SALEM™-1P

SINGLE-PHASE ELECTRONIC ENERGY METER

OVERVIEW

Analog Devices' SALEM-1P low-cost reference design for a microcontroller-based single-phase energy meter includes tamper detection and resistance. The design is based on an ADSST-EM-1010 chipset, which consists of a microcontroller with built-in analog-to-digital converter (ADC), nonvolatile memory and asynchronous communication port.

Figure 1 shows a block diagram of the SALEM-1P energy meter. In the SALEM-1P meter, the voltage signal is scaled down with a resistor network and then passed through a buffer stage. The current signals pass through current transformers and are then amplified. The conditioned voltage and the current signals are fed directly to the chip for processing. Dual current sensors enable the meter to detect tampering and register energy consumption even in the tampered condition.

HIGHLIGHTS

- ADSST-EM-1010 Chipset-Based Design
- Conforms to IEC-1036 Standard for Class 1 Accuracy at 15 A (Basic)/ 60 A (Maximum) Current
- 110 V/240 V Operation
- Line Frequency of 50/60 Hz
- Measures Active Energy, Frequency and Power Factor
- Measures RMS Value of Current and Voltage
- Tamper-Proof. Detects Earth Tampering
- Infrared Asynchronous Communication Port Conforming to IEC-1107 Protocol
- 8-Digit LCD Display

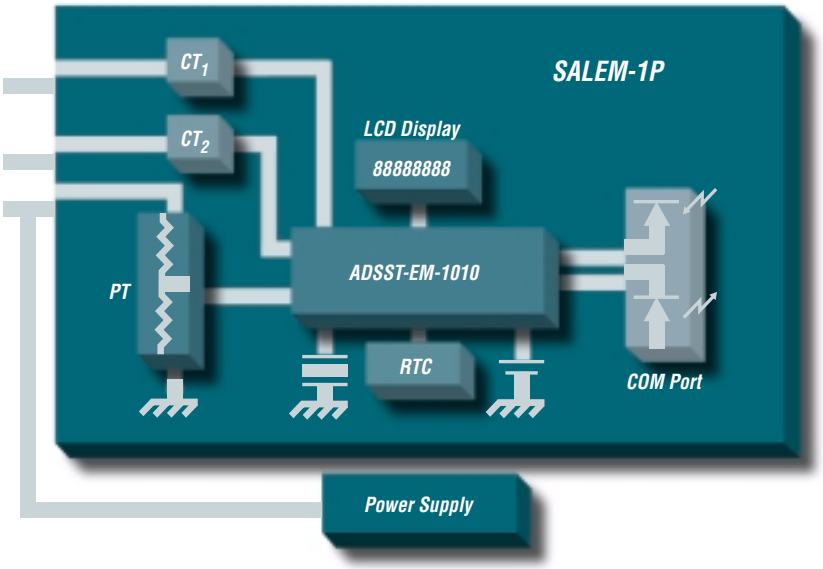

Figure 1. Block diagram of SALEM-1P

ANALOG DEVICES

SALEM-1P

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OPTIONAL FEATURES

- Battery Backup to Read the Meter During Blackouts
- Multi-Tariff Metering with Four Programmable Slots, Based on Time or Load
- Provision of Holiday/ Weekend Tariff

ADSST-EM-1010 Processor

The ADSST-EM-1010 is a low-cost single-chip processor, consisting of a microcontroller, ADC, nonvolatile memory and asynchronous communication port, optimized for standalone applications and an ideal choice for Single-Phase Energy Meters of Class 1 accuracy.

Theory of Operation

The phase voltage is scaled down by a resistor network and then passed through a buffer stage. The current signals are sensed by current transformers and then amplified. These conditioned signals are then fed to the ADC channel of the ADSST-EM-1010 for additional processing.

