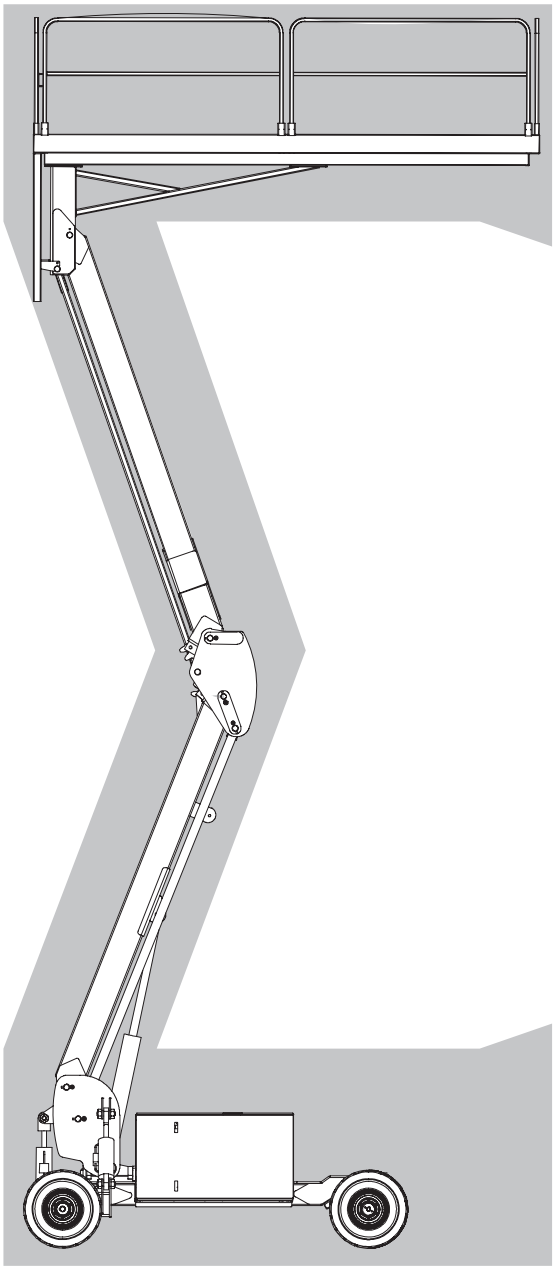
# SERVICE AND PARTS MANUAL

# Speed Level™ Sigma Lifts



## 2684 & 3084 RT Internal Combustion
## 2684 & 3084 ES Electric

**CE & ANSI certifications**

**Serial Number Range**

**11800001 - Up**

**Part # 91885**
**May 2010**

## Revision History

**Original Release Date: May 2010**

| Date | Reason for Update |
|---|---|
| 5/2010 | New Release |
| | |
| | |

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## Section 4a: Troubleshooting - 3084RT Model — Page

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**NOTES:**

# INTRODUCTION

This manual consists of Service and Illustrated Parts sections.

The Service Section of this manual is designed to provide you, the customer, with the instructions needed to properly maintain the MEC self-propelled aerial work platform. When used in conjunction with the Illustrated Parts Section and the Operators Manual (provided separately), this manual will assist you in making necessary adjustments and repairs, and identifying and ordering the correct replacement parts.

All parts represented here are manufactured and supplied in accordance with MEC quality standards.

We recommend that you use genuine MEC parts to ensure proper operation and reliable performance.

To obtain maximum benefits from your MEC Aerial Work Platform, always follow the proper operating and maintenance procedures. Only trained authorized personnel should be allowed to operate or service this machine. Service personnel should read and study the Operator's, Service and Parts Manuals in order to gain a thorough understanding of the unit prior to making any repairs.

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## FIGURES — PAGE

# Machine Specifications - RT Models

| | | 2684RT | | 3084RT | |
|---|---|---|---|---|---|
| Working Height* | | 32 ft* | 10.0 m* | 36 ft* | 11.0 m* |
| Platform Height | | 26 ft | 7.9 m | 30 ft | 9.0 m |
| Stowed Height | Rails Up | 107 in | 2.72 m | 105 in | 2.67 m |
| | Rails Folded Down | 72 in | 1.83 m | 70 in | 1.78 m |
| Maximum Occupants | 0 m/s wind | 5 | | 5 | |
| | 45 km/h (12.5 m/s) wind | 5 | | 5 | |
| | On Slide-Out Extension | 2 | | N/A | |
| Lift Capacity | | 1700 lbs | 770 kg | 1500 lbs | 680 kg |
| Slide-Out Deck Capacity | | 700 lbs | 320 kg | N/A | |
| Platform Dimensions | Length (inside rails) | 12 ft 2 in | 3.71 m | 14 ft | 4.27 m |
| | Length (platform extended) | 16 ft 2 in | 4.93 m | N/A | |
| | Platform Width (inside rails) | 72 in | 1.83 m | 72 in | 1.83 m |
| | Guardrail Height | 43.5 in | 1.1 m | 43.5 in | 1.1 m |
| | Toeboard Height | 6 in | 15 cm | 6 in | 15 cm |
| Overall Length | | 13 ft 2 in | 4.0 m | 14 ft 6 in | 4.4 m |
| Overall Width | | 84 in | 2.13 m | | |
| Wheel Base | | 100 in | 2.54 m | | |
| Wheel Track | | 72 in | 1.83 m | | |
| Turning Radius | Inside | 8 ft | 2.44 m | | |
| | Outside | 16 ft 8 in | 5.08 m | | |
| Ground Clearance | | 10 in | 25 cm | | |
| Machine Weight** (Unloaded)(Approximate) | | 7800 lb** | 3535 kg** | 8100 lb** | 3674 kg** |
| Drive System (Proportional) | | | | | |
| | Drive Speed - Platform elevated | 0-.4 mph | 0-.6 km/h | | |
| | Drive Speed - Platform lowered | 0-3.2 mph | 0-5 km/h | | |
| Lift/Lower Speeds (Approximate) | | 35 sec/40 sec | | | |
| Gradeability | | 40% | 22° | | |
| Ground Pressure/Wheel (Maximum) | | 90 psi | 6.3 kg/cm² | 94 psi | 6.6 kg/cm² |
| Wheel Load | | 2855 lb | 1295 kg | 2965 lb | 1345 kg |
| Wind Speed (Maximum) | | 28 mph | | 45 km/h (12.5 m/s) | |
| Tire Size - Standard | | 26 x 12D / 380NHS | | | |
| Tire Pressure | | 45 psi | 3.1 bar | | |
| | | Foam-filled tires are standard in Europe and Australia, optional in North America | | | |
| Wheel Lug Nut Torque | | 75-85 ft/lb | 102-115 Nm | | |
| Hydraulic Pressure | Main System | 2800 psi | 193 bar | | |
| | Lift System | 2800 psi | 193 bar | | |
| | Steering System | 2000 psi | 138 bar | | |
| Hydraulic Fluid Capacity | | 23 gallon | 87 liters | | |
| Engine | | Diesel -- Kubota D1105E, 25HP (18.6 kW), Liquid Cooled Dual Fuel (North America only) -- Kubota DF752, 20HP (14.9 kW), Liquid Cooled, | | | |
| Noise Level | | 86 dB maximum | | | |
| Maximum Vibration | | does not exceed 2.5 m/sec at operator's position | | | |
| Ambient Operating Range | | -30° C minimum; 50° C maximum | | | |
| Operating Inclination | | Manual and self-leveling, side/side to 14°, fore/aft to 10° | | | |
| Brakes | | Dual Rear Wheel Multi-disc | | | |

*Working Height adds 6 feet (2 m) to platform height.

