

Datawell GPS Buoy Finder Type 4A Manual

from serial no.: 41226



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1 Introduction

Welcome to the Buoy Finder 4A manual.

The Datawell Buoy Finder 4A is designed to facilitate the retrieval of lost or drifting Datawell buoys. The Buoy Finder 4A is based on the RX-C Waverider receiver but is enhanced for more reliable decoding of the GPS position. The Buoy Finder 4A uses a splash water resistive housing.

The Buoy Finder 4A is an advanced HF link portable receiver that can receive all Datawell Waverider buoys using the HXV or HVA transmission format. The HXV format is transmitted by the MkI, MkII and MkIII generations of buoys. The MkIII generation includes the WR-SG, the DWR-MkIII and the DWR-G. The HVA format is transmitted by the “4-series” generation of buoys. This includes the DWR4 and the GPS-DWR4. This manual covers Buoy Finder 4A’s from the serial number shown on the cover. Older Buoy Finder 4’s do not support the HVA format and are not covered in this manual. It’s possible however to upgrade your Buoy Finder 4 to a Buoy Finder 4A.

The new Buoy Finder 4A is equipped with synthesizer tuning which makes it possible to tune exactly into a buoy frequency without the need to change the receiving crystal. Also up to 6 buoy frequencies can be stored into its memory.

In Chapters 2 and 3 of this manual the installation and operation of the Buoy Finder 4A are described. Chapter 4 is about battery replacement and troubleshooting in case of bad or no reception while Chapter 5 contains the specifications of the Buoy Finder 4A. Finally the Datawell contact addresses can be found in Appendix A.

Important: check if the Buoy Finder 4A is compliant with the buoy you want to receive.

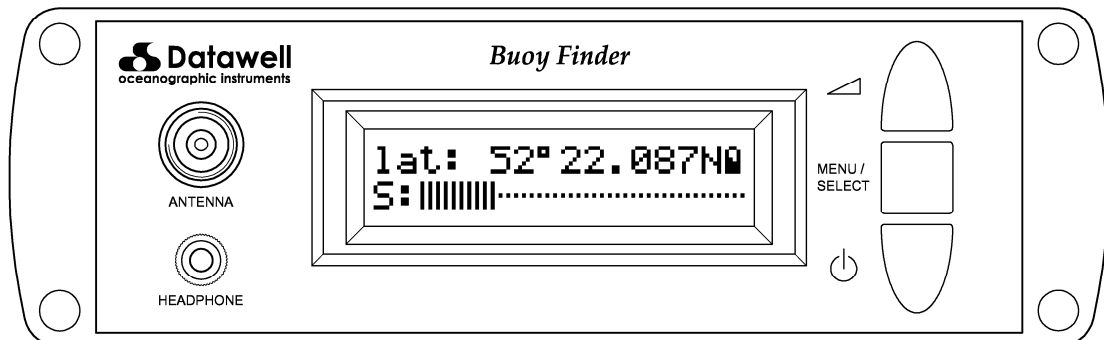
Check receiver mode:

HXV mode for DWR MKII, III, DWR-G and WR-SG

HVA mode for DWR4

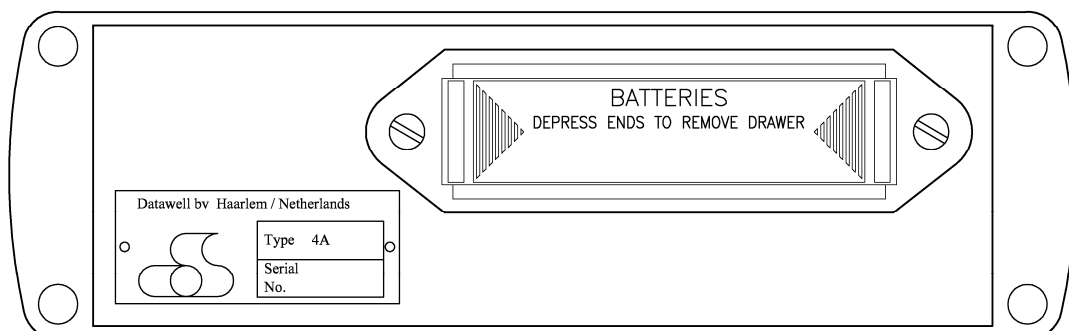
See chapter 3.6.3

2 Front- and back-panel layout



The front panel of the Buoy Finder 4A contains the following components:

- Antenna connector.
- Headphone connector.
- LCD (liquid crystal display).
- Up / volume switch (▲).
- Menu / select switch (■).
- Down / on/off switch (▼).



The back panel contains the battery compartment and the serial number plate.

3 Operation

This chapter describes the operation and programming of the Buoy Finder 4A. It is assumed that the receiver is connected properly to an antenna. Information on how to replace the batteries can be found in Chapter 4.

