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Introduction

Thank you for choosing this **Element-T** as part of your Elemental Machines Sensory Network™. 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 it 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-T**:

**Safety Information**

**Batteries**

**WARNING:** the **Element-T** is powered by 2 non-rechargeable AAA lithium batteries. These batteries can explode or leak and cause burns if installed backwards, disassembled, charged, or exposed to water, fire, high temperature or rapid warming from extremely cold temperature.

For this reason it is important that the box of the **Element-T** does not exceed its operating limits in temperature of 5 to 45 °C and in humidity of 0 to 95%RH (non-condensing).

**Non-ionizing Radiation exposure**

**Element-T**’s periodically send measurements to a **Gateway** using the 2.4GHz **Bluetooth® Low Energy** 4.2 Protocol. When transmitting, the radio module inside the **Element-T** works at a maximum power of 4.8 dBm (3 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.
Protecting the Environment

**Element-T’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-T’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-T’s** correctly, to help Elemental Machines in protecting the environment.

![](image)

The **Element-T** is marked with this symbol, the EU’s ‘wheeled bin’ symbol, to identify it as Electrical or Electronic Equipment that the EU requires not to be added to unsorted municipal waste when it has reached the end of its life. The correct disposal is:

- AAA lithium batteries that have reached the end of their life should be removed from the **Element-T**, kept separate from unsorted municipal waste and disposed of according to local regulations (EU Non-hazardous Waste code: 16 06 04)
- **Element-T’s** that have reached the end of their life should have their batteries removed for disposal as above and then returned to Elemental Machines (EU Non-hazardous Waste code 16 02 14)

When batteries need to be removed or replaced, slide the battery cover that forms most of the base open and remove the two AAA batteries; these can be replaced with new AAA lithium batteries
Installation Guide

What follows is the process we have found 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:

- 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 will be added to your Elemental Insights Dashboard™ with default names. When you first log in you will see all of your devices with a 'disconnected' status.
- When you open the box you will see several pieces of equipment, pictures are included here for reference:

One or more Element-T’s:

A Gateway device…

…which may be a tablet like this:
…or a Gateway-2 which looks like this:

And possibly: Element-T

Prior to installing Elements

Set up the Gateway and Power on your Devices

- To power on the **Element-T**, remove the battery pull tab. You should hear an ascending tone, repeated twice if the **Element-T** is now powered on.
• IMPORTANT: If you have a Gateway-2, please follow the setup instructions in 771-00021 Gateway, GW2 User Manual. If you have a tablet Gateway, please follow the setup instructions below

• To power on the Gateway, press and hold the upper Right-hand button on the device:
  o Wait for the main screen to come up
  o Press the 'home' button when you see the Elemental Machines Logo

  o Click on the Blue VM circle in the upper right corner (if the Blue VM circle is not visible, hit the hardware home button on the bottom of the tablet to make it appear, or swipe up if you do not have a hardware button):
Click on the settings icon:

Select WiFi from the list on the left:

Select your SSID and enter your credentials
Positioning the Tablet Gateway

**IMPORTANT:** If you have a **Gateway-2**, please follow the setup instructions in 771-00021 Gateway, GW2 User Manual. If you have a tablet **Gateway**, please follow the setup instructions below.

Tablet **Gateways** collect data from the **Elements**, collating it and transmitting it across the internet to Elemental Machines’ Cloud. The tablet **Gateways’** default is to transmit by Wi-Fi; for added reliability they fall back to Cellular connection when Wi-Fi connection drops out. There is a danger of data delay or even loss if all connection is lost, so tablet **Gateways** should be positioned where they are getting good Wi-Fi and Cellular connection.

Strength of the connection to both Wi-Fi and Cellular is displayed by Wi-Fi icon and the Cellular bar icons respectively. These are displayed on the tablet **Gateway** to the left of the battery percentage.

- 4 or more bars for both Wi-Fi and cell indicate good connectivity
- 2 bars for both Wi-Fi and cell runs an increased risk of some data delay or loss
- <2 bars for cell or Wi-Fi carry a danger of significant data delay or loss

All **Element-T** (and **Element-A**) sensors will need to be within **Bluetooth®** range of the tablet **Gateways**. This range is usually up to 30 feet from the tablet **Gateways** but can depend on the layout and concentration of equipment in your lab. **Bluetooth®** signal strength for an individual **Element** can be checked on the **Elemental Insights Dashboard™**. Go to the device in question and the signal icon will have 1-4 bars of strength. Like the signal for the **Gateway** above, the more bars will translate to a better signal. For **Bluetooth®** signal as long as there are 2 bars, the connection should be sufficient.

