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TT Heat Treatment Monitoring and Management

Technical and commercial overview

The TT application centralizes furnace monitoring and information associated with heat treatment operations. Recorded temperatures, operation parameters and batch contents can be viewed together, both during execution and afterwards, for verification and analysis.

The solution is intended for organizations that perform heat treatments and need process visibility, deviation detection and quick access to the treatment history of individual parts.

Benefits for production operations

- Real-time visibility into furnace status and temperature trends, with remote monitoring available within the authorized infrastructure.
- Prompt detection of temperature deviations, failure to meet defined time requirements and reading errors.
- Traceability between the operation performed, the treatment batch and the products and parts included in it.
- Quick access to charts and parameters for nonconformity analysis and verification of operations from previous shifts.
- Centralized data for reporting and performance evaluation, including the weights treated in each furnace.

Two modules for the same process

TT Monitor acquires data from controllers and supports the monitoring of operations in progress. TT Management organizes recorded information, master data, users, alarms and reports. Together, the two modules link production monitoring to the technical history of heat treatments.

TT Monitor and data acquisition

The main function of TT Monitor is to retrieve values from temperature controllers and record heat treatment charts. The monitoring panel brings together the furnaces being monitored and the information operators need.

Real-time furnace monitoring

- Displaying furnace status, such as running, in alarm or stopped, and the available temperature values.
- Viewing the measured temperature PV and setpoint temperature SP together with the operation chart.
- Setting alarm limits and display ranges for graphical indicators.
- Displaying recent alarms and allowing inactive furnaces to be hidden.
- Setting and recording the characteristics of TT operations and charts.

Communication with equipment

The published solution includes a communication submodule for the controllers' RS232 interface. Configuration parameters include the serial port, reading interval, response timeout and batch viewing range. The acquisition module receives data through events generated by the communication component.

Extensions

Data can be acquired through both RS-485 interfaces and Modbus TCP/IP for data acquisition from compatible PLCs, with support for recording a variable number of temperature series. The series are defined at controller type level and used consistently for furnaces that use that type.

The extended chart brings together the series configured for the furnace, allowing multiple temperature zones or measurement points to be monitored according to the data supplied by the equipment.

Support is also provided for running multiple TT Monitor instances, each with a configured group of furnaces. The allocation mechanism is intended to prevent the same furnace from being monitored simultaneously by different instances.

Equipment compatibility, available series and included extensions are defined for the proposed configuration based on the interfaces and parameters exposed by the controllers and PLCs.

TT operations and batch traceability

Each operation performed receives a unique TT code. This identifies the operation and links process data to the treated batch and temperature records.

Preparing and starting an operation

At initialization, the operation, TT batch, operator, specified temperatures, duration, process specification and comments can be recorded. Operation information may include the cooling medium, start and end temperatures and transfer time, depending on the process.

Operation definitions allow the names, temperature ranges, time ranges and margins used to monitor the treatment to be managed. Measured values can therefore be analyzed against the requirements established for the operation concerned.

Treatment batch contents

Information tracked	Role in traceability
Order and product	The link between the treatment performed and the production requirement.
Melt heat	Identifying the material batch from which the parts originate.
Part identifier	Retrieving the history of identified parts.
Number of pieces and weight	Recording the quantities included in the operation and providing a basis for summaries.

Batch contents can be copied from the previous operation, reducing repeated data entry for successive treatments. Changes to batch contents after an operation has started are restricted to users with special permissions.

Recording and closing an operation

During the operation, the application records values retrieved from the controller and allows the temperature chart to be monitored. When the operation stops, the information remains available for viewing and reporting. An electronic copy of the original chart can also be attached.

Linking these data helps identify the parts included in an operation and examine the conditions under which they were treated. Operation details and the associated chart can be viewed and printed to provide technical documentation.

TT Management and performance analysis

TT Management makes use of the data recorded by TT Monitor and provides functions for managing furnaces, operations, cooling media, users and alarms.

Managing process data

The code, name, scale, controller type and reading parameters can be defined for each furnace. The operations master data retains temperature and time ranges, while the cooling media master data identifies the medium and tank used. Organizing this information provides a common basis for recording treatments.

Alarm management

The application records temperature reading errors and deviations from the temperatures and times defined for the operation. The alarm list supports tracking of situations arising during execution, while management functions allow alarms to be administered and canceled.

Alarm history can be analyzed by period and in relation to operators, orders and batches to support nonconformity investigations and the identification of recurring situations.

Searching and viewing charts

Completed operations can be searched by period, TT batch, melt heat, order, furnace, operator, product, part identifier, cooling medium or comments. Operation details and the temperature chart can be viewed and printed for each record.

Changing the chart scale makes it easier to examine areas of interest and compare temperature trends with the limits and specified values available in the record. The history can also be used to quickly verify treatments performed during night shifts.

Reports for production and quality

- Lists of TT operations and charts, filtered by relevant criteria.
- Details of the operation, batch contents, temperatures and times.
- Lists and statistics of recorded alarms.
- Operation summaries, including the weights treated in each furnace.

Centralized data supports analysis of furnace operations and documentation of treatments. Additional indicators and any specific reports are defined during the implementation analysis stage.

Solution architecture and configuration

Component separation

The architecture described in the technical documentation separates the user interface, communication with controllers, application logic and database. The technology base presented includes Java EE for the application, JavaFX for the Windows interface and Microsoft SQL Server for persistence. The platform and installation versions are defined in the proposed technical configuration.

Access and recording continuity

Access is authorized according to permission levels. The application supports multiple users, handles concurrent access and provides for auditing of record creation and the last save.

The technical solution provides for continued recording of measured values when the database or application server is temporarily unavailable, followed by synchronization when resources are restored. Retention capacity and data acquisition operating conditions are sized for the installation used.

Integration with other applications

The documentation provides for bidirectional data exchange with business management and production applications. Linking orders, products and batches can reduce repetitive data entry and the risk of transcription errors. Interfaces, transferred fields and synchronization rules are defined according to the connected systems.

Defining an implementation configuration

A technical and commercial configuration is developed based on the number of furnaces, controller and PLC types, communication protocols and required data series. The operations to be monitored, alarm rules, traceability level, users and reporting requirements are then clarified.

For commissioning, communication with the equipment and the correspondence of recorded values should be checked, followed by validation of alarms, charts and searches using a representative workflow. Integration with other applications and functional extensions are defined in the implementation proposal.

The commercial value of the solution lies in shared access to process status and treatment history, with linked information for operators, production managers and quality personnel.