

Digitimer

SPP-400

Digital Trigger Generator

OPERATOR'S MANUAL



For Research Use Only

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Product Registration

Please take time out to register your new product.

You can even do it online at:-

www.digitimer.com/register

Contact Addresses

Manufacturer

Digitimer Limited

37 Hydeway

Welwyn Garden City

AL7 3BE

UK

Telephone: (UK) 01707 328347 (Int.) +44 1707 328347

Fax: (UK) 01707 373153 (Int.) +44 1707 373153

E-mail: sales@digitimer.com
technical@digitimer.com

Website: www.digitimer.com

Major Representative

North America: Digitimer North America, LLC

One East Broward Blvd.

Suite 700

Fort Lauderdale

FL 33301

USA

Telephone: +1 954 334-1070

Fax: +1 954 206-6227

E-mail: svalenti@digitimer.com

Please contact Digitimer for information regarding representation in other countries.

Product Registration

For a speedy response to all your questions now and in the future, please take time out to register your new SPP-400 Trigger Generator at www.digitimer.com/register now! Product registration permits us to advise you of any safety matters or new product information. This web address is your point of contact for all questions regarding the SPP-400. The contents of this site are now growing rapidly, so please bookmark it so that you can visit it regularly to check out the new items.

Why Register Your Purchase?

Digitimer periodically offers enhancements and firmware updates to our products. Without product registration, users of our products may miss announcements of important enhancements to the products that they are using. Digitimer Limited does not make our customer list available to anyone else. Any information that you provide to us is strictly confidential.

How to Register Your Purchase

Product registration may be accomplished in two ways. You may fill out and mail in the product registration/warranty card supplied with each Digitimer Limited product. You may also register on-line at our www.digitimer.com/register website.

Product Announcement Mailing List

Digitimer has E-mailing lists, which we use as our primary outlet for announcements of new products, product enhancements and product updates. We strongly recommend that all users of our products sign up for the list that is most appropriate to their area of interest. E-mail is kept to a minimum and list membership is kept in the strictest confidence. Only Digitimer Limited can send mail to members of our e-mailing lists.

Precautions and Warnings

Operator's Manual

Carefully study this Operators Manual before using the SPP-400 Digital Trigger Generator.

Explosion and Fire

The SPP-400 must not be used in an explosive atmosphere or volatile atmosphere.

Damage

The SPP-400 and/or any accessories must not be used if there are any signs of external damage.

Moisture

The SPP-400 and/or any accessories must not be used if any parts are wet or damp.

Electrical Interference

This unit has been fully tested for European (CE) EMC conformity. This unit should NOT be used near radio transmitters. If any 'strange' behaviour of the unit is noted, discontinue use immediately and refer to a qualified EMC engineer.

Servicing & Maintenance


This equipment does not require any regular maintenance but if you would like your SPP-400 to be serviced we are happy to do so. Please contact us for a reference number and instructions before despatching the unit.

Before each use, inspect the SPP-400 enclosure and headstage for any damage. The equipment should be sent for repair if any damage is found.

Environmental Considerations

The European Union has adopted Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), with requirements that went into effect August 13, 2005. WEEE is intended to reduce the disposal of waste from electrical and electronic equipment by establishing guidelines for prevention, reuse, recycling and recovery.

As part of our legal obligation, Digitimer Limited is a registered EEE producer. Our WEEE registration number is WEE/BJ0052TQ. For further information relating to the correct

method of disposal of any of our equipment, which features this label , please contact us.

Unpacking

After unpacking the SPP-400 from the shipping carton, please inspect it and accessories for any sign of shipping damage. Please contact the carrier and your supplier, or Digitimer Limited, immediately if there is any damage. Do not dispose of the shipping carton. The carrier will want to examine the shipping carton to process a damage claim. Digitimer Limited and our distributors insure all shipments to cover shipping damage.

It is also advisable to keep the shipping carton in the event that the instrument needs to be returned for service.

Supplied Accessories

As well as the main unit, the following items are included as part of the SPP-400:-

- Operator's Manual
- Mains Lead/Power Cord
- Mini-B USB Cable
- 24V (40W) DC Power Supply Adaptor (part code **D.PSU40**)

Optional Accessories

Digitimer can supply a range of accessories.

- **D185-TC3** BNC cable (1m long)
- **DS7A-HS1** Hand Switch
- **D185-FS1** Foot Switch (requires D.SPP-TIA)
- **D.SPP-TIA** Trigger Input Adaptor