3.1 Antenna

The Buoy Finder 4A comes with a small whip antenna. This antenna is designed for outdoor use only. It will not or badly work inside a building or a boat. If the Buoy Finder 4A is to be used indoors or on a location with bad reception, the antenna should be relocated by using a coaxial cable and a magnetic antenna foot. These are available as an option. Contact Datawell sales for more details.

3.2 Power switch

Pushing the “power” button once will switch the Buoy Finder 4A on. Holding this button will switch it off, unless the menu is activated. After power up, the receiver will be trying to receive a buoy¹, which can be seen on the LCD display showing the “synchroni zi ng” message.

If the buoy frequency matches the receive frequency the receiver will respond as described in Paragraph 3.4. If the receive frequency does not match the buoy’s transmission frequency the Buoy Finder 4A should first be set to the transmit frequency of the buoy. This will be explained in Paragraph 3.6, which also treats the other functions of the menu.

3.3 Display

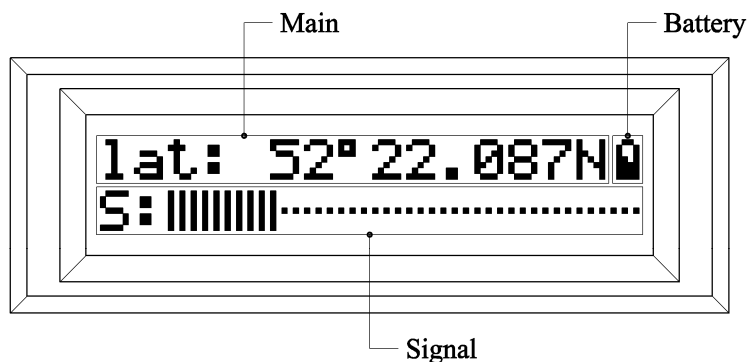


Figure 3.1. The three sections of the Buoy Finder 4A display in decode mode.

The operational screen of the Buoy Finder 4A is divided in 4 sections:

- **Main**
The main section shows synchronization state, the heave, GPS position, age of GPS position (HXV mode) or UTC time of last GPS position (HVA mode), the volume of the speaker, error messages or the “hold for menu” message, depending on the current operating mode.

¹ At power up its receive frequency is the last receive frequency which was stored into the non volatile memory of the Buoy Finder 4A, see also the **note** at the end of paragraph 3.7.3.

- **Signal**
The signal section shows the signal strength of the received buoy in logarithmic scale. A full-scale deflection of the bar graph corresponds with an input signal of -50 dBm or more, an empty bar graph corresponds with an input signal of -90 dBm or less. For signals weaker than -90 dBm the audio signal should be used to get an indication of the signal strength of the input signal.
- **Battery**
The battery indication shows the status of the batteries.
■ indicates full batteries, ■ almost empty batteries.

3.4 Buoy Finder 4A display messages

The following paragraphs describe the behaviour of the receiver and the meaning of the messages in the main part of the display. After power up, the receiver is set to synchronize mode.

Synchronization

At start-up or after signal loss, the Buoy Finder 4A will try to lock in to a buoy signal. The synchronization process is necessary to make sure that the receiver is properly aligned to the RF-signal and to the vector boundaries of the buoy's data pattern. The synchronization process is indicated by two messages on the receiver's display:

- | | |
|--------------------------|---|
| "synchroni zi ng" | The receiver has lost vector synchronization and is waiting for a valid sync-word to indicate the beginning of a new frame. |
| "checki ng sync" | The receiver has reached vector synchronization and is currently double-checking the vector boundary's. |

Normally, after power up or loss of signal, the receiver will display "synchroni zi ng" for some time and then will display "checki ng sync". After the Buoy Finder 4A has double checked the vector synchronization it will search for a GPS position and display the heave. If a valid GPS position is found, the Buoy Finder 4A will also show this position.

NOTE:

The process of synchronization can take anything between 30 seconds to several minutes. The time needed to reach frame-synchronization depends on several factors like signal strength, interference, noise bursts and type of buoy. During the synchronization it is possible that the message switches several times between "synchroni zi ng" and "checki ng sync".

If synchronization has been established some of the received data will be displayed in the main part of the display.

3.4.1 Gps messages

The GPS position is displayed in the three messages, one for latitude:

lat: DD°MM.FFFH

- H:** N for northern hemisphere, S for southern hemisphere
- DD:** 0-90 degrees.
- MM:** 0-59 minutes
- FFF:** 0-999 1/1000 minutes.

example: lat: 52°22.080N

one for longitude:

lon: DD°MM.FFFH

H: E for eastern hemisphere, W for western hemisphere

DDD: 0-180 degrees.

