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I. DISCLAIMERS, EXCLUSIONS AND LIMITATIONS OF LIABILITY

PLEASE READ AND NOTE PRESIDIUM WARRANTY TERMS AND CONDITIONS as stated in the warranty card. Presidium warranty for its devices are subject to proper use by its users in accordance with all the terms and conditions as stated in the relevant user handbook and shall cover only manufacturing defects.

Due to continuous product improvement, Presidium reserves the right to revise all documents including the right to make changes to the handbook without notice and without obligation to notify any person of such revisions or changes. Users are advised to check Presidium's website from time to time http://www.presidium.com.sg/

Presidium shall not be responsible for any damage or loss resulting from the use of this product or handbook.

Under no circumstances shall Presidium, its manufacturer or any of its subsidiaries, licensors, distributors, reseller, servant and/or agent be liable for any direct or indirect damages, resulting from the use of this device.

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, under no circumstances shall Presidium, its manufacturer or any of its subsidiaries, licensors, distributors, reseller, servant and/or agent be responsible for any special, incidental, consequential or indirect damages howsoever caused.

The Synthetic Ruby Identifier ("SRI") by Presidium in this handbook is provided and/or sold on an "as is" basis. Except as required by applicable law, no warranties of any kind expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

II. ABOUT THIS BOOK

Thank you for purchasing the world's first and only Synthetic Ruby Identifier ("SRI" or "device") by Presidium.

This handbook is designed to help you set up your device and describes all you need to know about how to use your gemstone testing device accurately and take care of it, in line with its requirements. Please read these instructions carefully and keep them handy for future reference.

This book also contains the terms and conditions in relation to the use of the device including the Disclaimer, EXCLUSION and Limitation of Liability clauses stated above in Section I.

III. About the Synthetic Ruby Identifier by Presidium

The Presidium Synthetic Ruby Identifier ("SRI") is a revolutionary new device developed to help identify amongst rubies, the synthetic ruby that is created through the flame fusion method. Researched and developed by Presidium in collaboration with the renowned Gem and Jewelry Institute of Thailand (GIT) near the traditional source hub of rubies, the Synthetic Ruby Identifier is a breakthrough in the development of gemological instruments, as it is the world's first and only tool, aside from expensive laboratory equipment, that identifies certain common synthetic rubies.

The Synthetic Ruby Identifier is designed as a test on known ruby stones and to differentiate the synthetic flame fusion rubies from natural and other forms of synthetic ruby. One way to ascertain if the gemstone is a ruby is to measure the thermal conductivity of the gemstone. If the gemstone is a ruby, the Synthetic Ruby Identifier can be used to further check if it is a synthetic flame fusion ruby.

Using the knowledge that when gemstones are subjected to deep UV irradiation, the difference in their light transmittance is significant enough to aid in differentiating known rubies, the Synthetic Ruby Identifier measures the UV light transmittance ability of ruby stones, as research¹ has found that synthetic flame fusion rubies are consistently more transparent to deep UV light.

¹ Sim, Hwa San; Leelawatanasuk, Thanong & Saengbuangamlam, Saengthip, "Handheld Synthetic Ruby Screener based on UV-VIS Light Absorption" in GIT 2012 (Bangkok; Gem & Jewerly Institute of Thailand, 2012), pp199-204.

The Synthetic Ruby Identifier features a deep-wave UV light that is activated to pass through the ruby towards the photo-detector on the base platform. Bars of coloured light on the front of the lid will provide an easy reading that indicates if the UV light transmittance ability of the tested ruby is high or low. Usually, a natural ruby will have a low UV transmittance due to the trace elements within that absorb the deep UV light. Other types of synthetic rubies such as those created through the flux and hydrothermal methods could either have high or low UV transmittance ability, depending on the presence of transition metal ions introduced during the growth process and hence the device cannot accurately identify those synthetic rubies. A synthetic flame fusion ruby which is the most common type of synthetic ruby though, will usually have few transition metal ions (mainly Chromium,Cr) due to relatively 'pure' melt growth process, resulting in high UV transmittance.

