Technical Article
Designing for a Scalable Metering Platform

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Everywhere you look, you can find references to "smart" things – smartphones, smart TVs, smart homes and even smart cities. The intelligence of the devices that surround us continues to increase, and perhaps that intelligence is most important in the utility systems that sustain our cities. The world's electricity grids in particular are undergoing a revolution in the control systems that connect generating plants to factories, businesses and homes. What was once a network of electromechanical systems is becoming much more highly automated and driven by ever-more-intelligent devices. These devices form a smarter electric grid that supports a number of trends: from centralized to distributed energy generation; from unidirectional to bidirectional information flow; and from traditional, constant power generation to a variety of renewable generation sources that may change over time.

These smart-grid trends bring improved connectivity, improved robustness in the face of shifting energy demand and greater overall energy efficiency. Microcontrollers (MCUs) are at the core of many devices – such as data collection gateways, fault indicators, remote terminal units and smart meters – that are central to the smart grid.

In this technical article, I'll discuss four important attributes of an MCU in smart grid/smart metering applications.

Large Integrated Memory

Added intelligence in a metering device means more complexity, more intelligence and more code. The smart grid uses a greater number of wired and wireless communication standards than traditional electric grids, and

those standards will change over time while new ones emerge. These conditions drive the need for a large amount of integrated flash storage, both to hold multiple communication stacks and to have the memory needed to support secure, reliable updates on a smart meter host. Over time, wired and wireless communication standard requirements are likely to increase, which means that your choice of MCU should include a platform that allows your design to scale.

Low-power Operation

As power sources become more varied, the supply of electricity may no longer be constant in some locations. Supporting a resilient grid requires low-power devices that can operate for as long as possible, even during power outages, to maintain control and communication. Low power is even more of a concern for nonelectric meters such as gas or water-flow battery-powered meters, whose life expectancy can be 10 or more years.

Accurate Sensing and Measurement

In a smart meter, the MCU is the hub responsible for collecting usage data and reporting it to upstream control nodes. Accurate sensing in the form of precision analog-to-digital (ADC) conversion coupled with higher sampling rates is needed to correctly measure energy or other utility usage. Low-power usage is important here too, since it allows higher sample rates and a more precise picture of utility usage without sacrificing battery life.

Unified Development Platform

Developing systems for the smart metering infrastructure requires the use of multiple MCUs to provide wired or wireless communications as well as metrology and host functions. A unified environment can enable fast and efficient development of new applications by providing validated and documented drivers, communication stacks and code examples. Building a system this way enables easy reuse of application code as the system scales to include more wireless protocols (such as Sub-1 GHz, 2.4GHz and dual-band solutions) or expands to include stack solutions (like Wireless M-Bus, Zigbee, Thread, 6LoWPAN, *Bluetooth*® low energy or other proprietary solutions).

Simplelink™ MSP432™ Mcus

To meet the evolving needs of smart grid devices and more intelligent utility meters, TI has developed the SimpleLink MSP432 line of MCUs. This family offers low-power operation with large flash memory options of 512kB, 1MB or even 2MB. The MCUs contain integrated peripherals targeted at the needs of the smart-grid infrastructure, including a precision low-noise, low-power ADC and a low-power liquid crystal display (LCD) controller. See Figure 1 below for an example of how you can start building your smart meter with the MSP432P4 host MCU.
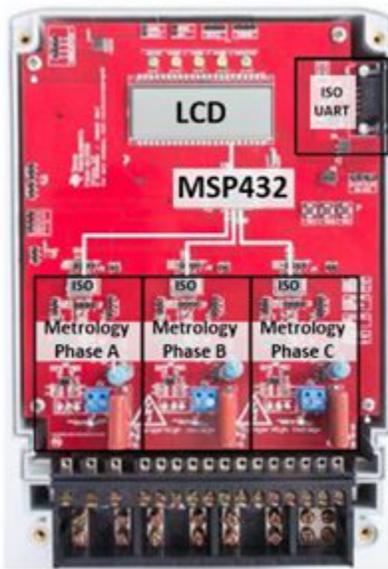
Figure 1. Setup for a smart meter with an MSP432 MCU

All features tie together with the SimpleLink software development kit (SDK), which enables a developer's investment in one device to carry over into the entire product family of SimpleLink wired and wireless MCUs.

Additional Resources

- For more information on how SimpleLink MCUs can help with your MCU-based system, see the TI TechNote, "SimpleLink MSP432P4 – Smart Metering Host."
- Check out the MSP432P4111 SimpleLink mixed-signal MCU, its LaunchPad™ development kit and the MSP432 SDK.
- See the Polyphase Shunt Metrology with Isolated AFE Reference Design.
- Read the application report, "Scaling Across the SimpleLink MSP432P4 MCU Family."
- Watch the training video, "5.2 SimpleLink MSP432 Bluetooth Low Energy OTA with LZ4 Compression."

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