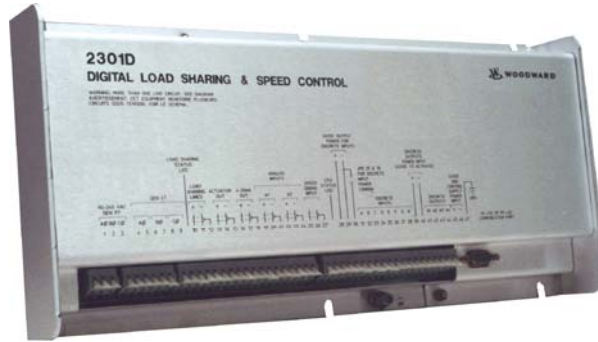


2301D-KG2

Digital Load Sharing and Speed Control

Applications

The 2301D-KG2 is a field-configurable control designed for single-shaft gas turbine applications. This control's configurability allows it to be easily applied in a diverse range of single-shaft gas turbine applications. The 2301D-KG2 control can be configured as a drop-in replacement for Woodward 2301A or 2301A LSSC controls, or for use within new turbine applications.



The 2301D-KG2 control includes the following turbine control functions:

- Speed Control
- Speed Accel/Decel Limiting
- CDP Start Fuel Ramp
- Load Sharing (with soft load/unload transfer)
- EGT limiter
- Droop/Isoch Control
- CDP limiter
- Servlink (DDE)/Modbus® * Communications
- Analog and digital synchronizer
- Platform Diagnostics
- Dual and bi-fuel operation
- Power/Actuator-Drive Droop
- Power Sensor Input (PTs & CTs)

An integral RS-232 communications port allows users to interface with the 2301D-KG2 through industry-standard Dynamic Data Exchange (DDE) protocol.

*—Modbus is a trademark of Schneider Automation Inc.

Description

The Woodward 2301D-KG2 is a microprocessor based control with integral application software designed for single-shaft gas turbine applications. Like Woodward's 2301A line of controls, this control is housed in a sheet-metal chassis and consists of a single printed circuit board. To facilitate unit retrofits, the 2301D-KG2's I/O terminals are located in the same general location as Woodward's 2301A line of controls.

This control is designed to perform the core fuel control functions of a small gas turbine package. The application software is field configurable, allowing it to be configured to meet site-specific requirements.

With more I/O than its predecessor (the 2301A LSSC), the 2301D-KG2 control also has serial communications, allowing it to easily interface with the package PLC or plant DCS using a DDE link.

The 2301D-KG2 is configured and serviced (dynamic adjustments made) via a laptop computer connected to the control's RS-232 communications port. These configuration and dynamic settings are set, changed, tuned, and saved via a laptop computer and Woodward's user-friendly Watch Window software program. This Windows based PC program allows users to set and adjust all application-based parameters, plus upload and download configurations to and from the control.

- Single-shaft small gas turbine applications
- Digital load sharing and speed control
- Droop and isochroous control
- Soft load transfer
- CDP accel / decel scheduling
- EGT limiting
- PC configurable with Woodward Watch Window software
- Dual Fuel and bi-fuel operation with two separate analog outputs

Control Functions

Turbine Start-up

The 2301D-KG2 provides configurable turbine start-up schedule via a Start Ramp with optional CDP maximum fuel limiting. On start-up, the turbine accelerates according to the Start Ramp or CDP schedule until the speed control loop takes control of the turbine.

Isoch/Droop Operation

When used for generator drive applications, the 2301D-KG2 can operate in either an isochronous or droop load mode. In the "Isoch" mode, the 2301D-KG2 controls plant/unit frequency by maintaining turbine speed. In the "Droop" mode the 2301D-KG2 controls generator load, and unit speed is controlled by the utility bus.

Load Sharing

The 2301D-KG2 includes an analog load sharing network input which is compatible with Woodward's 2301A line of controls. The control's soft load/unload transfer function can also be configured to rate limit unit loading and unloading.

Accel/Decel Limiters

The 2301D-KG2 can be configured for Speed Derivative limiting. With Speed Derivative limiting, the control senses the derivative (acceleration/deceleration) of the turbine speed via the control's speed input, and through a PID controller limits fuel valve position.

