

# 505/505E

## Digital Control for Steam Turbines



- 32-bit microprocessor based digital control
- Field-configurable
- User-friendly menu format
- View program and change dynamics while running
- LED display of all governor/turbine parameters
- Modbus<sup>®</sup> communications

### APPLICATIONS

The 505 and 505E are microprocessor-based controls designed to operate steam turbines of all sizes. The 505 is designed to operate steam turbines using one or two (split-stage) actuators to drive inlet steam valves. The 505E is designed to operate single extraction and/or admission steam turbines. These digital controls are field programmable. They use menu-driven software to instruct site engineers on programming the control to a specific generator or mechanical drive application. The 505 or 505E can be configured to operate as a stand-alone unit or in conjunction with a plant's Distributed Control System.

### DESCRIPTION

Woodward's 505 and 505E digital controls use a 32-Bit Microprocessor to control industrial sized steam turbines, small utility turbogenerators, or turboexpanders. The 505/505E package consists of printed circuit boards in an enclosure designed to be mounted within a system control panel. An optional NEMA 4X enclosure is available to allow these controls to be mounted within harsh environments.

An Operator Control Panel is provided on the 505's front panel. Easy to follow instructions are presented in English through the OCP's two-line display and operators can view actual and setpoint values from the same screen. Removable terminal blocks allow for easy wiring and installation.

### COST-EFFECTIVE DESIGN

The 505/505E is a field configurable steam turbine control and operator control panel integrated into one package. A comprehensive operator control panel, including a two-line (24 characters each) display, and a set of 30 keys is located on the 505/505E's front panel. This OCP is used to configure the 505/505E, make On-Line program adjustments, and operate the turbine/system.

The 505/505E also performs as a first-out indicator for system shutdowns, thus reducing troubleshooting time. Multiple system shutdowns (3) can be brought into the 505/505E to allow it to shut down the system safely, and latch-in the cause of the shutdown.

## COMMUNICATIONS

The 505/505E controls can communicate directly with plant Distributed Control Systems and/or CRT based operator control panels, through two Modbus<sup>®</sup> \* communication ports. These ports support RS-232, RS-422, and RS-485 communications using ASCII or RTU Modbus transmission protocols.

Communications between the 505/505E and a plant DCS can also be performed through hardwired connections. Since all 505 PID setpoints can be controlled through analog input signals, interface resolution and control is not sacrificed.

\*—Modbus is a trademark of Modicon, Inc.

## FLEXIBILITY

The 505/505E is field programmable, allowing site engineers to configure the control to their specific application, and make future control configuration changes. The 505/505E can be field programmed for mechanical drive or generator applications. Over 100 on-line tunables are available to allow program refinements while a unit is running. Inputs and Outputs are programmable as required by the application or interface.

## SYSTEM PROTECTION

- Integral Overspeed Protection Logic
- First-out Indication (3 individual Shutdown inputs)
- Bumpless transfer between control modes if a transducer failure is detected
- Local/Remote Control priority and selection
- Fail-safe Shutdown Logic

## CONTROL

The following PIDs are available to perform as process controllers or limiters:

- Speed/Load PID (with Dual Dynamics)
- Auxiliary PID (limiter or control)
- Cascade PID
- Extraction and/or Admission PID (505E only)

## CONTROL SPECIFICATIONS

### INPUTS

- Power: 18–32 Vdc, 90–150 Vdc, 88–132 Vac (47–63 Hz), 180–264 Vac (47–63 Hz)
- Speed: 2 MPUs (1–30 Vrms) or proximity probes (24 Vdc provided), 0.5 to 15 kHz
- Discrete Inputs: 16 Contact Inputs (4 dedicated, 12 programmable)
- Analog Inputs: 6 Programmable Current Inputs (4–20 mA)

## OUTPUTS

- Valve/Actuator Drivers: 2 Actuator Outputs (4–20 mA or 20–160 mA)
- Discrete Outputs: 8 Relay Outputs (2 dedicated, 6 programmable)
- Analog Outputs: 6 Programmable Current Outputs (4–20 mA)

## COMMUNICATION

- Serial: 2 Modbus (ASCII or RTU) Comm Ports (RS-232, RS-422, or RS-485 compatible)

## HMI

The 505View provides a powerful PC-based HMI engine to provide a graphical and intuitive interface option for the 505/505E controls. See Woodward Product Specification 03207 for additional information.

