

# 6600 Series Machinery Protection Monitors



The Entek 6600 Series is a state-of-the-art, digital machinery protection and condition monitoring system. Designed to monitor and protect machinery against high vibration and the resultant damage associated with excessive vibration, the 6600 product line also monitors associated process parameters such as temperature, pressure, and flow, as well as Turbine Supervisory Instrumentation (TSI) parameters including thrust, differential and case expansion, valve position, and eccentricity.

Designed using the latest in digital technology, each 6600 monitor is a stand-alone protection monitor, complete with its own processing, memory, communications, power supply, relays and terminations. In fact, each 6600 monitor is a microcomputer in its own right. The 6600 Series design illustrates Entek's philosophy of making high technology products easy to install, commission, use, and integrate with other systems.

Entek supplies a complete range of machinery reliability products and services to all industry segments worldwide.

## BENEFITS

### RELIABILITY.

The 6600 Series is designed to meet or exceed API 670, which ensures that the product is extremely reliable and will provide 100% protection for your machinery. Based on proven technology, the mean time between failure far exceeds traditional analog-based designs.



### ACCURACY.

6600 monitors utilize 10-bit (V2 Model) or 16-bit (DSP Model) A/D conversion, making the 6600 the most accurate protection system available. Individual transducer sensitivities are programmable to 0.01 mV per measurement unit, affording even greater measurement precision.

### FLEXIBILITY AND MODULARITY.

6600 monitors are designed to suit many applications, including vibration, order tracking, speed, thrust, case and differential expansion, valve position, temperature, and process parameters. The 6600 system architecture allows you to mix and match functionality to any degree within the system rack. Modular system architecture allows easy expansion as your needs grow. Each 6600 monitor is totally self-contained, and racks can be provided in any width from 1 to 12 positions.

### PROGRAMMABILITY.

6600 monitors require no DIP switches or jumpers to be set because they are fully field-programmable. Setup is fast and intuitive. Monitors are self-calibrating - no more time consuming calibration required. DSP Monitors allow users to perform remote programming via RS-485 serial link.

### BUILT-IN ANALYSIS.

6600 monitors have basic analysis functionality built-in so when machinery problems arise, analytical data is available immediately via the RS-485 serial interface so the situation can be handled promptly.

### MODBUS COMMUNICATIONS.

Modbus is the de-facto industry standard for serial communications. Each 6600 module provides a built-in RS-485 serial port for Modbus communications with host computer systems, allowing quick

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and simple interfacing to existing plant computer systems. RS-485 link provides communications with host at speeds up to 38.4 K baud and up to 4,000 feet of twisted pair cable.

### INTEGRATION CAPABILITIES.

Every 6600 monitor is capable of integrating seamlessly with any DCS or other Information Technology system, which utilizes Modbus protocol. There is no need to purchase special communications hardware (Modbus protocol specification provided). The 6600 system also integrates easily with Entek's EMONITOR Odyssey™ Online, and Enline 66 products, which allow the user to take full advantage of the powerful analysis capabilities provided with each protection monitor.

### DISPLAY.

Using a backlit, high-resolution dot matrix display, information is presented in a traditional bar graph format. Additional character-based information is available on alternate display pages, accessed via keys on the front panel. All configuration is performed locally from the front panel.

### REDUNDANT POWER SUPPLIES AND RELAY CONTROLS.

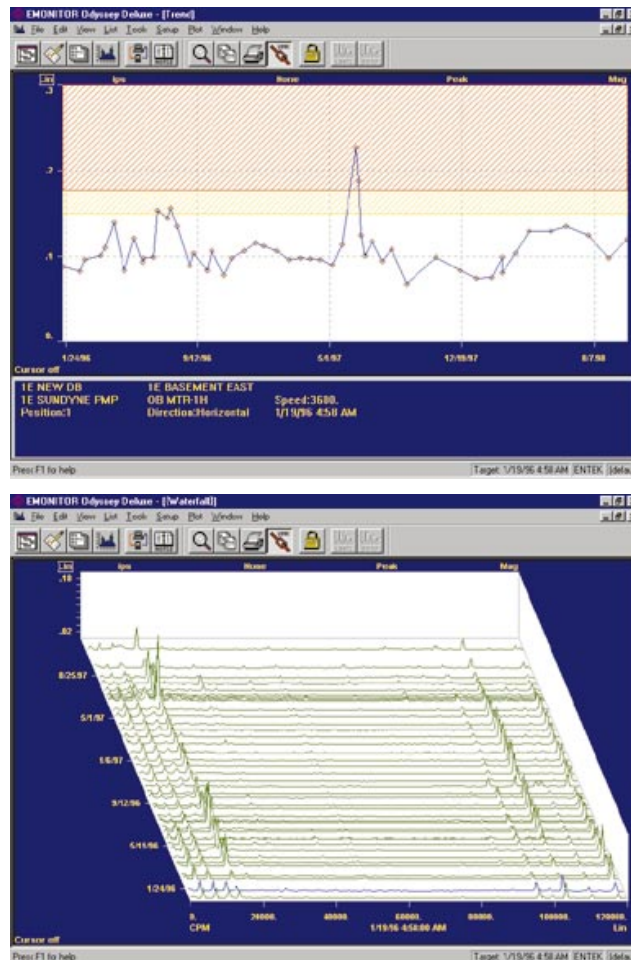
Each 6600 series monitor utilizes a dedicated power supply and relay control module. This ensures the integrity of your protection monitor, as each monitor will continue to operate in its intended fashion even if one monitor were to have a power supply fault. Similarly, the availability of seven dedicated relays for each monitor offers unequalled flexibility of configuration.

