

# 721 Digital Marine Control



#### **APPLICATIONS**

The Woodward 721 Digital Marine Control controls reciprocating engines in marine propulsion applications with single or multiple engines operating at variable or fixed engine speed, with either fixed or controllable pitch propellers.

The 721 marine control provides excellent control performance for low, medium and high speed engines and has flexible dynamics which allow you to tailor the performance for each engine's operating conditions.

An advanced speed sensing algorithm has a torsional canceling feature with no speed sensing delay. This technology provides stable operation for all engine conditions.

For maximum safe operation and the added benefit of a ballhead backup governor, the 721 control can be used with the PG-EG family of marine governor/actuators with ballhead backup, with EMA all-electric marine actuators, or with any Woodward electric-hydraulic actuator.

The 721 Digital Marine Control is designed to meet applicable standards of ship classification agencies (type approvals pending).

### **DESCRIPTION**

The Woodward Hand Held Programmer makes all adjustments quickly and easily. (A standard ASCII character computer terminal with an RS-422 serial port may also be used). The control saves all set points in permanent memory, which does not require batteries or other power sources to retain data. The Handheld Programmer prevents tampering with set points, yet allows entries to be easily changed when necessary.

#### Service Mode

**Monitor Analog** – monitors analog values (engine speed, speed reference, actuator output, limit condition, etc.)

**Dynamic** – adjusts the control (gain, reset, compensation, gain slope, etc.)

**Speed Set** – sets the control adjustments related to speed setting

**Limit Set** – sets the fuel limit adjustments that limit and define the actuator output current (manifold, torque, start, rough sea limit)

**Monitor Alarm** – monitors alarm conditions

**Control Mode**—monitors control conditions

Idle Droop - Sets idle droop

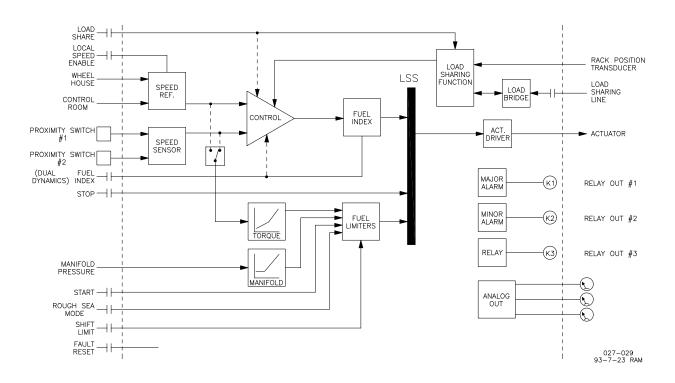
#### Configure Mode

This mode permits setting the control configuration (rated speed, gear teeth, actuator output, alarms, etc.).

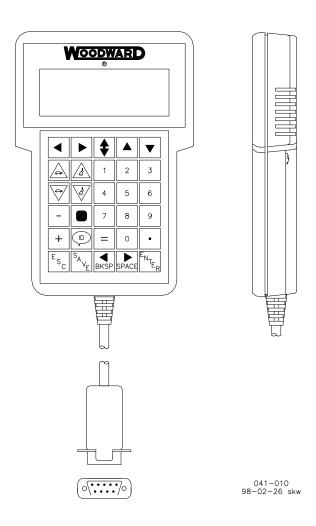
- Flexible Dynamics for Marine Engines
- Advanced Speed-Sensing Algorithms for Smoother Steady-State Operation
- Custom or Standard Application Software
- Compact, Reliable, Single Chassis Control
- EU Directive Compliant; UL/cUL Listed

