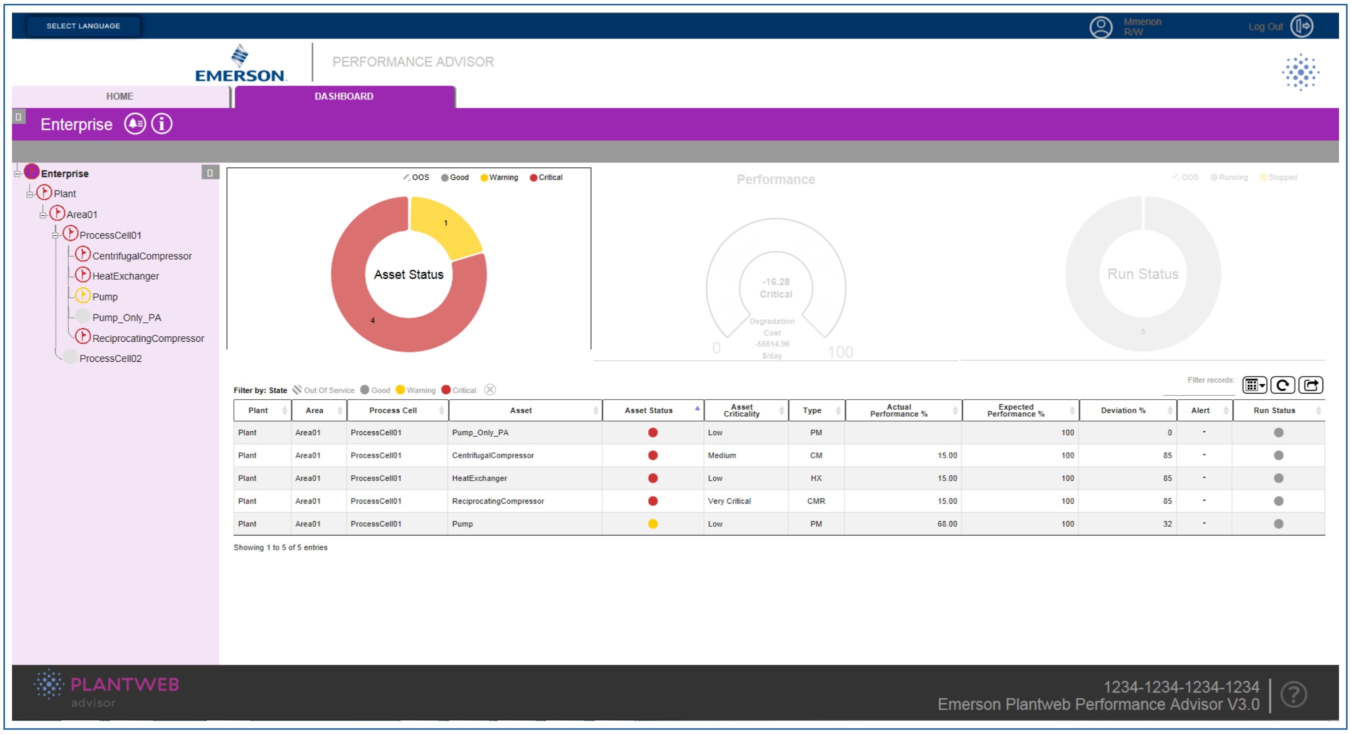
Plantweb™ Performance Advisor



Real-time equipment performance health feedback integrates with process automation so you can run your plant with confidence

- Achieve and maintain optimum equipment performance
- Track key performance indicators in real-time against target operation
- Quantify thermodynamic efficiency losses
- Prioritize and plan maintenance activities
- Determine the root cause of production ineficiencies

Introduction

The performance of all critical equipment will deteriorate over time, resulting in lost efficiency, increased energy usage, and reduced throughput. Identification of the deviation from equipment design, combined with early detection, is vital to your plant's profitability. Knowing the health and performance of your mechanical equipment allows you to be proactive with your operational and maintenance planning instead of reacting to unexpected events.

Plantweb Performance Advisor helps you to run your process more efficiently, track operating performance against targets, schedule maintenance activities, and determine the root cause of production asset inefficiencies. When your maintenance and operations staff are alerted to degrading asset performance, critical production decisions can be made to mitigate outages and improve your bottom line.

PLANTWEB advisor

EMERSON

Benefits

Plantweb Performance Advisor calculates thermodynamic-based equipment performance using industry-standard ASME PTC performance calculation techniques to facilitate KPIs and metrics that can be compared to design/baseline to determine "deviation from design" diagnostics for your critical machinery, including turbines, compressors, boilers, pumps and other production assets.

Specific key performance indicators combined with clear graphical operating plots show exactly where the equipment is currently operating versus expected or design condition.

Combining performance data with machinery condition, protection and prediction diagnostics helps your reliability program shift from reactive to proactive operation.

Performance Advisor provides calculated information for common non-exhaustive key equipment types, such as:

- Compressors – Multi-stage, centrifugal and axial
- Compressors – Multi-stage, reciprocating
- Gas Turbines – Mechanical drive, generating
- Steam Turbines – Mechanical drive, generating
- Boilers
- Fired Heaters / Furnaces
- HRSGs
- Condensers – Air cooled, water cooled
- Pumps
- Cooling Towers
- Chillers

Benefits for the Entire Facility

Operations: Receive real-time feedback of equipment performance to influence control changes and help meet operational production targets.

Maintenance: Experts access in-depth diagnostics to understand degradation trends and status by correlating condition and performance data.

Process Engineers: Identify potential instrument problems, pinpoint degradation sources, and evaluate the effectiveness of cost improvement actions.

Management: Understands financial impact of performance deviations and how it impacts plant operation.

Product Description

Plantweb™ Advisor Suite

Plantweb Performance Advisor is part of the Plantweb™ suite of integrated applications that monitor the health, performance and energy intensity for a site's key production assets. The Plantweb Advisor Suite includes the following applications:

- **Performance Advisor** – 1st principle thermodynamic modeling comparing actual performance against design expectations
- **Health Advisor** – Patented, statistical approach to calculating asset health using equipment sensors as well as process data
- **Energy Advisor** – Energy monitoring, consumption modelling, unit/area/site roll-up and tracking, and alerting for overconsumption events

These solutions monitor the mechanical integrity of the assets and flag efficiency deviations that, if not acted upon, often result in an unplanned shutdown.

Real-Time Equipment Performance Monitoring

The real-time information available from Plantweb Performance Advisor helps you pinpoint opportunities for performance improvement that would otherwise go unnoticed. Differentiating features add value and knowledge to equipment operation.

- Ability to apply KPI calculations retrospectively to view historical machinery performance
- Data connectivity to any historian or DCS regardless of vendor; gather data from multiple sources
- Intuitive graphical presentation clearly displays current operating point compared to design criteria in both time based, and operating envelope plots
- Facilitates integration of protection, prediction, and performance information for a complete condition and performance monitoring solution

Flexible Data Connectivity

Plantweb Performance Advisor receives measurement input data from existing field instrumentation, web-based data (such as weather information), and user data from manually-entered values. Data can be collected from any manufacturer's DCS or data historian using standard protocols. This flexibility means that plants with multiple sources of input data and information systems can unify their performance calculations in a single, centralized location.

Multiple Users

Plantweb Performance Advisor communicates specific diagnostics aligned to plant roles.

- Operators obtain real-time feedback on setpoint changes to ensure optimal asset performance is achieved and maintained.
- Maintenance resources can identify impending condition and/or performance issues and prioritize planned activities.
- Process Engineers can determine assets that are developing problems and assess the cost of degradation vs. the cost to repair.

Results You Can Trust

Plantweb Performance Advisor has been developed by experts in applying thermodynamic models on-line and therefore includes features designed to handle common challenges using real plant data. Key features include data validation and manipulation functions, "sense testing" of calculated results, and proper filtering of inputs.

Input Data Validation

Plantweb Performance Advisor evaluates the quality of DCS/historian input signals using data quality, expected range testing, and (alternative) data substitution techniques to ensure the best data is used for the performance calculation.

Equipment efficiency changes are often tracked down to tenths of a percent, so good input measurements are essential. Plant data can be error-prone. When data is bad, Performance Advisor can be setup to estimate from last good value, a calculated value, or a default value, ensuring the accuracy of the calculations and delivering reliable results. Suspect data is highlighted to the user within the GUI.

Analog Input Filtering

Noisy data from on-line systems often creates issues, particularly for 1st principle, heat-and-material balance models. Plantweb Performance Advisor data integrity is ensured through built-in analog input filtering and validation techniques. Analog signals may have a small degree of customizable smoothing applied inside Plantweb Performance Advisor to improve performance analysis, particularly when noisy data is present.

A reported “poor” or “suspect” status of any input or substituted value is made visible through the graphic interface, delivering an early warning mechanism for problematic data connectivity or measurement issues. The same techniques can be applied to key results to ensure sensible data is propagated to other systems as required.

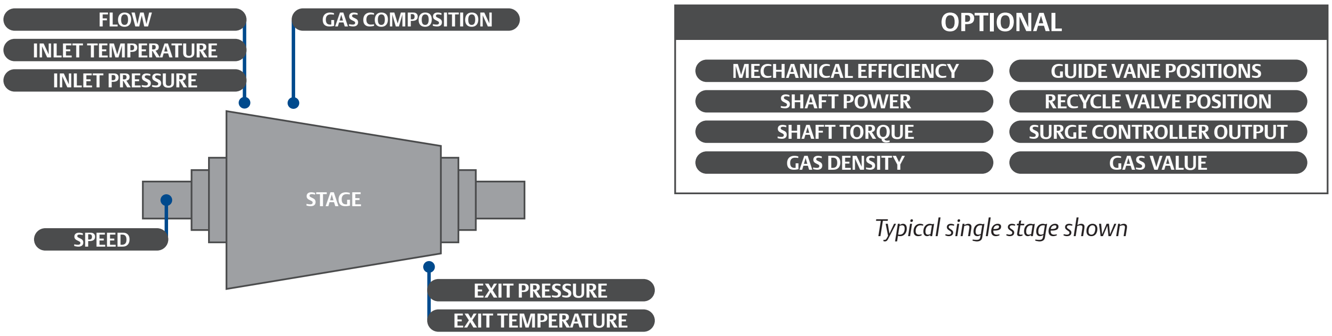
Common View of the Truth

Home-grown spreadsheet applications are often used for equipment performance calculations, but most companies find they are cumbersome, hard to maintain, do not usually operate in real-time and have limited users. Plantweb Performance Advisor is based on OSIsoft PI, the leading process historian in the continuous industries, with over 10,000 installations and hundreds of thousands of users.

