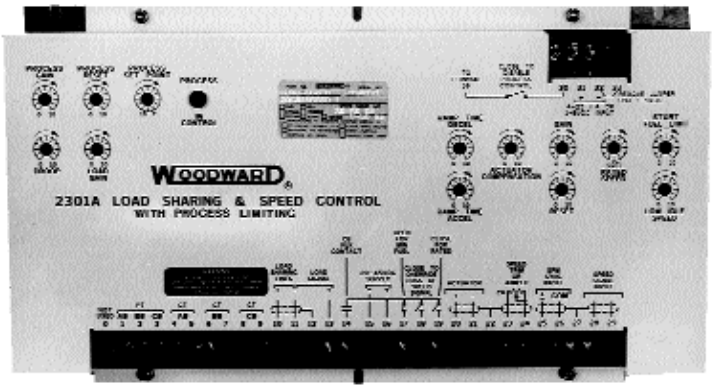
2301A Load Sharing & Speed Control

with Temperature or Process Limiting

Applications



Woodward's 2301A Load Sharing and Speed Control with temperature Limiting or Process Limiting is used in electric generator systems for which load sharing is desired. It can be used with diesel or gas engines, or steam or gas turbines, and is compatible with all Woodward electronic controls.

Description

Rugged construction has been designed into the 2301A control for high reliability in adverse environments.

Models for process limiting accept a 4–20 mA or 1–5 Vdc control signal. Models for temperature limiting accept a signal from a Type K thermocouple. Temperature Limiting and Process Limiting controls are available for either low voltage or high voltage supply.

Control of speed and load sharing requires, in addition to a 2301A control, a speed-sensing device, an actuator, an external power source, and a means of sensing voltage and current. These components make up a basic 2301A system. Additional devices such as Speed and Phase Matching Synchronizers, Import/Export controls, and Generator Loading Controls may be added.

Features

The 2301A models offer many functional design features. These include:

- A wide dynamic adjustment range to accommodate a variety of prime movers, including diesel or gas engines, or steam or gas turbines.
- Protection from electromagnetic and radio frequency interference.
- An internal, isolated power supply for improved noise immunity and ground-loop protection.
- Low-voltage model: Once powered at 15 volts or above, the control will operate with a supply voltage as low as 9.6 volts and as high as 77 volts for up to five minutes, or 120 volts for 1/10 of a second without damage and with negligible control transients. Normal power is 20–45 Vdc.
- High -voltage model: The control will operate with a supply voltage as low as 75 Vdc (60 Vac) and as high as 200 Vdc (140 Vac) for up to five minutes, or 300 Vdc (212 Vas) for 1/10 second without damage, and with negligible control transients. Normal power is 90–150 Vdc or 88–132 Vac.

- Isochronous or droop speed control
- Isochronous load sharing
- Linear idle to rated speed ramp
- Automatic fuel limiting during starts
- 24 and 115 volt operation
- Wide dynamic adjustment range

A circuit monitors the speed sensor for loss of speed signal, calling for minimum fuel when signal loss is detected. An optional override switch can be used when needed for start up.

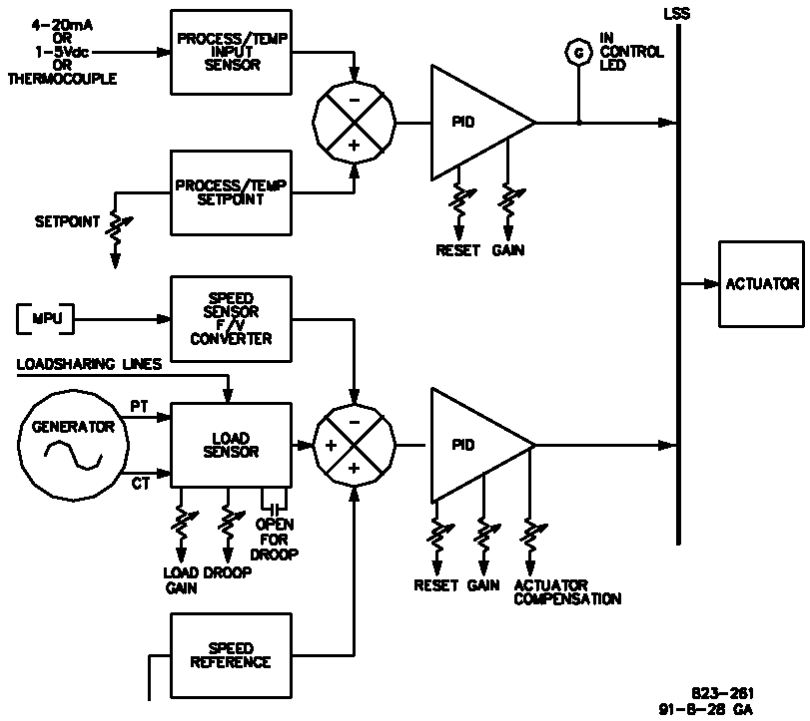
Either isochronous or droop speed control can be selected by an optional switch or relay in series with the circuit breaker auxiliary contact and terminal 14 on

