Encompass

GE’s Electronic Metering Family
Encompass Electronic Meters

- Meter traditional Energy and Demand rates for Polyphase and Singlephase applications
- Implement complex Reactive rate designs
- Collect critical Quality of Service and Load Analysis information

... all with one family of GE metering equipment
“GE combined the best features of the kV and kV2 Electronic Meters … and added some new ones … to provide a full product line to encompass both traditional and emerging needs of electric utilities …

.. the Encompass Family of Electronic Meters.”
Encompass Family Models

kV2c – the functionality of the kV2 .. and more

kV2n - designed specifically for network energy applications

kV2c+ - enables addition of the Revenue Guard option board (multi-phase power supply) or the H1 option board (extended support for 480 v delta applications); supports additional memory to store more LP data; designed to support AMR modules with higher power requirements; supports 57 to 120 v applications
Select the functionality that suits your needs today..

- Energy
- Energy and demand
- Time-of-use
- Load profile recording
- Waveform recording
- Power quality

... add functionality later with field-upgradeable option boards and softswitches.

**Meters for Today’s Rates…**
**That Can Expand to Handle Tomorrow’s Requirements**
kV Customers
- All meters include new diagnostic and trouble-shooting features available for immediate or future use
- Enhanced disk analog display
- New rate capabilities
- Additional recording and input/output options
- Reduced reading times possible
- Equal or better performance

kV2 Customers
- Transformer Loss Compensation testing through LED
- “High Voltage” and larger memory option availability
- Equal or better performance
Customer Benefits

➢ kV and kV2 Customers
  ▪ Designed to Enable New Levels of Service and Performance
    • Use of current IC technologies... some of kV components are obsolete
    • Fewer modules and bases... simplified product line
    • Incorporated industry-accepted CT for current sensing
  ▪ Minimal Impact
    ▪ Easy Catalog Number Conversion... the second digit changes from 4 to 8 (74X becomes 78X...)
    ▪ Program conversion utility added in MeterMate 5.00

Tangible Benefits …
More Features, Enhanced Service, Enhanced Performance
## Compatibility and Selection Guide

<table>
<thead>
<tr>
<th>Feature</th>
<th>kW</th>
<th>kW2</th>
<th>kW2c</th>
<th>kW2c+</th>
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<tbody>
<tr>
<td>Modem</td>
<td>x</td>
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<td>RSX</td>
<td>x</td>
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<td>LP-2</td>
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<td>8Mb (H switch)</td>
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<td>Rev Guard Brd</td>
<td>x*</td>
<td>x*</td>
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<tr>
<td>H-1 board</td>
<td>x*</td>
<td>x*</td>
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<td>PS+ (400mA output)</td>
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<tr>
<td>Enhanced Pwr Supply</td>
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<tr>
<td>57-120v Supply</td>
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<td>x</td>
</tr>
</tbody>
</table>

*x* - denotes the meter can have either the Rev Guard board or the H-1 (High Voltage board)

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**A Clear Migration Path….
Backwards Compatibility with kW2 Option Boards**
New network meter (12S/25S)
- Optimized for 120/208 volt network meter applications
- Comes ready to use with factory installed program for kWh rates
- Available as Class 200, 120 volt
- Single piece, tamper-resistant cover

A Factory-Programmed Energy-Only Network Meter
Encompass Family kV2c and kV2c+ have kV2 functionality and ....

- Calibration pulses compensate for TLC
- Additional thermal demand capability
- TF (transformer factor) is a displayable item
- Performs self-reads without having to purchase a load profile recording softswitch
- DC immunity alert (optionally selected as Diagnostic 5)
- Expanded load profile recording capability (kV2c+)
Wide voltage range operation
   • 120 ~ 480 Volts nominally, +10/-20%
     • Capable of metering 600/347 Volt 4-wire wye services
       NOT 600 V delta!
   • 57 ~ 120 Volt version also available (kV2c+)
➢ Class 20, 200, 320 available in S-base
➢ Class 20, 150 available in A-base
➢ Available in all popular forms
   • 1S, 2S, 3S, 4S, 9S, 12S, 16S, 36S, 45S, 56S
   • 10A, 13A, 16A, 36A, 45A, 48A
➢ Fitzall™ option allows form consolidation for inventory reduction
   • 9S, 16S for all TR & SC socket based applications
   • 10A or 48A, 16A for bottom connected applications
- **Energy (kWh) and Active Power (kW)**
  - Present energy & demands plus “last reset” values
    - Delivered only
    - Received only
    - Delivered + Received
    - Delivered – Received