## **SPECIFICATIONS**

Operating Temperature. 4.0 to +70 °C (-40 to +158 °F) Storage Temperature. 9.55 to +105 °C (-67 to +221 °F) Humidity. 9.59% at 38 °C (100 °F)	Environmental Specifications		
Humidity		40 to +70 °C (-40 to +158 °F)	
US MIL-STD 810D, Method 507.2, Proc. III EN 50082-2 and EN 50081-2 (and/or US MIL-STD 810D, Method 507.2, Procedure III ASTM B 117-73 Mechanical Vibration 24-2000 Hz swept sine, 2.5Gs constant accel Mechanical Shock US MIL-STD 810C, Method 516.2, Proc. I, II, V  Control Characteristics Steady State Speed Band Control Parameters Flexible controls are available with the following functions: *Map Dynamics Adjustment *Gain Slope *Window Control *Fuel Indexing Control *Fuel Indexing Control *Fuel Indexing Control *Gompound Engine Load Sharing *Fuel Control by Manifold Limiter, Torque Limiter, or Start Limiter  Inputs Speed Signal Input and Range1-2 magnetic pickups or 1-2 proximity switches 400 Hz to 15 000 Hz (10-2100 rpm)  18-40 Vdc (24 or 32 Vdc nominal) 88-132 Vac 50/60 Hz (120 Vac nominal) 90-150 Vdc (125 Vdc nominal) 90-150 Vdc (125 Vdc nominal) 90-150 Vdc (125 Vdc nominal) Power Consumption 18 W nominal Discrete Inputs (8) Typically assigned to any of the following: *Start/Stop *Inde/Rated *Local Speed Setting Enable *Fault Reset *Fault Res	Storage Temperature		
EMI/FRI Specification  EN 50082-2 and EN 50081-2 (and/or US MIL-STD 810D, Method 507.2, Procequer III  ASTM B 117-73  Mechanical Vibration  24-2000 Hz swept sine, 2.5Gs constant accel  Mechanical Shock  US MIL-STD 810C, Method 516.2, Proc. I, II, V   Control Characteristics  Steady State Speed Band  Rated speed ±% of 1% over all operating conditions  Control Parameters  Flexible controls are available with the following functions:  **Map Dynamics Adjustment  **Vindow Control  **Compound Engine Load Sharing  *Fuel Indexing Control  **Compound Engine Load Sharing  *Fuel Control by Manifold Limiter, Torque Limiter, or Start Limiter  Inputs  Speed Signal Input and  Range1-2 magnetic pickups or 1-2 proximity switches  400 Hz to 15 000 Hz (10-2100 rpm)  400 Hz to 15 000 Hz (120 Vac nominal)  **Be-132 Vac 50/60 Hz (120 Vac nominal)  **Power Consumption  18 W nominal  Discrete Inputs (8)  **Start/Stop  **Load Speed Setting Enable  **Start/Stop  **Load Sharing/(Dual Dynamics)  Analog Inputs (4)  **Typically assigned to any of the following:  **Lenable Load Sharing/(Dual Dynamics)  **Analog Inputs (4)  **Typically assigned to any of the following:  **1-2 Remote Speed Inputs (4-20 mA or 1-5 Vdc fror remotely setting engine speed)  **Manifold Air Pressure Input (4-20 mA or 1-5 Vdc fror manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients)  **Paced Input  **Speed Input  **Speed Setting  **Ack Position Sensor (for load sharing)  **Outputs  **Relays (3)  **Relays (3)  **Mainfold Air Pressure Input (4-20 mA or 1-5 Vdc from many of the following:  **Speed Input  **Speed Input  **Speed Setting  **Ack Position Sensor (for load sharing)  **Compliance  **UL/CUL  **Limit LSS  **Compliance  **UL/CUL  **Listed  **Listed	Humidity	95% at 38 °C (100 °F)	
Method 507.2, Procedure III  ASTM B 117-73  Mechanical Vibration		US MIL-STD 810D, Method 507.2, P	roc. III
Sait Spray	EMI/RFI Specification		
Mechanical Vibration	·		
Mechanical Vibration	Salt Spray		
Mechanical Shock	Mechanical Vibration	24-2000 Hz swept sine, 2.5Gs const	ant accel
Steady State Speed Band Rated speed ±¼ of 1% over all operating conditions.  Control Parameters Flexible controls are available with the following functions:  *Map Dynamics Adjustment *Gain Slope *Fuel Indexing Control *Uniform Control *Compound Engine Load Sharing *Fuel Indexing Control *Fuel Index Control			
Steady State Speed Band Rated speed ±¼ of 1% over all operating conditions.  Control Parameters Flexible controls are available with the following functions:  *Map Dynamics Adjustment *Gain Slope *Fuel Indexing Control *Uniform Control *Compound Engine Load Sharing *Fuel Indexing Control *Fuel Index Control	0 ( - 1 0   (		
Control Parameters			
*Map Dynamics Adjustment *Gain Slope *Fuel Indexing Control *Compound Engine Load Sharing *Idle Droop *Fuel Control by Manifold Limiter, Torque Limiter, or Start Limiter *Inputs**  Speed Signal Input and Range1-2 magnetic pickups or 1-2 proximity switches 400 Hz to 15 000 Hz (10-2100 rpm)  Power Supply			
#Window Control	Control Parameters		
#Compound Engine Load Sharing *Idle Droop *Fuel Control by Manifold Limiter, Torque Limiter, or Start Limiter			
#Fuel Control by Manifold Limiter, Torque Limiter, or Start Limiter  ### Imputs    Speed Signal Input and			
Inputs   Speed Signal Input and   Range1-2 magnetic pickups or 1-2 proximity switches   400 Hz to 15 000 Hz (10-2100 rpm)   18-40 Vdc (24 or 32 Vdc nominal)   88-132 Vac 50/60 Hz (120 Vac nominal)   90-150 Vdc (125 Vdc nominal)   90-150 Vdc nominal   90-150			
Speed Signal Input and Range1-2 magnetic pickups or 1-2 proximity switches		•Fuel Control by Manifold Limiter, To	rque Limiter, or Start Limiter
Speed Signal Input and Range1-2 magnetic pickups or 1-2 proximity switches	Inputs		
Adol Hz to 15 000 Hz (10–2100 rpm) Power Supply		Range1–2 magnetic pickups or 1–2 r	proximity switches
Power Supply			STOMITHEY OWNOTION
88-132 Vac 50/60 Hz (120 Vac nominal) 90-150 Vdc (125 Vdc nominal) Power Consumption		18–40 Vdc (24 or 32 Vdc nominal)	
Power Consumption			
Power Consumption			,
