

Introducing

GreenEye Monitor

AVAILABLE IN TWO VERSIONS:

Residential Single/Split Phase Systems

Three Phase commercial, light industrial

The GreenEye Monitor (GEM) is a multi-channel energy consumption monitor. Its primary purpose is to measure energy used by each of the various branch circuits of an electrical service panel. Measured data is then updated every second.

The GEM also includes temperature sensing and pulse counting inputs. It can accept pulses from water or gas meter which have pulse outputs and provide consumption information.

FEATURES

- 32 Power Monitoring Channels
- Measures “**True**” Power and Energy
- May be used for “NET Metering” of Solar and Wind Power Systems
- Capable of Monitoring Single or Split-Phase Systems (for 3-phase systems the “GreenEye Commercial” is required)
- Multitude of Communication Options Available: RS-232, WiFi, Ethernet, ZigBee
- Four Pulse Counter Inputs for Water or Gas Consumption
- 1-Wire Bus© for Temperature Sensing
- Concealed Lead Connection for Clean Installation
- Variety of Data Hosting Options



APPLICATIONS

The versatility of the GEM makes it ideal for a variety of applications:

1. Whole house monitor
2. Monitoring multiple dwelling or apartment building with 120V/240V electrical system. (3-phase electrical systems require the GreenEye Commercial version)
3. Wind or solar system net monitoring

CHANNELS

The GEM has 32 identical channels with the following capabilities:

- Measures “True” (Real) Power. This is what the power company charges for
- Compatible with any Brultech CT
- Monitor NET energy for Solar or Wind generating system

POWER/ENERGY MEASUREMENT

RESIDENTIAL VERSION (SINGLE OR SPLIT PHASE SYSTEMS)

- More than 32 individual breakers may be monitored. Two breakers may be ganged on a single channel. **(This does not apply to 3-phase commercial loads)**
- Ability to monitor a 120V or split-phase 120V/240V load on a single channel
- Double breakers with no neutral can be monitored with 1 CT

COMMERCIAL VERSION (3- PHASE, SINGLE OR SPLIT PHASE SYSTEMS)

- Compatible with four wire WYE 120V/208V services
- Capable of monitoring four wire Delta services
- **NOTE:** For 3-phase installations, each load phase requires a separate dedicated channel/CT

COMMUNICATION

The communication ports are used initially for GEM setup. Once all parameters have been configured, the port is used to transfer real-time data to the data host.

All GEM models incorporate two RS-232 ports COM1 and COM2. Other available communication options are:

- WiFi/Ethernet (uses COM1)
- ZigBee® (XBee® Module uses COM2)

The GEM provides a variety of “packet formats” and API options for transferring data to a host for storage, analysis and viewing. Some formats include the ability to post data to one of many data hosting sites. As new formats and data options are implemented, they will be available via “free” firmware upgrades. Packet data formats are available to GEM purchasers wishing to develop custom plug-ins or applications.

PULSE COUNTERS

The GreenEye Monitor has four pulse counter inputs. These counters detect pulses received from devices such as water or gas meters which have pulse output. These inputs may also be used to detect traffic via motion sensor. There are two types of counter inputs:

1. Counter 1 and 2 inputs are optically isolated from the GreenEye Monitor circuit. These require a pulsed voltage between 3VDC and 24VDC.
2. Counter 3 and 4 inputs require signal from “dry contacts”. This means that the pulses are generated by a reed switch or relay contacts and requires no voltage.

TEMPERATURE MEASUREMENTS

The GEM measures temperature via a “1-Wire Bus®”. The 1-wire bus is a Maxim®/Dallas® proprietary standard and accepts the very popular DS18B20 temperature sensor. The 1-Wire system uses a single three conductor (buss) to connect all sensors in parallel. The GreenEye Monitor can then address each individual temperature sensor.

