Manual De Uso Del HERMES

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Abstract

This is the user manual of the High-Frequency Emergency and Rural Multimedia Exchange System (HERMES) digital telecommunication system. HERMES combines a set of technologies in order to provide telecommunications services over the HF frequency band. Among these technologies are an affordable HF transceiver, a high performance software-defined modem, the Unix-to-Unix Communication Protocol (UUCP) and a set carefully configured user services which are available over a local WiFi network. This manual addresses the basic equipment operation, including the usage of the web-based graphic user interface (GUI) and the email transport system.

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1 Introduction

HERMES is a telecommunication system which operates in the High Frequency (HF) band. HERMES allows digital multimedia exchange between the users and stations, including exchange of text, image, audio or any other file type. The system interface to the users is the well known e-mail protocol, which can be managed and accessed thought the system's web interface or through specialized apps, like DeltaChat[1]. HERMES also support peer-to-peer secure messages between the hosts, which works as a bulletin board system (BBS) so that the peers can connect between them.

The system employs a star topology network in which a gateway station connect to all hosts in remote locations. The gateway station routes e-mail and other messages locally or over the Internet. The synchronization between the data to be sent or received from each remote station is asynchronous and orchestrated by the gateway station in a round-robin fashion (one after another, in order).

1.1 HERMES HF Transceiver

HERMES HF transceiver is typically assembled and delivered together with a WiFi antenna connected to the appropriate connector in the back panel. The front panel of the equipment is shown in Figure 2.

The HERMES box includes the following input / output interfaces, as shown in Figure 1.

1. Back Panel Hermes serial number;
2. Back Panel Ground connector;
3. Back Panel Ventilation openings;

[1] DeltChat, a multi-plataform e-mail messenger: https://delta.chat/

4. Back Panel HF antenna connector (PL-259 / UHF female);
5. Back Panel Fuse (10A);
6. Back Panel 12V DC power input positive (red) and negative (black) terminals;
7. Back Panel WiFi antenna connector (RP-SMA female);
8. Back Panel RJ-45 Ethernet port, for connection to external switch or a existing router;
9. Front Power key (on/off);
10. Front Panel with 4 indicator LED's (System LED, Antenna Status LED, Connected LED, Tx LED).

