined that the antenna is mounted incorrectly by $+ 5.7^{\circ}$, the correction value must be set to -5.7° accordingly.

The mecanical correction value cannot be omitted. Even if the installation is perfect and there is no mechanical offset, the value 0° must be entered for this setting. Otherwise, the antenna status will remain in the error state.

<u>Upside Down</u>

Set whether the antenna is mounted vertically upright (UP) or upside down (DOWN). This parameter is mostly relevant for mobile direction finder systems, which are e.g. mounted on the underside of the fuselage of an aircraft or on a drone. This type of mounting must be taken into account when determining the bearing. For fixed installations, the setting is usually "UP".

Orientation

Set how the antenna is oriented.



Figure 21: Setting options for antenna orientation

If the antenna is mounted on a ship or aircraft, the orientation of the antenna corresponds to the heading (HDG).

For the calculation of north-related bearing values such as TRUE BEARING or MAGNETIC BEARING, knowledge of the antenna orientation is essential. The explanation of the correlations between the bearing values and the antenna alignment is shown graphically in the following figures (Figure 22 and Figure 23).

The following settings are possible:

True North	The antenna is oriented 0° to geographic north. HDG = HDT = 0°
Magnetic North	The antenna is oriented 0° to magnetic north. HDG = HDM = 0°
COG (GPS)	For the antenna alignment or orientation the "Course Over Ground" is used by the configured GPS device. HDG = COG = HDT
HDT (Compass)	For the antenna alignment or orientation the "Course Over Ground" is used by the configured GPS device. HDG = HDT
HDM (Compass)	For the antenna alignment or orientation the "Course Over Ground" is used by the configured GPS device. HDG = HDM



Figure 22: Correlation of antenna alignment and bearing values for mobile DF systems



Switch Position / Reference Direc- tion Display	Meaning	Reference Direction	
QDM	Magnetic bearing (course) of aircraft / vessel to the DF station	Magnetic north	QDM = QDR ± 180° QDM = QUJ - VAR
QDR	Magnetic bearing from the DF to the aircraft / vessel	Magnetic north	QDR = QDM ± 180° QDR = QTE – VAR
QTE	True bearing from the DF to the aircraft / vessel	True north	QTE = QUJ ± 180° QTE = QDR + VAR
QUJ	True bearing (track) of air- craft / vessel to the DF sta- tion	True north	QUJ = QTE ± 180° QUJ = QDM + VAR
VAR ¹	Variation		

Figure 23: Correlation of antenna alignment and bearing values for fixed bearing systems

¹ West variation values are evaluated with the sign "-" and East values with the sign "+".

<u>Variation</u>

Variation:	Source:		Variation [xx.xx° E or W]:		
undefined	Manual Input	< SET <	2.3° W	Manual Input	
Position:	Source:		Position [Latitude, Longitude]:	Manual Input	
undefined	Manual Input	< SET <		GPS	

Figure 24: Setting the variation

Set the variation of the location.

If the DF antenna is mounted at a fixed position, it is recommended to select "Manual Input" and to enter the variation of the location manually. First the degrees are entered followed by the letter "E" or "W".

"W" stands for a negative, western variation. "E" on the other hand for a positive, eastern variation.

For example, 2.3° W corresponds to -2.3°.

In the case of a mobile DF system, the variation can be taken from a configured GPS device, provided that the GPS device supports the determination of the variation. To do this, set the variation to "GPS".

Position

Position:	Source:		Position [Latitude, Longitude]:	
undefined	Manual Input	< SET <		Manual Input
Altitude [m]:	Source:		Altitude [m]:	Manual Input 😽
undefined	Manual Input	< SET <		GPS

Figure 25: Entering the position

Set the GPS position of the direction finding antenna.

For a permanently installed antenna:

Select "Manual Input" and enter the GPS position. The following formats are supported:

Example:

Decimal Degrees (D):	54.300252°N 11.528357°E
Degrees and Decimal Minutes (DM):	54°18.842'N 11°32.125'E
Degrees Minutes Seconds (DMS):	54°16'47.79"N 11°32'16.51"E

The position can be copied directly from the map:

- To do this, close the menu. The settings are not lost in the process.
- Go to map view.
- Navigate and zoom to the desired position with the mouse and press the right mouse button.
- Press "Copy Coordinate".
- Go back to the antenna settings and click on the field to enter the position.
- Paste the copied position in the input field (key combination CTRL + V).

For a mobile DF antenna:

Set source to GPS. The position of the antenna is updated accordingly.

<u>Altitude</u>

Set the antenna altitude.

Altitude [m]:	Source:		Altitude [m]:		
undefined	Manual Input	< SET <	40		
Expected Transmitter Height [m]:			Expected Transmitter Height [m]:	Manual Input	
0.00 m		< SET <		GPS	15

Figure 26: Setting the antenna altitude

The altitude is important for the calculation of the radio horizon, it determines the range of the direction finder, if the altitude of the emitting objects is known.

For a permanently installed antenna:

Select "Manual Input" and type in the altitude manually.

For a mobile DF antenna:

Set the source to GPS.

If the altitude of a mobile radio direction finding system does not change, it can also be entered manually.

If the bearing system is installed on a ship, it is also useful to enter the altitude manually. In the case of an aircraft installation, GPS should be set as the source.

The altitude setting cannot be omitted. If this value is not set, the antenna status remains in the error state.

Expected Transmitter Height



Figure 27: Enter Expected Transmitter Height

Set the expected height of the transmitter.

In the case of a maritime application, the "Expected Transmitter Height" could correspond to a usual or minimum height of the ship's radio antenna (e.g. 5 m).

In the case of an air traffic control scenario, the minimum flight altitude of the aircraft to be located (e.g. 300 m) can be entered here.

The radio horizon is calculated in the system from the altitude of the antenna and the expected transmitter height.

NOTE:

The radio horizon can be displayed on the map by right-clicking on the bearing system.

Standard Deviation

Standard Deviation:		Standard Deviation [x.x°]:
1.00°	< SET <	

Figure 28: Setting the standard deviation

Set the standard deviation of the bearing system.

This setting results either from the measurement of the bearing accuracy at the location or can be taken from the data sheet of a corresponding radio direction finder. The standard deviation is also transmitted to the connected clients as a system parameter. It can be used for display inaccuracy or used for other calculations.

Additional Attenuation



Figure 29: Setting the additional attenuation

If an additional RF cable is used between the antenna and the DF system, its attenuation should be entered in the useful frequency band. This attenuation is used in the calculation of the field strength in $dB\mu V/m$.

Result

After all parameters have been entered, the "Antenna Device Setup" window should look like this, for example:

010 Antenna Device Setup				_	×		
Antenna System Status							
Antenna Status Antenna Status Messagi	P:						
Antenna Setup							
Antenna Type:							
RT-1000-VTS		< SET <					
Mechanical Correction:			Mechanical Correction [-180+180°]:				
0.00°		< SET <	0				
Upside Down:							
Up		< SET <					
Orientation:	Mode:						
0.00°	True North	< SET <					
Variation:	Source:		Variation [xx.xx° E or W]:				
15.00° W	Manual Input	< SET <	15W				
Position:	Source:		Position [Latitude, Longitude]:				
54°24.124'N 11°18.666'E	Manual Input	< SET <	54°24.124'N 11°18.666'E				
Altitude [m]:	Source:		Altitude [m]:				
40.00 m	Manual Input	< SET <	40				
Expected Transmitter Height [m]:			Expected Transmitter Height [m]:				
5.00 m		< SET <	5				
Standard Deviation:			Standard Deviation [x.x°]:				
3.00°		< SET <	3				
Additional Attenuation [dB]:			Additional Attenuation [dB]:				
9.00 dB		< SET <	9				
				с	LOSE		

Figure 30: Antenna setup (configured)

3.3.4 Channel Configuration

00 DF Commander MK2 - Client			- 🗆 X
≡ мар	BEARING MONITORI	NG SETUP	General Status 15:45:04 ERROR 2 Mar 2023
GENERAL	DF Systems	DF System Info	
DF SYSTEMS 🕨	Server Location:	System GPS Antenna ERROR OFF OK	
TRIANGULATORS	CREATE DELETE	System Message: No DF Channels configured!	
МАР	DF STABERHUK	System Name: DF STABERHUK Radio Horizon: 35.10 km Antenna Orienta Sustem IITC - 2023-02-0271/3/45/04.146/20 ocal Machine) Evo Transmitter Height: 5.00 m. Antenna Correct	tion: 0.00° (True North)
REMOTE SERVERS		Position: 54°24.124'N 11°18.666'E Altitude: 40.00 m Variation:	15.00° W
SBS		Position Source: Manual Input Course over Ground: undefined Speed over Grou True Heading: 0.00* Magnetic Heading: 15.00* Antenna Type:	nd: undefined RT-1000-VTS
		SYSTEM SETUP GPS SETUP ANTENNA SETUR ADD CHANNEL DELETE CHANNEL	
		DF Channels	
			1
			i .
			i .

Figure 31: Antenna is configured in DF SETUP

Channels can be added or removed from a DF system.

To do this, use the "ADD CHANNEL" or "DELETE CHANNEL" buttons. The channel to be deleted must be selected explicitly.

From the list of systems, select the system to which you want to add a new channel. Then press "ADD CHANNEL" to create a new bearing channel for the selected system.

00 DF Commander MK2 - Client			- 🗆 X
≡ мар	BEARING MONITOR	ING SETUP	General Status 16:07:37 ERROR 2 Mar 2023
GENERAL	DF Systems	DF System Info	
DF SYSTEMS 🕨	Server Location:	System GPS Antenna ERROR OFF COK	
TRIANGULATORS	CREATE DELETE	System Message: One or more DF Channels are in error state!	
МАР	DF STABERHUK Local	System Name: DF STABERHUK Radio Horizon: 35.10 km Antenna Orient:	ition: 0.00° (True North)
REMOTE SERVERS		System UIC: 2023-03-02115:07:37.452(Local Machine) Exp. Fransmitter Height: 5.00 m Antenna Correct Position: 54*24.124'N 11*18.666'E Altitude: 40.00 m Variation:	15.00° W
SBS		True Heading: 0.00° Magnetic Heading: 15.00° Antenna Type:	RT-1000-VTS
		SYSTEM SETUP GPS SETUP ANTENNA SETUP ADD CHANNEL DELETE CHANNEL	
		DF Channels	
		Channel Name: Frequency: True Bearing: Status: Current IP: undefined, MHz ERROR TCP TIME DATA DEV	Current Port:
		Hack Num: DF type: Squech: Level: Image: Constraint of the state of th	SETUP

Figure 32: New bearing channel has been added

Press "SETUP" to configure the channel.

