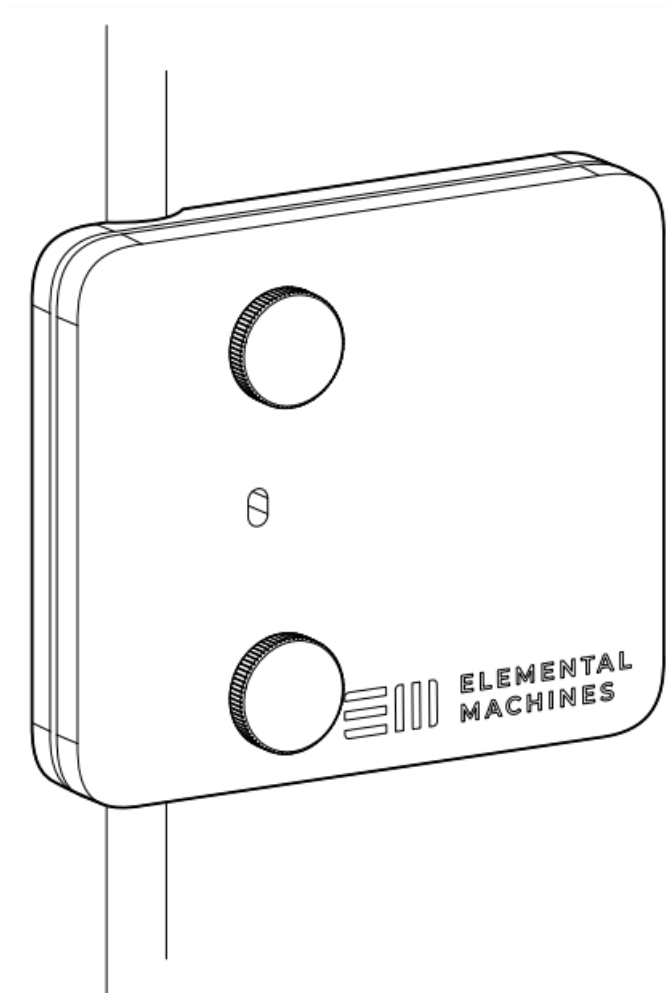


ELEMENTAL MACHINES EU3 Element-U LabOps Intelligence Platform User Manual

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ELEMENTAL MACHINES EU3 Element-U LabOps Intelligence Platform



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Introduction

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

Element-U is a battery-powered, wireless sensor that continuously monitors the real-time availability and usage of any powered instruments. The Element-U includes a custom clamp with two thumbscrews that secures it to most power cables. Installation does not interrupt the power circuit and can even be done safely while the machine is on. Usage data is securely transmitted to

the Elemental Machines Insights Dashboard™ where it is analyzed as the software digitally records and visually shows the usage timeline and percentage. The Usage Platform empowers agile lab operations to help guide the service, movement, efficiency, and purchase of lab equipment to optimize operating resources.

Safety Information

Batteries



WARNING: the Element-U, Model EU3 is powered by 2 non-rechargeable AA 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 this Element-U 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-U sends measurements to a Gateway using a low-power 2.4GHz wireless network. When transmitting, the radio module inside the Element-U works at a maximum power of 8 dBm (6.3mW). 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 residential installation. 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.

Protecting the Environment

Element-U is designed with consideration for the environment and complies with relevant regulations such as the EU's and UK's RoHS regulations and Batteries Directive, as well as the USA's EPA initiative to 'Reduce, Reuse, Recycle'. The Element-U hardware devices 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-U's correctly, to help Elemental Machines in protecting the environment.



The Element-U is marked with this symbol, 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:

- AA lithium batteries that have reached the end of their life should be removed from the Element-U, kept separate from unsorted municipal waste and disposed of according to local regulations (EU and UK Non-hazardous Waste code: 16 06 04)
- Element-U'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, remove the battery cover on the back of the device and remove the two AA batteries; these can be replaced with new AA lithium batteries.

Installation Guide

Below are the instructions for installing the Element-U. If you have any questions please contact help@elementalmachines.com.

