

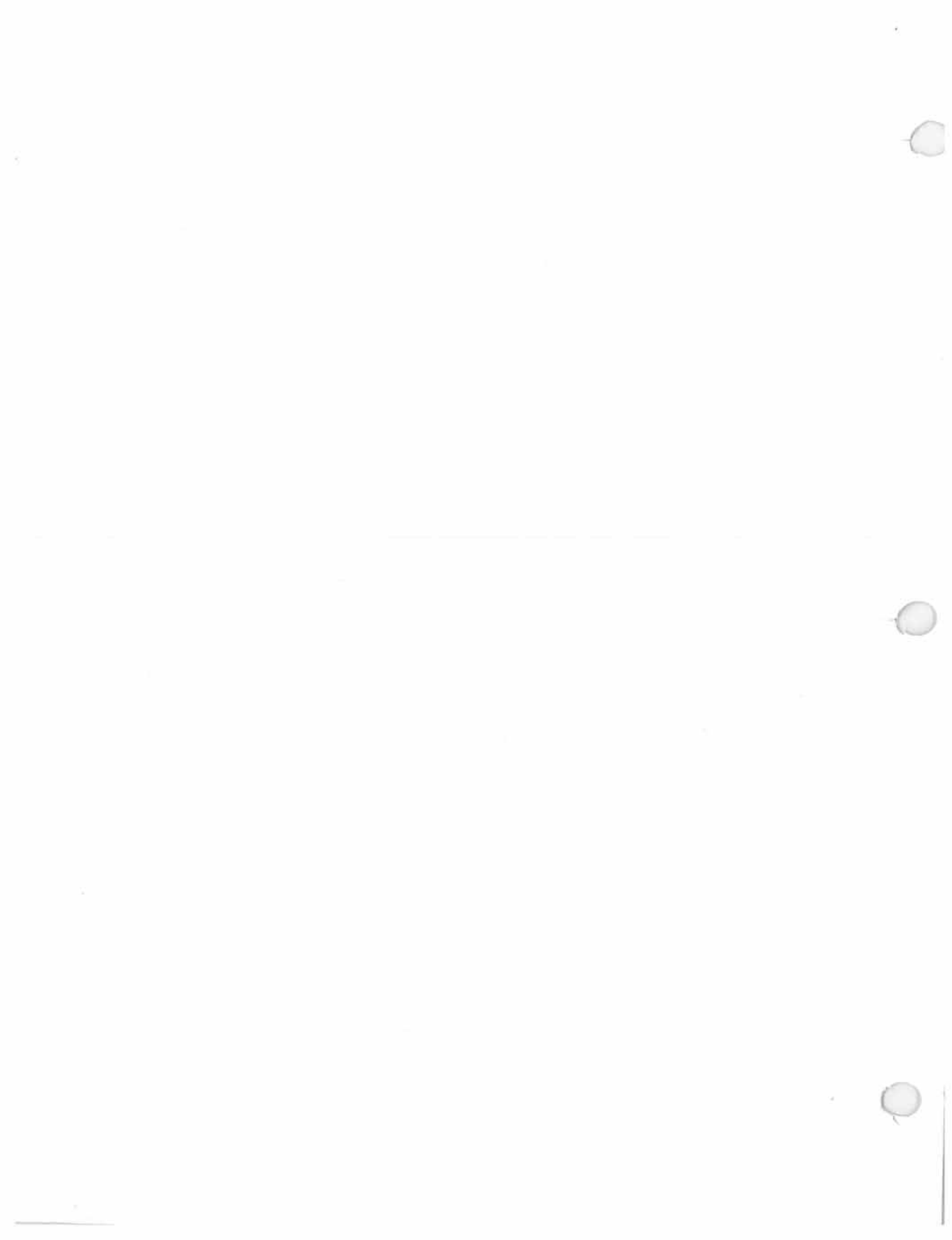


PUMA, BEARCAT & COUGAR 1000 Series
Electrical
and
Main Wiring Schematic



Contents

Wiring Schematic Connector Codes & Description	1, 2
Puma, Bearcat & Cougar 1000 Circuit Number Listing	3-5
Steerable Axle Electronic Control System Circuit Listing	6
Steerable Axle Calibration	7-9
Dash Calibration	10
Drivers Error Code Display	11, 12
TPH Operating Information	12-1, 12-2
TPH System Calibration - General Information	12-3
Recommended Calibration Procedures	12-4 thru 12-7
TPH System Troubleshooting Guide	12-8
TPH Electronic Control System Circuit Listing	12-9
Main Wiring Schematic	13-16
Puma 1000 Engine Electrical	
(Cummins 6-CTA-8.3 Engine)	17
Bearcat & Cougar 1000 Engine Electrical	
(Cat 3306 DIT & 3306 DITA Engines)	18
Bearcat & Cougar 1000 Engine Electrical	
(Cummins LT-10-A & LTA-10-A Engines)	19
Cab Electrical	20, 21
Cab Overhead Electrical	22
Air Seat Electrical	23
Puma 1000 Frame Electrical	24, 25
Bearcat & Cougar 1000 Frame Electrical	26, 27
Puma 1000 Transmission Electrical	28
Bearcat & Cougar 1000 Transmission Electrical	29
3-Pt Hitch Electrical	30, 31
Window Washer & Side Wiper Electrical	32
Rear Wiper Electrical	33
Bearcat & Cougar 1000 Differential Lock Electrical	34, 35
Puma 1000 Steerable Front Axle Electrical	36, 37



Wiring Schematic Connector Codes & Description

The following listing of wire harness connector codes are used throughout the main wiring schematics. These codes are printed in bold lettering on the schematics and are useful to reference specific wire connectors when it becomes necessary to use flow charts for troubleshooting some types of electrical or micro-processor problems.

ENGINE/TRANSMISSION HARNESS

<u>Code</u>	<u>Description</u>
ET-1	24-pin Amp connector at the right rear corner of the cab
ET-2	14-pin Amp connector at the rear of the engine
FF-1	16-pin Amp connector at the right rear corner of the cab
RF-1	14-pin Amp connector at the right rear corner of the cab

THREE POINT HITCH CONTROL

<u>Code</u>	<u>Description</u>
TPH-1	Relay receptacle
TPH-2	9-pin Amp connector at the electronic controller
TPH-3	16-pin Amp connector at the electronic controller
TPH-4	3-pin Packard connector for the command potentiometer
TPH-5	3-pin Packard connector for the lower rate potentiometer
TPH-6	Not Used
TPH-7	Calibration switch connector
TPH-8	3-Pt solenoid valve connector
TPH-9	3-pin Packard connector for the position potentiometer

DASH MODULE

<u>Code</u>	<u>Description</u>
DP-1	16-pin Amp connector at the rear of the dash display module
DP-2	9-pin Amp connector at the rear of the dash display module
DP-3	Center 9-pin Amp connector at the transmission

TRANSMISSION CONTROL

<u>Code</u>	<u>Description</u>
TM-1	10-pin connector at the transmission solenoid bank
TM-2	Packard weather pack 2-pin connector at the engine rpm magnetic pickup
TM-3	Packard 2-blade connector inside right console at transmission solenoid harness
TM-4	Packard 3-blade connector at the clutch pedal switch
TM-5	Packard 3-blade connector at the mode lever neutral safety switch
TM-6	Front 9-pin Amp connector at the transmission controller
TM-7	16-pin Amp connector at the transmission controller
TM-8	2-pin Packard weather pack connector at the clutch reed switch
TM-9	2-pin Packard weather pack connector at transmission front output shaft speedometer magnetic pickup
TM-10	5-blade Bosch relay connector at the neutral start relay
TM-11	5-blade Bosch relay connector at the transmission solenoid relay