00 DF Channel Setup					_		×
DF Channel Id:							
01141685-ae1b-4c88-9943-10d4	97d273fb						
Status:	Current IP:		Current Port;	New IP:		New Po	ort:
ERROR TCP TIME DATA DE							
Device Message:							
Disconnected				CONNECT	DISCONNECT	ON.	OFF
Protocol Type:							
RT-1000	< SET <	RT-500-M					
Channel Name:		New Channel Name:		RELATIVE	MAGNETIC	TRU	JE
undefined	< SET <						
Channel Rack Number:		New Channel Rack Nu	mber:				-
0	< SET <						
Squelch Level:		New Squelch Level [db	3m]:				
% dBm				LEVEL:	%	dBm	
-	MH	z			ENCY FAV	ORITE	S
Occurring Made							
	< SET <	Bearing Mode				CLC	DSE

Figure 33: Configuration of a DF channel

Create a TCP/IP connection to the corresponding DF channel by entering the IP address and port in the "New IP" and "New Port" fields and pressing "CONNECT". See Chapter 4 "Status Displays" in case of problems with the connection.

000 DF Channel Setup					_		×		
DF Channel Id:									
01141685-ae1b-4c88-9943-10d4	97d273fb								
Status:	Current IP:		Current Port:	New IP:		New Po	ort:		
ERROR TCP TIME DATA DI	EV	127.0.0.1	60010	127.	0.0.1	60	010		
Device Message:									
Bad Data! Not a RT-1000 dat	a format.			CONNECT	DISCONNECT	ON	OFF		
Protocol Type:									
		RT-SUU-M							
Channel Name:	< SET <	New Channel Name:		RELATIVE	MAGNETIC	TRU			
Channel Back Number:		New Chappel Back Nu	mber:	·			-		
0	< SET <		inder.						
				I L					
Squelch Level:		New Squelch Level [dB	im]:						
% dBm				LEVEL:	%	dBm			
-	MH	z		EDIT FREQUE	ENCY FAV	ORITE			
Operating Mode:									
Bearing Mode	< SET <					CLO	DSE		

Figure 34: Establishing the connection to the DF channel

In this case, the connection to the RT-500-M system was successfully established. The green "TIMEOUT LED" indicates that the device is sending out its data cyclically. However, the protocol type is set for the RT-1000 system. This means that the data from the RT-500-M system cannot be evaluated.

Protocol Type

Set the protocol of the bearing system used.

In the example shown above, the protocol must be set to RT-500-M because the RT-500-M bearing data are received (RT-500-M simulator is used).

Channel Name

Assign a name to the bearing channel: Type it in the "New Channel Name" field and press "< SET <".

Channel Rack Number

In the case of a radio direction finder with several direction finding channels, a corresponding number can also be assigned in the rack.

After successfully entering the parameters, the window should look like the following figure.

010 DF Channel S	etup								-		×
DF Channel Id:											
01141685-ae1l	b-4c88-99	943-10c	497	d273fb							
Chathana				Current ID:		Current Dente	New ID:			N D .	
OK	TCP TIME	DATA	DEV	Current IP:	127.0.0.1	60024	New IP:			New Po	
Device Message:]		00021	J L				
OK							CONNECT	DISCON	INECT	ON	OFF
Protocol Type:											
RT-500-M				< SET <	RT-500-M						
Channel Name:					New Channel Name:			MAGNE	τις	TRU	
DISTRESS				< SET <	DISTRESS					225	
Channel Rack Nu	ımber:				New Channel Rack Nu	mber:	225.0	240.0)	225	.0
1				< SET <	1						
Squelch Level:			-		New Squelch Level [db	3m]:	۱٫				
40 %	-114 dl	Bm					LEVEL:	60 %	-98	3 dBn	n
			121.	.500 Mł	Ηz		EDIT FREQU	ENCY	FAV	ORITE	S
Operating Mode:											
Bearing Mode				< SET <	Bearing Mode					CLC	DSE

Figure 35: Successful channel setting

In this example, the DF channel receives a signal on 121.500 MHz with a level of 60% which corresponds to -98 dBm at the receiver input. The squelch level is set to -114 dBm (40%). Since the receive level is 16 dB higher than the set squelch level, the bearing is set accordingly.

For example, the bearing channel determines a relative bearing of 225°. Since the antenna has been aligned to "True North" and a mechanical correction of 0° has been set, the "True Bearing" corresponds to the relative bearing value of 225°. The variation of the location was

set to 15° W in the antenna settings, i.e. -15°. This results in a value of 240° for the "Magnetic Bearing".

The values correspond to the example from Figure 23: Correlation of antenna alignment and bearing values for fixed bearing systems.

Setting the Squelch Level



Figure 36: Squelch setting

Enter the squelch level value in dBm in the "New Squelch Level [dBm]" field and press "< SET <".

Depending on the network connection, the setting may take some time. After the successful setting the new "Squelch Level" must appear in the left area.

Setting the frequency



Figure 37: Frequency setting

A new frequency can be set either directly or from the favorites list. Press "EDIT FREQUENCY" to enter the frequency directly.

🕅 Frequ	-	X						
Current Frequency [MHz]:								
121.500								
New Frequency [MHz]:								
156.800								
Freq	Chnl	Del						
7		9						
4		6						
1	2	2						
		3						
0								
Esc	Ok							

Figure 38: Input in MHz

Enter the new frequency in MHz and press "OK".

00 Frequ	—	Х
Current Channe	el:	
New Channel:		
05 9	Ship	S/C
Freq	Chnl	Del
7		
4		
1		
(
Esc	0	k

Figure 39: Input as VHF channel

Enter the maritime VHF channel number. If the VHF channel is a duplex channel, Ship or Coast must be selected accordingly. To do this, press "S/C". Then press "OK".

If no entry is made, the dialog closes automatically after approx. 10 seconds. Press "FAVORITES" to enter the frequency from the favorites list.

000 Favorite Frequency List	-	- 0	×
Favorite Frequencies:			
121.500 MHz			
156.800 MHz / Chn: 1	6		
156.025 MHz / Chn: 6	0 Ship		
ESC		ОК	

Figure 40: Entry from the favorites list

Select the desired frequency and press "OK".

Depending on the network connection, setting the frequency may take some time. After successful setting, the newly set frequency is displayed.

If no new frequency appears after approx. 8 seconds, the frequency could not be set. An error message is displayed.



Figure 41: Frequency error message

Possible causes are either that the network transmission took more than 8 seconds or that the bearing channel does not support the desired frequency.

3.3.5 Checking the Configuration

A DF system with one DF channel was set. Now the settings are to be checked.

Checking on the SETUP page

The setup menu should look like the following picture. None of the control LEDs should light up red. The system is configured locally, which is shown additionally.

E MAP BEARING MONITORING SETUP General Status OK 6 GENERAL DF Systems DF System Info OK 6 DF SYSTEMS Server Location: All System GPS Antenna System Message: System Message: System Message: System Message: System Name: DF STABERHUK Radio Horizon: 35.10 km Antenna Orientation: 0.00* (The System Viral	9:13:27 ar 2023
GENERAL DF Systems DF System Info DF SYSTEMS Server Location: All ALL OK OFF System GPS Antenna CREATE DELETE DF STABERHUK OF STABERHUK Local System Name: DF STABERHUK Radio Horizon: System Name: State Sta	
DF SYSTEMS Server Location: ALL System TRIANGULATORS CREATE DF STABERHUK Local DF STABERHUK Local SBS System Name: DF STABERHUK Local DF STABERHUK System Name: SBS State	
TRIANGULATORS CREATE DELETE MAP DF STABERHUK Local OK System Mares: DF STABERHUK Radio Horizon: 35.10 km Antenna Orientation: 0.00° (T) REMOTE SERVERS System VIC: 2023-03-06T08:13:26.6592(Local Machine) Exp. Transmitter Height: 5.00 m Antenna Orientation: 0.00° (T) SBS SBS Sistem VIC: 2023-03-06T08:13:26.6592(Local Machine) Exp. Transmitter Height: 5.00 m Antenna Orientation: 0.00° (T) Position Source: Manual Input Course over Ground: undefined Speed over Ground: True Heading: 0.00° Magnetic Heading: 15.00° Antenna Type: RT	
MAP DF STABERHUK Local System Name: DF STABERHUK Radio Horizon: 35.10 km Antenna Orientation: 0.00* (The second	
REMOTE SERVERS System OT: 2023-03-06108/13/20.6992(Local Machine) Exp. transmitter Height: 5.00 m Antenna Correction: Position: 54*24.124 Ni 11*18.666'E Altitude: 40.00 m Variation: Position Source: Manual Input Course over Ground: undefined Speed over Ground: True Heading: 0.00* Magnetic Heading: 15.00* Antenna Type: RT-	Je North)
SBS Position Source: Manual Input Course over Ground: undefined Speed over Ground: True Heading: 0.00* Magnetic Heading: 15.00* Antenna Type: RT-	5.00° W
	ndefined 000-VTS
SYSTEM SETUP GPS SETUP ANTENNA SETUP ADD CHANNEL DELETE CHANNEL	
DF Channels	
Channel Name: Frequency: True Bearing: Status: Current IP: Current Port: DISTRESS 121.500 MHz 127.000 MHz 127.0	ΓUP

Figure 42: Checking in the SETUP menu

Checking on the MONITORING page

Switch to the "Monitoring page" / "General Status Monitoring" by pressing the "MONITORING" button. None of the control LEDs should light up red.

🗰 DF Commander MK2 - Client					- 🗆 X
≡ мар	BEARING MONITORING	SETUP		General Status OK	09:15:43 6 Mar 2023
GENERAL STATUS MON	ITORING DF CHANN	EL MONITORING			
General Status General Message:					
ок					
Local OK					
General Server Status OK DETAILS	SERVER Local				Local
DF System DF STABERH OK	Internal Devices Gps Antenna OFF OK	DF Channels DISTRESS OK			

Figure 43: Checking on the MONITORING page / General Status Monitoring

Checking on the MAP page

To do this, switch to the map view and navigate to the set position of the DF antenna. The DF system must appear on the map view.

Press the right mouse button on the bearing system to display the radio horizon.



Figure 44: Checking on the MAP page

This completes the configuration of a DF system with one DF channel. Configuration of further systems and channels follows the same principle.

3.4 Triangulator

To be able to determine cross bearing results, also called triangulation results, the triangulator must be configured. However, this requires a successful configuration of at least two radio direction finding systems, each with at least one channel.

3.4.1 Configuration

In the following example, the triangulator is set up so that cross bearing results on two different frequencies from three independent radio direction finding systems can be calculated and displayed simultaneously.

Example of the sysems configuration

The radio direction finding systems must be configured before the configuration of the triangulator can be started.

Three radio direction finding antennas are configured as follows.

For other relevant system settings see the chapter 3.3 Configuration of a DF System (GPS does not need to be configured).