MM: 0-59 minutes

FFF: 0-999 1/1000 minutes.

example: lon: 4°37.190E

and one for the age of the position (HXV mode) or UTC time of last position (HVA mode):

fix=DD mins old (HXV mode)

DD: 0-99 minutes.

fix=HH:MM UTC (HVA mode)

HH: 0-24 hours.

DD: 0-59 minutes.

The Buoy Finder 4A continuously searches for newer GPS positions in the incoming data. When a new GPS position is found, the position is updated.

In HXV mode, the time elapsed (“age”) of the received buoy position is displayed in minutes. The age is referenced to the beginning of the transmission. It is not referenced to the time of acquisition. Please refer to the manual of the buoy for the time of acquisition relative to the start of a transmission. Normally, because a new position is sent every 30 minutes and receiving a position takes 4-6 minutes, the age of the position does not exceed 36 minutes. If the age of the last found position exceeds 60 minutes, the Buoy Finder 4A removes this position from its memory and will not show it anymore.

In HVA mode, the UTC time of the last received position is given. The GPS position fix will be updated every 10 minutes.

3.4.2 Heave

The momentary heave that is received is also displayed between the messages of the GPS position and continuously when the receiver has not yet received a GPS position.

The format is:

heave: DDDD cm

DDDD:0-9999 cm.




3.4.3 Bit errors

When a vector (64 bit data part) is received with errors, the receiver shows the message:

bad vector

3.5 Speaker

The speaker is mainly used to get an indication of the signal quality. A 1500 Hz frequency modulated beat-note should be heard against a clean background (none or clean noise without any sign of interference or noise bursts).




The volume of the speaker can be adjusted by pressing the  switch when you are not in the menu mode and then the  or  buttons.

3.6 Menu functions and programming


The Buoy Finder 4A receiver is fitted with a built in user interface. This user interface is used to adjust the receive frequency to a buoy frequency, to store and to recall up to six preset buoy reception frequencies and to monitor received signal characteristics.


The following paragraphs describe how to navigate through the menu functions.

The buttons used in the menu are (see also chapter 2):

- the up / volume button, indicated by a  ;
- the menu / select button, indicated by a  ;
- the down / on/off button, indicated by a .

3.6.1 Activating the menu function

To activate the menu function², push the “” button and the LCD shows the “hold for menu” message in its “main” area.

After a few seconds of holding the “” button the display text changes from the receive mode text into the following menu text:

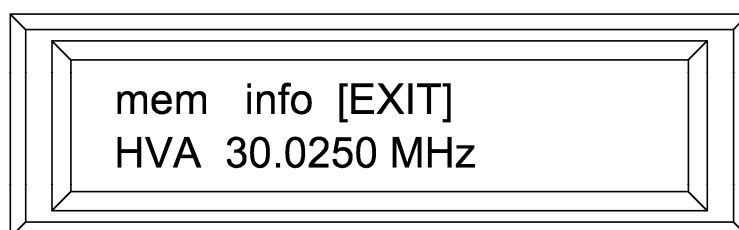





Figure 3.2. The menu function mode with the function EXIT selected.

From here we are able to access the memory and info functions, to change the receive frequency and / or to go back to the “receive mode” display text by using the “”, “” and “” buttons.

² Entering the menu function does not influence the receiving and the decoding functions of the Buoy Finder 4A, the receiver will continue to update the decoded position data.

3.6.2 Menu structure and control

We will first show how the menus are organised:

