Genie
A TEREX BRAND

Service and Repair Manual

Serial Number Range

S®-60 DC
S®-60 FE

from S60ED-101
from S60EM-101

This manual includes:
Repair procedures
Fault Codes
Electrical and
Hydraulic Schematics

For detailed maintenance procedures, refer to the appropriate Maintenance Manual for your machine.

Original Instructions
Part No. 1299608GT
Rev A3
June 2024

Introduction

Important

Read, understand and obey the safety rules and operating instructions in the appropriate Operatorès Manual on your machine before attempting any procedure.

This manual provides troubleshooting and repair procedures for qualified service professionals.

Basic mechanical, hydraulic and electrical skills are required to perform most procedures. However, several procedures require specialized skills, tools, lifting equipment and a suitable workshop. In these instances, we strongly recommend that maintenance and repair be performed at an authorized Genie dealer service center.

Compliance

Machine Classification

Group B/Type 3 as defined by ISO 16368

Machine Design Life

Unrestricted with proper operation, inspection and scheduled maintenance.

Technical Publications

Genie has endeavored to deliver the highest degree of accuracy possible. However, continuous improvement of our products is a Genie policy. Therefore, product specifications are subject to change without notice.

Readers are encouraged to notify Genie of errors and send in suggestions for improvement. All communications will be carefully considered for future printings of this and all other manuals.

Contact Us:

Internet: www.genielift.com
E-mail: awp.techpub@terex.com

Find a Manual for this Model

Go to https://www.genielift.com

Use the links to locate Service Manuals, Maintenance Manuals, Service and Repair Manuals, Parts Manuals and Operatorès Manuals.

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1299608GT Rev A3, June 2024

First Edition, First Printing

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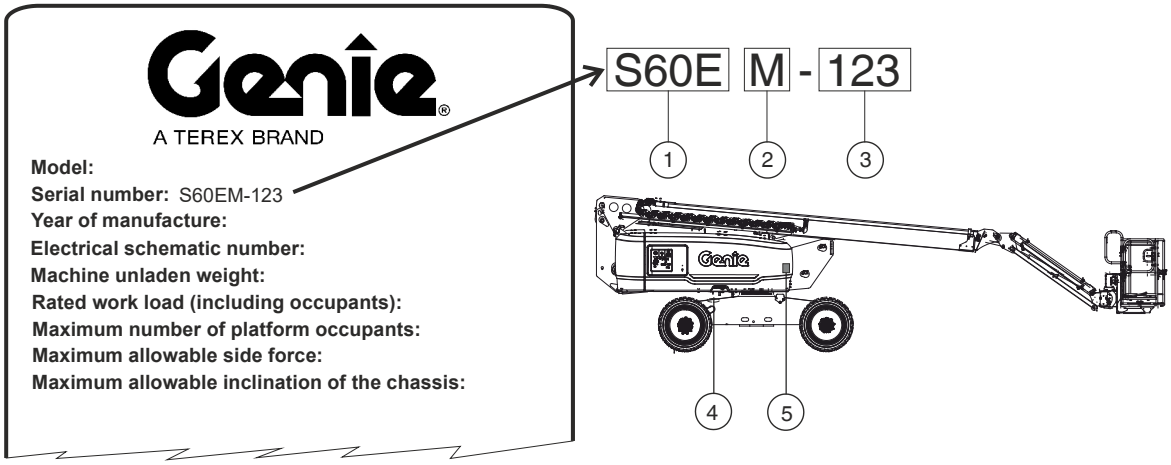
Revision History

Revision	Date	Section	Procedure / Page / Description
A	07/2021		Initial Release
A1	02/2022	Schematics	Hydraulic schematics
A2	12/2023	Repair	2-3
A3	6/2024	Front cover	Add facility code and serial break
		Repair	Calibration process steps

Reference Examples:	**Electronic Version** Click on any content or procedure in the Table of Contents to view the update.
Section è Repair Procedure, 4-2	
Section è Fault Codes, All charts	
Section è Schematics, Legends and schematics	

Introduction

Serial Number Legend



1 Model
2 Facility code
3 Sequence number
4 Serial number (stamped on chassis)
5 Serial label (located under cover)

Safety Rules



Danger

Failure to obey the instructions and safety rules in this manual and the appropriate Operatorès Manual on your machine will result in death or serious injury.

Many of the hazards identified in the operatorès manual are also safety hazards when maintenance and repair procedures are performed.

Do not modify or alter a MEWP without prior written permission from the manufacturer.

Do Not Perform Maintenance Unless:

☑ You are trained and qualified to perform maintenance on this machine.

☑ You read, understand and obey:

- manufacturerès instructions and safety rules
- employerès safety rules and worksite regulations
- applicable governmental regulations

☑ You have the appropriate tools, lifting equipment and a suitable workshop.

Safety Rules

Personal Safety

Any person working on or around a machine must be aware of all known safety hazards. Personal safety and the continued safe operation of the machine should be your top priority.



Read each procedure thoroughly. This manual and the decals on the machine, use signal words to identify the following:



Safety alert symbol© used to alert personnel to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠DANGER Indicates a imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, may cause minor or moderate injury.

NOTICE Indicates a potentially hazardous situation which, if not avoided, may result in property damage.



Be sure to wear protective eye wear and other protective clothing if the situation warrants it.



Be aware of potential crushing hazards such as moving parts, free swinging or unsecured components when lifting or placing loads. Always wear approved steel-toed shoes.

Workplace Safety

Any person working on or around a machine must be aware of all known safety hazards. Personal safety and the continued safe operation of the machine should be your top priority.



Be sure to keep sparks, flames and lighted tobacco away from flammable and combustible materials like battery gases and engine fuels. Always have an approved fire extinguisher within easy reach.



Be sure that all tools and working areas are properly maintained and ready for use. Keep work surfaces clean and free of debris that could get into machine components and cause damage.



Be sure any forklift, overhead crane or other lifting or supporting device is fully capable of supporting and stabilizing the weight to be lifted. Use only chains or straps that are in good condition and of ample capacity.



Be sure that fasteners intended for one time use (i.e., cotter pins and self-locking nuts) are not reused. These components may fail if they are used a second time.



Be sure to properly dispose of old oil or other fluids. Use an approved container. Please be environmentally safe.



Be sure that your workshop or work area is properly ventilated and well lit.

Table of Contents

Introduction	**Introduction**	**ii**
	Important Information	ii
	Find a Manual for this Model	ii
	Revision History	iii
	Serial Number Legend	iv
Section 1	**Safety Rules**	**v**
	General Safety Rules	v
Section 2	**Specifications**	**1**
	Machine Specifications	1
	Performance Specifications	2
	Hydraulic Oil Specifications	2
	Hydraulic Component Specifications	5
	Manifold Component Specifications	5
	Kubota D1105 Engine Specifications	6
	Machine Torque Specifications	7
	Machine Component Weights	7
	Hydraulic Hose and Fitting Torque Specifications	8
	Torque Procedure	9

Table of Contents

Section 3 **Repair Procedures 11**

Introduction 11

Cailbration Process Steps 13

How to Reset System Defaults from the Ground Controls 14

How to Reset General Parameter Defaults from the Platform Controls 14

How to Reset Calibration Defaults from the Platform Controls 15

How to Reset All Parameter Defaults from the Platform Controls 15

Platform Controls 16

1-1 Platform Controls 16

How to Adjust the Joystick Threshold Setting 17

How to Adjust the Joystick Max-out Setting 18

How to Adjust the Joystick Ramp Rate Setting 20

1-2 How to Calibrate Boom Angle Sensor 22

1-3 How to Clear the Fault History 23

Platform Components 24

2-1 Platform Leveling Slave Cylinder 24

2-2 Platform Rotator 25

2-3 Platform Overload System 27

How to Perform a Zero Load Platform Calibration 27

How to Perform a Full Load Platform Calibration 28

How to Replace the Platform Overload Load Cell 30

How to Reset Overload Recovery Message 31

2-4 Platform 31

Table of Contents

Jib Boom Components 32
3-1 Jib Boom 32
3-2 Jib Boom Lift Cylinder 33
Boom Components 34
Boom Legend 34
Boom Components 35
4-1 Cable Track 35
How to Remove the Cable Track 35
How to Repair the Cable Track 37
4-2 Primary Boom 38
4-3 Boom Lift Cylinder 39
4-4 Primary Boom Extension Cylinder 40
4-5 Platform Leveling Master Cylinder 41
4-6 Primary Boom Angle Sensor 43
ow to Repalce the Primary Boom Angle Sensor 43
Engines 44
5-1 RPM Adjustment 44
5-2 Air Intake Hose 44
Ground Controls 45
6-1 Control System Fault Recovery Switch 45
How to Use Control System Fault Recovery Switch 45
Hydraulic Pumps 47
7-1 Function Pump 47
How to Check the Function Pump Calibration 48

Table of Contents

Manifolds 49
8-1 Function Manifold Components 49
8-2 Valve Adjustments - Function Manifold 53
How to Adjust the Proportional Relief Valve and Hydraulic Pressure Sensor 53
8-3 Jib Boom / Platform Rotate Manifold Components 54
8-4 Turntable Rotation Manifold Components 55
8-5 How to Set Up the Oscillate Directional Valve 56
8-6 Valve Coils 56
How to Test a Coil Diode 57
Turntable Rotation Components 58
9-1 Turntable Rotation Assembly 58
How to Adjust the Turntable Rotation Gear Backlash 59
9-2 How to Replace the Universal Tilt Sensor 60
How to Calibrate the Universal Tilt Sensor 61
Axle Components 62
10-1 Oscillating Axle Cylinders 62
10-2 How to Remove the Steer Cylinder 63
How to Calibrate the Steer Angle Sensor 63
Battery Charger 65
11-1 Battery Charger 65
Selecting a Charge Profile 66

Table of Contents

Section 4 **Fault Codes** **68**

Introduction 68

Control System Fault Codes **69**

Fault Codes Ground Controls 69

How to Retrieve Control System Fault Codes - Platform Controls 70

Control System Fault Codes 71

Charger Fault Codes **91**

Battery Charger 91

Charger Fault Codes 92

Charger Error Codes 93

Pump Control Fault Codes **97**

Pump Controller Fault Handling 97

Drive Control Fault Codes **106**

Drive Controller Fault Handling 106

Table of Contents

Section 5	**Navigation Menus**	**126**
	Faults Navigation Menu	127
	Options Navigation Menu	128
	Settings Navigation Sub Menu	129
	Settings Navigation Sub Menu	130
	Settings Navigation Sub MenuSettings Navigation Menu	131
Section 6	**Schematics**	**132**
	Introduction	132
	Electrical Symbol Legend	133
	Hydraulic Symbols Legend	134
	Electrical Component and Wire Color Legends	135
	Kubota Engine Fuse and Relay Module	139
	Limit Switch/Angle Sensor Legend	140
	Electrical Schematics	**141**
	Electrical Schematic, DC/FE Models	142
	Electrical Schematic, GBOX	143
	Electrical Schematic, Turntable Controller	146
	Electrical Schematic, PBOX	147
	Electrical Schematic, Kubota D1105	150
	Electrical Schematic, CAN BUS	151
	Power Cable Wiring Diagram	154
	Electrical Schematics - Options	**155**
	AC Power Wiring Diagram - Options	156
	RCBO Wiring Diagram - Options	157
	Hydraulic Schematics	**159**
	Hydraulic Schematic - DC/FE Models	160

Specifications

Machine Specifications

Tires and Wheels	Rough terrain
Tire size (Rough terrain)	355/55D625
Tire weight, foam-filled (minimum) (Rough terrain)	426 lbs 193 kg
Tire weight, foam-filled (minimum) (Rough terrain non marking)	426 lbs 193 kg
Tire ply rating	14
Wheel lugs	9 @ 5/8 - 18
Lug nut torque, dry	240 ft-lbs 325 Nm
Lug nut torque, lubricated	180 ft-lbs 244 Nm
Overall tire diameter (Rough terrain, low profile tires)	36.9 in 93,7 cm
Fluid capacities	
Fuel tank	17 gallons 64,4 liters
Hydraulic tank	18 gallons 68 liters
Hydraulic system (including tank)	26 gallons 97 liters
Drive hubs	24 fl oz 710 cc
Turntable rotation drive hub	8 fl oz 237 cc

Drive hub oil type: MOBIL SHC 626 gear oil or equivalent

Batteries	
Type	L16G-AC lead acid AGM dry cell
Group	903-L16
Quantity	8
Capacity (lead acid) (dry cell)	390 AH 370 AH
Reserve capacity @ 25A rate	789 minutes 817 minutes
Weight, each	Refer to Machine Component Weights
Battery Box Screws Torque	162 ft-lbs 174 Nm
L16-AGM battery with DT terminal-Torque	88 in lb 10 Nm

For operational specifications, refer to the Operatorâs Manual.

Specifications

Performance Specifications

Drive speed, maximum	
Stowed	4.0 mph 6,44 km/h
	40 ft / 6.8 sec 12,2 m / 6,8 sec
Elevated	0.7 mph 1,1 km/h
	40 ft / 40 sec 12,2 m / 40 sec
Gradeability	See Operatorâs Manual
Braking distance, high range on paved surface	3 to 6 feet 0,9 to 1,8 m
Function speeds, maximum from platform controls	
Jib boom up	20 to 25 seconds
Jib boom down	20 to 25 seconds
Primary boom up	60 to 66 seconds
Primary boom down	60 to 66 seconds
Primary boom extend	45 to 49 seconds
Primary boom retract	36 to 40 seconds
Platform Level (10¡ range of motion)	3 to 5 seconds
Platform Rotate, per 90¡	10 to 14 seconds
Turntable rotate, per 90¡ Stowed	44 to 48 seconds
Turntable rotate, per 90¡ Not stowed	70 to 84 seconds

For operational specifications, refer to the Operatorâs Manual.

Hydraulic Oil Specifications

Hydraulic Fluid Specifications	
Genie specifications require hydraulic oils which are designed to give maximum protection to hydraulic systems, have the ability to perform over a wide temperature range, and the viscosity index should exceed 140. They should provide excellent antiwear, oxidation prevention, corrosion inhibition, seal conditioning, and foam and aeration suppression properties.	
Cleanliness level, minimum	ISO 15/13
Water content, maximum	250 ppm
Recommended Hydraulic Fluid	
Hydraulic oil type	Chevron Rando HD Premium
ISO Grade	32
Viscosity index, maximum	200
Optional Hydraulic Fluids	
Mineral based	Shell Tellus S2 V 32 Shell Tellus S2 V 46 Shell Tellus S4 VX 32 Shell Donax TG (Dexron III) Chevron 5606A
Biodegradable	Petro Canada Environ MV 46
Fire resistant	UCON Hydrolube HP-5046

Note: Genie specifications require additional equipment and special installation instructions for the approved optional fluids. Consult Genie Product Support before use.

NOTICE Optional fluids may not have the same hydraulic lifespan and may result in component damage.

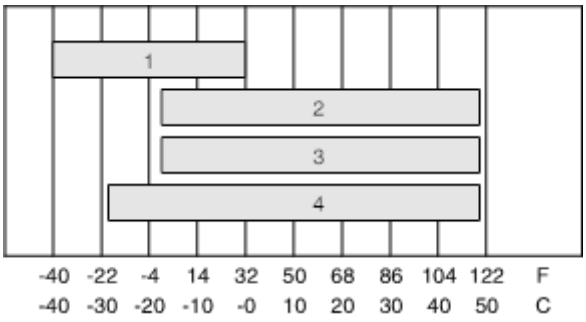
Note: Extended machine operation can cause the hydraulic fluid temperature to increase beyond its maximum allowable range. If the hydraulic fluid temperature consistently exceeds 200¡F / 90¡C an optional oil cooler may be required.

NOTICE

Do not top off with incompatible hydraulic fluids. Hydraulic fluids may be incompatible due to the differences in base additive chemistry. When incompatible fluids are mixed, insoluble materials may form and deposit in the hydraulic system, plugging hydraulic lines, filters, control valves and may result in component damage.

Note: Do not operate the machine when the ambient air temperature is consistently above 120¡F / 49¡C.

Hydraulic Fluid Temperature Range



Ambient air temperature

1 Chevron hydraulic oil 5606A
2 Petro-Canada Environ MV 46
3 UCON Hydrolube HP-5046D
4 Chevron Rando HD premium oil MV

Chevron Rando HD Premium Oil MV Fluid Properties

ISO Grade	32
Viscosity index, maximum	200
Kinematic Viscosity, maximum cSt @ 200¡F / 100¡C cSt @ 104¡F / 40¡C	 7.5 33.5
Brookfield Viscosity, maximum cP @ -4¡F / -20¡C cP @ -22¡F / -30¡C	 1040 3310
Flash point	375¡F / 190¡C
Pour point	-58¡F / -50¡C
Maximum continuous operating temperature	171¡F / 77¡C

Note: A hydraulic oil heating system is recommended when the ambient temperature is consistently below 0¡F / -18¡C.

Note: Do not operate the machine when the ambient temperature is below -20¡F / -29¡C with Rando HD Premium MV.

Specifications

Chevron 5606A Hydraulic Oil Fluid Properties

ISO Grade	15
Viscosity index, maximum	300
Kinematic Viscosity, maximum	
cSt @ 200¡F / 100¡C	5.5
cSt @ 104¡F / 40¡C	15.0
cSt @ -40¡F / -40¡C	510
Flash point	180¡F / 82¡C
Pour point	-81¡F / -63¡C
Maximum continuous operating temperature	124¡F / 51¡C

Note: Use of Chevron 5606A hydraulic fluid, or equivalent, is required when ambient temperatures are consistently below 0¡F / -17¡C unless an oil heating system is used.

NOTICE

Continued use of Chevron 5606A hydraulic fluid, or equivalent, when ambient temperatures are consistently above 32¡F / 0¡C may result in component damage

Petro-Canada Environ MV 46 Fluid Properties

ISO Grade	46
Viscosity index, maximum	154
Kinematic Viscosity, maximum	
cSt @ 200¡F / 100¡C	8.0
cSt @ 104¡F / 40¡C	44.4
Flash point	482¡F / 250¡C
Pour point	-49¡F / -45¡C
Maximum continuous operating temperature	180¡F / 82¡C

Shell Tellus S4 VX Fluid Properties

ISO Grade	32
Viscosity index, maximum	300
Kinematic Viscosity, maximum	
cSt @ 200¡F / 100¡C	9
cSt @ 104¡F / 40¡C	33.8
Brookfield Viscosity, maximum	
cSt @ -4¡F / -20¡C	481
cSt @ -13¡F / -25¡C	702.4
cSt @ -40¡F / -40¡C	2624
Flash point	>100
Pour point	-76¡F / -60¡C
Maximum continuous operating temperature	103¡F / 75¡C

UCON Hydrolube HP-5046 Fluid Properties

ISO Grade	46
Viscosity index, maximum	192
Kinematic Viscosity, maximum	
cSt @ 149¡F / 65¡C	22
cSt @ 104¡F / 40¡C	46
cSt @ 0¡F / -18¡C	1300
Flash point	None
Pour point	-81¡F / -63¡C
Maximum continuous operating temperature	189¡F / 87¡C

Specifications

Hydraulic Component Specifications

Function Pump	
Type	2 section tandem gear pump
Displacement per revolution (inner pump) (Outer pump)	 .40 cu in / 6.6 cc .20 cu in / 3.3 cc
Max flow rate (inner pump) (outer pump)	 6.8 gpm / 25.74 L/min 3.4 gpm / 12.87 L/min
Auxiliary pump	
Type	Fixed displacement gear pump
Displacement per revolution	1.7 gpm 6.44 L/min
Function manifold	
Proportional relief valve pressure, variable	50 to 3200 psi 3.4 to 220.6 bar
Platform level relief valve pressure	3000 psi 207 bar
Oscillate reducing proportional valve pressure, Variable	520 to 600 psi 35.9 to 41.3 bar
Hydraulic Filters	
High pressure filter:	Beta 5 û200
Hydraulic tank return filter	Beta 10 û1000

Manifold Component Specifications

Plug torque	
SAE No. 4	14 ft-lbs / 19 Nm
SAE No. 6	23 ft-lbs / 31.2 Nm
SAE No. 8	36 ft-lbs / 49 Nm
SAE No.10	62 ft-lbs / 84 Nm
SAE No. 12	84 ft-lbs / 114 Nm

Valve coil resistance

Note: The following coil resistance specifications are at an ambient temperature of 68¡F / 20¡C. As valve coil resistance is sensitive to changes in air temperature, the coil resistance will typically increase or decrease by 4% for each 18¡F / 10¡C that your air temperature increases or decreases from 68¡F / 20¡C.

Description	Specification
Proportional solenoid relief valve, 24V DC (schematic item AA)	22 Ω
Proportional solenoid valve, 3 position 4 way, 20V DC (schematic items B, G, and S	19 Ω
Proportional solenoid valve, 3 position 4 way, 20V DC (schematic items AE, E, I, O, R, and Z)	24 Ω
Solenoid valve, 2 position 3way, 12V DC (schematic item JA)	9 Ω

Specifications

Kubota D1105 Engine

Displacement	68.53 cu in 1.123 liters
Number of cylinders	3
Bore and Stroke	3.07 x 3.09 inches 78 x 78.4 mm
Horsepower, gross intermittent	24.8 @ 3000 rpm 18.5 kW @ 3000 rpm
Combustion system	Indirect injection
Firing order	1 - 2 - 3
Low idle	2150 rpm 208 Hz
High idle	3000 rpm 500 Hz
Compression ratio	24:1
Compression pressure	412 to 469 psi 28.4 to 32.3 bar
Governor	mechanical
Valve clearance, cold	0.0014 to 0.0025 in 0.145 to 0.185 mm
Lubrication system	
Oil pressure	28 to 64 psi 1.9 to 4.4 bar
Oil capacity (including filter)	5.4 quarts 5.1 liters
Oil viscosity requirements	
Below -10¡C (14¡ F)	SAE 10W-30
-10 to 25¡ C (14¡ to 77¡ F)	SAE 10W-30/ SAE 15W-40
Above 25¡ C (77¡ F)	SAE30, SAE10W-30/ SAE15W-40
Unit ships with 15W-40. Extreme operating temperatures may require the use of alternative engine oils. For oil requirements, refer to the Engine Operator Manual for your engine.	
Engine coolant	
Capacity	3.3 quarts 3.1 liters
Fuel injection system	
Injection pump make	Bosch MD
Injection pump pressure, maximum	1991 psi 137 bar
Injection timing	18¡ BTDC
Fuel requirement	
For fuel requirements, refer to the engine Operator Manual for your engine.	
Starter motor	
Cranking speed	200 - 300 RPM
Current draw, normal load	155A
Battery	
Type	12V DC
Group	70
Quantity	1
Ampere hour	75AH
Cold cranking ampere	450A
Reserve capacity @ 25A rate	70 minutes
Alternator output	40A @ 12V DC
Fan belt deflection	1/4 to 3/8 inch 7 to 9 mm
Electric clutch	1.6A @ 48 V DC 29.22 Ω +/- 5%

Specifications

Machine Torque Specifications

Platform Rotator	
1-8 center bolt, GR 5	
Lubricated	483 ft-lbs 655 Nm
1/2 -13 bolts, GR 8	
Removable threadlock	85 ft-lbs 115 Nm
Turntable rotate assembly	
Turntable rotate motor mounting bolts, Removable threadlock	170 ft-lbs 230 Nm
Backlash plate mounting bolts, lubricated	282 ft-lbs 382 Nm
Drive motors and hubs	
Drive hub mounting bolts, lubricated	93 ft-lbs 126 Nm
Drive motor leads square nuts (requires 12 point socket)	10 ft lbs 13.6 Nm

Machine Component Weights

Tire and wheel assembly	426 lbs 193 kg
Drive motor and hub	124.5 lbs 56.5 kg
Engine assembly	552 lbs 250 kg
Primary boom	1960 lbs 889 kg
Primary boom lift cylinder	360 lbs 163.3 kg
Primary boom extend cylinder	330 lbs 149.6 kg
Jib boom assembly + 6 ft / 1.8 m platform	800 lbs 363 kg
Jib boom cylinder	85 lbs 38.5 kg
Lift structure	5300 lbs 2404 kg
Turntable assembly without lift structure, includes counterweights	6600 lbs 2994 kg
Counterweight (x1)	1100 lbs 499 kg
Drive chassis assembly	5600 lbs 2540 kg
Oscillate cylinder	50 lbs 23 kg
6 ft / 1.8 m platform	275 lbs 125 kg
8 ft / 2.4 m platform	315 lbs 143 kg
Battery box assembly (without batteries)	308 lbs 140 kg
Battery 6 volt (wet)	106 lbs 48 kg
Battery 6 volt (maintenance free)	114 lbs 52 kg

Specifications

Hydraulic Hose and Fitting Torque Specifications

Your machine is equipped with Parker Seal-Lokπ ORFS or 37¡ JIC fittings and hose ends. Genie specifications require that fittings and hose ends be torqued to specification when they are removed and installed or when new hoses or fittings are installed.

Seal-Lokπ Fittings

(hose end - ORFS)

SAE Dash Size	Torque
-4	18 ft-lbs / 25 Nm
-6	30 ft-lbs / 41 Nm
-8	40 ft-lbs / 55 Nm
-10	60 ft-lbs / 81 Nm
-12	85 ft-lbs / 115 Nm
-16	110 ft-lbs / 150 Nm
-20	150 ft-lbs / 205 Nm
-24	230 ft-lbs / 315 Nm

JIC 37¡ Fittings

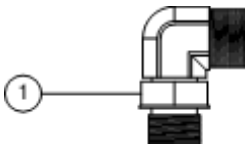
(swivel nut or hose connection)

SAE Dash Size	Thread Size	Flats
-4	7/16-20	2
-6	9/16-18	1 1/2
-8	3/4-16	1 1/2
-10	7/8-14	1 1/2
-12	1 1/16-12	1 1/4
-16	1 5/16-12	1
-20	1 5/8-12	1
-24	1 7/8-12	1

SAE O-ring Boss Port

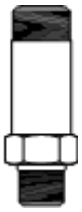
(tube fitting - installed into Aluminum)
(all types)

SAE Dash Size	Torque
-4	14 ft-lbs / 19 Nm
-6	23 ft-lbs / 31.2 Nm
-8	36 ft-lbs / 49 Nm
-10	62 ft-lbs / 84 Nm
-12	84 ft-lbs / 114 Nm
-16	125 ft-lbs / 169.5 Nm
-20	151 ft-lbs / 204.7 Nm
-24	184 ft-lbs / 249.5 Nm



Adjustable Fitting

1 jam nut



Non-adjustable fitting

SAE O-ring Boss Port

(tube fitting - installed into Steel)

SAE Dash Size		Torque
-4	ORFS / 37¡ (Adj) ORFS (Non-adj) 37¡ (Non-adj)	15 ft-lbs / 20.3 Nm 26 ft-lbs / 35.3 Nm 22 ft-lbs / 30 Nm
-6	ORFS (Adj / Non-adj) 37¡ (Adj / Non-adj)	35 ft-lbs / 47.5 Nm 29 ft-lbs / 39.3 Nm
-8	ORFS (Adj / Non-adj) 37¡ (Adj / Non-adj)	60 ft-lbs / 81.3 Nm 52 ft-lbs / 70.5 Nm
-10	ORFS (Adj / Non-adj) 37¡ (Adj / Non-adj)	100 ft-lbs / 135.6 Nm 85 ft-lbs / 115.3 Nm
-12	(All types)	135 ft-lbs / 183 Nm
-16	(All types)	200 ft-lbs / 271.2 Nm
-20	(All types)	250 ft-lbs / 339 Nm
-24	(All types)	305 ft-lbs / 413.5 Nm

Torque Procedure

Seal-Lok™ fittings

1 Replace the O-ring. The O-ring must be replaced anytime the seal has been broken. The O-ring cannot be re-used if the fitting or hose end has been tightened beyond finger tight.

Note: The O-ring in Parker Seal Lokπ fittings and hose end are custom-size O-rings. They are not standard size O-rings. They are available in the O-ring field service kit (Genie part number 49612).

2 Lubricate the O-ring before installation.

3 Be sure the O-ring face seal is seated and retained properly.

4 Position the tube and nut squarely on the face seal end of the fitting, and tighten the nut finger tight.

5 Tighten the nut or fitting to the appropriate torque. Refer to the appropriate torque chart in this section.

6 Operate all machine functions and inspect the hose, fittings and related components to confirm there are no leaks.

JIC 37° fittings

1 Align the tube flare (hex nut) against the nose of the fitting body (body hex fitting) and tighten the hex nut to the body hex fitting to hand tight, approximately 30 in-lbs / 3.4 Nm.

2 Using a permanent ink marker, make a reference mark on one the flats of the hex nut and continue the mark onto the body of the hex fitting. Refer to Illustration 1.

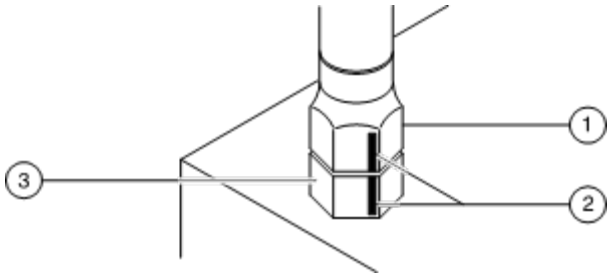


Illustration 1

1 hex nut
2 reference mark
3 body hex fitting

Specifications

3 Working clockwise on the body hex fitting, make a second mark with a permanent ink marker to indicate the proper tightening position. Refer to Illustration 2.

Note: Use the JIC 37¡ Fitting table in this section to determine the correct number of flats, for the proper tightening position.

Note: The marks indicate the correct tightening positions have been determined. Use the second mark on the body hex fitting to properly tighten the joint after it has been loosened.

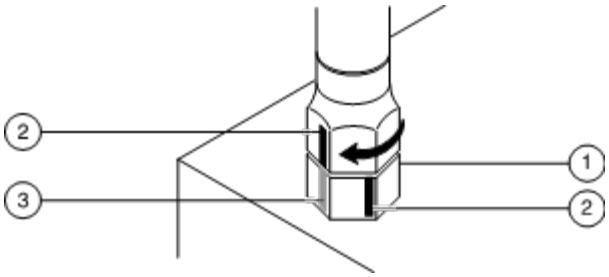


Illustration 2

1 body hex fitting
2 reference mark
3 second mark

4 Tighten the hex nut until the mark on the hex nut is aligned with the second mark on the body hex fitting.

5 Operate all machine functions and inspect the hose, fittings and related components to confirm there are no leaks.

Repair Procedures



Observe and Obey:

☑ Repair procedures shall be completed by a person trained and qualified on the repair of this machine.

☑ Immediately tag and remove from service a damaged or malfunctioning machine.

☑ Repair any machine damage or malfunction before operating the machine.

Before Repairs Start:

☑ Read, understand and obey the safety rules and operating instructions in the appropriate operatorâs manual on your machine.

☑ Be sure that all necessary tools and parts are available and ready for use.

☑ Use only Genie approved replacement parts.

☑ Read each procedure completely and adhere to the instructions. Attempting shortcuts may produce hazardous conditions.

Machine Configuration:

☑ Unless otherwise specified, perform each repair procedure with the machine in the following configuration:

- Machine parked on a firm, level surface
- Key switch in the off position with the key removed
- The red Emergency Stop button in the off position at both the ground and platform controls
- Wheels chocked
- All external AC power supply disconnected from the machine
- Boom in the stowed position
- Turntable secured with the turntable rotation lock

Repair Procedures

About This Section

Most of the procedures in this section should only be performed by trained service professional in a suitably equipped workshop. Select the appropriate repair procedure after troubleshooting the problem.

Perform disassembly procedures to the point where repairs can be completed. Then to re-assemble, perform the disassembly steps in reverse order.

Symbols Legend



Safety alert symbol© used to alert personnel to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠DANGER Indicates a imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, may cause minor or moderate injury.

NOTICE Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

⊙ Indicates that a specific result is expected after performing a series of steps.

☒ Indicates that an incorrect result has occurred after performing a series of steps.

Calibration Process Steps

It is required to perform the calibration process if system defaults have been reset or if new software has been installed. Any deviation in the order of these steps could result in improper machine function and fault codes to display.

1 **Set system defaults:** Turn the machine on at the ground controls and immediately move and hold both the function enable and auxiliary enable switches for 5 seconds.

⊙ Result: An alarm will sound indicating the system has been restored to defaults.

2 **Calibrate the pressure relief valve:** Refer to Repair Procedures, *How to Adjust the Proportional Relief Valve and Hydraulic Pressure Sensor.*

Note: Perform this procedure prior to calibrating other hydraulic functions.

3 **Calibrate the universal tilt sensor:** Refer to Repair Procedures*, How to Calibrate Universal Tilt Sensor.*

4 **Calibrate the platform overload:** Refer to Repair Procedures, *How to Calibrate the Platform Overload System*.

5 **Calibrate the primary boom angle sensor stowed position:** Refer to Repair Procedure, *How to Calibrate Boom Angle Sensor.*

Note: The one point calibration is optional. It allows 2 MPH / 3.2 Km/h of travel in the stowed position if the machine needs to be immediately moved.

6 **Calibrate the steer angle sensor:** Refer to Repair Procedures, *How to Calibrate the Steer Angle Sensor*.

7 **Complete calibrating the primary boom ange sensor stowed and elevated positions:** Refer to Repair Procedures, *How to Calibrate Boom Angle Sensor.*

8 **Verify pump efficiency calibration:** Refer to Repair Procedures, *How to Check the Function Pump Calibration*.

9 **Set hydraulic valve thresholds** for turntable rotate, primary up/down, secondary up/down, primary extend/retract, jib up/down, and platform rotate: Refer to Repair Procedures, *How to Adjust the Joystick Threshold Setting*.

10 **Set low flow hydraulic valves** for jib up/down and platform rotate: Refer to Repair Procedures, *How to Adjust the Maximum Speed Setting (Hydraulic Functions)*.

11 **Set high flow hydraulic valves** for primary up/down, secondary up/down, primary extend/retract and turntable rotate: Refer to Repair Procedures, *How to Adjust the Maximum Speed Setting (Hydraulic Functions)*.

12 **Check oscillate function** *(if equipped)*.

13 **Clear the fault history:** Refer to Repair Procedure, *How to Clear Fault History*.

Repair Procedures

How to Reset System Defaults from Ground Controls

It is required to perform the calibration process if defaults have been reset. Refer to *Calibration Process Steps*.

1 Turn the machine on at the ground controls and immediately move and hold both the function enable and auxiliary enable toggle switches for 5 seconds.

⊙ Result: The LCD screen will display "**PASSWORD**".

2 Momentarily activate the extend / retract toggle switch in the following sequence to enter the password.

<left><left><right><left>

⊙ Result: An audible alarm sounds for 1 second. Defaults have been reset.

⊠ Result: There is no audible alarm. Repeat this procedure.

Note: The password must be entered within 5 seconds.

How to Reset General Parameter Defaults from Platform Controls

General parameters do not include calibration parameters. Machine calibration is not required.

Note: Refer to Navigation Menus, *Settings Navigation Menu.*

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Do not start the engine (if equipped).

5 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

6 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

7 Navigate to **RESET GENERAL PARAMETERS** and press <**enter**>.

8 Press <**+**> to select **YES**.

9 Press <**enter**> to save the change.

10 Navigate to **EXECUTE PARAMETER RESET** and press <**enter**>.

11 Press <**+**> to select **YES**.

12 Press <**enter**> to save the change.

⊙ Result: An audible alarm sounds for 1 second. Defaults have been reset.

How to Reset Calibration Defaults from Platform Controls

It is required to perform the calibration process if defaults have been reset. Refer to *Calibration Process Steps*.

Note: Refer to Navigation Menus, *Settings Navigation Menu.*

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Do not start the engine (if equipped).

5 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

6 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

7 Navigate to **RESET CALIBRATION** and press <**enter**>.

8 Press <**+**> to select **YES**.

9 Press <**enter**> to save the change.

10 Navigate to **EXECUTE PARAMETER RESET** and press <**enter**>.

11 Press <**+**> to select **YES**.

12 Press <**enter**> to save the change.

⊙ Result: An audible alarm sounds for 1 second. Defaults have been reset.

How to Reset All Parameter Defaults from Platform Controls

It is required to perform the calibration process if defaults have been reset. Refer to *Calibration Process Steps*.