## FUNCTIONALITY

505 and 505E's control capabilities are:

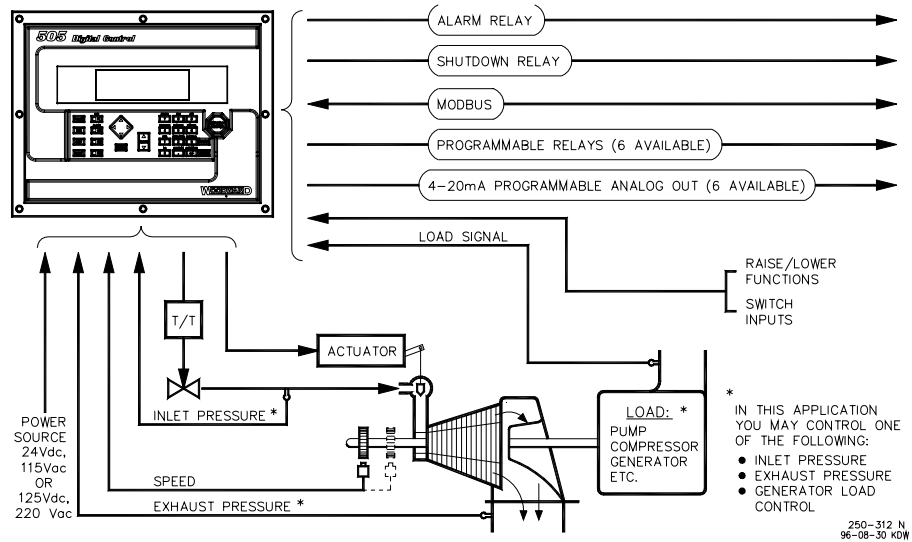
- Speed/Frequency Control
- Turbine or Generator Load Control/Limiting
- Turbine Inlet Header Pressure Control/Limiting
- Turbine Exhaust Header Pressure Control/Limiting
- Plant Import/Export Power Control/Limiting
- Isochronous Load Sharing between units (with DSLC™ control)
- Extraction and/or Admission Header Pressure Control (505E)
- Any process directly related to unit load

## FEATURES

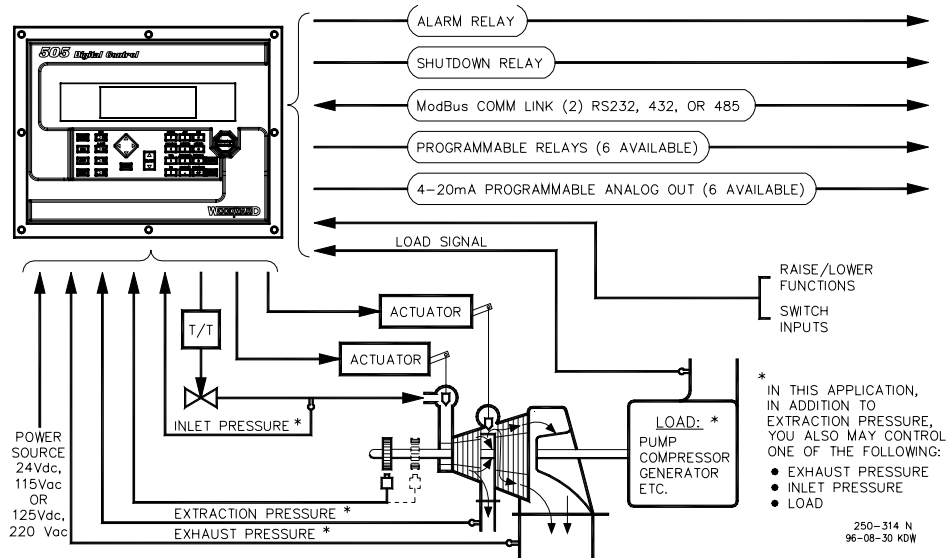
- Critical Speed Avoidance (2 speed bands)
- Auto Start Sequence (hot & cold starts)
- Valve Limiter(s)
- Security (Program is Password Protected)
- Dual Speed/Load Dynamics
- First-Out Indication (Shutdowns)
- Zero Speed Detection with proximity probe (<0.5 Hz)
- Peak Speed Indication for overspeed trip
- Two Programmable Functions Keys on the 505's front panel
- Hand Valve operation (using First Stage Pressure)
- Two independent Modbus comm links
- Remote analog setpoints for Speed/Load, Aux, Cascade, and Extraction/Admission
- Program upload/download capability

# OPERATING CONDITIONS

- -25 to +65 °C ambient air temperature range
- Optional NEMA type 4 (watertight and dust-tight, indoor/outdoor) enclosure for bulkhead mounting with a temperature range from -25 to +55 °C
- Approximate dimensions 14L x 11H x 4D inches (356 x 279 x 102 mm)
- Approximate bulkhead enclosure dimensions 20L x 20H x 7.6D inches (508 x 508 x 193 mm)
- Humidity: Lloyd's ENV2 test #1
- Dry heat: Lloyd's ENV3
- Salt fog: US MIL-STD-810 method 509.2 procedure 1
- Shock: meets US MIL-STD-810C, method 516.2-1, procedure 1B
- Vibration: Lloyd's ENV2 test #1
- Certifications: CE (18-32 Vdc version only), UL, and cUL



