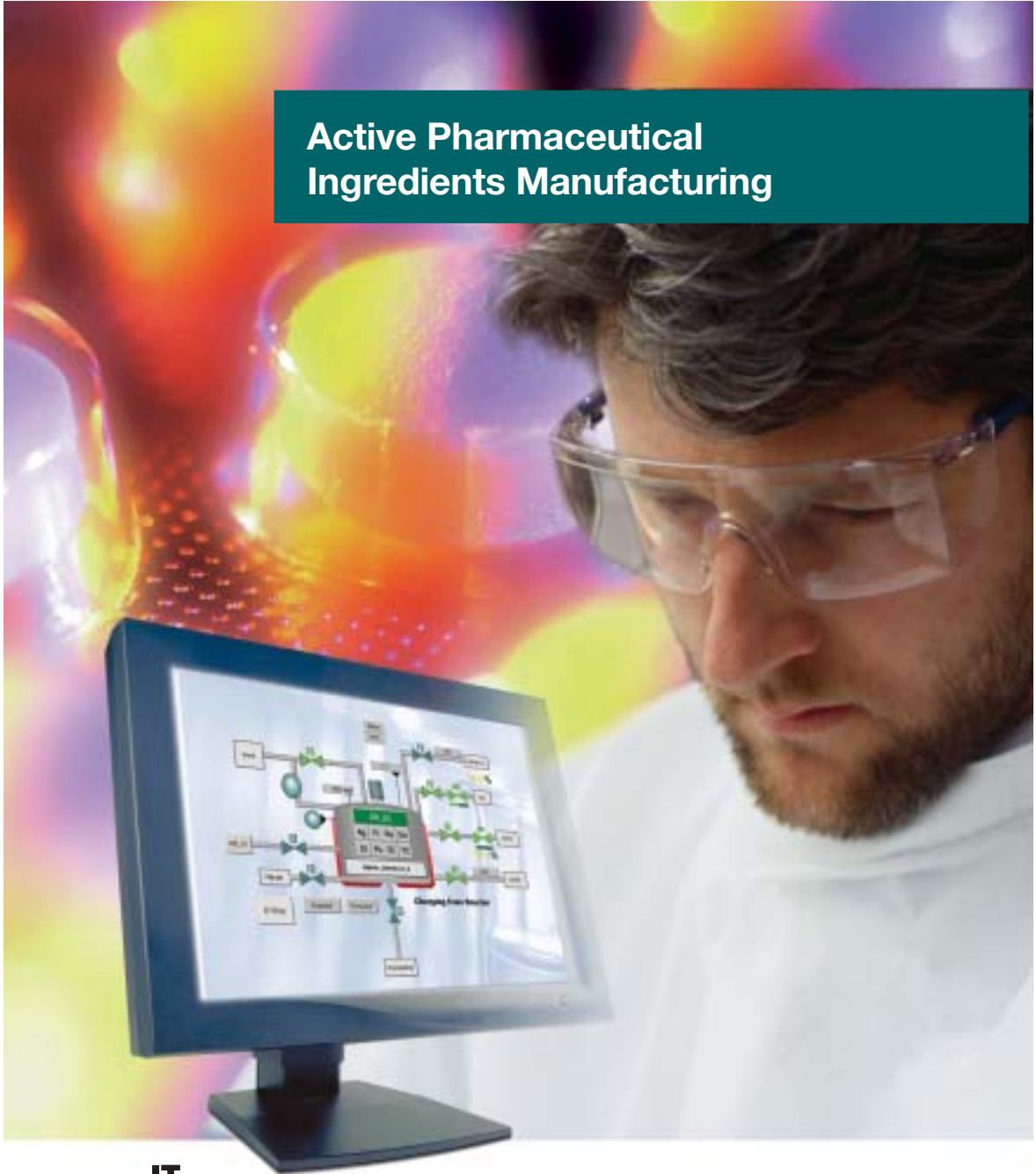


# Industrial<sup>IT</sup> Solutions for the Life Sciences Industry

## Active Pharmaceutical Ingredients Manufacturing



**Industrial<sup>IT</sup>**  
—enabled

**ABB**

# Manufacturing of Active Pharmaceutical Ingredients (API)

## Industrial<sup>IT</sup> Extended



### Fully integrated 21 CFR Part 11 support improves plant productivity

Active pharmaceutical ingredients (API) are individual substances or a mixture of substances used to produce a drug or medical product. These drug substances can be manufactured by processes like chemical synthesis, fermentation and extraction or by recovery from natural resources.

