

TRACTION CONTROL

DESCRIPTION OF FUNCTION NUMBERS:

FUNCTION 1 SPEED LIMIT CONTROLLED ACCELERATION (Push 1)

This function allows for the adjustment of the rate of time it takes for the control to accelerate to 96% applied battery voltage to the motor on hard acceleration when a speed limit switch is activated.

Range .27 to 68.0 seconds
Set 0 to 255
Resolution .27 seconds per set unit
Example: Setting of 20 = 5.67 seconds C/A

FUNCTION 2 CREEP SPEED (Push 2)

This function allows for the adjustment of the creep speed of the vehicle. A constant creep speed frequency will be maintained when an accelerator input voltage between 3.7 and 3.5 volts or an accelerator ohmic input between 6K and 4.7K ohms is provided.

Range 2% to 15% on time
Set 0 to 255
Resolution .05% per set unit
Example: Setting of 20 = 3% on time

FUNCTION 3 CONTROLLED ACCELERATION AND 1A TIME (Push 3)

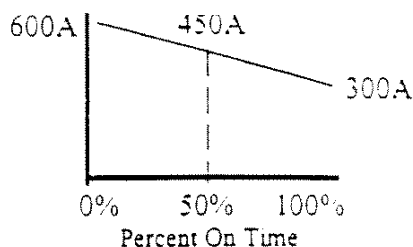
This function allows for the adjustment of the rate of time it takes for the control to accelerate to 96% applied battery voltage to the motor on hard acceleration. The 1A contactor will automatically close .2 seconds after the controlled acceleration stops and the accelerator input is less than .5 volts or less than 50 ohms.

Range .27 to 68.0 seconds
Set 0 to 255
Resolution .27 seconds per set unit
Example: Setting of 20 = 5.67 seconds C/A and 5.87 1A time.

FUNCTION 4 CURRENT LIMIT (Push 4)

This function allows for the adjustment of the current limit of the control. The rating of the control will determine the range of adjustment for this function. Please refer to the operating instructions for the control used in your vehicle.

Range See control C L curves
Set 0 to 255
Example: 0 = min. current, 255 = max. current



FUNCTION 5 NOT APPLICABLE

FUNCTION 6 1A DROP OUT CURRENT (Push 6)

This function allows for the adjustment of the 1A contactor drop out current. The 1A contactor will be dropped out and the vehicle motor torque will be limited to control current limit when the set drop out current is reached.

Range 300 to 1130 amps
Set 0 to 250
Resolution 3.32 amps per set unit

Settings above 250 set units will disable 1A drop out function (1A will not drop out).

Example Setting of 20 = 366 amps

FUNCTION 7 MINIMUM FIELD CURRENT (Push 7)

This function allows the adjustment of the field current when the accelerator is fully depressed.

Range -7.8 to +31 amps
Set 0 to 255
Resolution 0.153 amps per set unit

Example: Setting less than 51 yields 0 field current
Setting of 71 = 3.06 amps

FUNCTION 8 MAXIMUM FIELD CURRENT (Push 8)

This function allows for the adjustment of the field current when the accelerator is greater than 1.88 volts.

Range -7.8 to +31 amps
Set 0 to 255
Resolution 0.153 amps per set unit
Example: Setting less than 51 yields 0 field current
Setting of 71 = 3.06 amps

FUNCTION 9 NOT APPLICABLE

FUNCTION 10 NOT APPLICABLE

**FUNCTION 11 SPEED LIMIT 1 (SL1)
(Push 11)**

This function allows for the adjustment of the speed limit (maximum battery volts to the motor) when the SL1 limit switch input signal is received by the control card. SL1 limit switch is a normally closed switch connected to battery negative, the switch opening enables speed limit.

Range 96% to 0% battery volts
Set 0 to 180

Setting of 0 set units will disable speed limit function and allow top speed with no limit switch connected.

