13.6 C2002 Speed Control Unit Wiring and Troubleshooting

13.6.1 Wiring



Fig 1. C2002 Speed Control Unit Wiring

The terminal 1 and terminal 2 are for actuator.

The terminal 3 and terminal 4 are for speed sensor.

The terminal 5 and terminal 6 are for battery; the terminal 5 is negative and Terminal 6 positive.

The terminal 7 and terminal 9 are for speed trimming pot.

The terminal 7 and terminal 12 are for idle/rated speed switch.

Stability regulation is effect only when the terminal 10 and terminal 11 are in short circuit. (Applicable when integrated into power grid)

The terminal 13 is for input power. (Applicable to automatic load distribution when integrated into power grid) The terminal 14 is for output power of 10V (load capacity is 20 mA)

13.6.2 Knob Function



Fig. 2 C2002 Speed Control Unit

(1) STARTING FUEL knob is to regulate fuel at engine starting. Turning the knob in clockwise will increase fuel at engine starting, and vice versa. More fuel at engine starting will lead to heavy smoke and less fuel will fail to start up the engine. It is set by the manufacturer and usually needs no regulation.

(2) SPEED RAMPING knob is to regulate the duration from idle speed to rated speed. Turning the knob in clockwise will increase the duration, and vice versa. It is set by the manufacturer and usually needs no regulation.

(3) STABILITY knob and GAIN knob are to regulate engine speed stability. STABILITY knob is adjustable between 9 o'clock to 12 o'clock and the GAIN knob between 12 o'clock to 3 o'clock. These two knobs are only for dealing with speed hunting.

(4) IDLE knob is to regulate idle speed. Turning the knob in clockwise will increase the idle speed, and vice versa.

(5) SPEED knob is to regulate engine rated speed. Turning the knob in clockwise will increase the rated speed, and vice versa.

(6) DROOP knob is to regulate the speed droop of generators when they are parallel. Turning the knob in clockwise will increase speed droop, or the speed drops quickly with the increase of load. Turn the knob to the zero position when a single generator is in operation. This function is effective when the terminal 10 and terminal 11 are in a short circuit.

Note: All knobs can be only turned within 300 degrees. If a knob can be turned 360 degrees, the knob is damaged and the control unit needs replacing.

13.6.3 Troubleshooting

1) Unable to start

(1) Manually push the actuator hand lever. If the engine can start up, make the following inspection. If the engine cannot start up, consult the engine manufacturer.

(2) Check the terminal 5 and terminal 6 for availability of 24 VDC. If there is not, connect the terminal 5 and terminal 6 to the battery (no lower than 18 V) with the terminal 5 as negative post and the terminal 6 positive one.

(3) Check the terminal 3 and terminal 4 for wiring of the speed senor. Start the engine and measure the voltage of the terminal 3 and terminal 4 when the starter motor is running. The voltage should be about 5 VAC. If there is no voltage, remove the sensor and clean its inducing part. Measure the resistance of the sensor, and it must be about 400 Ω . Check the clearance between the sensor and flywheel teeth. Screw the sensor in to the dead end and turn it back half to one circle.

(4) Check the terminal 1 and terminal 2. Loosen the screws of the both terminals and remove their wires. Check the resistance of the both wire ends and they must be 2-5 Ω . The voltage must be about 9 V after engine has started up. If there is no voltage, check the connection of the wires to the actuator.

(5) Don't start the engine and electrify the speed control unit. Remove the wires of the terminal 1 and terminal 2, and connect the terminal 1 to the terminal 5 and the terminal 6 to the terminal 2 for a check. The actuator hand lever will move from zero fuel to Max fuel. If the hand lever does not move, the actuator needs replacing. And if it moves, the control needs replacing.

(6) If the idle speed, rated speed and max fuel are set too low, the engine cannot be started. Turn STARTING FUEL knob to 3 o'clock, and turn IDLE knob and SPEED knob in the mid position. After a successful starting up, turn SPEED knob in counterclockwise appropriately to avoid over-speed.

(7) Check the terminal 5 and terminal 14 and there should be 10 V power output. If not, change the speed control unit.

