

AMS Performance Advisor FREQUENTLY ASKED QUESTIONS

AMS[®] Suite: Global Performance Advisor

AMS Suite: Global Performance Advisor is an onsite, real-time application that calculates equipment performance. It is combined with AMS Suite: Asset Graphics to present protection, prediction, and performance information in one consolidated display. The inputs to the calculations already exist in a customer's historian and are retrieved utilizing OPC. The calculated outputs are also available as OPC values in the customer's historian.

AMS Performance Advisor shows the difference in equipment performance efficiencies (actual versus design) along with a graphical display of where performance is on the equipment performance 'curve.'

Answers to the most frequently asked questions on AMS Performance Advisor are provided below.

GENERAL INFORMATION

Q1. What is equipment performance?

Equipment performance refers to information that communicates *how efficiently process assets convert energy to output*. This applies to mechanical assets like compressors, gas turbines, steam turbines, pumps, and fans or process assets like boilers, heat exchangers, and cooling towers.

Q2. Why do I want/need to monitor equipment performance?

Knowing equipment performance helps you to identify the 1% in lost efficiency in equipment like compressors / boilers / turbines / etc. Just saving 1% in energy usage for every 100 MW consumed is worth approximately \$250k per year. Availability gains through predictive intelligence are worth up to 3% in overall uptime.

Q3. How can AMS Performance Advisor help me monitor equipment performance better than what I have been doing?

Equipment performance monitoring is not new to the market. In fact, the industry has been calculating asset efficiency performance for the last 30 years. A mechanical engineer is typically assigned to develop a thermodynamic model on key equipment and feed process values into the models either monthly or quarterly. Operators and process engineers then use this information. This approach is good, but there are a few challenges that make this approach cumbersome:

- Building models is arduous
- Entering data means reviewing all values for correctness, such as instrument drift
- Interpreting the data requires significant expertise
 - Employee turnover impacts expertise and tribal knowledge
- Bad or incorrect input values causes unrealistic calculated results

Q4. What solutions are available from Emerson?

Emerson has two performance monitoring applications that can be combined or used separately to meet your unique needs. AMS Suite: Equipment Performance Monitor is an existing service-based solution that provides monthly or quarterly expert analysis on critical equipment performance.

AMS Performance Advisor is an online, real-time performance monitoring application that addresses the need for timely delivery of information on performance condition. AMS Performance Advisor is designed to provide continuous feedback to a number of users:

- Operators can influence control changes to meet operational targets
- Maintenance can look into degradation trends by correlating both condition and performance data in order to plan actions to recover lost efficiency
- Process Engineers can identify potential instrument problems, pinpoint degradation sources, and evaluate effectiveness of cost improvement actions
- Management receives financial value of performance deviations from which to evaluate meeting availability targets

Q5. What application features are important to online monitoring of equipment performance?

All equipment performance applications include the following:

- Data Input/Output – retrieval of data from existing Historian, typically OPC
- Data Validation – pre-processing and validation of values prior to input to calculations; minimizes issues with poor or out-of-scale values that would cause incorrect efficiency calculations
- Calculation Engine – math methods required to calculate equipment efficiency
- User Interface – clear presentation of where equipment is operating
- Knowledge Base – recommended methods and procedures to guide personnel actions
- KPI /Business Metrics – clear presentation of the financial cost of not operating in green
- Alert Notification / Escalation – Displays alerts and escalation tactics (often email / group paging)
- Diagnostic Analysis – Helps correlate model or equipment issues using process flow diagrams
- Error / Event Logs – Document log by Operator when alerts or issues occur

Q6. What features differentiate AMS Performance Advisor from other performance monitoring applications?

