ZT-100 User Manual

Release Draft

ZONGE International

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CHAPTER

ONE

INTRODUCTION

This manual covers day-to-day operation of the ZT-100 control system.

The ZT-100 provides GPS-synchronized transmitter control with:

- Preset **100% DC** and **50%** operating modes
- Configurable frequency selection across a wide range
- Support for user-defined control signals in **Custom** mode
- Status, diagnostics, and firmware management through the device interface

1.1 User Interfaces

You can operate the ZT-100 in two ways:

1. **Front Panel**: Local screen-and-button control for mode, frequency, and core status functions.
2. **Web Interface**: Wi-Fi browser access for control, logs, updates, and network settings.

CHAPTER

TWO

QUICK START

This section covers the fastest path from power-on to first transmit.

2.1 Before You Start

- Connect the ZT-100 to an external generator power source (for example **Zonge ZMG9**, **ZMG30**, or similar).
- Connect the GPS antenna.
- Connect the transmitter cable.

2.2 Power On and Check Status

1. Power on the ZT-100.
2. Wait for GPS to begin locking.
3. Confirm satellite count is increasing and sync status moves toward locked.

2.3 Set Mode and Frequency

1. Select the operating mode (**100% DC**, **50%**, **Custom**, or **MMR 5Hz**).
2. Set the target frequency.

> **Note**
>
> In **MMR 5Hz** mode, frequency is fixed at 5 Hz and cannot be edited.

2.4 Start Transmit

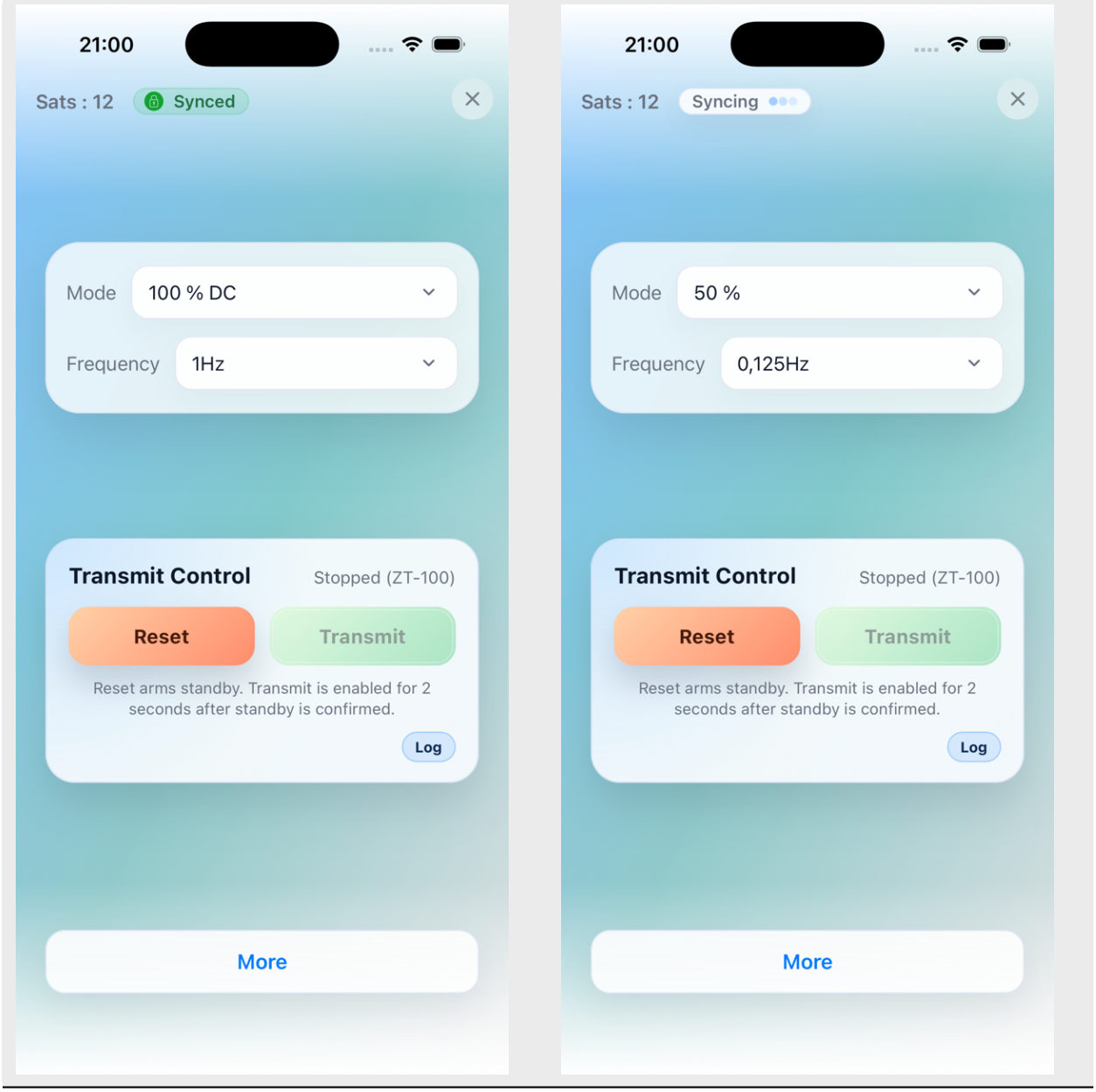
1. Press **RESET**.
2. You then have about 2 seconds to press **TRANSMIT**.
3. If everything is fine and load checks pass, transmit starts.

2.5 Stop Transmit

- Press either **RESET** or **TRANSMIT** to stop output.