Created with the user in mind, the Synthetic Ruby Identifier is engineered to allow for very quick screening of single mounted ruby stones (with open-back setting) and loose rubies to check if they are synthetic flame fusion rubies. It is designed as a lightweight, portable, sturdy and non-slip unit and it can be powered by 4 AAA batteries or through its USB port connecting to an external power source.

The Synthetic Ruby Identifier has been subjected to thorough and extensive laboratory testing in collaboration with the Gem & Jewelry Institute of Thailand (GIT), and will generally give clear and reliable reading of the ruby being tested. This device only helps to identify a certain type of synthetic ruby and to ascertain if your tested ruby is natural or other forms of synthetic ruby, you are advised to conduct further supporting tests.

The device was designed with the following objectives:

- Help to further quickly identify one type of common synthetic, the synthetic flame fusion ruby from amongst known rubies
- Aid to further enable identifying natural ruby by screening out one type of synthetic ruby
- Provide consistent and reliable test results under proper use and understanding of its functions
- Feature user-safe materials and user-friendly ergonomics that gives clear visibility of results, maximum sturdiness and grip, ease of use and portability

The capabilities of the Synthetic Ruby Identifier are as follows:

- · Help to identify most synthetic flame fusion rubies
- Tests on rubies within a range in dimension from 3 mm in width and up to 6mm in height (approx. 0.1 to 6 carat size)
- Tests on polished rubies of common shapes such as round-cut, oval-cut, princess cut, brilliant round cut, emerald cut, baguette cut, square brilliant cut, step cut and mixed cut
- Can be used on both loose stones and rubies mounted on jewelry with open-back setting
- · Complete testing almost instantaneously

The user is cautioned against using the Synthetic Ruby Identifier on the following as it may affect the accuracy of the readings:

- × Unknown stones (users should only test on known rubies)
- × Rough, unpolished stones
- × Stones that are more than 6mm in height as the specific UV wavelength has limited ray reach
- × Opaque or translucent stones, and stones of dark red shades
- $\times\,$ Testing if the stone has been subjected to treatments such as heat irradiation and glass-filling
- × Testing to identify other forms of synthetically created rubies such as synthetic hydrothermal or synthetic flux stones
- × Mounted stones more than 6mm in height on ring jewelry with inside diameter measuring larger than 14.88mm (Italy ring size 6)

The Synthetic Ruby Identifier features the following:

- The world's first and only technology that measures a gemstone's UV light transmittance ability with a specific deep-wave UV to help identify synthetic flame fusion rubies
- 7 colour coded (blue/red) indicator light bars to give a clear low or high reading of light transmittance
- · Instantaneous clear results within 2 seconds
- Exterior rubber pads on base to ensure non-slip sturdiness and prevent scratches to surfaces
- Stream-lined ergonomic design that enhances portability and stability
- · Low battery indicator
- Energy-saving auto power-off of device after 10 minutes without operation
- · Interior LED light source and testing area
- Energy-saving auto power-off of interior LED light source when lid of device is open or when Start Test button is not activated

The interior LED source and testing area features:

- UV light source pre-set at an optimum wavelength to accurately measure the light transmittance ability of rubies
- Light source latch to enable future removal/replacement/change of light source
- · User-friendly lever to secure the gemstone in place on base platform
- · Ring guide placement markings on the light source
- Concentric circles marking the base platform in the testing area to
 place the stone
- UV-sensitive Photo-detector in the centre of base platform to detect the amount of light that passes through the stone

The connectivity functions of the Synthetic Ruby Identifier include:

- Exterior USB port at back of unit for connecting to external power source or computer
- · International voltage compatibility

Included in your package:

- · Presidium Synthetic Ruby Identifier unit
- · Protective carrying case with interior accessories pouch
- USB cable
- · Presidium Universal Power Adaptor
- Quick Guide
- · QR Code Card



Fig.A Synthetic Ruby Identifier Unit

Features/Functions (Fig.A)

