TR89, TR99 CONTENTS

SECTION 1
ELECTRICAL SYSTEM

CONTENTS

GENERAL ELECTRICAL

INTRODUCTION

This section describes the electrical system of the TR89 and TR99 combines. The electrical system has been broken down into sub systems and circuits according to functions performed or monitored. The Table of Contents lists the sub systems and circuits. Each sub system and circuit listed contains a description of the electrical circuit, a schematic of the circuit, and diagnostic test procedures based on the symptom(s) that a system may demonstrate.

Read all the introductory information before starting any test procedure. Next, look through the test procedures and locate the correct symptom. Use that test procedure to locate and correct the problem. Follow the steps as instructed. Do not skip steps unless instructed to do so in the test procedures.

Prepare the machine for the test by following the pretest instructions. Perform the test and observe the results. Perform the indicated corrective action. Continue through the test procedure until the problem is corrected, then return the system to an operational condition (replace shields, etc.).

DEFINITION OF TERMS

ALTERNATING CURRENT (A.C.) - A flow of electrons which reverses its direction of flow at regular intervals in a conductor.

AMMETER - Measures the flow of electrical current in amperes. Ammeters are connected in series with the circuit to be tested.

AMPERE - A unit of measure for the flow of current in a circuit. The ampere is used to measure electricity such as “gallons per minute” is used to measure liquid flow.

CIRCUIT - A continuous, unbroken path along a conductor through which electrical current can flow from a source, through various units, and back to the source.

CIRCUIT BREAKER - A device to protect an electrical circuit from overloads.

COLD RATING - The cranking load capacity of a battery at low temperatures.

CONTINUITY - Unbroken path along a conductor through which electrical current can flow.

CURRENT - Movement of electricity along a conductor. Current is measured in amperes.

DIODE - An electrical device that will allow current to pass through itself in one direction only.

DIRECT CURRENT (D.C.) - A flow of electrons moving in the same direction along a conductor from a point of high potential to one of lower potential.

OHM - The standard unit for measuring resistance to flow of an electrical current.

OHMMETER - An instrument for measuring the resistance in ohms of an electrical circuit.

OPEN CIRCUIT - An open circuit occurs when a circuit is broken interrupting the flow of current through the circuit.

RELAY - An electrical switch which opens and closes a circuit automatically when activated.

RESISTANCE - The opposing force offered by a circuit. Resistance is measured in ohms.

SHORT CIRCUIT - A part of a circuit comes in contact with part of the same circuit or unintentionally touches a metallic object.

SOLENOID - A circular coil used for producing a magnetic field.

VOLT - A unit of electrical pressure which caused current to flow in a circuit.

VOLTAGE - The force which is generated to cause current to flow in an electrical circuit. Voltage is measured in volts.

VOLTMETER - An instrument for measuring the force in volts of electrical current. Voltmeters are connected in parallel to the points where voltage is to be measured.

HARNESSES

There are five main harnesses on the TR89/99 combine. The harnesses and their contents are as follows:

Main Cab Harness – contains all the wiring necessary to connect the electrical components inside the cab. This includes the instrument bar in the cab roof. The main cab harness also provides the connections for the other harnesses.

Cab Roof Harness – contains all the wiring necessary to connect the electrical components of the cab roof. This does not include the instrument bar. This harness connects to the main cab harness through connector A.

Engine Harness – contains all the wiring for the engine electrical systems and supplies the main power to the combine electrical systems. This harness connects to the main cab harness through connector B.

Monitor Harness – contains the wiring to and from the sensors that monitor the functional areas of the combine. This harness connects to the main cab harness through connector G.

Stack Valve Harness – contains the wiring necessary for control of the hydraulic stack valve as well as work lighting. This harness connects to the main cab harness through connector C.

The harnesses are interconnected by means of bulkhead connectors located behind the seat on the back wall of the cab.

Shown are the wire side of connector G, 1, connector B, 2, connector P, 3, and connector S, 4. Connector J, 5, connects two harnesses inside the cab to each other.

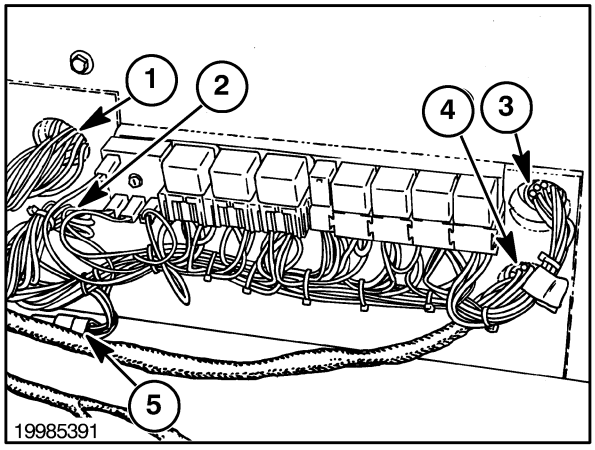

Figure 1-1

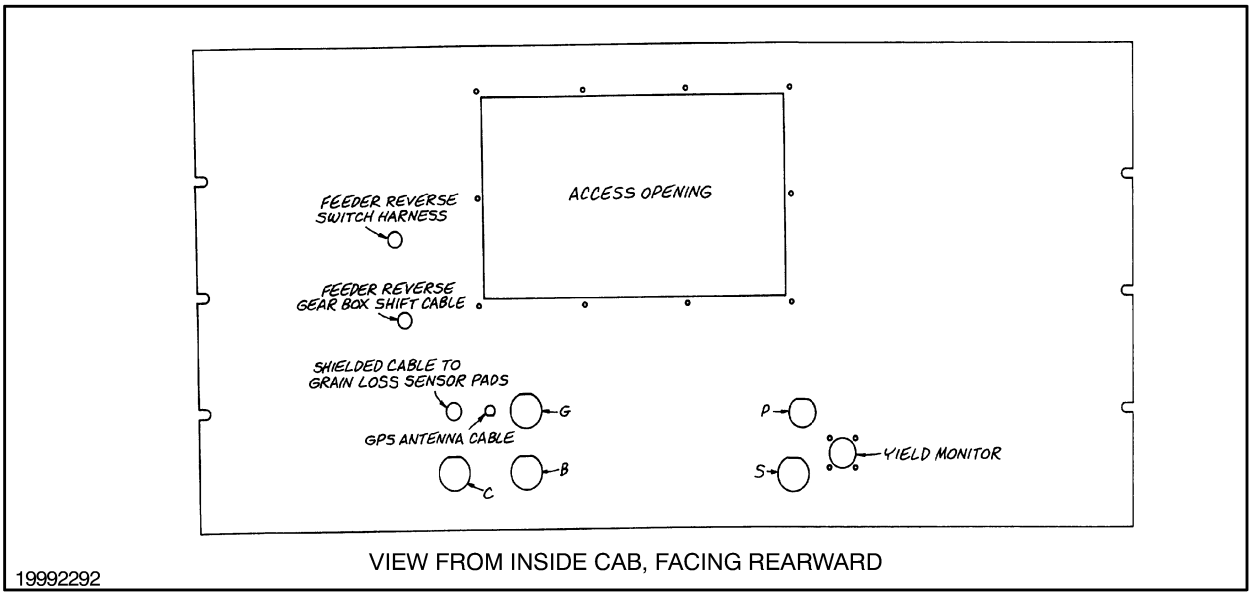

Figure 1-2

Bulkhead connectors are mounted on the lower back wall of the cab. The access opening allows access to the mating connectors outside the cab.

Connectors A and C are located under the relays in the right-rear corner of the cab. Shown are connector A, 1, the wire side of connector C, 2, connector G, 3, and connector B, 4. Connector T is located under connector A, 1, and not shown in this view.

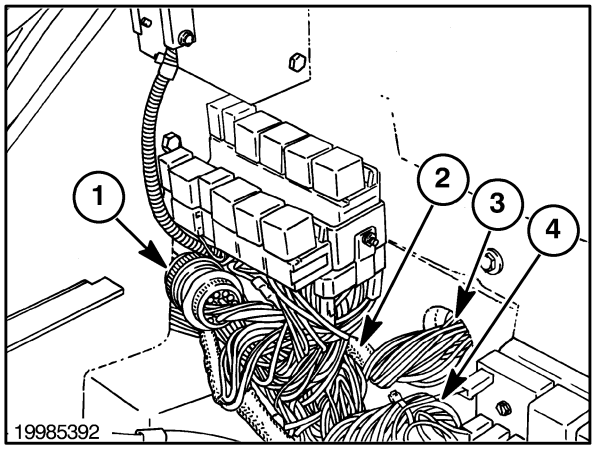

Figure 1-3

Electrical Connector Chart

Connector	Location	Function
A	Console under relays	Cab interior to cab roof
B	Rear cab bulkhead, lower left of three	Cab interior to engine
C	Rear cab bulkhead, lower right of three	Cab interior to stack valve & under cab platform
E	Rear of cab console	Cab interior to automatic head height control light bar
F	Flat plastic spade connector under a cover at right rear cab post	Cab roof harness to gauge bar for dimmer
G	Rear cab bulkhead, upper left of three	Cab interior to monitor sensors
H	Cab console	Cab roof to monitor for dimmer
J	Cab console under relays	Connects two cab interior harnesses; #86575533 & #86588235
K	Right front of feeder	Head height control raise/lower to header
L	Right front of feeder	Header height control tilt L/R to header
P	Rear cab bulkhead, left side	Cab interior to drives engage
S	Rear cab bulkhead, left side	Cab interior to concave, turret, lateral tilt potentiometer
T	Console under relays next to Connector A	Cab interior to instrument bar
W	Left side at feeder pivot	Monitor harness to stone trap
Y	Right rear of shoe	Shielded harness to grain loss sensors
Z	Cab console behind key switch	Cab interior to grain loss sensors
CC	Rear of cab console	Cab interior to header control switches

NOTE: This chart lists the major connectors only. These connectors are identified by letter in the text and on the diagrams.

