

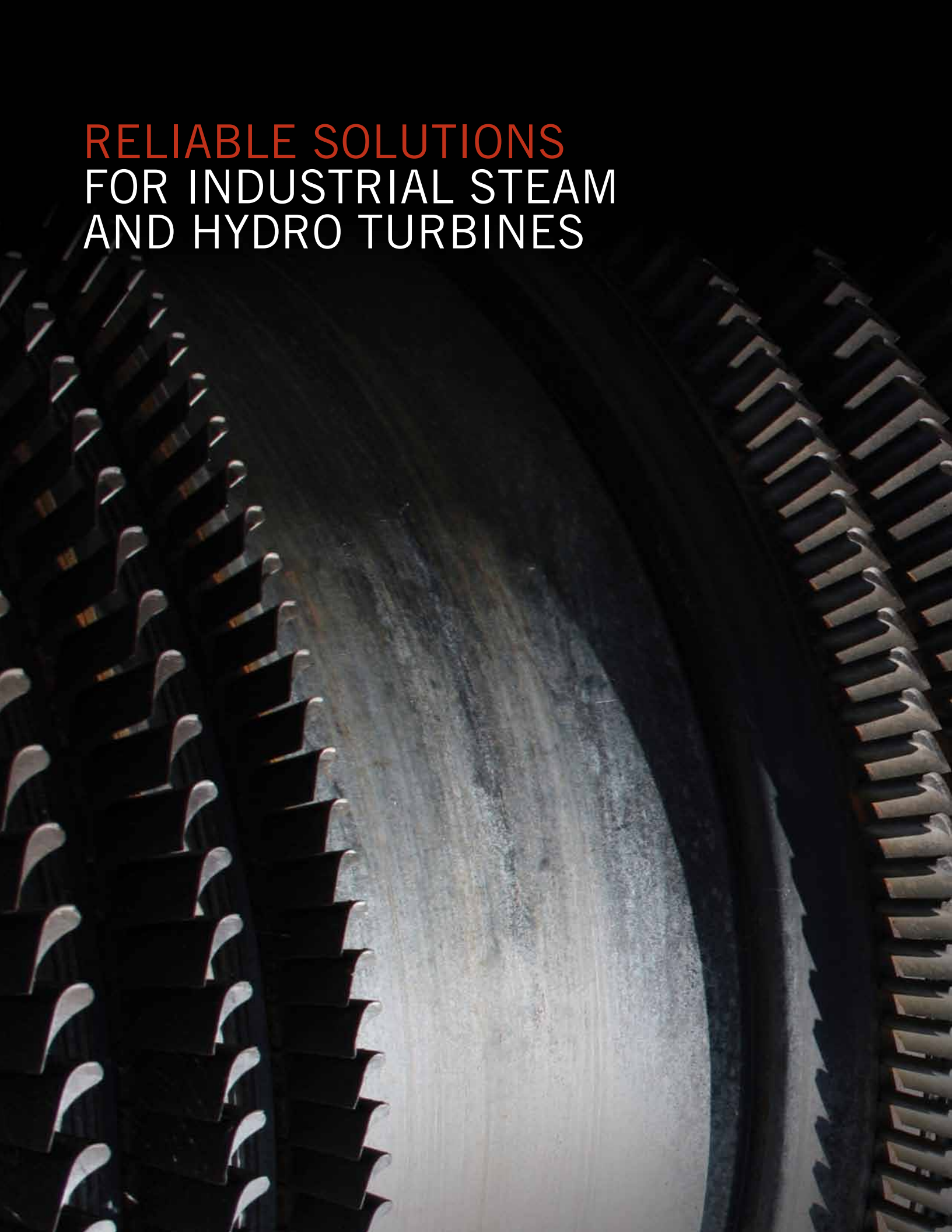
# 505 & 505XT CONTROLLERS FOR INDUSTRIAL STEAM TURBINES

