

# Portable RelayDoc™ (PRD) User Manual



## Publication History\*

Document name	Summary of change	Version	Revision	Date
V2.0	New User Manual produced for new app version	2.0	0	08/04/2024
V2.1	Added information on series/parallel testing	2.1	0	12/02/2025
V2.2	Added information about profile creation	2.2	0	12/02/2026

\*The latest version of this User Manual is available at [www.mrd.com.au](http://www.mrd.com.au)

### Portable RelayDoc™ User Manual

The software described in this manual is provided under a license agreement and may be used only in accordance with the terms of that agreement.

### Trademarks

The MRD logo is registered trademark of MRD Rail Technologies Pty Ltd.

All other trademarks or registered marks in this manual belong to their respective holders.

### Disclaimer

Information in this document is subject to change without notice and does not represent a commitment on the part of MRD Rail Technologies Pty Ltd.

MRD provides this document as is, without warranty of any kind, expressed or implied, including, but not limited to, its particular purpose. MRD reserves the right to make improvements and/or changes to this manual, or to the products and/or the programs described in this manual, at any time.

MRD intends that the Information in this manual is accurate and reliable. However, MRD assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.

This manual, and the product it relates to, might include unintentional technical or typographical errors. From time to time, MRD corrects such errors, and these changes are included in the latest version.

### Copyright Notice

© 2024 MRD Rail Technologies Pty Ltd. All rights reserved.

### Technical Support Contact Information

Manufacturer	MRD Rail Technologies Pty Ltd	
Address	235 South St, Cleveland. QLD. 4163. Australia	
Telephone	+61 7 3821 5151	
Email	support@mrd.com.au	
Web	www.mrd.com.au	
Downloads	User Manual	<a href="https://www.mrd.com.au/relay-testing/">https://www.mrd.com.au/relay-testing/</a>
	Quick-Start Guide	<a href="https://www.mrd.com.au/relay-testing/">https://www.mrd.com.au/relay-testing/</a>
	Datasheet	<a href="https://www.mrd.com.au/relay-testing/">https://www.mrd.com.au/relay-testing/</a>
	All other documentation	<a href="https://www.mrd.com.au/relay-testing/">https://www.mrd.com.au/relay-testing/</a>

## Table of Contents

<b>1. INTRODUCTION .....</b>	<b>4</b>
1.2 Package Contents .....	4
<b>2. PRODUCT DESCRIPTION .....</b>	<b>4</b>
2.2 Hardware Features.....	5
2.3 External Test Bases.....	6
2.4 Relay Compatibility .....	6
<b>3. APPLICATION OVERVIEW .....</b>	<b>7</b>
3.1 Creating a New User.....	7
3.2 Navigation.....	7
3.3 Home Page/Test a Relay.....	8
3.4 Test Reports .....	8
3.5 Relay Profiles .....	8
3.6 Relay Registry.....	8
3.7 User.....	8
3.8 Settings .....	8
3.8.1 Management .....	8
3.8.2 Advanced.....	9
3.8.3 Support.....	9
<b>4. RELAY PROFILES.....</b>	<b>10</b>
4.1 Installing the MRD Profile Set.....	10
4.2 Importing / Exporting Profiles .....	12
4.3 Creating a New Profile.....	12
4.4 Profile Editor .....	13
4.4.1 Basic Settings .....	14
4.4.2 Advanced Settings.....	16
4.4.3 Advanced Relay Switch Time Configuration .....	17
<b>5. TESTING A RELAY .....</b>	<b>18</b>
5.1 Hardware Setup .....	18
5.2 Connecting the Portable RelayDoc (Bluetooth) .....	18
5.3 Testing a Relay .....	19
5.4 Test Reports .....	20
<b>6. TEST PROCESSES AND FUNCTIONALITY .....</b>	<b>22</b>
6.1 Coil Resistance .....	22
6.2 Contact Resistance .....	23
6.3 Contact Conditioning.....	23
6.4 Contact Switching Time.....	23
6.5 Operating Voltage and Current .....	23
6.6 Release Voltage and Current .....	23
<b>7. MAINTENANCE .....</b>	<b>24</b>
7.1 General Maintenance.....	24
7.2 Calibration.....	24
7.3 Software Updates.....	24
<b>8. DATASHEET .....</b>	<b>25</b>
<b>9. WARRANTY .....</b>	<b>27</b>

## 1. INTRODUCTION

Your new Portable RelayDoc is a portable automated relay testing device, capable of assessing the health of many types of relays. By using multiple criteria points such as coil resistance, contact resistance, switch time and switch voltage/current, the Portable RelayDoc can give you a clearer picture than ever of the health of your relays. Once the Portable RelayDoc has analysed the relay it will generate a full report with both simple Pass/Fail indications and detailed values for diagnosis which will be stored permanently on the device and can be uploaded to an external web server for remote access and record-keeping if required. Thanks to the Portable RelayDoc, testing, diagnosing, and proving the health of your relay assets has never been easier.

### 1.2 PACKAGE CONTENTS

A new Portable RelayDoc includes:

- Portable RelayDoc with Tablet Holder
- Power Supply
- USB-C to USB-A cable
- Android Tablet (Samsung Galaxy Active Tab)
- Pre-installed Portable RelayDoc App
  - All updates are available from the Playstore
- USB with User Manual
- 50-pin Relay Base Cable
- One external Relay Test Base (selected at purchase)
  - Additional test bases can be purchased from MRD.

If any items are missing, please contact your Portable RelayDoc supplier.

## 2. PRODUCT DESCRIPTION

The Portable RelayDoc automates the process of Relay Testing and the subsequent generation and management of Relay Test Reports.

The Portable RelayDoc runs a Bluetooth connection to any Android device running the Portable RelayDoc app.

The RelayDoc is capable of testing the following characteristics of a relay:

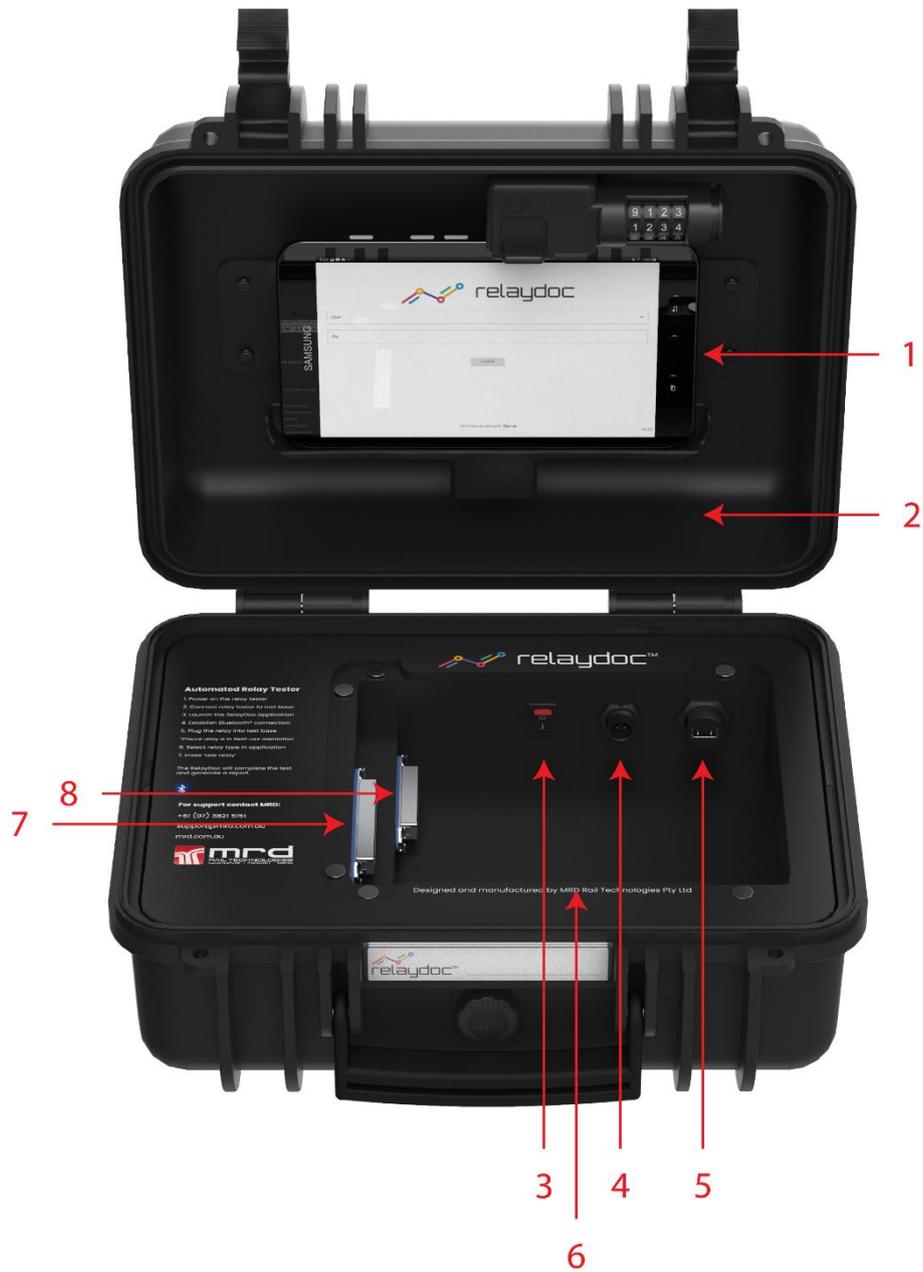
- Coil Resistance
- Coil Power
- Contact Resistance
- Contact Switch Time
- Operate Voltage and Current
- Release Voltage and Current

