

## ELECTRICAL SYSTEM TROUBLESHOOTING

The electronic control system used on the 3072ES and 3772ES is designed for very low maintenance and long trouble free operation. All wire harness plug connections are waterproof to avoid moisture related problems that can lead to short terminal life. The system consists of three electronic microprocessor controlled modules; the Matrix Module, P600 Motor Control Module and the GP400 Processor. The modules communicate through low voltage digital signal technology called **CAN bus** communication.

The modules are protected against short circuit and reverse polarity to protect against part failure or incorrect plug connections.

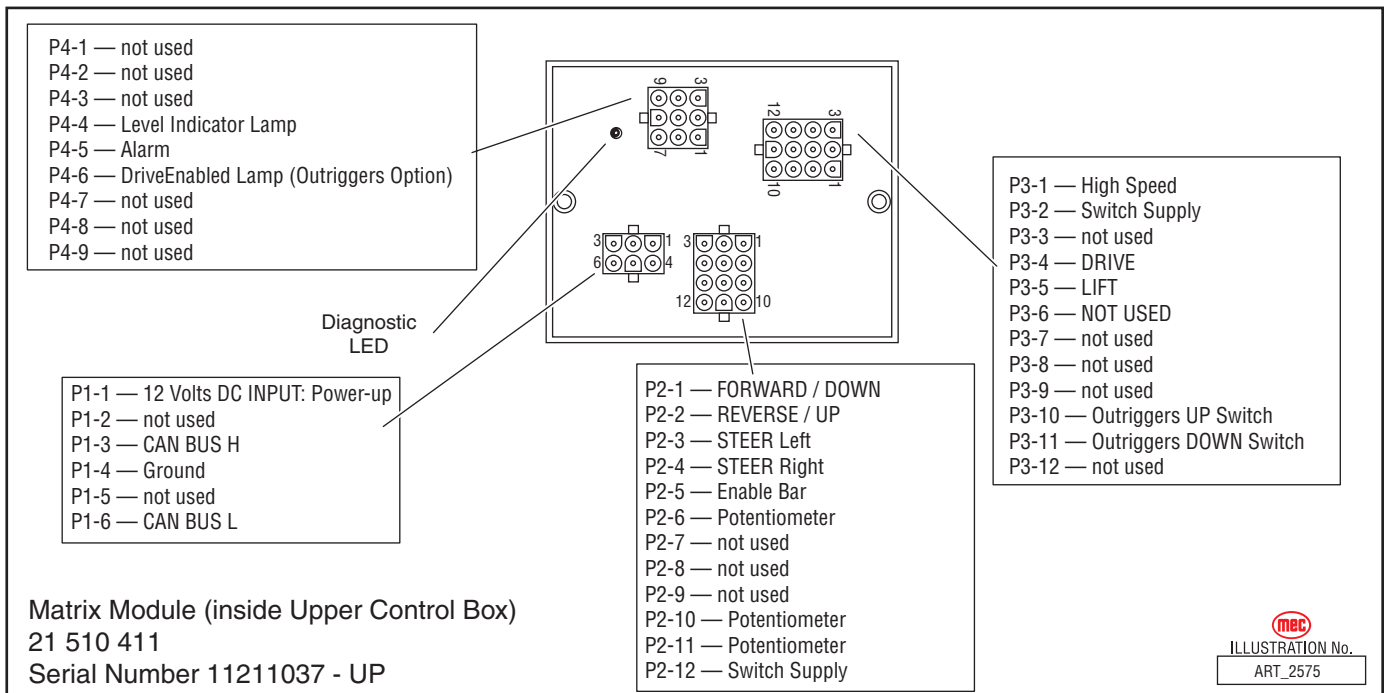
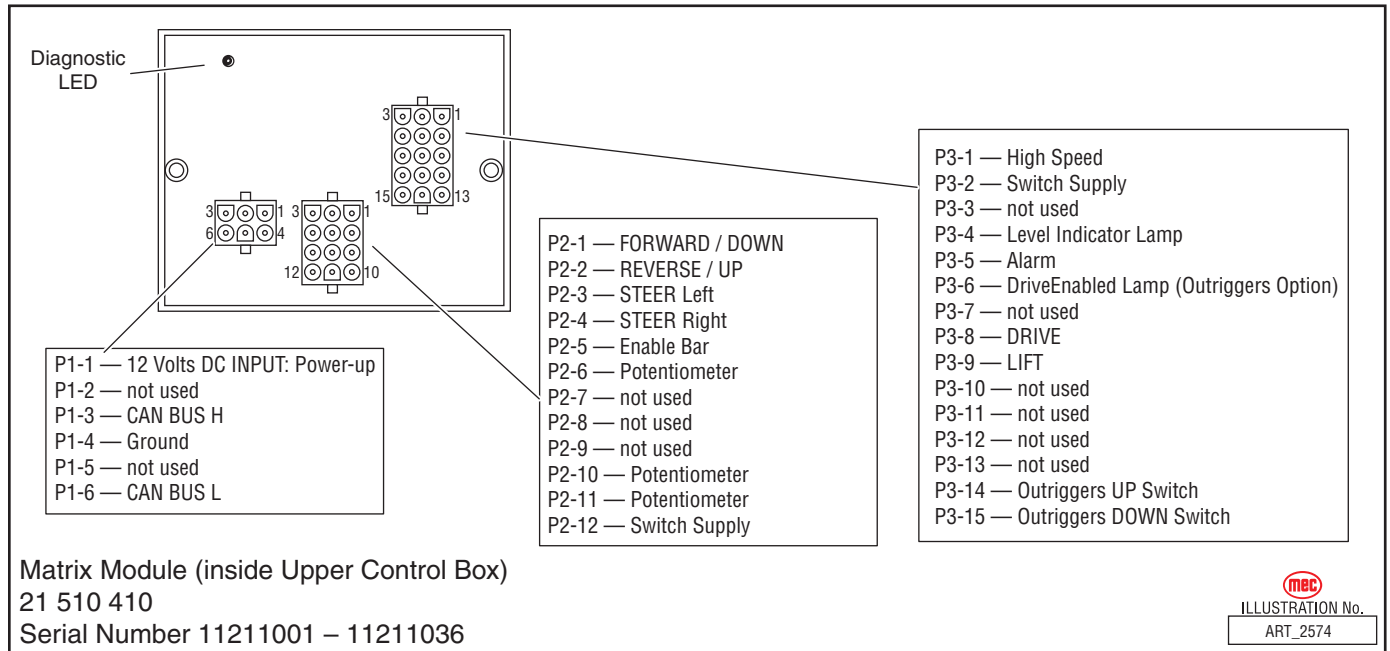


**NEVER ATTEMPT TO SUPPLY BATTERY POWER, OR VOLTAGE HIGHER THAN 12 VOLTS TO ANY PART OR MODULE IN THIS SYSTEM, CATASTROPHIC FAILURE OF THE MODULES MAY RESULT.**

**USE OF HIGH PRESSURE WASHING EQUIPMENT IN THE VICINITY OF THE MODULES CAN CAUSE THE SYSTEM TO STOP OPERATING AND IS HIGHLY DISCOURAGED.**

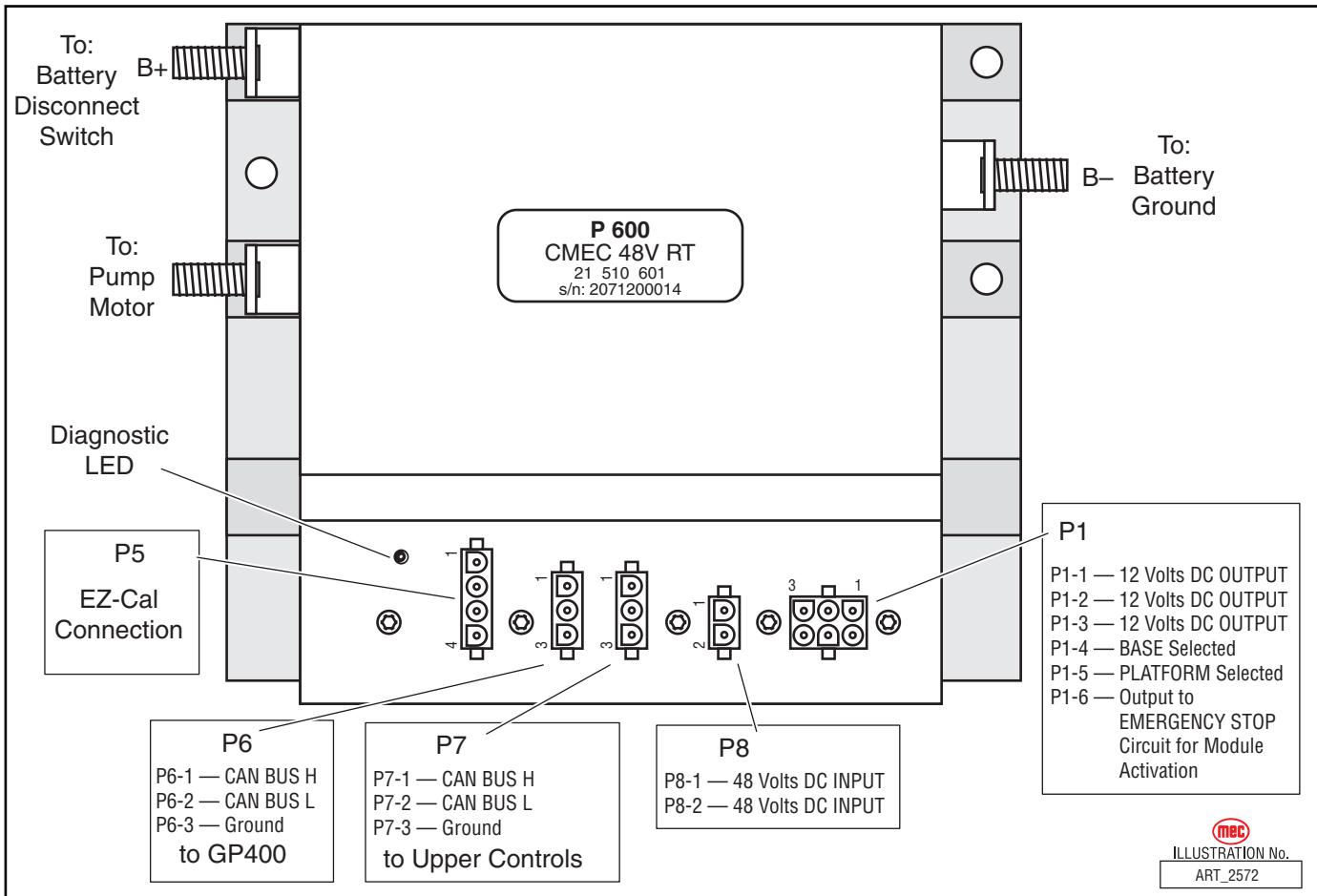
# Matrix Module

Located inside the upper control box, the Matrix Module receives inputs from upper control switches and communicates them to the GP400.



## P600 Motor Control Module

The Motor Control Module operates the electric pump motor with varied speeds depending on operator commands. Pulse-width Modulation provides smooth and controlled operation with maximum battery efficiency. The Motor Controller also converts battery voltage (48 volts DC) to the user-friendly 12 volts DC used throughout the rest of the system.

