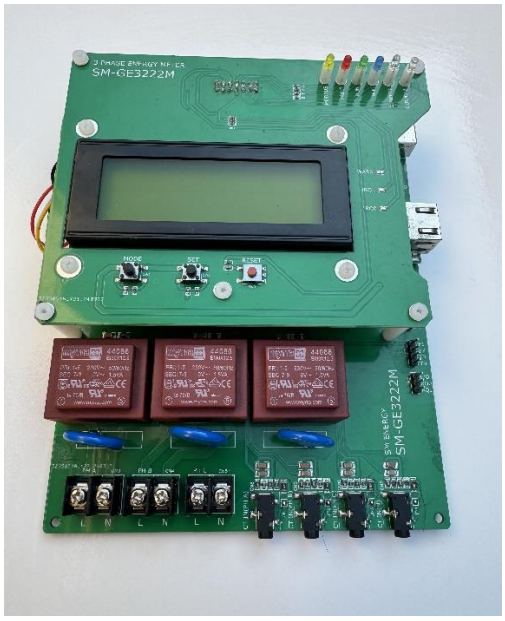
SM Energy GE3222M Smart Energy Monitor User Manual



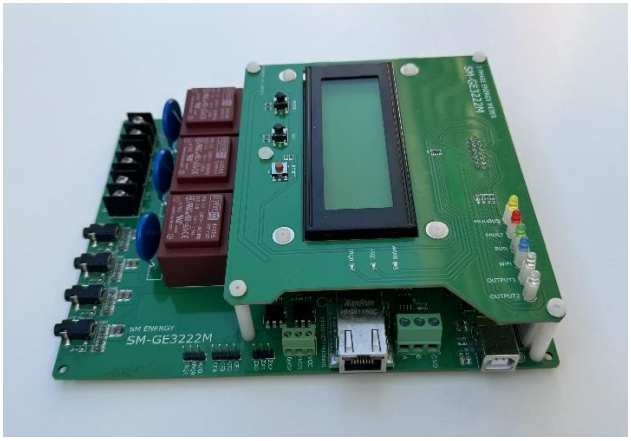


Table of Contents

Introduction

The SM Energy GE3222M is a flexible, ESP32-based 3-phase energy monitoring system designed for comprehensive power measurement and analysis. This user manual provides detailed information on installation, configuration, and operation of the device.

Hardware Overview

The SM-GE3222M is built around the powerful ESP32 WROOM microcontroller with integrated WiFi and Bluetooth connectivity, paired with the ATM90E36 energy monitoring IC for accurate power measurements.

Main Components:

- ESP32 WROOM 32 module (with internal or external antenna option)
- ATM90E36 Energy Monitoring IC
- 24C64 EEPROM for parameter settings and logging
- DHT22 temperature and humidity sensor
- MODBUS and Ethernet connectivity
- I2C interface for 20x4 LCD module
- USB Type-B interface for programming/debugging
- Opto-isolated digital outputs
- User-programmable buttons (SET and MODE)
- Status LEDs

Board Dimensions:

- 180mm x 140mm x 35mm

Technical Specifications

Power Supply

- Operating voltage: 9-12V DC
- Onboard 3.3V DC SMPS power supply

Measurement Capabilities

- 3-phase voltage inputs (AC RMS, < 250V)
- 3-phase current inputs via CT clamps
- 1 neutral current input via CT clamp

- Energy parameters measured: active/reactive power, voltage, current, power factor, frequency

Compatible Current Transformers

- 20A/25mA SCT-006
- 30A/1V SCT-013-030 (JP1, JP2, JP3 jumpers should be open)
- 50A/1V SCT-013-050 (JP1, JP2, JP3 jumpers should be open)
- 80A/26.6mA SCT-010
- 100A/50mA SCT-013-000
- 120A/40mA SCT-016
- 200A/100mA SCT-024
- 200A/50mA SCT-024

Connectivity

- WiFi (via ESP32)
- Bluetooth (via ESP32)
- MODBUS (RS485)
- Ethernet (W5500 module)
- USB interface for programming and debugging

