WARNING—FOLLOW INSTRUCTIONS
Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

WARNING—OVERSPEED PROTECTION
The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

General

The TQ-125™ control is an integrated analog speed control and 0.34 J (0.25 ft-lb) actuator. Upon start, the TQ-125 control brings the engine to rated speed and maintains isochronous single-engine speed.

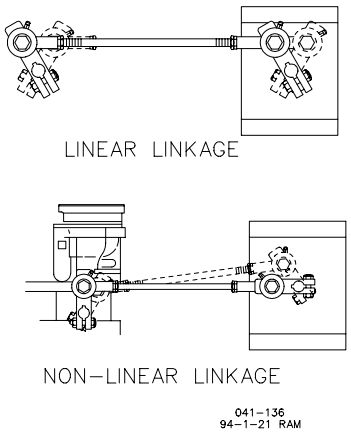
Installation

Cable lengths between the TQ-125 control and battery, should not exceed 6 m (20 ft). Mount the control in a location that allows space for potentiometer adjustment. Do not expose the control to sources of radiant heat such as exhaust manifolds or turbochargers. The TQ-125 control is designed to operate within an ambient temperature range of –40 to +70 °C (–40 to +158 °F). Also, choose a protected location so the control will not be damaged when moving the engine/generator set or when moving nearby equipment.

When using a magnetic pickup (MPU), install the MPU through a housing or rigid bracket. Make sure the sensed gear is of a magnetic material (usually iron or non-stainless steel). The gap between the pickup and the outside diameter of the gear should be set between 0.25 and 1.02 mm (0.010 and 0.040 inch) at the closest point (allow for radial runout).

1. The TQ-125 control should be rigidly mounted to the engine with a bracket. The control is mounted to the bracket with four 0.250-28 screws which attach to the shaft side of the control.

2. The linkage for diesel engine applications should be linear, and for carbureted engines non-linear. The linkage should not bind or have play in it.



3. A positive shutdown device, such as a spring, is required to ensure shutdown upon loss of signal to the TQ-125 control. The maximum force of the spring must be less than 0.17 J (1.5 in-lb) at the actuator.

Control Adjustment

Use either a tachometer or frequency meter to check engine speed for control adjustment.

1. When sensing speed from the ignition coil, set the appropriate DIP switches for the number of cylinders and the frequency (see chart). (The switch is on when the switch is depressed with a pen or pencil on the side closest to the control's outer edge.)

No. of Cylinders	Sw1	Sw2	Sw3
4	Off	Off	On
6	Off	On	Off
8	On	Off	Off

[When sensing speed with the DIS version, close DIP switch 3.]

Frequency	Sw4
60 Hz	On
50 Hz	Off

2. When using a magnetic pickup to sense speed, use the rated engine rpm and the number of teeth on the flywheel to calculate the rated MPU frequency in hertz:

$$\text{Rated MPU Frequency (Hz)} = \frac{(\text{rpm})\ (\#\ \text{of teeth on gear})}{60}$$

With this calculated MPU frequency, find the speed range in the table below that includes this MPU frequency.

Set the four-position DIP switch on the control to the switch combination that matches the desired speed range.

Speed Range (Hz)					
Low	**High**	**Sw1**	**Sw2**	**Sw3**	**Sw4**
1350	1621	Off	Off	On	Off
1554	1946	Off	Off	On	On
1876	2349	Off	On	Off	Off
2251	2819	Off	On	Off	On
2766	3464	Off	On	On	Off
3321	4159	Off	On	On	On
4074	5101	On	Off	Off	Off
4888	6122	On	Off	Off	On
4964	6216	On	Off	On	Off
5546	6944	On	On	Off	Off
5956	7459	On	Off	On	On
6438	8062	On	On	On	Off
6656	8334	On	On	Off	On
7726	9500	On	On	On	On

3. Check the mounting of the control and linkage to ensure the 60 degree actuator shaft rotation matches the fuel metering device. The actuator rotates counterclockwise as seen from the shaft side.

Pre-Start Potentiometer Settings

- Speed Trim fully counterclockwise (minimum)
- Start Fuel fully clockwise (maximum) [if equipped]
- Stability at mid-position
- Gain at mid-position

Start-up and Adjustment

Starting the Engine

Place the Run/Stop switch in the Run position. Start the engine using the manufacturer's instructions.

WARNING—START-UP
Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

If the engine does not start, check to ensure that the control is receiving the proper battery voltage, and that the magnetic pickup is putting out at least 1.0 Vrms. Also, check that the engine is cranking at a minimum of 5% of rated speed, that the engine is receiving proper fuel, and that the shutdown solenoid is in the run condition.