From the digitized values of voltage and current, the RMS value of voltage, the RMS value of current, frequency, power factor, and active power are calculated over synchronous intervals. The ADSST-EM-1010 computes the energy by integrating these power measurements. The computed active energy is stored in the internal data memory of the ADSST-EM-1010 processor. These parameters are cyclically displayed on the 8-digit LCD display.

The SALEM-1P energy meter will function normally even when tampered by one of the three basic tampering methods, including earth tampering. The tampering event is logged and stored in the internal nonvolatile memory. The on-board LED will indicate such a tampering event and can be reset only with an external terminal after verification of password. Figure 2 shows the internal connection of the meter.

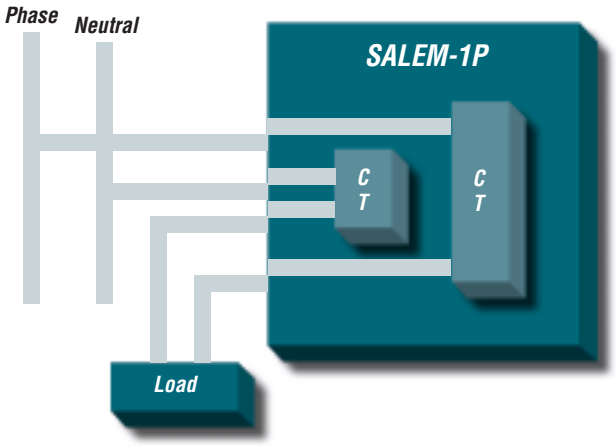

Figure 2. Internal Connection of SALEM-1P

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Calibration/Monitor Program

The SALEM-1P energy meter is calibrated with Windows-based AD-1P software by clicking just a few buttons, and does not require adjustment of any trim potentiometers. The on board impulse LED is useful for checking the meter accuracy. The AD-1P software can be usedto program various slots for time or load for multi-tariff metering, and various computed parameters can also be seen on the computer monitor. OEMs can modify and adapt the AD-1P software for hand-held terminals for automatic meter-reading.

Technical Specifications of Reference Design

- Nominal Operating Voltage: 240 Volts
- Basic Current: 15 Amperes
- Maximum Current: 60 Amperes
- Overvoltage Protection: 400 Volts
- Nominal Frequency: 50 Hz
- Temperature Range of Operation: –25°C to +70°C
- Storage Temperature Range: –40°C to +85°C

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Tamper-Proof

Figure 3 shows the standard connection diagram for the single phase meter.

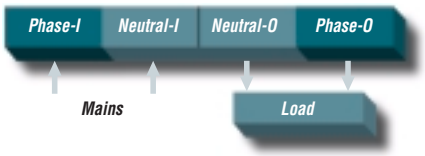
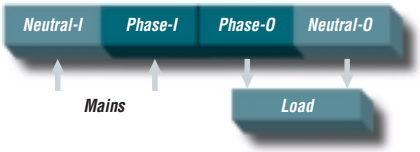


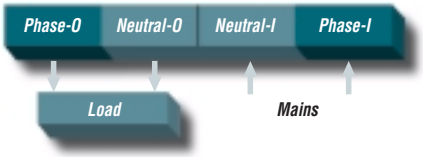
Figure 3. Standard Connection

The SALEM-1P meter can measure active energy even if the meter is tampered by the following methods:

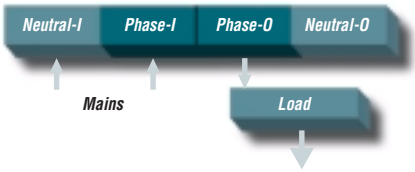
1. Reversal of Mains Phase and Neutral under normal load conditions.



2. Reversal of mains and load connections.



3. Drawings of load current through local earth when Mains Phase and Neutral are interchanged.



Analog Devices, Inc., together with its partner, Technology & Research Pvt. Ltd., are developing the most advanced software system solutions for single phase meter today.

All designs using this software must use ADSST-EM-10XX for ordering the chipset.

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