Note: Refer to Navigation Menus, *Settings Navigation Menu.*

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Do not start the engine (if equipped).

5 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

6 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

7 Navigate to **RESET ALL PARAMETERS** and press <**enter**>.

8 Press <**+**> to select **YES**.

9 Press <**enter**> to save the change.

10 Navigate to **EXECUTE PARAMETER RESET** and press <**enter**>.

11 Press <**+**> to select **YES**.

12 Press <**enter**> to save the change.

⊙ Result: An audible alarm sounds for 1 second. Defaults have been reset.

Platform Controls

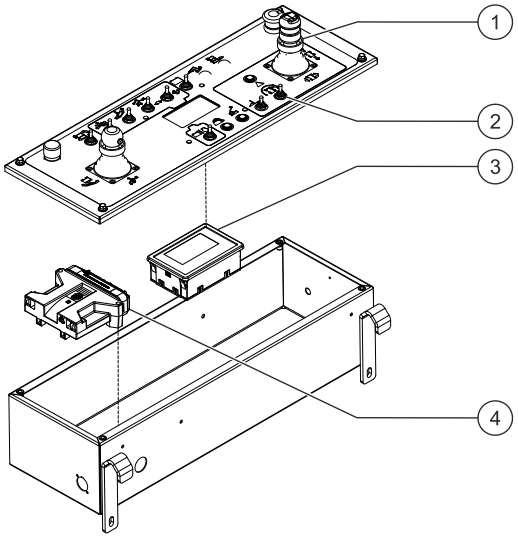
1-1 Platform Controls

The platform control box contains two control modules; The VCON is a LCD screen mounted between the boom and drive joysticks. The PCON (platform controller) inside the platform control box communicates with the VCON and controllers located on the turntable of the machine.

The joystick controllers at the platform controls utilize Hall Effect technology and require no calibration. Automatic calibration of center voltage occurs on power up if the signal value is in the valid range. Each joystick controller should operate smoothly and provide proportional speed control over its entire range of motion. The remaining boom functions operate by on/off toggle switches. Except for platform level, the speed of these functions are controlled by a function speed control switch.

The platform controls VCON can be utilized to perform a number of tasks:

- Read active and stored faults
- Battery SOC (State of Charge)
- Select options
- View function speed setting
- Fuel level (FE models)
- Operating mode (DC / FE)
- Software part number and version
- Aid in the calibration process



1 drive joystick with steer left/right rocker switch
2 drive enable toggle switch
3 VCON (diagnostic display)
4 PCON (platform control module)

How to Adjust the Joystick Threshold Setting

The threshold setting is the minimum output current at which a function proportional valve can open and allow the function to operate. There are two types threshold currents to adjust:

Joystick controlled functions - Primary Up/Down and Turntable Rotate.
Switch controlled functions - Primary Extend/Retract, Platform Rotate and Jib Up/Down.

The boom functions threshold current should be operating at near zero speed smoothly with no vibrations.

Note: Perform this procedure with the boom in the stowed position. Refer to Navigation Menus, *Settings Menu*.

1 Turn the key switch to platform controls. Do not start the engine (if equipped).

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

6 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

7 Momentarily activate the drive enable toggle switch in the right direction until VALVE AND SENSOR SETTINGS is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

9 Momentarily activate steer in the right direction until VALVE THRESHOLD CURRENT is shown on the display.

Joystick Controlled Functions:

10 Press down on the foot switch and slowly deflect the joystick to be adjusted until the valve is operating at the desired threshold current.

⊙ Result: The display will indicate the threshold current parameter in milliamps while operating the function.

11 While operating the function and the function is barely moving, momentarily activate the drive enable toggle switch in the right direction to save the desired value.

⊙ Result: The alarm will sound indicating the setting has been saved. Release the foot switch. Continue to the next threshold current adjustment.

Switch Controlled Functions:

12 Perform steps 1 through 9 to enter the sub menu THRESHOLD CURRENT on the display.

13 Momentarily activate the speed select toggle switch in either direction until the bar graph is at about 50% on the display.

Platform Controls

14 Press down on the foot switch and select the toggle switch controlled boom function to be adjusted.

⊙ Result: The display will indicate the parameter in milliamps while operating the function.

15 Momentarily activate the speed select switch in either direction while operating the function (foot switch depressed) to achieved the desired threshold value. Do not release the foot switch.

16 Momentarily activate the drive enable toggle switch in the right direction to save the value.

⊙ Result: The alarm will sound indicating the setting has been saved. Release the foot switch. Continue to the next threshold current adjustment.

To exit programming mode:

17 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

How to Adjust the Maximum Speed Setting (Hydraulic Functions)

There are three types of speed settings to adjust:
High Flow Functions: Primary Up/Down, Primary Extend/Retract and Turntable rotate.
Low flow Functions: Jib Up/Down, Platform rotate and Platform level.
Other Functions: Steering is set by a fixed flow regulating valve (non adjustable).

Note: Refer to Specifications, *Performance Specifications,* for each boom function speed. Check function pump calibration before adjusting the maximum speed setting. Refer to Repair Procedures, *How to Check Function Pump Calibration*.

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊠ Result: The display will show FAULTS.

6 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

7 Momentarily activate the drive enable toggle switch in the right direction until VALVE AND SENSOR SETTINGS is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

9 Momentarily activate steer in the right direction until VALVE MAXIMUM CURRENT is shown on the display.

10 Momentarily activate the drive enable switch to enter the sub menu VALVE MAXIMUM CURRENT.

High Flow Functions:

The function speeds are fixed by the flow rate supplied by the hydraulic pump. Excess flow is rarely produced resulting in little or no oil going over relief.

11 Momentarily activate and release the high flow boom function in one direction.

⊙ Result: The display shows the name, direction and current value in milliamps for the function being moved. Example: âPRI_UP_MAX 590.ó

12 Momentarily activate steer right five times to increase the mA value.

13 Activate the boom function again by pressing the foot switch and moving the function switch (or joystick to full speed) in the same direction. Momentarily active steer left once every three seconds to decrease the maximum mA value where pressure rises to about 3000 psi / 207 bar and an audible alarm sounds.

Note: The turntable function will only increase 300 psi and no audible alarm. When the 300 psi occurs, proceed to the next step.

14 Release the foot switch and momentarily activate steer in the right direction one time to increase the value by 10 milliamps. Repeat releasing the foot switch and momentarily activating steer right until the function moves with no valve throttling and no audible alarm for the primary up/down, secondary up/down and primary boom extend and retract.

15 Momentarily activate steer in the right direction three times to increase the value by 30 milliamps for the turntable function setting.

16 Momentarily activate the drive enable toggle switch in the right direction to save the value.

⊙ Result: The alarm will sound indicating the setting has been saved. Continue to the next desired high flow function adjustment.

To exit programming mode:

17 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

Low Flow Functions:

Hydraulic flow from the pump is fixed, and the function speed is controlled by the hydraulic directional control valve. Hydraulic flow will always exceed the flow allowed by the controlling valve and the excess flow will always be sent over the relief valve and back to tank. Function speed is set by changing control current (mA) and is confirmed by timing the function travel time with a stop watch. Refer to Specifications, *Performance Specifications* for each boom function speed.

18 Perform steps 1 through 10 to enter the sub menu VALVE MAXIMUM CURRENT on the display.

19 Momentarily active a low flow boom function in one direction.

⊙ Result: The display shows the name of the function, direction and current value in milliamps for the function being moved. Example: âJIB_UP_MAX 590.ó

Platform Controls

20 Activate the boom function again by pressing the foot switch and moving the function switch in the same direction. Using a stop watch, record the full motion function and compare this time to the performance specification.

21 While performing the function, activate steer in either direction to reach the desired speed.

Note: Activating steer right decreases the time it takes to perform the low flow boom function. Activating steer left increases the time it takes to perform the low flow boom function.

22 Momentarily activate the drive enable toggle switch in the right direction to save the value.

⊙ Result: The alarm will sound indicating the setting has been saved. Continue to the next low flow function adjustment.

To exit programming mode:

23 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

How to Adjust the Ramp Rate Setting

The ramp rate setting is an adjustment that controls the way boom function starts and stops. There are two types of ramp rates to adjust on separate menus:

Ramp Up Time: The amount of time it takes to accelerate to speed.
Ramp Down Time: The amount of time it takes to decelerate to a stop.

Note: Perform this procedure with the boom in the stowed position. Refer to Navigation Menus, *Settings Menu*.

1 Turn the key switch to platform controls. Do not start the engine (if equipped).

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

6 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

7 Momentarily activate the drive enable toggle switch in the right direction until VALVE AND SENSOR SETTINGS is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

9 Momentarily activate steer in the right direction to choose either RAMP UP TIME or RAMP DOWN TIME sub menus.

10 Momentarily activate the drive enable toggle switch in the right direction to enter the desired ramp time calibration sub menu.

11 Momentarily activate the boom function to be adjusted.

⊙ Result: The display shows the name of the function, direction, and time value in milliseconds. Example "PRI_UP_VALVE 2500" (2500 milliseconds / 2.5 seconds of ramp time).

Note: At this step, the function can be tested and ramp times can be measured. Release the foot switch prior to making a parameter adjustment.

12 Momentarily active steer to change the ramp up or ramp down value. Each activation will change the value by 50 milliseconds. Refer to the Ramp Rate chart for factory settings.

13 Momentarily activate the drive enable toggle switch in the right direction to save the value.

⊙ Result: The alarm will sound indicating the setting has been saved. Continue to the next desired Ramp time adjustment.

Ramp Rate (factory settings)	
Primary boom up/down	
ramp accelerate (up)	2 seconds
ramp decelerate (down)	0.6 second
Turntable rotate	
ramp accelerate (up)	1.5 seconds
ramp decelerate (down)	1.25 seconds
Extend/Retract	
ramp accelerate (up)	2 seconds
ramp decelerate (down)	0.4 seconds
Jib up/down	
ramp accelerate (up)	2 seconds
ramp decelerate (down)	0.4 second
Platform rotate	
ramp accelerate (up)	0.75 second
ramp decelerate (down)	0.3 second
Propel	
ramp accelerate (up)	5 seconds
ramp decelerate (down)	3 seconds
Platform level	
ramp accelerate (up)	1 second
ramp decelerate (down)	0.4 second

Platform Controls

1-2 How to Calibrate Boom Angle Sensor

Boom angle sensor is installed on the primary boom sections. The angle sensor is used to detect whether the boom is stowed or not stowed. A two point calibration procedure captures the signal with the cylinder fully extended and fully retracted to an angle measurement that is scaled to degrees within the program. If the angle sensor is in the uncalibrated state, drive speed is limited to out-of-stowed speed.

Note: Start this procedure with the boom in a stowed position. Position the machine in a suitable location with sufficient vertical space. Refer to Navigation Menus, *Settings Menu*.

Note: The one point calibration is optional. It allows 2 MPH / 3.2 Km/h of travel in the stowed position if the machine needs to be immediately moved.

1 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

2 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

3 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

4 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

5 Momentarily activate the drive enable toggle switch in the right direction until VALVE AND SENSOR SETTINGS is shown on the display.

6 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

7 Momentarily activate steer in the right direction until BOOM ANGLE CALIBRATE is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction to enter the BOOM ANGLE CALIBRATE screen.

9 Momentarily activate the drive enable toggle switch in the right direction to enter the sub-menu.

⊙ Result: The screen will display PRI SNSR MVXXXX. A flashing value indicates the mV (millivolt) value is within expected range.

10 Momentarily activate the drive enable toggle switch in the right direction to store the millivolt value.

⊙ Result: An alarm will sound for one second and the screen will display CALIBRATED.

11 Calibrate the boom elevated positions, fully raise the primary boom. Repeat steps 9 and 10 to store the millivolt value.

⊙ Result: An alarm will sound for two seconds and the screen will display CALIBRATED indicating both the primary and secondary angle sensors have been calibrated successfully.

To exit programming mode:

12 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

1-3
How to Clear Fault History

There are 1 thru 16 fault codes shown in the fault history menu, 1 being the most recent displayed. It may be necessary to clear the fault history in order to acquire the most recent fault codes. It is also good practice to clear fault history after performing any calibration procedure.

Note: Perform this procedure with the boom in the stowed position. Refer to Navigation Menus, *Faults Menu*.

1 Turn the key switch to platform controls. Do not start the engine (if equipped).

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

6 Momentarily activate the drive enable toggle switch in the right direction until ACTIVE FAULTS is shown on the display.

7 Momentarily activate steer in the right direction until FAULT HISTORY is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction to activate the clear fault history function.

⊙ Result: The display will read ENABLE at the bottom.

9 Momentarily activate steer in the right direction to change NO to YES on the display.

10 Momentarily activate the drive enable toggle switch to except the change.

⊙ Result: The alarm will sound indicating the fault history has been cleared.

Platform Components

2-1 Platform Leveling Slave Cylinder

The slave cylinder and the rotator pivot are the two primary supports for the platform. The slave cylinder keeps the platform level through the entire range of boom motion. It operates in a closed-circuit hydraulic loop with the master cylinder. The slave cylinder is equipped with counterbalance valves to prevent movement in the event of a hydraulic line failure.

How to Remove the Platform Leveling Slave Cylinder

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Extend the boom until the slave cylinder barrel-end pivot pin is accessible.

2 Raise the jib boom slightly and place blocks under the platform for support.

3 Lower the jib boom until the platform is resting on the blocks just enough to support the platform.

Note: Do not rest the entire weight of the boom on the blocks.

4 Remove the pin retaining fastener from the slave cylinder rod-end pivot pin. Use a soft metal drift to drive the rod-end pivot pin out.

⚠WARNING Crushing hazard. The platform could fall when the slave cylinder rod-end pivot pin is removed if not properly supported.

5 From the ground controls, use auxiliary power and activate platform level down to retract the slave cylinder rod.

6 Tag, disconnect and plug the hydraulic hoses from the slave cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

7 Remove the external snap rings from the barrel-end pivot pin.

8 Use a soft metal drift to drive the barrel-end pivot pin out.

9 Carefully pull the cylinder out of the boom.

How to Bleed the Platform Leveling Cylinder

Note: Do not start the engine. Use auxiliary power for this procedure.

1 Raise the jib boom to the horizontal position.

2 Simultaneously activate the boom up function and the platform level up function until the boom is fully raised.

3 Simultaneously activate the boom down function and the platform level down function until the boom is fully lowered.

2-2 Platform Rotator

The platform rotator is a hydraulically activated helical gear assembly used to rotate the platform 160 degrees.

How to Remove the Platform Rotator

NOTICE Component damage hazard. Mark the platform mounting weldment and the rotator flange before removing the platform mounting weldment. The platform mounting weldment must be replaced in the exact same position on the rotator flange as it was before removal. If a new rotator is installed or the rotator is disassembled, proper alignment can be achieved by rotating the rotator all the way to the left and then installing the platform mounting weldment all the way in the left position.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Remove the retaining fasteners securing the platform assembly to the platform rotator. Remove the platform assembly and set aside.

2 Tag, disconnect and plug the hydraulic hoses from the platform rotator manifold. Cap the fittings on the manifold.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

3 Support the jib boom leveling arms with an overhead supporting device. Do not apply any lifting pressure.

⚠CAUTION Bodily injury hazard. The jib boom leveling arms may fall if not properly supported.

4 Support the platform rotator with a suitable lifting device. Do not apply any lifting pressure.

Platform Components

5 Remove the pin retaining fasteners from the jib boom and jib boom leveling arms to platform rotator pivot pins. Do not remove the pins.

6 Use a soft metal drift to remove both pins and remove the platform rotator from the machine.

⚠WARNING Crushing hazard. The platform rotator could fall when removed from the machine if not properly supported.

Note: When installing the platform rotator fasteners, torque the fasteners to specifications. Refer to Specifications, *Machine Torque Specifications*.

How to Bleed the Platform Rotator

1 From the ground controls, fully rotate the platform to the right and then the left. Continue holding platform rotate in each direction for approximately 10 seconds.

2 Repeat this procedure until the air has been bled out of the platform rotator.

Note: Verify by pushing and pulling the platform side to side by hand. There should be minimal movement.

2-3
Platform Overload System

Calibrating the platform overload system regularly is essential to safe machine operation. Continued use of an improperly operating platform overload system, could result in the system not sensing an overloaded platform condition. Machine stability could be compromised resulting in the machine tipping over.

How to Perform a Zero Load Platform Calibration

Perform this procedure when platform overload is not operating within the calibration parameters. This procedure will re-calibrate the zero load point without affecting a previous full load calibration. In most cases the machine will maintain full load capacity, however, in some situations the platform load capacity may be reduced until a full load calibration has been performed.

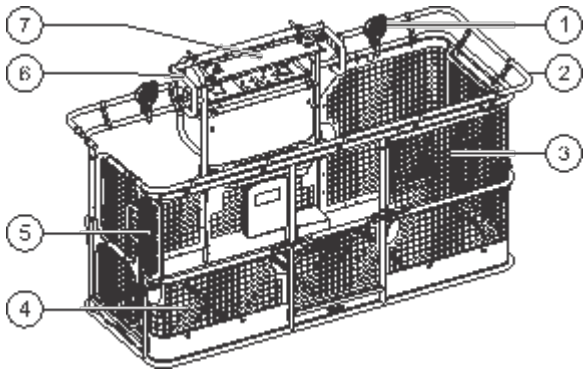
Note: Perform this procedure on a firm, level surface with the machine in the stowed position.

1 Fully retract and lower the boom. Level the platform.

2 Remove all weight, tools, accessories and equipment from the platform.

Note: Options and accessories that are considered integrated components of the platform do not require removal to perform calibration. Refer to *Integrated Options and Accessories*.

⚠ DANGER Tip-over hazard. Failure to remove all non-integrated factory and non-factory options and accessories could result in the machine tipping over, causing death or serious injury.



Integrated Options and Accessories

1 platform work lights
2 auxiliary top rail
3 platform full height mesh
4 platform half height mesh
5 swing gate latch guard
6 Contact alarm
7 control box cover

3 Turn the key switch to ground controls and pull out the red Emergency Stop button. Within 5 seconds, activate the primary boom up toggle switch 3 times.

Note: Do not activate function enable.

⊙ Result: The hour meter displays **CALIBRAT MODE**.

4 Activate and hold primary down for 3 - 4 seconds.

⊙ Result: Hour meter displays **ZEROLOAD CAL OK**. Calibration is saved.

⊠ Result: Hour meter displays **ZEROLOAD OUT OF RANGE**. Calibration has not been saved. Adjust the load cell and repeat this procedure.

Platform Components

How to Perform a Full Load Platform Calibration

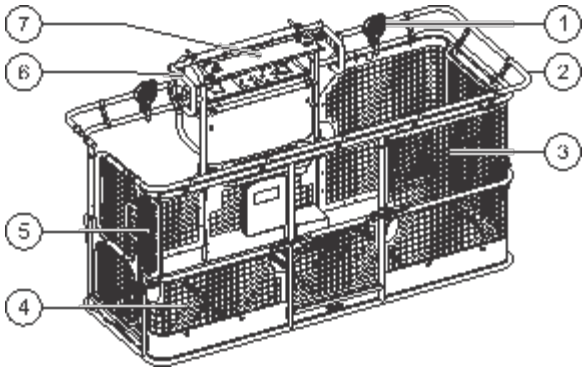
Note: Perform this procedure on a firm, level surface with the machine in the stowed position.

1 Fully retract and lower the boom. Level the platform.

2 Remove all weight, tools, accessories and equipment from the platform.

Note: Options and accessories that are considered integrated components of the platform do not require removal to perform calibration. Refer to *Integrated Options and Accessories*.

⚠ DANGER Tip-over hazard. Failure to remove all non-integrated factory and non-factory options and accessories could result in the machine tipping over, causing death or serious injury.



Integrated Options and Accessories

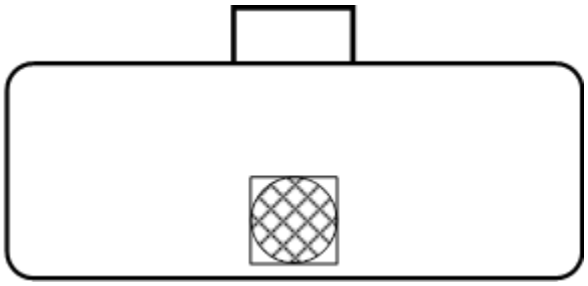
1 platform work lights
2 auxiliary top rail
3 platform full height mesh
4 platform half height mesh
5 swing gate latch guard
6 Contact alarm
7 control box cover

3 Perform a zero load calibration. Refer to *How to Perform a Zero Load Calibration*.

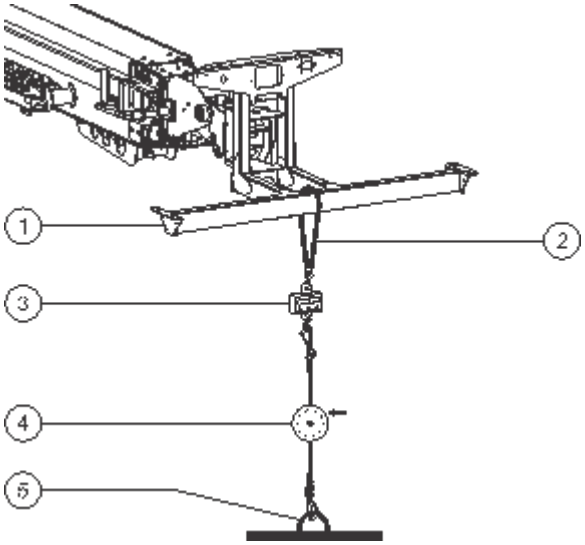
4 Place a test weight on the platform floor using a suitable lifting device. Place the weight near the center entry point of the platform, as far away from the operator controls as possible.

Weight = 660 lbs / 300 kg

Note: If test weights are not available, you may use an industrial scale to weigh available objects until it equals the platform's maximum capacity.



Note: Alternate method for achieving rated load in the platform is to attach a hanging scale to the bottom of the platform and apply load using a winch or chain hoist until the readout displays the appropriate weight.



Platform hidden from illustration for clarity

1 platform support
2 sling
3 hanging scale
4 winch or chain hoist
5 anchoring device

5 Activate and hold primary boom up for 3 - 4 seconds.

⊙ Result: Hour meter displays **MAXRATED LOAD CAL OK**. Calibration is saved.

⊠ Result: Hour meter displays **MAXRATED LOAD OUT OF RANGE**. Calibration has not been saved. Adjust the load cell and repeat this procedure.

6 Push in the red Emergency Stop button to the off position.

Confirm calibration:

7 Start the engine from the ground controls.

8 Add an additional 50 lbs / 23 kg of weight or load to the platform.

⊙ Result: The alarm sounds. The engine turns off. The platform overload indicator light or LCD symbol flashes at the platform controls and *Platform Overload* is displayed on the LCD screen at the ground controls.

Note: There may be a 2 second delay before the overload indicator lights flash and the alarm sounds.

9 Test all machine functions from the ground controls.

⊙ Result: Engine does not start. Limited APU functionality. Elevate and extend functions do not operate.

10 Remove the weight or rated load from the platform.

Note: For CE and **AS models**, reset the overload recovery message. Refer to Repair Procedure, *How to Reset Overload Recovery Faults.*

Platform Components

How to Replace the Load Cell Sensor

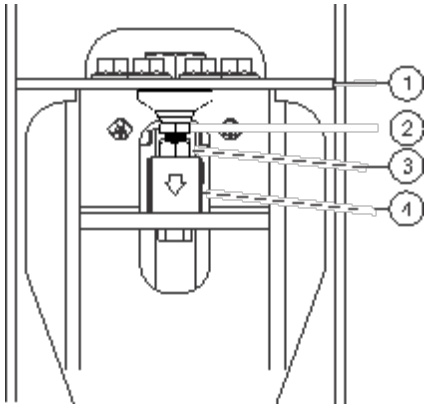
Note: The preload adjustment should only be performed after the load cell sensor has been replaced.

1 Remove all equipment or tools from the platform. Remove the welder if equipped.

2 At the platform, remove the plastic instruction holder from the document mount plate.

3 Tag and disconnect the load cell sensor harness.

4 Loosen the jam nut securing the load cell sensor foot and rotate the foot screw clockwise to remove the preload.



1 flex plate
2 load cell sensor foot
3 jam nut
4 load cell sensor

5 Remove the fasteners securing the load cell sensor and remove the sensor.

Install the new Load Cell Sensor

6 Screw the foot with jam nut into the top of the load cell sensor until the foot bolt extends out of the bottom of the sensor.The foot should not contact the flex plate when assembling onto the platform support.

Note: Verify the arrow on the load cell is in the downward position.

7 Assemble the load cell and foot assembly to the platform and securely tighten the two mounting screws. Torque the bolts to 101 ft-lbs / 137 Nm.

Set the Load Cell Sensor Preload

8 Rotate the foot screw counter clockwise until the foot just contacts the flex plate (finger tight).

9 Using an open end wrench, continue to rotate the foot counter clockwise an additional 1/2 turn (180¡). Then, while holding the foot bolt, securely tighten the jam nut. Torque the jam nut to 55 ft-lbs / 75 Nm.

10 Attach the load cell sensor harness.

11 Install the plastic instruction holder.

12 Calibrate the platform overload system. Refer to, *How to Perform a Full Load Platform Calibration.*

How to Reset Overload Recovery Faults (if equipped)

The message OVERLOAD RECOVERY will be displayed when a platform overload recovery occurs under auxiliary power. The message will persist until the reset overload recovery procedure is performed. Refer to Navigation Menus, *Faults Menu.*

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

6 Momentarily activate the drive enable toggle switch in the right direction until ACTIVE FAULTS is shown on the display.

7 Activate steer in the right direction until RESET OVERLOAD RECOVERY is shown on the display.

8 Momentarily activate the drive enable toggle switch in the right direction to lock the menu OVERLOAD RECOVERY RESET.

9 Enter the reset code by momentarily activating steer right three times then steer left one time.

⊙ Result: A one second pulse alarm will sound indicating the reset procedure has been saved.

2-4 Platform

How to Remove the Platform

1 Remove the cable clamp from the top of the platform mounting weldment.

2 Remove the mounting fasteners from the power to platform outlet box bracket. Lay the outlet box and bracket assembly off to the side. Do not disconnect the wiring.

3 Remove the foot switch mounting fasteners.

4 Remove the cover plate from the bottom of the foot switch to access the foot switch wire terminals.

5 Tag and disconnect the foot switch wiring from the foot switch. Remove the cable from the back of the platform.

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

6 Remove the platform control box mounting fasteners. Lower the control box and set it aside.

NOTICE Component damage hazard. Cables can be damaged if they are kinked or pinched.

Note: If your machine is equipped with an airline to platform option, the airline must be disconnected from the platform before removal.

7 Support and secure the platform to an appropriate lifting device.

8 Remove the platform mounting fasteners and remove the platform from the machine.

⚠WARNING Crushing hazard. The platform could become unstable and fall when it is removed from the machine if not properly supported.

Jib Boom Components

3-1
Jib Boom

How to Remove the Jib Boom

Note: Perform this procedure with the boom in the stowed position.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Remove the platform.

2 Remove the platform mounting weldment.

3 Remove the hose and cable cover from the side of the jib boom.

4 Remove the hose and cable clamp from the jib boom pivot pin. Lay all hoses and cables to the side.

NOTICE Component damage hazard. Hoses and cables can be damaged if they are kinked or pinched.

5 Tag, disconnect and plug the jib boom lift cylinder hydraulic hoses. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

6 Attach a lifting strap from an overhead lifting device to the jib boom assembly.

7 Place blocks under the platform leveling cylinder for support. Protect the cylinder rod from damage.

8 Remove the pin retaining fastener from the slave cylinder rod-end pivot pin. Use a soft metal drift to remove the pin.

⚠WARNING Crushing hazard. The jib boom could fall when the slave cylinder rod-end pivot pin is removed if not properly attached to the overhead lifting device.

9 Remove the pin retaining fastener from the jib boom bellcrank to primary boom pivot pin.

10 Use a soft metal drift to remove the pin and carefully remove the jib boom assembly from the primary boom.

⚠WARNING Crushing hazard. The jib boom may become unbalanced and fall when it is removed from the machine if it is not properly supported by the overhead lifting device.

3-2
Jib Boom Lift Cylinder

How to Remove the Jib Boom Lift Cylinder

Note: Perform this procedure with the boom in the stowed position.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Raise the jib boom slightly and place blocks under the platform mounting weldment. Then lower the jib boom until the platform is resting on the blocks just enough to support the platform.

Note: Do not rest the entire weight of the boom on the blocks.

2 Tag, disconnect and plug the jib boom lift cylinder hydraulic hoses. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

3 Remove the pin retaining fasteners from the jib boom lift cylinder rod-end pivot pin. Do not remove the pin.

4 Use a soft metal drift to tap the jib boom lift cylinder rod-end pivot pin half way out. Then lower one of the leveling arms to the ground. Tap the pin the other direction and lower the opposite leveling arm. Do not remove the pin.

5 Support the jib boom lift cylinder with a lifting device.

6 Remove the pin retaining fastener from the jib boom lift cylinder barrel-end pivot pin. Use a soft metal drift to remove the barrel-end pin and let the cylinder hang down.

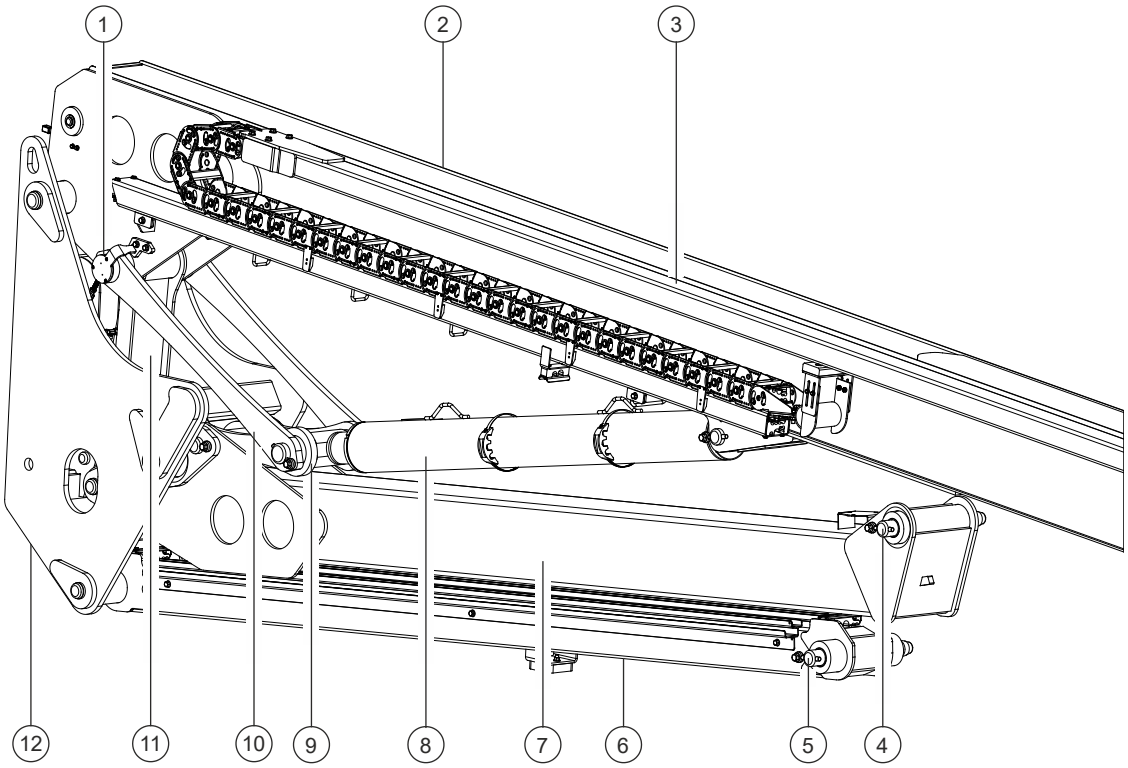
⚠WARNING Crushing hazard. The platform and jib boom could become unbalanced and fall when the jib boom barrel-end pivot pin is removed if not properly supported.

7 Attach a lifting strap from an overhead lifting device to the lug on the rod end of the jib boom lift cylinder.

8 Use a soft metal drift to remove the jib boom lift cylinder rod-end pin. Remove the cylinder from the machine.

⚠WARNING Crushing hazard. The jib boom lift cylinder may become unbalanced and fall when it is removed from the machine if it is not properly supported by the suitable lifting device.

Boom Components



1 angle sensor
2 primary boom
3 cable track
4 upper riser arm to turntable pivot pin
5 lower riser arm to turntable pivot pin
6 lower riser arm
7 upper riser arm
8 lift cylinder
9 pivot link
10 pivot lever
11 timing link
12 mid-pivot

4-1 Cable Track

The primary boom cable track guides the cables and hoses running up the boom. It can be repaired link by link without removing the cables and hoses that run through it. Removing the entire primary boom cable track is only necessary when performing major repairs that involve removing the primary boom.

How to Remove the Cable Track

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Open the platform control box.

2 Tag and disconnect the foot switch wiring from the terminal strip inside the platform control box. Pull the wiring out of the platform control box.

3 Raise the boom to a horizontal position.

4 Disconnect the wire connectors from the bottom of the platform control box.

Note: When installing the wire connectors to the bottom of the platform control box, match the color of the connectors to those on the control box to be sure they are installed in the correct location.

5 Remove the mounting fasteners from the power to platform outlet box bracket. Lay the outlet box and bracket assembly off to the side.

6 Remove the hose and cable clamps from the platform support and jib boom.

7 Tag, disconnect and plug the platform leveling slave cylinder hydraulic hoses from the bulkhead fittings on the side of the primary boom. Cap the bulkhead fittings.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

8 Tag, disconnect and plug the hydraulic hoses from the "V1" and "V2" ports of the jib boom/platform rotate manifold. Cap the fittings on the manifold.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

9 Remove the hose and cable cover from the side of the jib boom.

10 Locate all electrical cables under the boom at the pivot end that enter the cable track.

11 Tag and disconnect the electrical connectors for all cables that enter the cable track.

12 Remove the retaining fasteners from the electrical connector receptacles for the cables that enter the cable track.

13 Carefully pull the cables and connector receptacles out of the primary boom.

Boom Components

14 Tag, disconnect and plug all hydraulic hoses that enter the cable track from the bulkhead fittings at the pivot end of the boom.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

15 Pull the hydraulic hoses out of the primary boom.

16 Remove the cotter pin from the upper cable track at the platform end of the boom.

Note: Always replace the cotter pin with a new one.

17 Remove the cable track pull tube guide fasteners from the cable track guide at the platform end of the boom. Remove the cable track guide from the boom.

18 Place blocks in between the upper and lower cable tracks and secure the upper and lower tracks together.

⚠WARNING Crushing hazard. If the upper and lower cable tracks are not properly secured together, the cable track could become unbalanced and fall when removed from the machine.

19 Attach a lifting strap from an overhead lifting device to the cable track.

20 Remove the mounting fasteners that attach the lower cable track to the boom.

21 Carefully remove the cable track from the machine and place it on a structure capable of supporting it.

⚠WARNING Crushing hazard. The cable track could become unbalanced and fall if not properly attached to the lifting device.

NOTICE Component damage hazard. Cables and hoses can be damaged if they are kinked or pinched.

NOTICE Component damage hazard. The cable track can be damaged if it is twisted.

How to Repair the Cable Track

NOTICE Component damage hazard. The boom cable track can be damaged if it is twisted.

Note: A 4 link repair section of cable track is available through the Genie Service Parts Department.

1 Visually inspect the cable track and determine which 4 link section needs to be replaced.

2 Carefully remove the snap rings from each end of the damaged section of cable track.

3 Remove the retaining fasteners from the upper black rollers from the 4 link section of cable track to be replaced. Remove the rollers.

4 Lift up the hoses and cables and carefully remove the damaged 4 link section of cable track.

NOTICE Component damage hazard. Hoses and cables can be damaged if they are kinked or pinched.

5 Remove the upper rollers from the replacement section of cable track.

6 Lift up the hoses and cables and carefully insert the new 4 link section of cable track.

NOTICE Component damage hazard. Hoses and cables can be damaged if they are kinked or pinched.

7 Connect the ends of the replacement cable track section to the existing cable track using the snap rings.

8 Install the rollers onto the new section of cable track.

9 Operate the boom extend/retract function through a full cycle to ensure smooth operation of the new section of cable track.

