Introducing the Future of Heat Treating:
Precise, Fully-Automated Process Control
for Consistently Successful Results
Put Decades of Experience in Process Control to Work for You
With The New Computer-Controlled Heat Treat System (CCHTS) from ATS

Precise and predictable results are the goal of any heat-treating operation. In order to satisfy ever-tighter process specifications and today’s increasingly exacting customers, an automated system for temperature control, data acquisition, and reporting is rapidly becoming a necessity. The new CCHTS hardware/software system, offered exclusively by ATS, meets this need for accurate, timely data with which to ensure customer confidence and satisfaction.

The new CCHTS was laid on the groundwork of ATS’s well-established WinCCS II automation system for creep/stress-rupture testing. Many of the requirements of creep testing, such as precise temperature control, report generation, and retrieval of archived calibration records, are consistent with the requirements of a heat-treating facility. Supported by decades of experience in furnace and control system design, ATS is adequately qualified to offer this computerized system for complete facility management.

“Furnace Control” Extends Far Beyond Simple Temperature Control

Temperature control is just one of many important requirements in a furnace control system. Much more is demanded of a system where operational and equipment costs must be justified. The new ATS control system can therefore be thought of as a heat-treating facility automation system, having the capability to:

• Document, track, and archive the results of a heat-treating process for any job or lot of material
• Automatically attach event logs to a job record, eliminating the need to manually maintain a traveler or other progress record
• Write and store temperature profiles and specifications to be used
• Input and store system calibration results and automatically attach these files to the job record, eliminating the need for separately-maintained calibration records
• Display on a computer screen the status of an entire facility (furnaces and jobs to be processed), improving efficiency through better management of resources

These features combine to reduce the amount of process uncertainty while increasing the level of quality assurance that can be offered to a facility’s clients. Reducing process uncertainty can also reduce perceived risk with respect to product liability.

Complete Compatibility with Furnaces from Any Manufacturer

Electric furnaces, any number and in any combination, from any manufacturer, can readily be adapted to suit the CCHTS system. A complete setup includes the CCHTS software operating on a host computer and our innovative control consoles, one for each furnace, providing a reliable interface between master and slave furnaces and the host computer.
The system status window presents a concise overview of important furnace and work order parameters. An intuitive menu structure provides a quick and clear interface with the CCHTS system. Dialog boxes display step-by-step process and calibration instructions.

A versatile specification editor and built-in library feature make it easy to create, locate, select, and modify any new or previous heat-treatment procedure.

Reports are available in basic short form or in a flexible, user-defined long form. Graphing is as simple as selecting one or more of the plot types and formats.

Color-coded temperature graphs can include data such as setpoint, furnace and work temperatures, and upper and lower temperature limits.

Informative, Easy-to-Use Interface
The system status window, which appears when the software is first launched, is the main user interface. It includes an easy-to-use menu bar for controlling all aspects of the heat-treating process. This window provides a continuously updated, color-coded overview of key parameters, such as jobs in progress, furnace state, furnace temperature and power level, elapsed time, and alarm status. The intuitive design of the menu structure allows for specification creation and editing, system configuration, process initiation and termination, and all other operation, reporting, and maintenance functions. For tasks such as thermocouple calibration, dialog boxes are displayed to lead the operator step by step through the entire procedure.

Powerful Process Specification Editor
CCHTS gives you the power to easily create customized specifications for any heat-treating operation. Each new specification generated in CCHTS becomes part of a readily-accessible library of stored procedures and can be recalled for future use or quickly modified for new and similar requirements. Revision control ensures that there will be a permanent record of all specification changes. Heat treatment specifications are appended with conditions which comprehensively define process parameters, such as temperature setpoint and alarms, heating rate, soak time, pass/fail criteria, and reporting/recording options. Conditions are a very useful technique for extending the usefulness of a single specification. For example, a given specification can have multiple conditions such as varying temperature setpoints or different ramp rates.

Work Order Queuing and Data Tracking
The CCHTS setup eliminates the common problems associated with manually tracking multiple jobs and heat-treatment processes. Work orders are named, dimensions and material types are recorded, and specifications are selected via menu prompts and dialog boxes. This vital information is then saved and archived by the software and automatically becomes part of any report associated with that particular job. Only fully-defined, queued work orders are available to operators for processing.

