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**Introduction**

Thank you for choosing this Element-A 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-A:

**Safety Information**

**Battery Pack**

> **WARNING:** Element-A is powered internally by a non-rechargeable lithium battery pack. This battery 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-A does not exceed its operating limits in temperature of -10 to 45 °C and in humidity of 0 to 95%RH (non-condensing).

**Non-ionizing Radiation exposure**

Element-A’s periodically send measurements to the Gateway using the 2.4GHz Bluetooth® Low Energy 4.1 Protocol. When transmitting, the radio module inside the Element-A 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-A’s are designed with consideration for the environment and comply with the USA’s EPA initiative to ‘Reduce, Reuse, Recycle’. Element-A’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-A’s correctly, to help Elemental Machines in protecting the environment.

When the Element-A has reached the end of its life, which includes when the Battery pack has reached exhaustion, the correct disposal is to return the Element-A to Elemental Machines, or their agent, where:

- Lithium battery packs that have reached the end of their life can be removed from the Element-A for disposal according to local regulations.
- Element-A’s can have a new battery pack installed or, if they have reached the end of their life, will have their battery pack removed for disposal as above and then treated as Waste Electronic and Electrical Equipment (WEEE).
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.io 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:

  ![Element-A](image1)
  ![Gateway](image2)
  ![Element-T](image3)

sales@elementalmachines.io  Copyright © 2020 Elemental Machines
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Prior to installing Elements

Set up the Gateway and Power on your Devices

- Element-A’s are shipped with the power on and don’t need to be activated
- To power on the Gateway, press and hold the upper Right-hand button on the device:
  - Wait for the main screen to come up
  - Press the 'home' button when you see the Elemental Machines Logo
  - Click on the Blue VM circle in the upper right corner (if the Blue VM circle is not visible, hit the hardware home button to make it appear):
- Click on the settings icon:

- Select WiFi from the list on the left:

- Select your SSID and enter your credentials
Positioning the Gateway

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

Strength of the connection to both WiFi and cell is displayed by WiFi icon and the cellular bar icons respectively. These are displayed on the tablet to the left of the battery percentage.

- 4 or more bars for both WiFi and cell indicate good connectivity
- 2 bars for both WiFi and cell runs an increased risk of some data delay or loss
- <2 bars for cell or WiFi 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 Gateways. This range is usually up to 30 feet from the 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 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-A

In general, Elements should be installed as close to the front of the equipment as practical to ensure optimal communication with the 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-A:

- Install Element-A in a central location in the environment you want to monitor, or place it adjacent to any process or equipment you want to track.
  - For best results, ensure air can flow freely around the Element-A. When no magnetic surfaces are available, double-sided foam tape or Velcro squares are good alternatives.
  - Do not place the Element-A in condensing humidity environments. Do not submerge. Avoid placing directly under HVAC vents.

- Write the name and/or location of the piece of equipment being monitored on Element-A (particularly important if installing multiple devices). We recommend using a Sharpie.
• 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 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 Elemental Gateway via Bluetooth® low energy 4.1 (a low power 2.4GHz wireless communication, typically 5.3 dBm or lower power). Only whitelisted devices can connect with the Elemental Gateway; the whitelist is populated prior to shipping and adjusted with any subsequent additions to the network.

Communication through Customer WiFi:

The system uses established communication and security standards to protect data transmitted between Gateways and Elemental Insights.

- **SSL (Secure Socket Layer) a.k.a. TLS**, the web standard for protecting sensitive data including usernames, passwords, credit card, and banking information.
- **Symmetric 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.

Elemental Gateways socket connections through port 80 or port 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 - for sending data to the dashboard
- s3.amazonaws.com - 443 - configuration files
- *.awmdm.com - 443 - device management
- play.google.com - 443 - provisioning
- android.googleapis.com - 443 - provisioning
- android.clients.google.com - 80 - app management
- time.windows.com – 123 – time synchronization (UDP)
• *.pubnub.com – 443 – secure IoT device messaging
• *.pubnub.net – 443 – secure IoT device messaging
• *.pndsn.com – 443 – secure IoT device messaging
• *.papertrailapp.com – 443 – log management

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

1. Internet Communication over Port 80 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 or 443
5. There is no way for outside users to get into the user’s network
6. No ports are listened to by Elemental; that is the case even if the user opened ports 80 or 443 for receipt

Gateway Supplemental

Elemental 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 the Gateways and Element-D Devices
- Captive Portal: Not Supported

Local Wireless Network Information:

SSID: 

Password:
# Specifications

## Element-A Specifications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>EA1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>2.5”x2.5”x0.8”</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-10 – 45C</td>
</tr>
<tr>
<td>Operating Humidity Range</td>
<td>0 – 95% RH, Non-condensing</td>
</tr>
<tr>
<td>Operating Pressure Range</td>
<td>300 – 1100hPa</td>
</tr>
<tr>
<td>Battery Life</td>
<td>5 Year (3 Year Typical)</td>
</tr>
</tbody>
</table>

## Sensor Specifications

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>-10 – 45C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Accuracy*</td>
<td>Typical +/- 0.2C, Max +/- 0.5C, Drift: &lt;0.03 degrees C/yr</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>0 – 95% RH, Non-condensing</td>
</tr>
<tr>
<td>Humidity Accuracy*</td>
<td>0% to 80% RH Typical ±2.0% RH, Max ±3.0% 80% to 95% RH <em>Typical ±3.0% RH, Max ±5.0% Drift: typical &lt;0.25%/yr max of &lt;0.5%/yr</em>*</td>
</tr>
<tr>
<td>Pressure Range</td>
<td>300 – 1100hPa</td>
</tr>
<tr>
<td>Pressure Accuracy*</td>
<td>±1.0 hPa from 0C to 60C, ±1.7 hPa from -10C to 0C</td>
</tr>
<tr>
<td>Light Range</td>
<td>For light and dark cycle tracking only</td>
</tr>
</tbody>
</table>

*Temperature, pressure, and humidity are factory calibrated to a NIST traceable standard
**Extended exposure to high humidity and high temperature may cause an accrued RH offset

## 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>
</tbody>
</table>

FCC/IC Wireless Regulation Compliant
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 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.

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.