Boom Components

4-2
Primary Boom

How to Remove the Primary Boom

⚠WARNING Bodily injury hazard. This procedure requires specific repair skills, lifting equipment and a suitable workshop. Attempting this procedure without these skills and tools could result in death or serious injury and significant component damage. Dealer service is strongly recommended.

Note: Perform this procedure on a firm, level surface with the machine in the stowed position unless otherwise instructed.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Remove the jib boom. Refer to Repair Procedure, *How to Remove the Jib Boom.*

2 Raise the boom approximately 6 inches / 15 cm.

3 Place a block of wood 4x4x18 inches / 10x10x45 cm across the boom rest and lower the boom onto the block of wood.

4 Remove the covers from the pivot end of the boom assembly and the mid-pivot.

5 Working at the pivot end of the boom, remove the boom retract limit switch.

6 Tag, disconnect and plug the hydraulic hoses from the boom extend cylinder. Cap the fittings.Remove the cable tracks from both sides of the boom. Set them onto the machine side covers.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

7 Using an overhead lifting device with a strap of adequate capacity, support the platform end of the boom. Do not apply any lifting pressure.

8 Using an overhead lifting device with a strap of adequate capacity, support the barrel end of the primary boom lift cylinder.

9 Using a soft metal drift, remove the pivot pin securing the barrel end of the cylinder. Lower the cylinder onto the boom structure.

⚠CAUTION Crushing hazard. The cylinder could fall if not properly supported.

10 Using an overhead lifting device with a strap of adequate capacity, support the pivot end of the boom. Do not apply any lifting pressure.

11 Tag, disconnect and plug the hydraulic hoses from the platform level master cylinder at the pivot end of the boom. Cap the fittings.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

12 Using a soft metal drift, remove the pivot pin securing the barrel end of the cylinder.

Note: Use the access hole on the right side of the mid-pivot to remove the pivot pin.

13 Remove the boom lower pivot pin retaining fasteners. Use a soft metal drift to remove the pin.

14 Remove the boom upper pivot pin retaining fasteners. Use a soft metal drift to remove the pin. Remove the boom from the machine.

15 Using an overhead lifting device, support one of the pivot levers.

16 Using a soft metal drift, push the pivot pin in far enough that it can be lowered onto the boom structure.

⚠WARNING Crushing hazard. The pivot lever could fall if not properly supported.

17 Using an overhead lifting device, support the other pivot lever.

18 Using a soft metal drift, finish removing the pivot pin.

Note: Do not remove the metal drift. Only pull it back far enough to lower the pivot lever.

⚠WARNING Crushing hazard. The timing link will fall if the metal drift is removed before it has been properly supported.

19 Using an overhead lifting device, support the timing link.

20 Remove the metal drift and lower the timing link onto the mid-pivot of the boom structure.

21 Using a soft metal drift, remove the pivot pin securing the boom to the mid-pivot.

⚠DANGER Crushing hazard. The boom assembly will fall if not properly supported when removed from the machine.

22 Remove the boom from the machine.

4-3 Boom Lift Cylinder

The primary boom lift cylinder raises and lowers the primary boom. The primary boom lift cylinder is equipped with a counterbalance valve to prevent movement in the event of a hydraulic line failure.

How to Remove the Boom Lift Cylinder

⚠WARNING Bodily injury hazard. This procedure requires specific repair skills, lifting equipment and a suitable workshop. Attempting this procedure without these skills and tools could result in death or serious injury and significant component damage. Dealer service is strongly recommended.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Raise the boom until the lift cylinder rod-end pivot pin is above the side covers.

2 Attach a 5 ton / 5000 kg overhead supporting device to the platform end of the boom for support. Do not apply any lifting pressure.

3 Attach a 5 ton / 5000 kg overhead supporting device to the two lifting eyes located at the top of the mid-pivot. Do not apply any lifting pressure.

Boom Components

4 Tag, disconnect and plug the boom lift cylinder hydraulic hoses. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

5 Using a suitable lifting device, secure the barrel-end of lift cylinder.

6 Place a block of wood measuring 4x4x24 inches / 10x10x50 cm across the top of the turntable bulkhead and below the cylinder.

7 Remove the pin retaining fastener from the boom lift cylinder barrel-end pivot pin.

8 Using a soft metal drift, remove the pivot pin. Lower the cylinder onto the wooden block.

⚠CAUTION Crushing hazard. The lift cylinder will fall if not properly supported when the pivot pin is removed.

9 Adjust the lifting strap to the center of the lift cylinder.

10 Remove the pin retaining fastener from the boom lift cylinder rod-end pivot pin.

11 Using a soft metal drift, remove the pivot pin.

Note: Apply slight lifting pressure to the mid-pivot to remove pressure from the pivot pin.

12 Carefully remove the boom lift cylinder from the machine.

⚠WARNING Crushing hazard. The lift cylinder could become unbalanced and fall if not properly supported and secured to the lifting device.

4-4 Primary Boom Extension Cylinder

The primary boom extension cylinder extends and retracts the primary boom extension tube.The primary boom extension cylinder is equipped with counterbalance valves to prevent movement in the event of a hydraulic line failure.

How to Remove the Primary Boom Extension Cylinder

⚠WARNING Bodily injury hazard. This procedure requires specific repair skills, lifting equipment and a suitable workshop. Attempting this procedure without these skills and tools could result in death or serious injury and significant component damage. Dealer service is strongly recommended.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Raise the jib boom to a horizontal position.

2 Extend the boom until the extension cylinder rod-end pivot pins are accessible in the extension tube.

3 Raise the primary boom to a horizontal position.

4 At the pivot end of the boom, remove the cover from the end of the boom tube.

5 Remove the boom extend limit switch.

6 Tag, disconnect and plug the boom extension cylinder hydraulic hoses. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

NOTICE Component damage hazard. Hoses and cables can be damaged if they are kinked or pinched.

7 At the pivot end of the boom, remove the retaining fasteners and blocks securing the extend cylinder to the boom tube.

8 At the platform end of the boom, remove the external snap rings from the extension cylinder rod-end pivot pin. Use a soft metal drift to remove the pin.

9 Support and slide the extension cylinder out of the primary boom.

⚠WARNING Crushing hazard. The extension cylinder could fall when removed from the extension boom if not properly supported.

NOTICE Component damage hazard. Be careful not to damage the counterbalance valves on the primary boom extension cylinder when removing the cylinder from the primary boom.

4-5 Platform Leveling Master Cylinder

The platform leveling master cylinder acts as a pump for the slave cylinder. It is part of the closed-loop hydraulic circuit that keeps the platform level through the entire range of primary boom motion. The platform leveling master cylinder is located inside the upper mid-pivot at the pivot end of the primary boom.

How to Remove the Platform Leveling Master Cylinder

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

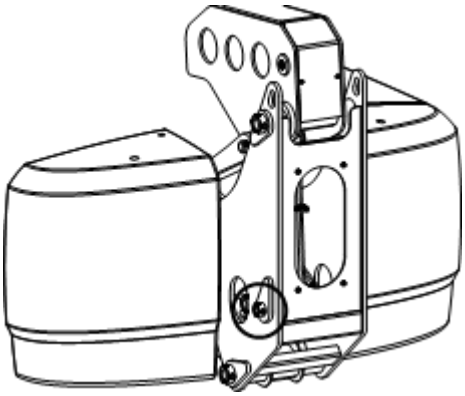
1 Remove the cover from the mid-pivot.

2 Tag, disconnect and plug the master cylinder hydraulic hoses. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

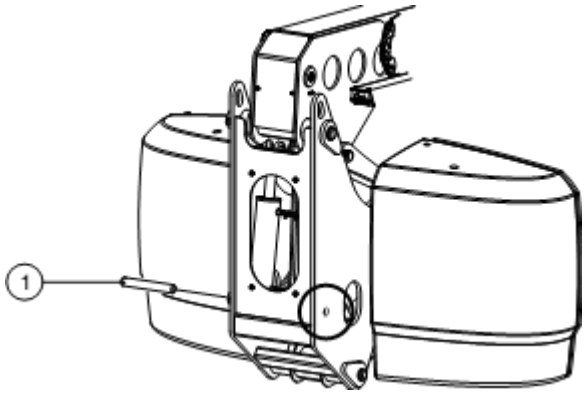
Boom Components

3 Remove the retaining fastener securing the barrel end pivot pin.



4 Using a soft metal drift, remove the pivot pin.

Note: Use the access hole on the right side of the mid-pivot to remove the pivot pin.



1 pivot pin

5 Raise the boom until the rod end pivot pin of the master cylinder is accessible.

6 Using an overhead supporting device, support the master cylinder.

7 Remove the retaining fastener securing the rod end pivot pin.

8 Using a soft metal drift, remove the pivot pin.

⚠ CAUTION Crushing hazard. The cylinder could fall if not properly supported.

9 Remove the master cylinder from the machine.

4-6
Primary Boom Angle Sensor

The primary boom angle sensor is used to limit the angle of the primary boom relative to the angle of the turntable and gravity.

How to Replace the Primary Boom Angle Sensor

Note: If the angle sensor is replaced, it must be replaced as a complete assembly.

1 Push in the red Emergency Stop button to the off position at both the ground and platform controls and turn the key switch to the off position.

2 Locate the boom angle sensor on the primary boom.

3 Tag and disconnect the electrical connector from the angle sensor.

4 Remove the retaining fasteners. Remove the angle sensor and magnet from the machine.

5 Install the new angle sensor and magnet onto the machine.

6 Securely connect the angle sensor harness to the main harness.

7 Calibrate the primary boom angle sensor. Refer to Repair Procedure, *How to Calibrate the Primary Boom Angle Sensor*.

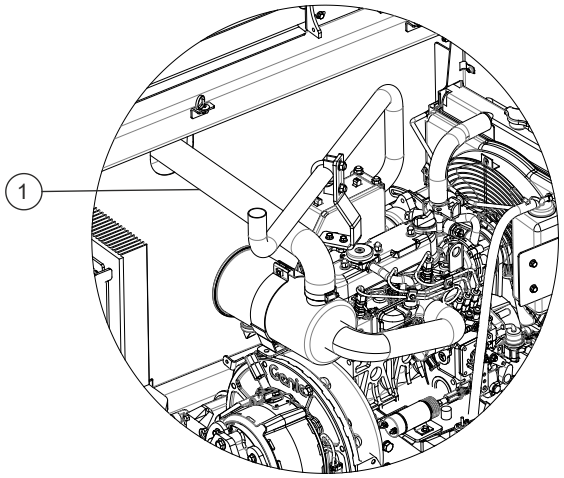
Engines

5-1 RPM Adjustment

Refer to Maintenance Procedure in the appropriate Service or Maintenance Manual for your machine, *Check and Adjust the Engine RPM*.

5-2 Air Intake Hose

Every time the engine tray is closed after maintenance, the air intake hose must be correctly placed into its seat.

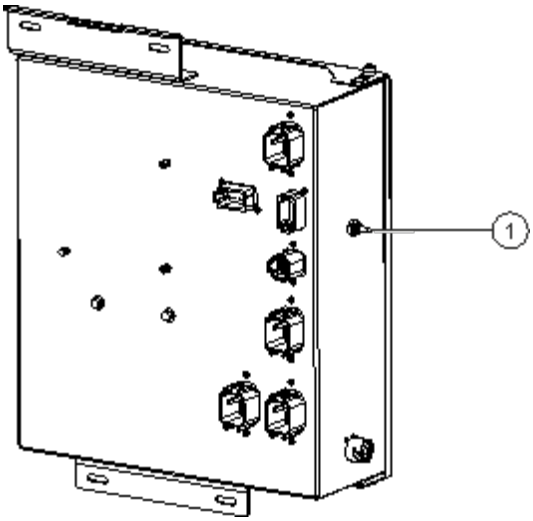


1 Air intake hose

6-1
Control System Fault Recovery Switch

The turntable The turntable control box (TCON) is the communication and operations center for the machine. The switch at the bottom of the control box is the control system fault Recovery switch. Bypass and Recovery mode is only intended for certain circumstances and is not part of normal machine operation. If the Recovery function is required, this indicates there may be faults with the machine. Contact trained personnel immediately.

Recovery is only to be used as a last attempt to retract and lower the platform when control system failures or CAN communication failures occur.



1 Recovery Switch

How to use Control System Fault Recovery Switch

Recovery is only to be used as a last attempt to lower the platform when the operator in the platform is unable to do so, system failure or in emergency situations.

⚠WARNING Bodily injury hazard. When using recovery mode, the platform may not fully lower to the ground when the recovery mode is completed. Failure to use only suitable equipment and/or practices to allow the operator to safely exit the platform could result in death or serious injury.

⚠WARNING Bodily injury hazard. Platform leveling is not active when using recovery mode. The platform could reach high out-of-level conditions when using this mode. The operator will need to secure themself to the platform to prevent falling injury.

Ground Controls

The **Recovery switch** allows the platform to be lowered in case of control system severe fault or **CAN** communication loss. The recovery switch permits to retract the primary boom and lower the primary boom, using the main pump at reduced speed to allow the operator to exit the platform.

1 In case of **CAN** communication loss or control system failure only, turn off the machine, wait at least two seconds and turn the key switch in **GROUND** position.

2 **Press** and **hold** the function enable button and move the **Recovery switch backward** to lower the primary boom or move the **Recovery switch forward** to retract the primary boom.

Note: The key switch must be held in the recovery position until the recovery sequence is complete or until the operator in the platform can safely exit the platform.

Note: If the Recovery function has been used, this will indicate there are faults with the machine. Tag and remove the machine from service until the fault has been corrected by trained personnel.

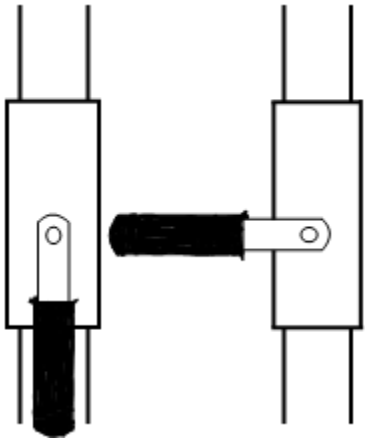
7-1 Function Pump

How to Remove the Function Pump

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Locate the hydraulic tank valve at the hydraulic tank. Close the valve.

NOTICE Component Damage hazard.Do not perform any functions with hydraulic tank shut off valve closed. Remove the key switch and tag the machine to inform personnel of the condition.



Open Closed

1

2 Tag, disconnect and plug function pump hydraulic hoses. Cap the fittings on the pump.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

3 Support the pump with a suitable lifting device.

4 Remove the pump mounting bolts. Carefully remove the pump.

NOTICE Component damage hazard. Be sure to open the hydraulic tank valve and prime the pump after installation.

Hydraulic Pumps

How to Check the Function Pump Calibration

Pump efficiency is calibrated automatically but must be verified after a new pump installation and before performing any boom speed calibrations. Refer to Repair Procedures, *Calibration Process Steps.* This procedure determines the number of revolutions that are required to create a determined amount of flow for both the large and small gear pumps.

Note: Start this procedure with the secondary boom in the stowed position and primary boom at or above horizontal. Position the machine in a suitable location with sufficient vertical space. Refer to Navigation Menus, *Settings Menu.*

Note: Primary angle sensor must be functional and calibrated. Refer to Repair Procedures, *How to Calibrate Booms Angle Sensor.*

1 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

Note: If the unit is equipped with the engine option, set the machine to DC mode.

2 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

3 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

4 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

5 Momentarily activate the drive enable toggle switch in the right direction until you see the VALVE AND SENSOR SETTINGS screen.

6 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

7 Continue to momentarily active the steer in the right direction until LARGE & SMALL PUMP EFFICIENCY is shown on the display.

8 Momentarily activate the drive enable toggle switch to enter LARGE & SMALL PUMP EFFICIENCY menu.

9 Fully elevate the primary boom.

⊙ Result: A one second pulse alarm will sound indicating a successful pump efficiency calibration. The display will indicate pump efficiency in %.

10 Fully lower the primary boom.

⊙ Result: A one second pulse alarm will sound indicating a successful pump efficiency calibration. The display will indicate pump efficiency in %.

To exit programming mode:

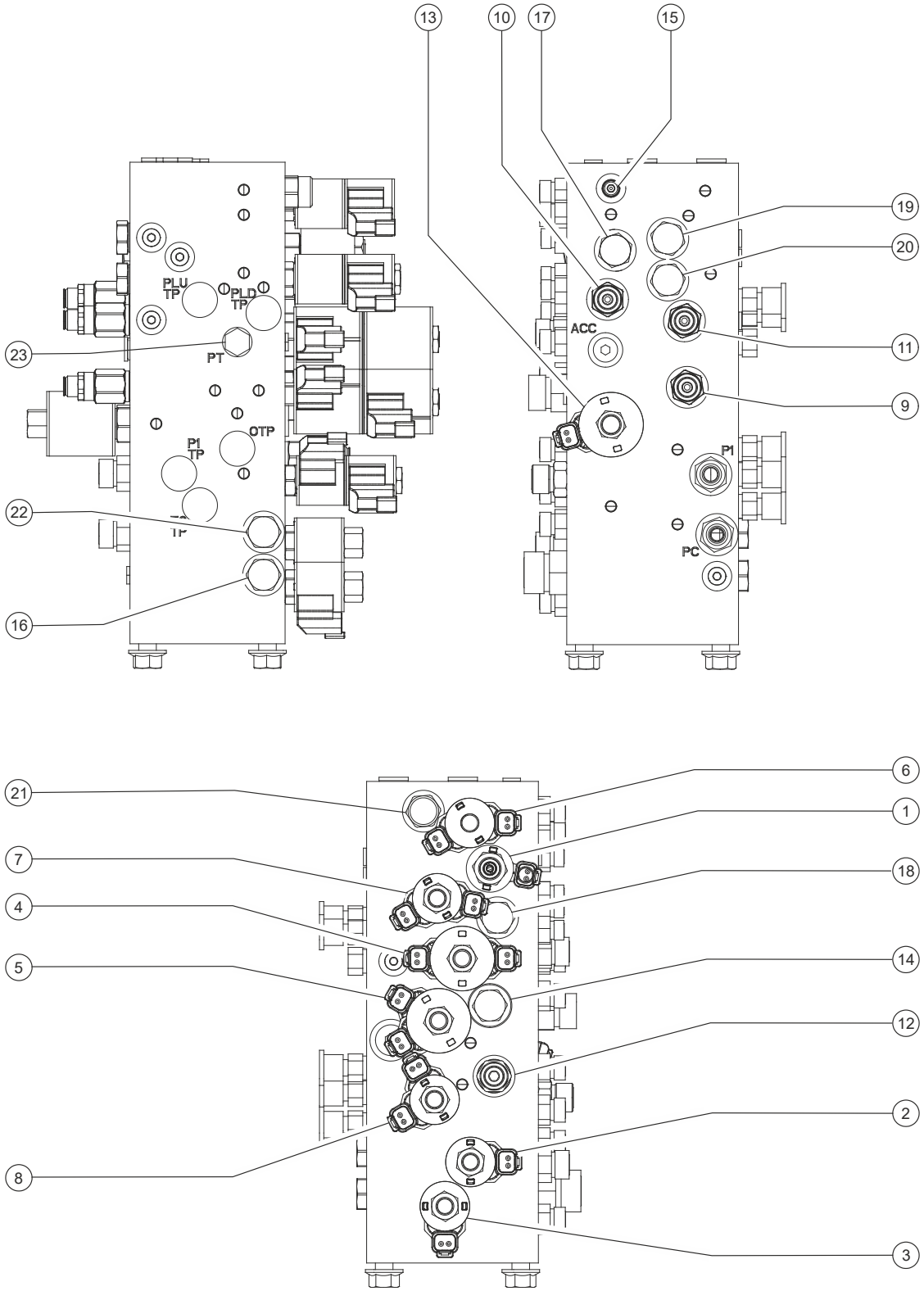
11 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

8-1
Function Manifold Components

The function manifold is mounted to the turntable next to the ground controls.

Index No.	Description	Schematic Item	Function	Torque
1	Valve, Proportional Relief	TS1	System relief	19-21 ft lbs / 26-29 Nm
2	Solenoid valve, 2 position 2 way (normally open)	SV2	P HI circuit enable	19-21 ft lbs / 26-29 Nm
3	Solenoid valve, 2 position 2 way (normally open)	SV3	P LO circuit enable	19-21 ft lbs / 26-29 Nm
4	Spool valve, 3 position 4 way	SP5	Primary boom up/down	19-30 ft lbs / 26-41 Nm
5	Spool valve, 3 position 4 way	SP6	Primary boom extend/retract	19-30 ft lbs / 26-41 Nm
6	Proportional solenoid valve, 3 position 4 way	SP3	Turntable rotate left/right	19-30 ft lbs / 26-41 Nm
7	Spool valve, 3 position 4 way	SP2	Platform level up/down	19-30 ft lbs / 26-41 Nm
8	Spool valve, 3 position 4 way, closed center	SP1	Steer left/right	16-20 ft lbs / 24-27 Nm
9	Relief valve, 2000 psi	RV3	Boom extend relief	33-37 ft lbs / 45-50 Nm
10	Relief valve, 3000 psi	RV1	Platform level up	33-37 ft lbs / 45-50 Nm
11	Relief valve, 3000 psi	RV2	Platform level down	33-37 ft lbs / 45-50 Nm
12	Sequence valve	RV4	Oscillate	24-26 ft lbs / 33-35 Nm
13	Proportional solenoid valve	TS2	Oscillate circuit	24-26 ft lbs / 33-35 Nm
14	Shuttle valve	LS2	Extend/retract regenerative circuit	19-21 ft lbs / 26-29 Nm
15	Shuttle valve	LS1	Turntable rotate	4-5 ft lbs / 5-7 Nm
16	Check valve, 10 psi	CV4	P LO circuit	19-21 ft lbs / 26-29 Nm
17	Check valve	CV2	Platform rotate/jib boom select	19-21 ft lbs / 26-29 Nm
18	Check Valve, pilot operated	DC1	Platform level	19-21 ft lbs / 26-29 Nm

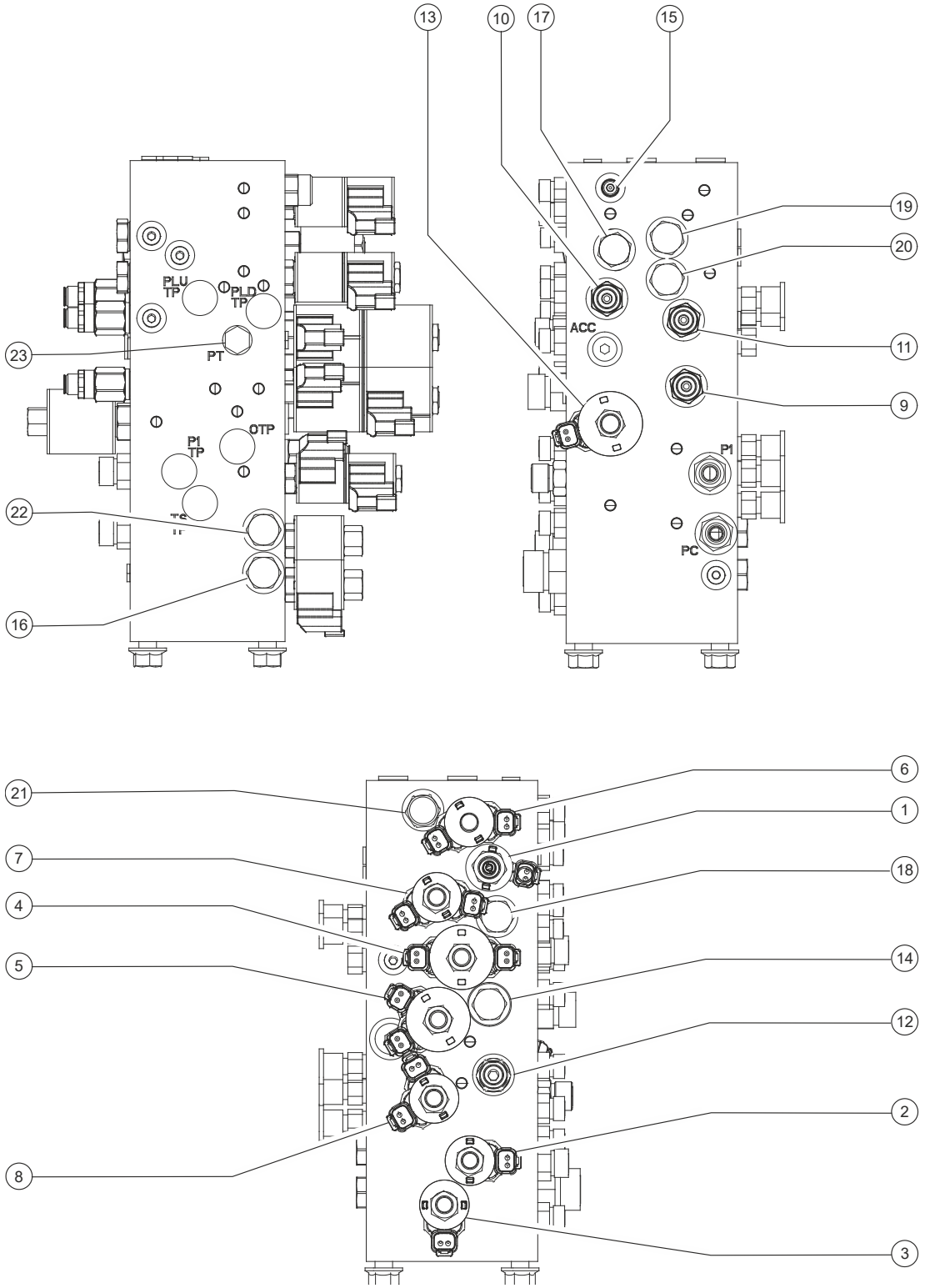
Manifolds


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OTP
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PC

Function Manifold Components, continued

Index No.	Description	Schematic Item	Function	Torque
19	Check valve, 25 psi	CV1	Tank return circuit	19-21 ft lbs / 26-29 Nm
20	Check valve, 30 psi	CV5	Tank return circuit	19-21 ft lbs / 26-29 Nm
21	Pressure compensator, 150 psi	EC1	Turntable rotate circuit	19-21 ft lbs / 26-29 Nm
22	Check valve, 10 psi	CV3	P HI circuit	19-21 ft lbs / 26-29 Nm
23	Pressure transducer	G	Pressure monitor	11 ft lbs / 15 Nm

Manifolds


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PLD
TP
PT
OTP
P1
TP
ACC
P1
PC

8-2
Valve Adjustments - Function Manifold

How to Adjust the Proportional Relief Valve, Hydraulic Pressure Sensor and Oscillate Pressure Reducing Valve

Note: Perform this procedure with the machine on a firm, level surface with the boom in the stowed position.

1 Connect a 0 to 5000 psi / 0 to 350 bar pressure gauge to test port #1 (TP1) on the function manifold.

2 Turn the key switch to Ground control. Pull out the platform red Emergency Stop button to the on position and pull out the ground control red Emergency stop button to the on position.

3 To enter the pressure sensor calibration mode, momentarily activate the ground control function enable switch three times within 5 seconds of pulling the red Emergency Stop button at the ground controls.

⊙ The pump motor activates and a green light flashes on the TCON controller. The ground display shows the current calibration steps along the entire procedure.

Note: The procedure will time out if any step is not completed within 120 seconds or terminate if the function enable switch is activated.

4 Activate the platform level toggle switch in the up direction to increase the relief pressure or in the down direction to decrease the relief pressure until the pressure gauge reads 1000 psi / 69 bar.

5 Activate the platform rotate toggle switch to store the value.

⊙ Result: The control system will continue to the next calibration procedure value - (3000 psi / 207 bar).

6 Activate the platform level toggle switch in the up direction to increase the relief pressure or in the down direction to decrease the relief pressure until the pressure gauge reads 3000 psi / 207 bar.

7 Activate the platform rotate toggle switch to save the value.

⊙ Result: The control system will automatically continue through the procedure and it automatically sweeps the following calibration values: 2500 PSI / 172 bar, 2000 PSI / 138 bar, and 750 psi / 52 bar.

Note: Wait until it displays "CONN.OTP" which indicates that all the pressure values are calibrated.

8 Disconnect the pressure gauge and connect to the Oscillate Port (OSC) such as 0 to 1000 psi / 69 bar pressure gauge or the digital meter.

9 Activate the platform rotate toggle switch.

⊙ Result: The display shows the next calibration value for the oscillate line.

10 Activate the platform level toggle switch in the up direction to increase the relief pressure or in the down direction to decrease the relief pressure until the pressure gauge reads 600 psi / 41.3 bar.

11 Activate the platform rotate toggle switch to save the value.

⊙ The control system will continue to the next calibration procedure value - (520 psi / 35.9 bar).

12 Activate the platform level toggle switch in the up direction to increase the relief pressure or in the down direction to decrease the relief pressure until the pressure gauge reads 520 psi / 35.9 bar.

13 Activate the platform rotate toggle switch to save the value.

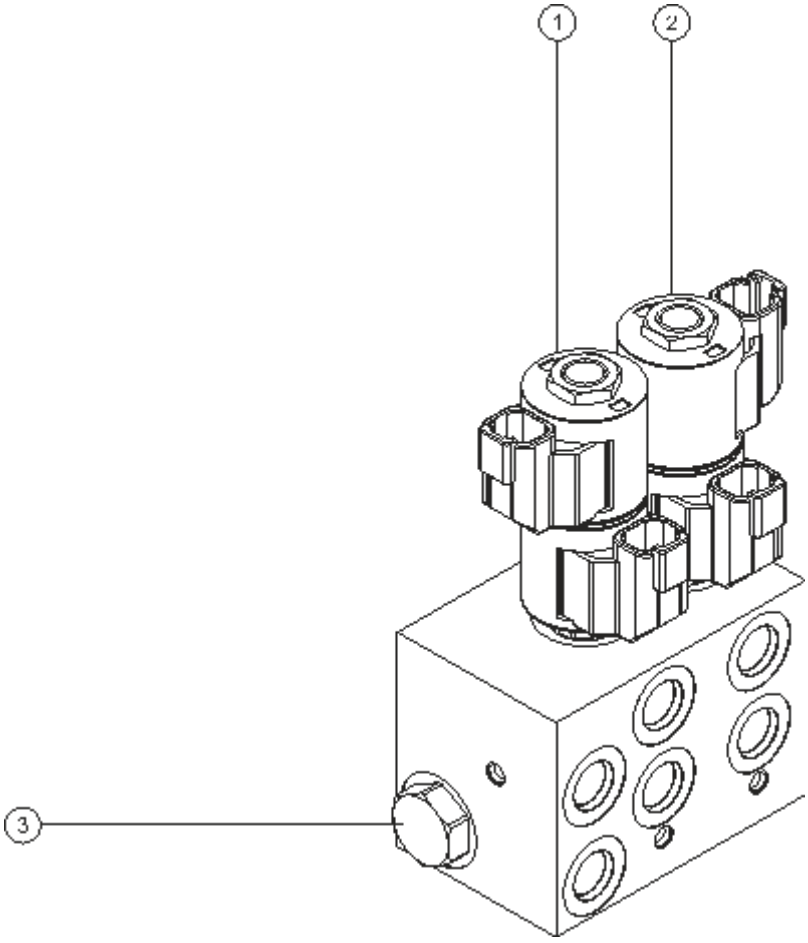
⊙ A one second pulse alarm will indicate the calibration procedure is complete.

Manifolds

8-3
Jib Boom / Platform Rotate Manifold Components

The jib boom / platform rotate manifold is mounted to the platform support.

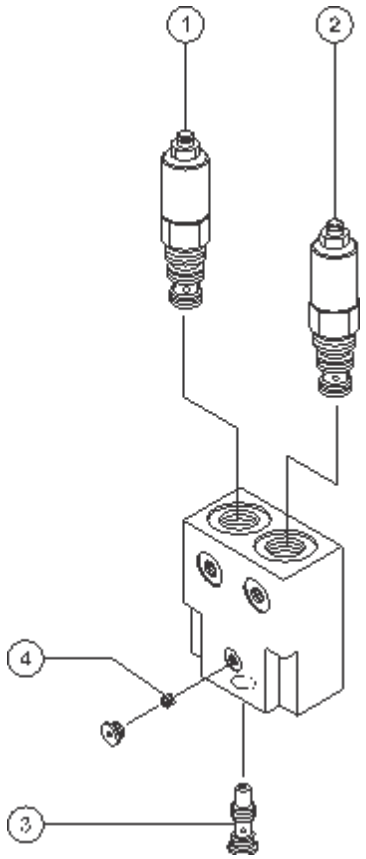
Index No.	Description	Schematic Item	Function	Torque
1	Solenoid valve, 3 position 4 way	X	Platform rotate left/right	26-30 ft-lbs / 35-40 Nm
2	Solenoid valve, 3 position 4 way	Y	Jib boom up/down	26-30 ft-lbs / 35-40 Nm
3	Check valve, 27 psi / 1,7 bar	Z	Tank return circuit	19-21 ft-lbs / 26-29 Nm



8-4
Turntable Rotation Manifold Components

The turntable rotation manifold is mounted to the turntable rotation motor.

Index No.	Description	Schematic Item	Function	Torque
1	Counterbalance valve	MM	Turntable rotate right	35-40 ft-lbs / 47-54 Nm
2	Counterbalance valve	NN	Turntable rotate left	35-40 ft-lbs / 47-54 Nm
3	Shuttle valve, 2 position 3 way	OO	Turntable rotation brake release	10-13 ft-lbs / 14-18 Nm
4	Orifice, 0.030 inch / 0.76 mm	PP	Brake release circuit(located inside port)	



Manifolds

8-5 How to Set Up the Oscillate Directional Valve Linkage

Note: Adjustment of the oscillate directional valve linkage is only necessary when the linkage or valve has been replaced.

Note: Perform this procedure with the machine on a firm, level surface with the boom in the stowed position.

Note: Two people will be required to perform this procedure.

1 Use a "bubble type" level to verify the working surface is completely level.

⚠WARNING Tip-over hazard. Failure to perform this procedure on a level floor could compromise the stability of the machine resulting in the machine tipping over.

2 Remove the non-steer end drive chassis and axle covers.

3 Locate and remove the ball joint retaining fastener from the bracket.

4 To level the chassis, perform any boom function and push up or pull down the threaded rod until the machine is completely level.

5 Verify that the ground and drive chassis are completely level.

6 Adjust the ball joint until the hole lines up with the retaining fastener hole in the bracket.

7 Install the ball joint to the axle and tighten the jam nut.

8 Check and make sure the drive chassis is completely level.

9 Measure the distance between the drive chassis and non-steer axle on both sides (from inside of the drive chassis.

Note: If the distance is not equal and the adjustment to the linkage was completed with ground and drive chassis level, repeat steps 4 thru 9 or consult Genie Product Support.

8-6 Valve Coils

How to Test a Coil

A properly functioning coil provides an electromotive force which operates the solenoid valve. Critical to normal operation is continuity within the coil that provides this force field.

Since coil resistance is sensitive to temperature, resistance values outside specification can produce erratic operation. When coil resistance decreases below specification, amperage increases. As resistance rises above specification, voltage increases.

While valves may operate when coil resistance is outside specification, maintaining coils within specification will help ensure proper valve function over a wide range of operating temperatures.

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

1 Tag and disconnect the wiring from the coil to be tested.

2 Test the coil resistance.

⊙ Result: The resistance should be within specification, plus or minus 30%.

⊠ Result: If the resistance is not within specification, plus or minus 30%, replace the coil.

Valve Coil Resistance Specification

Note: The following coil resistance specifications are at an ambient temperature of 68¡F / 20¡C. As valve coil resistance is sensitive to changes in air temperature, the coil resistance will typically increase or decrease by 4% for each 18¡F / 10¡C that your air temperature increases or decreases from 68¡F / 20¡C. Refer to Specifications, *Manifold Component Specifications* for valve coil specifications.

How to Test a Coil Diode

Properly functioning coil diodes protect the electrical circuit by suppressing voltage spikes. Voltage spikes naturally occur within a function circuit following the interruption of electrical current to a coil. Faulty diodes can fail to protect the electrical system, resulting in a tripped circuit breaker or component damage.

