Industrial Turbine Systems Newsletter

Misc. Project & Product News

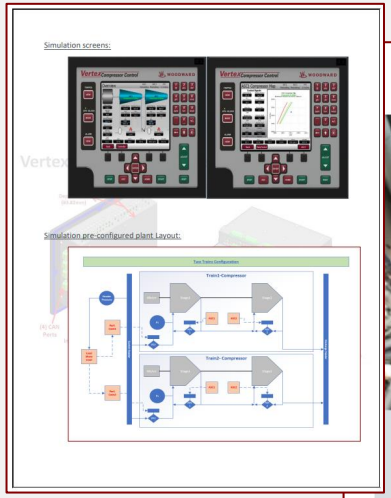
Jan 2023

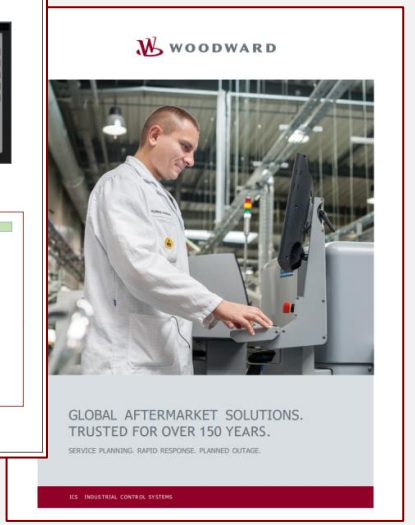
Proprietary Information

This presentation contains proprietary information of Woodward Inc., un-authorized disclosure may be in violation of applicable laws. This information is intended for Woodward sales personnel and channel partners.

Woodward ITS Newsletter Topics

1. Woodward Shipment/Delivery Updates
2. New 4G based Remote Access Kit
3. New Pricebook Release Announcement
4. New Product Catalog update 25180 Rev AD
5. Aftermarket Service Packages
6. AISF/ASI Agreement Update
7. Recent success stories
8. ITCC Core Software improvement updates
9. GS40, GS50 Valves Sales info
10. Ordering process/ sales support for Governor Valves
11. VariStroke Robustness updates
12. Woodward's Hydro turbine updates
13. Global Install Base references
14. Updates: Steam & Compressor Products
15. Legacy (gen2) 505 End of Line announcement
16. Placeholder: Latest Presentation and Documentation Locations





WOODWARD

Woodward updates on Shipment/Delivery

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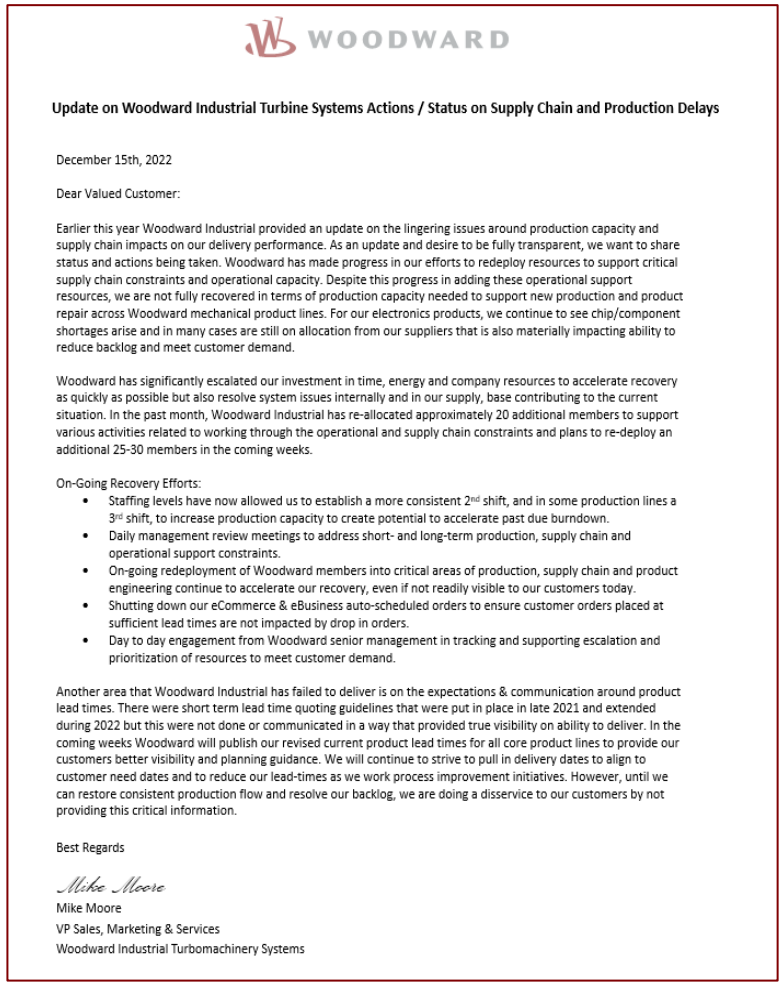
Woodward Shipment/Delivery Updates

Woodward is committed to keeping you and your sourcing teams informed of our current situation, any change to your shipment schedules and any improvements or delays related to our listed production lead times.

Woodward appreciates your patience and understanding during these challenging times. If you have any questions, please feel free to contact your Woodward sales account manager at any time. We have released Woodward Shipment Statement on Dec 15th , 2022.



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Update on Woodward Industrial Turbine Systems Actions / Status on Supply Chain and Production Delays

December 15th, 2022

Dear Valued Customer:

Earlier this year Woodward Industrial provided an update on the lingering issues around production capacity and supply chain impacts on our delivery performance. As an update and desire to be fully transparent, we want to share status and actions being taken. Woodward has made progress in our efforts to redeploy resources to support critical supply chain constraints and operational capacity. Despite this progress in adding these operational support resources, we are not fully recovered in terms of production capacity needed to support new production and product repair across Woodward mechanical product lines. For our electronics products, we continue to see chip/component shortages arise and in many cases are still on allocation from our suppliers that is also materially impacting ability to reduce backlog and meet customer demand.

Woodward has significantly escalated our investment in time, energy and company resources to accelerate recovery as quickly as possible but also resolve system issues internally and in our supply, base contributing to the current situation. In the past month, Woodward Industrial has re-allocated approximately 20 additional members to support various activities related to working through the operational and supply chain constraints and plans to re-deploy an additional 25-30 members in the coming weeks.

On-Going Recovery Efforts:

- Staffing levels have now allowed us to establish a more consistent 2nd shift, and in some production lines a 3rd shift, to increase production capacity to create potential to accelerate past due burndown.
- Daily management review meetings to address short- and long-term production, supply chain and operational support constraints.
- On-going redeployment of Woodward members into critical areas of production, supply chain and product engineering continue to accelerate our recovery, even if not readily visible to our customers today.
- Shutting down our eCommerce & eBusiness auto-scheduled orders to ensure customer orders placed at sufficient lead times are not impacted by drop in orders.
- Day to day engagement from Woodward senior management in tracking and supporting escalation and prioritization of resources to meet customer demand.

Another area that Woodward Industrial has failed to deliver is on the expectations & communication around product lead times. There were short term lead time quoting guidelines that were put in place in late 2021 and extended during 2022 but this were not done or communicated in a way that provided true visibility on ability to deliver. In the coming weeks Woodward will publish our revised current product lead times for all core product lines to provide our customers better visibility and planning guidance. We will continue to strive to pull in delivery dates to align to customer need dates and to reduce our lead-times as we work process improvement initiatives. However, until we can restore consistent production flow and resolve our backlog, we are doing a disservice to our customers by not providing this critical information.

Best Regards

Mike Moore

Mike Moore
VP Sales, Marketing & Services
Woodward Industrial Turbomachinery Systems

New 4G based Remote Access Kit (Secomea)

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Remote Access Kit: New Secomea 4G Mobile network based

Globally several countries have phased out 3G mobile communication technology by 4G mobile network.
We have listed 4G mobile network capable Remote Access Program (RAP) PN 1711-1418.
Note that if you are using LAN network then both 3G and 4G will work same and 3G based Secomea router still can be used through LAN network.

Program home page for accessing install base , ordering process:

http://inside/private/its/gts/rap/SitePages/Home.aspx

Sample 4G based Remote Access Program first year ordering

Part Number	Description	Quantity
1711-1418	REMOTE ACCESS UNIT - SECOMEA SITEMANAGER MODEL 1539/4G - GLOBAL GATEWAY DEVICE	1
8928-5347	LinkManager License	1
8928-5389	First Year GateManager Setup Fee (1-5 LinkMgr Licenses)	1

Yearly RAP support Fee

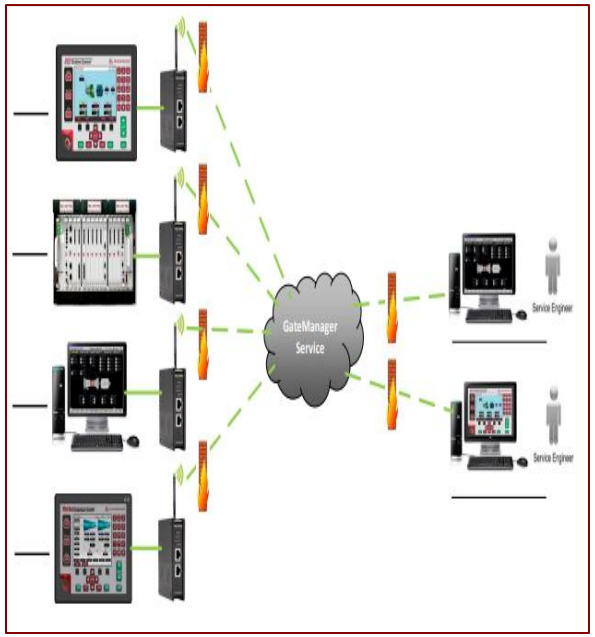
8928-5348	Yearly GateManager Support Fee (based on # of LinkMgr Licenses)	1

Remote Access Kit: New Secomea 4G Mobile network based

Site Manager is a security certified IIoT Edge Gateway in the Secomea Industrial Communication solution programmer that ensures unified , uninterrupted and secure access to remote industries equipment.

Easy to Set Up-Intuitive to Use

- **Built-in setup assistant.**
- **Single click configuration.**
- **DHCP-enabled.**
- **Alert capabilities between devices and servers.**
- **Security certified and built-in firewall.**



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New Pricebook Release Announcement

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Updated Pricebook Announcement-Internal Woodward

