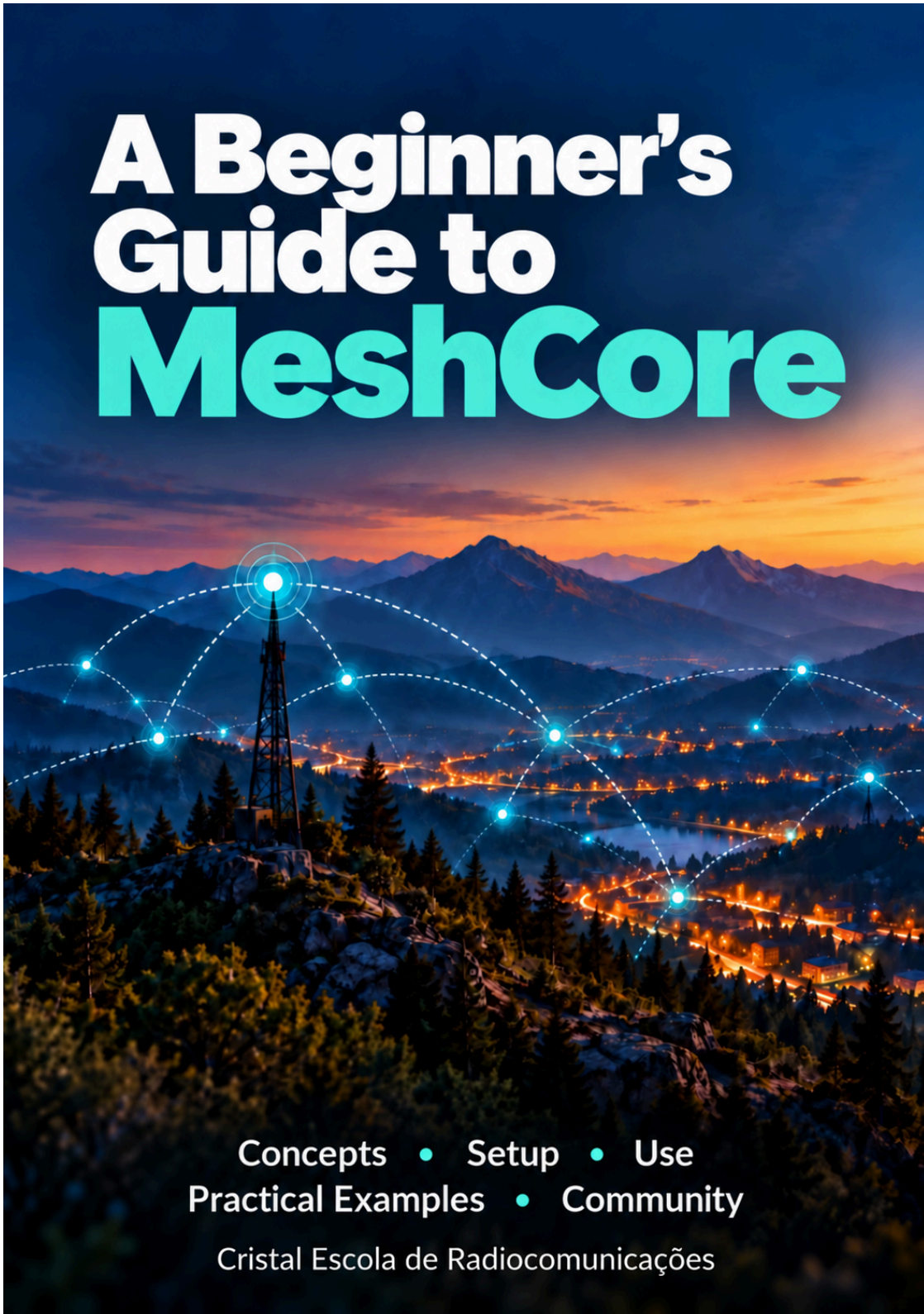
A Beginner's Guide to MeshCore



Concepts • Setup • Use
Practical Examples • Community

Cristal Escola de Radiocomunicações



A Beginner's Guide to MeshCore

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CRISTAL
Escola de Radiocomunicações

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Dedication

I dedicate this guide to those who teach and do not keep their knowledge to themselves.

To those who dare to be pioneers, to the visionaries, to those who never give up, and to those who carry their work forward.

...to ZéTó, “Febus” — wherever you may be



“Not all radios are the same”

“You do not need to know everything to get started.

But you do need to start to discover what you want to learn next.”

Ana PM

Preface

This is not a technical manual. It is a beginner's guide, written for anyone coming to MeshCore with no previous knowledge of the system.

The settings provided in this English edition are intended for use in Portugal.

It is not intended to replace the technical documentation or explain everything that goes on behind MeshCore. To keep the guidance simple and consistent, I have chosen to base my explanations on the standard MeshCore app, which I consider the most suitable for beginners. This guide aims to do what an introductory guide should: guide you through your first steps, explain the essential concepts in plain language, and help you start using the network without having to master its more complex aspects.

The order of the topics is deliberate: understand the system; choose and configure your equipment; start communicating; and finally, gain an initial understanding of some more advanced subjects. How far to explore those subjects is entirely up to the reader.

MeshCore, its firmware, the app and the organisation of the network are continually evolving. This guide describes them as they stand at the time of publication. Some procedures, names, options or parameters may have changed since then, so topics subject to change should always be checked against the official documentation.

This is only the starting point.

This guide draws on my own experience with MeshCore as someone without a technical background, the difficulties I encountered at the beginning, and those I see others facing. It also draws on the experience, knowledge and work generously shared by members of the MeshCore Portugal community.

I would particularly like to thank Miguel Santos (Mike 05) for his guidance, help and invaluable suggestions in preparing this guide. Without them, it would not have been written. I am also grateful to him and to João Brázio (Kasvoton) for expressly allowing me to use content published on the MeshCore PT website, which I have endeavoured to organise and explain in simple terms, in a format designed specifically for beginners.

This is my contribution to the development of the MeshCore Portugal network.

Ana Pardal-Monteiro

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PART I — UNDERSTANDING MESHCORE

1. What is MeshCore?

MeshCore is a text-messaging system based on LoRa[1] radio technology, designed to work without relying on a mobile network or an Internet connection.

[1]LoRa is a low-power radio technology used to transmit small amounts of data over long distances. The distances achievable depend on local conditions, the antenna, the installation and the available network.

Users send and receive messages through a small radio device configured as a Client (also called a Companion). Messages can be exchanged directly between two Clients or via a network of Repeaters, but always over radio frequencies.

The basic idea is simple: every participant has their own radio device, and the network operates independently of conventional communications infrastructure. MeshCore requires no service subscription or usage fees; you only need suitable equipment and a mobile phone with Bluetooth.

