BPR 3001 READER

Copyright

Trademarks

BPR 3001 and BioTerm are trademarks of Biomark, Inc.

All other trademarks, trade names, or images mentioned herein belong to their respective owners.

FCC and IC digital device limitations

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Interference Statement (Part 15.105 (b))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

▪ Reorient or relocate the receiving antenna.
▪ Increase the separation between the equipment and receiver.
▪ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
▪ Consult the dealer or an experienced radio/TV technician for help.

FCC Part 15 Clause 15.21

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CE Marking

Hereby, Biomark declares that the BPR 3001, if used according to the instructions, is in compliance with the essential requirements and other relevant provisions of the Radio Equipment Directive (RED) 2014/53/EU. For use in all countries of the EU.

In case of alteration of the product, not agreed to by us, this declaration will lose its validity.

This symbol indicates proof of conformity to applicable European Eco-nomic Community Council directives and harmonized standards published in the official journal of the European Communities.

$C\epsilon$

The following antennas are approved to be used with this device:

- BPR 3001 Racket Antenna

Table of Contents

Table of Contents

1 Reader Overview

1.1 Product Description

The **BPR 3001** (Reader) is a handheld 134.2 kHz radio frequency identification (RFID) tag reader intended for use with animal tags. The BPR 3001 reader has been designed specifically for use in fish and wildlife research applications. Consequently, it is the most capable and versatile reader available today for this purpose. The BPR 3001 reader is well suited to handheld field and bench top use but also contains additional features to facilitate standalone remote monitoring applications.

The Reader features:

- High-performance ISO 11784/11785 FDX-B/HDX 134.2 kHz portable RFID reader with continuous scan mode and automatic antenna tuning

- Tag detection capabilities include ISO 11784/11785 compliant FDX-B and HDX, FDX-B Fastag, FDX-B BioTherm temperature sensing tags

- Internal memory storage capacity of 1 million tag IDs

- Visual and audible indication of tag detections

- Sophisticated data logging and diagnostic features

- Rugged drop resistant and IP67 waterproof housing

- Internal high-capacity lithium battery pack

- 4.3" backlit high-resolution color TFT LCD display

- GPS synchronized internal clock

- "Geotagging" of RFID tag detections option

- Bluetooth v4.2 compliant dual mode BR/EDR and BLE interface

- USB type C interface with Power Delivery (PD) support

- Field-upgradable reader firmware via USB port

- Detachable external antenna

- Built-in dual-angle desk stand

- Dual-purpose hand strap and belt loop

1.2 Illustrated Diagrams

1.2.1 Front Panel Diagram

Tag Reading Status

Antenna   **USB-C**

Battery Charge-, RFID-Reading- & Alarm LED (RGB)

Tag Read LED (white)

Battery Level & Charging Status

Current File & Number of Tags within

GPS Signal

Current and Previous Tag IDs

USB Status

Bluetooth Status

Date & Time

Alarm Indicator

Softkeys

Power/OK Button

Read Button

Directional Buttons

Screen display:
File: 1
Tags: 99
Standby
Unique mode: 1 min
72%
3E7.0000055D32
3D4.00000F4B2E
3E7.0000055D32
03/26/2025 / 16:58
Menu   Read   View Alarms

1.2.2 Reader Connectors Diagram

1.2.3 Folding Desk Stand Attached Diagram

1.2.4 Loop Antenna Diagram

1.3 Supplied Equipment

- Biomark BPR 3001 Unit, (the Reader)

- Biomark BPR 3001 Racket Antenna

- Fish-Shaped FDX-B RFID Key-Chain Test Tag

- USB-C 60W PD power supply,100-240V, 50-60Hz, 3.5hrs to charge flat battery

- 2m Antenna Cable

- 2m USB Cable

- Dual-purpose hand strap and belt loop

- Custom hard case

Please ensure you have received all the above equipment upon receipt of your new Reader.

1.4 Care and Maintenance

While the BPR 3001 Reader has been designed to be as rugged and durable as possible, please observe the following points to ensure your Reader provides many years of trouble-free service:

- Charge the battery before first using the Reader.

- For long-term storage it is recommended never to store the device with the battery fully charged. A SoC (State-of-Charge) of 40-50% is recommended to prolong battery life, when the reader is not used for a longer period of time.

- The protective caps should be fitted to the connectors whenever possible to protect them from corrosion, dust, and physical damage.

- Always properly tighten the locking collets on cables connected to the Reader to prevent moisture entering the connectors and damaging the contacts.

- If the Reader has become wet, ensure the connectors and their caps are dry before removing the cables and replacing the caps. This is to avoid "locking in" the moisture and causing corrosion damage to the contacts.

- If the Reader is exposed to salt water, rinse the entire unit with fresh water and dry it before removing the cables.

- Clean and dry the reader before putting it back into its carry case.

Note: *Water cannot enter the Reader through the connectors with or without the protective caps fitted, but the moisture could damage the terminals in the connectors.*

1.5 Updating Firmware

Updates may become available that either enhance the BPR 3001 reader's function or fix a known error. To successfully update the reader, please observe the following steps:

- Download the latest firmware from the Biomark homepage.

- Download and unzip the file.

- Connect the BPR 3001 to your computer via USB and start the executable firmware update file.

- There is one update file for the application firmware and another for the RFID part (called 'Exciter'). The updates can be done independently but it is recommended to always use the latest version for both.
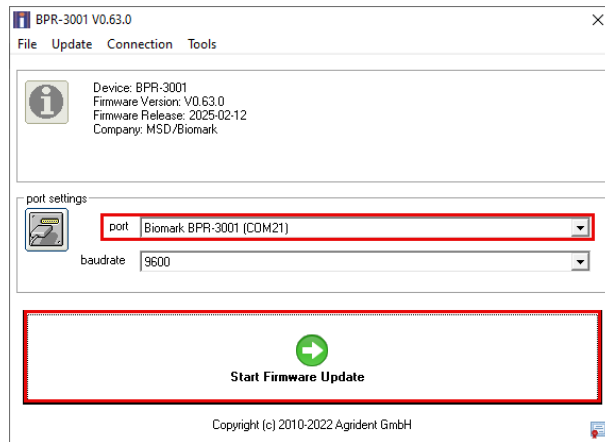
Select the BPR 3001 in from the 'port' drop-down menu (make sure the USB-Driver was installed before, otherwise the port will not display as 'Biomark BPR 3001').

The baud rate can be ignored for USB connections, it is automatically negotiated between the devices.

Click the button to start the update.
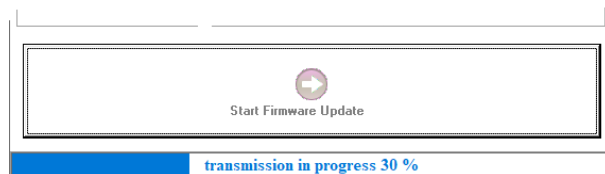
The transmission takes a few minutes and the progress is shown in the updater on the PC and on the BPRs display. Then the update is applied which takes another 30 seconds. The right LED is flashing yellow, red and finally green. Then the reader restarts with the new firmware.
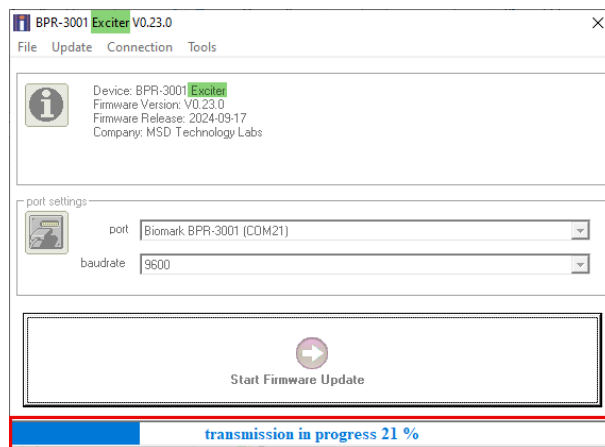
The 'Exciter' update works similar, but the transmission of the file is much faster because the firmware image is smaller.