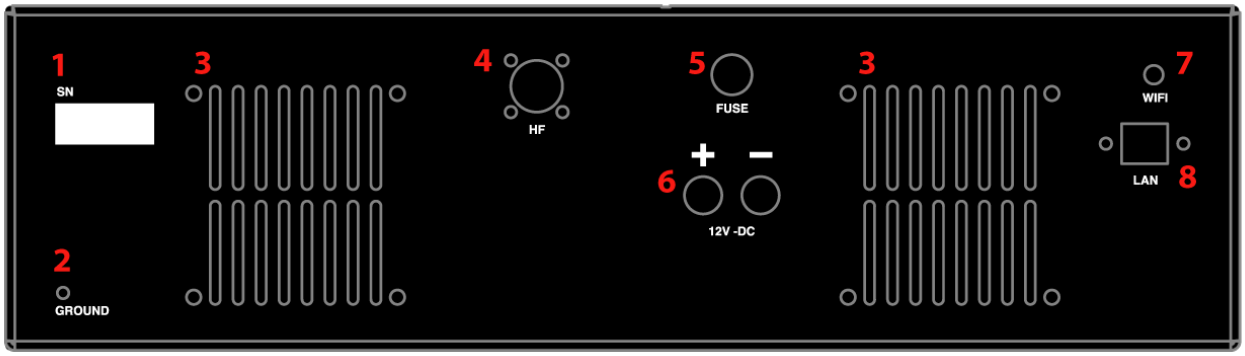

Figure 1: Back view of HERMES box

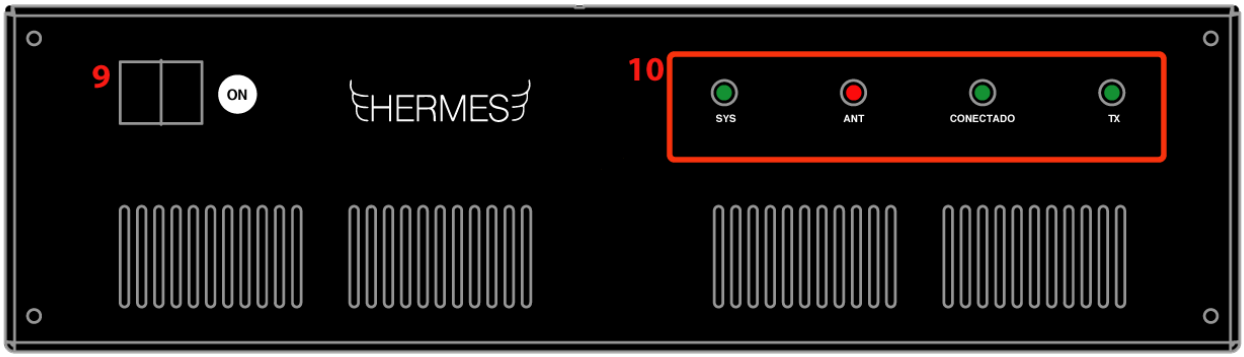

Figure 2: Indicator's LED on front panel

1.2 HF Antenna Recommendation

An HF antenna tuned to the desired operating frequency should be connected to the equipment. Never turn on the equipment without connecting to the HF antenna!

There exist many HF antennas, each one fitting a different purpose. For short and medium range communications (up to about 800 km), a quarter wavelength dipole installed in inverted V configuration is a good and affordable option.

1.3 Power Requirements

The system is designed to operate with 12V DC power, but up to 14V the system will work as expected without any problem. A typical setup would use 12V DC from battery power connected to solar controller and panels. Other setup is using a 12V or 13.8V AC/DC power supply. The red connector should be connected to the positive polarity, while the black connector to the negative polarity. The system has polarity inversion protection, but care should be taken to proper power installation of power connections. The equipment consumes approximately 2A in receive mode, and 6A in transmit mode.

2 Web Interface

HERMES provides a web interface which can be accessible through a local WiFi network. When accessing HERMES WiFi network, the following information applies:

- Network Name (ESSID): HERMES
- Password: amazonia

Be aware that in some mobile phones a browser will automatically open with the the main HERMES web page, while in others, to access the HERMES web interface you must open the browser and access `http://ac1.hermes.radio` or `http://10.0.0.1`.

On the main page 3 you will find the following links:

1. Domain name of your current station
2. Main menu;
3. Page title;
4. Compose and sent messages link;
5. Login and logout link and info;
6. Dark mode activator tab;
7. Compose and sent messages shortcut;
8. Station information and status;

The web interface allows users to manage e-mail accounts, to perform radio configurations (like setting frequency and SSB mode) and exchange direct messages between stations (BBS). The interface also contains its own administrative section, for managing users which can access HERMES administrative web interface. Important to note that same user name created for using the administrative interface will be used for the e-mail, for example, user "amelia" in the local interface will have the email "amelia@ac2.hermes.radio", the station that corresponds to the internet domain name, in this example, it'll be "ac2.hermes.radio". Each station domain name is written in the header on the Hermes web interface.

Figure 3: Hermes Home page and elements

2.1 Administrative Interface

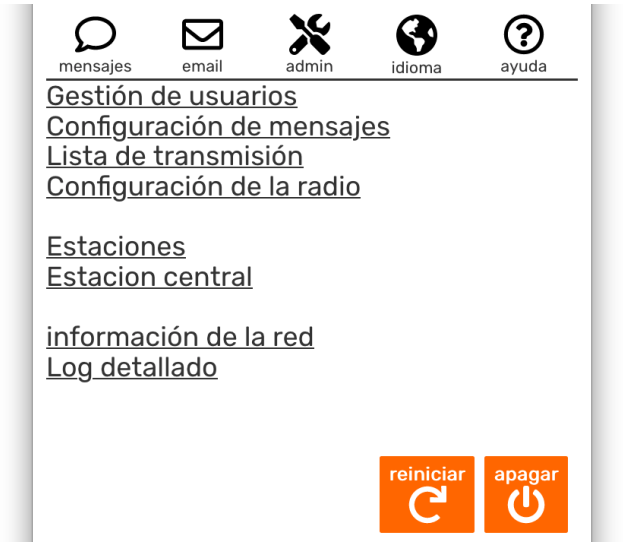

Figure 4: Admin interface

To access admin features, you need an admin password. While anyone can create an user account, only the system's admins can create new administrator users and give admin power to other users. To login, click on the login icon on the top right of the web interface. The default administrator login username is "root" and password "caduceu".