- Compared to do-it-yourself spreadsheets, Plantweb Performance Advisor provides overwhelming benefits.
- Full-function database and graphics engine which can be completely customized if desired
- Ability to scale up to hundreds of assets and users
- Modular structure for easy configuration and expansion
- Pre-engineered ASME PTC performance calculations for many equipment types
- Easy comparison to reference operation at “standard conditions”
- Calculation of the economic impact of degradation
- Easy data cleaning and validation techniques
- Able to retrospectively apply performance calculations to historical data
- Model data smoothing to help understand underlying performance trends
- Easy-to-use detailed graphical interface and historian capabilities that interface with multiple external data sources
- Consistent modelling approach for similar units on a site- wide and organization-wide basis

Module: Compressor – Centrifugal/Axial

Module Process Flow Diagram



Typical single stage shown

Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Operating Curves* – Head Versus Flow, Efficiency Versus Flow, Discharge Pressure Versus Flow**, Power Versus Flow*

Module Calculation Method

- AMSE PTC 10

Module Input Data Points (per stage)

- Flow (measured inside any recycle loops)
- Temperature – Inlet / Suction
- Temperature – Exit / Discharge
- Pressure – Inlet / Suction
- Pressure – Exit / Discharge
- Shaft Speed (On Variable Speed Machines)
- Inlet Gas – Composition
- Inlet Gas – Density (or Inlet Compressibility)
- Inlet Gas – Specific Heat (or Ratio of Specific Heats)

Optional Data If Available

- Exit Gas – Specific Heat
- Exit Gas – Density (or Compressibility)
- Shaft Power
- Shaft Torque
- Reference Condition – Power
- Reference Condition – Head
- Reference Condition – Volume
- Reference Condition – Density
- Reference Condition – Speed

** At various operational speeds*
*** Optional*

Module Outputs

- Polytropic Efficiency – Actual
- Polytropic Efficiency – Design
- Polytropic Efficiency – Deviation
- Polytropic Head – Actual
- Polytropic Head – Design
- Polytropic Head – Deviation
- Flow – Volumetric Flow Actual
- Flow – Mass Flow
- Shaft Power Consumption (if not measured)
- Deviation Cost (Lost Throughput and/or Additional Power)

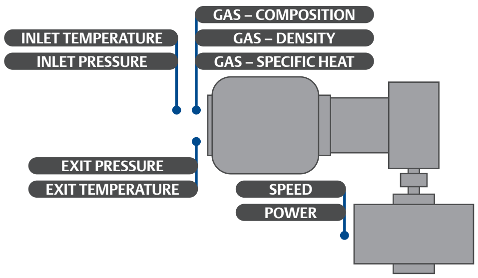
Additional Outputs (data dependent)

- Efficiency and Head – Adiabatic and Isothermal
- Power – Design
- Power – Deviation
- Compressor Gas Velocities – Inlet and Exit
- Flow – Mass Design and Deviation
- Suction Stagnation Conditions
- Discharge Stagnation Conditions
- Temperature – Theoretical Rise and Ratio
- Temperature – Actual Rise and Ratio
- Pressure – Rise and Ratio
- Corrected & Normalized – Volume Flow, Head and Power
- Machine Work Coefficients & Machine Mach Number

NOTE: A turbo-compressor is a turbine module + compressor module

Module: Compressor – Reciprocating

Module Process Flow Diagram



OPTIONAL

EXIT GAS – SPECIFIC HEAT
EXIT GAS – DENSITY
CAPACITY CONTROL
GAS FLOW

Typical single stage shown

Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets; Including – Single/Double Acting, Stroke Length, Bore, Piston Area, Rod Area , Valve size(s), Capacity Control, Design Operating Points
- Operating Curves (Required): Power Versus Flow, Capacity Control Curves

Module Calculation Method

- ASME PTC 9

Module Input Data Points

- Temperature – Inlet / Suction
- Temperature – Exit / Discharge
- Pressure* – Inlet / Suction
- Pressure* – Exit / Discharge
- Shaft Speed
- Inlet Gas – Composition
- Inlet Gas – Density (or Inlet Compressibility)
- Inlet Gas – Specific Heat (or Ratio of Specific Heats)
- Shaft Power

Optional Data If Available

- Gas Flowrate
- Discharge Gas – Density
- Discharge Gas – Specific Heat
- Temperature – Cooling Jacket Coolant Inlet
- Temperature – Cooling Jacket Coolant Exit
- Capacity Control Operation
- Rod Drop Measurement

** Pressure typically measured at suction/discharge dampener/bottles/drums*

Module Outputs

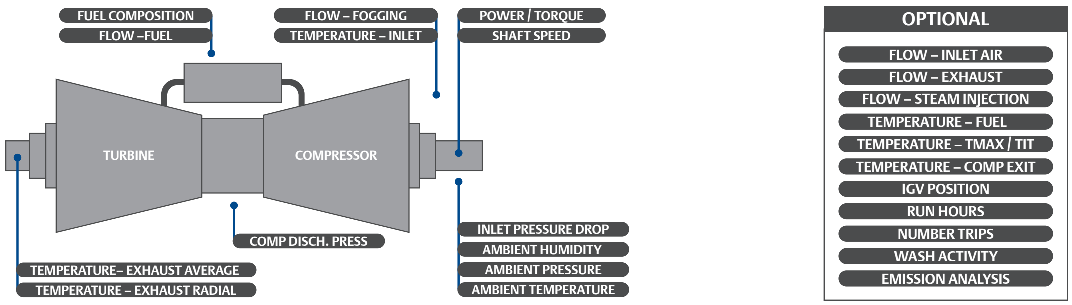
- Swept Volume
- Clearance – Volume and Percent (Crank End, Head End)
- Volumetric Efficiency – Actual
- Volumetric Efficiency – Design
- Volumetric Efficiency – Deviation
- Adiabatic Efficiency – Actual
- Adiabatic Efficiency – Design
- Adiabatic Efficiency – Deviation
- Adiabatic Head – Actual
- Power – Design
- Power – Deviation from Design Power
- Flow – Actual Volumetric and Mass
- Specific Power – per Mass Flow
- Flow – Design, and Deviation from Design Mass Flow
- Deviation Cost (Lost Throughput and/or Additional Power)

Additional Outputs (Data dependent)

- Compressor Gas Velocities – Inlet and Exit
- Shaft Efficiency
- Cylinder Suction Internal Conditions
- Cylinder Discharge Internal Conditions
- Temperature – Theoretical Rise and Ratio (with and without cooling duty)
- Temperature – Actual Rise and Ratio
- Pressure – Rise and Ratio
- Rod-loads (Head and Crank End)

Module: Gas Turbine (Electricity Generating & Mechanical Drive)

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets and Correction Curves to ISO Conditions
- GT Load Testing – Acceptance Testing Data; Design at various Gas Turbine Loads (50%, 75%, 100% load), at various Inlet Temperature conditions

Module Calculation Method

- ASME PTC 22 – Corrected output, heat rate, and thermal efficiency are calculated based on correction curves provided by the turbine manufacturer. Design combustion, turbine heat rate and efficiency are calculated based on turbine design data and compared to the corrected values.

Module Inputs

- Flow – Fuel
- Flow – Fogging / Evaporative Cooling (where present)
- Flow – Steam Injection (where appropriate)
- Temperature – Ambient
- Temperature – Air Inlet
- Temperature – Exhaust Profile
- Temperature – Power Turbine Exhaust (as appropriate)
- Pressure – Ambient
- Pressure – Compressor Exit
- Pressure Drop – Inlet Filter(s)
- Humidity – Ambient
- Shaft Speed(s)
- Shaft Power / Torque (MW, MVAR, etc)
- Fuel Composition

Optional Inputs If Available

- Flow – Inlet Air and Gas Exhaust
- Temperature – Fuel
- Temperature – Tmax or TIT or Turbine First Blade
- Temperature – Compressor Exit(s)
- IGV Position(s)
- Operating Hours / Number Trips / Number Starts
- Wash Activity / Inlet Heating Activity
- Stack O_2

Module Outputs

- Emissions Analyses (e.g. NOx / SOx / COx)
- Thermal Efficiency – Actual
- Thermal Efficiency – Design (Baseline)
- Thermal Efficiency – Deviation
- Thermal Efficiency – Corrected
- Heat Rate – Actual
- Heat Rate – Design (Baseline)
- Heat Rate – Deviation
- Heat Rate – Corrected
- Power Output – Actual
- Power Output – Design (Baseline)
- Power Output – Deviation
- Power Output – Corrected
- Deviation Cost (Increased Fuel and/or Reduced Power)

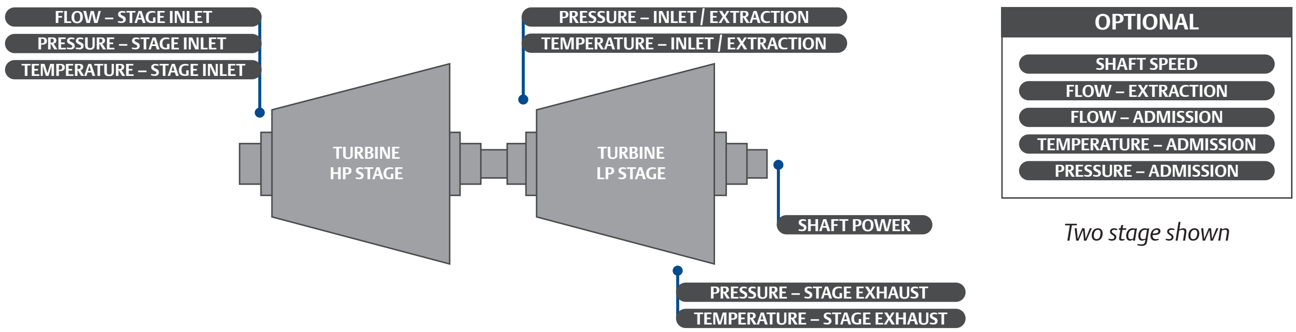
Additional Available Outputs

- Compressor Efficiency – Polytropic
- Compressor Temperature Ratio
- Compressor Pressure Ratio
- Temperature – Exhaust Spread
- Temperature Profile – Exhaust Deviation
- Operating Capacity (% Load, Remaining Power)
- Correction Factors
- Full Load Equivalent Power/Heatrate

NOTE: A turbo-compressor is a turbine module + compressor module

Module: Steam Turbine (Mechanical Drive / Generating)

Module Process Flow Diagram



Two stage shown

Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- OEM Heatload Diagrams at Various Outputs
- Operating Curves: Efficiency Versus Steam Flow, Efficiency
- Versus Power

Module Calculation Method

- ASME PTC 6 – This method utilizes the enthalpy drop approach.

