TE04 MCU TEST SET

Instructions for testing and troubleshooting Master Control Unit (MCU) and related Cessna 172R, 172S, 182S, 182T, T182T, 206H and T206H aircraft power systems.

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1. GL0SSARY OF TERMS AND FUNCTIONS

1.1. TERMS

ACU: The Alternator Control Unit (ACU) is located inside the Master Control Unit (MCU) and performs the following functions:

a. Alternator voltage regulation.
b. Monitors main bus voltage and provides an output for low voltage annunciation.
c. Monitors main bus voltage and opens ALT FIELD circuit breaker, removing power from the alternator system (ACU & Alternator Relay) if an over-voltage condition exists.
d. Monitors alternator feeder current and opens ALT FIELD circuit breaker, removing power from the alternator system (ACU & Alternator Relay) if reverse alternator feeder current is detected.
e. Monitors alternator field current and opens ALT FIELD circuit breaker, removing power from the alternator system (ACU & Alternator Relay) if excessive field current is detected.

ALT FIELD CIRCUIT BREAKER: Aircraft circuit breaker used to power alternator field, ACU, and alternator relay. Breaker may be opened by ACU protection circuitry if ACU detects either overvoltage, alternator feeder reverse current or over field current.

ALT FEEDER: Cable and connections that connect the alternator output to the ACU.

BUS FEEDER: Cable and connections that connect the Bus 1, 2, or 3 circuit breakers to the appropriate aircraft bus located on the aircraft circuit breaker panel.

MAIN BUS: The main electrical bus in the MCU (J-box) is made up of electrical connections that supply power to the aircraft through fuses or circuit breakers. These connections are the bus bars that connect the main battery relay, alternator relay, starter relay, current sensor and circuit breakers or fuses together. These connections all make one electrical node and it is at this node that the ACU senses for LV or overvoltage. The main bus voltage is the voltage at which power is supplied to the aircraft for all loads. The main bus is powered either by the battery via the battery relay or by the alternator via the alternator relay.

MCU: The Master Control Unit (MCU) is sometimes referred to as the Electrical Power Junction Box (J-box). The MCU is located on the forward, left hand engine firewall and includes primary electrical components such as: ACU, Battery Relay, Alternator Relay, Start Relay, External Power Relay, main battery Current Sensor, Bus 1, 2, & 3 circuit breakers, Clock Fuse, and the External Power Connector.

1.2. SWITCHES

MSTR: Positioning the master switch (MSTR) in the test set to ON provides a ground to energize the battery relay coil in the MCU which puts battery power to the main bus. This switch works similar to the BAT MASTER switch in the aircraft.

ALT: Positioning the alternator switch (ALT) in the test set to ON provides main bus power to the ACU and alternator relay coil. This switch works similar to the ALT MASTER switch in the aircraft except it does not receive its power from the ALT FIELD circuit breaker.

FLD: Positioning the field switch (**FLD**) in the **ON** position connects the field output from the ACU to the alternator field wire. Positioning the **FLD** switch to **OFF** allows for troubleshooting of the field wire and alternator faults. Positioning the **FLD** switch to **FAULT** applies a load greater than normal to the ACU field control circuit. The ACU protection circuitry should respond by shutting down causing **ACU TRIP** to illuminate and opening the alternator relay.

O.V. TEST: Positioning the over-voltage test switch (**O.V. TEST**) in the **TEST** position applies a voltage greater than normal on the ACU sense wire. The ACU should respond by shutting down causing **ACU TRIP** to illuminate and opening the alternator relay.

ALT TEST: Positioning the alternator test switch (**ALT TEST**) in the **GND** position simulates a ground fault on the alternator feeder. The ACU protection circuitry should respond by shutting down causing **ACU TRIP** to illuminate and opening the alternator relay. Positioning the **ALT TEST** switch in the **HOT** position with the **ALT** switch in the **OFF** position allows for checking for an alternator feeder or alternator shorted to ground. Short to ground can then be detected if the **ALT RLY** indicator is extinguished.

LAMP TEST: Positioning this switch to the TEST position tests all the LED's in the test set for operation. The **MSTR** switch must be in the **ON** position to perform lamp test.

1.3. INDICATOR LIGHTS

ACU PWR: The ACU power indicator (**ACU PWR**) illuminates when power is applied to the ACU and alternator relay coil.

ALT RLY: The alternator relay indicator (**ALT RLY**) illuminates when voltage is present on the alternator feeder, which is connected to the alternator relay.

