Installation and Operation Manual

IED Automatic Electromagnetic Impulse Device

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1. Introduction

ATCP Physical Engineering equipment and products have been projected and manufactured to provide a long-lasting and top-rated performance. This Installation and Operation Manual contains all necessary information regarding the use and maintenance of this equipment.

Carefully read this manual before using the equipment. Improper use may damage the product and compromise its performance.

2. Definitions

**Impulse Excitation Technique:** The Impulse Excitation Technique is a non-destructive test to determine the elastic moduli and the damping of materials using their resonance frequencies. This technique is described in the ASTM E1876 and correlated standards.

**Resonance Frequencies:** Natural frequencies of vibration of a sample.

**Elastic Modulus:** Elastic modulus is defined as the slope of the stress-strain curve at the elastic region, as described by Hooke’s Law.

**Damping:** Damping is the phenomenon by which mechanical energy is dissipated in dynamic systems. It is directly linked to the presence of defects and the microstructure of a material.

3. Application and features

IED AUTOMATIC ELECTRONIC IMPULSE DEVICE is a mechatronic system employed in automatic and manual configuration for the excitation of samples for a non-destructive characterization of Young’s modulus and damping coefficient of materials through the Impulse Excitation Technique.

IED IMPULSE DEVICE consists of a mechanic unit of impulse excitation (the IMPULSE DEVICE) and of a CONTROL UNIT. The impulse device was developed to be used with samples of a diverse geometry and material.

The CONTROL UNIT allows to locally and remotely (via USB) adjust the excitation level. To carry out this task, the IED IMPULSE DEVICE may be manually operated, by turning a KNOB located on the CONTROL UNIT; or by connecting the device to a computer using the USB PORT. In that case, the device is operated automatically by the Sonelastic® software.

IED IMPULSE DEVICE must be used together with one of the supporting apparatus manufactured by Sonelastic® Solutions.
4. Identifying the parts

4.1 RT Impulse Device

1. IMPACT TIP
   The impulse takes place when the IMPACT TIP touches the sample.

2. ADJUSTABLE SUPPORT
   This support is used for the precise positioning between the IMPACT TIP and the samples’ surface.

3. PILLAR
   Supporting pillar for the impulse device set.

4. ADJUSTING NUT
   This piece is responsible for moving the ADJUSTABLE SUPPORT and, therefore, for shifting the position of the IMPACT TIP.

5. BASE
   The BASE is what holds the set.

6. CABLE
   RT IMPULSE DEVICE CABLE connects it to the CONTROL UNIT.

7. CONNECTOR
   To be connected to the CONTROL UNIT OUTPUT JACK.

4.2 Light RT Impulse Device (optional)

1. HANDLE FOR SECURING THE TUBE
   Handle for securing and adjusting the height of the FIXATION TUBE.

2. FIXATION TUBE HANDLE
   Handle to lock the FIXATION TUBE at a specific height and position.

3. FIXATION ROD
   Tube for positioning and fixing the LIGHT RT IMPULSE DEVICE.

4. HANDLE FOR FIXING THE IMPULSE DEVICE
   Handle to lock THE LIGHT RT IMPULSE DEVICE to the FIXATION TUBE.

5. FRAME
   Frame for the precise position of the IMPACT TIP and sample's surface.

6. IMPACT TIP
   The impulse takes place when the IMPACT TIP touches the sample.

7. CABLE
   LIGHT RT IMPULSE DEVICE CABLE connecting it to the CONTROL UNIT.

8. CONNECTOR
   To be connected to the CONTROL UNIT OUTPUT JACK.
4.2 Control unit front panel

1. EXCITATION LEVEL KNOB
   It controls the intensity of the EXCITATION LEVEL under the manual configuration.

2. LOCAL/REMOTE LED
   The LED indicates if the equipment is on. The green light glows when on manual mode, and the red when it is connected to the computer.

3. TRIGGER
   The TRIGGER starts the impulse device, but only when connected to a computer. Otherwise this key has no use.