WOODWARD | INDUSTRIAL TURBOMACHINERY SYSTEMS

TURBOMACHINERY CONTROL EXPERTS  
Turbines | Compressors | Safety | Actuation

 **WOODWARD**

RELIABLE SOLUTIONS  
FOR INDUSTRIAL STEAM  
AND HYDRO TURBINES



# STEAM TURBINE CONTROLS



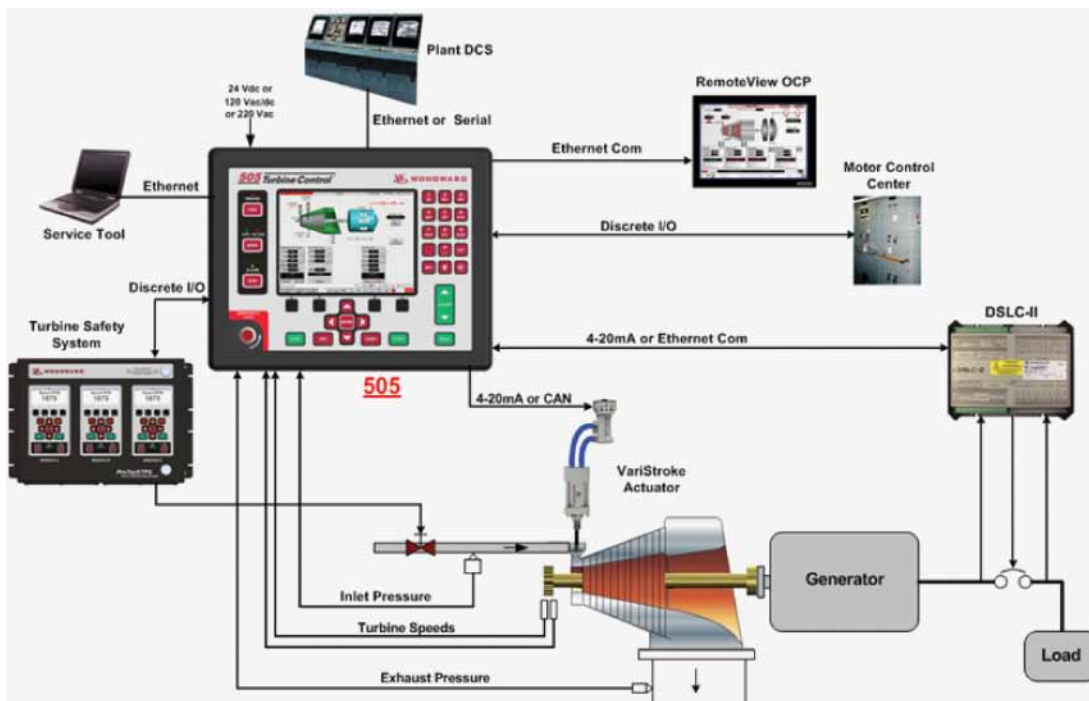
The 505 and 505XT are Woodward's line of standard off-the-shelf controllers for operation and protection of industrial steam turbines. These user configurable steam turbine controllers include specifically designed screens, algorithms, and event recorders to simplify use in controlling industrial steam turbines or turbo-expanders, driving generators, compressors, pumps, or industrial fans.

- Simple to use
- Simple to configure
- Simple to troubleshoot
- Simple to adjust (uses new OptiTune Technology)
- Simple to connect (with Ethernet, CAN or Serial protocols)

The base 505 model is designed for simple single valve steam turbine applications where only basic turbine control, protection, and monitoring are required. The 505 controller's integrated OCP (operator control panel), overspeed protection, and trip events recorder make it ideal for small steam turbine applications where overall system cost is a concern.

The 505XT model is designed for more complex single valve, single extraction or single admission steam turbine applications where more analog or discrete I/O (inputs and outputs) are required. Optional

inputs and outputs can be connected to the 505XT controller via Woodward's LinkNet-HT distributed I/O modules. When configured to control single extraction and/or admission based steam turbines, the 505XT controller's field-proven ratio-limiter function ensures that interaction between the two controlled parameters (i.e., speed and extraction or inlet header and extraction) is correctly decoupled. By simply entering maximum levels and three points from the turbine's steam map (operating envelope), the 505XT automatically calculates all PID-to-valve ratios and all turbine operation and protection limits.

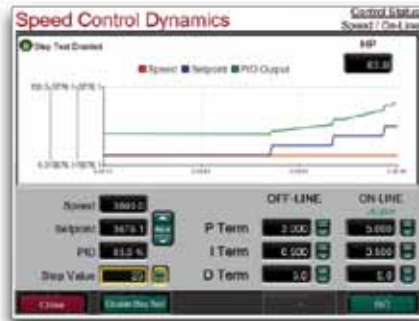


## OPERATOR CONTROL PANEL INCLUDED

When users are logged into the 505 controller as an operator, this controller’s user-friendly front panel allows plant operators to easily start and stop the turbine as well as enable/disable all control modes. The controller’s multi-lingual 8.4-inch (20 cm) graphical display allows operators to view actual and setpoint values from the same screen, simplifying turbine operation in their own language. Functioning like a window into the turbine and its driven equipment, the 505 controller’s front panel allows users to monitor and control all modes of operation, verify dynamic response via real-time trending screens, and understand the turbine’s performance capabilities through a real-time plotted steam performance map (extraction or admission steam turbines only). Optionally, application-specific tag names can also be given to input and output signals to assist plant engineers with locating system and sensor problems.