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

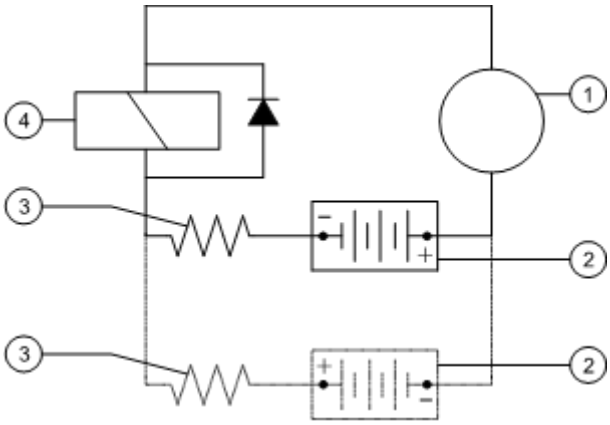
1 Test the coil for resistance. Refer to Repair Procedure, *How to Test a Coil*.

2 Connect a 10W resistor to the negative terminal of a known good 9V DC battery. Connect the other end of the resistor to a terminal on the coil.

Resistor 10Ω

Genie part number 27287

Note: The battery should read 9V DC or more when measured across the terminals.



1 multimeter
2 9v DC battery
3 10Ω resistor
4 coil

Note: Dotted lines in illustration indicate a reversed connection as specified in step 6.

3 Set a multimeter to read DC current.

Note: The multimeter, when set to read DC current, should be capable of reading up to 800 mA.

4 Connect the negative lead to the other terminal on the coil.

5 Momentarily connect the positive lead from the multimeter to the positive terminal on the 9V DC battery. Note and record the current reading.

6 At the battery or coil terminals, reverse the connections. Note and record the current reading.

⊙ Result: Both current readings are greater than 0 mA and are different by a minimum of 20%. The coil is good.

7 Result: If one or both of the current readings are 0 mA, or if the two current readings do not differ by a minimum of 20%, the coil and/or its internal diode are faulty and the coil should be replaced.

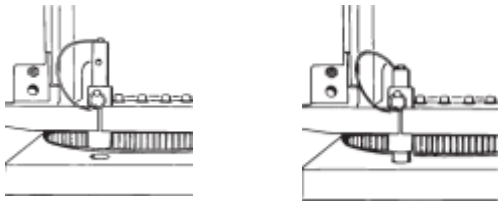
Turntable Rotation Components

9-1
Turntable Rotation Assembly

How to Remove the Turntable Rotation Drive Hub Assembly

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Secure the turntable from rotating with the turntable rotation lock pin.

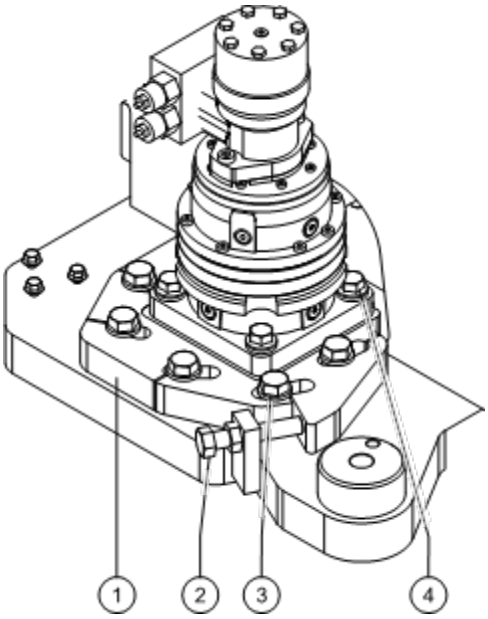


unlocked locked

2 Tag, disconnect and plug the hydraulic hoses from the drive motor. Cap the fittings on the motor.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

3 Attach a suitable lifting device to the turntable rotator assembly.



1 backlash pivot plate
2 adjustment bolt with locknut
3 backlash pivot plate mounting bolts
4 drive hub mounting bolts

4 Back off the locknut and loosen the adjustment bolt.

5 Loosen the backlash pivot plate mounting fasteners and slide the assembly away from the turntable rotate gear.

6 Remove the turntable drive hub mounting fasteners.

7 Carefully remove the drive hub assembly from the machine.

⚠WARNING Crushing hazard. The turntable rotate drive hub assembly could become unbalanced and fall when removed from the machine if not properly supported by the lifting device.

Turntable Rotation Components

When installing the drive hub assembly:

8 Install the turntable rotator assembly. Apply removable thread locking compound to fastener threads.Torque the backlash pivot plate mounting fasteners to 160 ft-lbs / 217 Nm.

How to Adjust the Turntable Rotation Gear Backlash

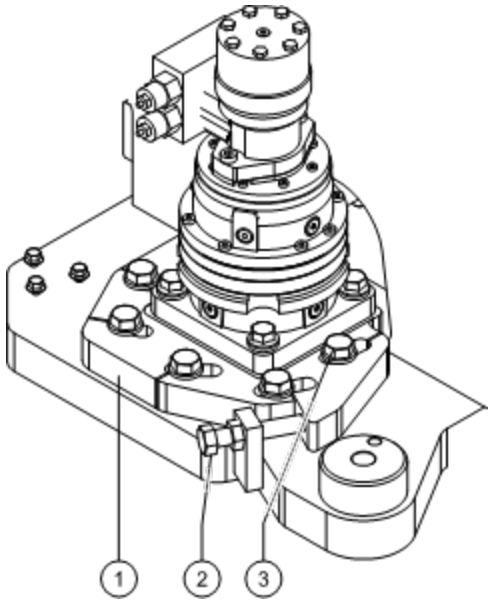
The turntable rotation drive hub is mounted on an adjustable plate that controls the gap between the rotation motor pinion gear and the turntable bearing ring gear.

Note: Perform this procedure with the machine on a firm, level surface with the boom in the stowed position.

1 Secure the turntable from rotating with the turntable rotation lock pin.

Note: The turntable rotation lock pin is located next to the function manifold.

2 Loosen the backlash pivot plate mounting fasteners.



1 backlash pivot plate
2 adjustment bolt with lock nut
3 backlash pivot plate mounting bolts

Turntable Rotation Components

3 Push the backlash pivot plate towards the turntable as far as possible (this will push the rotation gear into the turntable bearing ring gear).

4 Loosen the lock nut on the adjustment bolt.

5 Turn the adjustment bolt clockwise until it contacts the backlash pivot plate.

6 Turn the adjustment bolt 1/2 turn counterclockwise. Tighten the lock nut on the adjustment bolt.

7 Rotate the backlash pivot plate away from the turntable until it contacts the adjustment bolt. Then torque the mounting fasteners on the backlash pivot plate to specification. Refer to Specifications, *Machine Torque Specifications*.

8 Rotate the turntable through an entire rotation. Check for tight spots that could cause binding. Readjust if necessary.

9-2 How to Replace the Universal Tilt Sensor (UTS)

This machine has a dual axis angle-sensing device called the Universal Tilt Sensor (UTS). It is mounted on the turntable to monitor and communicate ground angle relative to gravity via CAN bus. Should the turntable be tilted at the *Allowable Tilt Angle* or greater an alarm will sound at both the turntable and the platform. If not calibrated, the machine will only drive in the stowed configuration in turtle mode.

Note: Perform this procedure on a firm, level surface with the machine in the stowed position.

1 Push in the red Emergency Stop button to the off position.

2 Tag and disconnect the harness from the tilt sensor.

Note: Record the X and Y axis orientation of the tilt sensor.

3 Remove the fasteners securing the tilt sensor to the turntable.

4 Secure the new tilt sensor using the existing fasteners removed in step 3. Tighten the fasteners.

5 Calibrate the tilt sensor. Refer to Repair Procedure, *How to Calibrate the Universal Tilt Sensor*.

How to Calibrate the Universal Tilt Sensor (UTS)

Note: Perform this procedure on a firm, level surface with the machine in the stowed position.

Note: The unit must be on a surface that is within 1 degree of level.

Note: Refer to Navigation Menus, *Settings Menu*.

1 Turn the key switch to platform control and pull out the red Emergency Stop button to the on position at both the ground and platform controls.

2 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

3 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

4 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

5 Momentarily activate the drive enable toggle switch in the right direction until VALVE AND SENSOR SETTINGS is shown on the display.

6 Momentarily activate the drive enable toggle switch in the right direction until CALIBRATE TILT SENSOR is shown on the display.

7 Momentarily activate the drive enable toggle switch in the right direction to enter the TILT SENSOR CALIBRATE screen.

8 Momentarily activate the drive enable toggle switch to save the X and Y axis values.

⊙ Result: An audible alarm will sound for one second indicating a successful calibration.

To exit programming mode:

9 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

Axle Components

10-1 Oscillating Axle Cylinders

The oscillating axle cylinders extend and retract between the drive chassis and the oscillating axle. The cylinders are equipped with counterbalance valves to prevent movement in the event of a hydraulic line failure. The valves are not adjustable.

How to Remove an Oscillating Axle Cylinder

Note: Perform this procedure with the machine on a firm, level surface with the boom in the stowed position.

Note: When removing a hose assembly or fitting, the O-ring (if equipped) on the fitting and/or hose end must be replaced. All connections must be torqued to specification during installation. Refer to Specifications, *Hydraulic Hose and Fitting Torque Specifications.*

1 Rotate the turntable until the boom is between the steer tires or tracks.

2 Tag, disconnect and plug the oscillating axle cylinder hydraulic hoses. Cap the fittings on the oscillate cylinder.

⚠ WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

3 Remove the pin retaining fasteners from the rod-end pivot pin. Use a soft metal drift to remove the pin.

4 Attach a lifting strap from an overhead lifting device to the barrel end of the oscillating cylinder.

5 Remove the pin retaining fasteners from the barrel-end pivot pin. Use a soft metal drift to remove the pin.

6 Remove the oscillate cylinder from the machine.

⚠ CAUTION Crushing hazard. The oscillate cylinder may become unbalanced and fall when removed from the machine if not properly attached to the lifting device.

10-2
How to Remove the Steer Cylinder

1 Adjust the steer tires so they are in a straight driving position.

2 Turn the key switch to the off position.

3 Push in the red Emergency Stop button to the off position at both the ground and platform controls.

4 Remove the drive chassis cover at the steer end of the machine.

5 Remove the cable clamp securing the steer sensor cable to the chassis.

6 Tag and disconnect the steer sensor harness from the main harness.

7 Tag, disconnect and plug the hydraulic hoses from the steer cylinder. Cap the fittings on the cylinder.

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

8 Remove the rue ring and clevis pin from each end of the cylinder.

9 Remove the cylinder from the machine.

NOTICE Component damage hazard. Hoses and cables can be damaged if they are kinked or pinched.

How to Calibrate the Steer Angle Sensor

Note: Perform this procedure on a firm, level surface with the machine in the stowed position. Refer to Navigation Menus, *Settings Menu*.

1 Turn the key switch to platform controls.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Adjust the steer wheels so they are pointing straight ahead, in line with the non-steer wheels. Release the foot switch.

4 Move and hold the drive enable toggle switch in the right direction while holding steer in the right direction.

5 When the display leaves **SYSTEM READY** mode, release the drive enable toggle switch and the steer joystick.

⊙ Result: The display will show FAULTS.

6 Momentarily activate steer in the right direction until SETTINGS is shown on the display.

7 Momentarily activate the steer right direction until you see the DRIVE SETTINGS screen.

8 Momentarily activate the drive enable toggle switch in the right direction until you see the STEER SENSOR CAL screen.

9 Momentarily activate the drive enable toggle switch in the right direction.

⊙ Result: The display will show steer sensor value in mV and ENABLE will appear at the bottom of the screen.

Axle Components

10 Momentarily activate the drive enable toggle switch in the right direction to save calibrate steer center.

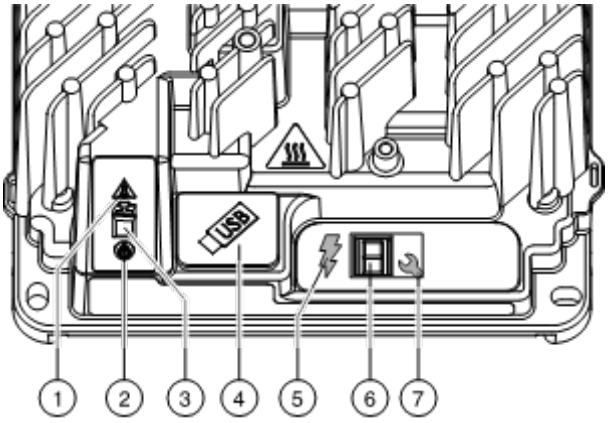
⊙ Result: The alarm will sound and the mV value flashes to indicate the setting has been saved.

To exit programming mode:

11 Move and hold the drive enable toggle in the left position until the display returns to SYSTEM READY mode.

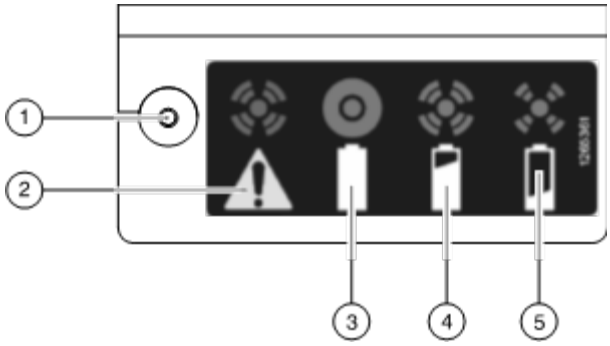
11-1
Battery Charger

The charger contains selectable charging profiles stored in its internal memory to charge batteries. These profiles are specific to each battery type. The charging profile must be programmed to match the specific battery type on the machine.



Charger status indicators

1 Error / Fault / USB indicator
2 AC power indicator
3 Battery charging indicator
4 USB port
5 Charging output indicator
6 Charger profile / Error display
7 Charger button



Remote charger status indicators

1 Error / Fault / USB indicator
2 Error / Fault
3 Charge complete
4 Charging, high state of charge
5 Charging, low state of charge

Battery Charger

Selecting a Charge Profile

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

1 At the ground controls, turn the key switch to the off position and push in the red Emergency Stop button to the off position.

2 Open the battery compartment.

3 Press and hold the charge profile selection button and plug the battery charger into an AC power source. Continue to hold the button until the amber error indicator is on and the green charging indicator light is flashing. Release the button.

4 Press and release the charge profile selection button to navigate to the charge profile appropriate for your machine and battery type. Refer to the chart below.

Profile	Description
P001	Flooded lead acid batteries - Temperature compensated *
P003	Flooded lead acid batteries - Not temperature compensated **
P007	Flooded lead acid batteries - Not temperature compensated **
P043	AGM batteries - Temperature compensated *

* Temperature compensated: Battery temperature sensor has been installed on the machine.

** Not temperature compensated: Battery temperature sensor has not been installed on the machine.

5 Press and hold the charge profile selection button until the error indicator and charging indicator lights turn off and the AC status indicator light turns on to confirm selection and exit charge profile mode. Release the button.

Note: Charge profile mode will time out and exit if there is 15 seconds of inactivity, the charge profile number has been displayed three times or the AC power source had been disconnected.

6 Press and release the charge profile selection button to confirm the correct charge profile has been selected.

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Fault Codes



Observe and Obey:

- ☑ Troubleshooting and repair procedures shall be completed by a person trained and qualified on the repair of this machine
- ☑ Immediately tag and remove from service a damaged or malfunctioning machine.
- ☑ Repair any machine damage or malfunction before operating the machine.
- ☑ Unless otherwise specified, perform each procedure with the machine in the following configuration:
  - Machine parked on a firm, level surface
  - Key switch in the off position with the key removed
  - The red Emergency Stop button in the off position at both the ground and platform controls
  - Wheels chocked
  - All external AC power supply disconnected from the machine
  - Boom in the stowed position
  - Turntable secured with the turntable rotation lock
  - Welder disconnected from the machine (if equipped with the weld cable to platform option)

Before Troubleshooting:

- ☑ Read, understand and obey the safety rules and operating instructions in the appropriate operatorâs manual on your machine.
- ☑ Be sure that all necessary tools and test equipment are available and ready for use.
- ☑ Read each appropriate fault code thoroughly. Attempting short cuts may produce hazardous conditions.
- ☑ Be aware of the following hazards and follow generally accepted safe workshop practices.

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

Note: Two persons will be required to safely perform some troubleshooting procedures.

Control System Fault Codes

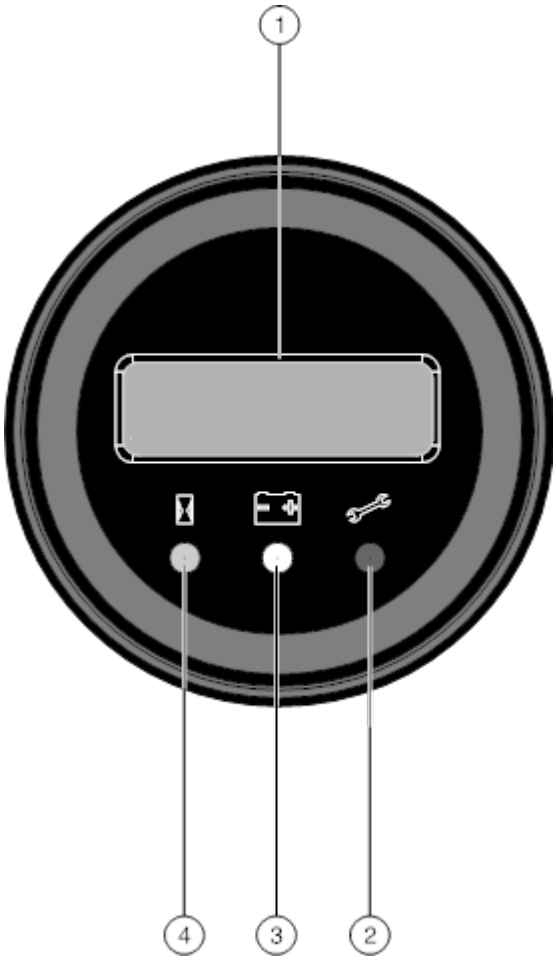
Fault Codes Ground Controls

Standard Genie fault codes shall be displayed and the red LED will illuminate when any faults are present. If more than one fault code is present, the codes shall be displayed in succession with each code displayed for 4 seconds. Once all active fault codes have been displayed the screen will pause for 4 seconds and then repeat the list of active fault codes. Use the *Control Systems Fault Codes* chart to aid in troubleshooting the machine by pinpointing the area or component affected.

Ground Display Smart Hour Meter

The smart hour meter will display unit hours and battery state of charge (SOC) whenever no faults are present on the system. The value will cycle between unit hours and battery SOC every 5 seconds. When the engine is running (if equipped), the display will cycle hours, SOC, and RPM.

Both Engine Hours and DC Function Enable Hours will be tracked. DC Function enable hours will be displayed on the smart hour meter by default. Engine Hours will be displayed if the hybrid mode select switch is held for three (3) seconds. Engine Hours will continue to display as long as the hybrid mode select switch is held.



1 LCD screen (8 character display)
2 Red LED below the wrench icon illuminates when system faults are displayed
3 Yellow LED below the battery icon illuminates when battery state of charge is displayed.
4 Green LED below the hourglass icon illuminates when unit hours are displayed.

Control System Fault Codes

How to Retrieve Control System Fault Codes from the Platform Controls

At least one fault code is present when the alarm at the platform controls produces one short beep every 30 seconds. Refer to Navigation Menus, *Faults Menu*.

1 Turn the key switch to platform control.

2 Pull out the red Emergency Stop button to the on position at both the ground and platform controls.

3 Do not press down the foot switch.

4 Move and hold the drive enable toggle switch in the right direction and hold steer in the right direction.

5 When the display leaves SYSTEM READY mode, release the drive enable toggle switch and steer.

⊙ Result: The display will show FAULTS.

To access active faults list:

6 Momentarily activate the drive enable toggle switch in the right direction until ACTIVE FAULTS is shown on the display.

7 Momentarily activate the drive enable toggle switch in the right direction to access the active fault codes.

8 Activate steer in the right direction to scroll through the fault codes. Fault codes will be listed in order 1 through 16.

To access motor controllers and battery charger faults list:

9 Momentarily activate the drive enable toggle switch in the right direction until COMPONENT FAULTS is shown on the display.

10 Momentarily activate the drive enable toggle switch in the right direction to access the active fault codes.

11 Activate steer in the right direction to scroll through the fault codes. Active fault codes will be listed in sequence.

To access fault history list:

12 Momentarily activate the drive enable toggle switch in the right direction until ACTIVE FAULTS is shown on the display.

13 Activate the steer rocker switch in the right direction until FAULT HISTORY is shown on the display.

14 Momentarily activate the drive enable toggle switch in the right direction to access the fault history list codes.

15 Activate the steer rocker switch in the right direction to scroll through the fault codes. Fault codes will be listed in order 1 through 16.

16 Refer to the *Control System Fault Codes* chart to aid in troubleshooting the machine by pinpointing the area or component affected

To clear fault history

17 Momentarily activate the drive enable toggle switch in the right direction until ACTIVE FAULTS is shown on the display.

18 Activate steer in the right direction until CLEAR FAULTS HISTORY is shown on the display.

19 Momentarily activate the drive enable toggle switch in the right direction to enter CLEAR FAULTS HISTORY.

⊙ Result: CLEAR FAULT HISTORY? NO will appear on the display.

20 Momentarily activate drive enable right to enter menu.

⊙ Result: Enable will appear at the bottom of the display.

21 Activate steer in the right direction to change the display from NO to YES.

22 Activate the drive enable toggle switch in the right direction to accept the change.

⊙ Result: The alarm will sound for one second. All fault history listings and counters will be cleared.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
15	**FOOT SWITCH**	21	Fault	Stuck ON (on @ power up)	Platform controlled functions disabled	Release foot switch and recycle power Verify: (when activated) · 24V supply on C11-1 (P22PWR WH) · 24V on C11-2, PCON C46-6 GY (C56FTS RD) when pressed, 0V when not pressed
		28	Timeout	ON for > Timeout Time		
16	**SPEED ADJUSTMENT TOGGLE SWITCH**	27	Active at startup	Stuck ON (on @ power up)	Toggle Switch functions operate at 50% speed	Verify: · 24V supply on toggle switch center (RD C134PWR) · 24V on pos 3, C48-11 VCON (C194DEC WH/BK) when pressing down on the switch · 24V on C48-10 (C194INC WH/RD) when pressing up on the switch (B- otherwise)
18	**Proportional Relief Valve**	21	Fault	Open or short circuit	Warning Will cause poor operating efficiency	Verify no open/short circuit across C28-2 RRDCON, C1-6, C3-3 (V191PCE WH/RD)
19	**AUX PUMP TOGGLE SWITCH**	27	Active at startup	Stuck ON (on @ power up)	AUX functions disabled	Verify: (when activated) · 24V created by AUX toggle switch TS1 at platform or ground controls(they are wired in parallel) · 24V at C35-11 to RRDCON C28-33 (C27AUX RD) to 24V when switch is activated · 24V across AUX Relay CR3-86 & CR3-85 (DC units only)
21	**PRIMARY UP/DOWN JOYSTICK**	11	Shorted to Supply	5V	Primary Boom disabled	Verify: · 5V at JC7-2 (P162PJW OR) · B- at JC7-1 (JSGND BR) · 500 to 4500 mV at JC7-3 & PCON C46-11 (C195STC BL/WH) through joystick motion.
		16	Value at 0 V	0V		
		17	Not Calibrated	Not between 2000 & 3000 mV at startup		
22	**PRIMARY UP VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across PCON C20-5 BK & B- (V01PBU RD)
		26	Value too low	Short or Ohms <5		

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
23	**PRIMARY DOWN VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across PCON C20-6 BK & B- (V02PBD RD/BK)
		26	Value too low	Short or Ohms < 5		
24	**PRIMARY BOOM ANGLE SENSOR**	11	Shorted to Supply	>4850 mV	Act as if in Out of Stowed Position · elevated drive speed · no elevated drive due to tilt drive cutout on CE units Note: Driving at 2 MPH is allowed if primary angle sensor is calibrated and the mV value is close to the calibrated, stowed value.	Verify: · 5V from C27-5 to C12-C (P109PWR GR/WH) · B- at Pin C12-A · Signal Output approximately 1000 - 4000 mV across range of motion at LRDCON C27-16 C123 PBS RD/BK) · Cycle Power with problem corrected to clear fault To Calibrate: · Stowed mV must be between 2600 & 3400 mV · Elevated mV must be between 400 & 1200 mV
		16	Value at 0 V	0V		
		17	Not Calibrated	Calibration Not Completed		
		19	Out of Range	Reported angle sensor value out outside normal range more than 3 degrees		
26	**PRIMARY EXTEND VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across TCON C20-3 BK & B- (V07PBE BK)
		26	Value too low	Short or Ohms < 5		
27	**PRIMARY RETRACT VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across TCON C20-4 BK & B- (V08PBR BK/WH)
		26	Value too low	Short or Ohms < 5		

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
36	**JIB UP/PLATFORM ROTATE LEFT VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across PCON C47-4 BK or C9-17 or C6-3 & B- (V17PRL GR) · Can occur during plat. Rotate L uses the same valve with selector.
		26	Value too low	Short or Ohms < 5		
37	**JIB DOWN/PLATFORM ROTATE RIGHT VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across PCON C47-5 BK or C9-18 or C6-4 & B- (V17PRR GR/BK) · Can occur during plat. Rotate L uses the same valve with selector.
		26	Value too low	Short or Ohms < 5		
40	**JIB SELECT VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across PCON C47-3 BK or C10-1 & B- (C19JSV GR/WH)
		26	Value too low	Short or Ohms < 5		
41	**TURNTABLE JOYSTICK**	11	Shorted to Supply	5V	Turntable Rotate disabled	Verify: · 5V at JC7-2 (P162PJW OR) · B- at JC7-1 (JSGND BR) · 500 to 4500 mV at JC7-4 & PCON C46-12 (C165TRS WH/RD) through joystick motion.
		16	Value at 0 V	0V		
		17	Not Calibrated	Not between 2000 & 3000 mV at startup		
42	**TURNTABLE CW VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across TCON C20-9 TCON BK & B- (V04TRL WH)
		26	Value too low	Short or Ohms < 5		
43	**TURNTABLE CCW VALVE**	25	Value too high	Open Circuit or Ohms > 60	Associated Function disabled	· Check Ohms · Verify no open/short circuit across TCON C20-10 BK & B- (V05TRR WH/BK)
		26	Value too low	Short or Ohms < 5		
44	**DRIVE ENABLE TOGGLE SWITCH**	27	Active at Startup	Stuck ON (on @ power up)	Drive disabled	Verify 5V VCON C48-4 (C66DRE BL) when switch is pressed right and 2.5V when pressed left.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
48	**SMALL PUMP ENABLE VALVE COIL**	25	Value too high	Open Circuit or Ohms > 60	fault indicator	· Check Ohms · Verify no open/short circuit across PCON C47-6 BK or C9-13 or C6-1&B- (V241HGP OR/RD)
		26	Value too low	Short or Ohms < 5		
49	**LARGE PUMP ENABLE VALVE COIL**	25	Value too high	Open Circuit or Ohms > 60	fault indicator	· Check Ohms · Verify no open/short circuit across PCON C47-6 BK or C9-13 or C6-1&B- (V241HGP OR/RD)
		26	Value too low	Short or Ohms < 5		
51	**DRIVE JOYSTICK**	11	Shorted to Supply	5V	Drive disabled	Verify: · 5V at JC3-2 (P162JW OR) · B- at JC3-1 (JSGND BR) · 500 to 4500 mV at JC3-4 & PCON C47-2 (C160JPL WH/RD) through joystick motion.
		16	Value at 0 V	0V		
		17	Not Calibrated	Not between 2000 & 3000 mV at startup		
56	**TELEMATICS DEVICE**	13	Not Detected	Genie Telematics device not detected when option is enabled	Only basic telematics functionality	Verify: - CAN bus wiring - Telematics Device is functioning
61	**STEER JOYSTICK**	11	Shorted to Supply	5V	Steer function disabled	Verify: · 5V at JC3-2 (P162JWOR) · B- at JC3-1 (JSGNDBR) · 500-4500 mV at JC3-3 (JC3-5 for dual axis joystick) & PCON C46-11 (C159STC BL/WH) through joystick motion. Note: 1500 to 3500 mV for rocker style joystick at JC3-5
		16	Value at 0 V	0V		
		17	Not Calibrated	Not between 2000 & 3000 mV at startup		

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
64	**HYDRAULIC PRESSURE SENSOR**	11	Shorted to Supply	12V	Warning Calibration affected which can lead to poor operating efficiency	Verify: · 12V (P198SEN RD) on Pin A · Signal (C245PSRGR) at C34-17 · ECON (Approx. 1000 mV at 0 psi, 1800 mV at 1000 psi & 3400 mV at 3000 psi) · B- (SENGND BK) at Pin C
		16	Value at 0 V	0V		
		17	Not Calibrated	Calibration not completed		
68	**FUNCTION ENABLE TOGGLE SWITCH (GROUND CONTROLS)**	27	Active at startup	Stuck ON (on @ power up)	Ground controlled functions disabled	Verify: · no open/short circuit across C3-14 or C20-2 (C47FE WH/BK) to either 24V or B-
71	**E-STOP RELAY**	21	Fault	Relay Contact Stuck -Platform E-stop detected when Key Switch is in Ground Position -or- Platform E-stop not detected when Key Switch is in platform position	All functions disabled	Verify: · Relay in operable condition · LRDCON C27-22 detects Platform E-stop when ON [passes thru C4-4 & C9-4] (P23PWR WH) · Key switch ground position detected at LRDCON C27-14 (C174PWER WH)
72	**LIFT GUARD CONTACT ALARM SWITCH**	14	Cross check fault	NO/NC contacts not connected correctly or welded		
		21	Generic Fault	Switch tripped	Relocate Contact Alarm Switch in the closed position	

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
76	**LOAD SENSE**	12	Overload	Overload condition detected	All functions disabled	Unload the exceeding weight on the Platform
		13	Not Detected	No CAN communication	All functions disabled	Verify CAN connection to LC
		15	Anti Tampering	Negative load detected while boom up triggered	All functions disabled	Check LC mounting and repeat calibration
		17	Not Calibrated	Load Sense not calibrated	All functions disabled	Perform full calibration of the LC
		21	Internal Fault	Vishay VPG internal error status	All functions disabled	Change LC
		23	Too High (Overloaded)	Zero/Full load gain outside limits	All functions disabled	Check calibration weight and LC mounting, repeat calibration, change damaged LC
		31	Invalid Calibration	Crosscheck between controllers failed	All functions disabled	Repeat Calibration, Check LC mounting, Change damaged LC
		36	Invalid Calibration (crosscheck error)	Too much weight in the platform	All functions disabled	Remove weight from platform
77	**VCON LCD DISPLAY (PLATFORM CONTROLS)**	13	Not Detected	No CAN communication	Lift functions disabled	Verify: *24V supply on C48-1 *B- at C48-2 *60 Ohm resistance across CAN+/- C49-1 and C49-2
78	**PCON CONTROLLER (PLATFORM CONTROLS)**	13	Not Detected	No CAN communication	All functions disabled	Verify: *24V supply on C47- 11, C47-12, C46- 2 *B- at C46-1 *60 Ohm resistance across CAN +/- C46-3 and C46-4
		29	Software version mismatch	Wrong software version	All functions disabled	Install correct software version. Revision of TCON & PCON software must match.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
79	**ROUND LCD DISPLAY (GROUND CONTROLS)**	13	Not Detected	No CAN communication	Warning	Verify: · 24V supply on C61-5 · B- at C61-8 · 60 Ohm resistance across CAN +/- C61-1 and C62-2
82	**LOAD SENSE RECOVERY**	21	Fault	Overload was ripped and AUX was used to lower the platform while overloaded	All functions disabled	Enter LCD menu at Platform, Navigate to RESET OVERLOAD RECOVERY (<Enter>,<+>, <+>, <+>) Enter reset pass code: <+>, <+>, <+>, <->
83	**TELEMATICS REMOTE DISABLE**	21	Fault	Unit shut down via remote telematics command	All functions disabled -or- drive speed reduced -or- lift speed reduced	Contact machine owner to have functionality restored
84	**TURNTABLE CHASSIS ANGLE**	13	Not Detected	No CAN communication	· 2WD or 4WD limited to 2.5 MPH (ANSI) · 2WD or 4WD Elevated Drive disabled (CE) · Tilt Alarm ON (Sensor or calibration fault latches, loss of CAN does not)	Verify: · 24V supply on C21-1 · B- at C1-2 · 60 Ohm resistance across CAN +/- C21-3 and C21-4
		17	Calibration not completed	Calibration not completed		Calibrate Level Sensor
		21	Fault	Internal Fault		Replace Sensor
89	**FUEL LEVEL SENSOR**	11	Shorted to Supply	Signal > 4975 mV	Display fault code only	Verify: · 24V supply on pin A of sensor · B1 on pin C · 1700 - 4500 mV on pin B
		12	Value too high	Signal > 4900 mV		
		16	Value too low	Signal < 150 mV		

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
95	**ENGINE RPM**	23	Value too high	Engine Speed higher than setting	Hybrid Mode disabled	Verify: · Proper operation engine high RPM solenoid · Proper engine RPM setting · Normal/Low 2150 RPM (208 Hz) · High 3000 RPM (290 Hz)
		24	Value too low	Engine Speed lower than setting		
96	**LOW OIL PRESSURE OR ENGINE OVER TEMPERATURE**	19	Out of Range	Either the over temperature or low oil pressure switch provided a ground to relay CR64 to shutdown the engine. A time delay of 5 seconds gives the oil pressure time to build after the engine is started.	Hybrid Mode disabled	Verify: · Over temperature switch is not activating Relay CR64 by providing a ground path to the relay coil {unplug oil pressure switch for this test} (C108SEL WH/ BK) · Oil Pressure Switch contacts open to B after engine start (C108SEL WH/BK) · Relay CR64 is operable. Output of relay CR64-87 is connected to C27-4 LRDCON through C35-1 (R108SEL WH/BK))
97	**MOTOR BRAKING FAULT**	21	Fault	Drive motors do not slow during braking	Electric Brakes set	Verify: · Proper operation and calibration of the UTS level sensor · Motor & motor controller phase leads and main power connections
100	**PLATFORM LEVEL UP VALVE**	21	Fault	Open or Shorted	Associated Function disabled	Verify: · no open/short circuit across ECON C34-3 & B- (V14PLU OR)
101	**PLATFORM LEVEL DOWN VALVE**	21	Fault	Open or Shorted	Associated Function disabled	Verify: · no open/short circuit across ECON C34-4 & B- (V14PLD OR/BK)
104	**STEER ANGLE SENSOR**	11	Shorted to Supply	12V	High Speed Drive disabled	Verify: · 12V supply Pin A & RRDCON C28-25 (P198SEN RD) in relation to C28-7 RRDCON (Sensor Ground) · 500-4500mV through steer motion at PIN B &C28-24 (C111LFS OR) and has no open/short circuit to either pin A or pin C · When wheels are straight, signal
		16	Value at 0 V	0V		
		17	Not Calibrated	Calibration not completed		

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
135	**WALL POWERED CHARGER FAULT CODES**	0	No Response	No CAN communication	Charger configuration not possible	Verify: · 24V supply on (+) Terminal · B- on (-) Terminal · 60 Ohm resistance across CAN +/- C22-6 and C22-10
		51	DC-DC failure: LLC excessive leakage fault	Internal charger fault		Remove AC and battery for minimum 30 seconds and retry charger
		52	PFC failure: PFC excessive leakage fault			
		53	PFC has taken too long to boost			
		54	The charger has been unable to calibrate the current offset.			
		55	The output relay voltage too high when relay is closed.			
135	**WALL POWERED CHARGER ERROR CODES**	1	High battery voltage error	Battery Voltage is too high to charge.		· Check the battery voltage and cable connections · Check battery size and condition. (This error will automatically clear once the condition has been corrected.)
		2	Low battery voltage error detected prior to starting a charge cycle	Battery Voltage is too low to charge.		
		3	Charge timeout	Charge Timeout caused by battery pack not reaching required voltage within safe time limit. Possible causes: Charger output reduced due to high temperatures. Poor battery health. Very deeply discharged battery. Poorly connected battery. Extra loads.		· Operate at lower ambient temperature · Replace battery pack · Check DC connections (This error will automatically clear once the charger is reset by cycling DC.)
		4	Battery defective	Battery could not be trickle charged up to the minimum voltage.		· Check for shorted or damaged cells · Replace battery pack · Check DC connections (This error will automatically clear once the charger is reset)

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
135	**WALL POWERED CHARGER ERROR CODES**	7	Ah Limit Exceeded	Safety limit exceeded, possible causes: · Poor battery health. · Discharged battery. · Poorly connected battery. · High parasitic loads on battery while charging.		· Replace battery pack · Check DC connections · Disconnect parasitic loads (This error will automatically clear once the charger is reset by cycling DC.)
		8	Battery temperature out of range error	Battery temperature sensor error.		· Check temperature sensor and connections · Reset charger (This error will automatically clear once the condition has been corrected.) Condition has been corrected.)
		11	Charger is disabled by external command			
		12	Reverse polarity error	Battery is connected the wrong way around.		· Check the battery connections. (This error will automatically clear once the condition has been corrected.)
		13	Battery does not take current	Battery voltage is detected but the charger is unable to charge the battery. This can be due to an electrical device connected between the charger and the battery, which passes through voltage but not current. Or if an algorithm is installed that does not require battery voltage then the charger can try to charge, but if it cannot supply current then this fault would be seen (Lithium application with a BMS perhaps).		Ensure the charger is properly connected to approved equipment (This error will automatically clear once the charger is reset by cycling DC.)
		16	Software upgrade failure			Ensure the USB Flash Drive is properly formatted and retry the update by reinserting the USB Flash Drive into the charger.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
135	**WALL POWERED CHARGER ERROR CODES**	17	USB error	There has been a problem mounting or un-mounting the USB Flash Drive.		· Remove and re-insert the USB Drive · If the condition persists then remove AC and battery for minimum 30 seconds and retry charger
		18	Slot CRC error	The software update failed.		Ensure the USB Flash Drive is properly formatted and retry the update by reinserting the USB Flash Drive into the charger.
		19	Hardware build does not support software version	The charger hardware does not support the new software version trying to be programmed. Existing SW is left running.		Contact Product Support
		20	No active algorithm selected	There is no active charge profile selected.		Select a charge profile.
		21	High battery voltage error detected while charging	Battery voltage is too high as detected by the algorithm.		Check the battery voltage and cable connections. (This error will automatically clear once the condition has been corrected.)
		22	Low battery voltage error detected while charging	Battery voltage is too low as detected by the algorithm.		Check the battery voltage and cable connections. (This error will automatically clear once the condition has been corrected.)
		23	High AC voltage error (>270VAC)	AC voltage is too high.		Connect charger to an AC source that provides stable AC between 85 - 270 VAC / 45-65 Hz. (This error will automatically clear once the condition has been corrected.)
		24	Failure to initialize	The charger has failed to turn on properly.		Disconnect AC input and battery for 30 seconds before retrying.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
135	**WALL POWERED CHARGER ERROR CODES**	25	Low AC voltage oscillation error	AC source is unstable. Could be caused by undersized generator and/or severely undersized input cables.		Connect charger to an AC source that provides stable AC between 85 - 270 VAC / 45-65 HZ. (This error will automatically clear once the condition has been corrected.)
		26	Script Failure	The software update failed.		Ensure the USB Flash Drive is properly formatted and retry the update by reinserting the USB Flash Drive into the charger.
		27	USB overcurrent fault	USB hardware overcurrent protection has been tripped		Remove and reinsert USB flash drive. (If condition persists, try using a different USB flash drive.)
		28	Charge profile incompatibility	USB hardware overcurrent protection has been tripped.		Update charger software or select a different charging profile.
		29	CAN Bus error	CANbus network error.		Check the physical CAN connector, electrical bus conditions and other CAN modules for correct functioning. For example check termination resistance is approximately 60ohms.
		30	COMM battery module error	CANbus battery module error		Check the CANbus battery module for correct functioning.
		31	The Vref for the ADC measurements has triggered an alarm	Internal charger error.		Remove AC and battery for minimum 30 seconds and retry charger.
		32	CAN Bus heartbeat error	CANbus heartbeat error.		Check the networked CANbus device(s) for correct functioning.