**Weight may increase with certain options or country standards.

# Machine Specifications - ES Models

| | | 2684ES | | 3084ES | |
|---|---|---|---|---|---|
| Working Height* | | 32 ft* | 10.0 m* | 36 ft* | 11.0 m* |
| Platform Height | | 26 ft | 7.9 m | 30 ft | 9.0 m |
| Stowed Height | Rails Up | 107 in | 2.72 m | 105 in | 2.67 m |
| | Rails Folded Down | 72 in | 1.83 m | 70 in | 1.78 m |
| Maximum Occupants | 0 m/s wind | 5 | | 5 | |
| | 45 km/h (12.5 m/s) wind | 5 | | 5 | |
| | On Slide-Out Extension | 2 | | N/A | |
| Lift Capacity | | 1700 lbs | 770 kg | 1500 lbs | 680 kg |
| Slide-Out Deck Capacity | | 700 lbs | 320 kg | N/A | |
| Platform Dimensions | Length (inside rails) | 12 ft 2 in | 3.71 m | 14 ft | 4.27 m |
| | Length (platform extended) | 16 ft 2 in | 4.93 m | N/A | |
| | Platform Width (inside rails) | 72 in | 1.83 m | 72 in | 1.83 m |
| | Guardrail Height | 43.5 in | 1.1 m | 43.5 in | 1.1 m |
| | Toeboard Height | 6 in | 15 cm | 6 in | 15 cm |
| Overall Length | | 13 ft 2 in | 4.0 m | 14 ft 6 in | 4.4 m |
| Overall Width | | 84 in | 2.13 m | | |
| Wheel Base | | 100 in | 2.54 m | | |
| Wheel Track | | 72 in | 1.83 m | | |
| Turning Radius | Inside | 8 ft | 2.44 m | | |
| | Outside | 16 ft 8 in | 5.08 m | | |
| Ground Clearance | | 10 in | 25 cm | | |
| Machine Weight** (Unloaded)(Approximate) | | 8400 lb** | 3810 kg** | 8700 lb** | 3946 kg** |
| Drive System (Proportional) | | | | | |
| | Drive Speed - Platform elevated | 0-.4 mph | 0-.6 km/h | | |
| | Drive Speed - Platform Lowered | 0-3.2 mph | 0-5 km/h | | |
| Lift/Lower Speeds (Approximate) | | 35 sec/40 sec | | | |
| Gradeability | | 40% | 22° | | |
| Ground Pressure/Wheel (Maximum) | | 98 psi | 6.9 kg/cm² | 101 psi | 7.1 kg/cm² |
| Wheel Load | | 3065 lb | 1390 kg | 3175 lb | 1440 kg |
| Wind Speed (Maximum) | | 28 mph | | 45 km/h (12.5 m/s) | |
| Tire Size - Standard | | 26 x 12D / 380NHS | | | |
| Tire Pressure | | 45 psi | 3.1 bar | | |
| | | Foam-filled tires are standard in Europe and Australia, optional in North America | | | |
| Wheel Lug Nut Torque | | 75-85 ft/lb | 102-115 Nm | | |
| Hydraulic Pressure | Main System | 2800 psi | 193 bar | | |
| | Lift System | 2800 psi | 193 bar | | |
| | Steering System | 2000 psi | 138 bar | | |
| Hydraulic Fluid Capacity | | 23 gallon | 87 liters | | |
| Electric Motor | | 8 hp (6kW): 3600 rpm | | | |
| Power Source -- Voltage | | 48 volts DC | | | |
| Batteries | | Eight 6-volt DC 370 amp-hour industrial deep cycle batteries | | | |
| Battery Charger | Input | 120 Volt AC, 50.60 Hz, 18 Amp - 240 Volt AC, 50.60 Hz, 9 Amp | | | |
| | Output | 48 Volt DC, 32 Amp, 1500 W, Timed Shutoff | | | |
| Maximum Vibration | | does not exceed 2.5 m/sec at operator's position | | | |
| Ambient Operating Range | | -30° C minimum; 50° C maximum | | | |
| Operating Inclination | | Manual and self-leveling, side/side to 14°, fore/aft to 10° | | | |
| Brakes | | Dual Rear Wheel Multi-disc | | | |

*Working Height adds 6 feet (2 m) to platform height.

**Weight may increase with certain options or country standards.

# MEC Operator Policy

**NOTE: The best method to protect yourself and others from injury or death is to use common sense. If you are unsure of any operation, don't start until you are satisfied that it is safe to proceed and have discussed the situation with your supervisor.**

Service personnel and machine operators must understand and comply with all warnings and instructional decals on the body of the machine, at the ground controls, and platform control console.

**DANGER**

***MODIFICATIONS OF THIS MACHINE FROM THE ORIGINAL DESIGN AND SPECIFICATIONS WITHOUT WRITTEN PERMISSION FROM MEC ARE STRICTLY FORBIDDEN. A MODIFICATION MAY COMPROMISE THE SAFETY OF THE MACHINE, SUBJECTING OPERATOR(S) TO SERIOUS INJURY OR DEATH.***

MEC's policies and procedures demonstrate our commitment to Quality and our relentless ongoing efforts towards Continuous Improvement, due to which product specifications are subject to change without notice.

Any procedures not found within this manual must be evaluated by the individual to assure oneself that they are "proper and safe."

Your MEC Aerial Work Platform has been designed, built, and tested to provide many years of safe, dependable service. Only trained, authorized personnel should be allowed to operate or service the machine.

MEC, As Manufacturer, Has No Direct Control Over Machine Application And Operation. Proper Safety Practices Are The Responsibility Of The User And All Operating Personnel.

**If there is a question on application and/or operation contact:**


**MEC Aerial Work Platform**

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# SAFETY SYMBOLS

To help you recognize important safety information, we have identified warnings and instructions that directly impact on safety with the following signals:


***"DANGER" INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.***

***THIS SIGNAL WORD IS LIMITED TO THE MOST EXTREME SITUATIONS.***


**"WARNING" INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.**


**"CAUTION" indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.**


**"Caution" without alert symbol indicates a situation which, if not avoided, may result in property damage.**

# General Safety Tips

Regular inspection and conscientious maintenance is the key to efficient economical operation of your aerial work platform. It will help to assure that your equipment will perform satisfactorily with a minimum of service and repair.

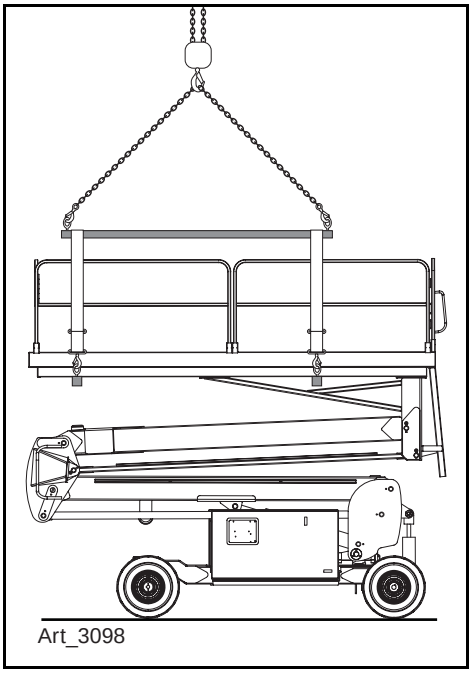
The actual operating environment of the machine governs the inspection schedule. Correct lubrication is an essential part of the preventative maintenance to minimize wear on working parts and ensure against premature failure. By maintaining correct lubrication, the possibility of mechanical failure and resulting downtime is reduced to a minimum.

