1.1 Wiring

Fig. 1 C1000A Speed Control Unit Wiring

(1) The terminal 1 and terminal 2 are for battery; terminal 1 is negative and Terminal 2 positive.

(2) Terminal 3, terminal 4, terminal 12, terminal 13 and terminal 14 are for actuator, among which the terminal 3 and terminal 4 are for actuator coil and the terminal 12, terminal 13 and terminal 14 for actuator feedback voltage.

(3) The terminal 5 and terminal 6 are for speed sensor.

(4) The terminal 7 and terminal 8 are for idle/rated speed switch.

(5) The terminal 9 and terminal 10 are for speed trimming pot.
1.2 Knob Function

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

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

(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) 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.

(5) MAX FUEL knob is to regulate fuel at engine starting. It is usually in the middle position. Turning the knob in clockwise will reduce fuel, and vice versa. It is set by the manufacturer and usually needs no regulation.

Note: All knobs cannot be turned 360 degrees. If a knob can be turned 360 degrees, the control unit is damaged.

1.3 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 1 and terminal 2 for power of 24 VDC. If there is no power, connect the terminal 1 and terminal 2 to the battery (no lower than 18 V) with the terminal 1 as negative post and the terminal 2 as positive one.

(3) Check the terminal 5 and terminal 6 for wiring of the speed sensor. Start the engine and measure the voltage of the terminal 5 and terminal 6 when the starter motor is running. The voltage should be over 3 VAC. If there is no voltage,
remove the sensor and clean its inducing part. Measure the resistance of the sensor, and it must be over 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 3 and terminal 4. Loosen the screws of the both terminals and remove their wires. Check the resistance of the both wire ends and they must be 1.5-5 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. Connect the terminal 11 and terminal 12 with a short wire and the actuator hand lever will move from zero fuel to Max fuel. If the hand lever does not move, the actuator needs replacing. The short wire connecting the terminal 11 and terminal 12 must be removed after checking, or otherwise the engine will go runaway.

(6) If the idle speed, rated speed and max fuel are set too low, the engine cannot start up. Turn MAX FUEL knob, IDLE knob and RATED SPEED knob in the mid position. After a successful starting up at idle, turn the RATED SPEED knob in counterclockwise appropriately to avoid over-speed.

(7) When there is 24VDC at the terminal 1 and terminal 2, measure DC voltage with the red pen of a multi-meter contacting the terminal 13 and the black one contacting the terminal 14 and by pushing the hand lever of actuator (type: A1000C-F3 or A2000C-F3) with hand. The voltage must **change** within 0.5 V (zero fuel) and 4 V (Max fuel). If there is no change in voltage, the actuator should be replaced.

2) No high and low speed

(1) The terminal 7 and terminal 8 are for the rated/idle speed shifting switch. When the terminals are in a short circuit, it shifts to the rated speed; when the terminals are open, it shifts to the idle speed. Use a short wire to do a test. After the engine has started up at idle, connect the terminal 7 and terminal 8 with the short wire. 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) Having started up at idle, the engine stops when it reaches the rated speed. Check the terminal 9 and terminal 10. If they are not connected with a speed trimming pot or in a short circuit, such problem will happen.

(3) If the rated speed is regulated to too low, the engine stops when it runs from the idle speed to 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. Turn STABILITY knob between 9 o’clock and 12 o’clock and GAIN knob between 12 o’clock and 3o’clock respectively. Stable rated speed with load is given preference over stable rated speed without load and **stable idle speed** at special circumstances.

(2) Check the speed sensor. Remove the sensor and clean its inducing part and reinstall it. Screw in the sensor 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.

(3) Damaged speed trimming pot or bad insulation can lead to unstable speed. Connect the terminal 9 and terminal 10 with a short wire to check if the pot is in good condition.

(4) The poor contact or poor insulation of the idle/rated speed switch can cause unstable speed. Loosen the terminal 7 and terminal 8 and remove their wires. After the engine has started up at idle, connect the terminal 7 and terminal 8 with a short wire, the engine will reach the rated speed.

(5) Run the engine without load to check its speed stability. If the speed is not stable, change the speed control unit or actuator and test.

(6) Unstable battery voltage will result in unstable speed. The speed control unit needs power from the
battery and its voltage must be 24-30 V.

(7) If the rated speed without load is stable and becomes unstable when loaded, check the engine.

(8) When there is 24 VDC at the terminal 1 and terminal 2, measure the DC voltage with the red pen of a multi-meter at the terminal 13 and the black one at the terminal 14 and by pushing the hand lever of actuator (type: A1000C-F3 or A2000C-F3) from zero fuel position to full fuel position with hand. The voltage must change from 0.5 V (zero fuel) to 4 V (Max fuel). If there is no change in voltage, the actuator must be replaced.

3) 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.

4) Notes for installation
(1) The speed control unit must work with a right actuator.
(2) Check the voltage and teeth number before using a speed control unit of C1000A series to avoid a serious accident. If a speed control unit of 24 VDC is used with 12 VDC power, the actuator will have a small or even no movement, and if a speed control unit of 12 VDC is used with 24 VDC power, the control unit will be damaged. If a speed control unit with more teeth is used for an engine with fewer teeth (flywheel teeth), the engine will go runaway, and if a speed control unit with fewer teeth is used for an engine with more teeth, the engine's speed will drop and voltage frequency is lower than required.
If the rated speed of a speed control unit is set 1000 rmp, it cannot be changed to 1500 rmp, and if the rated speed of a speed control unit is set 1500 rmp, it cannot be changed to 1000 rmp.
(3) When installing the actuator, check the rack initial position by inspecting the distance between the connecting center position of actuator connecting lever and the fuel pump rack and the actuator installing surface. If the connecting lever is short, it cannot reach Max fuel, and if it is long, there is no zero fuel. This will resulting in that the engine cannot be stopped and the engine goes over-speed once it starts up, which causes a serious accident.

1.4 Components check
1) Speed control unit check
(1) Power (VDC) check: turn power on, and check the voltage with the red pen of a multi-meter at the terminal 2 and the black one at the terminal 1. The power voltage should be 24 VDC (18-32 V) or 12 VDC (9-16 V).
(2) Voltage (VDC) check: remove the wire of the terminal 12. After electrifying the control unit, check the voltage with the red pen of a multi-meter at the terminal 12 and the black one at the terminal 14. The voltage should be $6.5V < V_{power} < 9.5V$.
(3) Insulation check: check insulation with the red pen of a multi-meter contacting the terminal 3 and the black one at the unit housing (heat radiating fins).
(4) 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 11 and terminal 12 with a short wire and check if the actuator hand lever moves to the max position and moves back when power is off. This is applicable to C1000A
speed control unit with double closed loops.

(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 Ω.

(5) Electrify the speed control unit and connect it to A1000C-F3 actuator or A2000C-F3 actuator. Set the multi-meter to DC and check the voltage with the red pen at the terminal 13 and black one at the terminal 14 and by moving the actuator hand lever manually. The voltage must change within 0.5-4 V. If there is no change in voltage, the actuator should be replaced.

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 5 and terminal 6. 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 5 and terminal 6 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.