Module Inputs

- Flow(s) – Stage Inlet
- Temperature(s) – Stage Inlet
- Temperature(s) – Stage Exhaust
- Pressure(s) – Stage Inlet
- Pressure(s) – Stage Exhaust
- Turbine Power (MW, Torque, or similar)

Optional Inputs If Available

- Speed
- Flow(s) – Extraction
- Steam Flow(s) – Admission
- Steam Temperature(s) – Admission
- Steam Pressure(s) – Admission
- Feedwater heater flow/temperature(s) for extraction estimation

Module Outputs

- Thermal Efficiency – Actual (per stage and overall)
- Thermal Efficiency – Design (per stage and overall)
- Thermal Efficiency – Deviation (per stage and overall)
- Power – Actual (per stage and overall)
- Power – Design (per stage and overall)
- Power – Deviation (per stage and overall)
- Steam Rate (per stage and overall)
- Deviation Cost (Increased Steam Usage or Reduced Power)

Additional Available Outputs

- Flow(s) – Turbine Section Extraction Steam
- Estimated Exhaust Quality (condensing stage)
- Expected Design Temperature(s)
- Operating Temperature Ratios
- Operating Pressure Ratio

Module: Boiler

Module Process Flow Diagram

See boiler figure on next page

Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Rated Cases: (50%, 70%, 80%, 90%, 100% load)

Module Calculation Method

- ASME PTC 4.1 (heat loss method) – For a regenerative or tubular type air heater, the module computes corrected gas outlet temperature and air heater gas-side efficiency in accordance with ASME PTC 4.3. Design gas-side efficiency is calculated and compared to the actual efficiency. For tri-sector type air heaters, air and gas-side efficiencies are calculated and compared to design values.

Module Inputs

- Fuel(s) – Feed Composition and Heating Values
- Flow – Fuel(s)
- Flow – Reheat Steam (as required)
- Flow – Steam and/or Feed Water
- Flow(s) – De-superheater Spray Water
- Flow(s) – Reheat De-superheater Spray Water
- Temperature – Air Inlet
- Temperature – Feed Water
- Temperature – Stack Gas
- Temperature – Steam Exit
- Temperature(s) – De-Superheater Spray Water
- Temperature – Reheat Inlet / Exit (as required)
- Temperature – Reheat De-Superheater Spray Water (as required)
- Pressure –Reheat In/Exit, Steam Exit and Drum (as required)
- Analysis – Flue Gas Combustion O_2

Optional Inputs If Available

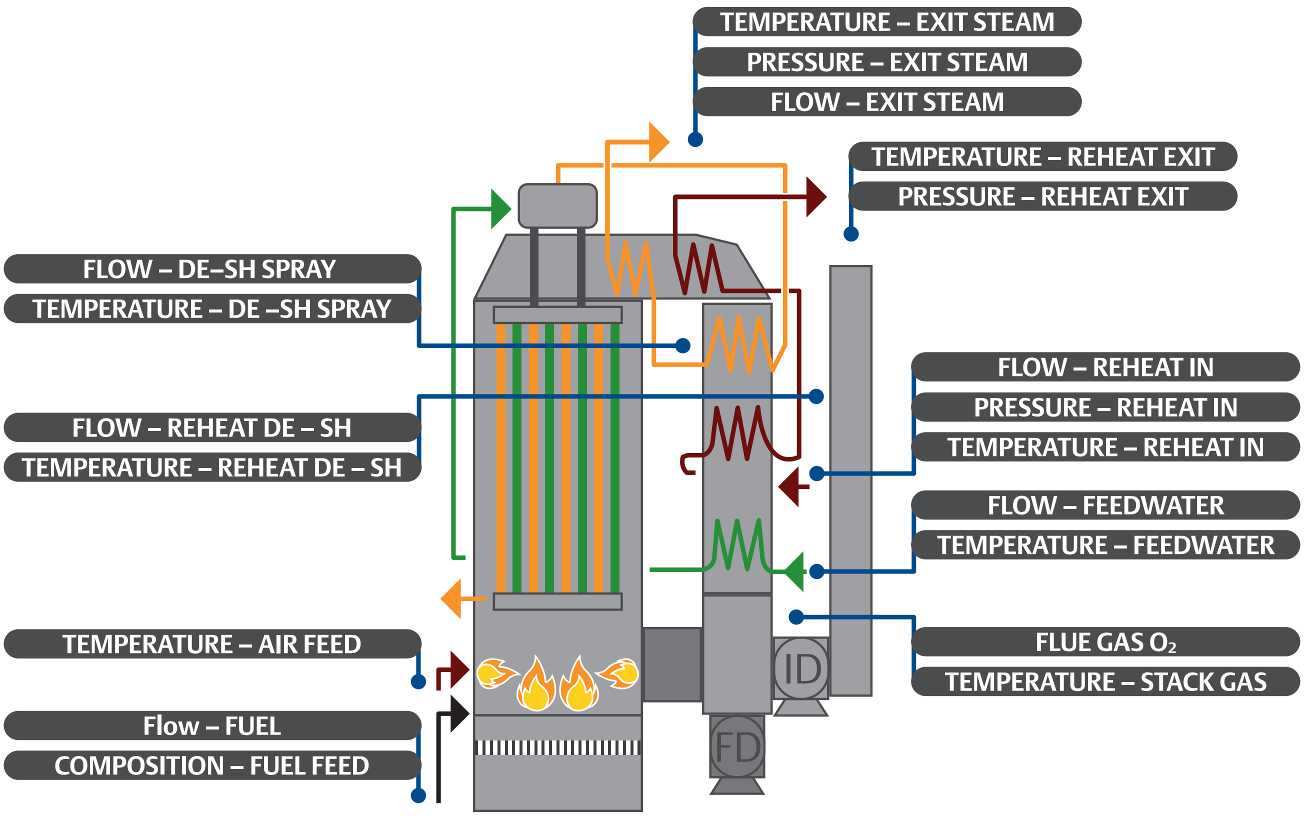
- Flow(s) – Feed Air
- Flow(s) – Soot Blowing Steam
- Flow – Drum Blowdown
- Temperature – Fuel Feed
- Temperature – Furnace Firing
- Temperature – Combustion Air
- Temperature(s) – Flue Along Gas Path
- Temperature(s) – Economizer Exit Water
- Temperature(s) – De-Superheater Steam Inlet/Exit
- Pressure – Boiler Feed Water
- Pressure(s) – Intermediate Steam Superheater(s) & Spray Water
- Analysis – Stack Excess O_2
- Analysis – Flue Gas (e.g. NOx / SOx / COx / H_2O)

Module Outputs

- Efficiency – Actual (Heat Loss and Input / Output)
- Efficiency – Design (Baseline)
- Efficiency – Deviation
- Flow – Steam Actual
- Flow – Steam Design (Baseline)
- Flow – Steam Deviation
- Combustion O_2 – Actual
- Combustion O_2 – Design (Baseline)
- Combustion O_2 – Deviation
- Total Fired Heat
- Deviation Cost (Lost Steam and/or Additional Fuel)

Additional Available Outputs

- Heat Loss – Total
- Heat Loss (Dry Gas)
- Heat Loss (Moisture in Fuel)
- Heat Loss (Moisture Formed from Hydrogen)
- Heat Loss (Moisture in Supplied Air)
- Heat Loss (Ash)
- Heat Loss (Radiation)
- Heat Loss (Carbon Monoxide)
- Temperature – Air Heater Air Inlet Deviation
- Temperature – Air Heater Gas Inlet Deviation
- Temperature – Air Heater Gas Outlet Deviation
- Excess Air – Actual
- Excess Air – Deviation
- Flow – Blowdown (if not supplied)
- Air Heater Leakage



OPTIONAL

FLOW – FEED AIR	TEMPERATURE(S) – SUPERHEATER(S)
FLOW(S) – SOOT BLOWING STEAM	TEMPERATURE(S) – DE–SUPERHEATER STEAM INLET/EXIT
FLOW – BLOWDOWN	PRESSURE – BOILER FEED WATER
TEMPERATURE – FUEL FEED	PRESSURE(S) – STEAM DRUM
TEMPERATURE – FURNACE FIRING	PRESSURE(S) – INTERMEDIATE SUPERHEATER STEAM
TEMPERATURE – COMBUSTION AIR	STACK EXCESS O_2
TEMPERATURE(S) – FLUE GASPATH	FLUE GAS ANALYSIS
TEMPERATURE – ECONOMIZER WATER	

Module: Heat Recovery Steam Generator (HRSG)/Waste Heat Boiler (WHB)

Module Process Flow Diagram

See boiler figure on next page

Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Rated Cases: (50%, 70%, 80%, 90%, 100% load)

Module Calculation Method

- ASME PTC 4.4 (input-output and thermal-loss efficiencies) – The design efficiency values calculated from performance data in accordance to the PTC definitions:
- Output is the heat absorbed by the working fluids.
- Input is the sensible heat in the exhaust gas supplied to the HRSG, plus the chemical heat in any supplementary fuel, plus the heat credit supplied by the sensible heat in any supplementary fuel.

Module Inputs

- Flow – Gas Turbine Exhaust (or Estimate)
- Flow* – Steam and/or Feed Water
- Flow* – De-Superheater Spray Water (as required)
- Flow – Supplementary Fuel (if Duct Burners present)
- Flow – Gas Turbine Fuel
- Temperature – Gas Turbine Exhaust / Duct Inlet
- Temperature* – De-Superheater Spray Water
- Temperature – Stack Gas
- Temperature* – Boiler Feed Water (BFW)
- Temperature* – Steam Exit
- Pressure* – Steam Exit
- Analysis – Stack Gas Excess O_2 (or Estimate)
- Analysis – Fuel Composition, Heating Value

Optional Inputs If Available

- Flow* – Blowdown
- Flow* – Evaporator Circulating Water
- Temperature(s) – Flue Gas Path
- Temperature* – Economizer Exit Water
- Temperature* – Intermediate Superheated Steam
- Temperature – Supplementary Fuel
- Pressure* – Boiler Feed Water (BFW)
- Pressure* – Steam Drum
- Duty – Additional Heat Sinks (e.g. District or Oil Heating)
- Analysis – Flue Gas Analysis (e.g. NOx / SOx / COx / H_2O)

**Required for each steam pressure level*

Module Outputs

- Thermal Efficiency – Actual
- Thermal Efficiency – Design (Baseline)
- Thermal Efficiency – Deviation
- Thermal Efficiency – Thermal Loss Actual
- Thermal Efficiency – Thermal Loss Design
- Thermal Efficiency – Thermal Loss Deviation
- Flow(s) – Steam
- Flow(s) – Steam Design
- Flow(s) – Steam Deviation
- Available Heat
- Deviation Cost (Lost Steam Production)

