Bitronics
Distribution
Grid Monitor

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Bitronics Distribution Grid Monitor

Built around the Bitronics® M661P3, the Distribution Grid Monitor (DGM) can be deployed on the distribution feeder to interface with Lindsey and other pole top sensors. The DGM provides essential real-time measurements that enable Distribution Management applications to better manage voltages and maintain high power quality. The DGM calculates better than 0.5% accurate voltages, currents, power, energy, and fault data from raw sensor measurements. A typical DGM system, with a simple part number designation, consists of the M661P3 pole top monitor, a local PPXIITD detached display, a NEMA enclosure, and a shelf for utility supplied radio, all packaged as one offering with Lindsey GEN2 sensors and supporting cables.

Why a Distribution Grid Monitor is Needed

Conditions within the distribution grid system are changing. Historically, voltage regulation devices and models accommodated only unidirectional power flow with line voltages dropping predictably along feeders from substation to customers. But larger scale integration of Distributed Energy Resources (DERs) is rendering traditional models and regulation techniques incapable of maintaining delivered voltages within ANSI C84.1 guidelines. New approaches are required for grid measurement, monitoring and control.

DER Integration and the Voltage Control Problem

- Increasing integration of renewables means variable load and generation fluctuations which work against the constant voltage profile. Distribution lines with high integration of DER require more supervision to maintain a flat voltage profile.

- Solar and wind DERs are, by nature intermittent. Managing unpredictable intermittency without measurement, monitoring and control is becoming much more difficult.

- In most cases, the utility cannot dispatch or monitor DERs.

- When renewables are switched in and out, voltage levels local to the injection point may increase or decrease outside ANSI guidelines.

- Voltage rises at injection points may create reverse systemic power flow. End-of-line voltage could be higher than other points on the line.

- Intermittent behavior of DERs may result in oscillatory voltages in the system.

- Combining Conservation Voltage Reduction (CVR) with DERs further complicates control scenarios.

- Customer demands for high power quality are increasing.

Meeting the DER Integration Challenge

Advanced Distribution Management Systems (ADMS) and modern Integrated Volt-VAR Optimization systems (IVVO) can manage DER integration, but need real-time data to implement their control strategies. The Bitronics DGM provides these data, including accurate voltages, loads, reactive power and fault data.

DGM: More than a Meter

The DGM is more than a meter in a box. The heart of the DGM – the M661P3 transducer – includes a preconfigured analog front-end that accepts the output from medium voltage sensors instead of from traditional CTs and PTs. These less-costly sensors provide safe, nominal 0-10V ac signals representing all measured voltages and currents, and can be installed without taking an outage.