ACU TRIP: The ACU trip indicator (**ACU TRIP**) illuminates when the ACU protection circuitry has detected a fault and has provided appropriate trip function that removes power from ACU and the alternator relay coil.

BUS1, BUS2, or BUS3: These indicators illuminate when there is voltage present on the individual bus feeders coming out of the MCU. All three of these indicators should be illuminated when the Main Bus is powered (**MSTR** switch is on). Note: MC01-2A MCU's do not have a Bus3.

BUS=28V: The **BUS=28V** indicator is turned on when the bus voltage in the MCU is approximately 27.25V or higher. This is an indication that the alternator is powering the bus and should be charging the battery. This indicator will be on when the alternator system is operating correctly.

CLK: The **CLK** indicator will come on when battery power is supplied to the MCU and the clock fuse has not opened.

FDR FAULT: The **FDR FAULT** indicator is used with the **ALT RLY** indicator when testing for a ground fault to the alternator feeder or alternator (reference: Instructions for Testing MCU on Aircraft section 4.3.F.). If **FDR FAULT** indicator illuminates and **ALT RLY** indicator is extinguished then there is a ground fault on the alternator feeder circuit.

FLD: The field indicator in the TE04 test set indicates if there is voltage present at the field wire that connects to the alternator.

LV: The low voltage (LV) indicator in the TE04 test set performs the same function as the LV annunciator in the aircraft. The Bus voltage is monitored in the MCU by the ACU and if the Bus voltage drops to approximately 24.5V or less then these LV indicators will turn on. When the ACU detects a low voltage condition at the Bus, which is sensed at the load side of the battery relay, it provides a ground to the LV indicator.

START: The start indicator (**START**) illuminates when the MCU receives power from the aircraft harness to engage the coil of the Start Relay.

1.4. TEST JACKS

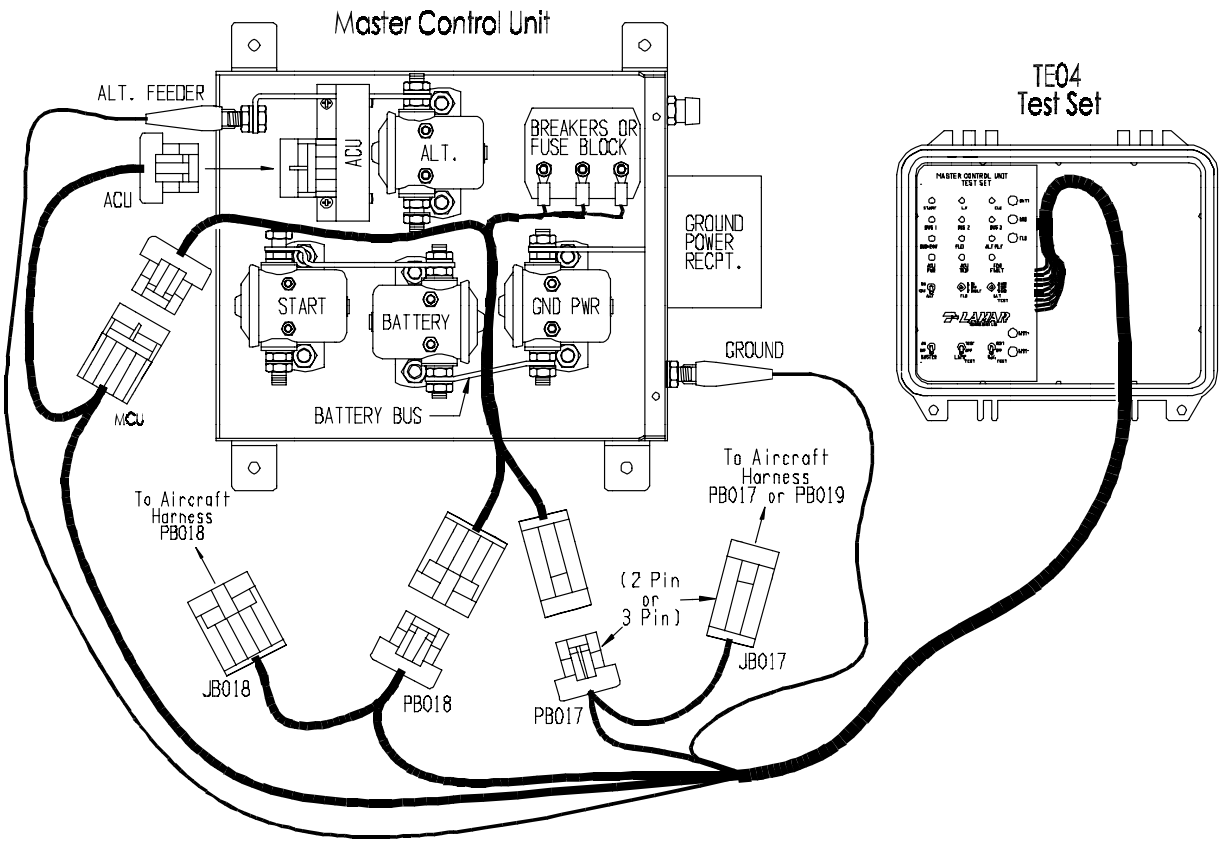
AMM+, AMM-: Use these test jacks with a voltmeter to check operation and accuracy of the Current Sensor inside the MCU.