API starting materials are raw materials, intermediates or other APIs that are incorporated as significant fragments into the API structure. Starting materials range from chemicals of defined properties and structure, to blood and plasma, or derivatives.

Life Sciences companies around the world produce APIs or API starting materials either in-house for further processing, directly for the international marketplace or under contract. For example:

- API by Chemical Synthesis
- API by Classical Fermentation
- Biotechnology API
- Plant/Animal Extraction API

Regulatory requirements that apply to the production or use of APIs include 21 CFR Part 11, good manufacturing practices (cGMP and GAMP guidelines), or similar regional regulations.

When designing API processes or facilities, engineers must ensure that the project and process will be profitable and will function according to tight regulatory requirements. Time-to-market for new products is the key to profitability.



The Industrial<sup>IT</sup> Extended Automation System 800xA from ABB offers you a fast path to manufacturing efficiency. It helps you manage applications like:

- Facility and building automation
- Equipment cleaning and control
- Batch management, from production scheduling to electronic batch recordkeeping
- Information management

The system 800xA is designed to facilitate validation and delivers the following benefits:

- Full FDA 21 CFR Part 11 compliance
- CIP capability
- Optimized usage of your assets
- Reduced time-to-market

You'll meet your targets and improve manufacturing efficiency with ABB's Industrial<sup>IT</sup> technology.



# Pharmaceutical Ingredients with Automation System 800xA

## Responsibility for production activities

For the manufacture of APIs, the Industrial<sup>IT</sup> Extended Automation System 800xA provides all the tools you need to achieve regulatory compliance. Security, audit trail, change management, electronic signature, automated reporting, archiving and retrieval are integral to all operations and system applications.

Quality should be the responsibility of everyone involved in manufacturing APIs. The Industrial<sup>IT</sup> system supports quality management by setting up user roles. Every user role is described according to a set of tasks to be performed (the role) and the profile of the person responsible for those tasks (the user).

## Personalized workplaces

The system 800xA automatically adjusts the user interface and the application to match the user profile and tasks.

It offers different views of the API process for an operator and for a process engineer. It presents information in different forms for the plant manager and for the maintenance engineer.

User roles also play a key role in controlling system and information access. 800xA reminds users of key elements of their job and prevents unauthorized access. Users can only do what they are trained for. Decisions are made faster as users have the key information they require to do their role.

## Focused information access

Depending on their responsibilities during API manufacture, the system 800xA allows users to:

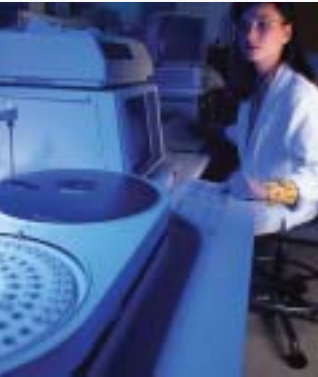
- Perform or approve proposed changes to recipes, the process or equipment controls
- Make sure that the necessary calibrations are performed and records are kept
- Confirm that the production facilities are clean and, when appropriate, disinfected
- Start and run automated cleaning procedures
- Approve recipes and release them for production
- Schedule batches for automated production execution
- Perform manual operations
- Review the production records and electronically sign them

## Audit trail

All operations are automatically recorded in the audit trail. Each change is recorded as a time-stamped audit trail event, including object or file name changes, operator ID, description of change and node. If authentication or electronic signature is required (for example, to initiate or approve a corrective action), the system immediately records the circumstances.