Introduction to the SPP-400

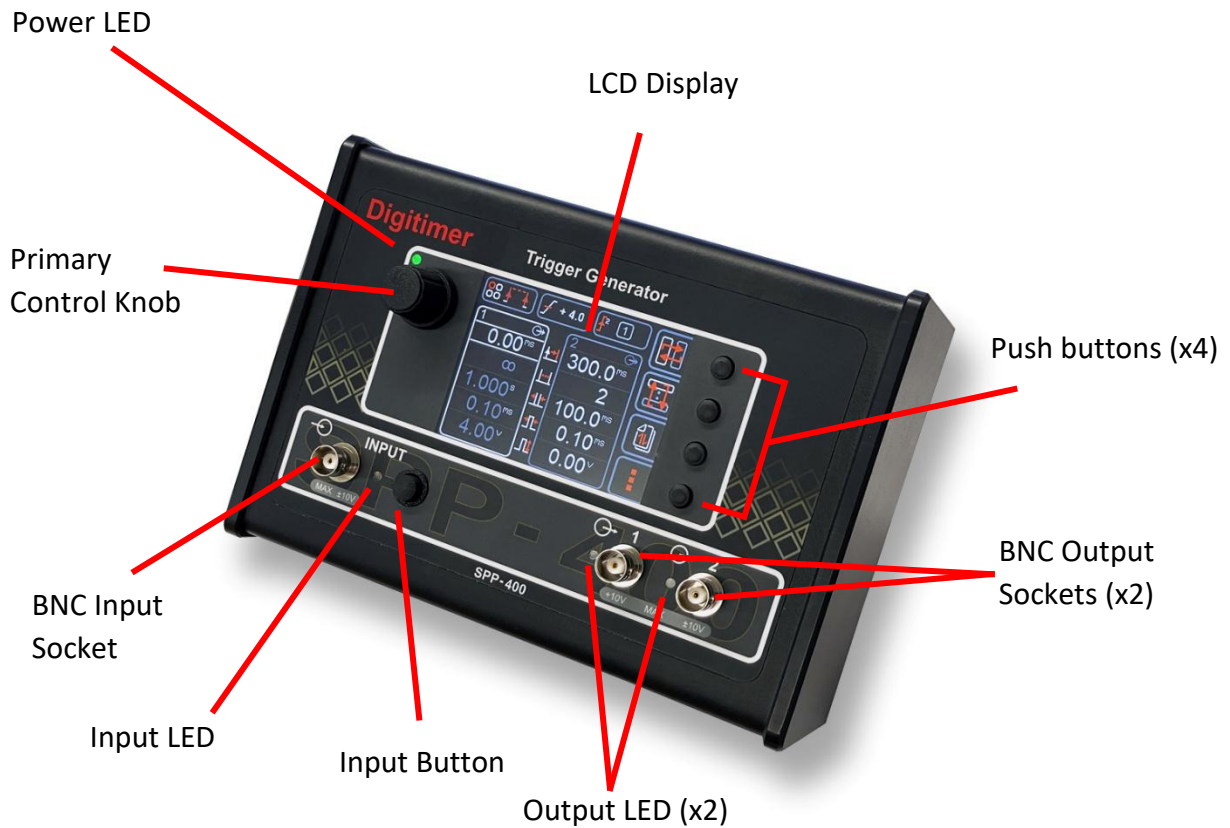


Developed within our **Small Product Platform** range, the SPP-400 provides a standalone trigger source that can be used to trigger our range of electrical stimulators and other third-party devices. The SPP-400 takes the capabilities of the Digitimer DG2A Trigger/Delay Generator and extends them to create a more precise and capable instrument suitable for delivery of continuous trigger pulses, discrete trains or repeating burst of triggers. Featuring two output channels, these can operate in parallel or be linked together to increase the trigger protocol complexity.

The SPP-400 can store up to 8 pre-set protocols, allowing users to rapidly recall previously used settings specific to a particular stimulation paradigm.

Yet to be implemented, software control will be available via USB connection to a host Windows PC. In the future, the SPP-400 will be supplied with a virtual front panel GUI, software capable of replicating the on-board functions. At the time of writing, the USB connection is only used to update the device firmware.

Hardware Overview



Physical Controls

There are just six physical controls, the primary control knob (actually a multi-function rotary encoder/push-button), four further push buttons and a single input button.

The primary control knob is used to power the SPP-400 on/off, adjust settings and to prematurely terminate active protocols.

The array of four buttons provide navigation control and access to the protocol manager and main menu screens.

The Input Button replicates the actions of, and may be used as an alternative to, an input applied to the BNC input socket or a foot/hand switch press.

Display

The full colour LCD display allow users to view and adjust SPP-400 settings. The screen [brightness is adjustable](#) to optimise for different lighting conditions.

Power LED

A single tri-colour LED above the primary control knob indicates the status of the amplifier and is illuminated GREEN during normal operation. This LED is blue when the unit is processing a setting change or solid red to indicate an error state. It flashes red when the SPP-400 is in bootloader mode (see [Updating Device Firmware](#))

Input LED

The input LED illuminates green when receiving a valid input (either via the BNC socket or Input Button). The LED will turn red if the SPP-400 receives an input before a previously triggered protocol has completed.

Output LEDs

A further pair of LEDs indicate the status of the Channel 1 & 2 outputs, illuminating GREEN when active.

BNC Input/Output Connections

Three BNC sockets are provided, one for connection to an input source (digital/TTL or hand/foot switch) and one for each of the two output channels (0-10V).

Fold-out Feet

The SPP-400 includes two fold-out feet that permit an alternative viewing angle.



Power & USB Connections

The side panel includes a 24V DC power supply input socket, which should be connected to the provided external power supply adaptor (D.PSU40). The SPP-400 will not operate without this power supply.

In addition, there is a Mini-B USB socket provided to allow the SPP-400 firmware to be updated. Once released, the SPP-400 GUI will use this connection to communicate with the host PC.



Powering the SPP-400

Powering On

1. Connect the supplied 24V DC power supply and mains lead to a powered wall socket, ensuring the wall socket is switched off.
2. Connect the round jack plug of the power supply to the SPP-400 power input socket.
3. The SPP-400 is powered on by briefly pressing the primary control knob located to the left of the display panel. The display should first show the Digitimer logo (including firmware version), then the main home screen. The power LED should sequentially turn green, blue and then red before returning to green.
4. The SPP-400 should then display the default home screen.

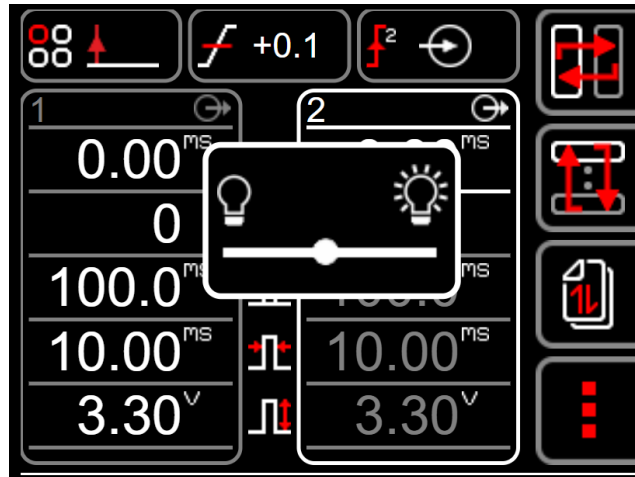
Powering Off

To power off the SPP-400, the primary control knob should be pressed in and held for approximately 5 seconds until the display and power LED turn off.

Note that all SPP-400 settings are persistent between power cycles.

Screen Brightness Adjustment

The brightness of the LCD screen may be adjusted to suit the user's preference.



Press and hold Button 1 and the brightness adjustment panel (below) will appear. Brightness is adjusted using the rotary encoder control. Pressing any of the four buttons will close the brightness control panel and save the setting.

