



# Section 4

## TROUBLESHOOTING

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## GENERAL TROUBLESHOOTING TIPS

### HYDRAULIC FLUID PUMP

The Hydraulic Drive Pump used in this model is a Variable Displacement, Axial Piston type pump. Proper adjustment is critical for normal operation of the machine. Refer to "Hydraulic Pressure Adjustment" on page 4-34.

The Functions/Lift pump is a fixed-displacement gear-type pump attached to the rear of the Drive Pump.

#### ***Common Causes of Electrical System Malfunctions:***

- Battery switch is turned OFF (located to the left of lower controls).
- Battery connections are loose or corroded
- Battery is not fully charged.
- Emergency Stop buttons are pushed (OFF position).
- Circuit breaker is tripped (OFF position).

#### ***Common Causes of Hydraulic System Malfunctions:***

- Hydraulic fluid level is too low.
- Incompatible hydraulic fluids mixed, destroying the additives and causing varnish build up, resulting in the valves sticking.
- Water in the hydraulic fluid due to a damp climate.
- Improper hydraulic fluid used. Viscosity too high in cold climates. Viscosity too low in warm climates.
- Hydraulic fluid contaminated with debris - filter change interval neglected.

**NOTE:** MEC uses a multiple viscosity fluid that is light enough for cold climates and resists thinning in warm climates. Use only the recommended hydraulic fluid. Substituting with a lower grade fluid will result in pump and drive motor failure. Refer to "Lubrication" in the *INTRODUCTION* Section

**NOTE:** Contamination always causes failure in any hydraulic system. It is very important to be careful not to introduce any contamination into hydraulic system during the assembly procedures. Please make sure all ports and cavities of the manifold and cylinders are properly covered/plugged during maintenance activities.

## ELECTRICAL SYSTEM TROUBLESHOOTING

The electronic control system used on this machine was designed for low maintenance and long, trouble-free operation. The system consists of two microprocessor based modules: the Matrix Module and the GP400 Processor. They communicate through a low voltage digital signal called CAN-Bus communication.

To protect against part failure or incorrect plug connections, the modules are fully short circuit and reverse polarity protected. All electrical plug connections are waterproof to promote longer trouble free operation and to increase terminal life.



**NEVER ATTEMPT TO SUPPLY BATTERY POWER, OR VOLTAGE HIGHER THAN 12 VOLTS TO ANY PART OR MODULE IN THIS SYSTEM, AS CATASTROPHIC FAILURE OF THE MODULES MAY RESULT.**

**USE OF HIGH PRESSURE WASHING EQUIPMENT DIRECTLY ON THE MODULES CAN FORCE WATER INTO SEALED CONNECTION AND CAN CAUSE A TEMPORARY SYSTEM SHUT-DOWN. HIGH PRESSURE WASHING WITHIN THE VICINITY OF THE MODULES IS HIGHLY DISCOURAGED.**

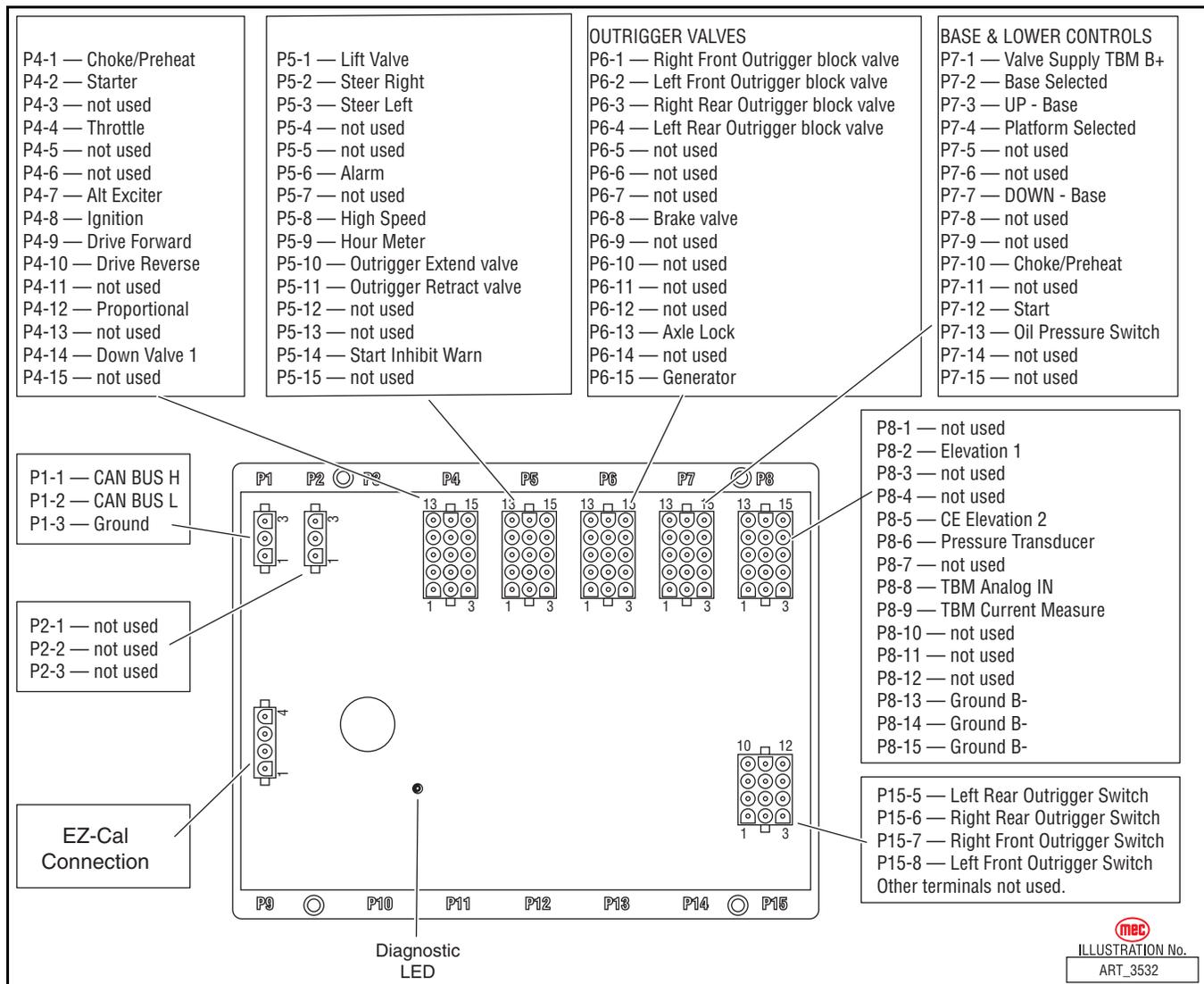
# GP400 MODULE

The GP400 module is “the brains” of the system. It receives and processes a variety of inputs both from the machine and the operator, then controls all the operative functions of the machine. It also has a feature that allows the technician to access and monitor all functionality of the system, along with a technician-friendly series of fault messages that can be accessed through the use of the EZ-Cal scan tool. Flash codes are also provided in case an EZ-Cal scan tool is not available.

Such information can be used for preventative maintenance and troubleshooting should a problem arise. A comprehensive list of EZ-Cal accessible information can be found later in this section.

The GP400 operates on 12 volts DC and should never be probed or operated with voltage higher than 14 volts DC

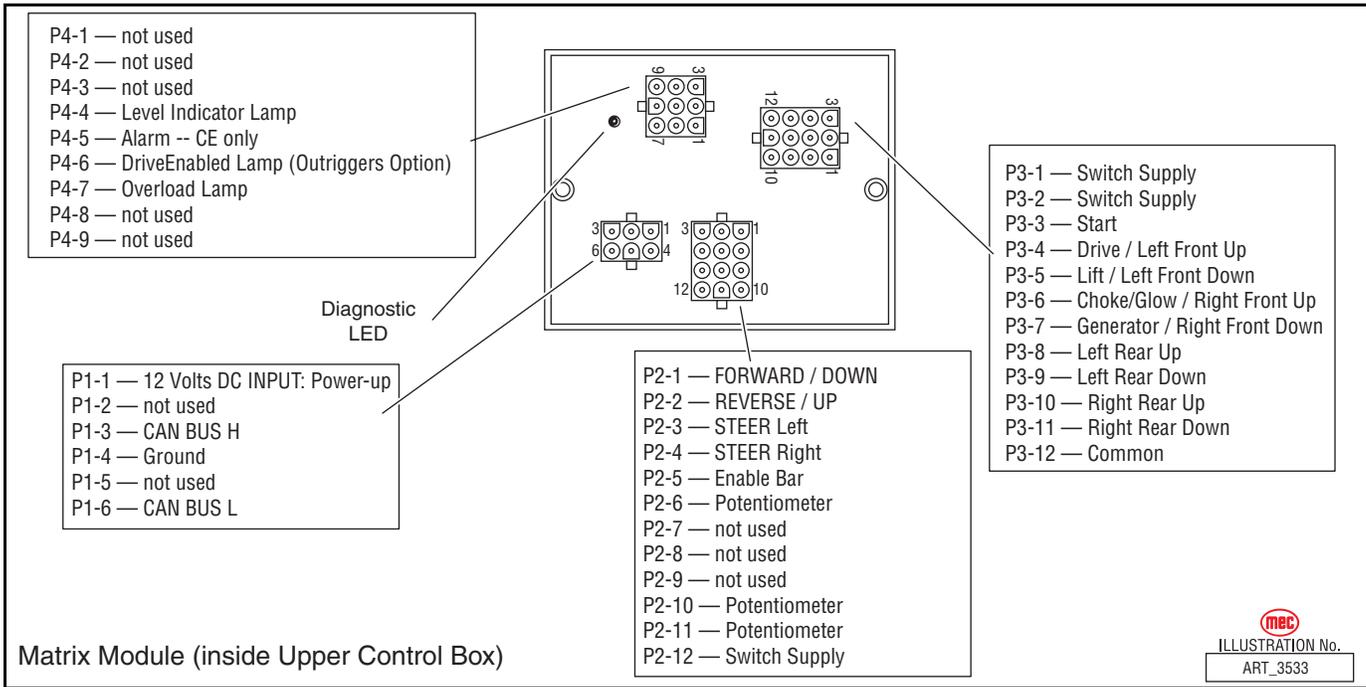
Figure 4-1: GP400 Module



## MATRIX MODULE

The Matrix Module is the remote module located inside the upper control box. It received inputs from the operator and relays them to the GP400.

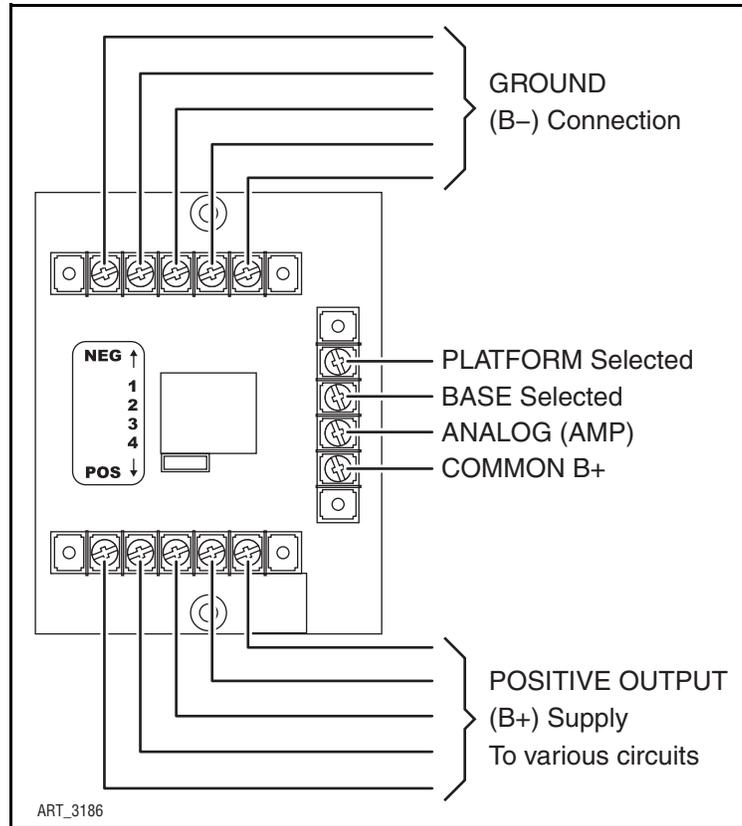
Figure 4-2: Matrix Module



## TERMINAL BLOCK MODULE (TBM)

There is a module inside the lower control box called a TBM (Terminal Block Module) that provides terminal point connections for both positive and ground circuits. A signal from the Emergency Stop circuit activates a load-reduction relay within the TBM that provides ample power to the B+ (positive) terminal strip. This arrangement protects the system against voltage drop conditions that can be detrimental to the electrical system.

Figure 4-3: Terminal Block Module (TBM)



## EZ-CAL SCAN TOOL

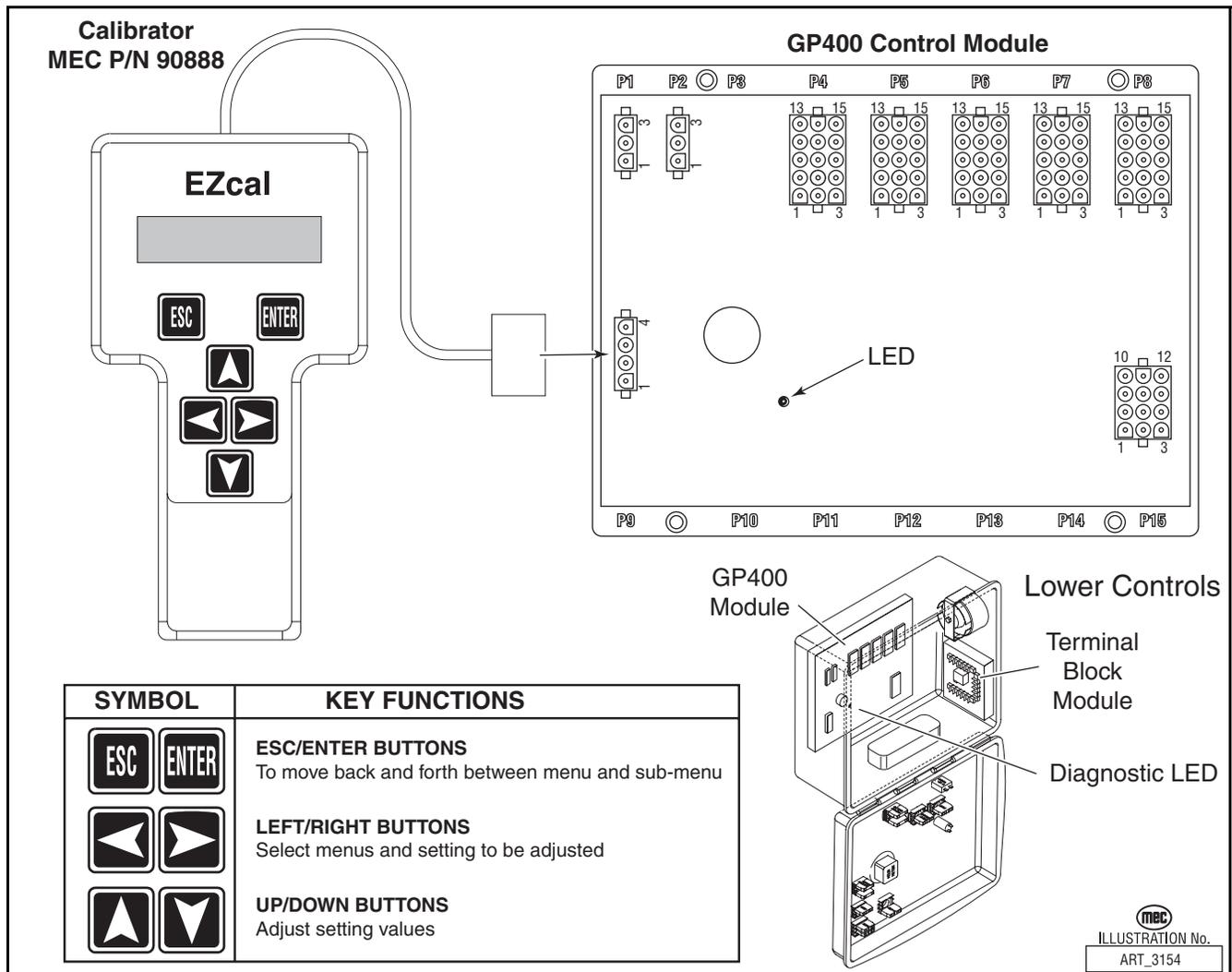
The EZ-Cal (MEC part # 90888; not part of the machine) is a hand-held scan tool that interfaces with the system to provide various information and adjustments. The EZ-cal receives its power from the GP400 when connected. The system must be powered up by closing the Battery disconnect switch and pulling out both emergency stop switches. You must also select Base or Platform depending on the station you will operate from.