- Power button (On/Off, Low Battery Indicator and Bluetooth Connectivity Indicator)
- 2. Lid
- 3 Base platform with concentric markings
- 4. Photo-detector
- 5. Interior LED Light Source with Ring Guide embossed on top
- 6. Light Source Lever to adjust Light Source
- 7. LED Light Source Replacement Latch
- 8. "Start Test" button
- 9. 7 Indicator Bars measuring UV Light Transmittance from Low to High
- 10. Micro USB port

Specifications

Length Width Height Weight without batteries Weight with batteries Power

130mm 100mm 65mm 210grams 250grams 4 AAA Batteries or via USB cable connected to external power source

IV. BACKGROUND AND DEVELOPMENT OF PRESIDIUM SYNTHETIC RUBY IDENTIFIER

The world of colored gemstones is a sparkling but somewhat mystical one. Unlike diamonds which have an established grading system that appraises a diamond based on colour, cut, clarity and colour, colored gemstones do not have a similar universal appraisal system. Furthermore, the range of colours can be seen across both precious and semi-precious stones allowing some people to mistake one easily for the other. The discovery of equally colourful synthetic materials may have also undermined the appreciation and authenticity of precious colored gems especially the corundum stones – sapphires and rubies.

Rubies, with its stunning red shades have captured the hearts of many since the ancient times. With such popularity, synthetic rubies have been man-made from as early as the 1800s with the Verneuil process which creates what is known to be flame fusion rubies. With its simple technology, low cost and convincing yield, it still remains a process that is widely used today.

Through the years as methods and technology gained sophistication, other crystal growth processes were discovered such as the flux method or the hydrothermal method. The methods developed to identify such synthetic gems are often limited only to gemologytrained experts or to the use of expensive laboratory equipment and it is difficult for most buyers to ascertain if synthetic gems may be marketed, sold and mixed with natural rubies.

With the knowledge of this, Presidium set out to work on researching more about synthetic rubies and developing a device that can aid in the quick identification of such rubies.

It is known that due to impurities or transition metal ions that are usually found in natural rubies, these stones are able to absorb deep UV light. Thus the UV transmittance ability of such stones is low. For synthetic flame fusion rubies, it was found that they usually did not contain such trace elements or impurities. Hence, the UV transmittance ability of synthetic flame fusion rubies is high, allowing the UV wavelength to pass through the stone.

This knowledge was shared with the Gem and Jewelry Institute of Thailand (GIT) which recognised and endorsed this methodology of utilizing the UV-VIS-NIR spectroscopy to measure the transmittance for identifying synthetic and natural rubies.

Believing this was a radical new methodology to identify certain gemstones, GIT also loaned Presidium a substantial sample size of both natural and synthetic ruby stones for testing and identifying. Presidium was able test these stones using the Synthetic Ruby Identifier and have the tests confirmed using GIT's advanced laboratory equipment. Working closely with researchers at GIT who readily shared their gemmological knowledge, testing trials for the Synthetic Ruby Identifier were also conducted by GIT for Presidium.

V. Important notice

- Keep the device dry. Precipitation and all types of liquids or moisture can contain minerals that will corrode electronic circuits. If your device gets wet, remove the battery and allow the device to dry completely before replacing it.
- Do not use, store or expose the device in dusty, dirty areas. Its moving parts and electronic component may get damaged.
- Do not use, store or expose the device in hot areas. High temperatures can damage or shorten the life of the device, damage batteries, and warp or melt certain plastics.
- Do not use, store or expose the device in cold areas. When the device returns to its normal temperature, moisture can form inside the device and damage electronic circuit boards.
- Do not attempt to open the device other than as instructed in this handbook.
- Do not drop, knock, or shake the device. Rough handling may break internal circuit boards and fine mechanics.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the device.
- Do not paint the device. Paint can clog the moving parts and prevent proper operation.

If the device is not working properly, kindly contact Presidium Customer Service at **service@presidium.com.sg** or:

Presidium Instruments Pte Ltd Unit 7, 207 Henderson Road Singapore 159550 Attn: Customer Service Executive

1. GETTING STARTED WITH YOUR Synthetic Ruby Identifier

1.1 Powering up your device

The Synthetic Ruby Identifier can be powered either by the use of batteries or through the USB cable connected to the Presidium Universal Power Adaptor that are both included with your product, or to an external power source.

