ELEMENTAL MACHINES ET3 Element-T Machine User Manual

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Contents

Introduction

This manual provides instructions on safety and installation of Element-T, including information regarding security, specifications, and certifications.

Element-T is a wireless, battery-powered Internet of Things (IoT) smart sensor used for measuring, monitoring, and recording temperature. Element-T device is one product within our LabOps monitoring solution helping protect your critical lab areas, instruments, and other assets from risk. Data is securely transmitted wirelessly to the Elemental Insights™ Dashboard via the Elemental Machines Gateway, where it is recorded and analyzed for record keeping and alerting

Safety Information

Batteries

 **WARNING**: 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 main housing of 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).t is important that the main housing of Element-B 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 sends measurements to a Gateway using a lowpower 2.4GHz wireless network. When transmitting, the radio modules inside the Element-T work at a maximum power of 8.0 dBm (6.3 mW) for Model ET3. 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 B digital device, which are designed to provide reasonable protection against harmful interference when the equipment is operated

in a commercial or residential environment. If not installed and used in accordance with this User Manual, the Element-T may possibly cause harmful interference to other radio communications. Possible remedies for any such interference include reorienting the receiving antennae or increasing the separation between affected equipment and Element-T.

Protecting the Environment
Element-T's are designed with consideration for the environment and comply with relevant regulations such as the EU's and UK's RoHS regulations and Batteries Directives, 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 Elemental Machines 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.

Element-T is marked with the international 'wheeled bin' symbol, to identify it as Electrical or Electronic Equipment that the EU and UK require 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 and UK Non-hazardous Waste code: 16 06 05).
- 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 and UK 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

Below are the instructions for installing Element-T. If you have any questions please contact **help@elementalmachines.com** or your account representative.

Prior to Receiving Element-T
If this is your first time setting up the Elemental Machines system, 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.

Positioning Element-T

Element-T needs to be within range of an Elemental Gateway. The range is usually up to 30 meters, but can depend on the layout and concentration of equipment in your lab. Signal strength for an individual Element can be acquired via the Elemental Insights™ Dashboard. Navigate to the device in

Installing Element-T
Elements should be installed as close to the front of the equipment as practical to ensure optimal communication

with a Gateway

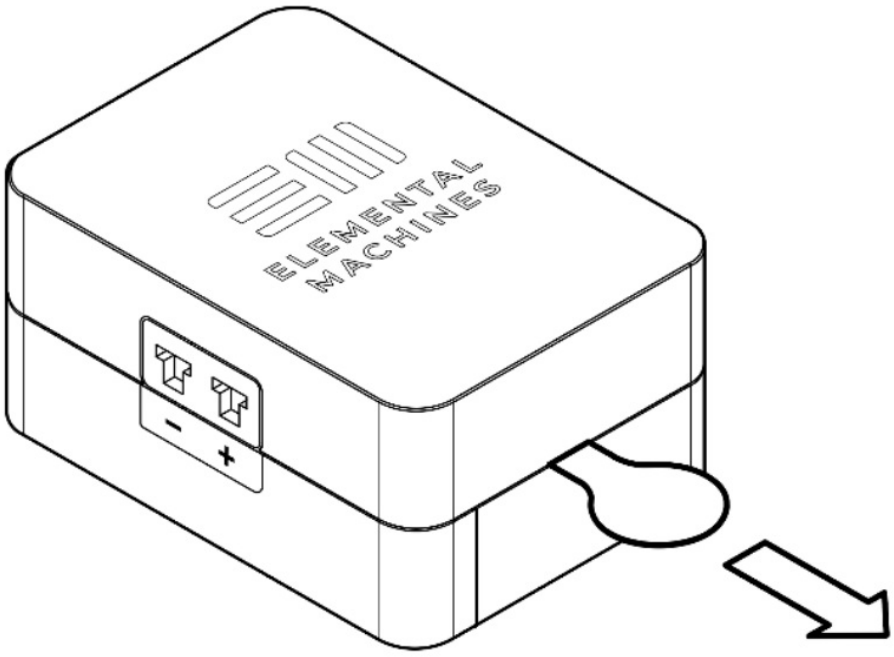
Gateway Setup

Element-T communicates wirelessly to an Elemental Gateway, which should be set up prior to connecting Element-T. Depending on your location and application, your Gateway type may vary. If you have a tablet Gateway, brief setup instructions are given in the appendix below. If you have a Gateway Model GW2 or GW3, please follow the setup instructions in your Gateway, GW2 or GW3 User Manual