2.6 Web Interface (Optional)

1. Enable Wi-Fi on the device.
2. In hotspot mode, connect to *ZT-100*.
3. Open `http://10.10.10.10/` in a browser.
4. Or use the mobile app. It automatically connects to the correct network and IP address.



For details, see *Basic Use and Menu Structure* and *Using the Web Interface*.

CHAPTER

THREE

ZT-100 CONTROLS AND CONNECTORS

3.1 Front Panel Overview

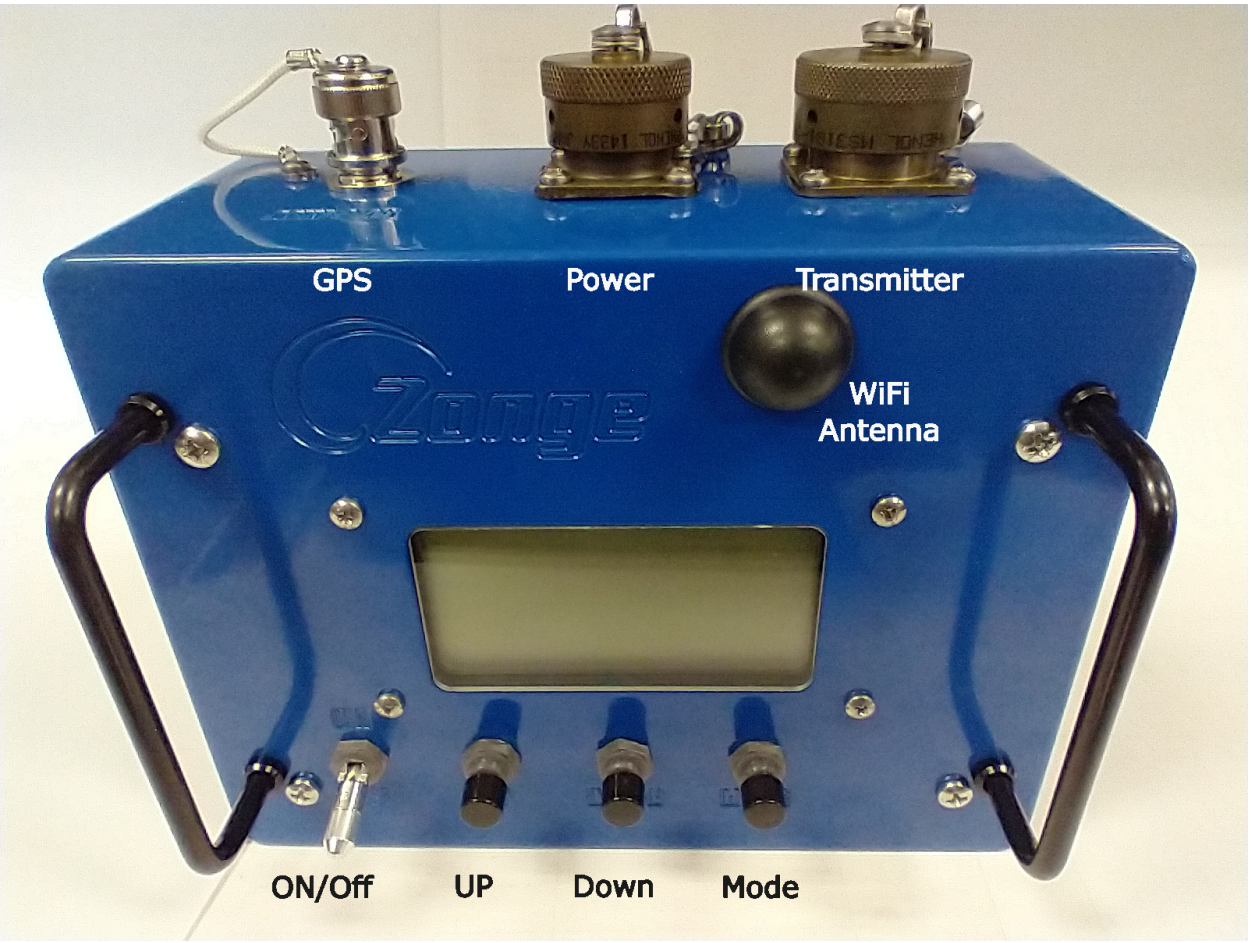


Fig. 1: Control elements and connectors of the ZT-100 controller.

The ZT-100 front panel uses a 128 x 64 pixel transflective display and three push buttons for menu control: **UP**, **DOWN**, and **SELECT (MODE)**. The transflective display is readable in bright sunlight, and the LED backlight allows operation at night.

There are two additional action buttons:

- **RESET**: Starts the reset/arm sequence, or stops transmit.

- **TRANSMIT**: Starts transmit during the arm window, or stops transmit.

3.2 Back Panel Connectors

On the back panel you will find:

- A 50 Ohm BNC connector for an active GPS antenna.
- A power connector.
- The Zonge transmitter interface connector.
- A CAN output connector.

3.3 ZONGE Transmitter Connector Pinout

On the ZT-100, the transmitter-control connector is a **15-pin female** MIL-spec circular connector. This allows the ZT-100 to be controlled by an XMT-R using the matching cable/connector set.

