TURBINE CONTROLLER AND DISPLAY UNIT

OPERATING INSTRUCTIONS

WIRING CONNECTION TO TCU

CAUTION
Battery power to the Turbine Control Unit (TCU) must go over a 10 A fuse.

1. The 2 Deans connectors (red connectors) are common to each other. OBSERVE POLARITY. One connector leads to the battery power and the other one to the turbine board.

2. The green connector (pump) connects to the fuel pump assembly.

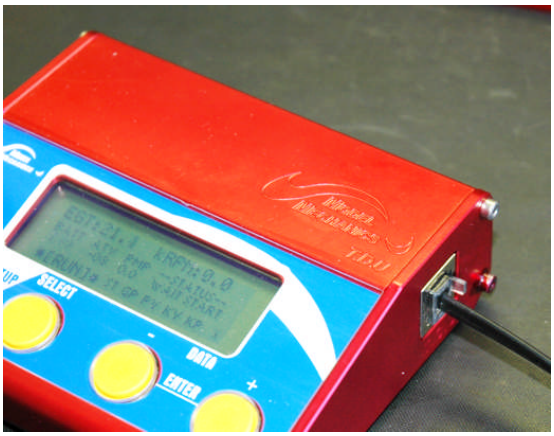
3. The turbine connector links to the turbine board.

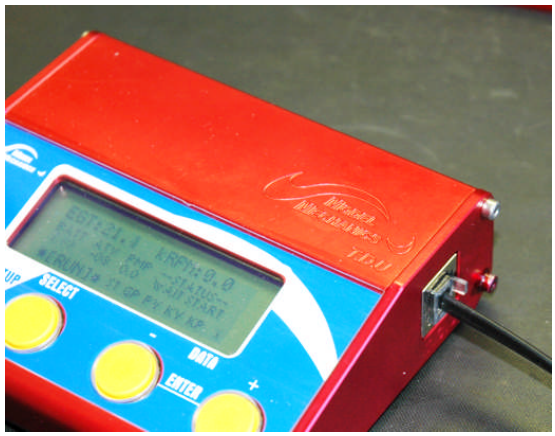
4. The Terminal connector links to the Turbine Display Unit (TDU).

5. The RX connector links to the Receiver. ENSURE THAT THE POLARITY IS CORRECT.

SYSTEM CALIBRATION

WARNING
The Turbine Control system is factory calibrated before shipping as part of the Quality Assurance process. However, the pilot must verify and make the necessary calibration adjustments required to suit the Transmitter and Receiver being used.





1. Ensure that both the trim and stick are down.

2. Plug one end of terminal cable into the TDU, and the opposite end of the terminal cable into the TCU.

3. Ensure that both the fuel and propane supplies are open.

NOTE
Ensure that the polarity between the RX connector and the TCU connector is correct.

4. Switch on both the Transmitter (TX) and Receiver (RX).

5. Switch on the TCU, which will also switch on the TDU. As the system boots, the following screens will display:

- Model Mechanics splash screen.
- Software version.
- Carrying out system check.
- System OK.
- Run Screen.
- STATUS wait for start.

NOTES
1. Should the system give any error messages, refer to the Fault Finding Section of the Owner's Manual.
2. The Communications Indicator in the bottom corner of the screen should be flashing.
3. The TDU can be disconnected or connected at any time. This will not interfere with the operation of the TCU.
4. On Run-up, you will note a brief message "NO COMMS"; this is normal.

5. Once the system has completed the SYSTEM CHECK and there are no ERRORS, the Run screen will display the WAIT START status.

6. The following information is provided on the Run screen:

- **EGT**: Exhaust Gas Temperature
- **KRPM**: Revolution Per Minute x 1000

- **BATT**: Battery Voltage
- **ATV**: Signal Strength
- **PMP**: Pump Voltage
- **ST**: Start
- **GP**: Glow Plug
- **PV**: Propane Valve
- **KV**: Kerosene Valve
- **KP**: Kerosene Valve
- **STATUS**: There are 4 different statuses, namely:
    - **WAIT START:** TCU system check completed and waiting for instruction.
    - **T-RUN:** When TCU hands over to transmitter command.
    - **Cool Down**: When the Turbine shuts down.
    - **T-STOP.** The Turbine cool down cycle has completed and the temperature is less than 100 °C.

7. With the RUN screen displayed, press the MENU and SELECT buttons simultaneously to select the SETUP SCREEN.

8. The following information is provided on the SETUP screen:

- **STKMIN.** Stick Down Trim Down
- **TRIMUP.** Trim Up
- **STKMAX.** Stick at Maximum Throttle
- **PMIN.** Minimum Voltage required for the pump to start pumping
- **PIDLE.** Idle Fuel Flow
- **PMAX.** Fuel Flow required for Maximum Turbine Speed (120,000 rpm).