Home Screen & Control Interface

The SPP-400 home screen is divided into three main zones:-



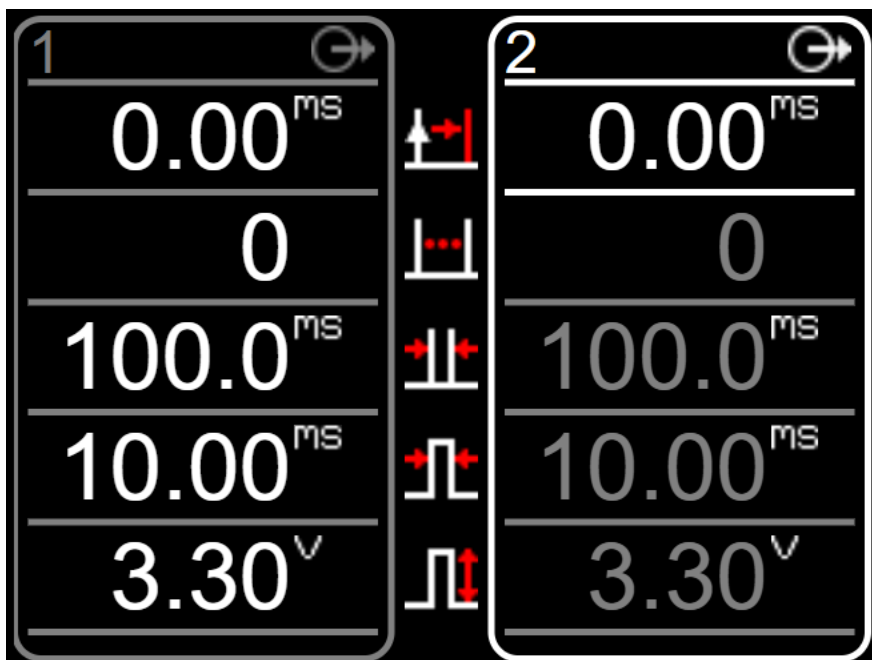
Zone 1 - Trigger Settings

The upper three panels display (i) triggering mode, (ii) input voltage setting and (iii) the Channel 2 trigger source. The settings for each are accessed and adjusted via the [Main Menu](#), via Button 4.



Zone 2 - Channel Settings

A column of icons, indicating the meaning of each setting, separates the parameters for the output channels. The horizontal navigation button (Button 1) allows the channel of interest to be selected, while the vertical navigation button (Button 2) cycles through the parameters. Adjustment is via rotation of the primary control knob.



Below is a detailed explanation for each parameter alongside the relevant icon.

	<p>DELAY This is the delay between a valid trigger being received and the output pulse from that channel. Adjustable between 0.00ms to 999.9s. The step size will automatically adjust as values increment or decrement.</p>
	<p>PULSE COUNT In Triggered Mode, this displays the discrete number of pulses to deliver. In Gated or Toggled modes this shows the infinity symbol (∞), as the pulse number will be determined by the input state of the channel. Adjustable between 1 and 9999.</p>
	<p>INTER-PULSE INTERVAL This sets the inter-pulse interval when repetitively triggering. Adjustable from 0.02ms to 999.9s. The step size will automatically adjust as values increment or decrement. As an example, if a frequency of 5Hz is required, this should be set to 200ms.</p>
	<p>PULSE DURATION Adjusts the output of individual pulses from 0.01ms to 999.9s. The step size will automatically adjust as values increment or decrement.</p>
	<p>OUTPUT VOLTAGE Defines the amplitude of the output pulses from that channel. Adjustable from 0 to +10V in 10mV steps. A voltage of +3V to +5V would generally be suitable for triggering TTL compatible devices.</p>

Settings Conflicts

For any given parameter, the full range of adjustment may not always be available, as other settings may conflict with them. For instance if the inter-pulse interval of Channel 1 is set at

200ms, it will be impossible to set the Channel 1 pulse duration to a value higher than 199.9ms. The SPP-400 will also detect conflicts between channels if they are linked (i.e. when Channel 2 receives its input from Channel 1).

If the Input Button is pressed or incoming trigger pulses are delivered while a protocol is still running, this will cause the input LED to illuminate red and the triggers will be ignored i.e. the device cannot be re-triggered during a running protocol. If the user wishes to terminate a running protocol, this can be accomplished by briefly pressing the Power button.

Zone 3 - Button Menu

To the right of the display there is an array of four buttons used to navigate the channel settings, manage stored protocols and access the Main Menu. These icons change to designate different functions when in the Protocol Manager or Main Menu.

	<p>Horizontal Navigation The top button navigates between the settings of Channel 1 and Channel 2. The active channel/parameter is highlighted with a white border.</p>
	<p>Vertical Navigation The upper-middle button cycles vertically through the individual settings for the active channel, with the active parameter highlighted in white and individual parameter settings adjusted using the main rotary control.</p>
	<p>Protocol Manager The lower-middle button accesses the Protocol Manager. Users can store and recall up to 8 protocols. When in the Protocol Manager the four buttons are re-assigned to load, save or delete protocols, with the bottom button returning to the home screen.</p>
	<p>Main Menu The bottom button accesses the Main Menu, which provides the user with access to range of settings.</p>

Trigger Mode Panel (Left)

Displays current trigger mode from:-

1. **Triggered Mode** – the SPP-400 will activate each time a valid trigger input is applied. In triggered mode the SPP-400 settings can permit protocols that last many seconds or even minutes. If the user wishes to prematurely terminate a protocol, this may be accomplished by briefly pressing the Power Button.
2. **GATED Mode** – the SPP-400 will be active while it is receiving a valid voltage input.

3. **Toggled Mode** – successive inputs will activate and deactivate the SPP-400 i.e. toggle the output On and Off.

Trigger Level Panel (Middle)

Displays the adjustable trigger input voltage threshold (range of $\pm 10V$) for external triggering or gating of SPP-400.

The physical trigger button works irrespective of this voltage setting.

Ch.2 Trigger Source Panel (Right)

Displays the trigger source for Channel 2 – can be DIRECT i.e. via input socket/button press or from the output of Channel 1.

Main Menu

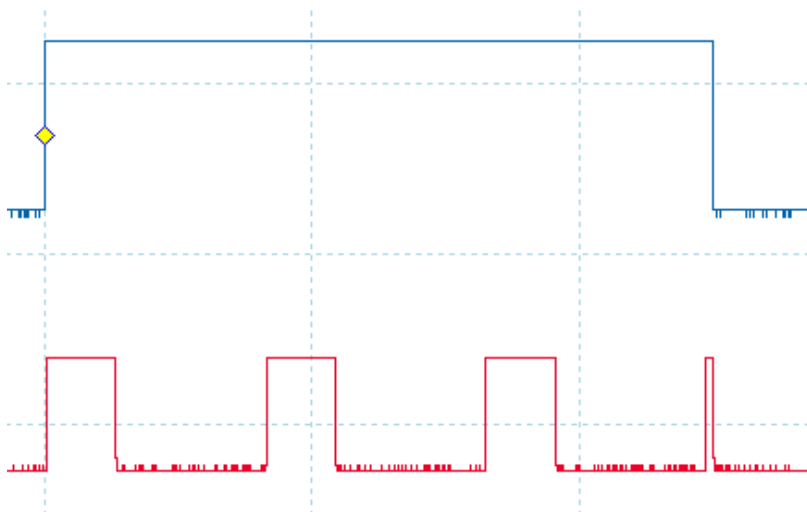
The Main Menu is accessed by pressing the bottom button (Button 4) and provides settings for the following:-

Trigger mode setting



Adjustable between three modes (i) Triggered, (ii) Gated and (iii) Toggled.

