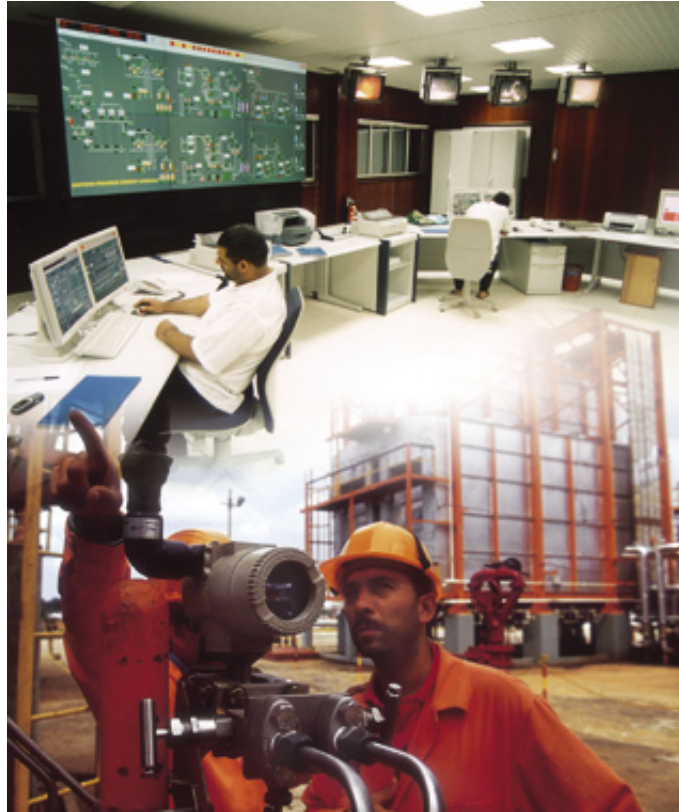


Features and Benefits

- **Complete Asset Optimization:** By monitoring the condition of assets at all plant levels, System 800xA provides a single interface for operations, maintenance, engineering, and management to optimize asset availability and utilization
- **Automatic Monitoring of Maintenance Conditions:** Real-time monitoring and alarming of asset Key Performance Indicators (KPI) facilitate fast, reliable implementation of corrective actions
- **Plant-Wide Adoption of Predictive and Proactive Maintenance Strategies:** System 800xA collects, aggregates, and analyzes real-time plant asset information to provide advanced warning of degrading performance and impending failure, a critical component of any Reliability Centered Maintenance (RCM) strategy
- **Consistent Reporting of Plant Asset Health:** Reporting features provide visualization of current health conditions via 800xA Process Portal. Analysis features provide the ability to drill down to the root cause of failure
- **Regulatory Compliance:** With integration of the Device Management System (DMS) software, System 800xA can provide users with traceable device calibration solutions for 21 CFR Part 11 compliance
- **Reduced Time to Repair through Optimized Work Processes:** Integration of disparate Computerized Maintenance Management Systems (CMMS), DMS Calibration Systems, Dynamic Overall Equipment Effectiveness (OEE) Tools and control systems streamlines the work flow process between operations and maintenance to reduce downtime



Knowledge is the most precious commodity in business today. Production facilities employing real-time Plant Asset Management (PAM) systems significantly increase process uptime while reducing maintenance costs. With data originating from a variety of devices and systems, the plant is teeming with information. The challenge, however, is having relevant information available at the right time, in the right form, and to the right people.

ABB's Industrial IT System 800xA provides the real-time plant asset management solution that presents real-time asset information seamlessly, and in the proper context, to operations, maintenance, engineering, and management. As a result, continuous improvement initiatives such as the implementation of Reliability Centered Maintenance (RCM) strategies, and the plant-wide adoption of proactive maintenance practices or autonomous maintenance minimize unscheduled shutdowns, optimize product quality and become more effective through the use of 800xA Asset Optimization. Typically a part of an Operational Excellence initiative, these activities result in higher return on assets and greater profitability.

Introduction

ABB takes a unified approach to asset management, offering a vast portfolio of productions and solutions unmatched in the market. (This portfolio is constantly being enhanced – for the latest information, please contact your ABB representative or visit us at www.abb.com)

800xA Asset Optimization (AO), is the cornerstone of ABB's asset management portfolio. AO, as described in this document, provides real-time asset monitoring, notification, and maintenance workflow optimization of automation equipment, plant infrastructure, plant equipment, field devices, IT assets, and production processes. 800xA Asset Optimization is unique in the marketplace, in that it brings together, in one user interface, all information resident in different, traditionally disparate, automation and monitoring systems to provide a composite view of the health and performance of an asset. Transparently maintaining all the richness of information, advantages, and capabilities of each specialized system, 800xA Asset Optimization eliminates the need for the user to switch between several systems, workplaces, application environments, and navigation schemes.



Figure 1. Single-click access to Plant Asset Information-Rich Aspect Systems

800xA Asset Optimization features are provided as extensions to Process Portal. Using Industrial IT patented Aspect Object™ technology, System 800xA collects and displays all information required to install, operate, and maintain each component with a single click of the mouse (Figure 1). For asset optimization features, these aspects are simply assigned to the appropriate object (asset); making them automatically available in each object's use instances.