**DANGER**

***NEVER PERFORM SERVICE ON THE MACHINE WITH THE PLATFORM ELEVATED WITHOUT FIRST SUPPORTING THE PLATFORM/BOOM ASSEMBLY.***

- Use a crane with chains and straps of adequate lifting capacity to support the platform.
- Never leave hydraulic components or hoses open. They must be protected from contamination (including rain) at all times.
- Never open a hydraulic system when there are contaminants in the air.
- Always clean the surrounding area before opening hydraulic systems.
- Use only recommended lubricants. Improper lubricants or incompatible lubricants may be as harmful as no lubrication.
- Watch for makeshift “fixes” which can jeopardize safety as well as lead to more costly repair.

***Figure 1-1:*** Support Platform



## HYDRAULIC SYSTEM

**WARNING**

**HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE AND BURN SKIN, DAMAGE EYES, AND MAY CAUSE SERIOUS INJURY, BLINDNESS, AND EVEN DEATH.**
**CORRECT LEAKS IMMEDIATELY.**

**CAUTION**

**Hydraulic fluid leaks under pressure may not always be visible. Check for pin hole leaks with a piece of cardboard, not your hand.**

## ELECTRICAL SYSTEM

**CAUTION**

**Prevent damage to battery and/or electrical system;**
**• Always disconnect the negative battery cable first.**
**• Always connect the positive battery cable first.**

When the negative cable is installed, a spark will occur if contact is made between the positive side of the battery and a metal surface on the machine. This can cause damage to the electrical system, battery explosion, and personal injury.

## TOTAL SYSTEM

**CAUTION**

**Engine coolant level must be checked only after engine has cooled. If radiator cap is removed while the coolant is at normal operating temperature, pressure within the coolant system will force hot liquid out through the filler opening and may cause severe scalding.**

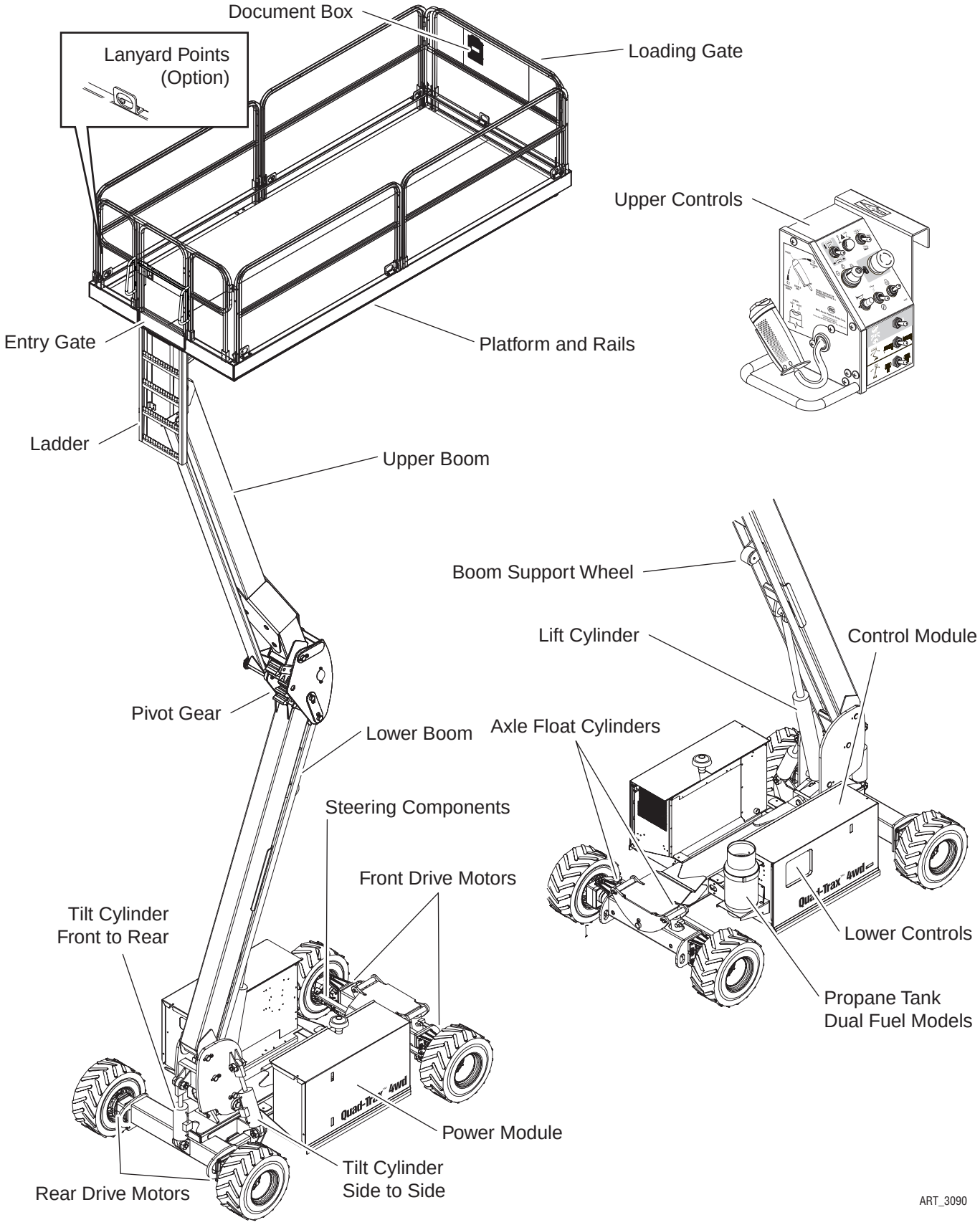
**Failure to perform preventive maintenance at recommended intervals may result in the unit being operated with a defect that could result in injury or death of the operator.**