BATT: Use this text jack and the **GND** jack with a voltmeter to determine battery voltage. This jack's connection is the same as the connection for the **CLK** indicator, which is prior to the battery relay and cannot be turned of with the **MSTR** switch. This jack may also be used to measure alternator output voltage with the **MSTR** and **ALT** switches on.

FLD: Use this text jack and the **GND** jack with a voltmeter for troubleshooting purposes to determine if field voltage is present at the field output of the ACU.

GND: The common ground return to be used with FLD and BATT test jacks.

2. CONNECTION DIAGRAM



3. INSTRUCTION FOR TESTING MCU ON BENCH

3.1. General

A. The TE04 Test Set aids in troubleshooting and verifying proper functions of the Master Control Unit (MCU) and related electrical components. For a complete verification of all proper functions perform all the following steps in order.

B. These instructions are for testing an MCU that has been removed from the aircraft. A DC power supply is necessary. Most tests can be done with an auxiliary power unit (APU), but a variable voltage power supply is preferred. Tests which require a variable power supply are in section 3.4.

Note: Step 3.3.I. requires a 24 amp power supply or charged 24 volt battery.

3.2. Setup of the MCU Test Set

A. Move the TE04 **MSTR** switch to **OFF.**

B. Remove the cover from the MCU.

C. Connect the TE04 connectors **PB017** and **PB018** to the MCU. There are two **PB017** connectors on the TE04, one with two wires, the other with three wires. Use the one that matches the MCU under test.

D. Disconnect the MCU harness from the Alternator Control Unit (ACU).

E. Connect the TE04 connector labeled **ACU** to the ACU.

F. Connect the TE04 connector labeled **MCU** to the MCU connector that was connected to the ACU.

G. Connect the clip labeled GND on the TE04 harness to the ground stud on the MCU.

H. Connect the red clip labeled **ALT FEEDER** on the TE04 harness to the alternator feeder bus that goes through the ACU. Be sure to connect it to the alternator side of the ACU rather than the relay side.

I. Connect the power supply (-) to the MCU ground stud and the (+) to the battery bus where the battery cable normally attaches. If using an APU, simply plug it into the external power connector just as would be done on the aircraft.

3.3. Test Procedures Using Either an APU or a Variable Power Supply

A. Ensure that all the TE04 switches are in the **OFF** position.

Power On, Lamp, and Clock Fuse Test

B. Turn on the power supply. If using a variable power supply, adjust the voltage to 28 volts.

C. Move the TE04 **MSTR** switch to **ON**

D. Move **LAMP TEST** switch to **TEST**.

(1) Observe that all TE04 lamps illuminate.

(2) If some lamps illuminate, but others don't, suspect TE04.

(3) If no lamp illuminates, verify steps from section 3.2 above. If nothing is found in error, suspect TE04.

E. Move **LAMP TEST** switch to **OFF.**

(1) Observe **CLK** illuminates. If **CLK** does not illuminate, suspect CLK fuse located in the MCU next to the APU connector.

(2) Observe **BUS 1**, **Bus 2** and **Bus 3** (if MCU is equipped) lights illuminate. If one or more of these lights does not illuminate, suspect 30 amp or 40 amp fuse or circuit breaker in the MCU. Ensure 20 amp fuses in test harness are properly installed and circuit breakers in the MCU are reset if applicable. If none of these lights illuminate, suspect Battery Relay. Ignore **LV** light until section 3.4.

Alternator On, Normal Operation Test

F. Move **FLD** switch to **ON**, and **ALT** switch to **ON**.

(1) Observe **FLD**, **ACU PWR** and **ALT RLY** illuminate.

(2) If **ALT RLY** does not illuminate, suspect alternator relay.

(3) If **FLD** does not illuminate, suspect ACU.