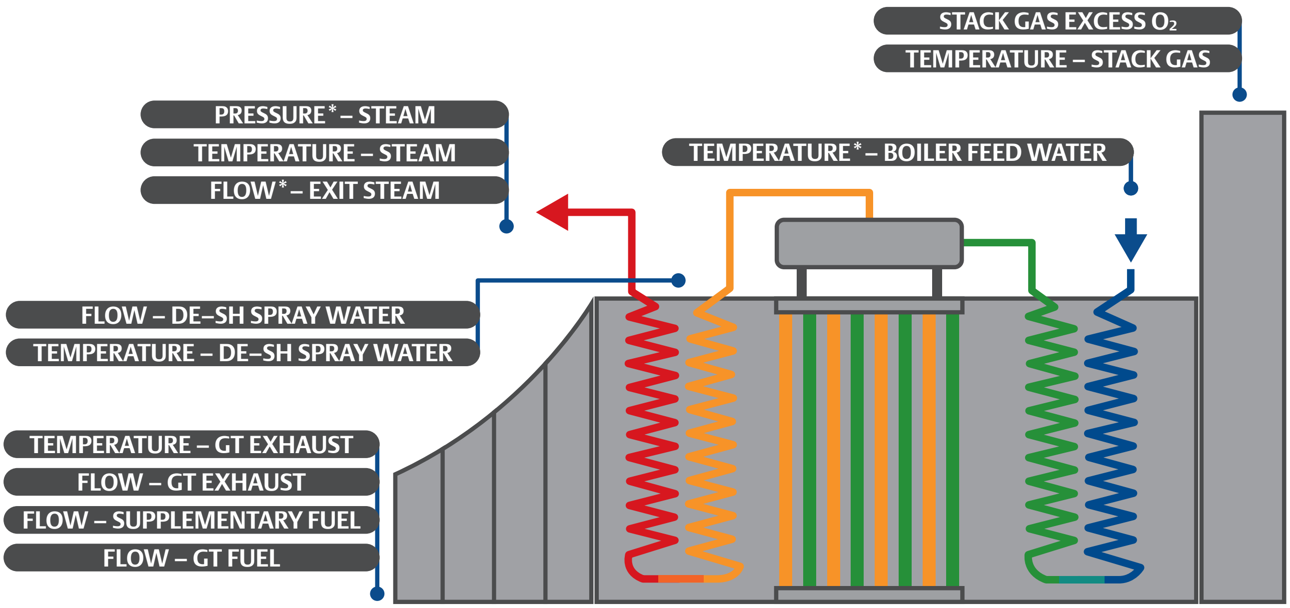
Additional Available Outputs

- Flow – Blowdown (if not supplied)
- Flue Gas Path Approach Temperatures
- Pinch Point Analysis

Module: Heat Recovery Steam Generator (HRSG)/Waste Heat Boiler (WHB)

Module Process Flow Diagram

- Single pressure level



OPTIONAL

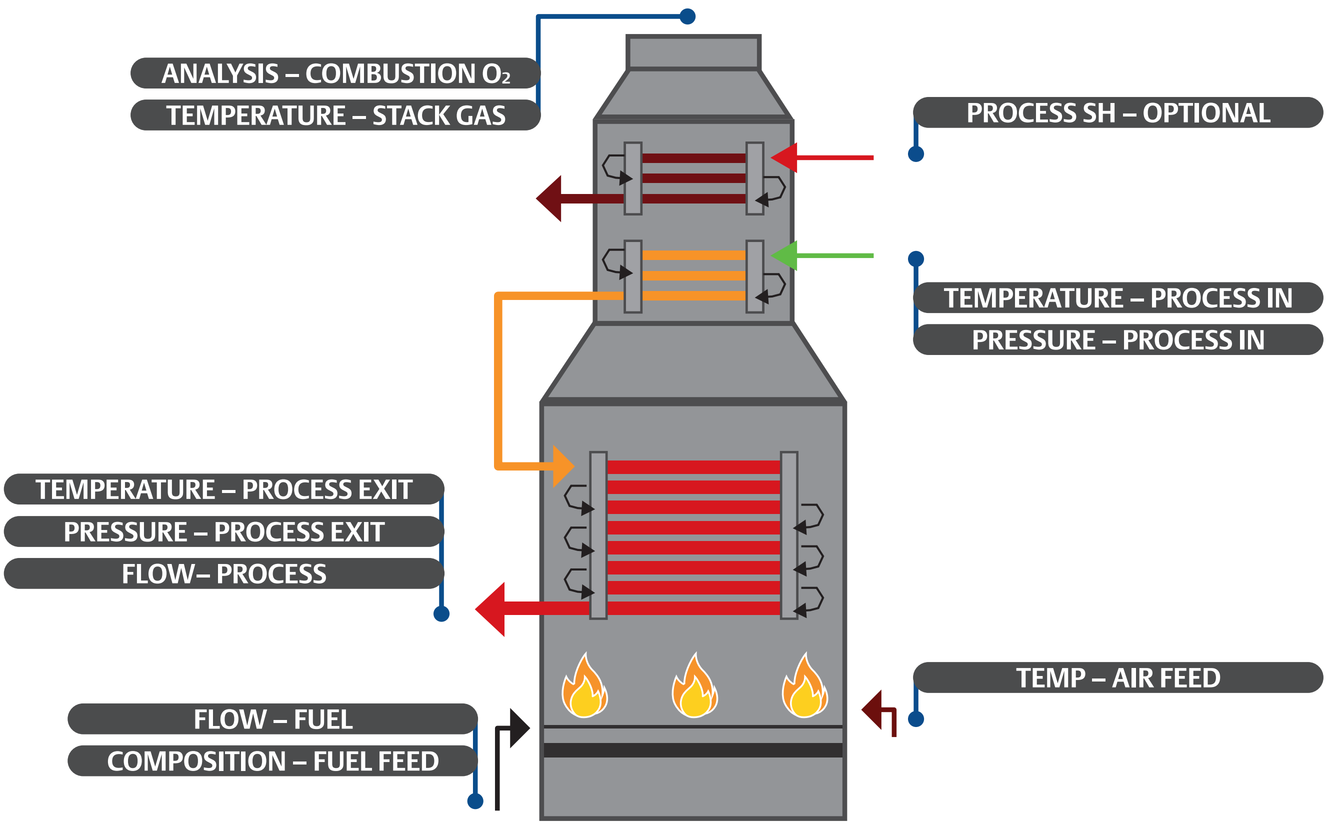
FLOW* – BLOWDOWN	PRESSURE* – BOILER FEED WATER
TEMPERATURE(S) – FLUE GAS	PRESSURE* – STEAM DRUM
TEMPERATURE(S) – ECONOMIZER EXIT WATER	COMPOSITION – SUPPLEMENTARY FUEL
TEMPERATURE(S) – INTERMEDIATE SH STEAM	ADDITIONAL USERS (E.G. DISTRICT HEAT)
TEMPERATURE – SUPPLEMENTARY FUEL	FLUE GAS ANALYSIS

Module: Fired Heater / Furnace

Module Process Flow Diagram	
See Fired Heater figure on next page	
Equipment Design Information	**Module Calculation Method**
■ Piping & Instrumentation Diagrams (P&ID) ■ OEM Design / Equipment Specification Sheets ■ Rated Cases: (50%, 70%, 80%, 90%, 100% load)	■ Equivalenced to ASME PTC 4.4 for Input-Output method and thermal loss efficiencies. ■ Input is the thermal heat supplied by the fuel (combustion and sensible heat) plus sensible heat in the combustion air ■ Output is the heat absorbed by the working fluids
Module Inputs	**Module Outputs**
■ Fuel – Composition, Heating Values ■ Flow(s) – Fuel ■ Flow(s) – Process ■ Temperature – Feed Air ■ Temperature(s) – Process Inlet ■ Temperature(s) – Process Exit ■ Temperature – Stack Gas ■ Pressure(s) – Process Inlet / Exit ■ Analysis – Combustion O_2 **Optional Inputs If Available** ■ Flow – Feed Air ■ Flow – Heat Recovery Medium (e.g. steam) ■ Temperature – Fuel Feed ■ Temperature – Furnace Firing ■ Temperature(s) – Heat Recovery Medium (e.g. steam) ■ Temperature(s) – Intermediate Process ■ Temperature(s) – Flue Gas Path ■ Pressure(s) – Intermediate Process Superheater ■ Pressure(s) – Heat Recovery Medium (e.g. steam) ■ Analysis – Stack Excess O_2 ■ Analysis – Flue Gas (e.g. NOx / SOx / COx / H_2O)	■ Efficiency – Actual (Heat Loss and Input / Output) ■ Efficiency – Design (Baseline) ■ Efficiency – Deviation ■ Flow – Process Actual ■ Flow – Process Design (Baseline) ■ Flow – Process Deviation ■ Combustion O_2 – Actual ■ Combustion O_2 – Design (Baseline) ■ Combustion O_2 – Deviation ■ Total Fired Heat ■ Deviation Cost (Additional Fuel Consumption) **Additional Available Outputs** ■ Heat Loss – Total ■ Heat Loss in Dry Gas ■ Heat Loss due to Moisture in the Fuel ■ Heat Loss in the Moisture Formed from Hydrogen ■ Heat Loss in the Moisture in the Supplied Air ■ Heat Loss due to Ash ■ Heat Loss due to Radiation ■ Heat Loss due to Carbon Monoxide ■ Process Duty ■ Process Approach Temperature ■ Additional Heat Recovery Duty

Module: Fired Heater / Furnace

Module Process Flow Diagram

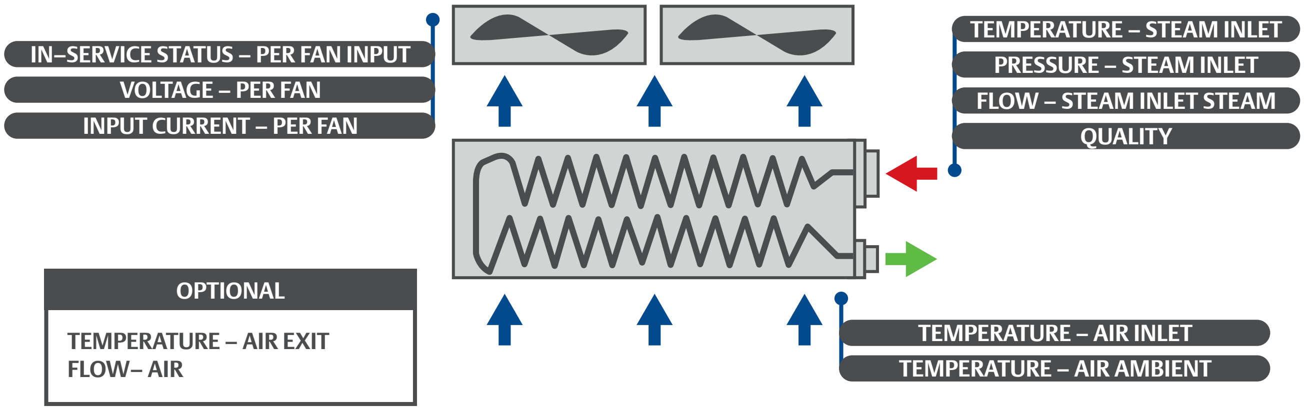


OPTIONAL

- FLOW – FEED AIR
- FLOW – HEAT RECOVERY
- MEDIUM TEMPERATURE – FUEL FEED
- TEMPERATURE – FURNACE FIRING
- TEMPERATURE – COMBUSTION AIR
- TEMP(S) – HEAT RECOVERY MEDIUM
- TEMPERATURE(S) – INTERMEDIATE PROCESS
- TEMPERATURE(S) – FLUE GAS ALONG PATH
- PRESSURE(S) – INTERMEDIATE PROCESS
- PRESSURE(S) – HEAT RECOVERY MEDIUM
- STACK GAS EXCESS O_2
- FLUE GAS ANALYSIS

Module: Condenser (Air Cooled)

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Operating Curves: Capacity Versus Ambient Temperature

Module Calculation Method

- ASME PTC 12.2 – Model utilizes the standards of Heat Exchange Institute for Steam Surface Condensers.
- ASME PTC 30.1 – Utilized with forced air draft systems.