ITS SCS PRICEBOOK 2023_01_05.xlsm

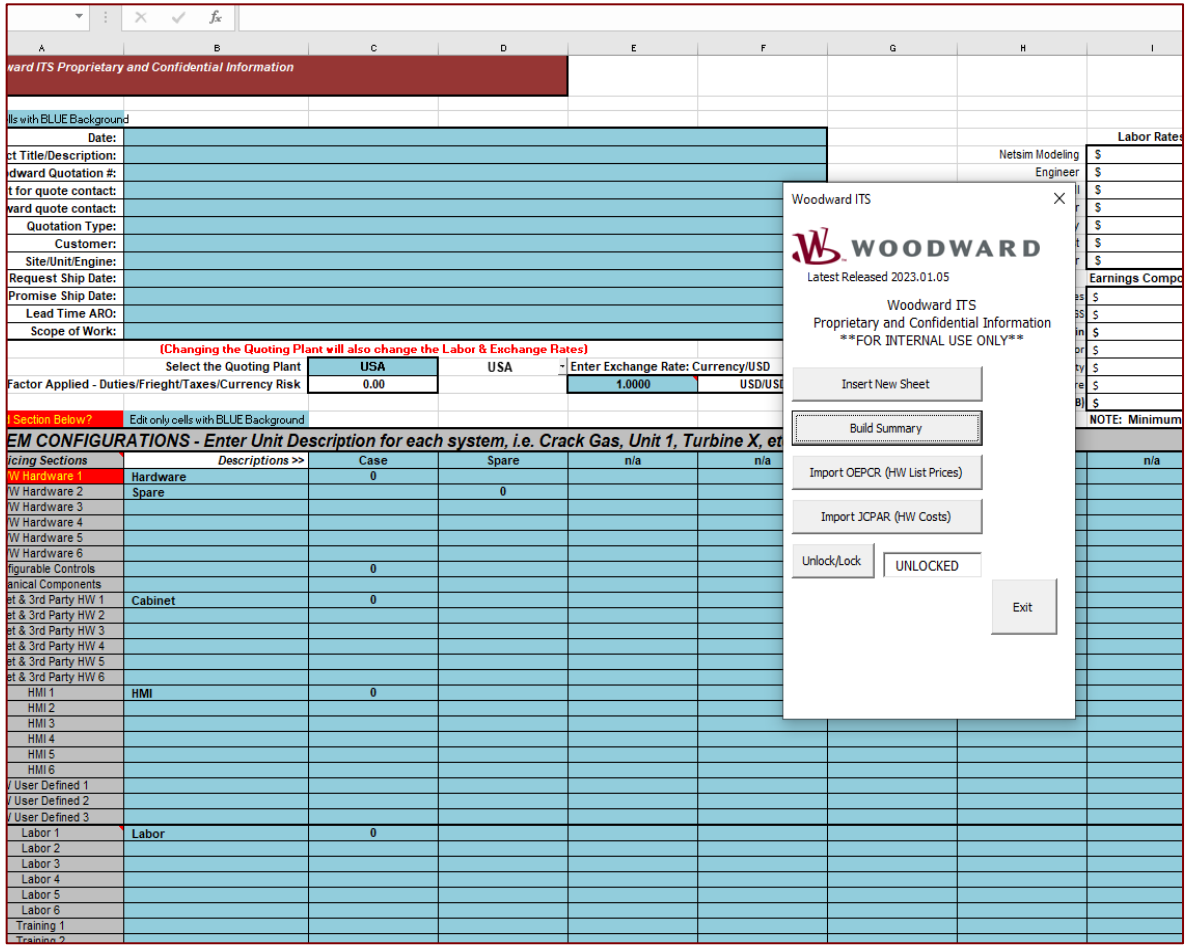
- Updated new CAT44 Price as on Oct 31st ,2022.
- Updated new cost JCPAR as on Nov 2nd ,2022.
- Added revised Engineering services rates.
- Added revised Engineering services cost.
- Reported bugs fixed.

Future Actions:

- Use of SQL query based automatic routines. WWD-India is leading this effort.
- Better user interface on each pages.
- Update Field Engineering and training quotation sheets.

File location Internal Woodward :
\\servf10\sharedir\SALESKIT\2 Industrial Turbine Systems\Proposals\SCS Pricebook

For feedbacks and comments , Please reach out to :
Vinai.Misra@Woodward.com



New Product Catalog update 25180 rev AD

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Product Catalog update 25180 Rev AD

Release of new Product Catalog is underway.
This new version have several improvements
from previous revisions.

Some key updates from previous versions

- **Addition of List prices for items.**
- **Removal of Electric Governors section including ProAct ISC , Flo-Tech Speed Controls, EPG.**
- **Addition of new PN of Network switches , Cables.**
- **Revised Electronic Controls section including removal of 2301A, 2301D,723Controls,828 control.**
- **Revised MicroNet System Modules, Cables and Accessories.**
- **Revised Turbine Controls and Associated devices.**
- **Revised Power Management Devices section.**
- **Revised Electro-Hydraulic Controls and Actuators section.**
- **Removed Ignition Products section, including coils and harnesses.**
- **Revised Gas Turbine valves section.**
- **Addition of VariStroke Actuators, including active VS-I, VS-II & GI models, Servos, Spare parts.**

Aftermarket Service Packages

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Updated Services brochure-aftermarket

Refer Services Brochure 51618

Updated services brochure with the latest details of *Gold* and *Silver* services to align with all our other efforts. The brochure is intended for the sales team and partners to start conversations with potential customers .

Service Planning

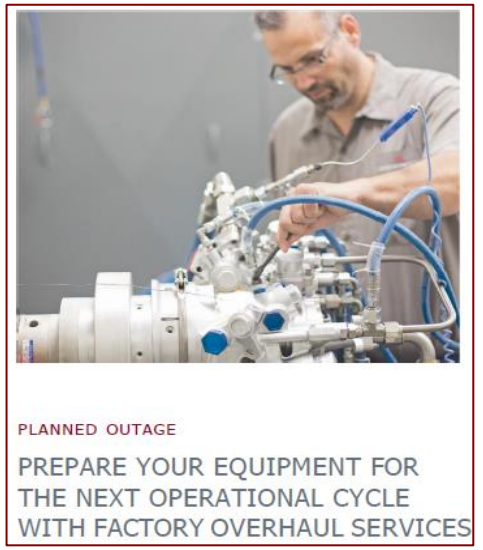
Plan for Services in advance of your next outage or new installation.

Planned Outage

Prepare your equipment for the next operational cycle with factory overhaul services.

Rapid Response

Get your operations back ONLINE with our global experts and services.



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Support Center Services for the Global Aftermarket

Key Points :

- Gold Level includes wear and non-wear component replacement within the flat rate.
- Silver level service includes only wear related components and does not include missing or damaged items.
- Gold = Factory tested as new products including flow testing.
- Silver = Functional bench test only, no flow testing completed.
- Original factory quality parts, services, and test that reset the clock to “new” on your equipment.

SUPPORT CENTER SERVICES FOR
THE GLOBAL AFTERMARKET.

SERVICES BY FACILITY	GOLD	SILVER
Spare Unit Purchase (New or Certified Used)	•	-
Field Service	•	•
Exchange Unit Service	•	•
Repair (Time & Material)	•	•
Overhaul (Flat Rate)	1	2
Test as Received (Flat Rate)	3	4
Warranty Evaluation	•	-
Root Cause Corrective Action ‘RCA” (Quoted)	•	-
Failure Analysis Report ‘FAR’ (Quoted)	•	-
Special Product Testing (Quoted)	•	-

1. Gold Level Service includes wear and non-wear component replacement within the flat rate.
2. Silver Level Service includes only wear related components and does not include missing or damaged items. See Definitions.
3. Gold = Factory tested as new products including flow testing.
4. Silver = Functional bench test only, no flow testing completed.

PRODUCTS BY FACILITY	GOLD	SILVER
Hydraulic Gas Fuel Control, Stop Ratio & Globe Valve Families	•	•
Electric Gas Fuel Control, Stop Ratio & Globe Valve Families	•	•
Hydraulic Inlet Guide Vane and Stator Vane Actuators	•	•
Electric Inlet Guide Vane and Stater Vane Actuators	•	•
Electric Gas Purge Valve Family (RVP-200)	•	•
GS6, GS16 & GS16DR	•	-
GS40 & GS50 Valves	•	-
GSOV25HT & GSOV80 Stop Valves	•	•
CPC-II, QuickTrip, VS-I & VS-II Products	•	•
All Other Products	•	1

1. Woodward has a long tradition of providing support for our products for extended periods of time and this practice will continue when possible. Check a Woodward authorized service center to find the category level (I, II, or III) for your product for serviceability versus upgrade/replacement.

FIND A SERVICE CENTER NEAR YOU
https://www.woodward.com/en/support/industrial

WOODWARD

Woodward Services

Our aftermarket support is tailored specifically to the service requirements of our customers. Our goal is always to provide ongoing, comprehensive support that maximizes the operational life of our products and minimizes risk, downtime, and outlay for our customers.

System Support Solutions for…


STEAM TURBINE


GAS TURBINE


HYDRO


COMPRESSORS

WOODWARD

General Offerings

Premium and Remote Access Services

Keep your operation online with access to Woodward service experts when you need them.

Process Improvements

Improve the efficiency of your plant and staff with dedicated project managers.

Training Services

Whether onsite or simulated Woodward offers training for all levels of plant facility staff.

Preventative Maintenance

Protect your equipment and stay on top of critical product and software upgrades and maintenance.

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AISF/ASI Agreement Information

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AISF/ASI Agreement Information

We have develped a new template related to channel partner agreement . Woodward is now using this template to reassign our key Channel partners gloablly.

Contact Rik Bergman / Rich Kamphaus for related questions.

WOODWARD

Recent success stories

Customer chooses MicroNet+ to replace CCC's Series 4+

UAE based largest Gas processing company was looking forward to a fault tolerant Compressor Control system with higher availability, improvement in efficiency and ease of operation. Also, the plant was looking for a partner willing to provide a long-term product & services support plan to ensure the new system remains online and functioning.

The Woodward solution was to replace 04 Nos. of existing CCC Series-4 controllers with MicroNet Plus based Control System. The systems were in 2 control cabinets. Each cabinet had 2 CCC Series 4 controllers, controlling the single stage Propane and Butane compressors driven by Variable speed Motors. 4 Sets of redundant MicroNet Plus controllers were installed in the existing cabinets and interfaced with plant DCS, ESD and other auxiliary systems.

Woodward had pre-assembled the Hardware-insert plates to reduce the installation time. In addition to the platform upgrade, Woodward provided a 15-year service support plan for the installed system

The result of the new system was leap forward in control technology. The MicroNet Plus provided a robust, fully reliable and redundant platform. Woodward's patented ASC algorithm was configured as per process requirements to derive an enhanced AS functionality thus achieving smoother operation of the process.

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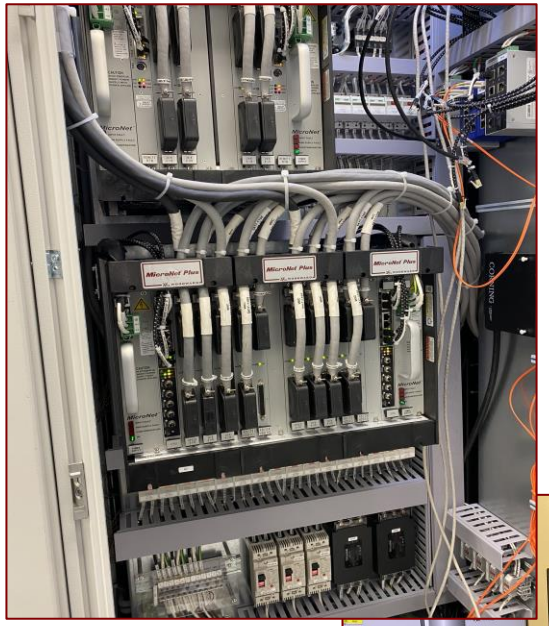
Retrofit of Siemens Compressors by MCO's – Fort Dodge Ammonia Capacity increase Project

This USA based plant upgrade was implemented to replace one Syn Gas compressor train and Air compressor train from existing SIEMENS packages to increases ammonia production capacity by 85,000 tone per year at its Fort Dodge plant at Fort Dodge, IOWA.

This turbine and compressor upgrade consisted of implementing the MicroNet Plus platform and installation of toolkit software, along with a complete HMI package. Included within this upgrade was the upgrade of the unit's anti surge and performance load sharing control algorithms (ITCC).

Customer achieved automatic extraction control with visibility in steam map. An accurate speed control helped to achieve better process control and stability in operation.



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GS40: Woodward's First Hydrogen Fuel Valve

Woodward demonstrated Hydrogen fuel metering capabilities for GE Turbine (LM6000 PC) at New York and UN climate summit , Shams , Egypt.

