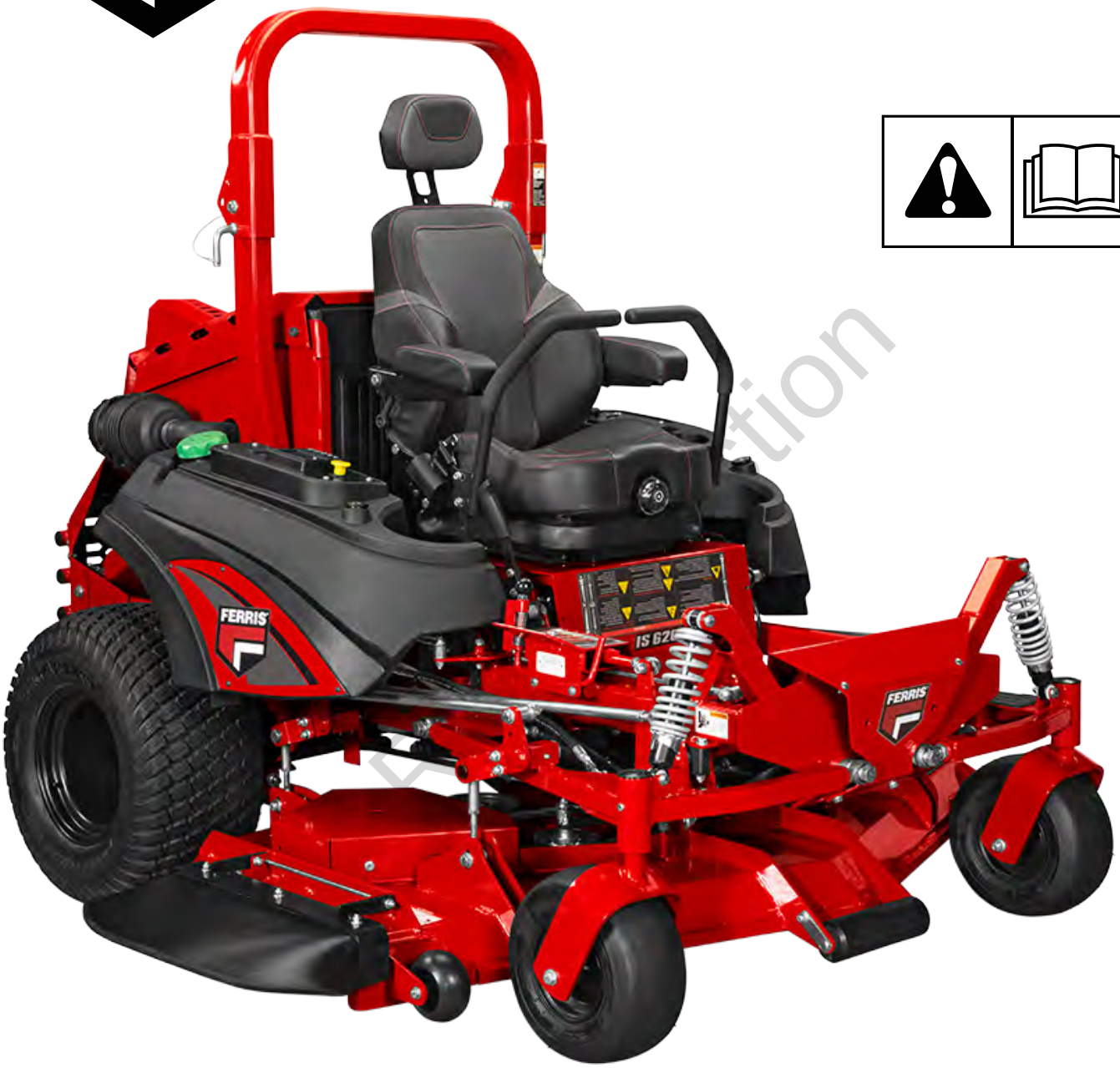
WIRE DIAGRAM
ELECTRICAL THEORY
OF OPERATION



Wire Harness Part Number 5109748 (IS6200)

5111442
Revision B

Manual Contents:

Service Maintenance Safety

WARNING

Amputation and crushing hazard.

Specific steps must be taken in order to perform service and maintenance procedures safely.

Read and follow all the applicable safety and instructional messages in the owner's manual.

Always disengage the mower blades, set the parking brake, turn the engine OFF, remove the ignition key, and wait for all movement to stop prior to performing service and maintenance procedures.

Always disconnect the spark plug wire(s) and fasten it away from the plug before beginning any maintenance or service procedures in order to prevent accidental ignition.

General Information

Electrical Theory for Wire Harness Part Number(s): 5109748

Models Series: Ferris IS6200 Series

(The object of this document is not to give you a failure mode and how to troubleshoot it. It is to give you knowledge on how the system works so that you may formulate a troubleshooting strategy and identify the point(s) of failure).

Models used on:

5901849, 5901850, 5901851, 5902162 and 5902163 in serial number range 4001933021 and Above

NOTE: Some models may feature serial number breaks that use different wire harnesses.