- **“Instantaneous” Values for Display**
  - Per phase Voltage (L-L or L-N) & Current
    - Fundamental frequency only, or with harmonics
  - Active Power (kW)
  - Power Quality measures
    - DPF, THD, TDD, Distortion kVA
    - Frequency
Provides Site Diagnostic Display Scroll

- Automatically identifies the service type
- Per Phase Voltage, Current with Phase Angles
- Power Factor
- Distortion Power Factor (dPF)
  - “Snapshot” at start of display scroll
  - Examples:
    - 0.05 represents 5% Distortion Power (not bad!)
    - 0.40 represents 40% Distortion Power (not good!)
- Diagnostic Counter values
- Reverts back to Normal display scroll when completed.

Diagnostic Options That Enable Application Verification
- Diagnostic 1 - Polarity, Cross Phase, Reverse Energy Flow
- Diagnostic 2 - Voltage Imbalance
- Diagnostic 3 - Inactive Phase Current
- Diagnostic 4 - Phase Angle Alert
- Diagnostic 5 A, B, C, T - High Distortion or DC Immunity
- Diagnostic 6 - Under Voltage, Phase A
- Diagnostic 7 - Over Voltage, Phase A
- Diagnostic 8 - High Neutral Current

You Program the Time That Elapses Before the Alert is Set
Display may be Freezing or Non-Freezing

Individually controlled “enable” & “display” parameters (except CA 000010)

- Loss of Program  CA 000040 *
- Unprogrammed  CA 000010 *
- Low Battery  CA 000001 *
- Potential Low  CA 000400 *
- Received kWh  CA 400000
- Leading kvarh  CA 040000
- Demand Overload  CA 004000 (kW, kvar, kVA, kQ)

* Message clears when condition clears. Other cautions require demand rese before clearing

Optional call-in to report the caution for most conditions

Last four cautions (above) optionally logged in Event Log
- Displayed anytime condition occurs (Freezing or Non-Freezing):
  - Battery & AC Power Fail (Time Loss) Er 000002
  - System Errors (Microprocessor) Er 000020
  - RAM Error Er 000100
  - EEPROM or Flash Error Er 000200
  - ROM or Flash Error Er 001000
  - Voltage Reference Error Er 100000
  - DAP Error Er 200000

- Message clears when condition clears
- Optional call in to report condition

Encompass Electronic Meters Check For and Report Potential Problems
Security Log

- **Demand resets**
  - Total number of resets
  - Date & Time of last reset (TOU/recorder)

- **Programming**
  - Total number of times programmed
  - Date & Time of last programming
  - User ID of last programmer

- **Calibration**
  - User ID of last calibrator
  - Date & Time of last calibration

- **OPTOCOM communications**
  - Total # of communications
  - Date & Time of last communication (TOU/recorder)

- **Outages**
  - Total number of outages
  - Cumulative Duration
  - Date & Time of last outage (TOU/recorder)

Encompass Meters Store Information That May Indicate Tampering
Optional Feature TOU (T Switch)

- Up to 4 TOU periods & 4 Seasons
- Up to 3 daily rate schedule types, plus one holiday schedule
- Up to 80 TOU Schedule set points
- Up to 150 programmable dates (50 in kV)
  - Holidays, Season Change, DST, Self Read, Reset
  - Perpetual calendar handles most dates
- Up to 5 billing & 5 demand measures per TOU period
  - Each demand measure capable of 2 coincident values
- Future activation of TOU Schedule & Calendar possible
- Enables load control output switch capabilities
- Enables Self Read actions on specified dates -- with or without a Demand Reset