It takes about a minute to transfer the update to the device and then to apply it. A progress bar appears on the BPR display for both processes.

After the update was applied, the new version displays. Press the right softkey. The reader will restart.

2 Getting Started

2.1 Switching the Reader on and off

The unit can be powered on by any of the following methods:

- Connecting the unit via USB (to the AC Adapter or USB port of a computer)

- Pressing and holding the OK button for more than 1 second

The unit can be powered off by pressing and holding the OK button for more than 1 second. A menu will pop up asking the user to confirm the shutdown.

Note: In the event of a firmware crash or Reader lockup, the unit can be forced Off by pressing and holding the OK button down for longer than 10 seconds.

2.2 Status Symbols

The status symbols are visible on the main screen only, also during RFID reading.

2.2.1 Battery Symbols

The battery symbol is displayed in the upper right corner.

Symbol	Meaning
	Battery capacity is higher than 80 percent.
	Capacity is between 60 and 80 percent.
	Capacity is between 40 and 60 percent.
	Capacity is between 20 and 40 percent (no charger connected → discharging)
	Capacity is between 10 and 20 percent (no charger connected → discharging), when flashing, capacity is lower than 11 percent.
	Capacity is between 20 and 40 percent (only green when charging).
	Capacity is between 10 and 20 percent (only green when charging).
	General charging error. There is a condition that prevents charging. Check the external power supply. If this error is shown repeatedly, the battery might not work correctly any longer and should be replaced.
	Charging not allowed because the battery temperature is outside the allowed range of 0°C to 45°C.

2.2.2 GPS Symbols

Symbol	Meaning
	No satellite signal received
	Fix on 1-3 satellites
	Fix on 4 satellites
	Fix on more than 4 satellites
12	The BPR 3001 also shows the number of locked satellites above the symbol, in this case 12.

2.2.3 USB Symbols

Symbol	Meaning
	USB-PD power supply is connected
	Reader is connected to USB-C Port of a PC
	A Standard USB power supply is connected *
	BPR 3001 is connected to an USB-A port of a PC

* QuickCharge (QC) not supported ! QC Power Supplies will be handled as standard USB 5V power supply.

2.2.4 Bluetooth Symbols

If Bluetooth is deactivated, no Bluetooth symbol is displayed.

Symbol	Meaning
	Bluetooth is switched on but there is not connection
	Bluetooth connection with other device established

2.2.5 Alarm Indicator

Symbol	Meaning
⚠️	An Alarm is present. See chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** for details.

2.3 Charging the Reader

The Reader has an internal 48 W/h lithium-ion battery pack which should be fully charged before first use.

To charge the Reader's internal battery, follow these steps:

- Plug the USB-C connector of the charger into the USB-C socket of the Reader.

- Connect the charger to a grounded AC power socket.

The right LED starts flashing green while the battery is charging. The faster the LED is flashing, the faster the charging speed. Charging is complete when the LED remains solid green.

Menu → Info → Power

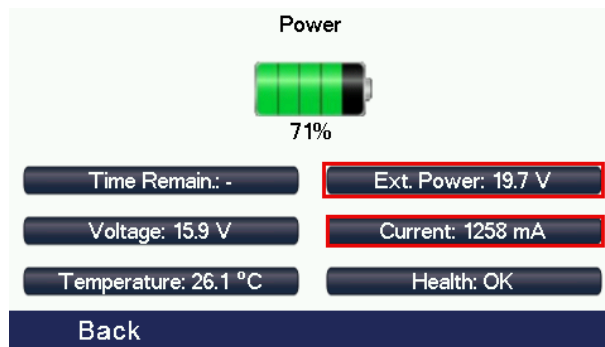The 'Power' Info window shows details concerning battery voltage and temperature, estimated remaining operating time (when not charging), battery health and the voltage from the external power supply and the battery charging current.

In this case the supplied USB-PD charger is used. The PD voltage is 20V and the battery is charged with more than 1 Amp.

The Reader will take around 3.5 hours to charge a completely depleted battery.

Note: The battery cannot charge if the internal temperature of the Reader is below 0°C (32°F) or above 45°C (113°F). The unit will indicate a charging error under these conditions.

It is possible to use alternate USB sources to charge and power the reader but it will take longer since 'standard' USB power supplies do not provide enough power. The supplied power adapter supports USB PD and delivers up to 40W to the reader. This is enough for fast-charging the battery pack and to operate the BPR 3001, including RFID reading.

2.4 Connecting the Accessories

The unit should be connected to the loop antenna with the supplied M12 cable. The cable has the same connector on both ends. To connect the reader to a PC, use the supplied USB cable. The threaded locking collets should be fully screwed onto their mating connectors.

2.5 Setting the Clock

To keep the clock in the Reader accurate, it will update automatically via the GPS satellite network whenever a GPS signal is available. The precise clock is useful for synchronizing tag reads in multiple Reader installations. In this situation, ensure that all Readers have been synchronized with the GPS time when setting up a multi-reader system.

Note: *So that your local time appears correctly on the display and in log files, set the current time zone in the settings menu (refer to chapter 3.2).*

To set the clock, move outside or place the unit near a window with a clear view of the sky. The time taken to update the clock will depend on the quality of the GPS signal, varying from a few seconds to a few minutes. You will notice the time and date change to the correct values. If the clock has not updated after 5 minutes, try positioning the reader in an area with a better view of the sky.

If the reader clock has become invalid, a message will appear upon turning on the reader: "The Clock Could Not Synchronize – GPS Signal Is Required."

This can happen if the Reader has been in storage for a long time and the internal battery has become deeply discharged. Fully recharge the battery as soon as possible before using the unit to read tags. Follow the above procedure to set the clock.

If you do not want to use the automatic synchronization of the clock via GPS, you can deactivate it and set the date and time manually. To do this, the "Use Time from GPS" setting must be deactivated, as described in chapter 3.2. The date and time can then be set manually in the same submenu.

Use the ◄ / ► keys to move from one field to another and ▼ / ▲ to change the values.

Finally, apply the date and time by pressing the right softkey.

2.6 Using the GPS Receiver

The Reader is able to store location information (latitude and longitude) along with each tag read; this is known as "geotaging". When using this feature, be sure that the unit has a valid GPS lock; otherwise, the geotag information will not be stored along with the tag read. Geotagging can be turned on or off in the settings menu, please refer to Section 3.

Note: *While the Geotagging option can be turned off, the GPS itself cannot. The power draw of the GPS module is insignificant to overall battery life.*

The GPS icon on the main screen will change from red to blue when a valid GPS lock is obtained, indicating the Reader is now tracking its location. One arc indicates a fix on 4 satellites and two arcs indicates a fix on more than 4 satellites.

To obtain a GPS lock, position the Reader in an area with a clear view of the sky. Achieving a valid GPS lock usually takes less than 2 minutes, but can take up to 5 minutes or more, particularly if the Reader has not been operated in the area previously or has been switched off for a long period of time.

Detailed information about the position can be displayed via the **Info → GPS** menu:
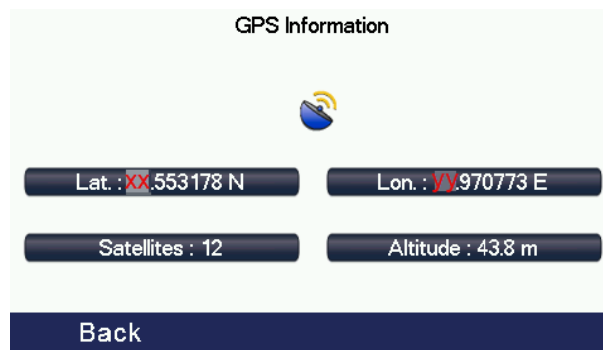

- **Lat.** - Displays the current latitude.