4.3 Control unit rear panel

1. OUTPUT JACK
   Output jack to connect with the impulse device.

2. USB PORT
   The port is used for connection with computers via USB cables. Note: USB cable included.

3. I/O POWER SWITCH
   Switches the equipment on and off.

4. AC POWER JACK
   Entry for the POWER CORD (90-240 VAC 50/60 Hz).
5. Typical configurations of supports using IED Impulse Device

Typical configurations of supports for samples when employing IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE are presented next:

<table>
<thead>
<tr>
<th>SA-BC adjustable support for bars and cylinders</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Configuration Image" /></td>
</tr>
<tr>
<td><strong>Configuration</strong>: Automatic.</td>
</tr>
<tr>
<td><strong>Impulse</strong>: Automatic.</td>
</tr>
<tr>
<td><strong>Sample</strong>: Light-weight.</td>
</tr>
<tr>
<td><strong>Microphone</strong>: Using a STURDY TRIPOD.</td>
</tr>
<tr>
<td><strong>Impulse Device</strong>: IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE with a HEIGHT-ADJUSTING DISC.</td>
</tr>
</tbody>
</table>

[1]

| ![Configuration Image](image2.png) |
| **Configuration**: Automatic. |
| **Impulse**: Automatic. |
| **Sample**: Heavy-weight. |
| **Microphone**: Using a STURDY TRIPOD. |
| **Impulse Device**: IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE. |

[2]

| ![Configuration Image](image3.png) |
| **Configuration**: Automatic. |
| **Impulse**: Automatic. |
| **Sample**: Medium-weight. |
| **Microphone**: Using a STURDY TRIPOD. |
| **Impulse Device**: IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE with a HEIGHT-ADJUSTING DISC. |

[3]
**SX-PD adjustable support for discs and rings**

**Configuration:** Automatic.

**Impulse:** Automatic.

**Sample:** Disc.

**Microphone:** Using a VERTICAL MOUNTING BASE.

**Impulse Device:** IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE.

[1]

**Configuration:** Automatic.

**Impulse:** Automatic.

**Sample:** Ring.

**Microphone:** Using a VERTICAL MOUNTING BASE.

**Impulse Device:** IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE.

[2]

**Configuration:** Automatic.

**Impulse:** Automatic.

**Sample:** Rectangular plate.

**Microphone:** Using a VERTICAL MOUNTING BASE.

**Impulse Device:** IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE.

[3]
SP-B high-precision support for rectangular bar

Configuration: Automatic.
Impulse: Automatic.
Sample: Rectangular bar.
Microphone: Mounted on the SB-P Support.
Impulse Device: IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE.

SB-AP support for rectangular bars

Configuration: Automatic.
Impulse: Automatic.
Sample: Small rectangular bars.
Microphone: Mounted on the SB-AP Support.
Impulse Device: IED IMPULSE DEVICE with LIGHT RT IMPULSE DEVICE mounted on the support (optional).
6. Specifications

Adjustable voltage range for the electrical pulse ....................... De 1 a 11 V
Adjustable time range for the electrical pulse ......................... De 1 a 60 ms
Protection against electric shock ........................................... Class I
Level of IP protection ......................................................... IP30
Supply voltage (input) ....................................................... 90-240 VAC (auto)
Frequency ................................................................. 50/60 Hz
Supply current (at 115 VAC) .............................................. 0.7 A
Supply current (at 230 VAC) .............................................. 0.35 A
Output voltage .............................................................. 11 Vdc (max)
Output current (maximum) .................................................. 1.25 A
Surge protection ...................................................................... Latch-off mode
Overcurrent protection ......................................................... Auto recovery
Working temperature range ................................................ -5 a +50°C
CONTROL UNIT dimensions (L x P x A) ....................................... 165 x 160 x 68 mm
RT IMPULSE DEVICE (Ø x A) maximum dimensions ............. 63 x 162 mm
LIGHT RT IMPULSE DEVICE maximum dimensions (L x P x A) ... 26 x 80 x 117 mm
Total weight of the equipment .................................................. 1.5 kg

7. Equipment installation

7.1 Requirements

- A 127 or 220 VAC three-pin ground wired electrical mains plug.
- The equipment must not be installed for long periods in places of excessive humidity.