Important: MeshCore is not simply a mobile phone app. The phone normally provides the interface for writing and reading messages — communication between Clients takes place by radio.

2. How a MeshCore network works

A MeshCore network consists of different devices, which may perform different functions:

Client (or Companion) — the radio device each person uses to send and receive messages. It can communicate directly with another Client within range or use the Repeaters available on the network.

Repeater — receives messages transmitted by other devices and retransmits them. This allows a message to reach places beyond the direct range of the user's radio, extending network coverage.

Room Server — a message room associated with a Repeater running dedicated firmware, somewhat like the old bulletin board systems (BBS). It can store

messages for later retrieval. This type of device is not widely used and is not essential to the MeshCore network.

There are other functions intended for more advanced networks and installations, which I mention here for information only:

Observer — a device used to monitor and diagnose network traffic. The information it collects can be viewed on the MeshCore Portugal website.

https://www.meshcore.pt/pt/docs/articles/mesh-metrics

Bridge — consists of two connected Repeaters and allows MeshCore's two radio bands to be linked. With a Bridge, a message received by the 433 MHz Repeater is retransmitted on that same band and also on 868 MHz, and vice versa.

For now, the key point is that the Client is the device you use to communicate, while Repeaters and Bridges help messages travel across the network. You do not need the other functions at this stage.

The official documentation explains the other functions and their settings for anyone wishing to learn more.

3. How messages travel

A message may reach its recipient directly or pass through one or more Repeaters. Each additional passage through another device is called a Hop.

There are therefore two basic situations:

Direct radio communication — the two Clients are within range of one another and can communicate directly by radio, without using a Repeater.

A → B

Communication via the network — when two Clients are out of direct range, communication takes place through one or more Repeaters providing a radio path between them.

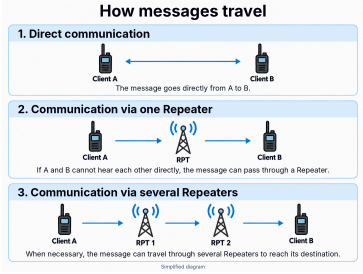


Fig. 1

However, the existence of a Repeater network does not mean that every message travels throughout the entire network. Routing mechanisms, limits and settings determine how messages propagate.

Some of the terms you will encounter are:

Flooding — a way of propagating messages through the network, reaching all possible Repeaters subject to the system's rules and limitations.

Advert — a transmission through which a device makes itself known to the network. In practice, it is rather like saying, "Hello, I'm here, and this is my name." Repeaters normally advertise once a day; Clients only send Adverts when instructed by their users.

You do not need to send an Advert in order to communicate. Send one only if you want other network users to discover your Client.

Path — information identifying the route a message has taken, or will take, between devices on the network.

You do not need a detailed understanding of these mechanisms to start using MeshCore.

4. Channels, direct messages and Flood Scopes

So far, we have looked at how a message can travel across the network. It is now important to distinguish a Direct Message from a conversation in a Channel.

Direct (or Private) Message — a message addressed specifically to another Client rather than sent to a group conversation.

To exchange Direct Messages, each user must add the other person's Client to their own contacts. Adding the contact on one side only is not enough. Contacts can be added by sharing a key, scanning a QR code or receiving an Advert from the other Client.

Note: In this context, a direct message, also called a private message, is addressed to a particular Client. "Direct" does not mean that the radio connection bypasses Repeaters.

Channel — a group conversation, similar to a chat room. Its name usually identifies the group or subject being discussed.

Important: Channels do not use different radio frequencies. Users continue to communicate on the same radio frequency used by the network; Channels simply separate and organise conversations in the app.

A Channel may be open or protected by a shared key, making it possible to create spaces for a family, a group of friends, neighbours or an organised group, for example.

Flood Scope — acts as a filter that helps determine how far packets may continue to be retransmitted across the network.

You do not need to understand or configure Flood Scopes to get started. They are briefly explained later, in Chapter 14 — Flood Scopes and regions.

PART II — GETTING STARTED

⚠️ **The settings provided in this English edition are intended for use in Portugal**

5. Before you buy

Your first step with MeshCore should not be to choose a device simply because of its photograph, its price or its popularity in online communities.

Before buying any equipment, find out how the MeshCore network is organised in your area:

• whether there is an active MeshCore network in your region, and which frequency band is most widely used — 433 MHz or 868 MHz — by checking the map at:

https://www.meshcore.pt/pt/mesh/map;

If you intend to use equipment you already own for another purpose or network, check:

• whether the device is compatible with MeshCore;

• whether MeshCore-compatible firmware is available for the exact model and revision of your device, and whether it supports operation as a Client with a Bluetooth connection to your phone.

Choosing the right band is particularly important. A 433 MHz radio cannot communicate directly with an 868 MHz radio, or vice versa: they use different frequencies. Check which Repeaters are available in your area and choose the band with the most coverage.

To get started, look for a device that is compatible with your local network and can operate as a Client. You do not need to install a Repeater straight away.

First learn to use the existing network. Later, if it makes sense, you can help extend it.

6. Equipment

Many devices are compatible with MeshCore, from small development boards to more complete devices with a screen, battery, GPS or keyboard.

Among the devices listed by MeshCore Portugal as examples of Clients, I would highlight:

• Heltec Mesh Node T114 — a compact, low-power device;

• Heltec WiFi LoRa 32 V3 — a compact board with Wi-Fi, Bluetooth, LoRa and a built-in OLED screen;

• Heltec WiFi LoRa 32 V4 — a development of the V3 with improved features;

• LilyGO T-Echo — a portable device with a screen, antenna and battery;

• SenseCAP Card Tracker T1000-E — a complete, compact and portable device.

The official MeshCore Portugal Telegram group is currently the main meeting place for the Portuguese community and a good place to seek advice before buying, learn about available solutions and find help with assembling and configuring equipment.



MeshCore Portugal Telegram:

@MESHCOREPT

https://t.me/MeshCorePT



Exemplos de rádios LoRa

At national and regional MeshCore meet-ups, members share experiences and help one another choose, assemble and configure equipment. Some community members also offer assembled devices for sale and ready-to-use kits. The devices mentioned in this chapter are merely examples available at the time of this edition. Before buying, ask the community about current options and confirm that compatible MeshCore firmware exists for the exact model and revision of your device.



7. 433 MHz or 868 MHz

One of the first decisions when buying a MeshCore device is which frequency band it will use.

In Portugal, both the 433 MHz and 868 MHz bands are used. Neither band is universally “better”: for beginners, the choice should primarily depend on the network already available in their area.