Module Inputs

- Flow – Steam Inlet (or Condensate)
- Temperature – Steam Inlet (or Condensate)
- Temperature – Condensate (if Subcooled)
- Temperature – Air Inlet
- Temperature – Air Ambient
- Pressure – Steam Inlet
- Steam Quality (if at Saturation)
- In-Service Status – Individual Fan (as appropriate)
- Input Voltage – Individual Fan (as appropriate)
- Input Current – Individual Fan (as appropriate)

Optional Inputs If Available

- Temperature – Air Exit
- Flow – Air

Module Outputs

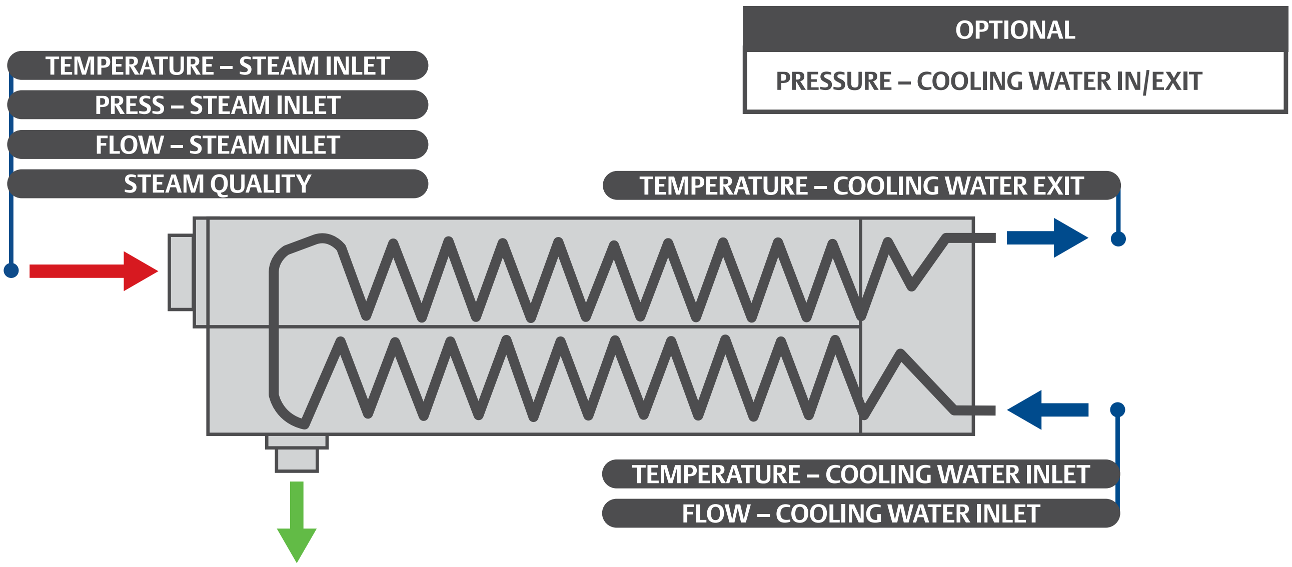
- Efficiency – Actual (Overall Duty)
- Efficiency – Design (Baseline Duty)
- Efficiency – Deviation
- Heat Transfer Coefficient – Overall
- Heat Transfer Coefficient – Design (Baseline)
- Heat Transfer Coefficient – Deviation
- Capacity (Heat Duty)
- Deviation Cost

Additional Available Outputs

- Temperature(s) – Approach
- LMTD (as appropriate)
- Air Temperature Rise

Module: Condenser (Water Cooled)

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Operating Curves: Heat Transfer Coefficient

Module Calculation Method

- ASME PTC 12.2 – Model utilizes the standards of Heat Exchange Institute for Steam Surface Condensers.

Module Inputs

- Flow – Steam Inlet
- Flow – Cooling Water Inlet
- Temperature – Steam Inlet
- Temperature – Condensate (if Subcooled)
- Temperature – Cooling Water Inlet
- Temperature – Cooling Water Exit
- Pressure – Steam Inlet
- Steam Quality (if at Saturation)

Optional Inputs If Available

- Pressure(s) – Cooling Water In / Exit

Module Outputs

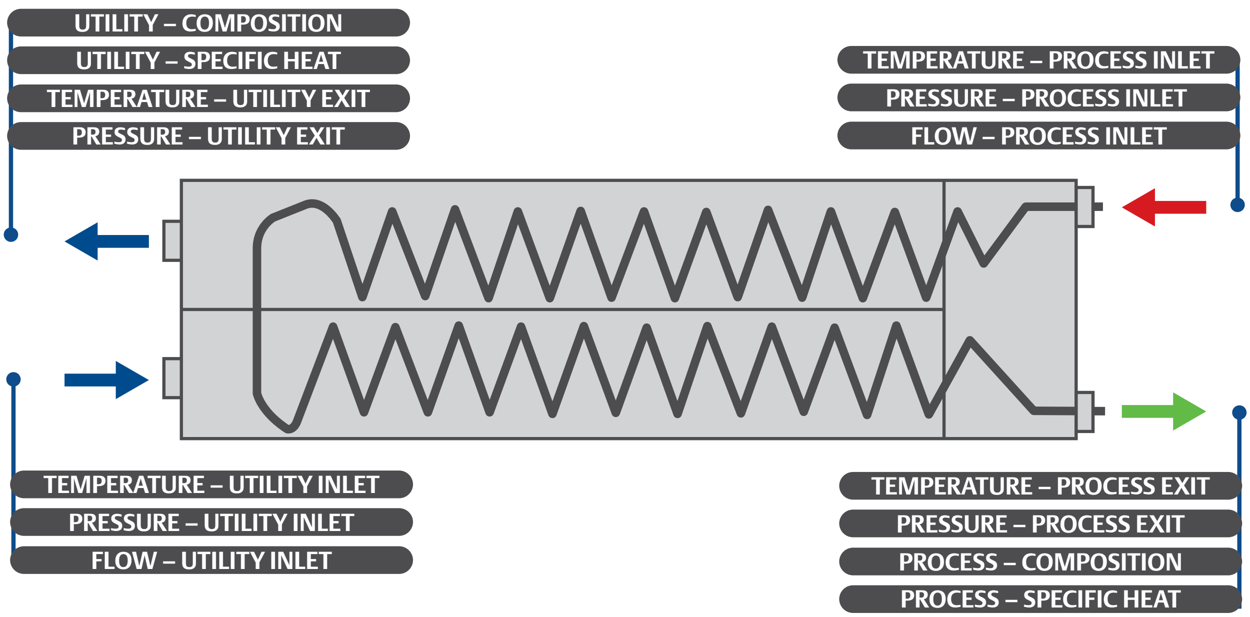
- Efficiency – Actual (Overall Duty)
- Efficiency – Actual (Overall Duty)
- Efficiency – Design (Baseline Duty)
- Efficiency – Deviation
- Heat Transfer Coefficient – Overall
- Heat Transfer Coefficient – Design (Baseline)
- Heat Transfer Coefficient – Deviation
- Capacity (Heat Duty)
- Deviation Cost

Additional Available Outputs

- Temperature(s) – Approach
- LMTD
- Cooling Water Pressure Drop
- Water Temperature Rise

Module: Heat Exchanger

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design Specification Sheets
- Operating Curves

Module Calculation Method

- ASME PTC 12.5 – Utilized in single phase applications.
- ASME PTC 30 (Air Cooled) – Utilized in air cooled single phase applications

Module Inputs

- Flow – Process Inlet
- Flow – Utility Inlet
- Temperature – Process Inlet
- Temperature – Process Exit
- Temperature – Utility Inlet
- Temperature – Utility Exit
- Pressure – Process Inlet
- Pressure – Process Exit
- Pressure – Utility Inlet
- Pressure – Utility Exit
- Utility Fluid Composition
- Utility Fluid Specific Heat Capacity (Cp)
- Process Fluid Composition (if available)
- Process Fluid Specific Heat Capacity (Cp)

Module Outputs

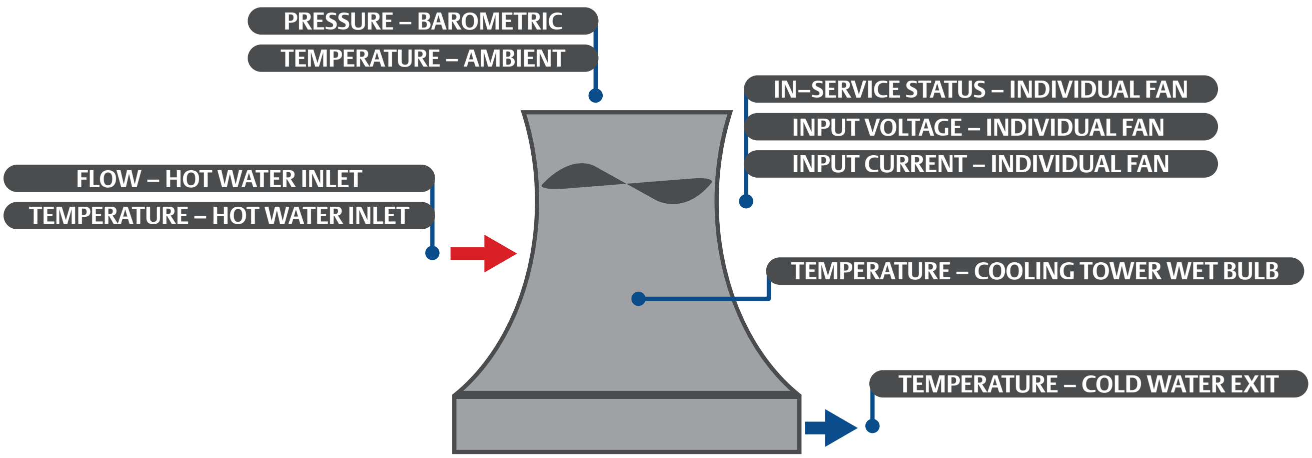
- Efficiency – Actual (Overall Duty)
- Efficiency – Design (Baseline Duty)
- Efficiency – Deviation
- Heat Transfer Coefficient – Overall
- Heat Transfer Coefficient – Design (Baseline)
- Heat Transfer Coefficient – Deviation
- Capacity (Heat Duty)
- Deviation Cost (Increased Utility Consumption)

Additional Available Outputs

- Temperature(s) – Approach
- Temperature Change – Utility
- Temperature Change – Process
- LMTD (as appropriate)

Module: Cooling Tower

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Operating Curves: Duty Versus Cooling Water Flow, Duty
- Versus Ambient Temp

Module Calculation Method

- AMS PTC 23

Module Inputs

- Flow – Water Inlet
- Temperature – Water Inlet
- Temperature – Water Exit
- Temperature – Cooling Tower Wet Bulb
- Temperature – Ambient
- Pressure – Barometric
- In-Service Status – Individual Fan (as appropriate)
- Input Voltage – Individual Fan (as appropriate)
- Input Current – Individual Fan (as appropriate)