The test process can be chosen at time of testing to enable or disable particular test characteristics (*See Section 6 Test Processes and Functionality*).

For each unique relay type, the Portable RelayDoc app stores a test profile. The test profiles are used to specify the values for the Portable RelayDoc to test to. These profiles can be user created to allow full customization of testing. Alternatively, a base set of test profiles can be downloaded from the MRD website (*See Section 4 Relay Profiles*).

Once testing is complete, a test report is automatically generated. The test report can be stored and viewed locally and can be exported from the tablet for recordkeeping purposes.

## 2.2 HARDWARE FEATURES



#	Feature
1	Android Tablet with pin-locking tablet holder
2	Portable, robust enclosure ensuring the unit can be used as a relocatable device
3	Power Switch – on power up the unit will beep 3 times
4	Power Input (19 to 24V DC <10W)
5	USB Type-A for charging only (no data)
6	D-sub 15-pin for Calibration and Verification (authorized use only)
7	Main external relay base connection
8	Extra external relay base connection

## 2.3 EXTERNAL TEST BASES

The Portable RelayDoc requires a connection to an external test base. This allows one Portable RelayDoc to test multiple different Relay Styles. The following is the current list of test bases available for purchase:

- BR930 (Q-style)
- B1
- B2
- NS1
- PN150 (VCOR)
- PN250
- PN258
- VR-1B
- QTD5 Timer Base

## 2.4 RELAY COMPATIBILITY

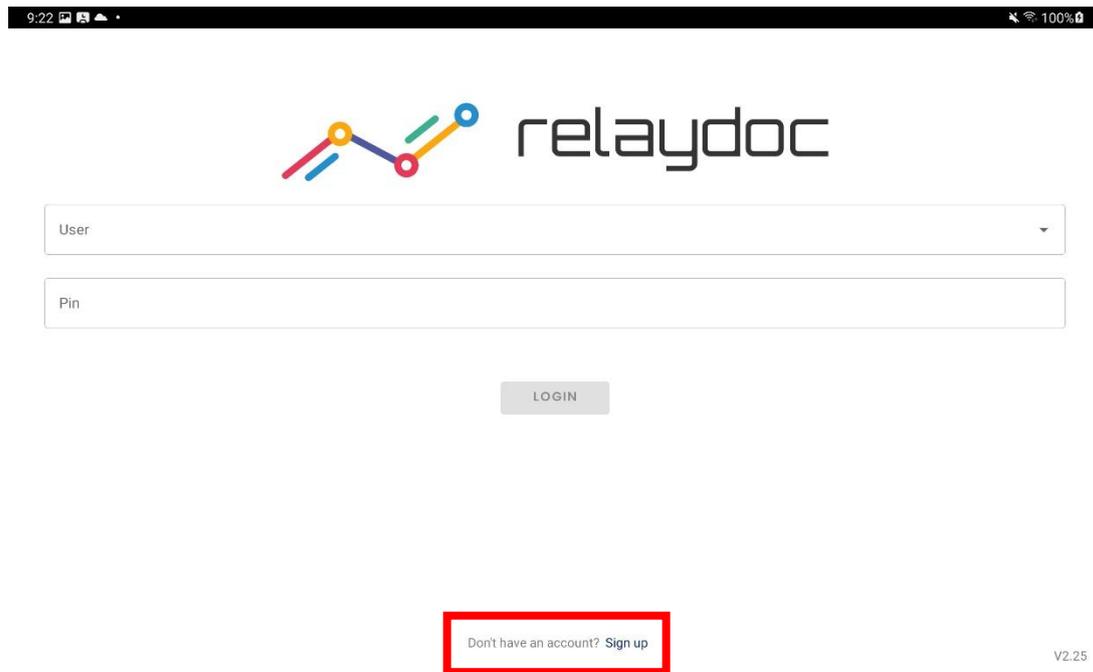
Although the Portable RelayDoc is designed to be robust and universal, there are some relay types which the unit cannot test to the full extent. A list of known compatible relays is available from the MRD Rail Technologies website.

### 3. APPLICATION OVERVIEW

The application is compatible with any Android device running Android 10 or newer. The application can be downloaded for free from the Android Play Store, under the title *RelayDoc 2*. The application comes pre-installed on the included tablet; however, it should always be kept up to date through the Play Store.

#### 3.1 CREATING A NEW USER

When first opening the application, the user will be greeted with the login screen.



- 1) Select the Sign-up button at the bottom of the screen. (Seen in the red box in the image above)
- 2) The user will be prompted to fill in some details. The first account setup on the tablet will need to be an Administrator role and all other accounts will be the User role by default. The Administrator can change the permissions of other users (See *Section 3.7 User*)
- 3) Once filled, select save. The app will return to the login screen.
- 4) Enter the name and pin used to create the account and select login.

#### 3.2 NAVIGATION

The navigation menu can be selected by the three vertical lines in the top left corner on any page.

The available options are:

- Home
- Test Reports
- Relay Profiles\*
- Relay Registry\*
- User\*
- Settings
- Logout

\*Administrators use only

The navigation also shows the version of the application in the bottom left corner.

### 3.3 HOME PAGE/TEST A RELAY

Once the user has logged in, they will be greeted with the home page. The home page is where all relay testing is started. Instructions on how to use this page and test relays can be found in section 5. *Testing Relay*.

### 3.4 TEST REPORTS

The Test Reports page has all test reports from relays which have been testing on this tablet. Individual test reports can be tapped on to show the test report.

Multiple test reports can be exported from the application by selecting the selection box on the left of each of the desired test reports. Once all the test reports have been selected, scroll to the bottom of the page, and select Export. The test reports can be exported via individual pdf files, or via a combined csv export.

### 3.5 RELAY PROFILES

The Relay Profiles page shows all the individual relay types which are configured to be tested on the Portable RelayDoc. Some relay profiles have been provided via the MRD website. In addition, further relay profiles can be added as new, and previous relay profiles can be edited to ensure tests are meeting all requirements.

In-depth information on relay profiles can be found in section 7. *Relay Profiles*

This page can only be accessed by a user with Administrator privileges.

### 3.6 RELAY REGISTRY

The Relay Registry sorts the historical relay tests, sorted by the serial number of the relay. By selecting a relay on this list, the Test a Relay page will auto-populate, allowing the user to quickly re-test a relay which has previously been tested.

In addition, a compliance test card can be exported which details all historic tests for the relay.

This page can only be accessed by a user with Administrator privileges.

### 3.7 USER

The User page details all the user accounts on this tablet. By selecting a user, all the details can be changed, including the role privileges.

This page can only be accessed by a user with Administrator privileges.

### 3.8 SETTINGS

The settings page includes a wide variety of options which may impact the testing of relays. Some settings are only available to Administrator users.

#### 3.8.1 Management

- Edit current user
  - Allows the current logged in user to edit their own information.
- Save failed reports (toggle)
  - If on, and a report fails it will be saved as normal.
  - If off, and a relay fails, its report will not be saved.
- Auto-Save relays to registry (toggle)
  - If on, relay details will automatically be saved to the Relay Registry.
  - If off, a relay will need to manually setup in the registry.
- Stay logged in (toggle)
  - If on, and the application is killed, the user will stay logged in.
  - If off, and the application is killed, the user will be logged out.