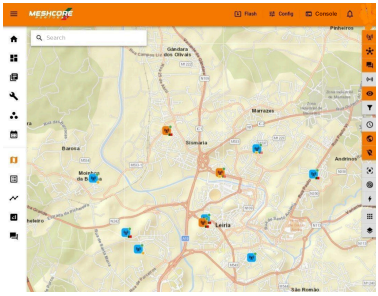


Fig. 2

You can check which band local Repeaters use on the map and Repeater list provided by MeshCore Portugal:

Repeater map

https://www.meshcore.pt/pt/mesh/map

Repeater list

https://www.meshcore.pt/pt/mesh/list

Before buying, find out:

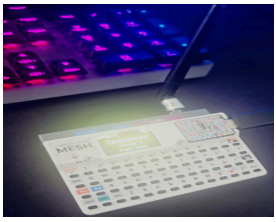
• which band is most widely used by Repeaters in your area;

• which band is used by any particular people you want to communicate with.

A 433 MHz device cannot communicate directly with an 868 MHz device, or vice versa.

Do not choose a band solely on the basis of claims such as “433 MHz has a longer range” or “868 MHz works better”. For a beginner, understanding the local network matters more than a theoretical comparison between the bands.

If you have particular people in mind with whom you want to exchange messages, it is equally important to know which band they use.



PART III — SETTING UP AND MAKING FIRST CONTACT

8. Preparing your equipment

Before starting the setup, make sure you know exactly which device you have and prepare everything you will need.

Check the following:

• Model and revision — check the exact model designation. Devices that look alike may have different specifications, so do not rely on appearance alone.

• Antenna — fit the antenna before connecting the device to your computer.

• Power — if your device has a battery, check that it is correctly connected and sufficiently charged. When connected to a computer by USB, the device is powered through the cable.

• USB cable — use a USB data cable to connect the device to your computer. Some cables are designed for power or charging only; although they may power the device, they cannot transfer the data required.

9. Firmware

Firmware is the software that controls how the device operates. The version you choose must support your particular radio model in the Client role.

If a compatible version is available for your radio, use LusoFW; otherwise, use the original MeshCore firmware.

Installing the firmware

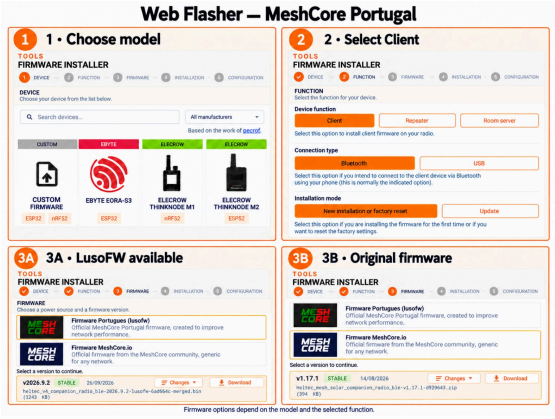


Fig. 3

For installation, I follow the procedure provided by the MeshCore Portugal Flasher.

Connect the device to your computer using a USB data cable and open the Flasher in your browser. Follow the instructions displayed.

https://www.meshcore.pt/pt/tools/flasher

1. choose the exact model of your device;
2. select Client as the device role;

3. select Bluetooth as the connection between the Client and the app;
4. under Installation Mode, select New installation or factory reset when installing MeshCore on the device for the first time; to update an existing MeshCore installation, select Update;
5. select LusoFW and check that a compatible file is available for your radio. If the message “No compatible firmware found for your selected device and role” appears, select the original MeshCore firmware instead;
6. choose the latest stable release;

➔ continue by following the instructions displayed in the Flasher.

IMPORTANT — Bluetooth or USB?

This setting refers to the connection the Client will subsequently use to communicate with the app, not the connection used to install its firmware. To use the Client with the mobile app, select Bluetooth, even though the device is connected to your computer by USB during installation.

10. The mobile app

Your phone provides the interface between you and your Client, with a keyboard, a larger screen and the controls needed to operate the device.

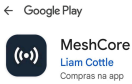
The app connects to the Client via Bluetooth. Even if your phone has an active Internet connection through Wi-Fi or mobile data, MeshCore does not use it to communicate. The Client always transmits and receives messages by radio frequency (RF).

USER ↔ APP (interface) ↔ Bluetooth ↔ CLIENT ↔ RF (MeshCore network)

Several apps are compatible with MeshCore. In this guide, I use the standard MeshCore app to illustrate the examples and guide you through your first steps.

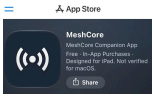
The standard MeshCore app is available for Android and iPhone/iOS.

Where to get the app



Android — Play Store

https://play.google.com/store/apps/details?id=com.liamcottle.meshcore.android



iPhone/iOS — App Store

https://apps.apple.com/nz/app/meshcore/id6742354151

Once you have installed the app, the general procedure is as follows:

- turn on Bluetooth on your phone;
- switch on your Client and keep it close to your phone;
- open the app and connect it to your Client, confirming Bluetooth pairing if requested;
- if asked for a PIN, devices with a screen will display it on the device itself. Devices without a screen use a preset PIN, usually 123456.

Important: Your private key identifies your Client on the MeshCore network. Whenever possible, keep a copy in a secure place, such as a password manager. Never share your private key or configuration files containing it.

Once connected, you can access the Client's functions and settings through the app.

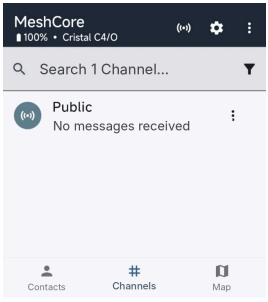


Fig. 9

Explore the app's menus and submenus to become familiar with its functions and where to find the different settings.

Note: This guide does not cover every menu of the app one by one. The following chapters explain the functions and concepts you need to begin using MeshCore.

11. Initial configuration

Configure your Client through the standard MeshCore app on your phone:

MeshCore PT Parameters		
Parameter	**433 MHz**	**868 MHz**
Frequency	433.375 MHz	869.618 MHz
Bandwidth (BW)	62.5 kHz	62.5 kHz
Spreading Factor (SF)	9	7
Coding Rate (CR)	6	6
Transmit power	10 dBm	27 dBm
Duty Cycle	10%	10%

Fig. 5

Identification and other settings

Check the essential settings to ensure that your Client is correctly identified and ready to use the network:

• In the app's radio settings, select the "Portugal 433" or "Portugal 868" preset, according to your device's band. A preset groups several parameters into a predefined configuration, allowing them to be applied together rather than entered individually.

• Client name — choose the name by which your device will be known on the network. You may choose any name, but Chapter 15 — Naming conventions offers some suggestions. Avoid using emojis in names and messages, as some Clients cannot interpret them.