9. When any one of the above is selected, the value as set by the factory, as well as the current value of the system will be displayed. For example:

Stored Value as set by the factory: [-08]

Current value of your system: >-12<

10. To calibrate any of the options listed in Paragraph 8, use the Select button to scroll down the menu and select the option to be calibrated. The selected option will have a bounding box around it.

NOTE
When the SETUP screen displays; STKMIN is selected by default, and it is only possible to scroll down the menu. If you need to re-set any value, you will have to scroll through the menu until you reach the required selection.

11. Start the calibration process at the top of the menu and then work through each item:

a. **STKMIN** With STKMIN selected, means radio and receiver on with the Stick and Trim Down >****< value. Save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-12] and >-12<.

b. **TRIMUP** With TRIMUP selected, push the Trim Stick on the TX all the way up to change the >****< value. Save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-18] and >-18<.

c. **STKMAX** With STKMAX selected, push the trim stick on the TX all the way up to change the >****< value. Save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-12] and >-12<.

d. Bring the Trim and Stick down.

e. **PMIN** Disconnect the fuel pipe from the Turbine and place the loose end over a small container.

CAUTION
Ensure that the container is held higher than the fuel tank to prevent the fuel from gravity feeding from the fuel tank.

f. With PMIN selected, push the trim stick on the TX all the way up and slowly increase throttle ± clicks until fuel just starts to drip from the fuel pipe. At this point, stop moving the throttle and save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-12] and >-12<. Return stick and trim down.

g. **PIDLE** Disconnect the fuel pipe from the Turbine and place the loose end over a small container, preferably a graduated measuring jug.

CAUTION
Ensure that the container is held higher than the fuel tank to prevent the fuel from gravity feeding from the fuel tank.

h. With PIDLE selected, push the trim stick on the TX all the way up and slowly increase throttle until the fuel pump output is 115 -120 ml per minute for a 7 kg Turbine or 120 ml – 135 ml per minute for a 12 kg Turbine. At this point, stop moving the throttle and save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-12] and >-12<.

i. **PMAX** Disconnect the fuel pipe from the Turbine and place the loose end over a small container, preferably a graduated measuring jug.

CAUTION
Ensure that the container is held higher than the fuel tank to prevent the fuel from gravity feeding from the fuel tank.

j. With PMAX selected, push the trim stick on the TX all the way up and slowly increase the throttle approximately ¾ of the way up until the fuel pump output is 320 ml per minute for a 7 kg Turbine or 450 ml per minute for 12 kg Turbine. At this point, stop moving the throttle and save the value by pushing the – and + Enter buttons simultaneously. You should now have the same value in both sets of brackets, for example [-12] and >-12<.<. Return stick and trim down.

k. **GLO** Disconnect the power cable from the Glow plug and remove the Glow plug from the Turbine.

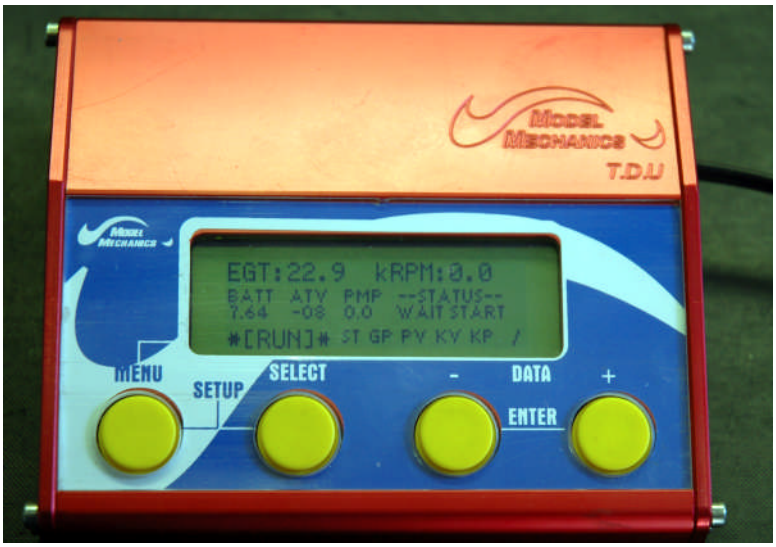
l. With GLO selected, connect the power cable back onto the Glow plug and earth the plug against the Turbine housing.

m. Use either the – or + button to adjust Voltage to the Glow plug. The value should be ± 40 - 50. At this setting, the Glow plug should be showing a nice bright orange glow. The value is automatically saved.

n. Press the Menu to return to the RUN screen.

