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Introduction

We are delighted to help you get up and running as quickly as possible and to support your work. This manual gives you instructions on how to install the **Element-U, EU1** – which we abbreviate for the remainder of this manual to the “**Element-U**” – as part of your Elemental Machines Sensory Network™ and supplementary information that you or people in your organization may wish to know regarding security, specifications, and certifications. But first, let’s start off with some important details about safely using your **Element-U**:

**Safety Information**

**Non-ionizing Radiation exposure**

**Element-U**’s regularly communicate over Wi-Fi and Cellular networks. When transmitting, the radio modules inside the **Element-U** work at a maximum power of 15 dBm (30 mW). This level is not recognized as hazardous, but several nations (e.g. Canada, Australia) advise not to use such a device within 20cm of your body i.e. as a personal electronic device without further precautionary testing.

This equipment has been tested and found to comply with the USA’s (FCC) limits for a Class A digital device, which are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. If not installed and used in accordance with this User Manual, the **Element-U** may possibly cause harmful interference to other radio communications. Possible remedies for any such interference include reorienting the receiving antennae, increasing the separation between affected equipment and **Element-U**, or connecting the affected equipment into an outlet on a circuit different from that to which the **Element-U** is connected.

**Handling of Electronic Components**

The **Element-U** exposes several small electronic components directly in the power cord bed, as a necessary part of its operation. To ensure safe handling, the **Element-U** should not be powered on before a mains power cord is fastened to the **Element-U**’s power cord bed, as described in the section *Attaching the Element-U to a Mains Power Cord*.

**Protecting the Environment**

**Element-U**’s are designed with consideration for the environment and comply with relevant regulations such as the EU’s RoHS regulations and Batteries Directive, as well as the USA’s EPA initiative to ‘Reduce, Reuse, Recycle’. **Element-U**’s are provided to customers to support the service Elemental Machines provides, but they remain the property of Elemental Machines and should be returned to EM at the end of their life for reuse, recycling or disposal as appropriate. Elemental Machines relies on customers to play their role in the process of disposing of **Element-U**’s correctly, to help Elemental Machines in protecting the environment.
Installation Guide

What follows is the process we find most streamlined for setting up the system. Many of the steps below can be done in a different order if that fits your deployment better. But remember, if you have any questions, please do contact help@elementalmachines.com or your account representative.

Element-U Installation Components

• Prior to receiving the devices, you will receive an email for your dashboard account verification. Save this email for when the devices arrive.
• When devices are shipped, they are added to the Elemental Insights Dashboard™ with default names. When you first log in you will see all your devices with a 'Disconnected' status.
• When you open the box you will see the following equipment, pictures are included here for reference:
Attaching the Element-U to a Mains Power Cord

Ensure the Element-U is powered off before this step!

To attach the **Element-U** to a main power cord, simply nest the cord between the end of all 3 cable ties, so that it is lying flat on the power cord bed, as shown below:

![Diagram of Element-U and power cord](image)

Once the power cord is in place, cinch down all 3 cable ties, starting with the outer ties and moving inward. Once the cable ties are properly cinched, you should not be able to move the cord at all by pulling or pushing it through the ties.
Powering on the Element-U

To power on your **Element-U**, simply plug in the provided 5 V micro-USB wall adapter, after installing the adapter into a mains outlet.
Connecting the Element-U to a Network

The Element-U requires an Ethernet or Wi-Fi connection to begin sending data. The Element-U transmits data in order of precedence:

1. by Ethernet,
2. by Wi-Fi

Connecting to Ethernet

To connect the Element-U to the internet via a wired connection, insert an ethernet cord directly into the exposed RJ-45 jack on the side Element-U. Make sure that the cord terminal’s locking mechanism has engaged fully after installation by gently tugging on the cord, which should remain firmly in the RJ-45 jack.
Connecting to Wi-Fi

To connect the **Element-U** to Wi-Fi, first ensure that no ethernet cable is plugged in. When the device is plugged into power and fully booted without an ethernet connection, it will begin to broadcast an access-point Wi-Fi network with the name “EM Setup xxxxxxx”, where xxxxxxx is the 7-character serial number which is available on the side of the **Element-U**. Connect to this Wi-Fi network on any iPhone or Android device, or on a Macintosh or Windows PC.