Module Outputs

- Cooling Tower Capability – Actual
- Cooling Tower Capability – Design
- Cooling Tower Capability – Deviation
- Capacity (Heat Duty)
- Deviation Cost (Increased Fan Power Consumption or Additional Cool Water required)

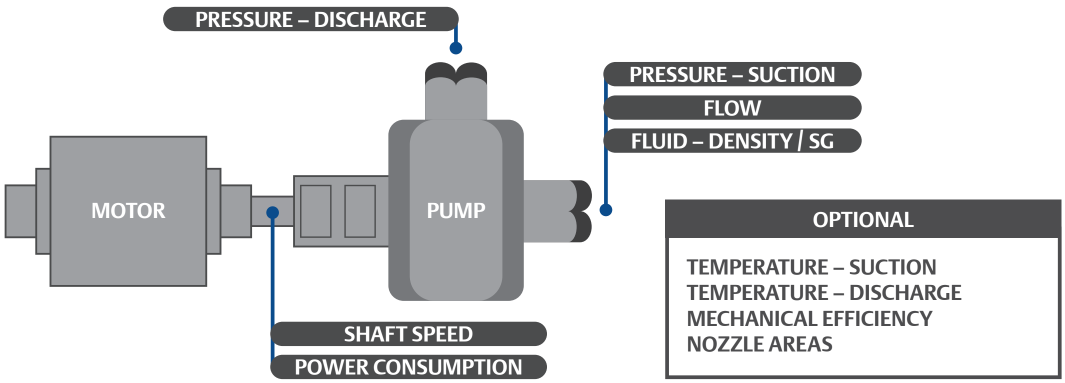
Additional Available Outputs

- Temperature(s) – Approach

Module: Pump

Module Process Flow Diagram

- Motor driven shown

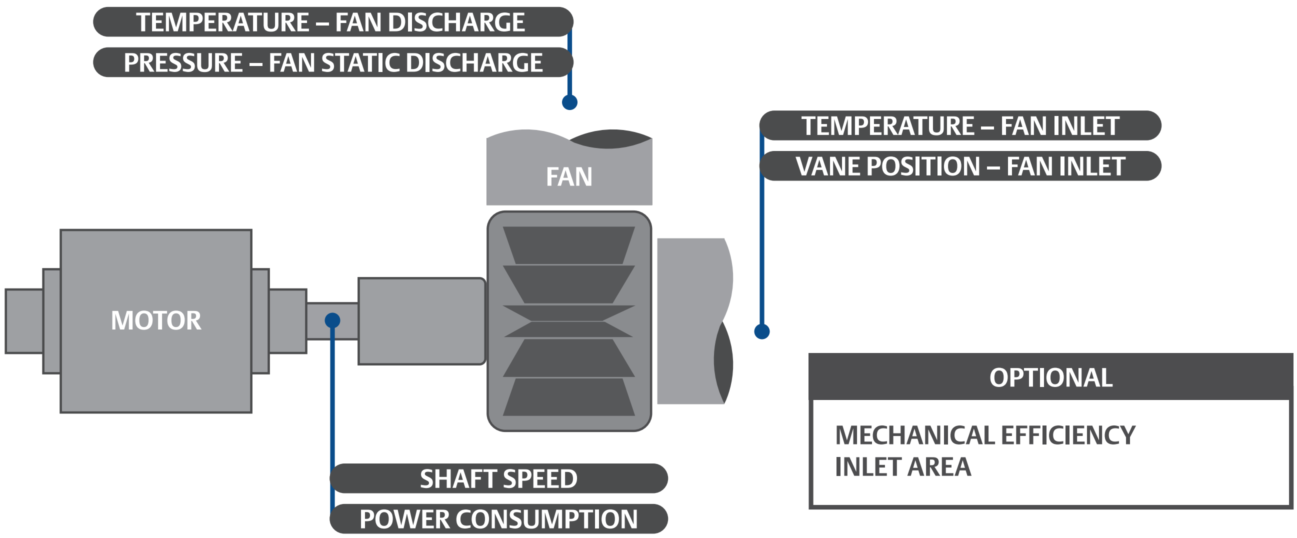


Equipment Design Information	Module Calculation Method
■ Piping & Instrumentation Diagrams (P&ID) ■ OEM Design / Equipment Specification Sheets ■ Operating Curves: Head Versus Flow, Efficiency Versus Flow ■ Power Versus Flow ■ Rated Cases: 60%, 80%, 90%, 100% load or at a constant rated speed	■ ASME PTC 8.2 – Pump efficiency, head and corrected head are calculated. Design pump head is calculated from the pump characteristic curve.

Module Inputs	Module Outputs
■ Flow – Measurement point inside any recycle loops ■ Pressure – Inlet / Suction ■ Pressure – Exit / Discharge ■ Shaft Speed (on variable speed machines) ■ Power Consumption (or Motor Current, Volts, and pF) ■ Fluid Characteristics – Density **Optional Inputs If Available** ■ Mechanical Efficiency (Shaft) ■ Temperature – Inlet / Suction ■ Temperature – Exit / Discharge ■ Nozzle Areas	■ 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 and/or Additional Power Consumption) **Additional Available Outputs** ■ Flow – Volumetric ■ Velocity – Suction ■ Velocity – Discharge ■ Velocity Head – Suction ■ Velocity Head – Discharge ■ Pressure Ratio ■ Speed – Design ■ Power – Actual ■ Power – Specific ■ Power – Corrected ■ Best Efficiency Point and Deviation

Module: Fan

Module Process Flow Diagram



Equipment Design Information

- Piping & Instrumentation Diagrams (P&ID)
- OEM Design / Equipment Specification Sheets
- Operating Curves: Head Versus Flow, Efficiency Versus Flow
- Power Versus Flow
- Rated Cases: e.g., 100% load, 90% load, or single-speed unit

Module Calculation Method

- ASME PTC 11 – Computes the efficiency of forced draft, induced draft, and primary and secondary air fans. Design efficiencies are computed based on manufacturer's design data and deviations are reported.

Module Inputs

- Pressure – Fan Static Discharge
- Vane Position – Fan Inlet / Suction
- Temperature – Fan Inlet / Suction
- Temperature – Fan Exit / Discharge
- Power Consumption (or Motor Current, Volts and pF)
- Shaft Speed (on variable speed machines)

Optional Inputs If Available

- Mechanical Efficiency (Shaft)
- Inlet Area

Module Outputs

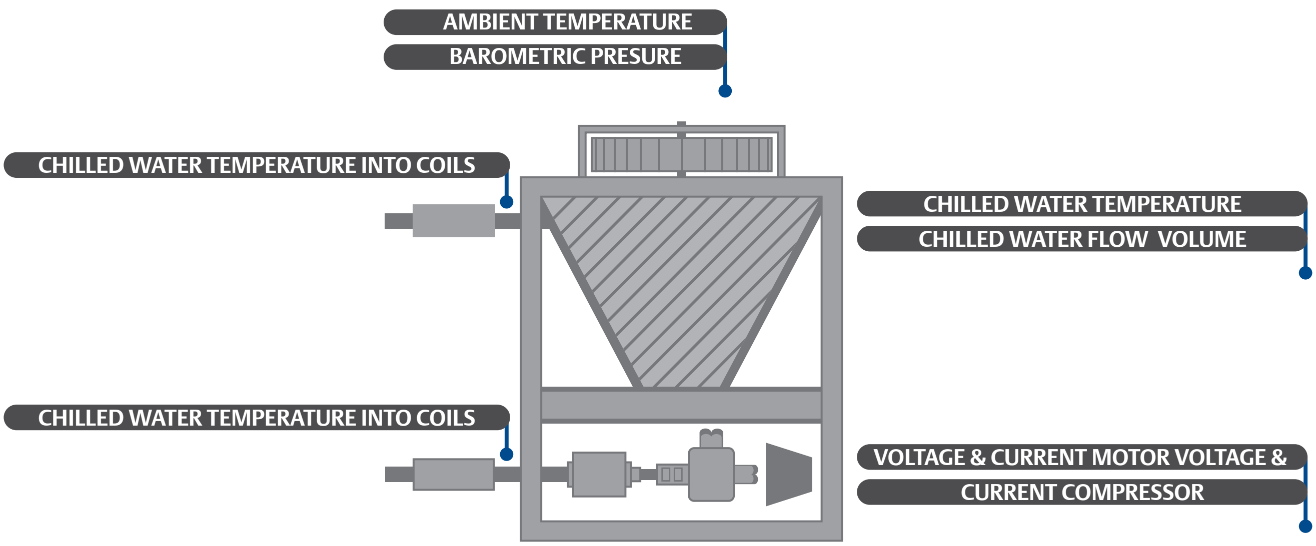
- Efficiency – Actual
- Efficiency – Design
- Efficiency – Deviation
- Fan Power – Actual
- Fan Power – Design
- Fan Power – Deviation
- Static Pressure – Deviation
- Deviation Cost (Lost Throughput or Additional Power Consumption)

Additional Available Outputs

- Flow – Volumetric
- Velocity – Suction
- Velocity – Discharge
- Velocity Head – Suction
- Velocity Head – Discharge
- Pressure Ratio

Module: Chillers

Module Process Flow Diagram



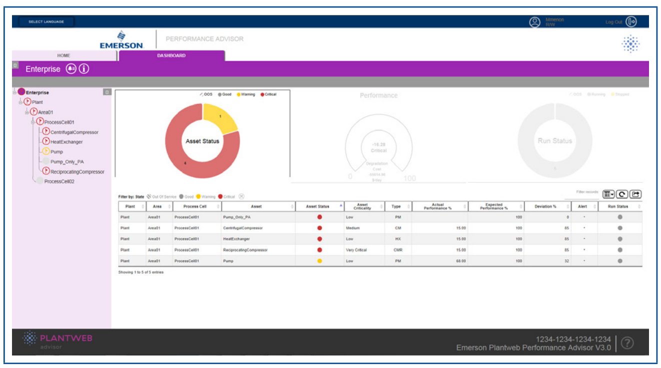
Equipment Design Information	Module Calculation Method
■ Piping & Instrumentation Diagrams (P&ID) ■ OEM Design / Equipment Specification Sheets ■ Rated Case: 100% (Full Power) ■ Design COP (Coefficient of Performance) ■ Design Compressor Motor Power Consumption ■ Design Compressor Blower Power Consumption	■ Flow/Energy Balance using standard engineering methodologies AHRI Standard 340/360

Module Inputs	Module Outputs
■ Power (or Current and Voltage) – Blower Motor ■ Power (or Current and Voltage) – Compressor Motor ■ Temperature – Chilled Water (or cooling liquid medium) into coils. ■ Temperature – Chilled Water (or cooling liquid medium) from coils. ■ Flow – Chilled Water (or cooling liquid medium) through coils. **Optional Inputs If Available** ■ Pressure – Ambient/Barometric ■ Cost – Electrical Power ■ Temperature – Air before cooling coils ■ Temperature – Air after cooling coils	■ Humidity – Air before cooling coils ■ Pressure – Chilled Water (or cooling liquid medium) into coils. ■ COP (Coefficient of Performance) ■ COP Deviation from Design ■ Thermodynamic Heat Transfer Duty ■ Percentage of Rated Heat Transfer Duty ■ Power Consumption, Actual ■ Power Consumption, Design ■ Power Consumption, Deviation from Design ■ Financial Cost (Hourly) of Degraded Operations ■ Financial Cost (Monthly) of Degraded Operations **Optional Outputs If Available** ■ Flow – Air Moisture Removal Rate

User Interface

The primary user interface to the Performance Advisor system is through a web based application designed for PCs as well as mobile device users. The web interface uses a tree structure to navigate between sites, plant areas, process units and assets. The user view has a similar look and feel at each level, with more detail added as the user drills down into the specific assets.