NOTE: In Gated mode any pulses that cannot be completed before the gate is closed are curtailed. In the example below, the gated ON period is shown by the blue trace, but is closed before completion of the fourth pulse, which as a result is shortened.

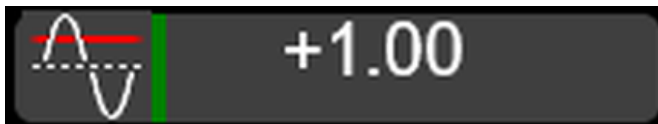


Edge setting



Sets whether the SPP-400 should trigger on a rising or falling TTL edge applied to the input BNC. The input trigger button will always operate irrespective of this setting.

Trigger threshold



Adjustable between -10V and +10V, this setting determines the voltage at which the SPP-400 will be triggered/activated. The input trigger button will always operate irrespective of this setting.

Channel 2 Trigger Source



Either triggering directly from a direct input, as with Channel 1, or using Channel 1 as the trigger for Channel 2.

Trigger Source Inactive Voltage



This should be set to match the voltage of the trigger source when it is inactive, so if the external device is normally producing +5V when the output is inactive and this drops to 0V when it becomes active, this value should be set to +5V.

Correct setting prevents unintended triggering when connecting or disconnecting cables from the input socket. If you are using the SPP-400 with a trigger source that is at 0V (Ground) by default, then this setting can be left on GND. The input trigger button will

always operate irrespective of this setting.

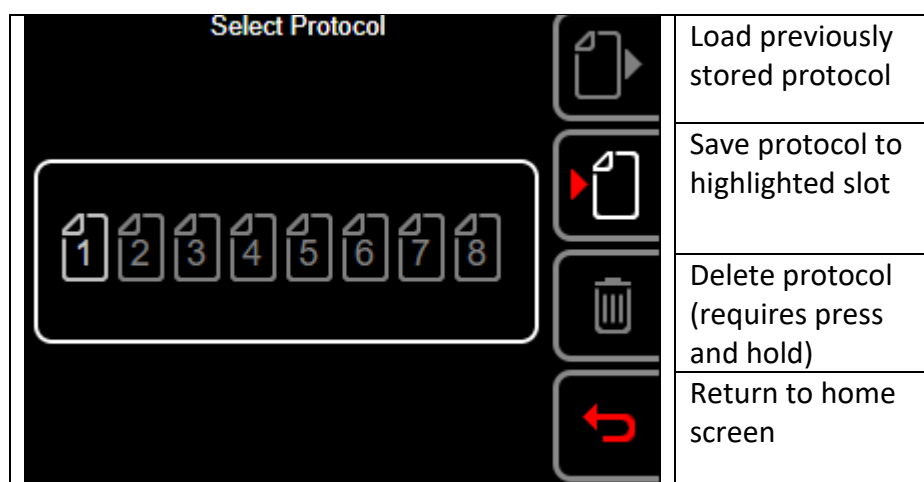
De-bounce



Used to prevent the phenomenon of switch bounce when using mechanical contact closure switches to activate the SPP-400. Switch bounce can lead to unintended multiple triggers. When the de-bounce is activated (designated by the green tick in the settings), the SPP-400 ignores successive triggers within 50ms of an initial trigger event. De-bounce should only be activated when a mechanical switch, such as our D185-FS1 or DS7A-HS1 are used to trigger the SPP-400.

Protocol Manager

The protocol manager allows users to store and recall up to eight different configurations for the SPP-400. Within the protocol manager, the main control knob is used to sequentially highlight the slots labelled 1 to 8. The button actions are detailed below to the right of their respective icons.



The user can choose to open a previously stored protocol (indicated in green), save a new protocol to an empty slot or delete a previously stored protocol. It is not possible to overwrite an existing protocol. Instead, unwanted protocols must first be deleted, then the existing settings can be saved into the newly created empty slot.

Deletion requires the user to highlight the target protocol, then **press and hold** the delete button indicated by the waste bin icon for approximately 3s, until the green highlight is removed.

When a protocol is saved or loaded, the SPP-400 immediately returns to the home screen.

Updating Device Firmware

Periodically Digitimer may release firmware updates for the SPP-400. Only files supplied by Digitimer should be installed.



Requirements

Before you commence the update process you will need the following:-

- SPP-400 Digital Trigger Generator.
- A Windows PC.
- Digitimer SPP Update Installer software.
- SPP-400 firmware file.
- Mini-B USB cable.

Instructions

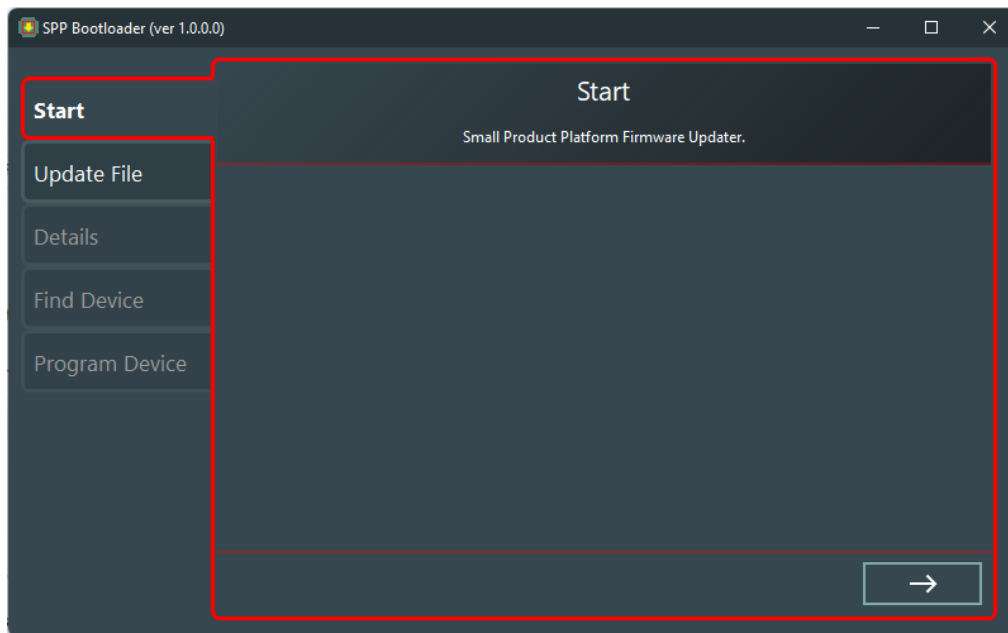
1. Replacement firmware files are supplied in a zip file (*.xml) along with an executable the Digitimer SPP update software (Windows compatible).