## 3.8.2 Advanced

- Edit Test Processes
  - Make edits to the test process. Allows the users to turn on and off certain test routines, edit the number of conditioning cycles (affecting the 'Contact Conditioning' routine), edit the number of contact resistance cycles (affecting the 'Contact Resistance' routine) and change the default contact resistance value.
  - For more details on the functionality of each of the test routines, please refer to *section 6 Test*.
- Calibration
  - The calibration menu should only be used with a MRD RelayDoc Calibration kit. Please see the included manual with the Calibration kit for instructions on how to calibrate.
- Advanced Relay Switch Time Configuration (toggle)
  - Allows editing of switch time in relay profiles as a string rather than a number. This allows switch times which can be dynamic and adjust based on other options. More detail about this can be found in *section 4.4.3 Advanced Relay Switch Time Configuration*.

## 3.8.3 Support

- System Self-Test
  - Performs some basic tests to ensure that the system is functioning correctly.
  - Note: The Portable RelayDoc must be connected to run this test.
- Backup/Restore Database
  - Backups all information from the application. Includes user info, relay profiles, relay registry and test reports.
  - This feature is useful for moving between Android devices, and ensuring there are backups.
- Override Report Logo
  - Changes the report logo for all pdf reports.
  - Ensure the base resolution is 500x128 pixels.
  - PNG files only

## 4. RELAY PROFILES

It is mandatory for a relay to have a relay profile before testing. Relay profiles detail all the information needed for the Portable RelayDoc to test a relay correctly.

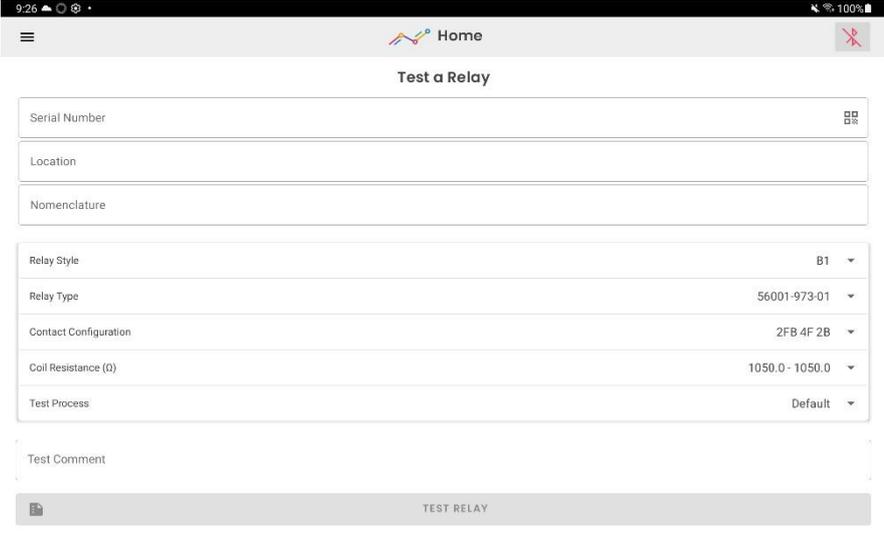
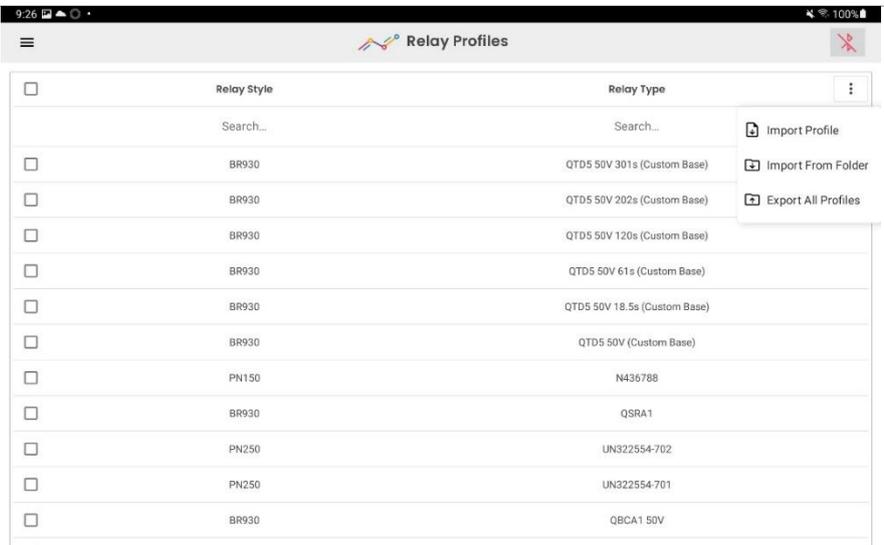
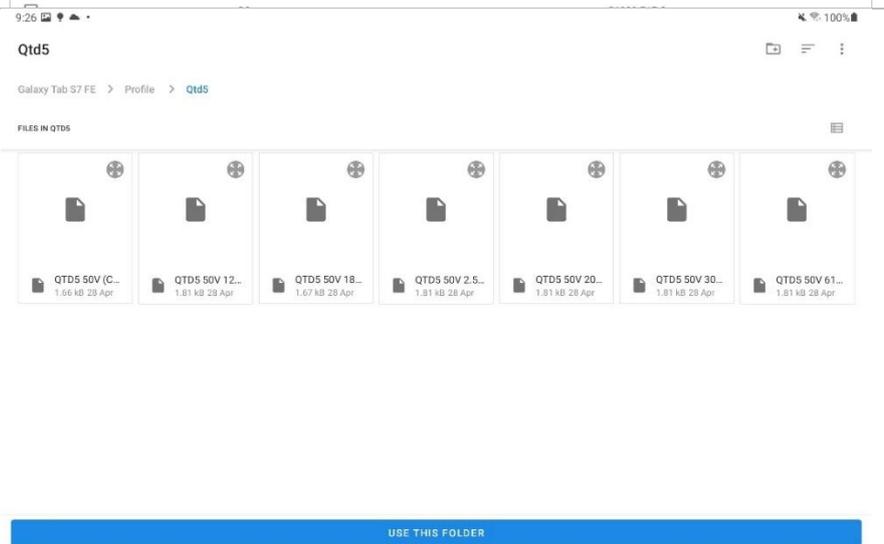
The user can import previously created profiles or can create their own. MRD provides a Profile set available from the website for initial use.

It is important to note that the testing characteristics may change depending on the age of the relay or where the relay is in use. It is very difficult to create a single profile to fit all testing cases, and as such the profiles should be reviewed to ensure they suit the application. Even within a single relay type, a criterion such as coil resistance can greatly differ over time due to changing material properties, and therefore the relay profile will change.

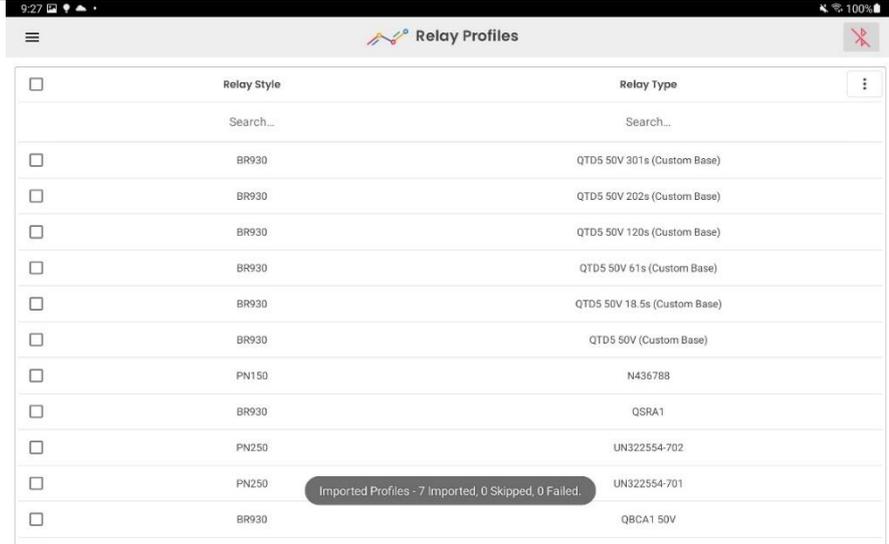
### 4.1 INSTALLING THE MRD PROFILE SET

The following table has instructions on how to download the MRD Profile Set, copy the desired profiles to the tablet, and install within the application.