12. Once you have refitted the Glow plug and ensured that the fuel line is secure, you are ready for start-up.

START-UP



WARNINGS

1. Before initiating the Start-up process, ensure that the fuel is connected at that there are no leaks.
2. When starting the Turbine for the first time, it is of utmost importance that when the TCU has completed the start-up sequence and the TX has control of the Turbine (STATUS = T-RUN), that the Turbine Idle and Maximum speeds be set on the DYNAMIC CALIBRATION screen. Failure to do so can result in Turbine failure and injury to personnel. Refer to the Section on Turbine Idle and Maximum Speed Adjustment.

1. Ensure that both the trim and stick are down.

2. Ensure that both the fuel and propane supplies are open.

3. Switch on both the Transmitter (TX) and Receiver (RX).

4. Switch on the TCU, which will also switch on the TDU. As the system boots, the following screens will display:

- Model Mechanics splash screen.
- Software version.
- Carrying out system check.
- System OK.
- Run Screen.
- STATUS. Wait for start.

NOTES
1. Should the system give any error messages, please refer to the Fault Finding Section of the Owner's Manual.
2. The TX has no control over the turbine until the TDU displays the T-Run status.

5. Shift the Trim up to initiate the start processes. The system status will go from WAIT START to RUN-UP.

6. The following sequence occurs on RUN-UP:

- The starter motor engages and spins the Turbine to ± 10,000 rpm, at which point the starter motor disengages. Simultaneously, the Glow plug heats up and the Propane Solenoid opens to allow Propane into the Turbine Combustion Chamber for Light-up.
- When Light-up is detected by the Thermocouple, the starter motor re-engages and spins the Turbine to ± 20,000 rpm. Simultaneously, the Glow plug switches off, and the Kerosene pump and Solenoid valve are energized to allow kerosene into the Turbine Combustion Chamber for primary ignition. The Propane is switched off at ± 35,000 rpm; note a slight drop in rpm.
- Turbine rpm will increase to ± 50,000 rpm, at which point the system status goes from RUN-UP to T-RUN indicating that the RX is now in command of the turbine speed.
- The Turbine will slow down to an idle speed of ± 40,000 rpm.
- The Aircraft will now be under TX control.

CALIBRATING THE TURBINE IDLE SPEED AND MAXIMUM SPEED

7. With the Turbine running, the TDU will display STATUS = T-RUN. Press the MENU button to go to the DYNAMIC CALIBRATION screen.

8. The screen displays the following:

- **Idle.** Turbine is at or close to idle speed. Adjust as required.

- >----<. Turbine is at half throttle.
- **MAX.** Turbine is at or has exceeded the maximum of 120,000 rpm.

Adjusting Turbine Idle Speed

9 Check the Turbine idle speed and then either press the – button to lower the idle speed or the + button to increase the idle speed. The Turbine should idle at 40,000 rpm.

Adjusting Turbine Maximum Speed

WARNING
Maximum Turbine speed is 120,000 rpm.

10. Slowly start increasing throttle until the throttle is at roughly ¾ of its travel. Check the Turbine speed. If the Turbine reaches maximum speed before the throttle has reached its fully open position, use the – button to decrease Turbine speed.

11. SLOWLY apply maximum throttle, all the while checking the Turbine speed. If the Turbine speed is above or below the Maximum when the throttle is fully open, use the – and + buttons to lower or increase the speed of the Turbine.

12. Disconnect the TDU and cable from the TCU and close up the aircraft.

SYSTEM CHECK

1. The CHECK screen is used to carry out pre-flight checks. Use the SELECT button to scroll down the menu. The bounding box indicates the selected menu, e.g., STARTER.