 Digitimer SPP Update Installer v1.exe	09/10/2025 11:26	Application	7,665 KB
 SPP-400_01_02_00.xml	06/10/2025 14:10	Microsoft Edge H...	250 KB

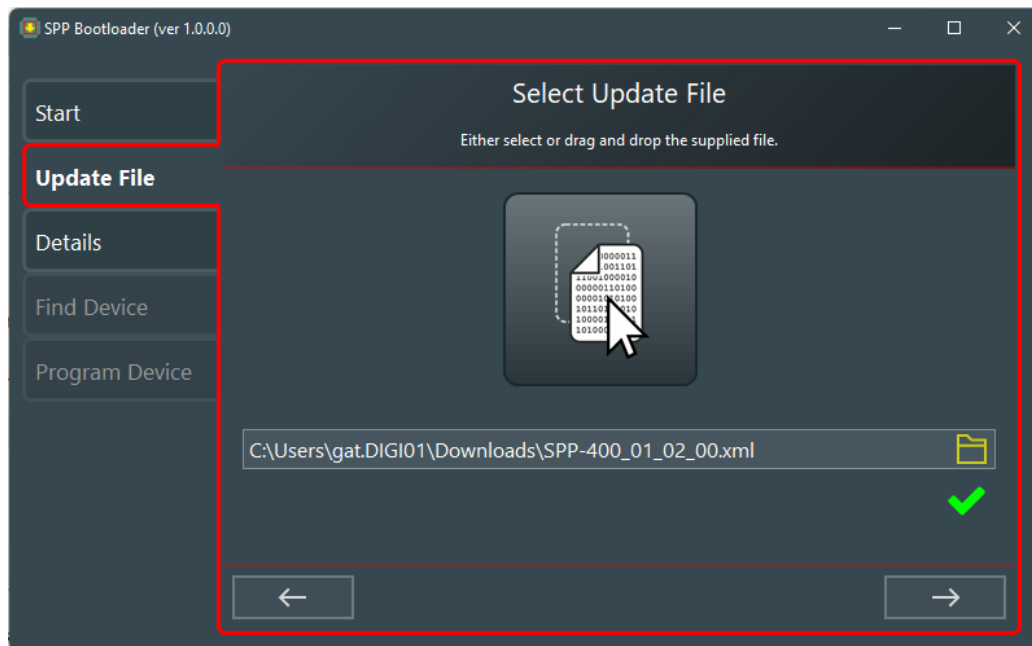
2. Download the zip file and extract to a local folder, then double click on the installer "Digitimer SPP Update Installer v1.exe" and follow the installation instructions.
3. Once installed the update program will included within the "Apps" folder on your PC under "SPP Device FW Update".



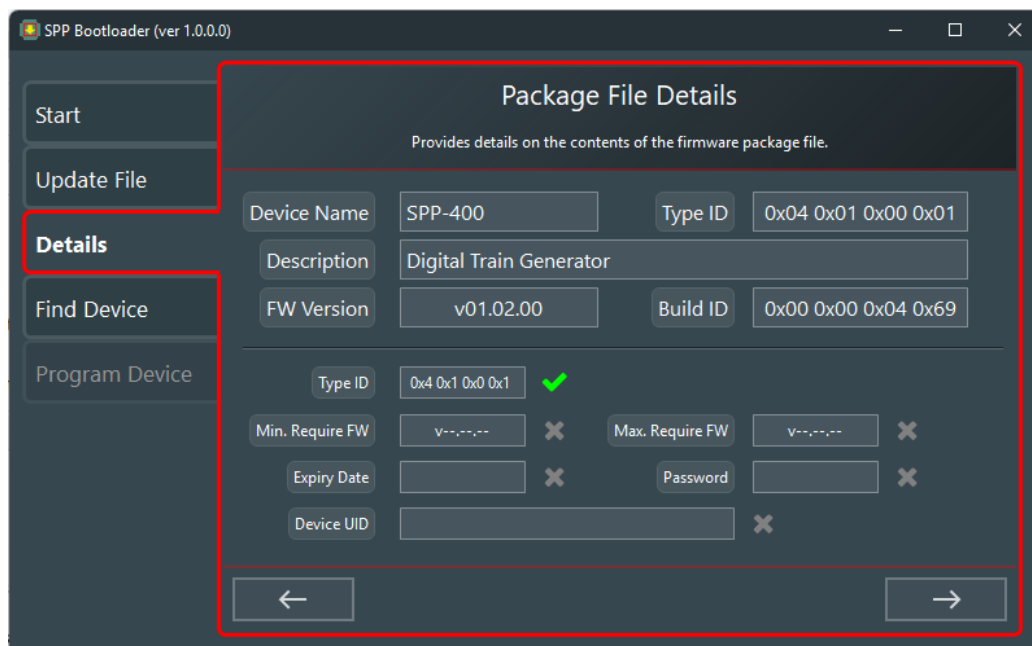
4. Run this program and follow the steps illustrated below.



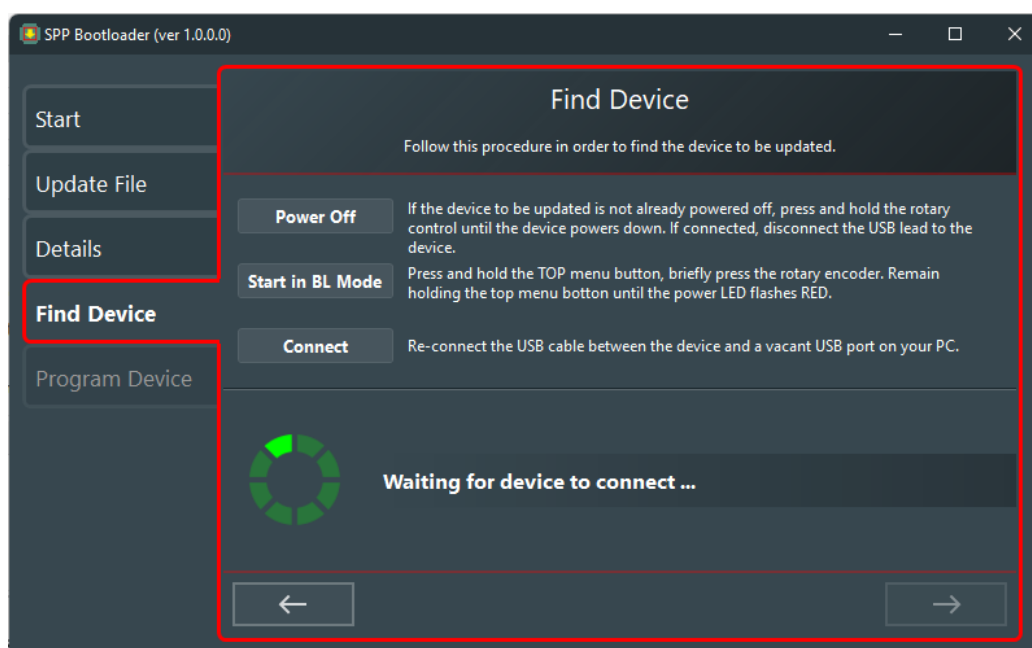
5. Locate and either drag and drop or browse to the supplied firmware file (SPP-400_01_02_00.xml). It is important that the filename has not been edited in any way.