In general, 800xA Asset Optimization features can be categorized into two user beneficial areas:

- Increased asset availability and performance
 - Asset Condition Monitoring
 - Asset Condition Reporting
- Optimized Operations and Maintenance effectiveness
 - Computerized Maintenance Management System (CMMS) Integration
 - Device Management System (DMS) Calibration Integration

Increasing Asset Availability and Performance

The primary objective of a maintenance organization is to ensure asset availability and performance so that operations can meet their production goals (throughput, quality, costs) on a predictable basis. To do so successfully, requires close collaboration between operations and maintenance so that the right maintenance activity can be performed, when it is needed, to reduce unnecessary downtime. Visibility throughout the enterprise is essential to asset health and its impact on plant performance.

Until recently, predictive maintenance or condition based maintenance was reserved for critical and expensive process equipment and required costly, specialized measurements. Today, the plant includes intelligent field devices, control systems, workstations, and network hardware all containing a rich set of embedded diagnostic information. Unfortunately, unless these assets are enabled to report health conditions, the information can go unnoticed for long periods of time. With 800xA Asset Optimization condition monitoring and reporting features, plant resident information can be collected, aggregated, analyzed, and compared to historical data to provide advanced warning of degrading device, equipment, or process performance and their impending failure. With 800xA Asset Optimization, the economic barriers to predictive maintenance have been removed.

Asset Condition Monitoring

800xA Asset Optimization includes software that monitors asset performance. While retrieving data from, and interacting with multiple data servers (real-time data servers, OPC® servers, etc.), asset monitors use real time plant information as inputs to:

- Detect health and performance conditions
- Assist in diagnosis of the problem
- Offer correction recommendations

Asset monitors vary in complexity from simply identifying status changes in an intelligent device or identifying high, low, or deviation limit conditions in the control system, to identifying abnormal conditions using advanced process equipment condition monitoring applications. When a performance condition is detected, the asset monitor issues an Asset Condition Document (ACD) and notifies the system. An ACD contains all information necessary to describe an asset condition. In turn, this information may be used to generate a work order for maintenance purposes (refer to Asset Condition Reporting).

Asset monitors can exist in any part of the plant hierarchy, such as the device, loop, equipment, area, process, plant, or enterprise (Figure 2). They can be written for higher-level assets (parents) that are themselves composed of many subassets (children). In addition, System 800xA pre-configured asset monitor types are available for assignment to assets of all levels.

Base Asset Monitors: 800xA Asset Optimization includes a base set of asset monitors which can be utilized as they are, or as 'building blocks' upon which to develop your own applications. Using information from plant systems, these asset monitors identify performance events. The base set of asset monitors includes: quality checks, Boolean checks, flow delta, limit (high, low, high/low), XY deviation, runtime and counter checks, as well as an SSAM (System Status Asset Monitor). Although the

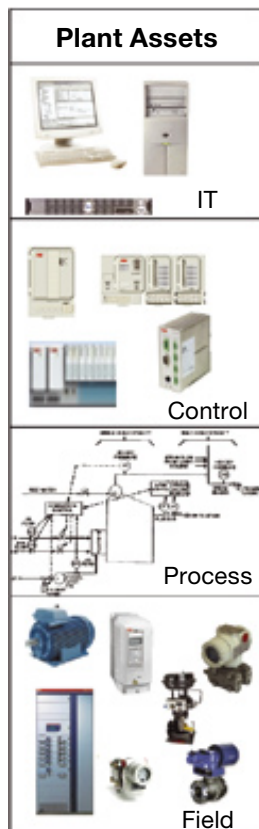


Figure 2. System 800xA asset monitors are designed with the flexibility and open standards in mind to support assets of all levels, from field instrumentation, to major plant equipment and processes, to IT assets.

information may be basic in nature, the applications derived from the use of these asset monitors can provide significant results. As an example, boiler efficiency can be effectively monitored by combining runtime, flow delta, bad quality, and XY deviation asset monitors with temperature profile.

Plant Equipment: Asset Monitors can be deployed on high level assets such as heat exchangers or machine skids (motors and their associated driven units; pumps, compressors, fans, etc.)

Heat Exchangers: ABB offers both a 'generic,' style of heat exchanger asset monitor whose operation is independent of geometry and thus can be applied to Plate, Frame, Finned-tube, Spiral Plate, etc., and a design that is specifically for Shell and Tube heat exchangers. With either type, the equipment is monitored to assess relative heat transfer performance. Only four temperature readings are required; flows and pressure are helpful but not necessary readings. A patented algorithm calculates efficiency and handles multiple operating points. No other physically invasive measurements are needed to detect operational degradation. The asset monitors 'train' on live or historical data. Changes due to fouling or changes in the operating point are identified and reported. These asset monitors are suitable for single-phase process fluid operation, as well as evaporating and/or condensing applications. The Heat Exchanger Asset Monitor is an integral part of 800xA Asset Optimization, as it monitors performance 24/7. For further information, please refer to details in the supporting 800xA Asset Optimization Heat Exchanger Asset Monitor Data Sheet (order number 3BUS094354).