### ANALYSIS CAPABILITIES.

All V2 model monitors have the ability to process and store (per channel) overall trend data (30 minutes of data at 1-minute intervals in a FIFO buffer). On an event, this data is copied to a separate trip trend buffer for later retrieval and analysis.

Vibration monitors have additional analysis capabilities, including 200 line spectral and order processing (1x, 2x, and 3x amplitude and phase, which require tachometer input). On an event, spectral data is also copied to the trip buffer.

DSP monitors were designed primarily for vibration applications, where advanced analysis may be required. DSP monitors process and store (per channel) up to 800 line spectra, up to 1800 trend points (at 1 second interval for 30 minutes), 300 sets of startup/ coastdown vectors, and shaft orbits, in addition to three order amplitude and phase processing when a tachometer input is used. All analysis data is available for off-loading via the serial Modbus port.



*Trend and Waterfall plots, available through EMONITOR Odyssey and Enline 66 software packages, demonstrate the standard analysis capabilities provided by the 6600 monitors*

### VERSIONS

- V2 Model hardware is designed to provide protection and basic analysis for your machinery. V2 hardware is available for all 6600 Series monitor applications.
- DSP Model hardware utilizes an advanced Digital Signal Processor (DSP) and additional memory, compared to the V2 model. The DSP version is available for vibration applications where more advanced data analysis is required. DSP monitors also provide the same high reliability protection as V2 hardware.

## PRODUCTS

Each monitor in the 6600 Series fulfills a different role in providing comprehensive machinery protection.

### **6622:**

Dual Channel Absolute Vibration (V2)

### **6622 DSP:**

Dual Channel Absolute Vibration (DSP)

### **6623:**

Single Channel Tracking

### **6652:**

Dual Channel Relative Vibration (V2)

### **6652 DSP:**

Dual Channel Relative Vibration (DSP)

### **6660:**

Six Channel Process

### **6666:**

Six Channel Temperature (RTD Input)

### **6667:**

Six Channel Temperature (T/C type J & K Input)

### **6675:**

Single Channel Rotation

### **6676:**

Single Channel Reverse Rotation

### **6682:**

Dual Channel Position

### **6686:**

Dual Channel Eccentricity

### **6687:**

Dual Channel Absolute/Shell Expansion

### **6688:**

Dual Channel Differential Expansion

### **6689:**

Dual Channel Valve Position

### **6691:**

Power Supply and Relay Card (V2)

### **6692:**

Power Supply and Relay Card (DSP)

### **Online 66™:**

Graphical software package for 6600 Series Protection Monitors.

### **6622: Dual Channel Absolute Vibration (V2)**

The 6622 Dual Channel Absolute Vibration Monitor is used to monitor casing or bearing pedestal vibration in rotating machinery. The 6622 is usually employed on machines with anti-friction bearings such as ball or roller bearings. With these stiff bearing types the movement between the rotor and casing is restricted; therefore, the significant portion of the vibration energy is transmitted to the machine casing. This is particularly applicable where the objective is to monitor vibration associated with anti-friction bearing defects and blade pass frequencies, which are characterized by high frequencies and small displacements. In addition, all of the 6600 vibration monitors accept a tachometer input to provide order analysis capabilities.