CIRCUIT BREAKERS

There are two groups of circuit breakers in the electrical system. The main circuit breaker panel is located on the frame next to the engine. This circuit breaker panel contains circuit breakers for the work lights, 1, road lights, 2, concave and turret motors (TR99 only), 3, control relay, 4, air conditioning, 5, run relay, 6, key switch, 7, unswitched circuit, 8, hazard lights, 9, and the start relay, 10.

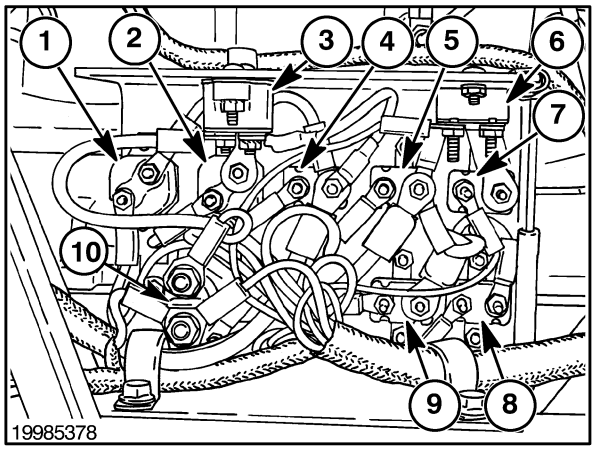

Figure 1-4

The second group of circuit breakers is located in a box next to the right-hand console in the cab. This group contains circuit breakers for the work lights, 1, controls, 2, thresher and seat, 3, and hydraulic control, 4.

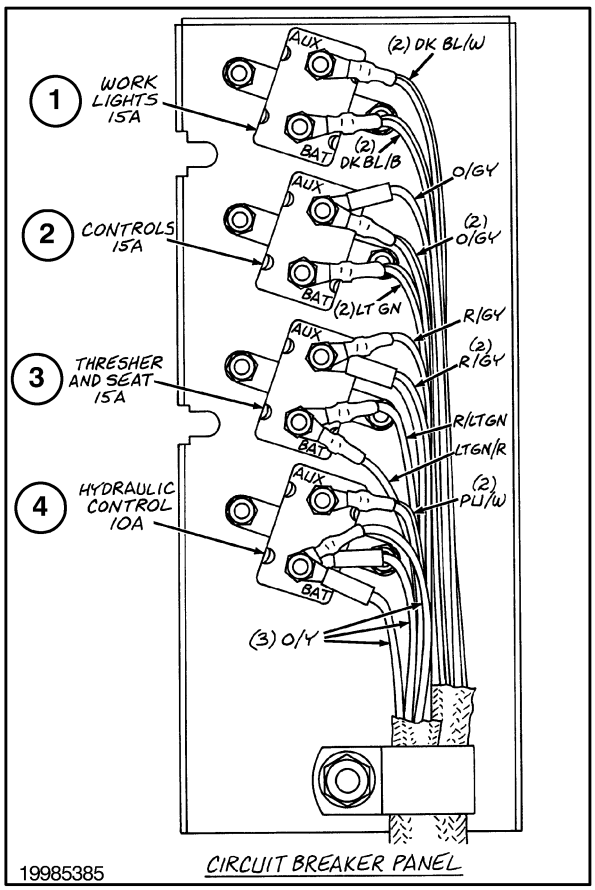

Figure 1-5

RELAYS

Located behind the operator's seat is a row of relays and three diode blocks. These components may be accessed by loosening two bolts, and lifting the shield up and off the bolts. The following relays are shown:

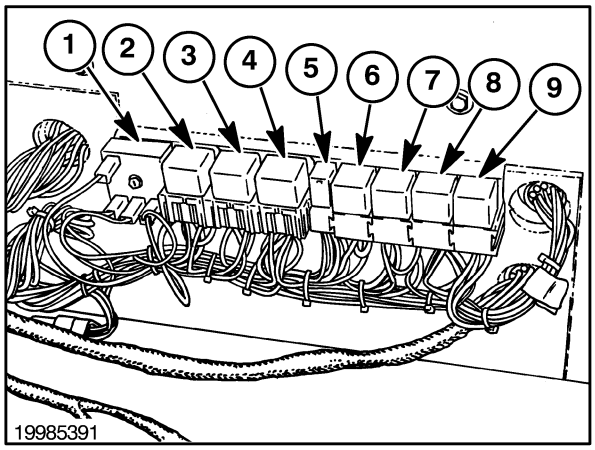

Figure 1-6

1	Time delay relay, header drive
2	One-amp diode module containing diodes D21 and D22
3	One-amp diode module containing diodes D23 and D24
4	Six-amp diode module containing diodes D25 and D26
5	Header run relay
6	Thresher run relay
7	Holdout relay, neutral start
8	Thresher engage relay
9	Thresher disengage relay

Located behind and to the right of the operator's seat is a double row of relays. These components may be accessed by removing two screws, and lifting the shield off the relays. The following relays are shown:

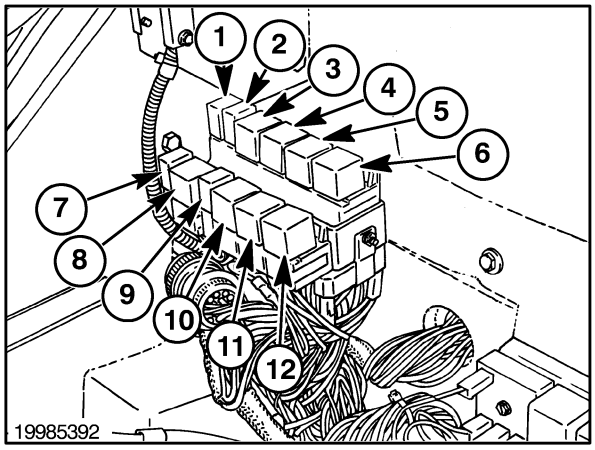

Figure 1-7

1	A/C power relay
2	A/C clutch relay
3	Work lamps relay
4	Control relay
5	Concave down relay (TR99 only)
6	Concave up relay (TR99 only)
7	Master valve relay
8	Run relay
9	Auto header height off relay
10	Auto header height on relay
11	Turret up relay [TR99 only (optional)]
12	Turret down relay [TR99 only (optional)]

KEY SWITCH POSITIONS

The key switch has four positions: Accessory, 1; Off, 2; On or Ignition, 3; and Start, 4. In position 1, the battery (BAT) terminal is connected to the accessory (ACC) terminal. In position 2, the battery (BAT) terminal is disconnected from all other terminals. In position 3, the battery (BAT) terminal is connected to the ignition (IGN) and accessory (ACC) terminals. In position 4, the battery (BAT) terminal is connected to the start (ST) terminal and the ignition (IGN) terminal.

The following table shows the battery connections for each switch position.

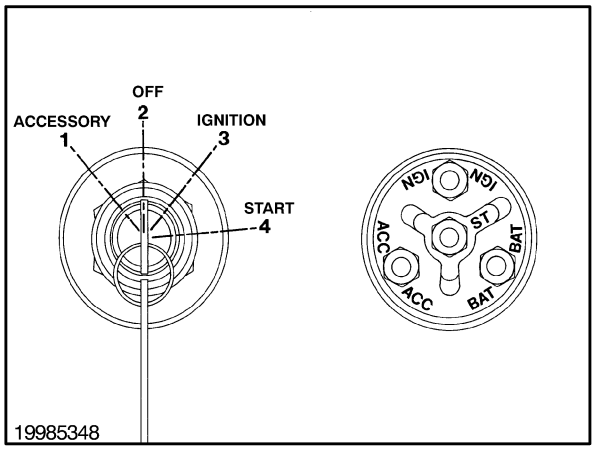

Figure 1-8

		Switch Position			
Terminal		**1 Accessory**	**2 Off**	**3 Ignition**	**4 Start**
Battery (BAT)	**[B]**				
Accessory (ACC)	**[A]**				
Ignition (IGN)	**[I]**				
Start (ST)	**[S]**				