Wiring Schematic Connector Codes & Description

BEARCAT/COUGAR DIFFERENTIAL LOCK CODES

<u>Code</u>	<u>Description</u>
DL-1	Packard 2-blade connector located rearward in the side console
DL-2	5-blade Bosch relay connector at the #1 diff lock relay
DL-3	5-blade Bosch relay connector at the #2 diff lock relay
DL-4	5-blade Bosch relay connector at the #3 diff lock relay
DL-5	5-blade Bosch relay connector at the #4 diff lock relay
DL-6	Packard 3-blade connector at the diff lock switch
DL-7	Packard 3-pin connector at the front diff lock shift motor
DL-8	Packard 3-pin connector at the rear diff lock shift motor

STEERABLE AXLE CONNECTOR

<u>Code</u>	<u>Description</u>
STA-1	Relay receptacle
STA-2	9-pin Amp connector at the electronic controller
STA-3	16-pin Amp connector at the electronic controller
STA-4	9-pin Amp connector between Run/Cal harness and steerable axle harness
STA-5	16-pin Amp connector between Run/Cal harness and steerable axle harness
STA-6	Hydraulic steering selector valve connector
STA-7	Articulation center potentiometer connector
STA-8	Front axle potentiometer connector

Puma, Bearcat & Cougar 1000 Circuit Number Listing

WIRE CIRCUIT NO.	DESCRIPTION
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	DIRECT BATTERY THRU MAIN BREAKER
11	DIRECT BATTERY THRU MAIN BREAKER
12	
13	
14	TACHOMETER (-) TO SENDER
15	SWITCH TO EITHER START SOLENOID
16	TACHOMETER (+) TO SENDER
17	IGN SW (S) TO NEUTRAL SAFE SWITCH
18	NEUTRAL SAFE SW TO START MAGNETIC SW
19	SWITCH TO STOP LAMPS
20	#6 RELAY TO CIRCUIT BREAKER
21	
22	
23	
24	
25	IGNITION #1 TO FUEL SOLENOID
26	DASH TO ENGINE OIL PRESSURE SENDER
27	DASH TO WATER TEMPERATURE SWITCH
28	WIPER PARK
29	WIPER LOW
30	WIPER HIGH
31	
32	RELAY TO COLUMN (HORN)
33	SWITCH TO WINDSHIELD WASHER PUMP
34	OPTIONAL EQUIPMENT (FRONT OUTLET)
35	REAR CAB FIELD LAMPS TO MAIN CAB HARNESS
36	DIMMER SWITCH TO HEADLAMP (LOW)
37	DIMMER SWITCH TO HEADLAMP (HIGH)
38	
39	
40	SWITCH TO DOME LAMP
41	CIRCUIT BREAKER TO TAIL LAMPS
42	CIRCUIT BREAKER TO STOP LAMP SWITCH
43	CIRCUIT BREAKER TO REAR FIELD LAMPS
44	
45	RIGHT TURN LAMPS & INDICATOR
46	LEFT TURN LAMPS & INDICATOR
47	SWITCH TO IMPLEMENT SOCKET
48	
49	
50	
51	
52	IGNITION SWITCH I ² TO RELAYS
53	
54	
55	CIRCUIT BREAKER TO IGNITION SWITCH B ³
56	CIRCUIT BREAKER TO IGNITION SWITCH B ²
57	
58	CIRCUIT BREAKER TO DOME LAMP SWITCH
59	CIRCUIT BREAKER TO CIGARETTE LIGHTER
60	
61	CIRCUIT BREAKER TO IMPLEMENT SOCKET SW
62	CIRCUIT BREAKER TO W/S WIPER & WASHER
63	
64	
65	CIRCUIT BREAKER TO IGNITION SWITCH B ¹
66	IGNITION SWITCH I ¹

WIRE CIRCUIT NO.	DESCRIPTION
67	
68	IGNITION ACCESSORIES TO RADIO & SEAT
69	
70	CIRCUIT BREAKER TO HEADLAMP DIMMER SW
71	
72	
73	
74	GROUND
75	WARNING TO PARK BRAKE SWITCH
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	IGNITION SW GROUND TO DASH LAMP CHECK
90	
91	
92	STARTER MAG SW TO STARTER SOLENOID (S)
93	CIRCUIT BREAKER TO AIR SEAT
94	AIR SEAT RELAY TO CIRCUIT BREAKER
95	
96	
97	
98	
99	
100	
101	
102	BATTERY TO HORN RELAY
103	
104	
105	RELAY TO HORNS
106	
107	
108	
109	
110	
111	BATTERY (MAIN CAB SUPPLY)
112	BATTERY THRU MAIN BREAKER
113	
114	SWITCH TO PANEL LAMPS
115	
116	
117	CIRCUIT BREAKER TO RADIO
118	
119	CIRCUIT BREAKER TO FRONT OUTLET SWITCH
120	COLUMN SWITCH TO W/S WIPER RELAYS
121	COLUMN SWITCH TO W/S WIPER RELAYS
122	
123	HVAC COMPRESSOR TO #6 RELAY
124	
125	
126	#8 RELAY (BATTERY)
127	#10 RELAY (BATTERY)
128	#9 RELAY (BATTERY)
129	#7 RELAY (BATTERY)
130	
131	
132	

Puma, Bearcat & Cougar 1 000 Circuit Number Listing

WIRE CIRCUIT NO.	DESCRIPTION
133	#2 RELAY TO POWERSHIFT SWITCH
134	POWERSHIFT RELAYS TO POWERSHIFT SWITCH
135	#2 RELAY TO CLUTCH POWERSHIFT SWITCH
136	POWERSHIFT RELAY TO CLUTCH SWITCH
137	CIRCUIT BREAKER TO #1 RELAY
138	CIRCUIT BREAKER TO POWERSHIFT SOLENOID
139	CLUTCH SWITCH FEED TO NEUTRAL SAFETY SW
140	FUEL SENDER TO DASH
141	
142	
143	CIRCUIT BREAKER TO CAB FIELD LAMPS
144	
145	
146	
147	
148	
149	
150	
151	
152	
153	SWITCH TO BLOWER MOTOR RELAY
154	
155	
156	
157	SWITCH TO PTO TACHOMETER
158	CIRCUIT BREAKER TO BLOWER MOTOR
159	
160	
161	BLOWER MOTOR RELAY TO CIRCUIT BREAKER
162	HYDRAULIC OIL TEMPERATURE SWITCH TO DASH
163	LUBE OIL TEMPERATURE SWITCH TO DASH
164	TRANSMISSION FILTER SWITCH TO DASH
165	HYDRAULIC FILTER SWITCH TO DASH
166	NOT USED
167	
168	
169	SPEEDOMETER TO SENDER
170	SPEEDOMETER TO SENDER
171	
172	LEFT SPEAKER (+)
173	LEFT SPEAKER (-)
174	RIGHT SPEAKER (+)
175	RIGHT SPEAKER (-)
176	#3 RELAY TO #4 RELAY
177	
178	
179	SWITCH TO MONITOR FEED
180	
181	
182	CIRCUIT BREAKER TO #10 RELAY
183	CIRCUIT BREAKER TO #9 RELAY
184	
185	CIRCUIT BREAKER TO #8 RELAY
186	CIRCUIT BREAKER TO #7 RELAY
187	CIRCUIT BREAKER TO TURN SIGNAL SWITCH
188	
189	BATTERY JUNCTION STUD TO CIRCUIT BREAKER
190	
191	SWITCH TO #8 RELAY
192	
193	
194	
195	
196	
197	
198	POWER SHIFT TRANSMISSION-SOLENOID "Y"