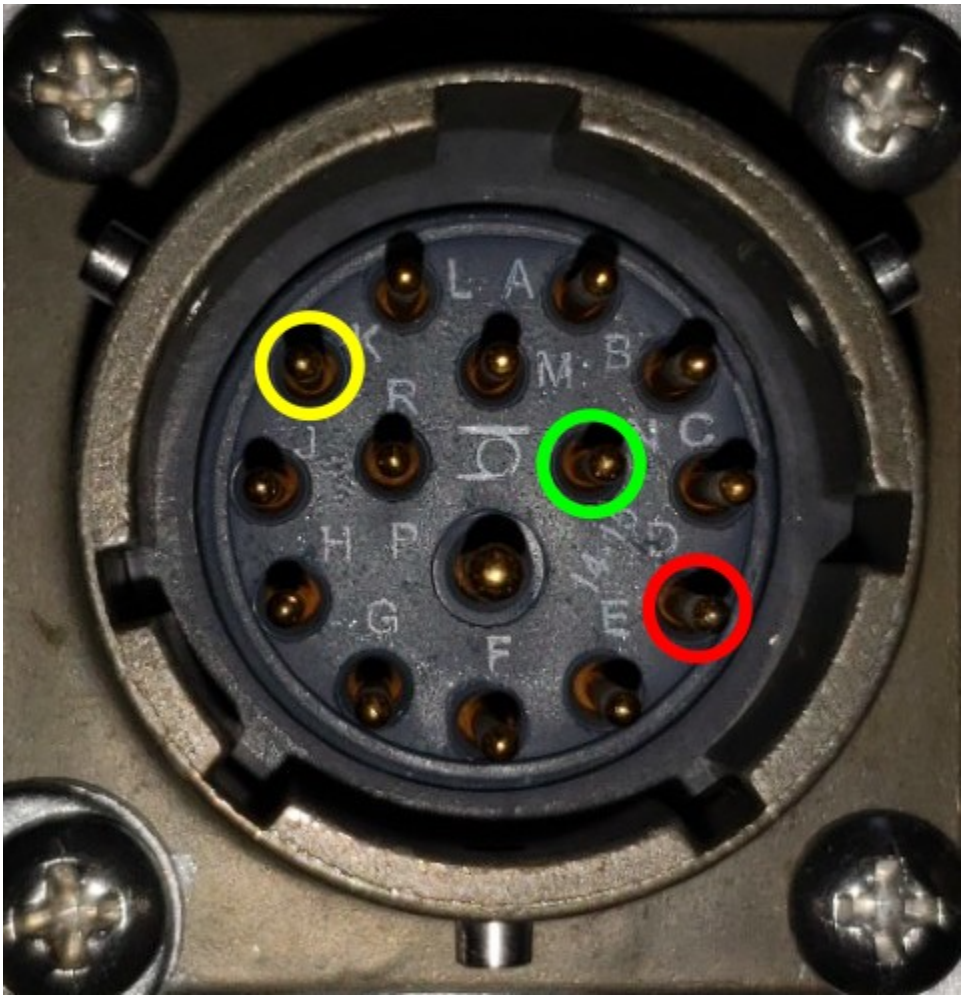


Fig. 2: Pinout of the 15-pin MIL transmitter controller connector. POL is on pin D (red), COMMON (GND) is on pin N (green) and ON/OFF is on pin K (yellow).

Use Zonge cable type **XMT/16-CN/6** for compatible transmitter/control connections.

3.4 ZONGE Power Connector

The power connector is a 3-pin MIL-spec circular connector of type **KPT02E12-3S**.

- Pin A: Positive lead from an external generator power source (for example Zonge ZMG9, ZMG30, or similar)
- Pin B: Negative lead
- Pin C: Not connected

3.5 GPS Antenna Connector

The GPS antenna connects via a 50 Ohm BNC connector. Use a 3.3 V active GPS antenna with minimum gain of 15 dB and maximum gain of 30 dB.

CHAPTER

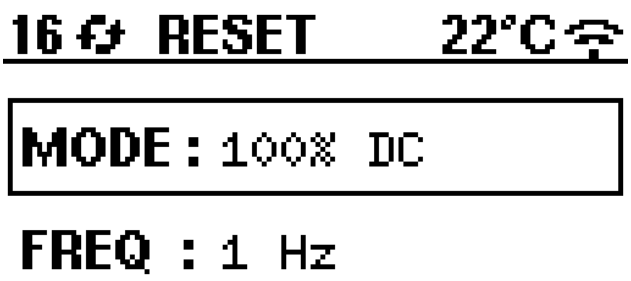
FOUR

BASIC USE AND MENU STRUCTURE

4.1 Main Page Overview

The main page provides a quick view of essential information:

- **Selected Mode**
- **Frequency**



The top status area shows:

- **Number of satellites** (GPS fix quality)
- **Sync status** (searching vs locked)
- **ZT-100 ID**
- **Wi-Fi status**

4.2 Button Basics

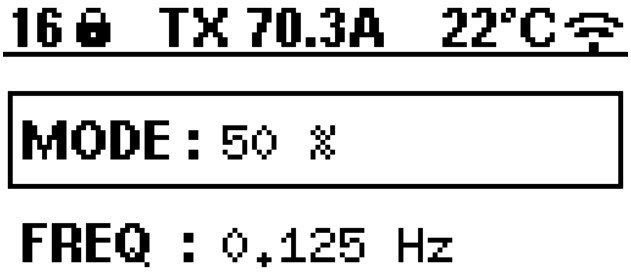
Long-press is about 2 seconds.

- **UP (short press)**: Move up in menus or increase a value.
- **DOWN (short press)**: Move down in menus or decrease a value.
- **SELECT (short press)**: Toggle selection on the main screen or select a menu item.
- **UP/DOWN (long press)**: Adjust Mode on the main screen or make fine changes in the value editor.
- **SELECT (long press)**: Enter/exit menus or confirm a value edit.
- **RESET**: Starts the reset/arm sequence, or stops transmit.
- **TRANSMIT**: Starts transmit during the arm window, or stops transmit.