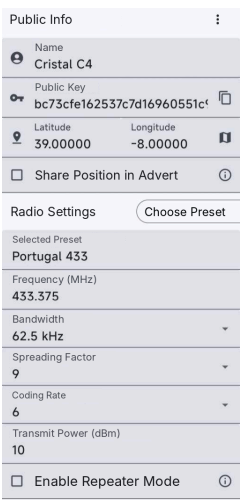


Fig. 6

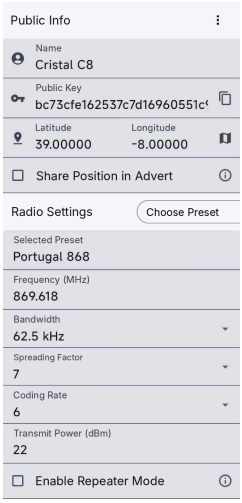


Fig. 7

• You can enter exact or approximate coordinates, as you prefer. To include them in your Adverts, enable “Share Position in Advert”. If you would rather not share them, leave this setting disabled, as shown in the illustration. If you know your coordinates, you can enter them manually; alternatively, select a location using the map icon on the same line.

• Keep “Enable Repeater Mode” switched off, with its box unticked, as shown. If you enable this function, you will no longer be able to communicate as a Client, so do not change it.

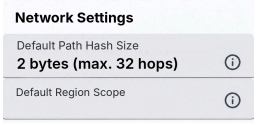


Fig. 8

• Under “Default Path Hash Size”, select “2 bytes (max. 32 hops)”, as illustrated (Fig. 8).

• For now, leave “Default Region Scope” blank (Fig. 8).

To save your changes, tap the tick ✓ in the top-right corner of the “Settings” screen.

You can review and change many of these settings later through the app.

Golden rule: if you do not know what a setting does, do not change it simply because the option is there.

Allow some time for your Client to receive information from the network. The devices that appear depend on local coverage, network activity and the Adverts and messages received. Avoid repeatedly changing your settings while you wait.

12. First contact and first communication

With your Client configured and connected to the app, start by sending a message in the Public channel. Try this near a window or outdoors. Indoors, with the supplied antenna, you may be out of range of the network.

Sending your first message

• open the “# Channels” tab and select “Public” (Fig. 9-1);

• type a short message, for example: “First MeshCore test. Can anyone hear me?” (Fig. 9-2);

• tap the send arrow;

• check whether “Heard Repeats” and a ✓ appear below your message. This confirms that your message was heard by Repeaters. If the status remains “Sent”, no such confirmation is available, although the message may still have gone through;

• if another user replies, reply in turn. This confirms that communication is working in both directions.

Adding Channels

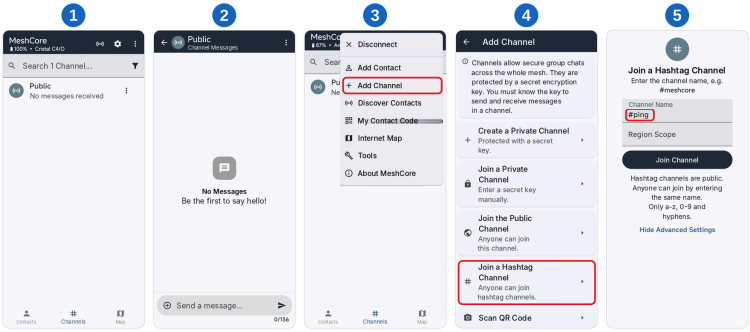


Fig. 9

Add the #ping and #testes Channels for the next steps:

• open the three-dot menu in the top-right corner of the app (Fig. 9-3);

• select “Add Channel”, enter the Channel name and then select “Join a Hashtag Channel” (Fig. 9-4);

• enter #ping, confirm and join the Channel (Fig. 9-5);

• repeat the procedure to add #testes (or any other Channels in future).

Select the #ping Channel and send the command !ping to receive an automatic reply from any available network bots.

Viewing Adverts and adding contacts

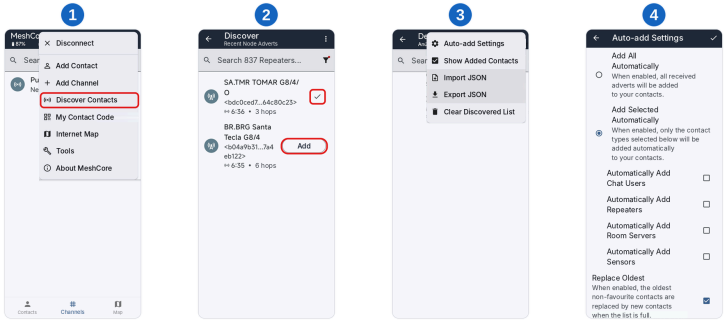


Fig. 10

Received Adverts allow you to identify other devices on the network. To view them and save contacts:

• open the three-dot menu and select “Discover Contacts” (Fig. 10-1);

• in the list, tap “Add” beside the Client or Repeater you want to save (Fig. 10-2).

A tick ✓ beside the name indicates that the device has already been added. Saved contacts are available under the “Contacts” tab.

Note: The app may automatically add devices that advertise themselves to your contacts. Because the contact list is limited, it is worth choosing what you want to add under “Auto-add Settings” (Figs. 10-3 and 10-4).

Discover Nearby Repeaters

The MeshCore app allows you to discover Repeaters that can communicate directly with your Client, without passing through other Repeaters.

How to use it:

1. Open the Tools menu.

2. Select Discover Nearby Nodes.

3. Tap Discover Repeaters.

4. Wait for the results to appear.

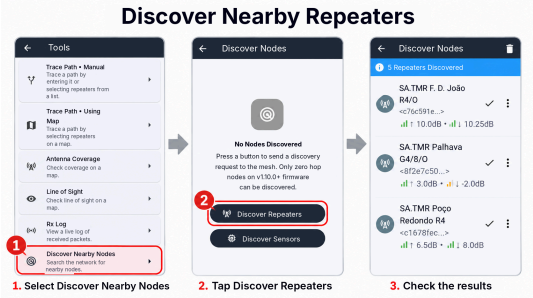


Fig. 11

The Repeaters found are listed with their names and information about the radio signal in both directions.

The values shown in dB indicate the signal-to-noise ratio (SNR). In principle, higher values indicate better reception conditions.

Note: Only directly reachable Repeaters (zero hops) can be discovered. Results depend on the devices within range of your Client and the radio communication conditions.

Advertising your Client

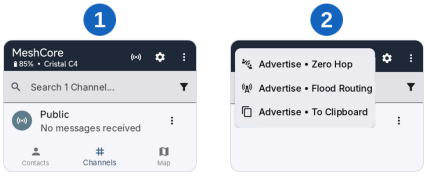


Fig. 12

If you want to make your Client known to others, tap the radio transmission icon at the top of the app (Fig. 12-1) and select “Advertise • Flood Routing” (Fig. 12-2).