AMS Performance Advisor differentiators include:

- Integration with any DCS, not tied to only Emerson systems
- AMS Machinery Manager software is not required as part of the AMS Suite solution. Other major providers require their base application software which adds significant cost to the solution.
- Provides financial value of the time operating below acceptable levels. Emerson refers to this as the percentage of Time Operating out-of-green zone.
- Intuitive screen presentation
- Quarterly tuning of system. Rather than set up an on-site calculator, Emerson has included tuning of the system that results in alert colors and a “Knowledge Base” that documents observations. The Knowledge Base helps to answer the question of what to do if equipment is not operating in the acceptable zones.

Q7. What benefits will AMS Performance Advisor deliver?

AMS Performance Advisor delivers the following benefits:

- Provides immediate feedback of equipment performance values and corrective actions
- Presents financial consequence of operational status (the cost of not running in 'green')
- Real-time updates (every 2 minutes is typical cycle update, capable of even faster updates)
- Provides efficiency deviation values (design / actual / delta-from-design) back to Operator's existing DCS screens
- Performance integrates with machinery protection and prediction capabilities of the AMS Suite
- Live Process Flow Diagrams (PFDs) help with problem analysis

Q8. What are the target applications?

AMS Performance Advisor has modules that calculate efficiency for equipment present in most process manufacturing industries and applications. Specific equipment supported includes:

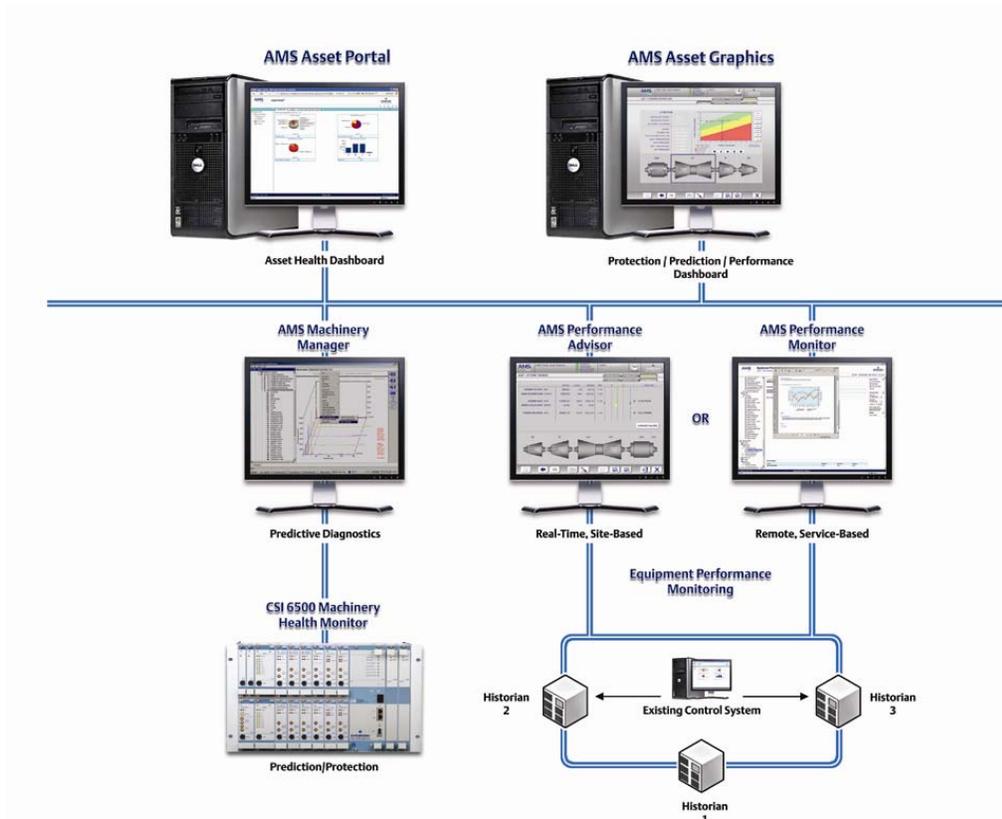
- Compressors (centrifugal / reciprocating / rotary screw)
- Gas Turbines
- Steam Turbines
- Heat Exchangers
- Boilers / Heaters / Furnaces
- HRSG (Heat-Recovery Steam Generators)
- Large Pumps
- Large Fans
- Cooling Towers

Q9. Does API 670 call for equipment performance monitoring?