(4) If **ACU TRIP** illuminates, suspect ACU.

(5) If **ACU PWR** does not illuminate, suspect TE04.

Over-voltage Protection Test

*Note: This test will apply a voltage greater than normal on the ACU sense wire. The ACU should respond by shutting down causing **ACU TRIP** to illuminate and open the alternator relay. The **MSTR** and **ALT** switches must be **ON** for this test. This test may require a volt meter.*

G. Move **OV TEST** switch to **TEST** and hold for 5 seconds.

(1) Observe **ACU TRIP** illuminate, **ACU PWR**, **FLD** and **ALT RLY** extinguish.

(2) If **ACU TRIP** does not illuminate, move **OV TEST** switch to **TEST** again for 5 seconds while measuring the ACU sense voltage with a voltmeter.

Note: **ACU** sense voltage is measured between the white/orange wire pin on the TE04 panel connector and the **GND** test jack. A small paper clip may be used as a probe to measure at the back of the white/orange wire pin.

a. If **AC TRIP** still does not illuminate and the sense voltage is greater than 34 volts for 2 seconds, suspect ACU.

b. If the sense voltage is not greater than 34 volts for 2 seconds, suspect TE04 (or low battery).

(3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move **MSTR** switch back to **ON**.

(4) Observe **ACU PWR**, **FLD**, and **ALT RLY** illuminate again.

Over Field Current Protection Test

*Note: This test will apply a load greater than normal to the ACU field control circuit. The ACU should protect itself by shutting down causing **ACU TRIP** to illuminate and open the alternator relay. The **MSTR** and **ALT** switches must be **ON** for this test.*

H. Move **FLD** switch to **FAULT** and hold for 5 seconds.

(1) Observe **ACU TRIP** illuminate, **ACU PWR**, **FLD**, and **ALT RLY** extinguish.

(2) If **ACU TRIP** does not illuminate, suspect ACU.

(3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move **MSTR** switch back to **ON**.

(4) Observe **ACU PWR** and **ALT RLY** illuminate again.

Reverse Alternator Feeder Circuit Protection Test

*Note: This test will simulate a fault on the alternator feeder wire. The ACU should respond by shutting down causing **ACU TRIP** to illuminate and open the alternator relay. This test requires a 24 amp power supply or charged 24 volt battery. The **MSTR** and **ALT** switches must be **ON** for this test.*

I. Move **ALT TEST** switch to **GND** and hold for 5 seconds **MAXIMUM**.
   (1) Observe **ACU TRIP** illuminate, **ACU PWR**, and **ALT RLY** extinguish.
   (2) If **ACU TRIP** does not illuminate, suspect ACU.
   (3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move **MSTR** switch back to **ON**.
   (4) Observe **ACU PWR** and **ALT RLY** illuminate again.

3.4. Test Procedures Which Require a Variable Power Supply

Note: This section assumes that you have already completed section 3.3 above.

A. Ensure that the TE04 **MSTR** switch and **ALT** switch are in the **OFF** position.

Low Voltage Annunciation Test

B. Turn on power supply, adjusting the voltage to 25 volts.
C. Turn on **MSTR**, **ALT** and **FLD** switches.
   (1) Observe that **FLD** is illuminated and **LV** is extinguished.
   (2) If **FLD** is not illuminated, suspect ACU.
   (3) If **LV** is illuminated, suspect ACU.
D. Slowly adjust the voltage down until **LV** illuminates (should be around 24.5 volts.) Note the voltage at which it comes on.
E. Slowly adjust the voltage up again and observe that **LV** extinguishes (should be around 24.5 volts).

Alternator Regulation Voltage Test

F. Adjust the voltage up until **FLD** extinguishes (should be around 28.5 volts). Note at what voltage it goes out.
G. Slowly adjust the voltage back down and observe that FLD illuminates again (should be around 28.5 volts).
H. Move **MSTR** and **ALT** switches to **OFF.**

4. INSTRUCTION FOR TESTING MCU ON AIRCRAFT

4.1. General

A. The TE04 MCU Test Set aids in troubleshooting and verifying proper functions of the Master Control Unit (MCU) whether equipped with fuses or circuit breakers. It also tests related aircraft components.

B. For a complete verification of all proper functions perform all the following steps in order. Refer to section 5. Troubleshooting on Aircraft for procedures to perform for troubleshooting. Refer to the appropriate Cessna Maintenance Manual for required time interval maintenance checks.