Step	Description	Additional Information/Images
1	Using the included USB-C to USB-A cable, connect the tablet to a PC. Ensure the tablet is turned on and unlocked.	There may be a popup asking permission for the PC to access the files on the tablet. If this is the case, select "allow".
2	The latest profiles can be downloaded from the MRD website. Using file explorer, navigate to the location where the profiles were downloaded.	If the profiles are in a zip file, right click on the zip file, and select extract all.
3	Select the folders which match the external base included with your Portable RelayDoc.	The profiles are sorted into folders depending on the type of relay. Each folder is a unique external base.
4	Copy the folders chosen to the tablet	A common folder used for this is "Download".

<p>5</p>	<p>Open the RelayDoc App and login. You should see the “Test a Relay” screen.</p>	
<p>6</p>	<p>Navigate to the Relay Profiles tab and select the three vertical dots in the top right corner</p>	
<p>7</p>	<p>Select “Import from Folder”, and Navigate to the folder with the new profiles</p>	

8 Select "Use This Folder". The profiles should be imported, and a popup informing the user can be seen.



## 4.2 IMPORTING / EXPORTING PROFILES

Once created, relays can be exported and re-imported for if multiple units are in use.

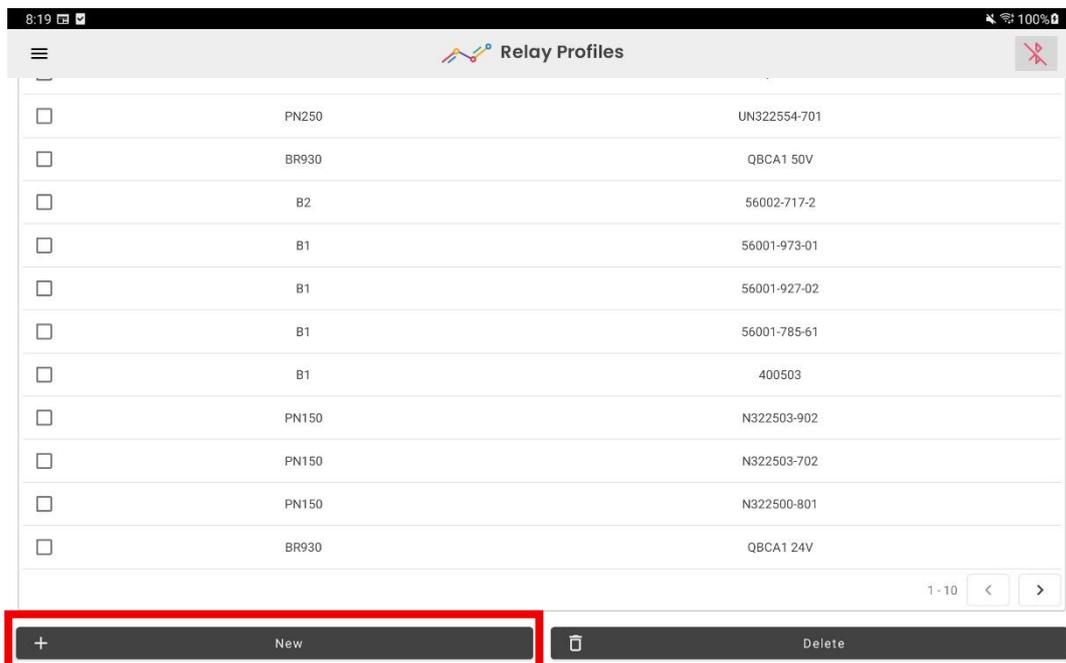
To import, simply use the three dots in the Relay Profiles tab. Selecting 'Import Profile' will allow a single profile to be imported. To import a folder of profiles, select 'Import from Folder'.

To export, select the profiles desired, select the three dots in the top right corner and click 'Export Selected'. Alternatively, all profiles can be exported via the 'Export All Profiles' option.

Once selected, the Android file explorer will open, and the user can choose the location to import/export the profiles. These locations can be accessed via a PC to allow access to the relay profiles.

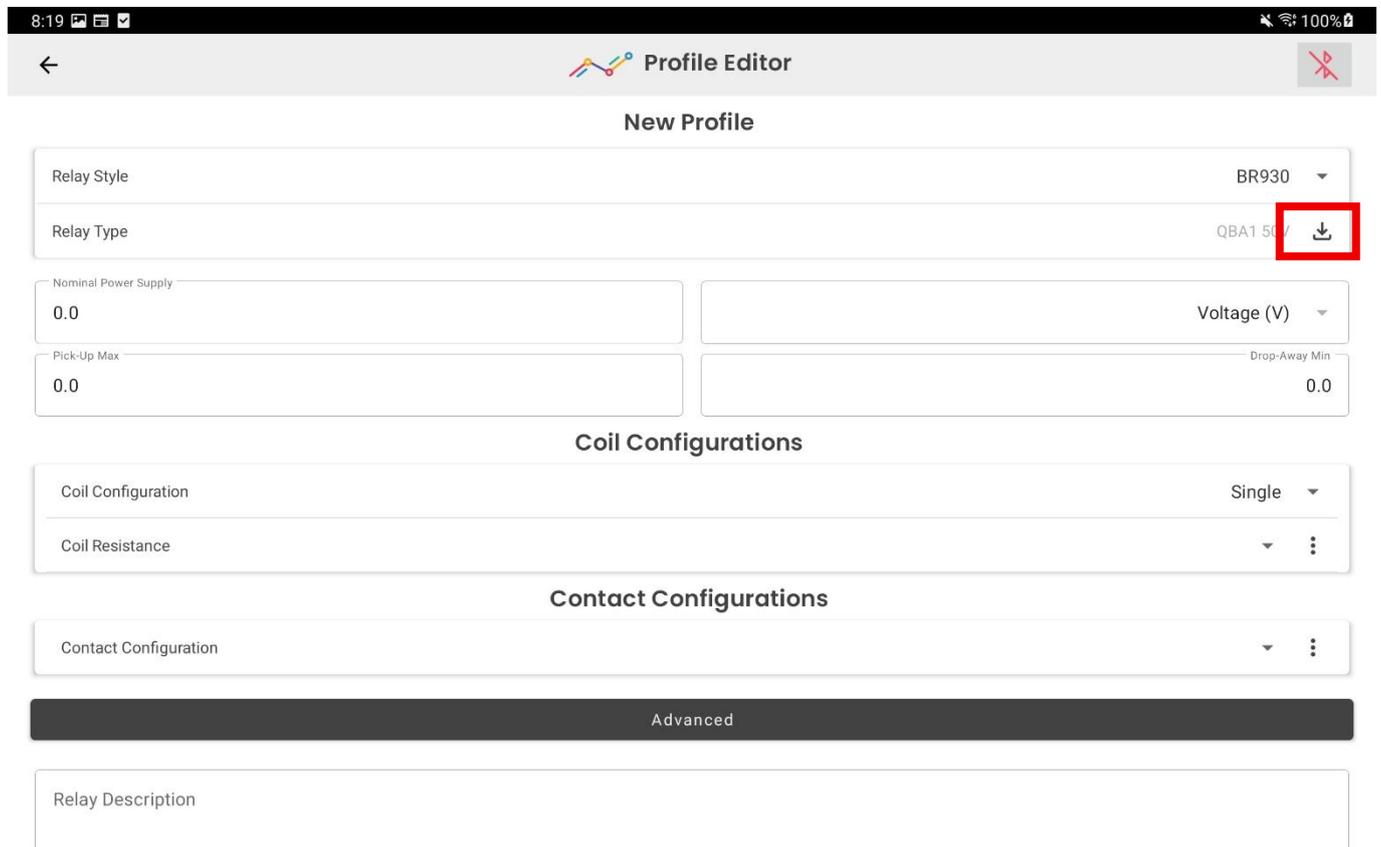
## 4.3 CREATING A NEW PROFILE

Relay profiles can be created from new. To do so, open the Relay Profiles page, scroll to the bottom, and select new. This will open the Profile Editor.