**FUNCTION 12 SPEED LIMIT 2 (SL2)
(Push 12)**

Same as Function 11 except using SL2 limit switch for input.

**FUNCTION 13 SPEED LIMIT 3 (SL3)
(Push 13)**

Same as Function 11 except using SL3 limit switch for input.

The SL3 set speed limit is activated by the Truck Management Module fault code 93. See instructions for IC3645TMM1A Truck Management Module for details.

**FUNCTION 14 INTERNAL RESISTANCE
COMPENSATION
(Push 14)**

This function is used when the Battery Discharge Indicator is present. Adjustment of this function will improve the accuracy of the BDI. In order to make this setting the voltage drop of the battery under load must first be determined by following the steps listed below.

1. Record open circuit voltage (V_o) by measuring the voltage at the control positive and negative power terminals.
2. Load the traction motor to 100 amps in 1A and record the voltage (V_L) at the control positive and negative power terminal.
3. Calculate voltage drop (V_{Drop}) as follows:
$$V_{Drop} = V_o - V_L$$
4. Use the table below to determine the setting using the calculated V_{Drop} as a reference.

**INTERNAL RESISTANCE COMPENSATION
TABLE**

Setting	V_{Drop}	Setting	V_{Drop}
2	11.44	17	01.34
3	07.60	18	01.27
4	05.72	19	01.20
5	04.57	20	01.14
6	03.81	21	01.09
7	03.27	22	01.04
8	02.86	23	00.99
9	02.54	24	00.95
10	02.28	25	00.91
11	02.08	26	00.88
12	01.90	27	00.85
13	01.76	28	00.82
14	01.63	29	00.79
15	01.52	30	00.76
16	01.43	31	00.74

**FUNCTION 15 BATTERY VOLTS
(Push 15)**

This function allows for the adjustment of voltage range for controls equipped with the Battery Discharge Indication function. In order for the BDI to operate properly, the setting as shown in the table must be entered.

Battery volts 180 volts
Set units Between 200 and 239

The following functions have function numbers larger than the numbers on the Handset keyboard. To access these function, push the CONT key and the number shown in the following instructions at the same time.

**FUNCTION 16 RATE OF FIELD CURRENT
INCREASE
(Push CONT 1)**

This function allows the adjustment of the rate of change of field current increase.

Range 0.09 to 22.9 sec.
Set 0 to 255
Resolution 0.09 sec per set unit
Example Setting of 50 = 4.59 sec.

FUNCTION 17 NOT APPLICABLE

FUNCTION 18 RATE OF FIELD CURRENT
DECREASE
(Push CONT 2)

This function allows for the adjustment of the rate of change of field current decrease.

Range	0.09 to 22.9 sec.
Set	0 to 255
Resolution	0.09 sec per set unit
Example	Setting of 50 = 4.59 sec.