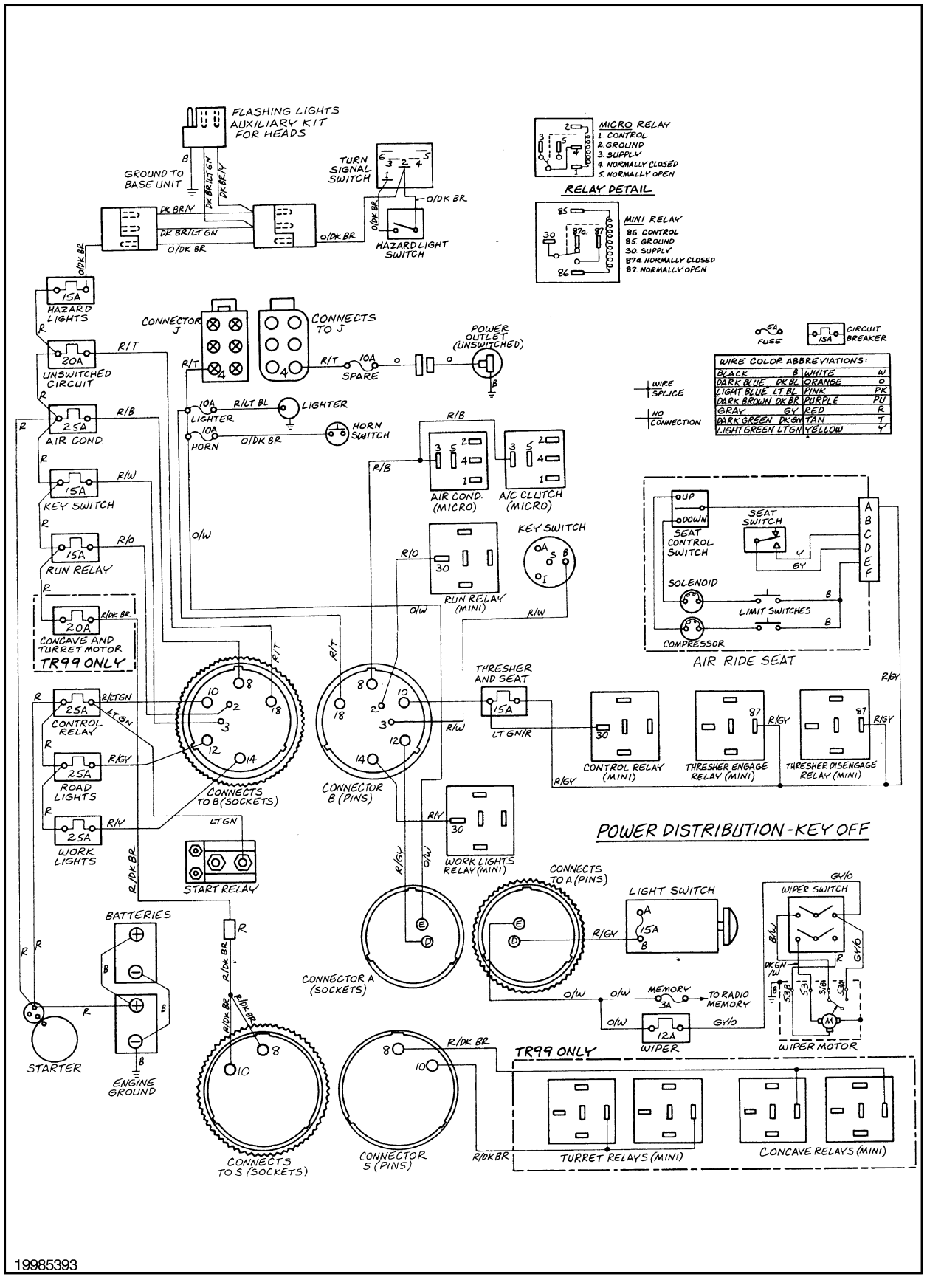
FLASHING LIGHTS AUXILIARY KIT FOR HEADS
GROUND TO BASE UNIT
TURN SIGNAL SWITCH
HAZARD LIGHT SWITCH
MICRO RELAY
1. CONTROL
2. GROUND
3. SUPPLY
4. NORMALLY CLOSED
5. NORMALLY OPEN
RELAY DETAIL
MINI RELAY
86. CONTROL
85. GROUND
30. SUPPLY
87a. NORMALLY CLOSED
87. NORMALLY OPEN
HAZARD LIGHTS
CONNECTOR J
CONNECTS TO J
POWER OUTLET (UNSWITCHED)
UNSWITCHED CIRCUIT
SPARE
LIGHTER
HORN
HORN SWITCH
AIR COND.
KEY SWITCH
RUN RELAY
CONCAVE AND TURRET MOTOR
TR99 ONLY
AIR COND. (MICRO)
A/C CLUTCH (MICRO)
RUN RELAY (MINI)
SEAT CONTROL SWITCH
SEAT SWITCH
SOLENOID
LIMIT SWITCHES
COMPRESSOR
AIR RIDE SEAT
CONTROL RELAY
ROAD LIGHTS
WORK LIGHTS
START RELAY
CONNECTS TO B (SOCKETS)
CONNECTOR B (PINS)
THRESHER AND SEAT
LT GN/R
CONTROL RELAY (MINI)
THRESHER ENGAGE RELAY (MINI)
THRESHER DISENGAGE RELAY (MINI)
WORK LIGHTS RELAY (MINI)
POWER DISTRIBUTION-KEY OFF
CONNECTS TO A (PINS)
CONNECTOR A (SOCKETS)
LIGHT SWITCH
WIPER SWITCH
MEMORY
TO RADIO MEMORY
WIPER
WIPER MOTOR
BATTERIES
STARTER
ENGINE GROUND
CONNECTS TO S (SOCKETS)
CONNECTOR S (PINS)
TURRET RELAYS (MINI)
CONCAVE RELAYS (MINI)
FUSE
CIRCUIT BREAKER
WIRE COLOR ABBREVIATIONS:
BLACK B
WHITE W
DARK BLUE DK BL
ORANGE O
LIGHT BLUE LT BL
PINK PK
DARK BROWN DK BR
PURPLE PU
GRAY GY
RED R
DARK GREEN DK GN
TAN T
LIGHT GREEN LT GN
YELLOW Y
WIRE SPLICE
NO CONNECTION
19985393

Figure 1-9

POWER-UP SEQUENCE

Key Off

When the key switch is in the off position, battery power, connected to the main circuit breaker panel, is connected to the following circuits and components:

- Through the 25-amp work lights circuit breaker and connector B pin 14 to the work lights relay pin 30.
- Through the 25-amp road lights circuit breaker, connector B pin 12, and connector A pin D to pin B of the light switch.
- Through the 25-amp control relay circuit breaker directly to the start relay. Also through connector B pin 10 to the 15-amp thresher and seat circuit breaker then to pin 30 of the control relay. Power is connected through the thresher and seat circuit breaker to pin 87 of the thresher engage relay, pin 87 of the thresher disengage relay, and through pin A of the seat connector to the seat control switch.
- On the TR99 only, through the 20-amp concave and turret circuit breaker and connector R to connector S. From connector S pin 8, power is routed to pin 87 of the concave up and concave down relays. From connector S pin 10, power is routed to pin 87 of the turret up and turret down relays.
- Through the 15-amp key switch circuit breaker and connector B pin 3 to the “BAT” terminal of the key switch.
- Through the 25-amp air conditioner circuit breaker and connector B pin 8 to pin 3 of the A/C and A/C clutch relays.
- Through the 20-amp unswitched circuit circuit breaker to the following: through connector J pin 4 to the 10-amp spare fuse then to the unswitched power outlet, through the 10-amp lighter fuse to the lighter, through the 10-amp horn fuse to the horn switch, and to connector A pin E. From connector A pin E, power is routed through the 3-amp memory fuse to the radio, if installed, and through a 12-amp circuit breaker to the wiper switch and wiper motor.
- Through the 15-amp hazard lights circuit breaker to the turn signal switch and then to the hazard light switch. If the flashing lights auxiliary kit for heads is installed, a jumper wire in the harness is used to make the wiring connection.