Key Updates:

- **GS40 with newest on-board driver with web-based service tool.**
- **Higher torque brushless motor.**
- **Fast pressure transduces for dP Flow Control.**
- **Resistant materials for Hydrogen.**

Project Summary

- **Testing completed with runs from mid to max power.**
- **H2 concentration from 5% to 40% by volume.**
- **Control algorithms verified.**
- **Good CO reduction with moderate NOx increase, water injection helped reducing the NOx.**

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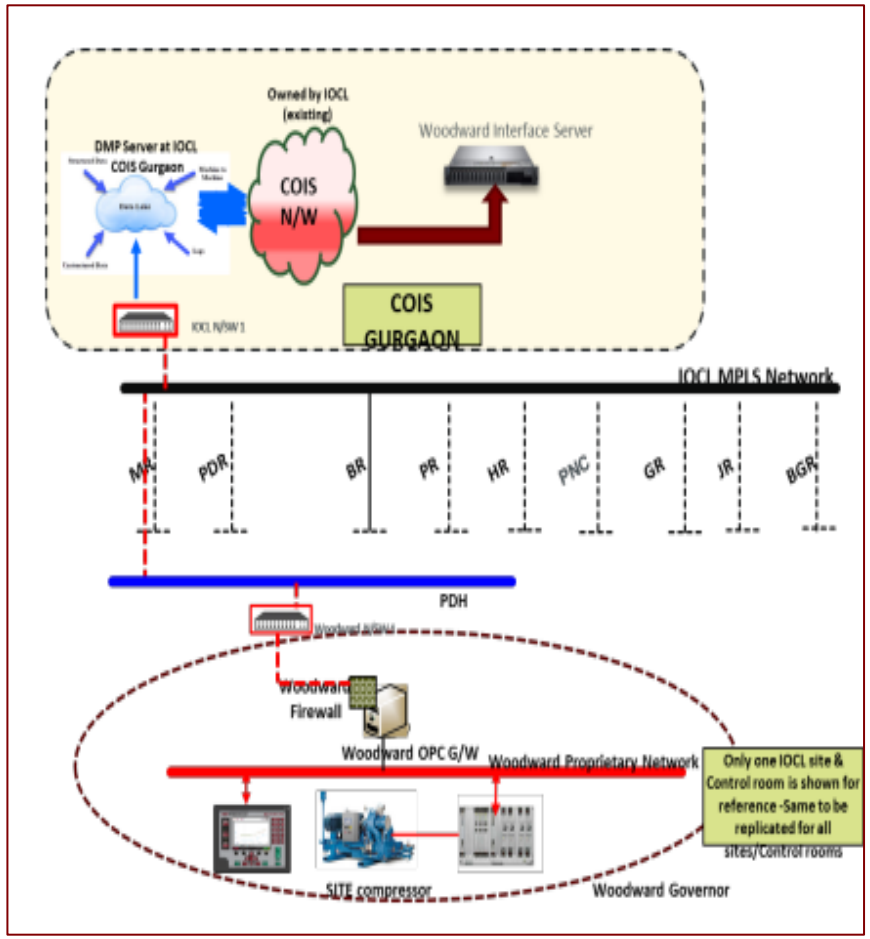
Woodward Predicative analytics and Machine learning project

The Woodward installation base at Indian Oil Corp. Ltd. (IOCL) includes 70 controls distributed across 9 refineries at India. Woodward will be providing remote access to each refinery through an appropriate Open Platform Communication (OPC) protocol. Refinery data required for predictive analytics will be stored on a Woodward server located onsite at IOCL and accessed by Woodward periodically during on-site visits.

The system analytics will be displayed according to principals of visual management on dashboards accessible to IOCL at IOCL HQ. Other outputs including alarms, prescriptive activities, and scheduled reports will be communicated by e-mail or other digital communication processes. This is first of its kind RMS offered by Woodard.

Woodward will also develop an appropriate machine learning application for IOCL refinery predictive analytics. This includes designing, building and validating health monitoring and predictive reliability models in collaboration with IOCL engineering



WOODWARD

New Improved ITCC Software Cores

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Improved Integrated Turbine and Compressor Software Cores

Woodward's GAP software core modules related to Steam turbine (STC), Anti-Surge control(ASC), Load sharing(LSC) , Performance controller(PFC), and Toolkit have been updated for the recent Phase-1 release.

Recent customer FAT based upon new cores was successfully completed. This testing validated following algorithms: steam turbine speed control, compressor suction pressure control, anti-surge control (ASC1-3), and quench control.

Planned for Phase-2 release: Pricing details for individual Cores, add further field requirements, prepare training and application documents, updating STCXT core, HMI standardization .

For more details , contact:

Vinai.Misra@woodward.com

Rafal.Gutkowski@woodward.com

CORE	DESCRIPTION	P/N
ASC	ASC Core software,bug fix, req. gathering, improvement, test procedure, documentation	5418-3675, -76, -77, -78
STC	STCXT Core Software,bug fix, req. gathering, improvement, test procedure, documentation	10-027-206
PFC	PFC Core Software,bug fix, req. gathering, improvement, test procedure, documentation	10-028-721
LSC	LSC Core Software,bug fix, req. gathering, improvement, test procedure, documentation	10-024-831
HW	HW Core Software,bug fix, req. gathering, improvement, test procedure, documentation	10-027-206
*HydroTurb	HT Core Software, bug fix, req. gathering, improvement, test procedure, documentation	*TBD
Integration	Integration Software: Integration of COREs, WISE release, bug management in Team forge, latest GAP/Coder updates, PN management, Team forge management	10-026-484
ToolKit/HMI	TK and ifix ,bug fix, req. gathering, improvement, test procedure, documentation	*TBD

WOODWARD

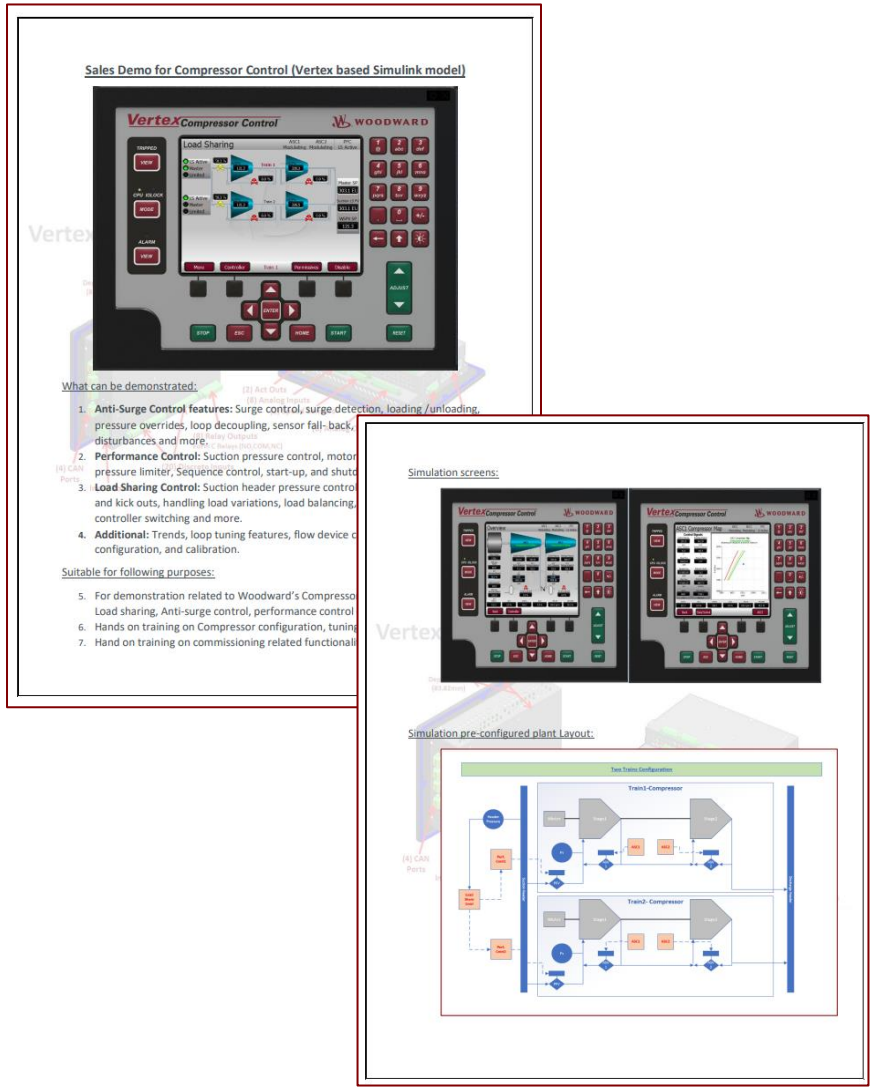
Basic Compressor control Sales Demo Tool

This tool uses Matlab based Simulink model to demonstrate our key capabilities such as anti-surge control, performance control, load sharing, fall-back strategies and many more features.
We can use this tool on laptop for any seminars, sales or technical presentations . It is based upon two compressor trains, driven by Motor and controlled from Vertex.

Related Woodward software are RemoteView HMI, Toolkit, nVe simulation.

Suitable for following purposes:

- **Demonstration of Woodward's Compressor control features such as Load sharing, Anti Surge control, performance control, decoupling etc. to the customers.**
- **Hands on training for Compressor configuration, tuning.**
- **Display of plant disturbances and impact on Woodward's compressor controls such as Transmitter failures, load / unload etc.**



For more details , contact :
Vinai.Misra@woodward.com

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GS40, GS50 Valves

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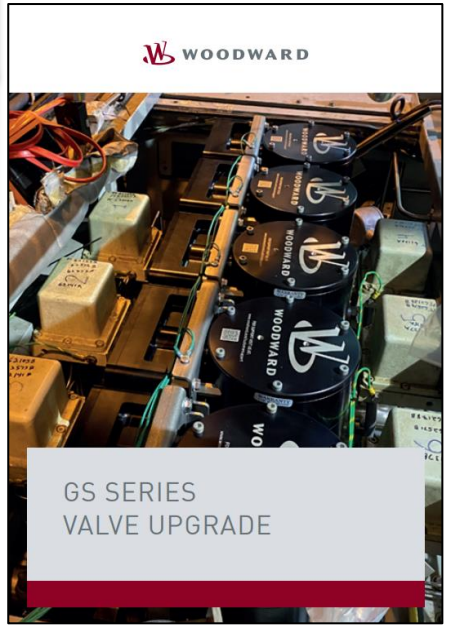
Finding sales info: GS40 and GS50 valves

With a design based on decades of Woodward experience, the GS40-50 valve family will contribute to the robustness of any gas fuel metering application. These valves can replace existing valves, with the added value of enhanced function, robustness, and features.

Some GS40/50 Product Features:

- **Direct Drive – Torque margin is greatly increased**
- **Return Spring – Valve failsafe return to closed position**
- **On Board Driver – DVP-Valve cabling eliminated; Driver incorporates SIL trip functionality**
- **Turndown Capability Improvements (reduced backlash) – Eliminates the need for 3103 & 3171 valves**
- **Products can now be used to full CL600 flange rating**
- **MTBO increase to 64000 hours**

GS Series (GS40/50) Valve upgrade Brochure and sales presentation are located at: :http://inside/private/gsm/ics_sales_playbook/Shared%20Documents/Forms/AllItems.aspx



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More Sales Information : GS40 and GS50 valves

Application:

The Woodward GS-Series gas fuel metering valve family is the latest version of rotary control valves utilizing an integrated actuator and on-board driver built on decades of application experience in the gas turbine market. The self-cleaning valve design is ideal for applications ranging from clean pipeline gas to wellhead gas. The valve features an on-board electric actuator driver for ease of packaging and installation.

Functions performed by On-Board driver:

The on-board driver eliminates the need for costly climate-controlled terminal boxes and associated cabling. Each valve includes redundant position feedback resolvers and an integral failsafe spring to maximize reliability and safety. The integrated driver incorporates redundant signal conditioning, fault detection, and selectable failure management options. The multiple valve sizes and trims can be configured in single or multi-path systems to enable a wide range of applications.