- **Lon.** – Displays the current longitude.

- **Satellites** – The number of satellites currently seen by GPS receiver. A minimum of 4 satellites is required for a valid GPS location fix.

- **Altitude** – Displays the current altitude (m).

Note: *The BPR 3001 GPS provides 1.5 m (CEP) accuracy positioning.*

3 Configuring the Reader

You can access the main menu by pressing the left softkey "Menu" on the home screen. From here, you can quickly navigate through the menus using the corresponding arrow keys.
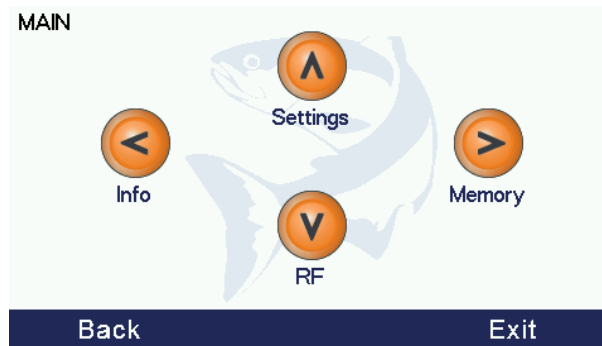
3.1 Settings Menu

Pressing the ▲ key from the main menu screen will display the Settings menu.
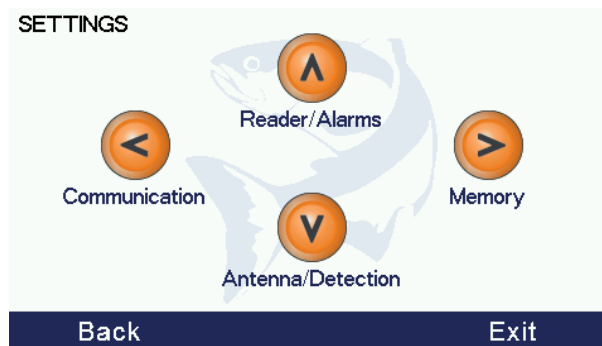
Use the arrow buttons to select a settings category. Within a category, use ▼ and ▲ to select a setting and ◄ / ► to alter the selection or press the OK button if indicated for a menu item. Pressing the left softkey "Back" takes you back to the previous menu and saves the changed setting(s).

3.2 Reader / Alarms

The *Reader / Alarms* menu allows the user to configure the hardware and to set local settings and thresholds.

The following parameters can be adjusted:

- **Reader ID** – The ID number of the Reader. This number will appear in log files, tag files, and when connecting the Reader to a PC. It is useful for Readers to have different IDs when more than one Reader is used at a time.

- **Timezone** – Set this to your current UTC offset to ensure the correct local time is displayed and stored in tag/log files. Refer to Appendix A for a time zone map or look up your current time zone on the Internet. Be sure to account for any daylight saving hours that may be in effect in your area.

- **Use Time from GPS** – Selects whether the date and time should be set automatically via GPS or manually.

- **Set Date & Time** – Opens a window to set date and time manually

- **Tag Display Format** – Chooses between hexadecimal (e.g. 3D9.1748D3AD9F) or decimal (e.g. 985.100006080033) tag number display

- **Buzzer Volume** – Adjusts the volume of the audible indicator

- **Display Brightness** – Set the desired screen backlight brightness. Lower settings will save battery power; a higher setting is useful for viewing the device in full sun.

- **Display Auto-Dim** – Sets the amount of time before the reader display dims to save power

- **Auto-Shutdown Inactivity** – This sets the amount of time before the reader automatically shuts down to save power. Note that this will not occur if the Reader is currently in tag reading mode or connected to a PC via USB or Bluetooth unless the *Auto-Shutdown in Standby Only* option is switched off.

- **Auto-Shutdown in Standby Only** – When enabled, the reader will only Auto-Shutdown when in Standby mode, not in Reading mode. If disabled, the device will shutdown while in Standby- or in Reading mode. When switching on the reader again, it will automatically enter the last operating mode again.

- **Antenna Imped. Low Threshold** – Sets the minimum allowed value for antenna impedance. If the impedance is below this threshold, there will be an alert and reading will be deactivated.

- **FDX-B Noise High Threshold** – Sets the maximum tolerated FDX background noise level above which an 'FDX-B Noise High' Alarm is triggered.

- **HDX Noise High Threshold** – Sets the maximum tolerated HDX background noise level above which an 'HDX Noise High' Alarm is triggered.

- **Alarms Unique Delay** – This time specifies how long to wait before rebroadcasting a persistent alarm on USB or Bluetooth. If the alarm condition clears and then reappears, the new alarm will be sent without delay.

- **Reset to Factory Settings** – This will reset the settings back to factory default. A confirmation window displays asking to verify this action. When "Yes" is pressed, the Reader will automatically reset all settings and restart. Tag data will not be erased.
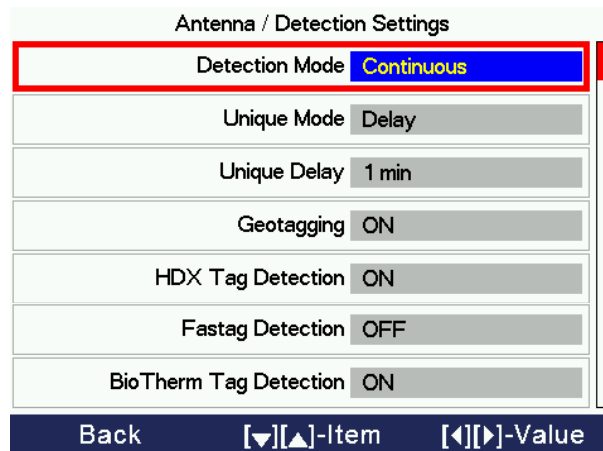
3.3 Communication

The *Communication* menu allows you to modify Bluetooth settings and to see information on Bluetooth device name and Bluetooth firmware version.
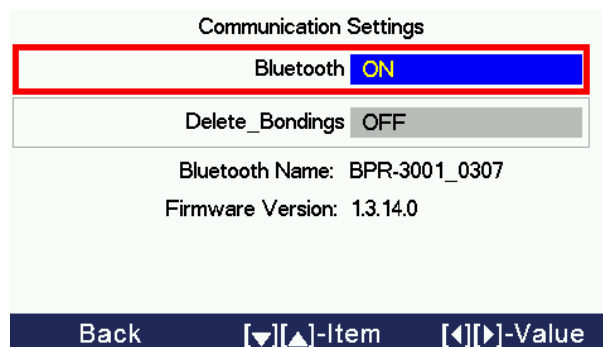
- **Bluetooth** – Enables or disabled the Bluetooth function
- **Delete_Bondings** – No idea what it does in detail …

3.4 Antenna / Detection

The *Antenna / Detection* menu is used to configure parameters associated with tag reading.

- **Detection Mode** – When 'Single' is configured, the BPR 3001 will read one tag and then return to *Standby* mode. It will also stop reading when the timeout of 5 seconds has expired. The READ button must be pressed again before another tag can be read. In 'Continuous' mode, the reader will stay in *Reading* mode even after a tag has been read. It will only stop reading if the READ button is pressed again ('Stop') or the battery is depleted, if external power is not connected.

