GE Smart Meters: Technology Overview

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Digitally Energy business overview

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<th>Smart Grid</th>
<th>Power Equipment</th>
<th>Prolec GE JV</th>
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<td>Overcoming power challenges to re-energize our planet's energy infrastructure to handle demand the next 100 years</td>
<td>Technology to ensure superior performance, accurate sensing, and industry leading energy efficiency</td>
<td>A reliable line of residential, commercial, and industrial transformers</td>
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<tr>
<td>• Metering &amp; Sensing Sys</td>
<td>• Power Quality</td>
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<td>• Grid Automation</td>
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End-to-end technology and expertise to build a smarter grid
GE metering technology evolution

ANSI Single Phase Meter

I70 AMR

1967

1996

2000

2002

2004

2007

Today

ANSI Poly Phase Meter

KV

KV2

KV2c

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GE’s growing smart meter footprint

Wide deployment of proven technology

*Deployment ongoing
Smart meter components & functions

**The Base**
- Plugs into the “socket” on the home
- Measures current flow with current transformers (CT’s)
- Contains a “service switch” to turn on/off service

**The “Meter”**
- Solid state electronics
- Converts signal from the CT’s and calculates all the metering values
- Displays the information on the local LCD screen

**Communications Module (Radio)**
- Receives metering information from the meter
- Communicates meter information to the utility and homeowner

**Meter Cover**
- Industrial grade plastic (or glass) to protect the meter
- Maintains the utility security “seal”
- Provides environmental protection

**Communications Module**

**Metrology Module**

**Switch**

**CT’s**
I210+c smart meter architecture*

- **AC Line**
- **Power Supply (120 / 240V)**
  - Non-Isolated
  - 3.3V
- **Voltage Sensing**
- **Current Sensing**
- **Relay 200A**
- **Load Side Voltage Sensing**
- **Load**
- **Metrology Chip**
  - **Metrology**
  - **RTC**
  - **UART**
- **LCD Display**
- **Battery / Supercap**
- **Load Profile, TOU**
- **Microcontroller**
  - **Relay Control**
  - **Memory interface**
  - **ANSI C2.18**
- **EEPROM**
  - **Data & Program Parameters**
- **AMI Port**
- **Mux Circuit**
- **AMI Module**
- **ANSI C12.18 Optical Port - PSEM**
- **ANSI C12.19 Std. Tables**

*Note – FPL smart meter deployment features GE I210+ design

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Smart meter data flows

**Collection** (1 second)
- **Metrology**
  - Watt-hours
  - VAR-hours
  - VA-hours
  - Voltages
  - Currents
  - Frequency
  - Temperature

**Calculations**
- **Load Profile Data** (up to 4 channels)
- **Summations** (Overall, Rates A-D)
- **Demands, Coincident Demands** (Overall, Rates A-D)
- **Demand Select**

**AMI-Meter Interface**
- **TX / RX**
  - AMI asynchronously sends requests to Meter and Meter responds
- **Trouble**
  - Meter indicates to AMI need to read event log

**Storage** (1-60 min)

**Communication** (60 seconds)

**Transmission** (Daily)

**Backhaul**
Meter security... a layered approach

Industry Standards
- GE smart meters conform to ANSI C12.18 protocol
- Optical port designed to not allow access to the AMI network

Testing & Validation
- Independent cyber security assessment conducted by internationally recognized 3rd-party
- Recommendations incorporated into product development lifecycle

Monitoring & Response
- Embedded metering technology supports comprehensive self-diagnostic functions
- Enables immediate detection and reporting of tampering, fraud, or irregular operation
## A closer look at meter safety

### Common concerns and mitigating measures

**Physical**

**“Hot socket” event**
- Meters designed and tested to perform to industry standards
  - ANSI C12.1 (i.e., temperature rise, insulation)
  - IEC 60695-2 (heat and flame tests)
  - UL 94 (flammability ratings)

**Over-voltage event**
- Meters designed to over-voltage industry performance standard (ANSI C12.20)
  - Withstand sustained over-voltage of +20%
  - Withstand temporary overloads to 12 kA
  - Withstand surge up to 6kV

### Environmental / RF

**AMI network interface**
- Smart meters emit RF emissions during the transmission of data across AMI network
- AMI radios comply with FCC limits on RF emissions (FCC 47 CFR 15 Class B limits)
- Annual RF emissions from a 15-min daily cell phone call = 375 years of RF emissions from a smart meter in normal operating mode

**Switching Mode Power Supply**
- SMPS used in smart meters and other modern electronics for efficient power conversion
- GE smart meters utilize filtering device to minimize SMPS RF emissions and comply with FCC limits

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