WIRE CIRCUIT NO.	DESCRIPTION
199	POWERSHIFT TRANSMISSION — SOLENOID "Z"
200	POWERSHIFT TRANSMISSION — COMMON
201	POWERSHIFT TRANSMISSION — SOLENOID "V"
202	POWERSHIFT TRANSMISSION — SOLENOID "Q"
203	POWERSHIFT TRANSMISSION — SOLENOID "T"
204	POWERSHIFT TRANSMISSION — SOLENOID "S"
205	POWERSHIFT TRANSMISSION — SOLENOID "W"
206	POWERSHIFT TRANSMISSION — SOLENOID "X"
207	TPH RELAY TO CIRCUIT BREAKER
208	CIRCUIT BREAKER TO TPH MODULE
209	CL SW FEED TO XMSN SOLENOID "S" (*)
210	
211	
212	
213	
214	
215	SWITCH TO #7 RELAY
216	SWITCH TO #10 RELAY
217	
218	
219	
220	
221	
222	
223	
224	
225	
226	
227	
228	
229	
230	
231	
232	
233	
234	
235	TURN SIGNAL SWITCH TO FLASHER
236	TURN SIGNAL SWITCH TO FLASHER
237	
238	
239	DIFF LOCK RELAY TO DIFF MOTORS (UNLOCK)
240	DIFF LOCK RELAY TO DIFF MOTORS (LOCK)
241	SWITCH TO RELAYS (DIFF L/O)
242	CIRCUIT BREAKER TO DIFF RELAYS 1 AND 3
243	
244	
245	
246	
247	TPH MODULE TO VALVE
248	TPH MODULE TO VALVE
249	TPH MODULE TO POSITION POT. POWER
250	TPH MODULE TO POSITION POT. SIGNAL
251	TPH MODULE TO POSITION POT. GROUND
252	SWITCH TO FREON SWITCH
253	
254	DIFF LOCK SWITCH TO DIFF RELAYS 2 AND 4
255	#6 RELAY TO FREON SWITCH
256	
257	(NOT USED)
258	(NOT USED)
259	(NOT USED)
260	DIFF LOCK RELAYS 1, 2, 3 & 4
260	TPH COMMAND POT SIGNAL
261	
262	CLUTCH SWITCH TO CONTROLLER
263	
264	

Puma, Bearcat & Cougar 1000 Circuit Number Listing

WIRE CIRCUIT NO.	DESCRIPTION
265	TPH MODULE TO LOWER RATE GROUND
266	TPH MODULE TO LOWER RATE POWER
267	TPH MODULE TO LOWER RATE SIGNAL
268	(NOT USED)
269	(NOT USED)
270	(NOT USED)
271	TPH MODULE TO CALIBRATE SWITCH
272	TPH MODULE TO CALIBRATE SWITCH
273	
274	
275	
276	
277	(NOT USED)
278	(NOT USED)
279	(NOT USED)
280	TPH MODULE TO COMMAND POT. GROUND
281	TPH MODULE TO COMMAND POT. POWER
282	
283	
284	
285	
286	
287	NEUTRAL SAFETY SWITCH TO CONTROLLER
288	NEUTRAL SAFETY (N.O.) TO RELAY NO. 2
289	
290	
291	
292	
293	
294	
295	TURN SIGNAL SWITCH TO FLASHER
296	TURN SIGNAL SWITCH TO FLASHER
297	TURN SIGNAL SWITCH TO FLASHER
298	
299	
300	STEERING POT. TO CONTROLLER
301	STEERING POT. TO CONTROLLER
302	STEERING POT. TO CONTROLLER
303	ARTICULATION POT. TO CONTROLLER
304	ARTICULATION POT. TO CONTROLLER
305	ARTICULATION POT. TO CONTROLLER
306	C.B. TO STRG SOLENOID AND CONTROLLER
307	SOLENOID TO SWITCH CONTROLLER
308	
309	RELAY TO CIRCUIT BREAKER
310	
311	
312	
313	
314	
315	
316	
317	
318	
319	
320	
321	
322	
323	
324	
400	CONTROLLER TO CODING SW & INDI LIGHT POWER
401	CONTROLLER TO CAL/RUN SW POWER
402	CODING SW TO CONTROLLER CAL-STORE COMMAND
403	INDI LIGHT TO CONTROLLER—CONTROLLED GROUND
404	CAL/RUN SW TO CONTROLLER MODE SELECT
405	

Steerable Axle Electronic Control System Circuit Listings

Wire No.	Routing Description "Function" and (Voltage Value)		
10	Right rear cab floor battery junction stud to the STA-1 Connector - #30 Terminal "Relay Power Feed" (12 VDC)	306	Steerable Axle 10-Amp Circuit Breaker -Auxiliary Terminal to STA-6 Pin B. "Steering Solenoid Valve Power Feed" (12 VDC)
52	Ignition Switch I ² terminal to DL-1 Connector. DL-1 Connector to STA-1 Connector #85 terminal. "Key Switch Actuation" (12 VDC)	306	Steerable Axle 10-Amp Circuit Breaker -Auxiliary Terminal to STA-4 Connector Pin #8. STA-4 Connector Pin #8 to STA-2 Connector Pin #8. "System Power Feed" (12 VDC)
74	STA-1 Connector - Pin #6 to right rear cab floor ground stud. "Test Light Ground" (not used)	307	STA-6 Connector Pin A to Steering Mode Selector Switch. "Steering Solenoid Ground" (12 VDC switch opened, 1 VDC switch closed)
74	STA-2 Connector - Pin #7 to STA-4 Connector Pin #7. STA-4 Connector Pin #7 to right rear cab floor ground stud. "System Ground"	307	Steering Mode Selector Switch to STA-4 Connector Pin #9. STA-4 Connector Pin #9 to STA-2 Connector Pin #9. "Steering Solenoid Ground" (0 VDC switch opened, 1 VDC switch closed)
74	STA-3 Connector Pin #13 to right rear cab floor ground stud. "Calibration Ground"	309	STA-1 Connector #87 Terminal to Steerable Axle 10-Amp Circuit Breaker Battery Terminal. "System Power Feed" (12 VDC)
300	STA-3 Connector Pin #16 to STA-5 Connector Pin #16. STA-5 Connector Pin #16 to STA-8 Connector Pin A. "Axle Potentiometer Ground" (1 VDC)	400	STA-2 Connector Pin #5 to Calibration Switch. Calibration Switch to Calibration Light. "Calibration Mode Power Feed" (12 VDC)
301	STA-3 Connector Pin #1 to STA-5 Connector Pin #1.	401	STA-3 Connector Pin #6 to Calibration/Run Switch. Calibration/Run Switch to STA-3 Connector Pin #11. "Calibration Mode Power Feed" (3 VDC)
301	STA-3 Connector Pin #1 to STA-5 Connector Pin #1. STA-5 Connector Pin #1 to STA-8 Connector Pin B. "Axle Potentiometer Sense" (1-4 VDC)	402	Calibration Switch to STA-3 Connector Pin #2. "Calibration Information Store Command" (12 VDC)
302	STA-3 Connector Pin #10 to STA-5 Connector Pin #10. STA-5 Connector Pin #10 to STA-8 Connector Pin C. "Axle Potentiometer Power Feed" (4 VDC)	403	Indicator Light to STA-2 Connector Pin #6. "Ground When Information From Potentiometers is in Acceptable Range" (12 VDC with light off, 0-1 VDC with light on)
303	STA-3 Connector Pin #7 to STA-5 Connector Pin #7. STA-5 Connector Pin #7 to STA-7 Connector Pin C. "Articulation Potentiometer Ground" (1 VDC)	404	Calibration/Run Switch to STA-3 connector Pin #15. "Calibration Mode Enable Command" (3 VDC in Calibration Mode, 0 VDC in Run Mode)
304	STA-3 Connector Pin #14 to STA-5 Connector Pin #14. STA-5 Connector Pin #14 to STA-7 Connector Pin B. "Articulation Potentiometer Sense" (1-4 VDC)		
305	STA-3 Connector Pin #5 to STA-5 Connector Pin #5. STA-5 Connector Pin #5 to STA-7 Connector Pin A. "Articulation Potentiometer Power Feed" (4 VDC)		