If batteries are used, you can locate the battery well at the bottom of the unit. Release the two catches on the battery cover and remove the battery cover to reveal the battery well. (Fig 1.1)

4 AAA batteries are needed to power the device. Do take note of the positive (+) and negative (-) directions of the batteries when inserting them into device. The use of alkaline batteries is recommended as it should generally give 2.5 hours of continuous operation with approximately 900 tests.





If an external power source is used, plug the provided micro USB cable to the port located at the back of the device (Fig 1.2) and the other end to the provided Presidium Universal Power Adaptor for connection to an external power socket.



Fig.1.2 Plug the micro USB into the port located at the back of the device

You may also connect the other end of the USB cable directly to an external power source (e.g. computer, laptop, etc).

It is recommended you use only the USB cable and the Presidium Universal Power Adaptor provided with your product.

1.2 Switching on your device

To switch on your Synthetic Ruby Identifier, press and hold the Power button located at the front of the unit. A blue light will blink for approximately 20 seconds to allow the product to warm up. (Fig 1.3).

Once the blue light stops blinking and remains stable, the device is ready for use.



Fig.1.3 Switch on Synthetic Ruby Identifier with the Power button

1.3 Switching off your device and Power-Saving Auto-Off

To switch off your Synthetic Ruby Identifier, press and hold the Power button for approximately 2 seconds until the light goes off.

To ensure that your Synthetic Ruby Identifier conserves power, the unit will automatically switch off 10 minutes after the last activity.

1.4 LOW BATTERY INDICATOR

When the battery is too low for the device to function, the Power button light will turn red (Fig 1.4).



Fig.1.4 Low Battery Indicator in Red Light on Power Button

When this Low Battery Indicator is lit in red, the device is not able to conduct any more tests and the LED light source inside the device will not be able to be switched on.

Replace the batteries or switch power source as necessary.

Battery Information

Do not leave worn out batteries in the battery compartment as the batteries may corrode or leak, and damage the circuitry of the device. It is recommended that batteries should be removed when the device is expected to be stored for an extended period of time.

Batteries do not have to be removed from the unit when the Presidium Power Universal Adaptor is used through the USB cable.

1.5 Power Button Overview

For a full overview of the Power Button and its functions, please refer to Section 5 in this book – "Overview of Indicators on your Synthetic Ruby Identifier".

2. Performing a test with your Synthetic Ruby Identifier

The Synthetic Ruby Identifier can only work accurately with known rubies and in identifying the commonly found synthetic flame fusion ruby amongst known rubies.

Before you begin a test, ascertain that the type of red stone that you are testing is a known ruby. There are many ways to check this based on the inherent properties of rubies. One way you can check is to use the Presidium Gem Tester which tests based on the gemstone's property of thermal conductivity. If your red stone falls within the Ruby – Sapphire range, you are likely to have a known ruby.

Once you know your stone is a ruby, you can proceed to use the Synthetic Ruby Identifier to check if it is a synthetic flame fusion ruby.

The "Start Test" button located at the top right corner of the device indicates when the device is ready for testing and activates the interior LED light source to begin the identifying procedure.

Press the "Start Test" button and the button will be lit in blue. This indicates the device is ready to begin testing. (Fig 2.1)

You should only begin to use the device for testing when the "Start Test" button is lit in a steady blue.



Fig.2.1 Press "Start Test" button to perform a test

Once the device is ready for testing, use the finger grips on the front of the lid to lift the lid and access the interior testing area. (Fig 2.2)



Fig.2.2 Lift the lid of the device using the finger grips on the front

The testing is performed under the lid of the Synthetic Ruby Identifier where a testing area is marked by a concentric-circled base platform with a Photo-detector in the centre and a protruding overhead LED light source (Fig 2.3).



Fig.2.3 The interior testing area inside the device

The following instructions will guide you through testing loose gemstones and mounted jewelry.