- **Unique Mode** – If set to 'OFF', each tag read will create a record in the memory, even if the EID is always the same. When 'Last 1' is configured, the same tag will only be saved once, even if there is a long break between two consecutive reads. A tag with a different ID will be saved immediately. If set to 'Delay', the same EID is saved again if this tag is read again after the expiration of the configured *Unique Delay*.

- **Unique Delay** – Sets the minimum time that must expire before saving a tag with the same EID again. Note that reading a tag with a different ID resets this delay time.

- **Geotagging** – When enabled, GPS data will be stored with the tag number but this is only possible if a valid GPS lock was available at the time of reading.

- **HDX Tag Detection** – When no HDX tags are being used in an application, you can set this option to 'OFF' to disable the detection of HDX tags. FDX-B tags can always be read.

- **Fastag Detection** – Enable this option to allow the detection of FDX Fastags.

- **BioTherm Tag Detection** – Activate the setting if you want to display and store the temperature of BioTherm tags together with the tag number. The temperature is displayed in a range between 25.1°C and 50.0°C (77.2°F to 122.0°F). "Low C" is displayed if the temperature is below 25.1°C and "High C" above 50.0°C.

3.5 Memory

The *Memory* menu allows the user to configure data storage parameters.

```
                      Memory Settings
        Store Tags To Memory   ON
   Store Test Tags To Memory   ON
        Memory File Number   1


     Back        [▼][▲]-Item      [◄][►]-Value
```

- **Store Tags To Memory**– When unselected, read tags will be displayed on the screen, but will not be stored into a file.

- **Store Test Tags To Memory** – When unselected, test tags will be displayed on the screen, but will not be stored into a file. Test tags have a 999 (3E7) as manufacturer code.

- **Memory File Number** – Selects the file number into which tag reads are stored. The Reader can store up to 100 different files.

Note: Once a tag file contains 10.000 tags, the reader will automatically create a new file into which all new records are written.

4 Reading Tags

4.1 Reading RFID Tags with the Reader

When switching on, the Reader will resume the last state it was in, i.e. Reading or Standby. Reading can be started and stopped by pushing the "READ" button on the device. The text at the top of the Main Screen will toggle between "Reading" and "Standby" when the "READ" button is pressed.

4.2 The Shortcut Button

The right soft key is linked to *Shortcut* functions on the Main Screen. These allow quick access to tag reading related settings via a popup menu.

- **Press the Up/Down arrows** to switch between the different Unique modes, which are explained in chapter 3.4.

- **Press the Right arrow** to jump to the *Memory* settings screen; this is a useful shortcut to adjust data storage parameters. The settings are described in chapter 3.5.

- **Press the Left arrow** to jump to the *Antenna / Detection* settings; this is a useful shortcut to adjust tag reading and storage settings. The Memory Settings screen is described in chapter 3.4.

Note: *Ensure that the Reader is correctly configured to operate as required for the application, paying particular attention to the Memory Settings and RF Settings.*

4.3 RF Settings and Diagnostics

Detailed information and settings related to the Radio Frequency (RF) functions of the device are configured in the *RF* Menu screen. This is accessible from the main menu by pressing the ▼ key.

RF			
Power:		●————— 60%	
Transmitter:		Antenna:	
Voltage:	N/A	Voltage:	N/A
Current:	N/A	Phase:	N/A
Power:	N/A	Impedance:	N/A
Temp:	N/A	Tuning:	N/A
FDX: N/A	HDX: N/A	BKG: N/A	
Back	Read	Tools	

RF			
Power:		●————— 60%	
Transmitter:		Antenna:	
Voltage:	9.0 V	Voltage:	71 V
Current:	622 mA	Phase:	-3
Power:	5.6 W	Impedance:	864 Ohm
Temp:	28 ºC	Tuning:	7
FDX: 4%	HDX: 10%	BKG: 8%	
Back	Stop	Tools	

The screen on the left shows the RF window when the RFID engine is deactivated. You can adjust the transmit power in 5 different levels using the ◄ / ► keys. The higher the power, the greater the tag read range. However, keep in mind this is not always a linear relationship. That is, the amount of read range increase will become less and less with each step up in power setting. Use the lowest practical power setting to prolong battery run time.

The RF diagnostic data are not available if RF is not activated. Press the READ key to activate the RFID engine. A number of measured values appear, which are also constantly updated. The details are explained in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**, as well as the advanced diagnostic options available here via the right softkey (*Tools*).

4.4 Testing the Unit

The supplied Fish RFID Keychain FDX-B test tag can be placed near the loop antenna to verify the correct operation of the unit. When the RFID tag is placed on-axis, i.e. the fish pointing into the loop, the tag should have read range of up to 20cm from the center of the loop, depending on the power setting.

The tag ID will appear on the display and the reader may beep and/or the tag read indicator will flash white, depending on the audible and visual indicator settings.

Note: *The antenna and tag should not be placed on or near any metallic object while reading, as this will significantly reduce the tag read range.*

5 File Management and Communication

The reader can interface with a PC or other equipment via USB and Bluetooth. And it's possible to view and delete tag and log files from the reader itself or to send them to a connected device.

It is also possible to "stream" live data via USB or Bluetooth. The Reader can be controlled remotely by commands received via USB or Bluetooth.

Note: *Biomark's terminal application 'BioTerm' is available on the Biomark website at:*
https://www.biomark.com/bioterm

5.1 Memory Menu

To access these features, select the *Memory* menu from the main menu screen.

File	Size	Date
#001	10000 tags	04-15-2025 10:47:30
#002	39 tags	04-15-2025 13:32:27
log.txt	26 lines	04-16-2025 07:21:23

Memory Files

Back   Actions

The *Memory* menu will list all the files currently stored on the reader, their corresponding size, and the date of the most recent tag read stored in the file.

Use the ▲ / ▼ keys to highlight the file you wish to perform an action on, then use the right soft key to open the list of available *Actions*.

Note: *You can select more than one file at a time.*

After pressing the *Actions* button, a pop-up box with the following options will appear:

16-2025 07:21:23

View File
Send to PC
Delete
Close
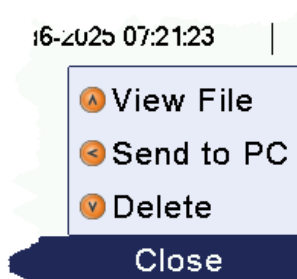
- **View Tags**– Displays the tag file on the screen
- **Send to PC** – Transfer the file to the PC via USB or Bluetooth (only available if the PC is running a terminal application such as BioTerm)
- **Delete** – Deletes the selected file

Press the corresponding arrow key for the desired action.

5.1.1 Viewing Tags

It is possible to review the data contained in a tag file. To do this, select the tag file you wish to view from the *Memory* menu and press the *Actions* button. The *View File* action will display the following screen:

- All tag numbers in this file will be displayed.

- Use the ▲ / ▼ buttons to scroll through the data record by record and ◄ / ► for page-by-page browsing.

- The "Geo" box will be checked if valid GPS location information is available with this tag read. The detailed geotag information is visible when the file is downloaded.

5.1.2 Viewing the Logfile

The BPR 3001 creates a logfile that will store alarm messages and communication messages related to the reader's functionality changes and parameters changes. To view the logfile, select the log.txt entry from the list of files in the memory, press the *Actions* button and then the ▲ key to view the messages.

- Use the ▲ / ▼ buttons to scroll through the data record by record and ◄ / ► for page-by-page browsing.

## 5.2 Connecting the Reader to other Devices via USB or Bluetooth

5.2.1 Connecting a PC to the Reader using USB

Observe the following steps:

- Before connecting the reader to a computer via USB for the first time, install the Agrident USB-CDC-ACM driver.