This Advert will be retransmitted through the network, allowing other users to add your Client to their contacts. Sending it is optional and is not required for communication.

Sending a direct (private) message

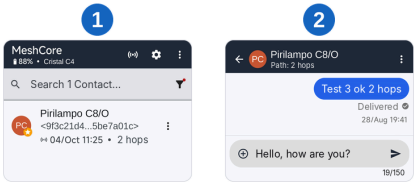


Fig. 13

To exchange direct messages, also known as private messages, each user must have the other person's Client in their contacts. They can add it using received Adverts, a shared key or a QR code.

Open the "Contacts" tab (Fig. 13-1), select the recipient's Client, write your message and tap the send arrow (Fig. 13-2).

Understanding message acknowledgements in Channels

Tap a message (Fig. 14-1) to see additional information:

• for received messages, the Path shows the route taken to reach your Client;

• for messages sent in Channels, "Heard Repeats" (Figs. 14-2 and 14-3) does not confirm that the message reached another user.

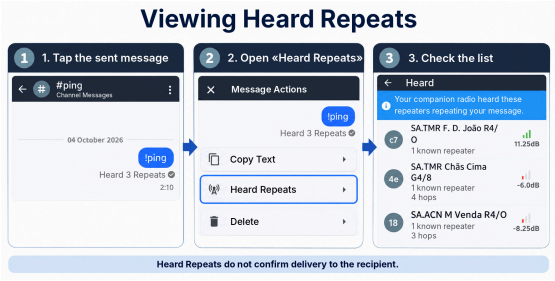


Fig. 14

Channels do not provide an individual delivery receipt. Delivery is confirmed when another user replies.

For direct messages, “Delivered” means that the recipient’s Client received the message. “Failed” means that the expected acknowledgement was not received; it does not prove that the message failed to arrive, only that the receipt may not have come back. A reply from the recipient confirms delivery.

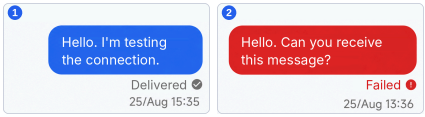


Fig. 15



PART IV — TAKING COMMUNICATION FURTHER

13. Repeaters and coverage

MeshCore is a community network that depends on its users' voluntary participation. Installing a Repeater can improve coverage and benefit others. The person who installs it is responsible for configuring and maintaining it, in accordance with the parameters adopted by the network.

If you wish to install a Repeater, follow the documentation and tutorials provided by MeshCore Portugal and use LusoFW (or the original MeshCore firmware if no compatible LusoFW version is available for your device).

How useful a Repeater is to the network depends on its location, antenna installation and the reliability of its power supply.

Install your Repeater in an elevated, unobstructed position. All else being equal, this will provide better coverage than a low-lying position or one surrounded by obstacles.

Use an antenna suited to the Repeater's band, correctly installed, with a low-loss cable to make the most of the signal.

Ensure a reliable power supply to keep the Repeater operating continuously. Choose a source suited to the site: mains electricity where available, or a battery and solar panel for an off-grid installation.

A Repeater's coverage does not form a perfect circle. Terrain, buildings, vegetation and antenna height may make communication easier in one direction and more difficult in another.

Check coverage by carrying out radio tests on site. Maps and estimates can help plan these tests, but they are no substitute for actual radio tests carried out on site.

For more information about Repeaters, see the dedicated documentation on the MeshCore Portugal website:

https://www.meshcore.pt/pt/hardware/repeater

14. Flood Scopes and regions

Flood Scopes, or simply Scopes, are something to explore later. You do not need them to begin communicating: for now, leave the Scope field blank, as explained in the initial setup (Fig. 8).

Scopes act as filters that limit the propagation of certain messages through the network. On a network with many users and Repeaters, they help prevent conversations intended for one area from being unnecessarily retransmitted into other regions.

Do not confuse Scope with coverage: a Scope does not change a radio's range. Communication still depends on available Repeaters, antennas, terrain and other conditions.

Nor should you confuse a Scope with a Channel:

• a Channel identifies and organises the conversation;

• a Scope controls where that traffic may continue to be retransmitted.

The Scope is set on the Client; you do not need to select it again each time you write a message.

Direct messages, also known as private messages, do not use regional Scopes.

If the Repeaters along the route do not recognise the Scope used for a Channel, they will not retransmit the message. The Scope chosen for transmission does not prevent a Client from receiving messages from the same Channel originating in other regions.

A conversation intended for a particular region may use a regional Scope. Communication between regions may require a wider Scope, such as #pt, provided the Repeaters along the route recognise it.

Regions are organised into several levels:

• #europe — Europe;

- #pt — mainland Portugal, the Azores and Madeira;
- #pt-norte — North;
- #pt-centro — Centre;
- #pt-lisboa-vale-do-tejo — Lisbon and Tagus Valley;
- #pt-alentejo — Alentejo;
- #pt-algarve — Algarve;
- #pt-acores — Azores;
- #pt-madeira — Madeira.

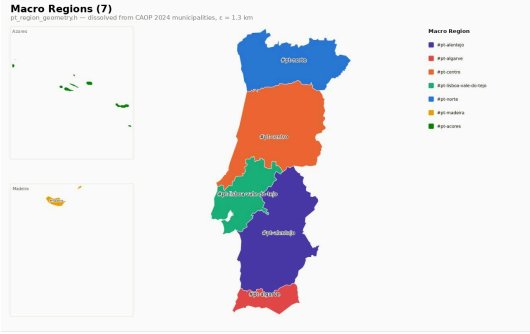


Fig. 16

There are also Scopes for individual districts and islands, intended for communications within smaller areas.

You do not need to memorise these names or codes. If you decide to configure a Scope later, check which one is used by the Channel and recognised by the Repeaters along the route. Refer to the regional structure and guidance on the MeshCore Portugal website.

Discover Regions

The MeshCore app allows you to view the regions discovered by your Client using the Discover Regions tool.

How to use it:

1. Open the Tools menu.

2. Select Discover Regions.

3. Wait for the results to appear.

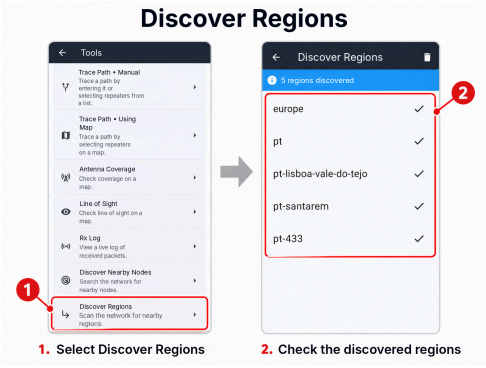


Fig. 17

The list shows the regions discovered by your Client. Their number and names may vary depending on the Repeaters reached and their configuration.