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
135	**WALL POWERED CHARGER ERROR CODES**	36	Battery Temperature Sensor Error	Battery temperature sensor is required by charge profile (battery temperature compensated algorithm) by it is not installed.		Check if sensor is connected correctly if alarm is shown or ensure the charge profile installed does not require temperature compensation.
		37	Stalled Cooling Fan Motor	Fan will not turn when commanded, rotor must be locked		Fan is obstructed, inspect the fan and clear the blockage.
		38	CANOpen reprogramming failed			Re-try CANOpen download or re-program using the USB

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
136	**Pump [ECON]**	0	No Response	No CAN communication	Drive disabled	Verify: 48V on C25-1, C25-11, C25-12 (R181PWR OR)
		12	Controller Overcurrent		Cut Drive, EM Brake	Cycle Power
		13	Current Sensor Fault		Cut Drive, EM Brake	Cycle Power
		14	Precharge Failed		Cut Drive, EM Brake	VCL/PC
		15	Controller Severe Undertemp		Cut Drive, EM Brake	Cycle Power
		16	Controller Severe Overtemp		Cut Drive, EM Brake	Cycle Power
		17	Severe B+ Undervoltage		None	Auto
		18	Severe B+ Overvoltage		Cut Drive, EM Brake	Cycle Power
		22	Controller Overtemp Cutback		None	Auto
		23	B+ Undervoltage Cutback		None	Auto
		24	B+ Overvoltage Cutback		None	Auto
		25	+5V Supply Failure		None	Auto
		26	Digital Out 6 Overcurrent		None	Auto
		27	Digital Out 7 Overcurrent		None	Auto
		28	Motor Temp Hot Cutback		None	Auto
		29	Motor Temp Sensor Fault		Limit Speed to Limited Operation Strategy (LOS)	Auto
		31	Coil1 Driver Open Short		None	Auto
		31	Main Open/Short		Cut Drive, EM Brake None	Auto
		32	Coil2 Driver Open/Short		None	Auto
		32	EMBrake Open/Short		Cut Drive,Regen Brake	Auto
		33	Coil3Driver Open/Short		None	Auto
		34	Coil4Driver Open/Short		None	Auto
		35	PD Open/Short		None	Auto

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
136	**Pump [ECON]**	36	Encoder Fault	Limit Speed to LOS		Cycle Power
		37	Motor Open	Cut Drive, EM Brake		Cycle Power
		38	Main Contactor Welded	Cut Drive, EM Brake		Cycle Power
		39	Main Contactor Did Not Close	Cut Drive, EM Brake		Cycle Power
		46	EEPROM Failure	Cut Drive, EM Brake		Cycle Power
		47	HPD/Sequencing Fault	None		Auto
		49	Parameter Change Fault	Cut Drive, EM Brake		Cycle Power
		68	VCL Runtime Error	Cut Drive, EM Brake		Cycle Power
		69	External Supply Out of Range	None		Auto
		71	OS General	Cut Drive, EM Brake		Cycle Power
		72	PDO Timeout	None		Auto
		73	Stall Detected	LOS/Reduce Drive		Cycle Power
		77	Supervisor Fault	Cut Drive, EM Brake		Cycle Power
		78	Supervisor Incompatible	Cut Drive, EM Brake		Cycle Power
		82	Bad Calibrations	Cut Drive, EM Brake		Cycle Power
		83	Driver Supply Fault	Cut Drive, EM Brake		Cycle Power
		84	Following Error Fault	Cut Drive, EM Brake		Cycle Power
		87	Motor Characterization Fault	Cut Drive, EM Brake		Cycle Power
		88	Encoder Steps Count Fault	Cut Drive, EM Brake		Cycle Power
		89	Motor Type Fault	Cut Drive, EM Brake		Cycle Power
		91	Motor Type Fault	Cut Drive, EM Brake		VCL/PC
		92	EM Brake Failed to Set	Cut Drive, EM Brake		Auto
		93	Encoder LOS	Limit Speed to LOS		Auto
		98	Illegal Model Number	Cut Drive, EM Brake		VCL/PC
		99	Parameter Change Fault	Cut Drive, EM Brake		Cycle Power

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
160	**STEER LEFT VALUE**	21	Fault	Open or Shorted	Associated Function disabled	Verify: · no open/short circuit across RRDCON C28-4 & B- (V37SCC BL/BK)
161	**STEER RIGHT VALUE**	21	Fault	Open or Shorted	Associated Function disabled	Verify: · no open/short circuit across RRDCON C28-3 & B- (V36SCW BL)
190	**RIGHT REAR DRIVE MOTOR**	21	Fault	Internal Motor Controller Fault	Reduced Speed Drive, Wheel affected locked	Verify: · Mechanical motor/gearbox coupling, EM brake functionality, Phases wiring
		25	Value too high	Motor is stalled and/or locked	EM brake set, Main Contactor Open, No Drive	
191	**LEFT REAR DRIVE MOTOR**	21	Fault	Internal Motor Controller Fault	Reduced Speed Drive, Wheel affected locked	Verify: · Mechanical motor/gearbox coupling, EM brake functionality, Phases wiring
		25	Value too high	Motor is stalled and/or locked	EM brake set, Main Contactor Open, No Drive	
192	**RIGHT FRONT DRIVE MOTOR**	21	Fault	Internal Motor Controller Fault	Reduced Speed Drive, Wheel affected locked	Verify: · Mechanical motor/gearbox coupling, EM brake functionality, Phases wiring
		25	Value too high	Motor is stalled and/or locked	EM brake set, Main Contactor Open, No Drive	
193	**LEFT FRONT DRIVE MOTOR**	21	Fault	Internal Motor Controller Fault	Reduced Speed Drive, Wheel affected locked	Verify: · Mechanical motor/gearbox coupling, EM brake functionality, Phases wiring
		25	Value too high	Motor is stalled and/or locked	EM brake set, Main Contactor Open, No Drive	
194	**RIGHT REAR BRAKE COIL**	21	Fault	Brake Motor Coil Failure (shorted, open circuit)		Check Brake Motor Coil wirings
195	**LEFT REAR BRAKE COIL**					
196	**RIGHT FRONT BRAKE COIL**					
197	**LEFT FRONT BRAKE COIL**					

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
198	**RIGHT REAR SPEED SENSOR**	21	Fault	Motor Sin/Cos Encoder feedback signal fault		Verify: · Motor Encoder (Sin/Cos) wirings
199	**LEFT REAR SPEED SENSOR**					
200	**RIGHT FRONT SPEED SENSOR**					
201	**LEFT FRONT SPEED SENSOR**					
204	**MAIN BATTERY POWER PACK VOLTAGE**	23	Value too high	Main 48V battery package voltage is exceeding maximum rating		Recharge the battery package, check for any wiring issue on the 48V power wirings paths
		24	Value too low	Main 48V battery package voltage is below minimum rating		
205	**DRIVE POWER CONTACTOR**	21	Fault	Main contactor does not close correctly	No Drive on any wheel drive	Check Main Contactor wiring or possible component damage
		27	Active at startup	Main contactor is found closed at power ON (welded contactor)	No Drive on any wheel drive	Check Main Contactor wiring or possible component damage
255	**RIGHT REAR DRIVE MOTOR TEMPERATURE**	20	Generic Warning	Motor Temperature exceeded warning temperature limit	Limited Speed Drive	Allow the motors to cool down, check for damaged gearbox or motor
		21	Generic Fault	Motor Temperature exceeded maximum rated temperature limit	No Drive	Allow the motors to cool down, check temperature sensor wirings, check for damaged gearbox or motor
256	**LEFT REAR DRIVE MOTOR TEMPERATURE**	20	Generic Warning	Motor Temperature exceeded warning temperature limit	Limited Speed Drive	Allow the motors to cool down, check for damaged gearbox or motor
		21	Generic Fault	Motor Temperature exceeded maximum rated temperature limit	No Drive	Allow the motors to cool down, check temperature sensor wirings, check for damaged gearbox or motor

Control System Fault Codes

257	**RIGHT FRONT DRIVE MOTOR TEMPERATURE**	20	Generic Warning	Motor Temperature exceeded warning temperature limit	Limited Speed Drive	Allow the motors to cool down, check for damaged gearbox or motor
		21	Generic Fault	Motor Temperature exceeded maximum rated temperature limit	No Drive	Allow the motors to cool down, check temperature sensor wirings, check for damaged gearbox or motor
258	**LEFT FRONT DRIVE MOTOR TEMPERATURE**	20	Generic Warning	Motor Temperature exceeded warning temperature limit	Limited Speed Drive	Allow the motors to cool down, check for damaged gearbox or motor
		21	Generic Fault	Motor Temperature exceeded maximum rated temperature limit	No Drive	Allow the motors to cool down, check temperature sensor wirings, check for damaged gearbox or motor

Control System Fault Codes

Error Source		Error Type				
ID	**Component**	**ID**	**Name**	**Cause**	**Effect**	**Solution**
259	**RIGHT REAR DRIVE CONTROLLER TEMPERATURE**	20	Generic Warning	Motor Controller Temperature exceeded or is below the warning temperature limit	Limited Speed Drive	Allow the motor controller to cool down or allow the to exit from too low Temperature warning temperature threshold
		23	Value too high	Motor Controller Temperature exceeded the maximum temperature limit	No Drive	Allow the motor controller to cool down, check dissipation plate connection status, check for component damage
		24	Value too low	Motor Controller Temperature exceeded the minimum temperature limit	No Drive	Move the machine in a warmer place or de-freeze
260	**LEFT REAR DRIVE CONTROLLER TEMPERATURE**	20	Generic Warning	Motor Controller Temperature exceeded or is below the warning temperature limit	Limited Speed Drive	Allow the motor controller to cool down or allow the to exit from too low Temperature warning temperature threshold
		23	Value too high	Motor Controller Temperature exceeded the maximum temperature limit	No Drive	Allow the motor controller to cool down, check dissipation plate connection status, check for component damage
		24	Value too low	Motor Controller Temperature exceeded the minimum temperature limit	No Drive	Move the machine in a warmer place or de-freeze
261	**RIGHT FRONT DRIVE CONTROLLER TEMPERATURE**	20	Generic Warning	Motor Controller Temperature exceeded or is below the warning temperature limit	Limited Speed Drive	Allow the motor controller to cool down or allow the to exit from too low Temperature warning temperature threshold
		23	Value too high	Motor Controller Temperature exceeded the maximum temperature limit	No Drive	Allow the motor controller to cool down, check dissipation plate connection status, check for component damage
		24	Value too low	Motor Controller Temperature exceeded the minimum temperature limit	No Drive	Move the machine in a warmer place or de-freeze

Control System Fault Codes

262	**LEFT FRONT DRIVE CONTROLLER TEMPERATURE**	20	Generic Warning	Motor Controller Temperature exceeded or is below the warning temperature limit	Limited Speed Drive	Allow the motor controller to cool down or allow the to exit from too low Temperature warning temperature threshold
		23	Value too high	Motor Controller Temperature exceeded the maximum temperature limit	No Drive	Allow the motor controller to cool down, check dissipation plate connection status, check for component damage
		24	Value too low	Motor Controller Temperature exceeded the minimum temperature limit	No Drive	Move the machine in a warmer place or de-freeze
269	**OSCILLATE PROPORTIONAL ELECTRICAL PRESSURE REDUCING VALVE**	25	Value too high	Open circuit or resistance >334 ohm	Extend Functions disabled	- Check Ohms - Verify no open/short circuit across TCON C20-41 (V55AXO GR/BK) - Can occur during driving, steering or turntable rotation.
		26	Value too low	Closed circuit or resistance <95 ohm	Extend Functions disabled	- Check Ohms - Verify no open/short circuit across TCON C20-41 (V55AXO GR/BK) - Can occur during driving, steering or turntable rotation.

Charger Fault Codes

Battery Charger

The charger continuously monitors internal and external conditions. Fault and Error codes are generated by the charger to indicate that an internal or external malfunction has been detected in the electrical system. The types of Diagnostic Trouble Codes that may occur are explained below.

Type "F" codes è Indicate an internal fault condition has occurred and caused charging to stop.

Type "E" codes - Indicate an external fault condition has occurred and caused charging to stop.

Type "P" code - Indicates charger programming mode is active. This will occur when the charger profile is being configured.

Type "USB" code - Indicates the USB interface is active, and the USB should not be removed. This will occur when the charger firmware is being updated.

 Solid red - Internal fault condition. Type "F" fault code.

 Flashing amber - External fault condition. Type "E" error code.

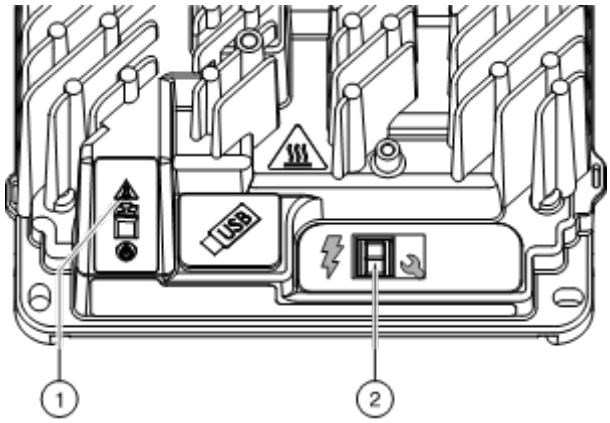
 Flashing green - USB interface is active.

 Solid green - Firmware update is complete. Remove USB from charger.

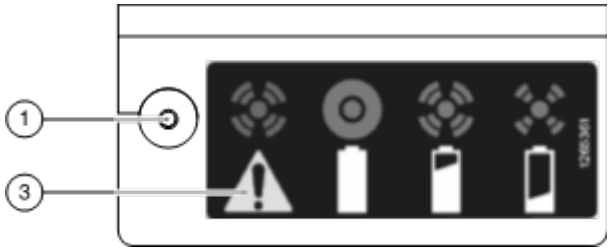
Codes are displayed as F, E or P and followed by three numbers and a period (example: E-0-0-4). The charger can display multiple codes.

If the batteries are changed from one type to another, (example: flooded lead acid to AGM), the charger profile must be programmed. Refer to Repair Procedure, *Programming the Charger Profile*.

Charger Fault Codes



Charger status indicators



Remote charger status indicators

1 Error / Fault / USB indicator
2 Charger profile / Error display
3 Error / Fault

Charger Fault Codes

Charger Fault Code	Genie Fault ID	Genie Fault Type	Description	Possible Causes	**Solution**
F-0-0-1	135	8	DC-DC failure: LLC excessive leakage fault.	Internal charger fault.	Disconnect AC input and battery pack for 30 seconds. If fault does not clear, replace charger.
F-0-0-2	135	8	PFC failure: PFC excessive leakage fault.		
F-0-0-3	135	8	PFC taken too long to boost.		
F-0-0-4	135	8	Charger unable to calibrate current offset.		
F-0-0-5	135	8	Output relay voltage too high when closed.		

Charger Error Codes

Charger Error Code	Genie Fault ID	Genie Fault Type	Description	Condition	Possible Causes
E-0-0-1	131	23	High battery voltage	Battery voltage too high to charge.	Check battery voltage and cable connections. Self clearing when condition has been corrected.
E-0-0-2	131	24	Low battery voltage detected prior to starting charge cycle	Battery voltage too low to charge.	Check battery voltage and cable connections. Check battery condition. Self clearing when condition has been corrected.
E-0-0-3	135	28	Charge timeout	Charge timeout caused by battery pack not reaching required voltage within safe time limit.	Charge output reduced due to high temperature. Charge at lower temperature. Check battery condition. Replace damaged battery. Check battery connections. Battery pack deep discharge. Disconnect battery pack for 30 seconds to clear fault when condition has been corrected.
E-0-0-4	204	21	Defective battery	Battery pack could not be trickle charged up to the minimum voltage.	Check battery condition. Replace damaged battery. Check battery connections. Disconnect battery pack for 30 seconds to clear fault when condition has been corrected.
E-0-0-7	264	23	Amp hour limit exceeded	Safety limit exceeded.	Check battery condition. Replace damaged battery. Check battery connections. Battery pack deep discharge. High parasitic loads on battery pack while charging. Disconnect parasitic loads. Disconnect battery pack for 30 seconds to clear fault when condition has been corrected.

Charger Fault Codes

Charger Error Codes

Charger Error Code	Genie Fault ID	Genie Fault Type	Description	Condition	Possible Causes
E-0-0-8	233	19	Battery temperature out of range	Battery temperature sensor.	Check temperature sensor and electrical connections. Rest charger. Disconnect AC power for 30 seconds. Self clearing when condition has been corrected.
E-0-1-1	135	8	Charger disabled by external command	Battery pack not being charged..	Power outage. AC power disconnected before charging complete.
E-0-1-2	135	8	Reverse polarity	Battery connected incorrectly.	Check battery connections. Self clearing when condition has been corrected.
E-0-1-3	204	21	Battery does not take current	Battery voltage is detected, but charger is unable to charge the battery pack..	Incorrect profile for battery type. Installed from a different machine with different battery type. Disconnect battery pack for 30 seconds to clear fault when condition has been corrected.
E-0-1-6	135	8	Software update failed	Software update failed.	Confirm USB Flash Drive is formatted with correct software. If software update continues to fail, contact Genie Product support.
E-0-1-7	265	21	USB error	USB not connected correctly.	Remove and re-insert USB Flash Drive Disconnect AC input and battery pack for 30 seconds.
E-0-1-8	135	8	Slot CRC error	Software update failed.	Confirm USB Flash Drive is formatted with correct software. If software update continues to fail, contact Genie Product support.
E-0-1-9	135	29	Hardware does not support software	Charger hardware does not support software version being programmed.	Confirm USB Flash Drive is formatted with correct software. If software update continues to fail, contact Genie Product support.
E-0-2-0	266	31	No algorithm selected	Charger profile not programmed.	Program the charger for the proper battery profile.

Charger Error Codes

Charger Error Code	Genie Fault ID	Genie Fault Type	Description	**Condition**	Possible Causes
E-0-2-1	254	23	High battery voltage detected while charging	Battery voltage too high as detected by charger profile.	Check battery voltage and cable connections. Confirm charger profile is programmed for correct battery type. Self clearing when condition has been corrected.
E-0-2-2	254	24	Low battery voltage detected while charging	Battery voltage too low as detected by charger profile.	Check battery voltage and cable connections. Confirm charger profile is programmed for correct battery type. Self clearing when condition has been corrected.
E-0-2-3	267	23	High AC voltage	AC voltage greater than 270 VAC.	Connect to a stable AC source between 85 - 270 VAC / 45 - 65 Hz. Self clearing when condition has been corrected.
E-0-2-4	135	8	Failure to initialize	Charger failed to turn on correctly.	Disconnect AC input and battery pack for 30 seconds. Contact Genie Product Support.
E-0-2-5	267	24	Low AC voltage oscillation	AC voltage unstable.	Connect to a stable AC source between 85 - 270 VAC / 45 - 65 Hz. Using an undersized generator. Self clearing when condition has been corrected.
E-0-2-6	135	8	Script failure	Software update failed.	Confirm USB Flash Drive is formatted with correct software. If software update continues to fail, contact Genie Product support.
E-0-2-7	265	21	USB over current fault	USB over current protection has been tripped.	Remove and re-insert USB Flash Drive Use different USB Flash drive.
E-0-2-8	266	21	Charge profile incompatibility	Selected charger profile is not compatible with charger software.	Update charger software. Confirm charger profile is programmed for correctly. Updating current firmware and error occurs, contact Genie Product Support.

Charger Fault Codes

Charger Error Codes

Charger Error Code	Genie Fault ID	Genie Fault Type	Description	Condition	Possible Causes
E-0-2-9	135	18	CAN Bus error	CAN Bus network error.	Check CAN Bus connections. CAN modules not functioning correctly. Termination resistance is ~60 ohms.
E-0-3-0	135	8	COMM battery module error	CAN Bus battery module error.	CAN Buss battery module not functioning correctly.
E-0-3-1	135	8	Vref for ADC measurements triggered alarm	Internal charger error.	Disconnect AC input and battery pack for 30 seconds. Contact Genie Product Support.
E-0-3-2	135	13	CAN Bus heartbeat error	CAN Bus heartbeat error.	CAN Bus devices not functioning correctly.
E-0-3-6	233	21	Battery temperature sensor charge profile	Battery temperature sensor is required by charger profile but is not installed.	Check battery temperature sensor connections. Check charger profile and confirm battery temperature sensor is installed.
E-0-3-7	135	8	CAN Open Error	CAN Open reprogramming failed.	Download CAN Open software. Reprogram charger using USB Flash Drive.
E-0-3-8	268	21	Stalled cooling fan	Fan obstructed.	Inspect fan for damage Clear blockage.

Pump Control Fault Codes

Pump Controller Fault Handling

The pump controller is located on the engine side of the machine and mounted to the battery compartment.

The pump controller can detect faults or error conditions. Faults can also be detected by the machine control system and PCON display.

Diagnostics information can be obtained by observing the fault code ID issued by the flashing status LEDàs.

The controller status LEDàs produce flash code IDàs displaying all the currently set faults in a repeating cycle. Each code ID consists of two digits.

The red LED flashes once to indicate that the first digit of the code ID will follow; the yellow LED then flashes the appropriate number of times for the first digit.

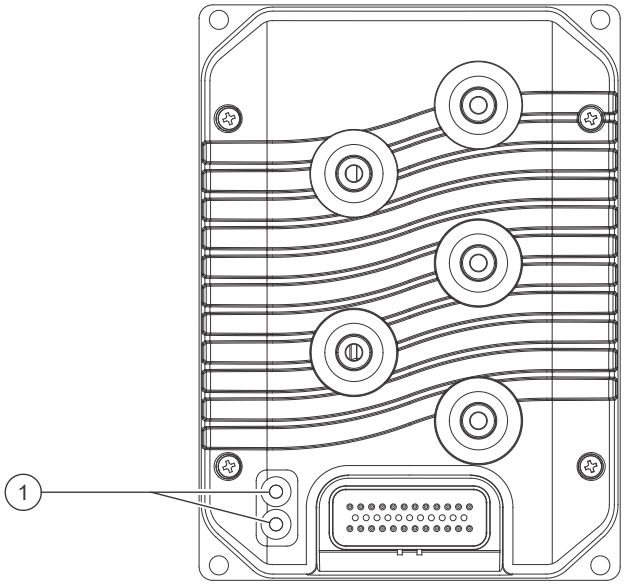
The red LED flashes twice to indicate that the second digit of the code ID will follow; the yellow LED flashes the appropriate number of times for the second digit.

Example:

The controller LEDàs will display this repeating pattern:

Fault Code	Name
23	B+ Undervoltage Cutback

Red	Yellow	Red	Yellow
*	* *	* *	* * *
first digit	2 flashes	second digit	3 flashes



1 status LED

Pump Control Fault Codes

LED Display Format:

The LEDs have five different display modes, indicating the type of information they are providing.

Display	Status
Neither LED illuminated	• Controller is not powered on. • Faulty battery. • Replace controller.
Yellow LED flashing	• Controller is operating normally.
Red and yellow LEDs on solid	• Controller is in flash program mode.
Red LED on solid	• Internal hardware fault detected by the Supervisor or Primary microprocessor. • Missing or corrupt software. Interrupting a software download may cause corruption of the software. Cycle the key switch to clear. Reload software or replace controller if necessary.
Alternating red and yellow flash pattern	• Active fault.

When a fault is detected and no wiring or component failure can be found, cycle the key switch off and back on to see if the fault clears.

- If the fault does not clear, turn the key switch to the off position and push in the red Emergency Stop button. Disconnect the 35 pin connector from the controller. Check the connector for corrosion or damage, clean it if necessary, and reconnect it to the controller.

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
1-2	Controller Overcurrent	1. External short of phase U,V, or W motor connections 2. Motor parameters are miss-tuned 3. Controller defective 4. Speed encoder noise problems	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Phase current exceeded the current measurement limit Clear: Cycle KSI.
1-3	Current Sensor Fault	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator) 2. Controller defective	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Controller current sensors have invalid offset reading Clear: Cycle KSI.
1-4	Precharge Failed	1. See Monitor menu ò Battery: Capacitor Voltage 2. Open circuit in external precharge relay, external precharge resistor, or associated wiring 3. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Precharge failed to charge the capacitor bank from the external precharge resistor Clear: Cycle Interlock input or use VCL function Enable_Precharge()
1-5	Controller Severe Undertemp	1. See Monitor menu ò Controller: Temperature 2. Controller is operating in an extreme environment	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Heatsink temperature below -40¡C Clear: Bring heatsink temperature above -40¡C, and cycle interlock or KSI
1-6	Controller Severe Overtemp	1. See Monitor menu ò Controller: Temperature 2. Controller is operating in an extreme environment 3. Excessive load on vehicle 4. Improper mounting of controller	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake.	Set: Heatsink temperature above +95¡C Clear: Bring heatsink temperature below +95¡C, and cycle interlock or KSI
1-7	Severe B+ Undervoltage	1. Battery parameters are misadjusted 2. Non-controller system drain on battery 3. Battery resistance too high 4. Battery disconnected while driving 5. See Monitor menu ò Battery: Capacitor Voltage 6. Blown B+ fuse or main contactor did not close	Reduced drive torque	Set: Capacitor bank voltage dropped below the Severe Undervoltage limit with FET bridge enabled Clear: Bring capacitor voltage above Severe Undervoltage limit

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
1-8	Severe B+ Overvoltage	1. See Monitor menu ò Battery: Capacitor Voltage 2. Battery parameters are misadjusted 3. Battery resistance too high for given regen current 4. Battery disconnected while regen braking	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Capacitor bank voltage exceeded the Severe Overvoltage limit with FET bridge enabled Clear: Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI
2-2	Controller Overtemp Cutback	1. See Monitor menu ò Controller: Temperature 2. Controller is performance-limited at this temperature 3. Controller is operating in an extreme environment 4. Excessive load on vehicle 5. Improper mounting of controller	Reduced drive and brake torque	Set: Heatsink temperature exceeded 85¡C Clear: Bring heatsink temperature below 85¡C
2-3	B+ Undervoltage Cutback	1. Normal operation. Fault indicates the batteries need recharging. Controller is performance limited at this voltage 2. Battery parameters are misadjusted 3. Non-controller system drain on battery 4. Battery resistance too high 5. Battery disconnected while driving 6. See Monitor menu ò Battery: Capacitor Voltage 7. Blown B+ fuse or main contactor did not close	Reduced drive torque	Set: Capacitor bank voltage dropped below the Undervoltage limit with the FET bridge enabled Clear: Bring capacitor voltage above the Undervoltage limit
2-5	+5V Supply Failure	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage 2. Battery parameters are misadjusted 3. Battery resistance too high for given regen current 4. Battery disconnected while regen braking 5. See Monitor menu ò Battery: Capacitor Voltage	None	Set: +5V supply (pin 26) outside the 5 Vº 10% range Clear: Bring voltage within range
2-6	Digital Out 6 Open/Short	External load impedance on Digital Output 6 driver (pin 19) is too low	Digital Output 6 driver will not turn on	Set: Digital Output 6 (pin 19) current exceeded 1 Amp Clear: Remedy the overcurrent cause and cycle power
2-7	Digital Out 7 Open/Short	External load impedance on Digital Output 7 driver (pin 20) is too low	Digital Output 7 driver will not turn on	Set: Digital Output 7 (pin 20) current exceeded 1 Amp Clear: Remedy the overcurrent cause and cycle power

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
2-8	Motor Temp Hot Cutback	1. Motor temperature is at or above the programmed Temperature Hot setting, and the current is being cut back 2. Motor Temperature Control Menu parameters are miss-tuned 3. See Monitor menu ò Motor: Temperature and ò Inputs: Analog2 4. If the application doesnà use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off	Reduced drive torque	Set: Motor temperature is at or above the Temperature Hot parameter setting Clear: Bring the motor temperature within range
2-9	Motor Temp Sensor Fault	1. Motor thermistor is not connected properly 2. If the application doesnà use a motor thermistor, Motor Temp Sensor Enable should be programmed Off 3. See Monitor menu ò Motor: Temperature and ò Inputs: Analog2	MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled	Set: Motor thermistor input (pin 8) is at the voltage rail (0 V or 10 V) Clear: Bring the motor thermistor input voltage within range
3-1	Main Open/Short	1. Open or short on driver load 2. Dirty connector pin 3. Bad crimps or faulty wiring	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Main contactor driver (pin 6) is either open or shorted. This fault can be set only when Main Enable = On Clear: Correct open or short, and cycle driver
3-2	EMBrake Open/Short (Start Relay)	1. Open or short on driver load 2. Dirty connector pins 3. Bad crimps or faulty wiring	ShutdownEMBrake; ShutdownThrottle; FullBrake Will drag tire with the bad brake	Set: Electromagnetic brake driver (pin 5) is either open or shorted. This fault can be set only when EM Brake Type >0 Clear: Correct open or short, and cycle driver
3-3	Coil3 Driver Open/Short (Ignition Relay)	1. Open or short on driver load 2. Dirty connector pins 3. Bad crimps or faulty wiring	ShutdownDriver3	Set: Driver 3 (pin 4) is either open or shorted Clear: Correct open or short, and cycle driver
3-4	Coil4 Driver Open/Short (High RPM Solenoid)	1. Open or short on driver load 2. Dirty connector pins 3. Bad crimps or faulty wiring	ShutdownDriver4	Set: Driver 4 (pin 3) is either open or shorted Clear: Correct open or short, and cycle driver

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
3-5	Proportional Driver Open/Short (Proportional Relief Valve)	1. Open or short on driver load 2. Dirty connector pins 3. Bad crimps or faulty wiring	ShutdownPD	Set: Proportional driver (pin 2) is either open or shorted Clear: Correct open or short, and cycle driver
3-6	Encoder Fault	1. Motor encoder failure 2. Bad crimps or faulty wiring 3. See Monitor menu ò Motor: Motor RPM	ShutdownEMBrake; Motor disabled	Set: Motor encoder phase failure detected Clear: Either cycle KSI, or if parameter LOS Upon Encoder Fault= On and Interlock has been cycled, then the Encoder Fault is cleared and Encoder LOS fault (code 93) is set, allowing limited motor control
3-7	Motor Open	1. Motor phase is open 2. Bad crimps or faulty wiring	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Motor phase U, V, or W detected open Clear: Cycle KSI
3-8	Main Contactor Welded	1. Main contactor tips are welded closed 2. Motor phase U or V is disconnected or open 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal)	ShutdownEMBrake; Motor disabled	Set: Motor encoder phase failure detected Clear: Cycle Power to KSI
3-9	Main Contactor Did Not Close	1. Main contactor did not close 2. Main contactor tips are oxidized, burned, or not making good contact 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging 4. Blown B+ fuse	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge Clear: Cycle KSI Power
4-6	EEPROM Failure	Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: Controller operating system tried to write to EEPROM memory and failed Clear: Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI
4-9	Parameter Change Fault	This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Adjustment of a parameter setting that requires cycling of KSI Clear: Cycle Power to KSI

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
6-8	VCL Runtime Error	1. VCL code encountered a runtime VCL error 2. See Monitor menu ò Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: Runtime VCL code error condition Clear: Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter defaults; cycle KSI
7-1	OS General	Internal controller fault	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake	Set: Internal controller fault detected Clear: Cycle Power to KSI.
7-2	PDO Timeout	Time between CAN PDO messages received exceeded the PDO Timeout Period	ShutdownThrottle; CAN NMT State set to Pre-operational	Set: Time between CAN PDO messages received exceeded the PDO Timeout Period Clear: Cycle KSI or receive CAN NMT message
7-3	Stall Detected	1. Stalled motor 2. Motor encoder failure 3. Bad crimps or faulty wiring 4. Problems with power supply for the motor encoder 5. See Monitor menu ò Motor: Motor RPM	ShutdownEMBrake; Motor disabled; Control Mode changed to LOS (Limited Operating Strategy)	Set: No motor encoder movement detected Clear: Cycle Power to KSI
7-7	Supervisor Fault	1. The Supervisor has detected a mismatch in redundant readings 2. Internal damage to Supervisor microprocessor 3. Switch inputs allowed to be within upper and lower thresholds for over 100 milliseconds	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: Mismatched redundant readings; damaged Supervisor; illegal switch inputs Clear: Check for noise or voltage drift in all switch inputs; check connections; cycle KSI

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
7-8	Supervisor In-compatible	The main OS is not compatible with the Supervisor OS	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: Incompatible software Clear: Load properly matched OS code or update the Supervisor code; cycle KSI
8-2	Bad Calibration	Internal controller fault	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Internal controller fault detection Clear: Cycle Power to KSI
8-3	Driver Supply Fault	Internal controller fault in the voltage supply for the driver circuits	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Internal controller fault detection Clear: Cycle Power to KSI
8-4	Following Error Fault	1.vThe Following Error Limit has been exceeded for the Following Error Time 2. Incorrect or overly restrictive Following Error Limit and Following Error Time parameter settings 3. Motor or drive train rotation obstruction or degradation	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: The Following Error Limit has been exceeded for the Following Error Time Clear: Cycle Power to KSI
8-8	Encoder Pulse Count Fault	Encoder Steps parameter does not match the actual motor encoder	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: Motor lost IFO control and accelerated without throttle command Clear: Ensure the Encoder Steps parameter matches the actual encoder; Cycle Power to KSI

Pump Control Fault Codes

Flash Pattern	Name	Cause	Effect	Solution
8-9	Motor Type Fault	The Motor_Type parameter value is out of range	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Cycle Power
9-1	VCL/OS Mismatch	The VCL software in the controller does not match the OS software in the controller	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1,2,3 &4; ShutdownPD; FullBrake	Set: VCL & OS software do not match; when KSI cycles, a check is made to verify that they match & a fault occurs when they don't Clear: Download the correct VCL and OS software into the controller
9-2	EM Brake Failed to Set (no brake on pump motor)	1. Vehicle movement sensed after the EM Brake has been commanded to set 2. EM Brake will not hold the motor from rotating	ShutdownEMBrake; ShutdownThrottle Position Hold is engaged when Interlock = On	Set: After the EM Brake was commanded to set & time has elapsed to allow the brake to fully engage, vehicle movement sensed Clear: Activate the Interlock
9-8	Illegal Model Number	1. Model_Number variable contains illegal value 2. Software and hardware do not match 3. Controller defective	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Set: Illegal Model_Number variable; when KSI cycles, a check is made to confirm a legal Model_ Number, and a fault is issued if one is not found Clear: Download appropriate software for controller model
9-9	Parameter Mismatch	1. Dual drive enabled on one controller 2. Incorrect position feedback type chosen for motor technology in use 3. Dual drive is enabled in torque mode	ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake	Clear: Adjust parameters to appropriate values and cycle KSI

Drive Control Fault Codes

Drive Controller Fault Handling

The drive controllers are located on the ground controls side of the machine and mounted to the bulkhead.