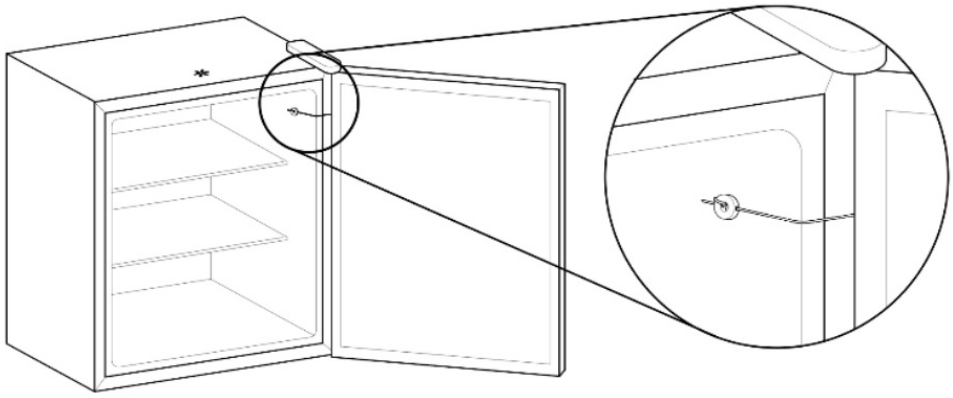
question and the signal icon will have 1-4 bars of strength. More bars indicate a better signal using a low power 2.4GHz wireless communication protocol. The connection should be sufficient as long as there are at least 2 bars.

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

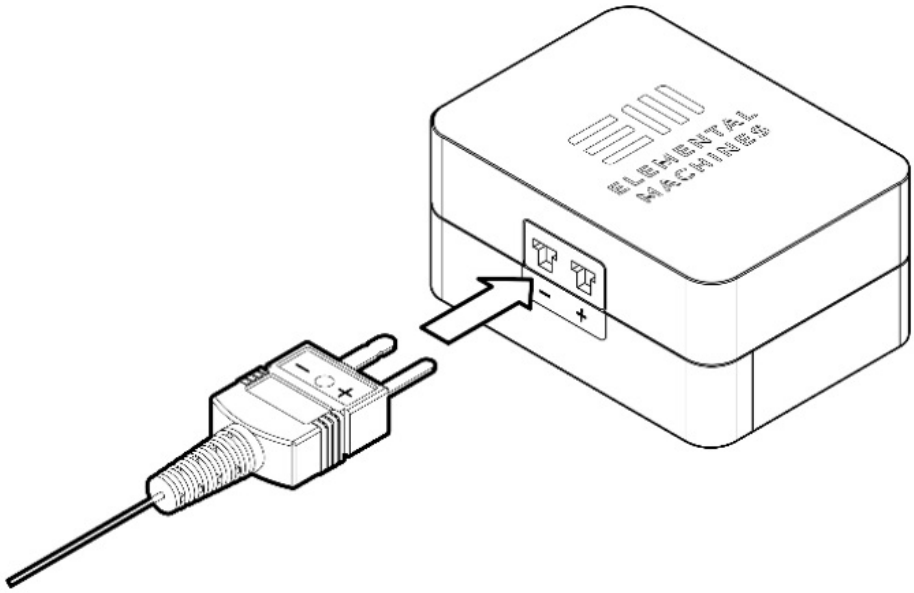
1. Securely position Element-T in the chosen location. Element-T has magnets which make it easily mountable to magnetic surfaces
2. To power on the Element-T, remove the battery pull tab. You should hear an ascending tone, repeated twice if the Element-T is now powered on.



