AD7750 Power Measurement Data Converters

DATA CONVERTERS AND REFERENCE DESIGNS FOR RUGGED, RELIABLE SOLID-STATE ENERGY METERS

While electromechanical energy meters have been popular for over 50 years, a solid-state energy meter can now deliver far more accuracy and flexibility. Just as important, a well designed solid-state meter can lead a longer useful life.

Our reference design, which includes our AD7750 power measurement data converter, has proven it. Studies show that – unlike the accuracy drifts of up to 5% associated with mechanical components in a classic energy meter – our solid-state power measurement data converter has an internal reference that contributes less than 0.05% drift to the energy meter accuracy over 20 years.

As for flexibility, the solid-state AD775x family allows you to benefit from a wide range of added features. Like tamper-resistant readings. Remote readability. Real, reactive and apparent power tracking. RMS current and voltage. Peak current and overvoltage thresholds. Undervoltage threshold. And frequency monitoring. All in reference designs that can be manufactured easily and inexpensively.

The AD7750 and its reference design can change the way you think about solid-state energy meters.

When used with our reference designs, the AD775x family brings a new level of reliability to solid-state energy meters.

FEATURES

- Four quadrant multiplication calculates accurate real power
  - Across all power factors
  - Including harmonics

- Reverse polarity is indicated when negative power is detected

- Many selection modes and frequencies facilitate design with various meter constants

- Fully differential bipolar inputs are available on a single 5 V supply

- Proprietary ADCs and DSP provide stable results across time and environment

- Low frequency complementary outputs directly drive a 5 V stepper motor counter to supply average real power

- Calibration frequency represents instantaneous real power

- Low cost CMOS device is priced at less than $2.00 for 100k units

- Surface mount package option (20-lead wide body SOIC) is available

ANALOG DEVICES

MORE THAN 30 YEARS EXPERIENCE IN HIGH PERFORMANCE ANALOG CIRCUIT DESIGN

Analog Devices has more than 30 years of experience designing, manufacturing and marketing a broad line of high performance linear, mixed-signal and digital integrated circuits that address a wide range of real-world signal processing applications. Our principle products include general purpose, standard function linear and mixed-signal ICs. And system-level ICs. The latter group includes general purpose digital signal processing ICs (DSPs) and more highly integrated, application-specific devices that typically contain analog and mixed-signal circuitry and a DSP core.

PRODUCT SPECIFICATIONS

<0.2% real power measurement error over the range 400% I$_{BASIC}$ to 2% I$_{BASIC}$

On-chip reference 2.5 V $\pm$ 8% (55 ppm/°C typical) with external override

$\pm$ 0.1 degrees phase error between channels at power factor equal to -0.5, 1, $+0.8$

Industrial operating temperature range (-40°C to $+85$°C)

HPF on current channel for dc offset removal

Single 5 V supply and low power (15 mW typical)

Optional voltage-to-frequency conversion on a single channel

THEORY OF OPERATION

The two ADCs digitize the voltage signals from the current and voltage transducers. These 16-bit ADCs are second order $\Sigma\Delta$ with an over sampling rate of 900 kHz. A programmable gain stage in the current channel further facilitates easy transducer interfacing. A high pass filter in the current channel removes any dc component from this signal. This eliminates any inaccuracies in the real power calculation due to offsets in the voltage or current signals.

The real power calculation is derived from the instantaneous power signal that is generated by a direct multiplication of the current and voltage signals. The real power information is extracted by low pass filtering the instantaneous power signal. This scheme calculates real power correctly for non-sinusoidal current and voltage waveforms at all power factors. All signal processing is carried out in the digital domain for superior stability over temperature and time.

The low frequency output of the AD7750 is generated by accumulating this real power information. The output frequency is proportional to the average real power. This average real power information can, in turn, be accumulated (e.g., by a counter) to generate real energy information. The F$_{OUT}$ output is proportional to the instantaneous real power. This is useful for system calibration purposes which would take place under steady load conditions.

AD7750 Single Phase Real Power, Motor Drive Output
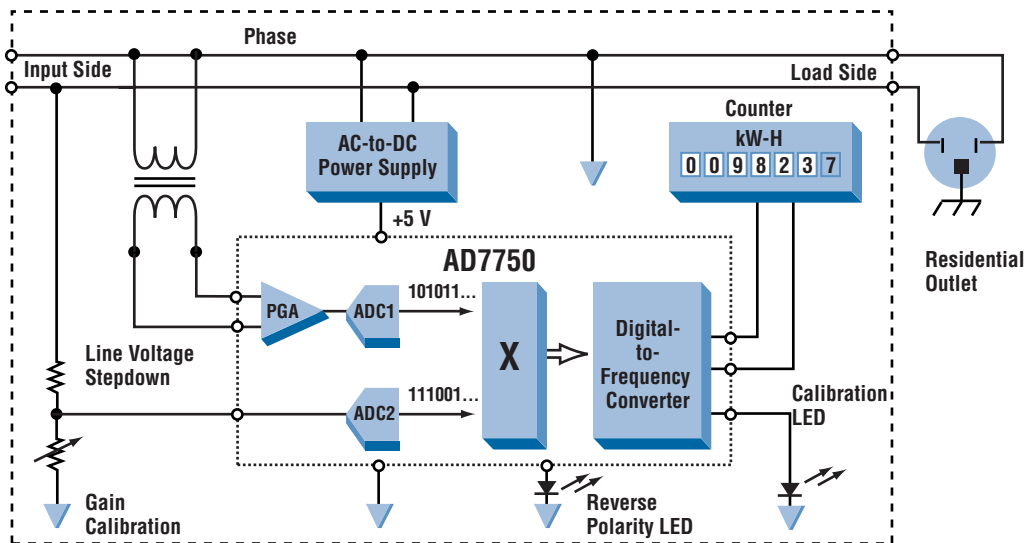
www.analog.com/energymeter

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