Steerable Axle Calibration



Figure 1: Front Steer Micro Processor

The steerable axle is controlled by a micro-processor that automatically shifts steering control from front steering to frame articulation, and from frame articulation to front steering when the combination steering mode is selected.

The micro-processor requires three data points: articulation center, left steer and right steer. Proper entry of these points will result in the correct operation of the steerable axle.



CAUTION: When performing the following procedure, be sure area is clear of any persons. Provide adequate room to perform full left or right turns.

Pre-Calibration Procedure

1. Front steering potentiometer

A. Start engine and move the front steerable axle to zero degree steer position as indicated by the axle to frame pointer.

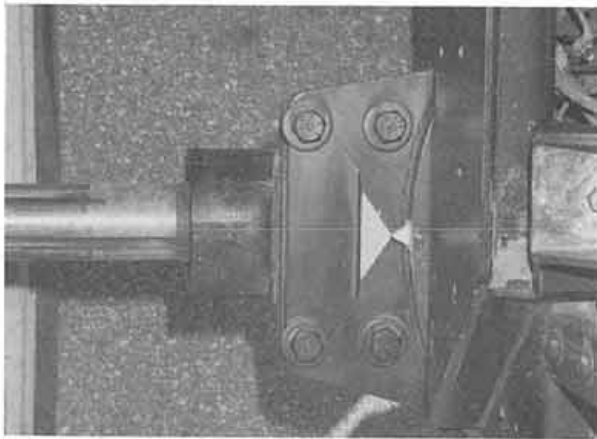


Figure 2: Front Steer Centering Indicator

B. Adjust front steer potentiometer actuation lever link (1) to 3.62 inch (91.9 mm) between center line of the rod ball sockets.

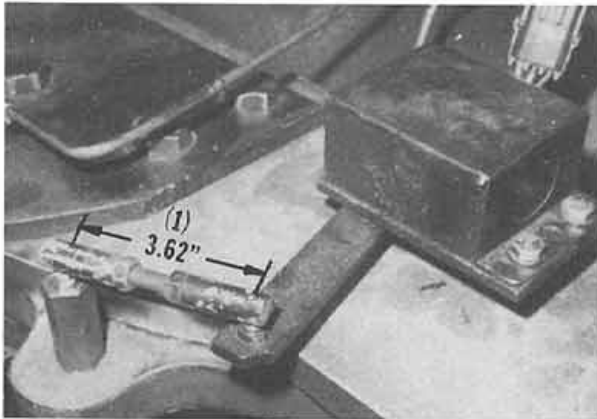


Figure 3: Front Steer Potentiometer

Steerable Axle Calibration

C. Adjust potentiometer so that the resistance between the center terminal of the potentiometer to any other terminal on the potentiometer is 500 ± 20 ohms. If necessary adjust potentiometer link (2) in or out to achieve these values.

NOTE: To adjust this link will require removing cover capscrews and cover as shown. Reinstall the cover and capscrews after adjustment.

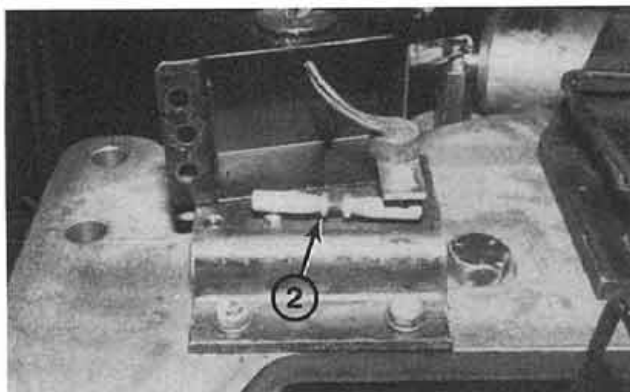


Figure 4: Front Steer Potentiometer

2. Frame articulation potentiometer

A. Start engine and move front and rear frame so that the tractor is in a zero articulation position. Install articulation lock bar or measure and equalize steering cylinder rod lengths.



CAUTION: Shut down engine and apply Park Brake before working in center hinge area.

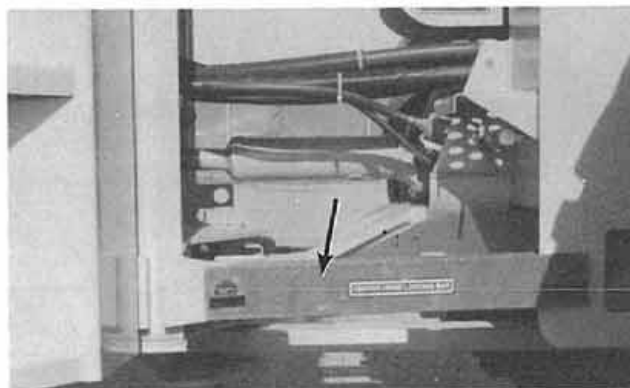


Figure 5: Frame Lock Bar

B. Adjust articulation potentiometer, actuation lever and link so that the resistance between the center terminal of the potentiometer to any other terminal on the potentiometer is 500 ± 20 ohms.

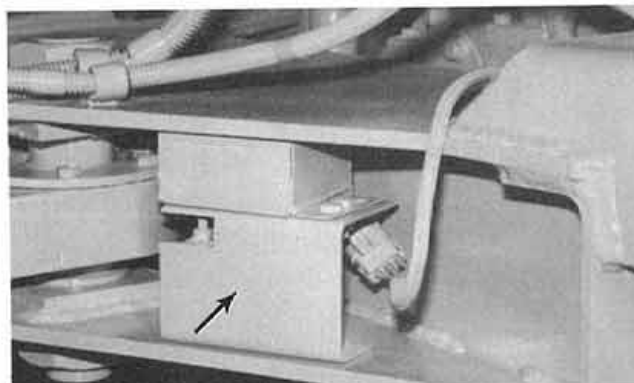


Figure 6: Center Hinge Potentiometer

Calibration Procedure

1. Center tractor articulation by equalizing cylinder rod lengths. Place steering mode switch in combination steer mode.

NOTE: The articulation lock bar may be installed.