- Plug the Reader into a computer via USB port. In Windows Device Manager, the reader should appear as *Biomark BPR 3001* followed by the port number:

- Run the desired application for connecting to the BPR 3001 on your PC. This can be Biomark Device Manager, for example.

- For Biomark Device Manager, select the reader type first and then select the correct serial port. It should start with *Biomark BPR 3001* … then click *Open*.
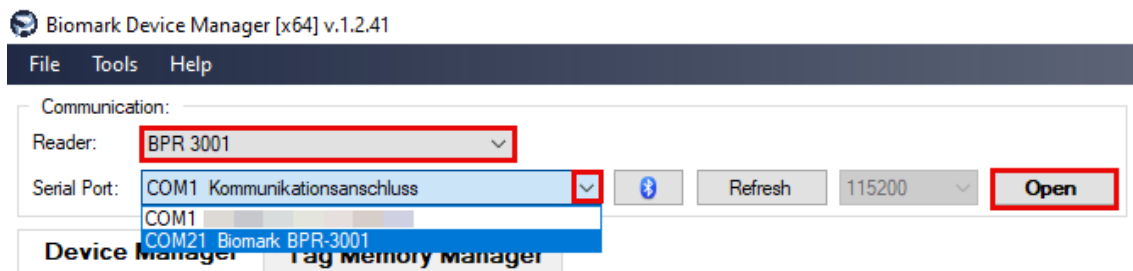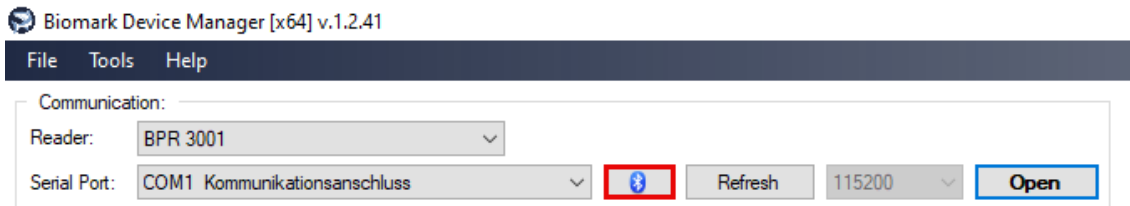

- The software should connect to the reader and download a full status report, that also includes the device settings.

- The "Send to PC" action in the "Actions Popup" (refer Section 5.1) will now be available if this function is supported by the PC software. . Data can also be streamed to the PC. Commands can be sent to and from the Reader (the available commands are listed later in this section).

## 5.2.2 Connecting to the Reader using Bluetooth

The BPR 3001 contains a dual-mode Bluetooth module. That means, it supports Bluetooth Classic (Serial Port Profile, SPP) and Bluetooth Low Energy (BLE). Both are available simultaneously.

Observe the following steps:

- To allow connections to another device via Bluetooth, like a PC or Smartphone, this device must have the required Bluetooth hardware and drivers installed. For example, if you want to connect via BLE, the device must also support BLE.

- The following example explains how to connect to Biomark Device Manager via Bluetooth. Start the software, select the BPR 3001 as reader type and click on the Bluetooth icon.

- You can choose if you want to connect via BT Classic or BLE via the check boxes.
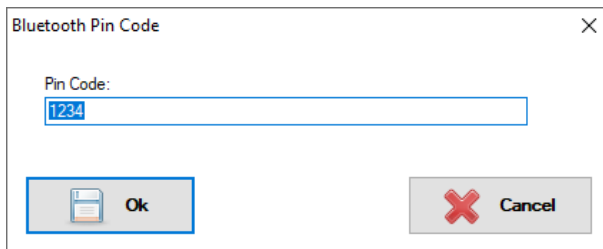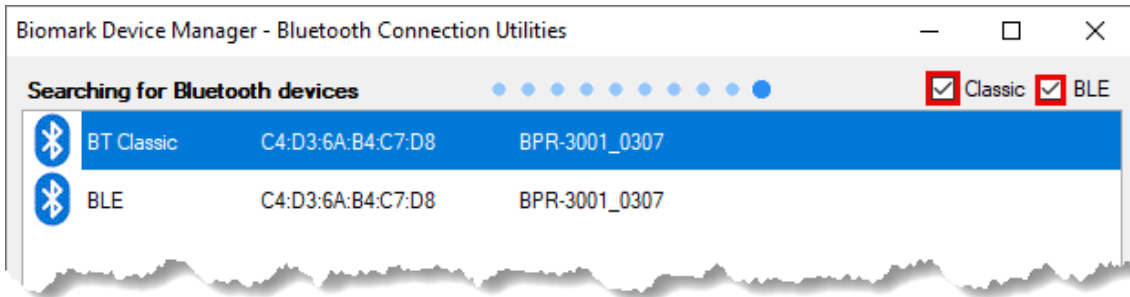
If you click on *BT Classic*, the software will ask for a pin code, which is '1234'.
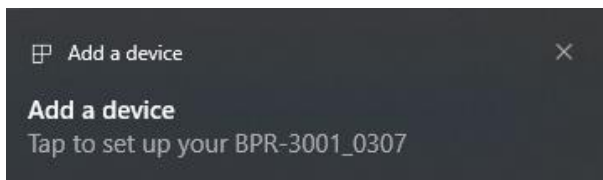
If the devices are paired already, the software should connect to the reader and download a full status report. If not paired yet, Windows will show a notification to tap on for device pairing.

- Both devices, the reader and your Windows computer, should now show a window with a pairing key. If the keys are identical, confirm pairing on both devices.
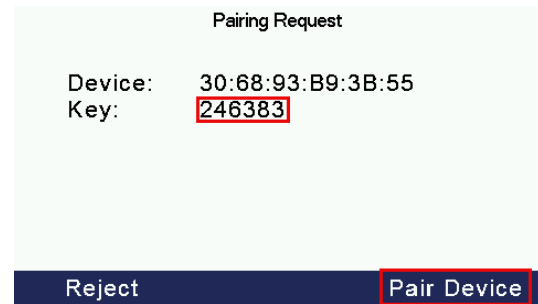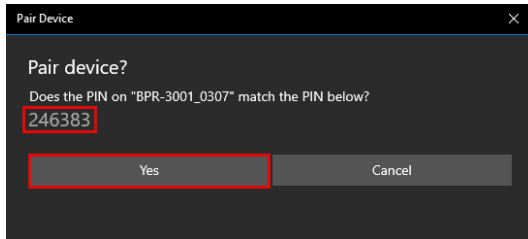
- The Windows PC should display two more notifications indicating that pairing was successful and the 'BPR 3001 is set up and ready to go'.
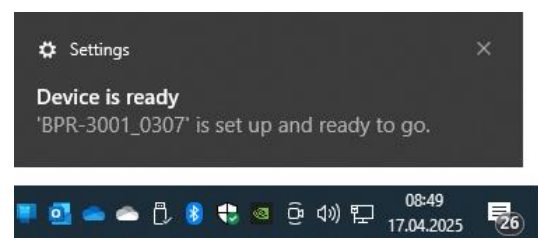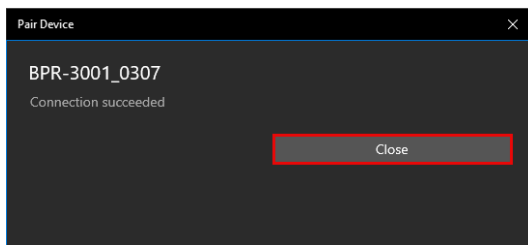
- Once the Reader is successfully connected the Bluetooth icon on the main screen of the BPR 3001 will turn blue indicating that the BPR 3001 has an active Bluetooth connection.