Inside the administration section, an admin user will find the following options: users management, messages administration, network information, stations, detailed log and radio configuration. If the station is the central station it will also find the central station menu.

2.1.1 Users management

Allows creation of new users, updating data of registered users and to delete users of the system. Every username correspond to an email account with the same name of the kind username@servername. On this station the server name will be shown in orange below the Hermes logo.

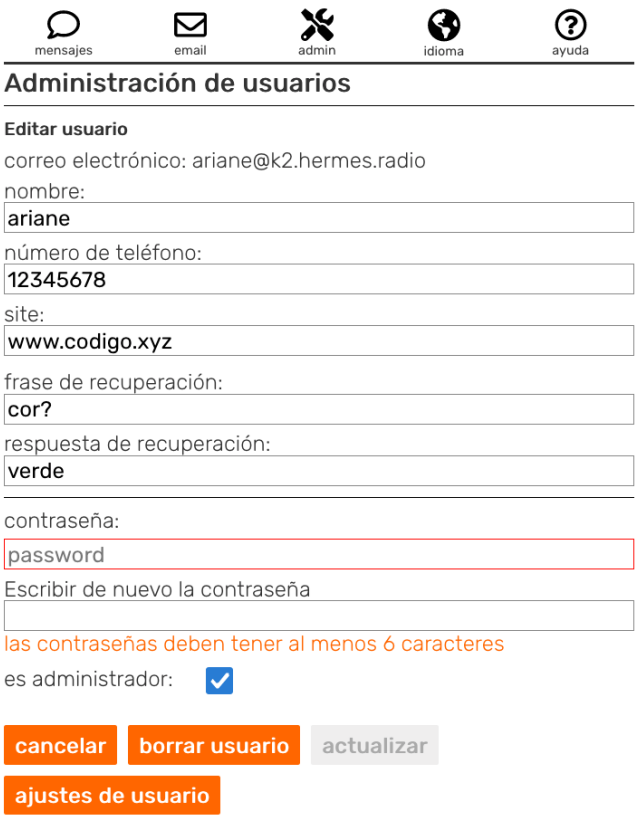

Figure 5: Create user interface

Administrators can also give admin powers to regular users, by clicking on the "is admin" checkbox on the update user interface.

2.1.2 Messages administration

On this link, the admin can determine who will be able to attach files on public messages between stations: everyone; only registered users or only administrators

Figure 6: Messages administration Interface

2.1.3 Network info

Displays some information about the system, such as network addresses, callsign, servername etc

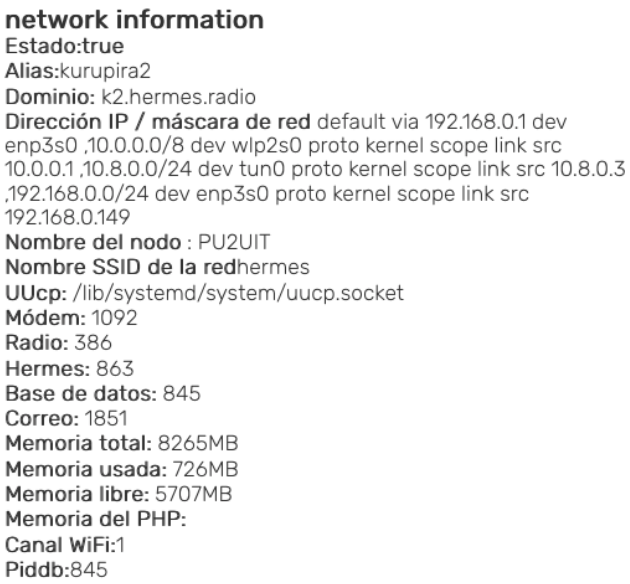

Figure 7: Network information page

2.1.4 Stations

Provides a list of the available stations on the system.

2.1.5 Detailed Log

Provides access to system logs, such as email logs and UUCP logs, that register every activity on the system.