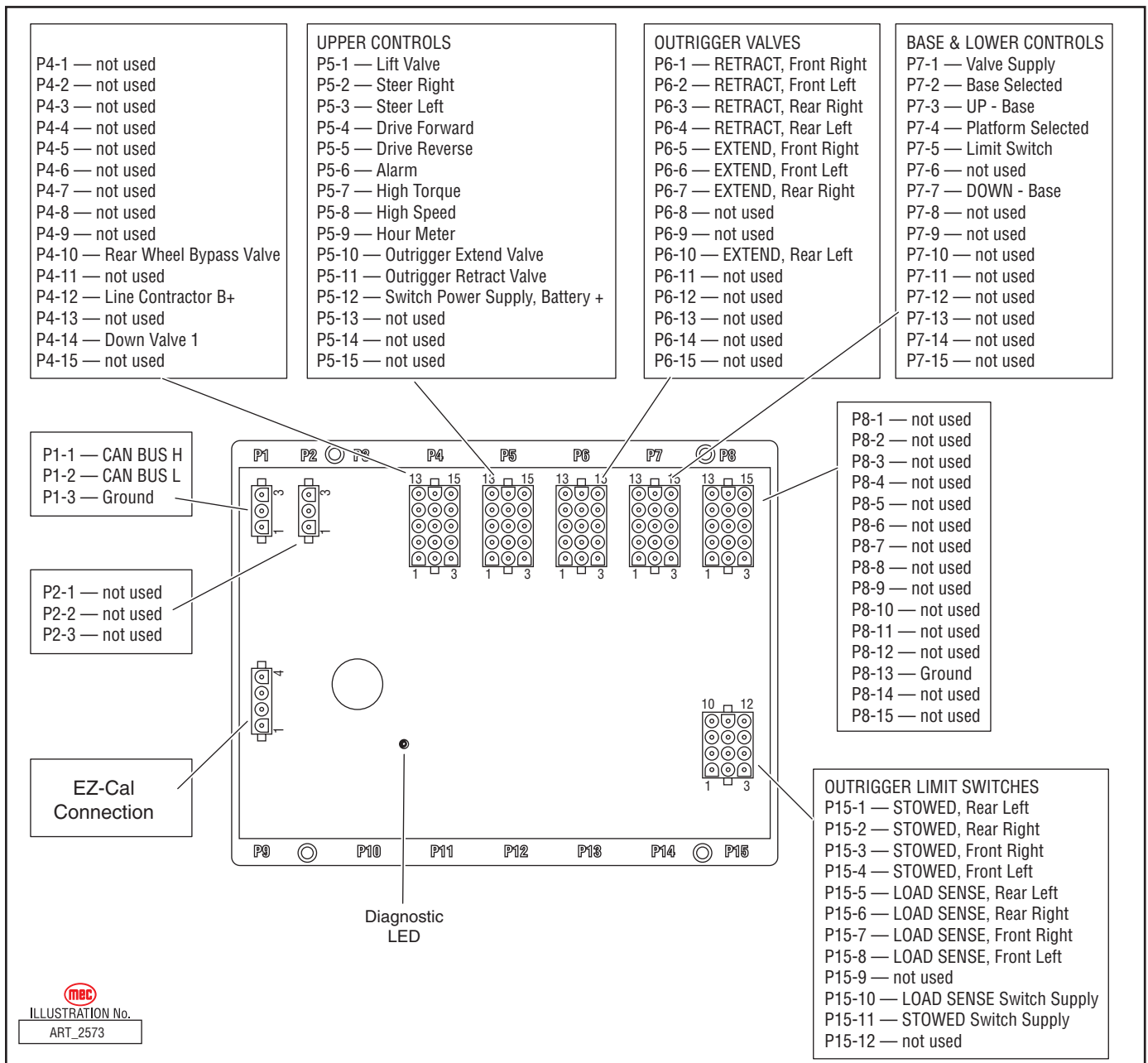


# GP400 Module

The GP400 Module sends, receives and processes inputs from the Motor Control and Matrix modules, then controls output function. Communication between the three modules is achieved through the use of CAN bus communication link.

The GP400 was designed with the technician in mind. Through the use of the EZ-Cal interface tool, it allows the technician to make adjustments to various personalities, monitor inputs and outputs in real time, plus access informational messages for both current and recent events. A complete list of EZ-Cal messages can be found on the following pages.

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



# EZ-CAL SCAN TOOL

The **EZ-Cal** is a hand-held interface tool that communicates with the GP400 processor to provide troubleshooting information and adjustments. The EZ-Cal receives its power from the GP400 when connected. It also conveniently provides back-lighting to the display.

## EZ-Cal Operation

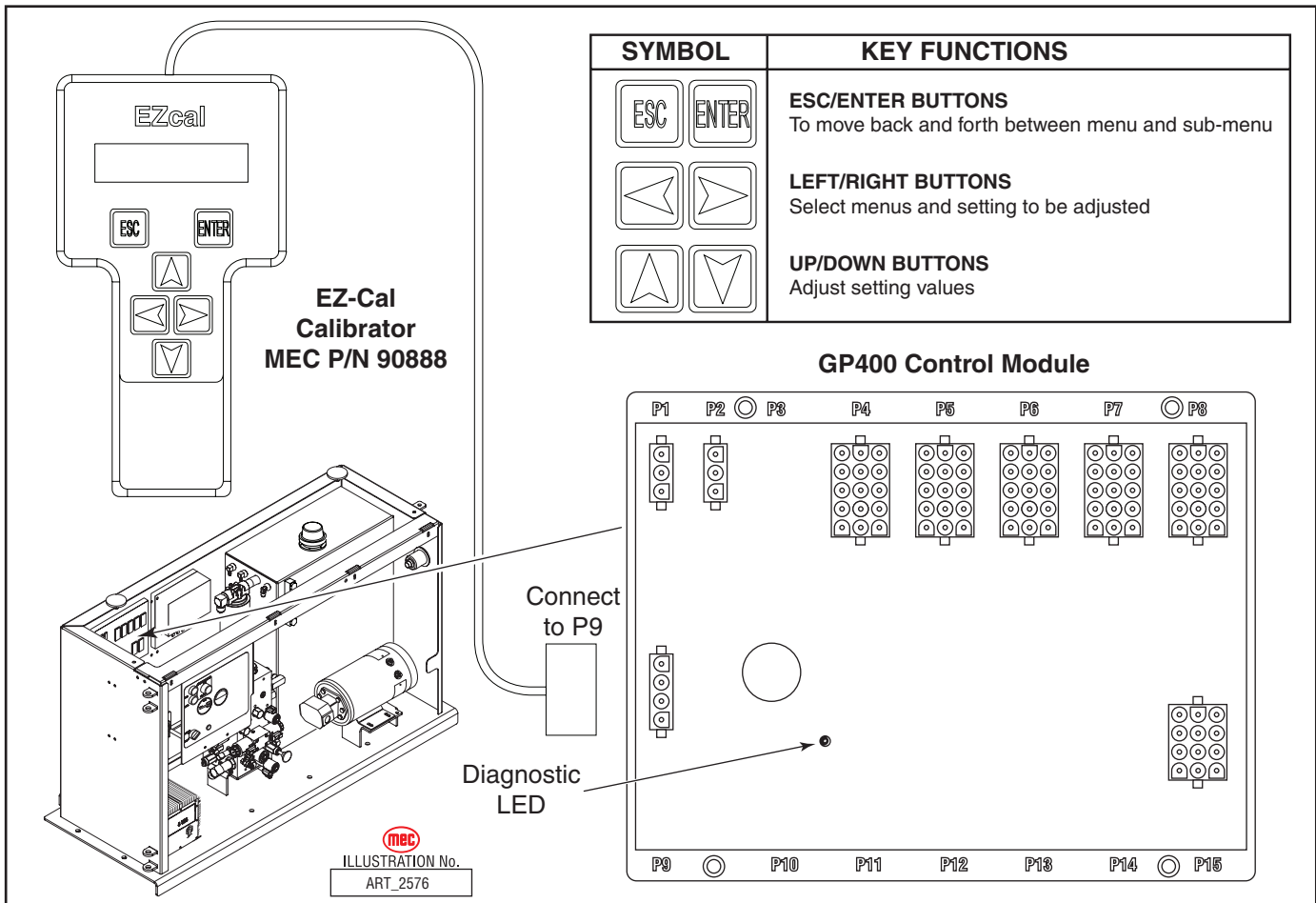
The system must be powered up to use the EZ-Cal. To power the system up;

- put the battery disconnect switch in the ON position
- reset the Base and the Platform emergency stop switches
- at the upper controls, turn the key switch to ON
- at the lower controls, select the station you will operate from (Base or Platform).

To operate the EZ-Cal, plug the cable into the open 4-terminal receptacle 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 press Enter to access sub menu.
- Use the right and left arrows to scroll through sub menus, press Enter again.
- The up/down arrows are used to change settings.
- Press ESC to go back one level.

The EZ-Cal Flow Chart on page 4-10 through page 4-13, and the EZ-Cal Tables beginning on page 4-14 will help to quickly locate diagnostic and adjustments information.



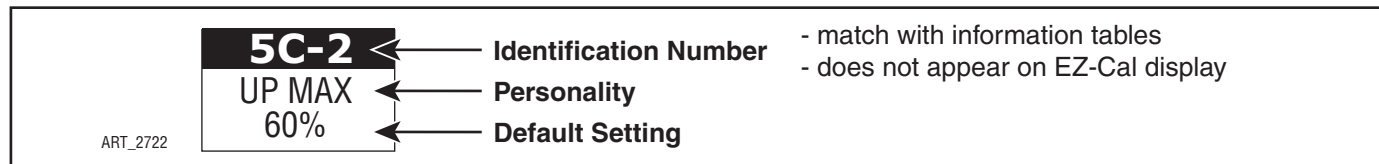
## Using the EZ-Cal with the Flow Charts

Use the EZ-cal Flow Charts on page 4-10 through page 4-13 as a guide to locate diagnostic information and make adjustments. Each box in the flow chart will have 3 bits of information.

**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.



### Changing Settings

It is necessary to enter Access Level 1 in order to change settings.

### Error Messages

Refer to *HELP Menu* on page 4-21.

### Scrolling Messages

The EZ-Cal will provide a scrolling message of the current error followed by a log of previous errors that may have occurred within recent operation. Refer to *Scrolling Message* on page 4-21.

### 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* beginning on page 4-25 For flash codes.

### Access Level 1

**Access Level 1 is restricted.** If Setup or Personality changes are necessary, contact the factory to obtain instructions and authorization to make changes to factory settings (publication number 91777).

Access Level 1 is required for Setup and Personality changes. Only qualified service personnel should be allowed to make adjustments in these areas.