CAUTION: Shut down engine and apply Park Brake before working in center hinge area.



Figure 7: Steering Mode Switch

Steerable Axle Calibration

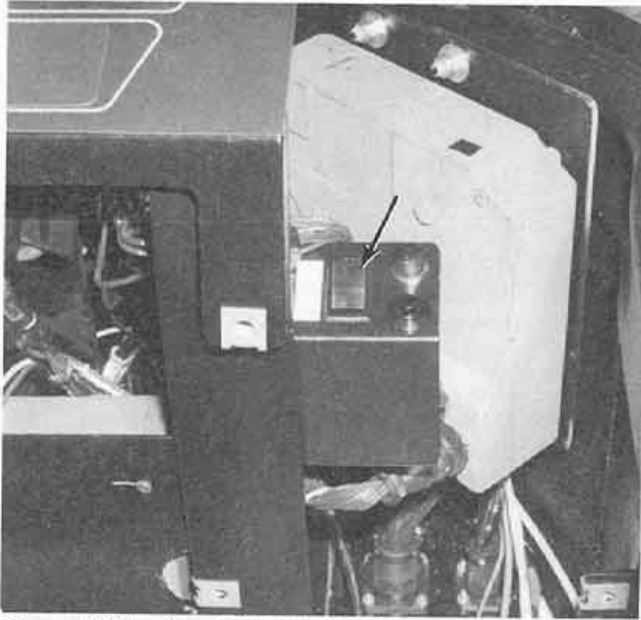


Figure 8: Steering Calibration Switch

2. Remove the right side console cover. The run/calibration switch is located in the right rear corner, just below the console cover. With key switch in off position, select the "calibration" mode on the calibration switch.

3. If installed, remove articulation lock bar. Start engine, observe that the calibration light comes on, indicating that the micro-processor is reading an acceptable articulation value.

NOTE: If calibration light does not come on, recheck articulation potentiometer per precalibration procedure number 2.

4. Momentarily depress calibration button. The calibration light will go out indicating that the micro-processor has received the data point for the articulation center.

5. Steer to the "left" until the steerable axle is in the maximum "left" steer position. Observe that the calibration light comes on, indicating that the micro-processor is reading an acceptable value.

NOTE: If calibration light does not come on, recheck front steering potentiometer per precalibration procedure number 1.

6. Momentarily depress calibration button. The calibration light will go out, indicating that the micro-processor has received the data point for the "left" steer position.

7. Steer to the "right" until the steerable axle is in the maximum "right" steer position. Observe that the calibration light comes on, indicating that the micro-processor is reading an acceptable value.

NOTE: If calibration light does not come on, recheck front steering potentiometer setting per precalibration number 1.

8. Momentarily depress calibration button. The calibration light will go out, indicating that the micro-processor has received the data point for the "right" steer position.

9. Turn key switch to off.

10. Select "run" position on run/calibration switch.

11. Restart engine, check for correct steering operation before moving tractor or installing the right side console cover.

Dash Calibration

To ensure correct engine rpm display and ground speed matching, the Puma, Bearcat and Cougar 1000 Series tractors require dash calibration for engine, axle and tire size.

Normally this calibration is done at the factory. However, tractors shipped without tires or receiving different tires in the field or if the dash assembly requires replacement, it will be necessary to perform a calibration check.

Calibration should be checked to the following chart:

Option	Display	Description
Engine	E1	Cummins CTA 8.3 L
	E2	Cat 3306
	E3	Cummins L-10
Axle	A1	ZF AP3445
	A2	Raba 598
	A3	Raba 592
Tires	T1	18.4 x 34 R1
	T2	14.9 x 38 R1
	T3	16.9 x 38 R1
	T3	20.8 x 34 R1
	T4	23.1 x 34 R1
	T4	18.4 x 38 R1
	T4	24.5 x 32 LS2
	T4	30.5 x 32 R1
	T5	24.5 x 32 R1
	T5	20.8 x 38 R1
	T5	30.5 x 32 LS2
	T5	24.5 x 32 R2
	T5	30.5 x 32 R2
	T6	18.4 x 42 R1
	T6	20.8 x 38 R2
	T6	20.8 x 42 R1

- To correct or calibrate a display, depress the PTO switch to advance the number.
- To advance the display to axles or tires, depress the hour switch button.
- To return the dash to operating mode after calibration, depress the hour switch button each time to advance the display from E to A to T and then to operating mode (0 in the display).

Example: Tractor is equipped with Cummins L-10 engine (E 3), Raba 598 Axles (A 2) and has been revised to 20.8 x 38 R1 tires (T 5).

Procedure:

Action	Display
1. Turn key switch "on"	0
2. Depress PTO and Hour Switch Buttons C 1.0 E-3	A 2
3. Depress Hour Button 1 time	T 3
4. Depress Hour Button 1 time	T 4
5. Depress PTO Button 1 time	T 5
6. Depress PTO Button 1 time	---
7. Depress Hour button 1 time	---

Calibration is now complete 0

Dash Calibration Procedure:

- Turn key switch to "on" position.
- With MPH and RPM LCD displays indicating 0 and gear display indicating A 0, simultaneously depress both the hour and PTO pressure sensitive switches until a C 1.0 is indicated on the RPM display.

NOTE: All calibration numbers will appear on the RPM display.

- Following the C 1.0, the engine calibration will be displayed.

Drivers Error Code Display

The following error codes will be displayed in the two most significant digits of the gear LCD dash display. They will appear beginning with an "E" then blank, then the specific two digit code "****", then blank and the sequence repeats until the error code is cleared by placing the mode lever in neutral and/or correcting the problem.

If or when an error code should be displayed, refer to the following guide to determine the specific error code meaning and possible check or field repair.

Error Code

E10 **NOTE:** Error Codes E10, E40 & E41 have continuous audio alarms.

Indicates low system voltage (less than 9.5 VDC). Check battery charge condition (recharge if necessary), check battery cable connections, alternator drive belt or charging system and/or reduce applied system load. When this error code is displayed the low voltage warning light should be illuminated.

NOTE: All transmission error codes (E2.* and E3.*) are continuous alarms.

E20 Transmission shift solenoid "Z" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E21 Transmission shift solenoid "Y" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E22 Transmission shift solenoid "X" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E23 Transmission shift solenoid "W" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E24 Transmission shift solenoid "V" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E25 Transmission shift solenoid "T" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E26 Transmission shift solenoid "S" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E27 Transmission shift solenoid "Q" open circuited. Check transmission control wire harness and/or connector at the transmission end.

E28 Indicates a complete transmission solenoid bank power loss. The audio alarm will sound for 2 seconds every two minutes. Check the wire harness connector into the transmission solenoid and/or wire harness.

E30 Transmission shift solenoid "Z" short circuited. Check the transmission wire harness for chaffing.

E31 Transmission shift solenoid "Y" short circuited. Check the transmission wire harness for chaffing.

E32 Transmission shift solenoid "X" short circuited. Check the transmission wire harness for chaffing.

E33 Transmission shift solenoid "W" short circuited. Check the transmission wire harness for chaffing.

E34 Transmission shift solenoid "V" short circuited. Check the transmission wire harness for chaffing.

E35 Transmission shift solenoid "T" short circuited. Check the transmission wire harness for chaffing.

E36 Transmission shift solenoid "S" short circuited. Check the transmission wire harness for chaffing.