At the Client, Plant, Area and Unit levels of the hierarchy, a list of the assets in that part of the hierarchy is shown with their overall status, active alerts and their performance values as shown below. The user can sort on any column by just clicking to column header. A search field at the top right provides a global search function.



Asset Summary View

From this view, the user is allowed to search, filter and sort by any of the fields in the display. This view provides:

- Quick visual assessment of asset performance through status button colors
  - Red - Critical
  - Yellow - Warning
  - Green - Healthy
- Alarm text and performance status (0-100%) indications for each asset
- Icons for each asset that provide shortcuts to the detail pages
- Double-clicking on any of the lines in the display will open a detailed display for that asset.
- Cost of degradation summary associated with the performance index
- Run Status summary of all the assets that are monitored

Asset View

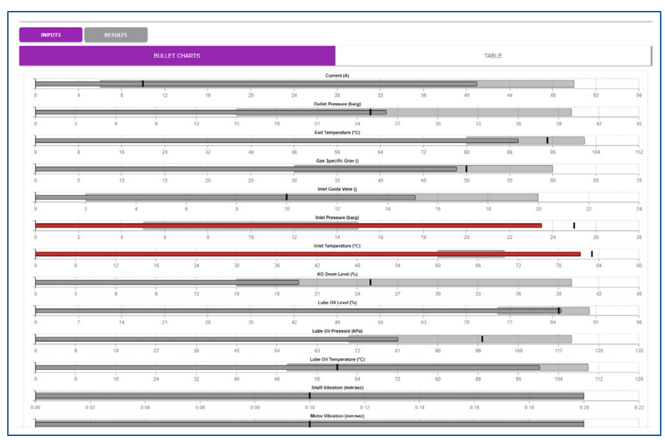
Each asset has a detailed view that provides a quick way to assess the performance, active alerts and deviations from the design condition.The asset view is divided into three main sections. At the top, a trend chart function provides trending for all the variables monitored for that asset.

From the Trend view, a user can:

- Choose a timeframe for the chart view: 8 hr, 24 hr, 1 week, 1 month or 1 year
- Select the end-time for the chart using the calendar icon
- Select/deselect variables to be trended Use a scroll bar to look at specific values in the trend

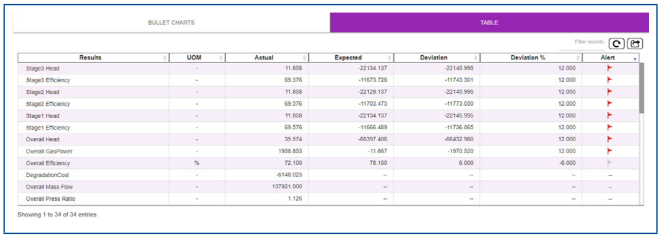
Trend View

Below the trend chart is a set of bar charts for all of the inputs and KPI calculations to provide a quick visual display of current value for all the variables along with the maximum and minimum alert limits and the baseline value. An example is shown below.



Input and KPI view

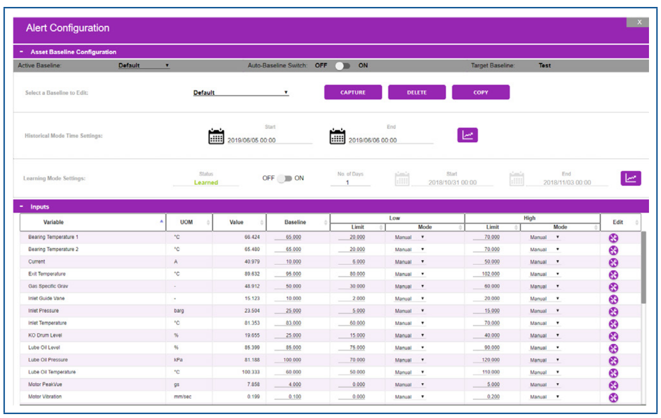
Finally, at the bottom of the Asset view is a table view of all the inputs, the performance results calculation, their status, current value and expected design value as shown below.



Input status view

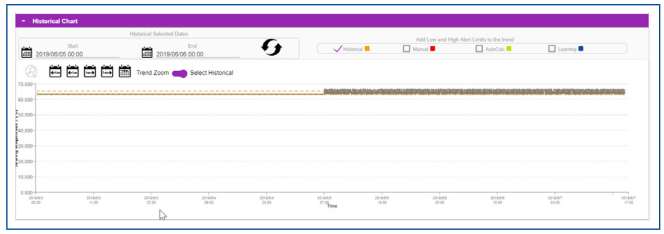
Baseline Capture

From the Asset view, a user can select the wrench icon at the top of the page to view and edit the alert limits. An example of the alert limits window is shown below.

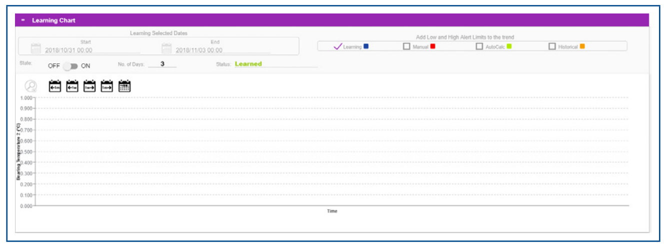


Alarm Configuration

From the Alarm Configuration window, a user can enable/ disable an alert. There are four options available to the user to set the alerts: Manual, Auto Limit, Historical & Learning. Manual "Mode" the user to set the baselines for each of the asset alerts manually. When Auto-limit is turned on, limits are automatically calculated from the baseline value. With the historical mode option, the user can select a historical time frame to capture the baseline for the asset. Based on the timeframe identified, Advisor auto-calculates the baseline and the alert limits associated with the asset.



Similarly, with the learning mode, user can define a time frame in future where it wants Advisor to learn and auto-calculate the baseline and alert limits for all the faults being monitored for the asset.

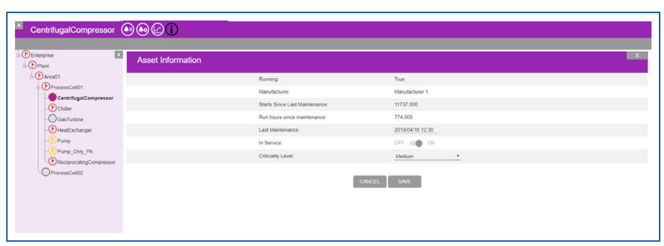


Auto Baseline Switch Feature

If the asset has multiple baseline conditions based on factors such as weather, operating conditions etc, then Advisor application has auto-switch feature where based on the condition defined in the application, advisor would automatically switch the baselines of the asset based on the identified operating condition.

Asset Information

Clicking on the Information icon at the top of the Asset view opens a window with more detailed asset information as shown below.



From this view, a user gets an overview of the asset status, manufacturer, installation date, total number of running hours, and starts and run time since last maintenance

Asset Performance Index

Asset performance Index is an indication of the functional performance of the asset. It is calculated from the performance deviations.

The alarm performance value is based on the weight of most severe active alarm. The vibration health is based on how close the current vibration value is to its baseline value and configured high alarm limit value. The color of the health value displayed shows how critical the asset condition is:

- Critical (<50%): Red
- Warning (50%-89%): Yellow
- Healthy (90%-100): Green

Hardware and Software Requirements

Emerson's experts will work with the customer to perform the necessary project and site scoping activities to define the hardware required, including any new recommended instrumentation and wireless infrastructure. While wireless devices provide an easy means of adding missing measurements, Plantweb Performance Advisor solutions can make use of existing wired or wireless measurements too, provided the minimum instrumentation requirement is met.

Emerson has created several tools to help determine what instrumentation and wireless capabilities are needed to support various assets at a site.

The Plantweb Performance Advisor models run on an OSIsoft PI Asset Framework (AF) server. Performance Advisor can be installed in conjunction with an existing plant PI system, or Emerson can supply a system as a part of the project. The AF server provides the object model for the equipment monitoring algorithms and context and hierarchy for the real-time data feeding the models. The application can be easily integrated with other existing plant historians (IP21, PHD, etc.) through data connectivity solutions from OSIsoft.

System Compatibility

Recommended Microsoft Windows operating systems supported by OSIsoft PI includes Window Server 2008 R2 SP1 or later. OSIsoft Asset Framework 2015 or later is required for the modules and IIS 7.0 or later for the Web Server.

Minimum system specifications for a single user system can be found on the OSIsoft Support web page listed below. Server requirements depend on the number of PI elements (or tags) in the system. AF can run on the same server or can be installed on a separate server for large systems. For the latest information on the hardware and software specification, see the OSIsoft Support page: **http://techsupport.osisoft.com**

Web Application Requirements

Current versions of browsers supported for:

- Chrome™
- Mozilla Firefox®
- Safari
- Microsoft Internet Explorer™

Ordering Information

The Plantweb Performance Advisor module libraries are licensed on a per-asset basis and will be delivered ready for configuration.

The Performance Advisor module library comes as a set of pre- configured templates in AF. There is also a Foundation license which includes the base functions used by all the asset modules.