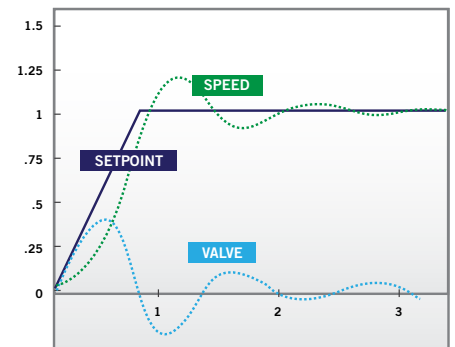
## FEATURE OVERVIEW

- Field/user configurable
- Integrated graphical operator control panel
- Automatic start routines
- Integrated first-out problem indicator
- User-friendly menu format
- Trip and Alarm event recorder
- Adaptive PID controllers
- Rotor stress monitoring
- Real-time clock synchronization via SNTP
- Ethernet communications
- Same form-fit function as previous 505 versions
- Sulfur-resistant conformal coating
- Certified for Hazardous Locations



## NO COMPUTER REQUIRED

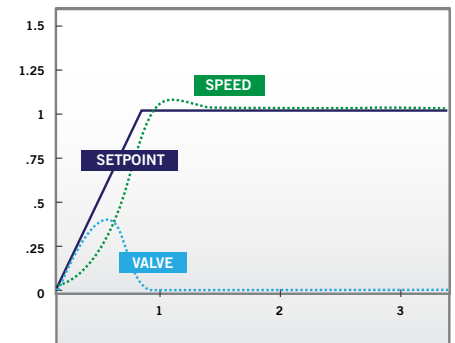
Depending on the mode of operation a user is logged into, the control’s front panel functions as an operator control panel (OCP) or an engineering station. As an engineering workstation, plant engineers are allowed to program and adjust all aspects of the turbine’s operation and plant connectivity. Since a steam turbine functions as an integral part of the overall plant or process, the 505 controller’s online service mode allows process engineers to make limited operational and dynamic changes to optimize both the turbine’s and the plant’s operation. Users and engineers can make the same program and service-based changes with the 505 controller’s optional software-based “Remote View” service tool.



Typical PID Response  
CURRENT

## TURBINE OPTIMIZATION IS NOW AUTOMATIC

These 505 models include Woodward’s OptiTune PID technology. This special PID technology analyzes a steam turbine’s dynamic system response and then calculates the optimum P, I, and D settings for the specific turbine parameter (speed, load, pressure, etc.). The OptiTune PID’s deterministic loop management and measurement make it ideal for rotating equipment based control loops. By using this PID’s special “Auto-Tune” function, plants no longer have to depend on inadequately trained engineering teams to dynamically adjust their turbine system control loops for optimum operation and performance.



Typical OptiTune PID  
TREND

## CONNECTIVITY YOUR WAY

Designed to allow the steam turbine to be easily integrated into any plant or plant process, the 505 controller allows direct communications with the plant Distributed Control System and/or remote operator control panel(s), through the following methods:

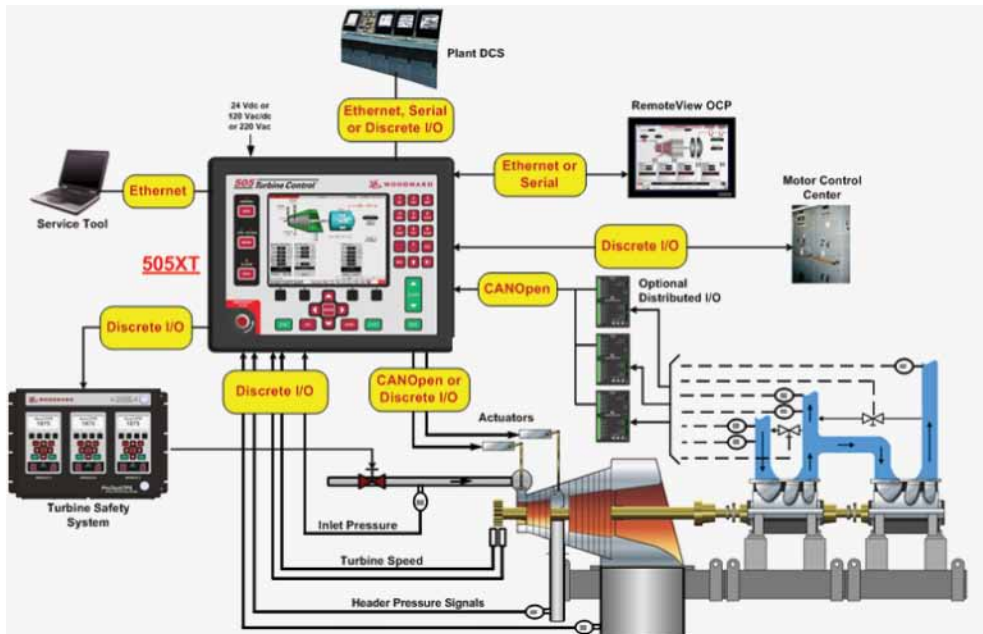
- Configurable analog and discrete signals
- (4) Ethernet ports using Modbus TCP/IP or OPC communication protocols
- (4) CANOpen based ports
- (1) Serial RS232/422 Modbus port