EGT and SPM-A Input

The 2301D-KG2 can be configured for EGT limiting. With this functionality, the control accepts a ± 3 Vdc or 0-5 Vdc signal representing turbine exhaust gas temperature (EGT). Via a PID controller it will limit fuel admission to a maximum exhaust temperature. The maximum EGT limit setting is adjustable both on- and off line.

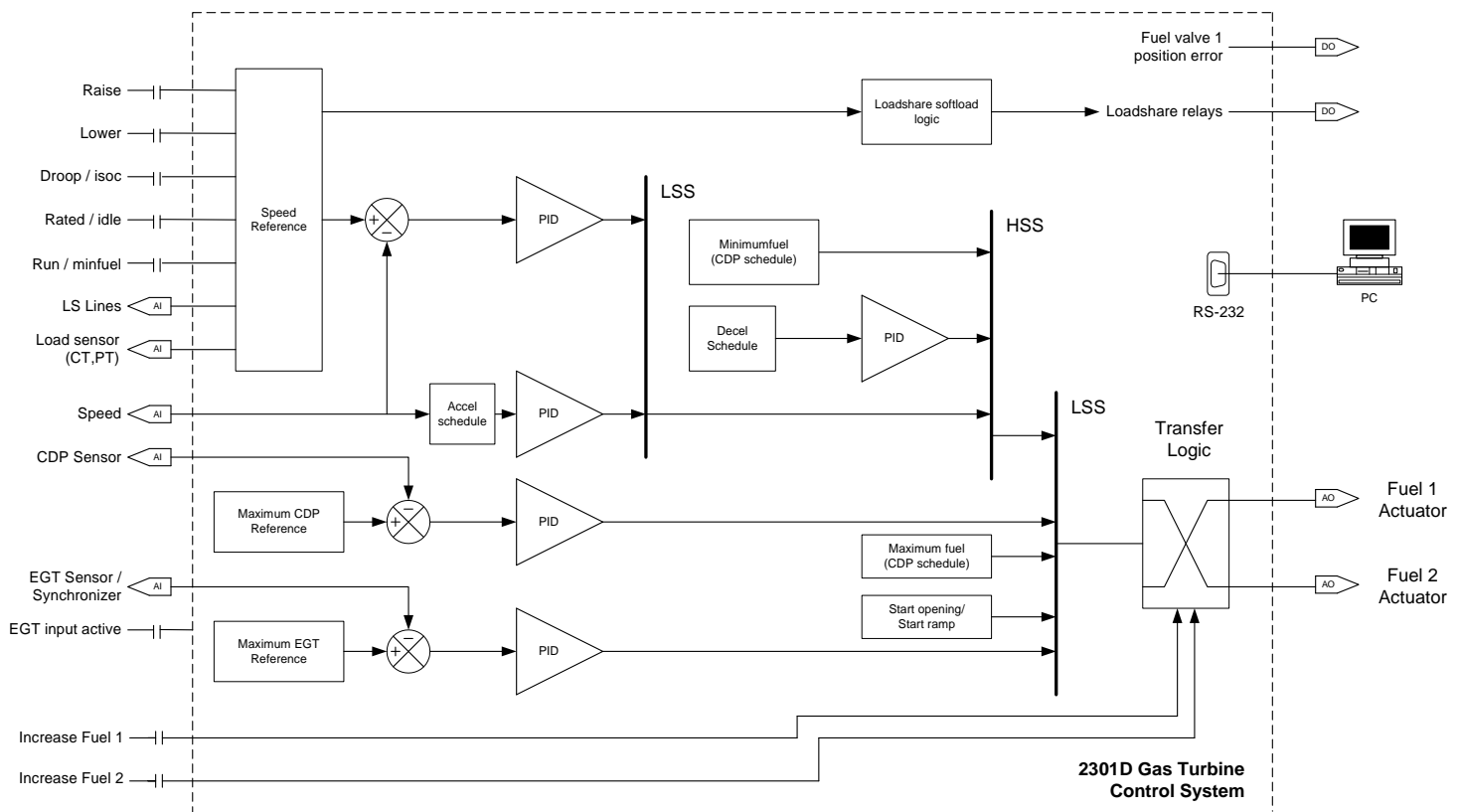
In addition, the 2301D-KG2 is configured to accept a ± 3 Vdc or 0-5 Vdc synchronizing signal on the same input channel. The ± 3 Vdc input is compatible with and intended to be used in conjunction with Woodward's SPM-A synchronizers.