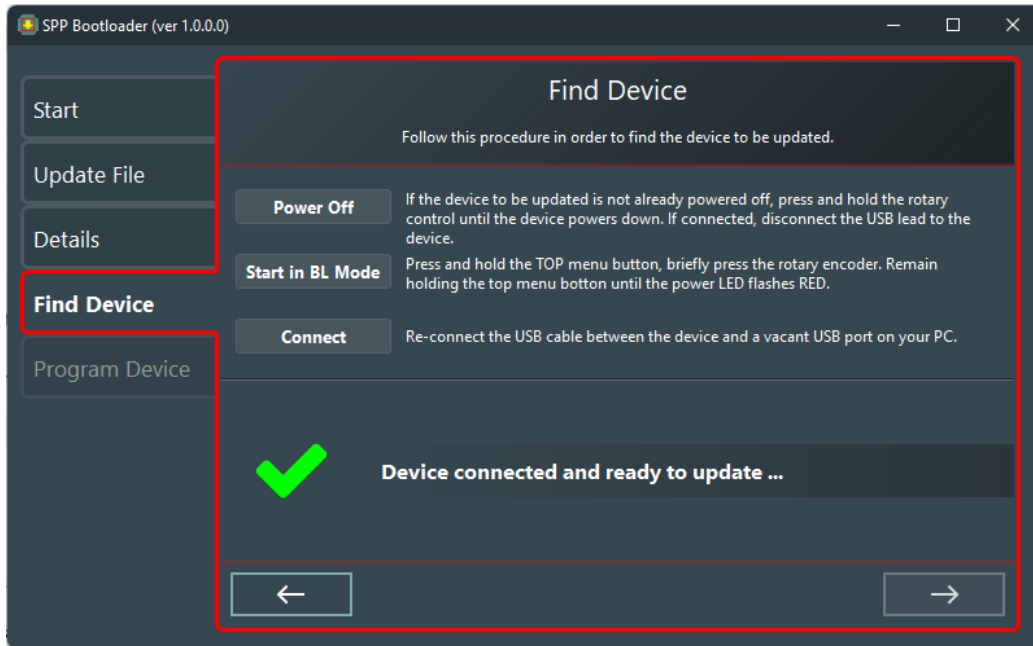
6. If validated (shown by green tick above), details for the firmware file are then displayed for checking prior to installation.



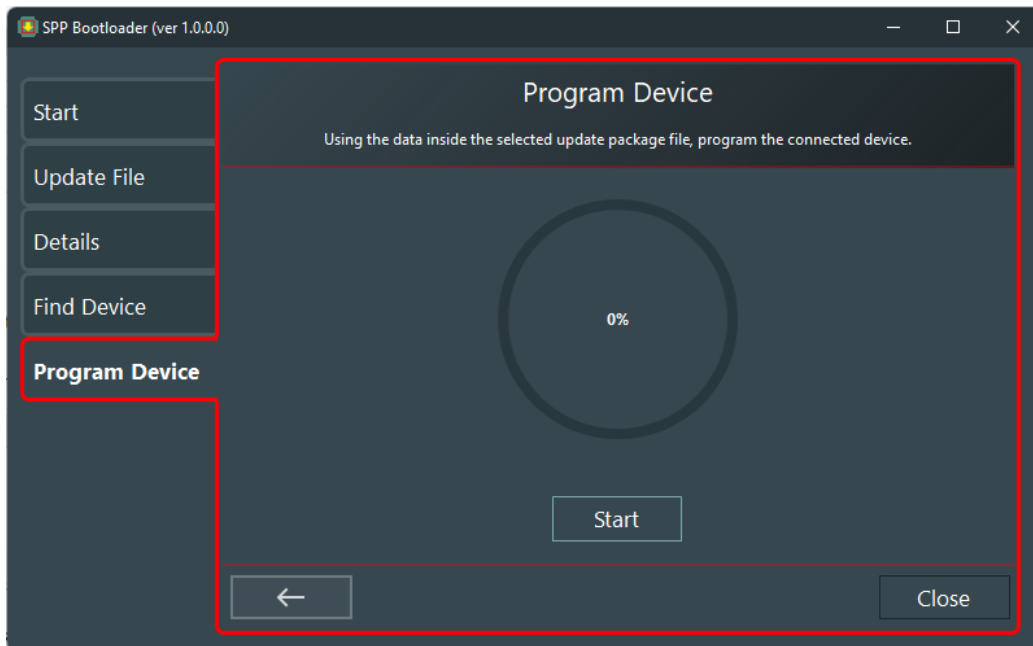
- Next, prepare for attachment to the SPP-400, by precisely following the instructions within the software under “Find Device”.