Prior to Receiving the Element-U

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.

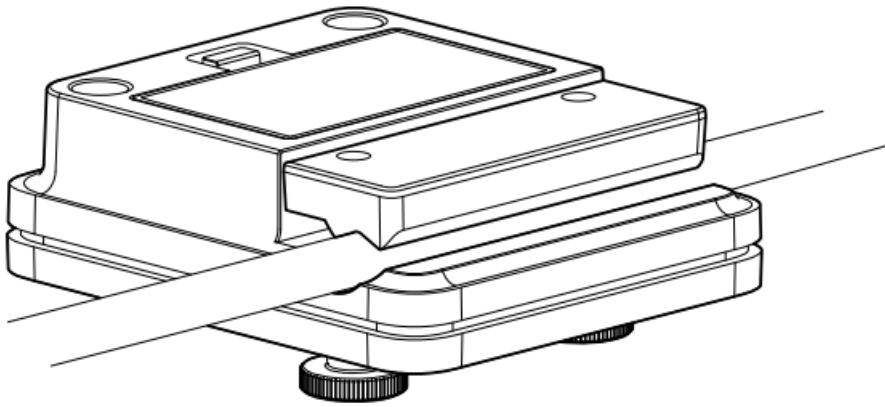
When devices are shipped they will be added to your Elemental Machines Insights Dashboard™ with default names. When you first log in you will see all of your devices with a 'disconnected' status.

Positioning Element-U

Element-U 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 Machines Insights Dashboard™. Navigate to the device in 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.

Clamp Method – For Most Power Cords (5-12mm)

The provided clamp and thumbscrews can be used to easily attach the Element-U to a mains power cord.



1. Unscrew the thumbscrews ensuring the cable clamp is still attached, but has enough room to slide the cable in place. Some larger cables may require removing the clamp completely and then screwing the clamp back on.
2. Lay the cord flat in the groove with the sensors.
3. Gently holding the clamp in place, rotate the thumbscrews from the opposite face of the Element-U.
4. Tighten the thumbscrews until they are finger-tight only. The Element-U should not move or slide on the cord with the clamp in place. Do not use tools to tighten the screws further.

Gateway Setup

This Element-U communicates wirelessly to an Elemental Gateway, which should be set up prior to connecting Element-U. 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 Model GW3, please follow the setup instructions in your Gateway, GW2 User Manual or Gateway, GW3 User Manual.

Install Element-U



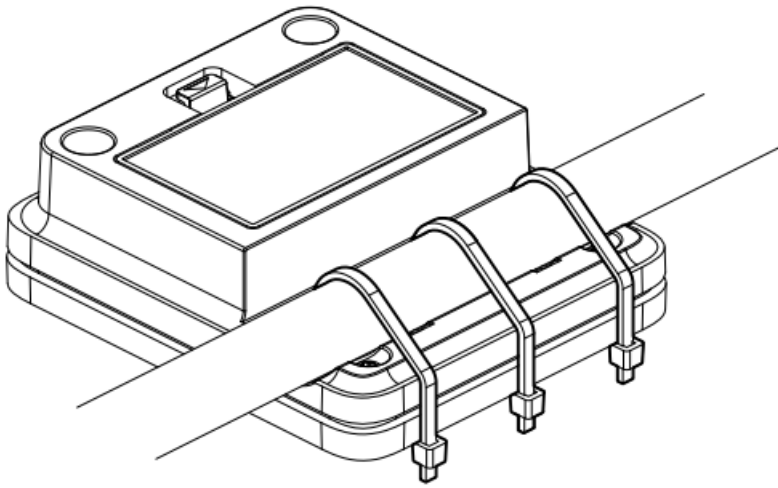
Be sure to read and comply with the safety information at the beginning of this manual concerning operating environment.

Element-U can be placed at any location on a mains power cord, but should be installed as close to the front/side of the equipment as possible to ensure optimal communication with a Gateway.

The Element-U provides two methods of attaching the device to a mains cord:

Cable Tie Method – For Larger Power Cords (>12mm)

For power cords larger than 12mm in diameter, cable ties should be used instead of the provided clamp.