Motors and Drives: 800xA Asset Optimization provides asset monitor types for motors and their associated load machines, such as pumps, compressors, and fans. These asset monitors identify abnormal or unstable process or equipment conditions that might stress the electrical equipment, and over time cause wear and failure. Asset monitor types range from basic, such as monitoring actual motor running hours and number of starts, to specific intelligent motor control center asset monitors, such as those that monitor the time-to-trip function related to motor thermal overload. ABB rotating equipment asset monitors include vibration monitoring, DriveMonitor (monitors the health of MV drives such as ACS6000, ACS5000 and ACS1000), MNSiS, which is an intelligent supervisor of MNSiS low voltage switchgear, a Propulsion Condition Management System, which integrates data from propulsion chain assets to create predictive diagnostic algorithms to optimize energy efficiency and late-stage system propulsion, Compressor/Pump Curves, which monitor the health of rotating equipment (compressors, turbines, pumps, etc.), and the UMC22, ABB's Universal Motor Controller Asset Monitor. The UMC22 is designed for protection and supervision of fixed speed low voltage AC motors. It is based on Device Type Management (DTM) for user friendly configuration and parameterization. It monitors both electrical and mechanical conditions of the motor, UMC22 electronics plus issues related to Contactors.

Additionally, ABB creates custom asset monitors using ABB's Asset Optimization Software Development Kit.

Control Network Asset Monitoring: 800xA Asset Optimization provides asset monitor types to assess performance of process control system equipment and

communications. Accessing diagnostic and status information resident in the system's controller, I/O, and communication modules, these asset monitor types identify degrading module/loop performance. For example, Advanced Harmony Control System Monitoring examines the status and performance of the Harmony Control System, and reports any significant abnormal change in operations of the Harmony Control System hardware. For further information, please refer to details in the supporting 800xA Asset Optimization Advanced Harmony Control System Monitor Data Sheet.

Control Loop Asset Monitor: Continuously monitors loop performance over the long term, indicating when degradation or operational changes have affected the performance of the equipment (the controller and/or Final Control Element). Diagnostic Conditions Monitored by CLAM include:

- Final Control Element (FCE) Stiction
- FCE Leakage
- FCE Size
- Excessive FCE Action
- Tuning Problem
- Loop Oscillations
- External Disturbances
- Loop Nonlinearity
- Data Reliability
- Insufficient Travel
- No Response to Signal Change
- Noisy or Unstable Output
- Sluggish Response
- Valve Body/Seat Wear

Resulting notifications can alert operations and maintenance staff to situations which are making control loop operation significantly more costly and inefficient. For further information, please refer to details in the supporting 800xA Asset Optimization Control Loop Asset Monitor Data Sheet (document number 3BUS094350).

Production Performance: Through the use of ABB's Real Time Production Intelligence (Real-TPD) product, equipment availability, performance and quality throughput, the factors of Overall Equipment Effectiveness (OEE), can be dynamically monitored to identify process bottlenecks. An asset monitor can detect these inefficiencies and alert operations and maintenance of pending production problems before they get out of hand. For further information, please refer to details in the supporting Real Time Production Intelligence overview.

PC, Network, and Software Monitoring: 800xA Asset Optimization provides asset monitor types for a predefined set of IT assets commonly associated with the 800xA system, such as printers, computers, switches, and software programs. The optimal behavior of these assets has significant impact on daily performance. For example consider the impact when performing with low free disk space, at a high CPU load, with high amounts of network traffic, or with faulty switch ports. Specifically, these asset monitors can identify root cause of IT performance problems by assessing conditions from the simple (printer out of paper), to the sophisticated (detection of a slow memory leak in the computer). For further information, please refer to details in the supporting 800xA Asset Optimization PC, Network, and Software Monitoring Data Sheet.

Field Devices (HART®, FOUNDATION Fieldbus™, PROFIBUS): Field Device asset monitors for HART, FOUNDATION Fieldbus, and PROFIBUS devices are available as part of the respective Device Libraries provided with System 800xA Device Management (see the System 800xA Device Management Overview document). Field Device asset monitors are available as either generic asset monitors or device specific asset monitors. The proper asset monitor is automatically assigned to individual plant devices.

The Device Libraries will be extended with devices from ABB and other manufacturers on a continuous basis. For the latest list of integrated devices and the corresponding asset monitors, please contact your local ABB representative or go to <http://www.abb.com/controlsystems1>.

Asset Condition Reporting

Continuous improvement of plant performance requires visualization of key plant information and asset performance metrics. Readily available plant information describes asset performance objectives, constraints, current behavior, and relationships with other plant assets. In general, asset information is available from all 800xA workplaces with maintenance personnel interacting with asset information via the Maintenance Workplace. System 800xA’s Maintenance Workplace organizes and arranges asset information for maintenance personnel in a way that is needed for efficient daily activities. Additional filters further refine this information for specific maintenance roles, such as the maintenance technician, maintenance engineer, and maintenance manager (Figure 3).