4.3 Mode Adjustment on Main Page

To switch modes on the main page:

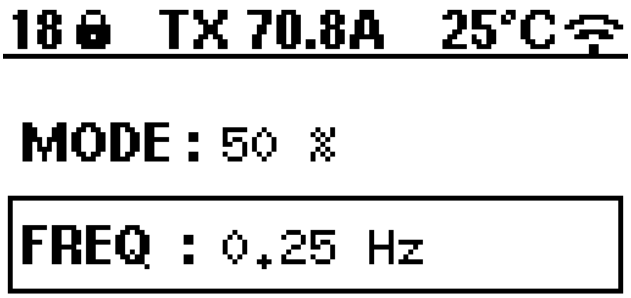
1. Make sure **MODE** is selected (use **SELECT**).
2. Press and hold **UP** or **DOWN** for about 2 seconds.



4.4 Frequency Adjustment on Main Page

To adjust frequency on the main page:

1. Make sure **FREQUENCY** is selected (use **SELECT**).
2. Use **UP/DOWN** to increase or decrease the frequency.



4.5 Modes

- **100% DC**: Full frequency range.
- **50%**: Limited frequency range (currently 0.0078125 Hz to 32 Hz).
- **Custom**: User-defined sequence mode (file upload via web app).
- **MMR 5Hz**: Fixed 5 Hz mode (frequency selection hidden).

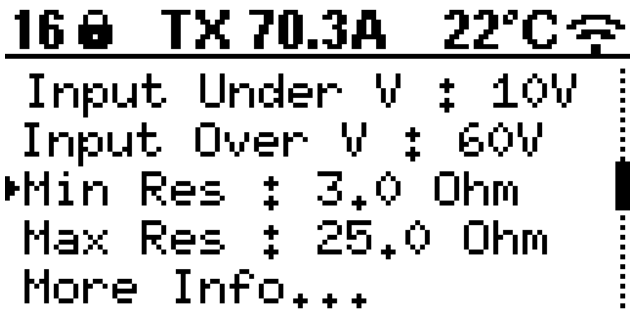
In **Basic** XMT mode, only **100% DC** and **50%** are available. In **Advanced** XMT mode, all four modes are available. You can switch between **Basic** and **Advanced** either from the device menu (**More Info -> XMT Mode**) or from the web interface **More** panel.

4.6 Menu Options

From the MENU screen you can:

- Adjust **Input Under Voltage** and **Input Over Voltage** limits.

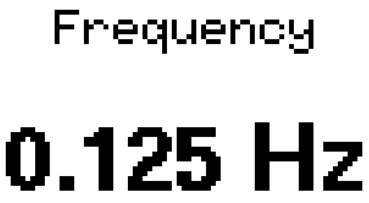
- Adjust **Minimum Resistance** and **Maximum Resistance** limits.
- Open **More Info…** for status and system tools.



4.7 Value Editor

Selecting a limit opens the value editor:

- **UP/DOWN (short press)**: Coarse steps.
- **UP/DOWN (long press)**: Fine steps.
- **SELECT (short press)**: Toggle coarse/fine mode.
- **SELECT (long press)**: Save and return.

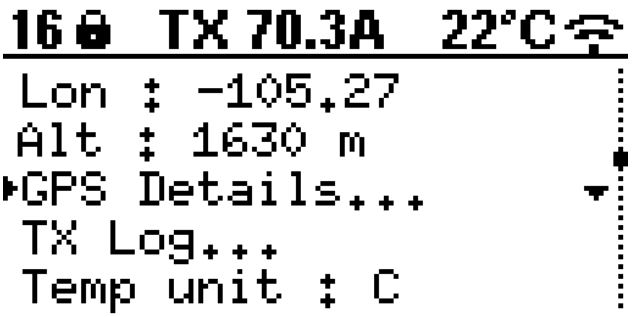


4.8 More Info Screen

The More Info screen shows status and configuration:

- **XMT Mode**: Toggle Basic/Advanced.
- **GPS Time / GPS Date**
- **Latitude / Longitude / Altitude**
- **GPS Details…**: Opens the GPS details list.
- **TX Log…**: Opens the transmit event log.
- **Temp unit**: C or F.
- **Version**: Firmware version.
- **ZT-100 #**: Instrument ID.
- **Screen Light**: On/Off.
- **Wi-Fi status**: On/Off.

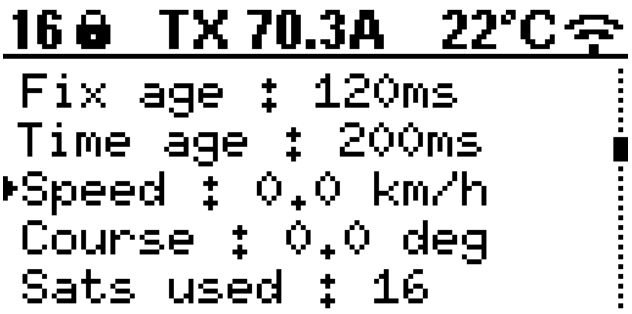
- **IP**: Shown when Wi-Fi is enabled.



4.9 GPS Details Screen

The GPS details list includes:

- HDOP
- Fix age and time age
- Speed and course
- Satellites used
- GPS satellites and GLONASS satellites
- PPS count



4.10 Transmit Workflow (Step-by-Step)

1. Press **RESET** to start the reset/arm sequence.
2. The system checks all protection and status conditions.
3. If no errors are reported, the screen shows **RDY** (arm window).
4. Press **TRANSMIT** during the arm window.
5. The system measures load resistance (**MOR**).
6. If the load is in range, transmit begins. If not, **ORE** is shown.
7. Press **TRANSMIT** or **RESET** to stop transmit and return to safe state.