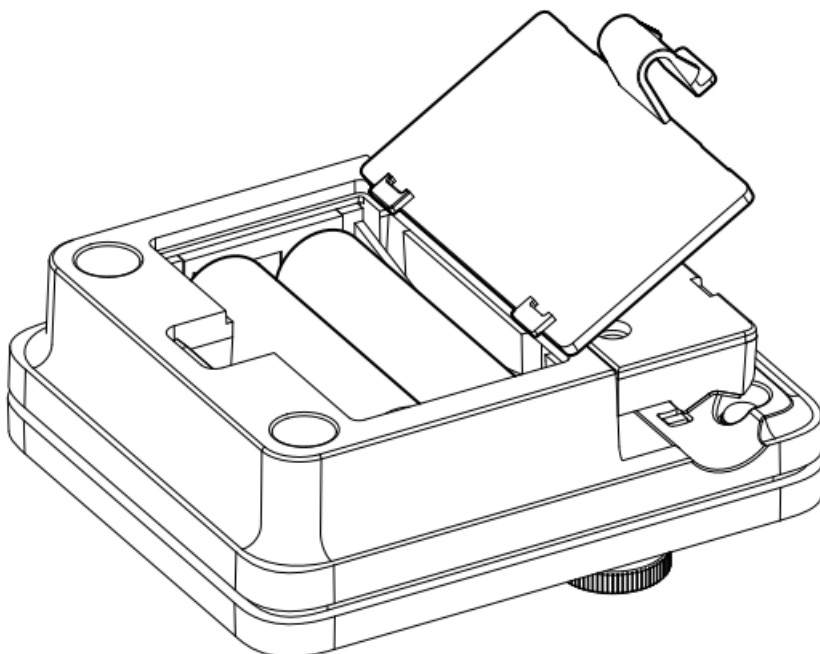
1. Completely unscrew the two thumbscrews and set the cable clamp & thumbscrews aside. They are not required for this installation.
2. Use the 3 provided cable ties through the Element-U. Do not close the cable ties yet.
3. Lay the cord flat in the groove with the sensors, sitting between the ends of the cable ties.
4. With the power cord in place, cinch down all 3 cable ties starting with the inner tie and moving outward. After all 3 are cinched, ensure the power cord can not move or slide by pulling or pushing it through the ties. The remaining cable-tie length can be clipped as necessary, but take care not to damage the mains cable.

Powering on the Element-U and Dashboard Setup

Remove the battery door on the rear of the Element-U and remove the battery pull-tab that isolates the batteries from the device. For optimal performance, use only the provided Energizer L92 AA batteries.

Use the Elemental Machines Insights Dashboard™, to confirm your Element-U is connected. You can also change the name/location and add tags for the device

For further assistance, e.g. to complete the dashboard setup, click on “Support” at the bottom left of the dashboard.



Specifications

ELEMENT-U SPECIFICATIONS

Model Number	EU3
Dimensions	3.6in x 3in x 1.1in (9.2cm x 7.8cm x 2.8cm)
Operating Temperature Range	41°F-113°F (5°-45° C)
Operating Humidity Range	0-95% RH, Non-condensing
Battery Requirements	2 AA replaceable lithium batteries (supplied)
Estimated Battery Life	~2 Years at the default sample rate of 10 seconds

UTILIZATION SPECIFICATIONS

Maximum Cable Diameter (Clamp)	0.47in (12mm)
Maximum Cable Diameter (Cable Tie)	0.63in (16mm)

COMMUNICATION

Default Data Sample Rate	10 seconds
Protocol (Element)	Proprietary
Range	98ft (30m)
Frequency band (power)	2.4 GHz (8 dBm \equiv 6.3 mW)

COMMUNICATION

Contains FCC ID	QOQ-GM220P, FCC Part 15.247
Contains IC ID	5123A-GM220P, RSS 247

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 follow in 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.