- The "Send to PC" action in the "Actions Popup" (refer to chapter 5.1) will now be available, if this function is supported by the PC software. Data can also be streamed to the PC. Commands can be sent to and from the Reader (the available commands are listed later in this section).

- When selecting *BLE* instead of *BT Classic*, no pairing is required.

6 Tools and Diagnostics
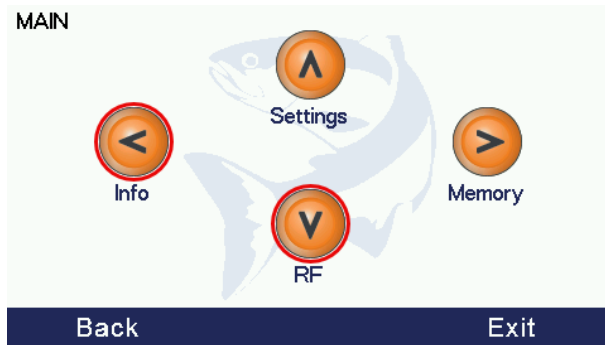
The reader has built in diagnostics tools that can aid in troubleshooting or logging of the operating parameters. These features are accessed by selecting the *Info* or *RF* in the main menu.

6.1 INFO
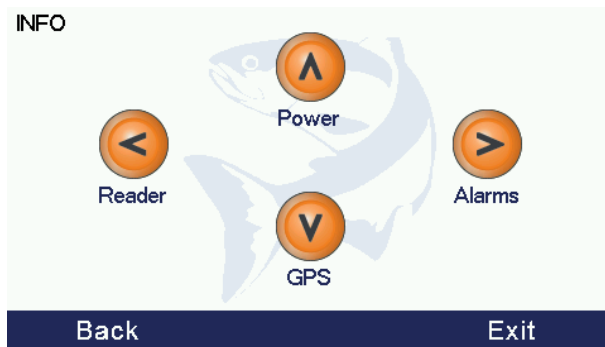
The *INFO* submenu contains the items *Reader, Power*, *GPS* and *Alarms*. Press the corresponding arrow key to access the desired item.

6.1.1 Reader
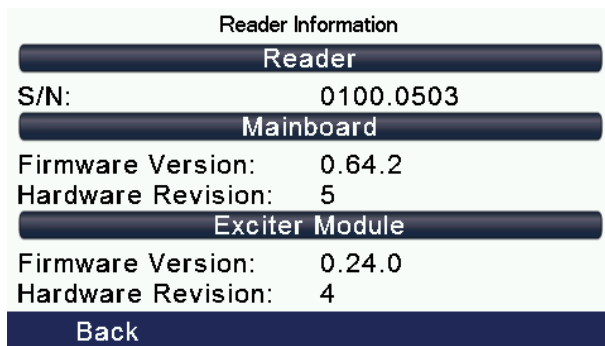
The *Reader* screen shows the readers serial number and firmware- and hardware versions for the mainboard and the exciter board.

You should be able to provide this information when requesting technical support.

6.1.2 Power

This screen shows information about the battery and charging parameters:

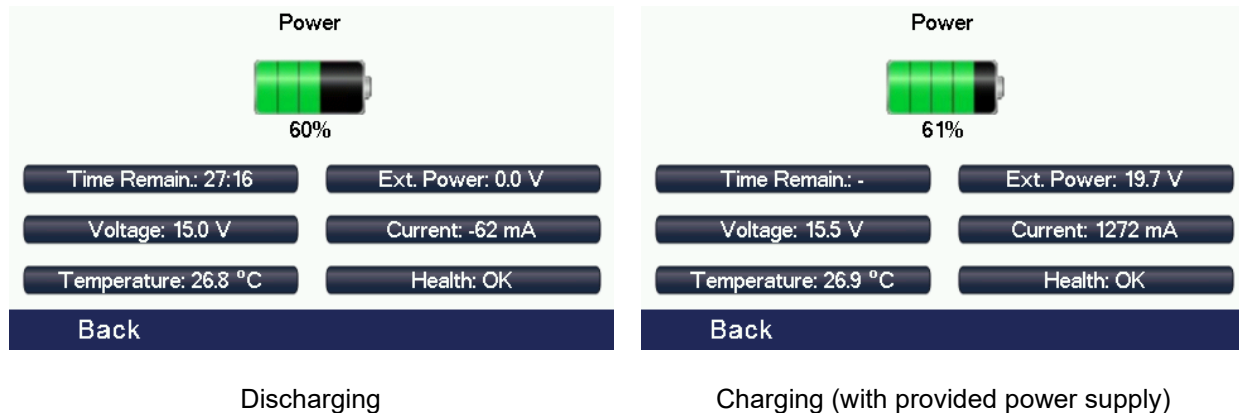|	
Power 60% Time Remain.: 27:16 Ext. Power: 0.0 V Voltage: 15.0 V Current: -62 mA Temperature: 26.8 °C Health: OK Back	Power 61% Time Remain.: - Ext. Power: 19.7 V Voltage: 15.5 V Current: 1272 mA Temperature: 26.9 °C Health: OK Back
Discharging	Charging (with provided power supply)

- **Battery symbol** – Displays the amount of charge remaining in battery.

- **Time Remain.** – Estimated remaining operating time (HH:MM) given the present rate of power consumption and state of charge. Note that this estimation is only available when discharging the battery, not during charging.

- **Voltage –** The voltage of the battery pack.

- **Temperature** – The temperature inside the Reader (°C)

- **Ext. Power** – The external power input voltage will be shown if a USB power source is connected. Computer USB ports and older USB power supplies can only supply 5V. USB-PD supplies can use higher voltages which allows faster battery charging. The reader and the power supply negotiate the charging parameters depending on the capabilities of the USB-PD supply. With the provided power supply the USB voltage is 20V and the current into the battery is more than 1 Ampere. This even allows to fast-charge the battery pack while operating the reader, incl. RFID reading.

- **Current** – The current flowing in or out of the battery pack. A negative value indicates the battery is discharging, a positive value indicates that it is charging.

- **Health** – Will indicate if the battery is too hot or too cold to allow charging.

6.1.3 GPS

The GPS info screen is explained in chapter 2.6.

6.1.4 Alarms

This is an information only screen listing all the alarms that have occurred and if the condition still persists. For transient conditions (e.g. high noise), the number of occurrences over time will be displayed. The presence of an alarm is indicated by a yellow exclamation on the main screen.

If an alarm event occurs, the following will happen:

- A message indicating the last un-acknowledged alarm event to occur and a *View Alarms* shortcut will appear on the main screen. Pressing this button will acknowledge the alarm and display the *Alarms* screen to list all alarms that have occurred.

- Depending on the selected alarm warning type, the right LED will flash red until the alarm is acknowledged by pressing the *View Alarms* shortcut. and the reader will beep three times.