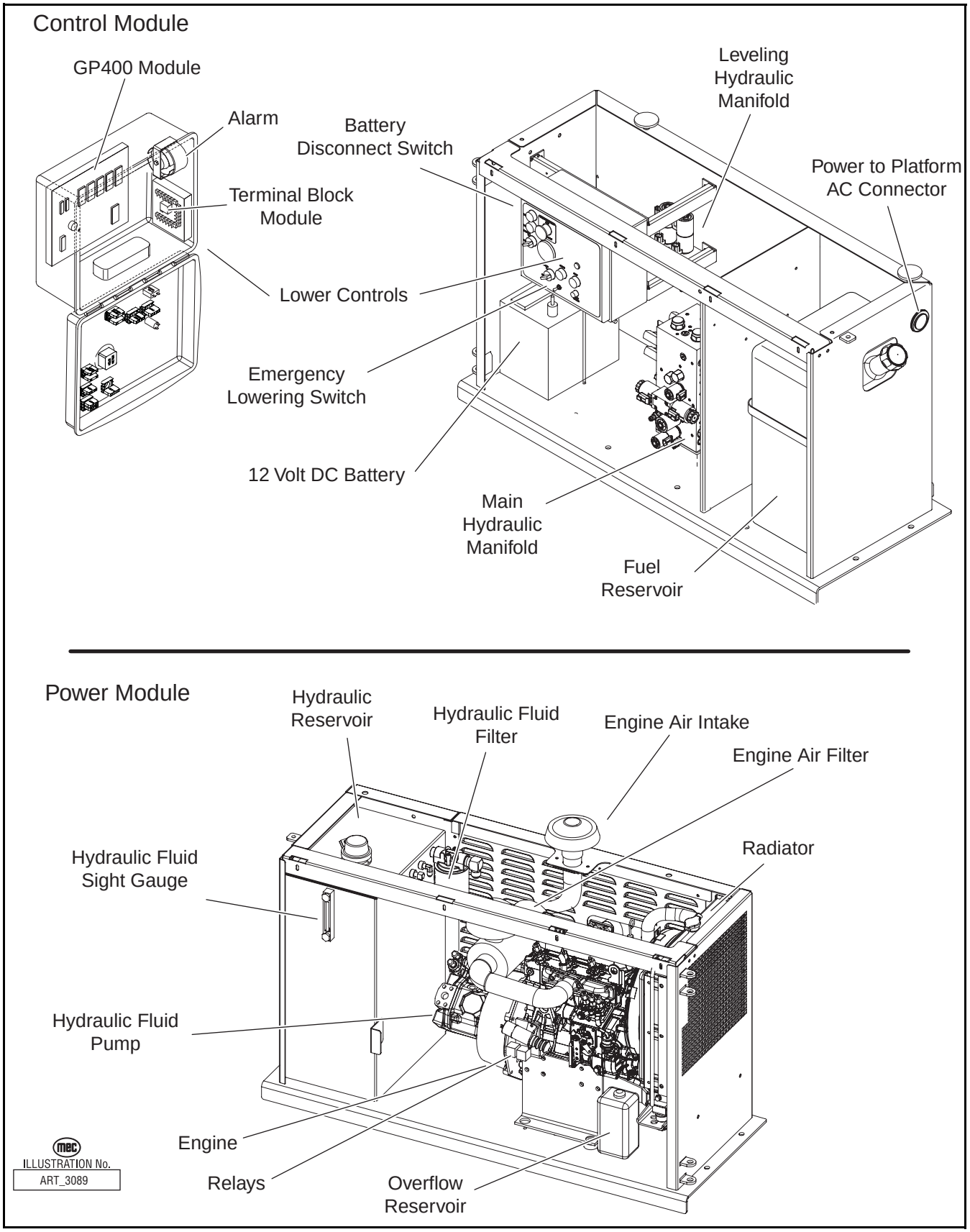
**Immediately report to your supervisor any defect or malfunction. Any defect shall be repaired prior to continued use of the aerial work platform.**

**Inspection and maintenance should be performed by qualified personnel familiar with the equipment.**

# PRIMARY MACHINE COMPONENTS

***Figure 1-2:*** Component Locations




Control Module
GP400 Module
Alarm
Battery
Disconnect Switch
Terminal Block
Module
Lower Controls
Emergency
Lowering Switch
12 Volt DC Battery
Leveling
Hydraulic
Manifold
Power to Platform
AC Connector
Main
Hydraulic
Manifold
Fuel
Reservoir
Power Module
Hydraulic
Reservoir
Hydraulic Fluid
Filter
Engine Air Intake
Engine Air Filter
Radiator
Hydraulic Fluid
Sight Gauge
Hydraulic Fluid
Pump
Engine
Relays
Overflow
Reservoir
ILLUSTRATION No.
ART_3089

# Torque Specifications

## Fasteners

Use the following values to apply torque unless a specific torque value is called out for the part being used.

| AMERICAN STANDARD CAP SCREWS | | | | | | | | | METRIC CAP SCREWS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAE GRADE | 5 | | | | 8 | | | | METRIC GRADE | 8.8 | | | | 10.9 | | | |
| CAP SCREW SIZE - inches - | TORQUE | | | | TORQUE | | | | CAP SCREW SIZE - millimeters- | TORQUE | | | | TORQUE | | | |
| | FT. LBS | | Nm | | FT. LBS | | Nm | | | FT. LBS | | Nm | | FT. LBS | | Nm | |
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| 1/4 - 20 | 6.25 | 7.25 | 8.5 | 10 | 8.25 | 9.5 | 11 | 13 | M6 X 1.00 | 6 | 8 | 8 | 11 | 9 | 11 | 12 | 15 |
| 1/4 - 28 | 8 | 9 | 11 | 12 | 10.5 | 12 | 14 | 16 | M8 X 1.25 | 16 | 20 | 21.5 | 27 | 23 | 27 | 31 | 36.5 |
| 5/16 - 18 | 14 | 15 | 19 | 20 | 18.5 | 20 | 25 | 27 | M10 X 1.50 | 29 | 35 | 39 | 47 | 42 | 52 | 57 | 70 |
| 5/16 - 24 | 17.5 | 19 | 23 | 26 | 23 | 25 | 31 | 34 | M12 X 1.75 | 52 | 62 | 70 | 84 | 75 | 91 | 102 | 123 |
| 3/8 - 16 | 26 | 28 | 35 | 38 | 35 | 37 | 47.5 | 50 | M14 X 2.00 | 85 | 103 | 115 | 139 | 120 | 146 | 163 | 198 |
| 3/8 - 24 | 31 | 34 | 42 | 46 | 41 | 45 | 55.5 | 61 | M16 X 2.50 | 130 | 158 | 176 | 214 | 176 | 216 | 238 | 293 |
| 7/16 - 14 | 41 | 45 | 55.5 | 61 | 55 | 60 | 74.5 | 81 | M18 X 2.50 | 172 | 210 | 233 | 284 | 240 | 294 | 325 | 398 |
| 7/16 - 20 | 51 | 55 | 69 | 74.5 | 68 | 75 | 92 | 102 | M20 X 2.50 | 247 | 301 | 335 | 408 | 343 | 426 | 465 | 577 |
| 1/2 - 13 | 65 | 72 | 88 | 97.5 | 86 | 96 | 116 | 130 | M22 X 2.50 | 332 | 404 | 450 | 547 | 472 | 576 | 639 | 780 |
| 1/2 - 20 | 76 | 84 | 103 | 114 | 102 | 112 | 138 | 152 | M24 X 3.00 | 423 | 517 | 573 | 700 | 599 | 732 | 812 | 992 |
| 9/16 - 12 | 95 | 105 | 129 | 142 | 127 | 140 | 172 | 190 | M27 X 3.00 | 637 | 779 | 863 | 1055 | 898 | 1098 | 1217 | 1488 |
| 9/16 - 18 | 111 | 123 | 150 | 167 | 148 | 164 | 200 | 222 | M3 X 3.00 | 872 | 1066 | 1181 | 1444 | 1224 | 1496 | 1658 | 2027 |
| 5/8 - 11 | 126 | 139 | 171 | 188 | 168 | 185 | 228 | 251 | | | | | | | | | |
| 5/8 - 18 | 152 | 168 | 206 | 228 | 203 | 224 | 275 | 304 | | | | | | | | | |
| 3/4 - 10 | 238 | 262 | 322 | 255 | 318 | 350 | 431 | 474 | | | | | | | | | |
| 3/4 - 16 | 274 | 302 | 371 | 409 | 365 | 402 | 495 | 544 | | | | | | | | | |
| 7/8 - 9 | 350 | 386 | 474 | 523 | 466 | 515 | 631 | 698 | | | | | | | | | |
| 7/8 - 14 | 407 | 448 | 551 | 607 | 543 | 597 | 736 | 809 | | | | | | | | | |
| 1 - 8 | 537 | 592 | 728 | 802 | 716 | 790 | 970 | 1070 | | | | | | | | | |
| 1 - 14 | 670 | 740 | 908 | 1003 | 894 | 987 | 1211 | 1137 | | | | | | | | | |

**Torque values apply to fasteneers as received from the supplier, dry or when lubricated with normal engine oil.**
**If special graphite grease, molydisulphide grease, or other extreme pressure lubricants are used, these torque values *do not apply*.**

# Hydraulic Components Torque Table

**NOTE: Always lubricate threads with clean hydraulic fluid prior to installation.**

Use the following values to torque hydraulic components when a specific value is not available. Always check for torque values in the following places before relying on the Hydraulic Components Torque Table;