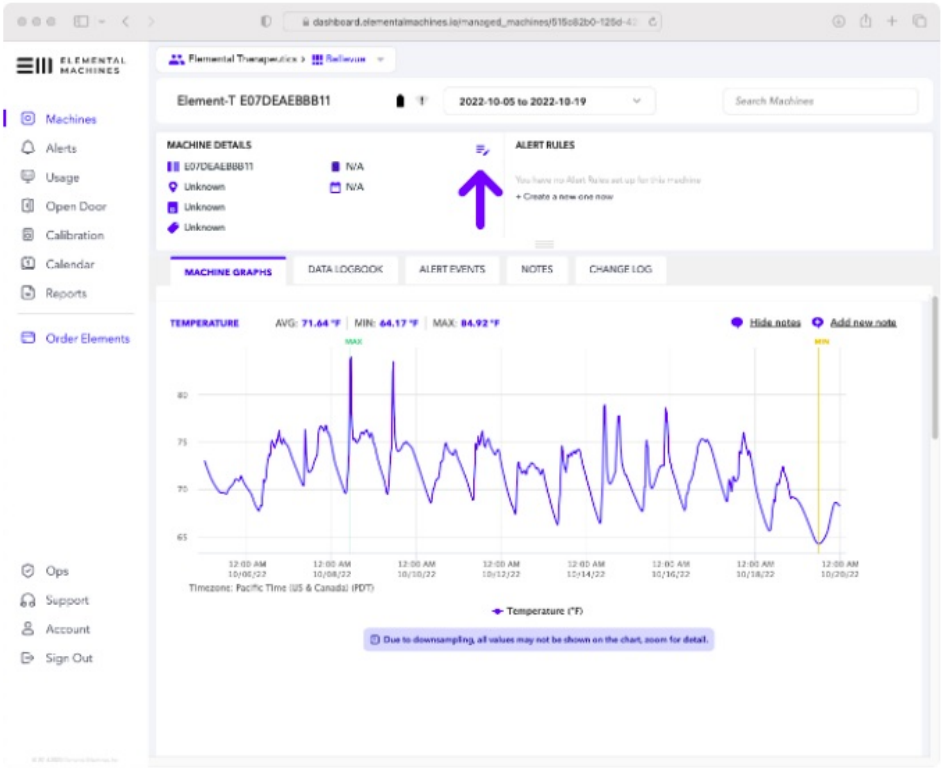
3. Install the thermocouple in the refrigerator/freezer as shown. We recommend installing the Element-T on the hinge side of the door and threading the thermocouple through the hinge side (as shown). Other equipment may have ports for cables through their sides or back which can be used, particularly if the door lacks soft seals or has a sliding mechanism. 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.



4. Per your discretion, write the name and/or location of the equipment being monitored on Element-T. This can be particularly helpful if multiple devices are being installed. Use of a Sharpie is recommended.
5. Plug the temperature probe into the side of the Element-T, being sure to match the positive and negative marked prongs to their same marked receptacles on the device. Note that the size and color of the prongs also differs between them.



6. Verify that the Element-T is displaying as “connected” on the Elemental Insights™ Dashboard.



7. Edit the device description in the Dashboard to include name and location of the device and provide details on the equipment or area being monitored. To edit, in the “Machines” Section select the Element-T to show the detail view. Under “Machine Details” click on the pencil icon to edit the name, tags, and additional information.
8. Further assistance to complete dashboard setup is available in the Support section.

Specifications

GENERAL SPECIFICATIONS

- **Model Number:** ET3
- **Dimensions:** 2.25 in x 1.6 in x1.0 in (5.7 cm x 4.0 cm x 2.5 cm)
- **Operating Temperature Range:** 5°C – 45°C
- **Operating Humidity Range:** 0 – 95% RH, Non-condensing
- **Power Requirements:** 2 AAA replaceable lithium batteries (supplied)
- **Estimated Battery Life:** ~1.5 Years

INTERNAL SENSOR SPECIFICATIONS

- **Temperature Range (Electronics):** 5°C – 45°C
- **Temperature Accuracy (Electronics)*:** ±0.5°C
- **Temperature Range (Thermocouple):** -200°C – 200°C
- **Temperature Accuracy (Thermocouple)**:** ± 1.0°C