Not directly. However, an appendix to API 670 5th Edition (CONDITION MONITORING INFORMATIVE ANNEX, Section 4) recognizes the value of equipment performance monitoring for early identification of predictable events. Machinery that is critical enough to protect is also a candidate for prediction and performance monitoring.

Q10. How does AMS Performance Advisor connect to my existing plant infrastructure?

AMS Performance Advisor runs on a dedicated work station computer that is connected to one or more source DCS/historians within your facility. The source measurements are processed in AMS Performance Advisor and posted to AMS Asset Graphics for visualization. Any value in AMS Performance Advisor is also available in the historian.



Q11. What is the tie between equipment performance monitoring and Emerson's Online Machinery Monitoring solution?

Emerson's Online Machinery Monitoring solution extends the PlantWeb[®] digital plant architecture to critical rotating equipment by integrated predictive diagnostics, equipment protection, and performance monitoring.

- Protection – For **unpredictable** events on expensive and critical mechanical assets. Protects human life and plant assets by monitoring vibration levels and tripping the process prior to catastrophic damage. Technology: CSI 6500 Machinery Health[®] Monitor
- Prediction – For **predictable** events that can identified through diagnostics. Identify specific faults well before an event occurs, providing ample time to make MRO decisions. Technology: CSI 6500
- Performance – For **predictable** and **controllable** events to identify lost efficiencies and degraded equipment performance so that Operations can control towards an optimal level. (Applies to AMS Performance Advisor and AMS Performance Monitor)

Q12. What are the requirements to run AMS Performance Advisor?

AMS Performance needs a *dedicated workstation*, but it *does not need to run on a server-class machine*. The workstation specifications are noted on the product data sheet. Note that the Microsoft Windows Vista operating system is not supported (as of October 2008).

Users should not run AMS Performance Advisor on the same server as AMS Machinery Manager or AMS Device Manager. AMS Asset Graphics and AMS Performance Advisor can run on the same computer. Users can even place *both of these applications on a touch screen computer* located above or near the CSI 6500 Monitor in a standard rack.

Users must also purchase the AMS Performance Advisor core license, desired equipment modules, AMS Asset Graphics, and a dedicated work station computer (or application station). All required INSTALL services are included in the price.

The core license includes:

- AMS Performance Advisor core software with first year tuning (rendered 1/quarter)
- INSTALL service to physically install and commission the software

The core license provides one year of quarterly system tuning to set credible alerts and create the equipment-specific knowledge base. The tuning services are provided by Emerson's Equipment Performance Center of Excellence located in our Teesside, UK facility. The locally-based Online Systems Engineer (OSE) is not required to understand the configuration details behind the AMS Performance Advisor database, but is involved to configure and support the application.

The knowledge base is the AMS Performance Advisor's document library that operators can use to determine "next steps" or troubleshooting actions to improve equipment performance back to optimal levels.

Q13. What are the available equipment modules?

The support equipment modules in AMS Performance Advisor are:

- Compressor – Centrifugal Module
- Compressor– Reciprocating Module
- Compressor – Rotary Screw Module
- Gas Turbine Module
- Steam Turbine Module
- Heat Exchanger Module
- Boiler / Heater / Furnace Module
- HRSG Module
- Large Pump Module
- Large Fan Module
- Cooling Tower Module
- Optional: 2nd Similar Equipment (same manufacturer and model)

Modules are purchased according to each unique equipment type. For example, after the CORE License purchase, select applicable Equipment Modules using this approach:

- 2 unique Boilers: 2 x Boiler Modules
- 2 similar Boilers: 1 x Boiler Module and 1 x 2nd Similar Equipment
- 2 similar Boilers and 3 similar Steam Turbines: 1 x Boiler Module, 1 x Steam Turbine Module, and 3 x 2nd Similar Equipments

Quotations are available through your world area Emerson office. Our Machinery Solutions Business Development Managers can assist with any specific questions regarding application or commercial offers.