STABERHUK:		MARIENLEUC	MARIENLEUCHTE:		KELSDORF:		
Antenna Type:		Antenna Type:	Antenna Type:		Antenna Type:		
RT-1000-VTS		RT-1000-VTS	RT-1000-VTS		RT-1000-VTS		
Mechanical Correction:		Mechanical Correction:	Mechanical Correction:		Mechanical Correction:		
0.00°		0.00°	0.00°		0.00°		
Upside Down:		Upside Down:	Upside Down:		Upside Down:		
Up		Up		Up			
Orientation:	Mode:	Orientation:	Mode:	Orientation:	Mode:		
0.00°	True North	0.00°	True North	0.00°	True North		
Variation:	Source:	Variation:	Source:	Variation:	Source:		
15.00° W	Manual Input	0.00° E	Manual Input	0.00° E	Manual Input		
Position:	Source:	Position:	Source:	Position:	Source:		
54°24.124'N 11°18.666'E	Manual Input	54°29.669'N 11°14.301'E	Manual Input	54°31.656'N 11°3.497'E	Manual Input		
Altitude [m]:	Source:	Altitude [m]:	Source:	Altitude [m]:	Source:		
40.00 m	Manual Input	40.00 m	Manual Input	40.00 m	Manual Input		
Expected Transmitter Height [m]:		Expected Transmitter Height [m]:	Expected Transmitter Height [m]:				
5.00 m		5.00 m	5.00 m				
Standard Deviation:		Standard Deviation:	Standard Deviation:				
3.00°		1.00°	1.00°				
Additional Attenuation [dB]:		Additional Attenuation [dB]:		Additional Attenuation [dB]:			
9.00 dB		0.00 dB	0.00 dB		5.00 dB		

Figure 45: Configuration of radio direction finding antennas

To make the setting eye-catching, each channel's bearing in this example is made using a DF simulator.

See the "MONITORING -> DF CHANNEL MONITORING".
010 DF Commander	r MK2 - Client												- 0	×
=	MAP BEARI		ING SETUP								Gene	eral Status	11:11:30	
			_											
GENERA	L STATUS MONITORING	DF	CHANNEL MONITORIN											
General Status	General Message:													
ок	ок													
Server Name:	System Name:	Channel Name:	Frequency:	Level:			Status			Current IP:	Port:	Device Message:		
Local	STABERHUK	60024	156.800 MHz		-98 dBm	15.0	ОК	TCP TIME OUT	DATA DEV	127.0.0.1	60024	ОК		
Server Name:	System Name:	Channel Name:	Frequency:	Level:		TB:	Status			Current IP:	Port:	Device Message:		
Local	WESTERLSDORF	60028	156.800 MHz		-98 dBm		ОК	TCP TIME OUT		127.0.0.1	60028	ОК		
Server Name:	System Name:	Channel Name:	Frequency:	Level:		TB:	Status	TIME		Current IP:	Port:	Device Message:		
Local	MARIENLEUCHTE	60026	156.800 MHz		-98 dBm	62.0		TCP OUT	DATA DEV	127.0.0.1	60026	OK		
Server Name:		60025	121 500 MHz	Level	-114 dBm	352.0		TCP TIME	DATA DEV	127 0 0 1	60025	OK		
Locat	SINDLAHOR	00025	121.300 14112		I H GDIII	332.0				127.0.0.1	00023			
Server Name:	System Name:	Channel Name:	Frequency:	Level:			Status			Current IP:	Port:	Device Message:		
Local	MARIENLEUCHTE		121.500 MHz		-114 dBm		ОК	TCP TIME				ОК		
Server Name:	System Name:	Channel Name:	Frequency:	Level:		TB:	Status			Current IP:	Port:	Device Message:		
Local	WESTERLSDORF	60029	121.500 MHz		-114 dBm		ок	TCP TIME OUT		127.0.0.1	60029	ОК		

Figure 46: Direction finding channels on monitoring page / DF Channel Monitoring

Task definition for triangulator configuration

The radio direction finding systems

- STABERHUK
- MARIENLEUCHTE
- WESTERMARKELSDORF

are to be used for the determination of the cross bearing.

Cross bearings should be able to be performed on the

- 121.500 MHz
- 156.800 MHz

frequencies.

Configuration of Triangulator

Go to "SETUP -> TRIANGULATORS" and press "CREATE" to generate a new triangulator. The general status LED shows the ERROR state as long as the created triangulator is not set up correctly.

000 DF Commander MK2 - Client				- 🗆 X
≡ МАР	BEARING MONITORI	NG		General Status 11:25:08 ERROR 6 Mar 2023
GENERAL	Triangulators	General Triangulator Setup		
DF SYSTEMS	Server Location:	Indication Hold Time: 3 sec.	<pre>< SET < 1 second</pre>	
	CREATE DELETE	SHOW BEARING CONES ON REPEAT		
MAP	Local 📑	Triangulator Setup		
REMOTE SERVERS				
SBS		ENABLE ENABLE	DISABLE TESTMOD	E ON TESTMODE OFF
		Triangulator ld: f4eb093e-ab1e-411e-b2e7-212112919302	Nerre	
		undefined		
		Friangulation Radius: 500.00 km	<pre></pre>	n Radius [km]:
		Sector Blanking: DISABLED Sector Blanking Status Message: C;/Users/lena.zverev/AppData/Local/DFComma	DISABLE FILE DIREC	TORY SHOW ON MAP
		Configured Frequencies:	Add New Frequer	ncy [MHz]:
			< ADD <	
		NO FREQUENCY CONFIGURED	REMOVE	
		Configured Systems:	Available Systems ADD < STABERHUK 91131bb9-51b REMOVE ALL	s: ve-42b5-929f-2ff93153c2eb
		NO DF SYSTEM CONFIGURED	REMOVE ALL BANKENCEOC BAbb5995-c5 WESTERMAR c84282d9-af0	664-4bbc-9c53-2c00ee411786 KELSDORF 00-455c-b0e6-094edf702b0a

Figure 47: Creating the new triangulator

The triangulator is initially in the error state as well. Only when the triangulator is able to calculate results does its state change to OK.

For this purpose, the following requirements must be met:

- Target frequencies are set in the triangulator.
- At least two radio direction finding systems are set in the triangulator.
- The direction finding channels of the radio direction finding systems used must be set to the target frequencies.
- Radio direction finding systems used must not be in error status.

In the "Add New Frequency" field, enter the frequency in MHz and press "< ADD <". The frequencies selected for triangulation then appear in the list "Configured Frequencies" on the left side.

Repeat the procedure for all desired frequencies.

000 DF Commander MK2 - Client						- 0	×
≡ мар	BEARING MONITORI	NG SETUP			Genera	l Status 13:41:4	42
CENEDAL						6 Mar 20	JZ3
GENERAL	Triangulators	General Triangulator Setup					
DF SYSTEMS	Server Location:	Indication Hold Time: 3 sec.					
TRIANGULATORS 🕨	ALL V	SHOW BEARING CON	ES ON REPEAT				
МАР	Travemuende_Traffic	Triangulator Setup					
REMOTE SERVERS		Triangulator Status	Status Message:				
SBS		ERROR Status:	No DF System confi	igured.			
			ENABLE	DISABLE	TESTMODE ON	TESTMODE OFF	
		Triangulator Id: f4eb093e-ab1e-411e-b2e7-2	12112919302				
		Triangulator Name:			New Triangulator Name:		
		Travemuende_Traffic		< SET <	Travemuende_Traffic	(m]:	
		500.00 km		< SET <			
		Sector Blanking:					
		DISABLED	ENABLE	DISABLE	FILE DIRECTORY	SHOW ON MAP	
		C:/Users/lena.zverev/AppDat	ta/Local/DFCommand	erMK2Client/Triangu	lationSektors.json does n	ot exist.	
		Configured Frequencies:			Add New Frequency [MHz]:		
		156.800 MHz		< ADD <	121.500		
		121.500 MHz		REMOVE ALL			
				REMOVE			
		Configured Systems:			Available Systems:		
				< ADD <	STABERHUK 91131bb9-51be-42b5-		
				REMOVE ALL	MARIENLEUCHTE		
		NO DF SYS	TEM		3bbb5995-c564-4bbc WESTERMARKELSDO	-9c53-2c00ee411786 RF	
		CONFIGUE	ED	REMOVE	c84282d9-af00-455c-	b0e6-094edf702b0a	

Figure 48: Triangulator frequency setting

The triangulator reports that the systems must be set. See "Status Message" - "No DF System configured".

Give the triangulator an appropriate name and press on "<ADD<".

Select the systems in the right field "Available Systems" and press "< ADD <". The systems then appear in the" Configured Systems" view.

🗰 DF Commander MK2 - Client		- 🗆 X
≡ мар	BEARING MONITORING SETUP	General Status 14:15:10 OK 6 Mar 2023
GENERAL	Triangulators General Triangulator Setup	
DF SYSTEMS	Server Location: ALL SET < 3 sec.	
TRIANGULATORS 🕨	CREATE DELETE SHOW BEARING CONES ON REPEAT	
МАР	Travemuende_Traffic Local ITriangulator Setup	
REMOTE SERVERS	Triangulator Status Status Message:	
SBS	ENABLE DISABLE TESTMOD	E ON TESTMODE OFF
	Triangulator Id: f4eb093e-ab1e-411e-b2e7-212112919302 Triangulator Name: New Triangulato	r Name:
	Travemuende_Traffic < SET < Travemuende Triangulation Radius: 50.0 Nm	_Traffic n Radius [km]:
	Sector Blanking:	
	Sector Blanking Status Message: C:/Users/lena.zverev/AppData/Local/DFCommanderMK2Client/TriangulationSektors.js	on does not exist.
	Configured Frequencies: Add New Freque 156.800 MHz < ADD < 121.500	ncy [MHz]:
	121.500 MHz REMOVE ALL	
	REMOVE	
	Configured Systems: Available System STABERHUK < ADD < STABERHUK	s:
	91131b59-51be-42b5-929f-2ff93153c2eb 91131bb9-51 MARIENLEUCHTE REMOVE ALL MARIENLEU 3bbb5995-c564-4bbc-9c53-2c00ee411786 3bbb5995-c	pe-4265-929f-2ff93153c2eb CHTE 564-4bbc-9c53-2c00ee411786
	WESTERMARKELSDORF c84282d9-af00-455c-b0e6-094edf702b0a	4KELSDORF 00-455c-b0e6-094edf702b0a

Figure 49: Triangulator successfully set

The triangulator is now able to perform calculations. Its status is OK.

Further parameters can be set:

Triangulation Radius

Triangulation radius limits the display and forwarding of the triangulation results if they were determined too far from the bearing station and are not reasonable due to physical conditions. A triangulation result is valid if the determined position is within the set radius around all radio direction finding systems.

Indication Hold Time:

The "Indication Hold Time" determines how long the cross bearing results are to be displayed on the map after the radio has stopped transmitting and the bearing disappeared. For this duration, the triangulation results are displayed in grey on the map. The setting "Infinite" means that the result does not disappear until a new valid result at the set frequency is calculated.

The checkbox "Show bearing cones on repeat" defines, how the calculated triangulation results appear on map.



Figure 50: Display of triangulation results with/whithout bearing cones

Sector Blanking

See Chapter 3.4.3 Sector Blanking.

3.4.2 Display on the Map



Figure 51: Triangulation results on the map

In the map view there are several options for displaying the triangulation result. Besides the graphical cross-bearing result (bearing cones with cross-polygons and resulting values), the numeric display in the right sidebar or as separate window are possible.

Open the right sidebar and select "Triangulation". The numeric triangulation result information is presented here.



Figure 52: Numeric triangulation results in the sidebar

Click on "+" in order to open triangulation results in a separate window. The "Triangulation Results" window appears. Click on the "eye icon" to turn on the transparency of the window.