*Temperature is factory calibrated to a NIST traceable standard
** In the temperature range -100°C – 200°C; for cryogenic applications recalibration may be necessary, which could compromise accuracy above 100°C

COMMUNICATION

- **Data Sampling and Transmission Rate:** 15 Seconds
- **Range:** Up to 30 Meters, depending on environmental conditions
- **Frequency band (power):** 2.4 GHz (8 dBm ≡ 6.3mW)
- **Contains FCC ID:** QOQ-GM220P, FCC Part 15.247
- **Contains IC ID:** 5123A-GM220P, RSS 247

CE	UKCA	Test Standards
2011/65/EU and amendment 2015/863 (RoHS)	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	EN 63000
2006/66/EC and amendment 2013/56/EU (Batteries Directive)	The Batteries and Accumulators (Placing on the Market) Regulations 2008 (S.I. 2008/2164)	EN 50419, EN 63000
2014/53/EU (RED)	The Radio Equipment Regulations 2017 (S.I.2017/1206)	ETSI EN 300 328
safety under 2014/35/EU (LVD)	The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	EN61010-1, EN 62311
And essential EMC reqs under 2014/30/EU	The Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	ETSI EN 301 489-1, EN61326-1, EN 61000-4-2, EN 61000-4-3, EN 55011

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.

Declarations of Conformity

EU DECLARATION OF CONFORMITY

1. Radio equipment: Element-T, ET3
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 European 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 61010-2-030:2021/A11:2021
- EN 61326-1:2013
- EN 62479:2010
- EN 63000:2018
- ETSI EG 203 367 V1.1.1 (2016-06)
- ETSI EN 300 328 V2.2.2 (2019-07)
- ETSI EN 301 489-1 V1.9.2 (2011-09)
- ETSI EN 301 489-17 V3.2.4 (2020-09)

Signed for and on behalf of: Elemental Machines on 2023 Jul 14 by Sridhar Iyengar, CEO

DECLARATION OF CONFORMITY

1. Radio equipment: Element-T, ET3
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 statutory requirements: Radio Equipment Regulations 2017 (S.I. 2017/1206), including:
   a. EMC under Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)
   b. safety under Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032) The Batteries and Accumulators (Placing on the Market) Regulations 2008 (S.I. 2008/2164) The Waste Electrical and Electronic Equipment Regulations 2013 (S.I. 2013/3113)
6. Relevant designated 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 61010-2-030:2021/A11:2021
- EN 61326-1:2013
- EN 62479:2010
- EN 63000:2018
- ETSI EG 203 367 V1.1.1 (2016-06)
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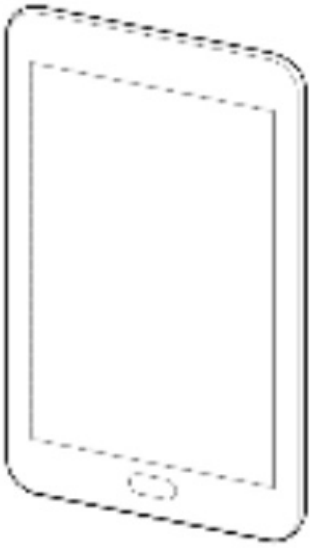
- ETSI EN 301 489-17 V3.2.4 (2020-09)

Signed for and on behalf of: Elemental Machines on 2023 Jul 14 by Sridhar Iyengar, CEO

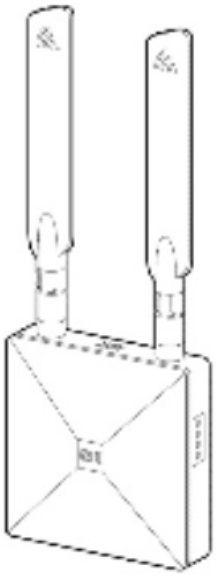
Gateway Setup

Elemental Machines provides multiple styles of Gateways. If you have a Tablet Gateway (Model GW1), please follow the setup instructions below. For Gateway-2, please follow the setup instructions in 771-00021 Gateway (Model GW2) User Manual. For Gateway-3, please follow the setup instructions in 771-00034 Gateway (Model GW3) User Manual.