Q14. Is historical data needed to develop the equipment module?

No. The only requirement is to have the equipment module input measurements as referenced in the product data sheet.

Q15. What equipment module input information is required for configuration?

During INSTALL execution, the input data is gathered utilizing a form as shown:

MODULE: Large Pump						
Unit ID	Manufacturer	Model	Description / Size / # Stages		Any Other Comments	
<i>Details Here</i>						
Module Inputs	Instrument ID	Tag Name in Historian / DCS	Engineering Units	Appropriate Range	Typical Value	Any Other Comments
				min max		
Flow Rate – Measurement point inside any recycle loops						
Pressure – Inlet / Suction						
Pressure – Exit / Discharge						
Shaft Speed (on variable speed machines)						
Power Consumption (or Motor Current, Volts & pF)						
Fluid Characteristics – Density						
Fluid Characteristics – Molecular Weight						
<i>Optional Inputs If Available</i>						
Mechanical Efficiency (Shaft)						
Temperature - Inlet / Suction						
Temperature – Exit / Discharge						
Nozzle Suction Area						
Module Outputs	Any Other Comments					
Efficiency – Actual (Overall Duty)						
Efficiency – Design (Baseline Duty)						
Efficiency – Deviation						
Pump Head – Actual						
Pump Head – Design						
Pump Head – Deviation						
Pump Head – Corrected						
Deviation Cost (Lost Throughput or Additional Power)						
<i>Additional Available Outputs</i>						
Flow Rate – Volumetric						
Velocity – Suction						
Velocity – Discharge						
Velocity Head – Suction						
Velocity Head – Discharge						
Pressure Ratio						
Speed – Design (as appropriate)						
Power - Actual						
Power – Specific						
Power – Corrected (as appropriate)						

Q16. How are measurements that are manually recorded by operators handled?

All equipment module input measurements that come into AMS Performance Advisor are designed to be received through the DSC/historian using OPC. If a particular equipment module input is not available or only recorded during an operator walking route, then this data should be hand entered into the DCS or historian manually. Of course, hand entered data will not be updated as quickly as automated measurements. As a result, AMS Performance Advisor will be configured to operate in one of the following ways:

- Run calculations only when equipment module input data are less than two minutes old
- Run calculation accommodating that some input data are older than two minutes, but compensate
- Do not run calculations if any module input data cannot validate properly
- Execute specialized decisions on executing calculations

Q17. What is the update rate for AMS Performance Advisor?

AMS Performance Advisor is typically configured to run calculations every two minutes. It is possible to configure an update rate as fast as every ten seconds; however, this update rate is impractical.

Q18. How are optional inputs and outputs handled in each equipment module?

Optional module inputs tie into optional module outputs. As long as AMS Performance Advisor has the required module inputs, it can provide the listed module outputs. These details are determined during the execution of INSTALL.

Q19. Why is the Cooling Tower Module the most expensive?

Computing cooling tower performance is based on environmental conditions, such as outside temperature, barometric pressure, and humidity. These factors all influence the evaporative process, making cooling towers complex to model accurately.

Q20. How does AMS Asset Graphics work with AMS Performance Advisor?

AMS Performance Advisor is only a calculation engine without any display. AMS Asset Graphics is used to render this information into intuitive equipment performance results for all users.

Q21. If I already have a data visualization user interface, is AMS Asset Graphics still required?

Yes. AMS Asset Graphics is required. However, contact a Machinery Solutions Business Development Manager through your local Emerson sales office if this path of execution is under consideration.

Q22. How does AMS Machinery Manager work with AMS Performance Advisor?