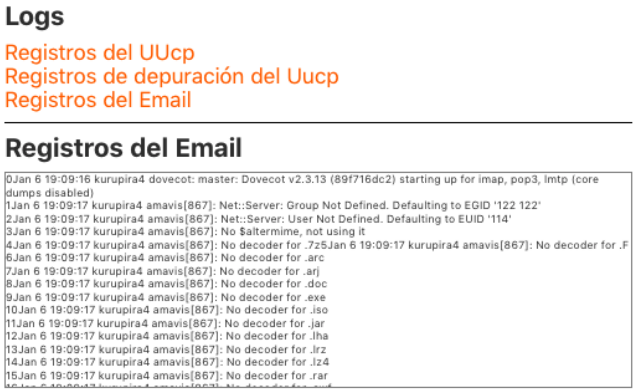

Figure 8: Logs page on the web interface

2.1.6 Radio configuration

Provides a direct interface to change some radio settings like frequency, transmission mode, restore factory configuration and it also allows to view some sensors readings about the HF antenna of the system.

Figure 9: Radio configuration interface

2.2 Public Messages (BBS)

Direct messages can be sent between stations with support for cryptography and multimedia compression. These messages can be found in the main page of the web interface.

2.2.1 How to write public messages

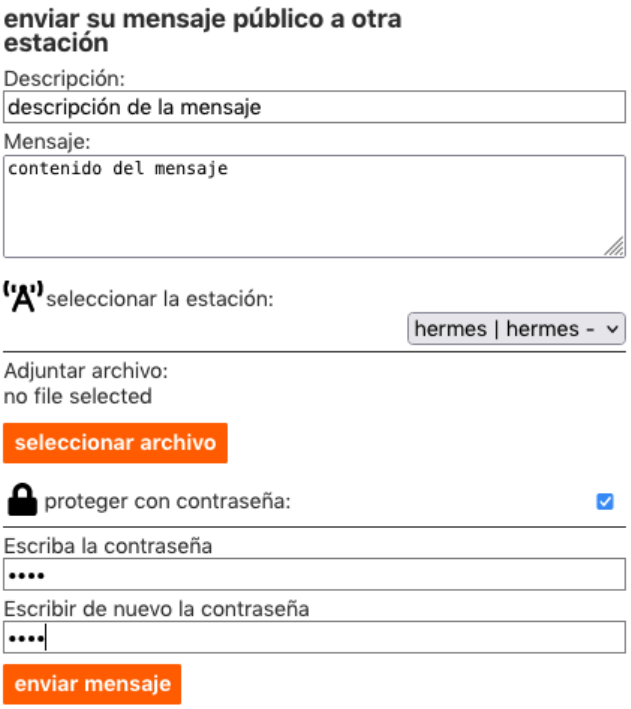

Figure 10: Interface to compose messages

By clicking on the compose ( )icon, it's possible to write a new message and to attach files such as images or audio files. The system's admin can determine who can attach files to public messages.

Public messages can be sent to your own station, which is an easy way to publicize news inside your own community.

Public messages can also be password protected, which means that only the ones that know the password will be able to read their content, but their description still will be readable by everyone. Have in mind that once a password for the message (has to be at least 4 characters) is defined, there is no way to recover it, nor to change it.

On the message administration link on the admin session, a system administrator can change who can attach files on messages between stations: everyone with access to the network, only registered users, or only administrators.

Because the radio propagation of data is very low, file attachments are constrained to 20KB sizes. The system will accept inputs for image and sound up to 30 MB and for other files up to 2 MB, and will try to compress them to fit the maximum size for packages. For image and sound, the resolution can be changed, and the quality may be affected. For other formats, a simple compressor will be applied, and message packages with size greater than 20 KB will be cancelled.

2.3 Transmission Queue

All the data exchange in the HERMES system is done through UUCP. As an asynchronous protocol, all the data is first queue before being transmitted. The elements of the UUCP queue are called "jobs", and each job in the HERMES system can be an e-mail, a public message, or special remote command execution message (for example, to inform of a new e-mail user creation). A system administrator

can cancel a job before it is sent. Administrators can also erase the public messages for any reason, including the case when the equipment storage space is reaching its end. The storage space available is shown on the web interface footer.

The queues of all stations are transmitted from times to times, when the gateway station connects to each remote station. In an emergency case, the system administrator can force message transmission queue by clicking on the "transmit now" link. This can interrupt receiving messages from other stations for a while and should be avoided unless it's really necessary.