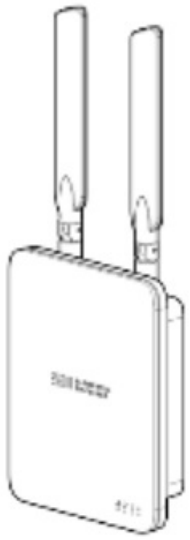
- Tablet Gateway (Model GW1)



- Gateway 2 (Model GW2)



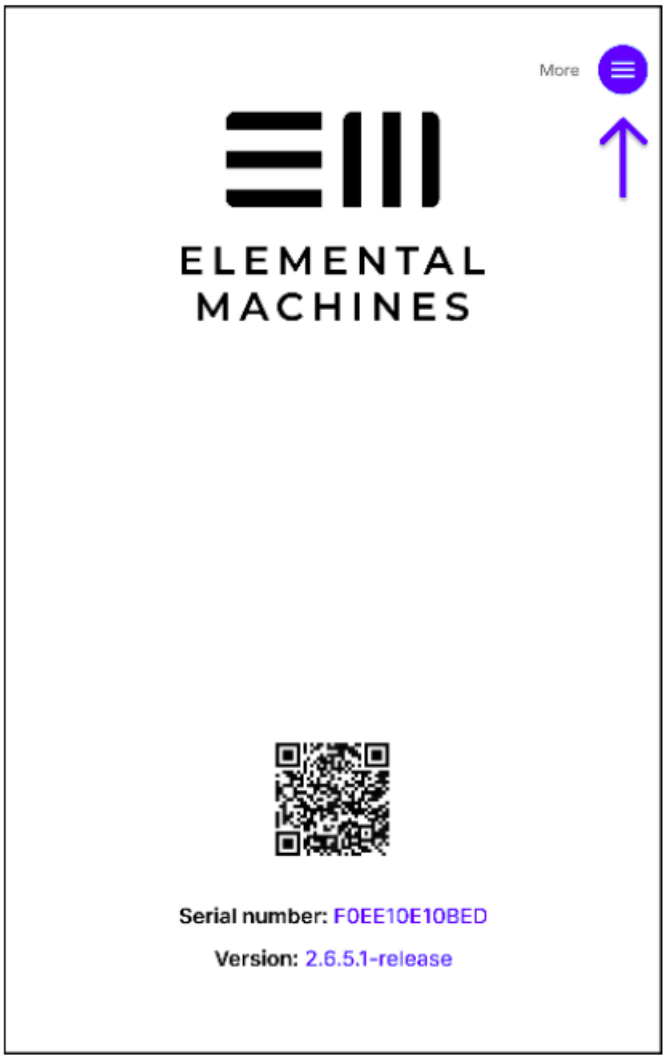
- Gateway 3 (Model GW3)