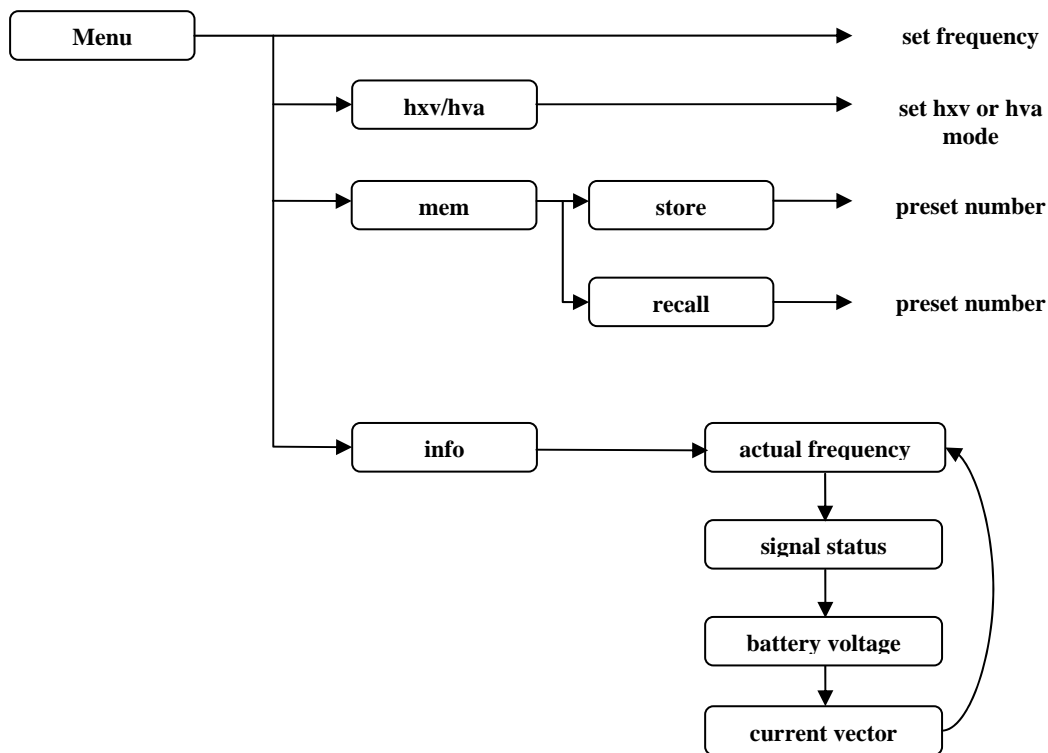


Figure 3.3. Organization of the menu structure.

By using the “▲”, “■” and “▼” buttons we are able to control the menu functions. The menu starting screen is depicted in *figure 3.2*. The **exit** function is highlighted by using capitals and brackets “[EXIT]”.

If we now would push the “■” (= select) button the **exit** function is activated and we would leave the menu and return to the normal receive mode screen of *figure 3.1*.

Pressing the “▼” knob once will select the **hxv** or **hva** mode function. We have to press the select button “■” to change between the two receiver modes. This submenu will be explained in *paragraph 3.6.3*.

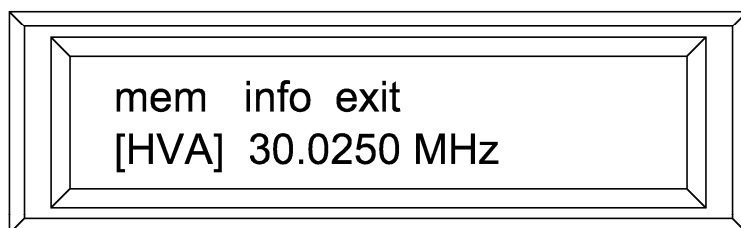


Figure 3.4. Selection of HXV or HVA mode function

Pressing the “▼” knob again will select the second digit (steps of one MHz,) of the **frequency adjustment** function, this is depicted in *figure 3.5* with an underlined number “0”:

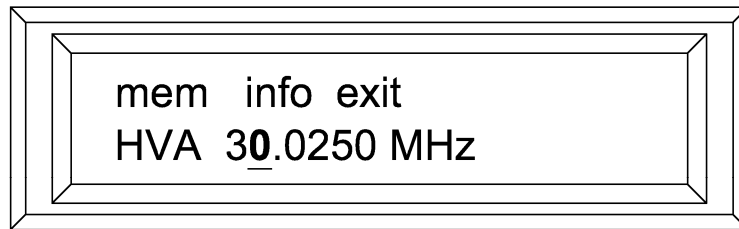
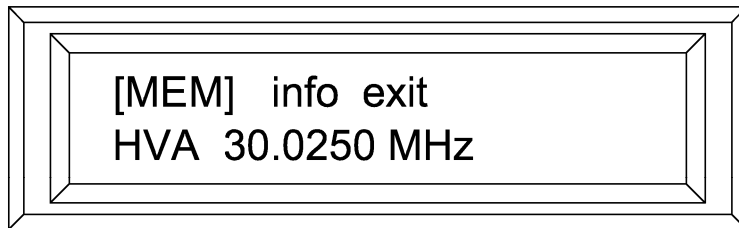


Figure 3.5. Selection of the 1 MHz steps digit of the frequency change function indicated by an underlined number 0.

Selecting and deselecting the digit is done with the “■” button, selecting the other digits is possible pressing the “▼” knob for the next digit (or function) or pressing the “▲” knob for the former digit (or function).

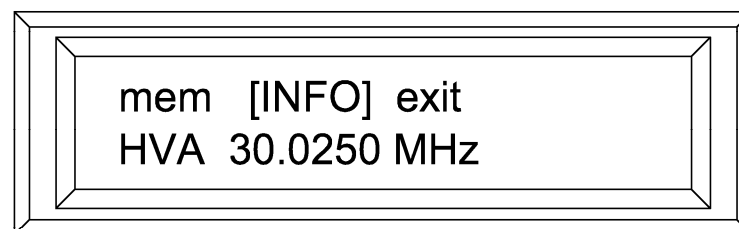
For example, when starting from the clean menu screen of *figure 3.2* we have to press the “▼” button six times or the “▲” knob two times to select the **mem** (memory) function as is shown in *figure 3.6*.