Port Sizes: GS40: 0.30 in^2, 0.75 in^2

GS50: 1.0 in^2, 1.5 in^2, 2.0 in^2

For more details reach out to: Wade.Burdick@woodward.com

GS40 Gas Fuel Valve Actuator with On-board Driver

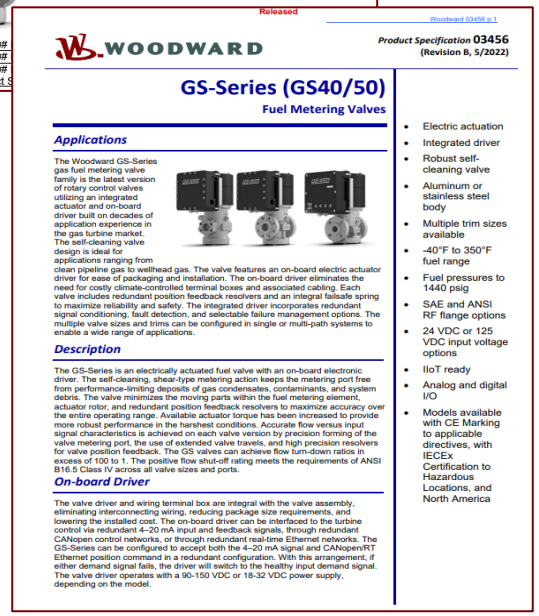
	Part Number
GS40, 0.30" Port Size, 600# RF Flange, 125 VDC, Conduit Connections	9908-1608
GS40, 0.75" Port Size, 600# RF Flange, 125 VDC, Conduit Connections	9908-1609

*Documentation: Product Spec: 03456, Manual: 35136

GS50 Gas Fuel Valve Actuator with On-board Driver

	Part Number
GS50, 1.0" Port Size, 600#	
GS50, 1.5" Port Size, 600#	
GS50, 2.0" Port Size, 600#	

*Documentation: Product S



Released

WOODWARD

Product Specification 03456
(Revision B, 5/2022)

GS-Series (GS40/50)
Fuel Metering Valves

Applications

The Woodward GS-Series gas fuel metering valve family is the latest version of rotary control valves utilizing an integrated actuator and on-board driver built on decades of application experience in the gas turbine market. The self-cleaning valve design is ideal for applications ranging from clean pipeline gas to wellhead gas. The valve features an on-board electric actuator driver for ease of packaging and installation. The on-board driver eliminates the need for costly climate-controlled terminal boxes and associated cabling. Each valve includes redundant position feedback resolvers and an integral failsafe spring to maximize reliability and safety. The integrated driver incorporates redundant signal conditioning, fault detection, and selectable failure management options. The multiple valve sizes and trims can be configured in single or multi-path systems to enable a wide range of applications.

Description

The GS-Series is an electrically actuated fuel valve with an on-board electronic driver. The self-cleaning, shear-type metering action keeps the metering port free from performance-limiting deposits of gas condensates, contaminants, and system debris. The valve minimizes the moving parts within the fuel metering element, actuator rotor, and redundant position feedback resolvers to maximize accuracy over the entire operating range. Available actuator torque has been increased to provide more robust performance in the harshest conditions. Accurate flow versus input signal characteristics is achieved on each valve version by precision forming of the valve metering port, the use of extended valve travels, and high precision resolvers for valve position feedback. The GS valves can achieve flow turn-down ratios in excess of 100 to 1. The positive flow shut-off rating meets the requirements of ANSI B16.5 Class IV across all valve sizes and ports.

On-board Driver

The valve driver and wiring terminal box are integral with the valve assembly, eliminating interconnecting wiring, reducing package size requirements, and lowering the installed cost. The on-board driver can be interfaced to the turbine control via redundant 4–20 mA input and feedback signals, through redundant CANopen control networks, or through redundant real-time Ethernet networks. The GS-Series can be configured to accept both the 4–20 mA signal and CANopenRT Ethernet position command in a redundant configuration. With this arrangement, if either demand signal fails, the driver will switch to the healthy input demand signal. The valve driver operates with a 90-150 VDC or 18-32 VDC power supply, depending on the model.

- Electric actuation
- Integrated driver
- Robust self-cleaning valve
- Aluminum or stainless steel body
- Multiple trim sizes available
- -40°F to 350°F fuel range
- Fuel pressures to 1440 psig
- SAE and ANSI RF flange options
- 24 VDC or 125 VDC input voltage options
- IIoT ready
- Analog and digital I/O
- Models available with CE Marking to applicable directives, with IECEx Certification to Hazardous Locations, and North America

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Ordering process and sales support for Governor valves

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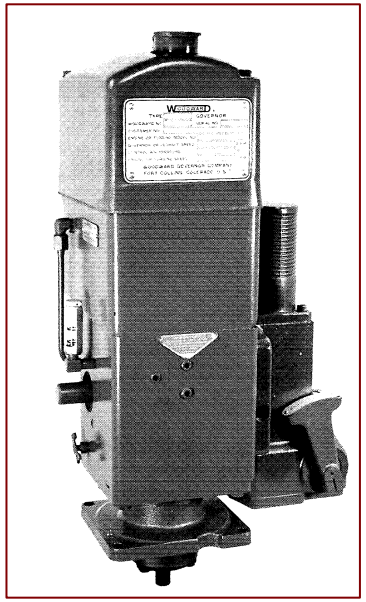
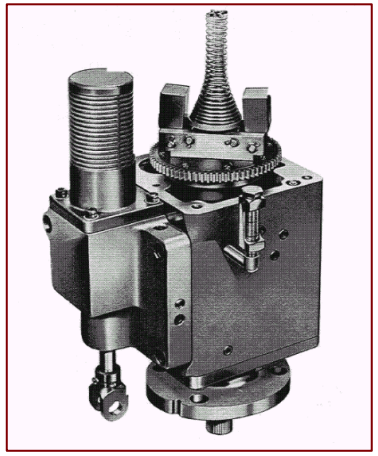
Quote and SAE procedure

- CSR submits questions or quote requests to Governor Support Engineers (refer next slide)
- Support Engineer and Engineering team use tools (supply chain's confirmation to get required parts) to construct a new BOM and send to Pricing team .
- Pricing team submits a quote to the CSR, including the additional NRE fee.
- CSR submits the quote to the customer.
- On receipt of the PO, the CSR will submit another CR for an SAE into Windchill with all pertinent information.
- Engineer will propagate a CN (change notice from the CR) and create a new part designation, BOM structure , spec sheet and other required documentations.
- After final signature , the CN is released, and Engineer sends out a confirmation email stating the new part designation has been released to the CSR, Planner and Process engineer. Planner submit the order and drives the demand.
- The process engineer sets up the routing and PPAP documentation in the system.

For any related query, reach out to your sales representative .





Support Structure

- For Sales supports related to PGPL governors , reach out to :

  Kumar M. : Kumar.M@woodward.com

- For support related TG actuators , reach out to :

  Bright Yu : Bright.Yu@woodward.com

- For support related UG actuators , reach out to :

  Rick Geng : Rick.Geng@woodward.com

For other Mechanical , Electronics products support refer to latest Product Engineering Support document located at :

\\Servf10\sharedir\PRODUCT_ENGINEERING\Responsibilities Archive

WOODWARD

VariStroke Robustness updates

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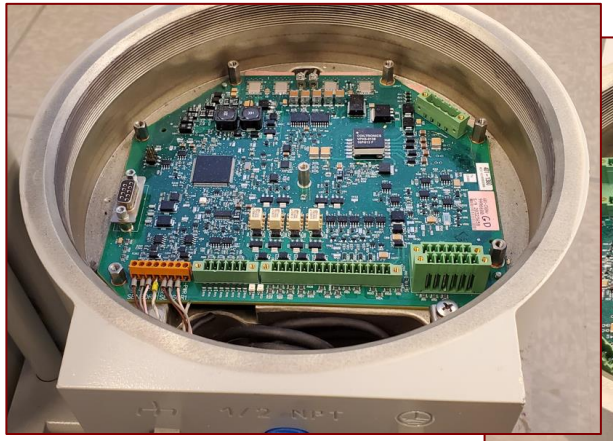
Planned features for VariStroke Robustness

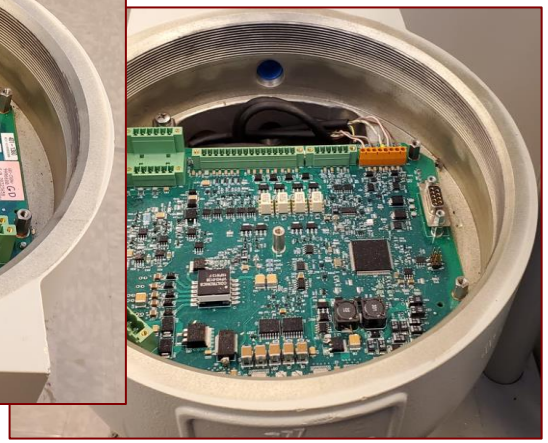
The new high-temperature sensor :

- **Same existing external dimensions of MLDT.**
- **Enhanced capabilities to work in higher temperature (~105 deg C)**
- **Improved sensor failure rate.**
- **Improvement in reliability.**

New conformal coating for electronic boards are in progress:

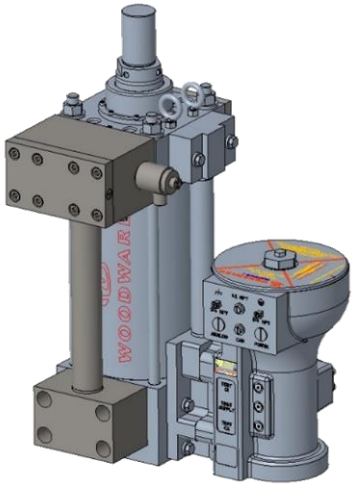
- **Electronics boards are being updated to use silicone coating.**
- **Enhanced protection against moisture , rust.**
- **Improved reliability and availability of the unit.**





WOODWARD

VariStroke-GI release overview



- As a product family, users can customize their order to ensure their ordered actuator has the correct bore, length, configuration, shaft threads, and return spring force to meet their specific application.
- Single-acting actuators utilize an internal or external return spring to force the output shaft and connected valve to a safe closed position upon a shutdown event and have several advantages over double-acting actuators including fail-safe action as well as not requiring the use of expensive accumulators.
- Optionally users can order VariStroke-GI actuators with or without an integrated fast-acting dump valve. This dump valve is designed to quickly dump oil from one side of the piston to the other side. Depending on the application these dump valves can be driven directly from the VariStroke-GI servo or from the turbine shutdown system.