E37 Transmission shift solenoid "Q" short circuited. Check the transmission wire harness for chaffing.

Drivers Error Code Display

- E40** Indicates a mode lever shuttle shift was attempted at speeds greater than safely possible. If the digital information in the MPH or RPM LCD displays are wrong, examine the wiring harness and/or connector at each respective engine RPM sender or transmission MPH sender. Alarm continuous.
- E41** Indicates a direction change without a neutral command from the mode lever neutral interlock switch. Inspect the neutral interlock switch for proper operation, examine for proper integrity and connection between the harness and controller. Alarm continuous.
- E50** Indicates a ground speed matching error for the present selected gear range. The audio alarm will sound for 2 seconds only. Check the digital information in the MPH or RPM LCD displays for proper values. If the displayed information is incorrect, check the wiring harness and connectors and the engine RPM sender and the transmission MPH sender.
- E60** Possible engine rpm sender failure, check for disconnected or damaged wire harness on rpm sender.
- E61** Possible mph sender failure. Check for disconnected or damaged wire harness on mph sender at the transmission output shaft.

TPH Operating Information

Using The 3-Pt Hitch Position Control System

General Operating Information

The 3-Pt Hitch Position Control System is electronically controlled by a micro-processor, but operates very similar to the conventional mechanical hitch control systems.

Hitch Raise & Lower (Fig. 8)

The hitch will move in relation to the operators movement of the raise/lower command lever located in the control console to the right of the operator.

To raise the hitch rockshaft, pull the position command lever (A) rearward.

To lower the hitch rockshaft, push the position command lever (A) forward.

NOTE: On tractor start-up, no hitch control will begin until the command lever is moved slowly through its full range of travel to a position that will match the actual hitch rockshaft position. This is to prevent hitch lurching on start-up and is defined as "capturing" the hitch. Once the command lever and hitch rockshaft positions are matched (captured) the hitch will follow the command lever movement until the key switch is turned off removing electrical power from the system. Any time the switch key is turned off, the hitch must be "recaptured" after start-up.

Transport Position (Fig. 9)

To prevent accidentally lowering the rockshaft, or when transporting, move the position control lever (A) to the fully raised position and place the control lever in the notch (A-1).

Adjusting Depth Stop (Fig. 10)

The command lever has a mechanical depth stop for maintaining a constant and repeatable working depth. It is easily adjusted while operating in the field by turning the position adjustment control knob (B) located directly to the rear of the command lever on top of the console, the rockshaft will then lower to the same selected depth stop position each time the command lever is pushed to the stop.

NOTE: If small incremental adjustments are necessary for more precise position control, it is advisable to raise the hitch and lower it to the new position stop each time, this will eliminate any dead band that may exist in the linkage.

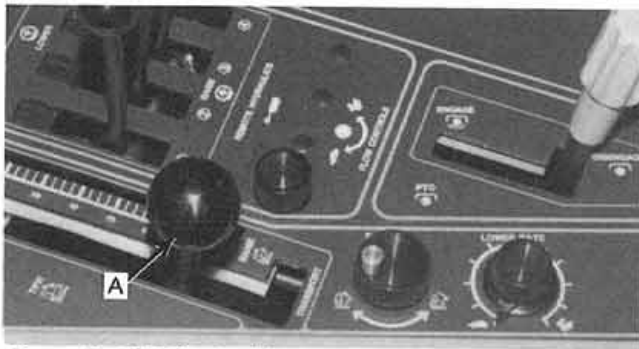


Figure 8: TPH Control Lever

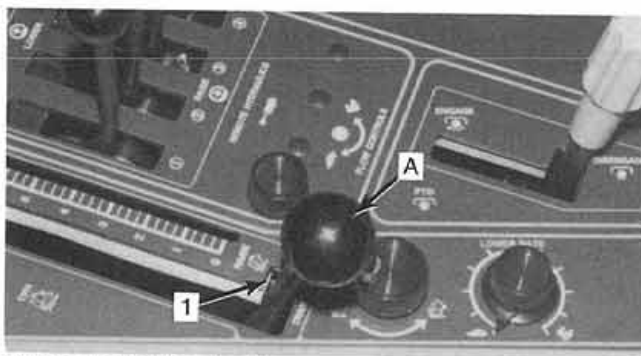


Figure 9: TPH Control Lever

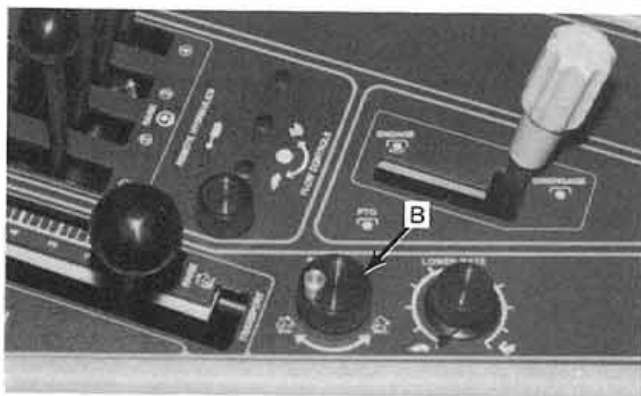


Figure 10: Depth Stop Adjustment

TPH Operating Information

Using Float Position (Fig. 11)

Equipment having depth gauge wheels may require the use of the float position to follow ground contours. The implement operators manual should tell you when to allow float.

To use the "float" position, hold the command lever to the left-hand side of the gate slot and push the lever all the way forward past the depth stop.

NOTE: When using "float", the lift links should also be adjusted to allow the individual links to float.

Implement Lowering Rate Adjustment (Fig. 12)

Because the 3-Pt hitch system is gravity lowered, (oil is vented from the lift cylinders directly to tank) an added feature to the control system is an adjustable lowering (drop) rate control conveniently located on the console to the right of the operator. This control allows the operator to compensate for implement weight difference and maintain a desired lowering rate.

When first connecting or changing implements this adjustment should be set in the mid-range so that the implement does not drop too fast and possibly cause damage.



CAUTION: Excessive speed of drop may cause damage or injury. Fully lowering the implement should require at least 2 seconds.

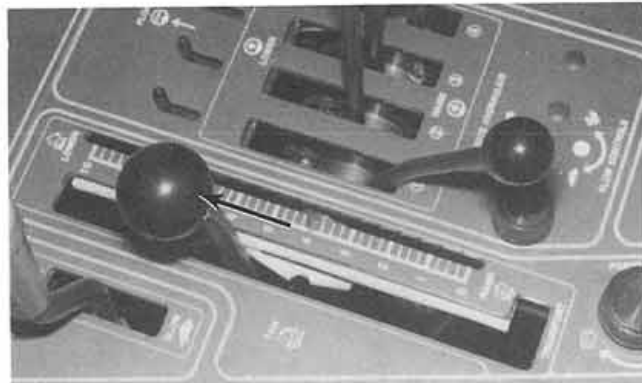


Figure 11: Float Position



Figure 12: Lowering Rate Adjustment

3-Pt Hitch System Calibration

System Calibration Sequence

General Information

The calibration sequence is an operator initiated procedure the hitch control system goes through to learn the TPH solenoid valve threshold voltage requirements to start a raise and start a lower. After this sequence is completed, the micro-processor controller keeps these values in memory, even after shut down, until the calibration sequence is initiated again by the operator. This process fine tunes the control system to the system solenoid valve characteristics and the given load on the hitch for smooth hitch control.