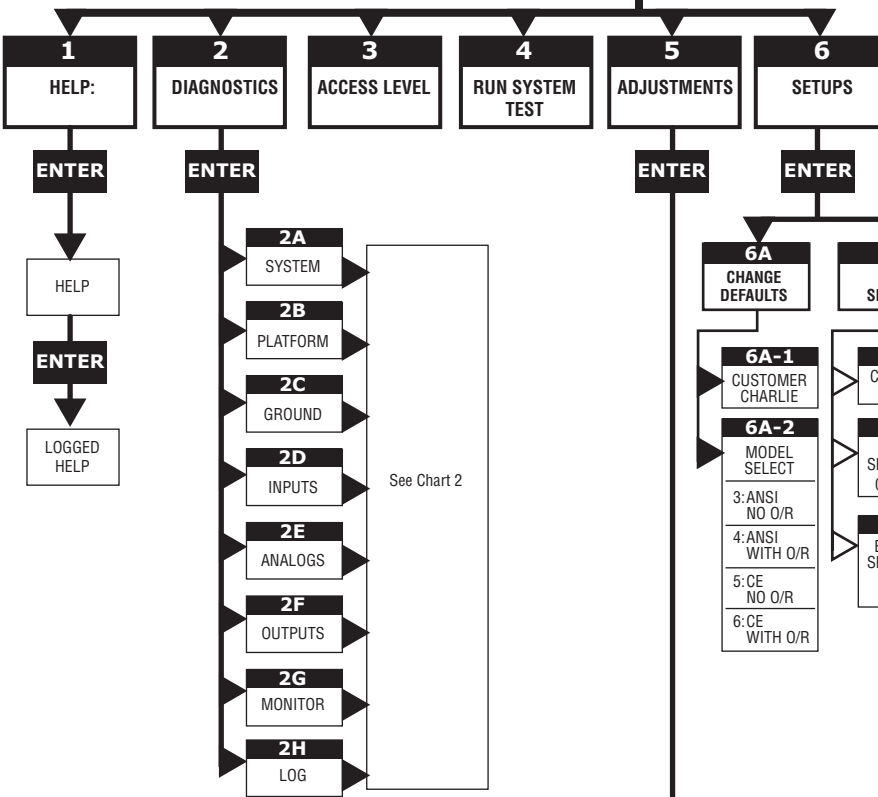
**PERSONALITIES ARE PRESET AT THE FACTORY TO PROVIDE PROPER MACHINE MOVEMENT AT SAFE SPEEDS. PERSONALITIES MUST NOT BE CHANGED WITHOUT PRIOR AUTHORIZATION FROM MEC AERIAL AND MAY ONLY BE RETURNED TO FACTORY SPECIFICATION.**

# Adjustments & Setup

## GP400 MENU

### EZ-Cal Flow Chart Chart 1 of 2

**ANSI Models**



SYMBOL	KEY FUNCTIONS
	<b>ESC/ENTER BUTTONS</b> To move back and forth between menu and sub-menu
	<b>LEFT/RIGHT BUTTONS</b> Select menus and setting to be adjusted
	<b>UP/DOWN BUTTONS</b> Adjust setting values

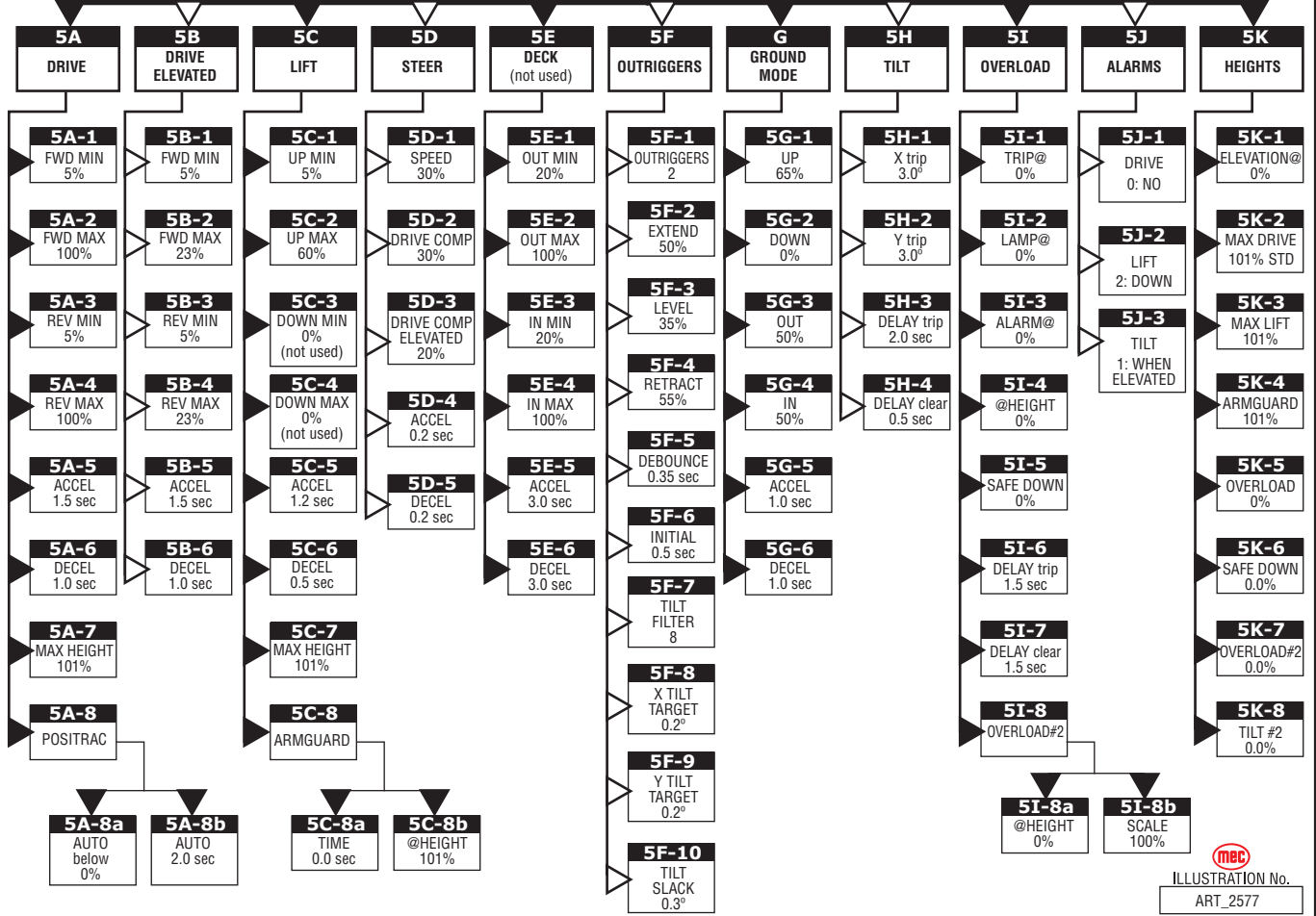


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# DIAGNOSTIC

Use in conjunction with Diagnostic Tables for thorough explanation of readout and values.

GP400 MENU

2  
DIAGNOSTICS

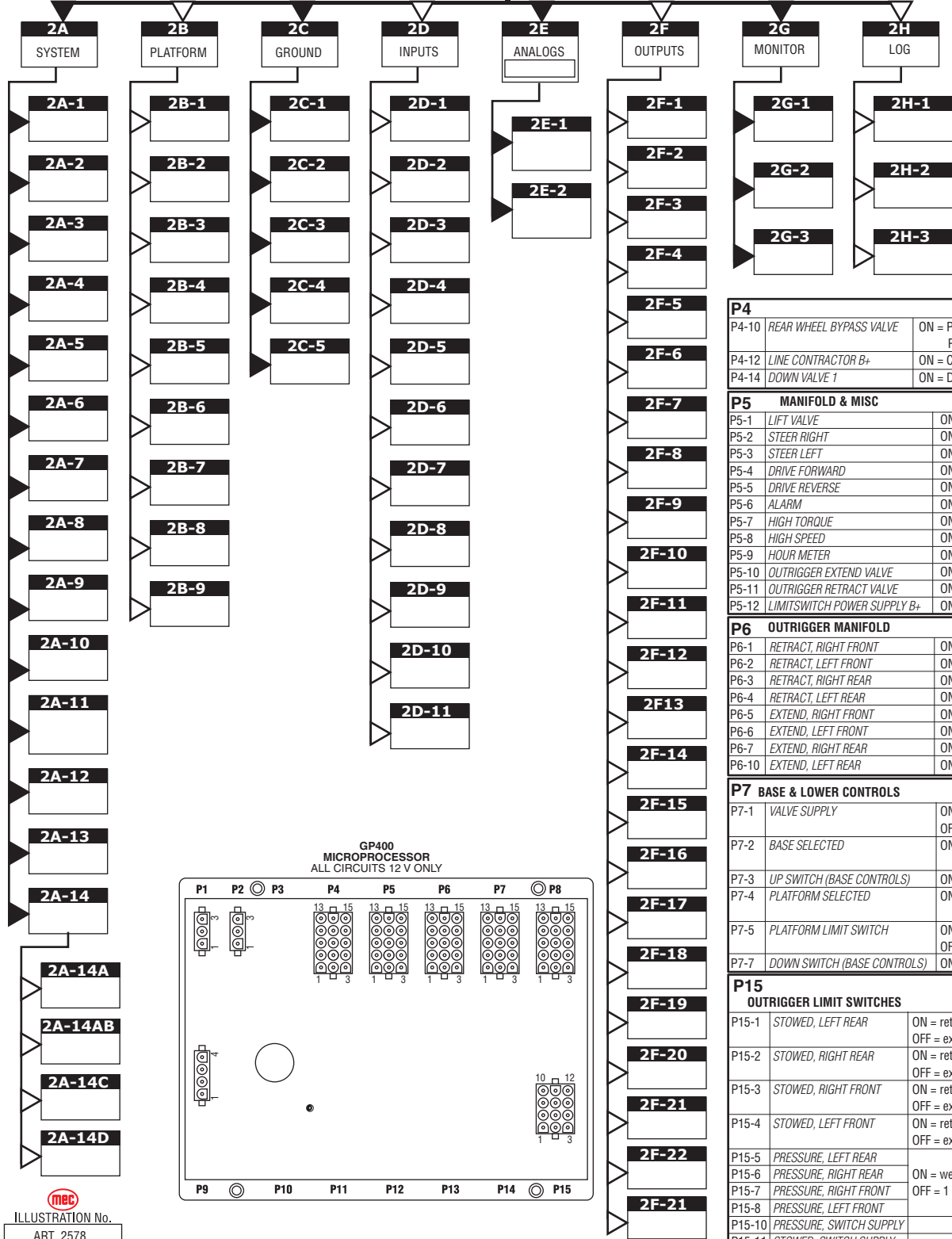
ENTER

## EZ-Cal Flow Chart

Chart 2 of 2

**ANSI Models**

SYMBOL	KEY FUNCTIONS
	<b>ESC/ENTER BUTTONS</b> To move back and forth between menu and sub-menu
	<b>LEFT/RIGHT BUTTONS</b> Select menus and setting to be adjusted
	<b>UP/DOWN BUTTONS</b> Adjust setting values



P4		
P4-10	REAR WHEEL BYPASS VALVE	ON = Powered - Rear Wheels in bypass
P4-12	LINE CONTRACTOR B+	ON = Contactor closed
P4-14	DOWN VALVE 1	ON = Down Valve activated

P5 MANIFOLD & MISC		
P5-1	LIFT VALVE	ON = Lift Valve activated
P5-2	STEER RIGHT	ON = Valve activated
P5-3	STEER LEFT	ON = Valve activated
P5-4	DRIVE FORWARD	ON = Valve activated
P5-5	DRIVE REVERSE	ON = Valve activated
P5-6	ALARM	ON = Alarm activated
P5-7	HIGH TORQUE	ON = Valve activated
P5-8	HIGH SPEED	ON = Valve activated
P5-9	HOUR METER	ON = Meter activated
P5-10	OUTRIGGER EXTEND VALVE	ON = Valve activated
P5-11	OUTRIGGER RETRACT VALVE	ON = Valve activated
P5-12	LIMITSWITCH POWER SUPPLY B+	ON = System powered-up

P6 OUTRIGGER MANIFOLD		
P6-1	RETRACT, RIGHT FRONT	ON = Valve activated
P6-2	RETRACT, LEFT FRONT	ON = Valve activated
P6-3	RETRACT, RIGHT REAR	ON = Valve activated
P6-4	RETRACT, LEFT REAR	ON = Valve activated
P6-5	EXTEND, RIGHT FRONT	ON = Valve activated
P6-6	EXTEND, LEFT FRONT	ON = Alarm activated
P6-7	EXTEND, RIGHT REAR	ON = Valve activated
P6-10	EXTEND, LEFT REAR	ON = Valve activated

