



Electronic Governor Installation Manual

Model E-402 Digital Controller

The following information is intended as an aid to properly install Precision Governors Model E-402 Digital Controller. The Model E-402 can be used in virtually any governed speed industrial application. These installation instructions for the E-402 Digital Controller are general in nature as these types of governing systems are used on a variety of engines in many different applications. If you have questions or require additional information regarding installation on your specific application, please consult our available factory technical support at (815) 229-5300.

These instructions require no electrical test equipment other than a multimeter for taking basic electrical measurements.

Many “governor problems” are usually installation problems, particularly in first-time installations. Careful attention to these installation guidelines will go far toward a successful installation in the least amount of time.

PRECISION GOVERNORS, LLC

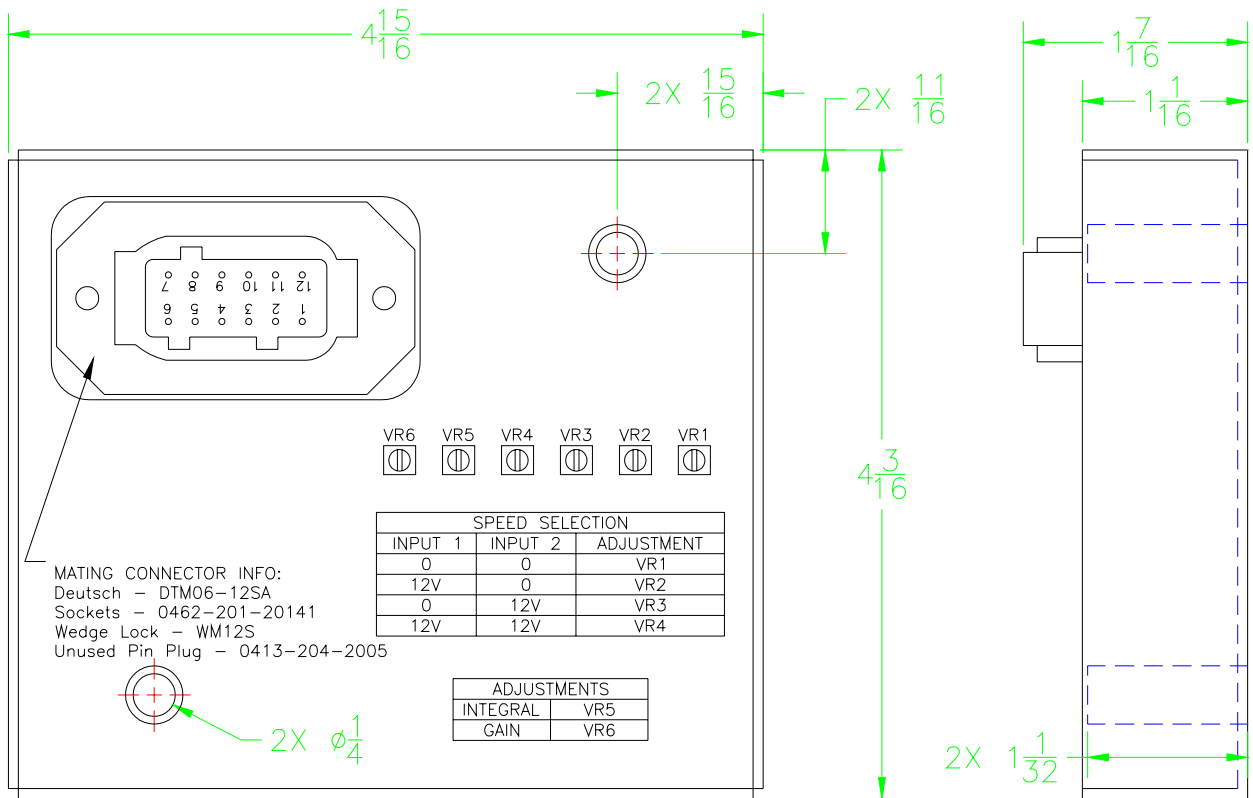
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An ISO 2000 Registered Company

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E-402 Pin-out, For use with P/N 9363 18" Cord Set		
Pin	Color	Connection
1		Not used
2		Not used
3		Not used
4	White	Speed select #1
5	Yellow	Mag pickup (+)
6	Black	Ground (common)
7	Brown	Actuator
8	Blue	Actuator
9	Red	Switched +12 volts
10	Orange	Speed select #2
11		Not used
12		Not used



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FACTORY SETTING OF PROGRAM PARAMETERS—MUST BE SET PRIOR TO SHIPMENT

- A. Flywheel teeth or input cycles per engine revolution.
- B. Mode of governing
 - Up to 4 discrete speeds: Speeds 1, 2, 3, & 4
 - Drive by Wire: Min/Max speeds
 - Ramp Up/Down: Min/Max speeds & speed change rate (rpm)

STEP 1 MOUNTING OF E-402 CONTROLLER

- A. Select a reasonably cool, dry, and vibration-free location to enhance performance and reliability.
- B. Mount the E-402 unit to a flat surface using the two 1/4-inch through holes.
- C. Mount away from sources of heat and mount vertically if possible.

