Mega Security System - Technical Documentation

1. System Overview

The Mega Security System is a modular alarm system firmware for the Arduino Mega 2560 platform, designed to integrate traditional security hardware (wired sensors, alarm panels) with modern smart home platforms like Home Assistant via MQTT.

The system supports:
- 16 configurable zones (expandable)
- Relay control for alarm panels
- Entry/exit delays with buzzer feedback
- Persistent zone configuration via EEPROM
- Web-based configuration UI
- Secure MQTT communication for monitoring and control

2. Feature Set

Alarm Features:
- Armed states: Home, Away, Night
- Disarmed and Pending states
- Trigger detection with optional entry delay
- Exit delay before arming
- Test Mode (no alarm triggering)
- Alarm relay control (active LOW)

User Interface:
- Password-protected web page /zones
- Editable zone descriptions
- Zone bypass toggle
- Save All changes to EEPROM
- Toggle Test Mode
- Reboot controller
- Light/dark theme toggle

MQTT Integration:
- State publishing and command reception
- Per-zone topics
- Master JSON with all zones
- Countdown timer updates
- Last triggered zone data

3. Hardware Requirements

Required Components:
- Arduino Mega 2560
- Ethernet Shield (W5100 or W5500)
- Magnetic contact switches / motion sensors
- Piezo buzzer (Pin 6)
- Relay module (Pin 5)

Pin Mapping:

Zone 1: 22
Zone 2: 23
... Zone 16: 37

4. Software Architecture

mega-security-eth_FINAL_PRO.ino - Main entry point, calls setup() and loop() for all modules
Modules:
- Zones.cpp/h: Zone reading, EEPROM storage, alarm triggering logic
- MQTTHandler.cpp/h: MQTT connection, subscription, publishing
- Countdown.cpp/h: Entry/exit delay countdown with buzzer
- WebEndpoints.cpp/h: HTTP routes and logic
- WebServer.h: Minified HTML/JS/CSS web UI
- AlarmStates.h: Shared alarm state constants
- credentials.h: Network, MQTT, and login settings

5. Setup Guide

Step 1 - Hardware: Wire sensors to pins, connect relay to PIN_ALARM, buzzer to PIN_BUZZER, install Ethernet Shield
Step 2 - Firmware Configuration: Edit credentials.h, compile, upload
Step 3 - Initial Web Setup: Access /zones, login, configure zones
Step 4 - Home Assistant Integration: Add home_assistant_config.yaml, restart HA

6. Web UI Reference

Zone Table: Editable description, bypass checkbox, color-coded status
Buttons: Save All, Toggle Test Mode, Reboot, Toggle Theme

7. Alarm Operation

Arming: Command via MQTT or UI sets state to Pending, runs exit delay, arms if clear
Triggering: Armed + triggered zone runs entry delay, triggers alarm if not disarmed
Disarming: Disarms via MQTT/UI, relay off

8. MQTT API Reference

home/alarm: state
home/alarm/set: command
home/alarm/countdown: seconds
home/alarm/test_mode: on/off
home/alarm/zones: JSON
home/alarm/zone/<n>: zone state
home/alarm/last_trigger: JSON

9. EEPROM Layout

Each zone: 20 bytes description + 1 byte bypass flag

10. Maintenance & Troubleshooting

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No MQTT updates: check broker/network
No Web UI: check IP/port
Zones always triggered: check wiring
Settings not saving: check EEPROM writes