WOODWARD

Product Manual 85017V1
(Revision E)
Original Instructions



505 Digital Governor for Steam Turbines with Single or Split-Range Actuators

9907-162, 9907-163, 9907-164
Volume 1

Manual 85017 consists of 2 volumes (85017V1 & 85017V2).

Installation and Operation Manual

Chapter 1.
General Information

Introduction

This manual describes the Woodward 505 Digital Governor for steam turbines. English versions are 9907-162, 9907-163, and 9907-164. The option charts below show the differences between the part numbers. Volume 1 of this manual provides installation instructions, describes the control, and explains the configuration (programming) and operating procedures. Volume 2 includes notes on applying the control to specific applications, Service mode information, and 505 hardware specifications. This manual does not contain instructions for the operation of the complete turbine system. For turbine or plant operating instructions, contact the plant-equipment manufacturer.

Manual 85018 describes the 505E Digital Governor for extraction steam turbines.

Part Number Options

Part Number	Power
9907-162	HVAC (180–264 Vac)
9907-163	AC/DC (88–132 Vac or 90–150 Vdc)
9907-164	LVDC (18–32 Vdc)

Optional Bulkhead Mounting Box (NEMA 4X) P/N 8923-439

505 controllers now utilize a special polyacrylate conformal coating material to coat and protect their internal circuit boards from corrosive environments. This new polyacrylate material replaces the previous silicon conformal coating and provides an improved barrier between board components and sulfur-based gases. 505 controls that have this coating will have a label on the side stating “SULFUR RESISTANT CONFORMAL COATED”. All 505 controllers shipped from Woodward with the revision letters listed below, or subsequent letters, were shipped with the new polyacrylate conformal coating material:

Table 1-1. 505s with Polyacrylate Coated Boards

Part Number	Revision	Label on 505
9907-162	U	9907-162U
9907-163	U	9907-163U
9907-164	R	9907-164R
9907-805	K	9907-805K
9907-806	K	9907-806K
9907-807	K	9907-807K
9907-813	D	9907-813D
9907-814	D	9907-814D
9907-815	D	9907-815D

General Installation and Operating Notes and Warnings

This equipment is suitable for use in Class I, Division 2 , Groups A, B, C, and D (Class I, Zone 2, Group IIC) or non-hazardous locations.

The 505s are suitable for use in European Zone 2, Group II environments per compliance with EN60079-15, Electrical apparatus for explosive atmospheres – Type of protection 'n'

These listings are limited only to those units bearing the certification identification.

Field wiring must be stranded copper wire rated at least 75 °C for operating ambient temperatures expected to exceed 50 °C.

Peripheral equipment must be suitable for the location in which it is used.

Wiring must be in accordance with North American Class I, Division 2 or European Zone 2 wiring methods as applicable, and in accordance with the authority having jurisdiction.

A fixed wiring installation is required.

Grounding is required by the input PE Terminal.

A switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach for the operator and is clearly marked as the disconnecting device for the equipment.

⚠WARNING

Ensure that power has been disconnected prior to opening the control or replacing the input power fuse.

⚠WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 2.

Do not use any test points on the power supply or control boards unless the area is known to be non-hazardous.

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

Ne pas utiliser les bornes d'essai du block d'alimentation ou des cartes de commande à moins de se trouver dans un emplacement non dangereux.

505 Software Changes Covered in This Manual Revision

1. PROGRAM MODE: Added an error check to ensure Rated Speed (when programmed as a gen set) was less than max gov.
2. SERVICE MODE: Changed the hold changes for Min Load to come from the Breaker Logic header's Hold Changes input. Previously the hold changes command was selected under the Speed Control Settings header.
3. SPEED SETPOINT RATES: Changed the minimum adjustment range for all speed setpoint rates to 0.01 (was 0.1).
4. AUX LIMITER or CONTROLLER: Added logic to ensure the inhibited status of Aux control when the input is failed. In addition, changed Aux re- enable logic such that when a failed aux input is restored there is no glitch to the speed LSS. Also changed breaker open logic to correct a Gen Opening Aux actuator output glitch.
5. AUX CONTROLLER: Changed the speed setpoint aux biasing logic to only allow the speed control limiting action (while in aux control) to be active when the speed setpoint reaches max gov. Prior to this fix the speed limiter could come into control during an extreme transient.
6. AUX DIRECT ENTERED SETPT: Changed Aux Entered setpoint to be reset/stopped on a shutdown pulse rather than held disabled on a shutdown condition. This change allows the Aux Limiter function direct setpoint entry even when the unit is tripped.
7. AUX and CASC DROOP: Changed the droop feedback lag-tau tunable range from a max of 10 to a max of 1000.
8. MODBUS: Changed the Gen and Tie Open alarms for Aux, Casc, and Remote to match the Modbus listing—the software eventlatch inputs were reversed/backwards with the Modbus listing.
9. CONTROLLED STOP: Made the Controlled Stop abort if speed raise/lower is selected or another control mode is selected. This can be tuned-out by setting CNTRL_STOP.RL_STOP.IN_2=*false in the debug mode.
10. ANALOG INPUTS: Changed max setting on the delay time’s tunable range from 3 ms to 3000 ms. The analog input failure delay setting is defaulted to zero but can be adjusted up to 3000 ms using the debug mode MAIN.AIx.LATCH_DLY where x is the analog input number. Added a tunable single pole filter (LAG) to each analog input. Output/input = 1/(1+st) where t = 1/(2(pi)f) = LAG_TAU. The Lag-tau is defaulted to zero but can be adjusted in the debug mode using MAIN.AIx_LAG.LAG_TAU where x is the analog input number (1-6).

General Description

General

The 505 microprocessor-based control is designed to control single or dual (split range) actuator steam turbines (extraction steam turbines require the 505E version). The 505 is field programmable which allows a single design to be used in many different control applications and reduces both cost and delivery time. It uses menu driven software to instruct site engineers on programming the control to a specific generator or mechanical drive application. The 505 can be configured to operate as a stand-alone unit or in conjunction with a plant’s Distributed Control System.