### USING THE EZ-CAL SCAN TOOL

To operate the EZ-cal, plug the cable into the 4-terminal receptacle P9 on the GP400 and power the system up.

- The EZ-Cal display will illuminate and read "HELP: PRESS ENTER". From this point, use the right and left arrows to scroll through the base menus.
- Once the desired base menu is obtained (i.e. *ADJUSTMENTS*) press Enter to access sub menus.
- Use the right and left arrows to scroll through sub menus, press Enter again.
- The up/down arrows are used to change settings only.
- Press ESC to back up one level.

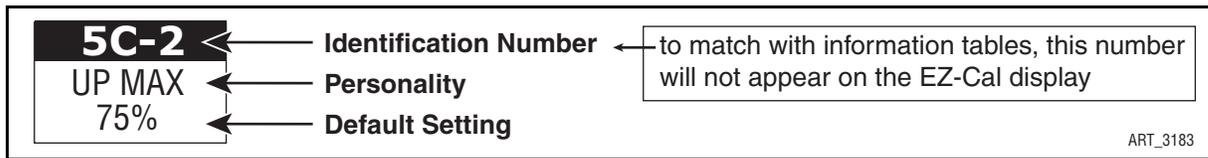
Figure 4-4: EZ-Cal Scan Tool Connections - GP400 Module



## USING THE EZ-CAL WITH THE FLOW CHARTS

Use the EZ-cal Flow Charts as a guide to locate diagnostic information and make adjustments. Each box in the flow chart will have 3 bits of information.

Figure 4-5: EZ-Cal Display Example



**The IDENTIFIER (5c2):** – Used to locate this specific personality in the informational charts. Here you can obtain specific information on the individual personalities.

**The PERSONALITY (Up Max):** – Identifies the individual personalities.

**The DEFAULT SETTING:** – The factory setting. If adjustments are made, they must be returned to default setting.



**ACCESS LEVEL 1 PROVIDES ACCESS TO CHANGE PERSONALITIES NORMALLY PRESET AT THE FACTORY TO PROVIDE PROPER MACHINE MOVEMENT AT SAFE SPEEDS. PERSONALITIES MUST NOT BE CHANGED WITHOUT PRIOR AUTHORIZATION FROM MEC AND MAY ONLY BE RETURNED TO FACTORY SPECIFICATION AS LISTED IN THE FOLLOWING TABLES.**

### ERROR MESSAGES

To obtain error messages from the EZ-cal Connect the EZ-cal as mentioned above. The display will read, “HELP:PRESS ENTER”. Press Enter to display the current error message. Use the following list of error messages to better understand the fault. Pressing Enter twice will provide a scrolling message of the current error followed by a log of previous errors that may have occurred within recent operation.

### FLASH CODES

Flash Codes, provided from the GP400 red LED, will also assist in the event an EZ-cal is not available. However, the EZ-cal yields considerably more relevant information. Refer to “EZ-Cal HELP Messages” on page 4-22 for flash coded error messages.

Figure 4-6: EZ-Cal Flow Chart: Adjustments and Setup, ANSI Models

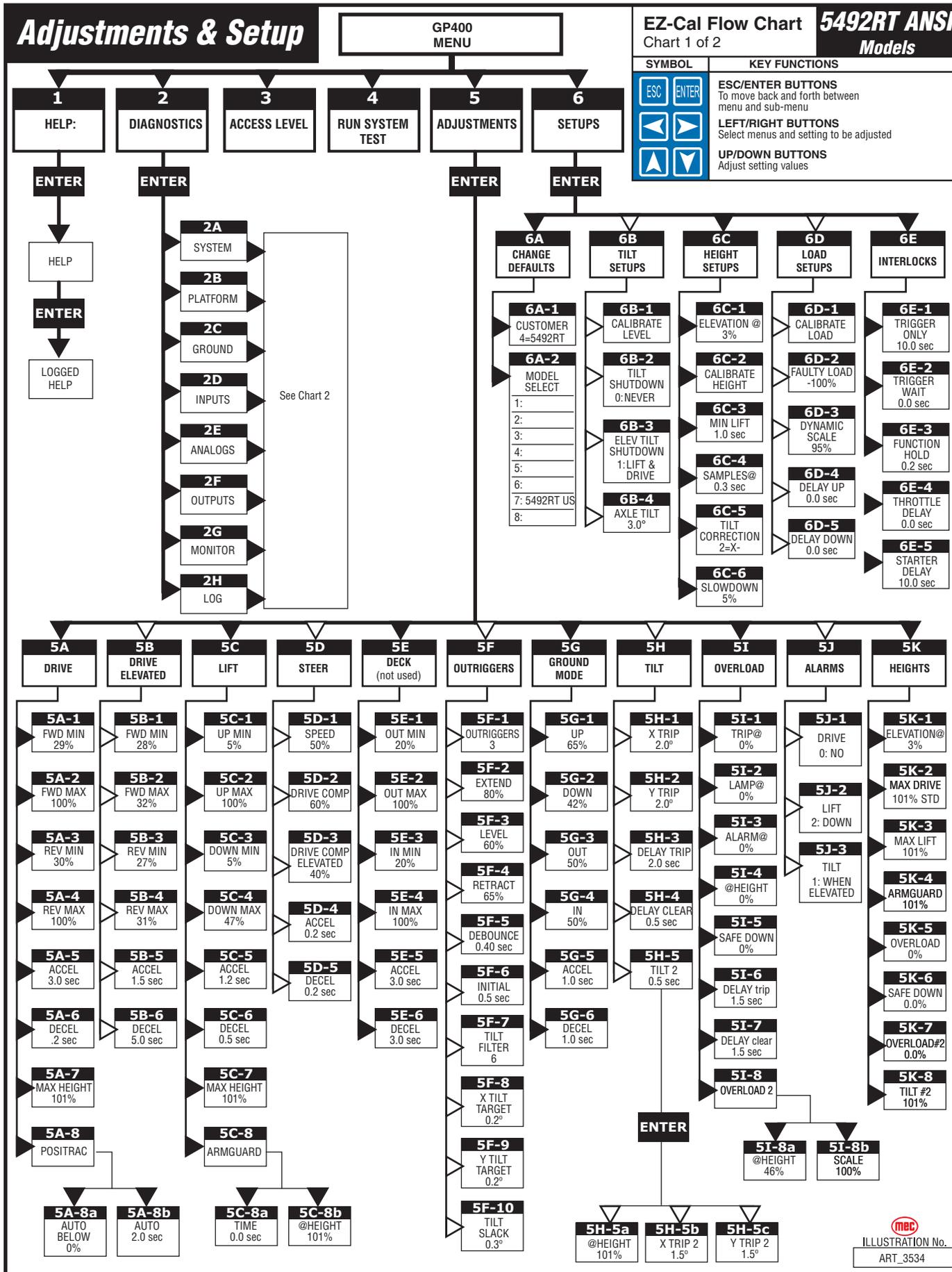


Figure 4-7: EZ-Cal Flow Chart: Diagnostic, ANSI Models

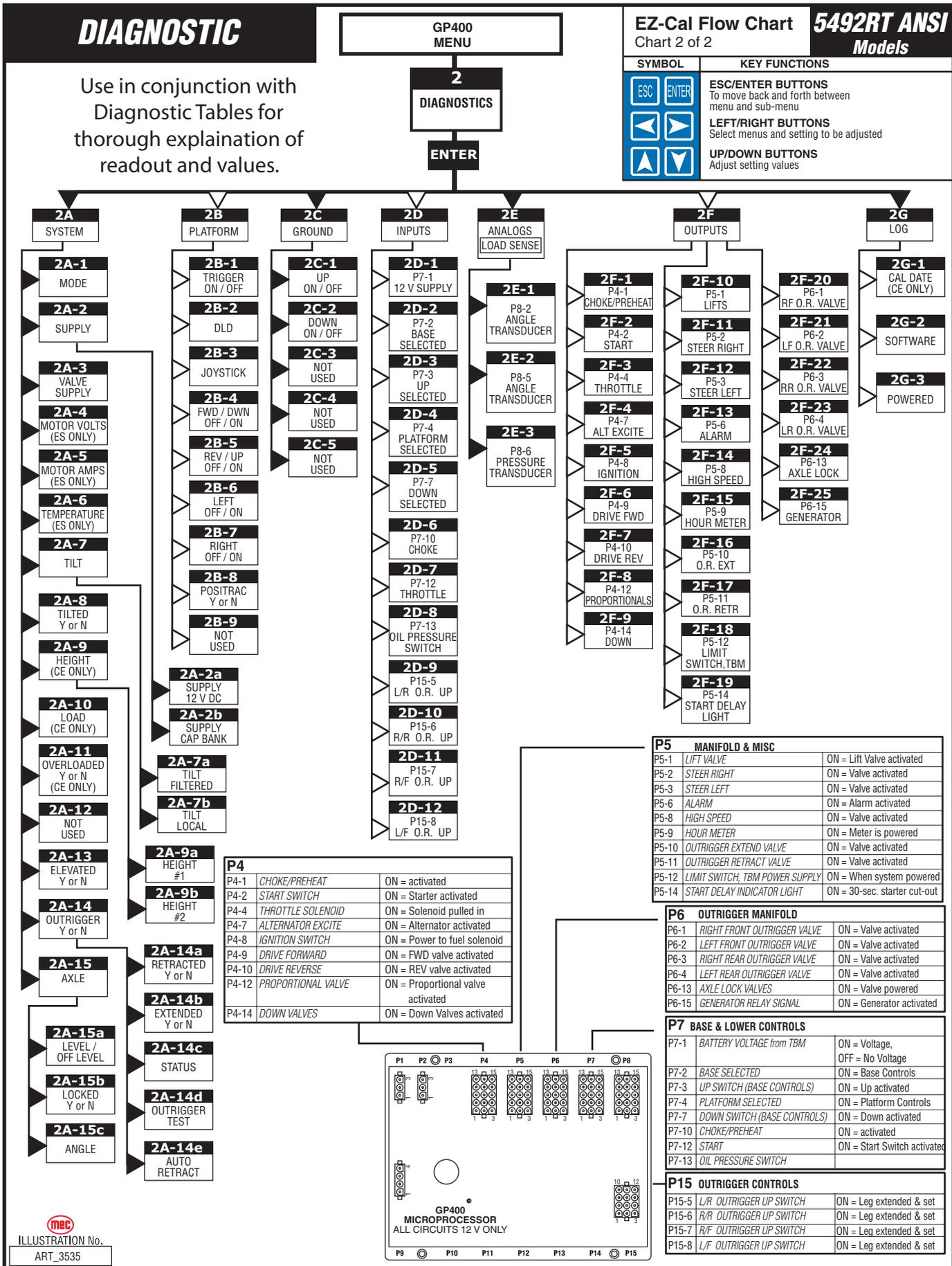


Figure 4-8: EZ-Cal Flow Chart: Adjustments and Setup, Optional Load Sensing System