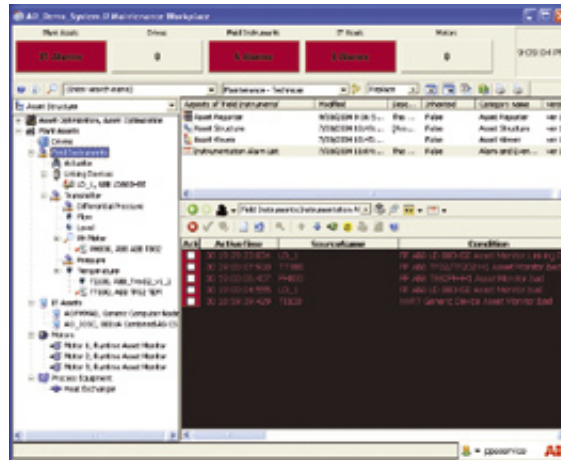


Figure 3. Maintenance Workplace

¹The online version of this document links to the corresponding web page. Otherwise, please select System 800xA, Device Management, and then Device Integration Center on the Control Systems homepage.

Within the workplace environment, maintenance personnel are provided with meaningful analysis and reporting tools needed to identify and analyze poor plant performers. Report screens provide immediate visualization of performance problems.

In addition to 800xA Asset Optimization’s reporting features, analysis tools identify problem causes, locations, and their impact on overall plant performance. System 800xA asset aspects such as field device diagnostics, electronic documentation, product instructions, loop diagrams, SOP documents, P&ID drawings, and Information Management analysis displays support performance breakdown root

cause analysis. These tools are described in detail in their respective System 800xA Overview documents. Via the Maintenance Workplace, System 800xA provides asset condition reporting through Alarm Bands, the Asset Tree, Asset Reporter, and Asset History Reports.

Asset Tree. The Asset Tree shows the status of associated plant objects (assets) based on Plant Explorer structural hierarchies. When a performance condition is detected, an asset alarm is generated. The Asset Tree, visible in the Asset Viewer, provides structural context for quick identification of these performance status alarms (Figure 4), with alarms distinguished by condition severity (severity range: 1 to 1,000). The most severe conditions are propagated up the tree to the root node. In addition, the Asset Tree displays, and propagates up the tree, the quality of each condition. Asset performance details are available from the Asset Reporter and corresponding Condition Details displays. By right-clicking on the alarm, a fault report can be created, thereby initiating the work order process. The fault report carries the information contained within the asset monitor and can be automatically submitted to the CMMS; thus avoiding potential mistakes, additional paperwork, and delays (refer to CMMS Integration).

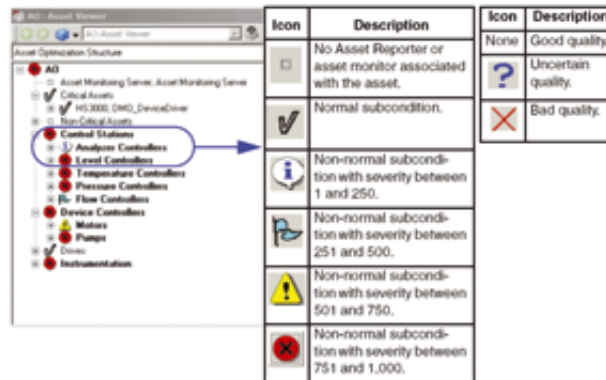


Figure 4. Asset Viewer and Icon Reference

Asset Reporter. The Asset Reporter is a detailed view of all asset monitor conditions for an asset. It displays the severity indicator for the asset itself, and information available to it from all asset monitors and their corresponding current subconditions. For each condition, the Asset Reporter will provide information about current subconditions, severity, asset monitor status, fault report availability, and work order availability. This information is available by right-clicking on the item of interest (Figure 5).