# Efficient production in a perfect environment



## Buildings and facilities

The conditions of buildings and facilities used for manufacturing intermediates or APIs may affect the product quality. Room conditions are critical factors for drug production, packaging and storage. The tasks involved in supervising a clean room or building environment include managing the air filter system, controlling the HVAC system and monitoring room temperature, humidity, air pressure, dust, particles and microorganisms.

800xA automation technology reaches beyond traditional automation systems to control buildings and process equipment. Using the same technology for building and manufacturing automation, the system 800xA:

- Reduces validation efforts
- Allows reuse of engineering
- Integrates recording and reporting

## Access environmental conditions at a glance

With the 800xA's intuitive system interface, you can start with an online view of the site plan and then zoom in for more details using floor plans or room graphics that show real-time measurements of all sensors. With the appropriate access rights, you can change settings from any connected workstation in the plant or office and easily supervise the status at a glance.

## Never fear warnings again

Conditions are continuously monitored. If predefined upper or lower limits are exceeded or other conditions are violated, the system automatically generates alarms, which are visible in all displays. Alarm categories include warnings, as well as safety, environment, process or machine control, and maintenance

events. The system can notify the responsible personnel even at a distance (through a pager, SMS or e-mail), or perform automated corrective actions, depending on the alarm type, priority and reason.

## Recording and reporting made easy

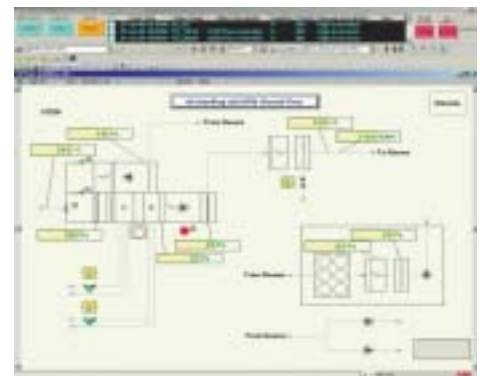
Temperatures, concentration values and other measurements, as well as operator actions, are automatically recorded, documented, reported and archived. Collected information is electronically managed, and allows different views of:

- Building, environment and process data
- Tag, sensor, device and machine-specific signals, events and alarms
- Continuous, maintenance and batch data

Information management and web-based reporting tools let you create:

- Environment reports
- Shift, daily, weekly and monthly overviews
- Site, building, floor and room overviews
- Charts and statistics

System 800xA integrated building automation supports the needs within regulated industry, both for meeting the requirements of FDA 21 CFR Part 11 and also for achieving product quality and safety in the API manufacturing process.



# Cleaning and sterilization: reproducible procedures

Production equipment could be permanently installed for example processing lines with bioreactors, storage containers, dryers, or portable equipment skids.

## Clean or sterile production?

Where equipment is assigned to continuous production or campaign production of successive batches of the same intermediate or API, the equipment must be cleaned to prevent any buildup of contaminations.

Visibility on availability of manufacturing equipment simplifies batch scheduling, leads to greater asset utilization, and contributes to better sales and operational planning. You can also tailor the system 800xA to establish and maintain manual, semi-automated or fully automated cleaning procedures.

## Improve routine monitoring

If the cleaning procedure is manual or includes manual operations, such as setting up clean-in-place (CIP) connections, ABB recommends using the 800xA to:

- Assign responsibilities for cleaning equipment
- Set up cleaning schedules
- Track the status of vessels (dirty, clean, sterile, etc.)
- Display cleaning instructions, when appropriate
- Prompt operators to perform instructions or inspections step by step, when appropriate

## Automate cleaning procedures

Fully automated cleaning procedures ensure efficiency and the highest degree of reproducibility, product quality and validation.

The 800xA fully controls the equipment status, and automatically:

- Monitors the maximum time that may elapse since the last cleaning
- Detects any change in produced products or campaign or batch IDs
- Executes cleaning schedules
- Starts cleaning operations as part of a batch recipe before the actual production procedure, if applicable
- Selects or suggests cleaning procedures based on the previous batch

## Maintain records and reports

The 800xA system traces:

- Equipment use and status
- Equipment cleaning, and any sterilization steps or procedures executed
- Use of cleaning agents or reagents
- Product residuals removed
- Operator prompts and confirmation that the cleaning process was successfully completed

Additionally, the audit trail shows the date, the time and the user name identifying the person who performed the manual or supervised the automated cleaning.