Your Emerson contact can help you identify the part numbers required for the Plantweb Advisor

PC Specifications

Hardware Requirements		
Processor	Minimum CPU Count	4 cores
	Recommended CPU Count	8 cores
Memory	Minimum RAM	16 GB
	Recommended RAM	24 GB
Network	Minimum Bandwidth	10 Mbps
	Recommended Bandwidth	100 Mbps
Storage AF Server	Minimum Local Disk Size	100 GB
	Recommended Disk Size	300 GB

Foundation License

Emerson Part Number	Product License Description
PAS-PA-BASE	Foundation (Installation & General Customization)

Asset Licenses

Emerson Part Number	Product License Description
PPI-CCP-CTG-PRF	Combustion Gas Turbine Performance Monitor & Plant Heat Rates UNIQUE 1ST
PAS-PA-CTG-PRF-ADDSIM	Combustion Gas Turbine Performance Monitor & Plant Heat Rates (Additional Similar)
PAS-PA-CCR-PRF-UNI1ST	Centrifugal Compressor Condition Monitor UNIQUE 1ST
PAS-PA-CCR-PRF-ADDSIM	Centrifugal Compressor Condition Monitor (Additional Similar)
PAS-PA-RCR-PRF-UNI1ST	Reciprocating Compressor Condition Monitor UNIQUE 1ST
PAS-PA-RCR-PRF-ADDSIM	Reciprocating Compressor Condition Monitor (Additional Similar)
PAS-PA-TEX-PRF-UNI1ST	Turbo Expander (Expansion Turbine) Condition Monitor UNIQUE 1ST
PAS-PA-TEX-PRF-ADDSIM	Turbo Expander (Expansion Turbine) Condition Monitor (Additional Similar)
PAS-PA-HRS-PRF-UNI1ST	HRSG Condition Monitor UNIQUE 1ST
PAS-PA-HRS-PRF-ADDSIM	HRSG Condition Monitor (Additional Similar)
PAS-PA-BLR-EFF-UNI1ST	Boiler Efficiency & Unit Heat Rates (Rankine Cycle Units) UNIQUE 1ST
PAS-PA-BLR-EFF-ADDSIM	Boiler Efficiency & Unit Heat Rates (Rankine Cycle Units) (Additional Similar)
PAS-PA-BAH-PRF-UNI1ST	Boiler & Air Heater Condition Monitor (Rankine Cycle Units) UNIQUE 1ST
PAS-PA-BAH-PRF-ADDSIM	Boiler & Air Heater Condition Monitor (Rankine Cycle Units) (Additional Similar)
PAS-PA-BAX-PRF-UNI1ST	Auxiliary Boiler Efficiency and Performance UNIQUE 1ST
PAS-PA-BAX-PRF-ADDSIM	Auxiliary Boiler Efficiency and Performance (Additional Similar)
PAS-PA-STB-PRF-UNI1ST	Steam Turbine Condition Monitor UNIQUE 1ST
PAS-PA-STB-PRF-ADDSIM	Steam Turbine Condition Monitor (Additional Similar)
PAS-PA-WCC-PRF-UNI1ST	Water Cooled Condenser Condition Monitor UNIQUE 1ST
PAS-PA-WCC-PRF-ADDSIM	Water Cooled Condenser Condition Monitor (Additional Similar)
PAS-PA-CTR-PRF-UNI1ST	Cooling Tower Condition Monitor UNIQUE 1ST
PAS-PA-CTR-PRF-ADDSIM	Cooling Tower Condition Monitor (Additional Similar)
PAS-PA-CWP-ADV-UNI1ST	Circulating Water Pump Advisor UNIQUE 1ST
PAS-PA-CWP-ADV-ADDSIM	Circulating Water Pump Advisor (Additional Similar)
PAS-PA-PMP-PRF-UNI1ST	Pump Condition Monitor UNIQUE 1ST
PAS-PA-PMP-PRF-ADDSIM	Pump Condition Monitor (Additional Similar)
PAS-PA-FWH-PRF-UNI1ST	Feedwater Heater Condition Monitor UNIQUE 1ST
PAS-PA-FWH-PRF-ADDSIM	Feedwater Heater Condition Monitor (Additional Similar)
PAS-PA-DEA-PRF-UNI1ST	Deaerator Condition Monitor UNIQUE 1ST
PAS-PA-DEA-PRF-ADDSIM	Deaerator Condition Monitor (Additional Similar)

PAS-PA-HX-PRF-UNI1ST	Heat Exchanger Condition Monitor UNIQUE 1ST
PAS-PA-HX-PRF-ADDSIM	Heat Exchanger Condition Monitor (Additional Similar)
PAS-PA-BLO-PRF-UNI1ST	Blower Condition Monitor UNIQUE 1ST
PAS-PA-BLO-PRF-ADDSIM	Blower Condition Monitor (Additional Similar)
PAS-PA-BBM-PRF-UNI1ST	Biomass Boiler Efficiency and Performance UNIQUE 1ST
PAS-PA-BBM-PRF-ADDSIM	Biomass Boiler Efficiency and Performance UNIQUE 1ST
PAS-PA-RKP-OCA-UNI1ST	Rankine Plant Operations Cost Analysis UNIQUE 1ST
PAS-PA-RKP-OCA-ADDSIM	Rankine Plant Operations Cost Analysis (Additional Similar)
PAS-PA-CHL-PRF-ADDSIM	Chiller Performance Monitor & Advisor (Additional Similar)
PAS-PA-GEN-RCP-UNI1ST	Generator Reactive Capability UNIQUE 1ST
PAS-PA-GEN-RCP-ADDSIM	Generator Reactive Capability (Additional Similar)
PAS-PA-CTG-FRC-UNI1ST	Combustion Gas Turbine Forecast UNIQUE 1ST
PAS-PA-CTG-FRC-ADDSIM	Combustion Gas Turbine Forecast (Additional Similar)
PAS-PA-PLT-FRC-SITE	Combined Cycle Output Forecast (Site)
PAS-PA-CTG-ETP-UNI1ST	Combustion Gas Turbine Exhaust Temperature Profile UNIQUE 1ST
PAS-PA-CTG-ETP-ADDSIM	Combustion Gas Turbine Exhaust Temperature Profile (Additional Similar)
PAS-PA-CTG-OCA-UNI1ST	Combustion Gas Turbine Operations Cost Analysis UNIQUE 1ST
PAS-PA-CTG-OCA-ADDSIM	Combustion Gas Turbine Operations Cost Analysis (Additional Similar)
PAS-PA-CTG-OWA-UNI1ST	Combustion Gas Turbine Offline Wash Advisor UNIQUE 1ST
PAS-PA-CTG-OWA-ADDSIM	Combustion Gas Turbine Offline Wash Advisor (Additional Similar)
PAS-PA-CHL-PRF-UNI1ST	Chiller Performance Monitor & Advisor UNIQUE 1ST
PAS-PA-WTB-PRF-UNI1ST	Wind Turbine Condition Monitor UNIQUE 1ST
PAS-PA-WTB-PRF-ADDSIM	Wind Turbine Condition Monitor (Additional Similar)
PAS-PA-WTB-FRC-SITE	Wind Turbine Forecast (per site)
PAS-PA-BLR-AEO	Adaptive Emissions Optimizer for Coal Boilers
PAS-PA-PLT-EPA-UNI1ST	Emissions & EPA Calculations UNIQUE 1ST
PAS-PA-PLT-EPA-ADDSIM	Emissions & EPA Calculations (Additional Similar)
PAS-PA-TTC-MDL-UNI1ST	Thermodynamic Turbine Cycle Model UNIQUE 1ST
PAS-PA-TTC-MDL-ADDSIM	Thermodynamic Turbine Cycle Model (Additional Similar)
PAS-PA-CCP-PLT-OPT	Combined Cycle Configuration Optimizer
PAS-PA-PLT-CTG-LCM-UNI1ST	Combustion Gas Turbine Stress and Life Cycle Monitor UNIQUE 1ST
PAS-PA-PLT-CTG-LCM-ADDSIM	Combustion Gas Turbine Stress and Life Cycle Monitor (Additional Similar)
PAS-PA-STB-LCM-UNI1ST	Steam Turbine Stress and Life Cycle Monitor UNIQUE 1ST
PAS-PA-STB-LCM-ADDSIM	Steam Turbine Stress and Life Cycle Monitor (Additional Similar)
PAS-PA-HRS-LCM-UNI1ST	HRSG Metal Stress and Life Cycle Monitor UNIQUE 1ST
PAS-PA-HRS-LCM-ADDSIM	HRSG Metal Stress and Life Cycle Monitor (Additional Similar)

PAS-PA-VIB-MON-UNI1ST	Vibrations Waterfall Monitor UNIQUE 1ST
PAS-PA-VIB-MON-ADDSIM	Vibrations Waterfall Monitor (Additional Similar)
PAS-PA-COK-BAT-TOT	Coking Battery and Oven Monitor and Totalizer

Bundled Package Licenses

Emerson Part Number	Product License Description
PAS-PA-RBL-PKG-UNI1ST	Rankine Boiler Solution 1st Boiler
PAS-PA-RBL-PKG-ADDSIM	Rankine Boiler Solution Additional Boiler
PAS-PA-RST-PKG-UNI1ST	Rankine Steam Turbine Solution 1st Turbine
PAS-PA-RST-PKG-ADDSIM	Rankine Steam Turbine Solution Additional Turbine
PAS-PA-CCS-PKG-UNI1ST	Combined Cycle Steam Turbine Solution 1st Turbine
PAS-PA-CCS-PKG-ADDSIM	Combined Cycle Steam Turbine Solution Additional Turbine
PAS-PA-CTG-PKG-UNI1ST	Combustion Gas Turbine Solution 1st Turbine
PAS-PA-CTG-PKG-ADDSIM	Combustion Gas Turbine Solution Additional Turbine
PAS-PA-CCP-PKG-UNI1ST	Combined Cycle Plant Solution 1st Plant
PAS-PA-CCP-PKG-ADDSIM	Combined Cycle Plant Solution Additional Plant

Related Products

Plantweb Advisor Suite: Uses predictive intelligence to improve the availability and performance of key production assets, including mechanical equipment, electrical systems, process equipment, instruments, and valves. This integrated family of diagnostic software applications enables users to detect plant equipment problems before they occur and provides the information to help make informed decisions.

- Plantweb™ Health Advisor: A cost-effective, statistically-based solution to monitor essential assets – those that have repeated failures or assets in important service areas where a failure can cause significant financial impact such as production loss, environmental or safety incidents.
- Plantweb™ Energy Advisor: A real-time Energy Management Information System (EMIS) that automates the process of mapping and managing energy consumption across a site, as it is being consumed. Real-time alerts, dashboards and emails notify decision- makers when energy consumption is above expected so that actions may be taken to drive down energy costs.

Plantweb™ Insight: Web-based application package used for real-time monitoring of key industrial assets. Part of Emerson's Plantweb digital ecosystem, Plantweb Insight uses strategic interpretation and analytics to transform raw data into actionable information designed to improve operational areas such as health, safety, reliability, and energy usage.

Plantweb™ Optics: Emerson's Plantweb Optics platform collects asset data from field-based wired and wireless sensors and delivers information on only the most critical situations, enabling you to make well informed decisions to maintain availability. The Optics Platform utilizes modern communication tools to deliver alerts to both traditional desktop PCs and laptops as well as the tablets and smart phones available outside the office or plant. Remote accessibility to smart alerts in a secure environment means operators and maintenance personnel alike are on top of the performance of critical production assets always.

AMS Intelligent Device Manager: helps avoid unnecessary costs from unplanned shutdowns and inefficient practices, with a universal window into the health of intelligent field devices. Based on real-time condition data from intelligent field devices, plant staff can respond fast and take informed decisions on device maintenance.

AMS Machinery Health Manager: Designed for rotating equipment specialists, Machinery Health Manager diagnoses and communicates the health of mechanical and rotating machinery using data from several maintenance technologies. The result is a comprehensive view of each monitored machine and a more accurate diagnosis when developing problems are discovered.

Emerson
Reliability Solutions
835 Innovation Drive
Knoxville, TN 37932 USA
+1 865 675 2400

www.emerson.com/plantwebadvisor

PLANTWEB advisor

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