### **6622 DSP: Dual Channel Absolute Vibration (DSP)**

The basic features and utilization of the 6622 DSP are identical to that of the 6622 V2 monitor; however, the 6622 DSP Dual Channel Absolute Vibration Monitor is primarily utilized where advanced analysis may be required. The 6622 DSP can process and store up to 800 line spectra, up to 1800 trend and trip trend data points, and 300 sets of startup/coastdown vectors (tachometer input required).

### **6623: Single Channel Tracking**

The 6623 is a single channel tracking monitor, which uses an automatically adjustable filter to track the running speed content of the vibration signal. This type of monitoring is extremely useful in gas turbine applications, where gas flow can often produce random noise making it difficult to monitor vibration using standard broadband measurements. To overcome this problem, the 6623 utilizes a narrow band filter, which automatically adjusts to track shaft speed given by a tachometer input signal. Although this monitor accepts input from an accelerometer or velocity sensor, the accelerometer is preferred due to its typically wider frequency response.

### **6652: Dual Channel Relative Vibration (V2)**

The 6652 Dual Channel Relative Vibration Monitor is used to monitor shaft vibration and shaft radial position (using X-Y probe configuration) in rotating machinery. The amplitude and frequency content of the vibration signal, as well as the shaft radial position (DC Gap) are good indicators of machine condition, and can help detect a host of machinery problems including: unbalance, wear, pre-load conditions/misalignment, rotor cracks, and rubs between rotating and stationary parts. In addition, all of the 6600 vibration monitors accept a tachometer input to provide order analysis capabilities.

### **6652 DSP: Dual Channel Relative Vibration (DSP)**

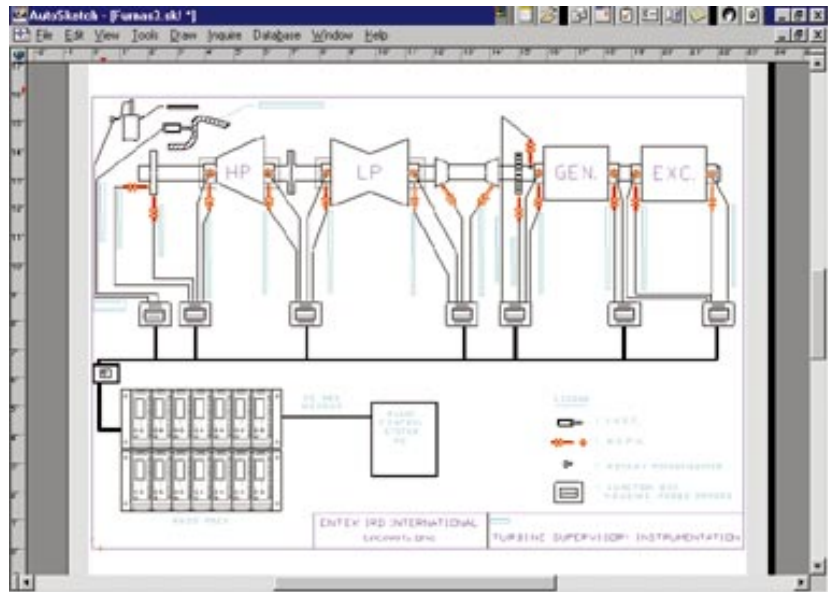
The 6652 DSP Dual Channel Absolute Vibration Monitor is primarily utilized where advanced analysis may be required. The 6652 DSP can process and store up to 800 line spectra, up to 1800 trend and trip trend data points, 300 sets of startup/coastdown vectors, and shaft orbits. In addition, the 6652 DSP can perform vector monitoring by comparing the current 1x vibration vector to an alarm region set around the endpoint of a reference vector; furthermore, the monitor can be configured such that the second Danger alarm relay is used for vector alarming (tachometer input required).

### **6660: Six Channel Process**

The 6660 is a six channel process monitor used for monitoring any process parameter including pressure, temperature, flow rate, or other DC analog signal. Similar to other 6600 monitors, the 6660 continually compares the input values to the Alert and Danger alarm setpoints for each channel. However, the 6660 also allows the user to customize relay mapping, facilitating complex combinations of alarms to trip a single relay using "voting" techniques.

### 6666: Six Channel Temperature (RTD Input)

The 6666 is a general purpose temperature monitor which utilizes an RTD temperature sensor to monitor up to six channels of input. Originally designed primarily for bearing temperature monitoring but it can also be used to monitor motor winding and process temperatures. The 6666 continually compares the value for each input channel to the user-defined Alert and Danger alarm setpoints. Furthermore, this monitor allows the user to customize relay mapping, allowing for complex combinations of alarms to trip a single relay using "voting" techniques.