If the engine is unstable after start-up, slowly turn the gain pot counterclockwise until it is stable. If the engine is stable, turn the gain slowly clockwise until the engine is unstable and then turn the gain slightly counterclockwise until the engine is stable again.

Speed Trim Adjustment

After the engine is stable, adjust the Speed Trim clockwise until the correct rated engine speed is obtained. If the rated engine speed cannot be obtained or if the engine speed is already above rated speed, the four-position DIP switch is not in the correct setting. If it is necessary to readjust the speed setting switch, the engine must be shut down during this procedure.

WARNING—SHUT DOWN ENGINE
The engine must always be shut down during speed switch adjustments to prevent the possibility of engine overspeed during this process.

Stability and Gain Settings

The Stability and Gain can now be adjusted to obtain the type of engine response desired. The stability and gain adjustments allow you to change the way the engine responds to load steps and speed changes. With a high stability setting, the engine will start at a controlled rate with little or no speed overshoot. Load steps will produce relatively little speed overshoot when the engine returns to rated speed. This "soft" engine response will occur at the expense of longer recovery times. A low stability setting will produce a "fast" engine response with short times to accelerate to rated speed and quick recovery times from load steps. This will occur at the expense of overshoots or underdamped oscillations (ringing) on speed and load transients. A Stability setting of mid-position is a good compromise between a "fast" engine response and a "soft" engine response, and it is usually quite acceptable for most installations and applications.

When either the Gain or Stability is increased, the other adjustment will have to be decreased to maintain a stable engine. It is desirable to have as high a Gain setting as possible at the selected Stability setting in order to reduce the amount of engine speed variations. Check the response of the engine after each adjustment by load-stepping the engine. If it is not possible to load-step the engine, the engine stability can be checked by bumping the actuator linkage to increase/decrease fuel rack position. Repeat the following tuning procedure until the engine responds as desired.

NOTE
Too high a gain setting may result in stable operation at normal temperatures but could cause oscillation when the engine is cold. Readjustment may be required for satisfactory cold-start operation.

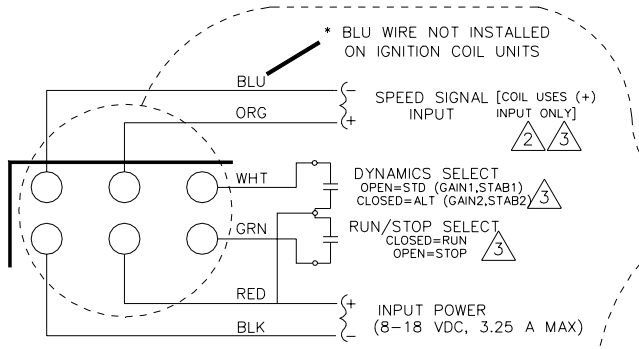
For dual-fuel applications, close the Dynamics Select switch, and repeat the Gain/Stability adjustments for the alternate fuel.

Start Fuel Limiting

(applies only to controls equipped with the Start Fuel Limiting option)

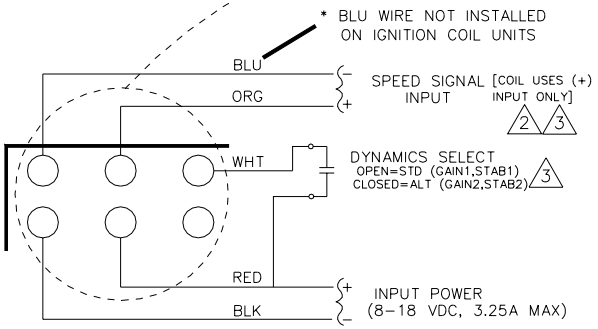
Use this procedure for diesel applications with optional start fuel limiting.

The purpose of Start Fuel Limiting is to limit the fuel that the fuel pump can deliver to the engine on start-up. When adjusted properly, Start Fuel Limiting supplies the engine with just enough fuel to start but not so much as to produce black smoke during start-ups. After the engine reaches rated speed, this fuel limiting feature is disabled, and the fuel pump is free to go to the maximum fuel condition. If the Start Fuel Limiting feature is not desired, adjust the pot to the full clockwise position. Otherwise, adjust the Start Fuel Limit pot to mid-position and re-attempt to start the engine. If the engine starts but produces black smoke, readjust the Start Fuel Limit pot counterclockwise slightly. If the engine did not start, turn the Start Fuel Limit pot clockwise slightly and repeat the start attempt.