Appendix 1: Declarations of Conformity

EU DECLARATION OF CONFORMITY

1. Radio equipment: Element-LI, EU3
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 62311:2008
EN 55011:2016+AI :2017	EN 63000:2018
EN 61000-4-2:2009	ETSI EG 203 367 VI.1.1 (2016-06)
EN 61000-4-3:2006+A2:2010	ETSI EN 300 328 V2.2.2 (2019-07)
EN 61010-1:2010+AI:2019	ETSI EN 301 489-1 VI.9.2 (2011-09)
EN 61326-1:2013	ETSI EN 301489-17 V3.2.4 (2020-09)

Signed for and on behalf of: Elemental Machines (2023 Mar 07]

(signature):

UK DECLARATION OF CONFORMITY

1. Radio equipment: Element-U, EU3
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: 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 harmonised standards used:

EN 50419:2006	EN 62311:2008
EN 55011:2016+AI:2017	EN 63000:2018
EN 61000-4-2:2009	ETSI EG 203 367 VI.1.1 (2016-06
EN 61000-4-3:2006+A2:2010	ETSI EN 300 328 V2.2.2 {2019-07}
EN 61010-1:2010+AI:2019	ETSI EN 301 489-1 VI.9.2 {2011-09}
EN 61326-1:2013	ETSI EN 301 489-17 V3.2.4 (2020-09)

Signed for and on behalf of: Elemental Machines [2023 Mar 07]

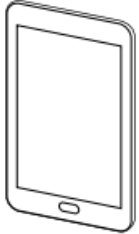
(signature):


Sridhar Iyengar, CEO

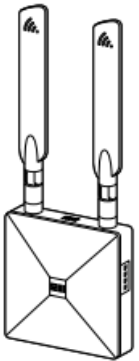
Appendix 2: Gateway Setup

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.

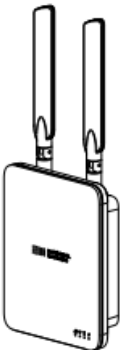
- Tablet Gateway (Model GW1)



- Gateway-2 (Model GW2)



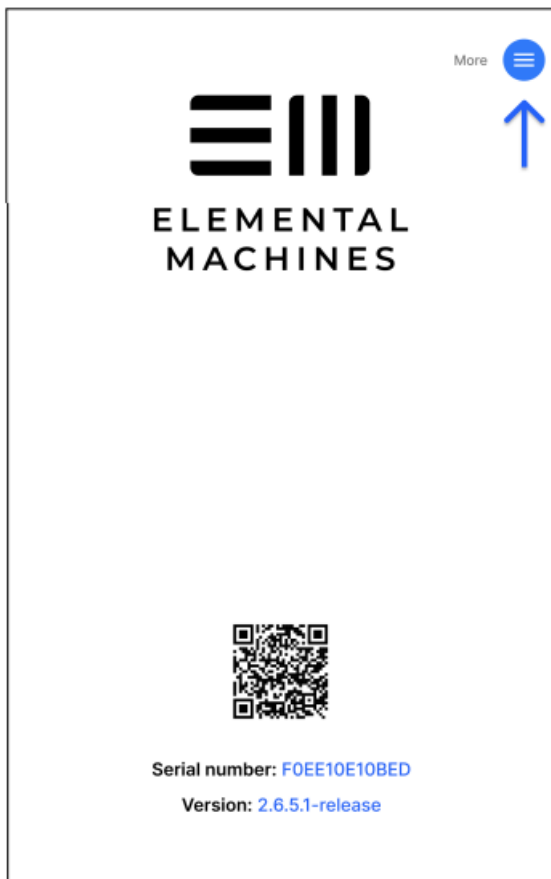
- Gateway-3 (Model GW3)