4.11 Status Labels (Top Bar)

The top bar shows a short label for the transmit state. Common labels are:

- **ZT-100**: Boot/initial state.
- **RESET**: Reset sequence active or waiting in safe state.
- **RDY**: Armed window open for transmit.
- **MOR**: Measuring load resistance.
- **ORE**: Load resistance out of range or timed out.
- **TRANSMIT**: Transmit active.
- **STOPPED**: Transmit stopped by operator.
- **ERR**: Shared error line asserted (failsafe wait state).
- **R x.x**: Last measured resistance shown during transmit.
- **TX x.xA**: RMS current shown during transmit.

4.12 Error Labels (Subsystem Codes)

Error labels appear in the top bar and in the TX Log. Any error forces the system back to a safe wait state.

Module codes:

- **SM** = Safety system
- **MM** = Monitoring system
- **GM** = Gate driver system
- **FM** = Cooling/fan system

Safety System (SM) errors:

- **SM EMER**: Emergency stop input active.
- **SM GIUV**: Global input under-voltage triggered.
- **SM GIOV**: Global input over-voltage triggered.
- **SM UDIUV**: User-defined under-voltage limit triggered.
- **SM UDIOV**: User-defined over-voltage limit triggered.
- **SM LERR**: Safety system local error.
- **SM ERR**: Other safety system error.

Monitoring System (MM) errors:

- **MM OVP**: Over-voltage positive.
- **MM OVN**: Over-voltage negative.
- **MM OCP**: Over-current positive.
- **MM OCN**: Over-current negative.
- **MM LERR**: Monitoring system local error.
- **MM ERR**: Other monitoring system error.

Gate Driver System (GM) errors:

- **GM OTMP**: Gate driver over-temperature.
- **GM LERR**: Gate driver local error.

Cooling/Fan System (FM) errors:

- **FM LERR**: Cooling/fan system local error.

CHAPTER

FIVE

USING THE WEB INTERFACE

5.1 Overview

When Wi-Fi is enabled on the ZT-100, the device hosts a web interface that mirrors the front-panel controls and provides administrative tools.

5.2 Mobile App Availability

The app is available on the Apple App Store as **Zonge ZT-100**. An Android version is planned for release soon.

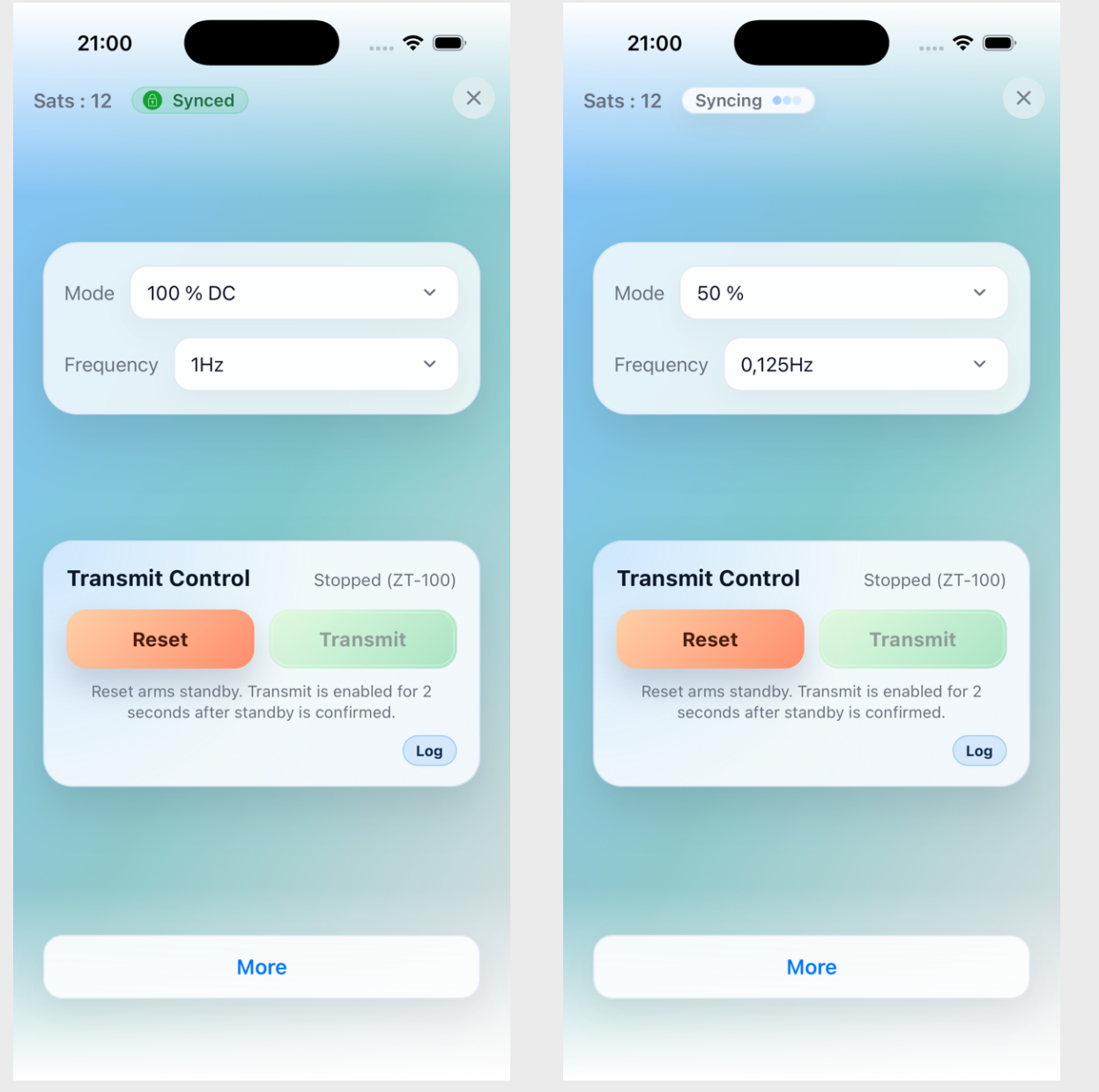
Hotspot mode (default):

- Join the device Wi-Fi network (SSID typically *ZT-100*).
- Open a browser and go to `http://10.10.10.10/`.
- Or use the mobile app, which automatically connects to the correct network and IP address.