The drive controller can detect faults or error conditions. Faults can also be detected by the machine control system and PCON display. The fault displayed is the four digit CAN Object.

The faults list is in the numerical flash code order. The fault's name and CAN Object are listed, including the fault type.

Cause, Effect and Solution are also listed. Effect is "what the controller will doówhen the fault is active.

Diagnostics information can be obtained by observing the flash pattern issued by the status LED.

The controller status LED produces flash code IDæs displaying all the currently set faults in a repeating cycle. Each code ID consists of two digits.

The LED flashes red indicating the first digit of the code ID.

The LED flashes yellow indicating the second digit of the code ID.

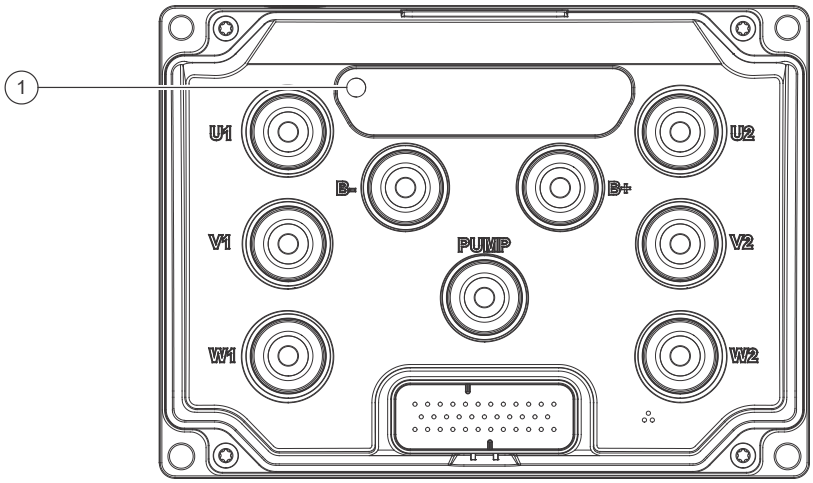
Example:

The controller's LED will display this repeating pattern:

Note: The CAN Object is displayed at the PCON.

CAN Object	Fault Code	Name
2121	23	Undervoltage Cutback

Red	Yellow
✱✱ 2 flashes	✲✲✲ 3 flashes



1 status LED

Drive Control Fault Codes

LED Display Format:

The LED has six different display modes, indicating the type of information it is providing.

Display	Status
LED not illuminated	• Controller is not powered on. • Faulty battery. • Replace controller.
Yellow LED flashing	• Controller is operating normally.
Yellow LED on solid	• Controller is in flash program mode.
Alternating red and yellow flash pattern	• Active fault.
Red LED on solid	• Internal hardware fault detected by the Supervisor or Primary microprocessor. • Missing or corrupt software. Interrupting a software download may cause corruption of the software. Cycle the key switch to clear. Reload software or replace controller if necessary.
Red LED flashing	• Non-production device profile software.

When a fault is detected and no wiring or component failure can be found, cycle the key switch off and back on to see if the fault clears.

If the fault does not clear, turn the key switch to the off position and push in the red Emergency Stop button. Disconnect the 35 pin connector from the controller. Check the connector for corrosion or damage, clean it if necessary, and reconnect it to the controller.

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2510	1-2	Controller Overcurrent 1 = Controller Over Current Phase U 2 = Controller Over Current Phase W 3 = Controller Over Current Phase V 4 = Irms > 135% Current Limit	1. External short of phase U, V, or W motor connections 2. Speed encoder noise problems 3. Motor parameters are mistuned 4. Controller defective	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Reset Controller
2832	1-3	Current Sensor Fault	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator) 2. Controller defective	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Controller current sensors have invalid offset reading Clear: Reset Controller
2223	1-4	Precharge Failed 1 = Abort 2 = Energy Limit Exceeded 3 = Time Limit Exceeded	An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging See Programmer ò System Monitor menu ò Controller ò Capacitor Voltage	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: The precharge failed to charge the capacitor bank Clear: Cycle Interlock or Reset Controller
2141	1-5	Controller Severe Undertemp	Controller is operating in an extreme environment See Programmer ò System Monitor menu ò Controller ò Controller Temperature	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Heatsink temperature below è40¡C (è40¡F) Clear: Bring the heatsink temperature above è 40¡C (è40¡F) and then Reset Controller
2142	1-6	Controller Severe Overtemp	Controller is operating in an extreme environment. Excessive load on vehicle Improper mounting of controller See Programmer ò System Monitor menu ò Controller ò Controller Temperature	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Heatsink temperature above +95¡C Clear: Bring heatsink temperature below +95¡C, and then Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2120	1-7	Severe B+ Undervoltage	1. Non-controller system drain on battery 2. Battery resistance too high 3. Battery disconnected while driving 4. Blown B+ fuse or main contactor did not close 5. Battery parameters are mis-adjusted See Programmer ò Monitor menu ò Controller ò Capacitor Voltage	No drive torque. Fault Action: ShutdownPump ShutdownMotor Dual Drive This Motor: TrimDisable Other Motor: TrimDisable	Set: When Main is closed and the FET Bridge is enabled, either the undervoltage drive current cut back = 0% for 64 ms or the Brownout Voltage is reached Clear: Undervoltage drive current cut back > 0% for 100 ms and capacitor voltage > brownout voltage
2122	1-7	Severe KSI Undervoltage	1. Non-controller system drain on battery/keyswitch circuit wiring 2. Resistance in low power (KSI) circuit is too high 3. KSI disconnected while driving Blown fuse See Programmer ò System Monitor menu ò Battery ò Keyswitch Voltage	Fault Action: ShutdownAll	Set: When below Brownout Voltage for 2 seconds Clear: Bring KSI voltage above Brownout Voltage
2130	1-8	Severe B+ Overvoltage	1. Battery parameters are misadjusted 2. Battery resistance too high for given regen current 3. Battery disconnected while regen braking See Programmer ò System Monitor menu ò Controller ò Capacitor Voltage	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Capacitor bank voltage exceeded the Severe Overvoltage limit with the FET bridge enabled Clear: Bring capacitor voltage below Severe Overvoltage limit, and then Reset Controller
2132	1-8	Severe KSI Overvoltage	Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit See Programmer ò Monitor menu ò Battery ò Keyswitch Voltage	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: KSI voltage exceeded the Severe Overvoltage limit Clear: Bring KSI voltage below the Severe Overvoltage limit, and then Reset Controller
2133	1-9	Speed Limit Supervision	1. Motor speed detected that exceeds the limit set by the Max Speed Supervision parameter 2. Misadjusted Max Speed Supervision parameters See: Programmer ò Application Setup ò Max Speed Supervision menu	ShutdownInterlock ShutdownEMBrake	Set: Motor rpm has exceeded the Max Speed Limit setting for the Max Speed Time Limit setting's duration Clear: Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2134	1-10	Travel Control Supervision	1. With the vehicle in the stopped state, the detected motor frequency and/or phase current exceeds the limit set by the Travel Control Supervision parameter 2. Mis-adjusted Travel Control Supervision parameters See: Programmer ò Application Setup ò Travel Control Supervision menu	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: The motor frequency and/or and phase-current are above their Travel Control Supervision settings when in the stopped state Clear: Reset Controller
2109	1-11	Critical OS General Fault Program execution within the controller encountered a critical problem and could not recover from this	(<100) Internal Fault, kindly contact your Curtis representative immediately (>100) Ill-formed or corrupted application package was loaded into controller	ShutdownAll;	Set: (<100) Internal Fault (>100) CIT version is too old to fully support the FOS version Clear: (<100) Internal Fault (>100) Update CIT version, re-package the project, and re-flash the application package
210A	1-12	OS General 2 Fault Program execution within the controller encountered a serious problem and could not recover from this	(<100) Internal Fault, kindly contact your Curtis representative immediately (>100) Ill-formed or corrupted application package was loaded into controller	ShutdownAll;	Set: (<100) Internal Fault (>100) CIT version is too old to fully support the FOS version Clear: (<100) Internal Fault (>100) Update CIT version, re-package the project, and re-flash the application package
2110	1-13	Reset Rejected	1. NMT Reset Rejected 2. Reset_Controller () Rejected	Shutdown Interlock; Shutrdown Throttlel;	Clear: Reset Controller
2140	2-2	Controller Overtemp Cutback	1. Controller is operating in an extreme environment 2. Excessive load on vehicle Improper mounting of controller which is preventing controller cooling 3. Controller is performance-limited at this temperature See Programmer ò System Monitor menu ò Controller: Temperature	Reduced drive torque Reduced regen-braking torque. Fault Action: None, unless a fault action is programmed in VCL	Set: Controller's Heatsink temperature exceeded 85¡C Clear: Bring heatsink temperature below 85¡C

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2121	2-3	Undervoltage Cutback	1. Batteries need recharging. Controller is performance limited at this voltage 2. Battery parameters are mis-adjusted. Non-controller system-drain on battery 3. Battery resistance too high 4. Battery disconnected while driving 5. Blown B+ fuse or main contactor did not close See Programmer ò System Monitor menu ò Controller ò Currents ò UnderVoltageCutback See Programmer ò System Monitor menu ò Controller ò Capacitor Voltage	Reduced drive torque Reduced regen braking torque Fault Action: None, unless a fault action is programmed in VCL	Set: Capacitor bank voltage dropped below the UnderVoltageCutback limit with the FET bridge enabled Clear: Bring the capacitor voltage above the controller's UnderVoltageCutback limit
2131	2-4	Overvoltage Cutback	1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage 2. Battery parameters are mis-adjusted 3. Battery resistance too high for given regen current 4. Battery disconnected while regen braking See Programmer ò System Monitor menu ò Controller ò Currents ò OverVoltageCutback See Programmer ò System Monitor menu ò Controller ò Capacitor Voltage	Reduced brake torque Note: This fault is declared only when the controller is running in regen Fault Action: None, unless a fault action is programmed in VCL	Set: The controller's capacitor bank voltage exceeded the OverVoltageCutback limit with the FET bridge enabled Clear: Bring controller's capacitor voltage below the OverVoltageCutback limit
2531	2-5	Ext 5V Supply Failure Ext_5V_Supply_Failure_Active Fault Type(s): 1 = 5V Supply's voltage is out-of-range 2 = 5V Supply's current is out-of-range.	External load impedance on the +5V supply is too low See the System Monitor ò Outputs menu: External_5V_Supply, Ext_5V_Current.	Disables the 5V Supply Fault Action: None, unless a fault action is programmed in VCL.	Set: (1) The 5V Supply is outside 5Vº 10% (2) The current is outside limits defined by: Ext_5V_Supply_Min Ext_5V_Supply_Max Clear: Reset Controller, or reset using the VCL variable Ext_5V_Output_Enable

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2532	2-6	Ext 12V Supply Failure Fault Type(s): 1 = 12V Supply's voltage is out-of-range 2 = 12V Supply's current is out-of-range	External load impedance on the +12V supply is too low See Programmer ò System Monitor menu ò Outputs: External_12V_Supply, Ext_12V_Current	Disables the 12V Supply Fault Action: None, unless a fault action is programmed in VCL	Set: (1) The 12V supply (pin 23) is outside 12V º 15% (2) The current is outside the limits defined by: Ext_12V_Supply_Min Ext_12V_Supply_Max Clear: Reset Controller or Reset using the VCL variable Ext_12V_Output_Enable
2151	2-8	Motor Temp Hot Cutback	1. Motor temperature is at or above the programmed Temperature Hot setting — resulting in a reduction of controller drive current 2. The motor temperature and sensor control parameters are mis-adjusted See Programmer ò AC Motor Setup ò Temperature Sensor	Reduced drive torque If the MotorBrakingThermalCutBack_Enable = On, then Regen Braking Torque is reduced Fault Action: None, unless a fault action is programmed in VCL	Set: Motor temperature is at or above the Temperature Hot parameter setting Clear: Bring the motor temperature within range
2150	2-9	Motor Temp Sensor	1. Motor thermistor is not connected properly 2. Sensor polarity (between Pin 8 and Pin 18) is incorrect 3. The motor temperature and sensor parameters are mis-adjusted See Programmer ò System Monitor menu ò AC Motor ò Temperature	Motor temperature cutback disabled Fault Action: None, unless a fault action is programmed in VCL	Set: Motor thermistor input (pin 9) is at the voltage rail Clear: Bring the motor thermistor input voltage within range
2222	3-1	Main Driver Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Open Wire (at pin)	Open or short on driver load Dirty connector pins at controller or contactor coil Bad connector crimps or faulty wiring	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Main Contactor driver is either open or shorted This fault can be set only when Main Enable = On Clear: Restore/repair any external wiring or device-coil to their correct state, then Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Name	Description & Fault Type	Cause	Effect	Solution
2320	3-2		EM Brake Driver Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Open Wire (at pin)	1. Open or short on driver load Dirty connector pins at controller or contactor coil 2. Bad connector crimps or faulty wiring	ShutdownEMBrake ShutdownThrottle FullBrake	Set: Electromagnetic brake driver (pin 4) is either open or shorted This fault can be set only when EM Brake Type >0 Clear: Restore/repair any external wiring or device-coil to their correct state, then Reset Controller
2420	3-3	PUMP DRIVER FAULT	Pump Driver Fault Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Open Wire (at pin) 7 = Undercurrent	The assigned pump-contactor driver is either open or shorted, or exceeded its overcurrent setting 1. Open or short on driver load 2. Dirty connector pins at controller or contactor coil 3. Bad connector crimps or faulty wiring		Set: Driver overcurrent, as set by the Driver x Overcurrent parameter See Programmer ò Controller Setup ò Outputs ò Driver x ò Driver x Overcurrent Clear: Correct the open or short, and then Reset Controller
2232	3-6		Sin Cos Motor Feedback 1. The signals from the sensor are above the configuration by 10% or at/above the supply rails for >100ms 2. Sensor failure	1. Motor encoder failure 2. Bad crimps or faulty wiring See Programmer ò System Monitor menu ò Hardware Inputs: Analog 3	ShutdownVehicle: ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Motor position/speed Sin/Cos sensor fault Clear: Either Reset Controller, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder Fault is cleared and Encoder LOS fault (flash code 9-3) is set, allowing limited motor control
2230	3-6		Encoder Fault Fault Type(s): 1 = Loss of regulation 2 = Over Current trips Loss of pulses 3 = Loss of speed signal pulses 4=Autocharacterization 5 = Encoder supply (voltage) fault	1. Motor encoder failure 2. Bad crimps or faulty wiring See Programmer ò System Monitor menu ò AC Motor: Motor RPM See Programmer ò AC Motor Setup ò Quadrature Encoder ò Encoder fault Setup	ShutdownEMBrake ShutdownThrottle ShutdownMotor	Set: Motor encoder phase failure detected Clear: Either Reset Controller, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Encoder Fault is cleared and Encoder LOS fault (flash code 9-3) is set, allowing limited motor control
2240	3-7		Motor Open Fault	Motor phase is open Bad crimps or faulty wiring	ShutdownVehicle: ShutdownMotor ShutdownMainContact or ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Motor phase U, V, or W detected open Clear: Reset Controller.

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2220	3-8	Main Contactor Welded	1. Main contactor tips are welded closed 2. Motor phase U or V is disconnected or open 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal)	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded (via the motor) for a short time and the voltage did not discharge, indicating a direct-contact to the battery (i.e., Main tips are welded closed) Clear: Reset Controller
2221	3-9	Main Contactor Did Not Close Fault Type(s): 1 = Main did not close when commanded 2 = Main disconnected during operation	Type 1: 1. Main contactor did not close 2. Main contactor tips are oxidized, burned, or not making good contact 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging 4. Blown B+ fuse 5. Main contactor parameters mis-tuned 6. Main Pull-in Voltage, 7. Main Holding Voltage Type 2: 1. Main contactor opened during operation (while commanded closed) 2. Driver wiring to contactor's coil (e.g., pin 3 wiring) removed during operation 3. Contactor/coil defective	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+ Clear: Reset Controller
2103	3-10	Motor Setup Needed Fault Type(s): Hex # Bit1 è 4 Binary 0000 => bits 4 3 2 1	Motor setup is required Please refer to fault type: Bit1: The current regulator needs to be configured Bit2: The slip gain test needs to be run Bit3: The base speed test needs to be run Bit4: The automated test needs to be run (full motor commissioning)	Fault Action: None Yet, the motor will not operate until the motor configuration and/or commissioning tests are complete	Set: Default for both ACIM and PMAC motors Clear: Run the appropriate motor commissioning sequences

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2102	3-11	Motor Misalignment Error	Motor offset has shifted so controller is producing torque in an uncommanded direction	Shudown Vehicle;	Clear: Reset Controller
2830	4-6	NV Memory Failure Fault Type(s): 1 = Invalid checksum 2 = NV write failed 3 = NV read failed 4 = NV write did not complete during power down	1. Failure to read or write to nonvolatile (NV) memory 2. Internal controller fault	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Set: Controller operating system tried to read or write to EEPROM memory and failed Clear: Download the correct software and matching parameter default settings into the controller and Reset Controller
2211	4-7	HPD Sequencing	1. Incorrect sequence in application of Keyswitch, Interlock, Direction, or Throttle 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state Verify input switch status. See Programmer ò System Monitor menu ò Inputs ò Switch Status Verify Throttle. See Programmer ò System Monitor menu ò Inputs ò Throttle Command	ShutdownThrottle	Set: HPD (High Pedal Disable) or SRO (Static Return to Off) sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs Clear: Reapply inputs in correct sequence
2460	4-7	Emergency Reverse High Pedal HPD	Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral	ShutdownThrottle ShutdownEMBrake Dual Drive Same, both motors	Set: At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral Clear: If EMR_Interlock = On, clear the interlock, throttle, and direction inputs If EMR_Interlock = Off, clear the throttle and direction inputs

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2813	4-9	Parameter Change Fault Type(s): Reports the CAN Object ID of parameter	While the Interlock was ON, a safety-based parameter was changed Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter menu listings	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Adjustment of a parameter setting that requires cycling of KSI Clear: Reset Controller
2710	5-1	User 1 Fault Global Drive Shutdown	A serious fault (Genie severity = 4) has occurred on one motor controller that requires that the other motor controllers shut down also	Drive Inhibited	Set: Serious fault on 1 or more drive controllers Clear: Re-power with problem corrected
2711	5-2	User 2 Fault Internal CAN communication error	1. CAN wiring 2. Damaged Controller	Drive Inhibited	Set: Loss of communication between left and right motor control sections Clear: Repower with CAN wiring problem corrected or replace controller
2712	5-3	User 3 Fault Invalid Motor Type Selection	Incompatible motor selected	See User 1 fault (above)	Set: Invalid Motor Type Selection Clear: Select valid Motor Type
2713	5-4	User 4 Fault Front to Back CAN bus fault	1. CAN wiring 2. Damaged Controller	See User 1 fault (above)	Set: Loss of communication between front and rear motor controllers Clear: Repower with CAN wiring problem corrected or replace controller
2820	6-8	VCL Run Time Error	Runtime errors are defined using the VCL Error Module and VCL Error See the System Information file: Curtis Software Suiteπ ò VCL Studio ò Help Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Set: VCL Run Time Error detected Clear: Edit the VCL application software to fix this error condition; flash the new compiled software and matching parameter settings; Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2831	7-1	Internal Controller Fault	1. Physical damage from external sources/events 2. Hardware damage	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Clear: Reset Controller
2541	7-2	PDO Timeout	The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter Adjust PDO Settings See Programmer ò Application Setup ò CAN Interface ò PDO Setups	ShutdownThrottle	Set: Time between CAN PDO messages received exceeded the PDO Timeout Period Clear: Receive CAN NMT message, or Reset Controller
2231	7-3	Stall Detected	1. Stalled motor 2. Motor encoder failure 3. Bad crimps or faulty wiring 4. Problems with power supply for the motor encoder See Programmerò System Monitor menu ò AC Motor ò Motor RPM	ShutdownEMBrake ShutdownThrottle ShutdownMotor Control Mode changed to LOS (Limited Operating Strategy)	Set: No motor encoder movement detected Clear: Either Reset Controller,Or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Stall Detected fault is cleared and the Encoder LOS fault (flash code 9-3) is set, allowing limited motor control
2550	7-6	Insulation Resistance Too Low	1. Component/PCB failure within controller 2. Moisture ingress	No Action (warning)	Clear: Reset Controller
2840	7-7	Supervision Fault	Internal controller fault	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Set: Internal controller failure Clear: Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
22A2	7-7	Interlock Input Conflict	1. Home switch disconnected, or broken 2. Check wiring to ensure both switches have continuity to controller connector 3. Check if configured correctly for NC/NO	ShutdownVehicle	Clear: Reset Controller
2841	7-9	Supervision Input Check	Internal controller fault	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Set: Damaged Controller Clear: Reset Controller
2542	8-2	PDO Mapping Error	The PDO Map has too many data bytes assigned or has objects mapped that are not compatible Adjust PDO Settings. See Programmer ò Application Setup ò CAN Interface ò PDO Setups	PDO message disabled Fault Action: None, unless a fault action is programmed in VCL	Set: Incorrect PDO map detected Clear: Reset Controller
2835	8-3	Internal Hardware Fault	Internal controller fault detected	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Internal controller fault detected Clear: Reset Controller
2850	8-7	Motor Characterization Error	Motor characterization failed during characterization process. The fault type indicates the cause	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Motor characterization failed during the motor characterization process Clear: Reset Controller
2234	8-8	Encoder Pulse Error	Encoder Steps parameter does not match the actual motor encoder Verify parameter settings: AC Motor Setup ò Quadrature Encoder ò Encoder Steps	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Detected wrong setting of the Encoder Steps parameter Clear: Ensure the Encoder Steps parameter matches the actual encoder Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2811	8-9	Parameter Out of Range Fault Type(s): Reports the CAN Object ID of parameter	1. Parameter value detected outside of the limits Use CIT or the 1313HHP to view the parameters range and adjust the parameter's value	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Parameter detected outside of limits Clear: Bring parameter within its limits
2815	9-1	Bad Firmware	The firmware in the controller is incorrect 1. The CRC of the application or OS does not match 2. The application was built with an incompatible OS version	Controller does not fully startup (without error)	Set: The loaded software is not compatible with the controller hardware Clear: Load the matching software Verify that the controller model matches the cdev version for the project and the VCL Studio application
2321	9-2	EM Brake Failed To Set	1. Vehicle movement sensed after the EM Brake has been commanded to set 2. EM Brake will not hold the motor from rotating	Position Hold is engaged when Interlock = ON Fault Action: None, unless a fault action is programmed in VCL	Set: After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed Clear: 1. Activate the Throttle (EM Brake type 2) 2. Activate the Interlock (EM Brake type 1)
2233	9-3	Encoder Limited Operating Strategy (LOS)	1. Limited Operating Strategy (LOS) control mode has been activated as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3) 2. Motor encoder failure 3. Bad crimps or faulty wiring 4. Vehicle has stalled	LOS Mode Fault Action: None, unless a fault action is programmed in VCL	Set: Either the Encoder Fault (flash code 3-6) or Stall Detected (flash code 7-3) was detected. If the parameter LOS Upon Encoder Fault = On and the Interlock has been cycled, then the Encoder LOS (flash code 9-3) control mode is activated, allowing limited motor control (limp home mode) Clear: Cycle KSI or, if LOS Mode was activated by the Stall Detected fault, clear by ensuring the encoder senses the proper operation, Motor RPM = 0, and Throttle Command = 0

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2520	9-5	Pump Overcurrent	1. External short of pump motor 2. Controller defective	Shutdown Pump	Clear: Reset Controller
2450	9-6	Pump Battery Discharge Indicator (BDI)	1. The BDI is below the Lift_BDI_Lockout setting 2. BDI parameters are mistuned	ShutdownPump	Set: Pump activated when the BDI Percentage is below the Lift Battery lockout setting Clear: Charge battery
2833	9-7	Pump Hardware Error Fault Type(s): 1 = Duty cycle not update with the update timeframe 2 = Mismatch of the Commanded pump dutycycle vs. output	1. External short of the pump motor 2. Controller defective	Shutdown Pump	Clear: Reset Controller
2812	9-8	Parameter Mismatch	Invalid Configuration of parameters	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Clear: Fix parameter mismatch and reset the controller
2332	9-10	Interlock Braking Supervision Fault Type(s): 1 = Motor speed is outside the Interlock Brake Supervision Speed Limit 2 = Interlock is Off and EM Brake not applied within time limit 3 = Interlock is Off and EM Brake not applied, and the rotor position is outside the RPM-position limit	During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters See Programmer ò Application Setup ò Interlock Braking ò Supervision Enable See Programmer ò Application Setup ò Interlock Braking ò Interlock Braking Supervision	ShutdownMotor ShutdownEMBrake ShutdownMainContactor	Set: During an interlock braking event, the motor speed exceeded the limit set by the Interlock Braking Supervision parameters Clear: Reset Controller

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2160	10-1	Driver 1 Fault Fault Type(s): 1 = Driver Short 2 = Driver Overcurrent 3 = Open/Short (High, should be Low) 4 = Open/Short (Low, should be High) 5 = Driver Open Requires driver checks enabled	1. Open or short on driver load Dirty connector pins at controller or contactor coil 2. Bad connector crimps or faulty wiring Driver overcurrent, as set by the Driver 1 Overcurrent parameter See Programmer ò Controller Setup ò Outputs ò Driver 1 ò Driver 1 Overcurrent	ShutdownDriver1	Set: Driver 1 is either open or shorted, or Driver 1 exceeded its overcurrent setting Clear: Correct the open or short, and then Reset Controller
2161	10-2	Driver 2 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver2	See Driver 1 Fault
2162	10-3	Driver 3 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver3	See Driver 1 Fault
2163	10-4	Driver 4 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver4	See Driver 1 Fault
2164	10-5	Driver 5 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver5	See Driver 1 Fault
2165	10-6	Driver 6 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver6	See Driver 1 Fault
2166	10-7	Driver 7 Fault Fault Type(s): See Driver 1 Fault	See Driver 1 Fault	ShutdownDriver7	See Driver 1 Fault

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2632	10-8	Driver Assignment Fault Type(s): 5 {X} = Driver number that cause the fault	A Driver Output is used for two or more functions See Programmer ò Controller Setup òIO Assignments ò Coil Drivers: Main Contactor Driver, EM Brake Driver, Hydraulic Contactor Driver	Fault Action: None, unless a fault action is programmed in VCL	Set: Driver assignment conflict (i.e., duplicate items assigned to the same driver) Clear: Resolve the conflicted driver assignment, then Reset Controller
2169	10-9	Coil Supply Fault Fault Type(s): 1 = short to B- or HW fault 2 = Coil Supply disabled due to shorted (internal) driver.* 3 = Coil Supply startup enable check failed 4 = Coil Supply startup disable check failed *a short must first be detected	1. Short on driver loads 2. Dirty connector pins at controller or device 3. Bad connector crimps or faulty wiring 4. Controller is defective	ShutdownAll: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle ShutdownInterlock ShutdownDriver1 to 7 ShutdownPD FullBrake ShutdownPump ShutdownCoilSupply ShutdownVehicle ShutdownLower ShutdownLift	Set: Short detected after the startup check has passed A low side driver short is detected and the respective fault action fails to cut-off driver current Coil supply startup test fails Clear: Reset Controller
2620	11-1	Analog 1 Out of Range Fault Type(s): 1 = above High limit 2 = below Low limit	1. Analog 1 input voltage is above the parameter setting of Analog 1 High 2. Analog 1 input voltage is below the parameter setting of Analog 1 Low See Programmer ò Controller Setup ò Analog Inputs ò Analog 1 See Programmer ò Controller Setup ò Analog Inputs ò Configure ò Analog 1 Low / Analog 1 High	Fault Action: None, unless a fault action is programmed in VCL	Set: (1) Input voltage (on pin) is above the parameter's set-point threshold (2) Input voltage (on pin) is below the parameter's set-point threshold Clear: Return the voltage to within the allowed range, then Reset Controller
2621	11-2	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2622	11-3	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2623	11-4	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range

Drive Control Fault Codes

CAN Object	Flash Pattern	Description & Fault Type	Cause	Effect	Solution
2624	11-5	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2625	11-6	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2626	11-7	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2627	11-8	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2628	11-9	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
262A	11-11	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2631	11-12	Analog Assignment Fault Fault Type(s): 13 X = Analog Input number that caused the fault {X = 1-9, 14, 18-19, 31}	1. An Analog Input is used for two or more functions 2. An Analog Input is outside the range of analog inputs See Programmer ò Controller Setup ò IO Assignments ò Controls	None (warning)	Clear: Resolve assignment conflict, and then Reset Controller
262B	11-13	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
262C	11-14	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2834	11-15	Pump Current Sensor Fault Sensor zero-current offset close to supply voltage or sensor (supply) ground	1. External short of pump motor 2. Controller defective	Shutdown Pump	Clear: Reset Controller

Drive Control Fault Codes

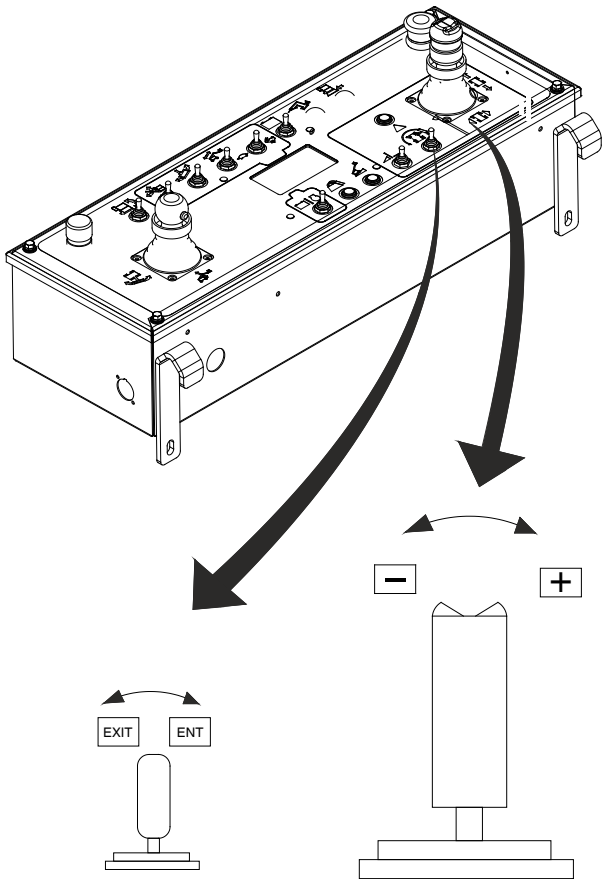
CAN Object	Flash Pattern	Name	Description & Fault Type	Cause	Effect	Solution
2860	12-1		Branding Error	Software and hardware branding mismatch For technical support on this fault, contact the Curtis distributor where you obtained your controller or the Curtis sales-support office in your region	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Software / hardware incompatibly Clear: As applicable: Load Branded software, or use Branded controller with the correct device profile and the correct Curtis Software Suite toolkit key
2880	12-4	PWM DRIVER COUNT	PWM Driver Count Too many drivers configured for full PWM control range	1. Home switch disconnected, or broken 2. Check wiring to ensure both switches have continuity to controller connector 3. Check if configured correctly for NC/NO		Clear: Change the bit flag, PWM_Drivers, such that the number of bits set are lesser than or equal to Max_PWM_Drivers
2629	12-5	PWM INPUT 10 OUT OF RANGE	PWM Input 10 Out of Range Fault Type(s): 1 = The input is disconnected 2 = The measured input frequency is below the tolerance 3 = The measured input frequency is above the tolerance 4 = The measured duty cycle is below set limits 5 = The measured duty cycle is above set limits	1. This fault diagnostic execution cycles every 4msec. The input is considered disconnected if no PWM signal occurs for 16msec or the measurements are not updated every 16msec 2. Mistuned parameters 3. Faulty wiring	None (warning)	Clear: Reset Controller
262D	12-6	PWM INPUT 17 OUT OF RANGE	See PWM input 10	See PWM input 10	See PWM input 10	See PWM input 10
2106	12-7		Analog 31 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range	See Analog 1 Out of Range
2107	12-8	INVALID CAN PORT	Dual CAN Port parameter is set to a CAN port that does not exist on a controller setup for Dual Drive			

Drive Control Fault Codes

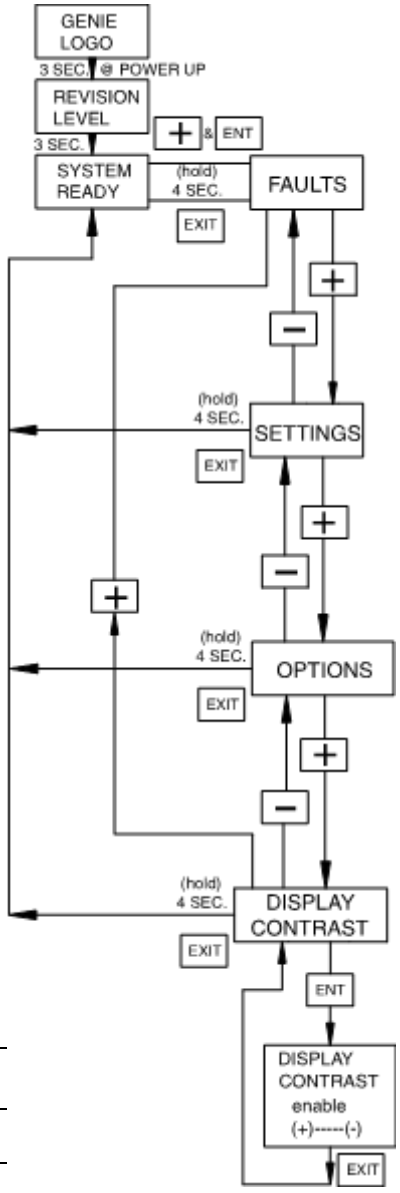
CAN Object	Flash Pattern	Name	Description & Fault Type	Cause	Effect	Solution
2108	12-9		VCL Watchdog The time interval of the VCL watchdog (WD#) exceeded the timeout value	See the associated VCL Functions: Set_Watchdog_Timeout( ) Set_Watchdog_Fault_Action( ) Kick_Watchdog( ) The fault actions can be defined by the User/OEM in the application-specific VCL software	ShutdownAll;	Clear: Kick_Watchdog( ). Starts and reset the specified watchdog timer
2111	12-10		Autobaud Failure on linked controller CAN port	1. Getting stuck in start manager (bootloader) 2. Internal CAN bus error	None (warning)	Clear: Reset Controller
2113	12-11		Primary State Error	Internal Controller Error	None (warning)	Clear: Reset Controller
210C	12-11	PWM INPUT 28 OUT OF RANGE	See PWM input 10	See PWM input 10	See PWM input 10	See PWM input 10
210D	12-12	PWM INPUT 29 OUT OF RANGE	See PWM input 10	See PWM input 10	See PWM input 10	See PWM input 10
2101	13-2	PHASE PWM MISMATCH	Phase PWM Mismatch Fault Type(s): 0 = U phase 1 = V phase 2 = W phase	Internal to Controller Motor Phase PWM	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: The difference between the commanded phase PWM duty cycle and the measured is greater than allowed Clear:Reset Controller
2870	13-3		Hardware Compatibility	1. The OS (device profile, .cdev file) is incompatible with the controller 2. The loaded software (.cdev) is not compatible with the controller hardware	ShutdownVehicle: ShutdownMotor ShutdownMainContactor ShutdownEMBrake ShutdownThrottle FullBrake ShutdownPump	Set: Incorrect OS (device profile). Clear: Load the matching OS (device profile)