Digital I/O

- 2 opto-isolated digital outputs (VCC < 80V DC)
    - Meter active energy pulse
    - Reactive energy pulse

User Interface

- MODE and SET buttons for configuration
- RESET button
- BOOT button (for manual firmware upload)
- Status LEDs:
    - MODBUS status
    - FAULT indication

- RUN status
- WiFi status
- OUTPUT1 and OUTPUT2 status
- Power LED

Installation

Mounting

1. Mount the SM-GE3222M in a suitable enclosure, ensuring adequate ventilation.
2. Position the device away from high-voltage components and sources of electromagnetic interference.
3. Secure using the mounting holes provided on each corner of the PCB.

Power Connection

1. Connect a 9-12V DC power supply to the power input terminals (CN1).
2. Verify the power LED is illuminated.

Current Transformer Installation

1. Install CT clamps around the phase conductors (L1, L2, L3) and neutral (if required).
2. Connect CTs to the appropriate inputs (CN3, CN4, CN5).
3. Ensure the correct orientation of CTs for accurate phase measurement.
4. **IMPORTANT**: For voltage output type CTs (SCT-013-030, SCT-013-050), JP1, JP2, and JP3 jumpers must be OPEN.
5. For current output type CTs, these jumpers should be shorted.

Voltage Connection

1. Connect phase voltages to the L terminals.
2. Connect neutral to the N terminals.
3. **WARNING**: All voltage connections must be < 250V AC.
4. **SAFETY NOTICE**: Voltage connections should be made by qualified personnel only.

Network Connection

- For MODBUS: Connect RS485 cable to the MODBUS terminal block.
- For Ethernet: Connect standard Ethernet cable to the RJ45 connector.
- For WiFi: Configure wireless settings via the programming interface.

Connection Diagram

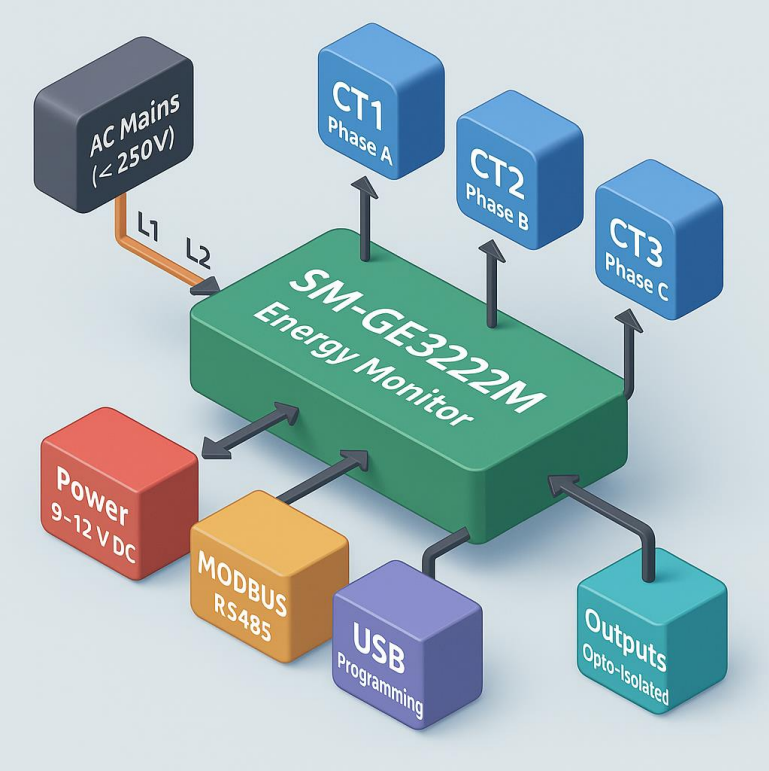


Figure 1: Block Diagram of SM-GE3222M Energy Monitor

Operation and Configuration

Initial Setup

1. Apply power to the device (9-12V DC).
2. The power LED will illuminate, and the RUN LED will begin flashing, indicating normal operation.

