

# PREDICTIVE MAINTENANCE SYSTEM

Maximize production and profits with IIoT

#### PREDICT FAILURES. PREVENT DOWNTIME. ENHANCE SAFETY.

- Remote equipment monitoring solution empowers your asset managers to make better maintenance decisions using real-time, actionable data.
- Cost-effective, end-to-end wireless solution combined with hardwired Ethernet I/P™ communication to optimize maintenance spends and enhance plant productivity and uptime.

GRACE

- Fully configurable and easy-to-deploy hardware architecture with intelligent edge processing to suit your unique application needs.
- A user-friendly and intuitive web application combined with secure data storage provides boundless opportunities for data retrieval, visualization, analysis, and reporting.
- Worker safety is enhanced by reducing hands-on and unplanned reactive maintenance activity.

FOR MORE INFORMATION VISIT GRACESENSE.COM OR CALL 1.800.280.9517



### SYSTEM OVERVIEW

The field-proven **GraceSense™ Predictive Maintenance System** is a suite of smart devices that utilize low-power wireless sensor technology. Advanced data analytics provide asset managers with deep insights to machine health to effectively prioritize resources and maximize the value of their maintenance spend. GraceSense™ technology improves overall plant reliability, safety, and maintenance metrics by remotely monitoring the asset health and sending timely notifications through SMS or email alerts when anomalous behavior is detected.



# **1** VIBRATION & TEMPERATURE NODE

Rugged wireless sensor with advanced edge processing and proprietary Zigbee compatible communication monitors vibration and temperature to insightfully predict health on any rotating equipment. Multiple mounting options ensure quick deployment across applications in any industry. Easy to replace batteries deliver 3-5 years of life (dependent on use).



# 2 PANEL-MOUNT<sup>™</sup> NODE OR CLOUDGATE<sup>™</sup>

Configurable hardware architecture with a wide selection of inputs, transducers, radios, and power options. Nodes can be mounted in our environmentally rated housing. Configured as a CloudGate<sup>™</sup> with an LTE or WiFi module, it can provide cloud-based support to thousands of other wireless nodes within a 30m radius, making the architecture massively scalable. Appearance of product shown to the left may change based on final product configuration.



# **3** HOT SPOT MONITOR (HSM)

GraceSense<sup>™</sup> Hot Spot Monitor is a non-conductive temperature monitoring device that detects potential hot spots and alerts personnel of any temperature anomalies occurring in electrical equipment. Additionally, by integrating HSM with a panel-mount node, data from the HSM can be remotely monitored along with other equipment parameters in the Maintenance Hub. For more information on the Hot Spot Monitor (HSM) please refer to the product specific datasheet.



# A MAINTENANCE HUB

The Maintenance Hub is an intuitive web application providing real-time asset status using dashboards, plot trends, and analytics. Hosted either in the cloud or on a local server, the Maintenance Hub displays system information, generates reports, and issues alerts via SMS and email containing actionable step-by-step remediation instructions. An open API lets you share data and alerts with existing systems (i.e. CMMS, SCADA, DCS). Some of the unique capabilities include:

- On-premise Audit Tool
- Multiple alert levels per channel
  Virtual channels that mathematically combine data from multiple sensors in real time

• Performing statistical calculations on sensing channels and displaying their values on the dashboard

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## PANEL-MOUNT<sup>™</sup> SERIES TECHNICAL SPECIFICATIONS



SERIES	Node	CloudGate <sup>™</sup>	ControlGate <sup>™</sup>
Mounting	Panel-Mount or Stand-Alone Station		
Local Wireless Protocol	IEEE 802.15.4, Range: 30M Line of Sight		
Antenna Type	Right Angle SMA Whip, 1.8dBi		
Local Communication Frequency	2400 - 2483.5 MHz		
Sensor Channels	Up to 12 Sensor Channels via terminal block Up to 6 Sensor Channels via Terminal Block		
Sensors Available	Acceleration, Velocity, Current, Temperature, Pressure, Flow, Strain, Load, Fluid Level, Humidity		
Supported Sensor Inputs	4 - 20mA, 0 - 10V, Thermistor, Accelerometer, Strain Gauge, RTD, Thermocouple, Rogowski Coil, Modbus RTU (RS-485)		
Cloud/DAQ Communication Protocols	N/A - Child Only	WiFi, LTE	EtherNet/IP™, MODBUS TCP/IP
Max. Number of Connected Nodes	N/A - Child Only	20-30 Nodes Recommended (limited only by the distance to the CloudGate <sup>™</sup> )	15 Nodes Maximum
Temperature Range	Operating Range: 0°C to 50°C		
Power Source	All: 24V DC, 5V USB, 5V DC Panel Mount Node Only: Optional Non-Rechargeable Lithium Metal Battery		
Battery Life	3 - 5 Years (use dependent) N/A - Must be powered by 24V/5V Supply		
Warranty	2 Years		

# FIELD-MOUNT<sup>™</sup> POWER AND I/O EXPANSION MODULES

Expansion modules allow for advanced capabilities for any field mount node to be able to handle tasks in the field.



