
Smart IntelliMeter: Three-Phase Bidirectional Energy Metering Evaluation/Development Board

Introduction:

Smart IntelliMeter is a 3-phase bidirectional energy metering development/evaluation board with an onboard STM8S207 controller. The board can interface a serial I2C display as well as an option for interfacing character LCDs (16x2, 20x2, 16x4, or 20x4) in 4-bit mode. The on-chip EEPROM of the controller is used to store the energy variables as well as calibration constants. The main features of the board are:

- STM8S207 controller with 32K Flash, 6K RAM, and 1K EEPROM
- An on-board 24MHz crystal for maximum processing speed of the controller
- USB Type-C port for serial communication between the board and PC to access measurement data on the PC.
- I2C port for serial interfacing of OLED displays (e.g., 0.96" or 1.3" OLED display or similar)
- 4-bit interface for character LCDs (e.g., 16x2, 20x2, 16x4, 20x4 or similar)
- Additional I/O pins for ADC and other purposes

The board includes ADE7758 24-pin SOIC which can also communicate via SPI communication with any external microcontroller unit to get the energy measurements. The technical specifications of the ADE7758 are:

- Highly accurate; supports IEC 60687, IEC 61036, IEC 61268, IEC 62053-21, IEC 62053-22, and IEC 62053-23
- Compatible with 3-phase/3-wire, 3-phase/4-wire, and other 3-phase services
- Less than 0.1% active energy error over a dynamic range of 1000 to 1 at 25°C
- Supplies active/reactive/apparent energy, voltage RMS, current RMS, and sampled waveform data.
- Two pulse outputs, one for active power and the other selectable between reactive and apparent power with programmable frequency
- Digital power, phase, and RMS offset calibration.
- On-chip, user-programmable thresholds for line voltage SAG and overvoltage detections
- An on-chip, digital integrator enables direct interface-to-current sensors with di/dt output.
- A PGA in the current channel allows a direct interface to current transformers.
- A SPI-compatible serial interface with IRQ

Since there is an onboard microcontroller (STM8S207) available for the communication with ADE7758 metering engine, the board can directly be used after programming of STM8S207 (see “Default Connection” section for more information). However, if the user wants to use their own external microcontroller, refer to the “Custom Connection” section of this manual.

Applications:

- Can be used to measure the energy for any three-phase household appliances.

- Can be used to measure the electrical power parameters of industrial machines.
- Can be used for personal/hobby projects.

Default Connection:

Since there is an onboard microcontroller (STM8S207) available for the communication with ADE7758 metering engine, the board can be directly used after the programming of STM8S207 (programming port using ST Link v2 is shown in Figure 1), and the electrical parameters can be obtained on the displays as well as on the PC. The default connection diagram for this mode is shown in Figure 1.

Note: For factory programmed boards, select appropriate options while ordering.