SPECIFICATIONS

POWER MONITORING SECTION	
Number of Channels	32 (expansion available in the future)
Measurement	POWER: True (or Real) Power using high speed volt and current sampling VOLTAGE: True RMS
Accuracy	Power/Energy Measurements: Typically +/- 1% plus CT accuracy Voltage Measurement: Better than 1% with PT-Type value trimmed to a reference.
Sampling Frequency	Voltage sampling @ 20.8 kHz Current sampling @ 10.4 kHz
Maximum Input Current	Dependent on current transformer. Currents greater than 1,000A may be monitored.
CT Input	Type A CT with AC <u>mV</u> output: <ul style="list-style-type: none"> • 700 mV max for single CT • 350 mV max for each of two connected CT on a given channel Type B CT with AC <u>mA</u> output: <ul style="list-style-type: none"> • 103 mA max for single CT • 51.5 mA max for each of two connected CT on a given channel NOTE: <ul style="list-style-type: none"> • Exceeding the specified input values will affect channel accuracy. • Connecting a Type B CT to terminals designated for TYPE A CTs may cause a channel overload to the point that all channels display unpredictable power values
Input Impedance:	<ul style="list-style-type: none"> • 255Ω for Type A CT connection. Terminals 1&2 and 3&4 • 6.8Ω (burden resistor) for Type B CT connection. Terminals 2&3
Potential Transformer	Input: 3.5mm Jack PT

(PT) Input	<ul style="list-style-type: none"> • Mono plug PT: signal 8VAC to 18VAC. Voltages greater than 14VAC require a PT shorting jumper to attenuate PT signal. • Stereo plug: “sleeve” and “ring” connection, “tip” not connected. 333 mVAC without PT shorting jumper or 666mVAC with shorting jumper. <p>Input: Mini USB Jack</p> <ul style="list-style-type: none"> • PT signal to pins 3 and 4 of mini USB • 333 mVAC without PT shorting jumper or 666mVAC with shorting jumper
Potential Transformer	<p>GEM supplied with UL/c wall transformer with < 2 degree phase error. Optional PT (part number PT01) may be ordered:</p> <ul style="list-style-type: none"> • 1% accuracy • Input voltages between 120V to 480V. • 600V rated leads
Load/System Types	Single and Polyphase systems.
System Frequency	50Hz or 60Hz. Configurable via software. Frequency must deviate more than .2% for the selected system frequency. If to be used with generator, verify generator’s frequency accuracy.
Resolution	Power: 1 Watt Energy: 1 Watt-Second (.000000277 kilowatt-hour) Voltage: 0.1 Volt
NET Metering	All channels are capable of NET metering. Two sets of watt-second counters are used for energy flow direction.
Watt-Second Counters	Each channel has two 5-byte incrementing watt-second counters, one absolute and one polarized. Counter “wrap around” occurs after 2^{40} watt-seconds or 305,419 kilowatt-hours.

PULSE COUNTING

Pulse Counting Channels	<p>Four Individual pulse counters</p> <ul style="list-style-type: none"> • Two dry contact inputs • Two DC pulse inputs
Counter Input	<p>Counter #1 and #2:</p> <ul style="list-style-type: none"> • Requires DC pulses • Galvanic isolated from GEM system via opto-isolator • Requires DC pulses between 3.5 and 24VDC. (5VDC ideal) <p>Counter #3 and #4:</p> <ul style="list-style-type: none"> • Requires “dry” contact closure from reed switch, relay, etc. • Input is not isolated from the GEM power supply therefore connection to this input must be isolated from the pulse source’s power supply. This is typical when using reed switches.
Pulse Frequency	<p>Less than 1pps (pulse/second) *Subject to change</p>
Pulse Width (Duration)	<p>Minimum pulse duration 550ms. *Subject to change</p>
Counter Registers	Each counter has a 3-byte up-counter

	Counter wraps around when full 2^{24} pulses.
Counter Volatility	Counter values are stored in RAM and preserved by battery power when a power interruption occurs.