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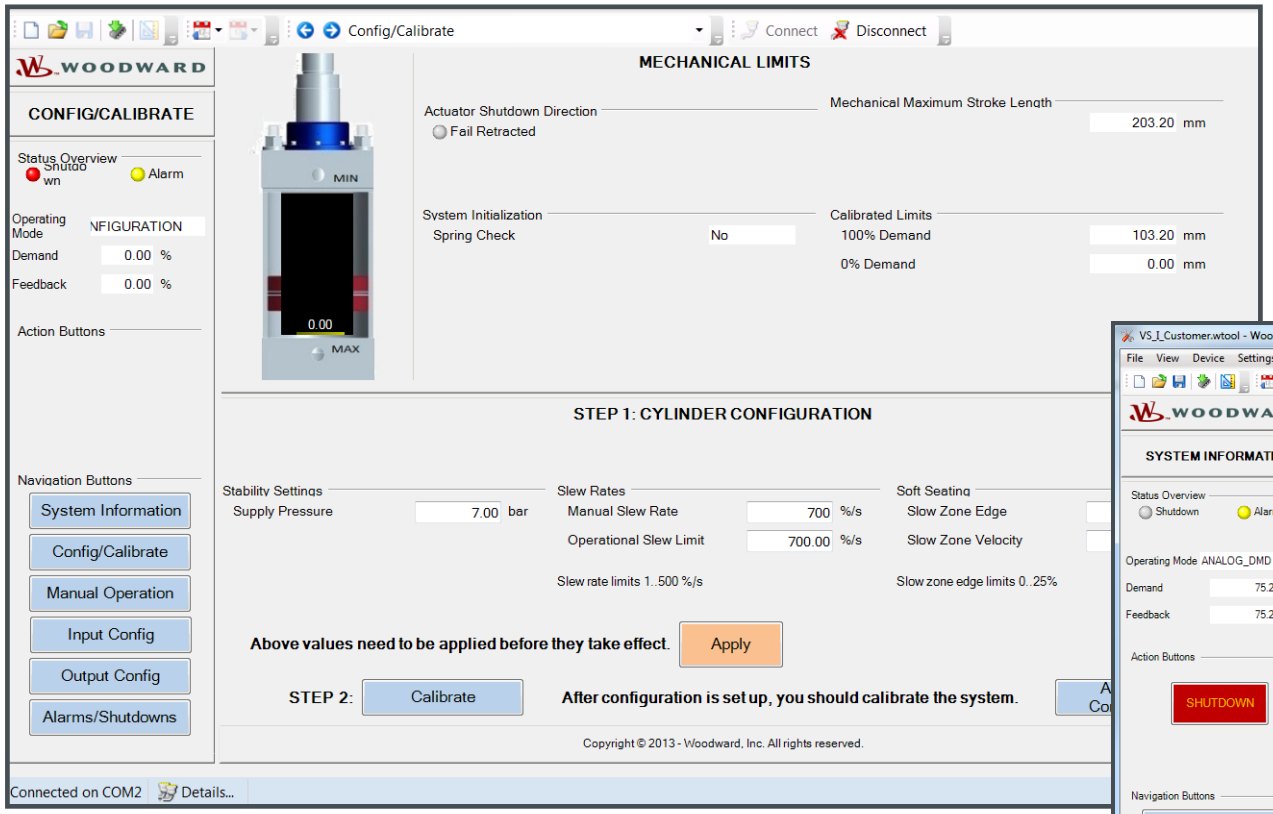
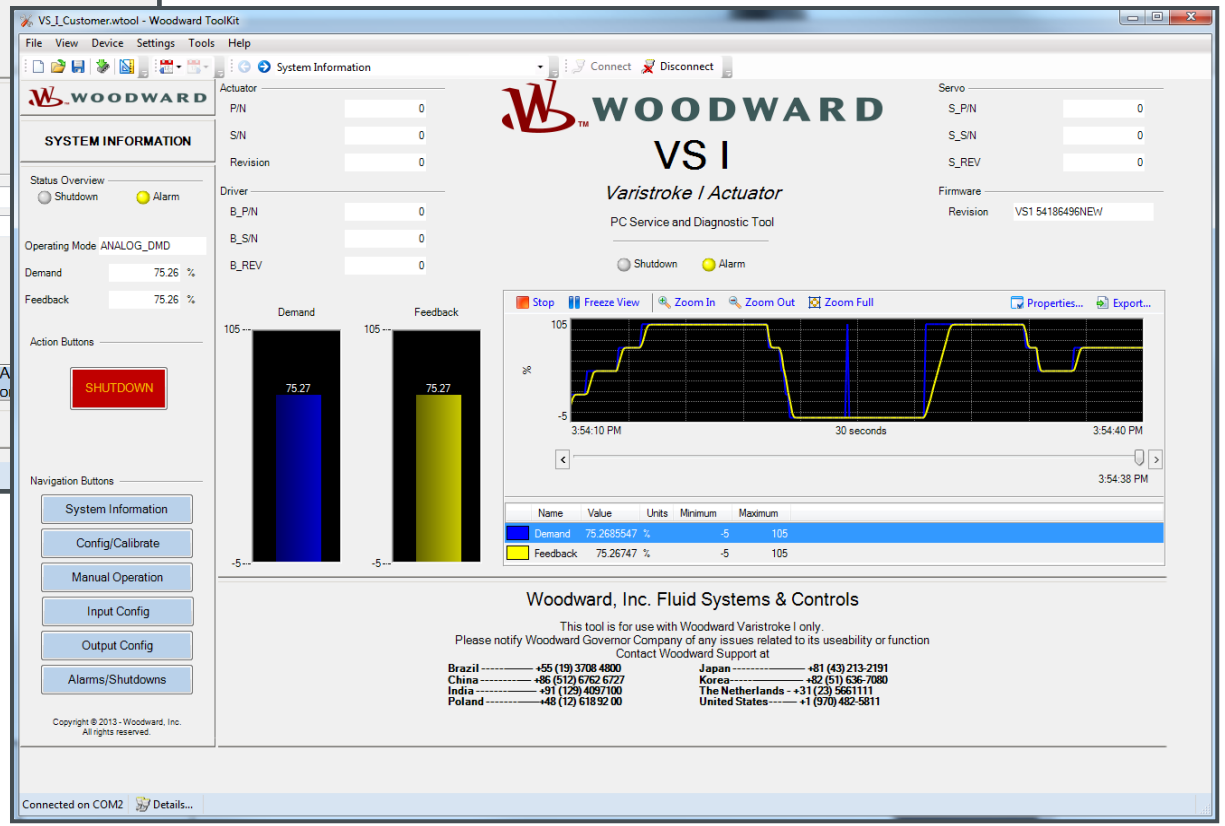
VariStroke-GI Service Tool



- Configure
- Calibrate
- Verify Response



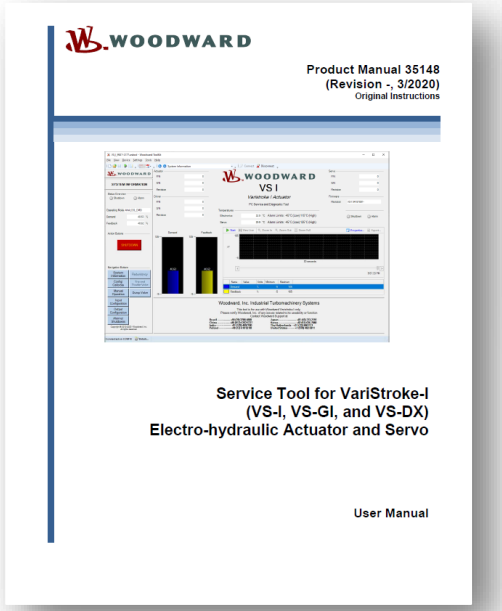
User Friendly Service Tool Included

WOODWARD

VariStroke-GI Documentation

Product Documentation

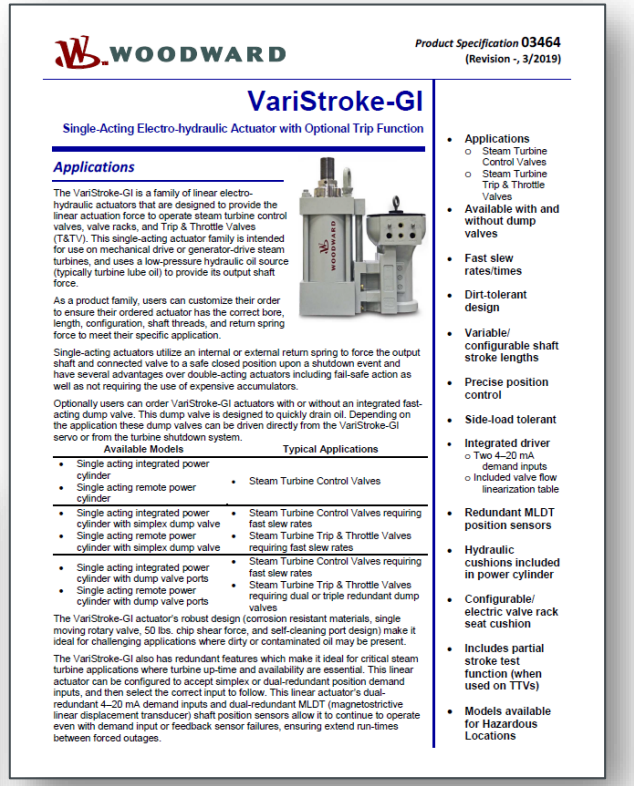
- Product Spec: 03464
- Product Manual: 35119
- Service Tool Manual: 35148


WOODWARD

Product Manual 35148
(Revision -, 3/2020)
Original Instructions

Service Tool for VariStroke-I
(VS-I, VS-GI, and VS-DX)
Electro-hydraulic Actuator and Servo

User Manual


WOODWARD

Product Specification 03464
(Revision -, 3/2019)

VariStroke-GI

Single-Acting Electro-hydraulic Actuator with Optional Trip Function

Applications

The VariStroke-GI is a family of linear electro-hydraulic actuators that are designed to provide the linear actuation force to operate steam turbine control valves, valve racks, and Trip & Throttle Valves (T&TV). This single-acting actuator family is intended for use on mechanical drive or generator-drive steam turbines, and uses a low-pressure hydraulic oil source (typically turbine lube oil) to provide its output shaft force.

As a product family, users can customize their order to ensure their ordered actuator has the correct bore, length, configuration, shaft threads, and return spring force to meet their specific application.

Single-acting actuators utilize an internal or external return spring to force the output shaft and connected valve to a safe closed position upon a shutdown event and have several advantages over double-acting actuators including fail-safe action as well as not requiring the use of expensive accumulators.

Optionally users can order VariStroke-GI actuators with or without an integrated fast-acting dump valve. This dump valve is designed to quickly drain oil. Depending on the application these dump valves can be driven directly from the VariStroke-GI servo or from the turbine shutdown system.

Available Models	Typical Applications
• Single acting integrated power cylinder • Single acting remote power cylinder	• Steam Turbine Control Valves
• Single acting integrated power cylinder with simplex dump valve • Single acting remote power cylinder with simplex dump valve	• Steam Turbine Control Valves requiring fast slew rates • Steam Turbine Trip & Throttle Valves requiring fast slew rates
• Single acting integrated power cylinder with dump valve ports • Single acting remote power cylinder with dump valve ports	• Steam Turbine Control Valves requiring fast slew rates • Steam Turbine Trip & Throttle Valves requiring dual or triple redundant dump valves

The VariStroke-GI actuator's robust design (corrosion resistant materials, single moving rotary valve, 50 lbs. chip shear force, and self-cleaning port design) make it ideal for challenging applications where dirty or contaminated oil may be present.

The VariStroke-GI also has redundant features which make it ideal for critical steam turbine applications where turbine up-time and availability are essential. This linear actuator can be configured to accept simplex or dual-redundant position demand inputs, and then select the correct input to follow. This linear actuator's dual-redundant 4–20 mA demand inputs and dual-redundant MLDT (magnetostrictive linear displacement transducer) shaft position sensors allow it to continue to operate even with demand input or feedback sensor failures, ensuring extend run-times between forced outages.

- Applications
  - Steam Turbine Control Valves
  - Steam Turbine Trip & Throttle Valves
- Available with and without dump valves
- Fast slew rates/times
- Dirt-tolerant design
- Variable/ configurable shaft stroke lengths
- Precise position control
- Side-load tolerant
- Integrated driver
  - Two 4–20 mA demand inputs
  - Included valve flow linearization table
- Redundant MLDT position sensors
- Hydraulic cushions included in power cylinder
- Configurable/ electric valve rack seat cushion
- Includes partial stroke test function (when used on TTVs)
- Models available for Hazardous Locations

WOODWARD

Woodward’s Hydro updates

WOODWARD

Updates from Hydro Turbine control

Woodward is currently retrofitting several hydro turbines in Asia and Brazil, we are looking for a site which is interested in letting us test our patented ITB technology (digital electronic 3-D cam for Kaplan turbine runner blades) , and benefit from higher turbine efficiency and lower fish kill.

In addition, please share the possibilities of finding Kaplan turbine-based Hydro project to test Index Test Box technology.

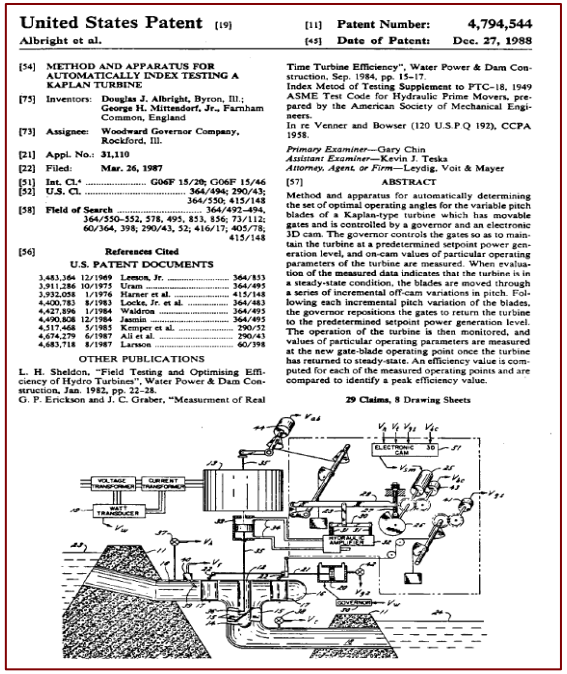
The 505-HT for Pelton Turbines is a standard off the-shelf control system designed to control Pelton turbines up to 6 nozzles, and digital deflector of all sizes. This hydro turbine controller includes specifically designed algorithms and logic to start, stop, control, and protect hydro turbines.

More info on 505HT:

https://www.woodward.com/en/shop/woodward44-industrial-turbines/8200-1400

More info on 2301E-HT: digital turbine speed and load control:

https://www.woodward.com/en/shop/woodward44-industrial-turbines/8273-2046



United States Patent [19]
Albright et al.