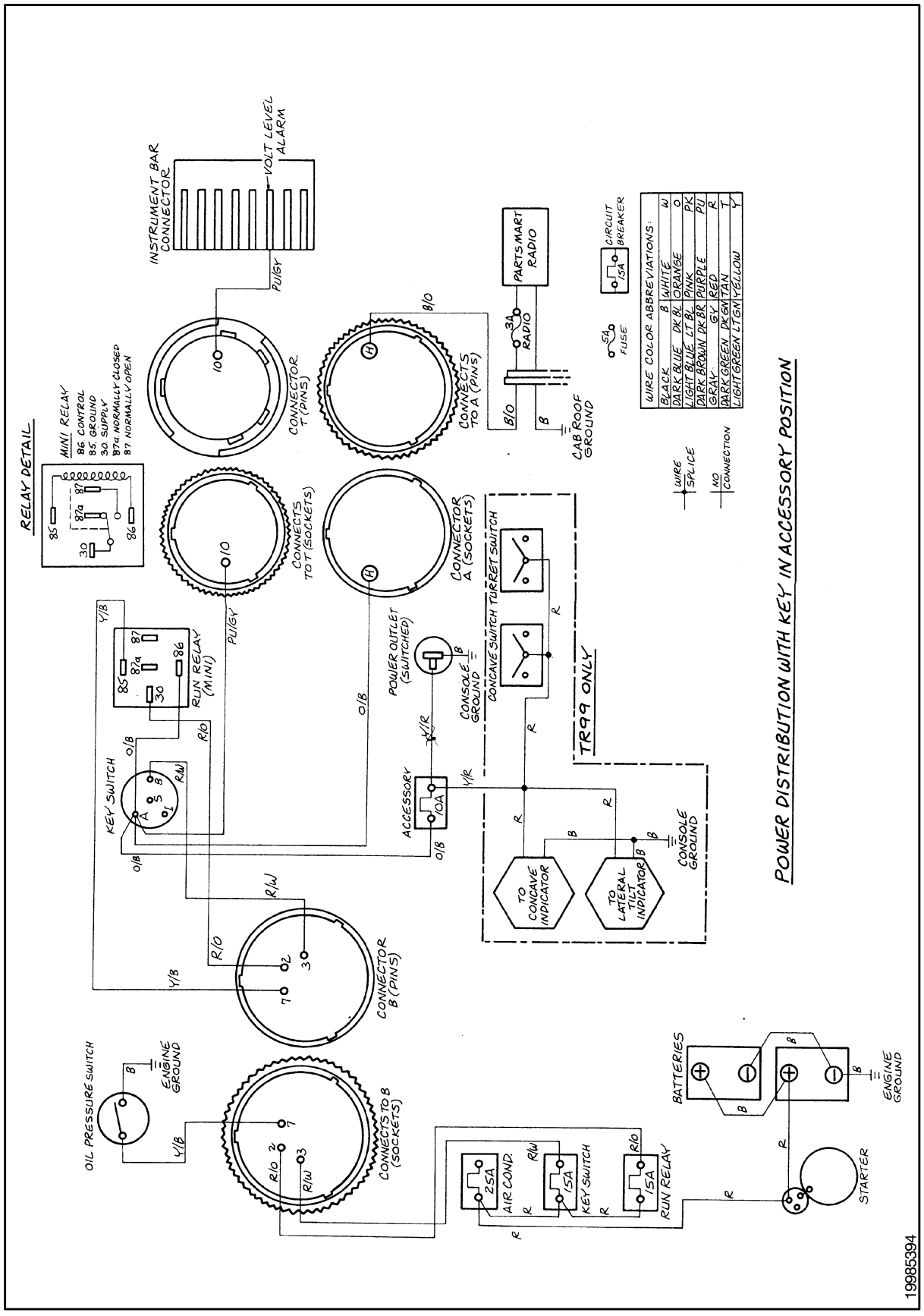
POWER DISTRIBUTION WITH KEY IN ACCESSORY POSITION
RELAY DETAIL
MINI RELAY
86 CONTROL
85 GROUND
30 SUPPLY
87a NORMALLY CLOSED
87 NORMALLY OPEN
INSTRUMENT BAR CONNECTOR
VOLT LEVEL ALARM
CONNECTOR T (PINS)
CONNECTS TO T (SOCKETS)
CONNECTS TO A (PINS)
CONNECTOR A (SOCKETS)
PARTS-MART RADIO
CIRCUIT BREAKER
15A
FUSE
CAB ROOF GROUND
WIRE COLOR ABBREVIATIONS:
BLACK B
DARK BLUE DK BL
LIGHT BLUE LT BL
DARK BROWN DK BR
GRAY GY
DARK GREEN DK GN
LIGHT GREEN LT GN
WHITE W
ORANGE O
PINK PK
PURPLE PU
RED R
TAN T
YELLOW Y
WIRE SPLICE
NO CONNECTION
KEY SWITCH
RUN RELAY (MINI)
POWER OUTLET (SWITCHED)
CONSOLE GROUND
ACCESSORY
10A
CONCAVE SWITCH TURRET SWITCH
TR99 ONLY
TO CONCAVE INDICATOR
TO LATERAL TILT INDICATOR
CONSOLE GROUND
CONNECTOR B (PINS)
CONNECTS TO B (SOCKETS)
OIL PRESSURE SWITCH
ENGINE GROUND
25A
AIR COND.
15A
KEY SWITCH
15A
RUN RELAY
BATTERIES
STARTER
ENGINE GROUND
19985394

Figure 1-10

Key In Accessory Position

When the key switch is in the accessory position, (1) the following circuits and components are powered or “hot”. These components are in addition to those shown in Figure 1-10.

- Run relay control pin 86 is now powered. The run relay does not energize because the engine is not running and the oil pressure switch is open.
- Through connector T pin 10 to light (flash) the volt level alarm (battery) in the instrument bar.
- Through connector A pin H, the radio harness, and the 3-amp radio fuse to power the radio, if installed.
- Through the 10-amp accessory circuit breaker to the switched power outlet in the cab and to provide power to the concave and lateral tilt indicators. In the TR99 only, power is also routed to the concave and turret control switches.

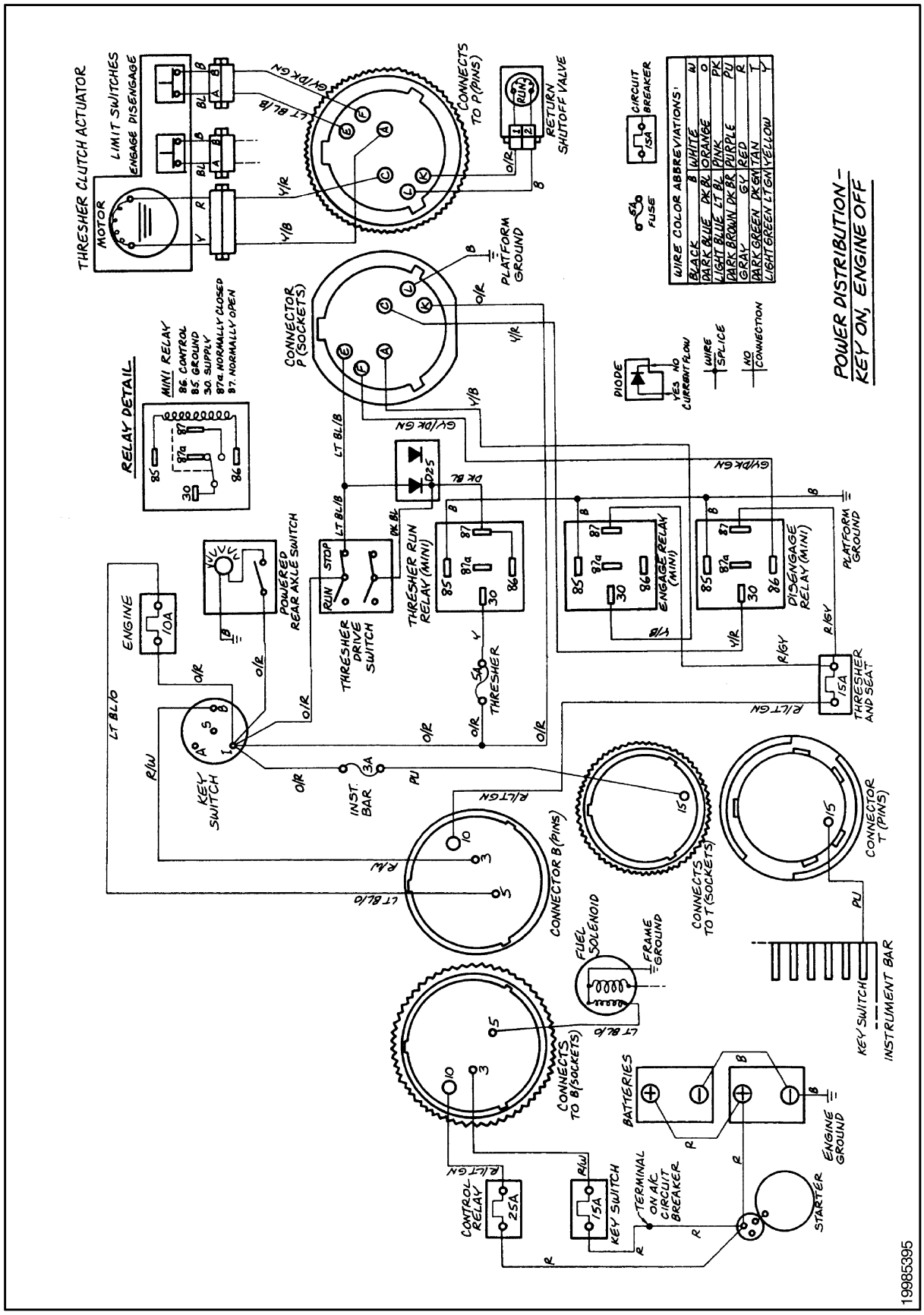
POWER DISTRIBUTION - KEY ON, ENGINE OFF
THRESHER CLUTCH ACTUATOR
MOTOR
LIMIT SWITCHES
ENGAGE DISENGAGE
CONNECTS TO P(PINS)
RETURN SHUTOFF VALVE
RUN
CIRCUIT BREAKER
15A
FUSE
WIRE COLOR ABBREVIATIONS:
BLACK B
DARK BLUE DK BL
LIGHT BLUE LT BL
DARK BROWN DK BR
GRAY GY
DARK GREEN DK GN
LIGHT GREEN LT GN
WHITE W
ORANGE O
PINK PK
PURPLE PU
RED R
TAN T
YELLOW Y
RELAY DETAIL
MINI RELAY
86. CONTROL
85. GROUND
30. SUPPLY
87a. NORMALLY CLOSED
87. NORMALLY OPEN
CONNECTOR P (SOCKETS)
PLATFORM GROUND
DIODE
YES, NO CURRENT FLOW
WIRE SPLICE
NO CONNECTION
ENGINE
10A
POWERED REAR AXLE SWITCH
THRESHER DRIVE SWITCH
RUN
STOP
THRESHER RUN RELAY (MINI)
ENGAGE RELAY (MINI)
DISENGAGE RELAY (MINI)
THRESHER
5A
THRESHER AND SEAT
KEY SWITCH
INST. BAR
3A
CONNECTOR B (PINS)
CONNECTS TO B (SOCKETS)
CONNECTS TO T (SOCKETS)
CONNECTOR T (PINS)
FUEL SOLENOID
FRAME GROUND
KEY SWITCH
INSTRUMENT BAR
BATTERIES
ENGINE GROUND
STARTER
TERMINAL ON A/C CIRCUIT BREAKER
CONTROL RELAY
25A
15A
KEY SWITCH
LT BL/O
R/W
O/R
R/LT GN
LT BL/B
GY/DK GN
DK BL
Y/R
Y/B
R/GY
PU
Y
R
B
19985395