Tablet Gateway (Model GW1) Software Setup

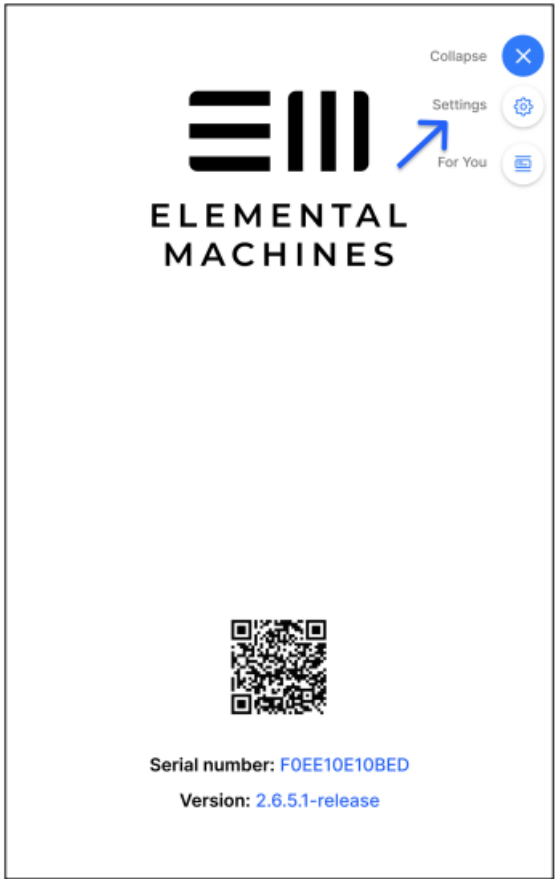
To power on the Gateway, press and hold the upper right-hand button on the device,

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



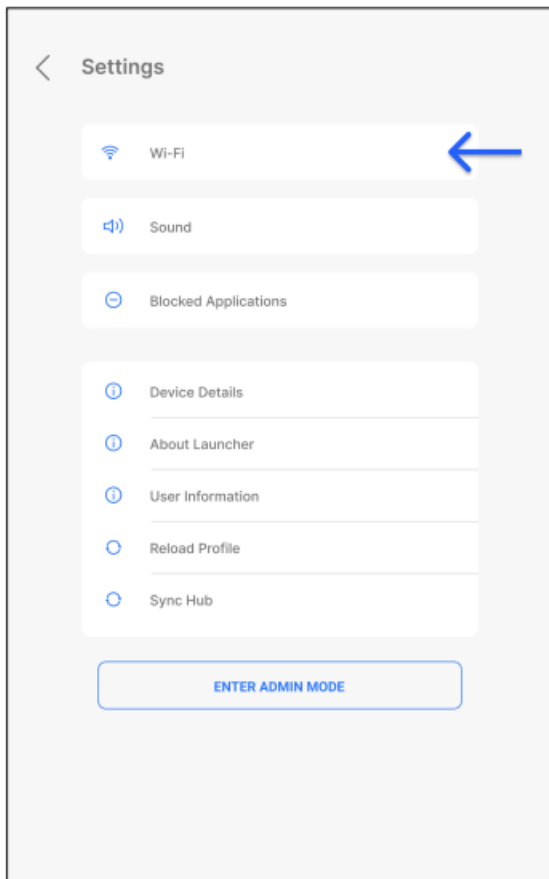
Click on the blue circle in the upper right corner (if the circle is not visible, press the hardware home button on the bottom of the tablet to make it appear, or swipe up if you do not have a hardware button) .





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.