Discrete Inputs (8) Typically assigned to any of the following:  -Start/Stop -Idle/Rated -Start/Stop -Start/Stop -Idle/Rated -Start/Stop -Start Fuel Limiter Level -Rough Sea Mode -Fault Reset -Enable Load Sharing/(Dual Dynamics) -Enable Fuel Indexing/(Dual Dynamics) -Typically assigned to any of the following: -1-2 Remote Speed Inputs (4-20 mA or 1-5 Vdc for remotely setting engine speed) -Manifold Air Pressure Input (4-20 mA or 1-5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) -Rack Position Sensor (for load sharing)			
Start/Stop  Local Speed Setting Enable  Rough Sea Mode  Enable Load Sharing/(Dual Dynamics)  Enable Fuel Indexing/(Dual Dynamics)  Finable Fuel Indexing/(Dual Dynamics)  Finable Fuel Indexing/(Dual Dynamics)  Typically assigned to any of the following:  1-2 Remote Speed Inputs (4-20 mA or 1-5 Vdc for remotely setting engine speed)  Manifold Air Pressure Input (4-20 mA or 1-5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients)  Rack Position Sensor (for load sharing)   Outputs  Actuator  20-160 mA or 4-20 mA  Analog Outputs (3).  Typically assigned to any of the following:  Speed Input  Actuator Output  Actuat			
•Local Speed Setting Enable •Rough Sea Mode •Fault Reset •Enable Load Sharing/(Dual Dynamics) •Enable Fuel Indexing/(Dual Dynamics)  *Typically assigned to any of the following: •1-2 Remote Speed Inputs (4-20 mA or 1-5 Vdc for remotely setting engine speed) •Manifold Air Pressure Input (4-20 mA or 1-5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) •Rack Position Sensor (for load sharing)  *Outputs*  Actuator			
•Rough Sea Mode •Enable Load Sharing/(Dual Dynamics) •Enable Fuel Indexing/(Dual Dynamics) •Enable Fuel Indexing/(Dual Dynamics) Typically assigned to any of the following: •1–2 Remote Speed Inputs (4–20 mA or 1–5 Vdc for remotely setting engine speed) •Manifold Air Pressure Input (4–20 mA or 1–5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) •Rack Position Sensor (for load sharing)  Outputs  Actuator			
•Enable Load Sharing/(Dual Dynamics) •Enable Fuel Indexing/(Dual Dynamics) Typically assigned to any of the following: •1–2 Remote Speed Inputs (4–20 mA or 1–5 Vdc for remotely setting engine speed) •Manifold Air Pressure Input (4–20 mA or 1–5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) •Rack Position Sensor (for load sharing)  **Outputs** Actuator			
•Enable Fuel Indexing/(Dual Dynamics)  Typically assigned to any of the following:  •1-2 Remote Speed Inputs (4-20 mA or 1-5 Vdc for remotely setting engine speed)  •Manifold Air Pressure Input (4-20 mA or 1-5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) •Rack Position Sensor (for load sharing)  Outputs  Actuator			
Analog Inputs (4)			
•1–2 Remote Speed Inputs (4–20 mA or 1–5 Vdc for remotely setting engine speed)  •Manifold Air Pressure Input (4–20 mA or 1–5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients) •Rack Position Sensor (for load sharing)  Outputs  Actuator	Analog Inputs (4)		
Manifold Air Pressure Input (4–20 mA or 1–5 Vdc from manifold air pressure sensor, for smoke limiting and to prevent overfueling during transients)     Rack Position Sensor (for load sharing)  Outputs  Actuator			
air pressure sensor, for smoke limiting and to prevent overfueling during transients)  Rack Position Sensor (for load sharing)  Outputs  Actuator			
during transients)  •Rack Position Sensor (for load sharing)  Outputs  Actuator			
•Rack Position Sensor (for load sharing)  Outputs  Actuator			
Outputs  Actuator			
Actuator		Rack Position Sensor (for load sharing)	
Actuator	Outpute		
Analog Outputs (3)  Typically assigned to any of the following:  Speed Input  Actuator Output  Limit LSS  Relays (3)  Relays (3)  Relays (3)  Relays (3)  Relays (3)  Major Alarm, Minor Alarm, and one other relay from any of the following:  Fuel Limiter Condition  Rough Sea Mode  Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL  Listed  European Union (EU)  Compliant with EMC Directive 89/336/EEC (some models)		20 160 mA or 4 20 mA	
•Speed Input •Actuator Output •Actuator Output •Limit LSS •Rack Position  Relays (3)  Major Alarm, Minor Alarm, and one other relay from any of the following: •Fuel Limiter Condition •Rough Sea Mode •Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL  Listed  European Union (EU)  Compliant with EMC Directive 89/336/EEC (some models)			
•Actuator Output •Limit LSS •Rack Position  Relays (3)	Alialog Outputs (5)		
•Limit LSS •Rack Position  Relays (3)			
Relays (3)			
following:  •Fuel Limiter Condition •Rough Sea Mode •Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL Listed  European Union (EU) Compliant with EMC Directive 89/336/EEC (some models)	Relays (3)		
•Fuel Limiter Condition •Rough Sea Mode •Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL	rtolayo (o)		and relay from any or the
•Rough Sea Mode •Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL			•Fuel Index Control
•Speed Setting Match (bridge and control room, or other parameter)  Compliance  UL/cUL			r der maex centrer
Department parameter)  Compliance  UL/cUL Listed  European Union (EU) Compliant with EMC Directive 89/336/EEC (some models)			
Compliance UL/cULListed European Union (EU)Compliant with EMC Directive 89/336/EEC (some models)			
UL/cULListed European Union (EU)	_ "	1	
European Union (EU)			
American Bureau of Shipping (ABS)Some Models			
	American Bureau of Shipping (ABS)	Some Models	