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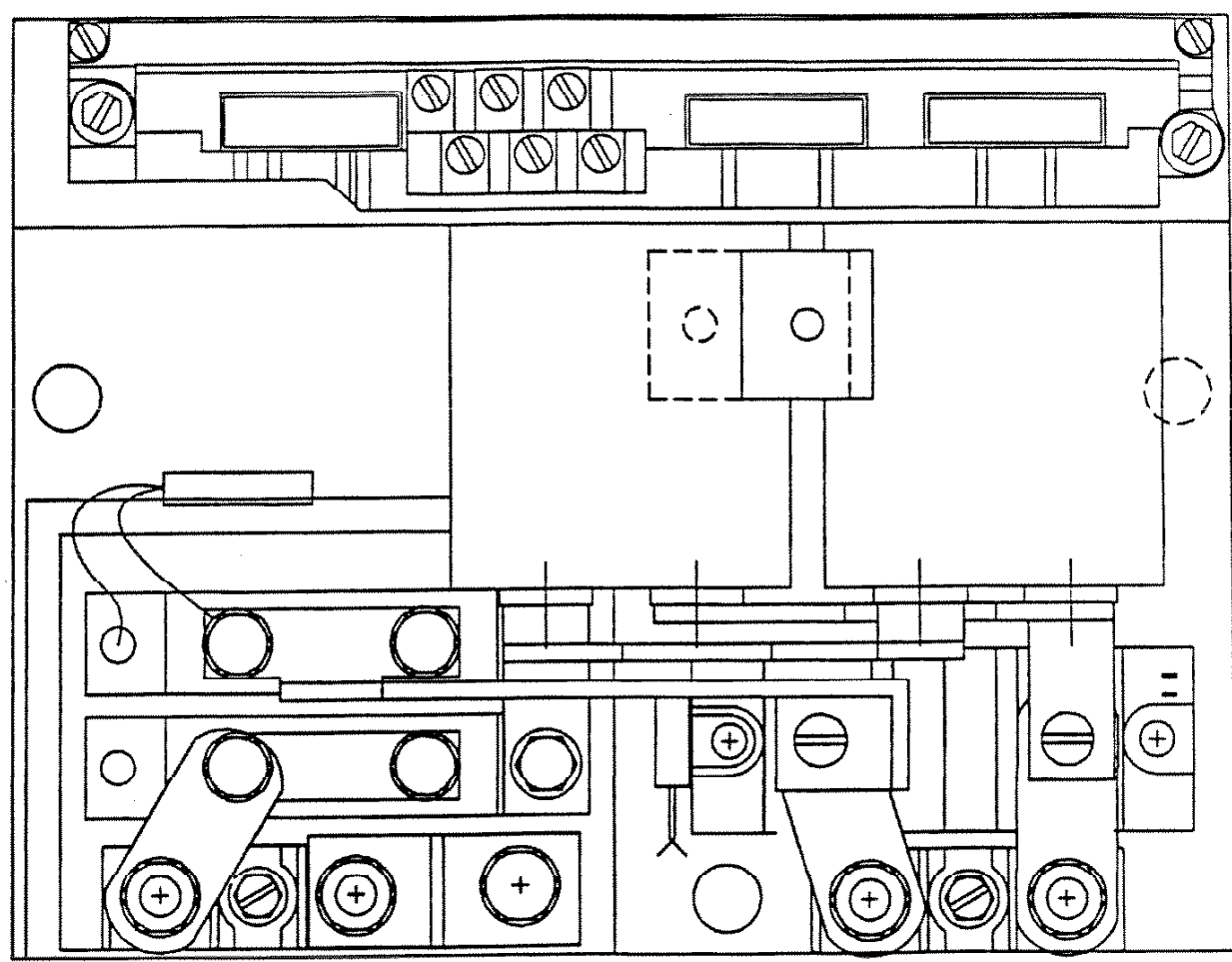
GEH-EV15SMSC-1



GE Electric Vehicle
Systems

INSTRUCTIONS
STATUS CODES

EV-T15SM IGBT Shunt Motor Automotive Control



The information contained herein is intended to assist truck users and dealers in the servicing of Solid-State controls furnished by the General Electric Company. It does not purport to cover all variations in equipment nor to provide for every possible contingency to be met with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the vehicle manufacturer through his normal service channels, not directly to the General Electric Company.

STATUS CODE -02	DESCRIPTION	MEMORY RECALL	No
	Drive (High) switch is closed on initial key on power up.		CONTROL TYPE
<p>SYMPTOM Line contractor closes, but control will not operate. R relay will not close.</p> <p>POSSIBLE CAUSE Drive directional switch is closed on initial start up (i.e. closure of key switch). Return gear shift lever to neutral and then return lever to drive (high) position.</p> <p>Drive switch is welded closed or mis-adjusted to be held closed. Replace or adjust drive switch to insure that it opens when the gear shaft is returned to neutral.</p> <p>Short circuit between TB5 and negative. Disconnect the wire from TB5 and check for a short circuit between wire and negative.</p> <p>Defective logic card. Replace the logic card.</p>		<p style="text-align: center;">Figure 1</p>	
		STATUS INDICATION CRITERIA	
		This status code will be displayed when TB5 is less than 5 volts on initial start up.	