The controller will compensate for the valve being out of adjustment within a certain range. If the hitch movement is jerky and has poor metering characteristics, the valve calibration sequence should be activated as defined in following procedure. If the hitch moves during engine shutdown or engine cranking, the TPH valve is too far out of adjustment for the calibration sequence and the valve must be adjusted as defined in the valve adjustment procedure.

NOTE: Normally the hitch calibration sequence only has to be initiated when a new system is installed, or after valve or controller replacement or after changing implements to fine-tune the system.

Calibration Switch (Fig. 13)

The calibration switch (C) is located under the console cover and can be operated through the hole provided in the console cover facing the right side window just forward of the right rear ROPS Post.

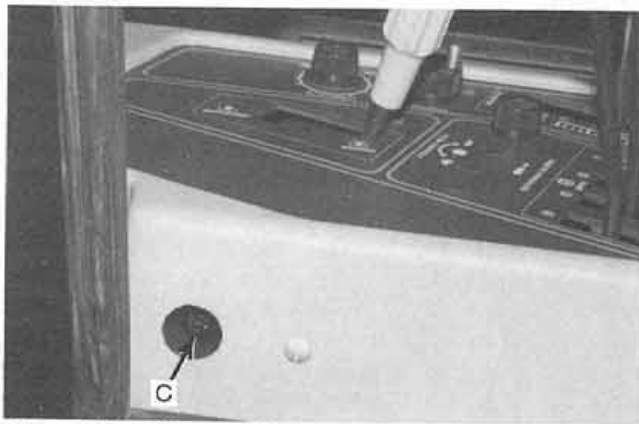


Figure 13: Calibration Switch

Conditions Required Before Calibration Cycle Will Activate

Certain conditions must be met before the hitch control system will go into an operator initiated calibration sequence:

1. The tractor must be running and supplying electrical and hydraulic power. System should be at normal operating temperature for better results.
2. The hitch must be in the lower 90% of its total travel.
3. Hitch should not be moving, but will engage calibration cycle if hitch is moving less than 1.8 degree/second.
4. Hitch with implement should be in a position so it will not contact the ground or any other structure when it moves up and down 2 degrees.

Recommended Calibration Procedures

Calibration Procedures



CAUTION: Be sure everyone stays clear of the hitch and/or implement during a calibration procedure. Hitch movement during this sequence is 1.5 degrees up and 1.5 degrees down. The hitch must be positioned so the implement can move within this range without contacting the ground or other structures.

1. Have the engine running and the system at normal operating temperature.
2. Have the implement to be used hooked to the hitch and have the hitch positioned so the implement is off the ground, otherwise incorrect hitch load data will be used and the calibration sequence may not improve hitch performance.
3. To activate the calibration sequence, momentarily depress the calibration button (C). Once initiated, the calibration sequence may take up to one minute to complete. (Fig. 14)



CAUTION: During the calibration sequence, the operator does not have control of the hitch and any command lever movements will not cause a hitch reaction. To stop the calibration sequence shut off the tractor.

4. The controller starts increasing the voltage to the valve and keeps increasing the voltage to the valve every 3 seconds until the hitch moves 1.5 degrees. Once the raise cycle is complete, it starts the same routine to find the lower threshold. This process may take over a minute to complete.
5. After the hitch has moved up 1.5 degrees and then back down 1.5 degrees, the calibration sequence is complete and the new TPH valve threshold data is stored into memory until the next calibration sequence.
6. The hitch will require recapture after the calibration sequence is complete.

NOTE: If the implement was sitting on the ground at initiation of the calibration sequence, it may not be able to calibrate an adequate lower threshold point and the controller could pull its own power. This would be indicated by the red L.E.D. in the controller and would require a restart. This will not harm the controller but may result in poor metering until the control has properly completed a calibration cycle.

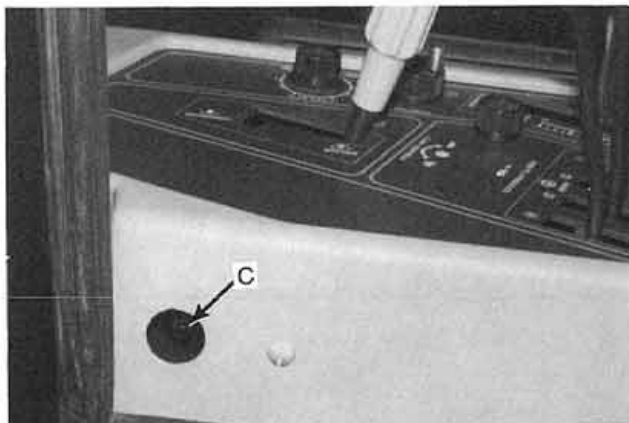


Figure 14: Calibration Switch

Recommended Calibration Procedures

Procedure for setting up and adjusting the TPH position control potentiometers.

General Information

The TPH control requires input from the operators raise/lower command lever referred to as "COM" and the position of the rockershaft referred to as "POS." The operator moves the command lever for a desired hitch position and with this voltage input from the COM potentiometer, the controller interprets and sends appropriate voltage inputs to the hitch valve to cause the hitch to move to the desired position so the COM and POS voltages match. For further explanation of system operation, see operating information.

The potentiometers have a 60 degree working range and must be orientated to accommodate the 48 degree COM and POS working range.

Mounting & Adjustment Procedure

1. First orientate the potentiometers to their mounting surfaces for good wire routing.
2. Adjust the potentiometer shaft relative to the rotating member to get it set in its working range.
3. Final minor adjustments may be best accomplished by loosening the lock nut and rotating the potentiometer.



CAUTION: Do not make these adjustments with the tractor running. Rotating to potentiometer may cause the hitch to move.

4. For potentiometer adjustments, voltage measurements should be taken with respect to tractor ground and the potentiometer sense line.

NOTE: It will be necessary to probe the correct wires or connector body to determine voltage values when adjusting potentiometers or troubleshooting the system.

The technician may also elect to fabricate a short test harness to temporarily connect in parallel between the wire harness connectors to perform these operations.

Rockershaft Potentiometer Setting (POS)

1. Raise hitch to full up position (cylinder travel should be 6.75").

Procedure if hitch not full up.

- a) Disconnect TPH valve connector TPH-8 wire leads.
- b) With tractor running, apply 5-12 volts DC to the black valve wire to raise. (Reversing the wires will cause a lower)



WARNING: Make sure everyone is clear from hitch and implement before applying voltage.

IMPORTANT: Do not apply 12 VDC to valve for more than 15 seconds every 5 minutes.

- c) Remove DC voltage supply from valve when hitch raises up against its top limits.
 - d) Shut off tractor engine.
2. Turn key on to provide electrical power but do not run engine.
 3. Attach voltmeter leads to TPH-9 connector GRND (wire #74) and POS (wire #250) sense line.
 4. Adjust POS potentiometer to read 3.80 to 3.90 volts DC. If this voltage cannot be obtained, then set it at .04 VDC less than maximum obtainable amount.

Command Lever Potentiometer Setting (COM)

1. Turn key on to provide electrical power but do not run engine.
2. Position raise/lower command lever full rearward to fully raised transport position.
3. Attach voltmeter leads to TPH-4 connector GRND (wire #74) and COM (wire #260) sense line.
4. Adjust COM potentiometer so it measures from .02 VDC to .10 VDC less than the POS potentiometer setting at full raised.