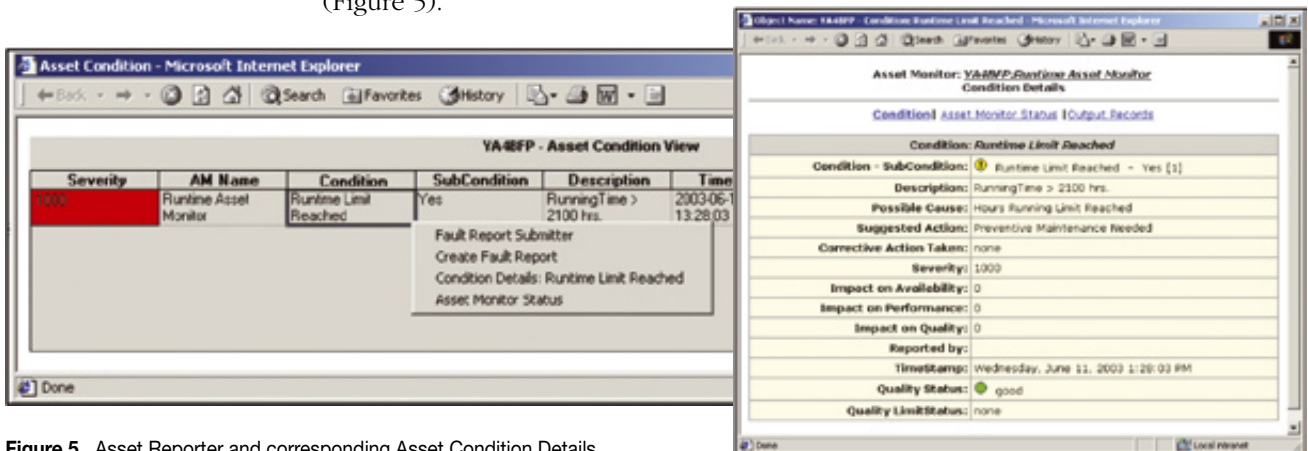


Figure 5. Asset Reporter and corresponding Asset Condition Details

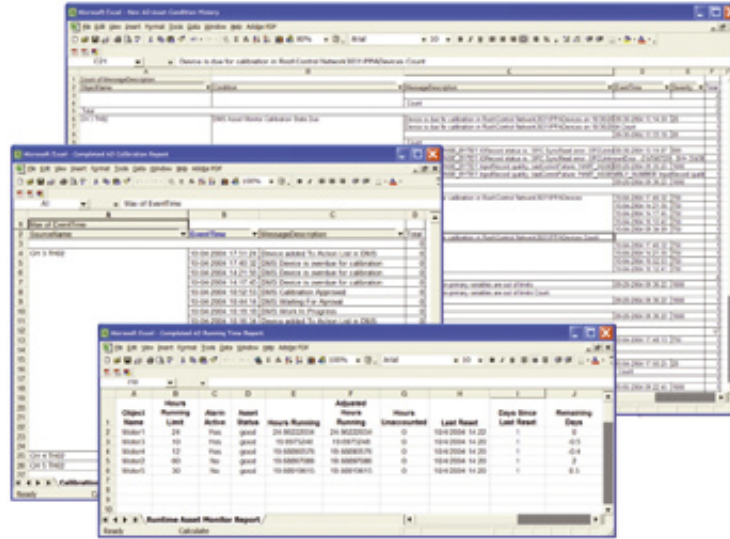


Figure 6. AO Asset Condition History report, Calibration report, and Running Time report

Asset Reports. Asset Reports give maintenance engineers comprehensive information to aid them in their every day decision-making process. They are used to define a proactive maintenance strategy (Figure 6). These reports include:

- AO Asset Condition History reports
- AO Calibration reports
- AO Running Time reports

For every asset, the AO Asset Condition History report gives a detailed listing of all asset maintenance conditions that have been active in a specific time interval and counts the number of faults per each condition. It identifies repeating asset condition offenders and highlights critical assets with high failure rates.

For every device requiring calibration, the AO Calibration report lists all calibration events with the time that the event occurred and displays the current calibration state on top of the list. The AO Calibration report helps to identify the current calibration state for every device; for example waiting for approval, due for calibration, or work in progress.

The AO Running Time report lists all assets in a given structure with a Runtime Asset Monitor. For each of these assets, the report shows the configured runtime limit value, the hours of operation, indication that the run-time limit is active, and the date of the last asset monitor reset. Furthermore, it calculates the remaining time in days of operation until the runtime limit is reached based on the current calculated average runtime rate.

Maximizing Operations and Maintenance Effectiveness by Reducing Time to Repair

System 800xA’s integrated environment for field device management and maintenance management provides users with a versatile plant life cycle management and optimization tool. By providing CMMS and DMS resident information within the 800xA Process Portal environment, users have a single

window interface for maintenance and calibration management (Figure 7). System 800xA allows plant personnel to significantly reduce the maintenance cycle by interacting with equipment data and accurately assessing equipment conditions in real time.

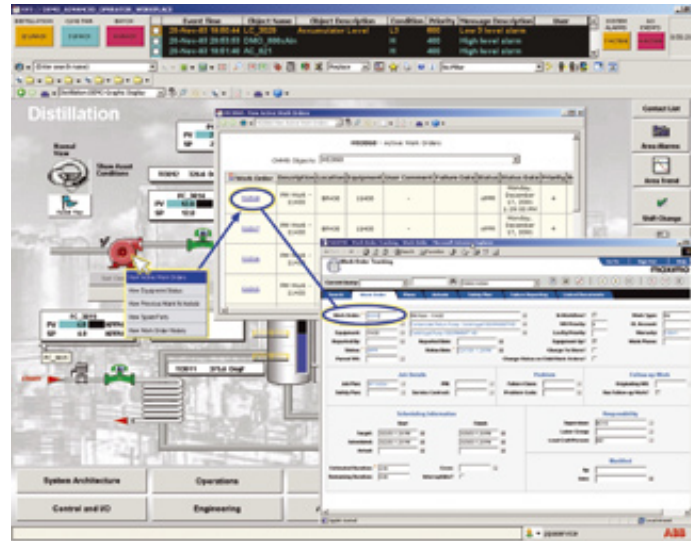


Figure 7. CMMS and calibration resident information is readily available for viewing by right-clicking on the graphic element related to the asset.