The combination of M661P3 and medium voltage sensors deliver average and instantaneous measurements via DNP3 to SCADA with an accuracy of 0.5%. The M661P3 updates measurements once per cycle and calculates both averaged and instantaneous values, accommodating slow poll rates. Reported voltages are "normalized" to 120.00V when the line is operating exactly at its nominal value. Load currents, fault currents, 51 pickup, power factor, and real and reactive power are all available as accessible DNP3 values, in addition to voltages.
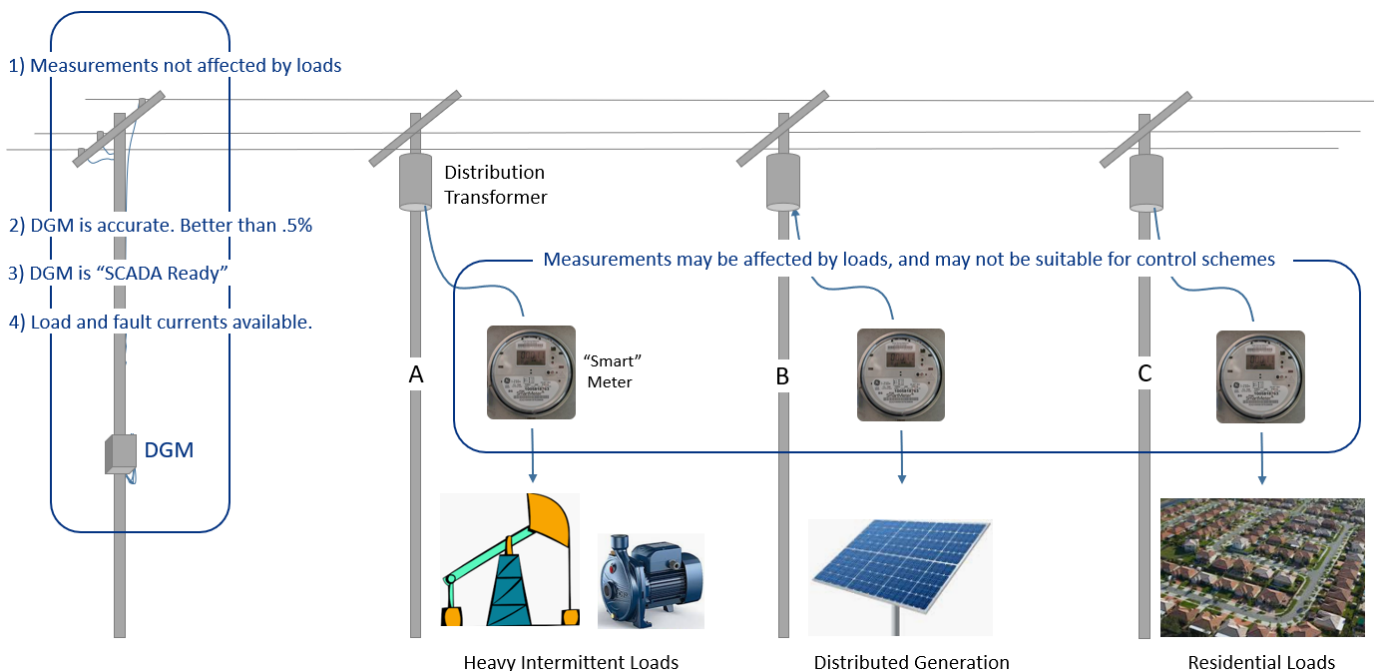
Unique physical features include 12W power out (12V @ 1A) for the user-supplied radio, as well as an external, replaceable surge suppressor circuit, door switch, and security sleeves over sensor connectors.

Applications for DGM

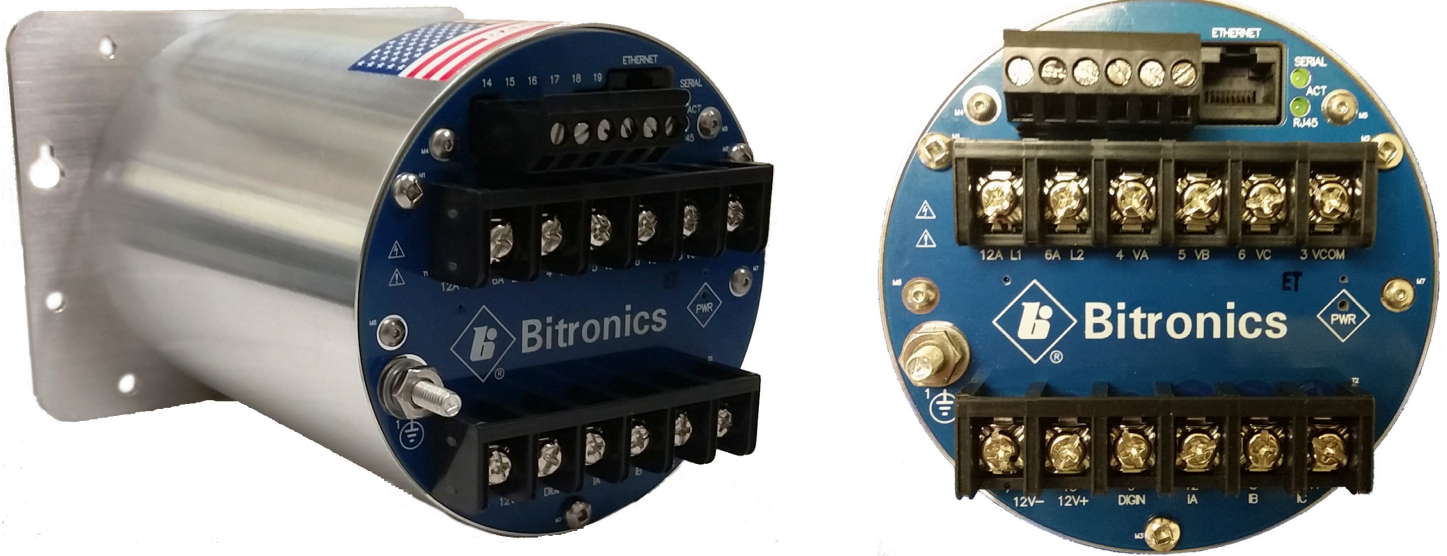The Bitronics DGM provides data to monitoring and control systems to better manage the Grid.