Minimum Fuel/Maximum Fuel Limits

The 2301D-KG2 control has configurable minimum and maximum fuel limits to limit fuel valve travel during turbine operation. The minimum fuel limit is used to prevent lean flame-out situations to occur.

Communications

The 2301D-KG2's RS-232 port serves two purposes: to configure and service the control, and optionally to interface with the control through DDE communications. A Windows based PC program used on a control-connected laptop is used to set and adjust all application-based parameters, plus upload and download configurations to and from the control. Once the control has been configured, an optional switch can be used to switch to ports Modbus protocol. Through Modbus communications, a user can monitor all turbine-specific parameters as well as control the unit (start, stop, etc.) as desired.



2301D-KG2 Digital Control Block Diagram

Configurability

The configurability of the 2301D-KG2's application software allows such parameters as turbine speed range, gear teeth, analog I/O ranges, internal control limits, and actuator output current to be configured off-line. Some parameters can also be modified on-line.

Configured Input Signals

Discrete Inputs (8)

All discrete inputs are assigned to predefined functions:

- Droop / Isoch operation
- GG rated speed / Idle speed
- Run / Minfuel operation
- Increase fuel 1
- Increase fuel 2
- Raise speed or load
- Lower speed or load
- Select EGT or synchronizer

Speed Signal (1)

One magnetic pickup speed signal (100–24 950 Hz)

Analog Inputs (2)

Two analog Inputs to accept:

- CDP signal
- EGT or Synchronizer

Configured Output Signals

Discrete Outputs (4)

Only one discrete output is configured:

- Fuel valve 1 position error
- Fuel transfer active
- Spare
- Spare
- Spare

Actuator Signal Output (1)

One actuator driver (4–20 mA/ 20–200 mA).

Analog Outputs (1)

A regular analog output is configured for the secondary fuel valve demand (4–20 mA).

Specifications

Woodward Part Numbers:	2301D-KG2 Digital Load Sharing and Speed Control, 24 Vdc input Watch Window Installation
8701-670	
8923-932	
Power Supply Rating	18–40 Vdc (SELV)
Power Consumption	less than or equal 20 W nominal
Input Supply Voltage & Current:	18 V (589 mA); 24 V (nominal) (431 mA); 32 V (319.6 mA)
Inrush Current	7 A for 0.1 ms (24 Vdc input)
Steady State Speed Band	±0.25% of rated speed
Magnetic Pickup	100–24 950 Hz
Discrete Inputs (8)	3 mA at 24 Vdc, impedance approximately 5.2 kΩ
Analog Input #1, #2	4–20 mA
Actuator Output	4–20 or 20–200 mA to actuator, software configurable
Analog Output	4–20 mA, internally powered
Discrete Outputs (4)	Configurable relay drivers, powered by external +12 or +24 Vdc source, max output current 200 mA
Communication Port (J2)	RS-232, 9-pin connector, 1200 to 38 400 baud, full duplex
Ambient Operating Temperature	–40 to +70 °C (–40 to +158 °F)
Storage Temperature	–40 to +105 °C (–40 to +221 °F)
Humidity	95% at +20 to +55 °C (+68 to +131 °F)
	Lloyd's Register of Shipping Specification Humidity Test 1
Mechanical Vibration	Lloyd's Register of Shipping Specification Vibration Test 2
Mechanical Shock	US MIL-STD 810C, Method 516.2, Procedure I (basic design test), Procedure II (transit drop test, packaged), Procedure V (bench handling)
Equipment Classification	Class 1 (grounded equipment)

Regulatory Compliance

European Compliance for CE Mark

EMC Directive

Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility.