Cleaning reports can be generated separately or as part of the batch reports. A report can be either printed or saved/archived as an electronic record compliant with 21 CFR Part 11 regulations, including electronic recordkeeping with electronic signatures. The 800xA documents the final approval of the successful cleaning process.



# Improving reliability, quality and cycle time



## Batch management

The ISA S88 methodology and standard can be applied regardless of the level of automation in an API factory. It can be used for fully automated operations as well as partially automated operations.

The procedures of the integrated 800xA batch management describe how the API should be manufactured. They include a hierarchical breakdown of the order, and the way the required equipment is used to produce the API batch.

## Batch production equipment

The 800xA library includes standard phase control modules that incorporate ISA S88 modes and states, in addition to shared equipment and unit control.

Typical equipment attributes and parameters are:

- Capacity and actual level
- Content identification, for example, assigned batch or material IDs
- If empty, the ID of the previous batch or material
- Cleaning status
- Expiration dates; for example, for the current cleaning cycle or for materials

The tight system integration means that all equipment information can be accessed by the operator as well as automatically for use in all system functions from control, to batch management, to asset management.



## Batch Records and Execution

By thoroughly automating API batches, the 800xA ensures:

- Quality management support and execution of approved procedures only
- Verification that the materials used are the ones that are specified for the intended API
- Automatic detection of deviations, with support for automated or manual corrections, and exception reporting
- Correct execution of the sequence of operations and critical process steps according to the specification and master production instructions
- Electronic recording of the complete batch production and all quality related actions at the same time as they are performed
- Automatic generation of batch reports, including information on equipment use and material consumption
- Consistency from batch to batch

## Schedule campaigns, blend batches

Batches or campaigns are easily scheduled based on master recipes, batch-specific formulation data and equipment allocation data. Production management includes support for:

- In-process mixing of fractions; for example, centrifuge loads from single batches
- Combining of fractions, or blending of small batches for further processing or to increase batch size under the same or a new batch ID

ABB's integrated recipe management functions help you improve quality and shorten delivery lead times.

# Quality assurance and reducing cost of compliance

Quality assurance and validation managers are under pressure to deliver greater assurance with smaller teams. They must document and record all quality relevant activities and data. The 800xA's documented evidence and information is a key asset for regulated industry.

## Manage information

In the 800xA, all system, configuration, real-time and historical data is protected by user access restrictions. Change management ensures the data's consistency.

Configuration changes are tracked to protect libraries, instantiated solutions, run-time and off-line data. Comparison tools display changes (for example comparing different recipes or different versions of the same recipe).

Historical, process, equipment and batch production data is collected in the embedded historian. You can be confident of meeting the full electronic recordkeeping requirements for regulated industries.

The reporting tools support the wide variety of reporting requirements for operation or maintenance personnel, managers, quality managers and regulatory agencies.

Examples are:

- Calibration records
- Audit trails, either complete or filtered to present GMP relevant data only
- Standard batch reports with alarms, events and trends
- Customized batch and campaign reports
- Batch-to-batch comparisons

## Reduce the risks

The system 800xA facilitates regulatory compliance. The 800xA is up to date with the FDA's guidance on 21 CFR Part 11. The API manufacturer can shift from paper records and hand signatures to electronic records and electronic signatures, and take full advantage of promised benefits.

## Validation

ABB offers you the benefit of our automation and validation experience and demonstrated competence with API projects.

800xA helps shorten project time scales due to smart engineering tools allowing building blocks to be validated and then duplicated. Formal configuration management enables significant reduction in validation effort. If building block types change, the modification can be propagated without major revalidation.