Consider the example where an operator recognizes the degrading performance of a cooling tower. Traditionally, the operator receives a process alarm and reviews the process graphics and alarms to identify where the problem is occurring; for example, a cooling tower's pH level control loop. Then, the operator either blindly sends a maintenance request via log entry, handwritten note, or email; or spends significant time searching several different systems in different locations, environments, navigation schemes, etc. to see if maintenance has been requested or scheduled.

Using System 800xA, the operator or maintenance technician is notified of the maintenance event via the analyzer's asset monitor and Process Portal alarm and events. For remote personnel, the maintenance event notification is delivered via mobile telephone, e-mail account, or pager by 800xA's SMS (Short Messaging Service) and e-mail messaging service. The accompanying Asset Condition Document describes the problem and cause. Then, the user quickly accesses CMMS resident maintenance information via the Active Work Order view to determine if a pH analyzer work order is required. If work is not currently scheduled, the user can automatically initiate the work order process by electronically submitting a fault report to the CMMS. In turn, if calibration is required, the CMMS work order is automatically forwarded to the DMS Action List. Thus, with 800xA Process Portal and single-click access to information and action, users can significantly reduce the latent time between problem identification and resolution.

Reduced time to repair is a result of:

- Streamlined work processes
(alarm → root cause analysis/detailed diagnosis → decision)
- Paperwork elimination
- Single, electronic audit trail

Similarly, integrating calibration services with the System 800xA environment can significantly reduce maintenance costs. For example, in many cases, calibration is a manual operation, scheduled on a routine basis. However, preventive calibration practices are very costly as these services are performed whether they are required or not. Using 800xA Asset Optimization, the optimal calibration schedule is determined using historical data, fault analysis, process analysis, and the calibration strategy. Calibration triggers notify users when calibration is required.

CMMS Integration

800xA's Asset Optimization CMMS Integration feature establishes the link that removes the barrier to information exchange between the CMMS, such as MRO Maximo®, SAP PM® or IFS, and the process control system environments. One of the issues that traditionally inhibits free interchange between these functional areas is their different naming conventions: an asset often has one name in the operations environment and another in the maintenance environment. This is because these systems have different focuses, purposes, and needs that their naming conventions must satisfy. 800xA Asset Optimization removes these barriers by pointing to the right context, regardless of the naming convention. The solution uses a unique approach that does not require a continuous software adjustment of the CMMS interface when the DCS application is modified. The one time set-up effort allows DCS modifications without requiring additional support and costs on the interface side.

800xA Asset Optimization's CMMS Integration brings maintenance management into the DCS environment. It provides maintenance personal, application engineers or operators with a single window interface for multiple systems. Context menus on process graphics, the alarm and event list, etc. provide access to several views and actions for the specific CMMS item.

The seamless interaction between process and maintenance is made possible through standard screens created by System 800xA. 800xA Asset Optimization's CMMS views present the relevant maintenance information for each specific piece of equipment (Figure 8).

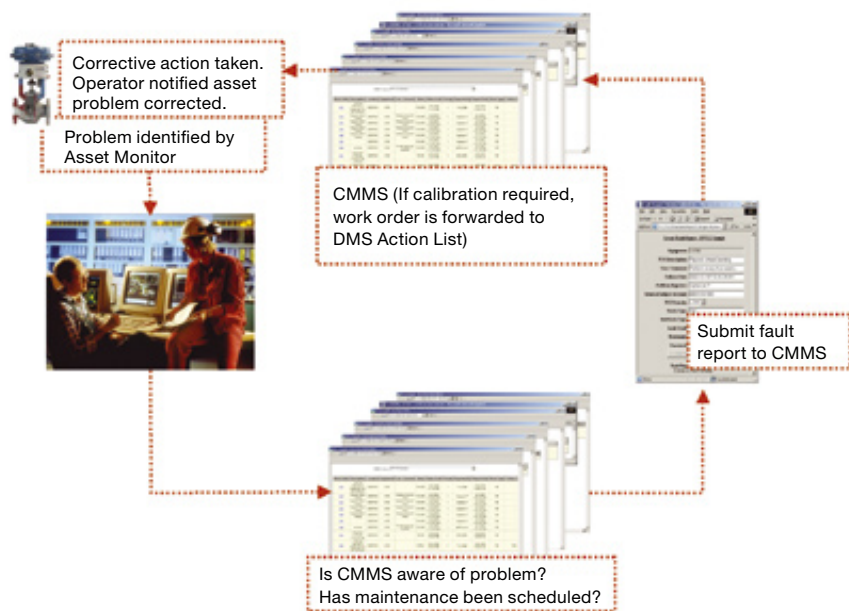


Figure 8. Seamless interaction between operations and maintenance reduces the maintenance cycle through streamlined work processes.

These informative displays include:

Active Work Orders View. The Active Work Orders view lists all active work orders in the CMMS for a particular asset or group of assets. The Work Order column contains links to the CMMS. Clicking on a link opens a native CMMS display for the selected work order (Figure 9).