**To install the Element-T**

In general, **Elements** should be installed as close to the front of the equipment as practical to ensure optimal communication with a **Gateway**. Note that the **Elements** have magnets for easy mounting on metal surfaces.

Be sure to read and comply with the safety information at the beginning of this manual concerning operating conditions.

**Specifically, for the Element-T:**

- Install the thermocouple in the refrigerator/freezer as shown. We recommend installing the **Element-T** on the hinge side of the door and threading the thermocouple through the hinge side (as shown). The thermocouple (threaded through the magnet holes and crimped slightly) should adhere to the side of the freezer, or to the underside of a shelf.
- Write the name and/or location of the piece of equipment being monitored on Element-T (particularly important if installing multiple devices). We recommend using a Sharpie.
• Plug the temperature probe into the side of the Element-T, being sure to match the copper and silver prongs to their same-colored receptacles on the device.

• Verify that the Elements are displaying as 'connected' on the Elemental Insights Dashboard™
- Edit the Element descriptions in the Elemental Insights Dashboard™ to include name and location of the device, and provide details on the equipment being monitored. Do this in the dashboard by clicking on Details, then Edit under by clicking on the three dots on the top right of the page and selecting “Edit equipment details”.

- Further assistance e.g. to complete the dashboard setup can be found by clicking on Support at the bottom left of the dashboard.
Elemental Machines Sensory Network™
Security Overview

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

Local Communication

Individual Elements communicate to a local Gateway via Bluetooth® Low Energy 4.2 (a low power 2.4GHz wireless communication, typically 5.3 dBm or lower power). Only whitelisted devices can connect with the Gateway; the whitelist is populated prior to shipping and adjusted with any subsequent additions to the network.

Communication through Customer Wi-Fi:

The system uses established communication and security standards to protect data transmitted between Gateways 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™ 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
Tablet Gateways open connections through port 80, 123, and 443 of a customer's firewall, opening only outbound connections. Elemental Gateways require the following outbound TCP connections to be open on your firewall for the system to work:

- *.elementalmachines.io:443, TCP – for sending data to the dashboard
- s3.amazonaws.com:[80|443], TCP – various files
- *.awmdm.com:443, TCP – device management
- play.google.com:443, TCP – provisioning
- android.googleapis.com:443, TCP – provisioning
- android.clients.google.com:80, TCP – app management
- time.windows.com:123, UDP – time synchronization
- *.pubnub.com:443, TCP – secure IoT device messaging
- *.pubnub.net:443, TCP – secure IoT device messaging
- *.pndsn.com:443, TCP – secure IoT device messaging
- *.papertrailapp.com:443, TCP – log management

Gateway-2’s open connections through ports 80, 123, and 443 of a customer's firewall, opening only outbound connections. Gateway-2’s require the following outbound TCP and/or UDP connections to be open on your firewall for the system to work:

- s3.amazonaws.com:[80|443], TCP – various files
- *.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

Tablet Gateway Supplemental

Tablet Gateways are based on the Android technology and therefore enjoy the security benefits of the Android Development Network and Google. Sourced from the Security whitepaper from Google about Android:

- Strives to prevent security issues from occurring through design reviews, penetration testing and code audits
- Performs security reviews prior to releasing new versions of Android and Google Play
- Publishes the source code for Android, thus allowing the broader community to uncover flaws and contribute to making Android the most secure mobile platform
- Works hard to minimize the impact of security issues with features like the application sandbox
- Detects vulnerabilities and security issues by regularly scanning Google Play applications for
malware, and removing them from devices if there’s a potential for serious harm to the user devices or data

- Has a rapid response program in place to handle vulnerabilities found in Android by working with hardware and carrier partners to quickly resolve security issues and push security patches

Elemental Machines Network Information

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

Local Wireless Network Information:

SSID:

Password:
## Specifications

### Element-T Specifications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>ET2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>2.25”x1.6”x1”</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>5 – 45°C</td>
</tr>
<tr>
<td>Operating Humidity Range</td>
<td>0 – 95% RH, Non-condensing</td>
</tr>
<tr>
<td>Battery Requirements</td>
<td>2 AAA replaceable lithium batteries (supplied)</td>
</tr>
<tr>
<td>Battery Life</td>
<td>1 Year (9 Months Typical)</td>
</tr>
</tbody>
</table>

### Sensor Specifications

<table>
<thead>
<tr>
<th>Temperature Range (Electronics)</th>
<th>5 – 45°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Accuracy (Electronics)*</td>
<td>+/- 0.5°C</td>
</tr>
<tr>
<td>Temperature Range (Thermocouple)</td>
<td>-200 – 200°C</td>
</tr>
<tr>
<td>Temperature Accuracy (Thermocouple)</td>
<td>+/- 1.0°C</td>
</tr>
</tbody>
</table>

*Temperature is factory calibrated to a NIST traceable standard

### Communication

<table>
<thead>
<tr>
<th>Data Sampling and Transmission Rate</th>
<th>15 Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol (Element)</td>
<td>Bluetooth® Low Energy 4.1</td>
</tr>
<tr>
<td>Range</td>
<td>30 Meters</td>
</tr>
<tr>
<td>Frequency band (power)</td>
<td>2.4 GHz (4.8 dBm ≡ 3 mW)</td>
</tr>
</tbody>
</table>

### Compliance

<table>
<thead>
<tr>
<th>FCC ID</th>
<th>TFB-1005, FCC Part 15.247</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC ID</td>
<td>5969A-1005, RSS 247</td>
</tr>
<tr>
<td>CE</td>
<td>2011/65/EU and amendment</td>
</tr>
<tr>
<td></td>
<td>2015/863 (RoHS)</td>
</tr>
<tr>
<td></td>
<td>2006/66/EC and amendment</td>
</tr>
<tr>
<td></td>
<td>2013/56/EU (Batteries Directive)</td>
</tr>
<tr>
<td></td>
<td>2012/19/EU (WEEE)</td>
</tr>
<tr>
<td></td>
<td>2014/53/EU (RED)</td>
</tr>
<tr>
<td></td>
<td>safety under 2014/35/EU (LVD)</td>
</tr>
<tr>
<td></td>
<td>And essential EMC reqs under 2014/30/EU</td>
</tr>
<tr>
<td>Giteki</td>
<td>Compliant to standard ARIB STD-T66 v3.7 201-170613 (PCB trace antenna)</td>
</tr>
<tr>
<td>RCM</td>
<td>Compliant to standard AS/NZS 4268:2017</td>
</tr>
</tbody>
</table>
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 B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:
• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

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 Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

Le présent appareil 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.
EU DECLARATION OF CONFORMITY

1. Radio equipment: Element-T, ET2
2. Name and address of the manufacturer or his authorised representative:
   Elemental Machines
   185 Alewife Brook Parkway, Suite 401
   Cambridge, MA 02138 USA
3. This declaration of conformity is issued under the sole responsibility of the manufacturer.
4. Object of the declaration:

5. The object of the declaration described above is in conformity with the relevant Union
   harmonisation legislation:
   Directive 2014/53/EU (RED), including:
   a. essential EMC requirements under Directive 2014/30/EU (EMC)
   b. safety under 2014/35/EU (LVD)
   Directive 2011/65/EU and amendment 2015/863 (RoHS)
   Directive 2006/66/EC and amendment 2013/56/EU (Batteries Directive)
   Directive 2012/19/EU (WEEE)
6. Relevant harmonised standards used:
   EN 50419:2006
   EN 55011:2016+A1:2017
   EN 61000-4-2:2009
   EN 61000-4-3:2006+A2:2010
   EN 61010-1:2010+A1:2019
   EN 62311:2008
   EN 63000:2018
   ETSI EG 203 367 V1.1.1 (2016-06)
   ETSI EN 300 328 V2.1.1 (2016-11)
   ETSI EN 301 489-1 V2.1.1 (2017-02)

Signed for and on behalf of: Elemental Machines on 04 Oct 2019 by Sridhar Iyengar, CEO

(signed copies of EU DoC available on application)