2.4 Languages supported

This version of the Hermes system is translated to Portuguese and Spanish, and the versions can be accessed on the languages tab of the main menu

Figure 11: Page to access translations

3 E-mail

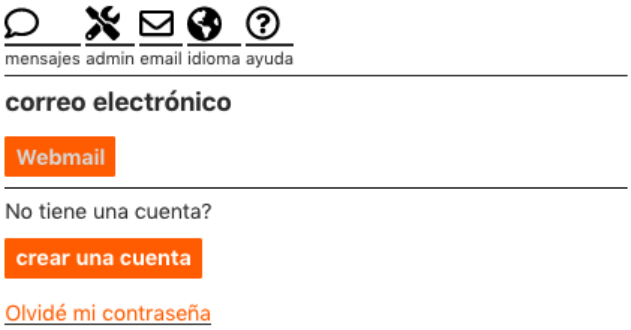

Figure 12: Page to access webmail interface

The main service provided by the HERMES system is the electronic mail (E-mail). E-mail is communication protocol which attributes to each e-mail bearer an address in the format "username@host". The "username" part of the email is created by a HERMES administrator user in the web interface, while the host (also called domain) is already set in the system, and typically has the format "community_id.hermes.radio". So a typical HERMES emails looks like, for example, "amelia@ac4.hermes.radio". The "username" is the same username as created in the user creation page in the HERMES administration interface.

HERMES email users can send and receive e-mail just like any other e-mail user. The only restriction which must be considered is that telecommunication in HF is slow, so emails with large attachments will be cancelled by the system, with the appropriate cancellation message sent to the user.

While there are many e-mail clients, like Thunderbird and Outlook Express, the recommended e-mail client to be used with HERMES is DeltaChat. DeltaChat Android, Windows, MacOS and Linux installer is available for download through the interface, while as a backup option, RoundCube webmail client is also accessible through HERMES web interface.

3.1 DeltaChat

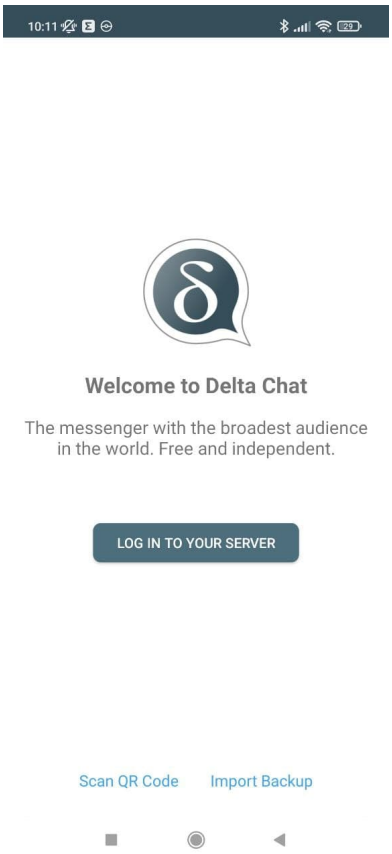

Figure 13: Deltachat intro (first screen)

Figure 14: Deltachat chat room example

With the Deltachat application, you can use HERMES emails to carry out personal communications for exchanging messages; This app works on most common smartphones and feels like a common message application such as whatsapp or telegram. Keep in mind that due to the message transmission schedule, messages may take a while to arrive, depending on the amount of messages in the queue and the opening hours of the transmitters.

3.1.1 Installation

The Deltachat is available in the most common app stores, but if you're not connected directly to the internet, you can download it through the HERMES web interface, selecting one of the packages provided according to your device operational system. We provide installation files for Android, GNU/Linux, Windows and MacOSX mobile or computer systems. and can be accessed here if you're reading this using a HERMES system network: Android, Windows, Debian and Mac OS

3.1.2 Configuration

The HERMES system includes an encryption system suitable to fit multimedia messages like images or audio and send them by HF. End-to-end encryption should be disabled in order to the server-based image and audio compression work, otherwise image and audio exchange will not be possible. The steps to find this feature in Deltachat is: Burger Menu (☰) -> Settings -> Advanced -> Autocrypt, turn off: Prefer End-To-End Encryption) as shown in Figure 15.

