

## The ultimate solution for maintaining your nationwide generator network

### Monitoring Systems for Generator Set Systems

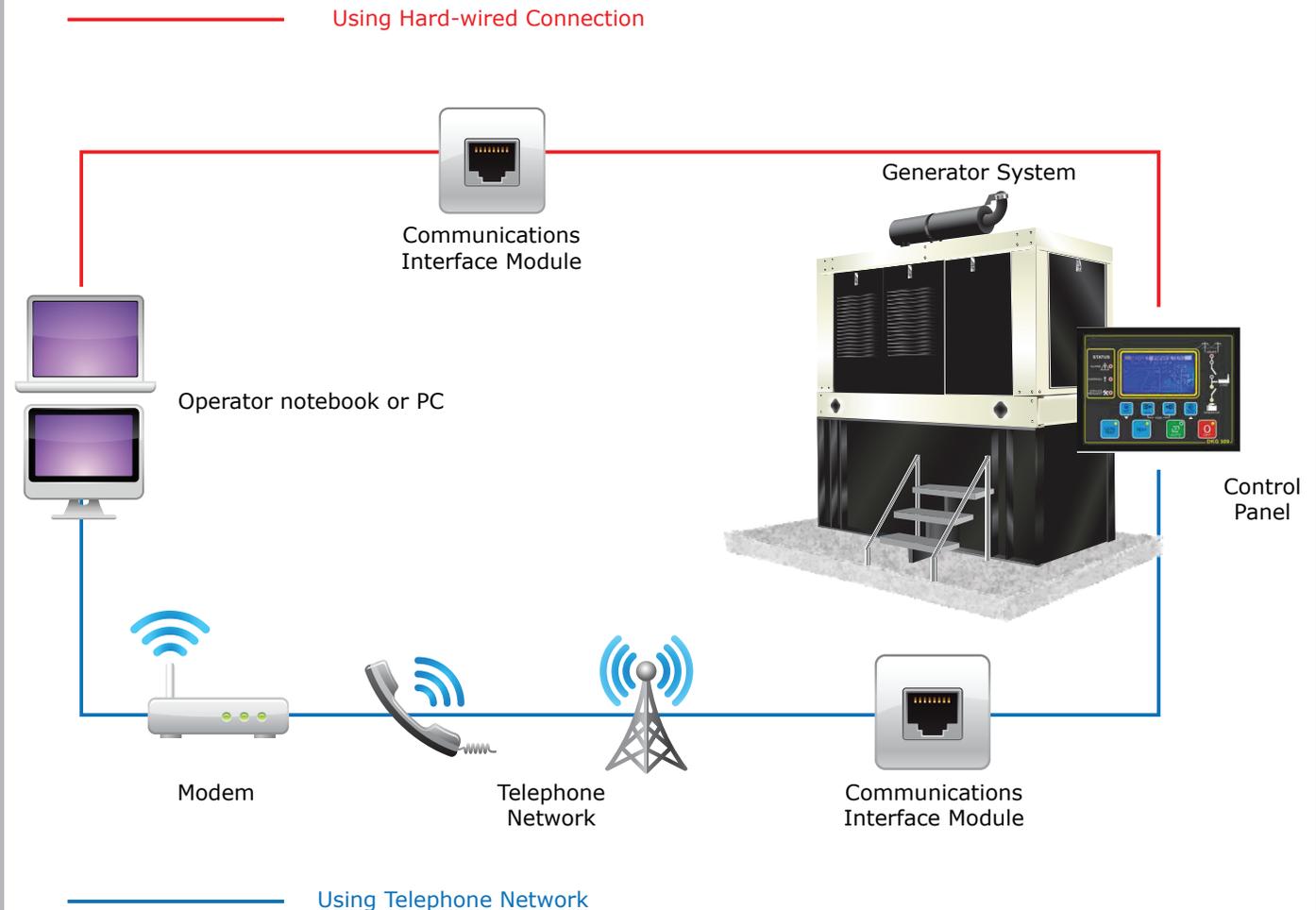
#### 1.0 Introduction

Generator set installations frequently are an important element within an overall system that is monitored and controlled from a central station. As such for complete system monitoring, the generator has to be equipped with a monitoring system.

*This Information Sheet discusses the various monitoring devices that are available for generator set systems and when they would be used.*

Today's generator set manufacturers can satisfy almost any customer requirement in terms of the monitoring capability of their genset. Modern technology in the form of electronics, micro-processors and controllers, printed circuit boards, computers, mobile phones, etc. have all greatly contributed to increase the scope and ability to provide customers with an almost unlimited array of complex and reliable monitoring systems to meet any demand and specification.