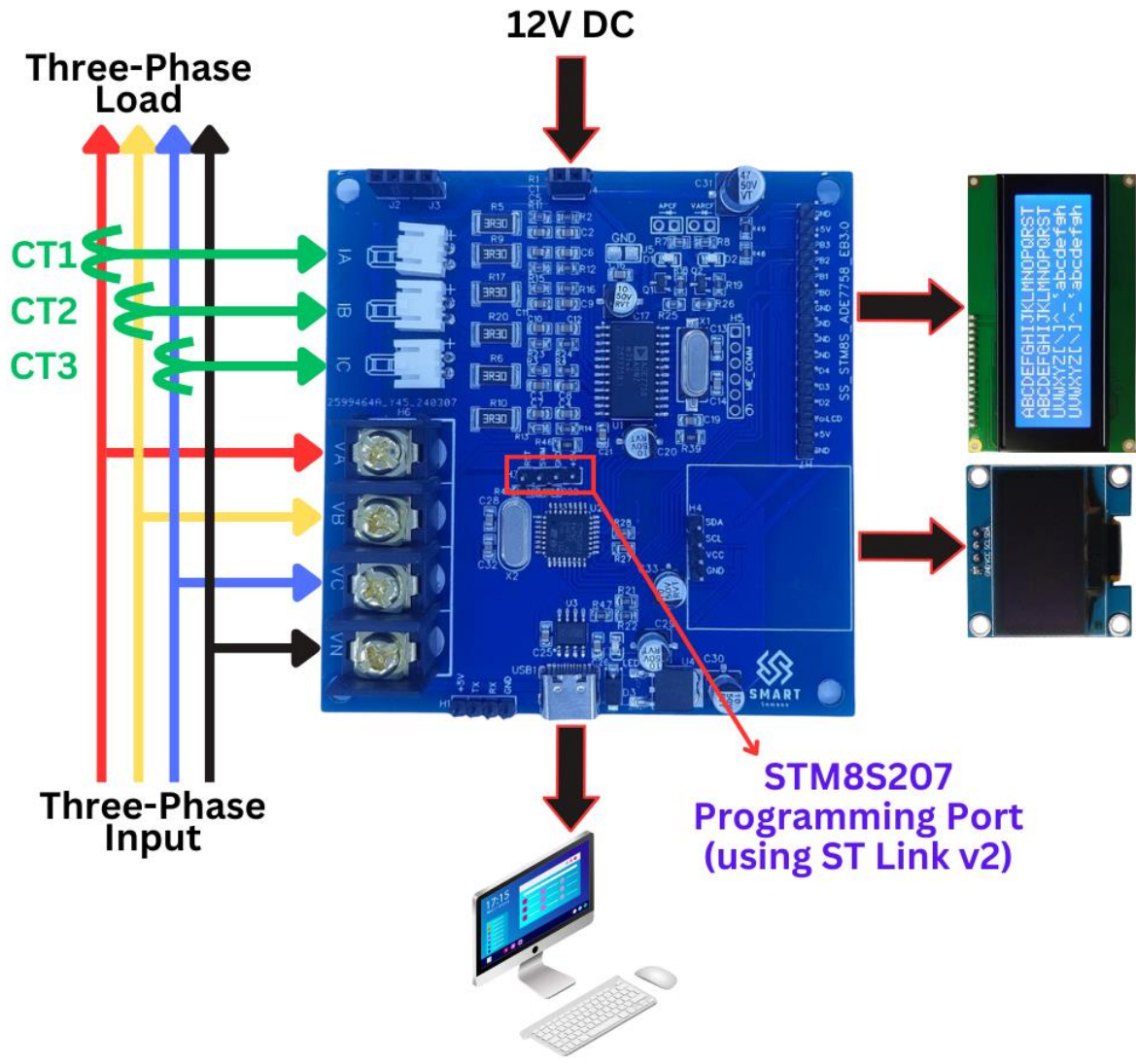


Figure 1: Default connection diagram.

Custom Connection:

If the user wants to use their own external microcontroller, it can be done by placing the STM8S207 in reset mode (connect RST pin of header H3 with GND) and using the header H5 port for SPI communication with any external microcontroller. The connection diagram for this mode is shown in Figure 2.