STATUS CODE -03	DESCRIPTION	MEMORY RECALL	No
	Low switch is closed on initial key on power up.		CONTROL TYPE
<p>SYMPTOM Line contractor closes, but control will not operate. R relay will not close.</p> <p>POSSIBLE CAUSE Low directional switch is closed on initial start up (i.e. closure of key switch). Return gear shift lever to neutral and then return lever to low position.</p> <p>Low switch is welded closed or mis-adjusted to be held closed. Replace or adjust drive switch to insure that it opens when the gear shaft is returned to neutral.</p> <p>Short circuit between PB4 and negative. Disconnect the wire from PB4 and check for a short circuit between wire and negative.</p> <p>Defective logic card. Replace the logic card.</p>		<p style="text-align: center;">Figure 1</p>	
		STATUS INDICATION CRITERIA	
		This status code will be displayed when PB4 is less than 5 volts on initial start up.	

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
	-05	Later	CONTROL TYPE

CLUTCH SWITCH ENGAGED

CAUSE:
 CHECK CLUTCH SWITCH TO MAKE SURE IT IS NOT CLOSED.
 CHECK CONNECTORS FOR SHORT TO BATT(-)
 - BAD CARD

Figure 1
 STATUS INDICATION CRITERIA

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
	-06	Accelerator depressed with gear shift in neutral.	CONTROL TYPE

SYMPTOM

Line contractor closes, but control will not operate. R relay will not close.

POSSIBLE CAUSE

Accelerator pedal is depressed before selecting a gear (Drive or Low.
 Status code will disappear when a gear switch is closed or when accelerator pedal is released.

Defective gear switch(s)
 Check drive and/or low switch to insure closure when gear is selected.

Open circuit between gear switch(s) and battery negative or between gear switch(s) and TB5 or PB4.
 Check all control wires and connections shown in Figure 1.

Figure 1

STATUS INDICATION CRITERIA
 This status code will be displayed when TB5 and PB4 are greater than 5 volts, and TB1 is less than 4.0 volts.

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		CONTROL TYPE	Traction
-08	Accelerator input voltage too low on power up after initial key switch closure.		
<p>SYMPTOM Line contractor closes, but control will not operate. R relay will not close.</p> <p>POSSIBLE CAUSE Accelerator input mis-adjusted or defective.</p> <ul style="list-style-type: none"> Input voltage at TB1 should be more than 4.7 volts. Adjust or replace accelerator unit to insure that the voltage at TB1 is more than 4.7 volts before depressing pedal. <p>Short circuit between battery negative and TB1 in accelerator input circuit.</p> <ul style="list-style-type: none"> Disconnect wire from TB1. Check for short circuit from wire to battery negative. <p>Defective Card</p> <ul style="list-style-type: none"> Disconnect wire from TB1. Measure voltage from TB1 to negative. Voltage should be greater than 4.9 volts, if not, replace card. 		<p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code will be displayed when the accelerator input voltage at TB1 is less than 4.7 volts, and the key switch is opened and closed.</p>	

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		CONTROL TYPE	Traction
-11	Both Drive and Low switches are closed at the same time.		
<p>SYMPTOM Line contractor closes, but control will not operate. R relay will not close.</p> <p>POSSIBLE CAUSE Drive or Low switch welded closed or mis-adjusted to be held closed.</p> <ul style="list-style-type: none"> Replace or adjust gear switches to insure that they open when gear shift is returned to neutral. <p>Short circuit between battery positive and TB5 and/or PB4.</p> <ul style="list-style-type: none"> Disconnect wires from TB5 and PB4 and check wire for short circuit to positive side of gear switch. <p>Defective card</p> <ul style="list-style-type: none"> Disconnect wires and measure voltage at TB1 and PB4. Voltage should be less than 5 volts. 		<p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code will be displayed when TB5 and PB4 are less than 5 volts at the same time.</p>	