4.2. Setup and Connection of Test Set to Aircraft

A. Ensure that all aircraft master, ignition, and system switches are off.

B. Place TE04 in left front seat of the aircraft and ensure that all TE04 switches are in the **OFF** position.

C. Run TE04 harness through left window.

D. Remove engine cowl as necessary to gain access to MCU.

E. Remove cover from MCU.

F. Disconnect MCU from aircraft harness connectors **PB017** or **PB019** and **PB018**.

G. Connect TE04 connectors **PB017** and **PB018** to MCU per TE04 Connection Diagram. Use either the two wire or three wire **PB017** connector corresponding to the MCU.

H. Connect aircraft harness connectors **PB017**or **PB109** and **PB018** to TE04 connectors **JB017** and **JB018** per diagram. Connect to either the two wire or three wire **JB017** connector as required.

I. Disconnect MCU harness from the Alternator Control Unit (ACU).

J. Connect TE04 connector labeled "**ACU**" to the ACU.

K. Connect TE04 connector labeled "**MCU**" to the MCU connector that was connected to the ACU.

L. Connect TE04 clip labeled "**GND**" to ground stud of MCU.

M. Connect red TE04 clip labeled "**ALT FEEDER**" to alternator feeder wire where it bolts to the ACU. Be sure to connect it to the alternator side of the ACU and not the relay side

Note: At this point all MCU connectors should be connected to the test harness

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4.3. Test With Engine OFF

Power On, Lamp, and Clock Fuse Test

A. Move the TE04 **MSTR** switch to **ON**. With TE04 **MSTR** switch **ON** electrical power will be available to aircraft loads through the Battery Relay.

B. Move **LAMP TEST** switch to **TEST**.

(1) Observe that all lamps illuminate.

(2) If some lamps illuminate, but others don't, suspect TE04.

(3) If no lamp illuminates, verify steps from section 4.2 above. If nothing is found in error, suspect TE04.

C. Move **LAMP TEST** switch to **OFF.**

(1) Observe **CLK** illuminates. If **CLK** does not illuminate, suspect **CLK** fuse located in the MCU next to the APU connector.

*Note: **CLK** fuse required for TE04 **BATT** test jack used in section 4.4.*

(2) Observe **BUS 1**, **BUS 2** and **BUS 3** (if MCU is equipped) lights illuminate. If one or more of these lights does not illuminate, suspect 30 amp or 40 amp fuse or circuit breaker in the MCU. Ensure 20 amp fuses in test harness are properly installed and circuit breakers in the MCU are reset if applicable. If none of these lights illuminate, suspect Battery Relay.

(3) **LV** illuminates when main bus voltage drops to approximately 24.5 volts or lower. Refer to section 4.4 for tests for the low voltage annunciation circuit.

Aircraft Essential and Crossfeed Diode Test

D. If MCU has fuses, remove **BUS 1** 30 amp fuse from fuseblock. If MCU has breakers, remove 20 amp **BUS 1** fuse from TE04 harness.

*Note: 20 amp **BUS 1** fuse is connected to pin A on **PB017** connector.*

(1) Observe **BUS 1** extinguish.

(2) If **Bus 1** does not extinguish, suspect shorted Essential or Crossfeed Bus diode in aircraft circuit breaker panel assembly.

E. Replace **BUS 1** fuse in fuseblock or in tester harness and repeat for **BUS 2**. The aircraft Essential and Crossfeed Bus diodes can only be checked with **BUS 1** and **BUS 2** and not with **BUS 3**.

Alternator or Alternator Feeder Shorted to Ground Test

Note: ***ALT*** *switch must be* ***OFF*** *for this test. This test checks the alternator feeder and alternator for a fault to ground with the alternator relay open. If there is no fault to ground, then both* ***FDR FAULT*** *and* ***ALT RLY*** *will illuminate although* ***ALT RLY*** *may be dimmer than* ***FDR FAULT****.*

F. Move **ALT TEST** switch to **HOT** position and hold while observing the **FDR FAULT** and **ALT RLY** indicators.

(1) Observe both **ALT RLY** and **FDR FAULT** illuminate.

(2) If only **FDR FAULT** illuminates, disconnect alternator feeder wire from the alternator at the terminal labeled "**BAT**" and repeat test. If only the **FDR FAULT** continues to illuminate, suspect alternator feeder wire for fault to ground. Otherwise suspect alternator for internal short or shorted external filter capacitor.

Alternator Relay Operation and Alternator Field Shorted to Alternator Feeder Test

G. Ensure **FLD** switch is **OFF**. Move **ALT** switch to the **ON** position.

(1) Observe **ACU PWR** and **ALT RLY** illuminate.