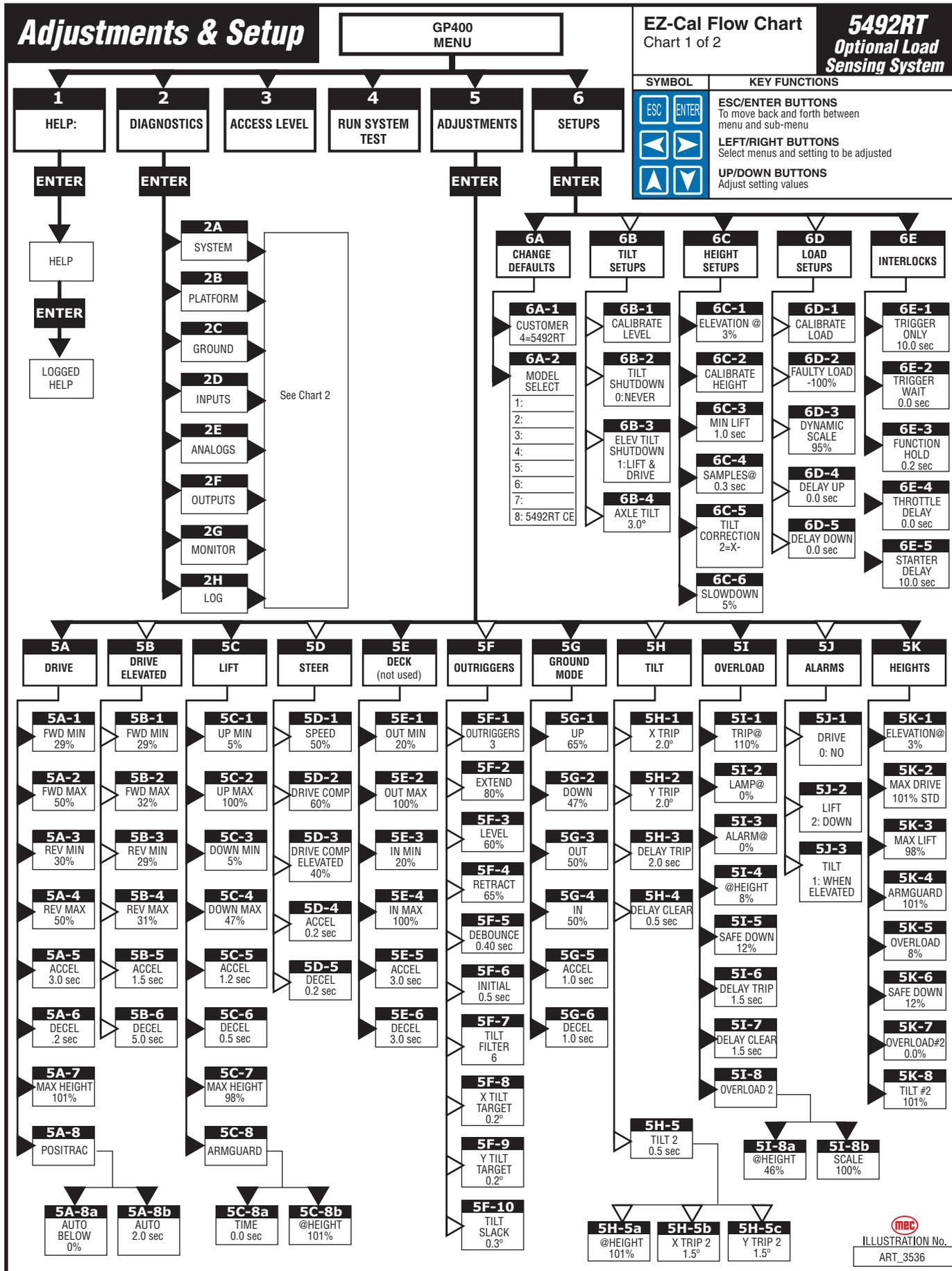


Figure 4-9: EZ-Cal Flow Chart: Diagnostic, Optional Load Sensing System

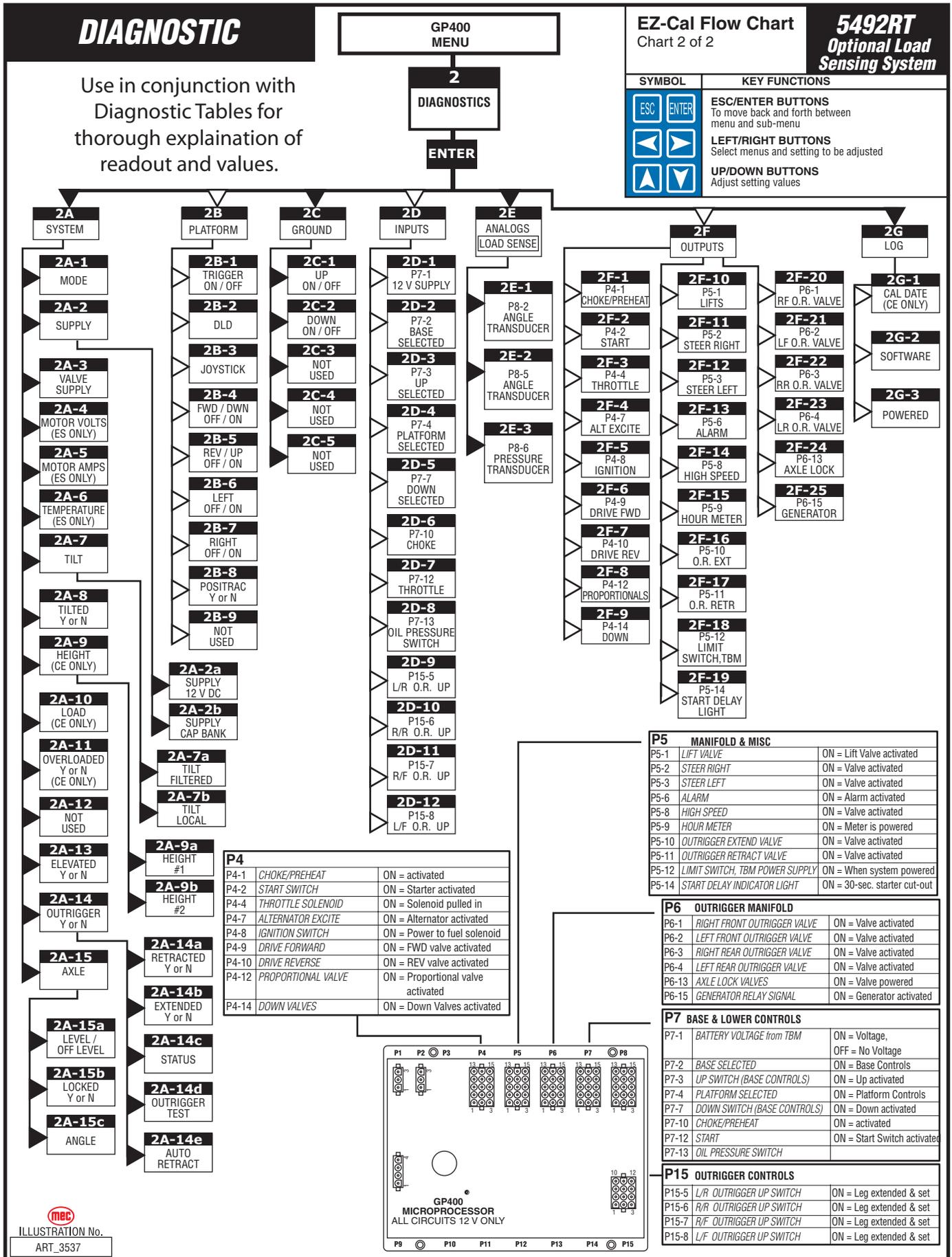


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## EZ-CAL ADJUSTMENT

Refer to "Using the EZ-cal Scan Tool" on page 4-7.

Adjustments are possible in Access Level 1 Only.

Before changing personalities, ensure that the correct customer and model have been selected in the SETUPS menu. Any changes to settings will be lost when the model or customer is changed.

To reach ADJUSTMENTS, first access Level 1, then press --> for ADJUSTMENTS.

Press Enter, then press --> to scroll through the sub-menus.

Once the desired sub-menu is found, press Enter again, then --> to scroll through the personalities. Press the Up or Down arrows to change the personality. Press ESC to go back one or more levels to reach other sub-menus.

**Table 4-1:** EZ-Cal Adjustment Table

OPERATION	ID	PERSONALITY	FACTORY SETTING	EXPLANATION
<b>5A DRIVE (PLATFORM STOWED)</b>	5A-1	FWD Min	29%	Slowest speed possible
	5A-2	FWD Max	50%	Maximum speed potential
	5A-3	REV Min	30%	Slowest speed possible
	5A-4	REV Max	50%	Maximum speed potential
	5A-5	ACCEL	3.0 sec	Ramp-up time to maximum
	5A-6	DECEL	.2 sec	Ramp-down time to stop
	5A-7	MAX Height	101%	Maximum drivable height
<b>POSITRACK</b>	5A-8	Positrack	—	Sub category, press ENTER to access
<b>Sub Menu</b>	5A-8a	AUTO below	0%	Not Used
	5A-8b	AUTO	Not Used	Not Used
<b>5B DRIVE ELEVATED</b>	5B-1	FWD Min	28%	Slowest speed possible
	5B-2	FWD Max	32%	Maximum speed potential
	5B-3	REV Min	27%	Slowest speed possible
	5B-4	REV Max	31%	Maximum speed potential
	5B-5	ACCEL	1.5 sec	Ramp-up time to maximum
	5B-6	DECEL	5.0 sec	Ramp-down time to stop
<b>5C LIFT</b>	5C-1	UP Min	5%	Slowest speed possible
	5C-2	UP Max	100%	Maximum speed potential
	5C-3	DOWN Min	5%	Slowest 2speed Possible
	5C-4	DOWN Max	47%	Maximum speed potential
	5C-5	ACCEL	1.2 sec	Ramp-up time to maximum
	5C-6	DECEL	0.5 sec	Ramp-down time to stop
	5C-7	MAX Height	<b>ANSI: 101%    LS*: 98%</b>	Maximum height potential
<b>ARMGUARD (LS*)</b>	5C-8	Armguard	—	Sub category, press ENTER to access
<b>Sub Menu</b>	5C-8a	Armguard Time	0.0 sec	Not Used
	5C-8b	Armguard @ Height	101%	Not Used
<b>5D STEER</b>	5D-1	Speed	50%	Maximum speed potential
	5D-2	Drive Compensation	60%	Adds additional to drive speed
	5D-3	Drive Comp Elevated	40%	Adds additional to drive speed elevated
	5D-4	ACCEL	0.2 sec	Ramp-up time to maximum
	5D-5	DECEL	0.2 sec	Ramp-down time to stop
<b>5E - DECK</b>	5E-	Not Used	Not Used	Power-out deck (not used)

**\*LS: Optional Load Sensing System**



Table 4-1: EZ-Cal Adjustment Table

OPERATION	ID	PERSONALITY	FACTORY SETTING	EXPLANATION
<b>5F OUTRIGGERS</b>	5F-1	Outriggers	3=Drive/Retract	Determines specific outrigger program
	5F-2	Extend	80%	O/R speed before all legs down
	5F-3	Level	60%	O/R speed after all legs touch down
	5F-4	Retract	65%	Maximum speed potential
	5F-5	Debounce	.4 sec.	Compensates for switch bounce
	5F-6	Initial	0.5	Outrigger movement before leveling
	5F-7	Tilt filter	6	Compensates for tilt sensor free movement
	5F-8	X Tilt target	0.2 deg	Target level stops movement
	5F-9	Y Tilt target	0.2 deg	Target level stops movement
	5F-10	Tilt Slack	0.3 deg	Additional compensation
	5F-11	Outrigger Test	Yes/No	To initiate outrigger test sequence
<b>5G GROUND MODE Lower Control Operations</b>	5G-1	UP	65%	Maximum speed potential up
	5G-2	DOWN	42%	Maximum speed potential down
	5G-3	OUT	0%	Power deck operation (not used)
	5G-4	IN	0%	Power deck operation (not used)
	5G-5	ACCEL	1.0 sec	Ramp-up time to maximum
	5G-6	DECEL	1.0 sec	Ramp-down time to off
<b>5H TILT</b>	5H-1	X Trip	2.0 degrees	Angle when tilt sensor signals Out Of Level
	5H-2	Y Trip	2.0 degrees	Angle when tilt sensor signals Out Of Level
	5H-3	Delay Trip	2.0 sec	Time delay between Tip and Interlock
	5H-4	Delay Clear	0.5 sec	Time delay between Tip and Interlock OFF
<b>TILT 2</b>	5H-4	Tilt 2	—	Sub category, press ENTER to access
<b>Sub Menu</b>	5H-5A	At Height	101%	Not Used
	5H-5B	X Trip 2	1.5 deg	Not Used
	5H-5C	Y Trip 2	1.5 deg	Not Used
<b>5I OVERLOAD</b>  ANSI: values = 0  LS*: values apply	5I-1	Trip @	ANSI: 0%    LS*: 110%	% of weight over maximum to trigger overload
	5I-2	Lamp @	ANSI: 0%    LS*: 0%	% of weight over maximum to trigger lamp
	5I-3	Alarm @	ANSI: 0%    LS*: 0%	% of weight over maximum to trigger alarm
	5I-4	@ Height	ANSI: 0%    LS*: 8%	% of elevation load sense starts monitoring weight
	5I-5	Safe Down	ANSI: 0%    LS*: 12%	% of elevation lift-down still operates in overload
	5I-6	Delay Trip	1.5 sec	Delay before overload trip
	5I-7	Delay Clear	1.5 sec	Delay before overload clear
	<b>OVERLOAD 2</b>	5I-8	Overload # 2	—
<b>Sub Menu</b>	5I-8a	@ Height	46%	% of height for secondary overload valve
	5I-8b	Scale	100%	% of reduced overload valve
<b>5J ALARMS</b>	5J-1	Drive: Yes/No	No	1 = FWD 2 = REV 3 = Both 4 = All Motion
	5J-2	Lift	2 = Down	1 = UP 2 = DOWN 3 = Both 4 = All Motion
	5J-3	Tilt	1 = When Elevated	1 = When Elevated 2 = Always
<b>5K HEIGHTS</b>	5K-1	Elevation	3%	Point at which machine enters elevated mode
	5K-2	Maximum Drive	101%	Maximum drivable height
	5K-3	Maximum Lift	ANSI: 101%    LS*: 98%	Maximum elevated height potential
	5K-4	Armguard	101%	Stops descent for 5 sec
	5K-5	Overload	ANSI: 0%    LS*: 8%	% of elevation load sense starts monitoring weight
	5K-6	Safe Down	ANSI: 0%    LS*: 12%	% of elevation lift-down still operates in overload
	5K-7	Overload # 2	0%	Not Used
	5K-8	Tilt # 2	ANSI: 0%    LS*: 0%	Reduced degree of tilt at % elevation

\*LS: Optional Load Sensing System

**EZ-CAL SETUP**

Refer to "Using the EZ-cal Scan Tool" on page 4-7

**Table 4-2:** EZ-Cal Setup Table

OPERATION	ID	PERSONALITY	FACTORY SETTING	EXPLANATION
<b>6A CHANGE DEFAULTS</b>	6A-1	Customer	4: 5492RT	Identifies Base Model Must be set when GP400 is Replaced
	6A-2	Model	7 = ANSI 8 = Optional Load Sensing System	Select from these choices only
<b>6D TILT SETUPS</b>	6B-1	Calibrate Level?	Y = ENTER N = ESC	Pressing ENTER twice will calibrate level sensor
		<b>WARNING! Refer to Tilt Sensor Calibration instructions before attempting calibration</b>		
	6B-2	Tilt Shutdown	2 = LIFT	Function shutdown tilted when platform stowed
	6B-3	Elevated Shutdown	1 = Lift & Drive	Function shutdown tilted when platform elevated
	6B-4	Axle Tilt	3.0 deg	Maximum deflection of axle before elevated drive interlock
<b>6C HEIGHT SETUP</b>  (Optional Load Sensing System ONLY)	6C-1	Elevation @	3%	% of elevation when machine enters elevated mode.
	6C-2	Calibrate Height	Optional Load Sensing System procedure	ENTER to begin calibration of height sensors
	6C-3	Minimum Lift	1.0 sec	Do not change
	6C-4	Samples	0.10 sec	Do not change
	6C-5	Tilt Correction	Disabled	Do not change
	6C-6	Slow Down	10%	Do not change
<b>6D LOAD SETUPS</b> (Optional Load Sensing System ONLY)	6D-1	Calibrate Load	Optional Load Sensing System procedure	ENTER to begin calibration of Optional Load Sensing System
	6D-2	Faulty Load	-100%	Optional Load Sensing System Only --DO NOT CHANGE
	6D-3	Dynamic Scale	95%	Optional Load Sensing System Only --DO NOT CHANGE
	6D-4	Delay Up	0.0 sec	Not Used
	6D-5	Delay Down	0.0 sec	Not Used
<b>6E INTERLOCKS</b>  <b>Delays</b>	6E-1	Trigger Only	10.0 sec	Enable bar held without operation before interlock
	6E-2	Trigger Wait	0.0 sec	Delay after enable bar pulled before function enabled
	6E-3	Function hold	0.2 sec	Function enabled after operator release
	6E-4	Delays	—	Sub category, press ENTER to access
<b>Sub Menu</b>	6E-4a	Throttle Delay	0.0 sec	Delay before throttle enabled
	6E-4b	Start Delay	10.0 sec	Interlocks start to protect start system from overheat

## EZ-CAL DIAGNOSTICS

The EZ-Cal Diagnostics menu provides the ability to view and test individual circuits for irregularities. Whether diagnosing a failure or testing functions during preventative maintenance, the *Diagnostics Menu* provides a quick view at the inputs and outputs as registered by the GP400 Control Module *in real time*. Using the EZ-Cal Flow Chart, compare ID number to this menu for circuit identification and result.

To reach DIAGNOSTICS menu from HELP;

- Press the right arrow and scroll to DIAGNOSTICS and press ENTER.
- Locate the desired sub menu and press ENTER.
- Press the right arrow to scroll through the test points.

**NOTE:** The ID number will not appear on the EZ-Cal display. It is shown in the *Diagnostics Menu* for reference only.

Using the ID number, match specific personalities from the Diagnostic Flow Charts with this table for additional information.

Press **ESC** to go back one level (necessary to change selection).

**Table 4-3:** EZ-Cal Diagnostics Menu

SELECTION	ID	EZ-cal READOUT	EXPLANATION
<b>2A SYSTEM</b>	2A-1	MODE	Shows current operation - Press ENTER to read interlock when 2-2 flash is present
	2A-2	Supply	System Voltage - Press ENTER for Supply sub-menus
<b>Sub Menu</b>	2A-2a	Supply	Voltage through EMS circuit to either Base or Platform input. 12 - 13.5 volts
	2A-2b	Cap Bank Voltage	Not used on I/C engine models
	2A-3	Valve Supply on/off	Supply all 12 volt circuits through TBM Module
	2A-4	Motor Volts	Not used on I/C engine models
	2A-5	Motor 1	Not used on I/C engine models
	2A-6	Temperature	Not used on I/C engine models
	2A-7	Tilt	Current state of tilt as measured by GP400
	<b>Sub Menu</b>	2A-7a	Tilt Filtered
2A-7b		Tilt Local	Current state of level as measured by level sensor located inside the GP400
	2A-8	Tilted Y/N	Indicates tilted state. Y=All motorized functions stop when in elevated state
	2A-9	Height	Current state of platform elevation in %.
<b>Sub Menu</b>	2A-9a	Height 1 %	Current state of platform elevation in % as read from EZ-fit #1 (see 2A-9)
	2A-9b	Height 2 %	Current state of platform elevation in % as read from EZ-fit #2-Optional Load Sensing System only
	2A-10	Load	Current load on platform in %. (Optional Load Sensing System only)
	2A-11	Overloaded Y/N	Platform overloaded. (Optional Load Sensing System only)
	2A-12	Last Moved	Not used
	2A-13	Elevated Y/N	Y=platform in elevated state; tilt cut-out and slow drive enabled
	2A-14	Outriggers	Press ENTER for outriggers sub-menu
<b>Sub Menu</b>	2A-14a	Retracted Y/N	All Retract switches closed
	2A-14b	Extended Y/N	All pressure switches closed, legs down
	2A-14c	Status	For outrigger equipped units only
	2A-14d	Outrigger Test	Follow instructions on EZ-cal to test O/R circuits
	2A-14e	Auto-retract 15s	Retract in drive mode - auto-retract feature used on 5492 models only
	2A-15	Axle	Press ENTER for Oscillating Axle sub menus
<b>Sub Menu</b>	2A-15a	Level / Off Level	Status of axle position as read by GP400
	2A-15b	Locked Y/N	Status of oscillating axle lock valves, Y = no oscillation
	2A-15c	Angle	Position of oscillating Axle relative to the chassis