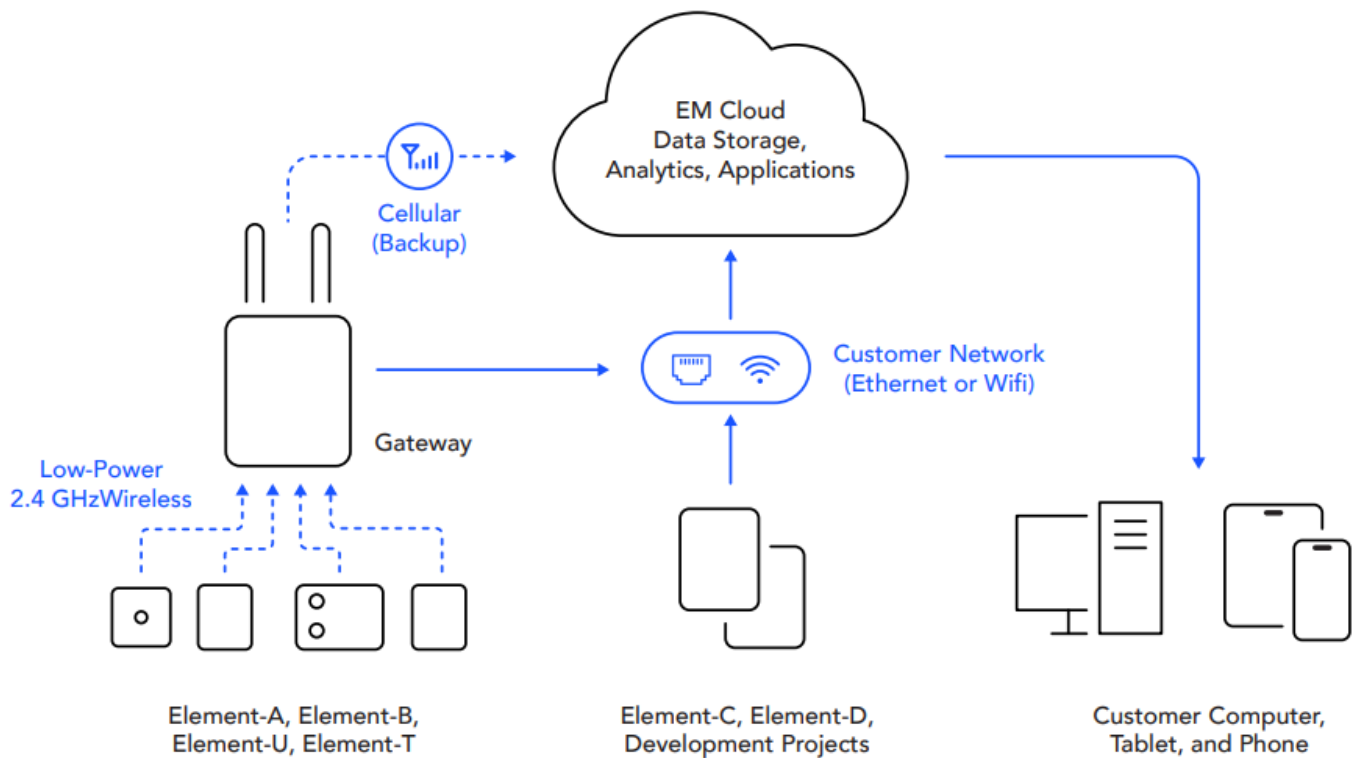
- 4 or more bars for both Wi-Fi and cell indicate good connectivity
- 2 bars for both Wi-Fi and cell runs an increased risk of some data delay or loss
- <2 bars for cell or Wi-Fi carry a danger of significant data delay or loss

Appendix 3: 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 work:

ENDPOINT	PORT	PROTOCOL	DESCRIPTION
*.elementalmachines.io http://api.elementalmachines.io ingest.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.com android.clients.google.com android.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
Elemental Gateway Models GW2 and GW3 require the following outbound TCP/UDP connections to be open:			
*.elementalmachines.io api.elementalmachines.io ingest.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 registry-data.balena-cloud.com	443	TCP	device management
*.docker.com *.docker.io	443	TCP	for verified operating system images
*.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 role-based 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 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 Gateway Models GW2, GW3 as well as Element-C, Element-D, and Element-U Model EU1 devices are based on the balena OS, a thin Linux environment that supports the balena Cloud 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 Element-C, Element-D, and Element-U1 devices
- Captive Portal: Not Supported
- Local Wireless Network Information:
- SSID:
- Password:

Customer Support

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– 771-00033 rev 03 Element U,
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elementalmachines.com



Documents / Resources

	<p>ELEMENTAL MACHINES EU3 Element-U LabOps Intelligence Platform [pdf] User Manual EU3 Element-U LabOps Intelligence Platform, EU3, Element-U LabOps Intelligence Platform, LabOps Intelligence Platform, Intelligence Platform, Platform</p>
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