Figure 53: Numeric triangulation results in the separate window

The Triangulation Results window displays the current status of the triangulator and corresponding triangulation results in a list view. By clicking on a result, the map is centered on it.



Figure 54: REPEAT and CLEAR

Press "TO CLIPBOARD" to copy the results to the clipboard. Now these results can be pasted anywhere, e.g., in a text editor, using the key combination CTRL + V.

If the radio signal is no longer transmitted on the corresponding frequencies, the cross bearing results are held for a selected time ("Indication Hold Time") and then no longer displayed:

- Press "REPEAT" to display the results again.
- Even now the results can be copied to the clipboard.
- Press "CLEAR" to remove the results from the map and from the list.
- Pressing "REPEAT" will cause the results to reappear until the next valid cross bearings are determined.
- Press DELETE LAST to permanently delete the last results. They will not appear again by pressing "REPEAT".

It is also possible to display/highlight the individual bearings in repeat mode if you click on the empty bearing values ("---") of the individual channel in the "DF Systems Info" slider.

3.4.3 Sector Blanking

In the area "Sector Blanking", the triangulator can be configured in a way that the triangulation results are only valid in certain areas. Only valid triangulation results are displayed on the map and transferred via integrated server.

000 DF Commander MK2 - Client						- 🗆 X
≡ мар	BEARING MONITOR	RING SETUP		(General Status	16:43:22
					UK	6 Mar 2023
GENERAL	Triangulators	General Triangulator Setup				
DF SYSTEMS	Server Location:	Indication Hold Time:				
		3 sec.	< SET <	1 second		
TRIANGULATORS 🕨	CREATE DELETE	SHOW BEARING CONES ON REP	EAT			
МАР	Travemuende_Traffic	Triangulator Setup				
REMOTE SERVERS			гээаус.			
		Status:				
SBS		ENABLED ENA	BLE DISABLE	TESTMODE ON TESTMODE OFF		
		Triangulator Id:				
		Triangulator Name:	2	New Triangulator Name:		
		Travemuende_Traffic	< SET <	New Triangulation Padius (km)		
		50.00 km	< SET <			
		Sector Blanking:				
		DISABLED		FILE DIRECTORY 🗹 SHOW ON MA		
		C:/Users/lena.zverev/AppData/Local/DF	CommanderMK2Client/Triang			
		Configured Frequencies:		Add New Frequency [MHz]:		
		156.800 MHz	< ADD <			
		121.500 MHz	REMOVE ALL			
			REMOVE			
		Configured Systems:		Available Systems:		
		STABERHUK	< ADD <	STABERHUK		
		91131bb9-51be-42b5-929F-2ff93153c2	REMOVE ALL	91131bb9-51be-42b5-929f-2ff93153c2eb MARIENLEUCHTE		
		3bbb5995-c564-4bbc-9c53-2c00ee41	1786	3bbb5995-c564-4bbc-9c53-2c00ee411786		
		WESTERMARKELSDORF	REMOVE	WESTERMARKELSDORF c84282d9-af00-455c-b0e6-094edf702b0a		
		C8428209-ar00-455C-b0e6-094edf70	200a			

Figure 55: Sector Blanking

Definition of valid sectors / polygons

Please define the polygons in GeoJSON format (see also the specification in RFC 7946) and save the polygons in the file TriangulationSektors.json.

The file TriangulationSektors.json must exist in the same location, where all other configuration files a stored. Click on "FILE DIRECTORY" in order to open the file path.

Create the file TriangulationSektors.json with any text editor of your choise. The polygons can be eather defined as "Multipolygon" type or as "FeatureCollection" type. See examples below.

Example Multipolygon:



Example FeatureCollection:





NOTE:

Using the following web page, the polygons can also be created very easily: www.geojson.io

Please go to <u>www.geojson.io:</u>



Figure 56: www.geojson.io

Draw a polygon using the tool "Draw a polygon".

Go to "Save" and to "GeoJSON. The file will be downloaded into the download folder of your browser.

Open this file and save it to TriangulationSektors.json in the folder with other configuration files (directory specified under "Sector Blanking Status Message").

Reading in the TriangulationSektors.json

Click on "ENABLE" to read in the polygons from the file and activate sector blanking.



Figure 57: Activate Sector Blanking

If the file exists and conforms to the appropriate format, sector blanking is activated. In the "Sector Blanking Status Message" area, you will receive a message that the file has been loaded. In the event of an error, a message with the corresponding error information also appears.

Activate the checkmark "SHOW ON MAP" to display the polygons on the map.

On the map you can now see that triangulation results are only valid within the defined polygons (cross bearing at 156.800 MHz in blue color). The cross bearing at 121,500 MHz (red cones), however, lies outside the polygons - it is not counted as a valid triangulation result.



Figure 58: Triangulation results valid only inside the polygons

3.5 Server Setup (only for "DF Commander MK2 Server" Application)

The status of all DF systems and their channels, triangulator status, bearing results and finally the triangulation results are available via the DF service. All connected clients receive this data and can also configure the system via the DF service. The client application itself ("DF Commander MK2 Client") does not include the local server functionality ("LOCAL SERVER"), only the server application ("DF Commander MK2 Server") does.

The corresponding protocol is described in the document "Radio Direction Finder Standard JSON Protocol".

WARNING:

The server is a simple TCP server with no special protection against common attacks such as Denial of Service Attack. It is designed to work in a trusted, secured network with appropriate safeguards.

000 DF Commander MK2 - Server				– 🗆 X
≡ мар	BEARING MONITORING	SETUP	General Status OK	10:10:03 7 Mar 2023
GENERAL	Local Server Setup			
DF SYSTEMS	TX Send rate: RX Receive rate:			
TRIANGULATORS	Server status OFF TCD Dects	START	STOP	
МАР	9999 Maximum number of clients:	< SET <	New maximum number of clients:	
LOCAL SERVER	99 Connected Clients (0):	< SET <		
REMOTE SERVERS	Status: Name:	HostName:	lpAddress:	
SBS				

The following describes how to configure the server.

Figure 59: Server configuration (server is disabled)

Switch to "SETUP" and then press "LOCAL SERVER". Press "START" to start the server. If necessary, allow the firewall to start.

If necessary, set the desired TCP port in the "New TCP Port" field and press "< SET <".

The server starts automatically on the new port.

The server can be reached via the IP address of the DF Commander MK2 computer and the configured TCP port.

010 DF Command	ler MK2 - Server						- 🗆	×
≡	MAP	BEARING	MONITORING	SETUP	G	General Status OK	11:06:47 7 Mar 2023	
GENE	ERAL	Local Server Setup						
DF SYS	STEMS	TX Send rate:	RX Receive rate:					
TRIANGU	JLATORS	Server status	ОК	START	STOP			
MA	١P	9090 Maximum number of clie	nts:	< SET <	9090	her of clients:		
LOCAL S	SERVER 🕨	5 Connected Clients (0):		< SET <	5	ber of caents.		
REMOTE S	SERVERS	Status: Name		HostName:	lpAddress:			
SE	S							

Figure 60: Server configuration (server is activated)

If necessary, set the maximum number of clients to be served by typing the number in the "New maximum number of clients" field and then pressing "< SET <".

010 DF Commander M	MK2 - Server					- 🗆 X
≡	MAP	BEARIN	IG MONITORING	SETUP	General St	atus 11:42:48
					ОК	7 Mar 2023
GENER	AL	Local Server Se	tup			
DF SYSTI	EMS	TX Send rat	e: RX Receive rate: kbps			
TRIANGULATORS		Server status	ОК	START	STOP	
		TCP Port:			New TCP Port:	
MAP		9090		< SET <		
		Maximum numbe	r of clients:		New maximum number of clier	its:
LOCAL SE	RVER 🕨	5		< SET <		
		Connected Clients	; (1):	11		
REMOTE SE	RVERS	Status:	DECommonderMK2Clie			Disconnect
			nt VVK51-207	192.108.77.157:57507	Disconnect	
SBS						

Figure 61: Server configuration (1 client connected)

The top line shows the transmission rate in kByte per second at which the server sends the data to the connected clients.

The server shows the connected clients in the "Connected Clients" list.

The relevant data of the clients such as the respective status, name, hostname and IP address / used port, are displayed.

3.6 Remote Servers Setup

The "DF Commander MK2 Server" as well as the "Client" application can connect to a remote server (one or more) in order to include and process its data e.g. for monitoring purposes. The description of the corresponding protocol can be found in the document "Radio Direction Finder Standard JSON Protocol".

3.6.1 Configuration of Remote Server

The following explains how to configure a remote server using the "DF Commander Client" application as an example.



Figure 62: Remote server configuration (no remote servers connected)

Go to "SETUP" and then press "REMOTE SERVERS". Press "ADD REMOTE SERVER".

The remote server can be reached via the IP address of the "DF Commander MK2" computer and the configured TCP port.



Figure 63: Remote server configuration (entering the IP address and port)

Other remote servers can be added in the same manner.

After the TCP/IP link is established, all connections are represented in a list of remote servers.

DF Commander MK2 - Client			– 🗆 X
≡ мар	BEARING MONITORING	SETUP	eneral Status 17:24:41 OK 20 Mar 2023
GENERAL	Remote Servers Setup		
DF SYSTEMS	ADD REMOTE SERVER	Remote Status Remote Message:	
TRIANGULATORS	Remote Servers		
МАР	Server Name:	Status: Current I OK TCP TIME DATA DEV	P: Current Port: 127.0.0.1 9090
REMOTE SERVERS 🕨	Host Name: WKST-267	Device Message: OK	
SBS	Redundant for server:	Server Connection Control: ON OFF	DELETE
	Server Name: Heiligenhafen-Traf Host Name: W10-64-Services Redundant for server:	Status: Current I OK TCP TIME DATA DEV 19 Device Message: OK Server Connection Control: ON OFF	P: Current Port: 2.168.66.90 9999 DELETE

Figure 64: Remote server configuration (two remote servers connected)

3.6.2 Checking the Configuration

Two remote servers are added. The resulting display of the (local and) remote servers on other pages can be checked.

Checking on the SETUP page

Go to the SETUP page and select the DF SYSTEMS tab.

The DF systems setup menu should look like in the following picture. None of the control LEDs should light up red.

The locally or remotely configured systems are additionally labeled with appropriate graphic symbols (and in words for local systems).