Drive Controller Fault Handling

Navigation Menu - Top Menus



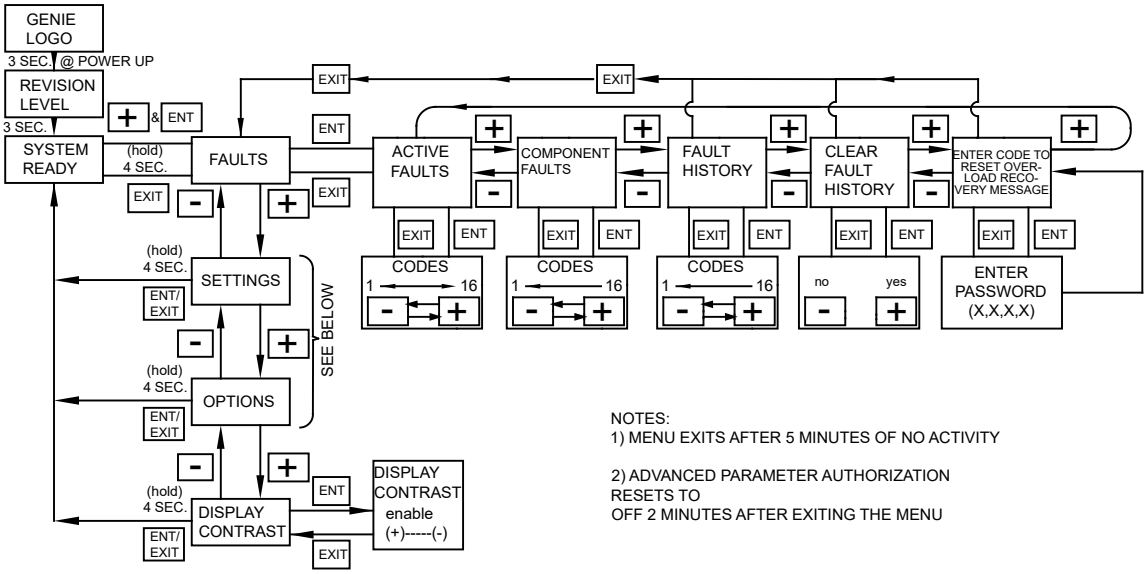
Drive enable switch Drive Joystick

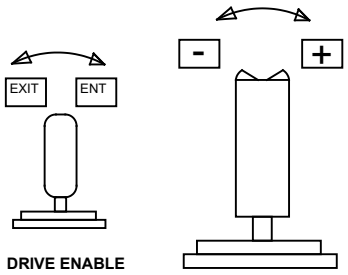


EXIT	Drive enable switch left
ENT	Drive enable switch right
−	Drive joystick left
+	Drive joystick right

Faults Navigation Menu

Faults Navigation Menu

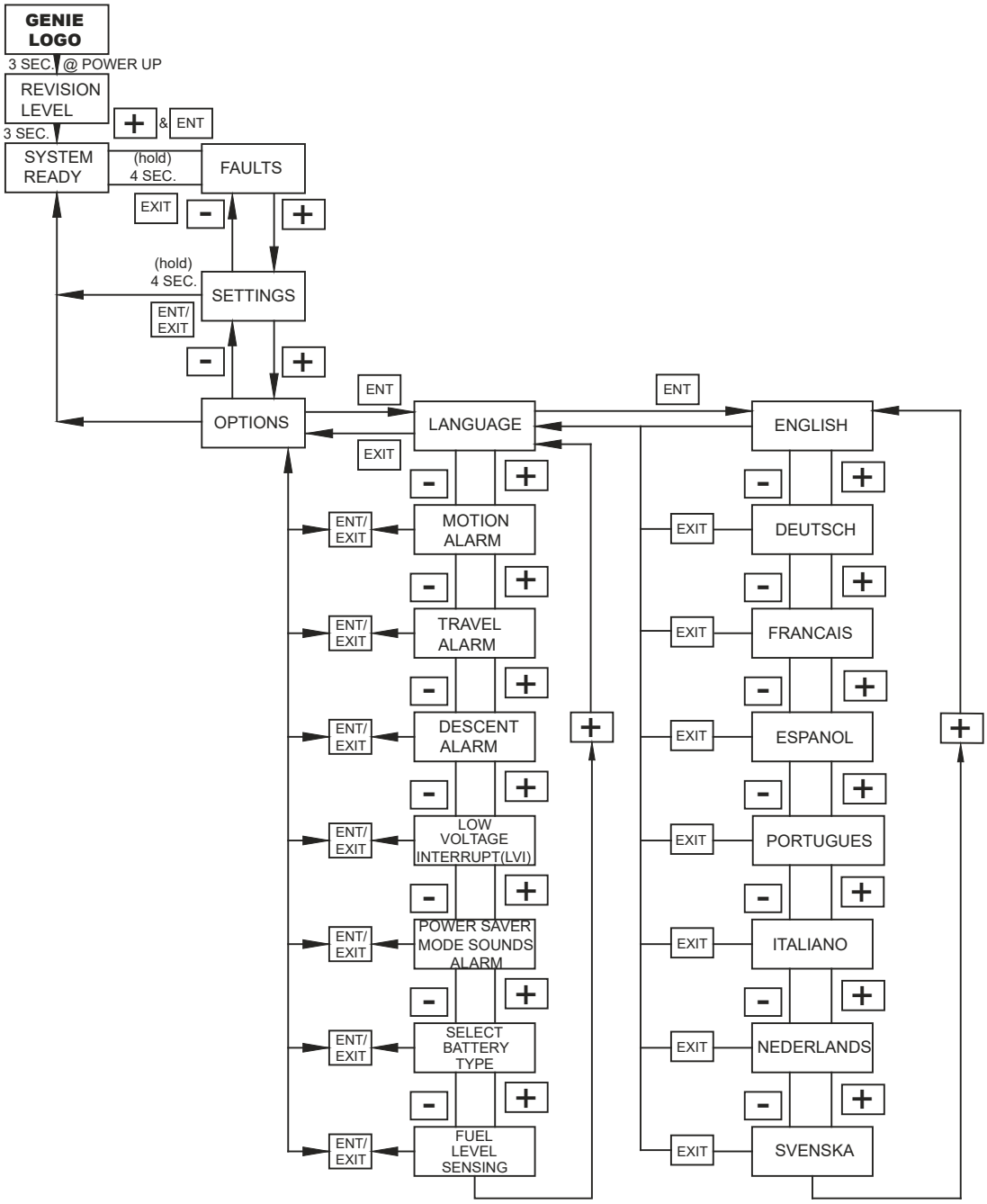




First press of <Enter> usually locks onto a menu, then +/- is used to change the value. A second press of <Enter> stores the value and re-enables menu navigation.

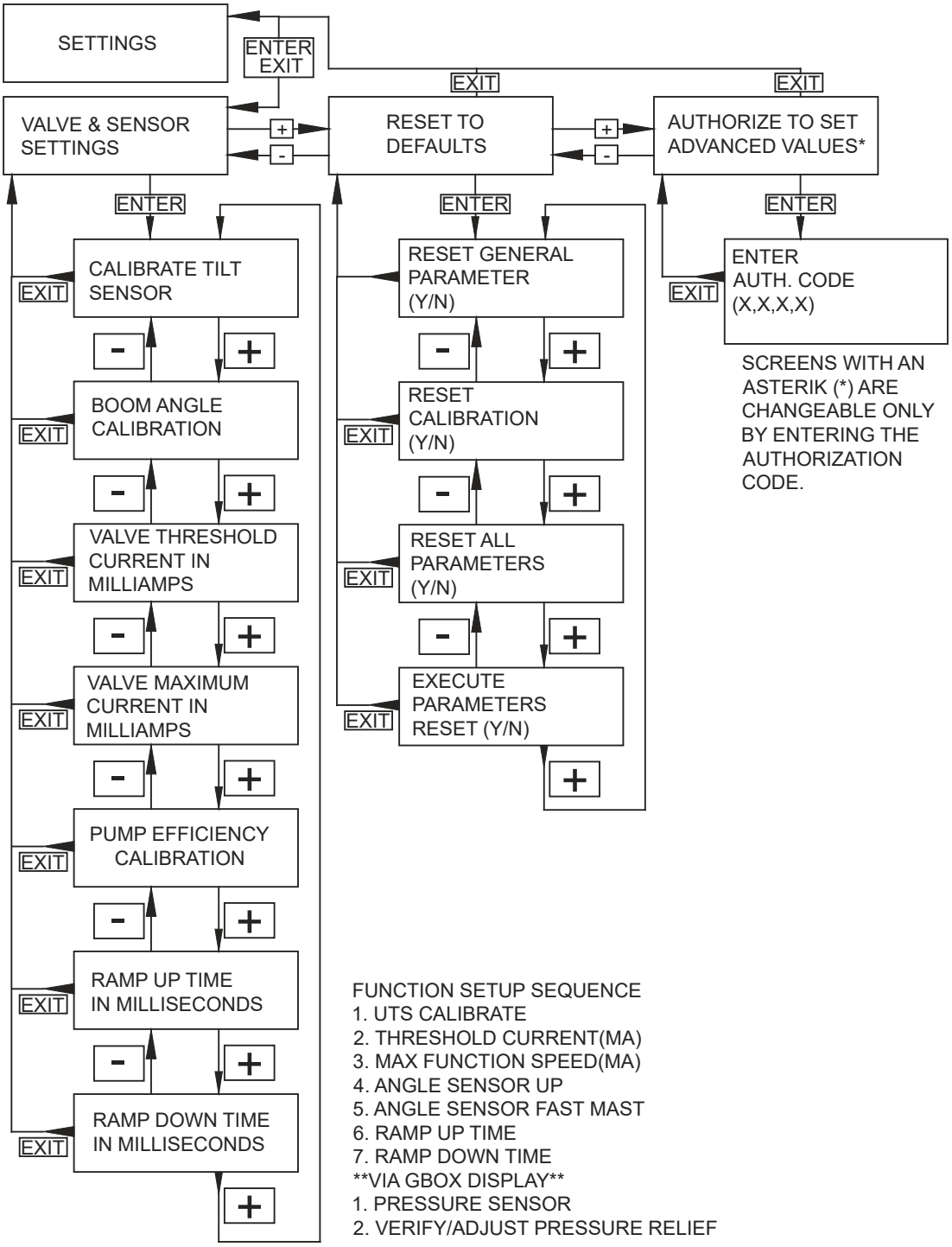
Options Navigation Menu

Options Navigation Menu



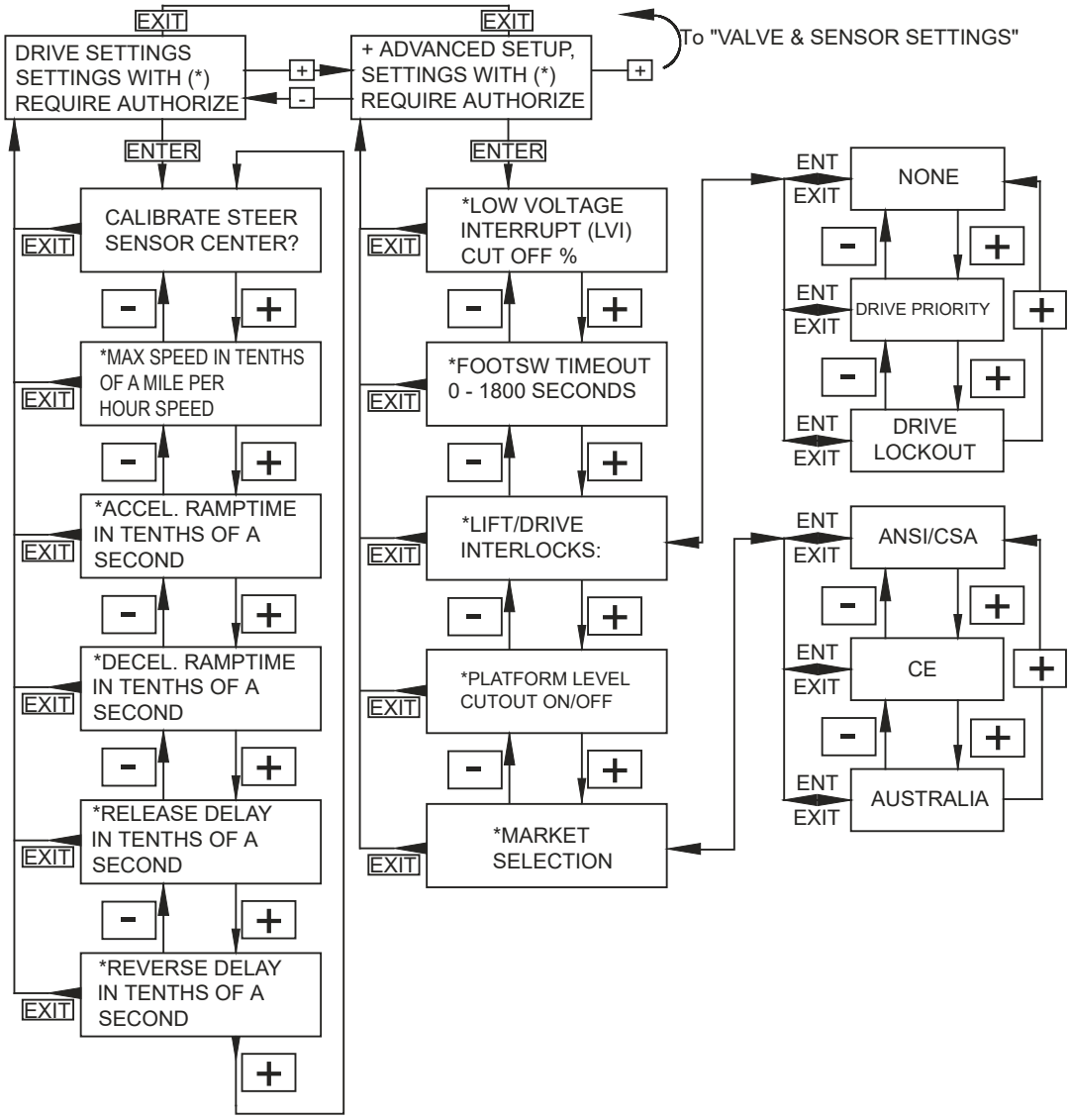
Settings Navigation Sub Menu

Settings Navigation Menu



Settings Navigation Sub Menu

Settings Navigation Menu



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Schematics



Observe and Obey:

- ☑ Troubleshooting and repair procedures shall be completed by a person trained and qualified on the repair of this machine
- ☑ Immediately tag and remove from service a damaged or malfunctioning machine.
- ☑ Repair any machine damage or malfunction before operating the machine.

Before Troubleshooting:

- ☑ Read, understand and obey the safety rules and operating instructions in the appropriate operatorâs manual on your machine.
- ☑ Be sure that all necessary tools and test equipment are available and ready for use.

About This Section

There are two groups of schematics in this section.

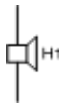
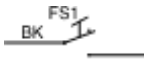
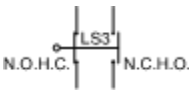
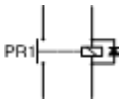
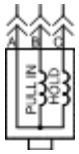
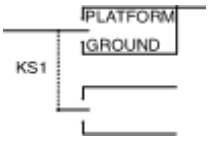
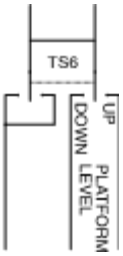
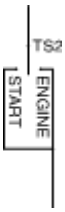
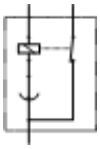
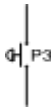
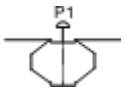
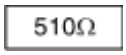
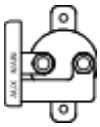
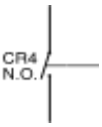
Electrical Schematics

⚠WARNING Electrocution/burn hazard. Contact with electrically charged circuits could result in death or serious injury. Remove all rings, watches and other jewelry.

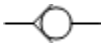
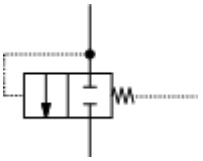
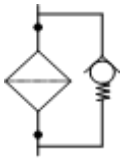
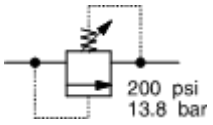
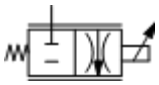
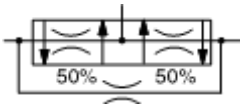
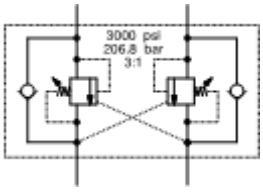
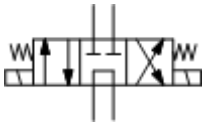
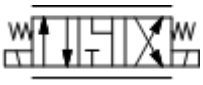
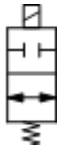
Hydraulic Schematics

⚠WARNING Bodily injury hazard. Spraying hydraulic oil can penetrate and burn skin. Loosen hydraulic connections very slowly to allow the oil pressure to dissipate gradually. Do not allow oil to squirt or spray.

Electrical Symbol Legend

 Battery	 Coil, solenoid or relay	 Horn or alarm	 Flashing beacon	 Gauge
 Diode	 Hour meter	 LED	 Fuse with amperage	 Foot switch
 T-circuits connect	 Limit switch	 Power relay	 Coil with suppression	 Fuel or RPM solenoid
 Connection - no terminal	 T-circuits connect at terminal	 Circuits crossing no connection	 Quick disconnect terminal	 Circuit breaker with amperage
 Key switch	 Toggle Switch DPDT	 Toggle Switch SPDT	 Pump or Motor	 Tilt sensor
 Horn button - normally open	 Emergency Stop button - normally closed	 Resistor with ohm value	 Battery separator	 Gauge sending unit
 Oil temperature switch normally open	 Coolant temperature switch - normally open	 Oil pressure switch normally closed	 Control relay contact normally open	 Diode starting aid, glow plug or flame ignitor

Hydraulic Symbols Legend

 Orifice with size	 Check valve	 Shut off valve	 Brake
 Pump, fixed displacement	 Pump, bi-directional variable displacement	 Motor, bi-directional	 Motor, 2 speed bi-directional
 Cylinder, double acting	 Pump, prime mover (engine or motor)	 Shuttle valve. 2 position, 3 way	 Differential sensing valve
 Filter with bypass relief valve	 Relief valve with pressure setting	 Priority flow regulator valve	 Solenoid operated proportional valve
 Directional valve (mechanically activated)	 Flow divider/combiner valve	 Pilot operated 3 position, 3 way shuttle valve	 Solenoid operated 2 position, 3 way directional valve
 Counterbalance valve with pressure and pilot ratio	 Solenoid operated 3 position 4 way directional valve	 Solenoid operated 3 position, 4 way proportional directional valve	 Solenoid valve, 2 position 2 way

Electrical Component and Wire Color Legends

Item	Description
B	**Battery**
B1	Engine Start - 12V DC
B7	Left/Right side battery packs, 48V DC
C	**Connector**
C1	GCON box to dual motor controller harness
C2	GCON box to ECON harness
C3	GCON box to turntable harness
C4	GCON box to 18/18 boom cable
C5	GCON box to 12/3 boom cable
C6	-
C7	GCON box to turntable harness
C8	PCON box to 12/3 boom cable
C9	PCON box to 18/18 boom cable
C10	PCON box to Platform MAN/LOAD
C11	PCON to foot switch
C12	Primary boom angle sensor
C13	EXT/RETR LS to function manifold harness
C14	12V battery charger
C15	-
C16	Fuse/contactor box
C17	PCON CAN1 connect
C18	DC/DC converter
C19/C20	TCON connector
C21	Tilt sensor
C22	Battery charger
C23	CAN connect (PCON)
C24	Hydraulic pressure sensor
C25	-
C26	-
C27	Rear L/R AC motor controller
C28	Front L/R AC motor controller
C29	Telematics Unit (Option)
C30	Jumper plug - Dual Output AC MC to Pump AC MC
C31	-
C32	Steer sensor extender
C33	AC Pump Motor
C34	ECON, AC motor / Generator controller
C35	Engine harness
C36	Battery status LED
C37	Drive enable limit switch
C38	Left front AC motor to front MC harness
C39	Right front AC motor to front MC harness
C40	Left rear AC motor to rear MC harness
C41	Right rear AC motor to rear MC harness
C42	Drive lights (option)
C43	Steer sensor
C44	Flashing beacon (option)
C45	-
C46/47	PCON (gray) / PCON (black)
C48/49	VCON (20 pin) / VCON (14 pin)
C50	Work light (option)
C51	Fuel shut off
C52	Battery box temperature, Sensor
C53/C54	relay block 1 / relay block 2
C55	Angle sensor common harness
C56	Primary angle sensor extender
C57	DCON CAN connect (ECON end)
C58	Jumper plug ECON to function harness
C59	-
C61	HCON
C62	DCON CAN connect
C63	-
C64	LF AC Motor
C65	RF AC Motor
C66	LR AC Motor
C67	RR AC Motor
C68	Inverter (option)
C69	Charger interlock 2
C70	12V charger
C71	Recovery Pump Override
C72	Extend/Retract limit switch
C73	Contact alarm
C74	GTPL GBOX service port
C75	GTPL PBOX service port
C80	Primary extend
C81	Primary retract
C82	Primary Up
C83	Primary Down
C86	Turret CW rotation
C87	Turret CCW rotation

Electrical Component and Wire Color Legends

C88	Platform right rotation
C89	Platform left rotation
C91	Platform level down
C92	Platform level up
C93	Steer left
C94	Steer right
C95	Pressure relief
C96	Small pump enable
C97	Large pump enable
C98	Jib Up
C99	Jib Down
C100	Oscillate pressure reducing valve

Item	Description
CB	**Circuit Breaker**
CB1	Fuel pump, 15A
CB2	Controls power, 24V DC, 15A
CB4	Charger box 12V, 10A
CB7	Engine RPM, 10A
CB9	Telematics, 5A (option)
CR	**Control Relay**
CR1	Engine start
CR2	Fuel pump
CR3	Auxiliary relay
CR4	Engine RPM
CR5	Horn
CR13	-
CR14	-
CR15a/b	Glow plugs relays
CR20	Dumpload relay
CR27	Brake circuit (lift/drive option)
CR30	Limit switch (lift/drive option)
CR47	Generator KS1 relay
CR62	E-stop relay
CR64	Engine Fault
CR80	Telematics
CR81	Contact alarm relay
CR88	Charger relay
FB1	Flashing beacon
F	**Fuse**
F1	Battery, 325A
F2/F3	Glow plugs 30A
F5	Spare 15A
F8	Charger, 40A
F9	Inverter, 175A
F18	Work lights, 7A
F33	Telematics, 6A
FS1	Foot switch
G	**Gauge**
G6	HCON

Electrical Component and Wire Color Legends

Item	Description
H	**Horn or Alarm**
H1	Tilt / Platform overload
H2	Horn
H5	Alarm (multifunction)
JC	**Joystick**
JC3	Drive/steer proportional joystick
JC7	Boom proportional joystick: primary up/down, turntable rotate
KS	**Key switch**
KS1	Key switch
L	**LED or Light**
L1	Drive enable led
L4	Platform overload led (AS/CE models)
L5	Battery mode led
L29	Work lights
L44	Hybrid mode LED
L45	Platform overload led (AS/CE models)
L48	Tilt alarm led (ANSI/CSA models)
L53	Charger LED
LS	**Limit Switch**
LS1	Primary boom retract
LS3	Drive enable
LS18	Platform overload (AS/CE models)

Item	Description
M	**Motor**
M1	Function pump motor/generator
M2	Auxiliary pump
M3	Engine starter
P	**Button**
P1	Red emergency stop (ground)
P2	Red emergency stop (platform)
P3	Horn
P4	Function enable
PR	**Power Relay**
PR1	Main contactor
PR2	Pump / Generator contactor
R	**Resistor**
R1	+5V
R2	+2.5V
S	**Sensor**
S7	Tilt sensor
S13	Steer angle sensor
S17	Primary angle sensor
S26	Function pump motor/generator
J173	Fuel level sensor
SW	**Switch**
SW2	Engine temperature switch
SW3	Engine oil switch
SW30	Proximity switch

Electrical Component and Wire Color Legends

TS	Toggle Switch
TS1	Auxiliary pump
TS3	Hybrid mode
TS5	Function speed
TS7	Platform rotate
TS8	Jib boom up/down
TS9	Platform level up/down
TS13	Primary boom extend/retract
TS14	Motor shift (high / low)
TS15	Drive enable
TS18	Work light (option)
TS46	Proximity kill (option)
TS47	Inverter (option)
TS51	Auxiliary pump
TS52	Mode select
TS57	Platform rotate
TS58	Jib boom up/down
TS59	Platform level up/down
TS61	Primary boom up/down
TS62	Turntable rotate
TS63	Primary boom extend/retract
TS69	Recovery

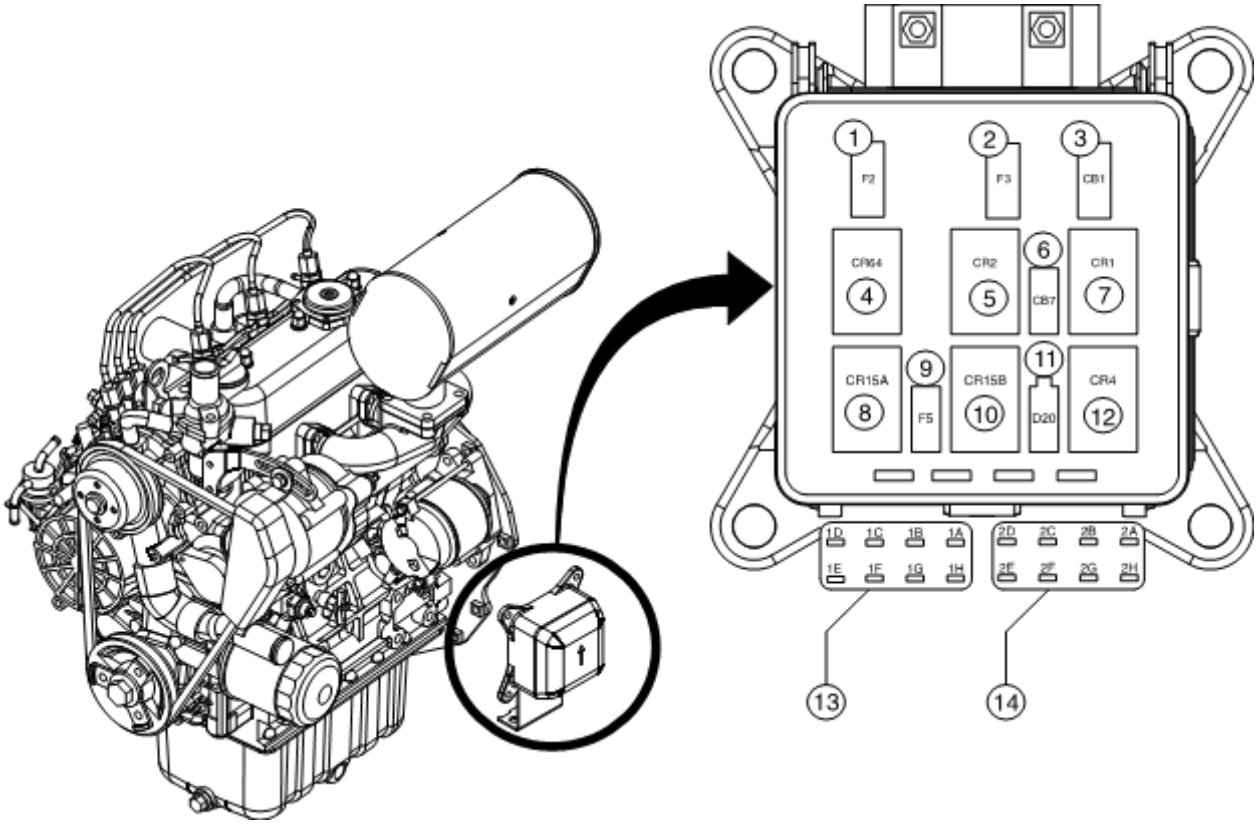
U	Module
U3A	DCON, RR, AC motor controller
U3B	DCON, LR AC motor controller
U3C	DCON, RF AC motor controller (4WD option)
U3D	DCON LF AC motor controller (4WD) option)
U4	48V charger
U6	2000W inverter

Wire Color Legend

Item	Description
BL	Blue
BK	Black
BR	Brown
GR	Green
OR	Orange
PP	Purple
RD	Red
WH	White
YL	Yellow
BL/BK	Blue/Black
BL/RD	Blue/Red
BL/WH	Blue/White
BK/RD	Black/Red
GR/BK	Green/Black
GR/WH	Green/White
OR/BK	Orange/Black
OR/RD	Orange/Red
OR/WH	Orange/White
RD/BK	Red/Black
RD/WH	Red/White
WH/BK	White/Black
WH/RD	White/Red
WH/YL	White/Yellow
YL/BK	Yellow/Black

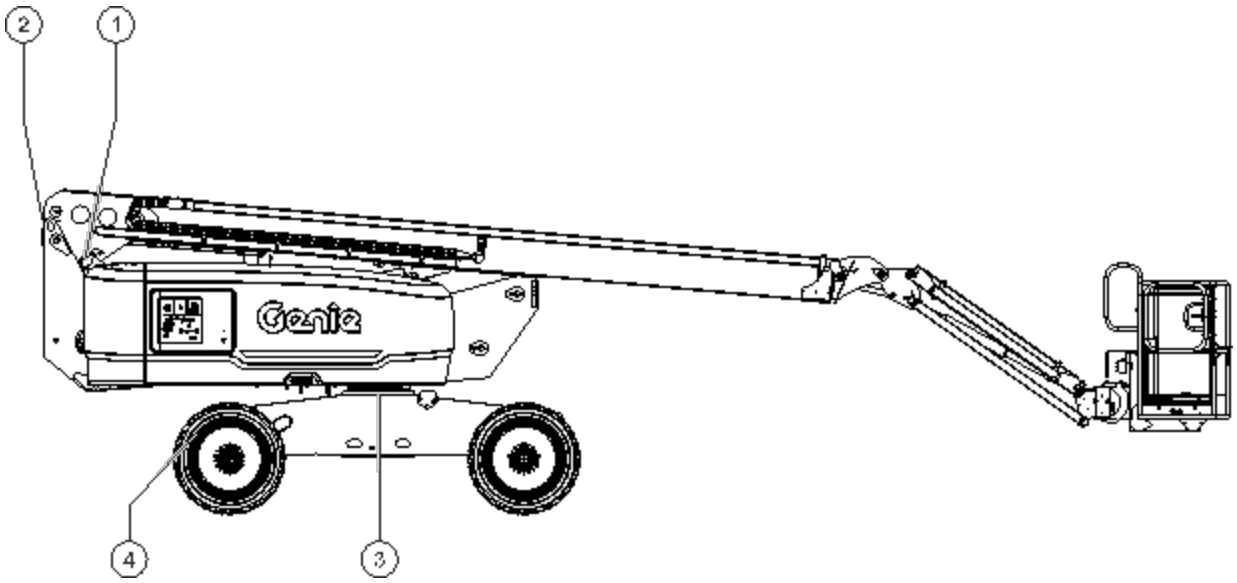
Kubota Engine Fuse and Relay Module

Kubota D1105-E4B



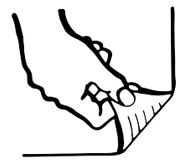
1 Fuse 1 - 15A (spare)
2 Fuse 3 - 30A glow plug
3 Circuit breaker 1 - 15A Engine start / Fuel pump
4 Control Relay 64 Engine fault
5 Control Relay 2 Fuel pump
6 Circuit breaker 7 - 10A Engine RPM
7 Control Relay 1 Engine start
8 Control Relay 15A glow plug 1
9 Fuse 5 - 15A (spare)
10 Control Relay 15B glow plug 2
11 Diode - 6A
12 Control Relay 4 Engine RPM
13 Connector 1 Blue
14 Connector 2 Orange

Limit Switch/Angle Sensor Legend

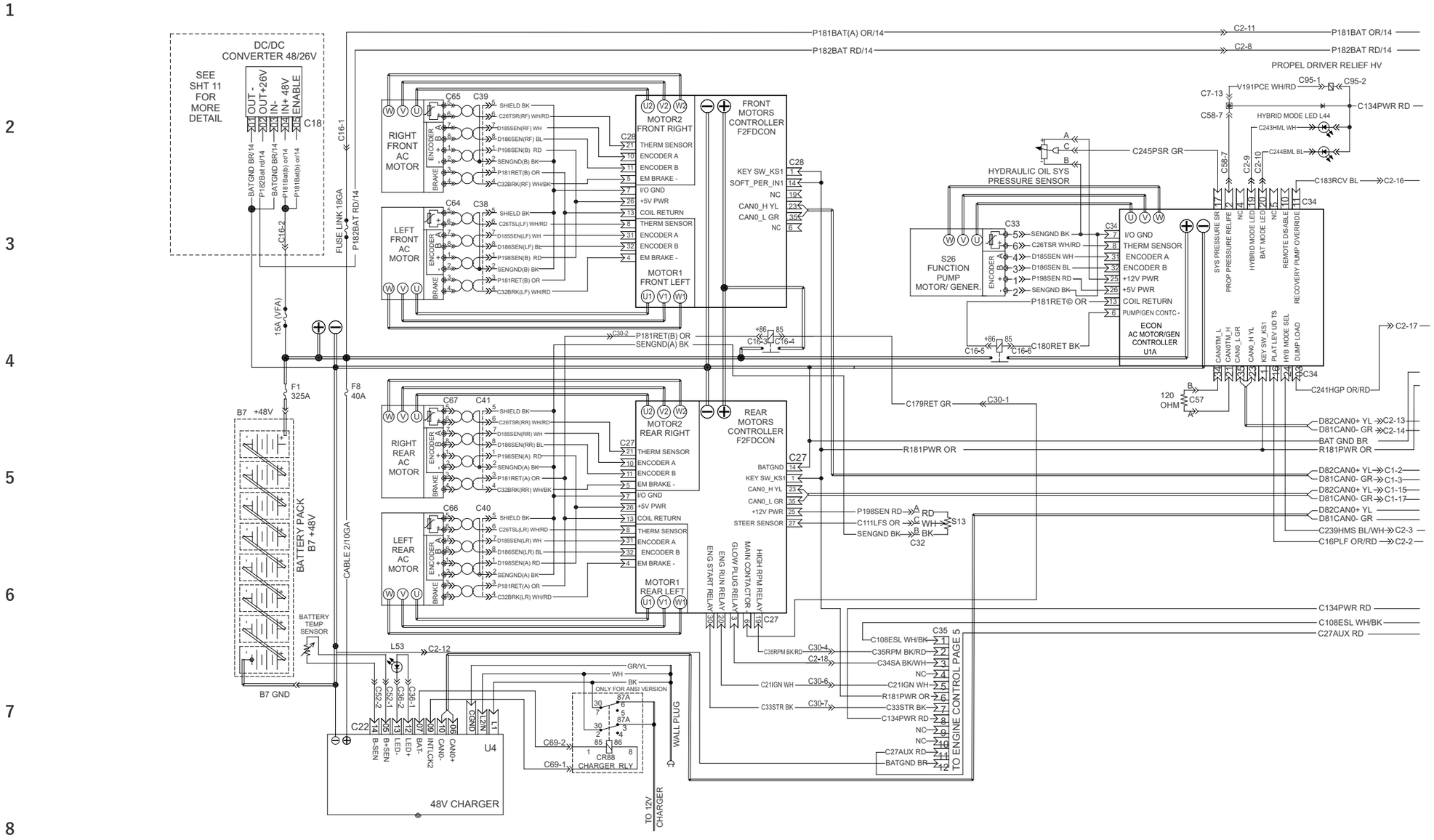


1 S17 Primary angle sensor
2 LS1 Boom extend limit switch
3 LS3 Drive enable
4 S13 Steer Angle sensor (inside steer cylinder)