[11] Patent Number: 4,794,544
[45] Date of Patent: Dec. 27, 1988

[54] METHOD AND APPARATUS FOR AUTOMATICALLY INDEX TESTING A KAPLAN TURBINE

[75] Inventors: Douglas J. Albright, Byron, Ill.; George H. Mittendorf, Jr., Farnham Common, England

[73] Assignee: Woodward Governor Company, Rockford, Ill.

[21] Appl. No.: 31,110

[22] Filed: Mar. 26, 1987

[51] Int. Cl.⁴ G06F 15/20; G06F 15/46

[52] U.S. Cl. 364/494; 290/43; 364/550; 415/148

[58] Field of Search 364/492–494, 364/550–552, 578, 495, 853, 856; 73/112; 60/364, 398; 290/43, 52; 416/17; 405/78; 415/148

[56] References Cited

U.S. PATENT DOCUMENTS

3,483,364	12/1969	Lemon, Jr.	364/853
3,911,286	10/1975	Uram	364/495
3,932,058	1/1976	Harner et al.	415/148
4,400,783	8/1983	Locke, Jr. et al.	364/483
4,427,896	1/1984	Waldron	364/495
4,490,808	12/1984	Jasmin	364/495
4,517,468	5/1985	Kemper et al.	290/52
4,674,279	6/1987	Ali et al.	290/43
4,683,718	8/1987	Larson	60/398

OTHER PUBLICATIONS

L. H. Sheldon, "Field Testing and Optimising Efficiency of Hydro Turbines", Water Power & Dam Construction, Jan. 1983, pp. 22–28.
G. P. Erickson and J. C. Graber, "Measurement of Real Time Turbine Efficiency", Water Power & Dam Construction, Sep. 1984, pp. 15–17.
Index Metod of Testing Supplement to PTC-18, 1949 ASME Test Code for Hydraulic Prime Movers, prepared by the American Society of Mechanical Engineers.
In re Venner and Bowser (120 U.S.P.Q 192), CCPA 1958.

Primary Examiner—Gary Chin
Assistant Examiner—Kevin J. Teska
Attorney, Agent, or Firm—Leydig, Voit & Mayer

[57] ABSTRACT

Method and apparatus for automatically determining the set of optimal operating angles for the variable pitch blades of a Kaplan-type turbine which has movable gates and is controlled by a governor and an electronic 3D cam. The governor controls the gates so as to maintain the turbine at a predetermined setpoint power generation level, and on-cam values of particular operating parameters of the turbine are measured. When evaluation of the measured data indicates that the turbine is in a steady-state condition, the blades are moved through a series of incremental off-cam variations in pitch. Following each incremental pitch variation of the blades, the governor repositions the gates to return the turbine to the predetermined setpoint power generation level. The operation of the turbine is then monitored, and values of particular operating parameters are measured at the new gate-blade operating point once the turbine has returned to steady-state. An efficiency value is computed for each of the measured operating points and are compared to identify a peak efficiency value.

29 Claims, 8 Drawing Sheets

2301E-HT with VariStroke at Peru

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Global Install-Base reference location

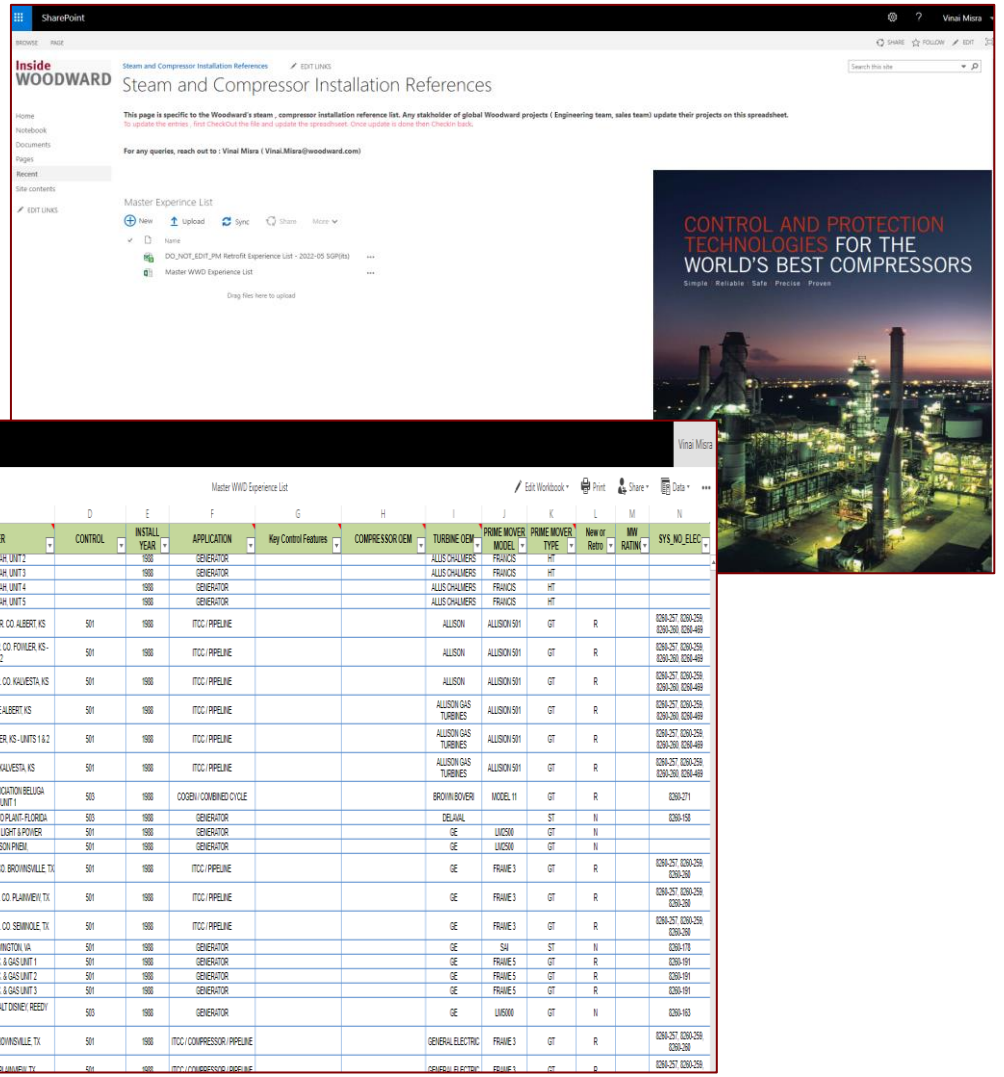
WOODWARD

Global Install base reference for Steam and Compressor

We have created a SharePoint page on Woodward Intranet and uploaded the existing Master install file. Many times, it was noticed that we have been asked from the customers for example project which Woodward has done such as any Propane compressor , or any 5 stages Acid gas compressor reference etc.. This install base file can be accessed and can be updated for global usages .

Internal Woodward link :
http://inside/private/ICS/steam_compressor_refs/SitePages/Home.aspx

The Master WWD experience list has additional info such as Application details, Turbine / Compressor details, upper-level part number. Regular update to the list is critical for shared benefit.



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Updates: Steam & Compressor Products

WOODWARD

Peak200 - Single valve, mechanical drive

Product P/N's

Bulkheads 8200-1500, -1501, -1502, -1506, -1508

Panel Mounts 8200-1503, -1504, -1504, -1507, -1509

Expected release timeline -Mid-2023

Key Updates for next Rev D :

- **Addition of Feature Pack options in standard release, no software license key needed.**
- **Addition of Normal Stop sequence routine (from GUI, Modbus or DI).**
- **Addition of a Ramp to Idle rate (can be different rate than Rate to Min. Gov).**
- **Addition of GAP Modbus Heartbeat Boolean (toggles every 2 sec).**
- **Bug fixing of reported bugs.**
- **Related manual updates.**

505D - Single valve, Gen/Mech

Product P/N's **8200-1300 -1301, -1302**

Current Rev is Software P/N 5418-6768 Rev F.

Expected release timeline -Mid-2023

Key Updates for next Rev :

- **Updated new Footprint to Coder 1.04**
- **Security update related to Achilles Level-1.**
- **Bug fixing of reported bugs.**
- **Related manual updates.**

WOODWARD

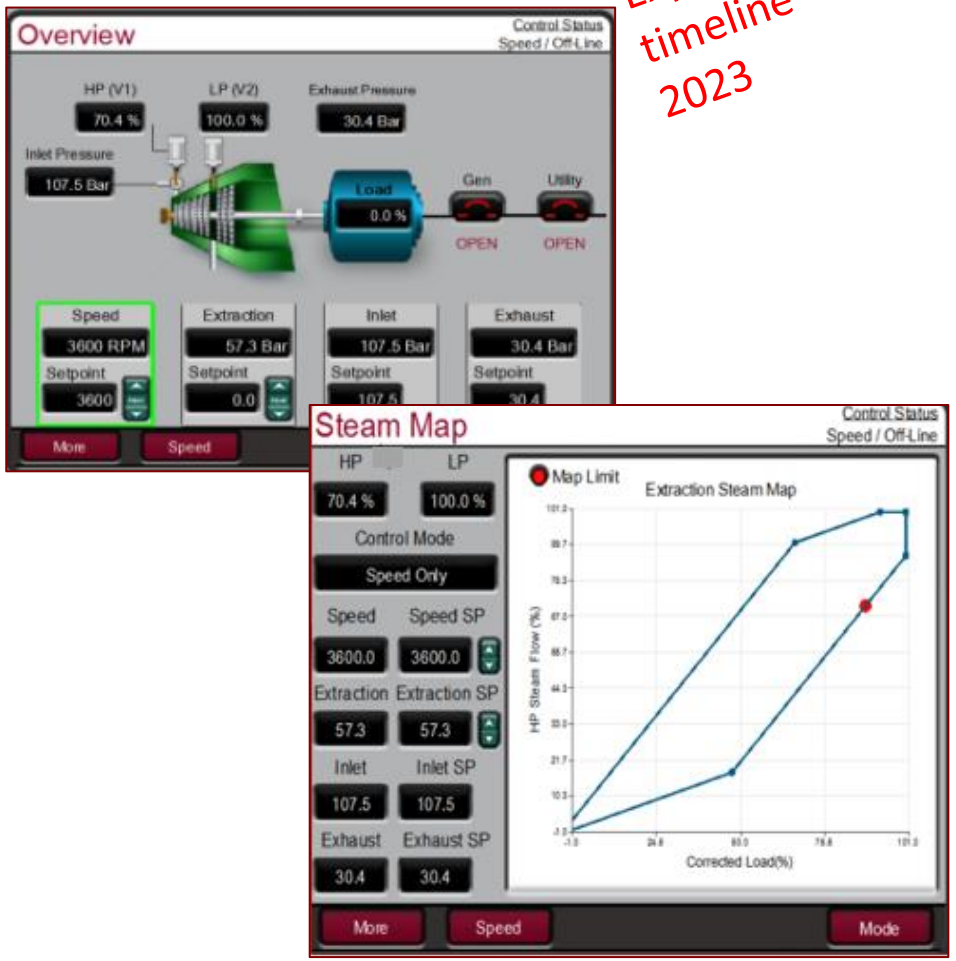
505XT- Single or Two valve, Gen/Mech

Product P/N's 8200-1310 -1311, -1312

Current Rev GAP Software P/N 5418-6769 Rev F.

GUI Software P/N 5418-7839 Rev F.