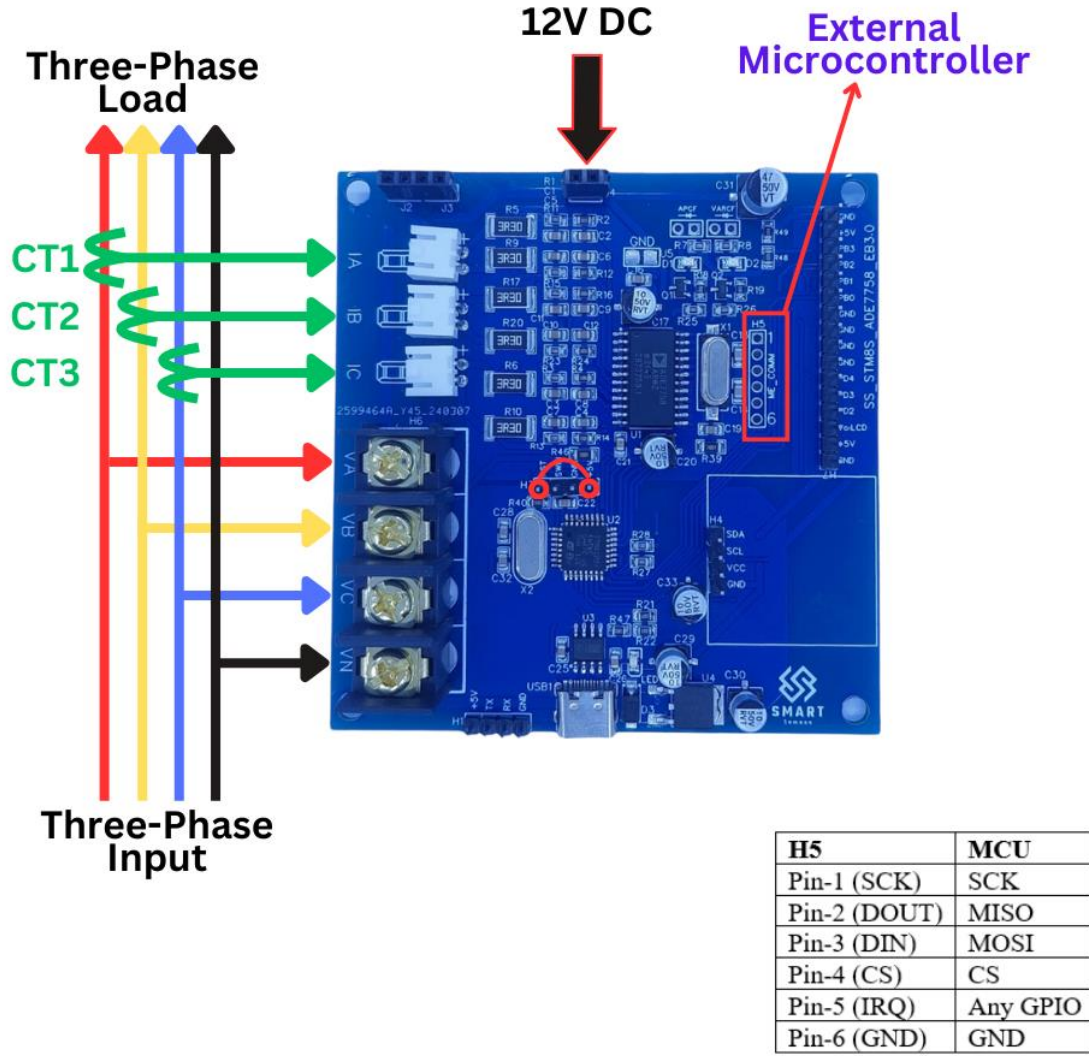


Figure 2: Custom connection diagram.

SMPS Power Supply Unit Integration:

The R&D team of Smart Samaan has developed an EMC compliance-based switch mode power supply board which can be installed on the Smart IntelliMeter board. In this way the Smart IntelliMeter board can be powered internally from the Phase-A of the three-phase input connected to it. The connection diagram for this mode is shown in Figure 3.