000 DF Commander MK2 - Client			- 🗆 ×
≡ мар	BEARING MONITOR	SETUP General Status OK	
GENERAL	DF Systems	DF System Info	
DF SYSTEMS	Server Location:	System GPS Antenna OK OFF OK	
TRIANGULATORS	CREATE DELETE	System Message: OK	
MAP	STABERHUK Local	System Name: STABERHUK Radio Horizon: 35.10 km Antenna Orientation: ()	0.00° (True North)
REMOTE SERVERS	MARIENLEUCHTE	Position: 54*24.124'N 11°18.666'E Altitude: 40.00 m Variation: Position: 54*24.124'N 11°18.666'E Altitude: 40.00 m Variation: Position Source: Manual Input Course over Ground: undefined Speed over Ground:	15.00° W undefined
SBS	WESTERMARKELSDORF	True Heading: 0.00° Magnetic Heading: 15.00° Antenna Type:	RT-1000-VTS
	West-BRM BREMEN_S 😤	SYSTEM SETUP GPS SETUP ANTENNA SETUP ADD CHANNEL DELETE CHANNEL	
	South-BRM BREMEN_S #	DF Channels	
	East-BRM BREMEN_S 😽	Channel Name: Frequency: True Bearing: Status: Current IP: Current Por 60024 156.800 MHz Rack Num: DF Type: Soule(h: Level: Device Message	SETUP
	HEILHAF_1 Heiligenhafen-Traf 😽	1 RT-500-M 40 % 60 % OK (Bearing Mode)	
	HEILHAF_2 Heiligenhafen-Traf 🏼 🌮	Channel Name: Frequency: True Bearing: Status: Current IP: Current Product Product 60025 121.500 MHz Image: Comparison of the status Image: Comparison of the status	t: SETUP

Figure 65: Remote servers on DF SYSTEMS setup page

Checking on the MONITORING page

Switch to the monitoring page by pressing the "MONITORING" button. The local and remote systems are sorted one below the other in a scrolling view. None of the control LEDs should light up red.

00 DF Commander MK2	- Client			- 🗆 ×
≡	МАР В	EARING MONITORING	SETUP General Status OK	
GENERAL ST	ATUS MONITOR	RING DF CHANNEI	EL MONITORING	
General Status Ger OK OK	ieral Message:			
Local BRE	MEN_S Heilig OK	jeen-Traf		
General Server Status OK	DETAILS	SERVER Local		Local
Triangulators TravemuTraffic OK	DF System STABERHUK OK	Internal Devices Gps Antenna OFF OK	DF Channels 60024 60025 OK OK	
	DF System MARIENLEUCHTE OK	Internal Devices Gps Antenna OFF OK	DF Channels 60026 60027 OK OK	
	DF System WESTESDORF	Internal Devices Gps Antenna OFF OK	DF Channels 60028 60029 OK OK	
General Server Status OK		SERVER BREMEN_S	127	7.0.0.1:9090
Triangulators Bremen-Traffic OK	DF System West-BRM OK	Internal Devices Gps Antenna OFF OK	DF Channels DISTRESS DSC DSC-Red OK OFF	
	DF System South-BRM OK	Internal Devices Gps Antenna OFF OK	DF Channels DISTRESS DSC OK OK	
	DF System East-BRM OK	Internal Devices Gps Antenna OFF OK	DF Channels DISTRESS DSC	
General Server Status OK	DETAILS	SERVER Heiligenhafen	1-Traf 192.168	66.90:9999
Triangulators Heiligenhafen OK	DF System HEILHAF_2 OK	Internal Devices Gps Antenna OFF OK	DF Channels CH16 OK	
	DF System HEILHAF_1 OK	Internal Devices Gps Antenna OFF OK	DF Channels CH16	

Figure 66: Remote (and local) servers on the monitoring page

Checking on the MAP page

To do this, switch to the MAP and navigate to the positions of the (local and remote) DF systems. The bearings and triangulation results (if applicable) must appear on the map view. Only the local server's triangulation results show the intersection polygons (cross-section of the bearing cones) centered on the triangulation result. The triangulation display from the remote servers only shows the results without the intersection polygons.





As a reminder, the triangulation results that are outside the sector blanking polygons (configurable in SETUP -> TRIANGULATORS) are not calculated and displayed as is the case in the upper image for triangulation on the local server at 156.800 MHz (in blue color).

3.6.3 Redundant Servers

The software offers a possibility to define one server as redundant for the other. This is often necessary for installations on critical locations to avoid system failures during monitoring. Or if the main server must be shut down for maintenance, a redundant server can

step in at any time.

A prerequisite for the correct functioning of the redundant server in the event of the failure of the primary server is that the configuration of both servers is completely identical. Only the names of the systems/channels may differ for better visibility.

- 1. Set up the hardware for the redundant server and install a "DF Commander MK2 Server" application on a separate PC.
- 2. Adopt the settings of the systems and their channels in the software exactly as it is set up on the primary server (for which it is currently being set up).
- 3. Add the redundant server as a remote server in the DF Commander MK2 application of the surveillance PC.

After the connection of the server, it should look like in the following picture: all LEDs are green.

00 DF Commander MK2 - Cli	ent							- 🗆	×	
≡ м4	P BEARING	MONITORING	SETUP			General S	tatus	08:56:10	3	
								22 14101 202		
GENERAL	Remote Servers Set	up								
DE SYSTEMS			Remote Status	Remote N	lessage:					
	ADD REM	ADD REMOTE SERVER			ок					
TRIANGULATORS	Remote Servers									
MAP	Server Name:		Status:			Current IP:		Current Port:		
	В	REMEN_S	ОК	TCP TIME OUT	DATA DEV	127.0.0).1	9090		
REMOTE SERVERS	Host Name:	ST_267	Device Message:							
000	Redundant for server:	31-207	Server Connectio	n Control:						
SBS			ON			OFF	D	ELETE		
	Server Name:		Status:			Current IP:		Current Port:		
	Heilig	jenhafen-Traf	OK	TCP TIME OUT	DATA DEV	192.168.6	6.90	9999		
	Host Name:		Device Message:			,				
	W10-6	4-Services	ОК							
	Redundant for server:	_	Server Connectio	n Control:		OFF	D	FLETE		
									_	
	Server Name:		Status:			Current IP:		Current Port:		
	Host Name	REM_RED	OK Device Message:	TCP OUT	DATA DEV	192.168.6	6.91	9090		
	vbo	xw10-1	OK							
	Redundant for server:		Server Connectio	n Control:						
		▼	ON			OFF	D	ELETE		

Figure 68: Adding the redundant server to remote servers list

4. The newly added remote server must now be defined as a redundant server. In the "Redundant for server" drop-down menu, select the primary server that is to be replaced in the event of a failure.

Server Name:		Status: OK	тср	TIME	DATA	DEV	Current IP: 192.168.6	6.91	Current Port: 9090
Host Name: vboxw10-1		Device Message OK	:						
Redundant for server:	Server Connecti Of	on Co N	ntrol:			OFF	D	ELETE	
BREMEN S Heiligenhafen-Traf	•								

Figure 69: Define the redundant and primary servers

5. The redundant server is graphically marked as such and is now "online" in the waiting state, i.e. its data will be ignored until a failure occurs, which is additionally explained by the device message.

BREM_RED OK TCP OUT DATA DEV 192.168.66.91 9	090				
Host Name: Device Message:					
vboxw10-1 OK, Redundant Server is in standby					
Redundant for server: Server Connection Control:					
BREMEN_S V ON OFF DELET					

Figure 70: The redundant server is arranged

On the MONITORING page the redundant server is shown empty, only its status data is displayed.

00 DF Commander	MK2 - Client					– 🗆 ×
≡	МАР	BEARING	MONITORING	SETUP	General Status OK	10:58:40 22 Mar 2023
GENERA	L STATUS MONITO	ORING	DF CHANNE	L MONITORING		
General Status OK	General Message: OK					
Local OK	BREMEN_S He	iligeen-Traf BR	em_red OK			
General Server St OK	DETAILS	SERVER	Heiligenhafen	-Traf	192.168.66	5.90:9999
Triangulators Heiligenhafen OK	DF System HEILHAF_2 OK	Internal Devic Gps OFF	es Antenna OK	DF Channels CH16 OK		
	DF System HEILHAF_1 OK	Internal Devic Gps OFF	es Antenna OK	DF Channels CH16 OK		
General Server St	atus DETAILS	SERVER	BREM_RED		192.168.66	5.91:9090

Figure 71: Indication of the redundant server on monitoring page

The following generally applies to the server redundancy concept in DF Commander MK2:

- Any server inside the remote servers list can be defined as a redundant server.
- More than one servers can be defined as redundant for the same primary server.
- If the primary server changes to ERROR state, the next free redundant server takes over the operation instead of the defective server.
- The remote status changes the current state to WARNING.

Remote Servers Setup		
	Remote Status	Remote Message:
ADD REMOTE SERVER	WARNING	One or more Redundant Servers are active!

Figure 72: The remote status is in warning state

- If the redundant server is out of function, the second redundant server takes over the operation.
- If the redundant server malfunctions (while the primary server is functioning properly), its status changes to ERROR. The remote status changes to WARNING.
- If a defective server can not be replaced by a redundant server, then the remote status goes to ERROR.
- If the defective server works again, its settings are taken from the corresponding redundant server. The remote status returns to OK.

3.7 Self Bearing Suppression

The Self Bearing Suppression (SBS) function is used to suppress the bearing indication while the RF signal is being transmitted from the ground transmitter station, e.g., while a tower controller is speaking to an aircraft. This function is also called Ground Transmitter Suppression (GTS).

To ensure this function, the hardware must be set up first.

The so-called PTT module is used to connect the push-to-talk button of the ground transmitter to the PC with installed DF Commander MK2 software (please refer to "User Manual PTT Module").

Then the appropriate software setup is required to connect the PTT module to the direction finder and ensure the SBS function with the desired parameters.

To configure the software for self-bearing suppression the following steps are required.

GENERAL	Self Bearing Suppression						
DF SYSTEMS	Status: OFF	Current I TCP TIME DATA DEV	P:	Current Port:	New IP:	New	Port:
TRIANGULATORS	Device Messag Device is di	e: sabled by user.			CONNECT DI	SCONNECT OF	N OFF
МАР	Hold Time: 300 ms		SET <				
LOCAL SERVER	100 ms		< SET <				
REMOTE SERVERS	DIO 0 UNDEF	Source Name PTT Contact 0	Suppressed Frequency				
SBS 🕨	DIO 1 Source Name UNDEF PTT Contact 1		Suppressed Frequency ALL FREQUENC	ON CIES	DI/O ACT		
	DIO 2 UNDEF	Source Name PTT Contact 2	Suppressed Frequency ALL FREQUENC		P		
	DIO 3 UNDEF	Source Name PTT Contact 3	Suppressed Frequency ALL FREQUENC				18
	DIO 4 UNDEF	Source Name PTT Contact 4	Suppressed Frequency ALL FREQUENC	ON CIES	TO REMOTE I	8xDI/0	
	DIO 5 UNDEF	Source Name PTT Contact 5	Suppressed Frequency ALL FREQUENC	ON CIES			
	DIO 6 UNDEF	Source Name PTT Contact 6	Suppressed Frequency ALL FREQUENC		DIGITAL I/O		
	DIO 7 UNDEF	Source Name PTT Contact 7	Suppressed Frequency ALL FREQUENC				

1. Go to the "SETUP" page and select "SBS".

Figure 73: Self Bearing Suppression Setup

 Connect the DF Commander to the PTT module: Press "ON", if status is "OFF", enter the IP address of the PTT module in the "New IP" field and the TCP port in the "New Port" field and press "CONNECT". The result should look like this:

Self Bearing Suppression										
Status:	us: Current IP: Currer		Current Port:	New IP:		New Po	ort:			
ОК	ТСР	TIME OUT	DATA	DEV	192.168.77.56	9500	192.168.77.56		9500	
Device Message	2:									
ОК				CONNECT	DISCONNECT	ON	OFF			

Figure 74: SBS setup connection established

In the event of an error see Chapter 4 Status Displays.