This information is for reference only: it does not change the Scopes configured on your Client or guarantee that communication is possible across all the regions displayed.

Note: The regions shown in the illustration are only examples. Each user may obtain different results.

For beginners, the rule is simple:

First learn to communicate. Then consider how far you want your messages to spread. In other words, do not use Scopes just yet.

15. Naming conventions

MeshCore Portugal proposes a common naming convention to make devices on the network easier to identify.

For Clients, the naming convention makes it easy to identify the band in use and certain characteristics of the device:

C4 — Client on 433 MHz

C8 — Client on 868 MHz

/M — mobile

For example:

Cristal C4/M — the Cristal Client, mobile and operating on 433 MHz.

Repeater and Bridge names should begin with the district and municipality codes, followed by the location name, device type, band and any applicable suffixes.

For example:

SA.TMR Cristal R4/O — Santarém, Tomar, Cristal, a 433 MHz off-grid Repeater.

LI.LSB Picoas R8/B — Lisbon, Lisbon, Picoas, an 868 MHz battery-powered Repeater.

This naming convention helps you interpret a message's Path by identifying the locations and devices involved along its route.

You do not need to memorise the entire naming system; understanding the logic and recognising the most common elements is enough. For the complete convention and updated codes, see the "Nomenclatura" article on the MeshCore Portugal website.

16. Antennas and range

An antenna suited to the frequency, correctly tuned and properly installed, is the deciding factor in achieving good results. Its position, height and the clear space around it directly affect how the signal is transmitted and received.

No Client or Repeater has a guaranteed range simply because of the manufacturer's specifications: range always depends on location and installation.

For Clients, as a general rule, a larger antenna is better.

17. Network maps

There are several ways to view the MeshCore network. For beginners, the most useful are the Map and Repeater List in the app, and the map provided by MeshCore Portugal.

The app's Map displays information your Client has received through Adverts. The map on the MeshCore Portugal website gives a broader picture of the Repeater infrastructure shared by the community.

The naming convention explained in Chapter 15 is particularly useful when viewing these maps and lists, because it makes it easier to recognise each device's location, type and frequency band.

Above all, remember that a marker on a map does not guarantee communication. Only a radio test carried out on site can confirm whether a particular device is within range.

18. Updates and maintenance

MeshCore is constantly evolving, with new versions of the app and firmware for Clients and Repeaters released regularly.

Keep your firmware and app up to date. As well as adding features, new versions may improve stability and performance.

Updates to the standard MeshCore app are available through the Play Store for Android and the App Store for iPhone/iOS, as described in Chapter 10.

Before any update — and as a matter of routine — make a backup of your Client's configuration. In the app, open "Settings" and select "Export Config" under "Extra Tools". You can choose what to save, including radio settings, Channels, contacts and regions. To restore them, use "Import Config". Take some time to explore these options and store the backup file somewhere safe.

To update the firmware on a Client or Repeater, use the MeshCore Portugal Flasher and follow the procedure described in Chapter 9, selecting "Update" under "Installation Mode".

Important: For a normal firmware update, do not select "New installation or factory reset", as this will erase the device's existing configuration.

Before updating, check the device model and role, and read the release notes for the version you are about to install.

https://www.meshcore.pt/pt/tools/flasher

19. When things do not work — Troubleshooting

If your Client is not communicating, start with the simplest checks and change only one thing at a time.

There is an important difference between a Client that has never communicated and one that has worked before. In the first case, you still need to establish whether MeshCore coverage is available at that location on the same frequency as your radio. If it has previously communicated from the same location, coverage has already been demonstrated.

- **The app cannot connect to the Client via Bluetooth** — make sure Bluetooth is enabled, the app has the necessary permissions, and no other app is connected to the device.
- **The computer does not recognise the Client over USB** — use a data cable and check that no other program is using the connection.
- **No Adverts appear and no messages are received** — check the app connection, power supply, antenna, frequency band and radio parameters. If the Client has never communicated, consult the MeshCore Portugal map and test whether it can reach nearby Repeaters on the same band. If it previously worked at the same location but has now stopped, check whether the Repeaters it used to reach are still available.
- **Adverts or messages are received, but nothing can be transmitted** — check the antenna and device, make sure “Default Region Scope” is blank and “Repeater Mode” is disabled. If possible, move the Client closer to a Repeater shown on the MeshCore Portugal map and try again.
- **Messages are transmitted, but no replies arrive** — send !ping in the #ping Channel and check “Heard Repeats”. If “Heard Repeats” appears, Repeaters have heard your message, but that does not confirm that it reached its intended recipient or that anyone will reply.

- **If you have another Client, test it at the same location using the same band and settings. Also try exchanging direct messages between the two Clients, to check communication without relying on Repeaters. These tests can help you establish whether the problem lies with your equipment or access to the network.**

- **Asking for help** — contact the MeshCore Portugal Telegram group, specifying your device, band, firmware, problem and any tests you have already carried out.

  https://t.me/MeshCorePT

20. Good practice

The MeshCore network works best when every user helps keep it simple, efficient and predictable.

- **Avoid unnecessary traffic and repeated messages. A mesh network has limited resources.**
- **Send Adverts only when you need to make your Client known to the network. They are not necessary for communication, and frequent Adverts take up too much network capacity.**
- **Keep the people you want to communicate with directly in your contacts, and make sure they have added you too.**
- **Test the network before relying on it in a real situation, checking both coverage and two-way communication.**
- **Identify your Client correctly using the naming convention adopted by the community.**
- **Before installing a Repeater, coordinate its location and settings with the community, so that it adds useful coverage rather than unnecessarily duplicating the existing network.**
- **If you install a Repeater, document it and keep it operational and up to date so it remains useful to the network.**

MeshCore is a community network. Using it responsibly helps preserve its efficiency and usefulness for everyone.

21. The 3-3-3 Plan on MeshCore

The 3-3-3 Plan is a routine for alternative radio communications, intended to build a network of contacts through which people can ask for help or keep in touch when conventional communications fail. The weekly exercise provides an opportunity to practise, test equipment and learn about radio coverage.

How to take part in the exercise

On MeshCore, the exercise takes place every Saturday from 9 p.m. to 10 p.m., mainland Portugal time.

To take part in the weekly exercise:



Fig. 18

• add the hashtag Channel #plano333 to the app, entering its name exactly as shown or scanning the Channel's QR code (Fig. 18);

• select that Channel during the exercise;

• send no more than three messages during the hour, in the following format:

CQ Plano 333, station name, city, locality

The station name is the name you use for your MeshCore Client. For example:

CQ Plano 333, Cristal C4, Tomar, Maxial

Keep the Channel for exercise-related messages and respect the transmission limit.