*Figure 3.6. Selection of the **mem** (= memory) function.*

We have to press the select button “■” to enter the **mem** submenu. This submenu will be explained in *paragraph 3.6.5*.

To select the **info** function from the menu screen of *figure 3.3* with [EXIT] selected we have to press the “▲” knob one time or the “▼” button seven times. The selected **info** submenu is shown in *figure 3.7*:



*Figure 3.7. Selection of the **info** function.*

Pressing the select button “■” now brings us into the **info** submenu. This submenu will be explained in *paragraph 3.6.6*.

The next subparagraphs will describe the control and monitoring functions in the menu in detail with a step by step approach.

3.6.3 Changing the receiver mode

The Buoy Finder 4A can receive data in the HXV format and in the HVA format. The HXV format is transmitted by the MkI, MkII and MkIII generations of buoys. The MkIII generation includes the WR-SG, the DWR-MkIII and the DWR-G. The HVA format is transmitted by the “4-series” generation of buoys. This includes the DWR4 and the GPS-DWR4.

To change the receiver mode, select the “hxv” or “hva” menu item on the top menu. Press the ■ button to change the receiver mode. Possible choices are HXV and HVA.

To save the new receiver mode to non-volatile memory, be sure to properly exit the top menu.

3.6.4 Changing the frequency

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds, *figure 3.2*.
- Step 2.** Press the “▼” button once so that the second digit (thus in steps of one MHz) of the frequency is selected for adjustment, *figure 3.4*.
- Step 3.** Select the one MHz step digit by pressing the “■” button, the digit now starts blinking and the speaker will be switched on so that the signal on the current frequency can be heard.
- Step 4.** Press the “▼” or “▲” button until the digit matches with the transmit frequency.
- Step 5.** Deselect the digit by pressing the “■” button, the digit now stops blinking and the speaker will be switched off.
- Step 6.** Proceed with selecting and changing the next digits (in 100 kHz, 10 kHz, 1 kHz, 100 Hz steps) by using the “▼” or “▲” buttons and following the procedure as described for the first digit in the **steps 3, 4 and 5**.
- Step 7.** Use the “▼” or “▲” buttons to go back to the **exit** menu (*figure 3.2*) and press the “■” button to go back to the normal receive mode or proceed with the **mem** or **info** submenu, for instance for storing the current frequency into a preset (described in *paragraph 3.6.5*).

Note:

The frequency change will be stored in non volatile memory only when you have gone back from the **menu** mode (*figure 3.2*) into the **receive** mode (*figure 3.1*) after this procedure !!!

3.6.5 Memory functions

There are two functions in the memory submenu, namely the store function in which a frequency can be stored into a preset, and the recall function which can recall an already stored preset.

Storing a frequency into a preset

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 2.** Make sure that the frequency in the display (*figure 3.2*) is the frequency which you want to be stored into a preset. If not adjust the frequency displayed as described in *paragraph 3.6.3*.

Step 3. Press the “▲” button twice so that the **mem** submenu is selected (*figure 3.6*).

Step 4. Push the “■” button and the memory submenu is shown (*figure 3.8*).

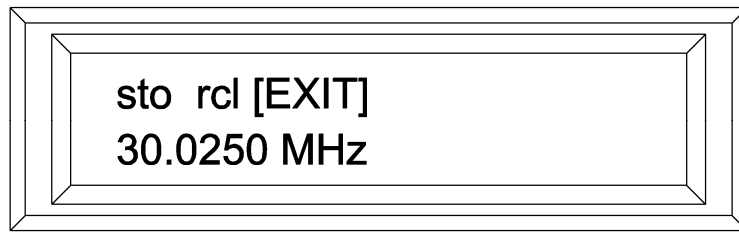


Figure 3.8. Display from the mem submenu.

Step 5. Select the **sto** (store) function by pressing the “▼” button once (*figure 3.9*).

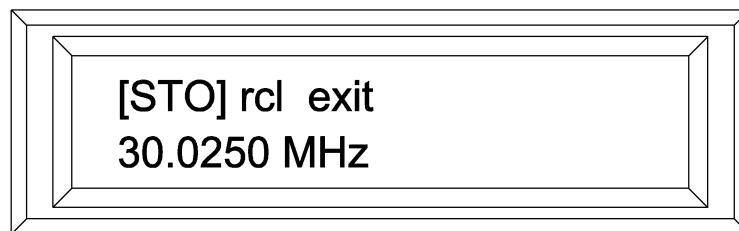


Figure 3.9. Selecting the store function in the mem submenu.

Step 6. Press the “■” button to enter the store preset menu (*figure 3.10*).