3. Set the SBS hold time.

Hold Time:			
300 ms	< SET <	0 ms	▼

Figure 75: SBS Hold Time setting

In practice, ground transmitters continue to transmit the RF signal for a certain time after the push-to-talk button is released (switch-off delay).

This setting is used to avoid an unwanted bearing indication to the ground transmitter during this "switch-off delay" time.

When the push-to-talk button is released (so that the DIO contact is no longer in the "low" state/connected to ground), the bearing suppression of the corresponding frequency remains active for a delay defined by the "Hold Time".

Hold time is set to 300 ms per default.

To change this setting, select the desired value in the drop-down menu and press "< SET <".

4. Set the sampling time.

Sampling Time:		
50 ms	< SET <	•
		(

Figure 76: SBS Sampling Time setting

The sampling time defines the periodicity in which DF Commander MK2 requests the status information of the inputs of the PTT module (status of the push-to-talk buttons).

This setting has a direct impact on the reaction to pressing of the push-to-talk button. If sampling time is set to e.g., 500 ms, in the worst case the bearing indication is only suppressed after 500 ms, i.e. the direction finder shows the bearing to the ground transmitter station for 500 ms. This looks like a brief deflection of the bearing arrow (signal-beam) from the aircraft/ship to the ground station.

If the tower controller wants then to check the last bearing, which should be the bearing to an aircraft/ship, by pressing the "Repeat" button, this is not possible because the last bearing is overwritten with the bearing to the ground transmitter.

Sampling time is set to 50 ms per default.

To change this setting, select the desired value in the drop-down menu and press "<SET<".

5. Configure the appropriate DIO(s) of the PTT module.



Figure 77: DIO setup

The push-to-talk button is connected to a certain DIO (digital input/output) of the PTT module. In this step, each DIO, that has a connection should be set up to enable proper SBS function.

1	DIO State LED	Shows the state of the correspondent DIO. The LED can take the following states:			
		OFF	The OFF state indicates that the actual input/output of the PTT module is in the "high" state (not connected to ground). If the push-to talk button is connected properly, this state means that the button is currently not pressed. The physical connection to the device is still maintained, even if the SBS function is not activated. This can be used to check the correctness of the hardware setup.		
		ACTIVE	The ACTIVE state indicates that the actual input/output of the PTT module is in the "low" state. If the hardware setup is correct, this means that push-to-talk button is currently pressed.		
		UNDEF	The UNDEF state indicates that the actual input/output state of the PTT module is unknown. This is the case, when the TCP/IP connection is interrupted or the device is disabled by user.		
2	2 Source Name This text input field allows the assignment of specific name to the DIO source. The default name indicate number of the physical push-to-talk contact (DIO number of the PTT module).				
		To chang dialog sh	ge the name, click into the text field. Following nows up:		
		010 Source N	lame — 🗆 X		
		PTT Cont	act 0		
			OK CANCEL		
		Enter the name an	e new name by overwriting the current source d press "OK".		
3	Suppressed Frequency	This inpu frequenc suppress	It field allows the assignment of a specific y (or maritime channel), which must be sed when the connected push-to-talk button is		

		1							
		pressed. It transmitter The defaul FREQUEN input field.	is also suppre t value ICIES". The fre	possible ession of of "Supp To chai equency	e to act n all fre pressec nge this input d	ivate th quencie d Freques value, ialog ap	e grour es. ency" is click ir opears:	nd s "ALL ito the	
		00 Frequency I	nput —] [010 Frequency Ir	iput —	- ×	7
		Current Freque	ency [MHz]:			Current Channe	: :		
		New Frequenc	y [MHz]:			New Channel:			
								S/C	
		SUPPRES	S ALL FREQ	UENCIES		SUPPRES	S ALL FREQ	UENCIES	
		Freq	Chnl	Del		Freq	Chnl	Del	
		7							
		4	5	6		4	5	6	
		1	2	3		1	2	3	
			0			C			
		Esc	С			Esc	o		
		Enter the ne MHz, or act by clicking t "SUPPRES FREQUENC "OK".	ew freque ivate all f he butto S ALL CIES", ar	ency in Trequencie n nd press	Ent es nur dup mu To pre	ter the ma nber. If th olex chan st be sele do this, p ss "OK".	aritime V ne VHF (nel, Ship ected ac press "S/	HF char channel i o or Coa cordingly C". Ther	inel s a st '. i
4	Checkbox "ON"	This check the corresp This mean level on the immediatel receives the module it co of all chann	box act bonding s that if e corres y (depe e inforr bccurred nels op	ivates the DIO. the PT sponding ending of nation of and su erating of of this DI(he Self T modu g DIO, t on the " on which on which on the s O.	Bearing the detect the DF Samplir n input of es the b suppres	y Suppl cts a lo Comma og Time of the F bearing sed fre	ression w volta ander M " settin TT indicat quency	at ge 1K2 g) tion

Short explanation of an example:

In this example the push-to-talk button is connected to DIO 2 of the PTT module. The ground transmitter has the name "Ground Control 1" with the frequency of 121.975 MHz. The SBS function is activated.

DIO 0	Source Name	Suppressed Frequency	ON	
OFF	PTT Contact 0	ALL FREQUENCIES		ETHLEMET RESET ()V-V+
DIO 1	Source Name	Suppressed Frequency	ON	STATUS Saov m
OFF	PTT Contact 1	ALL FREQUENCIES		
DIO 2	Source Name	Suppressed Frequency	ON	POWER
ACTIVE	Ground Control 1	121.975 MHz	\checkmark	•
DIO 3	Source Name	Suppressed Frequency	ON	Brainboxes www.brainboxes.com
OFF	PTT Contact 3	ALL FREQUENCIES		
DIO 4	Source Name	Suppressed Frequency	ON	TO 8xDI/0
OFF	PTT Contact 4	ALL FREQUENCIES		DEMOTE 1/0
DIO 5	Source Name	Suppressed Frequency	ON	REMOTE I/O
OFF	PTT Contact 5	ALL FREQUENCIES		
DIO 6	Source Name	Suppressed Frequency	ON	
OFF	PTT Contact 6	ALL FREQUENCIES		
DIO 7	Source Name	Suppressed Frequency	ON	040 7 040 6 040 6 040 2 040 2 040 2 040 2 040 2 040 2 040 2
OFF	PTT Contact 7	ALL FREQUENCIES		

Figure 78: SBS Example

The DIO state LED is "ACTIVE", which means that the tower control operator is currently speaking, the push-to-talk button of the ground transmitter is pressed.

The picture of the PTT module is displayed on the right side. This image represents the actual DIOs state of the hardware when it's properly set up. The "DIGITAL I/O" LEDs of the PTT module are shining green if the PTT buttons are not pressed. When a button is pressed, the corresponding pin LED turns off.

Consequently, the DIO 2 of the PTT module is in the "low" state and DF Commander suppresses the bearing indication on all channels with the frequency of 121.975 MHz.

4 Status Displays

All modules that require a network connection have a detailed status display. In the following, the display elements are described in detail on the basis of a bearing channel.



Figure 79: Status displays

1	General Status LED / General State LED	Shows the general status of a network device (e.g. bearing channel or GPS receiver). The LED can take the following states:				
		OFF	The data of the device are not utilized. Errors are ignored and not forwarded. The module can be deactivated by pressing the "OFF" button. The connection to the device can still be maintained. Disabling a device can be beneficial during a device repair or replacement. For example, no overall system error of a bearing system is generated while a bearing channel is exchanged.			
		ERROR	The device is in error state. It cannot serve its purpose. For example, a bearing channel cannot determine bearing values.			
		WARNING	The device can still do its job, but with limitations. Warning is also issued when a device is not operating within its specified conditions. For example, an operating temperature has been exceeded or the operating voltage has fallen dangerously below the specified value.			
		ОК	The device works perfectly.			
2	TCP LED	Indicates whether a TCP/IP connection to the device exists. Lights up red when there is no connection. Flashes yellow / red when trying to establish a connection. Green - the connection is established.				

3	TIMEOUT LED	The TIMEOUT LED lights up red when no data is being sent cyclically by the device. Green - data arrives cyclically.
4	DATA LED	The DATA LED indicates whether the data coming from the device is valid.
5	DEV LED	The DEV LED indicates whether the device itself issues an error or warning. Lights up red when the device issues an error message. Lights up yellow when the device issues a warning. Green – no errors.
6	Device Message	The bar displays the error status in plain text.
7	Current IP address	No input possible
8	Current TCP port	No input possible
9	New IP address	The new IP address is to be entered here.
10	New TCP port	The new TCP port is to be entered here.
11	CONNECT	Button for establishing the connection with the device
12	DISCONNECT	Button for closing the connection with the device
13	ON	Activating the device Data and status from the device are to be evaluated.
14	OFF	"Software" - Deactivating the device Data and status from the device should not be evaluated.

Examples based on a DF channel in a DF system:

Status:					Current IP:	Current Port:	New IP:	New Port:		
OFF	ТСР	TIME OUT	DATA	DEV	127.0.0.1	60010	127.	60010		
Device Message:										
DF Channel is disabled by user.						CONNECT	DISCONNECT	ON	OFF	

The bearing channel is deactivated. It may be that the TCP/IP connection is established, but the actual error status is unclear.

Status: Current IP: Current Port:							New IP:	New Port:		
ERRC	ERROR TCP TIME DATA DEV 127.0.0.1					60010				
Device Message:										
Disconnected						CONNECT	DISCONNECT	ON	OFF	

There is no connection to the DF channel.

Possible cause of error:

- CONNECT has not been pressed.

Status: Current IP: Current Port:							New IP:	New Port:		
ERROR	TCP	TIME OUT	DATA	DEV	127.0.0.1	60010	127.	60010		
Device Message:										
Connecting to 127.0.0.1:60010						CONNECT	DISCONNECT	ON	OFF	

An attempt is made to establish a connection to the IP address 127.0.0.1 and port 60010, but without success.

Possible cause of error:

- The TCP/IP server of the device does not work.
- There is no LAN connection to the device.

		New IP:	New Port:				
	T DATA DEV	127.0.0.1	60010	127.0	60010		
Device Message:							
Data Timeout: Chan	nel produce	CONNECT	DISCONNECT	ON	OFF		

The TCP/IP connection is established, but the device is not producing any data.

Such behavior can occur when a DF channel consists of two components. For example, a RT-1000 DF channel generates a RS-232 data stream that is fed to a serial to LAN converter. The converter assumes the role of a server to which a connection is established. Possible cause of error for devices using serial to LAN converters:

- The source of the serial data is switched off (DF channel is off, but not the serial to LAN

- converter).
 The serial line between the device and the serial to LAN converter is interrupted (no physical connection).
- The baud rate in the device is set incorrectly.
- The serial port settings in the serial to LAN converter are incorrect.