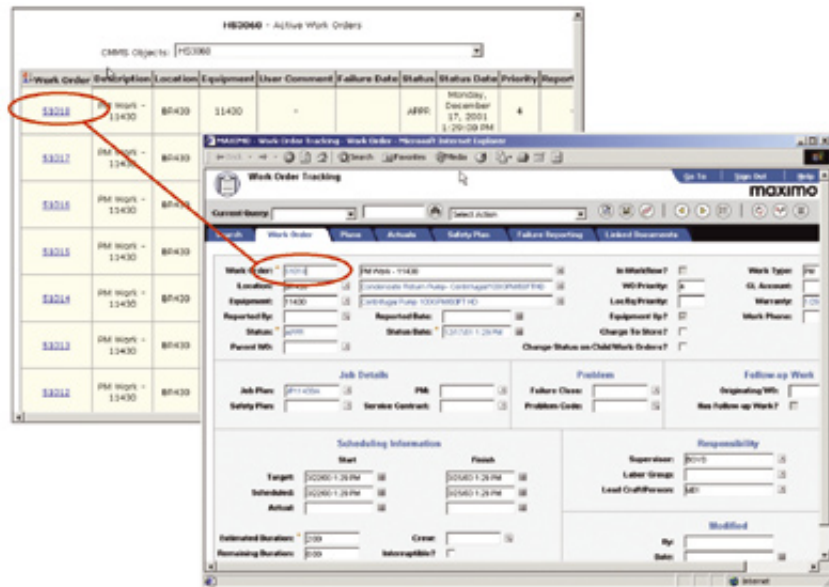


Figure 9. Active Work Orders View and Native CMMS Display

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Work Order History View. The Work Order History view lists the history of all work orders in the CMMS for a particular asset or group of assets. The Work Order column contains links to the CMMS. Clicking on a link opens a native CMMS display for the selected work order.

Equipment Status View. The Equipment Status view provides viewing of data returned from a status assessment in the CMMS of an asset of group of assets.

Preventive Maintenance Schedule View. The Preventive Maintenance Schedule view summarizes the maintenance schedule information in the CMMS for a particular asset or group of assets.

Spare Parts/Availability of Spare Parts Views (Maximo only). The Spare Parts view summarizes spare parts information for a piece of equipment in the CMMS. The Item Number column provides a link to spare parts availability data.

Fault Report Submitter/Viewer. For a particular asset problem, the Fault Report Submitter allows a user to electronically generate and submit a work request to the CMMS. The fault report content can either be entered manually or it can carry forward all information contained in the determined condition of an asset monitor. The Fault Report Viewer summarizes all fault reports for a given asset (Figure 10).

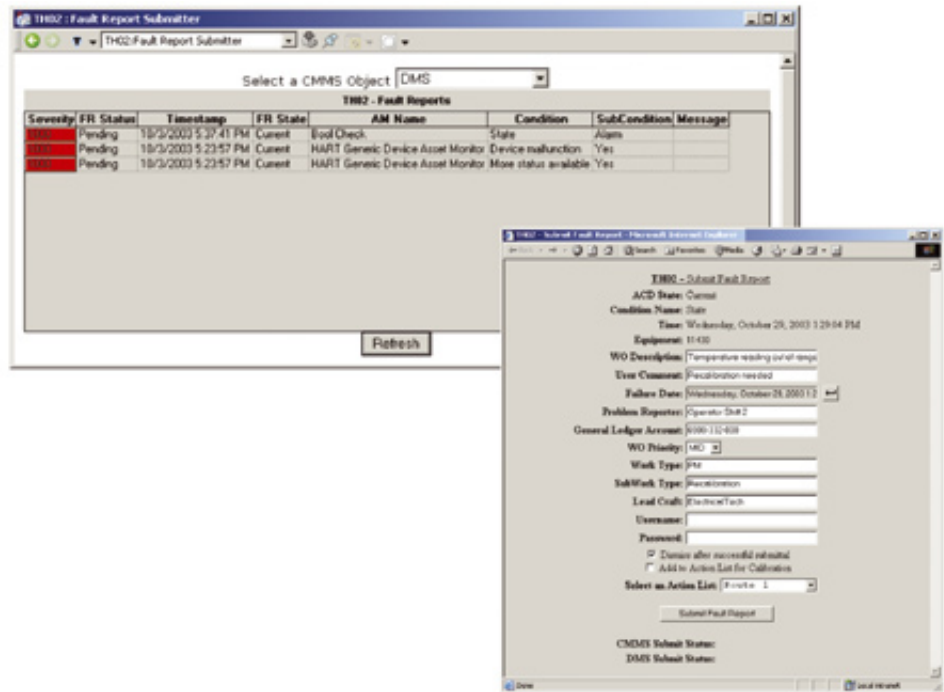


Figure 10. Fault Reporter Viewer and Submitter

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DMS Calibration Integration

Calibration management is an important facet of the plant maintenance strategy. By streamlining calibration workflow, quality of the process/product is improved while cost is reduced. System 800xA provides a complete field device management solution for plant devices. Using the Device Management System (DMS), the 800xA Fieldbus Management tools are extended to provide an integrated calibration management solution for HART or conventional 4-20 mA devices.