Optionally, the 505 controller can be configured to allow users to manage (enable/disable) connectivity real-time by selecting Remote/Local communication port operation. This option allows system operators to control connectivity as required by the specific application or event to safely protect equipment and people.

## PURPOSE BUILT FOR STEAM TURBINES!

The 505 and 505XT controllers are designed to operate single valve, or single extraction/admission industrial steam turbines of all sizes and applications. These purpose-built steam turbine controllers include the following functionality and logic to control and protect industrial steam turbines.

- Three critical speed avoidance bands
- Auto start sequence (hot and cold starts)
- Multiple ratio/limiter decoupling modes (505XT only)
- Overspeed detection and trip
- Reverse rotation detection (with two proximity probes)
- Manual operation valve limiters
- Programming, service, and operation password security
- PID-to-PID communications for bumpless transfers
- First-out event indication (shutdowns and alarms)
- Zero speed detection (with use of proximity probe)
- Peak speed indication for overspeed trip
- Remote analog setpoints for speed/load, aux, and cascade
- Fail-safe protection logic (with processor, memory, and data-bus error detection)
- High-speed digital communications to Woodward actuators and power management products



## FIRST LINE OF DEFENSE...

The first line of defense for any turbine rotor experiencing a full or partial load loss is a fast responding control system and governor valve actuator, and not the overspeed detection system. If the steam turbine control and governor valve actuator can together respond fast enough, a turbine rotor should never experience an overspeed event upon a sudden loss of load. To assist with decreasing the time of load-loss detection, these new 505 control modes include special anticipation logic which monitors rotor acceleration to quickly detect a loss of full or partial load. This anticipation logic allows these 505 controllers to respond much faster than older steam turbine controllers and PLCs and assists with keeping the turbine from reaching its overspeed limit and possibly being shut down or damaged.

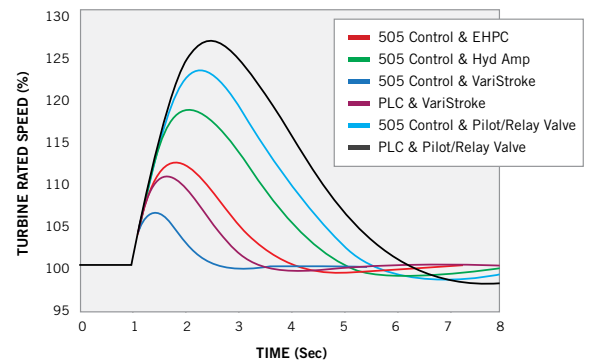


Diagram: Full Load Rejection Summary

# GLOBAL SUPPORT

Woodward's global support network and our turbomachinery OEM partners provide an extensive range of technical and after-sales support services. This global presence allows us to respond quickly to the needs of our customers anywhere in the world. In today's complex control world, customers have come to recognize our people's expertise beyond the control system and depend on our global teams as critical plant support assets.

## Colorado:

coloradofieldservice@woodward.com  
+1 970-498-3609  
turbinehelpdesk@woodward.com  
+1 970-482-5811, option 7

## Brazil:

vendas@woodward.com  
+55 19 3708-4800

## Europe:

fieldservice.europe@woodward.com  
+31-23-5661257  
helpdesk.europe@woodward.com  
+31-23-5661239

## China:

fieldservice.china@woodward.com  
+86 (512) 8818 5515  
helpdesk.china@woodward.com

## Japan:

fieldservice.japan@woodward.com  
+81-43-2132198  
helpdesk.japan@woodward.com

## India:

fieldservice.india@woodward.com  
+91 (129) 409 7100  
helpdesk.india@woodward.com  
+91 (124) 439 95330

## Middle East

fieldservice.middle-east@woodward.com  
+971 26267 929  
Saudi, +966 135 107 900

## Russia

fieldservice.russia@woodward.com  
+7 812 319 30 07

## CONTENT

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## DISTRIBUTOR INFORMATION



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