P7 BASE & LOWER CONTROLS		
P7-1	VALVE SUPPLY	ON = Voltage, OFF = No Voltage
P7-2	BASE SELECTED	ON = Base Controls Operation
P7-3	UP SWITCH (BASE CONTROLS)	ON = Up activated
P7-4	PLATFORM SELECTED	ON = Platform Controls selected
P7-5	PLATFORM LIMIT SWITCH	ON = lowered, OFF = elevated
P7-7	DOWN SWITCH (BASE CONTROLS)	ON = Down activated

P15 OUTRIGGER LIMIT SWITCHES		
P15-1	STOWED, LEFT REAR	ON = retracted, OFF = extended past 1/2"
P15-2	STOWED, RIGHT REAR	ON = retracted, OFF = extended past 1/2"
P15-3	STOWED, RIGHT FRONT	ON = retracted, OFF = extended past 1/2"
P15-4	STOWED, LEFT FRONT	ON = retracted, OFF = extended past 1/2"
P15-5	PRESSURE, LEFT REAR	ON = weight on all 4 legs OFF = 1 or more legs up
P15-6	PRESSURE, RIGHT REAR	
P15-7	PRESSURE, RIGHT FRONT	
P15-8	PRESSURE, LEFT FRONT	
P15-10	PRESSURE, SWITCH SUPPLY	
P15-11	STOWED, SWITCH SUPPLY	

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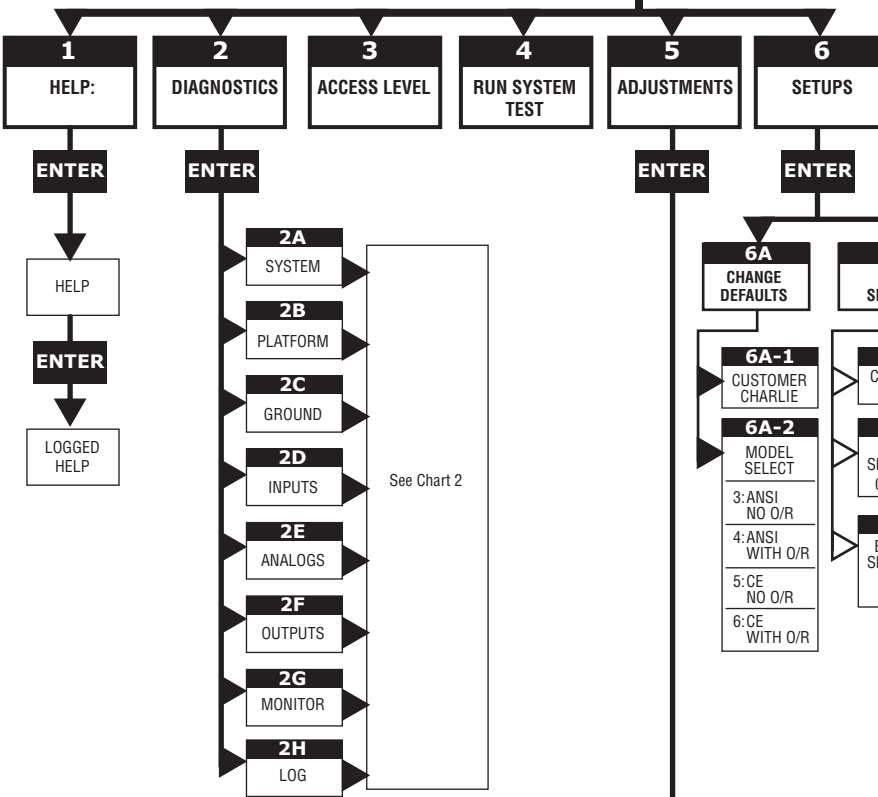
# Adjustments & Setup

## GP400 MENU

### EZ-Cal Flow Chart

Chart 1 of 2

**CE**  
Models



SYMBOL	KEY FUNCTIONS
	<b>ESC/ENTER BUTTONS</b> To move back and forth between menu and sub-menu
	<b>LEFT/RIGHT BUTTONS</b> Select menus and setting to be adjusted
	<b>UP/DOWN BUTTONS</b> Adjust setting values

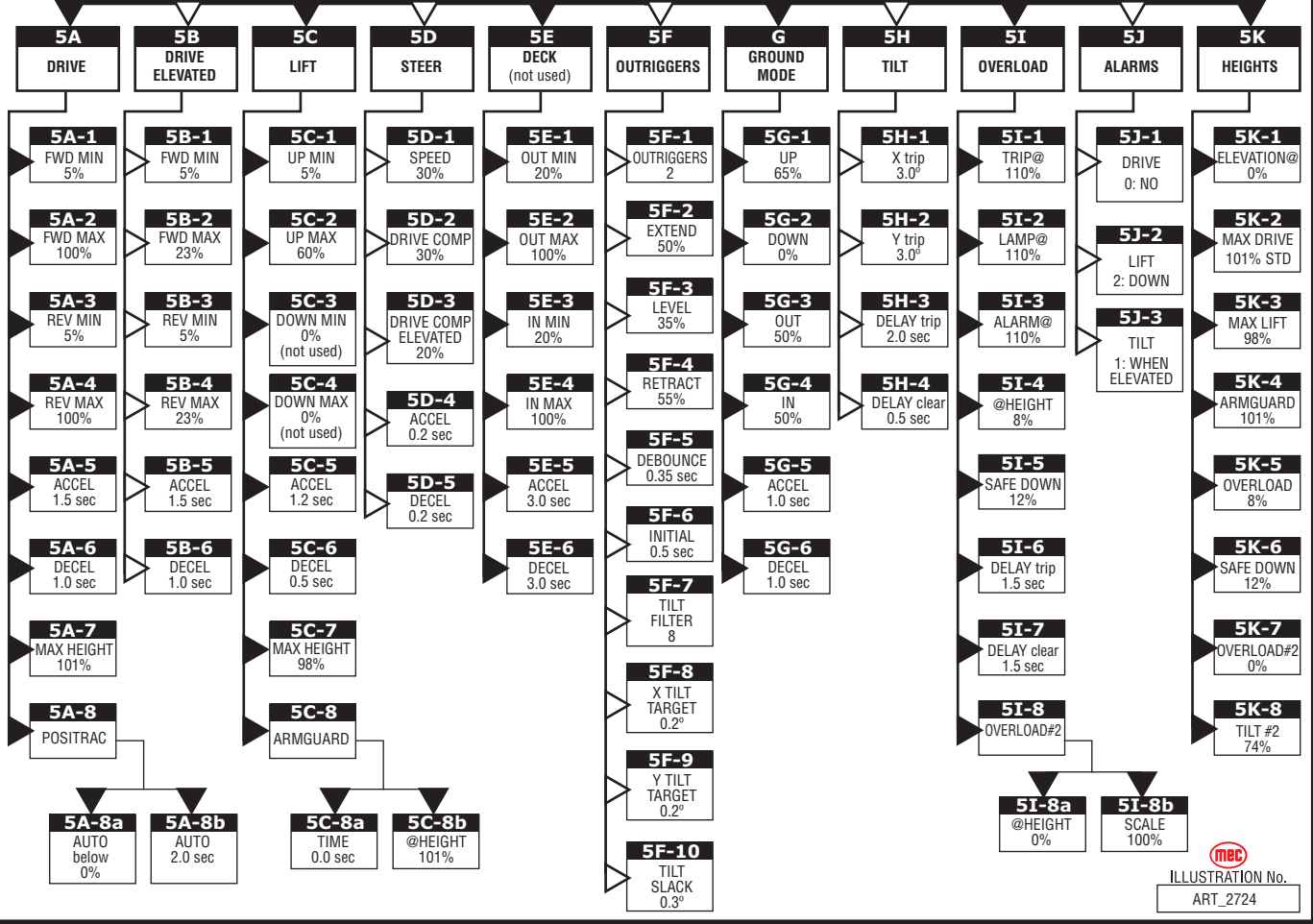


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# DIAGNOSTIC

Use in conjunction with Diagnostic Tables for thorough explanation of readout and values.

GP400 MENU

2

DIAGNOSTICS

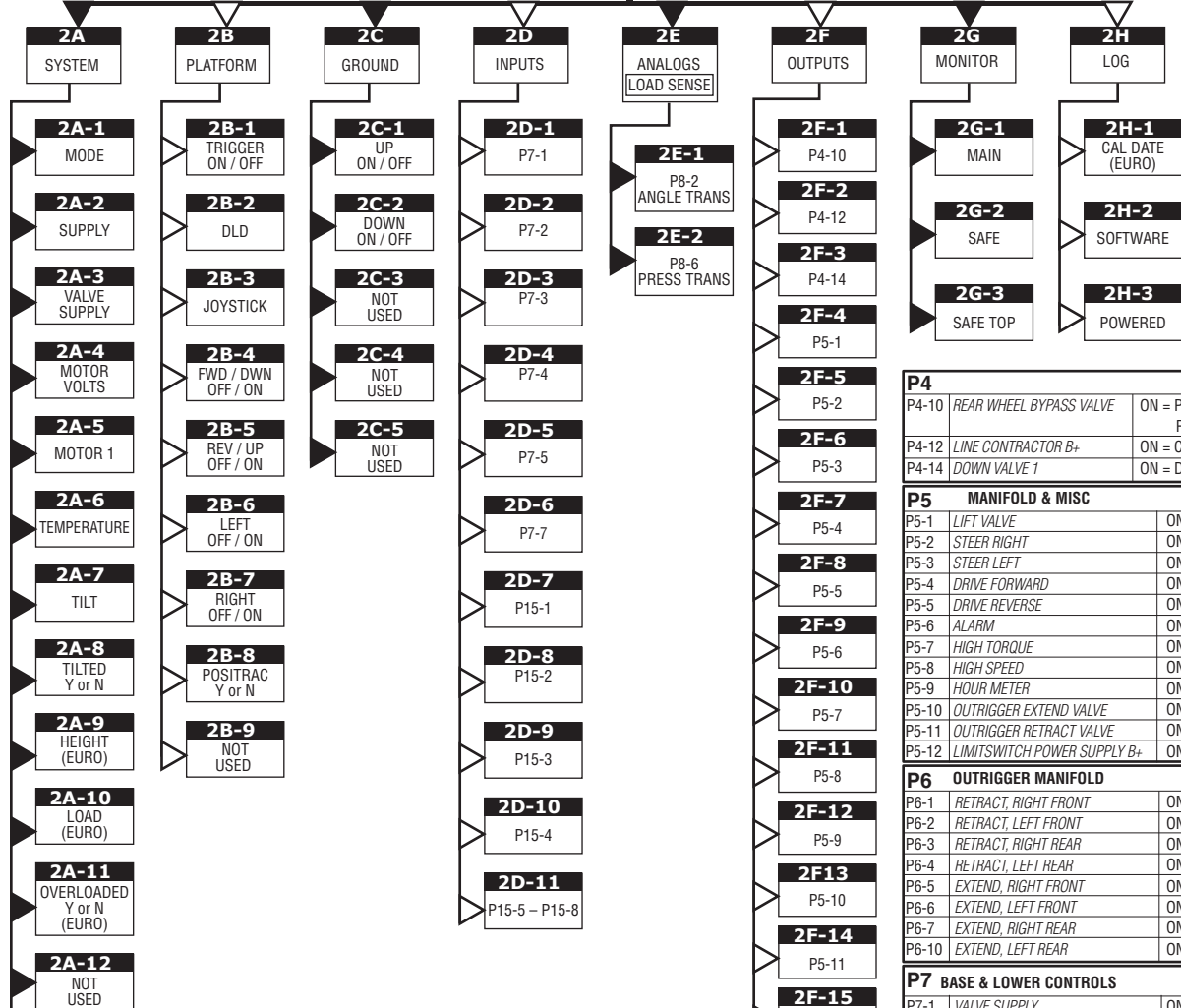
ENTER

## EZ-Cal Flow Chart

Chart 2 of 2

**CE**  
Models

SYMBOL	KEY FUNCTIONS
	<b>ESC/ENTER BUTTONS</b> To move back and forth between menu and sub-menu
	<b>LEFT/RIGHT BUTTONS</b> Select menus and setting to be adjusted
	<b>UP/DOWN BUTTONS</b> Adjust setting values