After the exercise, you can view the report of messages received by the network's Observers at:

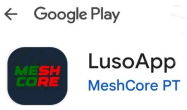
https://www.meshcore.pt/pt/projects/plano333

You can also join the official 3-3-3 Plan Telegram group to follow the weekly exercise and report the contacts you made:

https://t.me/Plano333_Portugal

LusoApp, introduced in the next chapter, provides tools to simplify and automate participation in this exercise.

22. LusoApp-specific features — the Portuguese app



Android — Play Store

https://play.google.com/store/apps/details?id=pt.meshcore.lusoapp&hl=pt

LusoApp is a Portuguese app for MeshCore that is still under development. This chapter introduces three features specific to it: tools for the 3-3-3 Plan, Quick Messages and SOS.

3-3-3 Plan

LusoApp has a dedicated 3-3-3 Plan menu, where you can prepare the three messages (CQs) used during the weekly exercise and, if you wish, schedule them to be sent automatically.

At the end of the exercise, share your contact report in the official 3-3-3 Plan Telegram group.

https://t.me/Plano333_Portugal

Quick Messages

LusoApp lets you prepare and save frequently used messages so you can send them without typing them again.

SOS

The SOS feature lets you prepare an emergency message, choose a recipient — either a Channel or another user — and decide whether to include GPS coordinates.

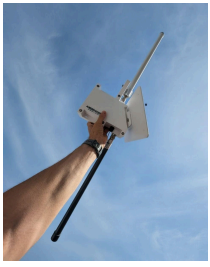
You can edit the message text. By default, it reads:

SOS — I need help! {GPS}

To reduce the risk of accidental use, the feature has a countdown timer before sending.

The SOS message should only be used in a genuine emergency.

This feature does not replace contacting the emergency services, nor does it guarantee that anyone able to provide assistance will receive the message.





PART V — APP TOOLS

The MeshCore app has a menu called Tools, which provides functions for exploring the network, viewing information about Repeaters and analysing communication conditions.

To access them, open the MeshCore app, go to Tools and select the tool you wish to use.

What tools are available?

• **Trace Path • Manual**: allows you to define a route through Repeaters selected from a list.

• **Trace Path • Using Map**: allows you to select Repeaters on a map to define a route.

• **Antenna Coverage**: displays an estimate of an antenna's radio coverage on a map.

• **Line of Sight**: checks the line of sight between two locations, taking terrain into account.

• **Rx Log**: shows real-time information about received data packets.

• **Discover Nearby Nodes**: searches for Repeaters and Sensors within direct radio range of your device.

• **Discover Regions**: displays regions used by Repeaters to manage message retransmission.

• **Noise Floor**: shows the radio noise level on the frequency in use.

Discover Nearby Repeaters

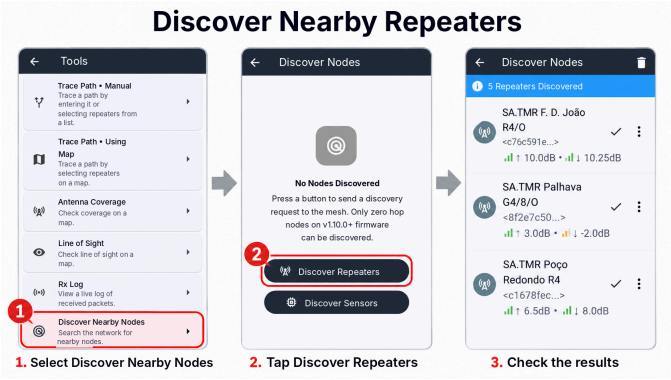


Fig. 19

The Discover Nearby Nodes tool allows you to discover devices that can communicate directly with your Client, without passing through other Repeaters.

How to use it:

1. Open the Tools menu.

2. Select Discover Nearby Nodes.

3. Tap Discover Repeaters.

4. Wait for the Repeaters to respond.

The Repeaters found are displayed in a list, together with information about radio signals received in both directions.

Important: This discovery feature only works with directly reachable devices running firmware v1.10.0 or later.

Discover Regions

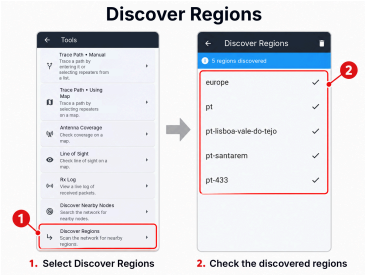


Fig. 20

The Discover Regions tool allows you to view the regions advertised by a particular Repeater.

These regions are part of the Flood Scopes system, which controls message retransmission across the network.

In the list, Flood Allowed means that the Repeater allows messages covered by that region to be retransmitted.

For example, a Repeater may display regions such as “pt”, “pt-433” or “pt-santarem”.

Not all Repeaters display the same regions, because their configuration may vary.

This tool allows you to view this information, but it does not mean that your Client can automatically communicate across all the regions displayed.

For a better understanding of how this works, see Chapter 14 on Flood Scopes.

Appendix I — Glossary

Advert — a message identifying a device and making it known to the network.

App — the software used to communicate with a Client and access its functions and settings.

Backup — a copy of data and settings that can be restored if the originals are lost.

Band — a range of frequencies used by a device, such as 433 MHz or 868 MHz.

Bluetooth / BLE — a wireless connection between the Client and a mobile phone.

Bot — a program that automatically responds to messages or commands, such as !ping.

Bridge / Gateway — a Repeater arrangement linking the 433 MHz and 868 MHz bands.

Channel — a group conversation space for users.

Client / Companion — a device used to send and receive messages through the app.

Delivered — indicates that the recipient's Client has acknowledged receiving a direct message.

Direct / Private Message — a message addressed to a particular user rather than a Channel. It may pass through Repeaters.

Failed — indicates that the expected acknowledgement for a direct message did not arrive. It does not prove that the message was not delivered.

Firmware — software installed on a device to control its operation.

Flasher — a tool used to install or update firmware.

Flood Advert — an Advert that may be retransmitted by Repeaters beyond the device's direct radio range.

Flood Scope / Scope — *a filter limiting the propagation of certain network traffic. It does not change a radio's frequency or range.*

Flooding — the propagation of a message through the network by retransmission.

GPS — a satellite-based positioning system used to obtain geographical coordinates.

Hashtag Channel — a Channel added by entering its name with a # prefix, such as #ping or #plano333.

Heard Repeats — indicates that Repeaters have heard a message. It does not confirm delivery to the intended recipient.

Hop — one passage of a message through a Repeater.

LoRa — the radio communication technology used by MeshCore.