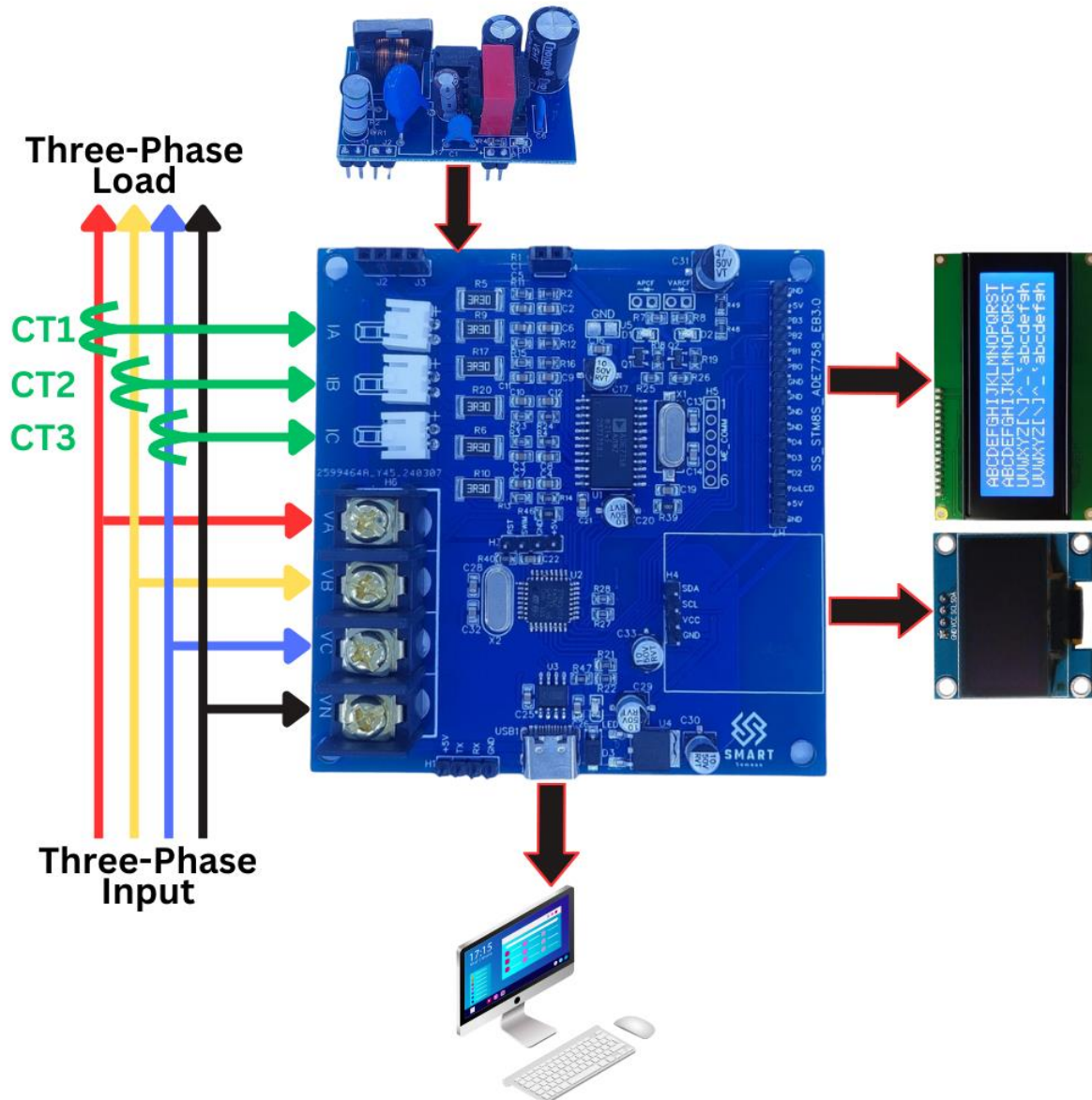


Figure 3: SMPS power supply integration diagram.

Sample Code and Library:

The sample C code and library for the Smart IntelliMeter development board with 0.96" OLED display is available at the following repository: <https://github.com/SmartSamaan/ADE7758-Smart-IntelliMeter>.

Disclaimer: Safety Precautions and Legal Notice

This product is intended for use by trained professionals only. Installation and operation of the Smart IntelliMeter board should be conducted by individuals with the appropriate technical expertise and understanding of electrical systems. It is imperative to adhere to all safety precautions outlined in the provided documentation, including but not limited to, the proper handling of high-voltage components and compliance with relevant electrical codes and regulations.

Warning: The Smart IntelliMeter board is designed to operate with high-voltage electricity. Improper installation, handling, or operation of the board may result in electric shock, serious injury, or even death. Extreme caution must be exercised during all phases of installation, testing, and maintenance to avoid contact with live electrical components.

Limitation of Liability: Smart Samaan and its affiliates shall not be held liable for any damages, losses, or injuries resulting from the use, misuse, or inability to use the Smart IntelliMeter board. Users assume all risks associated with the installation and operation of this product.

Indemnification: By purchasing and using the Smart IntelliMeter board, the user agrees to indemnify and hold harmless Smart Samaan, its officers, employees, and agents against any and all claims, damages, liabilities, costs, and expenses arising from the use or misuse of the product.

Product Modification: Any modification, alteration, or tampering with the Smart IntelliMeter board, including but not limited to, removing safety features or bypassing recommended procedures, voids any warranty and may result in increased risk of injury or damage.

Legal Compliance: Users are responsible for ensuring that the installation and operation of the Smart IntelliMeter board comply with all applicable laws, regulations, and standards in their jurisdiction.

Safety Certification: The Smart IntelliMeter board may not have undergone formal safety certification. Users are advised to verify compliance with relevant safety standards and regulations before deployment.

For Professional Use Only: This product is intended for use by professionals trained in electrical engineering or a related field. It is not suitable for use by unqualified individuals or in residential settings without proper supervision and expertise.

Contact Information: For inquiries regarding safety, installation, or technical support, please contact Smart Samaan at info@smartsamaan.com.