Alarm Message and Shortcut on Main Screen
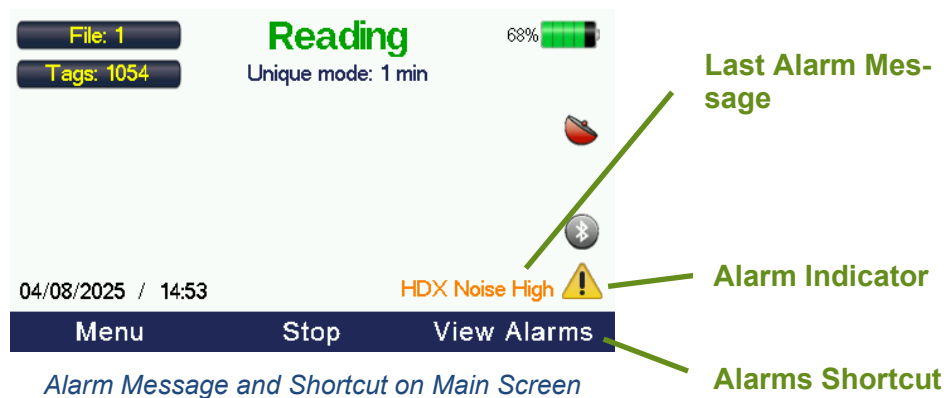
To access the list of Alarm messages, press the shortcut *View Alarms* in case an alarm is present. You can always access the alarm list via the menu: *INFO → Alarms*.
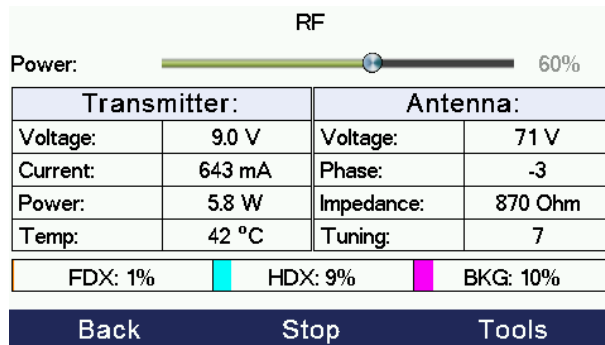

The alarm message list shows the date and time when the list was last updated and the alarm messages, if applicable, with their number of their occurrences.

Press the right soft key to update the list (*Run Now*) and the left soft key to exit the menu.

6.2 RF Diagnostics

This chapter describes the diagnostic capabilities of the device concerning antenna tuning and electromagnetic interference, often called 'noise'. Both affect the reading performance of the RFID system.

6.2.1 RF Main Screen

RF

| Power: | ──────○────── | 60% |

Transmitter:		Antenna:	
Voltage:	9.0 V	Voltage:	71 V
Current:	643 mA	Phase:	-3
Power:	5.8 W	Impedance:	870 Ohm
Temp:	42 °C	Tuning:	7

| FDX: 1% | | HDX: 9% | | BKG: 10% |

| Back | Stop | Tools |

Beside the possibility to change the RF power, this screen shows transmitter-, antenna- and receiver parameters that are useful for assessing current system performance.

Transmitter …

> **… Voltage** – depends on the selected power level, max. is 12V at 100% output power

> **… Current** – is a result of transmitter voltage and antenna impedance. A higher transmitter voltage increases the current. A lower impedance, which is equivalent to a lower antenna Q factor, increases the current as well.

> **… Power** – is the product of transmitter voltage and current and hence also a result of transmitter voltage and antenna impedance.

> **… Temp.** – is directly measured in the transmitter section of the RFID board and it depends on the environmental temperature and the transmitter power.

Antenna …

> **… Voltage** – a result of the transmitter voltage and the antenna impedance / antenna Q

> **… Phase** – is used for assessing the antenna tuning

> **… Impedance** – is equivalent to antenna Q and has to do with the inductance and the series resistance of the antenna coil. Together with the transmitter voltage it decides about the strength of the radiated RF field and hence also about the read range.

> **… Tuning** – refers to the 'Capacitor Pattern' that is currently used by the antenna Auto-tuning. Further details are explained in chapter 6.2.2.

FDX-B Noise – This is the amount of interference that will affect the read range of FDX-B tags. The higher the noise, the lower the resulting read range. FDX noise will jump to 99% while a FDX tag is being read, this is normal.

HDX Noise – This is the amount of interference that will affect the read range of HDX tags. The higher the noise, the lower the resulting read range. HDX noise will jump to 99% while a HDX tag is being read, this is normal. HDX noise should normally track the background noise value fairly closely unless HDX specific interference is present.

BKG Noise – This is the amount of background noise that will affect the read range of both FDX-B and HDX tags. If HDX detection is disabled, this graph will also be disabled.
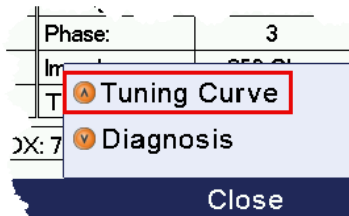
Possible sources of noise include:

- Adjacent metal objects
- Other electronic equipment
- Motorized equipment
- Structures with embedded reinforcing steel
- Excessive vibration
- Excessive water fluctuation or water splashing onto the antenna
- Adjacent power lines or power generating equipment
- Adjacent antennas that are in operation
- Overhead lights and power lines

6.2.2 Tuning Curve

The BPR 3001 provides antenna Autotuning. The tuning can be adjusted via a binary staged capacitor bank. Maintaining the correct antenna tuning is essential for a lower frequency RFID system. Basically it means to maintain the correct resonant frequency that depends on antenna inductance and tuning capacitance. Metal close to the antenna decreases the inductance of the antenna coil which would lead to a mistuned antenna circuit. By evaluating the antenna amplitude and phase the reader can detect a mistuned antenna and vary the Autotuning capacitance to compensate for the lower inductance.
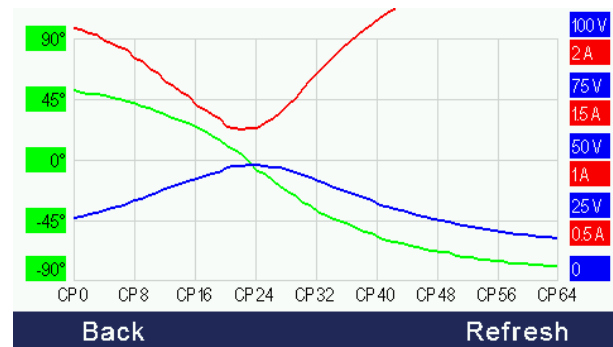
Phase:	3
Impedance:	856 Ohm
Tuning:	6
X: 8%	BKG: 5%
top	Tools
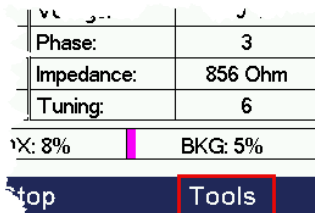
To open the tuning curve, first press the right soft key (*Tools*) in the RF main screen.

Phase:	3
Im	
T ⬆ Tuning Curve	
X: 7 ⬇ Diagnosis	
	Close

Then press ▲ to display the tuning graph.
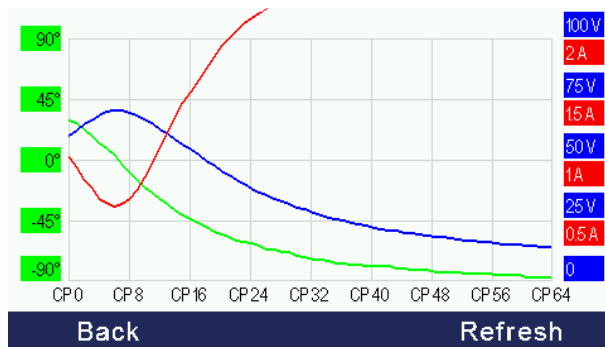

without metal

metal close to antenna

The left picture shows the tuning graph with an antenna without any metal close to it. The antenna voltage maximum is close to 70V at a 'Capacitor Pattern' (CP) of ~ 7. The antenna current has the lowest value in this case, which means smallest power dissipation with optimum tuning.

On the right side the same antenna was moved close to a metal object. Because of this, the antenna inductance decreases and to compensate that, the reader adds tuning capacitance – the CP value increases to ~ 24. So the reader can compensate for the reduced inductance and tuning the antenna back to resonance but what cannot be compensated is the losses caused by the metal – the antenna impedance decreases and so the antenna voltage. The antenna current and hence the power dissipation increases. For this reason metal close to the antenna should be avoided wherever possible.