Table 4-3: EZ-Cal Diagnostics Menu

SELECTION	ID	EZ-cal READOUT	EXPLANATION
<b>2B PLATFORM</b>	2B-1	Trigger ON/OFF	Current status of enable trigger - upper controls
	2B-2	DLD	Position of Lift/Drive selector switch
	2B-3	Joystick	Indicates % of stroke from center in real time. Direction not indicated here
	2B-4	FWD/DWN OFF/ON	Status of Forward micro-switch Forward stroke of the joystick
	2B-5	REV/UP OFF/ON	Status of Reverse micro-switch Reverse stroke of the joystick
	2B-6	LEFT OFF/ON	Status of Left Steer switch
	2B-7	RIGHT OFF/ON	Status of Right Steer switch
	2B-8	Positrac Y/N	Not used
	2B-9	EMSG OFF/ON	Not used
<b>2C GROUND</b>	2C-1	UP OFF/ON	Status of Up switch from lower control station
	2C-2	DOWN OFF/ON	Status of Down switch from lower control station
	2C-3	OUT OFF/ON	Not used
	2C-4	IN OFF/ON	Not used
	2C-5	EMSG OFF/ON	Not used
<b>2D INPUTS</b>	2D-1	P7-1	12 Volt Supply. Battery voltage from TBM Module
	2D-2	P7-2	Base Selected. ON= Base/Platform select switch in Base position
	2D-3	P7-3	Up. On= platform UP switch activated to elevate platform
	2D-4	P7-4	Platform Selected. ON= Base/Platform selector switch in Platform position.
	2D-5	P7-7	Down. ON= Down switch activated for platform lower operation
	2D-6	P7-10	Choke (gas engine) or pre-heat (diesel). ON= Choke or Pre-heat switch activated
	2D-7	P7-12	Start. ON= input from engine-start switch
	2D-8	P7-13	Oil Pressure Switch
	2D-9	P15-5	L/R Outrigger UP Switch. ON=leg extended and set
	2D-10	P15-6	R/R Outrigger UP Switch. ON=leg extended and set
	2D-11	P15-7	R/F Outrigger UP Switch. ON=leg extended and set
	2D-12	P15-8	L/F Outrigger UP Switch. ON=leg extended and set
<b>2E ANALOGS</b>	2E-1	P8-2	Elevation transducer 1 - measures state of elevation in %
	2E-2	P8-5	Elevation transducer 2 - measures state of elevation in % (redundant; Optional Load Sensing System only)
	2E-3	P8-6	Pressure transducer - measures lift system pressure in % (Optional Load Sensing System only)

Table 4-3: EZ-Cal Diagnostics Menu

SELECTI ON	ID	EZ-cal READOUT	EXPLANATION
<b>2F OUTPUTS</b>	2F-1	P4-1	Diesel pre-heat. ON= Pre-heat activated
	2F-2	P4-2	Engine Start. ON= Starter activated
	2F-3	P4-4	Throttle Solenoid. ON= Throttle solenoid pulled in
	2F-4	P4-7	Alternator Excite. ON= power to activate alternator charge
	2F-5	P4-8	Ignition. ON= power to fuel hold solenoid
	2F-6	P4-9	Drive Forward. ON=drive forward valve activated.
	2F-7	P4-10	Drive Reverse. ON=drive reverse valve activated.
	2F-8	P4-12	Proportional Valve. ON= Proportional valve activated
	2F-9	P4-14	Down Valves. ON= Down valves activated for platform lower operation
	2F-10	P5-1	Lift Valve. ON= Lift valve activated for platform Lift
	2F-11	P5-2	Steer Right. ON= steer right valve activated
	2F-12	P5-3	Steer Left. ON= steer left valve activated
	2F-13	P5-6	Alarm. ON= alarm activated (default alarm in Down, may be selected for other modes)
	2F-14	P5-8	High Speed. ON= high speed valve activated (drive range toggle in up position)
	2F-15	P5-9	Hour Meter. ON= Meter powered up
	2F-16	P5-10	Outrigger Extend Valve. ON=valve open to supply pressure to outrigger legs
	2F-17	P5-11	Outrigger Retract Valve. ON=valve open to supply pressure to outrigger legs
	2F-18	P5-12	Power Supply to limit switch and TBM module - should be ON when system powered
	2F-19	P5-14	Start delay indicator light. ON=starter delay interlock for 30 seconds for cool down
	2F-20	P6-1	Right-Front Outrigger Valve. ON =leg extending or retracting.
	2F-21	P6-2	Left-Front Outrigger Valve. ON =leg extending or retracting.
	2F-22	P6-3	Right-Rear Outrigger Valve. ON =leg extending or retracting.
	2F-23	P6-4	Left-Rear Outrigger Valve. ON =leg extending or retracting.
	2F-24	P6-13	Axle Lock Valves. ON=Axle valves powered; axle will oscillate
	2F-25	P6-15	Generator. On=Generator active.
<b>2G LOG</b>	2G-1	Cal Date	Date of Load Sense calibration (Optional Load Sensing System only)
	2G-2	Software	MEC specific software version
	2G-3	Powered	Accumulated time GP400 powered up (red LED on)

## EZ-CAL RETRIEVE MODE AND HELP MESSAGES

**NOTE:** *It is important to understand that an error message will only be available if the red Diagnostic LED is flashing. If the machine is not operating properly and the red Diagnostic LED is not flashing, the trouble may lie with something not monitored by the electronic control system, i.e. a switch, hydraulic valve or wiring damage.*

There are two different menus that you can access for message retrieval; MODE and HELP.

### MODE MENU

Allows the technician to see the current state of the controller with a short description. Go to, DIAGNOSTICS/SYSTEM/MODE (EZ-Cal Flow Chart 2, ID# 2a-1). Pressing ENTER a second time will provide additional information with certain messages.

### HELP MENU

Provides various HELP messages to identify failure modes.

Some error messages may also be identified by counting the number of times the red LED flashes on the controller so that even without access to an EZ-Cal, some simple diagnostics are possible. However, it is recommended to use an EZ-Cal to diagnose problems, and not rely on the LED! The EZ-Cal provides a much higher detail of information.

#### HELP MESSAGE

- Connect the EZ-Cal (see illustration).  
The display will read, "HELP: PRESS ENTER".
- Press Enter to display the current message.
- Refer to the following list of HELP messages to better understand the nature of the message or fault.
- If the GP400 does not register a fault, the display will read EVERYTHING OK.

**Pressing ENTER twice** will provide a scrolling message of the current message (if one exists).

**Pressing RT and LT arrows** provides access to a log of previous operations and/or errors that occurred immediately prior, starting with most recent. **All messages are cleared whenever the system is powered down.**

Other helpful menus available include **DIAGNOSTICS** which allows the technician to monitor specific plug input/output information. Refer to EZ-Cal Flow Chart 2 – Diagnostics (ANSI - Page 4-10; Optional Load Sensing System - Page 4-12).

### MODE MESSAGES

The purpose of **MODE** is to indicate, in real time, the current state of the controller with a short description.

#### INITIALIZING

- The system is preparing to operate, immediately after power-on.

#### SHUTDOWN!

- The system cannot operate – for example both the PLATFORM & GROUND inputs are active together.

#### CHECK CANBUS

- The system cannot operate – CANBUS communications is not successful (for example wire damage to the platform)

**PLATFORM, GROUND**

- The system is ready to operate, from the upper or lower controls as indicated (selected by the Base/Platform selector switch)

**GROUND UP, GROUND DOWN,**

- A ground function is operating normally

**GROUND UP LOCKED, GROUND DOWN LOCKED,**

- A ground function is selected but not allowed (for example, the function switch was closed at power-on)

**GROUND FAULTY**

- Multiple ground function inputs are active at the same time

**WAITING FOR TRIGGER**

- A platform function is selected, but the joystick trigger switch is not closed (close the trigger switch to proceed)

**TRIGGER CLOSED**

- The joystick trigger switch is closed, but no function is selected (select a function to proceed)

**TRIGGER LOCKED**

- The joystick trigger switch was closed at power-on, or closed for too long with no function selected (check trigger switch)

**FORWARD, REVERSE**

- A platform drive function is operating normally

**FORWARD (LEFT), FORWARD (RIGHT), REVERSE (LEFT), REVERSE (RIGHT)**

- A platform drive function is operating normally, with steer also active

**STEER LEFT, STEER RIGHT**

- A platform steer function is operating normally (without drive)

**UP, DOWN**

- A platform lift/lower function is operating normally

**FORWARD LOCKED, REVERSE LOCKED**

- A platform drive function is selected but not allowed (for example, the switch was closed at power-on)

**LEFT LOCKED, RIGHT LOCKED**

- A platform steer function is selected but not allowed (for example, the switch was closed at power-on)

**UP LOCKED, DOWN LOCKED**

- A platform lift/lower function is selected but not allowed (for example, the switch was closed at power-on)

**CHECK DRIVE/LIFT**

- Neither platform drive nor platform lift select is active, or both are active at the same time

**CHECK JOYSTICK**

- Both platform joystick directions are active at the same time

**STEER FAULTY**

- Both platform steer directions are active at the same time

**EXTENDING LEGS**

- Outrigger legs are extending normally

**RETRACTING LEGS**

- Outrigger legs are extending normally

**OUTRIGGERS LOCKED**

- An outrigger function is selected but not allowed (for example, the switch was closed at power-ON)

**INTERLOCKED\*\***

- An interlock shutdown is active, preventing one or more functions. The interlock can be due to many different causes ...

\*\*Press <ENTER> from the **MODE** display to see the precise cause of the interlock (listed below) – press <ESC> from that display to return to the **MODE** display:

**TEST MODE**

- The system test mode is active – switch power off and on again to clear

**TILTED**

- The vehicle is tilted beyond limits, descend, then move vehicle to a more level location

**OVERLOADED**

- The vehicle platform is overloaded, reduce platform load.  
(Optional Load Sensing System option only)

**TOO HIGH**

- The vehicle platform is too high to allow some functions – descend first

**ARMGUARD**

- During descent, the system is configured to stop movement to provide an armguard delay – release and re-select DOWN to continue lowering  
(Optional Load Sensing System only)

**TOO HOT**

- The EZLIFT heatsink has reached 75°C, preventing all functions except lowering. Functions will be allowed again when the heatsink cools to below 70°C.
- The heatsink temperature can be viewed in the DIAGNOSTICS/SYSTEM/ TEMPERATURE display, ID # 2a5.
- The heatsink must be bolted to a significant metal panel of the vehicle, capable of dissipating heat to the environment.

**UNCALIBRATED**

- The height and/or pressure sensors have not been calibrated see CALIBRATION OF OVERLOAD SYSTEM (Optional Load Sensing System only).
- If machine is not equipped with Overload system, refer to SETUPS table and change those personalities that do not match the figure listed in the table.

**EXTERNAL ALL, EXTERNAL DRIVE, EXTERNAL LIFT**

- An external cutout input is preventing functions – determine the cause of the external cutout (for example, a limit switch)

## EZ-CAL HELP MESSAGES

In addition to the **MODE** messages detailed above, the GP400 provides a **HELP** message to identify failure modes. Some error messages may also be identified by counting the number of times the red LED flashes on the controller so that even without access to an EZ-Cal, some simple diagnostics are possible. However, it is recommended to use an EZ-Cal to diagnose problems, and not rely on the LED! The EZ-Cal provides a much higher detail of information.

- Connect the EZ-Cal (see illustration).  
The display will read, "HELP: PRESS ENTER".
- Press Enter to display the current message.
- Refer to the following list of HELP messages to better understand the nature of the message or fault.
- If the GP400 does not register a fault, the display will read EVERYTHING OK.

**Pressing ENTER twice** will provide a scrolling message of the current message (if one exists).

**Pressing RT and LT arrows** provides access to a log of previous operations and/or errors that occurred immediately prior, starting with most recent. **All messages are cleared whenever the system is powered down.**

**NOTE:** When using the LED to attempt diagnosis, please note that a **DUAL FLASH** code is indicated. The LED will flash on/off a certain number of times, pause off for a short delay, then flash on/off a second certain number of times, followed by a much longer pause off. The sequence will then repeat.

## INFORMATION ONLY MESSAGES

The following are "information only" HELP messages which are not indicative of any possible problem – there is no LED flash code (the LED remains on steady):

**STARTUP!** \_\_\_\_\_ **(no flash code)**

- The system has just been powered on and is carrying out some initialization steps prior to being ready to operate. If you select a function during this time, it may be locked out until you release then re-select it.

**EVERYTHING OK** \_\_\_\_\_ **(no flash code)**

- There is no problem with the system – it is ready to operate in platform mode when a function is selected.

**NOTE:** *If this is the HELP message when a function is selected, check for open-circuit switches or wiring.*

**GROUND MODE ACTIVE!** \_\_\_\_\_ **(no flash code)**

- There is no problem with the GP400 – it is ready to operate in ground mode when a function is selected.

**CLOSE TRIGGER** \_\_\_\_\_ **(no flash code)**

- A platform function is selected but the trigger switch is not closed.

**VEHICLE TILTED** \_\_\_\_\_ **(no flash code)**

- The vehicle is tilted beyond the limits, some functions may be prevented.

## FUNCTION ACTIVE MESSAGES

The following **HELP** messages indicate that there is no problem with the GP400 but that a function is active – the vehicle should be moving as requested by the operator.

**DRIVING!** \_\_\_\_\_ (no flash code)

**LIFTING!** \_\_\_\_\_ (no flash code)

**LOWERING!** \_\_\_\_\_ (no flash code)

**STEERING!** \_\_\_\_\_ (no flash code)

**EXTENDING OUTRIGGERS!** \_\_\_\_\_ (no flash code)

**RETRACTING OUTRIGGERS!** \_\_\_\_\_ (no flash code)

## CALIBRATION MESSAGES

The following are “calibration” HELP messages – until the machine is properly calibrated for height and/or pressure (as required), many functions will not be available.

**NOT CALIBRATED** \_\_\_\_\_ **Flash Code: 1/1**

**FUNCTIONS LOCKED - NOT CALIBRATED** \_\_\_\_\_ **Flash Code: 1/1**

- The height and/or pressure sensors have not been calibrated and are required because of the setup of the GP400.
- Calibration procedures are accessible from the **SETUPS/HEIGHT SETUPS** and **SETUPS/LOAD SETUPS** menus.

**FAULT: CUSTOMER** \_\_\_\_\_ **Flash Code: 1/1**

- The system must be configured to the customer requirements – with the EZ-Cal in **SETUPS/CHANGE DEFAULTS** menu, scroll to the correct machine from this menu, the press Right Arrow to select the appropriate model.

**NOTE:** Selecting the incorrect customer or model will cause the machine to operate incorrectly or go into fault mode.

## SHUTDOWN HELP MESSAGES

This section lists “shutdown” HELP messages – functions can be shut down to prevent them being used:

### **SHUTDOWN - CHECK EMS SWITCHES!** \_\_\_\_\_ **Flash Code: 2/1**

- The Base/Platform selector switch position indicates the mode in which the system must operate if both are active together; the system does not know how to function

### **FUNCTIONS LOCKED - TEST MODE SELECTED** \_\_\_\_\_ **Flash Code: 2/2**

- Test mode is not accessible with this system. Switch power off/on to reset to normal operation

### **FUNCTIONS LOCKED - ARMGUARD (optional Load Sensing System only)**

**Flash Code: 2/2**

- During descent, the System can stop movement for a configurable time, to allow a safety check that no-one is close to the machine. The operator must release and re-select DOWN to continue lowering (after the delay time-out).

### **FUNCTIONS LOCKED – OVERLOADED (optional Load Sensing System only)**

**Flash Code: 2/2**

- System overload features are active, and the platform is excessively loaded to allow operation – the platform load must be reduced.

### **FUNCTIONS LOCKED – UNDERLOADED (optional Load Sensing System only)**

**Flash Code: 2/2**

- System overload features are active, and the platform load is too low to be valid – this could be caused by erroneous calibration, a sensor fault, or a change in the vehicle mechanics/hydraulics.

### **FUNCTIONS LOCKED - TOO HIGH** \_\_\_\_\_ **Flash Code: 2/2**

- The platform is raised too high to allow some functions. Certain functions may not be allowed above certain elevations.
- Check operator’s manual or ADJUSTMENTS/HEIGHTS/MAX DRIVE and MAX LIFT to see if drive and/or lift is allowed at all heights.