the control. The 2301A allows isochronous load sharing between 2301A systems (or other Woodward electronic load-sharing controls) through load-sharing lines.

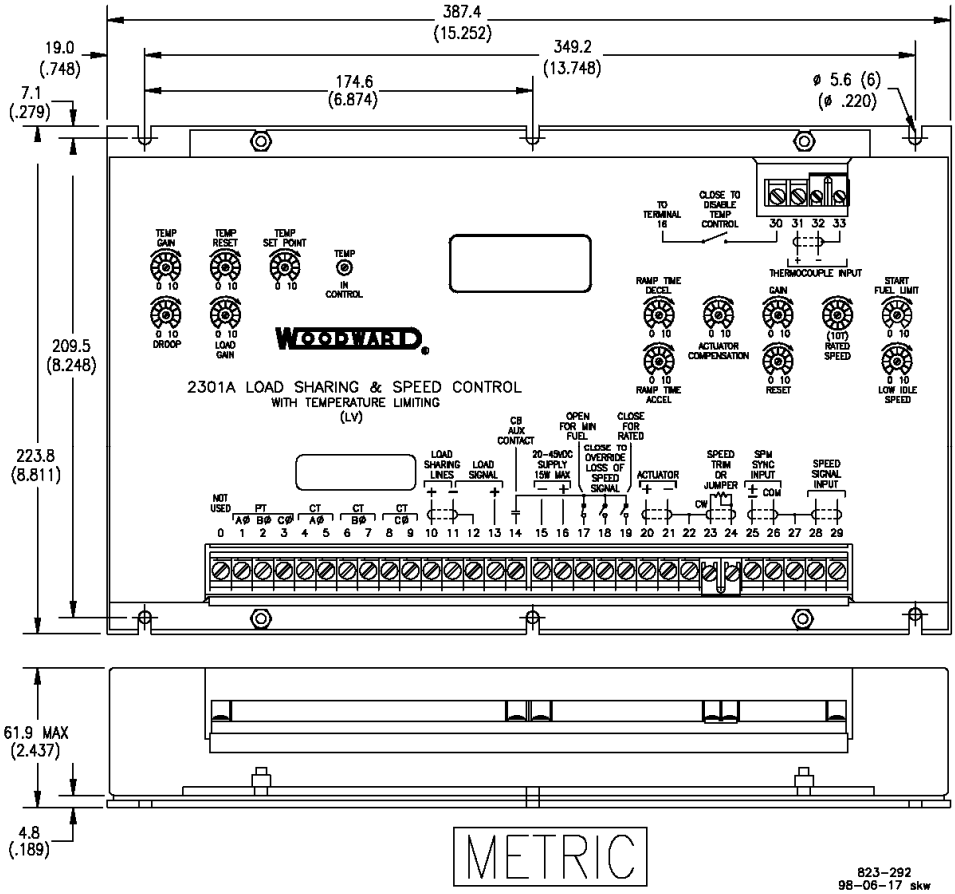
Idle speed, rated speed, and acceleration rates between these two speeds are adjustable from 0 to 10 seconds.