STATUS CODE -15	DESCRIPTION	MEMORY RECALL	No
	Later	CONTROL TYPE	Traction
		Figure 1	
		STATUS INDICATION CRITERIA	

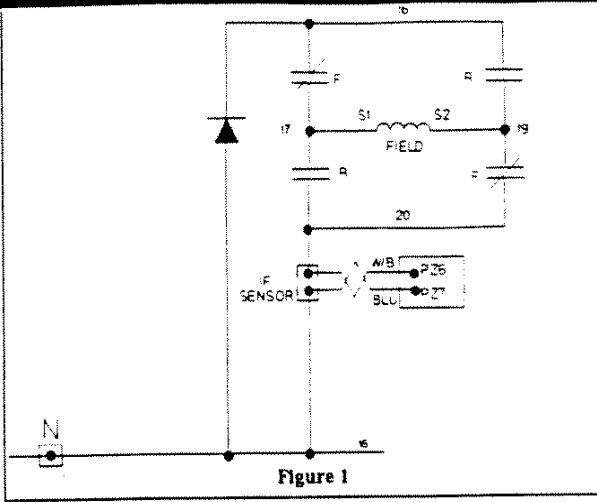
STATUS CODE -16	DESCRIPTION	MEMORY RECALL	No
	Later	CONTROL TYPE	Traction
		Figure 1	

STATUS CODE -23	DESCRIPTION	MEMORY RECALL	No
	Motor field current offset voltage is greater than 1.5 volts.	CONTROL TYPE	Traction

SYMPTOM
No power to traction motor in control range.

POSSIBLE CAUSE
Open sensor wire circuit to PZ-6
Check for loose connection or broken wire from IF Sensor to PZ-6 on the logic card.

Defective Logic Card
Replace logic card.

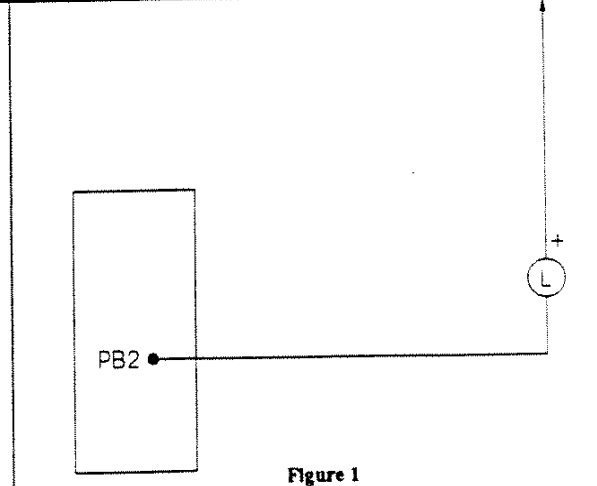


STATUS INDICATION CRITERIA
This status code is displayed when the motor field current offset voltage is greater than 1.5 volts. (Field current is than 3.2amps)

STATUS CODE -26	DESCRIPTION	MEMORY RECALL	No
	Line contactor coil current is greater than 4.0 amps.	CONTROL TYPE	Traction

SYMPTOM
Line contactor picks up immediately when key switch is closed.

POSSIBLE CAUSE
Defective coil driver internal to logic card.
Replace logic card.



STATUS INDICATION CRITERIA
This status code is displayed when there is a shorted Line contactor coil driver.