### **FUNCTIONS LOCKED - TILTED** \_\_\_\_\_ **Flash Code: 2/2**

- The vehicle is tilted too much to allow some functions.
- Check operator’s manual or ADJUSTMENTS/TILT/Xtrip and Ytrip, which determine the maximum allowed vehicle tilt.
- Refer to EZ-Cal Flow Chart 1 – Adjustments and Setup.

### **FUNCTIONS LOCKED - EXTERNAL SHUTDOWN** \_\_\_\_\_ **Flash Code: 2/2**

- An external shutdown is preventing functions – check DIAGNOSTICS/SYSTEM/ MODE/INTER-LOCK to see which external interlock is active.

### **CHECK GROUND INPUT SWITCHES!** \_\_\_\_\_ **Flash Code: 2/2**

- There is a problem with the ground function select switches – more than one is active at the same time.

### **SELECT DRIVE/LIFT MODE!** \_\_\_\_\_ **Flash Code: 2/2**

- There is a problem with the platform drive/lift select switch – neither mode is selected.

### **CHECK DRIVE/LIFT SELECT SWITCH!** \_\_\_\_\_ **Flash Code: 2/2**

- There is a problem with the platform drive/lift select switch – both modes are selected together.

**CHECK JOYSTICK SWITCHES!** \_\_\_\_\_ **Flash Code: 2/2**

- There is a problem with the platform joystick switches – both directions are selected together.

**RELEASE TRIGGER!** \_\_\_\_\_ **Flash Code: 2/2**

- The trigger was closed at power-on, or closed for too long with no function selected.

**RELEASE GROUND SWITCHES!** \_\_\_\_\_ **Flash Code: 2/2**

- Ground function switches were closed at power-on.

**RELEASE JOYSTICK SWITCHES!** \_\_\_\_\_ **Flash Code: 2/2**

- Platform joystick switches were closed at power-on, or closed for too long without trigger switch (see **SETUPS/INTERLOCKS/TRIGGERwait**).

**RELEASE OUTRIGGER SWITCHES!** \_\_\_\_\_ **Flash Code: 2/2**

- Outrigger switches were closed at power-on.

**WIRING MESSAGES**

The following are “wiring” HELP messages – problems have been detected which are likely due to vehicle wiring issues:

**FAULT: ENERGIZED VALVE - CHECK P5 WIRING!** \_\_\_\_\_ **Flash Code: 3/2****FAULT: VALVE FEEDBACK HIGH - CHECK VALVE WIRING!** \_\_\_\_\_ **Flash Code: 3/2**

- There is a voltage on one or more valve outputs, when all outputs are off.
- Check each valve output to trace where the invalid supply is coming from.

**FAULT: CAPBANK VOLTAGE TOO HIGH - CHECK LINE CONT!** \_\_\_\_\_ **Flash Code: 3/3**

- The voltage on the B+ stud of the controller (connected to an internal voltage stabilization capacitor bank) is too high when the line contactor is off. B+ stud voltage should be approximately 32 volts at idle.
- Check the line contactor tips are not welded, and check the power wiring for errors.

**FAULT: ENERGIZED LINE CONTACTOR - CHECK P5 WIRING!** \_\_\_\_\_ **Flash Code: 3/4**

- There is a voltage on the line contactor coil output, when it is off.
- Check wiring to the line contactor coil to trace where the invalid supply is coming from.

**FAULT: MOTOR OVERLOAD!** \_\_\_\_\_ **Flash Code: 3/5**

- The power protection circuits in the controller have activated to protect from extreme overload.
- Check for short-circuit power wiring; check for a seized or shorted motor.

## SUPPLY MESSAGES

The following are “supply” HELP messages – problems have been detected which are likely due to supply issues:

**FAULT: LOW OIL PRESSURE!** \_\_\_\_\_ **Flash Code: 4/1**

- Engine oil pressure switch open after start sequence initiated or engine stalled or unable to start.

**FAULT: BAD INTERNAL 5V!** \_\_\_\_\_ **Flash Code: 4/2**

- The internal “5V slave” supply is out of range; if the fault remains, the controller may have to be replaced.

**FAULT: BAD INTERNAL SLAVE!** \_\_\_\_\_ **Flash Code: 4/2**

- The internal “slave” is not operating correctly; if the fault remains, the controller may have to be replaced.

**FAULT: BAD INTERNAL 12V!** \_\_\_\_\_ **Flash Code: 4/3**

- The internal “12V” supply is out of range;
- 12V Supply is generated by the Motor control module and supplied to the GP400. Check for wiring errors between the two modules. If the fault remains, the Motor Controller may have to be replaced.

**FAULT: BATTERY VOLTAGE TOO LOW!** \_\_\_\_\_ **Flash Code: 4/4**

- The battery supply is too low – the batteries must be re-charged.

**FAULT: BATTERY VOLTAGE TOO HIGH!** \_\_\_\_\_ **Flash Code: 4/4**

- The battery supply is too high – check that the correct battery and charger are installed.

**FAULT: BAD 5V SENSOR SUPPLY - CHECK P2-1 WIRING!** \_\_\_\_\_ **Flash Code: 4/5**

- The “5V sensor” supply is out of range; this supply is available to power external 5V-powered sensors – check that it has not been overloaded or short-circuited to other wiring (Optional Load Sensing System only).

## **SENSOR MESSAGES - OPTIONAL LOAD SENSING SYSTEM**

The following are “sensor” HELP messages – problems have been detected which are likely due to sensor issues (optional Load Sensing System).

**FAULT: CHECK HEIGHT1 SENSOR** \_\_\_\_\_ **Flash Code: 6/1**

**FAULT: CHECK HEIGHT2 SENSOR** \_\_\_\_\_ **Flash Code: 6/1**

- A height sensor is giving an out-of-range voltage (below 0.5V or above 4.5V).

**FAULT: CHECK HEIGHT SENSORS** \_\_\_\_\_ **Flash Code: 6/1**

- When two height sensors are fitted, both should read the same height at all times; this message indicates that the sensors are reading different heights. Check for loose sensors and/or re-calibrate.

**FAULT: CHECK PRESSURE SENSOR** \_\_\_\_\_ **Flash Code: 6/2**

- A pressure sensor is giving an out-of-range voltage (below 0.5V or above 4.5V).

**FAULT: CHECK ELEVATION SWITCH** \_\_\_\_\_ **Flash Code: 6/3**

- The elevation switch is in disagreement with the height sensor(s).
- During calibration, the height at which the elevation switch opens (while lifting) and closes (while lowering), is recorded. Subsequently, height and these calibration points are continuously checked – any significant difference generates this error.

### **CANBUS MESSAGES**

This section lists “CANBUS” HELP messages – problems have been detected with CANBUS communications between different modules (of course, only applicable if more than one module is connected together via CANBUS):

**FAULT: CANBUS!** \_\_\_\_\_ **Flash Code: 6/6**

- There are problems with CANBUS communications between the different modules; messages expected from one or more module are not being received, or messages intended to one or more module cannot be transmitted.
- Check for open- and short- circuit problems with CANBUS wiring; ensure that the CANBUS is wired correctly pin-to-pin; ensure that the vehicle chassis is not erroneously shorted to the chassis (for example, due to insulator breakdown in the motor).

### **POWER WIRING MESSAGES**

The following are “power wiring” HELP messages – problems have been detected which are likely due to power wiring errors:

**FAULT: CAPBANK VOLTAGE TOO LOW - CHECK STUD WIRING!** **Flash Code: 7/7**

- The voltage on the B+ stud of the controller (connected to an internal voltage stabilization capacitor bank) is too low when the line contactor is off (a pre-charge circuit in the module normally applies approximately 32 volts to the capacitor bank).
- Check the 300 amp fuse, line contactor or power wiring for errors. Also check DC motor for internal grounding.

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**OTHER MESSAGES**

The following are other HELP messages:

**SOME BIG BAD PROBLEM!** \_\_\_\_\_ **Flash Code: 9/9**

- This message should not occur!

**FACTORY OVERRIDE** \_\_\_\_\_ **Flash Code: (fast flashing)**

- When the controller is first shipped, prior to initial calibration, it is configured in a special “factory override” state. In this state, none of the normal shutdowns or interlocks will occur – the vehicle can be freely lifted/lowered and driven irrespective of any calibration needs, vehicle tilt, etc.
- As soon as an EZ-Cal is connected to the controller, the factory override state is ended.
- If calibration does not occur, then the factory override state will recur if the EZ-Cal is disconnected and power is switched off/on.

**IMPORTANT:** – Never use a vehicle in factory override; this state is **ONLY** intended for use during manufacture! While factory override is active, the LED is rapidly flashed on/off.

## TROUBLESHOOTING CHART

The following chart is a guide to help the technician find the area of a problem. In order to benefit from the information, you are advised to fully assess the symptoms by operating all machine functions. There may be some functions that operate while others may not. Record this information and proceed down the left-hand column until you find the failure scenario that best fits the problem. Refer to the information provided to the right for possible causes and remedies. This unit contains a Microprocessor based control system which contains various safety features designed to protect itself and the operator in the event of a failure.

The EZ-Cal scan tool will provide the technician with detailed information related to the failure. ***It is strongly recommended that the technician use the EZ-Cal to read any displayed messages before using this Troubleshooting chart.***

Information on the use of the EZ-cal tool plus helpful Flow Charts and graphs can be found earlier in this troubleshooting section. Please read and familiarize yourself with all of the information provided in the troubleshooting section before attempting to diagnose or repair the machine.

**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>General Power Issue</b>		
<b>No operation from Upper or Lower control station</b>	Main Battery Switch turned OFF	Located left of Lower Control Box
	Emergency Stop Switch pushed or faulty; or Ignition Switch turned OFF or faulty	Upper or lower E-Stop will cut all power, as will the Ignition Switch in the Upper Control Box
	Battery discharged or faulty cables	Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge battery; repair cables
	Circuit Breaker Tripped	Located in Lower Control Box Panel Look for short circuit and/or damage in wiring or high amperage draw at valve coils or engine actuators.
	Damaged Upper Control Box harness	Inspect the harnesses and harness plugs for damage or broken wires - May receive 6-6 flash code on GP-400 (CAN bus) or no power at all
	Blown supply fuse	Locate source of short circuit. Inspect/replace fuse located just below Main Battery Switch
	Other fault in system monitored by GP400	Check HELP message on EZ-cal or check Flash Code for error
<b>Functions from Lower Controls but not from Upper Controls</b>	Base/Platform select switch not in the Platform position, or switch malfunction	Ensure that the switch is in the Platform position; check switch function
	Interlock Switch (Joystick)	Check power to red wire (power to switch) and power to purple wire (power out of switch) at the joystick plug
	Damaged Upper Control Box harness	Inspect the harnesses and plug connections for damage or broken wires

Table 4-4: Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>Engine-Related Issues</b>		
<b>Starter will not crank from upper or lower stations</b>	Battery discharged or faulty cables	4-4 or 7-7 flash on GP400. Clean, service and charge battery; repair cables.
	Malfunctioning start relay or fuse	Test/replace relay located on left hand side of engine; Test/replace fuse located near starter
	Malfunctioning starter	Test/replace starter
<b>Starter cranks but engine will not start</b>	Low fuel level	Check/fill fuel reservoir
	Malfunctioning fuel solenoid	Test/replace fuel solenoid located on front of engine, accessed from right side
	Malfunctioning glow plugs (cold climates)	Test/replace glow plug relay, fuse and glow plugs
	Obstructed air filter	Clean/replace air filter
	Contaminated fuel	Test/replace fuel
	Other engine issues	See engine manufacturer's troubleshooting guide
<b>No high throttle</b>	Malfunctioning throttle relay, solenoid, or blown fuse	Test/replace throttle relay and/or throttle solenoid and fuse
<b>Lift/Lower</b>		
<b>Platform will not raise</b>	Excessive weight on platform	Reduce weight to within platform capacity
	Main Relief Valve out of adjustment	Adjust Relief Valve to rated platform capacity; located on Function manifold - see Schematics section for location
	Lift Valve SV-1 not energized	Check wiring to lift valve; Check for EZ-cal message or flash code
	Level sensor out of level (platform elevated above 10')	Reposition machine to firm level surface Check level sensor signal using EZ-cal ID #s 2a-7 and 2a-8
	Main system pressure inadequate	Check pump output flow and pressure
	Battery discharged; no charge output	Check battery voltage, alternator output (14.5 volts) Clean, service and charge battery
	System interruption	Check HELP messages using EZ-cal
<b>Platform will not raise over 35 ft. (10 m)</b>	Outriggers must be deployed to raise platform to full height	All 4 outrigger legs must be supporting the machine's weight; lower platform and operate auto-level switch; reposition machine if necessary
	Malfunctioning outrigger limit switch(es)	Adjust/replace outrigger limit switches located on each outrigger leg
<b>Platform will not lower or lowers slowly</b>	Maintenance lock in maintenance position	Return maintenance lock to the stowed position
	Lowering valve not energized	Check wiring to lowering valve located inside control module; see Schematics section for location
	Lowering valve not shifting	Clean debris/damage; replace
	Lowering orifice plugged	Clean orifice located inside Function manifold - see Schematics section for location
	Down system diode failure	Check/replace diode inside lower control box
	System interruption	Check HELP messages using EZ-cal
<b>Emergency lowering not working</b>	Auxiliary power unit malfunction	Check APU located below lower control box
	Down system diode failure	Check/replace diode inside lower control box
	Lowering valve not shifting	Clean debris/damage; replace
	Lowering orifice plugged	Clean orifice located inside Function manifold - see Schematics section for location
	Battery discharged; no charge output	Check battery voltage, alternator output (14.5 volts) Clean, service and charge battery
	Emergency Down switch failure	Check/replace switch.

Table 4-4: Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>Drive</b>		
<b>No drive function</b>	Lift/Drive select switch not in Drive position or not operational	Select Drive position (upper control box), check switch, check switch position from GP400 with EZ-cal (see EZ-cal ID# 2b-2) DLD
	Drive valve not shifting (SVD1)	Check connections at valve Check Drive Valve for contamination Check Drive output from GP400 (See EZ-cal chart ID# 2f-6 & 2f-7)
	Outrigger legs not raised off the ground	Check for green indicator light on upper control box; raise outriggers until green indicator light illuminates
	Malfunctioning outrigger limit switch(es)	Adjust/replace outrigger limit switch(es) located on each outrigger leg
	Planetary hub bypass engaged	Check bypass plates located in the center of each planetary hub; should be convex--turn over if not
	Brakes not releasing	Check brake valve and brake system pressure - see Schematics section for location
	Low pump stand-by pressure	Check at Brake/Axle manifold--should be 300 psi (21 bar); adjust if necessary. See Schematics section for location
	Drive system shut down (interlock)	Check HELP and MODE message on EZ-Cal
<b>No drive elevated</b> <b>NOTE: Maximum elevated drive height is 35 feet (11 m)</b>	Unit out of level	Lower and operate on level surface
	Low pump stand-by pressure	Check at Brake/Axle manifold--should be 300 psi (21 bar); adjust if necessary. See Schematics section for location
	Outriggers deployed	Lower platform and retract outriggers
	System Interruption (interlock)	Check HELP messages using EZ-Cal
<b>Slow drive with platform stowed</b>	High torque (slow speed) enabled	Check Speed/Torque switch on upper controls; check 2-speed valve located on brake manifold - see Schematics section for location
	Low pump stand-by pressure	Check at Brake/Axle manifold--should be 300 psi (21 bar); adjust if necessary. See Schematics section for location
	FWD MAX, REV MAX settings incorrect	Reset drive speeds using EZ-cal
	Wheel motors not functioning correctly	Inspect wheel motors for damage or wear
<b>Poor gradeability or drive performance</b>	High speed enabled	Check Speed/Torque switch on upper controls
	Planetary hub bypass engaged	Check bypass plates located in the center of each planetary hub; should be convex--turn over if not
	Wheel motors not functioning correctly	Inspect wheel motors for excessive bypass
	Low pump stand-by pressure	Check at Brake/Axle manifold--should be 300 psi (21 bar); adjust if necessary. See Schematics section for location
	Incorrectly adjusted or worn hydraulic pump	See Hydraulics section for pump adjustment Inspect or replace pump
<b>Drive in one direction only</b>	Drive valve not energized in one direction	Check 12 volts to appropriate coil; check coil; check valve function (located on top of drive pump)
	No output from GP400	Check switch position output from GP400 (see EZ-Cal ID# 4f-7 – FWD or 2f-9 – Reverse)
<b>No low speed (high torque mode)</b>	Speed/Torque switch inoperative	Check continuity through Speed Select switch with wires disconnected terminals 2 & 1
	Valve SV3 not functioning	Check for 12 volts and ground to valve Check for faulty valve spool Check switch position output from GP400 (See EZ-cal ID# 2f-17)
	EP1 poppet valve not functioning	Check or replace valve (see hyd schematic for location)