## 721 FUNCTIONAL BLOCK DIAGRAM (TYPICAL EXAMPLE)



**HAND-HELD PROGRAMMER** 



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

Plants, Subsidiaries, Branch/Regional Offices

Australia Brazil China Czech Republic England Germany India Japan Korea Mexico Netherlands New Zealand Poland Scotland Singapore United Arab Emirates **United States** 

**Distributors & Service** 

Woodward has an international network of distributors and service facilities. For your nearest representative call (1)(800) 835-5182 or see the Worldwide Directory on our web site (http://www.woodward.com/industrial/address.htm).

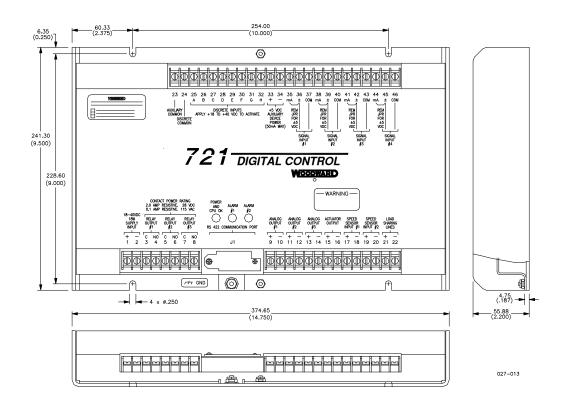
Corporate Headquarters Rockford IL, USA

Rockford IL, USA Ph: (1)(815) 877-7441

www.woodward.com

This document is distributed for informational purposes only. It is not to be construed as creating or becoming part of any Woodward Governor Company contractual or warranty obligation unless expressly stated in a written sales contract.

© Woodward Governor Company, 1993 All Rights Reserved



#### 721 DIGITAL SPEED CONTROL OUTLINE DRAWING

#### **DECLARATION OF INCORPORATION**

In accordance with the EMC Directive 89/336/EEC and its amendments, this controlling device, manufactured by Woodward Governor Company, is applied solely as a component to be incorporated into an engine prime mover system. Woodward Governor Company declares that this controlling device complies with requirements of EN50081-2 and EN50082-2 when put into service per the installation and operating instructions outlined in the product manual.

**NOTICE**: This controlling device is intended to be put into service only upon incorporation into an engine prime mover system that itself has met the requirements of the above Directive and bears the CE mark.

For more information contact:

00/2/F