Figure 11. DMS Calibration Software connectivity to 800xA Fieldbus Management Tools

The DMS software connectivity to System 800xA, in conjunction with the handheld DHH800-MFC HART Communicator and DHH810-MFT HART Calibrator/Communicator, results in an integrated hardware/software solution that is unmatched in the industry. With this offering, System 800xA can significantly reduce field device life cycle management costs through precise calibration, configuration, and secure electronic documentation of the calibration process. (Figure 11). For a complete description of 800xA's Fieldbus Management tools, please refer to the System 800xA Device Management Overview document.

800xA Asset Optimization DMS Calibration Integration allows plant personnel to access field device calibration information through Process Portal's common user interface, and streamlines the maintenance workflow (Figure 12). It manages data exchange between DMS and System 800xA for items such as alarms, synchronization of topology, device instances, and device specific parameters needed for calibration procedures in DMS. This means that any device engineered in the 800xA system will be automatically added to (or deleted) from DMS. Work orders required for calibration procedures are submitted to the maintenance management system, which automatically populates the DMS Action List, and initiates the calibration activity.

21 CFR Part 11 Enabled. 800xA Asset Optimization with DMS Calibration Integration provides the user with a detailed record of the maintenance action performed on virtually every field device in the plant. The integrated DMS solution including software, DHH810-MFT Calibrator, and the DHH800-MFC HART Communicator, has optional functionality to assist in implementing compliance to 21 CFR Part 11 requirements. 800xA's calibration management solution combines completely automated configuration, calibration test, and documentation procedures with electronic signatures and extends the signatures to the level of the handheld instrumentation, ensuring the validity and security of calibration and configuration procedures and results. Through these inherent features, only authorized users can affect changes to configurations and perform calibration functions while the device is in place. All in all, System 800xA with DMS integration performs its calibration management function over the entire device lifecycle.

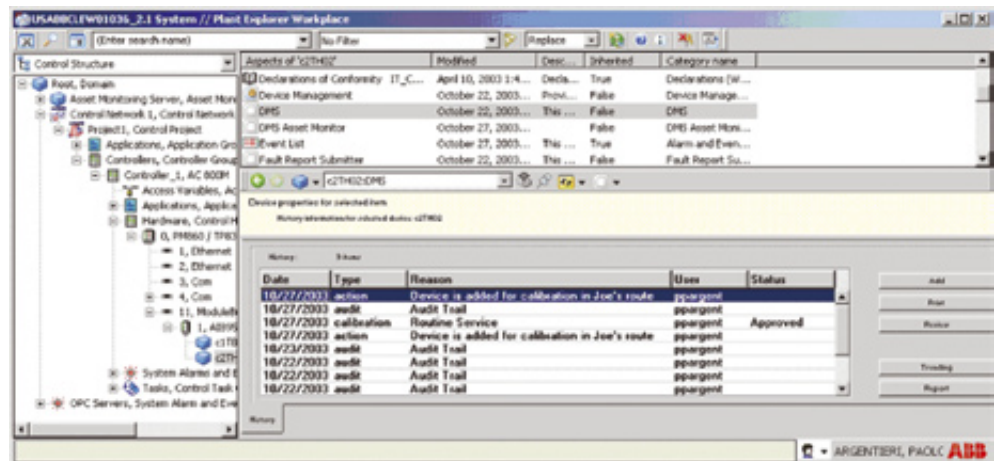


Figure12. DMS Aspect Showing Device Added to Action List in DMS

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DMS Calibration Integration supports:

- **Calibration administration:** Includes classification of devices and descriptions of general calibration procedures for different device types, calibration schedule, calibration history and reports per device, generation of work orders, and instructions for devices due for calibration.
- **Calibration process in the field with a unique device that combines hand-held calibrator and HART communicator:** Provides a device specific instruction list for calibration, logging of all executed steps and results for documentation purposes, and generation of the precise signals required to calibrate the device.

DMS Asset Monitor. The DMS asset monitor monitors the calibration state of a given device and provides notification in System 800xA when devices are due for calibration. It displays the current status of the actions taken, such as unscheduled, scheduled, work in progress, etc.

For the latest information on Asset Management at ABB, visit us at www.abb.com.



**ABB
Process Automation Division**

Västerås, Sweden
Phone: +46 (0) 21 32 50 00
Fax: +46 (0) 21 13 78 45
www.abb.com/controlsystems
email: processautomation@se.abb.com

**ABB
Process Automation Division**

Singapore
Phone: +65 6776 5711
Fax: +65 6778 0222
www.abb.com/controlsystems
email: processautomation@sg.abb.com

**ABB
Process Automation Division**

Wickliffe, Ohio, USA
Phone: +1 440 585 8500
Fax: +1 440 585 8756
www.abb.com/controlsystems
email: industrialitsolutions@us.abb.com

**ABB
Process Automation Division**

Mannheim, Germany
Phone: +49 (0) 1805 26 67 76
Fax: +49 (0) 1805 77 63 29
www.abb.de/controlsystems
email: marketing.control-products@de.abb.com

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