- parts drawings and service instructions in this manual.
- packaging and instruction sheets provided with new parts.
- instruction manuals provided by the manufacturer of the component being serviced.

| TYPE: SAE PORT SERIES | CARTRIDGE POPPET | | FITTINGS | | HOSES | |
|---|---|---|---|---|---|---|
| | FT. LBS | Nm | FT. LBS | Nm | FT. LBS | Nm |
| #4 | N/A | N/A | N/A | N/A | 135 - 145 | 15 - 16 |
| #6 | N/A | N/A | 10 - 20 | 14 - 27 | 215 - 245 | 24 - 28 |
| #8 | 25 - 30 | 31 - 41 | 25 - 30 | 34 - 41 | 430 - 470 | 49 - 53 |
| #10 | 35 - 40 | 47 - 54 | 35 - 40 | 47 - 54 | 680 - 750 | 77 - 85 |
| #12 | 85 - 90 | 115 - 122 | 85 - 90 | 115 - 122 | 950 - 1050 | 107 - 119 |
| #16 | 130 - 140 | 176 - 190 | 130 - 140 | 176 - 190 | 1300 - 1368 | 147 - 155 |

**WARNING**

**IF THE CONTROL SYSTEM FAILS WHILE THE PLATFORM IS ELEVATED, HAVE AN EXPERIENCED OPERATOR USE THE EMERGENCY LOWERING PROCEDURE TO SAFELY LOWER THE PLATFORM.**

**DO NOT ATTEMPT TO CLIMB DOWN ELEVATING ASSEMBLY.**

## EMERGENCY STOP

The machine is equipped with an EMERGENCY STOP switch on both control panels.

- Press the EMERGENCY STOP switch at any time to stop all machine functions.
- Turn switch *clockwise* to reset.

### SELECTOR SWITCH SET TO PLATFORM

- Either switch will stop all machine functions.
- Both switches must be reset or machine will not operate.

### SELECTOR SWITCH IS SET TO BASE

- The upper controls are locked out.
- The lower controls switch must be reset or the machine will not operate.
- The machine will operate from the lower controls if the upper controls switch is tripped.

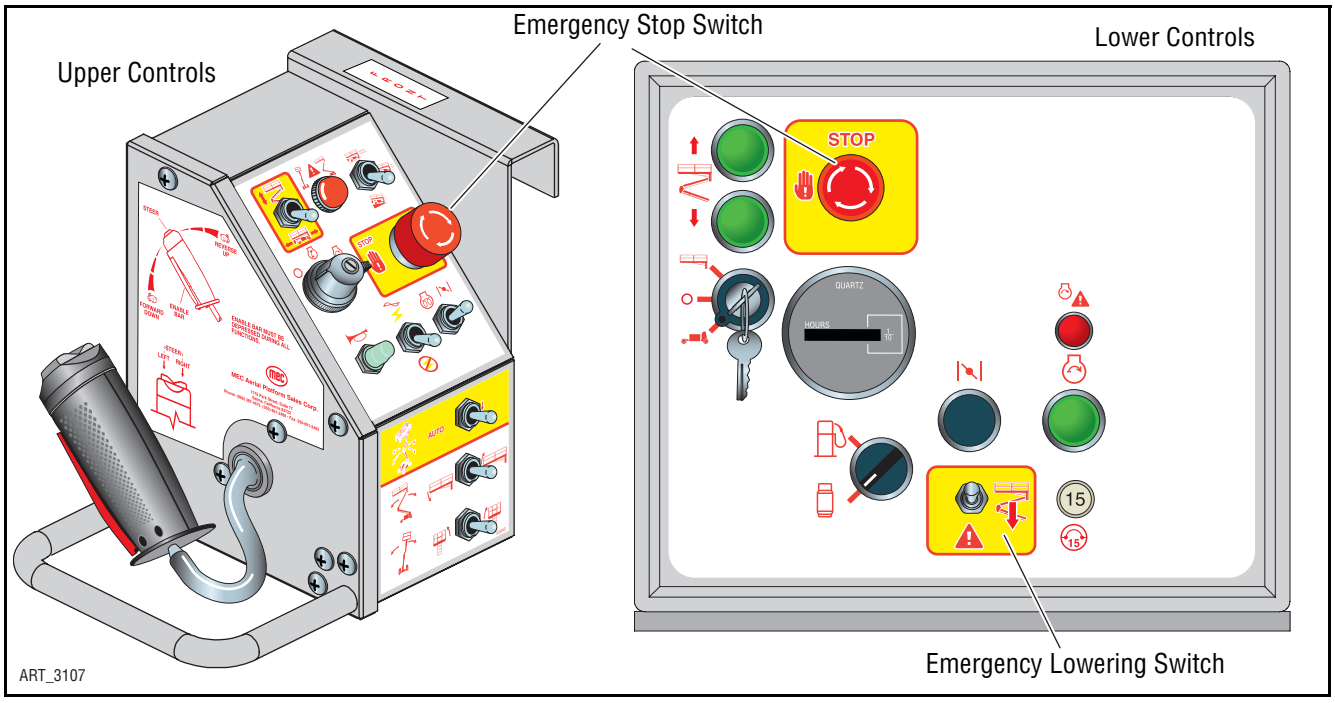
## EMERGENCY LOWERING

The Emergency Lowering System is used to lower the platform in case of power failure. The Emergency Lowering switch *will* continue to function if the EMERGENCY STOP switch is tripped.

To lower the platform, perform the following steps:

- Push and hold the toggle switch down to lower the platform.
- Once the platform is fully lowered, release the toggle switch.

***Figure 1-4:*** Emergency Lowering Switch



## Parking Brake and Towing Circuit

The machine can be winched or moved short distances in case of power failure at speeds not to exceed 5 MPH (8.05 km/h). Before towing or winching the machine, it is necessary to release the brake. Reset the brakes after winching or towing.

**DANGER**

***AFTER DISENGAGING BRAKES THERE IS NOTHING TO STOP THE MACHINE'S TRAVEL. MACHINE WILL ROLL FREELY ON SLOPES. BE ON GUARD AGAINST RUNAWAY.***

**CAUTION**

**Prior to manually releasing brakes, insure wheels are chocked to prevent unintentional movement.**

### Disengage Brakes Before Towing:

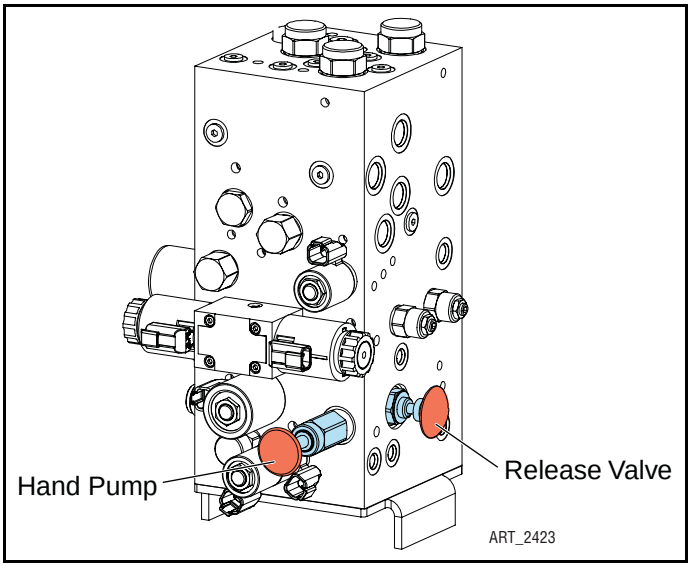
- Chock the wheels.
- Push and hold release valve.
- Using the hand pump on the manifold, pump valve until pressure is built and valve cannot be pumped.
- Machine is now ready for towing.