7.2 Connecting the Impulse Device

Step 01 – Connect the POWER CABLE of the IED IMPULSE DEVICE to the red OUTPUT JACK, observing the correct positioning of the connector, as pictured next:

[Image of connecting the cable to the IMPULSE DEVICE.]
7.3 Connecting the control unit to the power outlet

*Step 01* – Connect the POWER CABLE that is supplied together with the equipment to the POWER JACK, then to AC mains plug. *Note: The equipment is fitted with an automatic adjust of stress (90-240 VAC / 50-60 Hz).*

![](Connecting the POWER CABLE.png)

*Step 02* – Switch on the equipment by pressing the POWER SWITCH [I/O]. The LED [LOCAL/REMOTE] on the front panel of the equipment will glow, indicating that the equipment is on.

*Note:* The CONTROL UNIT must only be connected by using the USB PORT for remote operations.

7.4 Mounting the sample supports

The information regarding the installation and operation of sample supports to be used together with the IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE, as well as the information about the correct positioning of samples and of the RT IMPULSE DEVICE, can be checked more thoroughly by checking the installation and operation manuals provided with each support.

![Warning](Warning.png)

*The choice of the most adequate support will depend on the dimensions of the samples that are to be characterized.*

8. Equipment operation

Before using the equipment, check if all the points below have been properly followed:

- Install the Sonelastic® Software as described in its Installation and Operation Manual.
- Correctly install and position the sample according to the specific support’s Installation and Operation Manual. The support will be used together with IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE.

After checking the previous points, IED IMPULSE DEVICE will be ready for the characterization process. The necessary information to operate the equipment is presented next.
8.1 Using the Impulse Device set to local configuration (manual operation)

**Step 01** – Turn the CONTROL UNIT on by using the POWER SWITCH [ON/OFF], ensuring the unit is not connected to the computer via a USB cable at the time. The LED [Local/Remote] should immediately glow green, indicating that the equipment is switched on, under manual operation (Local).

**Step 02** – To position the RT IMPULSE DEVICE, follow the instructions contained in the Installation and Operation Manual of each support.

**Step 03** – To approximate or separate the IMPACT TIP from the sample surface, turn the ADJUSTING NUT. To lower it down, turn the nut clockwise, and to rise it, turn the nut anti-clockwise.

**Step 04** – After positioning RT IMPULSE DEVICE and placing the IMPACT TIP in the desired distance from the sample surface, press the TRIGGER. The device should excite the sample with a light tap, which will be under a controlled intensity.

**Step 05** – The intensity the IMPACT TIP hits the sample may be adjusted by using the EXCITATION LEVEL KNOB. Turn the knob clockwise to increase the EXCITATION LEVEL, and anticlockwise, to lower it down.

8.2 Using the Impulse Device set to remote configuration (automatic operation)

To be able to use IED IMPULSE DEVICE under automatic operation, it is necessary to have the Sonelastic® software correctly installed and set up in a computer, and then follow the steps described herein:

**Step 01** – Have the IED IMPULSE DEVICE correctly installed, but turned off. Connect the USB cable supplied together with the equipment to its USB PORT, and then connect the other end of the cable to the computer’s USB PORT. The Sonelastic® software should have already been installed.
Step 01 – Turn the equipment on using the POWER SWITCH [ON/OFF]. The LED [Local/Remote] should glow a red light, indicating that the equipment is turned on and configured under automatic operation (Remote).

Step 02 – Position the RT or LIGHT RT (optional) IMPULSE DEVICE as indicated by the Installation and Operation Manual supplied together with the chosen support.

Step 03 – To approximate or separate the RT IMPULSE DEVICE IMPACT TIP from the sample’s surface, turn the ADJUSTING NUT on the RT PILLAR clockwise – to lower it down – or anticlockwise, to rise it up, as illustrated in 8.1 - Step 3.

Step 04 – After having positioned RT IMPULSE DEVICE and placed the IMPACT TIP at an optimum distance (approximately 3 mm) from the sample’s surface, it is necessary to configure the Sonelastic® software to operate the device under the automatic control. Information regarding the configuration and operation of IED ELECTROMAGNETIC AUTOMATIC IMPULSE DEVICE using the Sonelastic® software can be found within its Installation and Operation Manual.

9. Warnings and equipment transportation

⚠ Reading all the information contained in this Installation and Operation Manual is compulsory for the correct use of the equipment;

⚠ The electricity network where the optional items and accessories will be connected for use must have a functional ground system;

⚠ Do not use this equipment for other purposes apart from the ones specified by this Manual;

⚠ The non-compliance with the instructions provided by this manual in what regards the use of the equipment may reduce or invalidate warranty time.