Node — a general term for a device on the network.

Observer — a device that collects information about network traffic.

Path — information about a message's route through the network.

PIN — a code used to confirm Bluetooth pairing when requested.

Preset — a predefined set of parameters that can be applied together.

Pre-Shared Key / PSK — a key shared by Channel participants to protect their messages.

QR code — a visual code that can be scanned by the app to add a contact or Channel.

Receipt — an acknowledgement that a direct message has been received by the recipient's Client.

RF / Radio Frequency — the medium used by devices to communicate by radio.

Repeater — a device that retransmits messages to extend network coverage.

Room Server — a device that stores messages in a room for its users to retrieve later.

RX — reception of signals or messages.

SOS — a request for help in an emergency.

TX — transmission of signals or messages.

USB — a wired connection used to power a device or transfer data, including during firmware installation.

Zero Hop Advert — an Advert that reaches only devices within direct radio range, without being retransmitted by Repeaters.

Appendix II — Quick Reference Guide

APPENDIX II

Quick Guide

Using MeshCore in practice.

SWITCH ON

- Antenna connected, Client on, Bluetooth enabled.
- Open the app and connect to the Client.

TALK IN A CHANNEL

- «# Channels» → «Public» → write → send arrow.
- «Heard x Repeats» + ✓ = heard by Repeaters.

TEST

- #ping channel → send !ping → replies from bots.

DIRECT MESSAGE

- «Contacts» → choose the contact → write → send arrow.
- No contact? ⋮ → «Discover Contacts» → «Add».
- «Delivered» = received. «Failed» = no confirmation.

MAKE YOURSELF KNOWN

- Icon (((•))) → «Advertise • Flood Routing».

NOT WORKING?

- Antenna, «Portugal 433» or «Portugal 868» preset, «Repeater Mode» off, «Default Region Scope» blank.
- Move closer to a listed Repeater and repeat !ping.

A Beginner's Guide to MeshCore

Appendix III — MeshCore Portugal Manifesto

MeshCore Portugal advocates for digital sovereignty, privacy, and mindful communication — free from noise and automation. Resource scarcity is treated as wisdom — every message has purpose. The ultimate goal is not technology, but community.

What does it mean to communicate freely?

Communication is the founding act of community. Every human society rests on the assumption that we can speak, listen, and respond. When that assumption is delegated to external entities — carriers, servers, algorithms — something essential is lost: the autonomy to connect with one another without intermediaries.

MeshCore Portugal does not merely build a technical network. It builds the possibility of a truly sovereign community.

I. On the necessity of autonomous communication

MeshCore Portugal believes that communication must be free, autonomous, and resilient. We do not wait for other networks to work; we build our own. We create a community network that is decentralized and independent of operators, capable of adapting, recovering, and remaining active even when traditional infrastructure fails.

We champion technological freedom. We work with open, transparent solutions that are understandable by all, because trust is born from knowledge. Privacy is an essential right: every message is encrypted, every user retains control, and every relay is voluntary and reinforces the network's autonomy.

In Portugal, the community naturally evolved to develop its own firmware and software. This was a direct response to the needs of our territory, our desire to evolve, and the way we operate as a community. Work that refines the existing system, fully compatible and aligned with the collaborative spirit that has always defined the project.

We believe in resilience, mutual aid, and preparedness. We want to ensure there is always a way to communicate, to request support, and to maintain the connection between people.

II. On digital sovereignty rooted in the land

Sovereignty begins with the ground beneath our feet. A network that does not depend on agendas, satellites, or undersea cables is a network that truly belongs to those who build it.

The network grows on the ground, not just in theory. Several relays already operate with solar panels and autonomous energy systems, ensuring that even during power outages, the network remains active and available. This energy independence reinforces MeshCore's central mission: keeping people connected, no matter what happens.

MeshCore Portugal is built by people who believe in taking action. We install relays, fine-tune parameters, experiment in the field, and share knowledge. Every contribution improves the network. Every relay extends its reach. Every member strengthens the community. It is a living project, in constant evolution.

III. On the discipline of silence: freedom in scarcity

Speaking only when it matters is the first form of respect. On a network where every byte counts, every message has value. That is why we communicate with intention, not with noise.

Fewer ads. Less automation. Less flooding. More purpose.

Scarcity is not a limitation — it is a form of wisdom. Unlike the Internet, which treats space as infinite and therefore allows unlimited noise, the MeshCore network imposes on us the discipline of silence. Every message, by being rare, becomes valuable. The efficiency of the network is not a technical flaw; it is an invitation to listen closely. In a world that shouts, MeshCore teaches us to whisper with purpose.

We are not against abundance. We are against the irresponsibility that unconscious abundance breeds. MeshCore Portugal practices an ecology of communication: use only what is necessary, preserve the shared resource, and ensure that no one's voice is lost in everyone's noise.

IV. On the ethics of limits: what we do not do

Because the network is decentralized and open source, its greatest power is also its greatest risk: everything is possible, including inadvertently destroying

what unites us. MeshCore is born from freedom, but it knows that freedom without awareness is noise. That is why we draw firm lines, even if invisible.

Bridging the MeshCore network with other networks, or resorting to the Internet to circulate messages between users, betrays the very idea of autonomy. It opens a breach through which digital sovereignty drains away. The network's independence is not technical stubbornness — it is an ethical choice, an affirmation that communication is only free when it arises between equals, without intermediaries who surveil or mediate it.

Likewise, we reject unconscious abundance. Automated messages, incessant streams, telemetry, audio, or imagery: anything that transforms human dialogue into mechanical noise threatens the shared space.

The limit, here, is not prohibition — it is wisdom. It is the understanding that preserving silence is also a form of communication. Every word transmitted must be worthy of the space it occupies — and every silence, worthy of the respect that sustains it. Thus, the network remains lucid and alive, not through excess, but through the harmony between speaking and listening.

V. On community as an end, not a means

Technology is the means; community is the purpose.

But what community? Not the community defined by algorithms, profiles, or retention metrics. The real community, made of faces, of antennas installed on rooftops, of batteries charged by solar panels, of messages that cross mountains without asking permission from any carrier.

We are MeshCore Portugal.

We connect people when it matters most.

www.meshcore.pt

Sources

MeshCore.io

MeshCore Portugal

MeshCore — official GitHub

3-3-3 Plan

LusoApp — Portuguese app

This guide was prepared with the assistance of AI and information from the sources listed above. It is intended as an introduction to MeshCore.

Photographs supplied by several MeshCore users and reproduced with their permission.

Procedures that may change with new versions of firmware, apps or settings should be checked against the current official documentation.

Cristal Escola de Radiocomunicações

🌐 https://www.cristal-radio.org/

Telegram https://t.me/escola_cristal

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