(2) If **ALT RLY** does not illuminate, suspect alternator relay.

(3) If **ACU TRIP** illuminates, suspect ACU.

(4) If **FLD** illuminates, disconnect field wire from alternator and repeat. If **FLD** still illuminates, suspect that field wire is shorted to alternator feeder wire, otherwise suspect alternator.

Alternator Field Shorted to Ground Test

H. Move **FLD** switch to **ON** position.

(1) Observe that **FLD** illuminates.

(2) If **ACU TRIP** illuminates, move **MSTR**, **ALT**, and **FLD** switches to **OFF** position. Disconnect field wire from alternator, then move **MSTR**, **ALT** and **FLD** switches to **ON** position. If **ACU TRIP** still illuminates, suspect field wire shorted to ground, otherwise suspect alternator.

Over-voltage Protection Test

*Note: This test will apply a voltage greater than normal on the ACU sense wire. The ACU should respond by shutting down causing **ACU TRIP** to illuminate and open the alternator relay. Aircraft **ALT FIELD** circuit breaker shall not open using the TE04 Test Set. The **MSTR** and **ALT** switches must be **ON** for this test. This test may require a voltmeter.*

I. Move **OV TEST** switch to **TEST** and hold for 5 seconds.

(1) Observe **ACU TRIP** illuminate, **ACU PWR**, **FLD** and **ALT RLY** extinguish.

(2) If **ACU TRIP** does not illuminate, move **OV TEST** switch to **TEST** again for 5 seconds while measuring the ACU sense voltage with a voltmeter.

Note: **ACU** sense voltage is measured between the white/orange wire pin on the TE04 panel connector and the **GND** test jack. A small paper clip may be used as a probe to measure at the back of the white/orange wire pin.

a. If **AC TRIP** still does not illuminate and the sense voltage is greater than 34 volts for 2 seconds, suspect ACU.

b. If the sense voltage is not greater than 34 volts for 2 seconds, suspect TE04 (or low battery).

(3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move **MSTR** switch back to **ON**.

(4) Observe **ACU PWR**, **FLD** and **ALT RLY** illuminate again.

Over Field Current Protection Test

*Note: This test will apply a load larger than normal to the ACU field circuit. The ACU should protect itself by shutting down causing **ACU TRIP** to illuminate and open the alternator relay. Aircraft **ALT FIELD** circuit breaker shall not open using the TE04 Test Set. The **MSTR** and **ALT** switches must be **ON** for this test.*

J. Move **FLD** switch to **FAULT** and hold for 5 seconds.

(1) Observe **ACU TRIP** illuminate, **ACU PWR**, **FLD**, and **ALT RLY** extinguish.

(2) If **ACU TRIP** does not illuminate, suspect ACU.

(3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move back to **ON**.

(4) Observe **ACU PWR** and **ALT RLY** illuminate again.

Reverse Alternator Feeder Circuit Protection Test

*Note: This test will simulate a fault on the alternator feeder wire. The ACU should respond by shutting down, causing **ACU TRIP** to illuminate and open the alternator relay. Aircraft **ALT FIELD** circuit breaker shall not open using the TE04 Test Set. The **MSTR** and **ALT** switches must be **ON** for this test.*

K. Move **ALT TEST** switch to **GND** and hold for 5 seconds **MAXIMUM**.

(1) Observe **ACU TRIP** illuminate, **ACU PWR**, and **ALT RLY** extinguish.
(2) If **ACU TRIP** does not illuminate, suspect ACU.
(3) Clear **ACU TRIP** by moving **MSTR** switch to **OFF**, wait at least 20 seconds, move **MSTR** switch back to **ON**.
(4) Observe **ACU PWR** and **ALT RLY** illuminate again.

L. Position all TE04 switches to **OFF** and proceed to section 4.4. Section 4.4 test may require a voltmeter.

4.4. Test With Engine Running

Note: This test may require a voltmeter that can plug into the TE04 panel test jacks.

A. Move the TE04 **MSTR** switch to **ON**. Leave TE04 **ALT** switch **OFF**. Leave aircraft **BAT/ALT** switch **OFF**.

Caution: Do not turn on aircraft avionics master or more than one electrical system switch with TE04 attached. ***MAXIMUM*** *electrical load shall be limited to approximately 15 amps or fuses in TE04 harness may open.*

Starter System Test

B. Clear prop area before attempting engine start.

C. Start engine using aircraft main battery and set to idle speed.

(1) If starter does not crank, observe TE04 **START** indicator when key-switch is in the START position. If **START** illuminates, suspect starter relay in MCU, starter, or start relay wiring inside the MCU. If **START** does not illuminate, suspect aircraft circuit breaker, key-switch or aircraft wiring.

