

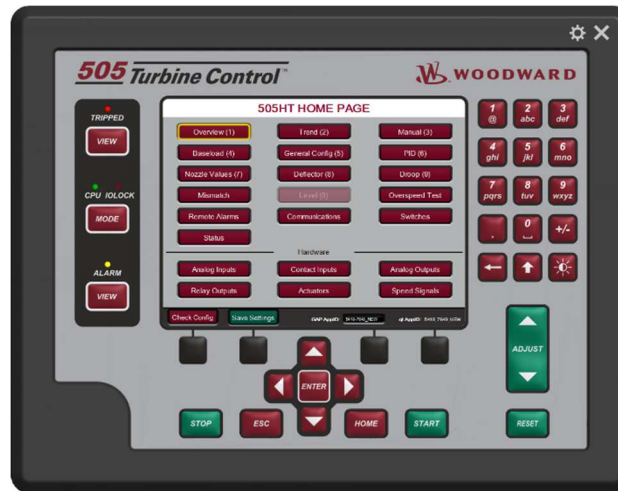
# 505HT for Francis/Kaplan Turbines

## Digital Turbine Speed and Load Control

### Applications

The 505-HT for Francis/Kaplan Turbines is a standard off-the-shelf control system designed to control Francis or Kaplan hydro of all sizes. This hydro turbine controller includes specifically designed algorithms and logic to start, stop, control, and protect hydro turbines. Its configurable program allows users to configure it through the HMI or remotely by using the Remote View software. Ethernet and serial communications allow users to easily connect the 505HT into the plant or process control system. All controller inputs, outputs, and statuses can be monitored, and all start/stop or enable/disable commands can be given through industry standard Modbus® \* TCP. The 505HT uses SNTP (synchronized network time protocol) over Ethernet to allow users to synchronize the 505's real-time clock to the plant distributed control system.

\* Modbus is a trademark of Schneider Automation Inc.



### Description

The 505 control is packaged in an industrial hardened enclosure designed to be mounted within a system control panel located in a plant control room or next to the turbine. The control's front panel serves as both a programming station and operator control panel (OCP). This user-friendly front panel allows engineers to access and program the unit to the specific plant's requirements, and plant operators to easily start/stop the turbine and enable/disable any control mode. Password security is used to protect all unit program mode settings. The controller's 8.4-inch (21 cm) graphical display allows operators to view actual and setpoint values from the same screen, simplifying turbine operation.

The display has multi language capability (english and portuguese)

Turbine interface input and output wiring access is located on the controller's lower back panel. Un-pluggable terminal blocks allow for easy system installation, troubleshooting, and replacement.

- Field-configurable
- Integrated graphical operator control panel
- Start / Stop / unload routines
- Gate/Blade Manual Control
- Baseload Control
- Black Start routine
- Small System detection logic
- Brake Logic
- Generator Breaker Routine
- Level control (pond or Tail)
- Blade Control Algorithms (for Kaplan turbines)
- Speed / Load / Gate / Blade Switches
- Integrated first-out problem indicator
- Trip and Alarm
- Shutdown Datalog
- User-friendly menu format
- Real-time trend screens

Designed for hydro turbine control, the 505HT control includes four PID controllers (Offline, Online, Isoch, and Baseload), start-up routine, and multiple protection functions (overspeed, Small System Detection, etc.) which can be configured by a user depending on the specific turbine application's requirements. Users can configure the 505's different PID controllers, start routines, discrete and analog I/O functions and protection levels themselves without the need for a special control engineer. A first-out indication feature for system shutdowns reduces troubleshooting time. Once configured, the 505HT performs a configuration check routine to ensure that the programmer did not make any basic configuration mistakes.

- Real-time clock synchronization via SNTP
- Ethernet communications
- Multi Language Capabilities
- Models are available with certification for North American Ordinary Locations
- Models are available compliant with the applicable CE Directives

Optionally, users can utilize Woodward's RemoteView software program with the 505HT to function as a remote operator control panel and/or engineering station. Once loaded onto a remote computer or touch panel, this software program allows the computer or touch panel to perform all of the 505 front panel display functions (monitor, operate, tune, and configure). Password-based login level security allows users to manage which functions they want the remote panel user to have. Refer to product specification 03424 for more information on RemoteView's capabilities.