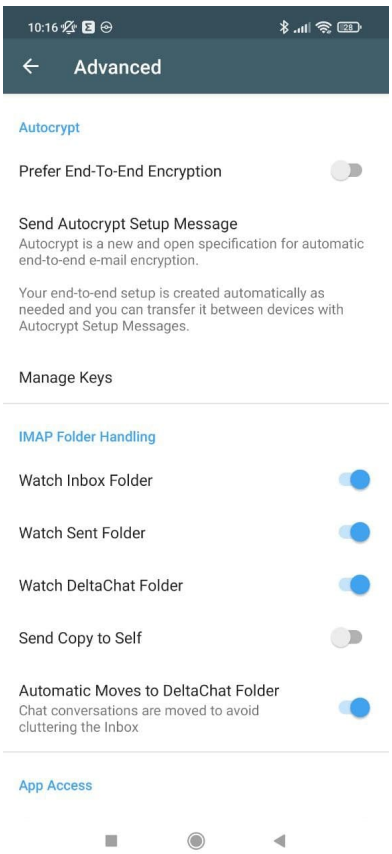

Figure 15: Deltachat Advanced settings

The Deltachat by default, tags its emails and show only the "known" messages (emails) that was sent by another Deltachat application. In order to be able to interact with e-mails from any e-mail client software, enable the option "show all emails". The steps to find this feature in Deltachat is: Burger Menu (☰) -> Settings -> Chats and Media -> Show Classic E-Mails -> All. As shown in Figure 16

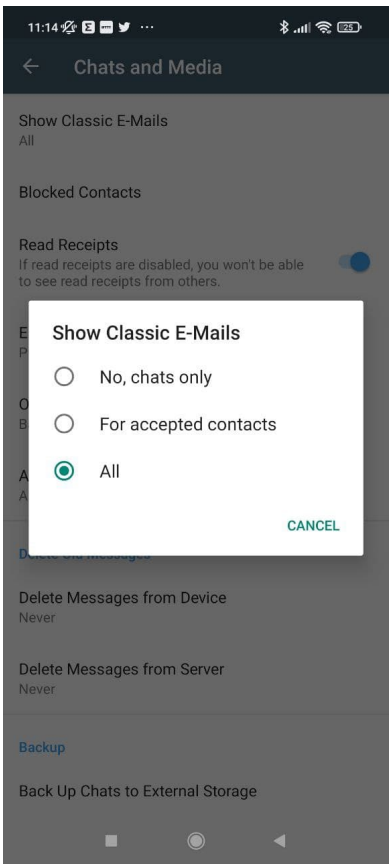

Figure 16: Deltachat Setup all emails

3.1.3 Usage

In order to configure the DeltaChat e-mail client, first an e-mail account should be created, as described in section 2.1. In order to login to an e-mail account, just the e-mail address and password fields should be filled, as shown in Figure 17.

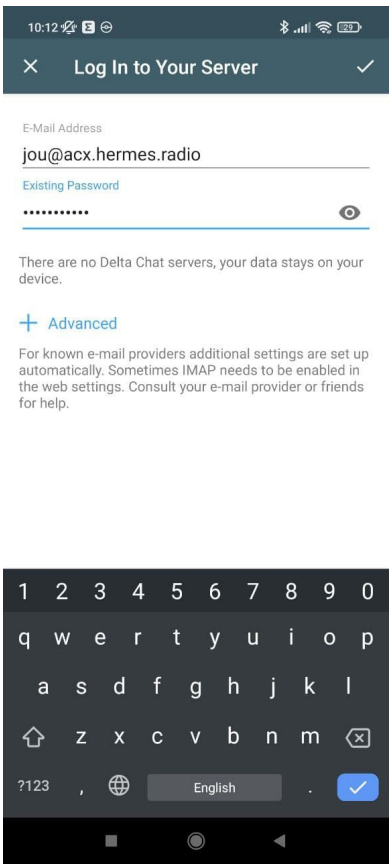

Figure 17: Deltachat Login example

3.2 Other email clients

Other email clients can also be used. We can't cover all cases, but the HERMES setup uses default services like IMAP to synchronize email folders and SMTP to send the messages, the specifics technical information about the ports can be found in the appendix: A.2.1

4 Troubleshooting

In case of problem in the Antenna, a red led in the antenna (ANT) position will light up on the HERMES box, in this case, check the correct position of the power supply wires and check the position and integrity of the Antenna, coaxial cable, and the transmitter.

If the messages in the transmission list are not being transmitted over time, check if the radio settings have been changed, if that's not the case, it's possible that the other stations are offline.

The HERMES web interface also indicates when something is wrong with the system. When a red dot appears on the footer bar (figure 18), it becomes interactive, and when clicked, it lists the names of the services that can have a problem.

Figure 18: Red dot on the web interface can be clicked to check what part of the system may be broken

A Appendix - technical information

A.1 Network Information

Each HERMES system is a WiFi access point. The configuration is:

- WiFi Network Name: `HERMES`
- WiFi Password: `amazonia`

The IP of the HERMES station (in the wireless interface) **10.0.0.1** and the ethernet connection will connect as a dhcp client in a already existing network.