Figure 1-11

Key In On or Ignition Position, Engine Off

When the key switch is in the on or ignition position (3) and the engine is not running, the following circuits and components are powered or “hot”. These components are in addition to those shown in Figures 1-9 and 1-10.

- Through the 10-amp engine circuit breaker, the hold-in coil of the fuel solenoid. The hold-in coil is not strong enough to energize and open the fuel solenoid, but will keep the solenoid energized enough to keep the solenoid opened after the engine is started.
- The powered rear axle switch.
- The return shutoff valve.
- Through the 5-amp thresher fuse to pin 30 of the thresher run relay.
- Through the thresher drive switch, in the stop position, and through diode D25 to the thresher run relay. This energizes the thresher run relay to allow the thresher circuit to operate after the engine is started and running.
- Through the thresher drive switch, in the stop position, to the thresher clutch actuator disengage limit switch. If this switch is closed, indicating that the thresher clutch is not fully disengaged, power will pass through the switch to energize the thresher disengage relay. This connects power from the batteries through the 25-amp control relay circuit breaker, the 15-amp thresher and seat circuit breaker, and the closed contacts of the disengage relay to the thresher clutch actuator motor. The ground return for the motor is through the normally closed contacts of the engage relay.
- Through the 3-amp instrument bar fuse to the key switch terminal of the instrument bar. This energizes the instrument bar. If the park brake is applied, the BRAKE warning light will flash. Also, the OIL PRESS warning light will flash.

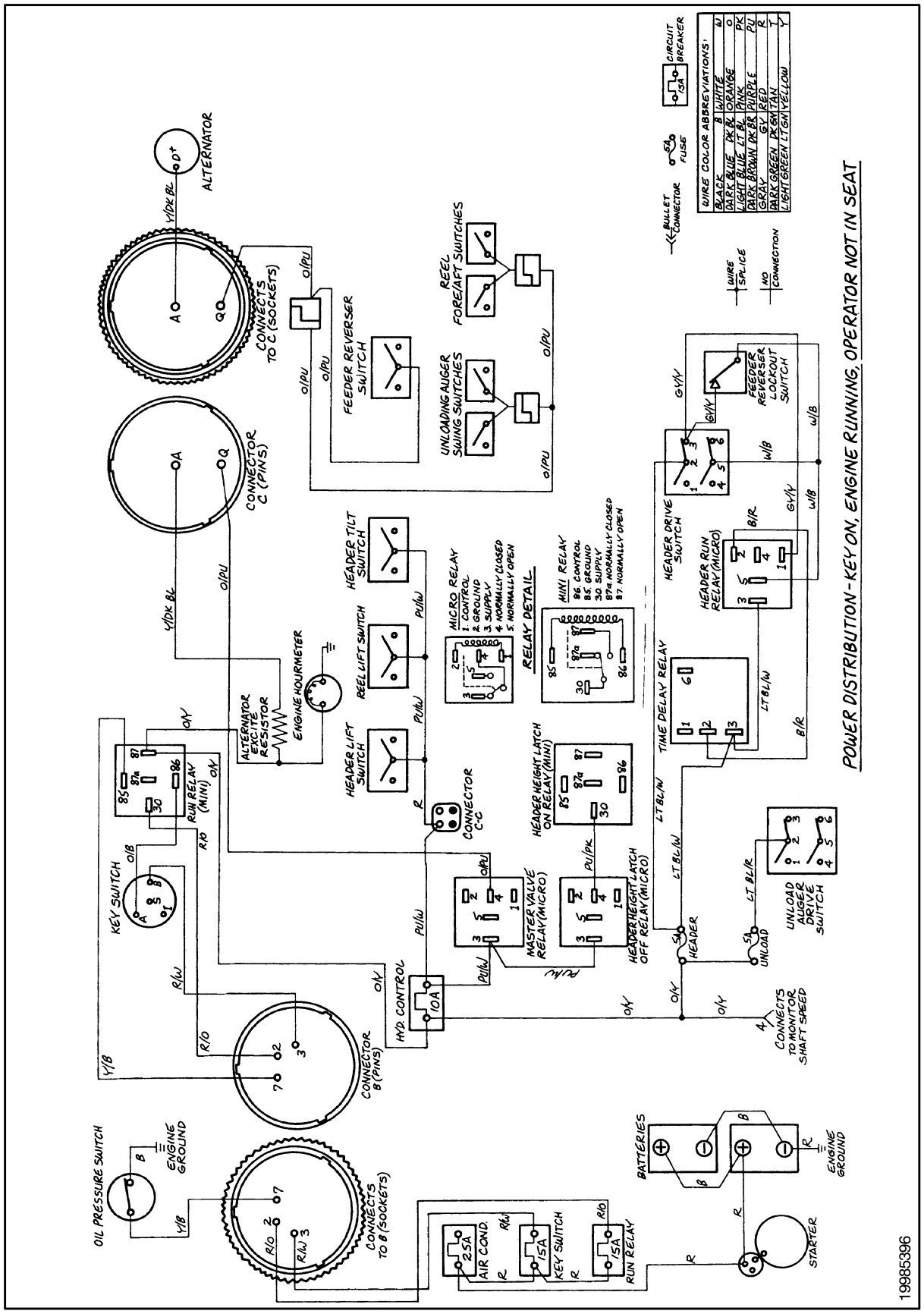
POWER DISTRIBUTION - KEY ON, ENGINE RUNNING, OPERATOR NOT IN SEAT
ALTERNATOR
CONNECTOR C (PINS)
CONNECTS TO C (SOCKETS)
FEEDER REVERSER SWITCH
UNLOADING AUGER SWING SWITCHES
REEL FORE/AFT SWITCHES
HEADER TILT SWITCH
REEL LIFT SWITCH
HEADER LIFT SWITCH
MICRO RELAY
1. CONTROL
2. GROUND
3. SUPPLY
4. NORMALLY CLOSED
5. NORMALLY OPEN
RELAY DETAIL
MINI RELAY
86. CONTROL
85. GROUND
30. SUPPLY
87a. NORMALLY CLOSED
87. NORMALLY OPEN
ALTERNATOR EXCITE RESISTOR
ENGINE HOURMETER
CONNECTOR C-C
HEADER HEIGHT LATCH ON RELAY (MINI)
MASTER VALVE RELAY (MICRO)
HEADER HEIGHT LATCH OFF RELAY (MICRO)
TIME DELAY RELAY
HEADER DRIVE SWITCH
HEADER RUN RELAY (MICRO)
FEEDER REVERSER LOCKOUT SWITCH
RUN RELAY (MINI)
KEY SWITCH
HYD. CONTROL
10A
CONNECTOR B (PINS)
CONNECTS TO B (SOCKETS)
CONNECTS TO MONITOR, SHAFT SPEED
HEADER
UNLOAD
UNLOAD AUGER DRIVE SWITCH
OIL PRESSURE SWITCH
ENGINE GROUND
BATTERIES
STARTER
AIR COND
KEY SWITCH
RUN RELAY
BULLET CONNECTOR
5A FUSE
CIRCUIT BREAKER
WIRE SPLICE
NO CONNECTION
WIRE COLOR ABBREVIATIONS:
BLACK B
DARK BLUE DK BL
LIGHT BLUE LT BL
DARK BROWN DK BR
GRAY GY
DARK GREEN DK GN
LIGHT GREEN LT GN
WHITE W
ORANGE O
PINK PK
PURPLE PU
RED R
TAN T
YELLOW Y
19985396

Figure 1-12

Key In On or Ignition Position, Engine Running, Operator Not In Seat

When the key switch is in the on or ignition position (3), the engine is running, and the operator is not in the seat, the following circuits and components are powered or “hot”. These are components that are powered after the oil pressure switch closes to energize the run relay and no other switches are actuated. These components are in addition to those shown in Figures 1-9, 1-10, and 1-11.