ERROR TCP TIME OUT DATA DEV 127.0.0.1 60010 127.0.0.1 600 Device Message:	Status: Current IP: Current Port:							Current Port:	New IP:	New Port:	
Device Message:	ERROR	т	ТСР	TIME OUT	DATA	DEV	127.0.0.1	60010	127.	60010	
	Device Message:										
Bad Data! Not a RT-1000 data format. CONNECT DISCONNECT ON	Bad Data! Not a RT-1000 data format.						CONNECT	DISCONNECT	ON	OFF	

A TCP/IP connection is established.

The device sends data cyclically.

However, the data is not intended for the set device. In this case, data from an RT-1000 bearing channel is expected according to the RT-1000 data protocol. The incoming data cannot be evaluated.

Possible causes of error:

- The connection was established to an incorrect device (e.g. to a GPS device or to another DF system).
- The protocol setting of the bearing channel is wrong (e.g. RT-1000 protocol was set, although RT-500-M protocol is desired).

Status:				Current Port:	New IP:	New Port:			
ERROR	ТСР	TIME OUT DATA	DEV	127.0.0.1	60010	127.	60010		
Device Message:									
Error 01: AU No Receiver						CONNECT	DISCONNECT	ON	OFF

A TCP/IP connection is established.

The device sends data cyclically.

The data is valid.

However, the device itself produces an error. To find the cause of the error, the documentation of the respective system must be consulted.

In this example, a connection was established with an RT-500-M device. It reports an error: "Error 01: AU No Receiver". According to the RT-500-M system documentation, the receiver in the Antenna Unit has failed.

Status: Current IP: Current Port:						Current Port:	New IP:	New Port:	
WARNING	ТСР	TIME OUT	DATA	DEV	127.0.0.1	60010	127.	60010	
Device Message:									
Warning 02: No Compass Found						CONNECT	DISCONNECT	ON	OFF

A TCP/IP connection is established.

The device sends data cyclically.

The data is valid.

However, the device itself produces a warning. To find the cause of the warning, the documentation of the respective system must be consulted.

In this example, a connection is established with an RT-500-M device. It reports a warning: "Warning 02: No Compass Found". Without a compass connection, the bearing system can only determine relative bearing values – no north-related bearing values. Accordingly, it works with limitations.

Status: Current IP: Current Port:							New IP:	New Port:		
ОК	тср	TIME OUT	DATA	DEV	127.0.0.1	60010	127.	60010		
Device Message:										
ОК						CONNECT	DISCONNECT	ON	OFF	

In this case, the TCP/IP connection, as well as the cyclic data are valid and correct. The system is expected to function properly.

5 Monitoring Page

The Monitoring page is used for the technical monitoring of all configured DF systems and their channels. Configuration is not possible here.

According to requirements, it can be chosen between two views of the monitoring page.

5.1 General Status Monitoring

"General Status Monitoring" offers the status data of all servers (local and remote), their systems and triangulators, defined by LEDs.

If general status LED is in ERROR or WARNING state, this page is the quickest way to find the cause of the problem, as all statuses are visible at a glance.



Figure 80: Monitoring page / general status monitoring

5.2 System Details

If more information about specific servers is needed on the General Status Monitoring page, there is also a possibility to view more detailed information.

To do this, click the "DETAILS" button next to the server name.



Figure 81: Monitoring page / setup details of a specific server

1	<u>General Status LED and General Message</u> Displays the combined status of all DF systems. As soon as a bearing system or a bearing channel reports an error, the state of the LED also changes to error. A plain text message is displayed accordingly.
2	System status LED bar Contains the status LEDs of individual bearing systems in one bar. Since the bars are always displayed at the top, it is possible to see at a glance which system has a fault. Click on an LED to go to the corresponding system.
3	System data display Displays all current data of the respective bearing system.
4	Status LED of the system with the corresponding plain text message In the event of an error, the plain text message can assist in troubleshooting.
5	<u>DF channel list</u> Displays all configured bearing channels of the respective system. All relevant information is displayed for each channel. The status display is particularly important for troubleshooting. See Chapter 4 "Status Displays" for details.

5.3 DF Channel Monitoring

The DF Channel Monitoring is a good tool to monitor all configured channels simultaneously. The status information and some main settings are displayed on this page.

The receiving situation can be monitored particularly well, since it is immediately apparent on which channel, at which frequency a bearing (degrees and signal level) is currently being received.

All channels are displayed in a scrollable list view.

000 DF Commander MK2 - C	lient										- 0	×
≡ №	1AP BEARI	ING MONITOR	ING SETUP						Gene	ral Status		
										ОК	23 Mar 2023	
GENERAL STA	TUS MONITORING	DF (CHANNEL MONITORING									
General Status Gener	ral Message:											
ок ок												
		T (
Server Name:	System Name:	Channel Name:	Frequency:	Level:		Status		Current IP:	Port:	Device Message:		
Local	STABERHUK	60024	156.800 MHz	-98 dBm	31.0	ок	TCP TIME DATA DEV	127.0.0.1	60024	OK		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status		Current IP:	Port:	Device Message:		
Local	STABERHUK	60025	121.500 MHz	-114 dBm	348.0	ОК	TCP OUT DATA DEV	127.0.0.1	60025	OK		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status		Current IP:	Port:	Device Message:		
Local	MARIENLEUCHTE	60026	156.600 MHz	- <u>40 ap</u> m	64.0		OUT DATA DEV	127.0.0.1	60026	UK		
Conver Name	Sustem Name	Channel Namer	Francosu	Lavalı	тр.	Status		Current ID:	Dort	Davice Message		
Local	MARIENLEUCHTE	60027	121.500 MHz	-114 dBm	1.0	OK	TCP TIME DATA DEV	127.0.0.1	60027	OK		
										я		
Server Name:	System Name:	Channel Name:	Frequency:	Level:		Status		Current IP:	Port:	Device Message:		
Local	WESTESDORF	60028	156.800 MHz	-98 dBm	96.0	ок	TCP TIME DATA DEV	127.0.0.1	60028	ОК		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status	TIME	Current IP:	Port:	Device Message:		
Local	WESTESDORF	60029	121.500 MHz	-114 dBm	58.0	ОК	TCP OUT DATA DEV	127.0.0.1	60029	OK		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status		Current IP:	Port:	Device Message:		
Heiugennalen-Trai		Спю	150.800 MHZ	-114 dbm	524.0		OUT DAIN DEV	127.0.0.1	60017	UK		
Server Name	System Name	Chappel Name	Frequency	Level:	TR·	Status		Current IP:	Port	Device Message		
Heiligenhafen-Traf	HEILHAF_1	CH16	156.800 MHz	-114 dBm	358.0	ОК	TCP TIME DATA DEV	127.0.0.1	60016	OK		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status		Current IP:	Port:	Device Message:		
BREMEN_S	West-BRM	DISTRESS	156.800 MHz	-114 dBm	25.0	ок	TCP TIME DATA DEV	192.168.66.90	60010	ОК		
Server Name:	System Name:	Channel Name:	Frequency:	Level:	TB:	Status		Current IP:	Port:	Device Message:		
BREMEN_S	West-BRM	DSC	156.525 MHz	-114 dBm	97.0	ОК	TCP OUT DATA DEV	192.168.66.90	60011	ОК		

Figure 82: Monitoring page / DF channel monitoring

The page provides a way to select a single server (or multiple specific servers) to view. Within the server status LED is a checkbox that can be activated to choose only the channels of this particular server to display. The channels of the unselected servers are hidden in this case.

000 DF Commander MK2 - Client			– 🗆 X
■ MAP BEARING MONITORING	SETUP		General Status 14:44:58 OK 23 Mar 2023
GENERAL STATUS MONITORING DF CHANNEL	MONITORING		
General Status General Message:			
OK			
Local BREMEN_S Helligeen-Traf BREM_RED OK OK OK OK OK			
Server Name: System Name: Channel Name: Frequency:	Level: TB:	Status Current IP:	Port: Device Message:
Heiligenhafen-Traf HEILHAF_2 CH16 156.	800 MHz -115 dBm 324.0	OK TCP TIME DATA DEV 127.0.0.1	60017 OK
Server Name: System Name: Channel Name: Frequency:	Level:	Status Current IP:	Port: Device Message:
Heiligenhafen-Traf HEILHAF_1 CH16 156.	800 MHz -108 dBm 358.0	OK TCP TIME DATA DEV 127.0.0.1	60016 OK

Figure 83: Monitoring page / DF channel monitoring of one server
6 Bearing Page

The Bearing page allows the display of bearing results and signal levels of selected bearing channels on a compass rose. This view is used to support the navigators and the technical system monitoring.

The Bearing page can be opened on a separate monitor in an independent window. This makes it possible, for example, to have the monitoring page open on one screen and several bearing pages open on another screen in order to monitor certain bearing channels from a nautical/navigator or air traffic controller/pilot's point of view.



Figure 84: Bearing page

1	Selection of the system
2	Selection of the bearing channel
3	<u>Operating mode indication</u> The operating mode can be set under SETUP/DF SYSTEMS, channel setup.
4	<u>"REPEAT" button</u> Pressing the REPEAT button displays the last bearing as long as the button is held. A current bearing naturally takes precedence over the repeat display.
5	<u>Frequency setting in MHz</u> See Figure 38: Input in MHz and Figure 39: Input as VHF channel

6	<u>Frequency setting via the favorites list</u> See Figure 40: Entry from the favorites list.
7	<u>Display of the current frequency</u> In the case of a marine band frequency, a corresponding VHF channel is displayed with Ship or Coast identification, if applicable.
8	<u>Level display</u> The scale of the level display can be reconfigured. Thus level displays in %, dBm, dBµV and dBµV/m are possible.
9	Squelch setting Use the mouse to move the control element to the desired value and release. The squelch is set to the desired value. The squelch setting is limited to reasonable values.
10	Bearing rose The numbers of the bearing rose refer to the central bearing display (point 11). If "TRUE" is set in the central display, the numbers also correspond to TRUE bearing. The bearing rose can be rotated (see point 13). If the Bearing page is used by an ATC or VTS navigator, the bearing rose can be rotated so that the upper number corresponds to the window viewing direction. This allows the operator to visually follow the displayed arrow and potentially see a vessel or aircraft directly.
11	<u>Central bearing display</u> A bearing value is displayed here in the corresponding reference. In the current display, the reference is set to "TRUE". This means that the numerical value corresponds to the "True bearing". Press the reference to set another reference. The following references are possible: RELATIVE, MAGNETIC, TRUE, QDM, QDR, QTE, QUJ.
12	<u>"NEW WINDOW" button</u> Opens the Bearing page in a separate window.
13	<u>"CONFIGURE" button</u> Opens the configuration window for the Bearing page. The configuration refers to all open bearing windows.
14	<u>Runway display</u> A runway can also be displayed on the bearing rose to give the tower controller better orientation (see point 13).

Press "CONFIGURE" to open the configuration window.