**Table 4-4:** Troubleshooting Chart

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REMEDY/SOLUTION</b>
<b>No High Speed</b>	Speed/Torque selector switch inoperative	Check continuity through Speed Select switch with wires disconnected
	2-speed valve not functioning	Check for 12 volts and ground to valve Check for faulty valve spool Check switch position output from GP400 (See EZ-cal ID# 2f-14)
<b>Steer</b>		
<b>No steer in either direction</b>	Lift/Drive selector switch in the Lift position	Switch must be in Drive position for steer operation
	Joystick rocker switch malfunction	Check continuity through rocker switch on green and yellow wires (right & left) with blue wire (input).
	Steering valve malfunction	Check steering valve for power, damage or contamination; Check switch position output from GP400 (see EZ-cal ID # 2f-11 & 2f-12)
	System Interruption	Check HELP messages using EZ-Cal
	Proportional valve malfunction	Check variable signal to valve; check for contamination - see Schematics section for location; See EZ-cal ID 2f-8
	Hoses connected incorrectly	See Schematics section for proper connection
	Pressure relief valve set too low	Set steer relief valve to 2600 psi (179 bar) - see Schematics section for location
<b>Steers in one direction only</b>	Steering valve inoperative or stuck	Inspect/replace steering valve
	No power to steering coil	Check for power and ground in both directions; repair wiring; Check switch position output from GP400 (see EZ-cal ID#s 2f-11 right & 2f-12 left)
	System Interruption	Check HELP and MODE message on EZ-Cal
<b>Steers but not fully, or steers slowly</b>	Failure of one or both steering cylinder internal seals	Inspect/replace steering cylinder seals
	Pressure relief valve set too low	Set steer relief valve to 2600 psi (179 bar) - see Schematics section for location
	King pin(s) seizing in the bore	Disassemble and inspect; repair; replace bushings

**Table 4-4:** Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	REMEDY/SOLUTION
<b>Outriggers (Auto and Manual)</b>		
<b>No Auto - level operation</b>	System senses platform elevation above 10 feet (3.2m)	Check elevation status using the EZ-cal (see ID# 2a-13); Recalibration of Height may be necessary (see Calibration section for instruction); See EZ-cal ID #2a-9 for analog input from height sensor in %
	System interruption	Check HELP messages using EZ-cal
	Outrigger switch(es) malfunction	Check outrigger switch(es) located in the upper control box; Check GP400 for verification of operation--go to DIAGNOSTICS>SYSTEM> MODE (see EZ-cal ID# 2a-1)
	Proportional Valve malfunction	Check variable signal to valve; check for contamination - see Schematics section for location; See EZ-cal ID 2f-8
	Level Valves malfunctioning	Located on Function Manifold; Check valve for power or damage; check switch position output from GP400 (see EZ-cal ID# 2f-16 (extend) and 2f-17 (retract))
<b>Auto-level operates but platform is not level when cycle is complete</b>	Level sensor not properly calibrated	See Calibration section for proper level sensor calibration
	Unit on too extreme an angle	Relocate unit to more level ground
	Lower control box loose	Tighten all lower control box mounting screws
	Outrigger leg switch(es) inoperative or out of adjustment	See EZ-cal ID #s 2d-9 through 2d-12 to locate problem switch. ON=leg down and set.
	One or more outrigger valves is sticking	Located on each outrigger leg; Inspect valves for power, contamination or damage; Check switch position output from GP400 (see EZ-cal ID# 2f-20 through 2f-23)
	Level cylinder hoses not connected in correct location	See Schematics section for correct locations
	Outrigger valves wired incorrectly	See Schematics section for proper plug connection.
	Relief valve out of adjustment	Set steer relief valve to 2600 psi (179 bar) - see Schematics section for location
<b>No Manual level operation</b>	See "No Auto-level Operation" for information	

## HYDRAULIC PRESSURE ADJUSTMENT

- Before attempting to check and/or adjust pressure relief valves, operate the machine for 15 minutes or long enough to sufficiently warm the hydraulic fluid.
- Insert a 0-5000 psi gauge onto the pressure test port on the valve manifold using gauge adapter fitting MEC part no. 8434

**Table 4-5:** Hydraulic Pressure Settings

Model	Drive		Charge	
5492RT	4500 PSI	310 bar	348 PSI	24 bar
	Lift		Steer/Outriggers	
	2800 PSI	193 bar	2800 PSI	193 bar

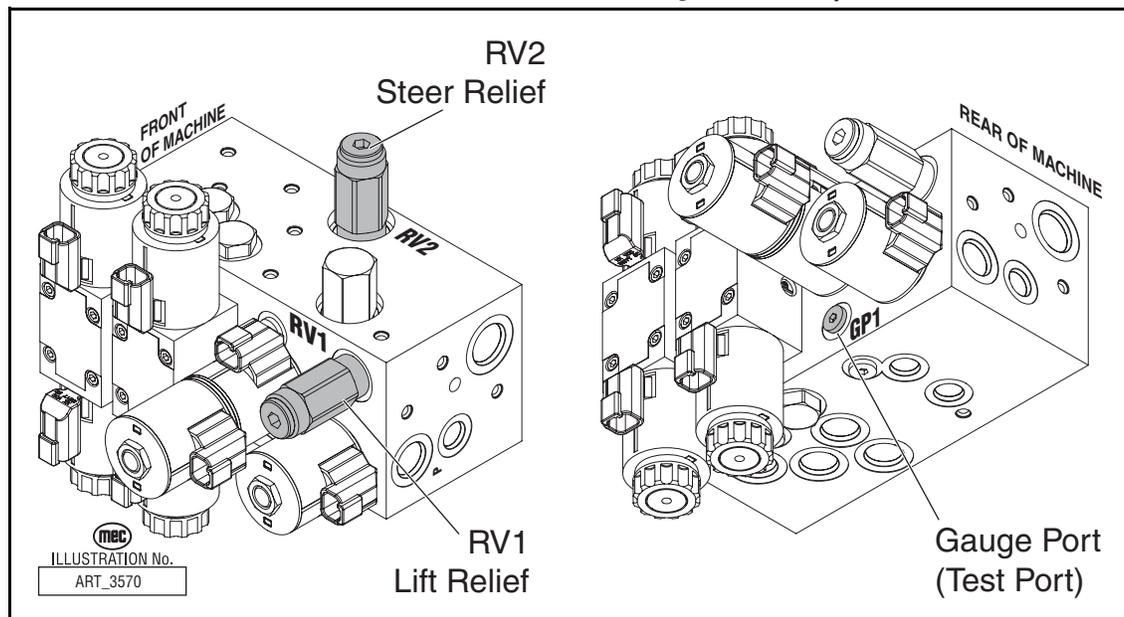
### ADJUSTING RELIEF VALVES

- Remove the tamper proof cap.
- Turn adjustment screw “IN” to increase pressure.
- Turn adjustment screw “OUT” to decrease pressure.
- When correct pressure is obtained replace tamper proof cap with a new one.



**Do not operate pump with tamper proof cap removed. Fluid will emit under pressure.**

**Figure 4-10:** Adjustable Valves Location



## ADJUSTMENTS

### COUNTERBALANCE VALVES

The counterbalance valves, located on the lift and axle lock cylinders of the 5492RT, are set by the manufacturer and should not be adjusted for any reason.

Replace any counterbalance valve that shows evidence of adjustment or tampering.

### LIFT RELIEF (RV1)

The Lift Relief Valve (RV1) should be checked during routine maintenance to ensure proper lift capacity. It will be necessary to remove the cap from the relief valve if adjustment is necessary.

REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

To check Lift Relief valve setting, park the machine on a firm level surface free from overhead obstructions.

Lift Relief Valve (RV1) should be set to 2800 psi (193 bar).

- Insert a 0-5000 psi gauge into the port GP of the Functions Manifold.
- Extend the platform to full height with **no load on platform**.
- Hold the switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust lift relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust lift relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.

### STEERING RELIEF (RV2)

The steering Relief Valve (RV2) should be checked during routine maintenance to ensure proper steering function. It is necessary to remove the cap from the relief valve if adjustment is necessary.

REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

Steering Relief Valve (RV2) should be set to 2800 psi (193 bar).

- Insert a 0-5000 psi gauge into the port GP of the Functions Manifold.
- Energize the steering to full left.
- Hold the switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust steering relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust steering relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.

## DRIVE PUMP ADJUSTMENTS

This section offers instruction on inspection and adjustment of pump components. Read through the entire topic before beginning a service activity.



**Contamination can damage internal components and void your warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines**

### ***Standard Procedures***

1. With the engine off, thoroughly clean the outside of the pump.
2. If removing the pump, tag each hydraulic line. When you disconnect hydraulic lines, immediately cap them and plug each open port to prevent contamination.
3. Ensure the surrounding area is clean and free of contaminants like dirt and grime.
4. Inspect the system for contamination.
5. Check the hydraulic fluid for signs of contamination: oil discoloration, foam in the oil, sludge, or metal particles.
6. If there are signs of contamination in the hydraulic fluid, replace all filters and drain the hydraulic system. Flush the lines and refill the reservoir with the correct filtered hydraulic fluid.
7. Before re-installing the pump, test for leaks.
8. See the pump start-up procedure in Section 2.

### Charge Pressure Relief Valve Adjustment

This procedure explains how to check and adjust the charge pressure relief valve.

1. Install a 1000 psi (50 bar) pressure gauge in charge pressure gauge port GCP on the Brake Manifold. This gauge shows charge pressure.
2. Install a 100 psi (10 bar) gauge at case pressure port L1, L2, or L3. This gauge shows case pressure.
3. Operate the system with the pump in neutral (zero displacement) when measuring charge pressure.

**NOTE:** Ensure charge pressure is properly set before checking pressure limiter. See Section 1.

4. The charge pressure relief valve setting for this pump is 348 psi (24 bar). This pressure assumes 1800 rpm pump speed, charge flow of 7 gal/min (26.5 l/min), and reservoir temperature of 120°F (50°C). The charge pressure references case pressure.

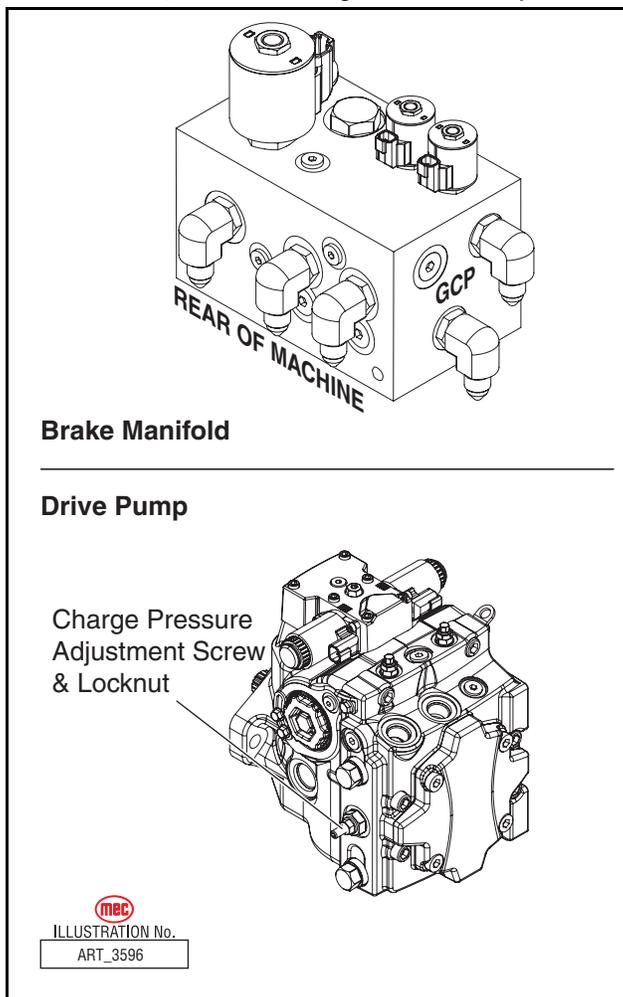
**NOTE:** At higher pump speeds or higher charge flows the charge pressure will rise over the rated setting.

5. Rotate the adjusting screw clockwise to increase the setting; counter clockwise to decrease it.  
Subtract the case pressure reading from the charge pressure reading to compute the actual charge pressure.

**NOTE:** Pressure change per turn is dependant on charge flow entering pump.

6. While holding the adjusting screw, torque locknut to 13 lb-ft (17 Nm).
7. When you achieve the desired charge pressure setting, remove the gauges and plug the ports.

Figure 4-11: Charge Pressure Adjustment



## Pressure Limiter Adjustment

**NOTE:** Ensure charge pressure is properly set before checking pressure limiter.

At the Platform Controls, set the Speed/Torque Switch to HIGH SPEED (up).

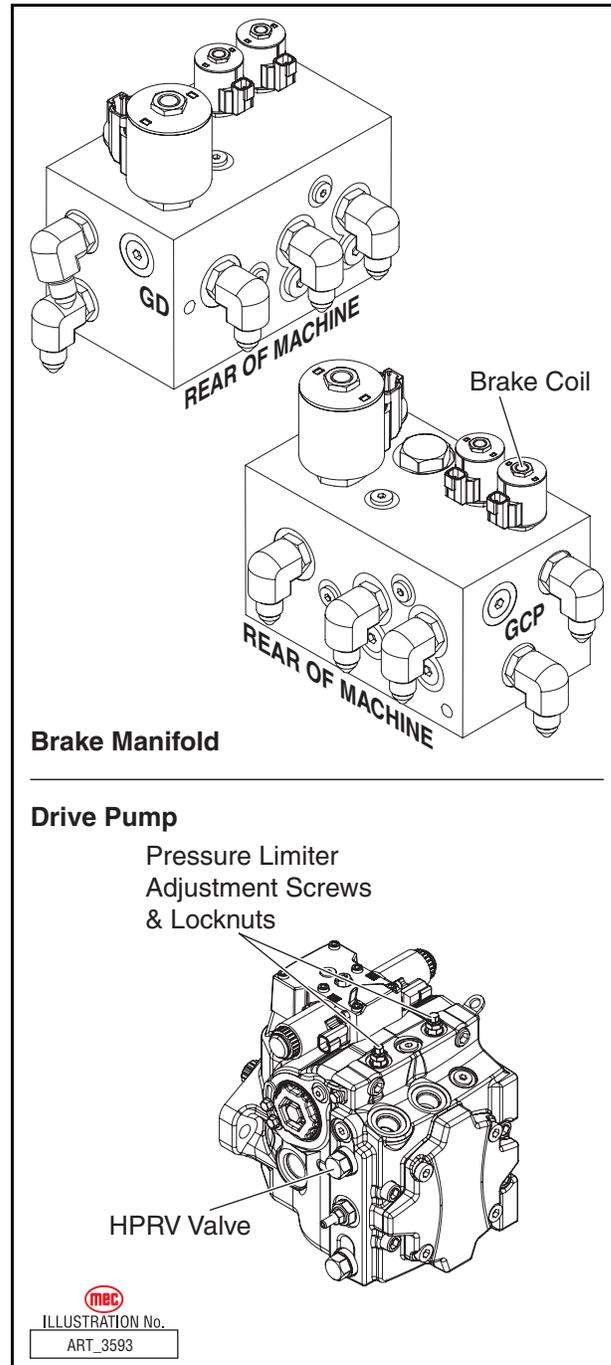
**Position the platform such that it cannot drive and the wheels cannot rotate.**



**THIS PROCEDURE REQUIRE THAT THE DRIVE SYSTEM BE BROUGHT TO FULL PRESSURE WITH THE MACHINE IMMOBILIZED. THE MACHINE MUST BE SECURELY RESTRAINED BEFORE PERFORMING THIS PROCEDURE.**

1. Install a 5000 psi (350 bar) pressure gauge in port GD of the Brake Manifold. Install a 1000 psi (50 bar) pressure gauge in port GCP of the Brake Manifold.
2. Start the engine and run at idle.
3. Use a 17mm wrench to loosen the locknut.
4. Activate the Drive Joystick until pressure in the high side of the system loop stops rising. This pressure is the PL setting.
5. Release the Drive Joystick and adjust the PL setting using an internal hex wrench. Turn the adjusting screw clockwise to increase the PL setting, counter clockwise to decrease it. The adjustment is very sensitive. Change per full turn is approximately 2176 psi (150 bar).
6. Repeat steps four and five until pressure read 4500 psi (310 bar). After adjustment, torque the locknut to 9 lb/ft (12 Nm). Do not over torque.
7. Shut down the engine. Remove gauges and replace plugs.