Flexible Enough to Handle Simple and Complex TOU Rates…
Adds kvar(h), kVA(h), kQ(h), and PF measurement capability
- kvar(h) may be IEEE defined or “Fuzzy vars”
- kVA(h) may be Phasor, Apparent, or Arithmetic Apparent
- PF may be user defined
  - Traditional (kWh / Phasor or Apparent kVA)
  - Alternative (kWh / Arithmetic Apparent kVA)
  - Displacement PF (filtered to the fundamental frequency)

Coincident Demand/PF capability makes the K switch an even more powerful feature

... As Well As Reactive Rates
Accumulation or Load Profile Recording of these power quality related values:

- Distortion kVA(h) (total and per element)
- Distortion PF (total and per element)
- Total Demand Distortion (TDD)
  - TDD = Total Harmonic Current / Max. Current Per Phase
- Total Harmonic Distortion (THD): \( I_{THD} \) & \( V_{THD} \) per element
- Per phase line currents (A, B, C, N): \( I \) (max, min, store); \( I^2h \)
- Per phase voltages (L-L, L-N): \( V_A \), \( V_B \), \( V_C \), (max, min, store); \( V^2h_A \), \( V^2h_B \), \( V^2h_C \)
Optional Features Per Element (M Switch), By Quadrant (B Switch)

- **Per Element Measurements (M softswitch)**
  - Accumulation or Load Profile Recording of these “per element” values:
    - kWh & kW Demand
    - kvarh & kvar Demand *
    - Apparent kVAh & kVA Demand *
      - Also adds per element, per quadrant for Apparent kVA(h)

- **By Quadrant Measurements (B softswitch)**
  - Allows the enabled measurements to be tracked by quadrant
    - kWh and kW demand
    - kvarh and kvar demand *
    - kVAh and kVA demand(Phasor, Apparent, Arith. Apparent)*

*Also requires a K soft switch
Monitors all phases for voltage sags and swells

- Independently set magnitude threshold for sags and swells
  - 0~100% of Reference Voltage in 1% increments
- Duration threshold from 1 to 65,535 cycles (18.2 min. @ 60Hz)
- Event ends when all phase voltages are within tolerance
- Voltage Event log is separate from regular Event Log (E switch)
- Separate sag and swell event counters (65,535 events max.)
- For each of the most recent 200 events, the Log captures:
  - Event type (sag or swell)
  - Max (swell) or Min (sag) RMS cycle voltage for each phase
  - RMS current coincident with voltage max/min
  - Duration of the event (in cycles -- up to 65,535)
  - Date/Time recorded if meter is in Demand/LP or TOU mode
Enables capture of sample data from the kV2c

- 6 sets of 70 samples each (3 voltages, 3 currents)
  - 54.7 samples per cycle, per phase, @ 60 Hz

- MMCOMM command triggers the data capture
- MMCOMM generates harmonic analysis reports for each voltage and current input
- Power Analysis report also generated
- Capture the data Locally or Remotely
Other softswitches available in the kV2c and kV2c+:

- A Switch  Alternate Communication (“enabled” as standard in all meters)
- C Switch  Call In on Outage (switch is “set” within Modem option board)
- D Switch  DSP Sample Output (“enabled” as standard in all meters)
- E Switch  Event Log
- I Switch  Instrument Transformer Correction
- L Switch  Transformer Loss Compensation
- P Switch  Pulse Initiator Output (“enabled” as standard in all meters)
- R Switch  Basic Recording (Four-channel, 64 kB memory)
- X Switch  Expanded Recording (20-channel, 192 kB memory)
- Z Switch  Totalization

The softswitches below are available in the kV2c+ only:

- G Switch  Revenue Guard Plus
- H Switch  Advanced Recording (20-channel, 384 kB memory)

Flexibility That Lasts…
Softswitches May Be Moved From One kV2c to Another
4-Channel Recording (R softswitch)
- Enables up to 4 channels of load profile recording in 64KB of on-board memory

Expanded Recording (X softswitch)
- Enables up to 20 channels of load profile recording in 192KB of on-board memory

Additional Recording kV2c+ only (H softswitch)
- Enables up to 20 channels of load profile recording in 384KB of on-board memory