Specifications

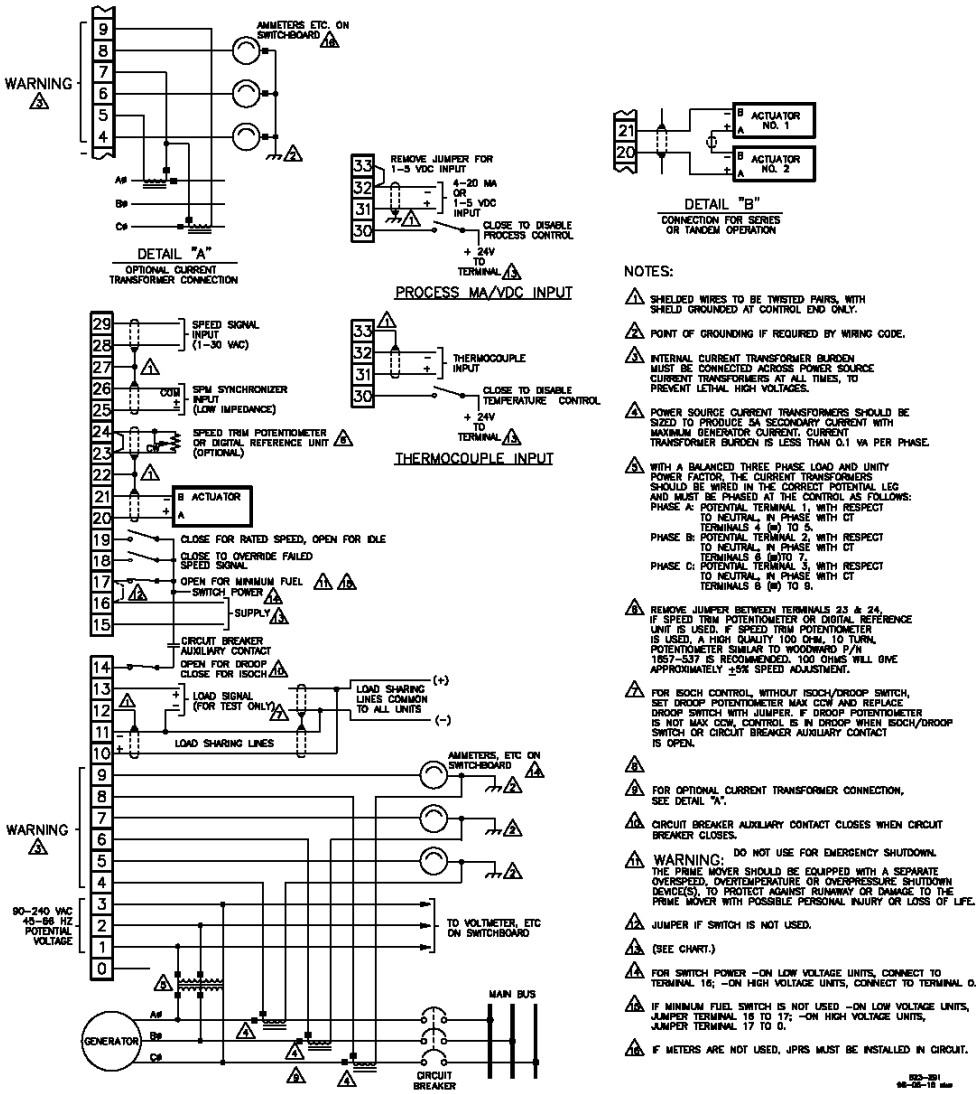
Temperature Input	Type K thermocouple (temperature limiting models only)
Process Input	4–20 mAdc or 1–5 Vdc (process limiting models only)
Load Sensing	3-phase potentials—90 to 240 Vac, 45 to 66 Hz. Maximum load 3 VA per phase 3-phase currents—3 to 7 A at full load. Maximum load is 1 VA
Minimum Fuel (optional)	Opening an external contact in series with terminal 17 and the control's switch power, will send a min-fuel signal to the actuator. The min-fuel signal is intended as an optional means for a normal shutdown.
Droop (optional)	The droop contact is wired in series with the circuit breaker auxiliary contact and terminal 14, and the switch power circuit. Isochronous operation is selected if either is open.
Speed Sensing	1 to 30 Vac. Maximum load is 1 kΩ at 1 kHz
Speed Range	A switch selects one of the following speed ranges: 500 to 1500 Hz 2000 to 6000 Hz 1000 to 3000Hz 4000 to 12 000 Hz Hz = (number of teeth x rpm)/60 The highest expected speed must be in the speed range selected.
Speed Trim (optional)	0 to 100 Ω for 0 to –10% speed change
Failed Speed Signal Override (optional)	An external contact to override the failed speed protective circuit when required for start up
Idle/Rated Ramp (optional)	An external contact to accelerate from idle to rated speed when the contact is closed. Ramp time is adjustable from 0 to 20 seconds
Actuator Output	0 to 200 mA, 30 to 45 Ω
Steady State Speed Band	±0.25% of rated speed
Load Sharing	Within ±5% of rated load with speed settings matched
Droop	0 to 10% range for 6 Vdc load gain
Start Fuel Limit	25 to 100% of specified maximum actuator current
Ramp Times	Acceleration and deceleration times individually adjustable from 0 to 20 seconds between rated and idle
Thermocouple Input Part Numbers	Low Voltage—8272-611 High Voltage—8272-609
mA/Vdc Input Part Numbers	Low Voltage—8272-608 High Voltage—8272-610
Operating Temperature	–40 to +85 °C (–40 to +185 °F)
Storage Temperature	–55 to +105 °C (–67 to +221 °F)
Humidity	95% at 38 °C (100 °F)
Vibration and Shock	4 Gs between 5 and 500 Hz vibration—60 Gs shock
Technical Manual	82386