Complete Process Control
Fully-defined work orders are kept in a list which is available to the operator for selection. When a particular job is selected, CCHTS ensures that only furnaces suitably equipped for the specification linked with that job will be available to the operator for the test. The operator is then prompted, if appropriate, to choose from a list of previously calibrated thermocouples or to follow a step-by-step procedure to calibrate new thermocouples for a particular run. The samples are then loaded and any necessary instructions are given. As the process continues, pass/fail conditions are continuously evaluated, and CCHTS instantly alerts the operator to any anomalies. When heat treating is complete, the operator is prompted to remove the samples and record any other necessary data.

Graphing and Report Generation
Reports can be generated at any time for procedures in progress or for completed or archived runs. A wide range of report choices is available, including short and long form reports. Short form reports contain basic information for process evaluation while long form reports are custom-configured to include data such as thermocouple calibration, work order information, events, and temperature data in a color-coded format. Information can also be displayed in a clear and concise graph format. All data can be easily exported for use in spreadsheet programs and publications, or they can be e-mailed and faxed to others.
The majority of computer-control systems available today range from simple computerized operation of discrete setpoint controllers to centralized systems requiring thermocouple input from each furnace wired back to a central computer. The latter systems often have high installation costs, and the possibility of computer failure could disrupt the productivity of an entire facility. The new computer-controlled heat treat system from ATS eliminates these drawbacks by utilizing a unique master-slave control structure. (See Fig. 1)

Using such a control scheme serves to reduce installation costs by minimizing the amount of thermocouple wiring that needs to be done, and because each master controller is responsible for only four furnaces and is independent of any other controllers within the facility, any adverse effects from a catastrophic controller loss is confined to only these four furnaces.

![Figure 1: System Architecture](image)

Each master controller connects to the host computer via an addressable RS-485 serial communications link. In this way, a maximum of 32 master controllers can be accommodated by a single computer port. In turn, each master controller is capable of operating three slave controllers, and two NIST-listed thermocouple inputs (in any combination) from each furnace can be wired back to the master controller for processing.

Each master controller houses a 32-bit MC68331 CPU that provides processing power for the master and slave controllers, and each furnace benefits from its own dedicated 8-bit processor. Each console also provides an important level of protection from system-wide failure: Loss of contact with the host computer will not result in process interruption or data loss. Each controller is designed to autonomously continue operating in its current mode and recording data for up to 96 hours. When computer contact is restored, the accumulated data is then uploaded to the host computer.

Inputs are also available to detect open doors and other situations, and outputs are available to control items such as gas flow and control valves. The provision for operator annunciators is incorporated into the software, and outputs are provided. All input and output lines are optically isolated to eliminate the unwanted effects of ground loop potential.
Specifications

Furnace Accommodation............Any combination of electric furnaces; all major manufacturers; new and retrofit.

Standard Interfaces/Controls........Master/Slave Controllers: Single-zone furnace temperature control; furnace power control; single-loop heater controller indicating current temperature and setpoint. Master Controllers Only: Eight thermocouple input channels for furnace control and data logging; communications and processing capabilities for management of up to three slave controllers.

Optional Interfaces/Controls........Master/Slave Controllers: One thermocouple input channel for optional over-temperature control. (Several layers of internal safety features make a separate over-temperature controller totally redundant, but this feature is provided where necessary to meet required safety codes.)

Furnace Control....................Single-zone furnace temperature control with patented PID power control system (replaces discrete temperature controllers and phase-angle SCR power control); preemptive power compensation automatically eliminates temperature changes due to line voltage fluctuations; high-resolution thermocouple A/D and PID algorithms for precise temperature control.

Control Methods....................Possible control methods depending on the type of heating element involved are solid-state relay (SSR) switching at zero-voltage crossing points and analog output to drive the silicon-controlled rectifier (SCR) systems required by silicon carbide and other high-temperature elements.

Thermocouple Calibration..........Automatic step-by-step thermocouple calibration routine and classification; automatic thermocouple calibration correction ensures that all references to temperature are accurate.

Process Specifications..............Full heat-treatment process specification editor for creating and modifying procedures; complete revision and access control.

Data Handling.......................Identification and tracking system maintains and archives all data associated with each work order for instant access and reporting; data is ASCII exportable.

Reports..............................Short form; long form; events; thermocouple calibration data; process specification; temperature data; system configuration.