000 DFCommanderMK2Client			-		×
Level Scale					
Level Scale Min: Level Scale Max: Squel -140 -50 -80 0 100 % -14050 dBm -3	ch Limit: 30 60 dBuV	dBm ▼			
Compass Rose					
Comp	ass Rose Direction:				
2 <u> </u>	60	Manual 🔻			
Runway					
3 Runw	ay Orientation Angle: 90	APPLY	V RUNW	AY ON/C	DFF
Colors					
4	Central Display:	LOAD DEFAULT			
Bearing Indication Hold Time					
5 5 sec. ▼					

Figure 85: Bearing page configuration window

1	Level display settings In the upper line the level display can be adjusted flexibly. Define the minimum, maximum and limit for the squelch setting. Select the unit. The following units are possible: %, dBm, dBμV, dBμV/m. Press "APPLY" to accept the level display configuration. In the second line "scale hotkeys" are available. They allow a quick adjustment of the level display scale with already preset conceivable values.
2	<u>Rotation of the bearing rose</u> Move the slider or enter the value of the alignment of the bearing rose directly and press "APPLY".
3	<u>Runway setting</u> Define a runway orientation angle in degrees, and switch on the indication by checking the "RUNWAY ON/OFF" box.
4	<u>Color setting</u> In this menu you can set colors for the values and the arrow, for the background, for the compass rose and the background of the central bearing display. Press the corresponding rectangle and select the color. The color is applied immediately. Press "LOAD DEFAULT" to return to the default color settings.
5	Bearing Indication Hold Time / afterglow time of the arrow and the values When the radio signal is no longer received, the bearing is still displayed in light grey. After this afterglow time the display disappears. The value "Infinite" means that the values are displayed until a new bearing is determined.



7 MAP Page

Figure 86: Map display

1	Sidebar control element Press the control element to open the sidebar which contains relevant data regarding the indication on map. The relevant information can be opened in corresponding windows, that are bound to the map and are only visible in the map.
2	<u>Right mouse button</u> Press the right mouse button and "Copy Coordinate". This copies the current coordinates of the mouse to the clipboard. They can be inserted anywhere, e.g. in a text editor.
3	<u>Open in Window</u> Press this button to open the map view in a separate window. Only one window is possible.
4	<u>Map Control</u> Press this button to open the map control element.
5	<u>GPS Notation</u> Press "GPS Notation" to set the GPS format. This function has exactly the same effect as the setting in General setup. See Chapter 3.1.3 "GPS Format".
6	<u>Coordinates</u> Shows the GPS coordinates of the current mouse position on map.

8 COSPAS-SARSAT Scan & Decode / Marine Scan

The DF Commander MK2 supports COSPAS-SARSAT scan as well as the graphic display of COSPAS-SARSAT signals.

The actual COSPAS-SATSAT scan, detection and decoding is done by the direction finding system. DF Commander MK2 application only represents the data.

8.1 COSPAS-SARSAT Scan / Marine Scan

To use the COSPAS-SARSAT or Marine scan function, first set the COSPAS-SARSAT or Marine scan mode on the direction finding system and then in the DF Commander software. The scan modes are set under channel setup menu, with the "Operating Mode" setting (SETUP / DF SYSTEMS / DF Channel SETUP).

NOTE:

For the exact scan / decode behavior please refer to the user manual of the DF system in use.

8.2 COSPAS-SARSAT Decode

To use the COSPAS-SARSAT decode function, first set the COSPAS-SARSAT decode mode on the direction finding system. Then go to SETUP / DF SYSTEMS / DF Channel SETUP and select the "Cpss Decode Mode" on the corresponding DF channel.

010 DF Channel	Setup									-		×
DF Channel Id:												
2a20461f-e84	le-405	5e-84	0e-7d	6437	74fe49							
Status:					Current IP:		Current Port:	New IP:			New Po	ort:
ОК		TIME	DATA		192	2.168.66.193	9999					
Device Message	:											
ОК								CONNECT	DISCONN	IECT		
Protocol Type:												
RT-500-M												
Channel Name:						New Channel Name:					TRU	
CH16					< SET <			J I				
Channel Rack N	umber:	:			/ CET /	New Channel Rack Nur	mber:					
v												
Squelch Level:						New Squelch Level [dB	im]:					
18 %	-12	8 dB	m					LEVEL:	11 %	-133	dBm	
						Cpss Scan						
				406	5.025 MI	Cpss Decode Made		EDIT FREQU	ENCY		ORITE	
Operating Mode	2:					Marine Scan						
Bearing Mode											CLC	

Figure 87: Switching to COSPAS-SARSAT Decode Mode in DF channel

When a COSPAS-SARSAT beacon is detected, it is shown on the map at the decoded position with the corresponding beacon ID.



Figure 88: Decoding DF system with the bearing line to the CP-SS beacon

The DF system, which detects and decodes the COSPAS-SARSAT data, shows this on map by blinking "CPSS RECEIVED" and drawing bearing line(s) to the beacon position(s), if the position data is contained in the COSPAS-SARSAT message.

If the position data is not contained, the beacon ID appears in the list of the COSPAS-

SARSAT beacons, but the bearing line to the beacon is then not available.

The list of detected beacons can be viewed in the sidebar of the map.

To show the details to the specific beacon, click on it in the beacons list.

D	F Systems	Triangulation	CP-SS List	
C B	ospas Sars eacons List	at t		
	2034	1500BF81FE0 Last Signal: 00:26:25	Ŷ	
	UTC:	2023-03-	28T13:25:23.546Z	
	Latitude:		43°31.933'N	
	Longitude:		1°25.517'E	
	Country:		Norway	
	Protocol Id:		National Location	
	Self Test:		False	
	System Name:		HEILHAF_1	
	DF Latitude:		54°22.882'N	
	DF Longitude:		10°56.126'E	
"	Channel Name:		CH16	
	Frequency:		406.025 MHz	
	DF True Bearing:		undefined	
	2024	F72524FFBFF		
	1	Last Signal: 00:00:04	°	
	2024	F72525FFBFF		
		Last Signal: 00:14:43	^	

Figure 89: Cospas-Sarsat beacons list with opened details of a specific beacon

8.3 COSPAS-SARSAT Files

The COSPAS-SARSAT files are located in a separate folder, in the configuration files directory, which is opened in SETUP / GENERAL by clicking on the "OPEN DIRECTORY" button.

The files of the individual decoded beacons are sorted in the separate folders.

NOTE:

The files of the COSPAS-SARSAT beacons are never deleted, even if the "CLEAR" button is operated.

Should it be desired to delete these files, it must be done manually in the files directory.

9 Limitations

Some additional limitations must be paid attention to.

RT-500-M Antenna Unit RT-600 Antenna Unit RT-600 Antenna Unit	Only one DF Channel can be connected to the Antenna Unit at a time.
RT-500-M DCU	Only one DF Channel can be connected to the RT-500-M DCU at a time when using COSPAS-SARSAT Decode Mode, if revision of RT-500-M DCU is [Rev 3.06] or less.
Local Server TCP Port	Limited to ports available on the used machine. If chosen TCP port is already in use, TCP Server cannot be started.
COSPAS-SARSAT	Storage of COSPAS-SARSAT messages is limited to 5000 messages per beacon. If more messages are received, the oldest ones are deleted.
MAP page	"Open in Window" button is limited to opening only 1 new window.

Table 1: General Limitations

10 Installation

NOTE:

Please make sure your personal firewall or virus & malware protection is configured not to block the installation of the "DF Commander MK2" software.

NOTE:

If the user changes or replaces the dynamic link libraries, RHOTHETA Elektronik GmbH no longer accepts liability for the functionality of the entire software. This voids the warranty.

10.1 Minimum PC and Network Requirements

NOTE:

If the text is not visible in the dialogs of the DF Commander MK2, the font "Cantarell" must be configured on your PC.

Minimum PC and network requirements				
Operating systems:	Windows 10 or higher (64 Bit) Linux RHEL 8.4 (64 Bit)	Windows 10 or higher (64 Bit) Linux RHEL 8.4 (64 Bit)		
Processor:	Intel Core i5 (5 th Gen) or AMD Ryzen 5			
Hard Disk:	500 GB			
Memory:	16 GB RAM			
Interfaces:	1 x RJ45 (LAN), interfaces for mouse and keyboard			
Monitor resolution:	Minimum: Recommended:	1024 x 768 1280 x 1024		

	 Protocol: RHOTHETA DF Standard JSON Protocol Data content: Active bearing on all channels (bearing update every 250 ms) Active trinagulation on all different frequencies if possible Network Layer: TCP 				
	Data rates for <u>one</u>	<u>client</u> connected to integ	grated server:		
Minimum required network bandwidth for integrated	Total number of DF Channels	Average*	Max. Peak**		
Server.	1	25 kBit / s	150 kBit / s		
	3	75 kBit / s	500 kBit / s		
	6	150 kBit / s	800 kBit / s		
	12	300 kBit / s	1500 kBit / s		
	18	450 kBit / s	2500 kBit / s		
	24	600 kBit / s	5500 kBit / s		
	*Average is the minimum data rate which must be provided by network (This data rate was measured in a period of 60 seconds) ** Max_Peak is the data rate measured with the max_hold method whithin				
	100 ms time slot ove	er a period of 5 minutes.	ne max. noid method whithin		
Preinstalled Software	Adobe Acrobat Re	ader (Not older than 201	6)		
	Table 2: Minimu	m PC requirements			

10.2 Installation in Windows

Double click on the delivered installer:

DFCommanderMK2-Server-X.XX-xxx-xxxxxxxxx-Installer.exe or

• DFCommanderMK2-Client-X.XX-xxx-xxxxxxxxx-Installer.exe

and follow the subsequent instructions.

It is recommended to install the software into the user home directory: e.g.:

C: Users max.mustermann DFCommanderMK2-Server

The executable file is:

- DFCommanderMK2-Client.exe **or**
- DFCommanderMK2-Server.exe

To remove the program, run maintenancetool.exe, which is located in the same folder.

10.3 Installation in Linux

```
Unpack the delivered tarball, e.g.:
DFCommanderMK2-Server-X.XX.tar.gz
```

into the user home directory:

tar xzf DFCommanderMK2-Server--X.XX.tar.gz

To run the program, start.sh must be called up on the command line: cd DFCommanderMK2 ./start.sh

10.4 Licensing

After starting the software, you will be prompted to enter the credentials. Fill out the form, if necessary, select a network interface from the list, read and confirm the agreements. At the end of the process the license key must be entered. To get a license key, copy the data from the last window (or save it in a file) and send it to RHOTHETA. Depending on the ordered options, RHOTHETA will generate a specific license key.

If you already own a DF Commander MK2 application and only want to expand it with additional options, please contact RHOTHETA.

A new license key can be entered via folding menu in the left upper corner by selecting "About", and using the same procedure as described above.

11 Abbreviations

Term:	Definition:
ATC	Air Traffic Control
VTS	Vessel Traffic Service
DF	Direction Finder, Direction Finding System
HMI	Human Machine Interface
ID	Identification
IP	Internet Protocol
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
SAR	Search And Rescue
System	In the context of the DF Commander a "system" is an antenna with at
	least one direction finder.
PTT	Push-To-Talk
GTS	Ground Transmitter Suppression
SBS	Self Bearing Suppression
VTS	Vessel Traffic Service

Table 3: Terms and Abbreviations

12 Notes