### Engage Brakes Before Driving:

- Pull out the manual brake release valve to reset brakes.

**NOTE: Brakes will reset automatically when drive function is activated.**

***Figure 1-5:*** Disengage Brakes



# Lift and Support the Machine

**DANGER**

***DEATH OR SERIOUS PERSONAL INJURY MAY RESULT FROM THE USE OF SUBSTANDARD LIFTING DEVICES AND/OR JACK STANDS. ENSURE THAT ALL LIFTING DEVICES AND JACK STANDS ARE OF ADEQUATE CAPACITY AND IN GOOD WORKING CONDITION BEFORE USE.***

The following are needed to safely lift and support the machine;

- a jack with a lifting capacity of two (2) tons or more.
- jack stands with a rating of two (2) tons or more.

### To raise the machine

1. Move machine to a firm level surface capable of supporting the weight of the machine.
2. Chock tires on one end of machine and raise the other end of machine.
3. If wheel is to be removed, break loose but ***do not remove*** lug nuts before raising the machine.
4. Position a jack at the end of the machine to be lifted, under a solid lifting point in the center of the frame.
5. Raise the machine and place two (2) suitable jack stands under solid support points at the outer ends of the frame.
6. Lower the machine to rest on the jack stands and inspect for stability.

### To lower the machine

1. Tighten lugs to proper torque (refer to machine specifications).
2. Raise machine slightly and remove jack stands.
3. Lower the machine and remove the jack.
4. Remove chocks.

# Transporting the Machine

## Safety Information

**WARNING**

**THIS INFORMATION IS PROVIDED FOR REFERENCE AND DOES NOT SUPERSEDE ANY GOVERNMENT OR COMPANY POLICY REGARDING THE LOADING, TRANSPORT OR LIFTING OF MEC MACHINERY.**

**DRIVERS ARE RESPONSIBLE FOR LOADING AND SECURING MACHINES, AND SHOULD BE PROPERLY TRAINED AND AUTHORIZED TO OPERATE MEC MACHINERY.**

**DRIVERS ARE ALSO RESPONSIBLE FOR SELECTING THE CORRECT AND APPROPRIATE TRAILER ACCORDING TO GOVERNMENT REGULATIONS AND COMPANY POLICY.**

**DRIVERS MUST ENSURE THAT THE VEHICLE AND CHAINS ARE STRONG ENOUGH TO HOLD THE WEIGHT OF THE MACHINE (SEE THE SERIAL NUMBER PLATE FOR MACHINE WEIGHT).**

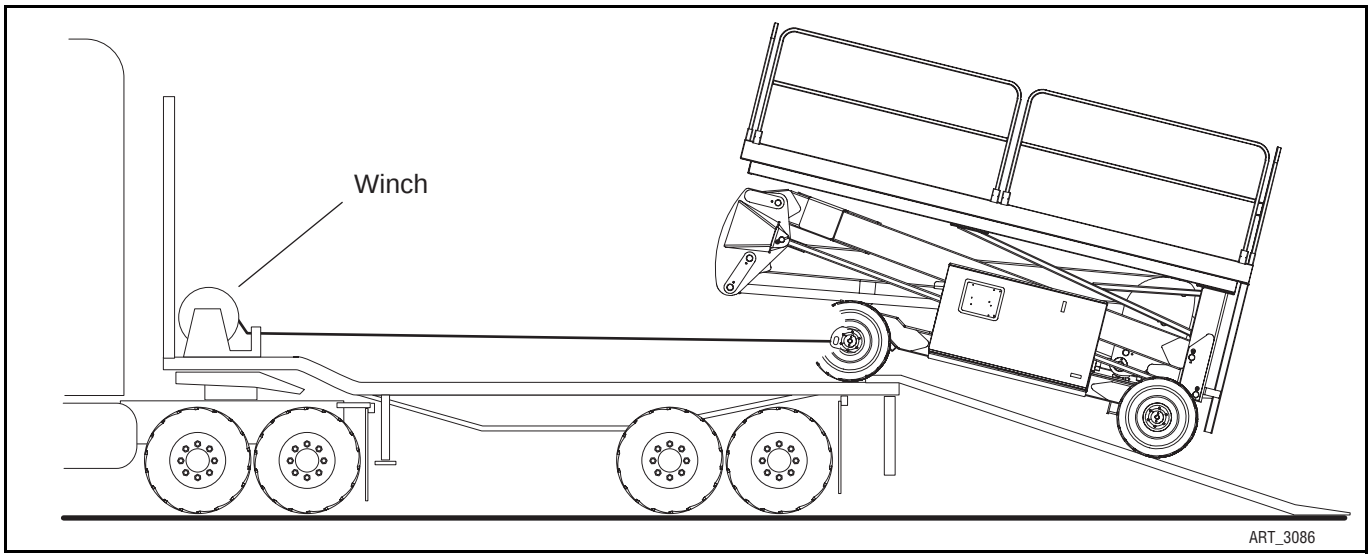
### Driving or Winching onto or off of a Transport Vehicle

**WARNING**

**MEC DOES NOT RECOMMEND UNASSISTED LOADING OR UNLOADING. ALWAYS ATTACH THE MACHINE TO A WINCH WHEN LOADING OR UNLOADING FROM A TRUCK OR TRAILER BY DRIVING.**

Refer to the Operator's Manual for loading, unloading, driving and operating instructions.