System Safety.......................Several levels of user-programmable under-temperature and over-temperature alarms ensure automatic shutdown when appropriate temperature deviation is experienced; software-independent watchdog feature initiates furnace shutdown if processor function is interrupted; controllers are isolated from host computer failure; furnace console continues running in current mode and collecting data autonomously for 96 hours.

System Security.....................Multi-level access with password protection; system administrator determines each user’s privileges and restrictions.

ISO 9000.............................Complies fully with documentation, control, and specification requirements.

Computer Requirements..........OS: Microsoft® Windows™ NT (4.0, 2000, XP, or higher)
Processor: Intel® Pentium™ III or Celeron™ (or equivalents) 500MHz or higher
Memory: 64MB RAM or higher
Hard Disk: 1.6GB or larger
CD-ROM: Required
Modem: V.90 or better
Software: Symantec® pcAnywhere™ required
I/O: RS-485 interface port and card
Display: 17” or larger SVGA monitor recommended for easy viewing
Printer: Color printer or plotter recommended for graph generation
Storage: DAT backup drive recommended to prevent data loss due to computer failure

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More CCHTS Features

For Precise and Comprehensive Control, Ease of Use, and Reliability

Efficient, Patented Furnace Control
• CCHTS replaces conventional temperature controllers and SCRs with a patented PID control system that eliminates RFI/EMI problems and power factor corruption, reducing the level of electrical noise in a facility and often resulting in savings in electric power costs. High-resolution A/D conversion of thermocouple signals helps hold temperatures to the highest accuracy.
• Temperature fluctuations caused by line voltage drift are eliminated by a preemptive algorithm that detects and corrects for voltage changes before furnace temperatures are affected.

Automatic Thermocouple Calibration and Correction
• Automatic step-by-step calibration and archiving of individual thermocouples, as well as establishment of a correction factor for each thermocouple. The need to manually correct variances in temperature information caused by imperfections in thermocouple wire is thus eliminated.
• Any combination of NIST-listed thermocouples can be used, and types can be changed with a simple notation in the menu-driven software.

Failure Protection
• Microprocessor control in each console isolates processes from any host computer failures. In the event of a computer failure, heat-treating will continue in the current mode and data will be collected autonomously for up to 96 hours. When the computer link is reestablished, data is automatically uploaded to the host computer for processing.

ISO 9000 Compliance and Data Management
• Complies fully with documentation, control, and specification requirements. (As more emphasis is placed on ISO 9000 certification and its documentation and data control requirements, a computer-controlled system like CCHTS will become essential for information management in a heat-treating facility.)

System Security
• Multi-level access with password protection. Each user’s privileges and restrictions are determined by the system administrator.

“Unique and Very Useful”

After beta-testing the new CCHTS package, the president of Dirats Laboratories in Westfield, MA, made the following comments: “The ability of the system to automatically correct temperature using the thermocouple-wire calibration data and to display and record the actual corrected temperatures along with the tolerances allowed within the test specification is unique and very useful. We never had anything like that with our strip chart recorder system. The program architecture makes it easy to replicate the profile for subsequent jobs, thereby eliminating the chance for human error. The fact that the computer is keeping track of jobs even before they go to the furnace allows the department to run more efficiently. It’s not just a temperature control system. It’s a work management system. The autonomy of the individual controllers eliminates concern for computer failure. The architecture of the hardware is much more flexible than PLC-based systems and allows the lab to be set up for the convenience and safety of the operating personnel.”

CCHTS: The Perfect Upgrade for Existing Furnaces from Any Manufacturer

The ATS computer-controlled heat treat system provides improved productivity, accuracy, and reliability for any multiple-furnace installation. Furnaces from any manufacturer, in any combination, can be upgraded to take advantage of the enhanced CCHTS system. ATS has extensive experience with equipment from all major manufacturers and can provide detailed engineering support to integrate your system exactly to your requirements.

CCHTS and a Furnace Installation from ATS: The Perfect New System for Heat Treating
If you are planning a new heat-treatment facility or are ready to replace or add to your existing equipment, then combine your new CCHTS system with furnaces and accessories from Applied Test Systems. ATS furnaces offer superior design and the best performance, features, and value in the industry. We have been designing furnaces for more than 30 years, so we have the right experience and equipment for any process on any material. Contact us for detailed information on our extensive line of furnaces, with temperature capabilities up to 3272°F (1800°C).

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