-27

12V BUS ON LOGIC CARD IS LOW -

CAUSE - BAD 16BT CIRCUIT - BAD LOGIC CARD

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		CONTROL TYPE	Traction
-40	Motor is overheated.		
<p>SYMPTOM Current in the motor armature circuit is reduced to 200 amps maximum.</p> <p>POSSIBLE CAUSE Defective thermal protector. Disconnect wires from PA4 and negative. At room temperature (25°C or 75°F) measure resistance between the two wires. Replace MTP if ohmic value is less than 800 ohms.</p> <p>Motor is in thermal cut-back. Allow motor to cool, status code should disappear.</p>		<p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code is displayed when PA4 is less than 0.6 volts.</p>	

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		CONTROL TYPE	Traction
-41	Open thermal protector (TTP) or transistor over temperature.		
<p>SYMPTOM Reduced or no power to traction motor in control range.</p> <p>POSSIBLE CAUSE Open thermal protector circuit. Check for loose connection or broken wire between: Black wire-Thermal protector and PZ-2. Gray wire-Thermal protector and PZ-5.</p> <p>Defective thermal protector. Disconnect wires from PZ-2 and PZ-5. At room temperature (25°C or 75°F) measure resistance between black and gray wire. Replace TTP if ohmic value is greater than 300 ohms.</p> <p>Control is in thermal cut-back. Allow control to cool, status code should disappear.</p>		<p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code is displayed when the voltage between PZ-2 and PZ-5 is greater than 1.8 volts.</p>	

STATUS CODE -42	DESCRIPTION	MEMORY RECALL	No
	Motor armature offset voltage is too high.	CONTROL TYPE	Traction

SYMPTOM
No power to traction motor in control range.

POSSIBLE CAUSE
Open sensor wire circuit to PZ-13.
Check for loose connection or broken wire (green wire) from current sensor to PZ-13 on the logic card.

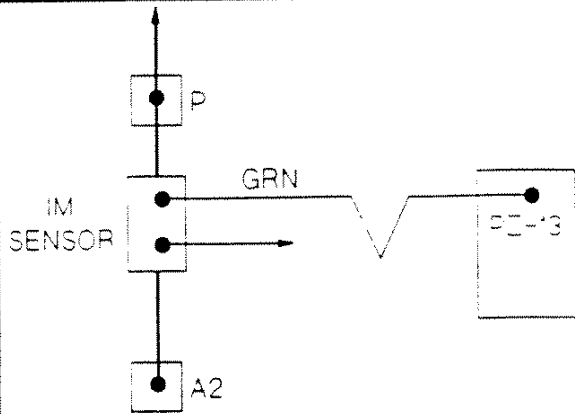


Figure 1

STATUS INDICATION CRITERIA
This status code is displayed when voltage between PY7 and negative is greater than 2.7 volts with no current flowing in the motor circuit.

STATUS CODE -43	DESCRIPTION	MEMORY RECALL	No
	Motor armature offset voltage is too low.	CONTROL TYPE	Traction

SYMPTOM
No power to traction motor in control range.

POSSIBLE CAUSE
Open sensor wire circuit to PZ-12.
Check for loose connection or broken wire (yellow wire) from current sensor to PZ-12 on the logic card.