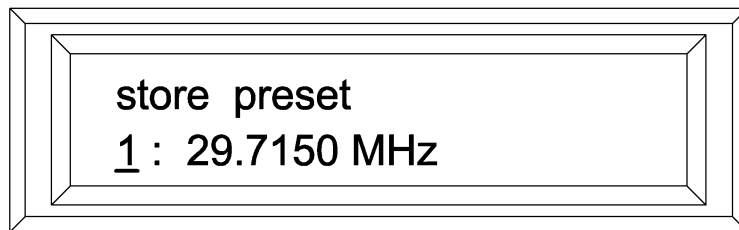


Figure 3.10. The store preset display.

Step 7. Proceed with selecting the preset number (in *figure 3.9* indicated with the underlined 1) by using the “▼” or “▲” buttons. Up to six preset frequencies can be stored.

Step 8. Use the “■” button to confirm your selection of the preset number. The old preset value will be overwritten and the display from *figure 3.11* will be shown for two seconds before returning to the main menu of *figure 3.2*.

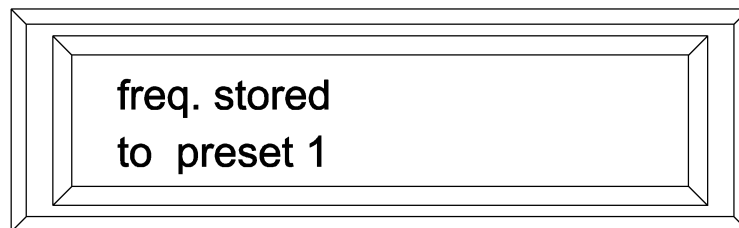


Figure 3.11. Message after confirming a preset store command.

Step 9. Go back to the normal display of *figure 3.1* by pressing the “■” button in order to save the stored preset(s) into non volatile memory.

Recalling a frequency from a preset

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 2.** Press the “▲” button twice so that the **mem** submenu is selected (*figure 3.7*).
- Step 3.** Hit the “■” select button and the memory submenu is shown (*figure 3.9*).
- Step 4.** Select the **rcl** (recall) function by pressing the “▲” button once (*figure 3.12*).

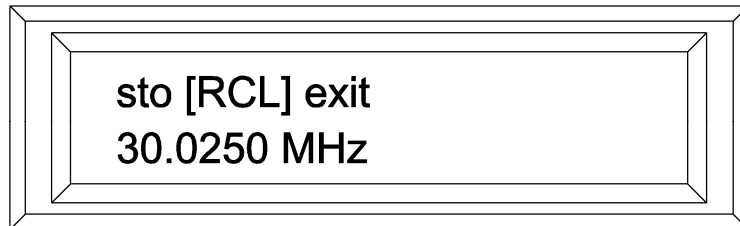


Figure 3.12. Selecting the recall function in the mem submenu.

- Step 5.** Press the “■” button to enter the recall preset menu (*figure 3.13*).



Figure 3.13. The recall preset display.

- Step 6.** Proceed with selecting the preset number (in *figure 3.13* indicated with the underlined 3) by using the “▼” or “▲” buttons. Up to six preset frequencies can be selected.
- Step 7.** Use the “■” button to confirm your selection of the preset number. Now the display from *figure 3.14* will be shown for two seconds before returning to the main menu of *figure 3.2*.

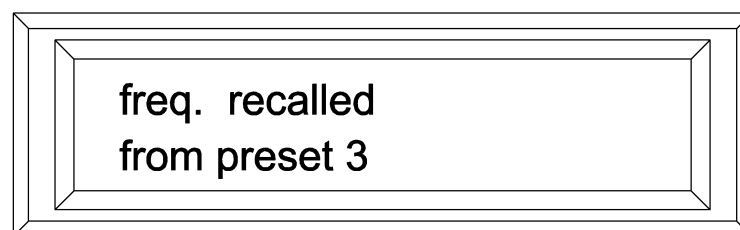


Figure 3.14. Message after confirming a preset recall command.

- Step 8.** Go back to the normal display of *figure 3.1* by pressing the “■” button.

3.6.6 Info functions and signal quality monitoring

Four displays with parameters from the receiver can be displayed, namely the actual receive frequency, the signal status, the battery status and the current vector. These will be described below.

Actual frequency display

The actual frequency display shows the frequency to which the receiver is tuned with a resolution of 1 Hz. This information might be valuable when troubleshooting.

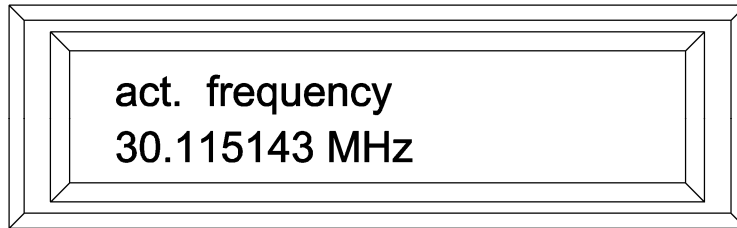


Figure 3.15. Displaying the actual receive frequency.