(2) Observe **START** indicator extinguishes after starting engine. If **START** indicator does not extinguish, immediately shut down engine and suspect key-switch.

(3) Observe aircraft battery ammeter. If ammeter shows a larger than normal charge (positive) then immediately shut down engine and suspect starter. If ammeter shows a larger than normal discharge (negative) then immediately shut down engine and suspect start relay.

Low Voltage Annunciation Test

D. Observe **LV** indicator illuminated and **BUS=28V** extinguished. Observe aircraft low voltage annunciation illuminated.

(1) If **LV** does not illuminate plug the leads of a voltmeter into the **BATT** and **GND** jacks on the front of the TE04 panel and note the voltage reading. If the reading is greater than 24.5 volts, turn on the Landing light for about 10 seconds to lower voltage of main battery.

(2) If **LV** still does not illuminate suspect ACU.

(3) If **LV** illuminates but aircraft low voltage annunciations does not, suspect open wire to aircraft annunciation unit or annunciation unit failure.

Alternator On, Normal Operation Test

E. Move TE04 **ALT** and **FLD** switches to **ON** and advance engine speed to at least **1200 RPM**.

(1) Observe **BUS=28V** illuminates.

(2) Observe **LV** indicator extinguishes. Observe aircraft low voltage annunciation extinguishes.

a. If low voltage annunciation in aircraft does not extinguish and **BUS=28V** indicator illuminates, a false low voltage annunciation is present, shut down the engine and remove pin **A** from aircraft connector **PB018**. Start engine and perform this test again. If **LV** extinguishes but the low voltage annunciation remains illuminated, suspect wire shorted to ground between pin **A** on **PB018** and annunciator unit or annunciation unit failure. If **LV** still remains illuminated suspect ACU.

b. If low voltage annunciation in aircraft does not extinguish and **BUS=28V** indicator remains extinguished, plug the leads of a voltmeter into the **BATT** and **GND** jacks on the front of the TE04 panel and note the voltage reading.

i. If the reading is greater than 25.0 volts a false low voltage annunciation is present. Refer to step 4.4.E(2)a. above to trouble shoot a false low voltage annunciation.

ii. If the reading is less than approximately 24.5 volts then press the **ALT TEST** switch to the **HOT** position and hold. Note the condition of the **BUS=28V** indicator. If this indicator is illuminated while the aircraft low voltage annunciator is illuminated then suspect alternator relay failure (high resistance across the contacts). If the **BUS=28V** indicator does not illuminate then return the **ALT TEST** switch to **OFF** and put the positive lead of the voltmeter in the **FLD** jack on the TE04 panel. Note the voltmeter reading. If the reading is approximately battery voltage than suspect field wire circuit or alternator. If voltage reading is small (approximately 2 volts or less) then suspect the ACU

(3) Observe charge indication on the main battery ammeter in aircraft instrument panel.

a. If no charge indication on the ammeter and **BUS=28V** illuminates, check for voltage at **AMM+** and **AMM-** with voltmeter. Expect to see 8mV for each 10 amps of current. If not, suspect current sensor in MCU or related wiring, otherwise suspect aircraft ammeter system.

(4) Observe that **FLD** illumination may reduce in intensity after battery is charged and may flicker corresponding to engine rpm and aircraft electrical loads.

F. Test is complete. Turn off all TE04 switches and remove TE04 harness from aircraft. Reconnect aircraft harness to MCU and MCU harness to ACU.

5. TROUBLESHOOTING ON AIRCRAFT

5.1. General

A. The following table lists some common fault symptoms on the aircraft that the TE04 Test Set can be used to help troubleshoot. Refer to the **INSTRUCTION FOR TESTING MCU ON AIRCRAFT** (section 4.) for the following troubleshooting procedures.