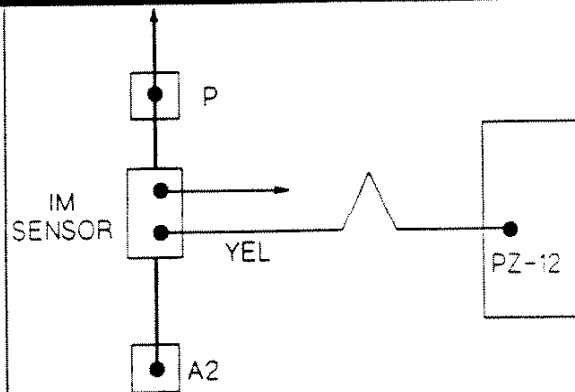
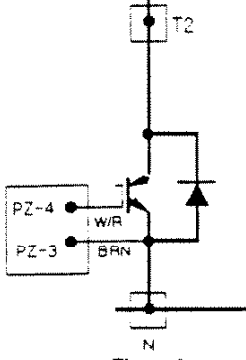
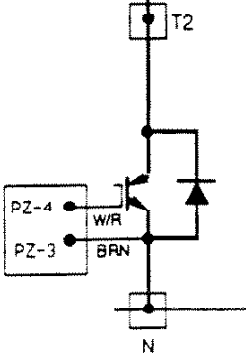
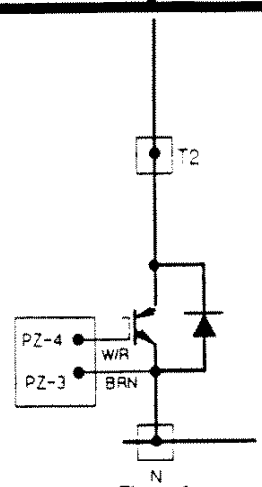


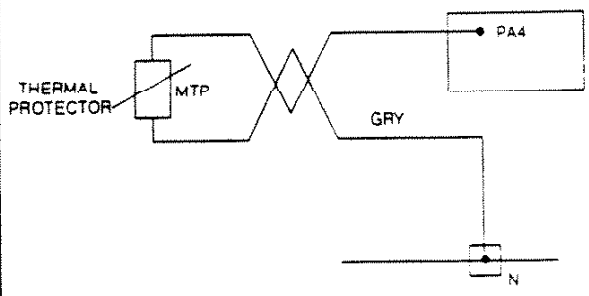
Figure 1

STATUS INDICATION CRITERIA
This status code is displayed when voltage between PY7 and negative is less than 2.3 volts with no current flowing in the motor circuit.

STATUS CODE	DESCRIPTION	MEMORY RECALL	Yes
		CONTROL TYPE	Traction
-44	Armature transistor does not turn off properly.		
<p style="text-align: center;">SYMPTOM</p> <p>Line contactor opens and then can only be closed by opening and closing the key switch.</p> <p style="text-align: center;">POSSIBLE CAUSE</p> <p>Transistor defective.</p> <ul style="list-style-type: none"> • Turn off time for transistor is out of specification. No field test is possible. Replace transistor. • Check for open circuit or loose connections between the transistor and PZ-4. (W/R wire) 		 <p style="text-align: center;">Figure 1</p>	
		<p>STATUS INDICATION CRITERIA</p> <p>This status code is displayed when, during control operation, the armature transistor fails to turn off.</p>	

STATUS CODE	DESCRIPTION	MEMORY RECALL	Yes
		CONTROL TYPE	Traction
-45	Armature transistor does not turn on properly.		
<p style="text-align: center;">SYMPTOM</p> <p>Line contactor opens and then can only be closed by opening and closing the key switch.</p> <p style="text-align: center;">POSSIBLE CAUSE</p> <p>Defective transistor circuit.</p> <ul style="list-style-type: none"> • Check for open circuit or loose connections between the transistor and PZ-4. (W/R wire) • Check for open circuit or loose connection between T2 and positive side of transistor power connection. • Check for open circuit or loose connection between Negative and negative side of transistor power connection (PZ-3 wire). <p>Defective transistor.</p> <ul style="list-style-type: none"> • Intermittent or open transistor gate. Field test may or may not show defect. Replace transistor after above checks, show no problem found. 		 <p style="text-align: center;">Figure 1</p>	
		<p>STATUS INDICATION CRITERIA</p> <p>This status code is displayed when the transistor fails to gate on.</p>	

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		-46	Look ahead test for T2 volts. (Less than 12% of battery volts)
<p>SYMPTOM Line contactor will not pick up.</p> <p>POSSIBLE CAUSE Defective transistor. Check for shorted transistor.</p>		 <p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code is displayed when the voltage at T2 is less than 12% of battery volts.</p>	