P4		
P4-10	REAR WHEEL BYPASS VALVE	ON = Powered - Rear Wheels in bypass
P4-12	LINE CONTRACTOR B+	ON = Contactor closed
P4-14	DOWN VALVE 1	ON = Down Valve activated

P5 MANIFOLD & MISC		
P5-1	LIFT VALVE	ON = Lift Valve activated
P5-2	STEER RIGHT	ON = Valve activated
P5-3	STEER LEFT	ON = Valve activated
P5-4	DRIVE FORWARD	ON = Valve activated
P5-5	DRIVE REVERSE	ON = Valve activated
P5-6	ALARM	ON = Alarm activated
P5-7	HIGH TORQUE	ON = Valve activated
P5-8	HIGH SPEED	ON = Valve activated
P5-9	HOUR METER	ON = Meter activated
P5-10	OUTRIGGER EXTEND VALVE	ON = Valve activated
P5-11	OUTRIGGER RETRACT VALVE	ON = Valve activated
P5-12	LIMITSWITCH POWER SUPPLY B+	ON = System powered-up

P6 OUTRIGGER MANIFOLD		
P6-1	RETRACT, RIGHT FRONT	ON = Valve activated
P6-2	RETRACT, LEFT FRONT	ON = Valve activated
P6-3	RETRACT, RIGHT REAR	ON = Valve activated
P6-4	RETRACT, LEFT REAR	ON = Valve activated
P6-5	EXTEND, RIGHT FRONT	ON = Valve activated
P6-6	EXTEND, LEFT FRONT	ON = Alarm activated
P6-7	EXTEND, RIGHT REAR	ON = Valve activated
P6-10	EXTEND, LEFT REAR	ON = Valve activated

P7 BASE & LOWER CONTROLS		
P7-1	VALVE SUPPLY	ON = Voltage, OFF = No Voltage
P7-2	BASE SELECTED	ON = Base Controls Operation
P7-3	UP SWITCH (BASE CONTROLS)	ON = Up activated
P7-4	PLATFORM SELECTED	ON = Platform Controls selected
P7-5	PLATFORM LIMIT SWITCH	ON = lowered, OFF = elevated
P7-7	DOWN SWITCH (BASE CONTROLS)	ON = Down activated

P15 OUTRIGGER LIMIT SWITCHES		
P15-1	STOWED, LEFT REAR	ON = retracted, OFF = extended past 1/2"
P15-2	STOWED, RIGHT REAR	ON = retracted, OFF = extended past 1/2"
P15-3	STOWED, RIGHT FRONT	ON = retracted, OFF = extended past 1/2"
P15-4	STOWED, LEFT FRONT	ON = retracted, OFF = extended past 1/2"
P15-5	PRESSURE, LEFT REAR	
P15-6	PRESSURE, RIGHT REAR	ON = weight on all 4 legs
P15-7	PRESSURE, RIGHT FRONT	OFF = 1 or more legs up
P15-8	PRESSURE, LEFT FRONT	
P15-10	PRESSURE, SWITCH SUPPLY	
P15-11	STOWED, SWITCH SUPPLY	

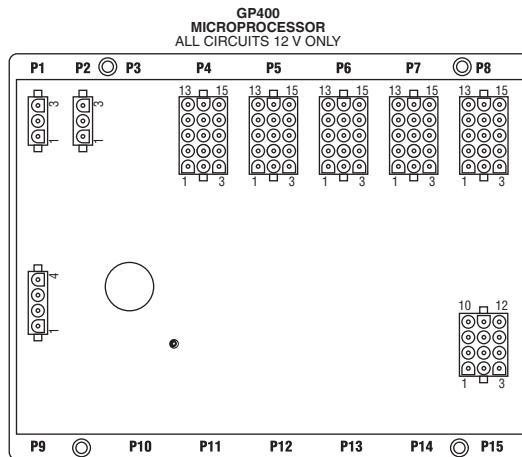


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## EZ-CAL ADJUSTMENT

EZ-Cal Adjustment is only possible in Access Level 1.

**Access Level 1 is restricted.** Refer to *Access Level 1* on page 4-9.

### EZ-Cal ADJUSTMENT Table

OPERATION	ID	PERSONALITY	FACTORY SETTING	EXPLANATION
<b>5A</b> <b>DRIVE</b> (PLATFORM STOWED)	5A-1	FWD Min	5 %	Slowest speed possible
	5A-2	FWD Max	100 %	Maximum speed potential
	5A-3	REV Min	5 %	Slowest speed possible
	5A-4	REV Max	100 %	Maximum speed potential
	5A-5	ACCEL	1.5 sec	Ramp up time to maximum
	5A-6	DECEL	1.0 sec	Ramp down to stop
	5A-7	MAX Height	101 %	Maximum Drivable Height
	5A-8	Positrack	Not Used	Not Used
<b>Sub Menu</b>	5A-8a	AUTO below	0%	Not Used
	5A-8b	AUTO	2.0 sec	Not Used
<b>5B</b> <b>DRIVE -</b> <b>ELEVATED</b>	5B-1	FWD Min	5 %	Slowest speed possible
	5B-2	FWD Max	23 %	Maximum speed potential
	5B-3	REV Min	5 %	Slowest speed possible
	5B-4	REV Max	23 %	Maximum speed potential
	5B-5	ACCEL	1.5 sec	Ramp up time to maximum
	5B-6	DECEL	1.0 sec	Ramp down to stop
<b>5C</b> <b>LIFT</b>	5C-1	UP Min	5 %	Slowest speed possible
	5C-2	UP Max	60 %	Maximum speed potential
	5C-3	DOWN Min	0 % (not used)	Gravity down (not used)
	5C-4	DOWN Max	0 % (not used)	Gravity down (not used)
	5C-5	ACCEL	1.2 sec	Ramp up time to maximum
	5C-6	DECEL	0.5 sec	Ramp down to stop
	5C-7	Max Height	<b>ANSI: 101 %    CE: 98%</b>	Maximum height potential
	5C-8	Armguard	—	CE Option Only
<b>Sub Menu</b>	5C-8a	Time	0.0 sec	CE Option Only
	5C-8b	@ Height	101 %	CE Option Only
<b>5D</b> <b>STEER</b>	5D-1	Speed	30 %	Maximum speed potential
	5D-2	Drive Compensation	30 %	Adds additional to drive speed
	5D-3	Drive Comp Elevated	20 %	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 to stop
<b>5E DECK</b>	5E-	Not Used	Not Used	Power-out deck (not used)

*continued...*

## EZ-Cal ADJUSTMENT Table *continued*

OPERATION	I D	PERSONALITY	FACTORY SETTING	EXPLANATION
<b>5F</b> <b>OUTRIGGERS</b>	5F-1	Outriggers 1=N 2=Y	2	Prevents drive when outrigger legs are down
	5F-2	Outrigger Test	Y / N	Test feature (see outrigger section)
	5F-3	Extend	45 %	Maximum speed potential
	5F-4	Level	35 %	Extend speed after pads touch down
	5F-5	Retract	55 %	Maximum speed potential
	5F-6	Debounce	0.35 sec	Compensates for switch bounce
	5F-7	Initial	0.5 sec	Push outrigger legs when deployed / operated
	5F-8	Tilt Filter	8	Compensates for tilt sensor free movement
	5F-9	X Tilt Target	2 Degrees	Target level stops movement
	5F-10	Y Tilt Target	2 Degrees	Target level stops movement
	5F-11	Tilt Slack	3 Degrees	Variance to tilt target
<b>5G</b> <b>GROUND MODE</b> Lower Control Operations	5G-1	UP	75%	Maximum speed potential
	5G-2	DOWN	0 %	Gravity 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 to stop
<b>5H</b> <b>TILT</b>	5H-1	X Trip	3.0 degrees	Angle tilt sensor signals out of level
	5H-2	Y Trip	3.0 degrees	Angle tilt sensor signals out of level
	5H-3	Delay Trip	2.0 sec	Time delay between tip and signal
	5H-4	Delay Clear	0.5 sec	Time delay between clear tip and signal off
<b>5I</b> <b>OVERLOAD</b> CE: values apply ANSI: values = 0	5I-1	Trip @	<b>ANSI:</b> 0%    <b>CE:</b> 110%	% of weight over maximum to trigger overload
	5I-2	Lamp @	<b>ANSI:</b> 0%    <b>CE:</b> 0%	% of weight over maximum to trigger lamp
	5I-3	Alarm @	<b>ANSI:</b> 0%    <b>CE:</b> 0%	% of weight over maximum to trigger alarm
	5I-4	@ Height	<b>ANSI:</b> 0%    <b>CE:</b> 8%	% of elevation load sense starts monitoring weight
	5I-5	Safe Down	<b>ANSI:</b> 0%    <b>CE:</b> 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
	5I-8	Overload #2	—	Sub category, press ENTER to access
<b>Sub Menu</b>	5I-8a	@ Height	0%	% of height for secondary overload valve
	5I-8b	Scale	100%	% of reduced overload valve
<b>5J</b> <b>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</b> <b>Heights</b>	5K-1	Elevation @	0%	
	5K-2	Maximum Drive	101%	Maximum driveable height
	5K-3	Maximum Lift	<b>ANSI:</b> 101%    <b>CE:</b> 98%	Maximum elevated height potential
	5K-4	Armguard	101%	Stops descent for 5 sec
	5K-5	Overload	<b>ANSI:</b> 0%    <b>CE:</b> 8%	% of elevation load sense starts monitoring weight
	5K-6	Safe Down	<b>ANSI:</b> 0%    <b>CE:</b> 12%	% of elevation lift down still operates in overload
	5K-7	Overload #2	0%	Not Used
	5K-8	Tilt #2	<b>ANSI:</b> 0%    <b>CE:</b> 74%	Reduced degree of tilt at % elevation

## EZ-CAL SETUP

EZ-Cal Setup is only possible in Access Level 1 or Access Level 2.