If the device is on a local network, use its IP address instead.

5.3 Main Page Controls

The main page shows GPS status, sync status, mode, and frequency. It also provides transmit control and the TX log.



Mode

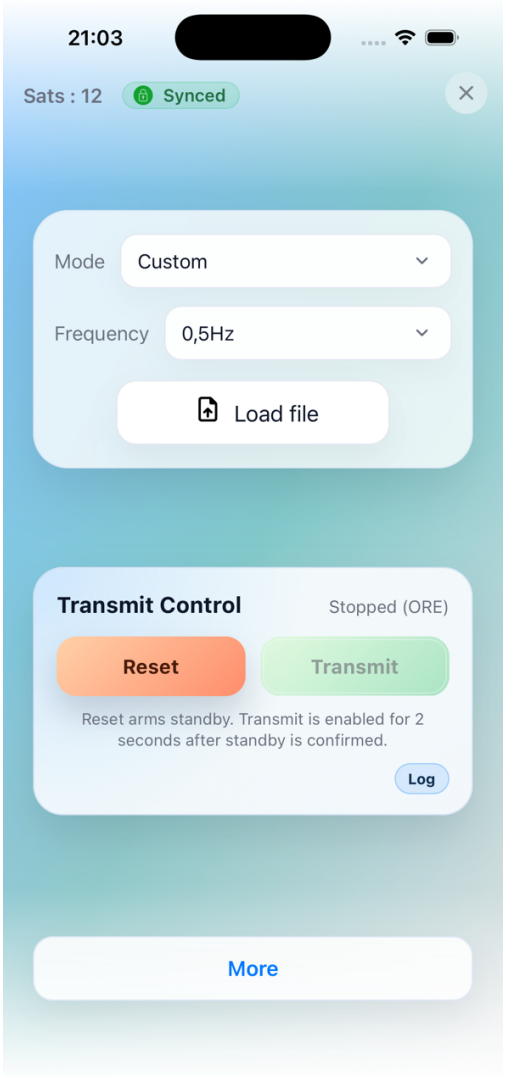
- Select **100% DC**, **50%**, **Custom**, or **MMR 5Hz**.
- In **Basic** XMT mode, only **100% DC** and **50%** appear.
- In **Advanced** XMT mode, all four modes appear.

Frequency

- Sets frequency from 0.0078125 Hz up to 8192 Hz.
- In **50%** mode the maximum is limited (currently 32 Hz).
- In **MMR 5Hz** mode, frequency selection is hidden.

Custom Files (Custom mode)

- A file loader and file list appear only in **Custom** mode.
- Upload **.usm** files. The UI rejects files larger than 256 KB.
- Use the list to select the active custom file.



Transmit Control

- **RESET**: Starts the reset/arm sequence, or stops transmit.
- **TRANSMIT**: Starts transmit during the arm window, or stops transmit.
- **Status line**: Shows *Stopped*, *Standby ready*, *Transmitting*, and includes the current status label in parentheses.

More

- Opens a panel with GPS time, latitude, longitude, altitude, and **XMT Mode** (Basic/Advanced).
- You can switch between **Basic** and **Advanced** here, or from the device screen menu (**More Info -> XMT Mode**).

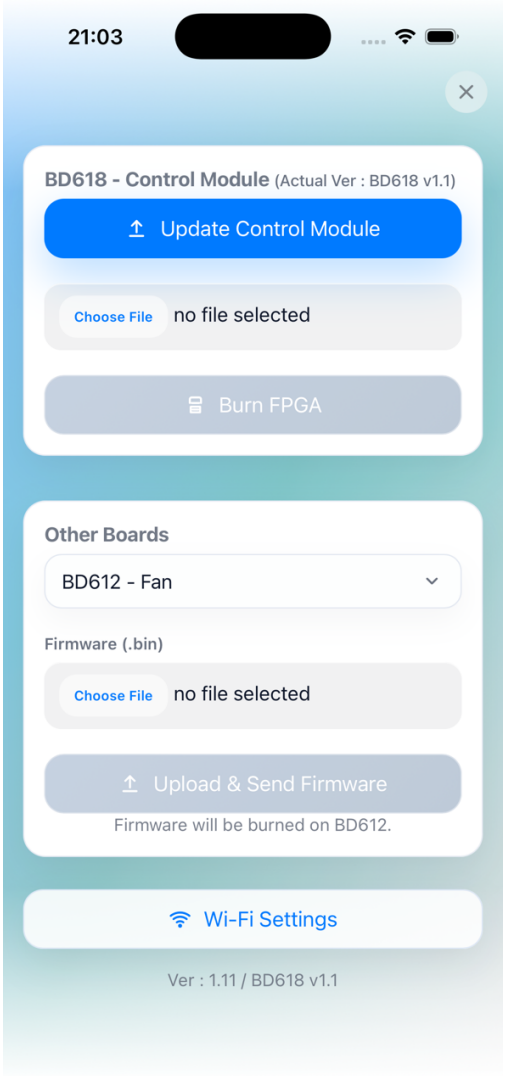
5.4 How to Transmit (Web UI)

1. Click **Reset**.
2. You then have about 2 seconds to click **Transmit**.
3. If everything is fine and load checks pass, transmit starts.
4. Click **Stop** to end transmit.