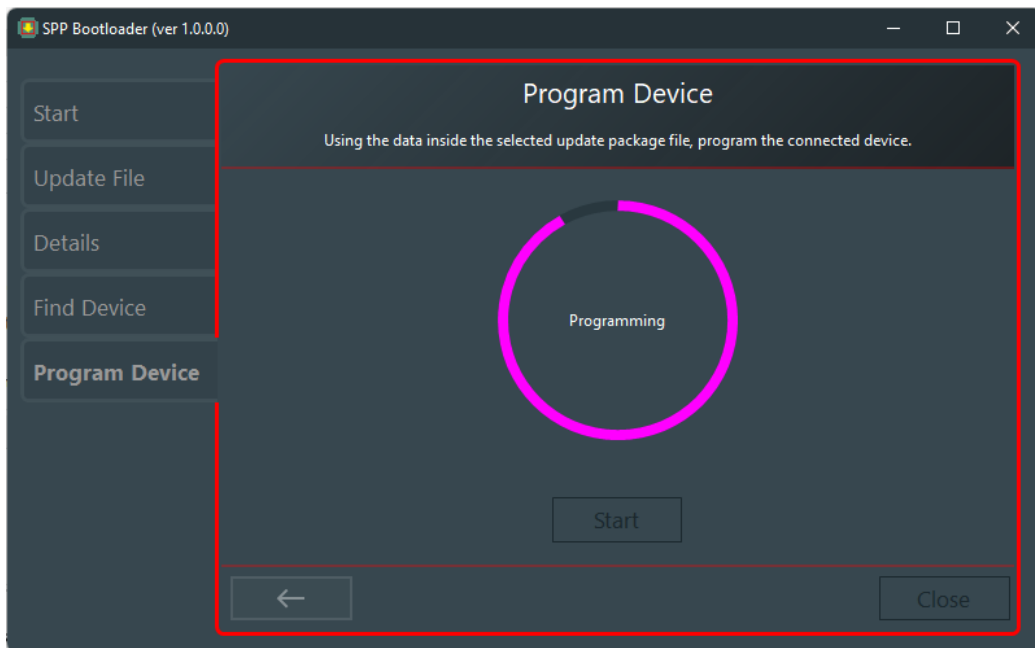
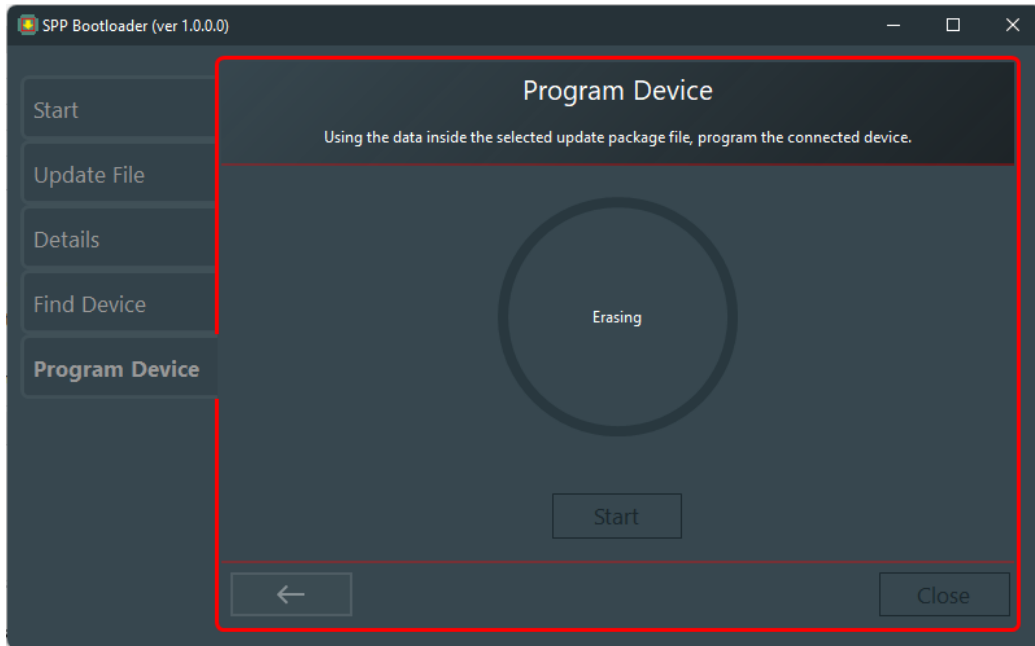


- Once the SPP-400 is in bootloader (BL) mode and physically connected via USB cable, the software will confirm successful connection as shown below.

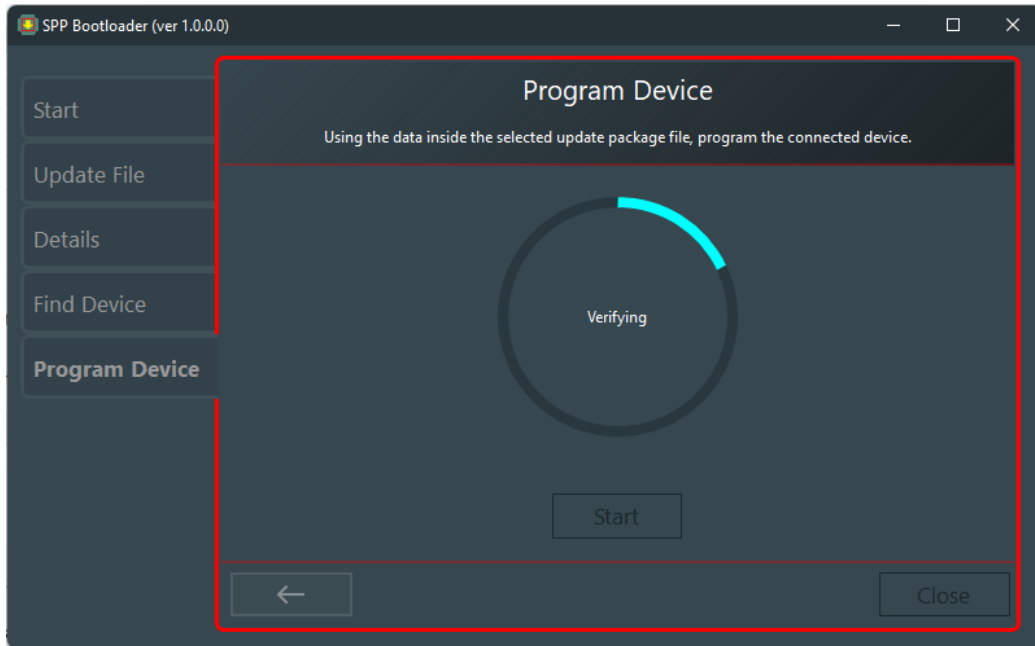


9. The SPP-400 can then be updated with the new firmware, by clicking on the “Start” button below the progress indicator. The updater will first erase the existing firmware and then replace it.