**Access Level 1 and Access Level 2 are restricted.** Refer to *Access Level 1* on page 4-9.

### EZ-Cal SETUP Table

OPERATION	ID	FUNCTION	FACTORY SETTING	EXPLANATION
<b>6A</b> CHANGE DEFAULTS	6A-1	Customer	Charlie	Identifies MEC Aerial brand
	6A-2	Model Select	3 = ANSI, No Outriggers 4 = ANSI, With Outriggers 5 = CE, No Outriggers 6 = CE, With Outriggers	Identifies model of machine
<b>6B</b> TILT SETUPS	6B-1	Calibrate Level? Y=ENTER – N=ESC      Pressing ENTER twice will calibrate level sensor <b>Ensure machine is on flat level surface before calibrating level sensor</b>		
	6B-2	Tilt Shutdown	2 = Lift	Function shut down tilted when platform stowed
	6B-3	Elevated Tilt Shutdown	1 = Lift & Drive	Function shut down tilted when platform elevated
	6C-1	Elevation @	0 %	CE Option only
<b>6C</b> HEIGHT SETUP (CE OPTION ONLY)	6C-2	Calibrate Height	CE procedure	for calibration of CE Load Sense system
	6C-3	Minimum Lift	1.0 sec	CE Option Only
	6C-4	Samples	0.10 sec	CE Option Only
	6C-5	Tilt Correction	Disabled	CE Option Only
	6C-6	Slow Down	10 %	CE Option Only
	<b>6D</b> LOAD SETUPS (CE OPTION ONLY)	6D-1	Calibrate Load	CE procedure
6D-2		Faulty Load	100 %	CE Option Only
6D-3		Dynamic Scale	95 %	CE Option Only
<b>6E</b> INTERLOCKS	6E-1	Trigger Only	10.0 sec	Delay enable pulled before timeout
	6E-2	Trigger Wait	0.0 sec	Delay before function after enable pulled
	6E-3	Function Hold	0.2 sec	Time function holds after enable released

## 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 and the P600 Motor 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.

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

### EZ-Cal DIAGNOSTICS Menu

SELECTION	ID	READOUT	EXPLANATION
2A SYSTEM	2A-1	MODE	Current function message/s, press ENTER for additional information
	2A-2	Supply	Indicates valve supply output on or off, should be ON
	2A-3	Valve Supply	Regulated 12 volt signal output from Motor Controller to supply all 12 volt circuits
	2A-4	Motor Volts	Real time motor voltage
	2A-5	Motor 1	Real time motor amperage draw. Varies depending on load and motor speed
	2A-6	Temperature	Motor controller chassis temp. Error message "too Hot" at 75 C.
	2A-7	Tilt	Current state of tilt as measured by internal tilt sensor in degrees
	2A-8	Tilted Y/N	Indicates tilted state. All motorized functions stop above limit
	2A-9	Height	Current state of platform elevation in %. (Over load option only)
	2A-10	Load	Current load on platform in %. (Over load option only)
	2A-11	Overloaded Y/N	Platform overloaded. (Over load option only)
	2A-12	Last Moved	Not used
	2A-13	Elevated Y/N	Shows platform elevation above/below limit switch
	2A-14	Outrigger	See 2A14 Outrigger sub categories below for outrigger diagnostics
SUB CATAGORIES	2A-14a	O/R Retracted Y/N	Status of outrigger retract and mechanical switch operation
	2A-14b	O/R Extended Y/N	Status of outrigger extend and pressure switch operation
	2A-14c	O/R Status	current o/r status will be displayed
	2A-14d	O/R Test Y/N	Follow EZ-Cal instruction sequence for outrigger valve and switches test (next page)

*continued ...*

## EZ-Cal *DIAGNOSTICS* Menu *continued*

SELECTION	ID	READOUT	EXPLANATION
<b>2B PLATFORM</b>	2B-1	Trigger ON/OFF	Current status of enable trigger - platform controller
	2B-2	DLD	Status of Lift/Drive selector switch
	2B-3	Joystick	Indicates % of stroke from center in real time. Direction not indicated here.
	2B-4	FWD/DOWN 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	Posi-track Y/N	Status of rear wheel solenoids activation. Activated in high speed or elevated drive
	2B-9	EMSp 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	EMSp OFF/ON	Not used
<b>2D INPUTS</b>	2D-1	P7-1	12V supply from Motor Controller. ON= Voltage, OFF= no voltage
	2D-2	P7-2	Base selected, ON= selector on Base position - unit operating from base controls
	2D-3	P7-3	Up selected from base controls, ON= Up activated
	2D-4	P7-4	Platform Selected. ON= selector in platform position. Operate from platform controls
	2D-5	P7-5	Platform Down limit switch. ON= platform down, OFF= platform elevated
	2D-6	P7-7	Down selected from base controls, ON= Down activated
		P7-6 & P7-8 – P7-15	Not used
	2D-7	P15-1	Outrigger retracted L/R. ON= retracted, OFF= extended beyond 1/2"
	2D-8	P15-2	Outrigger retracted R/R. ON= retracted, OFF= extended beyond 1/2"
	2D-9	P15-3	Outrigger retracted R/F. ON= retracted, OFF= extended beyond 1/2"
	2D-10	P15-4	Outrigger retracted L/F. ON= retracted, OFF= extended beyond 1/2"
2D-11	P15-5 – P15-8	O/R pressure switches. ON= weight on all 4 outrigger legs, OFF= one or more legs up	
	P15-9	Not used	
<b>2E ANALOGS</b>	2E-1	P8-2	Current state of angle transducer (overload option only)
	2E-2	P8-6	Current state of pressure transducer (overload option only)

*continued...*



## EZ-Cal *DIAGNOSTICS* Menu *continued*

SELECTION	ID	READOUT	EXPLANATION
<b>2F OUTPUTS</b>  READOUT = Plug# and Pin# example: P7-1 = Plug 7-Pin1 refer to schematic		Numbers not listed but displayed by EZ-Cal <i>are not used.</i>	
	2F-1	P4-10	Rear wheel bypass valves. ON= valves powered - rear wheels in bypass
	2F-2	P4-12	Line Contactor signal B+. ON= Contactor closed
	2F-3	P4-14	Down Valve/s signal B+. ON= down valve activated
	2F-4	P5-1	Lift Valve Signal B+. ON= lift valve activated
	2F-5	P5-2	Steer right signal B+. ON= valve activated
	2F-6	P5-3	Steer Left signal B+. ON= valve activated
	2F-7	P5-4	Drive FWD signal B+. ON= valve activated
	2F-8	P5-5	Drive Rev signal B+. ON= valve activated
	2F-9	P5-6	Alarm signal B+. ON= alarm activated
	2F-10	P5-7	High Torque signal B+. ON= valve activated
	2F-11	P5-8	High Speed signal B+. ON= valve activated
	2F-12	P5-9	Hour Meter signal B+. ON= Meter activated
	2F-13	P5-10	Outrigger Extend signal B+. ON= valve activated (sends oil to O/R legs)
	2F-14	P5-11	Outrigger Retract signal B+. ON= valve activated (sends oil to O/R legs)
	2F-15	P5-12	Power supply to Limit Switch. Should be ON when system is powered up
	2F-16	P6-1	Retract R/F outrigger. ON= valve activated.
	2F-17	P6-2	Retract L/F outrigger. ON= valve activated.
	2F-18	P6-3	Retract R/R outrigger. ON= valve activated.
	2F-19	P6-4	Retract L/R outrigger. ON= valve activated.
	2F-20	P6-5	Extend R/F outrigger. ON= valve activated
	2F-21	P6-6	Extend L/F outrigger. ON= valve activated
	2F-22	P6-7	Extend R/R outrigger. ON= valve activated
	2F-23	P6-10	Extend L/R outrigger. ON= valve activated
<b>2G MONITOR</b>	2G-1	MAIN	Refers to valve output,
	2G-2	SAFE	Refers to P4-12 – P4-15 outputs
	2G-3	SAFE TOP	embedded circuit protection, failure here = internal failure
<b>2H LOG</b>	2H-1	Cal Date	Date of Load Sense calibration (Euro option only)
	2H-2	Software	Should read 'V22.3' This is MEC specific software.
	2H-3	Powered	Accumulated time GP400 powered up (red LED on)



## RETRIEVE MODE AND HELP MESSAGES FROM THE EZ-CAL

**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# 2a1). 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.

### **MODE 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.

### **Scrolling Message**

Pressing **ENTER** twice will provide a scrolling message of the current message (if one exists) followed by 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 4-11 – CE page 4-13).

## **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 CAN bus**

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

### **PLATFORM, GROUND**

- The system is ready to operate, from the platform or ground 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.  
(CE 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 (CE option 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 (CE option 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)

## **OUTRIGGERS**

- Drive is prevented if the outriggers are not all retracted. Green LED, located on upper control box, will illuminate when outriggers are retracted.

## 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) followed by 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.
- If overload functions are active (**ADJUSTMENTS/OVERLOAD TRIP@**, **LAMP@** or **ALARM@** set to a non-zero value) then both the height and pressure sensors must be calibrated.
- If overload functions are not active, but height-based decisions are active (**ADJUSTMENTS/HEIGHT** values set to between 1% and 100%) then the height sensors must be calibrated.
- 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, select Charlie.

## **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 (CE option 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 timeout).
- If the armguard feature is not wanted, set **ADJUSTMENTS/LIFT/ ARMGUARD/TIME** to 0.0s.

**FUNCTIONS LOCKED – OVERLOADED (CE option 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.
- If the overload features are not wanted, be sure to set ADJUSTMENTS/ OVERLOAD TRIP@, LAMP@ or ALARM@ to 0%.

**FUNCTIONS LOCKED – UNDERLOADED (CE option 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.
- If the under-load feature is not wanted, be sure to set SETUPS/LOAD SETUPS/ FAULTY LOAD to -100%.

**FUNCTIONS LOCKED - TOO HIGH ----- Flash Code: 2/2**

- The platform is raised to high to allow some functions.
- Check ADJUSTMENTS/HEIGHTS/MAX DRIVE and MAX LIFT; if drive and/or lift is allowed at all heights, set to 101% to disable the MAX HEIGHT function.

**FUNCTIONS LOCKED - TILTED ----- Flash Code: 2/2**

- The vehicle is tilted too much to allow some functions.
- Check ADJUSTMENTS/TILT/Xtrip and Ytrip, which determine the maximum allowed vehicle tilt. See chart 5 – EZ-Cal Adjustments for factory default values.
- Also check SETUPS/TILT SETUPS/TILT SHUTDOWN and ELEV.TILT SHUTDOWN which determine what functions to prevent when the vehicle is tilted. See chart 6 – EZ-Cal Setups for factory default values.

**FUNCTIONS LOCKED - EXTERNAL SHUTDOWN ----- Flash Code: 2/2**

- An external shutdown is preventing functions – check DIAGNOSTICS/SYSTEM/ MODE/INTERLOCK 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.

## **P600 TEMPERATURE Messages**

- This section lists “temperature” HELP messages – problems have been detected which are likely due to excessive dutycycling or poor heatsinking:

**FAULT: BAD INTERNAL TEMPERATURE SENSOR! ----- Flash Code: 4/1**

- The heatsink temperature is out of range; if the fault remains, the power controller may have to be replaced.

**FUNCTIONS LOCKED - TOO HOT! ----- Flash Code: 4/2**

- The heatsink temperature exceeds 75°C, preventing all functions except lowering. Check for excessive motor current draw; check for good heatsinking to vehicle chassis.

## **SUPPLY Messages**

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

**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 (CE models).

***SENSOR Messages CE MODELS***

The following are “sensor” HELP messages – problems have been detected which are likely due to sensor issues (CE models).

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

**FAULT: CAN BUS! ----- Flash Code: 6/6**

- There are problems with CAN bus 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 CAN bus wiring; ensure that the CAN bus 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.