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
		-47	Motor thermal protector circuit is open.
<p>SYMPTOM Current in the motor armature circuit is reduced to 200 amps maximum.</p> <p>POSSIBLE CAUSE Open thermal protector circuit. Check for loose connection or broken wire between: Thermal protector and PA4. Thermal protector and negative.</p>		 <p>Figure 1</p>	
		<p>STATUS INDICATION CRITERIA This status code is displayed when PA4 is greater than 4.9 volts.</p>	

STATUS CODE -49	DESCRIPTION	MEMORY RECALL	No
	Field Current is less than 2.5 amps during the run mode.		CONTROL TYPE
<p>SYMPTOM Line contactor picks up. Control does not operate.</p> <p>POSSIBLE CAUSE</p> <p>Defective R relay.</p> <ul style="list-style-type: none"> F or R power tips fail to close because: <ol style="list-style-type: none"> Normally closed power tips fail to close. Binding relay tip assembly. <p>Open motor field circuit</p> <ul style="list-style-type: none"> Check for open circuit or loose connections in motor field circuit from the S1 connection and S2 connection on the control panel including all plug connections. <p>Defective transistor circuit.</p> <ul style="list-style-type: none"> Check for open circuit or loose connections between the Field transistor and PZ-11. (W/V wire) Check for open circuit or loose connection between the R relay and Field Transistor. <p>Defective transistor.</p> <ul style="list-style-type: none"> Intermittent or open transistor gate. Open Field transistor <p>Defective IF Sensor circuit</p> <ul style="list-style-type: none"> Check for open circuit or loose connections between the IF Sensor and PZ-6 (W/B wire). Check for open circuit or loose connections between the IF Sensor and negative, and between the IF sensor and the R relay. <p>Defective Logic Card</p>		<p>Figure 1</p>	
		STATUS INDICATION CRITERIA	
		This status code is displayed when field current is less than 2.5 amps during the run mode.	

STATUS CODE -51	DESCRIPTION	MEMORY RECALL	No
	Capacitor voltage is less than 85% of battery volts on start up.		CONTROL TYPE
<p>SYMPTOM Line contactor does not close.</p> <p>POSSIBLE CAUSE</p> <p>Defective capacitor.</p> <ul style="list-style-type: none"> Check capacitor bank per component checking section. Check for loose or open connections in capacitor circuit. <p>Defective control fuse.</p> <ul style="list-style-type: none"> Check control fuse for open circuit. <p>Defective logic card</p> <ul style="list-style-type: none"> Replace logic card. 		<p>Figure 1</p>	
		STATUS INDICATION CRITERIA	
		This status code is displayed when capacitor voltage is less than 85% of battery volts on start up.	

STATUS CODE -54	DESCRIPTION	MEMORY RECALL	No
	Shorted R relay coil driver.		CONTROL TYPE
<p>SYMPTOM Control will not operate.</p> <p>POSSIBLE CAUSE Defective logic card. Replace logic card.</p>		Figure 1	
		<p>STATUS INDICATION CRITERIA This status code is displayed when the R coil driver is shorted internal to the logic card.</p>	

STATUS CODE -57	DESCRIPTION	MEMORY RECALL	No
	Current sensor input voltage polarity check.		CONTROL TYPE
<p>SYMPTOM Line contactor opens and then can only be closed by opening and closing the key switch.</p> <p>POSSIBLE CAUSE Reversed yellow and green current sensors wires. Insure that the green wire connects to PZ-13 with no open circuits and that the yellow wire connects to PZ-12 with no open circuits or loose connections.</p> <p>Reversed power cable connection. Insure that the battery positive cable connects to control P and the motor A2 cable connects to control A2.</p>		Figure 1	
		<p>STATUS INDICATION CRITERIA This status code is displayed when the voltage input to PZ-12 and PZ-13 is the wrong polarity.</p>	