*Figure 4-12:* Brake Manifold



**Control Neutral Adjustment**

All functions of the Electric Displacement Control (EDC) are preset by the pump manufacturer. Adjust the pump to neutral with the pump running on the vehicle with the engine operating. If adjustment fails to give satisfactory results, it may be necessary to replace the control or coils.

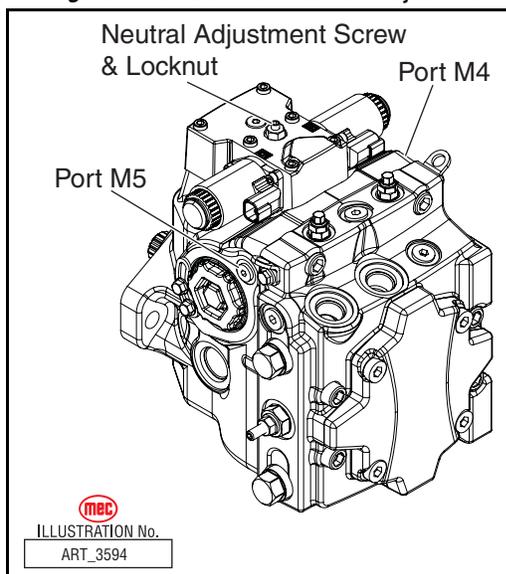


**UNINTENDED MOVEMENT OF THE MACHINE MAY CAUSE INJURY TO THE TECHNICIAN OR BYSTANDERS. TO PROTECT AGAINST UNINTENDED MOVEMENT, SECURE THE MACHINE AGAINST MOVEMENT AND DISCONNECT THE BRAKE COIL WHILE SERVICING. SEE FIGURE 4-12 ON PAGE 4-38 FOR LOCATION OF COIL.**

1. Install a 1000 psi (50 bar) gauge in each of the two servo gauge ports (M4 and M5). Disconnect the external control input (electrical connections) from the control. Start the engine and operate at idle speed.
2. Use a 4mm internal hex wrench to hold the neutral adjusting screw stationary while loosening the locknut with a 13mm wrench.
3. Observe pressure gauges. If necessary, turn adjusting screw to reduce any pressure differential.
4. Rotate the neutral adjusting screw clockwise until the pressure increases on the gauge. Note the angular position of the wrench. Then rotate the neutral adjusting screw counter clockwise until the pressure increases by an equal amount on the other gauge. Again note the angular position of the wrench.
5. Rotate the neutral adjusting screw clockwise half the distance between the wrench positions noted above. The gauges should read the same pressure, indicating that the control is in its neutral position.
6. Hold the neutral adjusting screw stationary and tighten the lock nut. Torque to 7 lb/ft (10 Nm). Do not over-torque the nut.
7. When the neutral position is set, stop the engine, remove the gauges, and install the gauge port plugs. Reconnect the external control input.

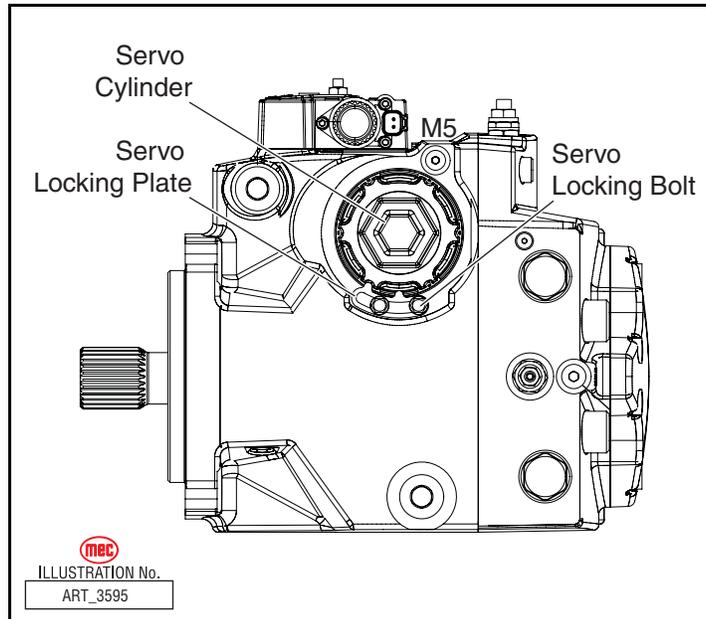
**NOTE:** A small pressure differential of 22 psi (1.5 bar) or less is acceptable. Zero differential is usually not possible.

**Figure 4-13:** Control Neutral Adjustment



**Mechanical Neutral Adjustment****SERVO ADJUSTMENT****Figure 4-14:** Servo Adjustment, Port M5 Side

1. Run engine at 1800 rpm.
2. If using a PWM signal, ensure the signal is off. Check the servo pressure gauges. Ensure the differential between M4 and M5 is less than 22 psi (1.5 bar).
3. Using a 3/4 in hex deep socket, unthread both servo cylinders 2-3 turns. This step ensures the servo cylinders have no contact with the servo piston.
4. Stroke the pump by turning the control eccentric screw, or by supplying current to solenoid C1, until the servo pressure at port M4 is 1 to 2 bar [14– 29 psi]



- greater than at port M5 and the system pressure gauges indicate displacement. Pressure should be greater at port MB. This also indicates the servo piston is in contact with the servo cylinder on side M5.
5. Slowly thread the servo cylinder on the M5 side in until the system pressure differential starts to decrease. Maintain servo pressure differential between 1-2 bar [14-29 psi] during this step. Continue turning the servo cylinder in until the system pressure differential (between ports MA/MB) is less than 22 psi (1.5 bar). This procedure sets the servo and swash plate to mechanical neutral on the M5 side.
6. Repeat steps 1-5 but stroke the pump in the opposite direction by turning the eccentric screw in the opposite direction, or by supplying current to solenoid C2. Reverse gauge locations (M4 for M5, MB for MA) from those stated above since the pump is now stroking the other direction.
7. Remove all gauges and replace gauge port plugs.

**VERIFY NEUTRAL SETTING**

1. If using a PWM signal to set mechanical neutral, check that servo pressure differential is less than 22 psi (1.5 bar). Refer to "Control Neutral Adjustment" on page 4-39.
2. To verify mechanical neutral, provide current to solenoid C1, or turn neutral adjustment screw, until the servo pressure differential is 3 bar [43 psi]. The system pressure differential must be below 22 psi (1.5 bar). Repeat test on solenoid C2 side.
3. The current required to set the servo pressure differential to 3 bar [43 psi] should be the same for each solenoid.
4. If using neutral adjustment screw to set mechanical neutral, reset control neutral. Refer to "Control Neutral Adjustment" on page 4-39.



# Section 5

## SCHEMATICS

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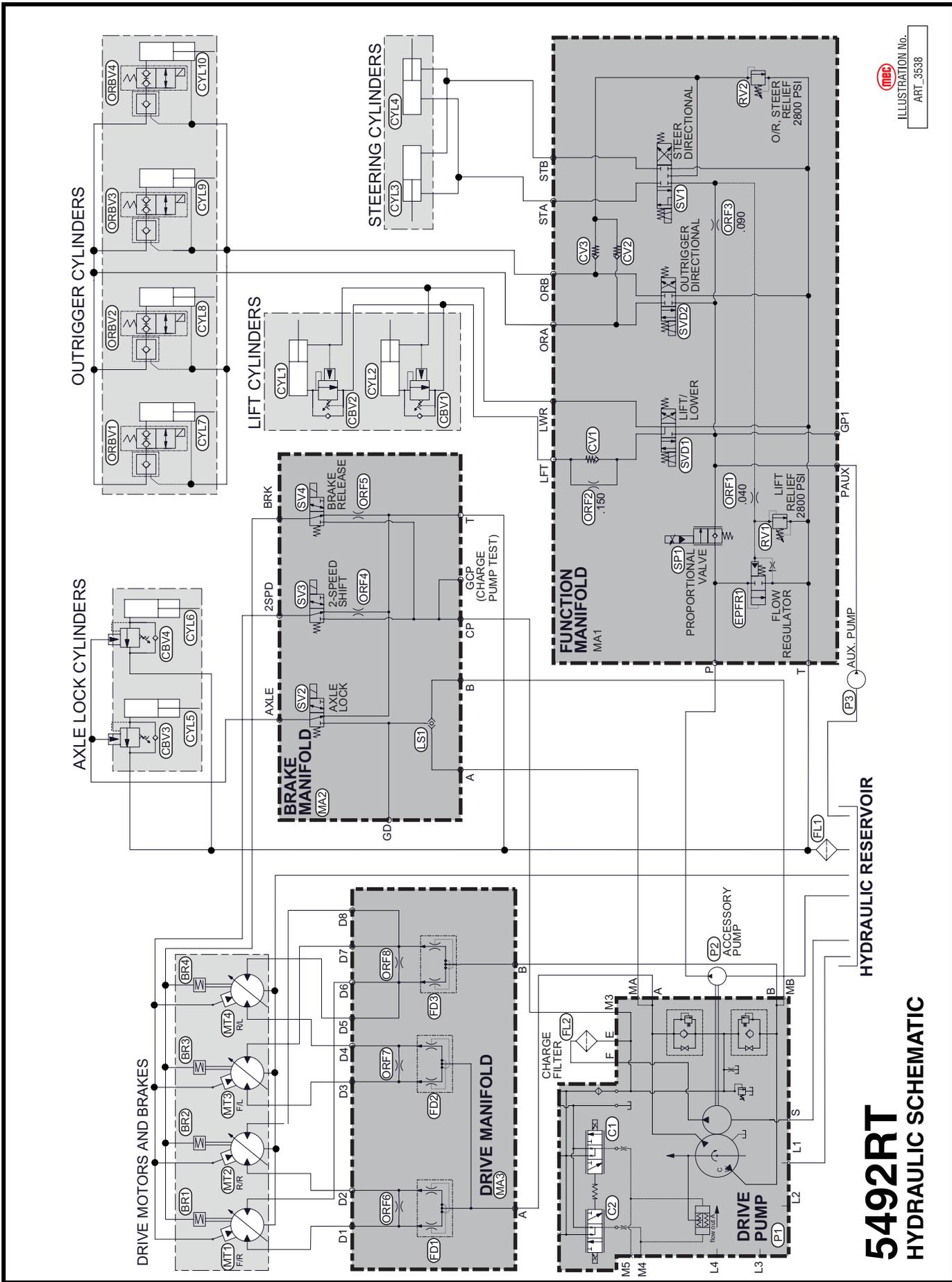
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# HYDRAULIC SCHEMATICS

The following table applies to Figure 5-1, Figure 5-2, Figure 5-3 and Figure 5-4.

Callout	Description
BR1 - BR4	Brake, Integral to the torque hubs
C1	Valve, Drive directional
C2	Valve, Drive directional
CBV1, CBV2	Counterbalance Valve, Lift cylinder hold
CBV3, CBV4	Counterbalance Valve, Axle lock cylinders
CYL1	Cylinder, Hydraulic lift
CYL2	Cylinder, Hydraulic lift
CYL3, CYL4	Cylinder, Steer
CYL5, CYL6	Cylinder, Axle lock
CYL7 - CYL10	Cylinder, Outrigger
EPFR1	Flow Regulator, Diverts unused oil to tank
FD1 - FD3	Flow Divide Valve, drive traction control
FL1	Filter, Hydraulic oil return
FL2	Filter, Charge pump
LS1	Check Valve, Drive signal for Axle Lock
MA1	Manifold, Main
MA2	Manifold, axle lock, 2-speed, brake
MA3	Manifold, Drive
MT1 - MT4	Wheel Drive Motor
ORB1 - ORB4	Outrigger Blocking Valve, O/R control
ORF1	Orifice, Flow regulator control
ORF2	Orifice, Lower max speed control
ORF3	Orifice, Steer max speed control
ORF4	Orifice, Brake apply control
ORF5	Orifice, 2-speed shift control
ORF6 - ORF8	Orifice, Drive flow-divide bypass
P1	Pump, Drive hydrastatic
P2	Pump, Lift, steer and outriggers
P3	Pump, Emerg power unit
RV1	Relief Valve, Lift, Lower max pressure
RV2	Relief Valve, Outrigger, steer max pressure
SP1	Proportional Valve, Speed control
SV1	Solenoid Valve 5-way, 3 pos, Steer directional
SV2	Solenoid Valve 2-way, 2 pos, Axle Lock
SV3	Solenoid Valve 2-way, 2 pos, 2-speed shift
SV4	Solenoid Valve 2-way, 2 pos, Brake release
SVD1	Solenoid Valve 4-way, 3 pos, Lift, Lower
SVD2	Solenoid Valve 4-way, 3 pos, Outrigger directional