- From run relay pin 87 to the engine hour meter and through the 50-ohm alternator excite resistor to the D+ terminal of the alternator.
- From run relay pin 87 to the 10-amp hydraulic control circuit breaker, the 5-amp header fuse, the 5-amp unload fuse, and to pin 4 of the monitor connector.
- Through the 10-amp hydraulic control circuit breaker to the master valve ready relay and header height latch off relay and to the header lift switch, reel lift switch, and header tilt switch.
- Through the master valve relay to the feeder reverser switch, the unloading auger swing switch, and the reel fore/aft switch.
- Through the header height latch off relay to the header height latch on relay.
- Through the 5-amp header fuse to the header drive switch, the time delay relay, and the header run relay. From pin 3 of the header drive switch to pin 1 of the header run relay, through the coil (from pin 1 to pin 2), then to pin 2 of the time delay relay. Since the operator is not in the seat, the time delay relay is de-energized and pin 2 is open. Also from pin 3 of the header drive switch, through the feeder reverser lockout switch, to pin 5 of the header drive switch, and to pin 5 of the header run relay. This is the loop that keeps the header run relay energized after the operator sets in the seat and switches on the header drive.
- Through the 5-amp unload fuse to the unload auger drive switch.

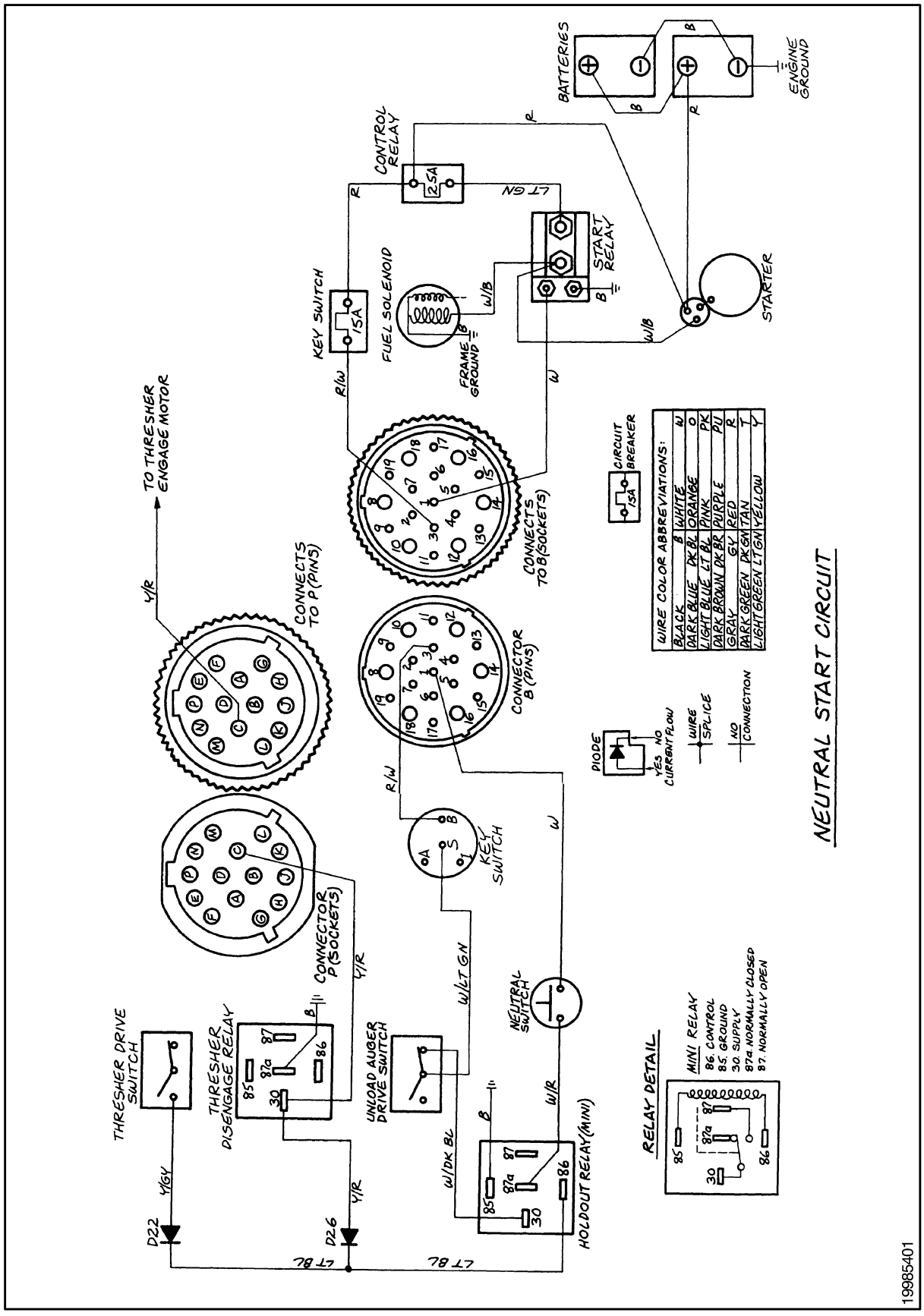
NEUTRAL START CIRCUIT
BATTERIES
ENGINE GROUND
CONTROL RELAY
START RELAY
STARTER
KEY SWITCH
FUEL SOLENOID
FRAME GROUND
CIRCUIT BREAKER
TO THRESHER ENGAGE MOTOR
CONNECTS TO P(PINS)
CONNECTS TO B(SOCKETS)
CONNECTOR B (PINS)
CONNECTOR P(SOCKETS)
KEY SWITCH
DIODE
YES NO CURRENT FLOW
WIRE SPLICE
NO CONNECTION
WIRE COLOR ABBREVIATIONS:
BLACK B WHITE WH
DARK BLUE DK BL ORANGE O
LIGHT BLUE LT BL PINK PK
DARK BROWN DK BR PURPLE PU
GRAY GY RED R
DARK GREEN DK GN TAN T
LIGHT GREEN LT GN YELLOW Y
THRESHER DRIVE SWITCH
THRESHER DISENGAGE RELAY
UNLOAD AUGER DRIVE SWITCH
NEUTRAL SWITCH
HOLDOUT RELAY (MINI)
D22
D26
RELAY DETAIL
MINI RELAY
86. CONTROL
85. GROUND
30. SUPPLY
87a. NORMALLY CLOSED
87. NORMALLY OPEN
19985401

Figure 1-13

Neutral Start Circuit

When the key switch is turned to the start position, power flows from the BAT terminal of the key switch through the unload auger drive switch, when in the off position, to the holdout relay.

If the thresher drive switch is in the off position and the thresher drive actuator is fully extended (extend limit switch open), the holdout relay will be de-energized. Power will then flow from pin 30 through the holdout relay to pin 87, through the neutral switch on the hydrostat control lever, to the start relay.

The start relay energizes and couples power from the battery through the 25-amp control relay circuit breaker, the closed contacts of the start relay, to the pull-in coil of the fuel solenoid and to the start solenoid on the starter. This engages and powers the starter to turn the engine.

ELECTRICAL SYSTEM COMPONENTS

MOMENTARY SWITCHES

Momentary switches are used to direct power to circuits. These switches will return to the neutral position when released. Power flow through the switch is shown in the schematic.

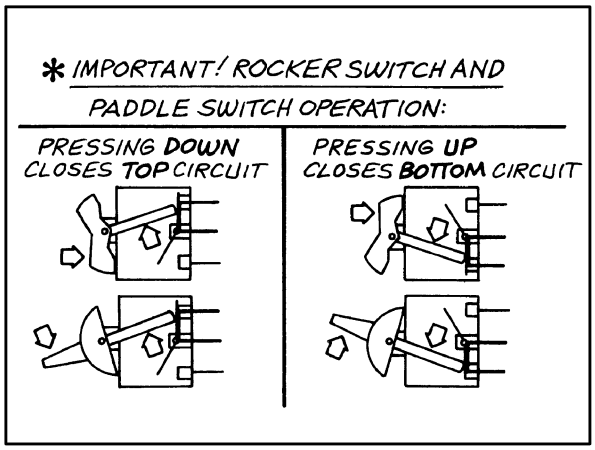

Figure 1-14

CIRCUIT BREAKERS

Circuit breakers are used to protect wires and electrical parts from overload caused by short circuits or circuit overload.

FUSES

Fuses protect electrical parts from overload. Use the correct size fuse, as specified, for the circuits. Use of higher rated or slow-blow fuses could cause damage to components.

POTENTIOMETERS

Two potentiometers are used on the TR99 combine only. One potentiometer is positioned behind the right side of the faceplate, to provide a signal for the lateral tilt display. The second potentiometer is connected at the left side of the concave rockshaft, to provide a signal for the concave clearance display.