The actual frequency display can be accessed as follows:

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 2.** Press the “▲” button once so that the **info** submenu is selected (*figure 3.7*).
- Step 3.** Hit the “■” select button and the actual frequency is shown (*figure 3.15*).
- Step 4.** Press the “■” button twice to return to the normal receive mode display of *figure 3.1*.

Signal status display

The signal status display gives us an average Frame Error Rate (FER)³ and Instantaneous Frequency Deviation (IFD). The FER gives us an indication of the quality of the received signal, while the IFD might be used in the case when strong RF interferers mess up the received signal. Their purpose is thus mainly for troubleshooting.

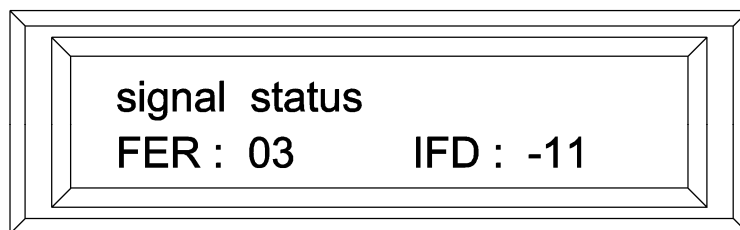


Figure 3.16. Displaying the signal status, the frame error rate (FER) is 3 %, the instantaneous frequency deviation is -11 Hz.

³ The FER is averaged over 128 frames, thus over 100 seconds. The FER is the percentage of frames which contain an error.

The signal status display can be accessed as follows:

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 2.** Press the “▲” button once so that the **info** submenu is selected (*figure 3.7*).
- Step 3.** Hit the “■” button and the actual frequency is shown (*figure 3.15*).
- Step 4.** Press the “▼” button once and the signal status is shown (*figure 3.16*).
- Step 5.** Pressing the “■” button twice returns you to the normal receive mode display of *figure 3.1*.

Battery status display

The battery status display shows the voltage of the batteries. If the voltage is 2.1 V or less the receiver will only work for some hours.

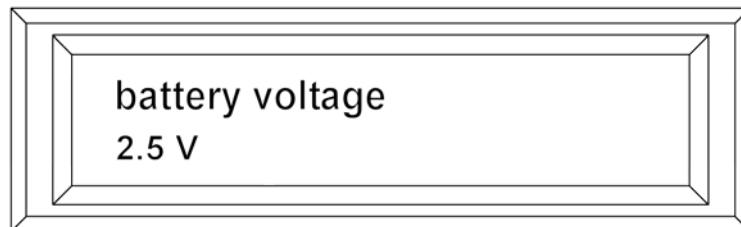


Figure 3.17. Displaying the battery voltage.

The battery status display can be accessed as follows:

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 1.** Press the “▲” button once so that the **info** submenu is selected (*figure 3.7*).
- Step 2.** Hit the “■” button and the actual frequency is shown (*figure 3.15*).
- Step 3.** Press the “▼” button twice and the battery voltage is shown (*figure 3.17*).
- Step 4.** Pressing the “■” button twice returns you to the normal receive mode display of *figure 3.1*.

Current vector display

The current vector display shows the last decoded vector. Those vectors contain the information received from the buoy such as the GPS position information of the buoy.

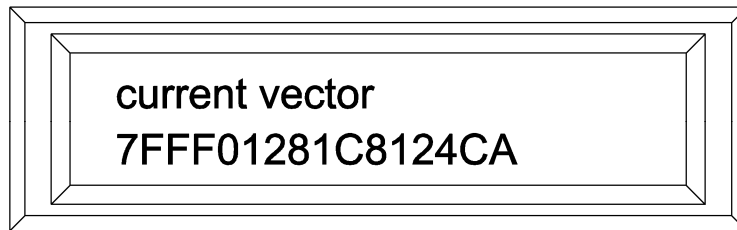


Figure 3.18. Displaying the current vector.

The current vector display can be accessed as follows:

- Step 1.** From the **receive** mode first enter the **menu** function by pressing the “■” button a few seconds.
- Step 2.** Press the “▲” button once so that the **info** submenu is selected (*figure 3.7*).
- Step 3.** Hit the “■” button and the actual frequency is shown (*figure 3.15*).
- Step 4.** Press the “▼” button three times and the current vectors are shown (*figure 3.18*).
- Step 5.** Pressing the “■” button twice returns you to the normal receive mode display of *figure 3.1*.

4 Battery replacement and troubleshooting

This section of the manual describes the steps you should take when you believe the Datawell Buoy Finder 4A is operating improperly or when the batteries are empty.