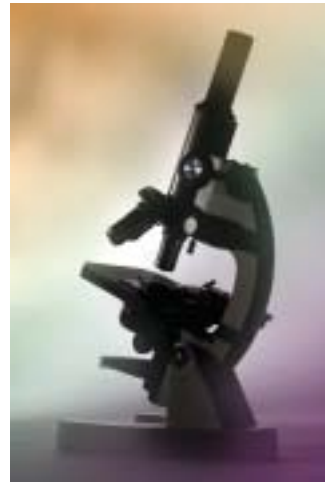
## Industrial<sup>IT</sup>

Your customers expect your APIs to meet the highest quality standards. ABB is your partner in turning your automation and regulatory challenges into competitive products and compliance success.

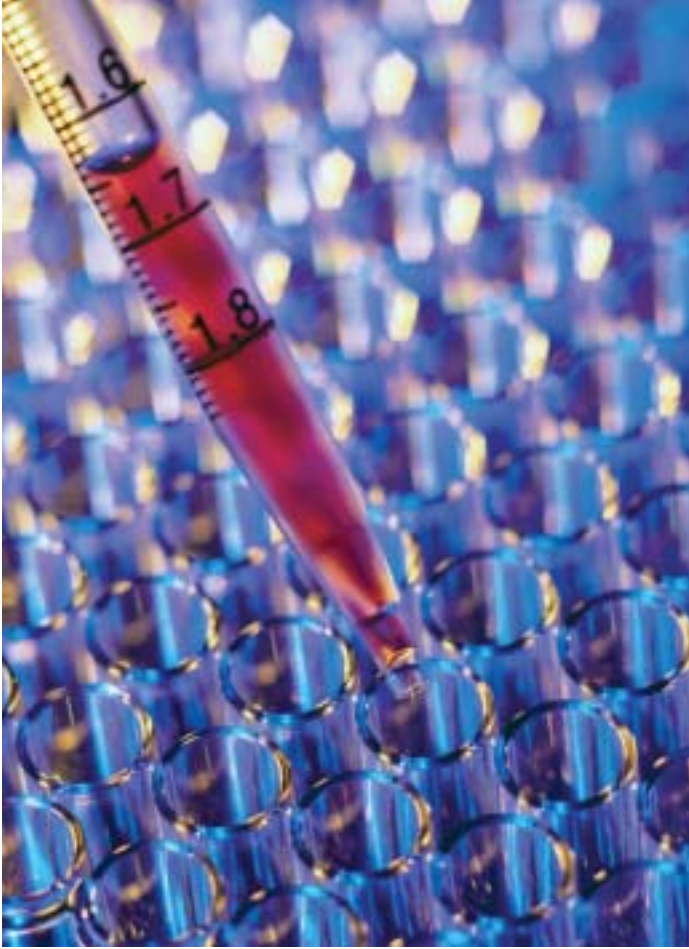
Industrial<sup>IT</sup> with its 800xA extended automation solutions allows you to operate your API plant the way you want to. Enhance the operation of your facility by:

- Optimizing the cycle time for API processes
- Improving the overall reliability, safety and quality of complex operations
- Reducing costs of compliance

With Industrial<sup>IT</sup> you're always in full control.



# Industrial<sup>IT</sup> for the Life Sciences Industry



Visit us at:

[www.abb.com/lifesciences](http://www.abb.com/lifesciences)

## An overview of Industrial<sup>IT</sup> products and services for the Life Sciences Industry

### Analysis and Instrumentation Equipment

- Raw material identification
- On-line monitoring of API manufacturing process, and solvent recovery process
- On-line moisture analysis
- At-line analysis of powder blend homogeneity, and solid dosage from content uniformity

### Automation

- Discrete control and visualization systems
- Process control systems
- Fieldbus technology and asset management
- Engineering and optimization software
- Batch control and management
- Building automation system

### Manufacturing Execution Systems (MES/EBR)

### Robot-based Manufacturing

- End-of-line packaging cells
- Robots to pick, pack and palletize

### Regulatory Compliance Services

- Business systems validation
- Computer systems validation
- Equipment and facilities qualification
- Laboratory systems validation
- Quality systems and standard operating procedures
- Risk assessment
- Spreadsheet validation

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