Before continuing, pull up the wire schematic(s) on the Power Portal eParts for your above model number to use as a reference while reviewing the electrical theory for each circuit.

Please select the circuit from the table of contents for theory of operation.

Charging Circuit

Function:

Supply charging voltage to the battery from the engine voltage regulator to charge the battery.

Unit Running Conditions:

- Key switch in the run position
- Engine running

Electrical Theory of Operation

The battery receives charging voltage on the red wire at the positive terminal of the battery from the connection at the starter. Voltage is created at the alternator by battery voltage flowing across a resistor after the keyswitch. This causes the voltage to drop so that the alternator windings will become excited by seeing low voltage at terminal D and in turn they will create charging voltage on the output terminal B+. The diode provides protection for the circuit from voltage flowing the incorrect direction back to the key switch.

Note: The alternator cannot charge at idle, the idle must be elevated or the machine must be in use to create charging voltage.

Cranking Circuit

Function:

Energize the starter solenoid (12 Volts) to engage the starter and crank the engine.

Unit Run Conditions:

- Key switch in the start position
- Parking brake on
- Left and Right Control Handles in the Neutral Position
- PTO switch in the off position

Electrical Theory of Operation

The key switch (terminal 2) is energized (12 Volts) through the #3 splice in the wiring harness. Voltage passes across the 20amp fuse and is present at the starter relay at terminal 30. The starter relay must be energized so the relay will close the top terminals and then voltage will flow across the terminals and on to the starter. The power for the starter relay is created by an input request from the keyswitch to the ECM on JI-32. The output voltage comes out of the ECM at JI-18 and is then present at the relay on terminal 86.

The relay closes when ground is supplied to the relay at C-9 (terminal 85). When continuity to ground is present at terminals P-8, P-9, P-20, and P-29, the digital display will supply ground to the starter relay through P-16. The operator presence indicator lights must be illuminated to indicate continuity of ground through these circuits. Once all of these conditions are met, the relay will close, supplying the starter with 12 volts, cranking the engine.

ECM Power and Fuel Pump Circuit

Function:

Engage the fuel pump relay to supply fuel to the engine by closing the engine load relay.

Unit Run Conditions:

- Operator in Seat
- Key in the start position

Electrical Theory of Operation

The key switch receives power from the battery through a 5 amp fuse (B-3 to B-7). This will then send power from the O-4 terminal of the keyswitch to ECM pin J1-9, supplying the ECM with key on power.

The engine relay must receive power at B-31 terminal so that the engine relay can close and supply voltage to the fuel pump relay as well as the ECM power feed terminals. Voltage is passed through a 30 amp fuse from terminals B-10 to B-14. It will then be distributed when it connects at splice #8. This will supply voltage to the engine relay coil, thus closing the relay and connecting terminals B-39 & B-32. When these close, voltage can pass through B-32 and connect at splice 4. This will give our ECM power at terminals J1-1 and J1-2.

The voltage at splice 4 is also what will be needed to close our fuel pump relay, turning our fuel pump on. Voltage passes from splice #4 through the 5 amp fuel pump coil fuse and will be present at terminal B-17 of the fuel pump relay coil. When this is hot and B-26 has ground, the relay will connect terminals B-25 and B-18, allowing voltage to flow to our fuel pump at terminal E-1.

Ground to our fuel pump is supplied all the time through splice 1 which directly connects to the main battery ground.

Electronic Throttle Control

Function:

Send throttle lever feedback back to the ECM so it can adjust other running parameters accordingly

Unit Run Conditions:

- Key switch in run position

Electrical Theory of Operation

Note: **This type of throttle control is only used on CE/ AUS models.**

The Sender CAN Module is used to convert throttle signal voltages into the proper CAN voltages that can be interpreted by the ECM. The throttle lever is electronic and works on a direct relationship between the desired throttle position and the voltage that is sent back to the sender can module to be turned into a CAN signal for the ECM.

The key switch supplies battery voltage along the red wire to terminal A-1 of the Sender Can Module as it needs to be powered from a 12 volt source. Ground to the module is supplied from terminal 3 of the PTO switch to the module at terminal A-2 (black wire).

Terminal C-F of the throttle control is supplied with a 5 volt reference signal to be used for the idle validation switch. This will be supplied back to the sender can module through terminal D of the throttle control as the IVS return signal. The purpose of having this feature is to filter out possible erratic signals that may cause the throttle to act irrationally. It will keep the engine running smoothly.

The IVS return signal works on a 0.6v-4volt range based on desired throttle. The 5 volt supply voltage is brought into the control lever from terminal C-C. When the throttle control lever is pushed forwards, the IVS return voltage supplied to the Sender CAN Module will be higher. When the throttle control lever is pulled back towards idle, the IVS return voltage will be towards the lower end of this scale. By taking the reference supply voltage and modifying it based on the lever position, the sender module will know how to properly adapt engine parameters for throttle movements.

Note: **Throttle control for Domestic Models**

On domestic models of the IS6200, the throttle is controlled through the digital display. The display allows for adjustability of the desired throttle setting.