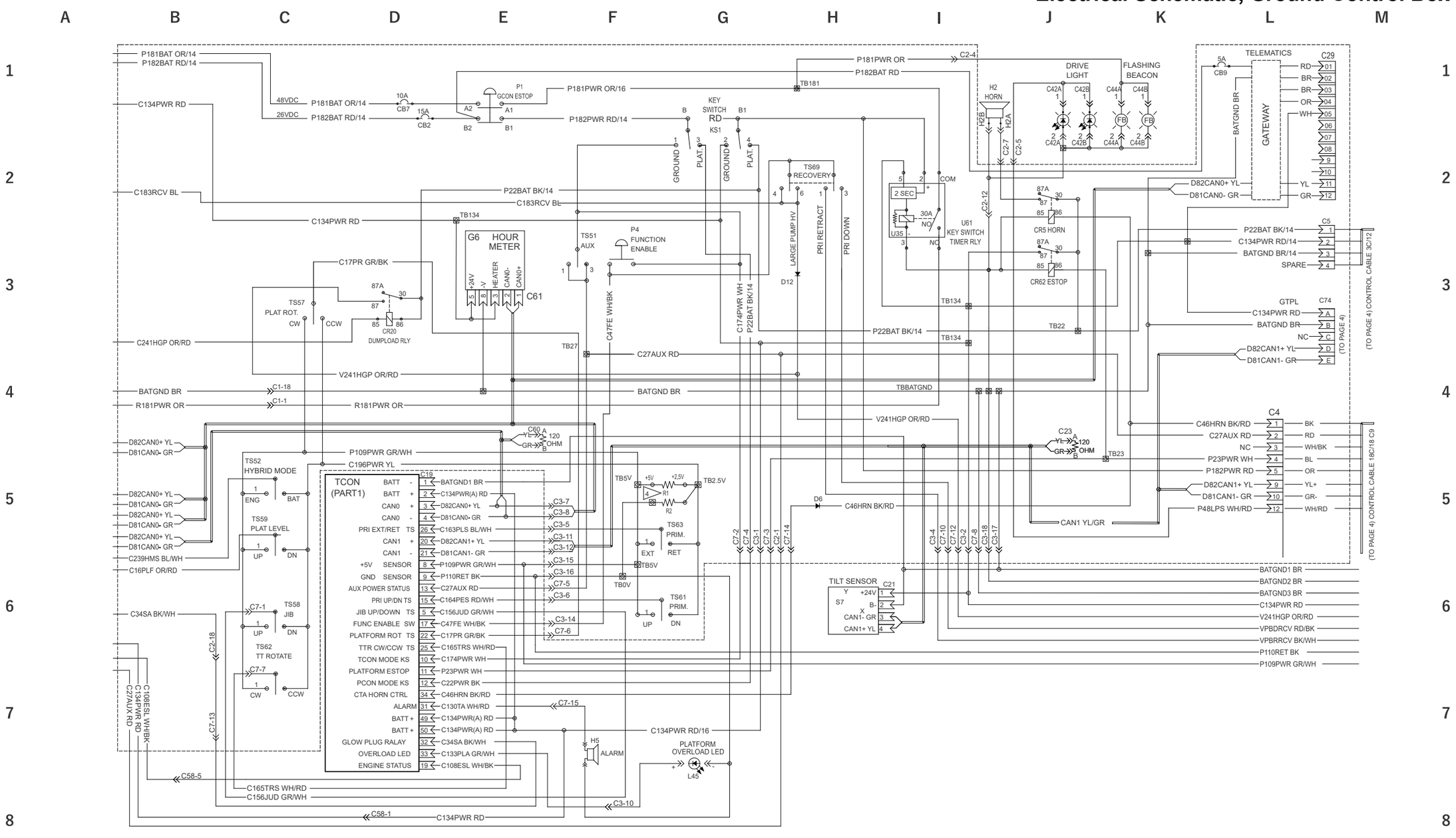
Electrical Schematic, DC/FE Models



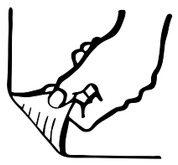
Electrical Schematic, DC/FE Models



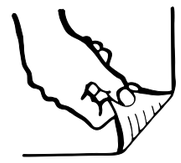
Electrical Schematic, Ground Control Box



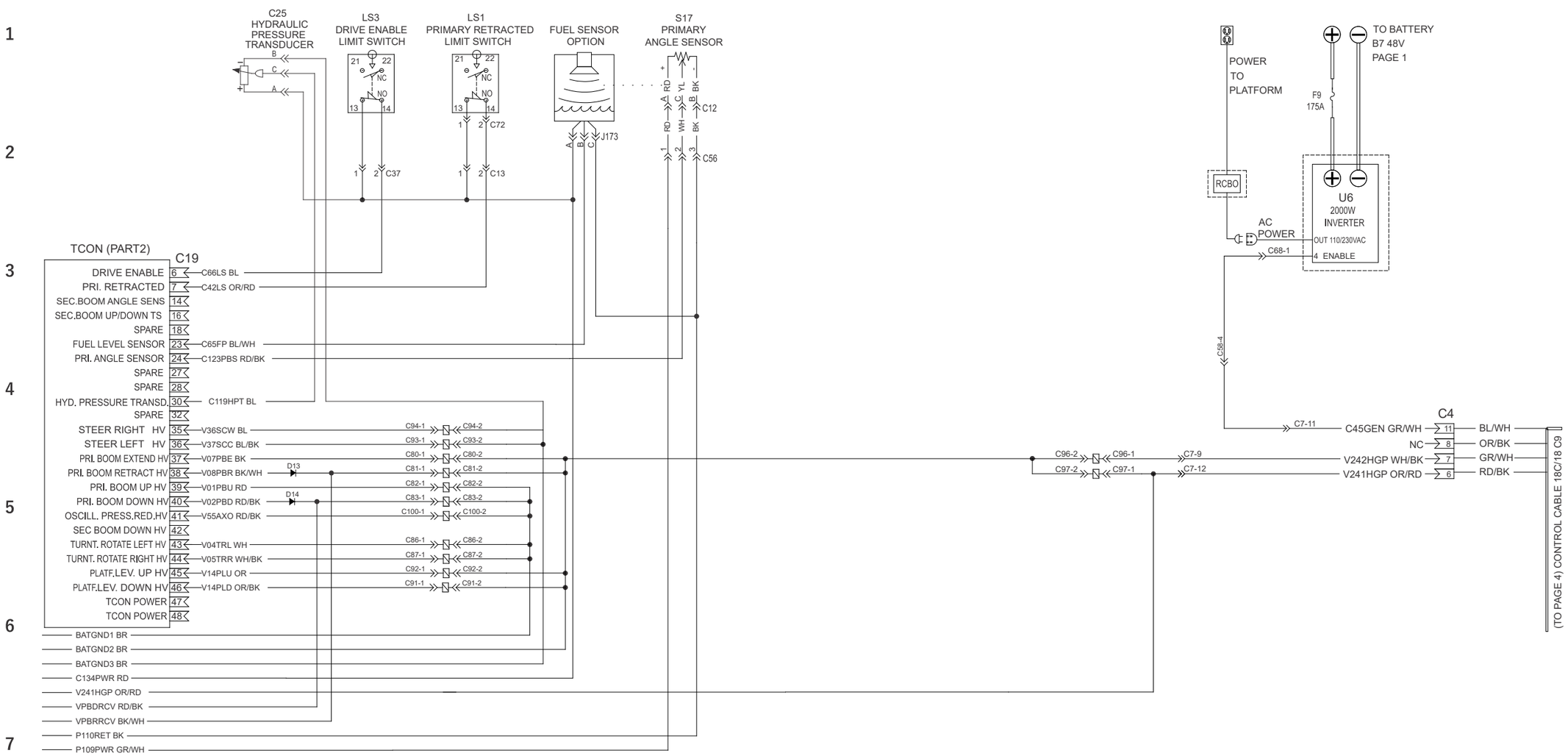
Electrical Schematic, Ground Control Box



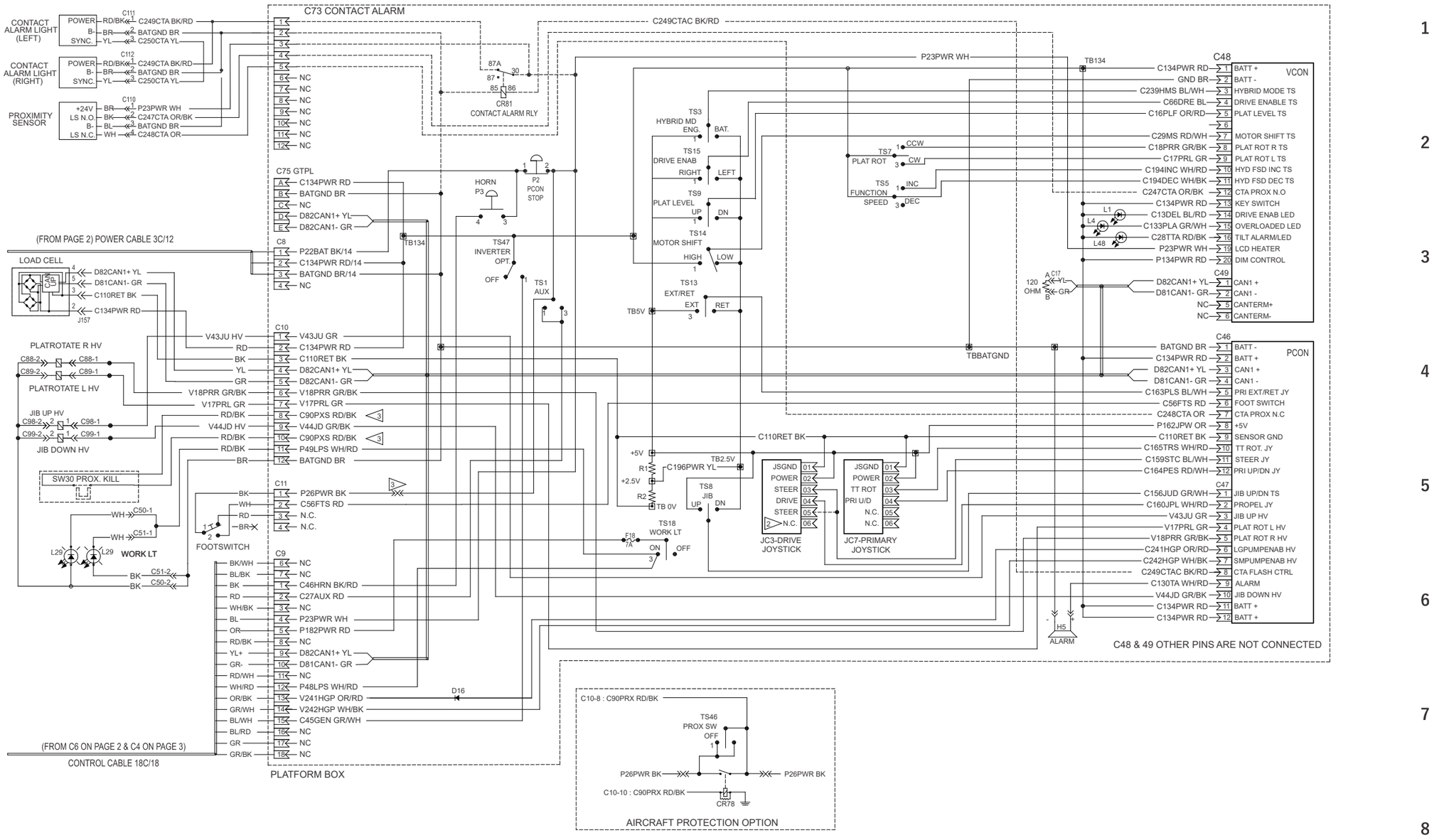
Electrical Schematic, Turntable Controller



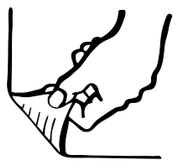
Electrical Schematic, Turntable Controller



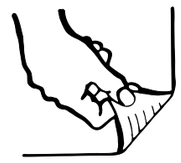
Electrical Schematic, Platform Control Box



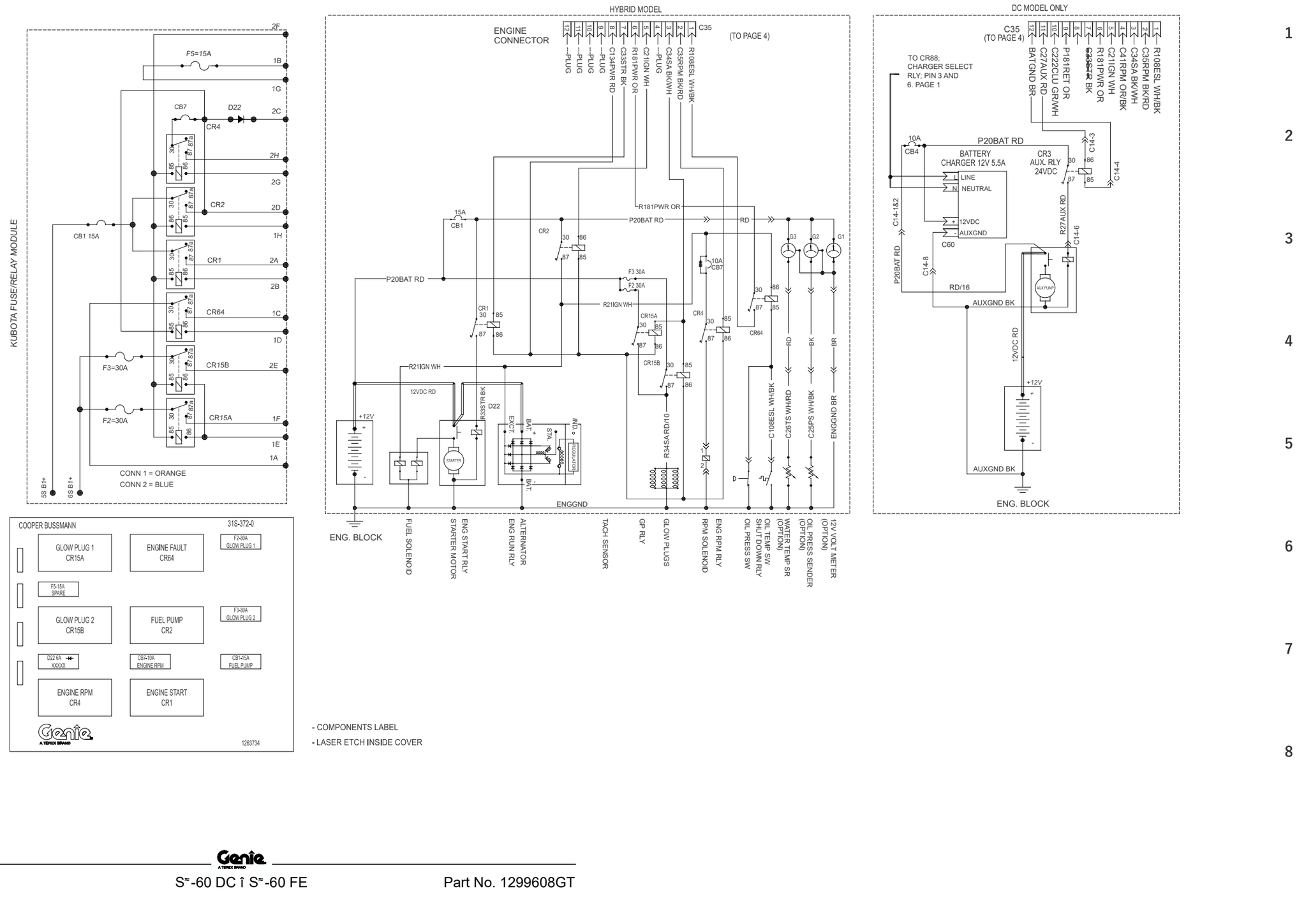
Electrical Schematic, Platform Control Box



Electrical Schematic, Kubota D1105

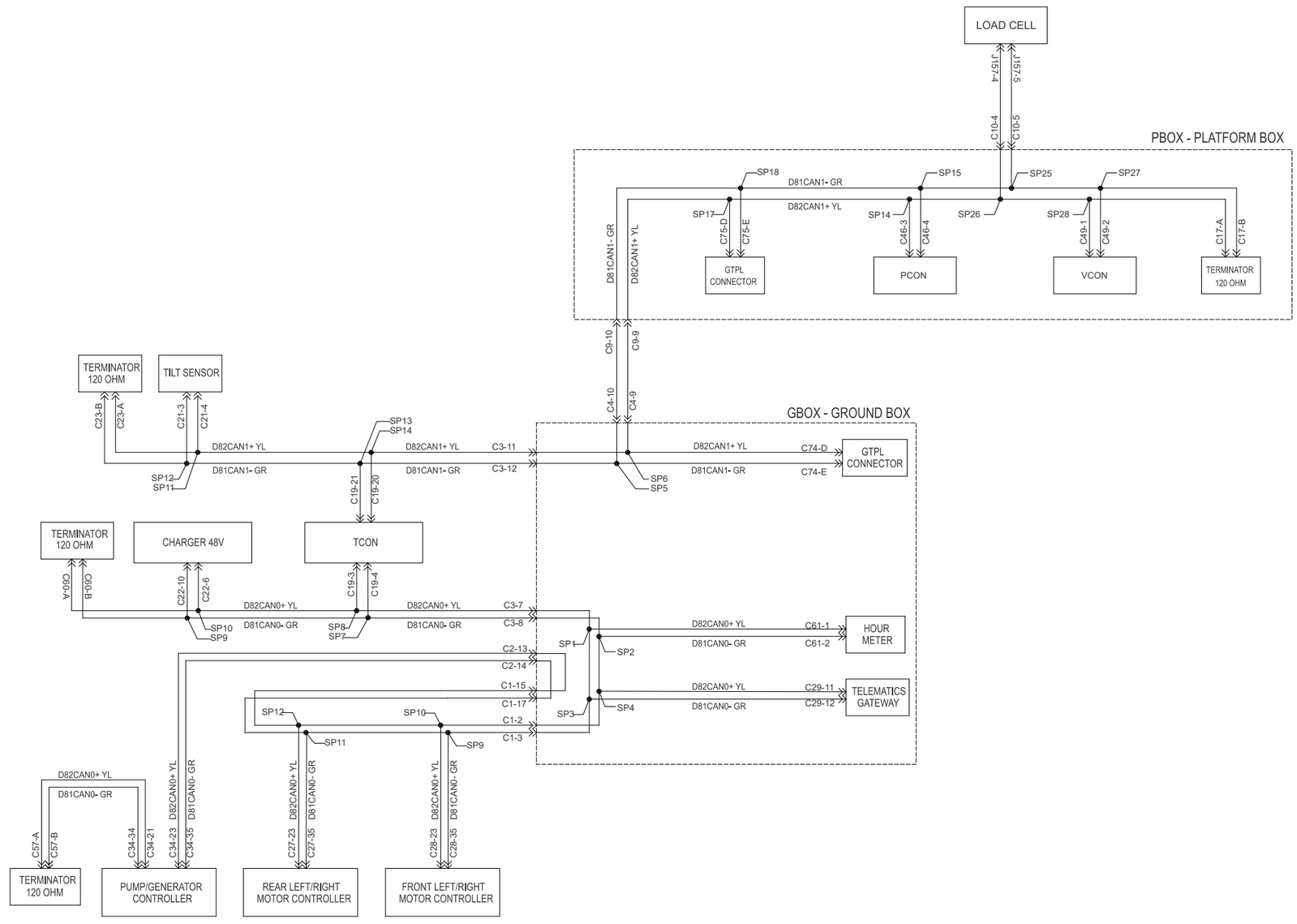


Electrical Schematic, Kubota D1105

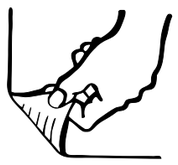


- COMPONENTS LABEL
- LASER ETCH INSIDE COVER

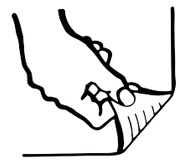
CAN BUS Wiring Diagram



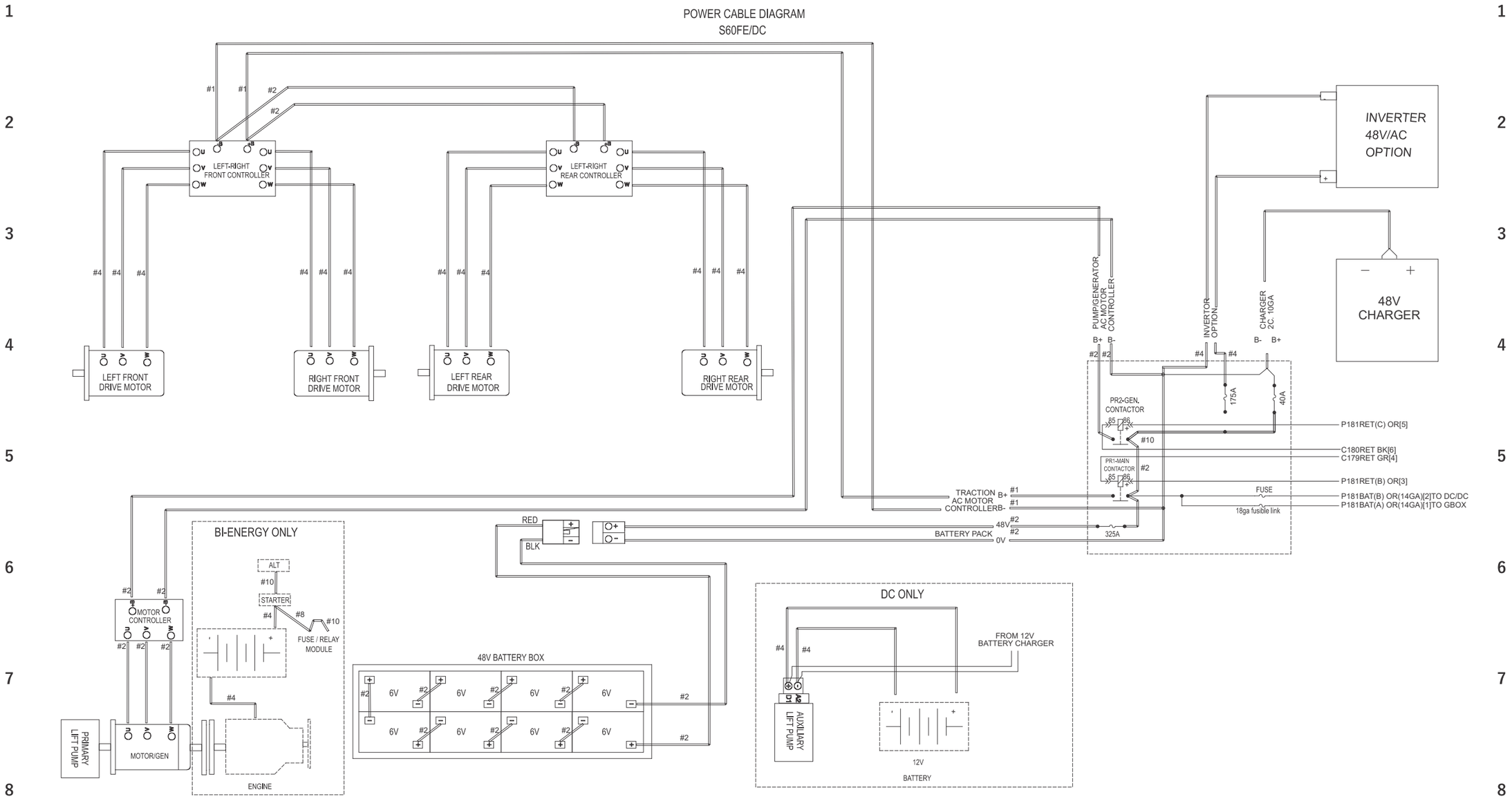
CAN BUS Wiring Diagram



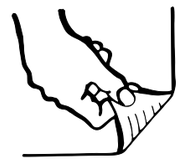
Power Cable Wiring Diagram



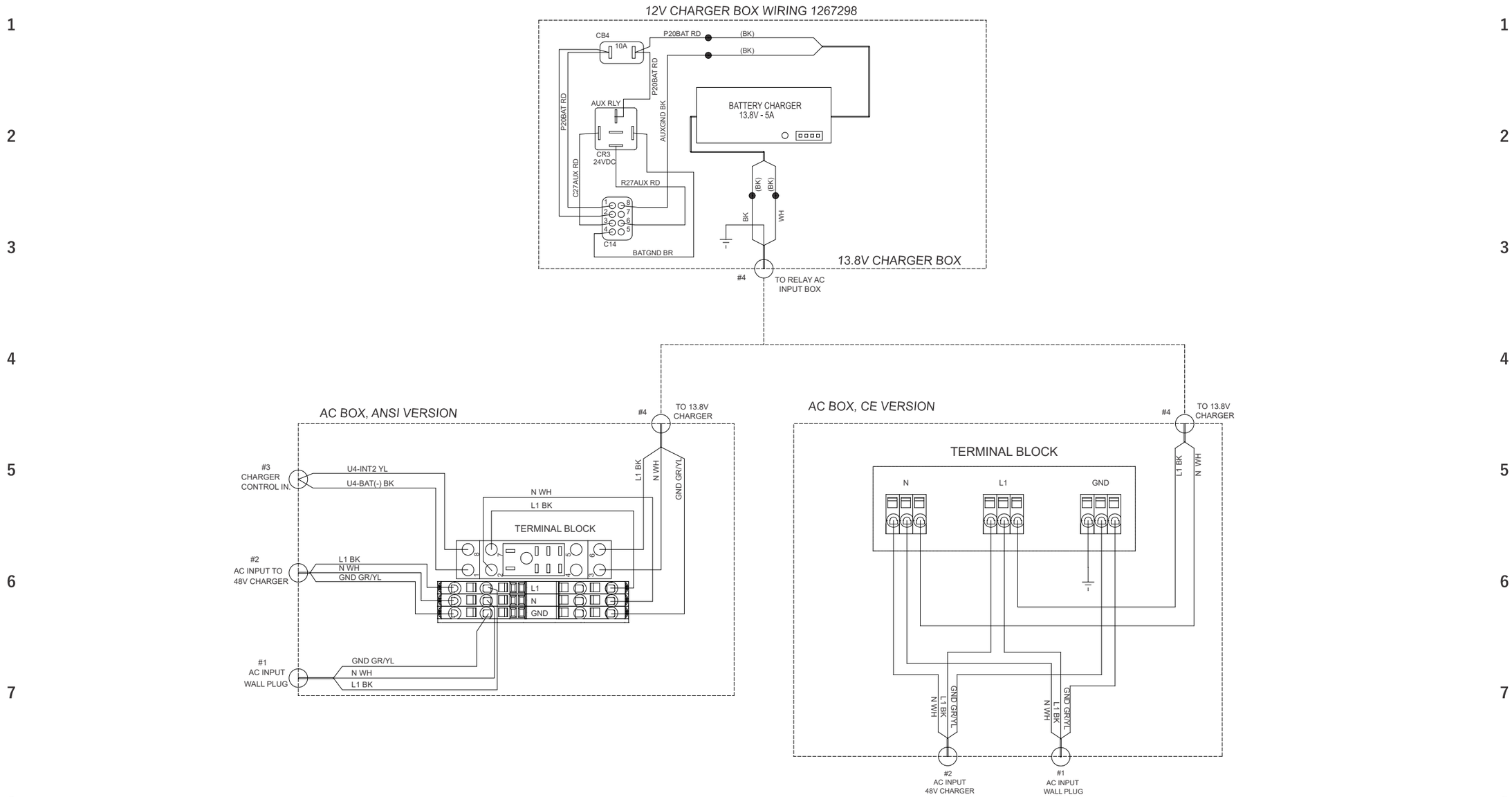
Power Cable Wiring Diagram



Wiring Diagram, AC Power Options

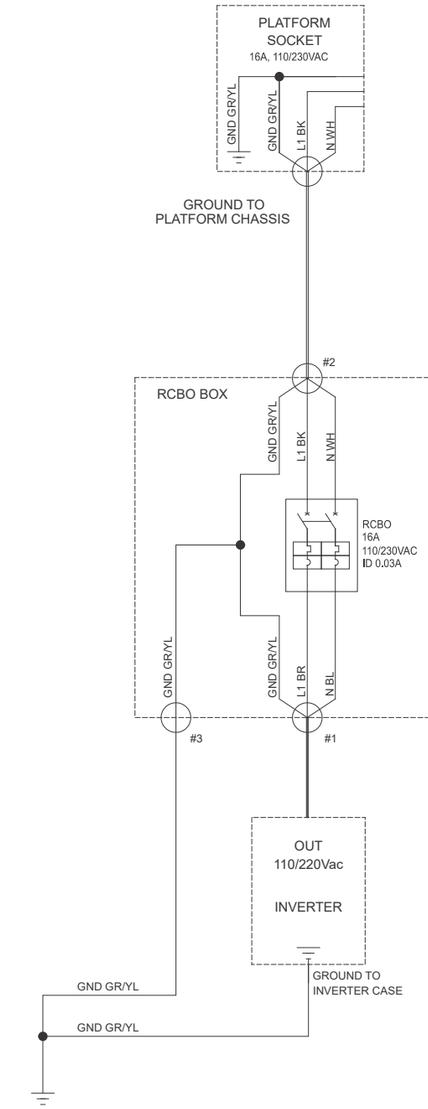


Wiring Diagram, AC Power Options



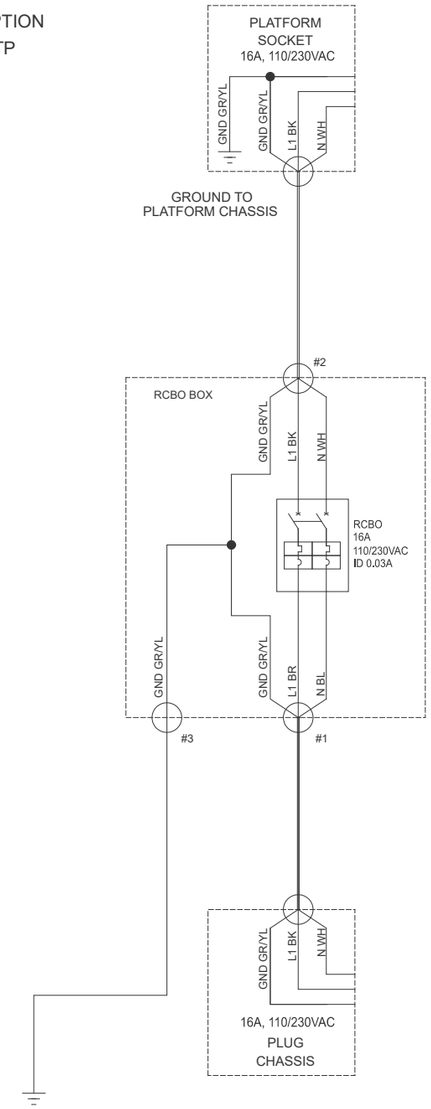
Wiring Diagram, RCBO Options

RCBO OPTION
USING INVERTER



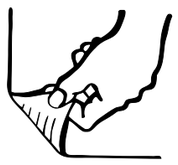
GROUND TO MACHINE CHASSIS

RCBO OPTION
USING PTP

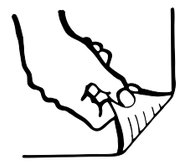


GROUND TO MACHINE CHASSIS

Wiring Diagram, RCBO Options

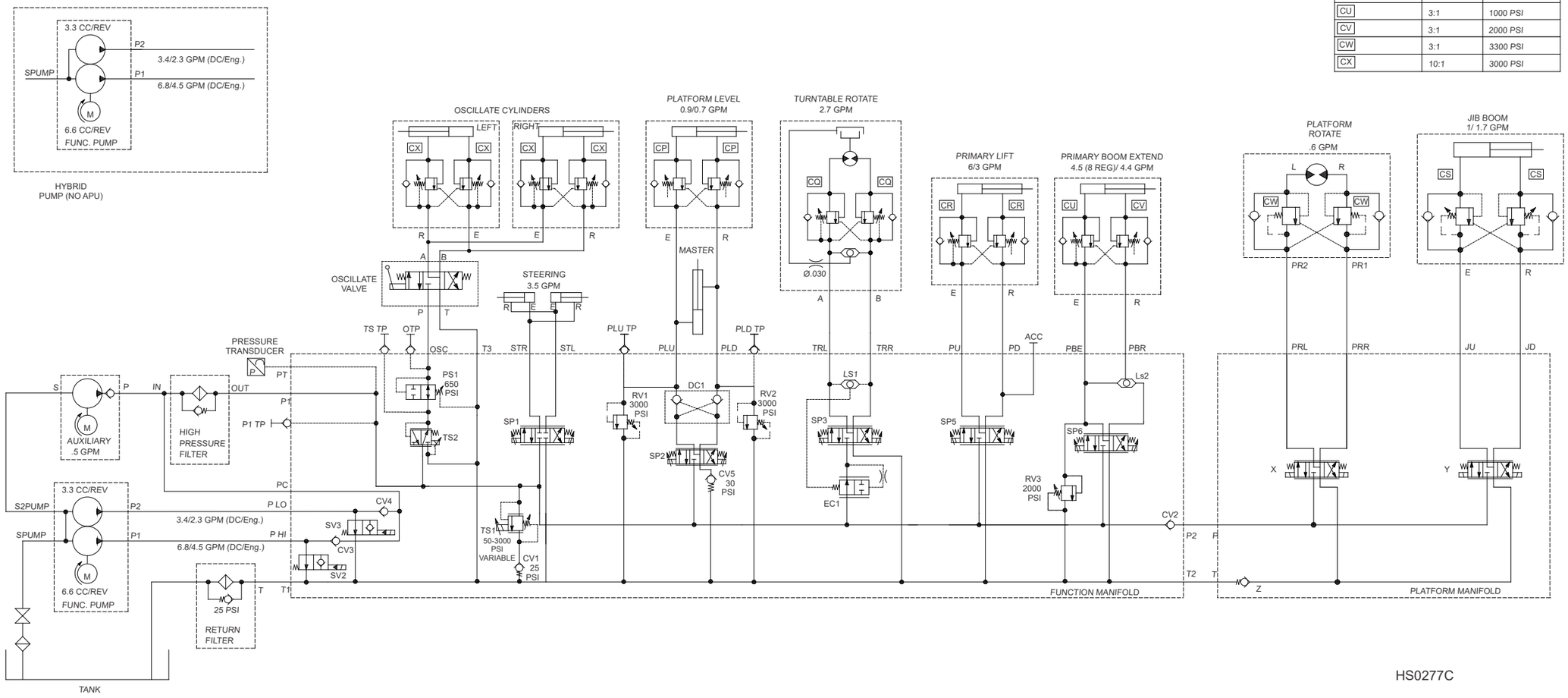


Hydraulic Schematic, DC/FE Models



Hydraulic Schematic, DC/FE Models

COUNTERBALANCE VALVES	
RATIO	PRESS
CP 4.5:1	3500 PSI
CQ 3:1	1000 PSI
CR 3:1	3500 PSI
CS 4.5:1	3500 PSI
CU 3:1	1000 PSI
CV 3:1	2000 PSI
CW 3:1	3300 PSI
CX 10:1	3000 PSI



HS0277C

California Proposition 65

WARNING

Operating, servicing and maintaining this equipment can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. These chemicals can be emitted from or contained in other various parts and systems, fluids and some component wear by-products. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your equipment and vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your equipment or vehicle and after operation. For more information go to www.P65Warnings.ca.gov/passenger-vehicle.

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel.

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