The 505HT includes a suite of service tools to allow users to perform the following functions:

- Download configuration settings files to the 505
- Upload configuration settings files from the 505 to save on another device
- View real-time or saved trend files



Figure 1. Example RemoteView Screens

## Communication

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The 505HT controls can communicate directly with plant Distributed Control Systems and/or CRT-based operator control panels, through four Ethernet ports using Modbus TCP or OPC communication protocols, or via one serial Modbus port. The single serial port supports RS-232 or RS-485 communications using ASCII or RTU Modbus protocols. Communications between the 505 and a plant DCS can also be performed through hard-wired connections.

## Features

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- Feed forward control
- Speed Control / Droop Control (kW and Position) / Baseload / Isochronous
- Small System detection logic
- Level control (pond or tail)
- Blade control algorithms (blade pre-position, start position, stop position, blade tilt, blade lock, blade manual)
- Up to 9 Blade curves
- Gate / Blade limit
- Black Start Logic
- Remote analog setpoints for speed, gate, level, power and manual control
- Selectable start mode (auto/manual)
- Selectable actuator outputs (4-20mA/20-160mA)
- Four speed inputs (2 actives and 2 passives)
- Creep detection
- Local/remote control
- Generator breaker logic
- Level switches for: Speed, Gate Position, Blade Position and Load
- First-out indication of shutdowns
- Real time clock indicated Alarms and Trips log
- Overspeed test Logic

## System Protection

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- Overspeed protection logic
- First-out indication shutdown
- Bumpless transfer between control modes
- Local/Remote control priority
- Fail safe for speed switch logic
- Password protected configuration

## Specifications

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### INPUTS

Power:	LV models = 18–32 Vdc HV models = 88–264 Vac & 90–150 Vdc
Speed:	2 Passive MPUs and 2 Active Proximity probes (0.5—32 000 Hz)
Discrete Inputs:	20 Contact Inputs (5 fixed and 15 configurable inputs)
Analog Inputs:	8 Configurable 4–20 mA Inputs

### OUTPUTS

Valve/Actuator Drivers:	2 Actuator Outputs, 4–20 mA or 20–200 mA
Discrete Outputs:	8 configurable Relay Outputs (2 relays rated for 24 Vdc @ 5 A, 6 relays rated for 24 Vdc @ 2 A)
Analog Outputs:	6 Programmable 4– 20 mA Current Outputs

### COMMUNICATIONS

Ethernet:	4 ports (Modbus TCP or OPC protocols)
Serial:	1 Modbus port (ASCII or RTU) Comm Ports (RS-232 or RS-485 compatible)
CAN:	4 ports (Woodward CANopen protocol) – Not used

## Control Accessories

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**RemoteView**—Once installed on a computer or touch panel, the RemoteView software program can be used as an engineering workstation and/or remote operator control panel. As an operator control panel, this software program can be used to monitor all system parameters, start and stop the turbine, and enable/disable all modes of operation.

**Control Assistant**—The Control Assistant software program functions as an engineering workstation and/or service tool that can be used with the 505 control to view real-time trends, view saved trend files, or compare differences in configuration files. As an engineering workstation, this software program can be used to upload and download settings and log files to and from the 505 controller (details in product spec 03424).

**AppManager**—Tool for setting the IP addresses of the Ethernet ports, setting SNTP functionality, Program upload/download capability, retrieving datalog files, Start/Stop the Display program.

## Operating Conditions

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- –30 to +70 °C ambient air temperature range
- 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

### Pollution Resistance

- Particulate Pollution Resistance: IEC 664-1 Pollution Degree 2 (normally only non-conductive pollution occurs)
- IEC 60068-2-60:1995 Part 2.60 Methods 1 and 4 (Flowing Mixed Gas Corrosion Test)
- Gaseous Pollution Resistance: Module conformal coating withstands NO<sub>2</sub>, CO<sub>2</sub>, SO<sub>2</sub>, and H<sub>2</sub>S gases
- Will withstand levels typical of telecommunications and computer installations as defined by Battelle Labs Class III (between IEC60721-3-3 classification 3C1 and 3C2, light industrial to urban industrial, heavy traffic)

## Regulatory Compliance

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### European Compliance for CE Marking

These listings are limited to only those units bearing the CE Marking.

- EMC Directive: Directive 2014/30/EU
- Low Voltage Directive: Directive 2014/35/EU
- RoHS Directive: Restriction of Hazardous Substances 2011/65/EU: Woodward Turbomachinery Systems products are intended exclusively for sale and use only as a part of Large Scale Fixed Installations per the meaning of Art.2.4(e) of directive 2011/65/EU. This fulfills the requirements stated in Art.2.4(c) and as such the product is excluded from the scope of RoHS2.