The throttle can be adjusted by tapping the increase (button “E”) or decrease (button “D”) RPM buttons. These allow the user to tap the button to get the desired throttle amount. These button inputs would be supplied to the display which would then send these inputs to the ECM to adjust throttle accordingly.

The display also has the ability to adjust the throttle to max RPM or idle. To adjust the throttle to full RPM, the “B” button of the display must be pressed. To bring the RPM’s back to the idle position, the “A” button must be pressed.

Glow Plug Circuit

Function:

To cycle the glow plugs to warm the combustion chamber before cranking

Unit Run Conditions:

- Key switch in the accessory position.

Electrical Theory of Operation

Voltage must be supplied to the glow plug relay coil so that it will close and send voltage to the glow plugs. Terminal 30 of the relay will see battery voltage when the key is placed in the accessory position. Voltage will be supplied directly through the battery and across a 25 amp fuse before terminating at terminal 30 (relay closed). The ground side of the relay (Terminal 85) will be grounded through splice 3, then splice 1, where ground terminates at the negative battery terminal. When the key is placed in the accessory position, the ECM will send voltage from the J1-33 ECM terminal to terminal 86 of the glow plug relay. Once the relay is energized, the top terminals of the relay (30 to 87) will connect, letting voltage pass to the glow plugs, warming the combustion chambers prior to starting.

The key must be held in this position until the Digital Display message “Wait to Start” disappears from the display. When this message has gone away, the engine is ready to be started.

Operator Presence/Safety Circuit

Function:

Ensure proper position of safety interlock switches prior to starting. If the criteria is not met, the digital display will not send a request to the ECM to engage the starter. This circuit will also shut the engine down if one of the criteria is lost.

Unit Run Conditions:

TEST 1 - Engine SHOULD NOT crank if:

- PTO switch is engaged, OR
- Parking brake is not engaged, OR
- Ground speed control levers are not in the NEUTRAL position.

TEST 2 - Engine SHOULD crank if:

- PTO switch is not engaged, AND
- Parking brake is engaged, AND
- Ground speed control levers are locked in the NEUTRAL position.

TEST 3 - Engine should SHUT OFF if:

- Operator rises off seat with PTO engaged, OR
- Operator rises off the seat with the parking brake disengaged.
- Operator moves ground speed control levers out of their neutral positions before disengaging the parking brake.

Electrical Theory of Operation

The operator presence circuit works through continuity of ground rather than a power circuit. If continuity is lost through any of the circuits, the digital display panel will recognize this & a request will be sent for the engine to be shut off. If the switches are placed in their correct position the engine will be sent a request from the digital display panel to send voltage to the starter and crank the engine.

Power to Digital Display Circuit

Function:

Provide power to the digital display system.

Unit Run Conditions:

- Power in accessory, start, and run positions.

Electrical Theory of Operation

The digital receives power when the key is in the accessory, start, and run positions. It receives a constant ground from splice #3 (receives ground from main battery ground) which grounds the display at connector P, terminal P-29.

Power is transferred to the digital display in the form of a “main power supply” and a “wake up signal.” When the key switch is in the “on” position, power will flow through the 5 amp fuse on terminal B-3 and come out on terminal B-7. Voltage will then move across the keyswitch and over to the display at terminal P-27, “waking” the module up.

Main power to the module is supplied when the key switch is in the accessory, run, and start positions. Power passes through the 25 amp fuse on terminal B-4 to terminal B-8. Once this happens, voltage will be present at terminal P-28 of the display module, powering up the display.

PTO Clutch Circuit

Function:

Provide power to the PTO clutch, engaging the blades.

Unit Run Conditions:

- Key switch in the run position, engine running.
- Operator in seat.

- Parking brake off.
- Left & Right control handles pulled in the operating position.
- PTO switch pulled into the ‘Up’ position.

Electrical Theory of Operation

The PTO circuit must have some parameters met before power is sent to the PTO clutch. Once these conditions noted above are met, the pto clutch will become energized with voltage, engaging the mower deck. The display will reflect this as the emblems for each circuit will be illuminated when each operator presence circuit criteria has been met. All of these parameters must be met before the PTO switch is ‘pulled up’ or the engine will shut down.

When the PTO switch is engaged, continuity to ground will be made on terminal 6 of the PTO as well as terminal 8 of the CAN display. Once this signal is received, the display will provide a ground to the PTO relay from terminal P-3 of the display connector. This ground will be supplied to terminal B-28 of the PTO relay coil.

Voltage will be present at the relay coil positive terminal B-19 at all times as it comes through one 20 amp fuse direct from the battery. When ground is supplied from the display, the relay will close, allowing power to cross the relay from B-27 to B-20 where it will then travel to the soft start module.

The goal of the soft start module is to ramp up power to the clutch progressively so as not to damage it. There is an inline diode that prevents electricity from backfeeding through the soft start module and the rest of the circuit. This ensures circuit voltage protection. The ground for the clutch (yellow wire) is directly tied in with splice #3 which connects to the battery ground.

The cutter deck will also be shutdown if low oil pressure or high coolant temperature is observed. The switches will ground out & this will be recognized by the digital display. Respective error lights should illuminate on the display. The display will then remove the ground to the pto relay, effectively shutting off the deck.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