6.2.3 Diagnosis

Beside correct antenna tuning and ideally no metal close to the antenna, the 'background noise' impacts the reading performance. This means reading range but also reading speed. The reader contains two separate receivers to allow the reception of FDX-B and HDX tags.
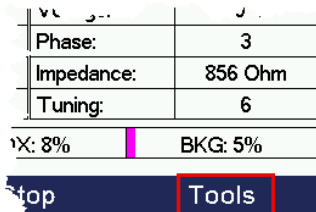
To open the diagnosis window, first press the right soft key (*Tools*) in the RF main screen...
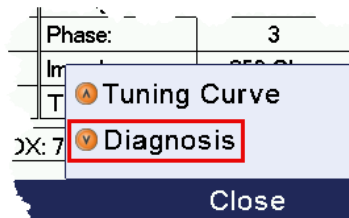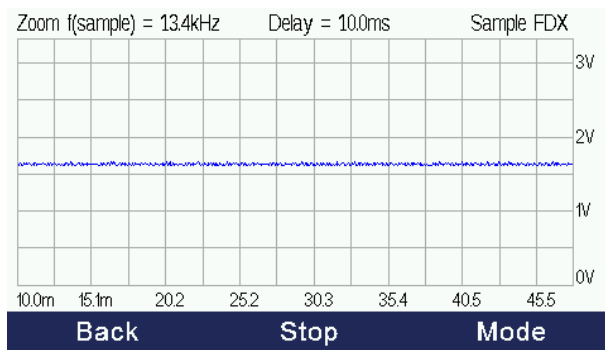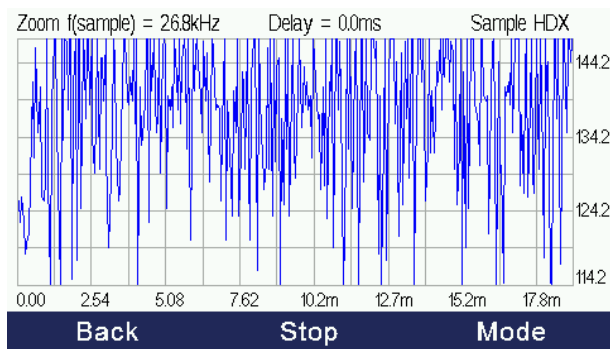
… and then ▼.

The Diagnosis window works similar to an oscilloscope and you can switch between different input signals

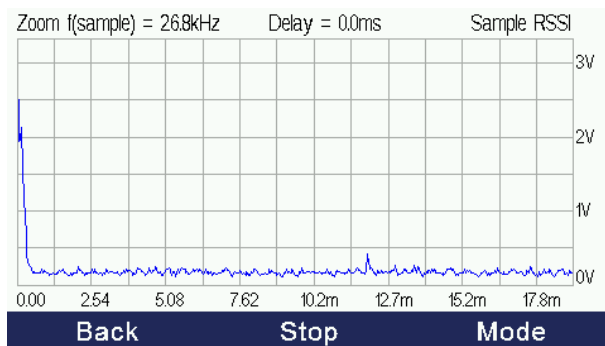| Key	Function
left soft key	exit diagnosis window
READ	start sampling in selected mode
right soft key	switch between modes: FDX, HDX, RSSI
▲ / ▼	increase / decrease sample frequency
◄ / ►	decrease / increase delay time

FDX Signal (ASK)

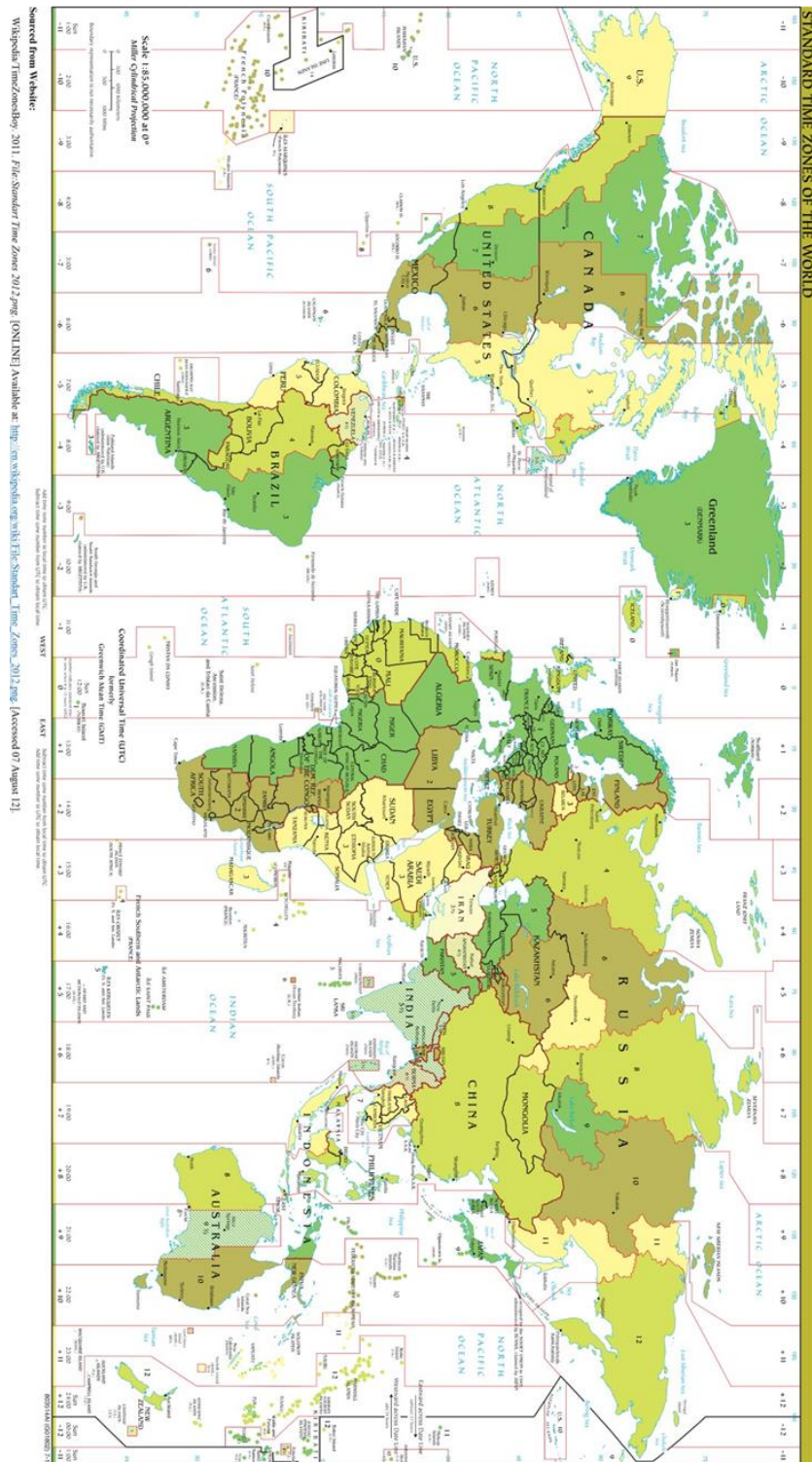HDX Signal (FSK)

(frequencies over time, no signal strength!)

HDX RSSI

(only signal strength, does not contain frequency information)

The above signals represent a low noise environment…

Appendix A – UTC Time Zone Map

Biomark

SPECIALISTS IN IDENTIFICATION SOLUTIONS

705 S. 8th Street

Boise, Idaho 83702, USA

+1.208.275.0011

www.biomark.com

biomarkservice@merck.com

PIT TAGS   READERS   IMPLANTERS   SOFTWARE   TISSUE SAMPLING   CUSTOM SYSTEMS