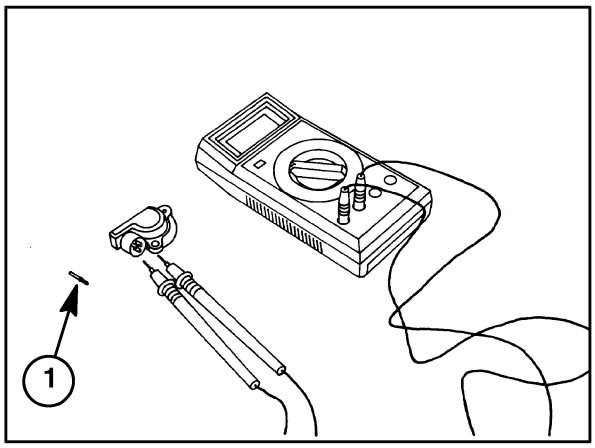

Figure 1-15

To test a potentiometer, connect an ohmmeter between the pins in the plug. A Deutsche-type connector pin, 1, part #900364, can be used to make it easier to connect the ohmmeter to the potentiometer.

Pins	Ohmmeter Reading
A – B	Fixed between 5000 & 8000 ohms
B – C	*Varies between 1000 & 8000 ohms
A – C	*Varies between 1000 & 8000 ohms

The ohmmeter reading should vary smoothly and consistently as the center of the potentiometer is rotated. If the reading jumps around erratically, or stays the same while the potentiometer is rotated, replace the potentiometer.

If the ohmmeter reading is out of the range, replace the potentiometer.

DIODES

Diodes permit electrical current to flow in one direction but not the other. Diodes are used in the electrohydraulic system so that one wire can be used with more than one circuit to control a relay or solenoid. Diodes also prevent arcing at the contact points of the relays and momentary switches.

Two sizes of diodes are used in the electrical system. Generally, one-amp diodes are used to operate relays or other light loads, while six-amp diodes are used to operate solenoids or other high load circuits.

A six-amp diode or diode module may be substituted for a one-amp diode or diode module, but a one-amp diode must not be used in place of a six-amp diode.

One-amp diodes are smaller in size than six- amp diodes as shown. One-amp diodes also have two parallel lines on each side of the diode while six-amp diodes have plain sides with a large bulb on top.

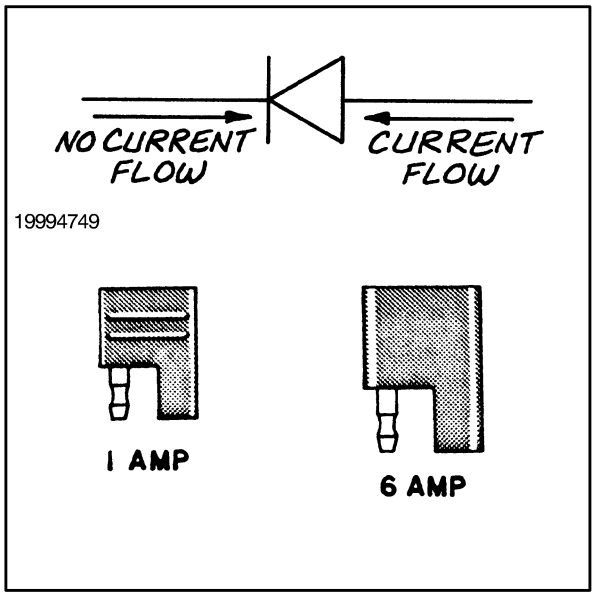

Figure 1-16

Diode modules, containing two diodes in a molded block, are also used.

One-amp diode modules are identified by the number 100685 and six-amp diode modules are identified by the number 100690 on the module case. Diodes are connected between pins T1 - T2 and T3 - T4, as shown.

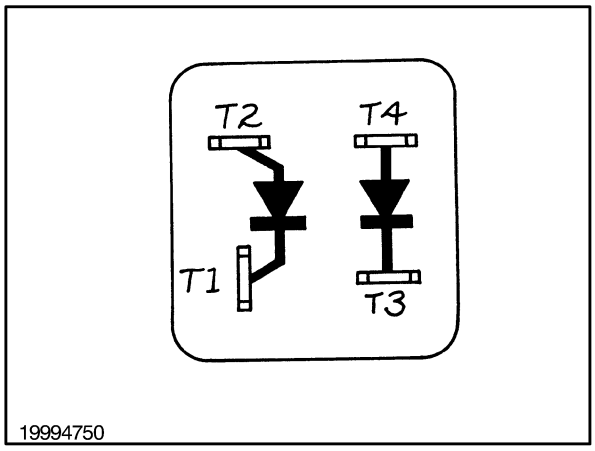

Figure 1-17

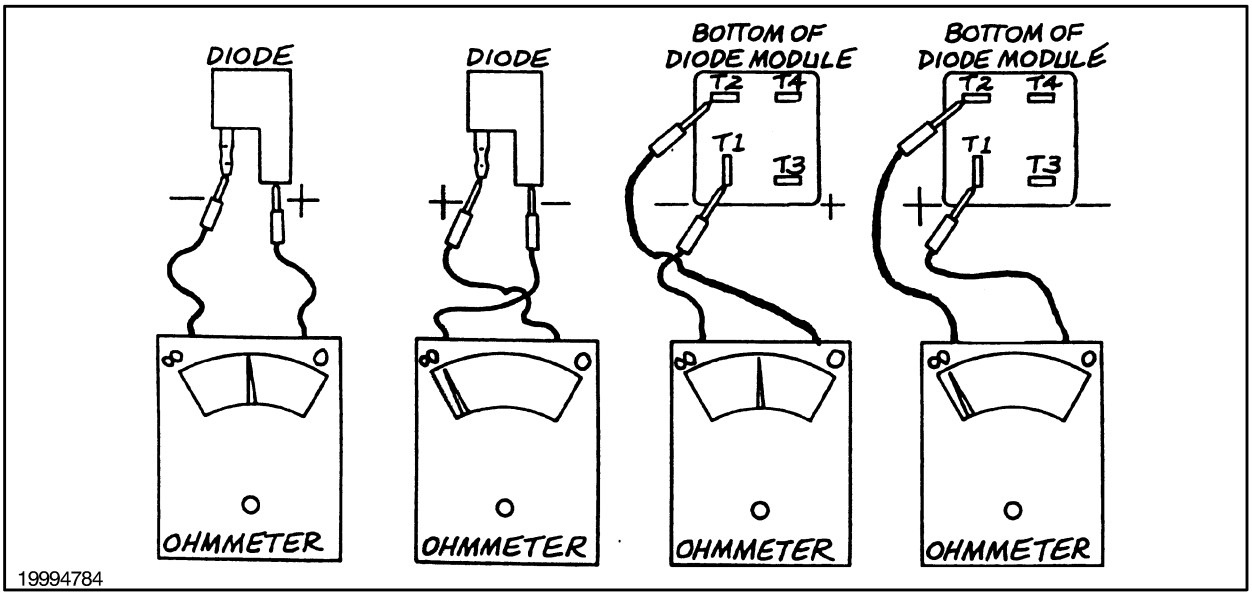

Figure 1-18

Diode Test Procedure

Diodes can fail in either an open condition, in which no power passes in either direction, or a closed condition, in which power flows in both directions. Failures usually occur due to overload or by short circuits. DO NOT SHORT WIRES TO GROUND TO DETERMINE IF POWER IS AVAILABLE (SPARK TEST). THIS WILL CAUSE DIODES TO FAIL.

To test a diode, use a digital multimeter (DMM) set to the diode test function. Remove the diode and connect the DMM test leads to the ends of the diode. Check the reading then reverse the test leads. In one direction, forward, the DMM should show 0.5 volts. When the test leads are reversed, the DMM should display "OL". If the two readings are 0.0 volts or "OL", the diode is defective and must be replaced.

If a DMM with a diode test function is not available, use a multimeter, capable of measuring resistance, set to the R x100 or higher scale. With the leads connected in one direction, the meter should read near zero ohms. With the leads reversed, the meter should read close to infinite ohms (∞).

CAUTION: NEVER CHECK DIODES WITH A MULTIMETER SET TO THE R x1 SCALE. THE HIGH CURRENT GENERATED BY SOME MULTIMETERS, SET TO MEASURE SMALL RESISTANCE, CAN BURN OUT DIODES.

If a DMM or multimeter is not available, replace a suspected defective diode with a diode from a working circuit or a known good diode.

DIODE CHART

The chart shows which functions will be affected by a diode that fails open or closed. The symptoms that the operator will observe are listed first (1.). The electrical symptoms that will be observed at the coils of the stack valve(s) are listed second (2.).