## **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.**



# SECTION 5

## SCHEMATICS

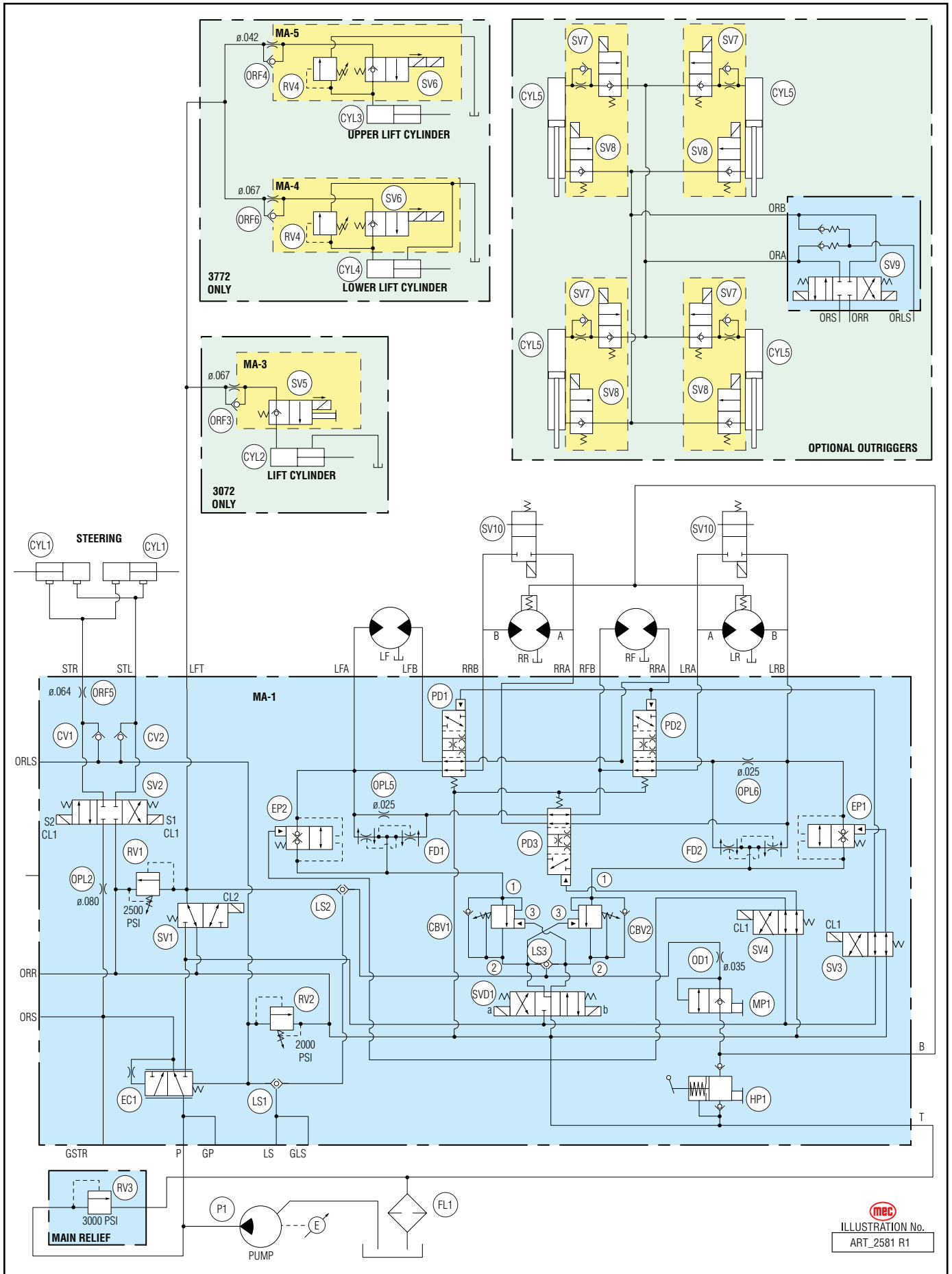
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# HYDRAULIC SCHEMATIC

Callout	Description
	Lift Cylinder Components (3072ES)
CYL2	Cylinder
MA3	Manifold, Lift Cylinder
SV5	Solenoid Valve - 12V Cable Attach
ORF3	Orifice - 0.067
	Lift Cylinder Components (3772ES)
CYL3	Cylinder, Upper
MA5	Manifold, Lift Cylinder, Upper
SV6	Solenoid Valve - 12V Dual Coil
RV4	Relief Valve - 3200 PSI
ORF4	Orifice - 0.067
CYL4	Cylinder, Lower
MA4	Manifold, Lift Cylinder, Lower
SV6	Solenoid Valve - 12V Dual Coil
RV4	Relief Valve - 3200 PSI
ORF6	Orifice - 0.042
	Wheel Motor Components
LF	Wheel Motor - Left Front
LR	Wheel Motor - Left Rear
SV10	Solenoid Valve – Cross Port Valve
RF	Wheel Motor - Right Front
RR	Wheel Motor - Right Rear
SV10	Solenoid Valve – Cross Port Valve
P1	Pump - Fixed Displacement
FL1	Return Filter - 10 Micron
CYL1	Cylinder, Steering
	Optional Outriggers Components
CYL5	Outrigger Cylinder
SV7	Solenoid Valve, Poppet N.C.
SV8	Solenoid Valve, Poppet N.C.
SV9	Spool Valve, 4-way, - 3-Position

Callout	Description
	Manifold Components
MA1	Manifold, Main Valve Block
SVD1	Spool Valve, Drive, 4-Way - 3-Position
SV1	Spool Valve, Lift, 3-Way
SV2	Spool Valve, Steer, 4-Way - 3-Position
SV3 - SV4	Spool Valve, Series Parallel, 4-Way - 3-Position
RV1	Relief Valve, Lift - 2500 PSI
RV2	Relief Valve, Steer - 1500 PSI
PD1 - PD2 - PD3	Piloted Spool Valve, 4-Way - 3-Position
EP1 - EP2	Piloted Poppet Valve
MP1	Manual Pull Valve
LS1 - LS2 - LS3	Load Sense Shuttle Check Valve
CBV1 - CBV2	Counter Balance Valve
CL1	Coil, Series 8 - 12V
CL2	Coil, Series 10 - 12V
CL3	Coil, Series 10 E-Coil - 12V
HP1	Hand Pump, Brake Release
FD1 - FD2	Flow Divider / Combiner
EC1	Pressure Compensator
CV1 - CV2	Check Valve, Load Sense
OD1	Orifice Disc, Brake - 0.035
OPL2	Orifice Plug, Steer - 0.080
OPL5 - OPL6	Orifice Plug, Flow Divider Bleed - 0.025
ORF5	Orifice, Steer Control - 0.064
	Main Relief Manifold
RV3	Main Relief Valve





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 ILLUSTRATION No.  
 ART\_2581 R1

# Main Hydraulic Manifold

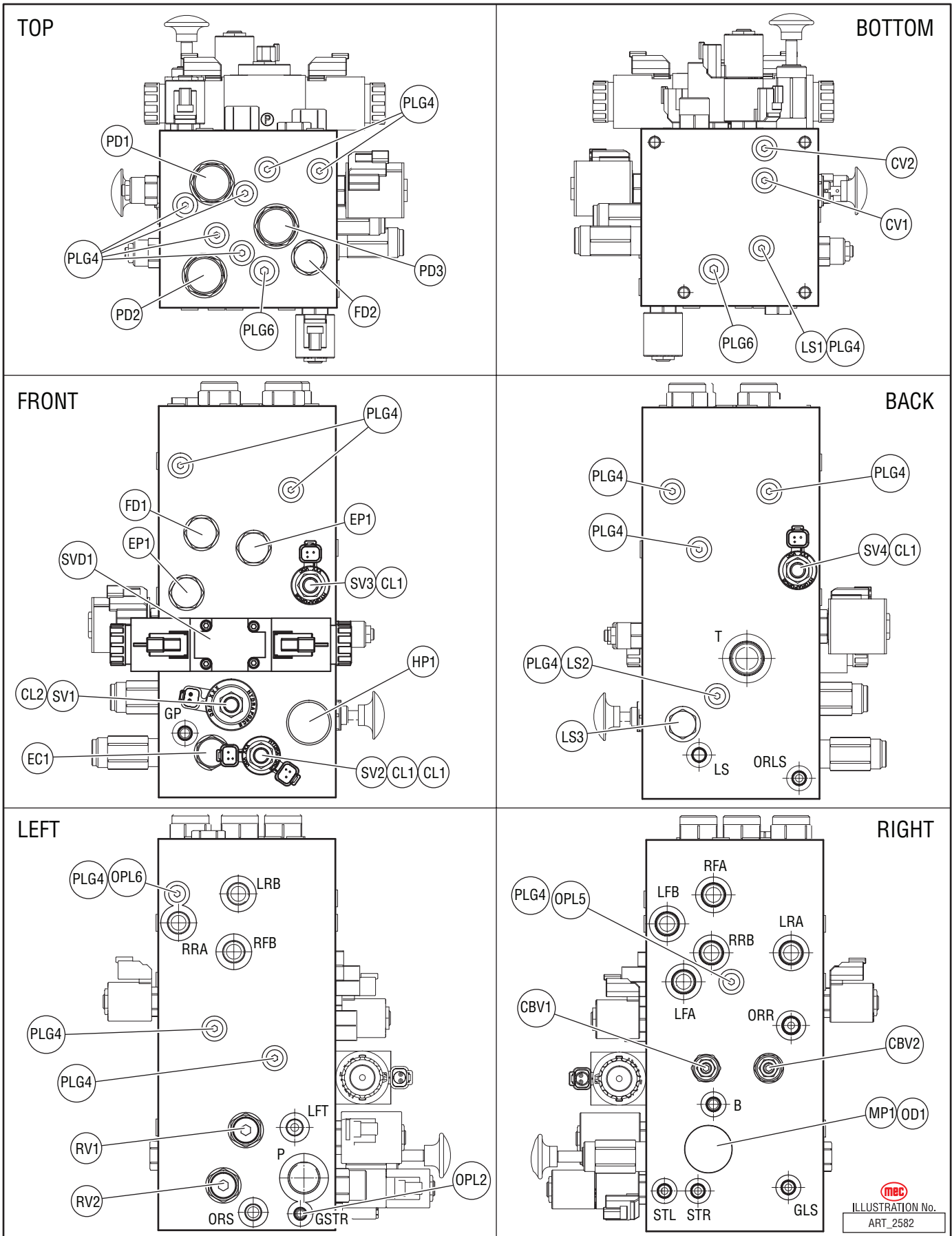
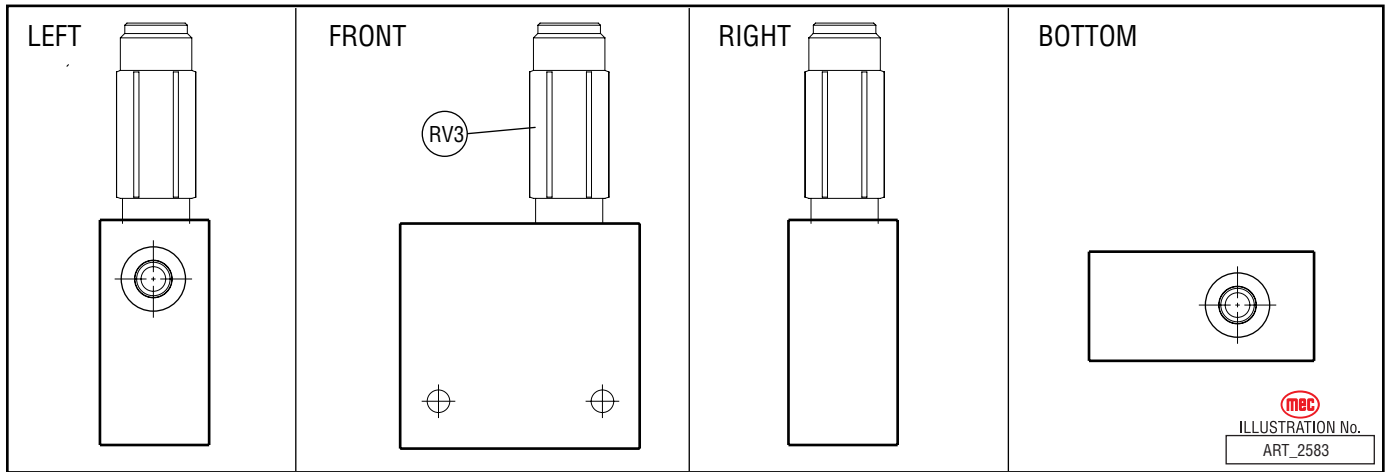
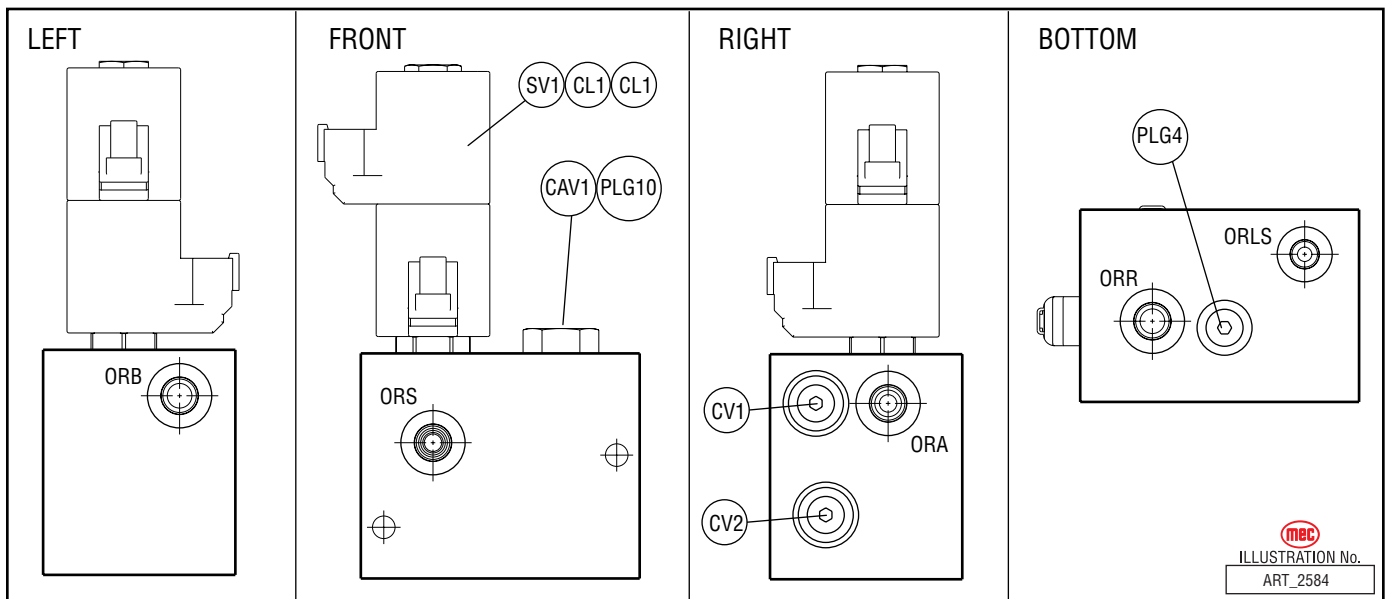