In the profile editor, explained further in section 4.4, the user can enter all the relay testing parameters required to test the relay.

Alternatively, settings from a different profile can be imported to prevent having to re-enter information multiple times. This can be done by creating a new profile and select the download icon on the right of the Relay Type input. A menu will appear prompting selection of an existing profile to import the settings of.



The screenshot shows the 'Profile Editor' app interface. At the top, there's a status bar with the time 8:19 and battery level 100%. Below that is a navigation bar with a back arrow, the 'Profile Editor' title, and a close icon. The main content area is titled 'New Profile' and contains several input fields and dropdown menus:

- Relay Style:** A dropdown menu currently set to 'BR930'.
- Relay Type:** A dropdown menu currently set to 'QBA1 50V'. A red box highlights a download icon (a square with a downward arrow) to the right of this field.
- Nominal Power Supply:** A text input field containing '0.0'.
- Voltage (V):** A dropdown menu.
- Pick-Up Max:** A text input field containing '0.0'.
- Drop-Away Min:** A text input field containing '0.0'.
- Coil Configurations:** A section header followed by:
  - Coil Configuration:** A dropdown menu set to 'Single'.
  - Coil Resistance:** A dropdown menu with a three-dot menu icon to its right.
- Contact Configurations:** A section header followed by:
  - Contact Configuration:** A dropdown menu with a three-dot menu icon to its right.
- Advanced:** A dark grey bar with the text 'Advanced' centered.
- Relay Description:** A large text input field at the bottom.

Once selected, the settings can be then modified to meet the new criteria.

## 4.4 PROFILE EDITOR

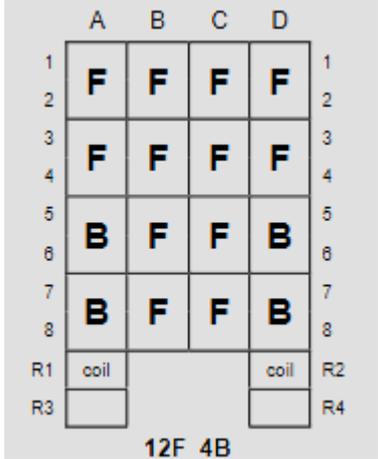
The relay profile is the 'definition' of the relay. It holds the testing criteria of each relay, allowing the unit to test the relay correctly. Ensuring the profile is configured correctly is of vital importance to the relay being tested successfully.

**Caution:** Creating a profile from new requires a fundamental understanding of the relay. By using the wrong settings, a relay test may be invalid, or the worst case is a relay can be damaged. Most profile values should be taken directly from the manufacturer's datasheet.

The examples in the following table are taken from a QBA1 50V 12F4B relay (Siemens part number B18507/16) which is a BR930 (or Q-style) relay.

## 4.4.1 Basic Settings

Item	Description	Additional Information
Relay Style	Style/Family of Relay the profile will be designed for. Types are: BR930, B1, NS1, PN150, PN250, PN258, VR-1B	This must match the external test base with the system. For our example, it is a BR930
Relay Type	Type of Relay within the family	E.g. QBA1 50V
Nominal Power Supply	The voltage OR current value of which the relay should be powered at. The voltage/current box can't be edited on its own but will change depending on the <b>Coil Configuration</b> settings.	E.g. for a QBA1, this value should be set to 50V.
Pick-Up Max	Maximum value that the relay should pick-up by	E.g. 40V (taken from manufacturer's datasheet)
Drop-Away Min	Minimum value the relay should drop-away by	E.g. 7.5V (taken from manufacturer's datasheet)
Coil Configuration	Select the type of coil: <ul style="list-style-type: none"> <li>• Single (Voltage)</li> <li>• Dual (Voltage)</li> <li>• Latching (Voltage)</li> <li>• Current</li> <li>• Dual Current</li> <li>• AC</li> <li>• Dual CW (Change over contacts)</li> <li>• Timer</li> <li>• Test Base (for unit testing only)</li> </ul>	E.g. Single
Coil Resistance	<p>Create a coil resistance field by selecting the three dots.</p> <p>Enter the coil resistance(s).</p> <p>Select the coil contact setup. It is recommended to auto-detect the coil contact field by inserting the relay into the unit and selecting "Auto Detect Coil Position". The unit will perform some tests and these fields will auto-fill. Please check to ensure the generated field looks correct.</p> <p>For dual coil PN150, PN250, B1 and B2 relays, the Coil Test Configuration field will be available. This allows the unit to test the dual coil relay in either series or parallel. In general, test in series unless otherwise indicated.</p> <p><b>Advanced</b> Alternatively, the coil contact field can be manually entered. The field is dependent on the type of base chosen, however, in general, when looking at the empty plugboard, the top left coil pin is R1, top right is R2, bottom left is R3 and bottom right is R4. Coil 1 is A (A+ and</p>	<p>E.g. 920 ohms, R1 is A+, R2 is A-.</p> <p>Multiple coil resistance fields can be added and chosen at time of test for different relays under the one relay type.</p>

	<p>A-) and Coil 2 is B (B+ and B-). Match the relay base pin with the relevant coil pin. MRD has example profiles available from the website to use as a reference, ensure to use the correct profile type.</p>	
<p>Contact Configurations</p>	<p>Create a contact configuration field by selecting the three dots.</p> <p>Enter the contact configuration name (e.g. 8F4B).</p> <p>Enter the contacts. It is recommended to auto-generate the contact string by connecting the desired relay and selecting "Auto Detect Contacts". The unit will perform tests and the field will auto-fill. Please check to ensure the generated field looks correct.</p> <p><b>Advanced</b> Alternatively, the contact string can be entered manually. This is a contact map which is a string indicating what each contact pin function is. The string consists of capital letters F (front/make), B (back/break) and S (unused/open). Starting from pin 1, enter the function of the pins up until the final pin, filling unused pins with S.</p> <p>If heavy contacts are required, enter the heavy contact pins as lower case.</p> <p>The contact string can also be auto generated, by connecting the desired relay and selecting "Auto Detect Contacts". The unit will perform tests and the field will auto-fill. Please check to ensure the generated field looks correct.</p> <p>For any relays other than BR930, there are different base configurations which are made via the external relays. These will change depending on the type of contact arrangement of the relay.</p>	<p>E.g. Contact Configuration: 12F 4B Contacts: FFBBFFFFFFFFFFBB</p>  <p>Multiple contact configuration fields can be added and chosen at time of test for different relays under the one relay type. For example, the QBA1 50V relay also has 8F8B, 8F4B, 6F6B and 4F4B contact configurations.</p>
<p>Relay Description</p>	<p>Below the advanced settings button, a relay description can be entered. This should be general information about this type of relay taken from the manufacturer.</p>	<p>E.g. QBA1 - Designed primarily for use in railway signalling circuits, where operation of the relay is dependent on the polarity of the coil current. In addition to a biasing magnet, the relay is fitted with a slug and shunt to provide ac immunity.</p>

## 4.4.2 Advanced Settings

Advanced profile options can be accessed by selecting the Advanced button. These are all set to the defaults indicated but can be changed depending on preference.

Item	Description	Additional Information
<b>Coil Settings</b>		
Skip Coil Resistance Test	Toggle to skip the coil resistance test for this relay only	Some relays include bridge rectifiers before the coil, causing the resistance read by the Portable RelayDoc to be incorrect.  Default: Off
Min Coil Power (w)	Set the minimum coil power in Watts for the relay to be tested to	Default: 0W
Max Coil Power (w)	Set the maximum coil power in Watts for the relay to be tested to.	Default: 3W
Operate Voltage (%)	Sets the voltage at which the PRD powers the relay to test switch time. This is a percentage of the nominal voltage/current. This can be set higher than 100%	Default: 100%
Release Voltage (%)	Unused.	Default: 100%
Coil Resistance Tolerance (%)	Coil resistance tolerance used in the test report generated after a test to pass/fail. This is a percentage of the coil resistance set in the coil configuration.	Default: 10%
Coil Switch Timeout (S)	Time the PRD waits after powering a relay to measure a contact pin. If the contact pin has not switched after this timeout, it will move to the next contact. Units are seconds.	Useful for timer relays, or relays with many 'S' fields.  Default: 3 seconds
<b>Operate/Release Settings</b> <i>(See 4.4.3 for Advanced Relay Switch Time Configuration Information)</i>		
Min Operate Time (s)	Minimum operate time pass/fail value in seconds	Default: 0.0s
Max Operate Time (s)	Maximum operate time pass/fail value in seconds	Default: 0.0s
Min Release Time (s)	Minimum release time pass/fail value in seconds	Default: 0.0s
Max Release Time(s)	Maximum release time pass/fail value in seconds	Default: 0.0s
<b>Ramp Up Settings</b>		
Step (v) or (mA)	Step size for operate voltage/current test process. Units will switch between volts and milliamps, depending on if the relay is setup as a voltage or current coil.	Default: 0.1V or 0.1mA
Time (ms)	Time between steps in milliseconds.	Default: 100ms