### North American Compliance

Certified as a component for turbine and compressor use.

- CSA: CSA Certified for Ordinary Locations

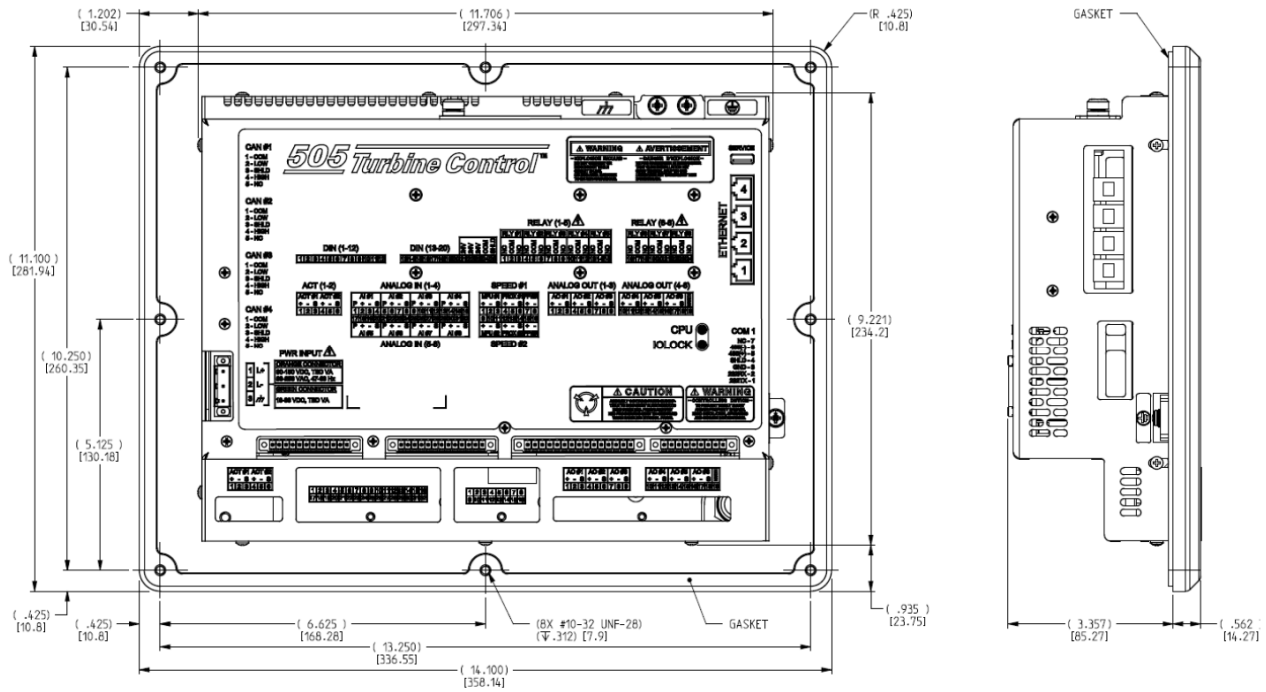


Figure 2. 505HT Dimensions (do not use for construction)