SYMPTOM	POSSIBLE FAULT CONDITION	PROCEDURE
(1) Low Voltage Condition With engine speed above 1000RPM, low voltage annunciation in aircraft, aircraft bus voltmeter indicates less than 24.5 volts; aircraft main battery ammeter shows discharge and ALT FIELD circuit breaker IN (not tripped).	1. **ALT FIELD** circuit breaker failed open. 2. **ALT MASTER** switch failed open. 3. Open wire circuit between ALT FIELD circuit breaker and ACU power/alternator relay coil. 4. Open field wire circuit. 5. Open alternator feeder wire. 6. Alternator field circuit, brushes or winding/diode failure. 7. Alternator relay high resistance across contacts. 8. Alternator relay failure or contacts not closing. 9. ACU regulation circuit failure.	Perform sections 4.2, 4.3 A thru 4.3 C (1), 4.4 A. thru 4.4 C, 4.4 E thru 4.4 E (2).
(2) False Low Voltage Annunciation With engine running, low voltage annunciation in aircraft, aircraft bus voltmeter indicates more than 25.0 volts, and aircraft main battery ammeter shows charge.	1. ACU low voltage detection circuit failure. 2. Wires and connections between ACU and annunciator unit shorted to ground. 3. Annunciator unit failure.	Perform sections 4.2, 4.3 A thru 4.3 C (1), 4.4 A thru 4.4 C, and 4.4 E thru 4.4 E (2).

SYMPTOM	POSSIBLE FAULT CONDITION	PROCEDURE
(3) No Low Voltage Annunciation No low voltage annunciation in aircraft with main bus voltage less than approximately 24.5 volts.	1. ACU sense wire not connected to main bus inside MCU. 2. Open wire circuit between ACU and annunciator unit. 3. Annunciator unit failure. 4. ACU low voltage detection circuit failure.	Visually inspect that the orange ACU sense wire is connected firmly to the main bus using the top battery relay stud. Perform sections 4.2, 4.3 A thru 4.3 C (1), and 4.4 A thru 4.4 D.
(4) Ammeter – Main Battery Aircraft main battery ammeter shows zero or non-operational or questionable accuracy.	1. Ammeter sensor calibration error or failure. 2. Open or shorted ammeter wiring. 3. Open ammeter sensor fuse (not required for CS3100 sensor). 4. Ammeter sensor ground wire open or not connected inside MCU (CS3100 sensor only). 5. Indicator calibration error or failure.	Perform sections 4.2, 4.3 A, 4.3 B, 4.4 A thru 4.4 C and 4.4 E (3). Note: The **AMM+** and **AMM-** test jacks may be used with or without engine running to check ammeter sensor.
(5) ALT FIELD Circuit Breaker Open Unexplained ALT FIELD circuit breaker opening.	1. Alternator internal shorts for field circuit or feeder windings. 2. Aircraft alternator feeder wiring shorted to ground. 3. Shorted alternator filter capacitor. 4. Aircraft field wire circuit shorted to alternator feeder wiring or to another power circuit. 5. Alternator field wiring shorted to ground. 6. ACU protection circuitry failure causing breaker to open. 7. ACU regulation circuitry failure resulting in protection circuitry to open circuit breaker. 8. **ALT FIELD** circuit breaker failure.	Perform sections 4.2, 4.3 A, 4.3 B, and 4.3 F thru 4.3 K.

SYMPTOM	POSSIBLE FAULT CONDITION	PROCEDURE
(6) Over-voltage Condition Aircraft bus voltmeter indicates more than 29 volts with engine running.	1. Aircraft field wire circuit shorted to alternator feeder wiring or to another power circuit. 2. ACU regulation circuit failure. 3. ACU protection circuit failure if voltage goes above 32 volts without opening **ALT FIELD** circuit breaker	Perform sections 4.2, 4.3 A, 4.3 B, 4.3 G, and 4.3 I.
(7) Bus Feeder Failure Loss of one or more aircraft individual electrical load buses.	1. Shorted or opened bus feeder. 2. Opened Bus 1, 2 or 3 circuit breakers or fuses. 3. Failed open Bus 1, 2 or 3 circuit breakers or fuses 4. Battery relay failure (contacts not closing).	Perform sections 4.2, 4.3 A, 4.3 B, 4.3 C (2).
(8) Engine Start Failure Turning Start Switch does not engage starter.	1. Start relay failure (contacts not closing). 2. Starter failure. 3. Open start relay coil wire circuit. 4. Open start feeder wire circuit. 5. Open aircraft circuit breaker for start circuit. 6. Failed start key-switch. 7. Main Battery low capacity.	Perform sections 4.2, 4.3 A, 4.3 B, 4.4 B, and 4.4 C.
(9) Engine Start Disengage Failure Starter does not disengage after returning Start Switch from START to BOTH.	1. Failed start key-switch. 2. Start relay contacts failed closed. 3. Starter bendix failed extended.	Perform sections 4.2, 4.3 A, 4.3 B, 4.4 B, 4.4 C (2), and 4.4 C (3).