Configuration Using Buttons

The SM-GE3222M can be configured using the onboard MODE and SET buttons:

MODE Button (GPIO32)

- Press to cycle through different operating modes and display screens.
- Long press to enter configuration menu.

SET Button (GPIO33)

- Press to select parameters or adjust values within the current mode.
- Long press to save changes and exit menus.

RESET Button

- Press to restart the device and ESP32 module.

LED Indicators

- MODBUS (Yellow): Illuminates during MODBUS communication.
- FAULT (Red): Indicates error conditions.
- RUN (Green): Flashes during normal operation.
- WiFi (Blue): Indicates WiFi connection status.
- OUTPUT1 (White): Active energy pulse output status.
- OUTPUT2 (White): Reactive energy pulse output status.

Power Modes

The ATM90E36 has four power modes, selectable via the PM1 and PM0 pins:

PM1/PM0 Value	Power Mode
00	Normal (N mode)
01	Power Management (M mode)
10	Detection (D mode)
11	Sleep (S mode)

Configure these modes using the power mode selection jumper on the board.

SPI/DMA Mode

The ATM90E36 interface can be configured using the SPI/DMA Mode jumper (J3):

- SPI mode: For standard communication
- DMA mode: For high-speed data logging

Programming and Firmware Updates

Arduino IDE Setup

1. Select "ESP32 Dev Module" or "WEMOS D1 MINI ESP32" as the board.
2. Set the upload speed to 921600 baud for faster programming.
3. Select the appropriate COM port.

Programming Procedure

1. Connect the device to your computer using a USB cable.
2. The device will automatically enter programming mode (no need to press BOOT button).
3. Upload your sketch or firmware from the Arduino IDE.
4. The device will restart automatically after programming.

Manual Programming Mode

If automatic programming fails:

1. Press and hold the BOOT button.
2. Press the RESET button briefly.
3. Release the BOOT button.
4. Upload your sketch from the Arduino IDE.

ESP32 Pin Configuration

Refer to the ESP32 pin configuration tables for available GPIO pins and their functions. Key pins include:

- GPIO32: MODE button
- GPIO33: SET button
- GPIO0: BOOT enable
- GPIO4: DHT22 sensor data
- GPIO5, GPIO18, GPIO19, GPIO23: ATM90E36 SPI interface
- GPIO27: MODBUS control
- GPIO14: Ethernet module select
- GPIO21: I2C SDA
- GPIO22: I2C SCL

Troubleshooting

Power Issues

- Verify 9-12V DC power is correctly connected.
- Check the power LED is illuminated.
- Measure the 3.3V output at test points.

Communication Issues

- MODBUS not working:
    1. Check RS485 wiring
    2. Verify MODBUS address settings
    3. Check MAX485 direction control signal
- WiFi not connecting:
    1. Verify WiFi credentials
    2. Check WiFi LED status
    3. Try positioning the device for better signal strength

Measurement Issues

- Incorrect readings:
    1. Verify CT orientation and connections
    2. Check voltage reference connections
    3. Verify CT type matches jumper settings (JP1, JP2, JP3)
    4. Calibrate the meter using the programming interface

Programming Issues

- Cannot upload firmware:
    1. Ensure external power is applied
    2. Try manual programming procedure
    3. Check USB cable connection
    4. Verify correct board selection in Arduino IDE

Appendix

Pin Configuration Tables

The ESP32 GPIO pins are configured for specific functions. Please refer to the pin configuration tables for detailed information on available GPIOs and their assigned functions.

Safety Considerations

- All voltage connections must be < 250V AC.
- Current transformers should be installed by qualified personnel.
- The device should be installed in a suitable enclosure to prevent electrical shock.
- Always disconnect power before modifying connections.

Supported Libraries

- ESP32 Arduino Core
- ATM90E36 Library
- Wire (I2C) Library
- SPI Library
- WiFi Library
- Ethernet Library
- MODBUS RTU Library
- DHT Sensor Library

Regulatory Compliance

This device is designed for development and integration purposes. When incorporated into a final product, ensure compliance with relevant electrical safety and EMC standards for your region.