Ramp Down Settings		
Step (v) or (mA)	Step size for operate voltage/current test process. Units will switch between volts and milliamps, depending on if the relay is setup as a voltage or current coil.	Default: 0.1V or 0.1mA
Time (ms)	Time between steps in milliseconds.	Default: 100ms

### 4.4.3 Advanced Relay Switch Time Configuration

If the toggle within the settings menu is on (*Section 3.8.2 for more details*), then the switch time within the profile will become a string rather than a number. This allows for more control over the switch time. The strings available are:

- MaxFrontOperateTime
- MinFrontOperateTime
- MaxFrontReleaseTime
- MinFrontReleaseTime
- MaxBackOperateTime
- MinBackOperateTime
- MaxBackReleaseTime
- MinBackReleaseTime
- B Only
- F Only

The strings are case sensitive and can be used with mathematical symbols. The B Only and F Only strings are special commands indicating if the operate or release time should only be applied to front contacts (F only) or back contacts (B only). The following table has some examples:

Relay Style	MinOperateTime	MaxOperateTime	MinReleaseTime	MaxReleaseTime
BR931 A	0	MinBackOperateTime+0.300(F Only)	0	MinBackReleaseTime+0.300(F Only)
BR933 A	MaxFrontReleaseTime+0.400(F Only)	MaxFrontReleaseTime+3(F Only)	0	0.200(F Only)
BR963	0.150(F Only)	0.250(F Only)	0.150(F Only)	0

## 5. TESTING A RELAY

To test a relay, first ensure the following steps are completed.

- 1) The User is logged into the app (Refer to *Section 3.1 Creating a New User*)
- 2) The Relay Profile is installed for the relay to be tested (Refer to *Section 4 Relay Profiles*)

### 5.1 HARDWARE SETUP

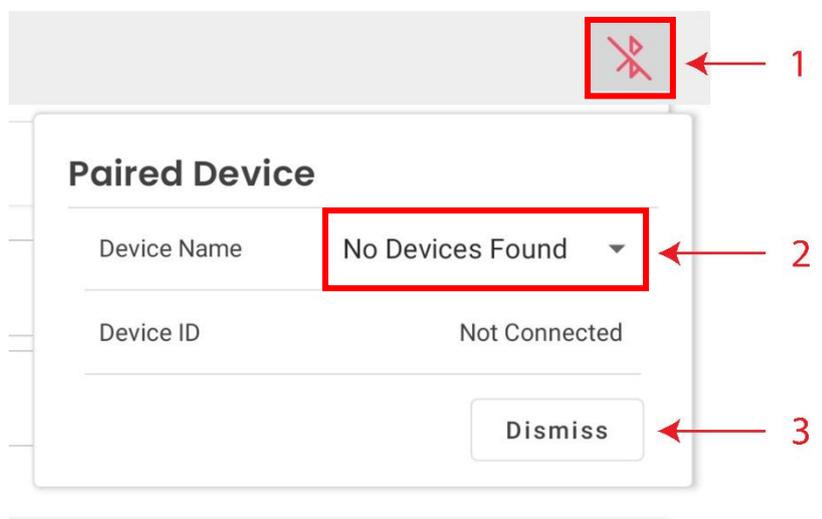
The following connections need to be made:

- 1) Connect the power cable into the unit, with the other end connected to mains power.
- 2) Connect 50 pin cable to main external relay base connection and connect the other end to the relay base.
- 3) Plug the desired relay into the base.
- 4) Ensure the relay is oriented in the same way as it would be used in the field.
  - a. This step is vital to ensure accurate testing, as different orientations will cause the relay results to differ.
- 5) Optional: Connect the USB-A to USB-C cable to the tablet for charging if required.
  - a. This is not a data connection and does not need to be connected to operate the Portable RelayDoc.
- 6) Turn on the unit with the power switch.
  - a. The unit should beep three times to indicate it has been powered on.

### 5.2 CONNECTING THE PORTABLE RELAYDOC (BLUETOOTH)

Before testing a relay, the unit will need to be connected to the tablet. The only way to do this is via the Bluetooth connection.

- 1) In the application, select the Bluetooth button in the top right corner (the menu can be seen in the image to the right)
- 2) Next to device name, open the drop-down menu, and select the name of the device. The name will be the serial number of the unit (PRD-xxxxx). The unit should automatically connect.
- 3) When connected, the Portable RelayDoc should beep three times again to indicate it has connected to the application.

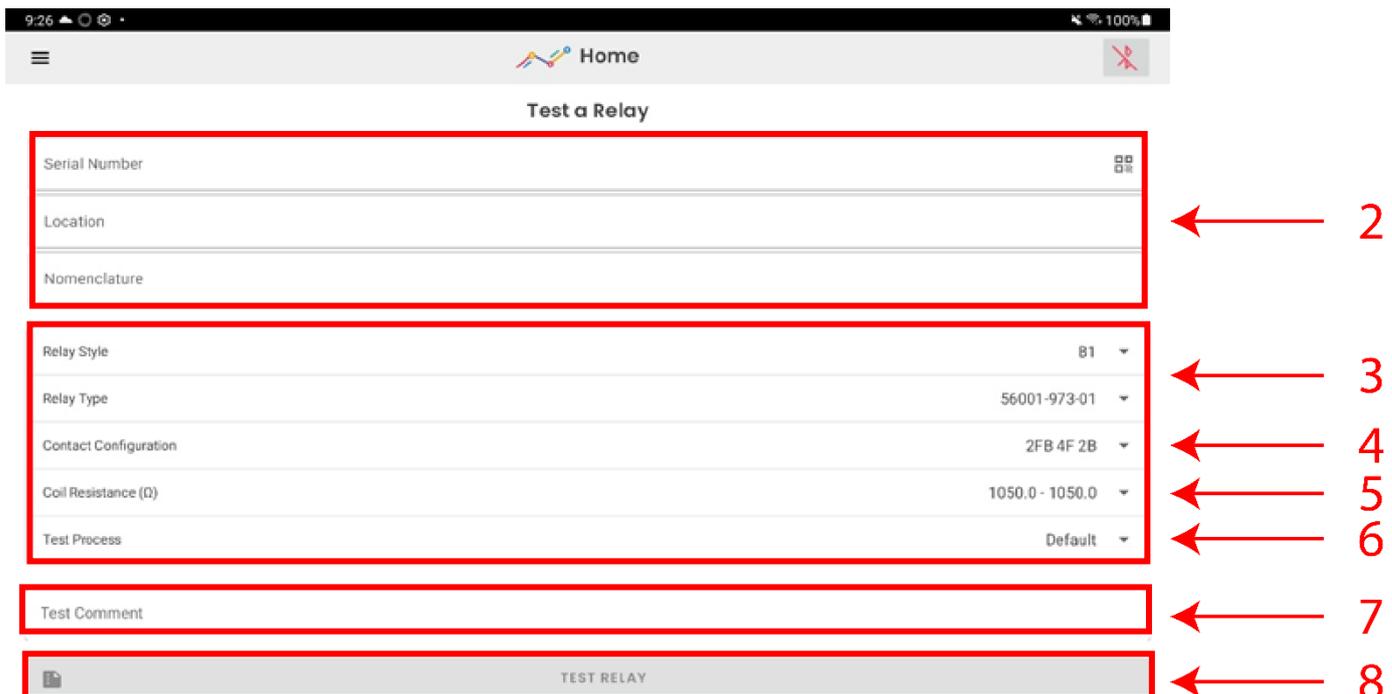


### 5.3 TESTING A RELAY

Once the hardware is setup, and the Portable RelayDoc has been connected via Bluetooth to the application, then the test process can begin.