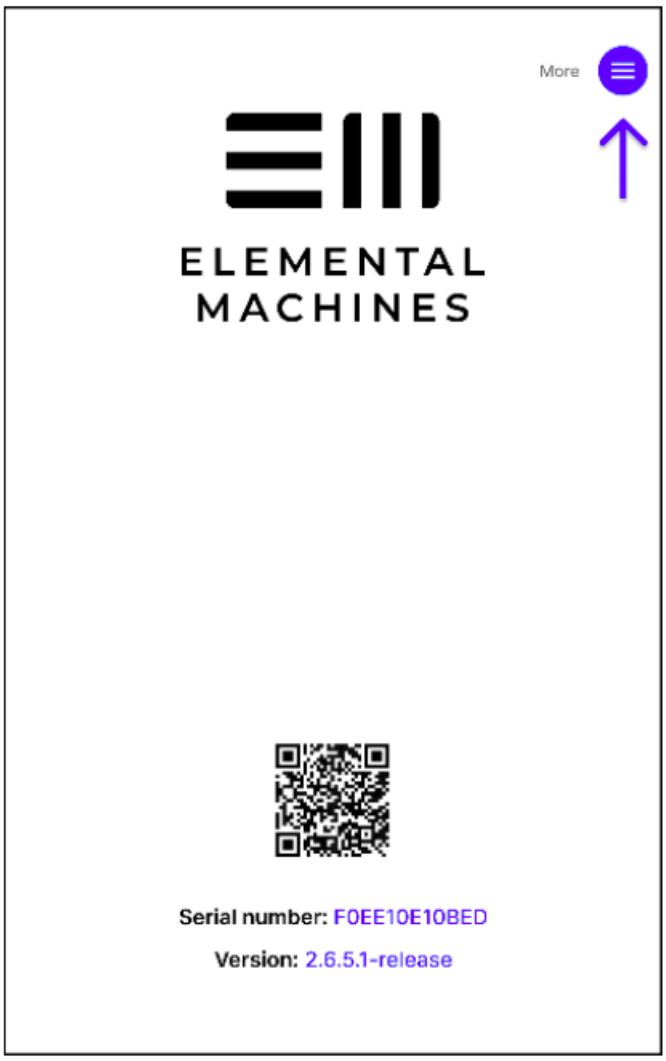
Tablet Gateway (Model GW1) Software Setup
To power on the Gateway, press and hold the upper right-hand button on the device,

- Wait for the main screen to come up
- Press the ‘home’ button when you see the Elemental Machines Logo

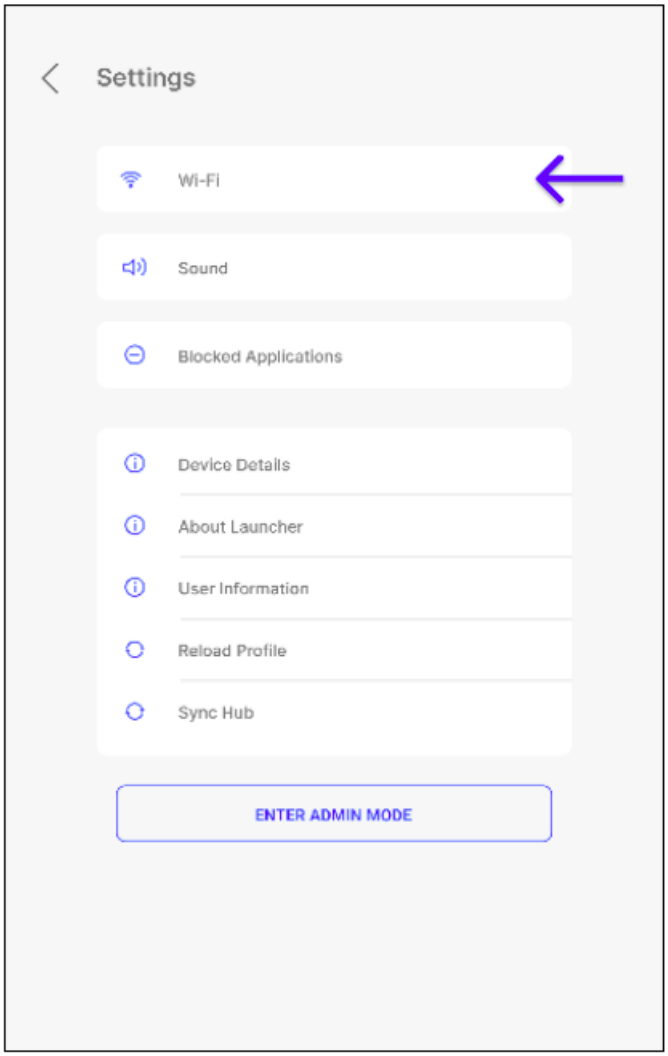
Click on the blue circle in the upper right corner (if the circle is not visible, press the hardware home button on the bottom of the tablet to make it appear, or swipe up if you do not have a hardware button)



Click on the settings icon



Select WiFi from the list



Positioning the Tablet Gateway

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.