G-FM-ACC-EXP-PIO1 External Antenna, Power/Triggering, and Battery Configuration.



G-FM-ACC-EXP-PIO3 External Antenna and Power/Triggering Configuration.



G-FM-ACC-EXP-PIO2 External Antenna and Battery Configuration.



G-FM-ACC-EXP-PIO4 Power/Triggering and Battery Configuration (NOTE: Battery is a necessary component even when powering with 24V as the battery contains the antenna for local communication.)



Fully Assembled Vibration Temperature Node with I/O Expansion Module (Vibration Temperature Node sold separately)

# FIELD-MOUNT SERIES TECHNICAL SPECIFICATIONS

SERIES	G-FM-VBT1
Mounting	Ерох
Local Wireless Protocol	
Antenna Type	2.4GHz Patch Antenna
Operating Frequency	
Edge Processor	ARM Cortex M4 3
Accelerometer	Tri-Ax
Sampling Rate	Up to 1600 Hz
Bandwidth	800 Hz
Measurement Range	Software Selectab
Resolution	
Temperature Range	Operating Ra
Environmental Ratings	
Power Source	
Battery Life	3 - 5 Years (use dependent)
Warranty	
Optional Accessories	Power and I/O Expa

#### ACCESSORIES





G-FM-ACC-MGB1 Magnetic Mount (Applicable only to Field-Mount Series)

G-FM-ACC-FMB1 Fin Mount (Applicable only to Field-Mount Series)

G-FM-ACC-PMB1 Plate Mount (Applicable only to Field-Mount Series)

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G-FM-ACC-BAT3 Replaceable 3.6V 2.8Ah Battery Pack



G-ACC-PS01 1A Power Supply 120VAC Flying Leads to 24VDC Flying Leads (Applicable only to Panel-Mount™ Series)



G-ACC-PS02 1A Power Supply 120VAC Plug to 24VDC Flying Leads (Applicable only to Panel-Mount™ Series)



**G-ACC-ENC1** Stand Alone Station Easily mount your CloudGate™ to the station when a panel is not available.



#### **DIMENSIONS & DETAILS**

**Field-Mount Node** 



Function Indicating LED



Panel-Mount<sup>™</sup> Node or CloudGate<sup>™</sup>



#### **CYBERSECURITY**

The entire GraceSense<sup>™</sup> family of products have been developed with your cybersecurity in mind and can be locally hosted for additional security. First, GraceSense™ Nodes communicate with each other using an encrypted and proprietary IEEE 802.15.4



protocol, and cannot be addressed from outside of our proprietary local network. Then, our GraceSense™ CloudGates™ securely transmit local data to our cloud-based Amazon AWS databases for storage. Lastly, system users like you access your data through our secure Microsoft Azure-hosted web application built with SSL for end-to-end encryptions.

#### **IIoT SUCCESS STORY**

GraceSense™ Predictive Maintenance technology was recently deployed at a Leading Automobile Manufacturing Stamping Plant. Like many automotive stamping plants, this facility encompasses millions of square feet and houses more than a dozen stamping lines. These lines usually operate 20 shifts per week and produce parts that are shipped to numerous other facilities across the United States and around the world.

During an initial pilot at the Stamping Plant, the GraceSense™ Predictive Maintenance System captured nearly 28 million data points over a 24-month period. In that time, a swift return on investment was realized as the system provided alerts that prevented eight downtime incidents, saving the manufacturer over \$2M in losses; almost fifteen times the cost of the entire GraceSense<sup>™</sup> project.

#### **CONFIGURATION OPTIONS**

The Grace Sales Team is here to help you configure a part to meet the needs of your application. Contact us at sales@gracetechnologies.com or by calling 1-800-280-9517 and select Option 3 for Technical Support when prompted. Listed below are a variety of configuration options for any application.



Multiple sensor procurement options available Please call us at 1-800-280-9517 for details

#### **TOP PANEL MOUNT NODES**

#### G-XX-W1W2-K3XX

CloudGate<sup>™</sup> only configured with IEEE 802.15.4 wireless communication and cloud connectivity via WiFi. Includes a panel-mount IP-65 rated enclosure and powered by 24VDC.