5.5 Admin Page

Navigate to `/admin` for firmware and FPGA updates.

- **Update Main Firmware**: Upload the firmware for the main controller.
- **Burn FPGA**: Upload the FPGA image.
- **Other Hardware Targets**: Select the target listed in the UI and upload the matching firmware file.

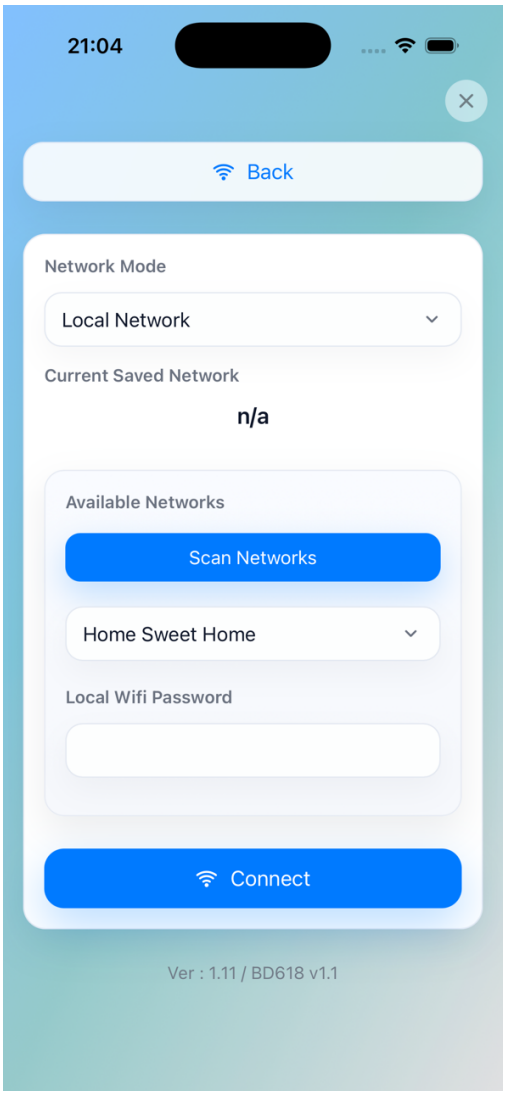


If the selected target and firmware file do not match, the upload is rejected.

5.6 Wi-Fi Settings Page

Navigate to `/wifi` from the Admin page.

- **Network Mode**: Hotspot or Local Network.
- **Scan Networks**: Populate the available SSID list.
- **Connect**: Apply the selected mode and credentials.



CHAPTER

SIX

GENERATE USER DEFINED SEQUENCES

In addition to the pre-programmed 50% and 100% duty-cycle control signals the ZT-100 allows user-defined control signals in **Custom** mode. This enables specialized ternary transmission sequences when required by the survey design.

6.1 Control Signals

The transmitter output can have three states:

1. Positive ON
2. OFF
3. Negative ON

Positive ON and Negative ON refer to current flow through the transmitter in opposite directions. The ZT-100 defines the output signal using two binary control signals:

1. ON#
2. POL

Each control signal can be LOW or HIGH. HIGH corresponds to 3.3 V and LOW corresponds to 0 V.

- **ON#** controls whether the transmitter is on. The # indicates **active low**. When ON# is LOW the transmitter is on; when ON# is HIGH the transmitter is off.
- **POL** controls the direction of current flow. POL HIGH corresponds to positive current flow, POL LOW corresponds to negative current flow.

6.2 Output Signal Example

The red graph shows ON#, the green graph shows POL, and the black graph shows resulting transmitter output. The sequence includes all three states.

Note

The control signals are binary and do not contain amplitude information. The output signal amplitude is set on the transmitter hardware.

6.3 Generating the Signal Definition File

To use a user-defined signal, create a **.usm** file and upload it via the web interface. The file contains a sequence of control signal states. At each base clock tick, the next POL and ON# values are read and applied. When the end of file is reached the sequence loops back to the beginning.

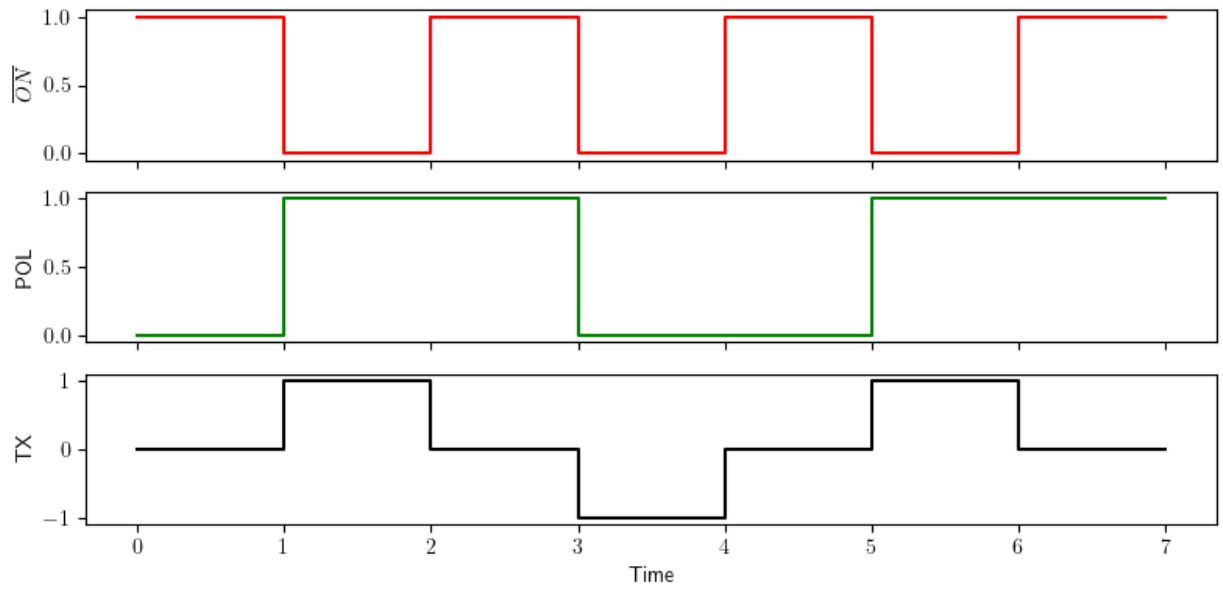


Fig. 1: Generation of a 50% duty-cycle output signal.