ILLUSTRATION No.  
ART\_2582

## Main Relief Hydraulic Manifold

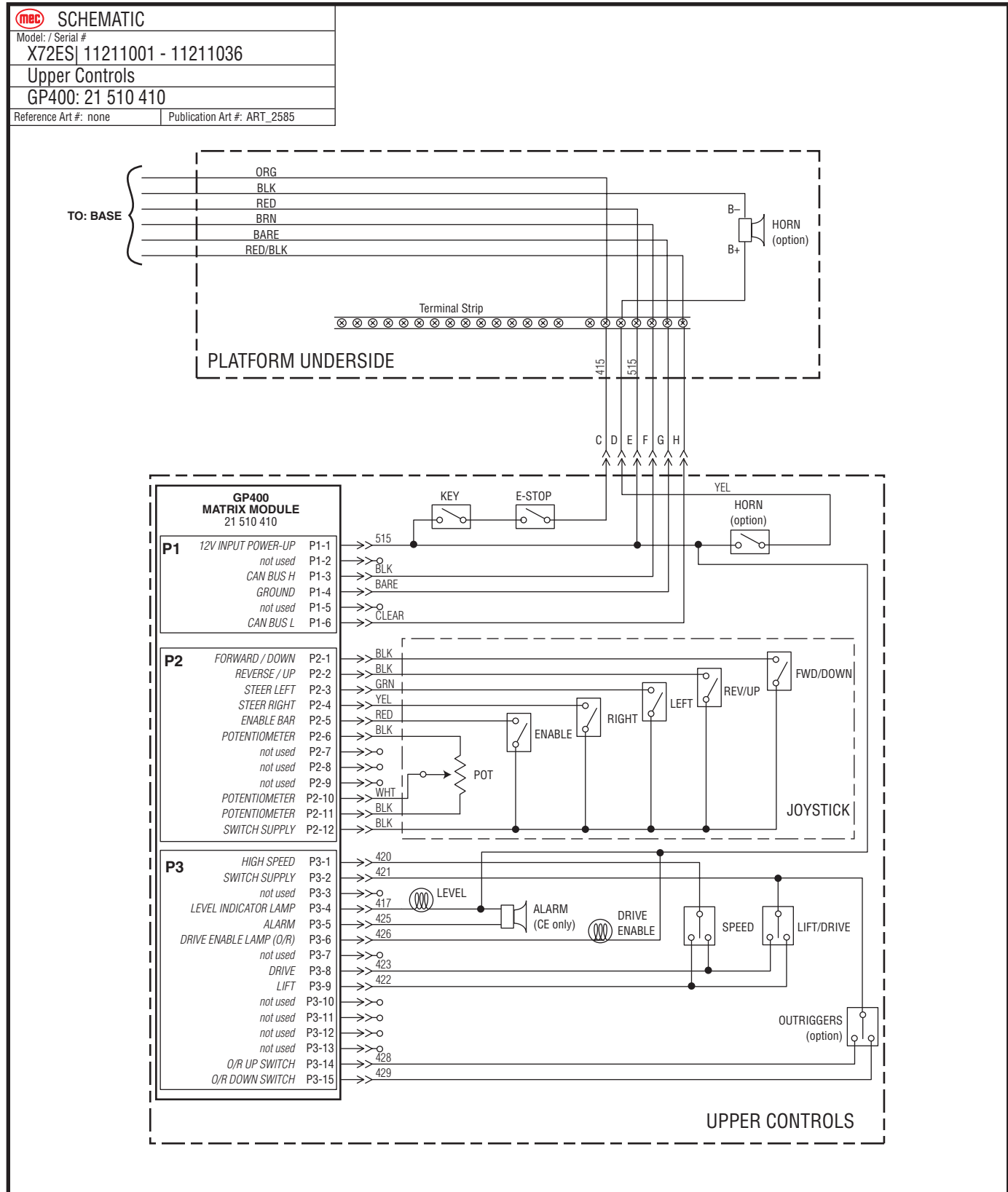


## Optional Outriggers Hydraulic Manifold



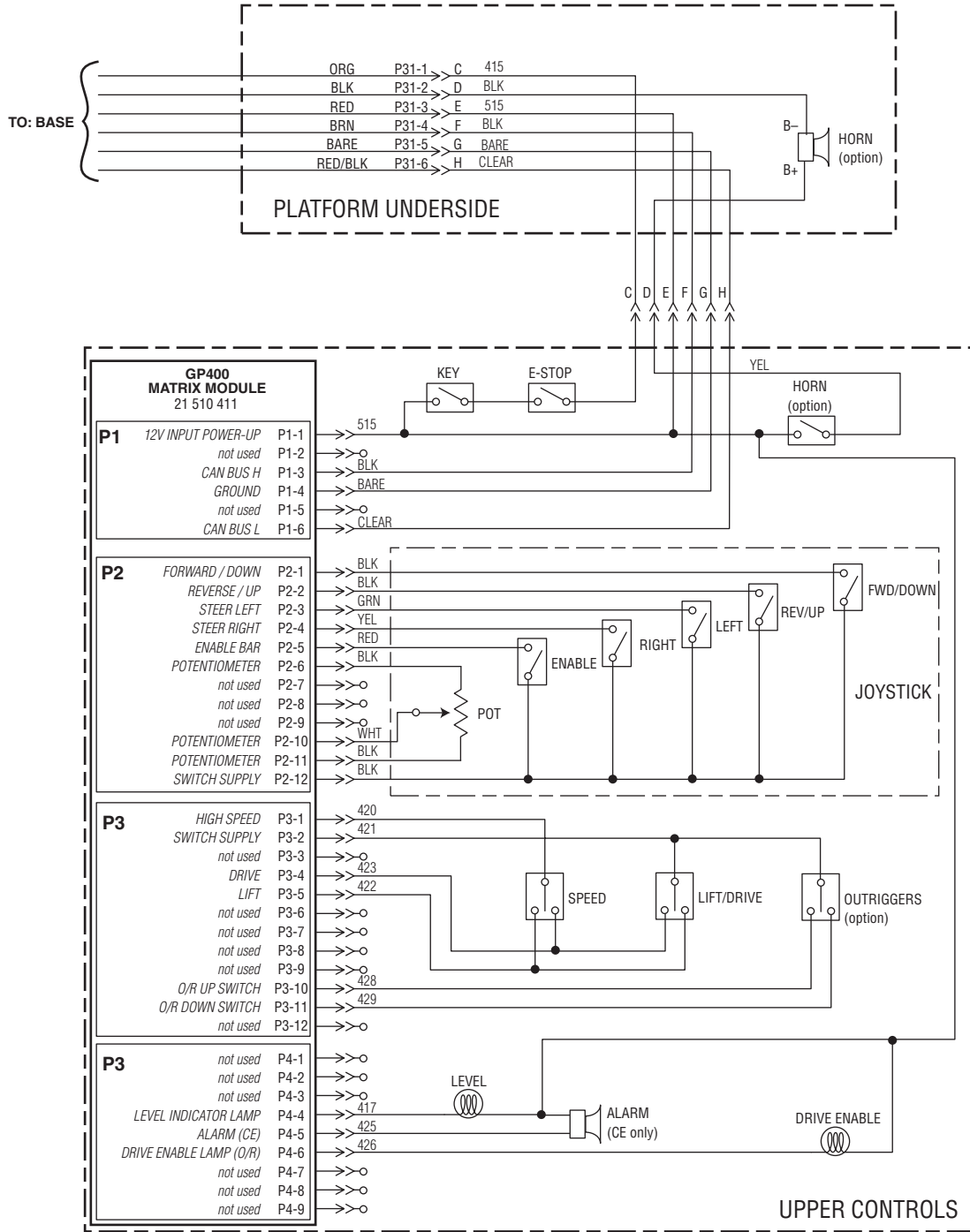
# ELECTRIC SYSTEM

## Electric Schematics: Upper Controls, Early Models



# Electric Schematics: Upper Controls, Current Models

<b>MBC</b> SCHEMATIC	
Model / Serial # X72ES   11211037 - UP	
Upper Controls GP400: 21 510 411	
Reference Art #: none	Publication Art #: ART_2586





# Electric Schematics: Base