STEP 2 WIRING OF E-402 CONTROLLER

- A. See the wiring pin-out diagram on Page 2 for connection details.
- B. Use #18 wire minimum; #16 is preferred.
- C. Keep all wiring lengths as short as possible.
- D. Go directly from the controller ground terminal by dedicated wire to the battery minus terminal. If this cannot be done, go by dedicated wire to a very good engine ground.
- E. A properly functioning engine electrical system will supply 13.5 to 14.8 VDC when the engine is running. If wiring size is adequate, with good connections and proper grounds, this voltage will be obtained at terminals 9 and 6 of the connector when the governor is controlling engine speed. Be sure to verify this.

STEP 3 WIRING OF E-402 THROUGH AN IGNITION SWITCH (SWITCHED POWER)

CAUTION: Improper hook-up can damage electronic circuits. Re-check wiring *before* applying power.

- A. Run power to the governor directly via a dedicated #16 wire.
- B. Check that the wiring from the battery to the switch is at least #14.
- C. Fuse wire at 5 amps.

STEP 4 CHECK-OUT & INITIAL START-UP PROCEDURES

Once the actuator and controller installation and wiring are completed, proceed with start-up procedures as follows:

- A. Turn ignition switch on. Do not start the engine at this time.
- B. Use a multimeter to check battery voltage at the battery. Check battery voltage at the machine connection points for terminals 9 & 6. The second voltage reading should be the same as at the battery. If not, stop and correct wiring before proceeding.
- C. Before proceeding, familiarize yourself with the locations of the Speed Set pots (VR1, VR2, VR3, VR4) and the Gain pot (VR6).
- D. Adjustment of Potentiometers—please read the next paragraph before adjusting pots. **Single turn adjustments** – These pots are 3/8" square and have a 1/8" plastic screw slot in the center. **Be gentle!** These pots turn 270 degrees and over-turning will break the internal stops, making adjustments impossible. Turning these pots CW increase speeds or response while turning CCW decreases speeds or response.
- E. Start the engine and set the machine controls to call for the highest governed speed required. Adjust the **Speed Set** pots (VR1, VR2, VR3, and/or VR4) slowly as needed to obtain the speed desired. If engine surges, reduce the **Gain** (VR6) slightly.



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- F. Re-check the voltage between the connections for terminals 9 & 6. The reading should be between 13.5 and 14.6 VDC. If not, inspect the system for undersized wiring or for other components wired in parallel with the governor.
- G. Carefully adjust the **Gain** (VR6, sometimes referred to as sensitivity pot). When adjusting the gain, you are looking for the best compromise between quick response and good stability. Make very small adjustments, then load and unload the engine. Usually, a good set-up is one that makes 1 to 3 small 'bounces' and then settles down after a large load change. Too much **Gain** shows up as a rapid (once per second) instability, most commonly at light loads. Too little **Gain** shows up in large overshoots on startup or large load changes and generally sluggish operation.
- M. Set machine controls (if present) to obtain other engine speeds. Make any adjustments required to the other speed pots (VR1, VR2, VR3, and/or VR4). The engine speed should now change between the selected speeds, following the action of the speed switch on the machine.
- N. The **Integral** adjustment (VR5) controls how quickly the governor makes the final corrections to reach the desired speed. Remember, the initial response is controlled by the gain adjustment. Too much or excessive integral will cause the engine speed to wander slowly.

TROUBLESHOOTING

If the governor system fails to operate or doesn't operate properly, check the following and apply corrections as appropriate.

- A. **Power and wiring** – Check the wiring to the diagram furnished here or with the machine. Also, perform the voltage tests described above in the wiring section. Wiring to the actuator should also be adequate and not be contacting the frame or engine.
- B. **Speed reference signal** – The magnetic pick-up mounted on the engine sensing the ring gear teeth must deliver a minimum signal of 5 VAC during cranking. A low or erratic signal may result in erratic or full mechanically governed engine speed. Check the magnetic pick-up installation per the manufacturers' specifications.
- C. **Machine speed selection switches or relays** – Check that all machine wiring is functioning properly and is providing the proper voltage and signals to the E-402 controller.

If the above tests do not show a fault, the unit can be operationally checked as follows:

- E. With the engine stopped, remove the actuator from the engine.
- F. Start the engine and operate the fuel shutdown lever by hand running the engine above and below the speed for which the governor is set. As the engine speed goes above and below the set speed, the actuator shaft should move in and out. This indicates the governor system is working and trying to control fuel to the engine. If suitable operation is noted with the actuator removed, check for any interference, rubbing or drag in the fuel shutdown arm or the connected linkage.
- G. Check during cranking that the actuator shaft to the full fuel on position (actuator pulls completely in).

Check the controller potentiometer adjustments. The controller is factory set during engine test for optimum performance. If any adjustments have been changed since shipment, it may be wise to return the adjustments to a known starting point. Mid range on the **Speed** pots (VR1, VR2, VR3, VR4) is normally satisfactory. A good starting point on the **Gain** and **Integral** pots (VR6 & VR5) is full CCW, then CW ¼ turn. The **Gain** pot is the basic adjustment for stability or sensitivity. Make any adjustments as necessary and then re-check engine and/or governing performance.