• Provides voltage measurements to DMS and VVO systems, from the end-of-line and along the feeder
  ◊ Supports applications with high integration of DERs where voltage delivery cannot be easily modeled, and where voltage control schemes require additional real time measurements
  ◊ Supports applications requiring reported voltage to an accuracy of 0.5% or better, from sensor to DNP value
  ◊ Supports applications where measurements must be rapidly presented to perform control

• Provides fault detection to DA schemes for Fault Location, Isolation and Service Restoration (FLISR)
  ◊ The Bitronics DGM provides a Definite Time Overcurrent protective relay element

• Provides Peak Fault Currents to for Fault Location and Asset Management
  ◊ The DGM records three-phase peak fault currents and presents data as DNP3 values

• Provides real and reactive power measurements, and power factor, for capacitor control schemes

The Bitronics DGM Difference

1) Measurements not affected by loads
2) DGM is accurate. Better than .5%
3) DGM is "SCADA Ready"
4) Load and fault currents available.

DGM

Distribution Transformer

Measurements may be affected by loads, and may not be suitable for control schemes

A   "Smart" Meter   B   C

Heavy Intermittent Loads   Distributed Generation   Residential Loads

Bitronics M661P3

The M661P3AL13 transducer is the heart of the DGM system.

Product Details

Measurements
- Full measurement set including volts, amps, watts, VARs, kWh, demands, peaks and frequency
- Peak fault currents and time overcurrent pickup
- Voltage measurements: 0.2% of reading (3.5 to 20Vrms)
- Current Measurements: 0.25% of full scale (200Vrms input to transducer)
- Updated every cycle
- 12 V dc @1A (12W) power for radio
- 10 V ac input for three-phase volts and currents
- Fault indication using a definite time overcurrent relay element (ANSI code 51)
- DNP3 output via radio, Ethernet or serial
- Connects to multicore Lindsey Sensors and other pole-top sensors

Environmental
- Operating temperature range:
  - -40 to +70°C, operating temperature
  - -40 to +85°C, storage temperature
- Humidity: 0-95% non-condensing
- Surge withstand: ANSI/IEEE C37.90.1: 2002
- Surge Voltage: IEEE C62.41-1991

Specifications (M661P3)
Dimensions: 4" H x 5.25" W x 6.34" D
(102mm H x 133mm W x 161mm D)

Weight: 1.8 lbs. (.81 kg)