Equipment Transportation:
- Transport the equipment with care;
- Avoid impacts and falls when transporting the equipment;
- Do not transport the equipment under the rain, even when wrapped in its original packaging.

10. Maintenance

- To avoid deterioration and to always keep the equipment under satisfactory condition of use, clean regularly using a slightly damped cloth with water and neutral soap;

- If using the Impulse Device to characterize abrasive materials, clean all removable parts of the device at the end of each experiment;

- Keep the threads of the ADJUSTING NUT always well lubricated with industrial Vaseline;

- To keep the equipment in good working order and extend its life spam, keep its accessories and optional items always clean;

- IED AUTOMATIC ELECTROMAGNETIC IMPULSE DEVICE has an AC POWER JACK located on its rear panel to allow the use of different standard POWER CORD (according to each country) or to replace the same in case of that being damaged.
### 11. Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The equipment does not turn on.</td>
<td>Power plug used to connect the equipment to lacks electricity.</td>
<td>Use another plug that is operating under adequate conditions.</td>
</tr>
<tr>
<td></td>
<td>POWER CABLE is damaged.</td>
<td>Replace the POWER CABLE for a non-damaged one of same style.</td>
</tr>
<tr>
<td></td>
<td>ON/OFF POWER SWITCH is on the “OFF” position.</td>
<td>Turn the SWITCH to the “ON” position.</td>
</tr>
<tr>
<td>The LED is glowing the green light, but the IMPULSE DEVICE does not work when pressing the TRIGGER push button.</td>
<td>Device connector is not properly inserted into the OUTPUT JACK.</td>
<td>Reconnect the cable, certifying this time that it is correctly inserted into the jack.</td>
</tr>
<tr>
<td></td>
<td>The IMPULSE DEVICE is connected the computer via a USB CABLE.</td>
<td>Disconnect the USB cable.</td>
</tr>
<tr>
<td></td>
<td>The IMPULSE DEVICE POWER CABLE is damaged.</td>
<td>Contact the supplier to replace the damage cable.</td>
</tr>
<tr>
<td>The LED is glowing the red light, but the IMPULSE DEVICE does not work with the software.</td>
<td>O cabo USB está mal conectado. The USB cable is not properly connected.</td>
<td>Reconnect the USB cable, certifying that this time it is correctly connected.</td>
</tr>
<tr>
<td></td>
<td>The software has not been correctly configured.</td>
<td>Configure the software according to the supplier’s instructions. Reinstall the IMPULSE DEVICE driver from the “Drivers Sonelastic” folder, which would have been generated after the software installation.</td>
</tr>
<tr>
<td>The tap against the sample causes the sample to move from its original position.</td>
<td>The EXCITATION LEVEL intensity has been over calculated.</td>
<td>Lower the EXCITATION LEVEL turning the KNOB to a lower number on the IMPULSE DEVICE software screen.</td>
</tr>
<tr>
<td></td>
<td>The support in place to hold the sample was wrongly chosen (sample is too small for it).</td>
<td>Use a more adequate style of support for the kind of sample to be measured.</td>
</tr>
</tbody>
</table>

### 12. Symbology

- **USB Port**
- **Attention! Risk of danger.**
- **Volts Alternating Current**
- **VAC**
- **Volts Direct Current**
- **VDC**
- **O** Turn on the equipment
- **I** Turn off the equipment
13. Technical support and warranty

If the equipment presents any abnormality, check first if the problem is listed in 11 – Troubleshooting. If the problem still cannot be fixed, contact ATCP.

ATCP Physical Engineering offers a 12-month warranty with this equipment, starting from the date of purchase. It covers manufacturing defects or materials defects, but some factors may cause the loss of warranty:

1 – The non-compliance with the recommended care regarding the installation and operation of this equipment, as describe herein;

2 - Accidents, falls, inadequate installation or any other damage cause by incorrect use or action of natural agents.

3 - Violation, repair or any other modification or alteration done in the equipment or parts of the equipment carried out by non-authorized agents (non-authorized by ATCP Physical Engineering).

After the 12 months of warranty, parts, expenses and services shall be charged.

14. Statement of Responsibility

ATCP Physical Engineering takes total technical and legal responsibility over the IED Automatic Electromagnetic Impulse Device and guarantees that all information here provided are true.
NOTES:

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