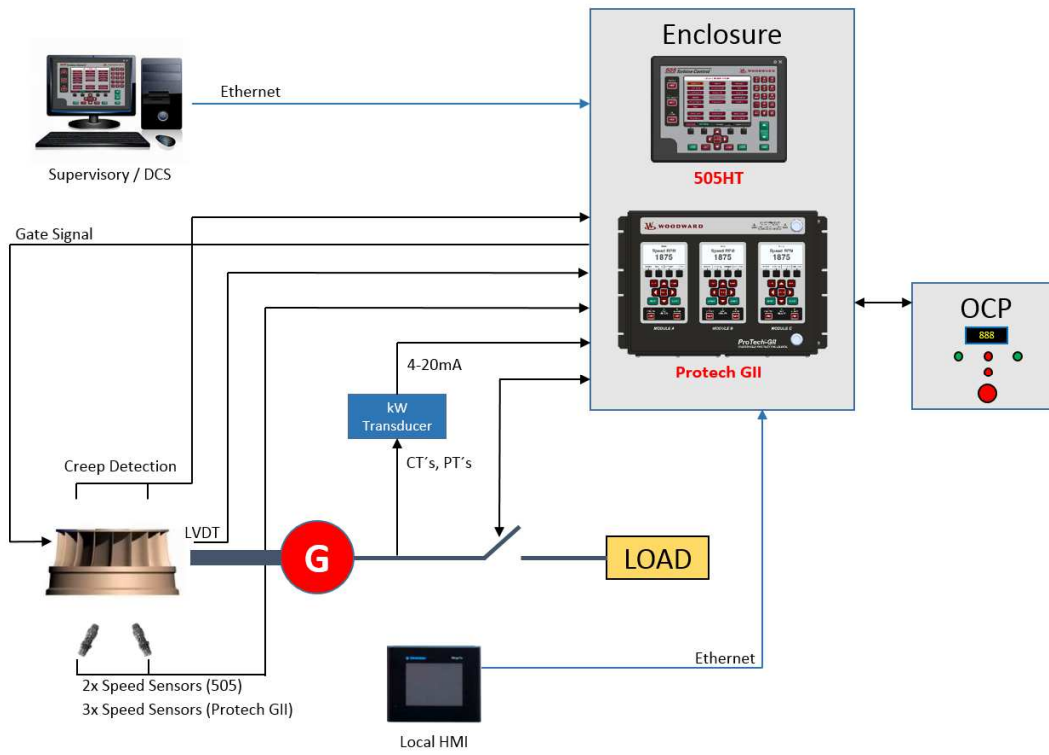


Figure 3. Typical 505HT Application for Francis Turbine

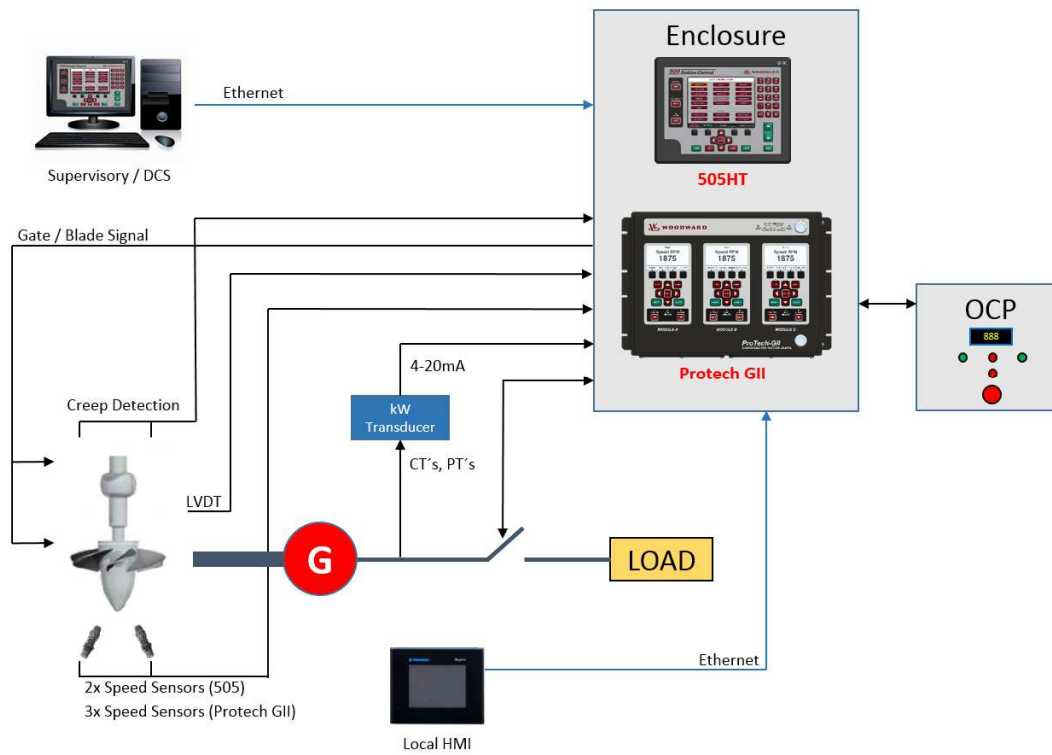


Figure 4. Typical 505HT Application for Kaplan Turbine

### Available PN's:

#### 505HT for Francis/Kaplan Turbines

**8200-1402**

505HT (LV-STD) FRANCIS/KAPLAN TURBINE CONTROL

**8200-1403**

505HT (HV-STD) FRANCIS/KAPLAN TURBINE CONTROL



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