The strength of the Wi-Fi and Cellular connection are displayed by the Wi-Fi icon using Cellular bar icons. These icons 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

Platform Network Summary

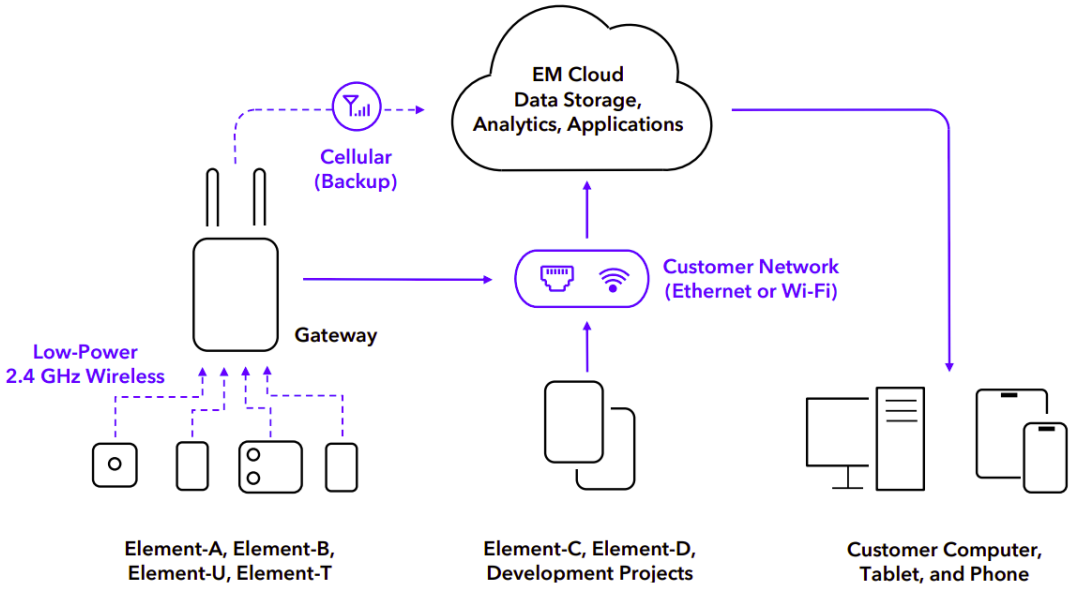
Elemental Machines' platform delivers actionable intel to operators that will help improve operations and speed discovery.

Elemental Machines devices are designed to operate securely on our customers' networks. The entire platform includes:

- Devices called Elements that monitor critical equipment and/or the ambient environment

- Elemental Gateway that gathers data from the non-cloud connected Elements
- Elemental Insights™ dashboard

The full scope of Elemental Machines' Data Services is shown below:



Local Communication

Wireless sensors (Element-T, Element-A, Element-U Model EU2, and Element-B) communicate individually to a local Elemental Gateway (either an Elemental Tablet Gateway, Elemental Gateway models GW2 or GW3) via a low powered 2.4 GHz wireless communication protocol. These devices do not connect to the corporate network. Each Elemental Gateway will only process data from Elements that are on a pre-defined list that is unique to each installation. This list is created prior to shipping the Gateway and is updated whenever new Elements are added to the network.

Element-C, Element-D, and Element-U model EU1 devices do not require an Elemental Gateway and transmit data directly from a piece of equipment to the Elemental Insights™ dashboard via customer Wi-Fi or ethernet.

Communication through Customer Ethernet or Wi-Fi

Elemental Gateway Models GW2/GW3 and Element-C, Element-D, and Element-U Model EU1 will always connect to Ethernet first, if available. If there is no Ethernet then the device will connect to Wi-Fi. The system uses HTTPS to protect data transmitted between Elemental Gateways, Element-C, Element-D, and Element-U Model EU1 devices and necessary API and data ingest endpoints, such as Elemental Insights™. HTTPS is the established communication and security standard for protecting sensitive data transmitted across the web, with applications that include usernames, passwords, credit card, and banking information.

Elemental Machines devices use socket connections through port 80, 123, and 443 of a customer's firewall, opening only outbound connections.