AMS Machinery Manager is not required to operate AMS Performance Advisor. However, AMS Performance Advisor, when combined with the appropriate elements, can send equipment performance data using an

OPC-to-Modbus input to AMS Machinery Manager for trending with other machinery health values. A Machinery Solutions Business Development Manager (BDM) can provide more specific details.

Q23. Is this product similar to the Global Performance Advisor sold by Emerson’s Power & Water Solutions division?

AMS Performance Advisor is the same application that has been sold through Emerson’s Power & Water Solutions division since 1998. The Asset Optimization division modified the application to make it a part of the AMS Suite and also added compressor models to address the needs of users outside of the power industry.

Q24. Does AMS Performance Advisor come with INSTALL and IMPLEMENT services?

Yes. These services are included in the product offering. The INSTALL service is part of the configuration of each Equipment Module. The IMPLEMENT service is achieved through the quarterly tuning. Users can also extend the quarterly tuning beyond the first year. See the product data sheet for part numbers and details.

Q25. Do I need an expert to come out and scope a job?

No. The data tag inputs to the modules are clearly outlined in the product data sheet. It is important to use the data sheet to identify the necessary input measurements prior to placing an order. If the minimum measurement inputs are not available, the modules may need additional time and effort from our solution expertise to consider if there are alternative methods of calculating good results. A Machinery Solutions BDM can provide more advice on your circumstance.

Q26. What is the process once a purchase order is submitted?

The focus of INSTALL is to get the technology working and resources trained. Executing INSTALL involves two trips to the site by the Online Systems Engineer who is INSTALL-certified on AMS Performance Advisor.



The typical interface at the installation site is the process engineer.

Pre-INSTALL Preparation Details

- Task 0. Solicit pre-trip details and project requirements in advance of first site visit

Trip #1 – Online Systems Engineer (OSE)

- Task 1. Review functionality & screens
- Task 2. Gather equipment information
- Task 3. Determine Data Connectivity

Off-site Configuration - Equipment Performance Center of Excellence

The engineering, project management, and documentation are executed by Emerson's Equipment Performance "Center of Excellence" located at Teesside, UK facility.

- Task 4. Create configuration files
- Task 5. Perform Factory Acceptance Test (FAT)

Trip #2 – Systems Engineer

- Task 6. Install & configure software
- Task 7. Site Acceptance Test (SAT) / minor changes
- Task 8. Review basic functions
- Task 9. Review formal training / mentor
- Tasks 10. Backup database

IMPLEMENT

Executing IMPLEMENT Task 7 continues with system tuning that yields credible feedback. The tuning is executed by Emerson's Equipment Performance "Center of Excellence" over first 12 months.

Q27. What is the shortest possible timeframe required to execute the Site Acceptance Test (SAT) which is INSTALL Task 7?

A significant aspect of executing INSTALL for AMS Performance Advisor is the configuration time. INSTALL Task 7 (SAT) occurs during the second OSE trip and can only be executed after the previous tasks have been completed.

INSTALL Tasks 4 and 5 (off-site configuration) takes a significant amount of time. As a rule of thumb, expect that each equipment module will take ~2 man-weeks. Therefore, configuration of an example 3 unique equipment modules can take about 6 man-weeks as a best case.

Using this example, a project time line for 3 unique equipment modules would look like the following:

- | | | | |
|--------------|---|-------------|----------------------|
| • Task 0 | Pre-trip preparation details | Week 1 | ~30 minute duration |
| • Tasks 1-3 | Data gathering and functionality conformation | Week 4 | ~1 man-day duration |
| • Tasks 4-5 | Configuration and FAT | Week 5 – 14 | ~45 man-day duration |
| • Tasks 6-10 | Installation of software, SAT, and training | Week 15 | ~2 man-day duration |

These times are approximate, but illustrate the time significance of configuration tasks. A quotation includes the man-day efforts necessary for each solution in considering likely SAT target dates.



AMS Suite: Global Performance Advisor powers PlantWeb with predictive and proactive maintenance through performance monitoring of process and mechanical equipment to improve availability and performance.

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