- 1) Open the home screen ('Test a Relay')
- 2) Fill out the relay serial number, location and nomenclature.
  - a. The serial number can be scanned in via a barcode by selecting the icon at the very right of the input field.
- 3) Select the relay style and type from the drop-down menu.
  - a. Found on the name plate of the relay under test.
- 4) Select the contact configuration from the drop-down menu.
  - a. Found on the name plate of the relay under test.
- 5) Select the coil resistance from the drop-down menu.
  - a. Found on the coil of the relay under test.
- 6) Select the test process from the drop-down menu.
  - a. Refer to Section 3.8.2 Advanced Settings for more information on the test process.
- 7) Optional: Enter any test comments required
- 8) Select 'Test Relay'

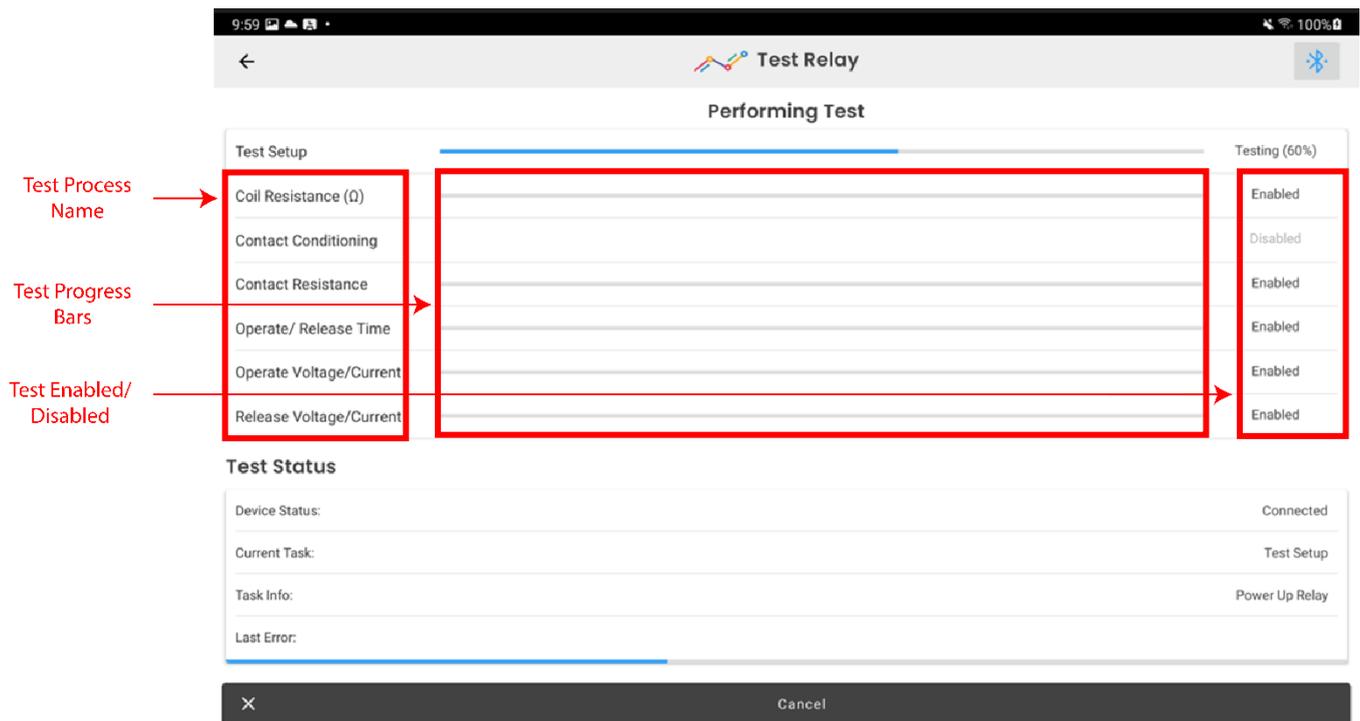
Note: The drop-down menus are filled with information taken from the profiles installed. If any option is missing, then the relay profile needs to be updated or created to ensure compatibility with the relay under test.



The screenshot shows the 'Test a Relay' screen in a mobile application. The screen is titled 'Test a Relay' and has a 'Home' button at the top. The form contains the following fields and buttons:

- Serial Number: Input field with a barcode icon on the right. Callout 2 points to this field.
- Location: Input field. Callout 2 points to this field.
- Nomenclature: Input field. Callout 2 points to this field.
- Relay Style: Drop-down menu with 'B1' selected. Callout 3 points to this field.
- Relay Type: Drop-down menu with '56001-973-01' selected. Callout 3 points to this field.
- Contact Configuration: Drop-down menu with '2FB 4F 2B' selected. Callout 4 points to this field.
- Coil Resistance (Ω): Drop-down menu with '1050.0 - 1050.0' selected. Callout 5 points to this field.
- Test Process: Drop-down menu with 'Default' selected. Callout 6 points to this field.
- Test Comment: Input field. Callout 7 points to this field.
- TEST RELAY: Button at the bottom. Callout 8 points to this button.

Once the test has started, the application will show the 'performing test' page, as seen in the image below.



Depending on the test process settings (*Section 6 Test Processes and Functionality*), not all tests may be enabled. This is represented on the right side of the screen.

Each test will occur sequentially down the list, with each test having its own progress bar to inform the user of the process through that test.

The test status section shows some details about the device status, the current task, and any task info.

The last error section will show any errors that occurred during the test. This includes criteria the relay has failed, or any hardware problems identified on the Portable RelayDoc.

At any point, the test can be cancelled by selecting cancel at the bottom of the screen.

## 5.4 TEST REPORTS

Once the test has completed, a test report will be generated. Select view report at the bottom of the screen to view it immediately. It can also be found in the Test Reports page via the navigation menu.

If any criteria had failed during the test, it will be marked as FAIL, and be highlighted red.

The Test Report is laid out in the following format:

- Relay Information
  - Shows all information relevant for this test including values used from the profile and values entered pre-test.
- Relay Characteristics Table
  - Shows coil test results (coil resistance, coil power, operate and release voltages), and a summary of the contact table.
- Contact Table

- Shows details information regarding operating contact resistance, release contact resistance, operate time and release time.
- Description
  - The description of the relay entered via the test profile.

The test report can be exported by selecting the three vertical dots in the top right corner when viewing the report and selecting either Export (PDF) or Export (CSV). Alternatively, the report can be exported from the Test Reports page.

## 6. TEST PROCESSES AND FUNCTIONALITY

There are six independent tests the Portable RelayDoc can perform on a relay:

- 1) Coil Resistance
- 2) Contact Resistance
- 3) Contact Conditioning
- 4) Contact Switching Time
- 5) Operating Voltage or Current
- 6) Release Voltage or Current

The pass and fail parameters for each test are configured for each individual relay type via the relay profile (see *Section 4 Relay Profiles*).

These six test processes have options which affect all relay tests, and can be modified in the settings menu (see *Section 3.8.2 Advanced*). These can be saved as Test Processes and can be named to identify them.

These settings are:

- Enable or disable each of the six tests.
- Change the amount of contact conditioning cycles.
- Change the amount of contact resistance cycles.
- Change the max contact resistance for pass/fail values in the test report.
  - As contact resistance is a parameter wherein accuracy will change depending on the scenario the relay is used in, this is useful in keeping testing relevant.

To assist in understanding the Test Process profiles, the following is a basic example:

*A Portable RelayDoc in use testing brand new relays will want a minimal contact resistance setting and not to use Contact Conditioning, so a test process can be created named “New Relay Verification Profile”, with Contact Conditioning turned off, and max contact resistance is set to 0.1 ohms.*

*Additionally, that same Portable RelayDoc is also used to test 10-year-old field relays. In which case, contact conditioning may need to be used, and the max contact resistance should be a larger value. So max contact resistance is set to 1 ohm under a test process named “Field Relay Verification Profile”.*

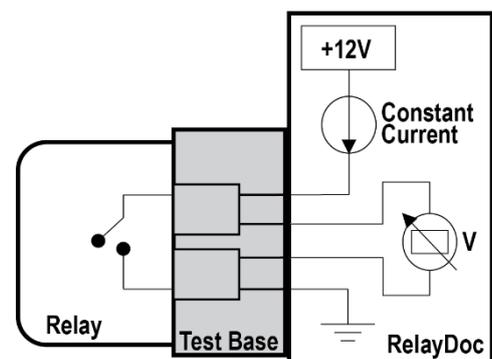
*The user can then choose between these profiles by selecting the Test Process when filling out the Test a Relay page, depending on the use case of the relay under test.*

### 6.1 COIL RESISTANCE

The coil resistance test passes a precise constant current through the coil. The voltage drop across the coil is measured and the coil resistance is calculated. The result is recorded.