TEMPERATURE SENSING

Temperature Sensor Channels	8 Channels
Sensor Type	Uses 1-Wire Bus system Compatible with the following 1-Wire sensor types: <ul style="list-style-type: none"> • DS18B80 • DS18S80
1-Wire Bus	Uses three push terminals: <ul style="list-style-type: none"> • GND • DATA • +5 VDC “1-Wire” devices are connected in parallel For more info visit: http://www.1wire.org/
Conversion Interval	All temperature sensors perform a temperature conversion every 16 seconds
Sensor Read Interval	Each enabled temperature sensor is read once every 64 seconds One of eight temperature sensors is read every 8 seconds, hence $8 \times 8 = 64$ sec
Temperature Units	The GEM may be configured for Celsius or Fahrenheit degrees
Temperature Resolution	0.5° C resolution. Fahrenheit degree values are derived from the C value and converted to 1 decimal point accuracy.

COMMUNICATION

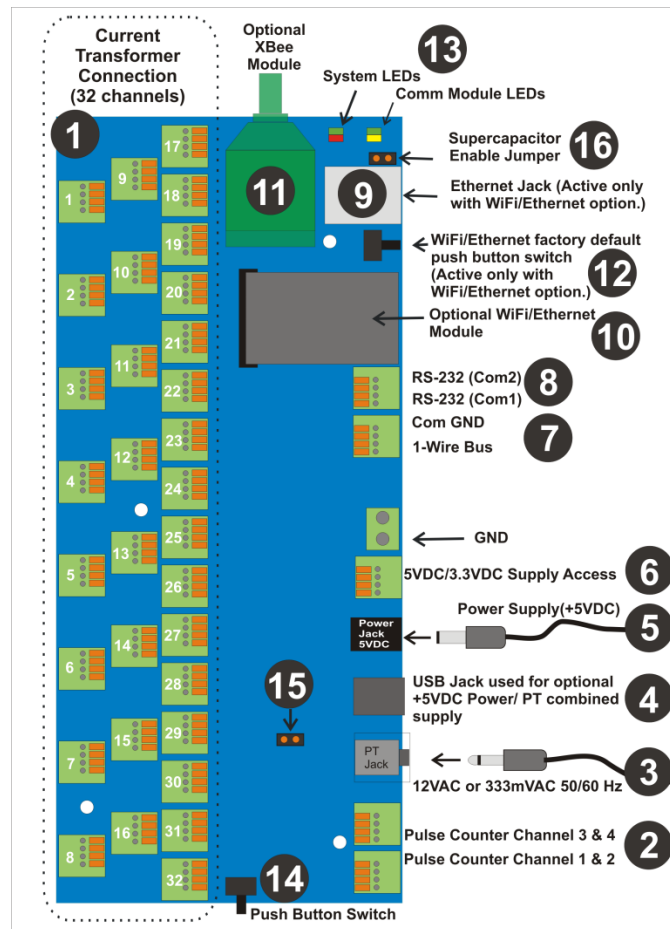
Standard Communication Ports	<ul style="list-style-type: none"> • RS-232 via COM1 and RS-232 via COM2 • 19,200 baud 8-bits, no parity, one stop bit (8N1) • GND, TX, RX no hardware flow control • Connection via “push terminals”
Optional Board SMT Soldered WiFi Module (Discontinued)	Uses Roving Networks RN-171 WiFly Module <ul style="list-style-type: none"> • Receive Sensitivity: -83dB typical • Output Power: 12 dBm • Serial Communication 19,200 baud • On board wire whip antenna
Ethernet Module (Discontinued)	Uses third party Ethernet Module <ul style="list-style-type: none"> • Supports: TCP, UDP, ICMP, IPv4 ARP, IGMP, PPPoE, Ethernet • Client, Server and Mixed modes. Default is “Client” mode • 10BaseT/100BaseTX Ethernet PHY • Configured via UDP using simple setup application