**Controlled Single Valve Steam Turbine**



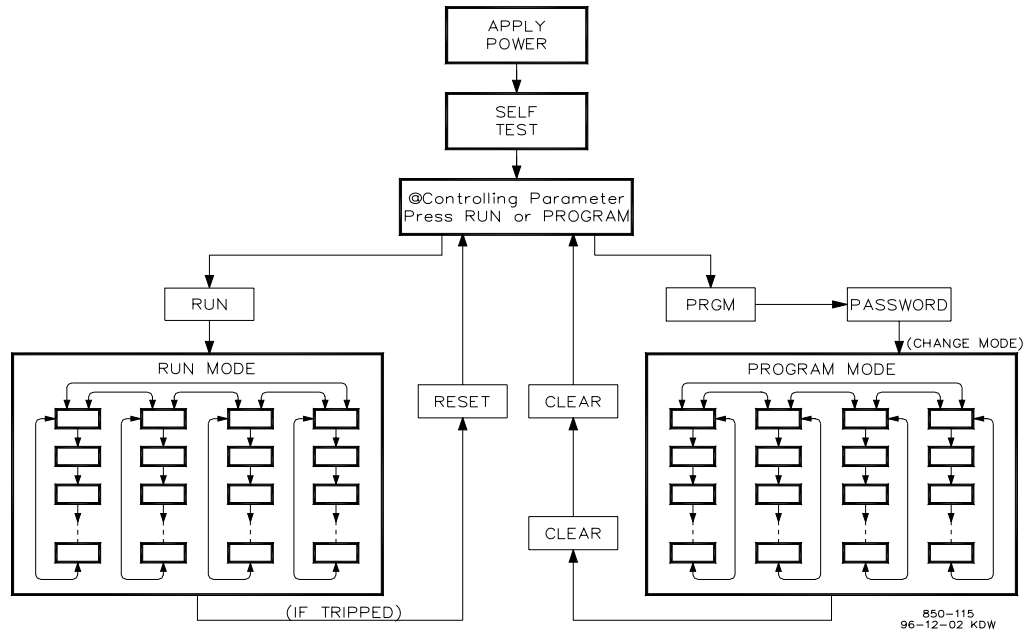
**Controlled Extraction Steam Turbine**

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 Fort Collins CO, USA  
 80522-1519  
 1000 East Drake Road  
 Fort Collins CO 80525  
 Ph: +1 (970) 482-5811  
 Fax: +1 (970) 498-3058

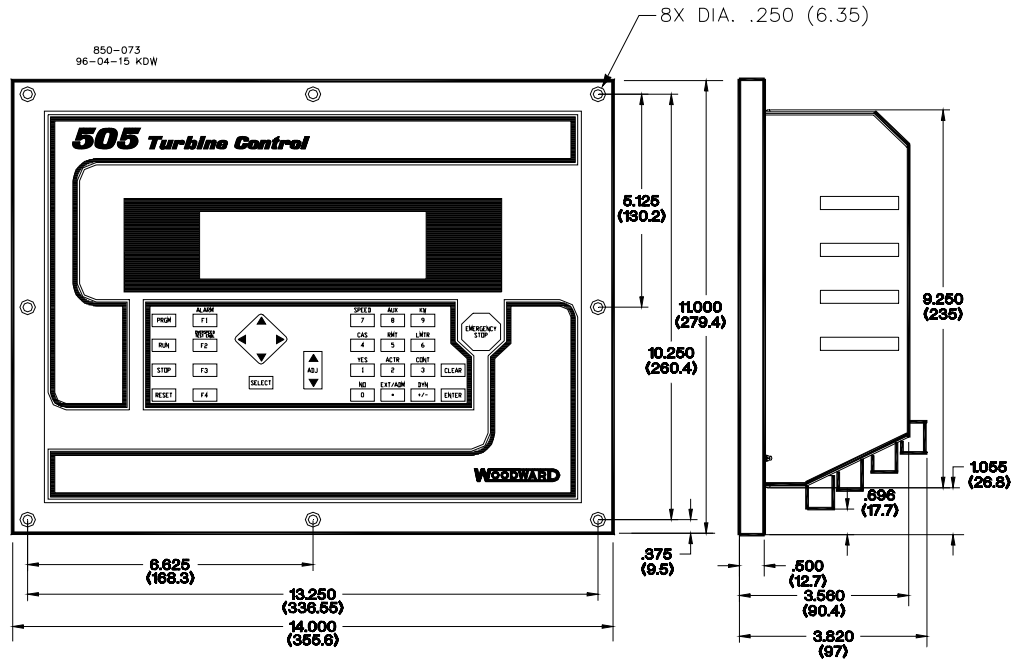
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 Woodward has an international network of distributors and service facilities. For your nearest representative, call the Fort Collins plant or see the Worldwide Directory on our website.

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**Basic Program Architecture**



**505/505E Dimensions**  
 (Do not use for construction)

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