6.4 File Format

The .usm file is stored in binary form and contains three parts:

1. Sequence length
2. List of POL entries
3. List of ON# entries

The sequence length is a 16-bit unsigned integer in big-endian byte order, allowing up to 65,536 entries.

POL and ON# entries are stored as packed bits. Every eight consecutive bits are stored as a byte. If the sequence length is not a multiple of 8, pad the final byte with zeros. The firmware ignores padded bits based on the length value.

6.5 Example: Generate a PRBS .usm File

The following Python code generates a 4th order PRBS sequence file:

```
import numpy as np
np.set_printoptions(formatter={'int':hex})

pol = [1,1,0,0,0,1,0,0,1,1,0,1,0,1,1]           # sequence for polarity
on_ = [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]           # sequence for ON# (active low)
slen = len(pol)                                 # sequence length

# Pad to a multiple of 8
apol = 8-len(pol)%8
for i in range(apol):
    pol.append(0)
    on_.append(0)

```

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```
pol_bytes = (np.packbits(np.array(pol),bitorder='big'))
on_bytes  = (np.packbits(np.array(on_),bitorder='big'))
print(pol_bytes)
print(on_bytes)

print('Sequence length = {}, {}'.format(slen,slen.to_bytes(2,byteorder='big')))
print("Pol array = {}".format(pol))
print("ON_ array = {}".format(on_))

with open ("PRBS_4.usm", "wb") as binary_file:
    binary_file.write(slen.to_bytes(2,byteorder='big'))
    binary_file.write(pol_bytes)
    binary_file.write(on_bytes)
```

6.6 Uploading a .usm File

1. Enable Wi-Fi on the ZT-100.
2. Open the web interface and switch to **Custom** mode.
3. Use the file loader to upload the .usm file.

6.7 Transmitting a User Defined Sequence

The .usm file defines the control sequence only. Select the desired base frequency in the web interface to generate the final transmitter waveform.

CHAPTER

SEVEN

TROUBLESHOOTING

This section focuses on the most common operational issues and how to resolve or diagnose them using the screen and web interface.

7.1 No GPS Lock / Sync Searching

Symptoms:

- Satellite count is low or zero.
- Sync indicator shows searching.

Actions:

- Verify the GPS antenna is connected to the BNC port.
- Move to an open area with clear sky view.
- Wait a few minutes for initial acquisition.

7.2 Transmit Button Disabled

Symptoms:

- **Transmit** is disabled on the web UI.
- The screen does not show **RDY**.

Actions:

- Press **RESET** to start the reset/arm sequence.
- Wait for **RDY** (arm window). The window is short (about 2 seconds).
- If **RDY** never appears, check for errors (see Error Labels).

7.3 ORE (Out-of-Range Resistance)

Symptoms:

- Status label shows **ORE**.
- Transmit does not start after pressing **TRANSMIT**.

Actions:

- Verify transmitter and load connections.

- Check that the minimum/maximum resistance limits are appropriate.
- Press **RESET** and try transmit again.

7.4 ERR (Shared Error Line)

Symptoms:

- Status label shows **ERR**.

Actions:

- A safety/monitoring subsystem has asserted the shared error line.
- Check the TX Log or error label on the screen.
- Resolve the underlying error and press **RESET**.

7.5 Error Labels

Any error label returns the system to a safe wait state. Use the label to identify the source subsystem:

- **SM** = Safety system
- **MM** = Monitoring system
- **GM** = Gate driver system
- **FM** = Cooling/fan system

Common errors:

- **SM EMER**: Emergency stop input active.
- **SM GIUV/GIOV**: Global input under/over-voltage.
- **SM UDIUV/UDIOV**: User-defined under/over-voltage limit.
- **MM OVP/OVN**: Over-voltage (positive/negative).
- **MM OCP/OCN**: Over-current (positive/negative).
- **GM OTMP**: Gate driver over-temperature.
- **SM/MM/GM/FM LERR**: Local error on that subsystem.

7.6 Wi-Fi Not Visible

Symptoms:

- No ZT-100 SSID appears.

Actions:

- On the front panel, open **More Info** and set **Wi-Fi status** to **ON**.
- Wait for the Wi-Fi icon to appear on the top bar.

7.7 Can't Open the Web UI

Symptoms:

- Browser cannot reach the device page.

Actions:

- If in hotspot mode, connect to the device SSID and open `http://10.10.10.10/`.
- If in local network mode, use the IP address shown on the screen.
- Confirm **Wi-Fi status** is **ON**.

7.8 Custom File Upload Fails

Symptoms:

- Upload rejected or file not listed.

Actions:

- Ensure the file extension is **.usm**.
- The web UI rejects files larger than 256 KB.
- Stay in **Custom** mode while uploading.

7.9 OTA Update Fails

Symptoms:

- Upload rejected or target mismatch.

Actions:

- Confirm the firmware file matches the selected target in the web UI.
- If the upload is rejected, re-check target selection and file version.
- Keep the browser open until the update process completes.