A.2 Network Services

A.2.1 E-mail services

The email system provides these public services. The email settings are the following:

- Server address: `hermes` (IP `10.0.0.1`)
- SMTP (Simple Mail Transfer Protocol): port `25`
- SMTPS (Secure Simple Mail Transfer Protocol): port `465`, with SSL support (used for deltachat, the certificates valid until 2031)
- IMAP (Internet Message Access Protocol): port `143`
- Webmail URL acessible: `http://hermes/mail` or `http://10.0.0.1/mail`

The use of these settings should not be needed by the user, as DeltaChat automatically identify all the settings by entering just the e-mail address and password in the login prompt.

A.2.2 Web services

The HERMES web interface runs on port 80 on http, and provides these capabilities:

- BBS P2P public messaging capability (over UUCP);
- E-mail user administration;
- UUCP queue management;
- HF radio transceiver management tools;
- Customized permissions for users send multimedia messages;
- Hidden page for radio service tasks (like test tone generation and PTT control);

services	user	password
web interface	root	caduceu
root email	root@domain.hermes.radio	caduceu

- Network information page (for cases in which the HERMES system connects to a larger; IP network);
- DeltaChat e-mail client downloads for Android, MacOS, Windows and Linux.

A.3 Other network Services

- SSH Secure Shell - for special system administration: port 22
  user: "hermes", password: hermes
  user: "root" password: "caduceu"
- VPN - Virtual Private Network client ready for remote maintenance
- ISPCONFIG admin web interface
  port 8080 / credentials: "admin" "caduceu"
- mariaDB, the Database server for store messages and users on station-api and ISPconfig
- E-mail services with transports connected to uucp
  Postfix, dovecot, spamassin, postgrey, amavis, clamav (hold) and ISPconfig as a manager
- iwatch: handle inbox HMP folder and trigger uucp spool compression
- hostapd: sets the wireless interface into access point mode
- dnsmasq: provides a domain name server and aliases
- uucp: accessible via network with credentials user/pass
- VNC: Virtual X session environment with VARA monitor port: `5901` (vncviewer 10.8.0.2:5901)
  user: "hermes", password: "caduceu"

B Additional information

The main system runs Debian GNU/Linux release Bullseye and we try to follow their guidelines.

B.1 Password Cheat Sheet

B.2 Field trials

HERMES system was tested on a test bed set by Rhizomatica in Brazil. Three stations where used, installed in three cities: Brasília/DF, Belo Horizonte/MG and Hortolândia/SP. Most of the tests happened between Brasília and Belo Horizonte, and Belo Horizonte and Hortolândia. The straight line distance between Brasília and Belo Horizonte is 620 km, while Belo Horizonte and Hortolândia straight line distance is 470 km. All the stations are equipped with simple dipole installed as inverted V, tuned to the 40m amateur radio band.

In our internal tests between Belo Horizonte and Hortolândia, the modem reaches more than 1000 bps in an average propagation condition (0db of SNR in the receiver). A 10Kb message, which is the typical size of an email with a picture takes about 4 minutes to be exchanged. In bad propagation conditions, this time can go up to 10 minutes.

The adaptive modem starts the communication with slower speeds, but if propagation is good, it gears up and automatically increases the speed, and on the other hand, if propagation deteriorates, the modem reduces the speed, increasing the signal robustness.

B.3 Source Code

The source code is available inside the folders /home/hermes/install with the latest git versions before the deploy and is also available online in:

- Web Front-end Interface, written using the Angular framework: https://github.com/DigitalHermes/angular;
- Web Back-end Interface, written in PHP: https://github.com/DigitalHERMES/station-api;
- HF transceiver description and schematics: https://github.com/DigitalHERMES/rhizo-transceiver;
- HF transceiver firmware and userland tools, written in C: https://github.com/DigitalHermes/ubitxv6;
- Network management software for UUCP and the HF modem (VARA or Ardop) integration, written in C: https://github.com/DigitalHERMES/rhizo-uuardop

C Licensing

All the project's source code is licensed under the GPL version 3 or any greater version, unless stated differently in the repository.

C.1 GNU General Public License Version 3

High-Frequency Emergency and Rural Multimedia Exchange System (HERMES).