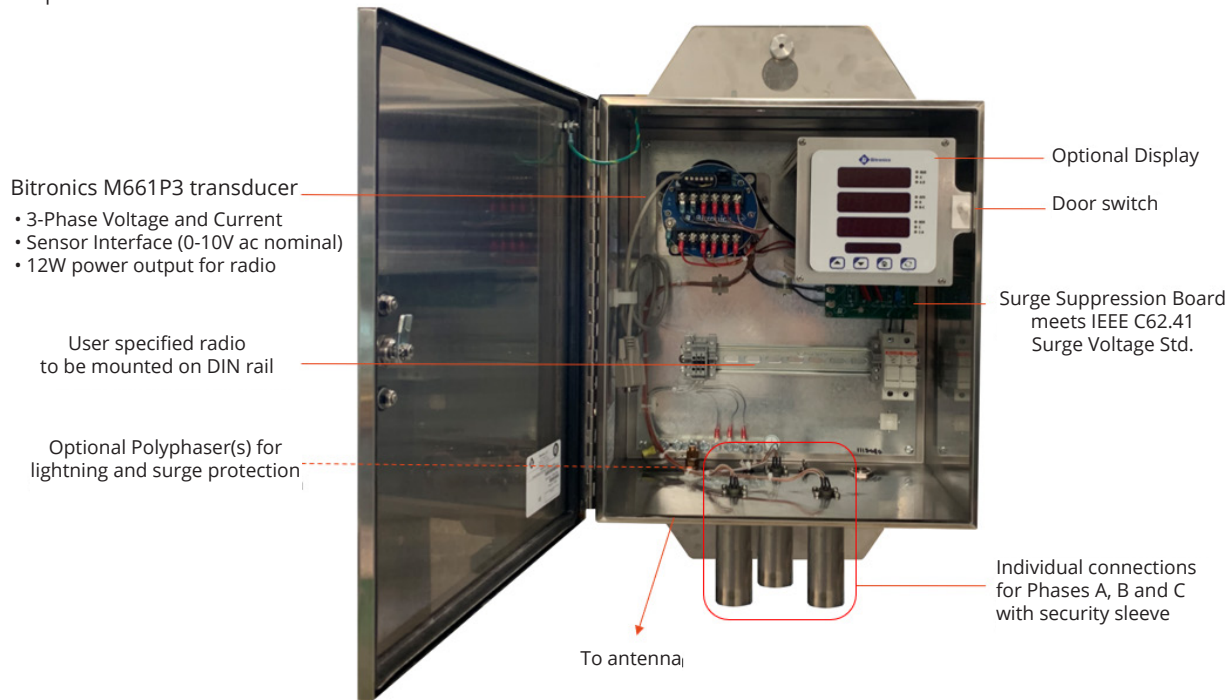Power Supply: 120V ac or 240V ac

Voltage Inputs:
- Four terminals (A, B, C, and Common)
- Present 1MΩ load to the voltage sensor. Up to 20V ac

Currents:
- Three terminals
- Input impedance > 10Kohm, nominal
- Inputs are 10Vrms (representing 600A rms)
- Accommodates peaks of 200V rms for measuring fault currents

Inputs/Outputs:
- RJ45 10BaseT/100BaseTX port for service port functions and protocols
- Serial port RS-232/RS-485 four-wire and one binary input
- Internally-wetted input for door switch

Bitronics M661P3 transducer
- 3-Phase Voltage and Current
- Sensor Interface (0-10V ac nominal)
- 12W power output for radio

User specified radio
to be mounted on DIN rail

Optional Polyphaser(s) for
lightning and surge protection

Optional Display

Door switch

Surge Suppression Board
meets IEEE C62.41
Surge Voltage Std.

Individual connections
for Phases A, B and C
with security sleeve

To antenna

The DGM Enclosure

The M661P3 is provided in an enclosure with the following:
- Powder-coated steel ANSI 61 Gray 16"x14"x10" NEMA 4 or Stainless Steel NEMA 4X enclosure with brackets with bolt holes for mounting to pole
- Bitronics PPXIITD display to provide local indication of measurement values
- Door switch connected to binary input on M661P3 to provide alarm on door opening
- Security sleeves (over bayonet connectors on sensor cables)
- Polyphasers to protect antenna
- Surge suppression board
- Provision for accommodating user-provided radio on shelf

Lindsey GEN2 Post Insulator Sensors and Cables

- Less than one half the weight of Lindsey Polysil-based sensors
- Hotstick-friendly conductor keeper with washer-less bolts accommodate a wide range of conductor sizes
- Glove-friendly cable with bayonet-style connectors that "snap" when properly tightened
- 0.5% voltage accuracy, with flat harmonic response, and no phase shift. 1% current accuracy with no phase shift.
- Voltage and current accuracy is independent of weather and conductor diameter
- Safe, low voltage, low current outputs
- Hydrophobic cycloaliphatic epoxy provides high performance in polluted and wet environments