#### Diagram of Remote Generator Set Monitoring System



To fulfill our commitment to be the leading network service provider in the Power Generation Industry, the USA, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

The generator set system designer has the following control systems to consider.

## 2.0 Manual Control Panel

This provides for a manual stop/start control of the generator with the simplest indicators, gauges and meters (either analog/mechanical or electrical/digital) with respective wiring harnesses that normally cover the principal functions of the engine and alternator. This could include: key, toggle or push button start, AC voltmeter, three ammeters or single meter with phase selector switch and frequency (Hz) meter, with a main line circuit breaker to prevent electrical overload of the generator, together with any engine pre-heat device, etc. Also such engine fault controls (with local annunciator, warning/failure lights and audible alarms) as engine protection with automatic shutdowns for oil pressure, high coolant temperature, engine over-speed, low fuel and oil levels, battery charging with indicator lights and DC voltmeter, etc. Additional accessories such as running hour recorder (hour-meter), engine RPM, emergency stop button (to immediately shut down the generator in an emergency situation), engine fault lights, battery charging ammeter, voltage adjust potentiometer, etc., can be supplied. Any manual or automatic control of pre-heating requirement for lubricating oil, coolant and battery, e. g. due to low ambient operating conditions, can be included in the monitoring controls.

## 3.0 Auto Start Panel

This panel will probably contain the above components and function with a selector switch for manual/test start, auto start and off modes. The auto start system normally allows for three unassisted attempts before shutdown and will show a failure-to-start light. This can work in conjunction with an automatic transfer switch in applications of standby or emergency installations. A programmable exerciser clock can be incorporated for automatic weekly (or other) runs of ten minutes or more with adjustable characteristics for shutdown after steady utility supply has been reestablished, to permit cool-down of the generator. Any automatic pre-heat requirements for lubricating oil and coolant due to low ambient operating conditions will be designed into the control system. Remote start signals can be provided.

## 4.0 Remote Annunciator Panel

This enables the operator to monitor the status of the generator from a remote location. This can be required for NFPA 99 and 110 installations.

## 5.0 Remote Wireless Monitoring

The addition of this feature using cost-effective GSM digital wireless technology and the internet, allows the customer to observe the generator function, set certain operation parameters such as start, test, adjust setting of exercise time and day, and receive maintenance reminders at a distance from the generator physical site, on a 24/7 basis. This is normally contained in a small battery-powered device and can include any generator failure warning signals or indication that the generator needs attention. It can offer the ability to monitor the utility voltage and some offerings can include the capability to graph trends of engine RPM, utility voltage and battery voltage. Any power quality issues will be notified by instant messages to the designated recipients via pager, phone, cell phone, fax, XML, voice-mail or E-mail.

## 6.0 Digital Control Systems

Many generator manufacturers now offer digital controls to suit most requirements. This can mean ready availability of an integrated, reliable and comprehensive monitoring of the engine, alternator and auxiliary equipment, providing the critical information necessary to manage the generator operation and maintain reliability. Such controls can survive vibration, temperature extremes, electrical transients and other harsh conditions. This also permits greater flexibility in adding remote monitoring and control capabilities. These will interface directly with the generator and run continuously, improving system reliability and reducing maintenance costs, while providing self-diagnostics and event reporting with ability to detect failure. A PC-based service tool will allow fast diagnosis of problems and more convenient service and testing. It is easy to utilize other languages than English, for monitoring displays.

## 7.0 Controls for Paralleling Two or More Generators

Technology advances have greatly enhanced to ability and lowered costs of the equipment to automatically parallel two or more generators. All synchronizing, load sharing, etc. can be provided with advanced diagnostics.

## 8.0 National Fire Protection Association (NFPA) Codes referring to Generator Controls

NFPA 99 and 110 requirements call for the following specification:

### a) Engine Functions:

- Over crank shutdown
- High engine temperature shutdown
- High engine temperature warning
- Low water (engine) temperature warning
- Low oil pressure warning
- Low oil pressure shutdown
- Over speed shutdown
- Low fuel (level or pressure) warning
- Low coolant level shutdown
- High battery voltage warning
- Air damper indicator (if equipped)

### b) General Functions

- Battery charger warning
- Master switch not-in-auto setting
- Lamp test
- Audible alarm silence

NFPA 110 Level 1 typically applies to health care facilities while Level 2 applies to less critical applications.



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