Expected release timeline -Late-2023



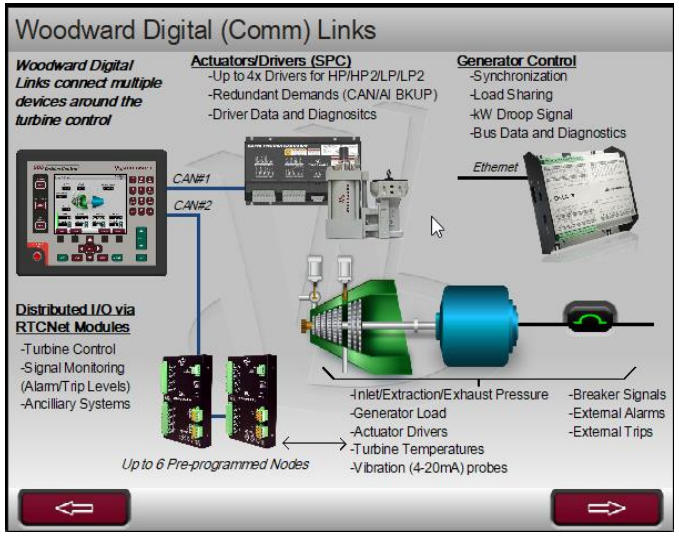
Key Updates for next Rev :

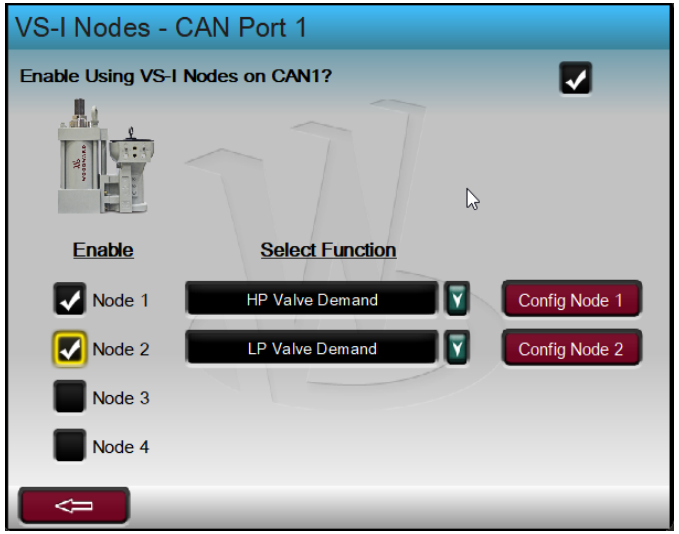
- **Updated new Footprint to Coder 1.04**
- **Security update related to Achilles Level-1.**
- **Prioritization on the feedback received globally (VOC)-Next slide.**
- **Bug fixes and improvement.**

WOODWARD

505XT- Single or Two valve, Gen/Mech

- Addition of VS1 (w/ CAN) to the digital driver network (4 units) .
- Addition of SPC Drivers (w/ CAN) to the digital driver network (4 units).
- Addition of a communication link interface to EasyGen family.
- Addition of support for interfacing to Trip & Throttle valves.
- Addition of logic to support Utility Grid stabilization (primary frequency control/testing modes).
- Addition of support for dual coil/redundant actuators (like 505-DR).
- Roadmap for Woodward link interfaces (Woody links): DSLC-II, LS-5,LinkNet HT (5 nodes), VS-I (4 nodes), VS-GI (TTV-1 node),SPC (4 Nodes), EasyGenXT. Removal of MFR300, High Protech and VSII.





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5009XT - MicroNet TMR product

Product Kit P/N's	**8262-1141, -1142, -1143**
	8269-1073 CCT Touch Panel PC
Current Software P/N	**5418-7830 Rev D.**

Expected release timeline -Mid-2023

Key Updates for next Rev :

- **Updated reported feature related to multiple redundant trip DIs.**
- **Ifix based HMI option . Product spec 03476.**
- **Addition of Read-Only GAP in next BCD release .**
- **Related manual updates.**

WOODWARD

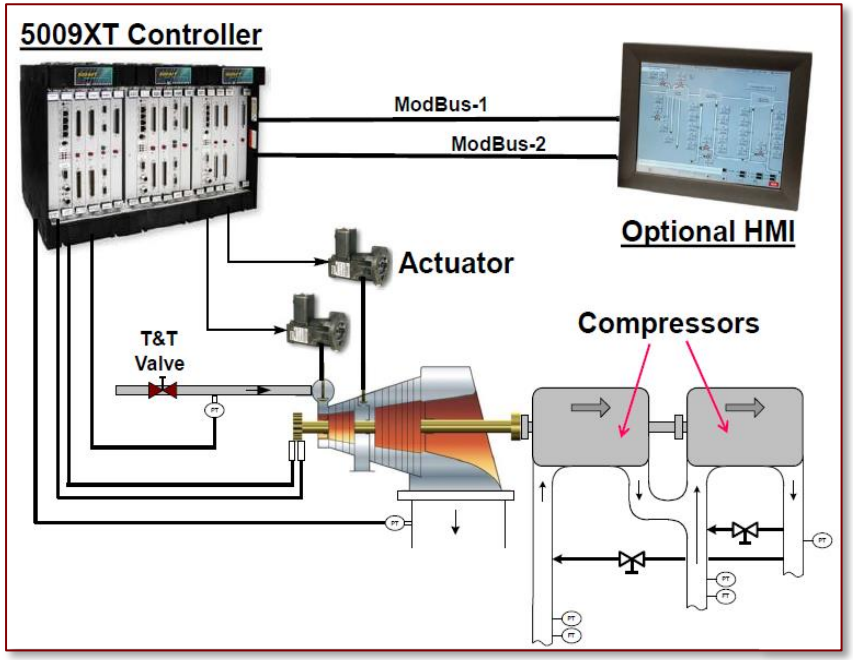
Upcoming ifix HMI for 5009XT in addition to QT based HMI

Ifix based HMI software (optional),planned to be released for 5009XT controller.

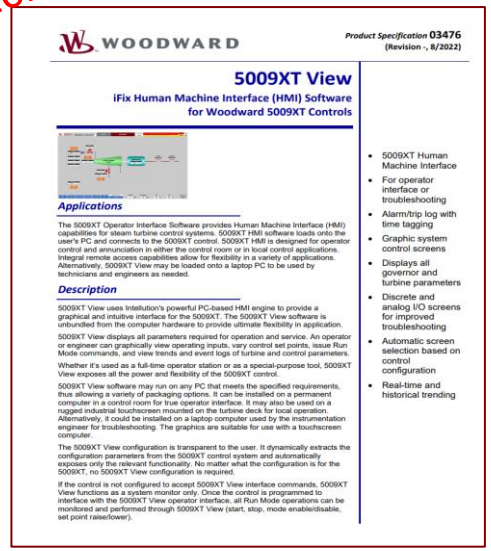
Additional Features

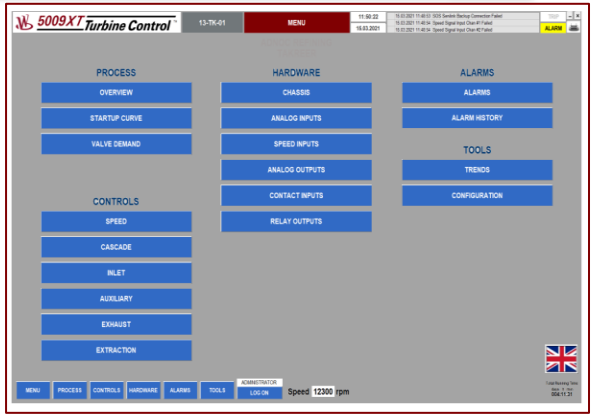
- Automatic screen generation based on control configuration.
- Real-time and historical trending.
- Alarm/trip status indication.
- Event status logging history.
- I/O and system troubleshooting.
- Remote access capability.
- Security with multiple password levels.

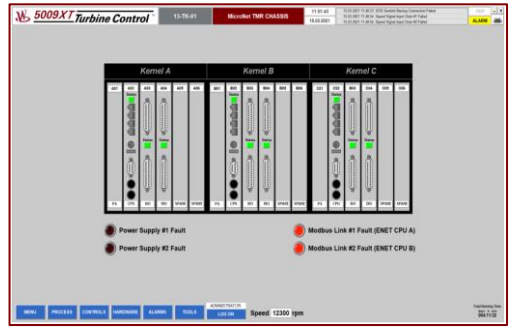
Refer manual 35135V3, appendix G for configuration procedure, requirements and further details.



Expected release timeline -Mid-2023







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Legacy (Gen2) 505 End of Life

WOODWARD

Gen2 -505 End of Life

As of February 15, 2023, the 2nd generation 505 (including the 505, 505E and 505 Enhanced) will be transitioning to the "Repair Only" stage of Woodward's Product Life Cycle plan. As of February 15, new orders will not be accepted for these products.

Woodward plans to provide repair support for at least the next 5 years. Any customers needing additional units should transition to the 3rd generation Woodward 505 (505D, 505XT, 505HT, 505DR). The 3rd generation will be our primary offering in this market for the foreseeable future.

Refer to Standard Products Publication 25180 rev AD for updated part numbers.

505 Steam Turbine Controls	Part Number
	
505 - LVDC, Ordinary Location	8200-1300
505 - HVAC/DC, Ordinary Location	8200-1301
505 - LVDC, Zone-2 Hazardous Location *Documentation: Product Spec: 03422, Manuals: 26839V1, 26839V2	8200-1302
505-XT - LVDC, Ordinary Location	8200-1310
505-XT - HVAC/DC, Ordinary Location	8200-1311
505-XT - LVDC, Zone-2 Hazardous Location *Documentation: Product Spec: 03423, Manuals: 35018V1, 35018V2	8200-1312
505-DR - LVDC, Ordinary Location	8200-1330

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Latest Presentation and Documentation Locations

Latest Presentation and Documentation Locations

Internal Woodward sales teams only :

- **ICS Sales Playbook :Find Product Support statements, Sales Presentations, Training videos.**

http://inside/private/gsm/ics_sales_playbook/Shared%20Documents/Forms/AllItems.aspx

- **Sales Kit: Product brochures, support statements, sales training, Product Photos and Graphic images**

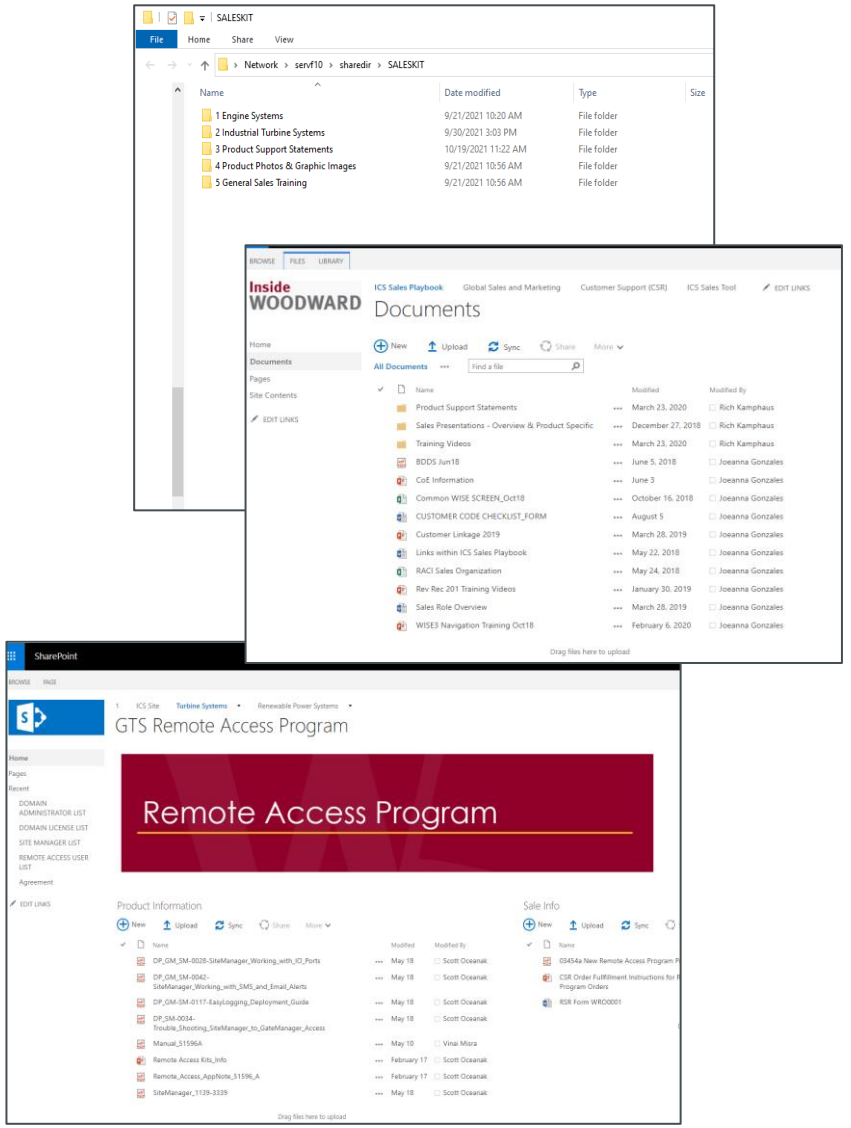
\\servf10\sharedir\SALESKIT

- **Latest case studies**

\\servf10\sharedir\SALESKIT\2 Industrial Turbine Systems\5 Brochures\ITS Case Studies