*GEN2 Sensor
shown with "keeper" open
and closed on cable*

Sensor resister divider and tank circuit
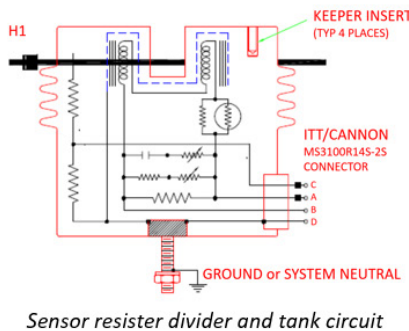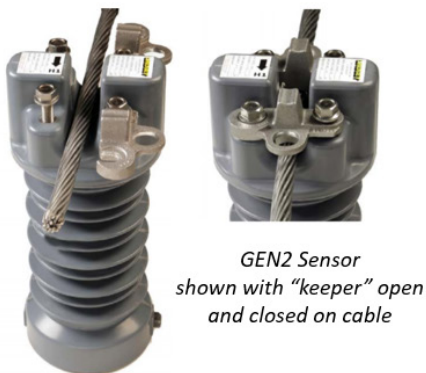
Durable bayonet-style connectors

Lindsey sensors being installed on energized distribution feeder

Ordering a DGM

The part number for the DGM is simple: DGM-60-XX-Y where:

   XX = The sequential number corresponding to the specific elements requested by the customer

   Y = The number of sensors (0 where the customer supplies the pole-top sensors, or 1, 2, or 3 depending upon the number of phases to be monitored)

Two previously-created DGM part numbers are detailed below. These can be ordered or used as a reference for equipment selection.

BOM	Southwest Utility	New England Utility
Part Number	DGM-60-02-3	DGM-60-03-3
Transducer	Bitronics Part # M661P3AL13	Bitronics Part # M661P3AL13
Firmware	v2.52	v2.52
LED Display	Bitronics Part # PPXIITD	Bitronics Part # PPXIITD
Door switch	included	included
Radio	various (supplied by user)	SierraWireless AirLink RV55 (supplied by user)
Radio (mounting bracket)	projection-mounted shelf	DIN rail mount (supplied by user)
Radio (power)	12V regulated output from M661	12V regulated output from M661
Sensors	Lindsey Part # 9E650/E1106: 15kV Multicore (GEN2)	Lindsey Part # 9E650/E1106: 15kV Multicore (GEN2)
Cables (sensors)	3 x Lindsey Part # 9-789/45/9-793: 1 cable per phase, bayonette-style Amphenol connectors	3 x Lindsey Part # 9-789/45/9-793: 1 cable per phase, bayonette-style Amphenol connectors
Power (source)	120V ac supplied by tapping into nearby dist. transformer	120V ac supplied by tapping into nearby dist. transformer
Power (surge supression)	2A slow-blow fuses plus MOV board	2A slow-blow fuses plus MOV/TVS board
Power (cable)	45' length, SOOW-14/3 cable	45' length, SOOW-14/2 cable
Cable: transducer to radio	included	included
Cable: radio to antenna	supplied by user	supplied by user
Antenna	supplied by user	supplied by user
Surge suppression (antenna)	2 x PolyPhaser TSX-NFF (698MHz-2.7GHz)	n/a
Door handle	Hammond Part # EJPA: padlock adaptor	Hammond Part # EJPA: padlock adaptor
Heater	n/a	n/a
Time sync	DNP3 (SNTP if TCP/IP radio link is available to transducer)	DNP3 (SNTP if TCP/IP radio link is available to transducer)
Tamper sleeves	n/a	3 x 1⅝" x 5" stainless steel cylinders
Box material	ANSI 61 Gray powdercoated mild steel	Stainless steel, brushed finish
Box dimensions	16"x14"x10"	16"x14"x10"
Box environmental rating	NEMA 4	NEMA 4X
Attachment to pole	plate with key-holes C/L top and bottom for lag bolts	plate with key-holes C/L top and bottom for lag bolts

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