6600 monitors are particularly useful in Turbine Supervisory Instrumentation (TSI) applications

### 6667: Six Channel Temperature (T/C type J & K Input)

The 6667 is a general purpose temperature monitor which utilizes type J, K & T thermocouples to monitor up to six channels of input. This monitor is designed primarily for bearing temperature monitoring; however, it can also be used to monitor motor winding and process temperatures. The 6667, which utilizes cold junction compensation required for thermocouples, continually compares the value for each input channel to the user-defined Alert and Danger alarm setpoints. Furthermore, this monitor allows the user to customize relay mapping, allowing for complex combinations of alarms to trip a single relay using "voting" techniques.

### 6675: Single Channel Rotation

The 6675 is a single channel rotation monitor used to provide continuous monitoring of rotating machinery speed as measured by a non-contact eddy current probe or a magnetic interrupter. Although the default configuration for the 6675 is a single channel monitor, it can be factory configured to accept a second, redundant input, which facilitates automatic switching to the second probe if the first probe fails. In addition to monitoring machine speed, the 6675 provides zero speed detection, locked rotor alarming

and acceleration monitoring. Locked rotor alarming provides monitoring of the startup sequence of large electric motors. Zero speed detection is most commonly used in the operation of machines with high mass rotor systems, such as steam turbines, to detect when to engage the turning gear.

### 6676: Single Channel Reverse Rotation

The 6676 Single Channel Reverse Rotation Monitor provides reverse rotation detection and continuous monitoring of rotating machinery speed, measured by non-contact eddy current probes. This monitor utilizes two non-contact probes to monitor both speed and direction, and can detect speeds up to 50,000 rpm in the forward direction and 10,000 rpm in the reverse direction. This functionality is very useful in fan, boiler feed water pumps, and small steam turbine applications, where any reverse rotation of the machine can cause extensive damage. For example, in a boiler feed water pump application, where water is pumped up a vertical rise, the pump can actually reverse direction when shutdown, due to the back pressure from the water.

In this case, the 6676 monitor detects the operational direction of the pump and prevents the startup motor from operating until the pump has once again come to a stop.

### 6682: Dual Channel Position

The 6682 Dual Channel Position Monitor provides continuous monitoring of shaft axial position on rotating machinery. The primary application of the 6682 is to monitor the axial position of a thrust bearing at the end of a shaft; however, the 6682 can also be used for other applications including guide vane position monitoring and axial vibration monitoring. High axial vibration can be an indicator of misalignment and compressor surge. Other machinery fault modes that can be detected with the 6682 monitor include: thrust bearing wear, balance piston wear, and a loose thrust bearing.

### 6686: Dual Channel Eccentricity

The 6686 is a dual channel eccentricity monitor, which is used to evaluate the bow or mechanical runout of a shaft. This bowing is often caused by the shaft weight, when it is at rest between supporting bearings.

As the shaft begins to rotate, this bowing results in vibration measured as eccentricity. Eccentricity is also an indication of bearing wear and heavy preload, which can be caused by misalignment. Finally, the 6686 can provide an indication of rotor stability, since eccentricity provides a direct relationship with the shaft attitude angle.

#### **6687: Dual Channel Absolute Shell Expansion**

The 6687 Dual Channel Absolute Shell Expansion Monitor is used to monitor thermal expansion of machine casings. The absolute shell expansion measurement is important for steam turbines during startup and shutdown cycles to ensure that the turbine case expands at the specified rate and that the growth is uniform on both sides of the machine. Excessive expansion rate or non-uniform growth can result in serious damage to the machine and possibly the machine foundation. In addition to absolute shell expansion monitoring, the 6687 can also be used for monitoring guide vane position.

#### **6688: Dual Channel Differential Expansion**

The 6688 Dual Channel Differential Expansion monitor is used to monitor differential thermal expansion between rotating and stationary machine elements. The differential expansion measurement is important for steam turbines during startup and shutdown cycles to ensure that differences in thermal expansion between rotating and stationary parts do not become excessive. Excessive differential expansion can result in a rub or cause serious damage to the machine. The 6688 can also monitor single or dual differential expansion, ramp differential expansion (angled target expansion), or complementary differential expansion. This is achieved through alternative monitor configurations, which utilize the two input transducer signals to provide either dual independent evaluation or single extended range evaluation.