2.1 For testing on loose gemstones

Ensure your loose gemstone is wide enough to cover the Photodetector. It should be approximately 3mm in width. Your loose gemstone should also not exceed 6mm in height to ensure that the UV wavelength transmitted by the LED light source can be accurately measured.

Place the loose gemstone over the Photo-detector (Fig 2.4).



Fig.2.4 Placing the loose gemstone on the Photo-detector

The flattest side of the stone should be placed face-down on the Photo-detector.

Ensure that the Photo-detector is completely covered by the gemstone so that the emitted wavelength is through the stone material.

Should the Photo-detector not be completely covered by the gemstone, the emitted UV light will not be able to pass through the stone, reaching the Photo-detector instead and will give an inaccurate reading of the UV light transmittance ability of the stone material.

Adjust the lever to lower the LED light source and secure the gemstone in place on the Photo-detector for testing (Fig 2.5).



Fig.2.5 Adjust the LED light source downwards to secure the gemstone in place on the Photo-detector

Close the lid and press the "Start Test" button.

The button will begin to blink in white whilst the test is being performed. When the test is complete, the button will be lit in a steady white light and your test results will be displayed in the 7 Indicator Lights. You should see your results within 2 seconds.

Users are recommended to place each ruby stone in at least 4 different positions since the test results could be influenced by the positioning of the ruby. Always place the flattest face of the stone on the Photo-detector.

To understand your test results, refer to Section 3 in this book – "Reading test results on your Synthetic Ruby Identifier".

2.2 For mounted jewelry or gemstones

Ensure that the stone is set with an open-back setting, meaning you can still see a clear view and colour of the stone when you view the back of it and it is not obscured by the jewelry metal or other stones. (Fig 2.6).



Fig.2.6 An example of jewelry with open-back setting

If your mounted open-back gemstone is in a ring, place the ring in the centre of the cross-hair marking on the Ring Guide that is embossed on the LED light source. The front of the mounted stone should be directly facing the Photo-detector.

With the ring hung within the Ring Guide area, use the lever to lower the LED light source to secure the stone over the Photo-detector (Fig 2.7).



Fig.2.7 Place open-back ring jewelry on the Ring Guide on the LED light source and push the LED light source down to secure the stone against the Photo-detector

If your gemstone is mounted with open-back setting in other types of jewelry that cannot be placed over the Ring Guide, place the jewelry onto the base platform, with the stone covering the Photo-detector and lower the LED light source to secure the jewelry in place for testing.

Ensure that the Photo-detector is completely covered by the gemstone so that the emitted wavelength is through the stone material.

Should the Photo-detector not be completely covered by the gemstone, the emitted UV light will not be able to pass through the stone, reaching the Photo-detector instead and will give an inaccurate reading of the UV light transmittance ability of the stone material.

Close the lid and press the "Start Test" button.

The button will begin to blink in white whilst the test is being performed. When the test is complete, the button will be lit in a steady white light and your test results will be displayed in the 7 Indicator Lights. You should see your results within 2 seconds.

To understand your test results, refer to Section 3 in this book – "Reading test results on your Synthetic Ruby Identifier".

2.3 Important Notes about Performing a test

- Ensure your tested gemstone does not exceed 6mm in height and its width covers the Photo-detector completely. The carat equivalent of this is approximately 0.1 to 6 carats.
- Conduct prior supporting tests to ascertain the type of red stone for testing.
- · Only open-back mounted jewelry can be tested.
- Rough, unpolished stones may not be able to test with accurate results.
- Opaque or translucent stones, and stones of dark red shades may not be able to test with accurate results.
- The tested gemstone or jewelry will need to be secured against the Photo-detector by adjusting the light source directly onto the tested stone or jewelry.
- To enhance accuracy, it is recommended to place the ruby gemstone in at least 4 different positions on the Photo-detector and checking if the readings are consistent.
- To prevent inaccurate results, no test can be conducted when the Power button turns red, indicating low battery.
- You can only conduct a test when the "Start Test" button is pressed and is lit in blue.
- A test is completed when the "Start Test" button stops blinking and remains stable and lit in white.
- To reset and start a new test, press the "Start Test" button to return it to be lit in blue.