***Figure 1-6:*** Loading the Machine



# Section 1

# HYDRAULIC SYSTEM

## CONTENTS



## FIGURES

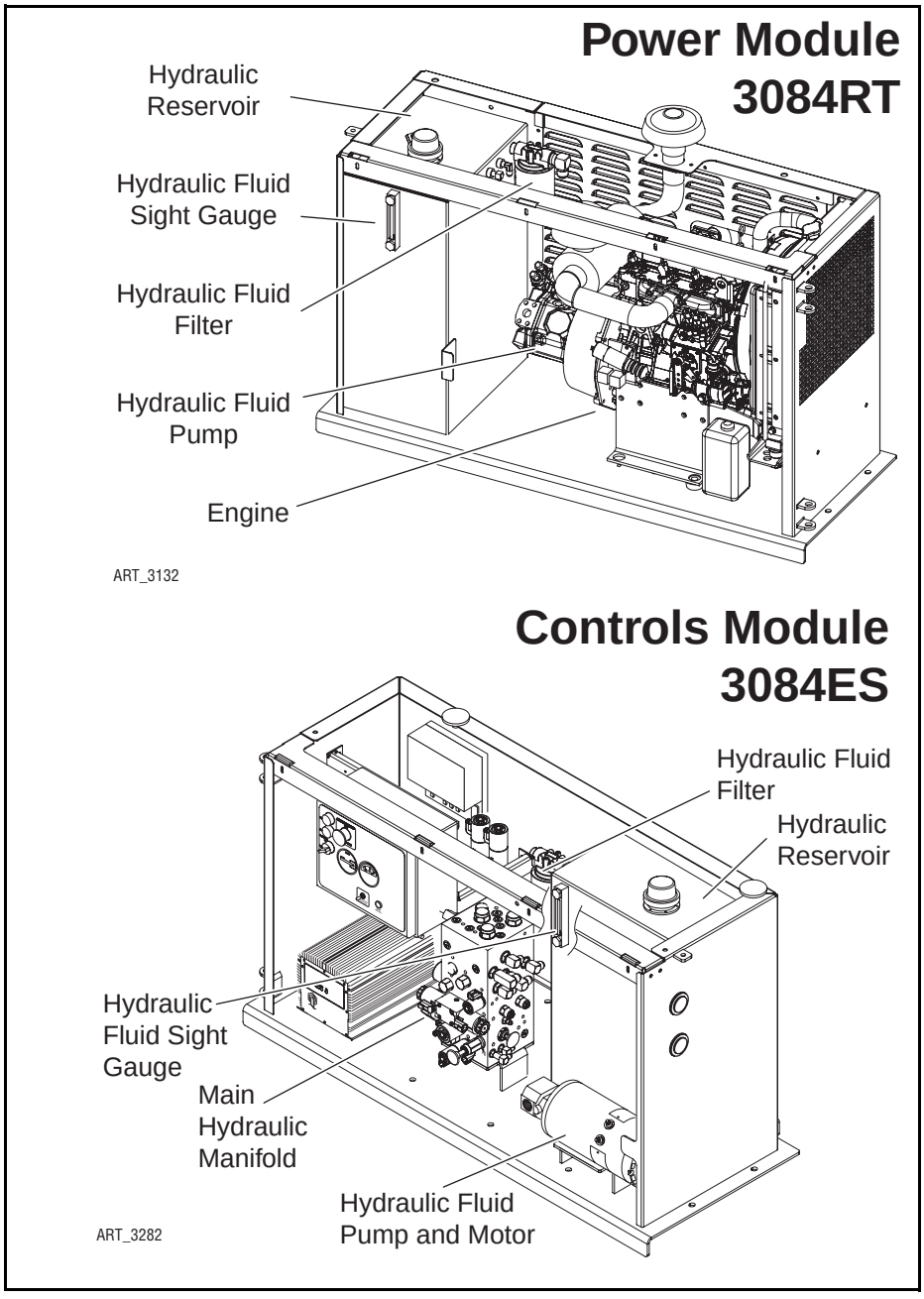
# HYDRAULIC SYSTEM – GENERAL

The hydraulic integrated circuit, generally known as the manifold system (valve type) is designed to control all or part of machine functions by integrating various hydraulic cartridge valves into a manifold to provide directional, pressure, flow, and load control.

The hydraulic system is a feedback, load-sensing type. Generally in this type of system, hydraulic fluid is provided by a variable displacement, pressure compensated, axial piston type pump which is directly coupled to the engine. As the engine turns, the hydraulic pump drains fluid from the reservoir and pumps this fluid to the valve manifold.

If no function is selected to perform, the pump remains on standby and no fluid is pumped through the manifold. Each function has a maximum pressure control limit set by pressure relief valve.

***Figure 1-1:*** Hydraulic System



# HYDRAULIC ROADMAP

## HYDRAULIC RESERVOIR

Hydraulic fluid is held in the reservoir for delivery to the various components and then returned to the reservoir. Returning hydraulic fluid is routed through a filter before entering the reservoir. The reservoir also serves as the oil cooling device.

## PUMP

The pump delivers hydraulic fluid under pressure to the main hydraulic manifold.

## HYDRAULIC MANIFOLD

The main manifold directs the hydraulic fluid to the hydraulically operated components and returns fluid to the reservoir through the use of electronically operated solenoid valves.

## DRIVE AND BRAKE SYSTEM

There are four (4) hydraulic, fixed-displacement gear wheel motors to provide power to all four wheels [two (2) front and two (2) rear].

The two rear wheel motors have integral spring-held brakes. The brakes are released by hydraulic pressure developed in the drive circuit during drive mode. A fixed orifice in the brake circuit controls the deceleration rate and initiates a smooth stop.

## FLOATING AXLE LOCK CYLINDERS

Two (2) hydraulic cylinders control the floating axle on the front of the machine. When platform is elevated, the cylinders lock into place to increase machine stability.

## STEERING SYSTEM

Two (2) hydraulic cylinders control steering.

## LIFT SYSTEM

The machine is equipped with one (1) hydraulic lift cylinder.

## TILT SYSTEM

The boom and platform tilts as a unit to provide a level work platform, regardless of chassis level. One (1) hydraulic cylinder provides tilt from front to rear, and one (1) hydraulic cylinder provides tilt from side to side.

## OPTIONAL GENERATOR SYSTEM

If equipped, the generator is driven by a hydraulic motor which receives hydraulic fluid directly from the pressure port of the pump.

# HYDRAULIC FLUID

## HANDLING PRECAUTIONS

**WARNING**

**PERSONS IN REGULAR CONTACT WITH MINERAL-BASED HYDRAULIC FLUID NEED TO BE AWARE OF THE IMPORTANCE OF THOROUGH HYGIENE AND THE PROPER METHODS FOR HANDLING MINERAL OILS, IN ORDER TO AVOID POTENTIAL HAZARDS TO HEALTH.**

**IF MINERAL-BASED HYDRAULIC FLUID IS SPLASHED INTO THE EYES, IT MUST BE WASHED OUT THOROUGHLY USING ABUNDANT QUANTITIES OF WATER. SEEK MEDICAL ATTENTION IF IRRITATION PERSISTS.**

**HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE AND BURN SKIN, DAMAGE EYES, AND MAY CAUSE SERIOUS INJURY OR BLINDNESS.**

**FLUID LEAKS UNDER PRESSURE MAY NOT ALWAYS BE VISIBLE.**

## FLUID RECOMMENDATIONS

MEC recommends the use of **Mobile Fluid DTE 10, DTE 13 M or AW32** hydraulic fluid. Do not substitute with lower grade fluids as pump damage may result.

## SYSTEM FLUSHING PROCEDURE

1. With platform fully down, drain hydraulic fluid from hydraulic reservoir into a clean, empty container.
2. When the hydraulic reservoir is empty, remove suction strainer and hoses.
3. Remove the bypass filter and hose.
4. Flush the hoses with clean hydraulic fluid.
5. Discard old bypass filter element and replace.
6. Flush out the reservoir with hoses removed from the hydraulic reservoir.
7. Reinstall all hoses removed in the previous steps.
8. Fill hydraulic reservoir with filtered, fresh hydraulic fluid (refer to Lubrication Chart).
9. Loosen output hose fittings at pump to flood with hydraulic fluid. Tighten fittings.
10. Start up the machine. Briefly operate all functions. Two or three lift cycles may be necessary to purge all air from lift cylinder(s).
11. When the above procedures have been completed, fill hydraulic reservoir to full mark on sight gauge.
12. Check all leaks and correct as necessary. Machine is now ready to be placed back in operation.

**NOTE: Avoid mixing petroleum and synthetic base fluids. It is not advisable to mix fluids of different brands or types, except as recommended.**

# HYDRAULIC FLUID RESERVOIR

Consists of the reservoir, a filler cap with breather, a drain plug, a sight gauge, and a bypass filter with a 10 micron filter element.