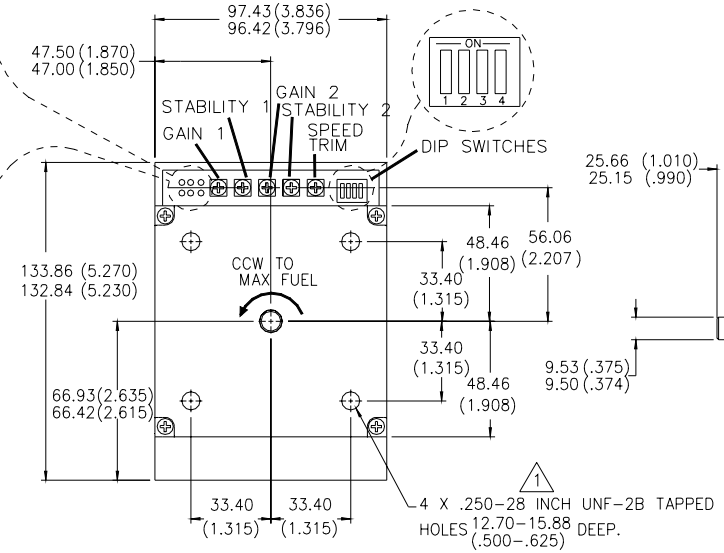
PLANT WIRING DIAGRAM

(For 8405-206,207,208 & 212 with pig tail connections)

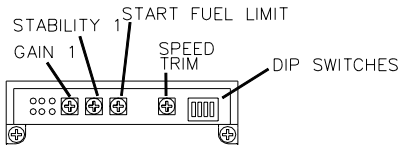


PLANT WIRING DIAGRAM

(For 8405-209,210 & 211 with 0.25" male spade connections)



OUTLINE DRAWING



(Potentiometers for 8405-208 & 211 units with adjustable START FUEL LIMIT)

1. MOUNTING SCREWS MUST BE USED IN ALL FOUR HOLES.
2. FOR NEGATIVE GROUND SYSTEMS, CONNECT THE ORG (+) LEAD OF IGNITION COIL UNITS TO THE NEGATIVE (-) SIDE OF COIL.
3. SEE SPECIFICATIONS FOR MAXIMUM INPUT RATINGS

NOTE: INCHES SHOWN IN PARENTHESIS

041-134
94-12-22 RAM

TQ-125™ Control Specifications

Woodward Part Numbers:	
8405-206	TQ-125, 12 Vdc, MPU speed signal, Run/Stop option
8405-207	TQ-125, 12 Vdc, ignition speed signal, Run/Stop option
8405-208	TQ-125, 12 Vdc, MPU speed signal, start fuel limit, Run/Stop option
8405-209	TQ-125, 12 Vdc, MPU speed signal, 1/4” (6 mm) male spade connector
8405-210	TQ-125, 12 Vdc, ignition speed signal, 1/4” (6 mm) male spade connector
8405-211	TQ-125, 12 Vdc, MPU speed signal, start fuel limit. 1/4” (6 mm) male spade connector
8405-212	TQ-125, DIS (distributorless ignition system), 1/4” (6 mm) male spade connector
Agency Approval:	UL and cUL Class 2 listed, File #E97763
Environment:	
Ambient Operating Temperature	–40 to +70 °C (–40 to +158 °F)
Storage Temperature	–55 to +105 °C (–67 to +221 °F)
EMI/RFI Specification	IEC 801
Shock & Vibration	US MIL-STD-810
Typical Control Characteristics:	
Steady State Speed Regulation	Rated speed ±0.25% of rated speed for magnetic pickup on diesel or propane applications Rated speed ±0.35% of rated speed for magnetic pickup on gasoline or natural gas applications Rated speed ±0.50% of rated speed for ignition coil applications
Inputs:	
Speed Signal Input and Range	Magnetic pickup or ignition coil input
Magnetic Pickup Input	1350 to 9500 Hz, 30 Vac max.
Ignition coil Input	Switchable for 4, 6, or 8 cylinders for standby generator sets with rated speeds of 1500 to 1800 rpm @ 50/60 Hz, 18 Vdc continuous, 300 Vdc max. for 100 µs
Dynamics & Run/Stop Inputs	8 to 18 Vdc, 1.2 mA max.
Power Supply	8 to 18 Vdc, 3.25 A max input (12 Vdc nominal) UL requires a Class 2 power source
Power Consumption	60 W maximum

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