The coil resistance measurement uses two different scales to generate high precision results.

Scale	Current	Range	Precision
1	10mA	0 – 500 Ω	1 Ω
2	1mA	500 – 10 kΩ	1 Ω



## 6.2 CONTACT RESISTANCE

The contact resistance test passes a precise constant current through each contact. The voltage drop across each contact is measured and the contact resistance is calculated. Accurate results are the result of using a Four Wire Kelvin measurement method up to the Test Base contact. This eliminates any resistance error from cables or connections between the Portable RelayDoc and the EUT.

The Portable RelayDoc manages the Contact Resistance Measurement, automatically increasing the applied current in stages until the measured resistance is in one of the ranges shown right.

Stage	Current	Range	Precision
1	100mA	0-5 $\Omega$	0.001 $\Omega$
2	10mA	5-50 $\Omega$	0.01 $\Omega$
3	1mA	50-500 $\Omega$	0.1 $\Omega$

Measured resistance over 500 $\Omega$  is defined to be OPEN state.

## 6.3 CONTACT CONDITIONING

Contact conditioning is not a measurement; however, it is a flash cleaning method. In the Portable RelayDoc implementation, a constant current source (CCS) provides 100mA as the relay contacts. There is a short current surge as the contact opens or closes and the resulting plasma arc cleans the contact surface.

Portable RelayDoc prevents contact conditioning being included in any default Test Process. If EUT fails an initial resistance test, the Portable RelayDoc will ask the operator to authorise contact cleaning and re-test of any failed relays, prior to creating the Test Report. Only Relays that fail the initial test will be conditioned and re-tested.

The user may select contact conditioning to be included in the current Test Process, in which case the software will not offer conditioning following a resistance test failure.

## 6.4 CONTACT SWITCHING TIME

This test is performed by measuring the time it takes for a relay contact to change state from Open to Close or vice versa. Open and Close values are factory set.

## 6.5 OPERATING VOLTAGE AND CURRENT

The Relay Operate voltage is measured using a ramp method: The coil supply voltage is swept from zero volts up to nominal rated voltage (set in the relay profile), while monitoring from an open to closed contact state.

## 6.6 RELEASE VOLTAGE AND CURRENT

The Relay Release voltage is measured using a Ramp Method: The coil supply voltage is swept from the nominal rated voltage (set in the relay profile) to zero, while monitoring from an open to closed contact state.

## 7. MAINTENANCE

### 7.1 GENERAL MAINTENANCE

The Portable RelayDoc requires very little maintenance. The main maintenance item is to keep the external relay base contact pins clean and free from contamination, as this can cause large variants in the contact resistance tests.

Complete the following items on an as required basis:

- Store all external relay bases in the provided carrying bag. This prevents excess build-up of dust.
- Clean Relay Contacts with Contact Cleaner and cotton buds.
- Wipe down the external surfaces with a just-damp soft cloth.

### 7.2 CALIBRATION

Calibration is required every 12 months. The calibration status of the Portable RelayDoc may be determined by:

- Checking the calibration label – this can be found attached to the device.
- Checking the calibration certificate – this is supplied with the device, or can be found in the application by selecting Settings > Calibration > View Calibration Report.

Calibration must be done by trained Operators, using the RelayDoc Calibration Kit (part number RDCK). RDCK is available for purchase from MRD, otherwise return the unit annually for calibration.

### 7.3 SOFTWARE UPDATES

All software updates can be downloaded from Google Play Store:

<https://play.google.com/store/apps/details?id=com.mrd.relaysense>



## 8. DATASHEET



### Portable RelayDoc

The Portable RelayDoc is a portable relay testing system designed to assess the condition of your relays with ease and accuracy. Including an Android tablet preloaded with our RelayDoc app featuring a simple pass-or-fail test format, the RelayDoc is the perfect tool for your on-site maintenance needs.

Test reports are generated automatically and stored internally where they are then available for on-screen viewing and analysis.



### On-The-Go Relay Testing

Now available in a portable version, RelayDoc makes on-the-go relay testing painless. Simply plug in a relay and press test. RelayDoc automatically performs numerous tests on your relays using key performance indicators to provide you with an instant state of condition report to help you find faults, and repair them quickly and easily.

#### Features

- Portable, anti-shock carry case
- Tests PNI50, PN250, B1, B2 and BR930 relay types
- Automatic relay-type detection using code-pins
- Simple user interface and test functionality in Android application
- Tablet provided with each unit
- Remote data access via web server
- LAN & USB
- Barcode reader compatible
- Displays test results in a simple pass/fail format

#### Benefits

- Fast and reliable asset monitoring
- Targeted maintenance management
- Remote access to recorded data
- No training required



## Portable RelayDoc

Portable Relay Tester

MRD Rail Technologies Pty Ltd  
+61 7 3821 5151  
sales@mrdd.com.au  
www.mrd.com.au



### Part Numbers

Portable RelayDoc	PRD
Test Base BR930 Relays	PRD-TB-BR930
Test Base PN150 Relays	PRD-TB-PN150
Test Base PN250 Relays	PRD-TB-PN250
Test Base B1 Relays	RP-TB-B1
Test Base B2 Relays	RP-TB-B2

### Technical Specifications

#### General Data

Dimensions (W x H x D)	300 x 304 x 194mm
Weight	5.4kg
Operating Temperature	-20 to 60°C

#### Test Range

Coil voltage	0 - 110V DC
Coil current	0 - 500mA
Coil type	Single, Dual (Twin), Latch and Current
Contacts	Up to 32 contacts testable

### Relay Test Parameters

Contact configuration check	
Max coil power	
Operate and Release voltage and current	
Coil resistance:	0 - 5k, Tolerance +/-1% Resolution 1R
Contact resistance range:	0 - 500R, Tolerance +/-1% Resolution 0.001R
Contact switch time:	+/-0.01 sec Resolution 0.001s
Clean current:	100 - 3000mA, Tolerance +/-1% Resolution 10mA
Coil voltage:	0 - 50V, Tolerance +/-1%, Resolution 0.1V

## 9. WARRANTY

*Congratulations on choosing an MRD Portable RelayDoc.*

*MRD Products are designed and manufactured to the highest standards: your Portable RelayDoc is backed with a ONE YEAR Warranty covering materials or manufacturing defects, commencing on the date of customer receipt.*

Please record your product details below.

Model	Serial Number	HW Version	Date of Purchase	Supplier
PRD	_____	_____	___/___/20___	

### Conditions

MRD warrants your new Portable RelayDoc device shall be free of material or manufacturing defects and shall operate as designed, when installed, used, and maintained according to the applicable Installation Guide, Technical Data Sheet, and User Manual.

This warranty does not cover:

- Normal wear and tear
- Problems not caused by materials or manufacturing defects
- Damage caused in-transit, by fluid ingress, by accident, or intentionally
- Damage resulting from installations or applications not expressly approved by MRD
- Devices that are altered in any way, including software or removal of the serial number
- Any other event, act, default or omission beyond MRD's control.

In the event of a possible warranty claim, immediately **stop using the device and contact your supplier for assistance**. It may be possible to solve the problem without returning the device.

### Returns

Do not return the device unless authorised by your supplier. If a return is required, it is your responsibility to pack the device for safe shipping, and to ship the device as instructed by your supplier. Return shipping is at your expense.

MRD will inspect returned devices. We will repair or replace devices or parts of devices that are found defective due to material or manufacturing faults. We will quote to repair other problems, if requested. We will return devices determined to be No Fault Found, at your expense.

### Limited Liability

The benefits provided by this warranty are in addition to other rights and remedies available to the consumer under the law. In no instance shall MRD be liable for consequential damages.

### For Australia Only

MRD Rail Technologies Pty Ltd goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.



This warranty is offered by:

**MRD Rail Technologies Pty Ltd**  
235 South St, Cleveland. QLD.  
4163. Australia.  
+61 7 3821 5151  
support@mrd.com.au

**END OF MANUAL**