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
	D1	Cab Console	NOT USED	
Reel Raise	D2	Cab Console	1. Reel will not raise when the reel raise circuit is activated. 2. Power to reel raise solenoid, no power at master solenoid when the reel raise circuit is activated.	1. Reel will raise when head is raised or head tilt circuits are activated. 2. Power to reel raise solenoid when listed systems are activated.
Head raise and automatic head height	D3	Cab Console	1. The head will not raise, and the head raise light does not light, when the manual head raise switch is activated. The head will raise and the head raise light will light when the automatic head height raise switch is activated on the head. 2. No power to the head raise or master solenoids when the manual head raise switch is activated.	1. The head will not raise, and the head height power on light goes out when the automatic head height control raise switch is activated on the head. The head raises normally when the manual head raise switch is activated. 2. Power at the P/O wire connection at the head height latch off relay base when the relay is removed and the automatic head height control raise switch on the head is activated.
Head raise	D4	Cab Console	1. Head will not raise, but the head raise indicator light lights when the head raise circuit is activated. 2. Power to the head raise solenoid, no power to the master solenoid when the head raise circuit is activated.	1. Head will raise when the head raise, reel raise, or head tilt circuits are activated. 2. Power at the head raise solenoid when the listed functions are activated.

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Head lower	D5	Cab Console	1. System works properly until the automatic head height system is activated. Then, the automatic head height control system will not work and the automatic head height control system on light will not light. 2. There is power to the head lower solenoid but no power to the automatic head height and head tilt switches when the head lower switch is depressed.	1. System works properly until the automatic head height control is activated. Then the head will continually lower and the head lower light will stay on. When the automatic head raise switch is activated, the head will raise very slowly. Both the head raise and head lower lights will light. 2. There is continual power to the head lower solenoid when the automatic head height system is activated with connector K disconnected.
Head tilt clockwise	D6	Cab Console	1. Head will not tilt clockwise but the clockwise indicator light will light. 2. Power to clockwise tilt solenoid, but no power to the master solenoid when the clockwise tilt system is activated.	1. Head tilts clockwise when reel lift and head lift circuits are activated. Head will not tilt when counterclockwise tilt circuit is activated. The clockwise tilt indicator light will light when any of the listed functions are activated. 2. Power to clockwise head tilt solenoid when listed functions are activated.
Head tilt counter-clockwise	D7	Cab Console	1. Head will not tilt counterclockwise but the counterclockwise indicator light will light. 2. Power at counter-clockwise tilt solenoid, no power at master solenoid when the counterclockwise tilt system is activated.	1. Head will tilt counterclockwise when reel lift or head lift circuits are activated. Head will not tilt when clockwise tilt circuit is activated. The counterclockwise tilt indicator light will light when any of the listed functions are activated. 2. Power to counter-clockwise head tilt solenoid when listed functions are activated.
	D8		NOT USED	
	D9		NOT USED	

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Unloading auger swing-out	D10	Under Cab Floor	1. Unloading auger will not swing-out. 2. Power at the swing-out solenoid, no power at the master solenoid when the system is activated.	1. Unloading auger will swing-out when the reel raise, head raise, head tilt CW or CCW, feeder reverser, or reel fore-aft systems are activated. The auger will not move when the swing-in system is activated. 2. Power to the swing-out solenoid when any of the listed functions are activated.
Unloading auger swing-in	D11	Under Cab Floor	1. Unloading auger will not swing-in. 2. Power at the swing-in solenoid, no power at the master solenoid when the system is activated.	1. Unloading auger will swing-in when the reel raise, head raise, head tilt CW or CCW, feeder reverser, or reel fore-aft systems are activated. The auger will not move when the swing-out system is activated. 2. Power to the swing-in solenoid when any of the listed functions are activated.
Feeder reverser reverse direction	D12	Stack Valve	1. Reverser will not work in the reverse direction. 2. Power at the reverse solenoid, no power at the master solenoid when the system is activated.	1. Reverser will operate in the reverse direction when the reel raise, head raise, head tilt CW or CCW, unloading auger swing-in or out, or reel fore-aft systems are activated. The reverser will not move when the forward direction system is activated. 2. Power to the reverse solenoid when any of the listed functions are activated.

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Feeder reverser forward direction	D13	Stack Valve	1. Reverser will not work in the forward direction. 2. Power at the forward solenoid, no power at the master solenoid when the system is activated.	1. Reverser will operate in the forward direction when the reel raise, head raise, head tilt CW or CCW, unloading auger swing-in or out, or reel fore-aft systems are activated. The reverser will not move when the reverse direction system is activated. 2. Power to the forward solenoid when any of the listed functions are activated.
Automatic head tilt counter-clockwise lower switch (located on the head)	D14	RH Header	1. Head will not tilt CCW when the automatic CCW lower switch is activated. CCW indicator light does not light. 2. No power at the CCW tilt solenoid or the master solenoid when the automatic CCW lower switch is activated.	1. Head will not tilt CCW when the automatic CCW raise switch is activated. Both CW and CCW indicator lights light. 2. Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CCW raise switch is activated.
Automatic head tilt clockwise raise switch (located on the head)	D15	RH Header	1. Head will not tilt CW when the automatic CW raise switch is activated. CW indicator light does not light. 2. No power at the CW tilt solenoid or the master solenoid when the automatic CW raise switch is activated.	1. Head will not tilt CW when the automatic CW lower switch is activated. Both CW and CCW indicator lights light. 2. Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CW lower switch is activated.

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Automatic head tilt counter-clockwise raise switch (located on the head)	D16	LH Header	1. Head will not tilt CCW when the automatic CCW raise switch is activated. CCW indicator light does not light. 2. No power at the CCW tilt solenoid or the master solenoid when the automatic CCW raise switch is activated.	1. Head will not tilt CCW when the automatic CCW lower switch is activated. Both CW and CCW indicator lights light. 2. Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CCW lower switch is activated.
Automatic head tilt clockwise lower switch (located on the head)	D17	LH Header	1. Head will not tilt CW when the automatic CW lower switch is activated. CW indicator light does not light. 2. No power at the CW tilt solenoid or the master solenoid when the automatic CW lower switch is activated.	1. Head will not tilt CW when the automatic CW raise switch is activated. Both CW and CCW indicator lights light. 2. Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CW lower switch is activated.
Rotor speed decrease	D18	Behind Stack Valve	1. Rotor speed will not decrease when the rotor speed decrease circuit is activated. 2. Power to rotor speed decrease solenoid on the stack valve but no power to the solenoid on the rotor speed isolation valve when the rotor speed decrease switch is activated.	1. Rotor speed will not increase or increases very slowly. 2. Power to the master solenoid, rotor speed increase solenoid, rotor speed decrease solenoid on the stack valve and power to the solenoid on the rotor speed isolation valve when the rotor speed increase switch is activated.

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Rotor speed increase	D19	Behind Stack Valve	1. Rotor speed will not increase when the rotor speed increase circuit is activated. 2. Power to master solenoid and rotor speed increase solenoid on the stack valve but no power to the solenoid on the rotor speed isolation valve when the rotor speed increase switch is activated.	1. Rotor speed will not increase or increases very slowly. 2. Power to the master solenoid, rotor speed increase solenoid, rotor speed decrease solenoid on the stack valve and power to the solenoid on the rotor speed isolation valve when the rotor decrease switch is activated.
Unloading auger drive valve solenoid surge suppression diode	D20	Cab Console	1. No symptoms 2. No symptoms	1. Unloading auger drive will not engage. 2. Unloading auger drive fuse blows as soon as unloading auger drive switch placed in run.
Drives warning alarm - thresher switch in run	D21	Behind Seat	1. No alarm when thresher drive switch placed in run and operator out of seat. 2. Power to engage the thresher drive, no power to thresher drive alarm.	1. No symptoms 2. Power at Y/GY wire connection at thresher drive switch with switch in stop and thresher not fully engaged.
Thresher run holdout relay	D22	Behind Seat	1. Able to start engine with thresher drive switch in run. 2. No power at control terminal of holdout relay with thresher drive switch in run.	1. No symptoms 2. Power at Y/GY wire connection at thresher drive switch with switch in stop and thresher not fully disengaged.

CIRCUIT	DIODE	LOCATION	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Drives warning alarm - thresher not fully disengaged	D23	Behind Seat	1. Thresher clutch engaged alarm goes out as soon as thresher drive switch placed in stop. 2. Power to thresher disengage relay, no power at PK/DK BL wire at diode D23 while thresher disengaging.	1. Thresher does not engage when thresher drive switch placed in run. 2. Power at control terminal of both thresher engage and thresher disengage relays.
Operator not in seat time delay rely	D24	Behind Seat	1. Header will not run 2. With engine off, no continuity between LT GN/R wire connection at time delay and a good ground with operator in seat.	1. No symptoms 2. No symptoms
Thresher run	D25	Behind Seat	1. Thresher will not engage 2. No power at #5 prong of thresher drive switch with thresher drive switch in stop.	1. Placing thresher drive switch in run, thresher will start to engage, then stop. If thresher is engaged when failure occurs, thresher will start to disengage, then stop. 2. Power at control terminal of both thresher engage and thresher disengage relays with thresher drive switch in run
Thresher not fully disengaged holdout relay	D26	Behind Seat	1. Able to start engine with thresher drive switch in stop but thresher not fully disengaged. 2. No power at LT BL wire connection at holdout relay with thresher not fully disengaged.	1. Key main circuit breaker trips as soon as thresher drive switch placed in run. 2. Continuity between Y/GY wire connection at thresher drive switch and ground.