3. Reading Test Results with your Synthetic Ruby Identifier

The Synthetic Ruby Identifier measures the UV transmittance ability of the stone and this measurement is communicated as a low or high reading displayed through the 7 Indicator Light bars on the front of the device.

After the "Start Test" button is pressed, the button will start to blink in white as testing is underway. When the test is complete, the "Start Test" button will stop blinking and be lit in a steady white, indicating the test is complete. One of the 7 Indicator Light bars will also be lit, displaying if the UV transmittance result is low or high (Fig 3.1).



Fig.3.1 Results are to be read from the 7 Indicator Lights

To start a new test, press the "Start Test" button again to return it to ready mode. The button light should return to be lit in blue.

You should only perform a test when the "Start Test" button is lit in blue.

Low Reading

The first 4 bars from the left fall within the Low reading range and if any measurements within this range is recorded, a blue light will light up within these 4 bars (Fig 3.2).



Fig.3.2 Low Reading

A Low reading with blue light means the UV light transmittance ability of the tested gemstone is low and this is probably due to trace elements within the stone which can occur during the natural ruby growth process or through flux and hydrothermal synthetic ruby growth processes.

You are advised to conduct further supporting tests to ascertain if your tested gemstone is a natural ruby.

High Reading

The last 3 bars fall within the High reading range and if any measurements within this range is recorded, a red light will light up within these 3 bars (Fig 3.3).



Fig.3.3 High Reading

A High reading with red light means the UV light transmittance ability of the tested gemstone is high and the UV light can pass through the tested gemstone to the Photo-detector easily. This could mean the stone has a high UV transparency which is commonly a result of the flame fusion creation process. The tested ruby is hence likely to be a synthetic flame fusion ruby.

You can use the Synthetic Ruby Identifier to quickly sort through a parcel of ruby stones and identify which ones are synthetic flame fusion rubies.

4. Overview of Indicators on your Synthetic Ruby Identifier

The table below summarizes the functions and representations of the buttons and lights on the Synthetic Ruby Identifier device.

Power Button

Description	Light	Function
Power Button is pressed and held when device is switched off	Blinking blue	Device is being switched on and will start warming up.
Device is ready for operation	Steady blue	Device is being warmed up and is ready for use.
Low Battery Indicator	Steady red	Device cannot operate with low battery.
Power Button is pressed and held for 2 seconds during operation	No lights	Device is being switched off.

Start Test Button

Description	Light	Function
Ready for testing	Steady blue	Device lid is closed and ready for testing with the interior LED light source switched off.
		Note: The Start Test button will not light up when the device lid is open.
Testing is underway	Blinking white	Device is conducting the test with the interior LED light source switched on.
Test is complete	Steady white	Device has completed the test and a result should be displayed within the 7 Indicator Lights.
		Note: To conduct the next test, you will need to press the Start Test button once to reset it back to ready for testing, indicated with a steady blue light.

7 Indicator Lights Display

Description	Light	Function
Red Light Bar within the 7 Indicator Lights	Steady red	The test is complete and the tested ruby has recorded a High UV Transmittance ability, indicating that it is likely a synthetic flame fusion ruby.
Blue Light Bar within the 7 Indicator Lights	Steady blue	The test is complete and the tested ruby has recorded a Low UV Transmittance ability, indicating that it could be a natural ruby or other type of synthetic ruby.

5. Taking care of your Synthetic Ruby Identifier

The Synthetic Ruby Identifier should be handled with care. Always cover it or place it securely in its custom carrying case when the device is not in use. Caution should be taken so as not to damage the device.

Do not leave worn out batteries in the battery compartment as the batteries may corrode or leak, and damage the circuitry of the device. It is recommended that batteries should be removed when the device is expected to be stored for an extended period of time.

Your tester is a product of extensive design and craftsmanship, please treat it with care.

Thank you for taking time to go through the user handbook, which helps you to understand your recent purchase better.

Presidium also recommends that you register your warranty by sending the provided warranty registration card to us or by registering online at http://www.presidium.com.sg/.