#### **6689: Dual Channel Valve Position**

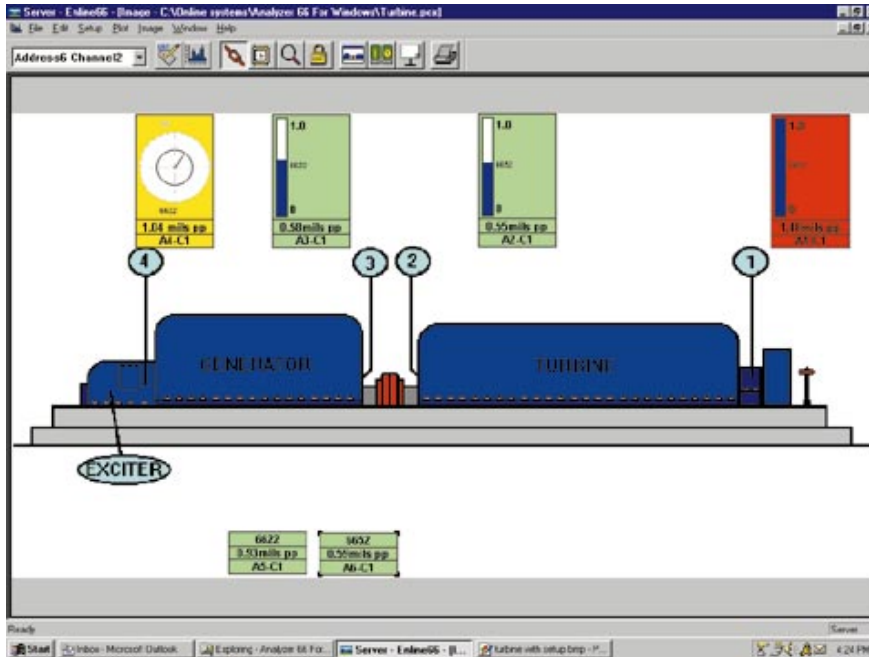
The 6689 provides continuous monitoring for up to two channels of input from a rotary cam (valve) potentiometer or a Linear Variable Differential Transformer (LVDT). The primary application of the 6689 is to monitor the inlet valve position on a steam turbine. Valve position is usually expressed in degrees rotation; therefore, the input signal is provided in units of mV/ ° Rotation. The monitor is then configured to display the valve position on a percent open scale.

#### **6691: Power Supply and Relay Card (V2)**

The 6691 Power Supply provides output voltage directly to 6600 V2 Series Protection Monitors, as well as relay output directly to the backplane of the rack for input into annunciators. Furthermore, the 6691 can supply +/- 18, +/- 24, and - 12 VDC to power transducers and charge amplifiers. The 6691 power supply can use any combination of one AC input and two DC inputs, up to a total of three power inputs. The monitor and power supply automatically switch among the power inputs if one source of power fails. This power supply can be purchased in the following configurations:

#### **6692: Power Supply and Relay Card (DSP)**

The 6692 Power and Relay Card provides voltage directly to 6600 DSP Series Protection Monitors as well as relay output for input into annunciators. Furthermore, the 6692 power supply provides a DC current to transducers and charge amplifiers directly from the backplane of the rack. The 6692 power supply can use any combination of one AC input and two DC inputs, up to a total of three power inputs. The monitor and power supply automatically switch among the power inputs if one source of power fails.



Enline 66 software utilizes digital images of your machine with an up-to-date view of vibration levels and alarm status

#### Enline 66™:

A graphical software package that displays data and alarm status information from the Entek 6600 Series Protection Monitors. Enline 66 provides your Plant Maintenance personnel with both monitoring and diagnostic capabilities on your most critical machines.

Enline 66 supports both the 6600 version 2 and DSP protection monitors and connects to multiple 6600 monitors through your PC's serial port. Enline 66 is available in both a single user and a Client-Server version for multi-user access on a plant's network.

Enline 66 provides an up-to-date view of your most critical machine's condition and alarm status. Information is presented using an intuitive mimic display. Enline 66 includes trend, spectrum, spectrum map (waterfall), polar, orbit, and Bode-Nyquist plots. Each plot has a suite of diagnostic cursors and hotkeys, described in the convenient online help for the plot.

Part Number	Description
C6691	Power Supply and Relay Unit (-24 VDC)
C6691/ICP	Power Supply and Relay Unit for ICP Transducers
C6691-12	Power Supply and Relay Unit (-12 VDC used for older LVDTs)
C6691-18	Power Supply and Relay Unit (-18 VDC)
C6691/18	Power Supply and Relay Unit (18 VDC)
C6691/24	Power Supply and Relay Unit (24 VDC)

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