2) No high and low speed

(1) The terminal 7 and terminal 12 are for the rated/idle speed shifting switch. When the terminals are in a short circuit, it shifts to the idle speed; when the terminals are open, it shifts to the rated speed. Use a short wire to do a test. After the engine has started up at idle, disconnect the terminal 7 and terminal 12. If the engine runs at the rated speed, either the rated/idle speed control circuit or the switch is damaged, and replacement of relevant parts must be made. If the engine cannot run at the rated speed, the control unit must be replaced.
(2) If the rated speed is regulated to too low, the engine cannot run at the rated speed.

3) Unstable speed

(1) Unstable speed usually refers to idle hunting as well as rated speed hunting with and without load.

Regulation **is** usually done by adjusting the idle speed only after the rated speed with and without load has been adjusted and has been stable. Stable rated speed with load is given preference over stable rated speed without load and stable idle speed at special circumstances.

(2)The terminal 7 and terminal 9 must be connected to a speed trimming opt. If not, speed hunting will come. The terminal 7 and terminal 9 must therefore be connected with a short wire. But this will cause the increase of rated speed, thus leading to engine overspeed. So turn SPEED knob 2 grids in anticlockwise before starting the engine to reduce the rated speed prior to connecting the terminal 7 and terminal 9. The battery voltage should not be too low.

(3) First adjust GAIN knob. Turn GAIN knob in clockwise with a screwdriver until the engine starts hunting, turn it

back (anticlockwise) until the hunting disappears and then turn the knob 1 grid further back. This is the best position.

Note: the knob can only be turned 300 degrees. Do not turn it with force or it will be damaged, leading to speed hunting.

(4) If the speed hunting does not disappear, turn GAIN knob to 10 o'clock and then turn STABILITY knob as the above step.

(5) If the speed hunting still exits, move No. 1 dial-up (see upper right in Fig. 5) upwards and repeat the above 2 steps.



Fig. 3 Dial-up Switch of C2002 Speed Control Unit

(6) If the hunting is still there, check the resistance of the speed sensor and it should be 900-1000 Ω . Check the clearance between the sensor and flywheel teeth. Loosen the sensor and screw it in to the dead end and turn it back half to one circle.

Note: the sensor is only for the electronic governor and cannot be used for other control systems at the same time.

4) Engine speed drops with load increase

(1) Push the actuator hand lever to fuel increase with hand. If the engine speed increases, the electronic governor has problems. Check the governor.

(2) Push the actuator hand lever to fuel increase with hand. If the engine speed drops, the problem is with the engine or fuel system line.

(3) Push the actuator hand lever to the max fuel with hand. If required load cannot be attained, check the fuel injection pump for max fuel.

(4) If the problem still exits after the above checks, replace the speed control unit, speed sensor and actuator respectively. If it does not work, check the fuel system and generator set.

13.6. 4 Components check

1) Speed control unit check

(1) Voltage (VDC) check: after electrifying the control unit, check the voltage with the red pen of a multi-meter at the terminal 2 and the black one at the terminal 1. The voltage should be $6.5V < V_{power} < 9.5V$.

(2) Insulation check: check insulation with the red pen of a multi-meter contacting the terminal 1 and the black one at the unit housing (heat radiating fins).

(3) Check the type of actuator and the number of teeth to avoid accident.

2) Actuator check

(1) Connect the actuator and electrify the speed control unit. Connect the terminal 1 and terminal 2 with a short wire and check if the actuator hand lever moves to the max position and moves back when power is off.

(2) Check the actuator rack to see if it can move smoothly.

(3) Set a multi-meter to conduction check and check the conduction by placing the red pen at the terminal 3 or 4 of the actuator and the black one at its housing. If the actuator is conductive, change it.

(4) Set the multi-meter to resistance check. Check the resistance by placing the red and black pens at the terminal 3 and terminal 4 of the actuator. The resistance should be $1.5-5 \Omega$.

3) Check speed sensor

(1) Set a multi-meter to resistance check and measure the sensor resistance with the red and black pens of a multi-meter at the terminal 3 and terminal 4. The resistance of sensor M18 should be 322-385 Ω and the one of M16 400-470 Ω .

(2) The sensor installation clearance can be inspected by checking speed signal voltage at the terminal 3 and terminal 4 with a multi-meter. The voltage is about 3 V at the idle speed and about 8 V at the rated speed. If the voltages are not correct, the clearance needs **adjusting**. The signal voltage of the lowest speed must **not** be less than 1.5 VAC.