The instructions are divided into two categories:

- Battery power and replacement.
- Antenna, signal strength and noise.

If none of the steps described in those sections solve your problem, contact the Datawell Service Department listed at the end of this manual.

4.1 Battery power and replacement

The Buoy Finder 4A runs on four 1.5 V AA type batteries. The batteries are placed in the battery compartment at the back panel, see Chapter 2.

When the batteries are empty this is shown as follows:

The Buoy Finder 4A does nothing or switches off automatically after a short time.

Display is not lit, no audio is heard via the internal speaker when adjusting the speaker volume. If any of these signals is available, battery power is OK. If not, replace the batteries by simultaneously pulling and depressing the ends of the drawer containing the batteries.

The choice of batteries has a significant influence on the operating time. Therefore only alkaline types are recommended. Some alkaline batteries are designated as 'high-power' or 'high drain' types. These batteries are optimized to deliver their energy in a relatively short time span and are especially suitable for the Buoy Finder 4A.

NOTE:

The specified battery life is measured using alkaline batteries during continuous operation at room temperature. Low operating temperatures will shorten the battery life while interrupted usage (allowing the battery to 'recharge' it self) will lengthen the battery life.

4.2 Antenna, signal quality and noise

Faults in this area will typically give a working system, but with bad data, intermitted reception and/or lots of noise.

The Frame Error Rate (FER) as described in paragraph 3.6.6 gives an indication of the signal quality. A low number (00 ... 10 percent) indicates an excellent to acceptable reception quality. A percentage of 11 to 30 % indicates questionable signal quality with many errors while a FER above 30 % will bring the Buoy Finder 4A in the "synchronize mode" as described in paragraph 0.

The signal strength indicator (figure 3.1) gives a graphical indication of the received signal. No lit bar indicates a low signal level, and a full scale, indicates a high signal level, usually due to a short transmission path.

An occasional bad vector, indicated by a message on the display (figure 3.1, paragraph 3.4.3) is normal and no reason for concern. The same goes for an occasional "checking sync" messages. Only continuous flipping between "synchronizing" and "checking sync" means that the signal-to-noise or interference ratio is troublesome. Switch on the speaker (see paragraph 3.5) and listen to the signal. Normally only the beat-note (characteristic warbling sound) of the buoy signal accompanied by more or less noise should be audible.

If nothing is heard or in the case of a bad signal quality check antenna cabling for short or opens. Coaxial cables may also be damaged by sharp bends or twists. Look for mechanical damage or contamination of the antenna.

If the beat-note is heard together with another signal the bad reception is due to interference from other transmitters. Unfortunately things are crowded in the frequency range used by the buoy transmitter and the spectrum must be shared with other users. It is entirely possible that some frequencies are unusable in your vicinity due to other users. Try to shift to another frequency in cases of prolonged interference.

5 Specifications

RF front-end

Frequency range:	25.5 ... 35.5 MHz, other frequencies on request.
Tuning:	PLL synthesizer tuning.
Frequency accuracy:	± 100 Hz.
Usable sensitivity:	-116 dBm (0.5 μ V).
Dynamic range:	>60 dB. In practice this means that a signal differing 5 kHz or more with the buoy signal will do no harm at signal levels below -50 dBm.
Receiver bandwidth:	1.2 kHz RF bandwidth, 160 Hz BW in the DSP.
Antenna input:	Coaxial BNC, 50 Ω nominal input impedance.

Power Supply

Battery:	4 x 1.5 V penlite, type AA / LR6 / MN1500.
Consumption:	Power consumption approximately 600 mW.
Battery life:	≥ 10 hours using Duracell Ultra alkaline batteries, standby time approximate 1.5 years.

Digital backend

Link bit rate:	81.92 bits per second (HXV mode) 163.84 bits per second (HVA mode)
Type of modulation:	2FSK (HXV mode) 4FSK (HVA mode)
Display:	2 * 16 character liquid crystal display with backlight.

Output

Headphone output:	3.5 mm connector for 32 Ω or 300 Ω headphone.
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Environmental

Temperature range:	-10...+50 $^{\circ}$ C.
Relative humidity:	10...80% (non condensing).
Weight:	1.2 kg.
Dimensions:	170 x 55 x 225 mm (W x H x D, excluding switches and knobs).

Appendix A: Datawell Sales and Service Addresses

Sales:

Zomerluststraat 4
2012LM Haarlem
The Netherlands
Tel: +31 23 531 6053
Fax: +31 23 531 1986
E-mail: sales@datawell.nl

Service:

Voltastraat 3
1704RP Heerhugowaard
The Netherlands
Tel: +31 72 571 8219
Fax: +31 72 571 2950
E-mail: servdept@datawell.nl

www.datawell.nl