Elemental Tablet Gateway requires the following outbound TCP/UDP connections to be open in a customer's firewall for the system to wor

ENDPOINT	PORT	PROTOCOL	DESCRIPTION
*.elementalmachines.io http://api.elementalmachines.iongest.elementalmachines.io	443	TCP	sending data to the dashboard
s3.amazonaws.com	80, 443	TCP	configuration files
*.awmdm.com appwrapandroid.awmdm.com discovery.awmdm.com signing.awmdm.com gem.awmdm.com	443	TCP	mobile device management
http://play.google.comandroid.clients.google.comandroid.googleapis.com	443	TCP	provisioning
time.elementalmachines.io	123	UDP	time synchronization
*.pubnub.com *.pubnub.net *.pndsn.com	443	TCP	secure IoT device messaging
*.papertrailapp.com	443	TCP	log management
*.elementalmachines.io http://api.elementalmachines.ioingest.elementalmachines.io	443	TCP	sending data to the dashboard
s3.amazonaws.com	80, 443	TCP	configuration files
time.elementalmachines.io	123	UDP	time synchronization
*.balena-cloud.com vpn.balena-cloud.com cloudlink.balena-cloud.com api.balena-cloud.com registry2.balena-cloud.com registrydata.balenacloud.com	443	TCP	device management
*.docker.com *.docker.io	443	TCP	For verified operating system imagesq
*.pubnub.com *.pubnub.net *.pndsn.com	443	TCP	secure IoT device messaging
8.8.8.8			Google's Public DNS server (Balena default, can be reconfigured)

For All Devices, no inbound ports need to be opened. Security vulnerability using the above configuration is prevented as follows:

- Internet communication over Port 80, 123, and 443

- Device must be able to transmit outward to the Internet on 443
- Clients do not open inbound ports
- There is no need to open the firewall to receive on port 80, 123, or 443
- There is no way for outside users to get into the user's network
- No ports are listened to by Elemental Machines, that is the case even if the user opened ports 80 or 443 for receipt

Elemental Insights™ Dashboard

Communication between the Dashboard and web browsers always uses HTTPS. User access to the Dashboard is restricted to invite-only, requires hardened passwords, and can be revoked by admins at any time. Users are further restricted in what they can access or edit by rolebased account policies

Supplemental Security Information

Elemental Tablet Gateway is based on Android technology and therefore enjoy the security benefits of the Android Development

Network and Google. Security benefits, as listed in a security whitepaper from Google about Android, are as follows:

- Strives to prevent security issues from occurring through designreviews, 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 Gateway Models GW2, GW3 as well as Element-C, Element-D, and Element-U Model EU1 devices are based on the balenaOS, a thin Linux environment that supports the balenaCloud services and user application containers. Balena offers security by design:

- API access control
- Multiple authentication methods
- Minimized available attack surfaces
- Balena operates its own Virtual Private Cloud (VPC) on Amazon Web Services (AWS) This isolation gives Balena an added layer of security

Elemental Machines Cloud Services

Elemental Machines' data ingestion and server infrastructure are

hosted on Google Cloud Platform, which provides a managed security layer for Google services (PubSub, BigQuery, etc.) and are automatically updated by Google. Other components such as

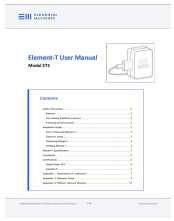
Ruby-on-Rails, Influx, and Postgres databases are maintained to at least the minimum supported version and are updated for any high/critical security vulnerabilities per vendor guidance.

Elemental Machines Network Information

- Wireless Requirements:
- SSID: Not hidden is preferred
- Security: WEP, WPA, or WPA2
- IP Assignment: Dynamic is preferred
- Number of Unique Devices: Sum of the Gateways and ElementC, Element-D, and Element-U1 devices
- Captive Portal: Not Supported Local Wireless Network Information:
- SSID:
- Password:

elementalmachines.com

Documents / Resources

	ELEMENTAL MACHINES ET3 Element-T Machine [pdf] User Manual ET3, ET3 Element-T Machine, Element-T Machine