After a connection is established, your device will bring up a “captive portal”-style window which will prompt you to select the SSID of the network to which you would like to connect the **Element-U**, and to enter the Passphrase of your selected Wi-Fi network:

![Captive Portal Window](image)

After pressing the connect button, the “captive portal” window will minimize, and the connection process will begin on the **Element-U**. If the Passphrase you entered was incorrect, then the network “EM Setup xxxxxxx” will be available again in ~30 seconds, and you can re-enter the Passphrase.
Positioning the Element-U

The **Element-U** transmits data in order of precedence:

1. by Ethernet,
2. by Wi-Fi

If all network connections are lost there is a danger of data delay or even loss, so **Element-U**’s should be located and orientated where they can get a wired ethernet connection or a good Wi-Fi connection.

**Signal**

To prevent data loss or delay, ensure the Wi-Fi signal is maximized by not placing the **Element-U** directly behind large metallic surfaces, whenever it can be avoided.

**Heat**

Because the **Element-U** is installed in environments containing equipment which might rise significantly above the ambient temperature of the room, it is important to position the **Element-U** far away from any equipment which might vent significant amounts of heat.
Sensory Network Security Overview

The Elemental Machines Sensory Network™ is designed to operate securely on our customers’ networks. The system can include Elements, wireless devices that monitor critical equipment and/or the ambient environment, Gateways, which gather data from some Elements, and the Elemental Insights Dashboard™.

Communication through Customer Wi-Fi:

Transport Security

The system uses established communication and security standards to protect data transmitted between Element-U’s and the Elemental Insights Dashboard™.

- **TLS**, the web standard for protecting sensitive data including usernames, passwords, credit card, and banking information.
- **Asymmetric Cryptography** is used to encrypt the data transmitted. The keys for this symmetric encryption are generated uniquely for each connection and are based on a shared secret negotiated at the start of the session.

The Elemental Machines Sensory Network’s™ external communication is designed to work even in the strictest environments. The communication uses an adaptive transport mechanism that is designed to work well when confronted with proxy authorities, firewalls, and antivirus software.

No inbound ports need to be opened. Security vulnerability using the above configuration is prevented as follows:

1. Internet Communication over Port 80, 123, and 443
2. Device must be able to transmit outward to the Internet on 443
3. Clients do not open inbound ports
4. There is no need to open the firewall to receive on port 80, 123, or 443
5. There is no way for outside users to get into the user’s network
6. We do not listen to any ports; this is the case even if the user opens ports 80, 123, or 443 for receipt

Network Whitelist

Element-U’s open connections through port 80, 123, and 443 of a customer’s firewall, opening only outbound connections. Element-U’s require the following outbound TCP and/or UDP connections to be open on your firewall for the system to work:

- *.elementalmachines.io:443, TCP – for sending data to the dashboard
Network Requirements

Wireless Requirements:

- **SSID** – Not hidden
- **Security** – WEP, WPA, or WPA2
- **IP Assignment** – Dynamic Preferred
- **Number of Unique Devices** – Sum of all Gateways and other Element-D/C/U devices
- **Captive Portal** – Not Supported

- *balena-cloud.com*:443, TCP – for device management
- *docker.com*:443, TCP – for verified operating system images
- *docker.io*:443, TCP – for verified operating system images
- *time.elementalmachines.io*:123, UDP – for time synchronization
- 8.8.8.8:443, TCP – for DNS resolution
## Specifications

<table>
<thead>
<tr>
<th>Element-T Specifications</th>
<th></th>
</tr>
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<tbody>
<tr>
<td><strong>Model Number</strong></td>
<td>EU1</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>96×84×40mm (3.8”×3.3”×1.6”)</td>
</tr>
<tr>
<td><strong>Operating Temperature Range</strong></td>
<td>-10 – 45 °C</td>
</tr>
<tr>
<td><strong>Operating Humidity Range</strong></td>
<td>0 – 95% RH, Non-condensing</td>
</tr>
<tr>
<td><strong>Operating Pressure Range</strong></td>
<td>300-1100 hPa</td>
</tr>
</tbody>
</table>

### Communication

| Wi-Fi 2.4GHz Max. TX Power | 30mW |
| Wi-Fi 5GHz Max. TX Power | 25mW |

### Compliance

<table>
<thead>
<tr>
<th>FCC ID</th>
<th>FCC Part 15.247</th>
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<tr>
<td>ID</td>
<td>2ABCB- RPI3P</td>
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<table>
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<th>IC ID</th>
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<tbody>
<tr>
<td>ID</td>
<td>20953-RPI3P</td>
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Certifications

United States FCC:

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

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

WARNING: Changes or modifications not expressly approved by Elemental Machines, Inc. could void the user’s authority to operate the equipment.

Canada IC:

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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

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