#### G-EIP-W1W2-K3XX

ControlGate<sup>™</sup> configured with IEEE 802.15.4 wireless G-AA1DA0-W1-K3B1 communication, cloud connectivity via WiFi, and Node configured for up to 2 thermistors, 4 analog based sensors, and Modbus RTU Input. Has IEEE 802.15.4 wireless EtherNet/IP™ using RJ45 Ethernet port. Allows for simultaneous communication. Includes a panel-mount IP-65 rated enclosure Cloud connection to the Maintenance Hub as well as integration EtherNet/IP™ networks. Includes a panel-mount IP-65 rated and powered by battery or 24VDC. enclosure. Powered by 24VDC.

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(Choose one)		
CODE	OPTION	
K2	Type 4X, Panel-Mount Housing	
K3	Type 4, Panel-Mount Housing	
K4	Type 12, Panel-Mount Housing	
Pattony Type Ontione:		

Battery Type Options: (Choose one)			
CODE	OPTION		
XX	No Battery		
B1	2800mAh Non-Rechargeable Lithium Metal Battery		

#### G-AA1-W1C1-K3XX

CloudGate<sup>™</sup> configured for up to 2 thermistors and 4 analog based sensors. Has IEEE 802.15.4 wireless communication and cloud connectivity via AT&T LTE. Includes a panel-mount IP-65 rated enclosure and powered by 24VDC.

#### FREQUENTLY ASKED QUESTIONS

- Q: How is Vibration and Temperature data wirelessly communicated from my asset?
- A: The wireless sensor mounted on your asset communicates the data using a proprietary Zigbee compatible protocol to a Panel-Mount CloudGate node that is installed on your panel.
- Q: How far apart can the GraceSense<sup>™</sup> wireless sensor nodes and a Panel-Mount CloudGate be installed?
- A: The maximum allowed distance from the wireless sensor node to the CloudGate is 30 Meters radius line of sight.
- Q: What's the difference between a Panel-Mount Node and a Panel-Mount CloudGate?
- A: The Panel-Mount CloudGate has connection to the remote cloud via WiFi or LTE connection.
- Q: How many wireless nodes can a Panel-Mount CloudGate support?
- A: While each CloudGate can support thousands of nodes, we find that due to normal asset density in industrial environments, we recommend 20-30 nodes per CloudGate.
- Q: Can I have more than one Panel-Mount CloudGate in my installation, and why?
- A: As the footprint of your GraceSense IIoT deployment increases, additional CloudGates that are strategically placed will ensure that you have a strong connection from one end to the other. The network is self-healing as well to where if a node loses connection with a CloudGate the node will attempt to find a new CloudGate to connect to.

#### Q: What types of sensing can be done with your IIoT system?

- A: We offer a wide range of sensing options to meet our unique customer needs. The most common sensing types are temperature, current, and vibration. We also offer a variety of other sensing types, including flow, pressure, humidity, strain, etc.
- Q: What if I do not want to use WiFi or no WiFi network is present?
- A: If there is no WiFi present for the CloudGate to use, we do offer a 4G LTE cellular option. Some customers also use this option to simplify wireless set-up during pilot projects.

- Q: Can I use my company's data plan for an LTE cloud connection?
- A: We currently support AT&T<sup>®</sup> and Verizon<sup>®</sup> for LTE with your own data plan. If you would like Grace to provide the data plan, we offer AT&T<sup>®</sup> as our cellular provider.

#### Q: What is an Application Interface and why should I use it?

- A: An Application Interface is essentially in I/O module. We group sensing types that are typically offered together to target specific applications. For example, you may want to monitor the voltage drop and current draw of your motor in addition to vibration data to better understand the asset's operational status.
- Q: What if my application doesn't support wireless sensors, but I still want to use your IIoT Platform for my predictive maintenance needs?
- A: Yes, you can still use the GraceSense<sup>™</sup> IIoT platform and access Maintenance Hub for your predictive maintenance needs with the use of hardwired sensors/transducers connected to our Panel-Mount Node and communication via a CloudGate.

#### Q: Can I bring data from the nodes into my PLC or SCADA/DCS system?

A: This can be achieved a few different ways. One way is that there is bi-directional MODBUS communication that would allow a CloudGate to send their data to another system via MODBUS. MODBUS TCP/IP and EtherNet/IP<sup>™</sup> are under development as well. The second way is that we have an open API that would allow 3rd party software to pull the data they need from our Maintenance Hub cloud interface.

#### Q: What is the warranty on the GraceSense Predictive Maintenance System?

A: The warranty on the GraceSense Predictive Maintenance system is 2 years, excluding the battery.



For a complete listing of Frequently Asked Questions please scan the QR Code to the left to go to our Knowledge Base.