<table>
<thead>
<tr>
<th>Channels</th>
<th>Interval Size</th>
<th>Softswitch</th>
<th>R</th>
<th>X</th>
<th>H (kV2c+ only)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>R</td>
<td>X</td>
<td></td>
<td>H (kV2c+ only)</td>
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<td>4</td>
<td>15</td>
<td>20</td>
<td>60</td>
<td>60</td>
<td>181</td>
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<tr>
<td>20</td>
<td>NA</td>
<td>NA</td>
<td>13</td>
<td>39</td>
<td>26</td>
</tr>
</tbody>
</table>

Maximum Flexibility…
Select the Memory Option that Best Suits Your Application
- **Call-in On Outage (C softswitch)**
  - Enables automated “call-in” to report an outage
  - Requires a communication option board and the call-in-on-outage battery pack
  - “C” Softswitch stored in communication option board (not in the meter)

- **Revenue Guard Plus (G softswitch: requires Revenue Guard Option Board)**
  - Allows a 3-element meter to revert to 2 1/2 element operation upon the loss of any (one) voltage input on a 4-wire wye service
  - Optional Event Log entry is made when meter reverts to 2 1/2 element operation
  - “Loss of phase voltage” condition tested every 5 seconds when in 3-element operation mode (less than 1/2 of expected voltage)
  - Three consecutive failures triggers 2 1/2 element operation
  - Reverts to 3-element operation after a programmable timeout and resumes testing for “loss of phase voltage” condition
Ability to select the event types that are logged and the number of occurrences to track - up to 500 occurrences max.

Date & time of event is logged when meter equipped with Load Profile and/or TOU options

Logged Events include
- Diagnostics 1~8: when set & when cleared
- Cautions: Under voltage, Demand overload, leading kvarh, reverse energy flow -- when set & when cleared
- Real Time Pricing activation and deactivation
- Test Mode activation and deactivation
- Externally initiated meter reading (local or remote)
- Programming sessions
- Power up, power down
- Demand resets
- Self Reads
- Revenue Guard Plus activation

A Log of Events That Occur On Your System
Changes Made

- Allows users to create and optionally use an alternate set of calibration constants.
- Input the CT and VT ratio and phase angle correction factors for the instrument transformers used at that installation.
- MMCOMM uses those factors, plus the original factory calibration constants, to calculate new calibration constants.
- The adjusted calibration constants are stored separately from the original factory constants.
- MMCOMM allows users to choose whether to apply the alternate set of calibration constants or not (makes calibration testing easier.
- All measurements, including the Test LED output, are affected.

Encompass Meters allow you to match the specifics of an installation.
Transformer Loss Compensation Option (L Switch)

- Allows users to create and optionally use a set of transformer and line loss coefficients to compensate watts and vars
- Losses may be added to, or subtracted from, the metered values
- Input the no-load and load loss data for the power transformers and conductors used at that installation
- MMCOMM translates the data into compensation factors to be optionally used by the meter
- Original factory calibration constants are unaffected
- MMCOMM allows users to choose whether to apply the loss compensation factors or not (makes field calibration testing easier)

Thus Improving Your Ability to Measure & Bill on True Cost of Service
Enables combination of data from up to 5 meters
- 4 external meter inputs plus the kV2c metered data
- External inputs require use of the Multiple I/O option board

Up to 8 data combinations allowed -- “totalization maps”
- Add or subtract inputs with the same engineering units
- May use one totalization channel as input to a second totalization channel

Enables data scaling of external pulse inputs
- External inputs may be recorded and displayed as unscaled raw pulse counts without the Z soft switch installed

The Encompass Meters Also Support Totalization
Option Boards

- **Simple I/O**
  - 2 Three-Wire Outputs
  - 1 Two-Wire Output
  - 1 RTP Input

- **Multiple I/O**
  - 2 Three-Wire Outputs
  - 6 Two-Wire Outputs
  - 4 Pulse Inputs (Three-Wire or Two Wire)
  - 1 RTP Input

- **Internal Modem**
- **RSX Communications** (RS-232/485 or ext. modem)
- **ModBus Communications**
- **Revenue Guard - 3 phase power supply** (kV2c+)
- **H-1 High Voltage Board** (kV2c+)