Low Voltage Directive

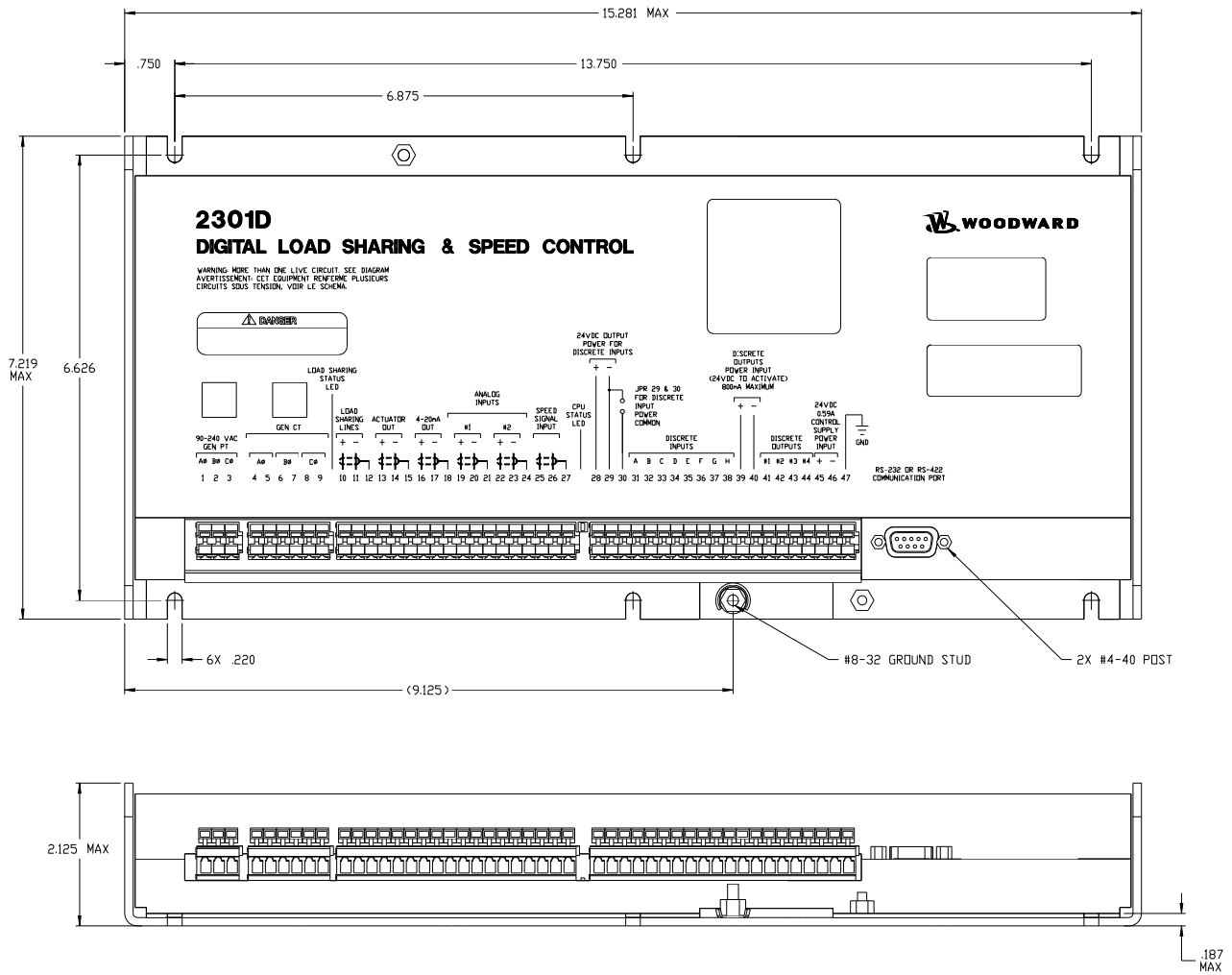
Declared to the 73/23/EEC COUNCIL DIRECTIVE of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

North American Compliance

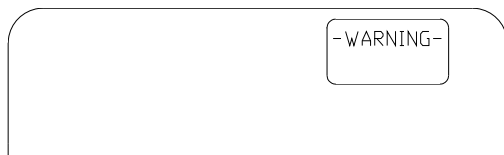
CSA

CSA certified for Ordinary Locations for use in Canada and the United States (Certificate 1150575).

NOTE—Wiring must be in accordance with applicable electric codes with the authority having jurisdiction.



2301D-KG2 Digital Control Outline Drawing



15.281	388.0
13.750	349.2
7.219	183.3
6.875	174.6
6.626	168.3
2.125	54.0
.750	19.0
.220	5.6
INCH	MM
INCH TO MM CONVERSION	

260-038
00-08-04



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