Figure 5-1: Hydraulic Schematic



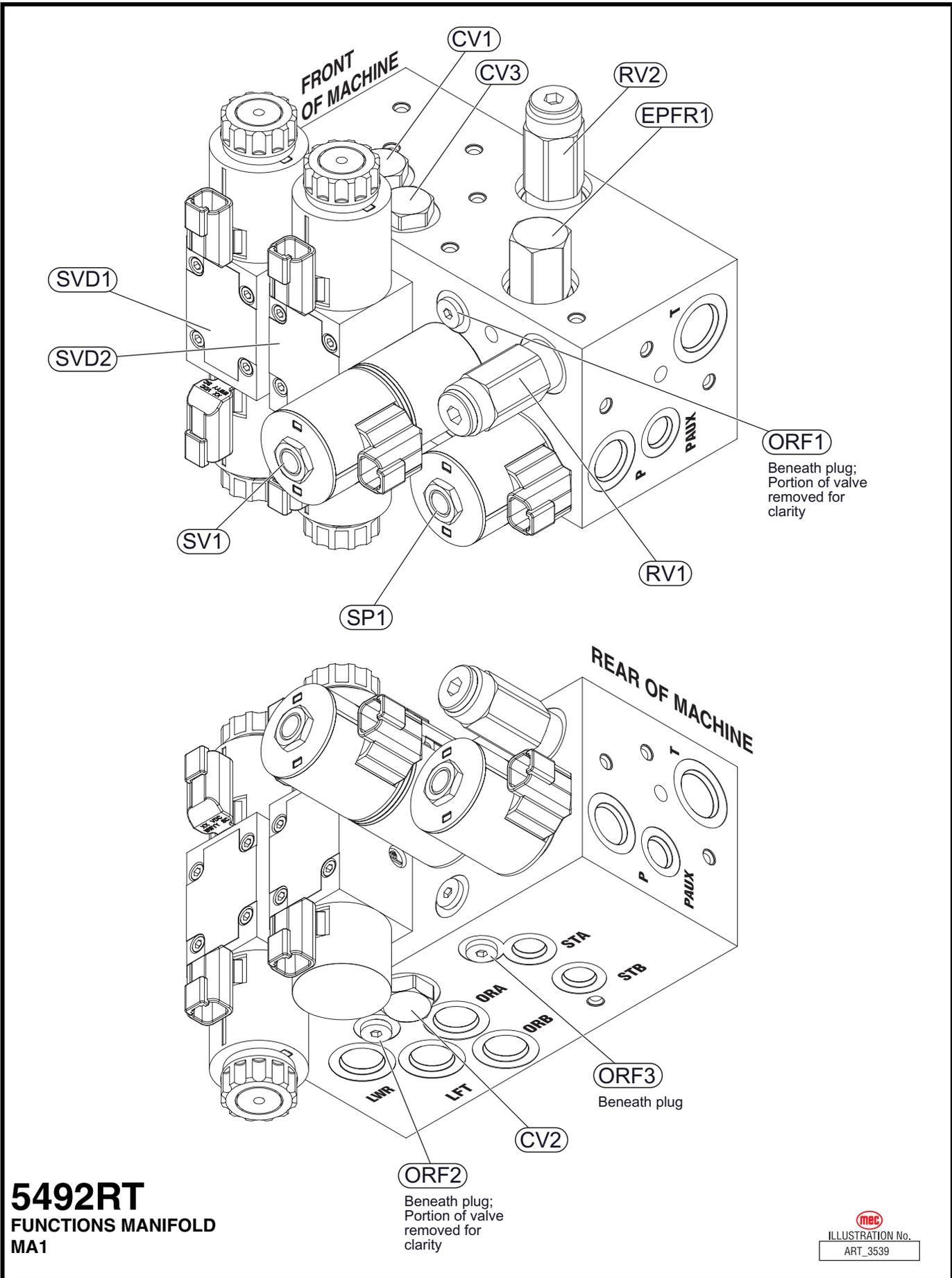
# 5492RT

## HYDRAULIC SCHEMATIC

MEC  
ILLUSTRATION No.  
ART\_3538



Figure 5-2: Function Manifold, MA1

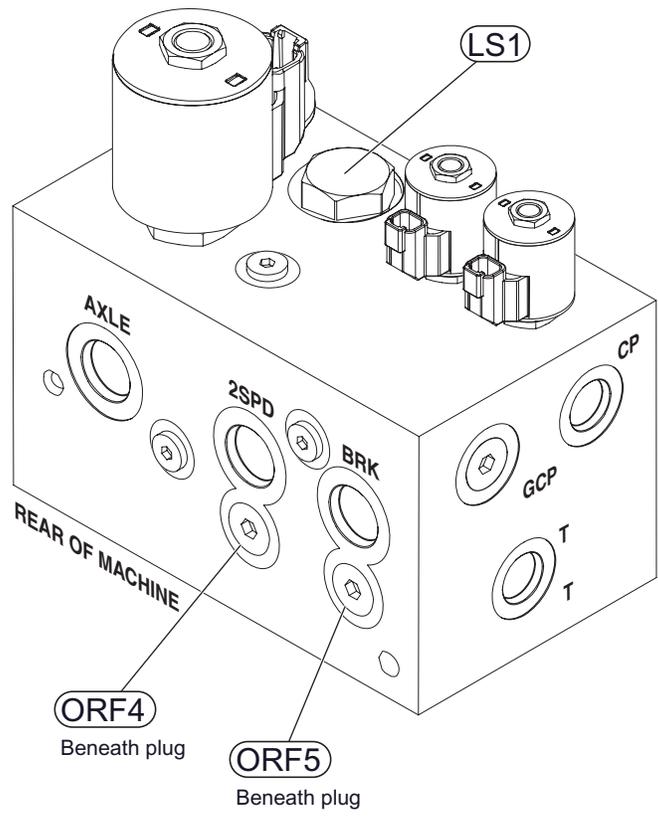
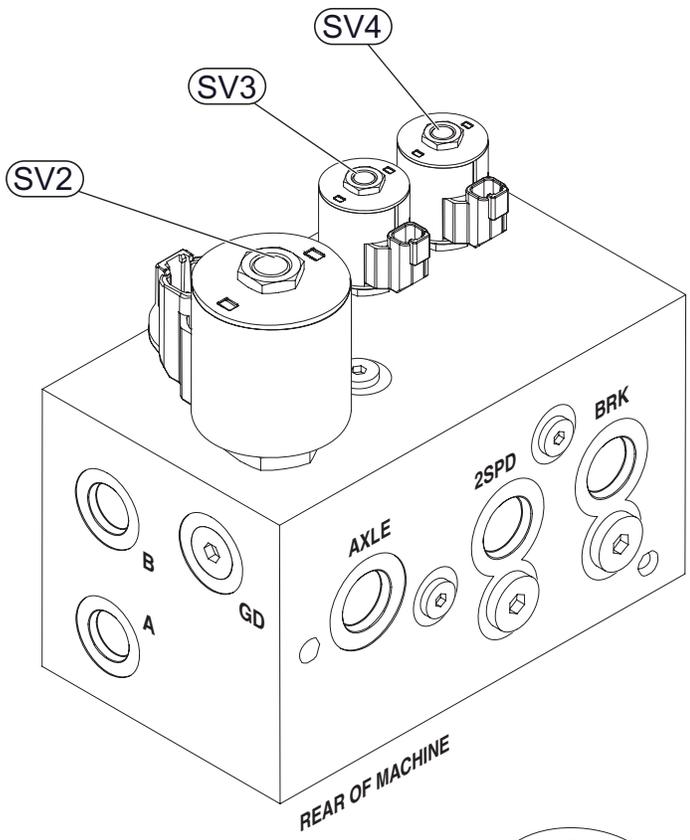


**5492RT**  
**FUNCTIONS MANIFOLD**  
**MA1**

  
 ILLUSTRATION No.  
 ART\_3539



Figure 5-3: Brake Manifold, MA2

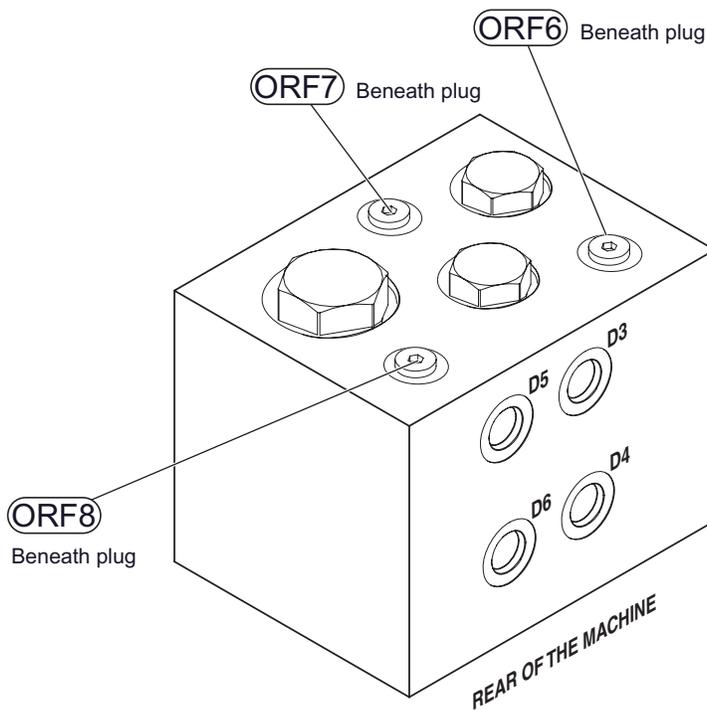
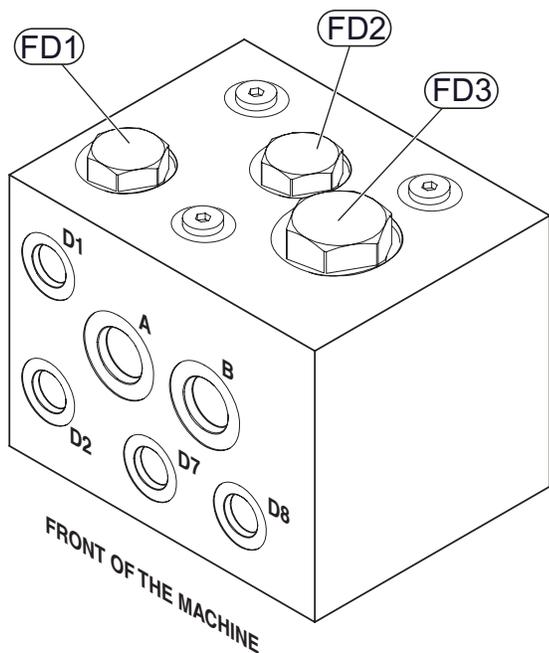


**5492RT**  
BRAKE MANIFOLD  
MA2

  
ILLUSTRATION No.  
ART\_3540



Figure 5-4: Drive Manifold, MA3



**5492RT**  
DRIVE MANIFOLD  
MA3

  
ILLUSTRATION No.  
ART\_3541

# ELECTRICAL SCHEMATICS

Figure 5-5: Electric Schematic, Lower Control Box

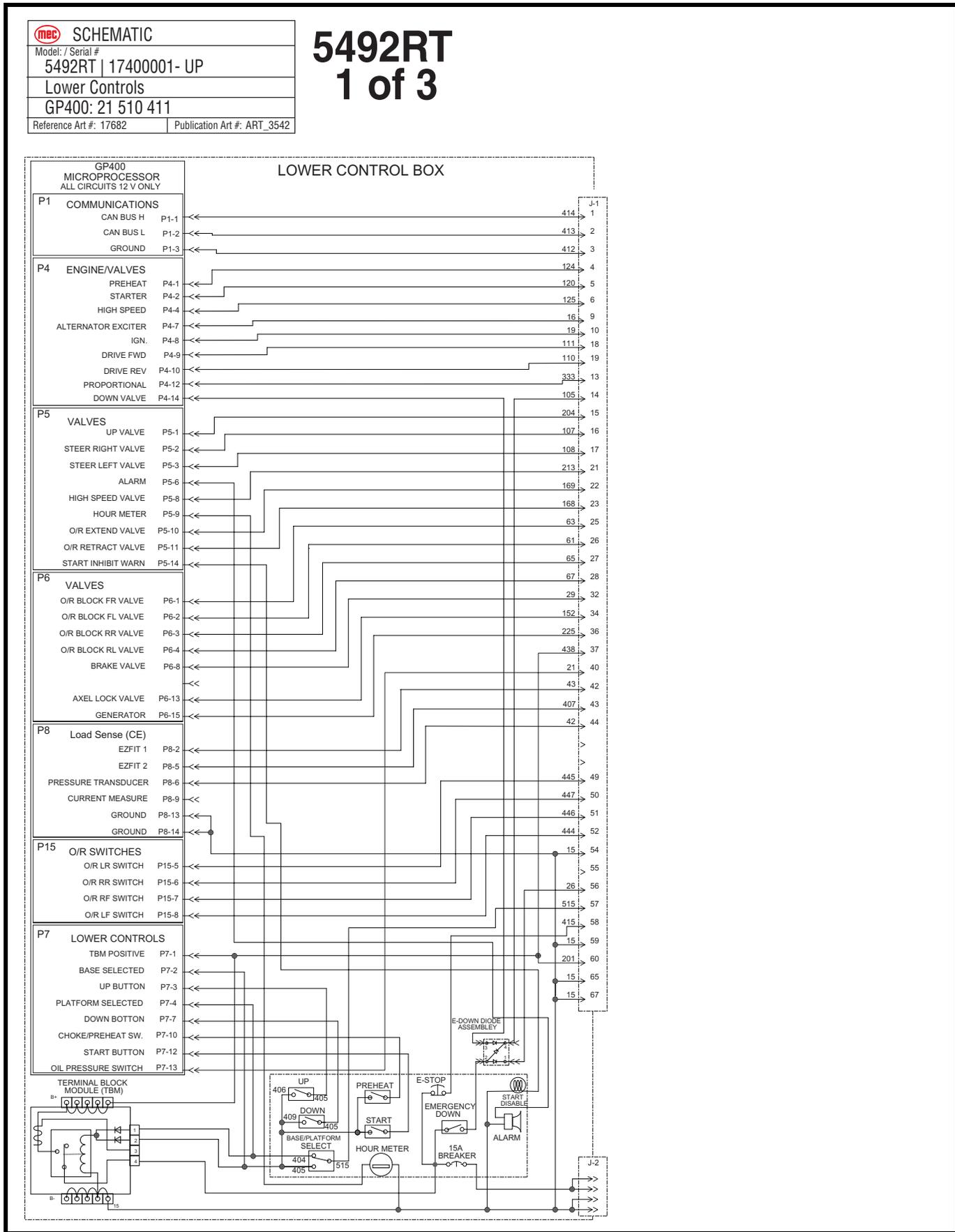


Figure 5-6: Electric Schematic, Base

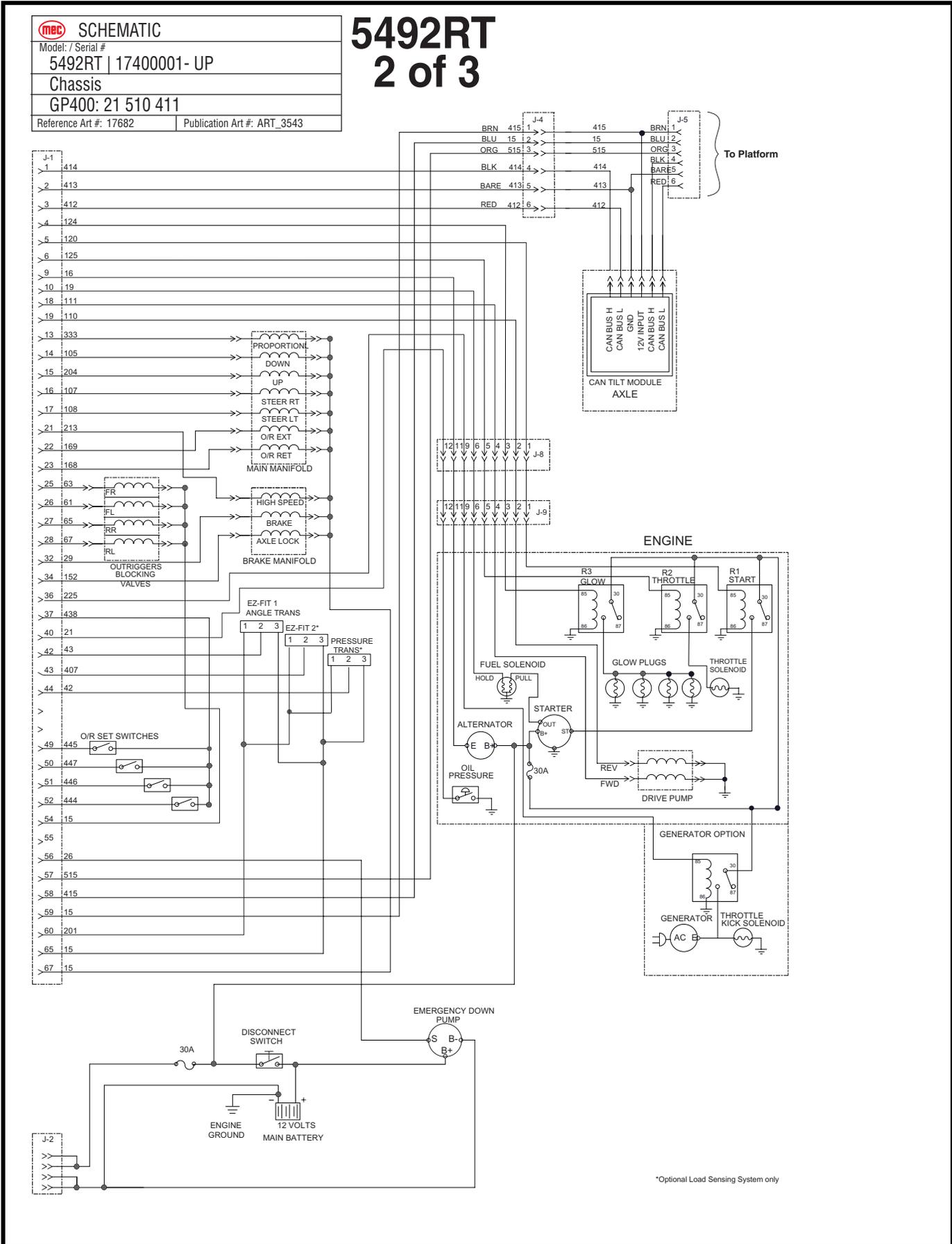


Figure 5-7: Electric Schematic, Upper Control Box

<b>MEC</b> SCHEMATIC	
Model: / Serial #	
5492RT   17400001- UP	
Upper Controls	
GP400: 21 510 411	
Reference Art #: 17682	Publication Art #: ART_3544

# 5492RT

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