Block Diagram of 2301A LSSC with Temperature or Process Limiting



Outline Drawing of Low Voltage 2301A LSSC with Temperature Limiting
(Do not use for construction)



NOTES:

1. SHIELDED WIRES TO BE TWISTED PAIRS, WITH SHIELD GROUNDED AT CONTROL END ONLY.
2. POINT OF GROUNDING IF REQUIRED BY WIRING CODE.
3. INTERNAL CURRENT TRANSFORMER BURDEN MUST BE CONNECTED ACROSS POWER SOURCE CURRENT TRANSFORMERS AT ALL TIMES, TO PREVENT LETHAL HIGH VOLTAGES.
4. POWER SOURCE CURRENT TRANSFORMERS SHOULD BE SIZED TO PRODUCE 5A SECONDARY CURRENT WITH MAXIMUM GENERATOR CURRENT. CURRENT TRANSFORMER BURDEN IS LESS THAN 0.1 VA PER PHASE.
5. WITH A BALANCED THREE PHASE LOAD AND UNITY POWER FACTOR, THE CURRENT TRANSFORMERS SHOULD BE WIRED IN THE CORRECT POTENTIAL LEG AND MUST BE PHASED AT THE CONTROL AS FOLLOWS:
   PHASE A: POTENTIAL TERMINAL 1, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 4 (∞) TO 5.
   PHASE B: POTENTIAL TERMINAL 2, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 6 (∞)TO 7.
   PHASE C: POTENTIAL TERMINAL 3, WITH RESPECT TO NEUTRAL, IN PHASE WITH CT TERMINALS 8 (∞) TO 9.
6. REMOVE JUMPER BETWEEN TERMINALS 23 & 24, IF SPEED TRIM POTENTIOMETER OR DIGITAL REFERENCE UNIT IS USED. IF SPEED TRIM POTENTIOMETER IS USED, A HIGH QUALITY 100 OHM, 10 TURN, POTENTIOMETER SIMILAR TO WOODWARD P/N 1857-537 IS RECOMMENDED. 100 OHMS WILL GIVE APPROXIMATELY ±5% SPEED ADJUSTMENT.
7. FOR ISOCH CONTROL, WITHOUT ISOCH/DROOP SWITCH, SET DROOP POTENTIOMETER MAX CCW AND REPLACE DROOP SWITCH WITH JUMPER. IF DROOP POTENTIOMETER IS NOT MAX CCW, CONTROL IS IN DROOP WHEN ISOCH/DROOP SWITCH OR CIRCUIT BREAKER AUXILIARY CONTACT IS OPEN.
8.
9. FOR OPTIONAL CURRENT TRANSFORMER CONNECTION, SEE DETAIL "A".
10. CIRCUIT BREAKER AUXILIARY CONTACT CLOSES WHEN CIRCUIT BREAKER CLOSES.
11. WARNING: DO NOT USE FOR EMERGENCY SHUTDOWN. THE PRIME MOVER SHOULD BE EQUIPPED WITH A SEPARATE OVERSPEED, OVERTEMPERATURE OR OVERPRESSURE SHUTDOWN DEVICE(S), TO PROTECT AGAINST RUNAWAY OR DAMAGE TO THE PRIME MOVER WITH POSSIBLE PERSONAL INJURY OR LOSS OF LIFE.
12. JUMPER IF SWITCH IS NOT USED.
13. (SEE CHART.)
14. FOR SWITCH POWER -ON LOW VOLTAGE UNITS, CONNECT TO TERMINAL 16; -ON HIGH VOLTAGE UNITS, CONNECT TO TERMINAL 0.
15. IF MINIMUM FUEL SWITCH IS NOT USED -ON LOW VOLTAGE UNITS, JUMPER TERMINAL 16 TO 17; -ON HIGH VOLTAGE UNITS, JUMPER TERMINAL 17 TO 0.
16. IF METERS ARE NOT USED, JPRS MUST BE INSTALLED IN CIRCUIT.

Plant Wiring Diagram

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