2. The following pre-flight checks must be carried out:

- **STARTER.** Select Starter and press the + button to run the starter motor. Once you are satisfied, press the – button to stop the starter motor. When this function is running, the indicator for this function is ST and will have a bounding box around it: ST. Scroll down to the next item using the SELECT button.
- **GLOPLUG.** Remove the glow plug from the turbine and, with the power cable connected to the glow plug, earth the glow plug against the Turbine. Select GLOPLUG and press the + button to power the glow plug. Once you are satisfied, press the – button to switch off the power to the Glow Plug. The indicator for this function is GP and will have a bounding box around it: GP. Scroll down to the next item using the SELECT button.
- **KEROPMP**. To purge air from the fuel system, disconnect the fuel line from the Turbine and place the loose end over a small container. Press the + button to power the Kerosene pump. Run the pump until the flow of fuel is free of air bubbles. Once you are satisfied, push the – button to switch off the Kerosene pump. The indicator for this function is KV and will have a bounding box around it: KV. Scroll down to the next item using the SELECT button.
- **PROPV.** Connect the gas system to the Turbine. Press the + button to activate the Propane valve. The valve will pulsate and the yellow LED on the pump will flash, indicating that power is supplied to the solenoid valve. Once you are satisfied, push the – button to switch off the Propane valve. The indicator for this function is PV and will have a bounding box around it: PV. Scroll down to the next item using the SELECT button.

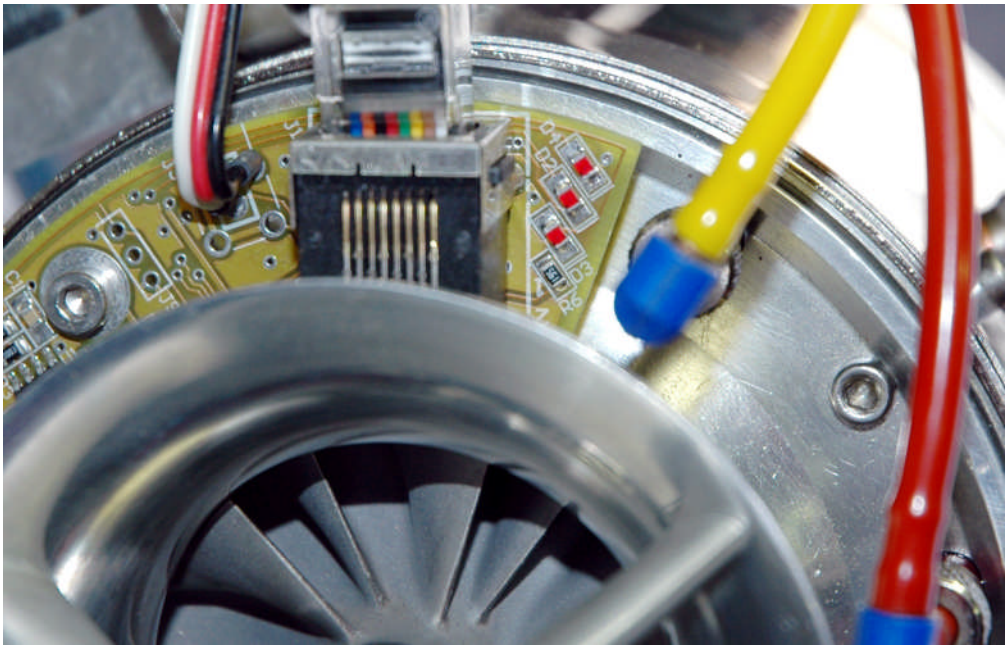
CAUTION
Once you have completed testing the Propane valve and disconnected the Propane system, spin the Turbine with the starter motor to clear any build-up of propane in the Turbine.

- **KEROV.** Disconnect the Fuel pipe from the Turbine to prevent flooding of the Turbine with fuel.
- Select KEROV and then press the + button to activate the valve. The red LED on the pump will illuminate, indicating that the valve is open. Once you are satisfied, push the – button to close the Kerosene valve. The indicator for this function is KV and will have a bounding box around it: KV.

3. On the bottom right of the display are the following test indicators for the:

- **Battery.** The battery status will either be; BATT-OK. Indicating the battery has sufficient voltage, or if the battery voltage is below 6.8 V, the status will read BATT LOW.
- **Thermocouple**. The Thermocouple status will either be TC-OK, in which case the Thermocouple is serviceable, or the status will read TC-OC, which indicates that the Thermocouple is not connected or is burned, or the polarity is reversed.

- **Glow Plug.** The Glow plug will either be GP-OK which indicates that the Glow plug is serviceable or GP-CO, which indicates that the Glow plug does not have its power lead connected, or is blown.



4. Switch on RX, TX and the TCU. If it is possible to see the Turbine Control Board, check that the LED D2 flashes once when the TCU is switched on. This indicates that the power from the battery is being supplied to the Turbine Control Board.

5. Select the CHECK menu. Switch on the starter motor and check that LED D3 is flashing, indicating that the turbine speed sensing system is functional. Also check that LED D2 is flashing, indicating that power is being supplied to the starter motor.

6. Switch on the glow plug and check that LED D4 has illuminated, indicating that power is being supplied to the Glow plug.