- **GTS Remote Access Program: Remote Access Program, product info, Sales info, User list**

http://inside/private/its/gts/rap/SitePages/Home.aspx



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Latest Presentation and Documentation Locations

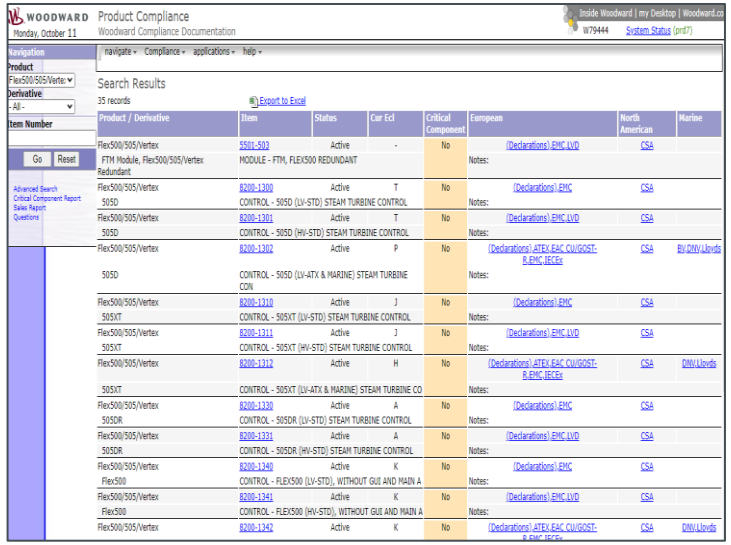
Internal Woodward sales teams only :

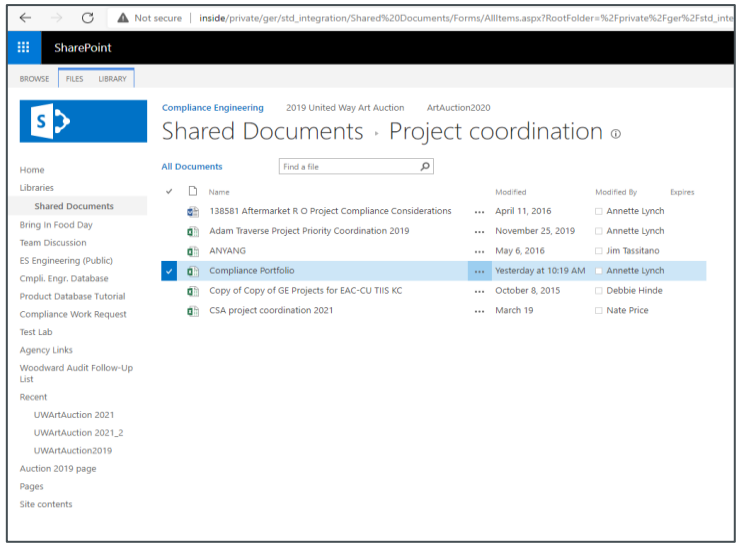
- **Product Compliance Portal: Find compliance related documents such as certificates, EMC,LVD declarations etc.**

http://webftc2/icgapps/ProductCompliance/Default.cfm

- **"Compliance Portfolio" file stored in SharePoint Compliance site that typically has all active and future projects for Compliance Team. This is a good source of information for all kinds of certificates that our devices have or are in the works.**

http://inside/private/ger/std_integration/Shared%20Documents/Project%20coordination/Compliance%20Portfolio.xlsx?d=w324dd76924a94bc58574bda701736b42





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Latest Presentation and Documentation Locations

External Woodward :

- **Industrial Partners & Collaboration site : Find marketing material, technical training material, Bronze/Silver level details.**

https://wwdinc.sharepoint.com/teams/Collab_Indust/SitePages/Home.aspx

- **Woodward YouTube Channel: For informative videos on Woodward's product.**

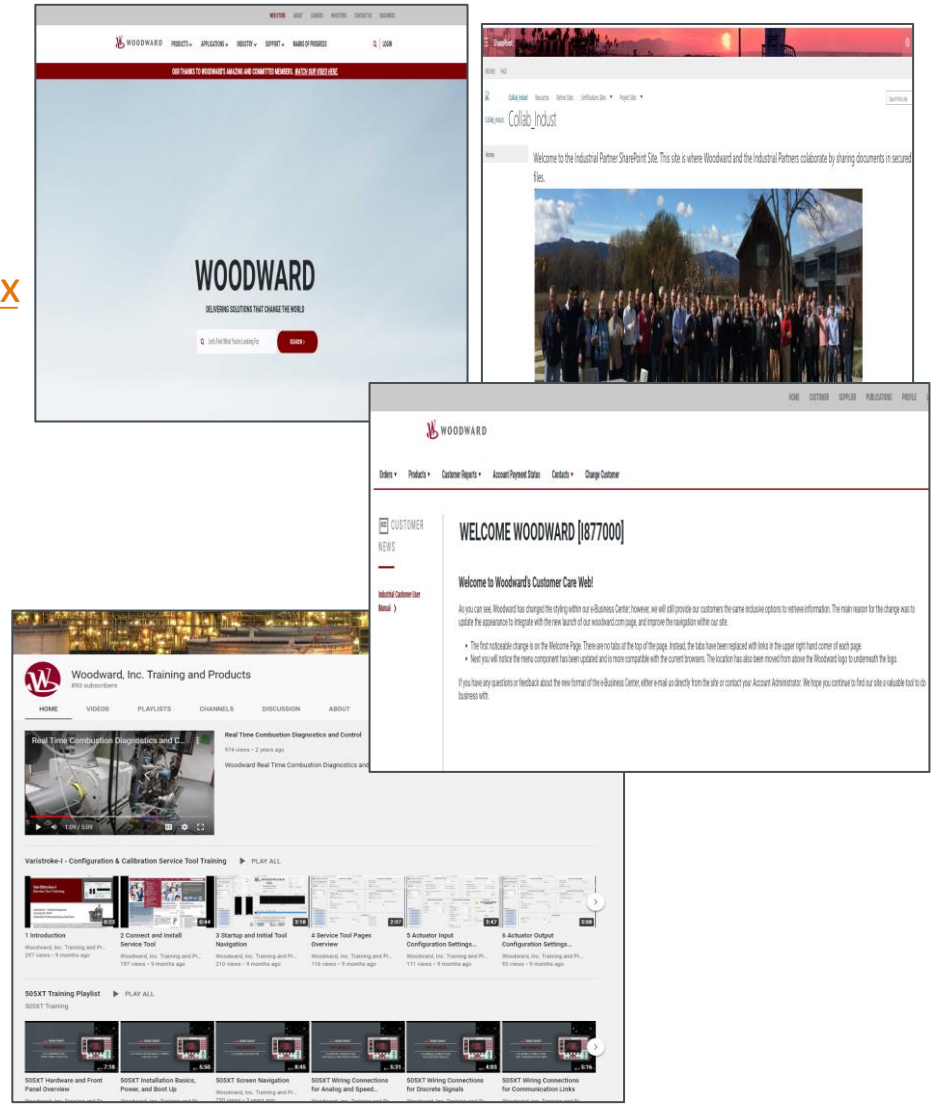
https://www.youtube.com/c/WoodwardIncTrainingandProducts/featured

- **E-Business Portal: Product pricing , serial no, order status, payments.-**

https://ebus.woodward.com/eBusiness/Security/Login.cfm

- **Woodward website : To download installation files of Software, product manuals, helpdesk, product info, knowledgebase**

https://www.woodward.com/



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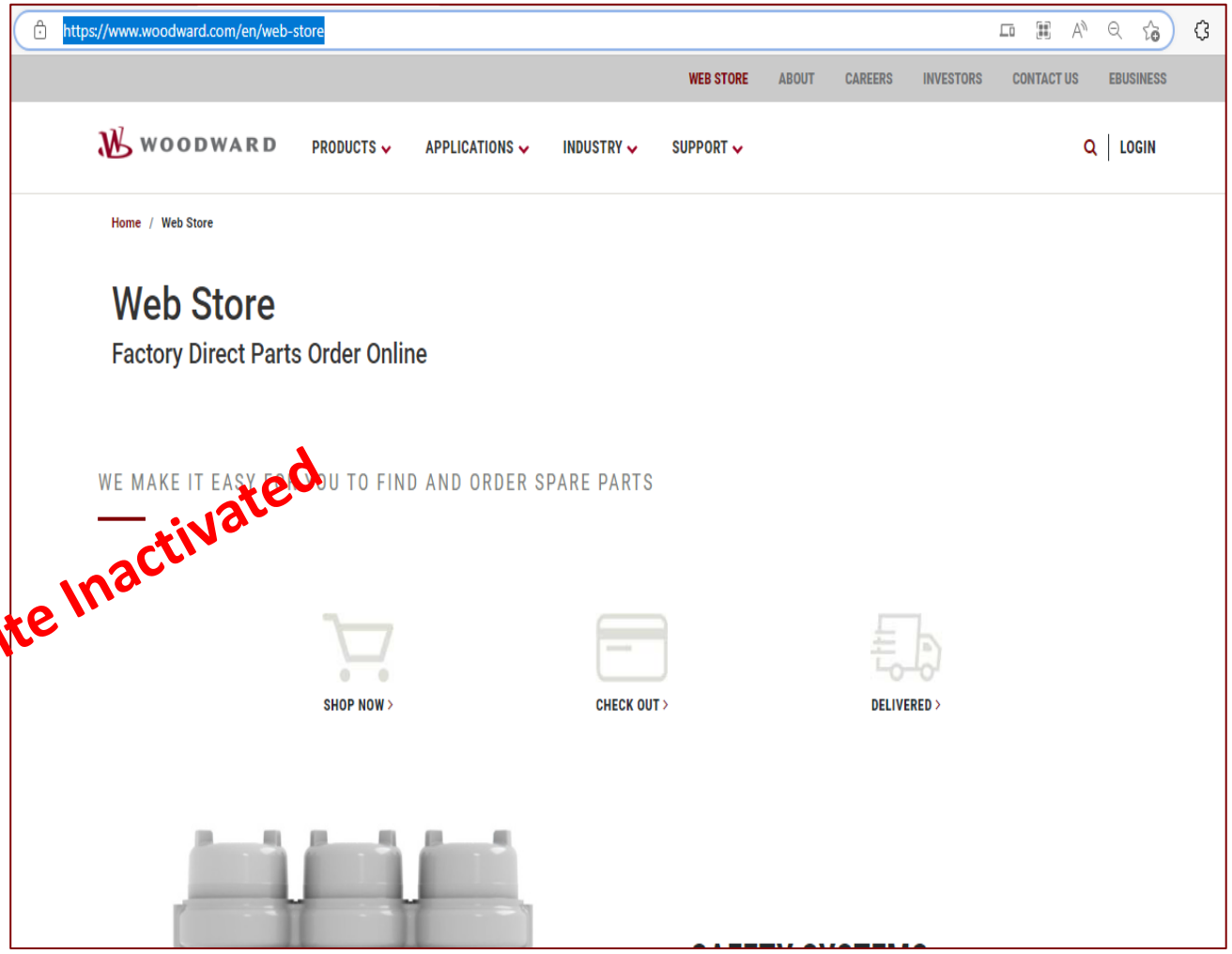
Inactivation of Woodward E-Commerce webstore

Woodward's e-commerce website is inactivated until further notice . Please contact your Woodward representative or Channel partner for sales requirements .

E-Commerce Portal :https://www.woodward.com/en/web-store



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