Recommended Calibration Procedures

System Check

1. Make sure potentiometers and associated hardware were tightened after adjustment and that valve and potentiometer wire leads are connected.
2. Capture hitch control by starting tractor and slowly moving the command lever through its full operating range until the hitch starts to move. When the COM and POS potentiometer sense voltages are matched, the system is captured and will respond to operator movement of the command lever.
3. If the control does not capture, readjust COM potentiometer as per procedure as previously outlined.
4. With hitch control captured, cycle the hitch up and down a few times.
5. Check the cylinder travel at the full up position. The cylinder travel should be approximately 6.5 inches.

NOTE: If the hitch goes too high or raises to end of cylinder causing the pump to stay at high pressure standby, follow the POS potentiometer setting procedure and adjust the POS potentiometer to increase voltage output. (General guideline .09 VDC = .25 inch cylinder rod travel.)

If hitch doesn't go high enough, readjust POS potentiometer so its voltage output is decreased.

TPH Solenoid Valve Adjustment

1. Disconnect TPH-8 connector wires to valve.
2. Adjust with tractor running, usually have best results with implement on hitch and system at operating temperature.



CAUTION: Make sure everyone is clear of hitch and implement area before making valve adjustments because hitch will move.

3. Loosen solenoid valve set screw jam nut with 3/4" wrench.
4. Adjust valve centering set screw with 1/4" hex headed Allen wrench.
5. Mark adjustment screw and valve in its original position.



Figure 15:

Recommended Calibration Procedures

6. Rotate adjustment screw CCW until hitch starts to raise. (May want to try several times to determine the position it starts to raise.) Mark the orientation of the adjustment screws at that point.
7. Rotate adjustment screw CW until hitch starts to lower and mark that position.
8. The adjustment screw should be set in the centered position between the raise and lower threshold marks. You also have a visual indicator of how much the valve was adjusted from its original position.
9. Once the valve has been adjusted, hook up the valve TPH-8 connector wires.
10. Go through a calibration sequence so the controller will learn the new valve threshold.
11. During calibration sequence, the voltage to the valve can be monitored to check for centered position. The maximum voltage required for a raise or lower should be close to equal. If voltage is significantly greater for one direction, the valve should be readjusted in the proper direction for closer valve threshold values (CW for lower, CCW for raise). This procedure should be conducted with weight on the hitch.
12. After final valve adjustment, go through sequence again.

Electronic System Diagnostics (Fig. 16)

The controller is located in the right rear corner of the cab under the control console cover. To get at the controller, the console plastic bezel must be removed. Through a small window at the top of the controller enclosure, red and green L.E.D. indicators can be seen. When the green light is on it indicates the electronic system is functioning properly. If the red light is on it indicates some problem in controller or an electrical component has caused the controller to shut itself off. To reset the controller, shut tractor down and wait at least a minute before restart. The green light should come back on if the system is operable. If the red light comes back on, this indicates a problem with controller, wires or potentiometers causing it to shut itself down.



Figure 16: L.E.D. Window

TPH System Troubleshooting Guide

PROBLEM	FAILURE MODE	POSSIBLE CORRECTION PROCEDURE
1. Hitch won't move when command lever moved	1.1 System not captured 1.2 No voltage to solenoid valve	1.1.1 Go through capture sequence 1.2.1 Check wire connections 1.2. Check controller status LED in controller a) If "green" controller is operating b) If "red" shut down tractor for a minute then restart c) If LED stays red, recheck all wire connection and potentiometers or replace controller if problem persists
2. Hitch goes up but not down	2.1 Lowering restrictor set too low	2.1.1 Increase lowering rate setting
3. System won't capture	3.1 Potentiometer readings don't match	3.1.1 Check potentiometer wire connections at command lever and rockershaft 3.1.2 Set potentiometer to proper voltage. Check controller status LED in controller.
4. Calibration sequence won't	4.1 Hitch in upper 10% of hitch travel 4.2 Calibration switch wiring connection	4.1.1 Try moving hitch into lower 90% of working range 4.2.1 Check for loose wiring connections
5. Jerky hitch movements or poor metering.	5.1 System out of calibration. 5.2 TPH solenoid valve not centered	5.1.1 Engage calibration sequence 5.2.1 Perform TPH valve adjustment
6. Hitch moves during engine shut-down or engine cranking	6.1 Valve out of adjustment	6.1.1 Perform TPH valve adjustment

TPH Electronic Control System Circuit Listing

Wire No.	Routing Description "Function" and (Voltage Value)	
10	Transmission 10 amp Circuit Breaker - Battery terminal to TPH-1 connector - #30 terminal "Power Feed" (12 VDC)	
52	Ignition Switch - I ² Terminal to TPH-1 connector- #85 Terminal "Key Switch Actuation" (12 VDC)	
74	TPH-1 Connector - #86, Ground Terminal to Ground Stud on the component assembly. "Relay Field Coil Ground"	
74	TPH-3 Connector - Pin #13 to the right rear floor ground stud. "System Ground"	
74	TPH-2 Connector - Pin #7 to the right rear floor ground stud. "System Ground"	
207	TPH-1 Connector - #87, normally open terminal to the Three Point Hitch 5 amp circuit breaker "System Power Feed" (12 VDC)	
208	Three Point Hitch 5 amp circuit breaker -Auxiliary Terminal to TPH-2 connector -Pin #8. "System Power Feed" (12 VDC)	
247	TPH-2 Connector - Pin #6 to TPH-8 connector Pin A. Has a 1-amp in-line fuse. "TPH Hydraulic Valve, Lower Command" (0-7 VDC)	
248	TPH-2 Connector - Pin #9 to TPH-8 connector Pin B. Has a 1-amp in-line fuse. "TPH Hydraulic Valve, Raise Command" (0-7 VDC)	
249	TPH-3 Connector - Pin #5 to TPH-9 connector Pin C. "Position Potentiometer Power Feed" (4 VDC)	
250	TPH-3 Connector - Pin #15 to TPH-9 connector Pin B. "Position Potentiometer Sense" (1-4 VDC)	
251	TPH-3 Connector - Pin #6 to TPH-9 Connector Pin A. "Position Potentiometer Ground" (1 VDC)	
260	TPH-3 Connector - Pin #14 to TPH-4 Connector Pin B. "Command Potentiometer Sense" (1-4 VDC)	
265	TPH-3 Connector - Pin #6 to TPH-5 Connector Pin A. "Lower Rate Potentiometer Ground" (1 VDC)	
266	TPH-3 Connector - Pin #10 to TPH-5 Connector - Pin C. "Lower Rate Potentiometer Power Feed" (4 VDC)	
267	TPH-3 Connector - Pin #1 to TPH-5 Connector Pin B. "Lower Rate Potentiometer Sense" (1-4 VDC)	
271	TPH-2 Connector - Pin #5 to TPH-7 Connector. "Calibrate Switch Power Feed" (12 VDC)	
272	TPH-7 Connector to TPH-3 Connector - Pin #2. "Calibration Mode Signal" (12 VDC when calibration switch is actuated).	
280	TPH-3 Connector - Pin #7 to TPH-4 Connector Pin C. "Command Potentiometer Ground" (1 VDC)	
281	TPH-3 Connector - Pin #1 to TPH-4 Connector Pin A. "Command Potentiometer Power Feed" (4 VDC)	