**Communication and I/O Options to Match Your Requirements... and More to Come...**
Windows-based .. Supports Win98, Win98SE, Chinese 98, WINNT, WIN2000 and WINXP

Integration of program manager & profile manager into one executable, MMPROG

Conversion utility for converting kV and kV2 programs into kV2c programs

Support for Win and Soft modems

New PSEM dll’s for faster communication

Support for USB-RS232 converters & USB-SMARTCOUPLERs

Save and print phasor graphs

Softswitches and service can be displayed

Ability to generate up to 10 reports at once from reader files
Conversion Utility

- Existing kV and kV2 programs are converted into kV2c programs
- No difficulty for user; easy program identification
  - Programs are created with same program ID
  - Existing kV and kV2 programs are still available
- Simple to use
  - MMCOMM takes care of displaying correct programs for meter being programmed

- kV I/O support editors are converted into kV2C I/O support editors
Equipped to meter your simplest and most complex rates
Field upgradeable to allow changes required by you or your end customer
Part of your inventory management program via use of the Fitzall™ feature
Enhancements that take the reliability of GE’s existing electronic meters to an even higher level
Paving the way for enhanced service by providing one cost-effective product platform

Encompass Electronic Meter Family – Meets Your Metering Needs of Today and Tomorrow
Appendix – Optional Slides
Introducing the Encompass Family of Meters for Polyphase and Singlephase applications... for Basic and for High End Meter Applications

“GE combined the best features of the kV and kV2 Electronic Meters... added new features... simplified their product line... and delivers their best electronic meter family yet... the Encompass Family of Electronic Meters.”
Available in kV2c and kV2c+

- **A Switch** Alternate Communication
- **B Switch** By-Quadrant measurements
- **C Switch** Call In on Outage (Modem) *
- **D Switch** DSP Sample Output
- **E Switch** Event Log
- **I Switch** Instrument Transformer Correction
- **K Switch** kVA - Power Factor, kvar and kVA measures
- **L Switch** Transformer Loss Compensation
- **M Switch** Expanded Measures - per element measurements
- **P Switch** Pulse Initiator Output
- **Q Switch** Power Quality Measures
- **R Switch** Basic Recording (Four-channel, 64 kB memory)
- **T Switch** Time of Use
- **V Switch** Fast Voltage Event Monitor and Log (Sag and swell, 1 to 65k cycles)
- **W Switch** Power analysis (70 sample sets - 6 measures per set - V & I per phase)
- **X Switch** Expanded Recording (20-channel, 64 kB memory)
- **Z Switch** Totalization

Available in kV2c+ Only

- **G Switch** Revenue Guard Plus
- **H Switch** Advanced Recording (20-channel, 384 kB memory)

Legend:
* Set in all meters
** Set in Comm board, not meter, may not be removed once set.

Notes
- 16 of these are sold in switch holders
- Soft switches may be moved from meter to meter in kV2c & kV2c+

16 of these are sold in switch holders
Soft switches may be moved from meter to meter in kV2c & kV2c+
<table>
<thead>
<tr>
<th>Component</th>
<th>kW</th>
<th>kV2</th>
<th>kW2n</th>
<th>kW2c</th>
<th>kW2c+</th>
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<tbody>
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<td>744x</td>
<td>784x</td>
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<td>A-Base</td>
<td>745x</td>
<td>785x</td>
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<tr>
<td>Switchboard</td>
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<td>786x (future)</td>
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<tr>
<td>Switchboard</td>
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<td>783x (future)</td>
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</table>
Current Sensing

- Designed with high performance current transformers
  - Construction enables high quality & long life
  - High stability with mechanical stress and temperature variation
  - Enhanced linearity in ratio & phase over a wide range of operating conditions
  - Excellent magnetic properties including low losses
Encompass Family kV2c and kV2c+ have kV2 functionality and ....

- Calibration pulses compensate for TLC
- Additional thermal demand capability
- TF (transformer factor) is a displayable item
- Performs self-reads without having to purchase a load profile recording softswitch
- DC immunity alert (optionally selected as Diagnostic 5)
- Unsealed passwords
- Expanded load profile recording capability (kV2c+)

Responding to Our Customers’ Needs... Committed to the Industry