<p>WiFi+Ethernet Module</p>	<p>Provides Both Wifi and Ethernet Options simultaneously</p> <ul style="list-style-type: none"> • Support 802.11b/g/n wireless standards • Output Power: <ul style="list-style-type: none"> ○ 802.11b: +20dBm ○ 802.11b: +18dBm ○ 802.11b: +15dBm • Web Configuration Page • Supports WEP/WPA-PSK/WPA2-PSK/WAPI • Encryption: WEP64/WEP128/TKIP/AES • RP-SMA 2dBi external antenna
<p>XBee® (ZigBee®) Module</p>	<ul style="list-style-type: none"> • Socketed for Digi International XBee® ZB modules • Accepts any of the three ZB-24 module antenna options • Communicates at 19,200 baud • Hardware flow control may be enabled • GEM setup option provides the option of chunking data to XBee® modules in order to limit data flow restrictions inherent with ZigBee® protocol
<p>Data Communication:</p>	<p>Real-Time Data:</p> <ul style="list-style-type: none"> • May be configured to “push” energy usage data at a user defined interval or “pull” data via API • Various data packet formats available • May be configured to post data using “POST” or “GET” methods • Efficient binary packet options available • Packet formats available for custom software development • Custom packet formats may be available upon request • Setup Commands • Documentation available listing the commands used to read or write GEM setup parameters
<p>GEM Firmware Upgrades</p>	<p>Firmware upgrades may be accomplished using any of the communication options above including USB if a “serial to USB” adaptor is available.</p>
<p>Alternate Communication Options</p>	<p>Custom communication solutions are available via a 10-pin header or XBee® socket header providing access to UART TTL COM1 or COM2 ports.</p> <p>NOTE: Contact Brultech support before attempting to use these headers! Improper use may damage the GEM and void warranty</p>

<h2 style="margin: 0;">GEM SYSTEM</h2>	
<p>Power Supply</p>	<p>Volt: 5VDC +/- 5% UL/CSA approved Consumption: Typically less than 1 watt Power Connection:</p> <ul style="list-style-type: none"> • 2.1mm X 5.5mm barrel jack, center positive (standard) • Optional power connection via mini USB jack instead of barrel jack
<p>Isolation</p>	<p>The GEM must not be installed in the electrical breaker panel!</p> <ul style="list-style-type: none"> • All connection to the GEM must have galvanic isolation to the power-line • Signals to the GEM must be Class2 low voltage

	<ul style="list-style-type: none"> Current transformers (CT) and the Potential Transformer (PT) connected to the monitored electrical panel must be UL/c listed and suitably rated above the maximum voltage and current to be encountered
LED Indicators	<p>Left LED: Tri-color system LED displays system status, communication activity, etc.</p> <p>Right LED: Two color communication module status</p> <ul style="list-style-type: none"> Displays status of the communication module. Color sequence depends on the module installed When no communication modules are installed only the green LED will come on when 5VDC power is present. This is due to the jumper connection between pins 2 and 7 of the header (#9)
Battery	<ul style="list-style-type: none"> CR-2032 battery used for memory backup when 5VDC power is lost Typically drains less than 2 uA when GEM is powered down Life: approximately same as battery shelf life Battery replacement should be done while GEM is powered up if accumulated watt-second, counter and time values are to be preserved
Memory Backup	<ul style="list-style-type: none"> Uses EEPROM to store GEM user settings Battery backup holds CPU ram content during power outages. This includes all watt-second, counter and time registers
Operating Temperature	Better than: 0 - 40C (TBD)
Humidity	5% to 95% non-condensing
Enclosure Material	UL94-V0 ABS Plastic
Dimensions	9 1/8" X 7 1/8" X 2"
Weight (GEM Device)	Between 1.2 and 1.4 pounds depending on installed modules
FCC Certification	<p>The GEM complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p> <p>Depending of the GEM options, the following wireless modules may be installed in the GEM:</p> <ul style="list-style-type: none"> Roving Networks WiFly Module FCC ID: T9J-RN171 Digi International XBee® Module FCC ID: OUR-XBEE2 WiFi Module FCC ID: AZYHF-A111

OVERVIEW / LAYOUT



Note re USB jack (4) in the diagram above. No combined supply is currently available for this jack. A standard 5Vdc mini USB power supply may be used to power the GEM via this jack instead of the barrel jack (5).