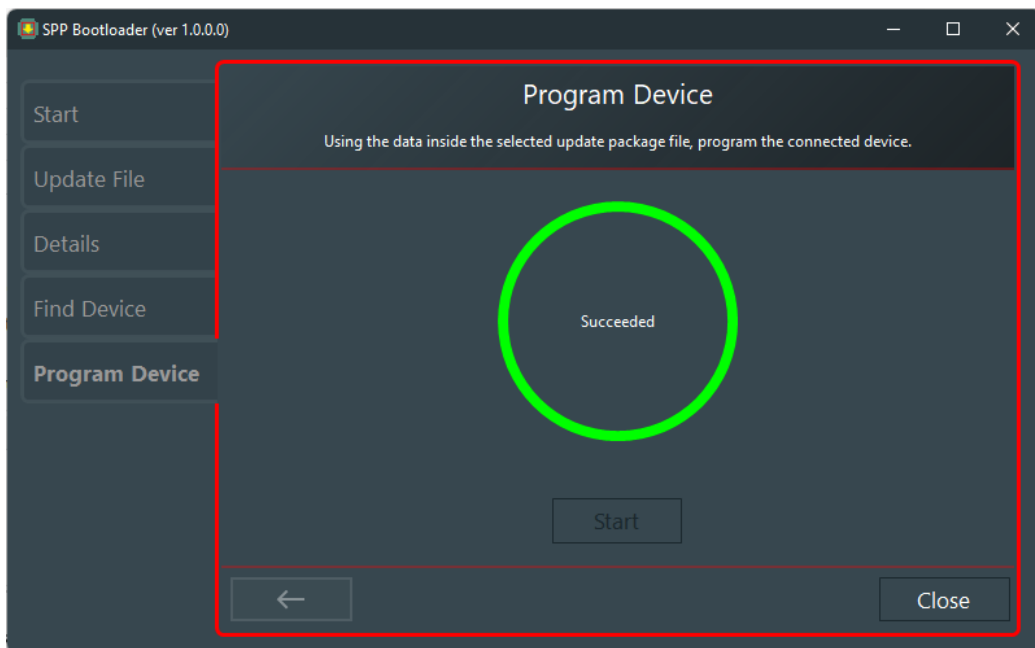




10. Once programmed, the software will verify the success of the update.



11. With the update validated, the software may then be closed, the SPP-400 powered off and re-booted.



12. Once the SPP-400 has restarted, please verify that it is working correctly.

Report any problems with the update process to Digitimer or our local representative.

Specifications

Hardware

Dimensions (W x H x D) mm: 190 x 98 x 132 (includes controls & feet, excludes power connector)

Material: ABS UL94-V0

Tilt Option: Flat / 18° (Rear feet extend to allow the unit to be angled)

Weight: 678g (excluding AC/DC adapter)

Triggering

Trigger Modes:	(i) Triggered (ii) Gated (iii) Toggled
Trigger Edge:	Rising or falling edge
Trigger Threshold:	±10V (0.1V resolution)
Channel 2 Trigger Source:	Direct or Channel 1
Inactive Voltage Level:	Ground or adjustable between +10V and -10V. (Set to match inactive voltage level of trigger source if not Ground)
De-bounce:	Inactive or Active (When active the input ignores successive triggers for 50ms)

Output Parameters

DELAY	Max. Range:	0-999.9s
	Resolution:	10µs for 0ms to 99.99ms
		100µs for 100ms to 999.9ms
		1ms for 1s to 9.999s
		10ms for 10s to 99.9s
100ms for 100s to 999.9s		
PULSE COUNT	Max. Range:	0 – 9999 pulses

INTER-PULSE INTERVAL	Max. Range:	0.02ms -999.9s
	Resolution:	10 μ s for 0.02ms to 99.99ms
		100 μ s for 100ms to 99.9ms
		1ms for 100ms to 9.999s
		10ms for 10s to 99.9s
		100ms for 100s to 999.9s
PULSE DURATION	Max. Range:	0.01ms -999.9s
	Resolution:	10 μ s for 0.02ms to 99.99ms
		100 μ s for 100ms to 99.9ms
		1ms for 100ms to 9.999s
		10ms for 10s to 99.9s
		100ms for 100s to 999.9s
OUTPUT VOLTAGE	Max. Range:	0.00V to +10.00V
	Resolution:	10mV

Controls

Single rotary encoder with push-button action for power and protocol termination

Single push-button for "input"

Four button array for navigation, protocol manager and main menu

LED Indicators

Power – Tri-colour LED (green, blue or red)

Input – Bi-colour LED (green or red)

Output – Bi-colour LED (green or red)

Power Supply

Input: 24V DC, 1A (Universal AC/DC with IEC 60320 C14 receptacle)

Connections

Input: BNC socket

Output: 2x BNC socket

USB: Mini-B USB

Power: 2.1mm DC Barrel Connector (Only use AC/DC adapter supplied by Digitimer)

Warranty Information

Limited Warranty

Digitimer Limited warrants to the first purchaser, for a period of one year from the date of purchase, that this Digitimer instrument (hereafter referred to as the "Product") will be free from defective workmanship and materials, and agrees that it will, at its option, either repair the defect or replace the defective Product or part thereof at no charge to the purchaser for parts and labour. The Product must be returned to Digitimer Limited, carriage paid and insured. Digitimer Limited will return the Product, carriage paid and insured, in the most appropriate method as determined by Digitimer Limited. If a faster shipping service is desired by the customer, any additional special delivery expenses must be paid by the customer.

This warranty does not apply to shipping damage. Digitimer Limited fully insures all shipments. Any claims of damage upon receipt must be filed with the carrier and Digitimer Limited immediately.

This warranty does not apply to any exterior appearance item of the Product which has been damaged or defaced, which has been subjected to misuse and abuse, abnormal service or handling, or which has been altered or modified in design or construction.

This warranty does not apply to any interconnection cables supplied with the Product.

This warranty does not apply if any unauthorised repairs, modifications or alterations have been made to the Product.

No sales organisations, other than Digitimer Limited itself, are authorised to make any warranties other than those described above, or to extend the duration of any warranties beyond the time period described above on the behalf of Digitimer Limited. If Digitimer Limited agrees to such a modification of this warranty, Digitimer will furnish a modified copy of this agreement, which must be presented if a claim is being made under these modified terms.

Obtaining Warranty Service

Warranty service of this Product can be obtained by returning the Product, carriage paid and insured, to Digitimer Limited, or the Distributor from whom the equipment was purchased. Prior authorisation before shipping the product is advised for the most expedient service.

Product change or discontinuation

Digitimer reserve the right to discontinue any instrument or to change its specification without notice, and without responsibility for incorporating changes in instruments already sold.

References

The SPP-400 is a new product so at this time there are not peer reviewed publications that cite its use.

If you publish research that uses the Digitimer SPP-400, the correct citation format should be:

SPP-400 Digital Trigger Generator (Digitimer Limited, Welwyn Garden City, UK)

We appreciate receiving PDF copies of any publications that employ our products.

Digitimer Limited
37 Hydeway
Welwyn Garden City
AL7 3BE
UK

Web: www.digitimer.com

Email: sales@digitimer.com

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