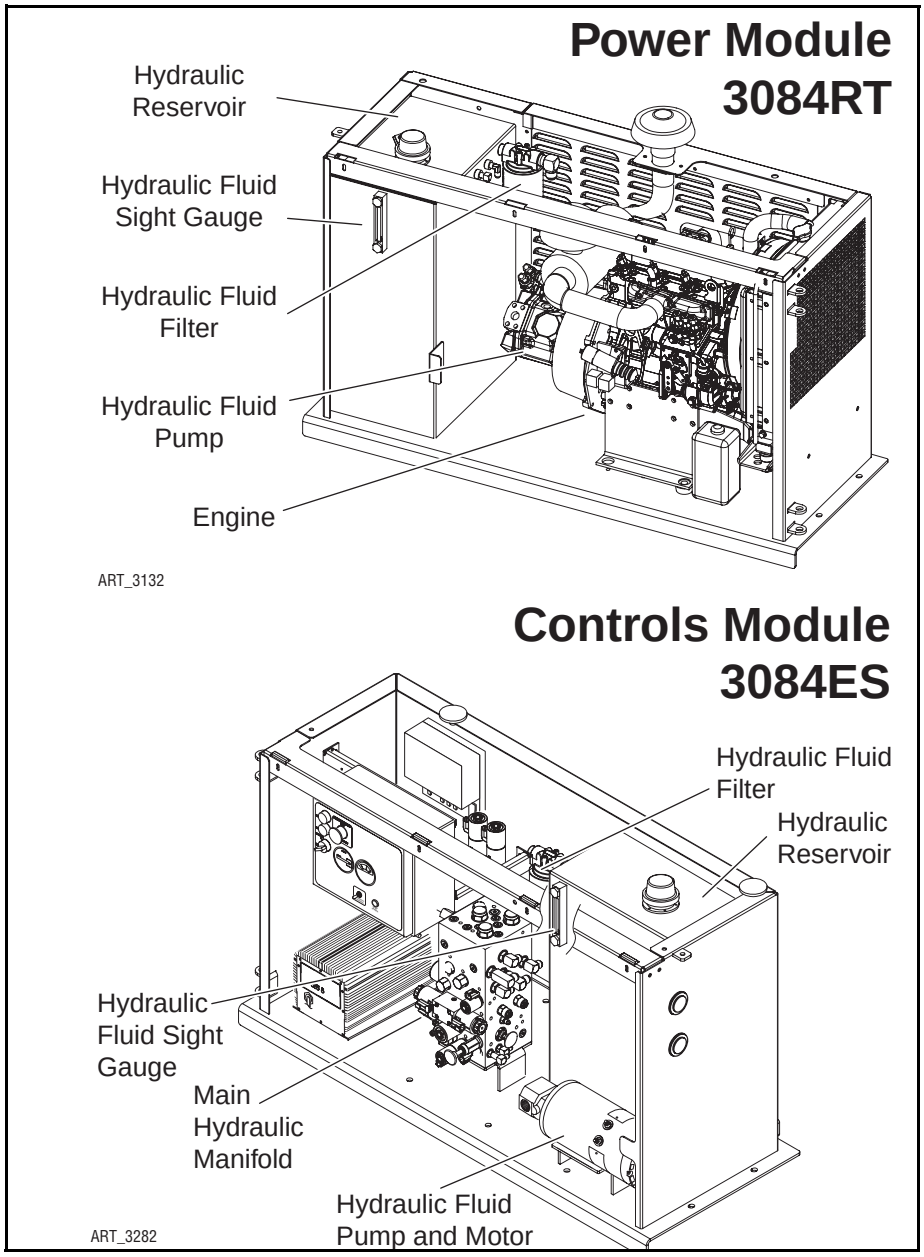
- Check reservoir for signs of leakage weekly.

## HYDRAULIC RESERVOIR ASSEMBLY

**CAUTION**

All machines are produced with a spin-on, bypassing filter. When the filter is clogged, hydraulic flow bypasses the filter element. The filter element must be changed every six (6) months or 500 hours. Extremely dirty conditions may require that the filter be replaced more often. **Beware of hot fluid. Contact with hot fluid may cause severe burns.**

***Figure 1-2:*** Hydraulic Fluid Reservoir



# HYDRAULIC PUMP - 3084RT

**NOTE: Refer to *Section 4 – Hydraulic Pressure Adjustment Procedures*.**
**Refer to *Parts Section F*.**

An internal combustion engine drives a variable displacement axial piston pump.

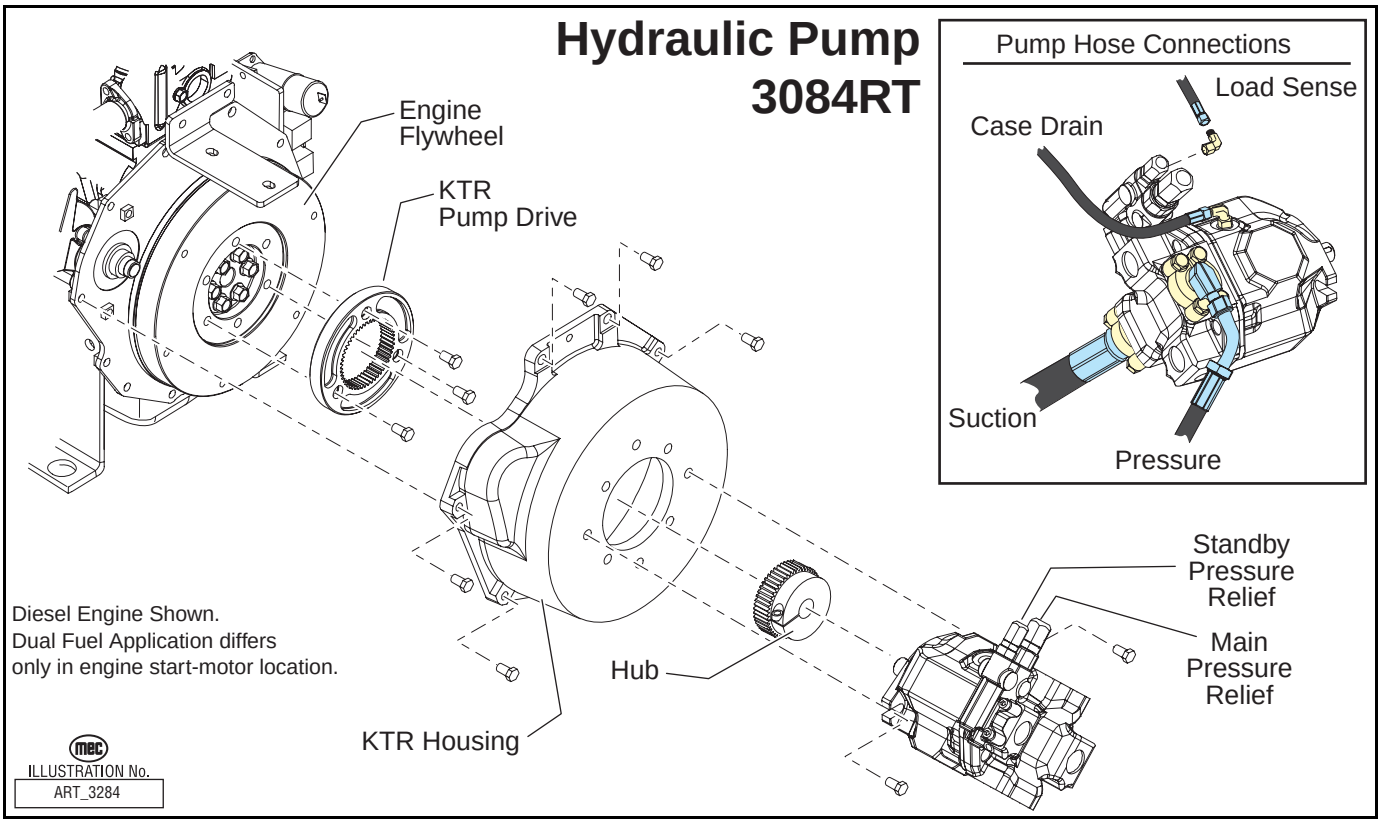
## REMOVE

1. Turn the Battery Disconnect Switch (inside Control Module) to the OFF position.
2. Place a large container under the engine and pump to catch fluid that will be lost during pump replacement. Dispose of used fluid properly.
3. Tag and disconnect hydraulic hoses, and IMMEDIATELY cap or cover the openings to prevent contamination.
4. Remove the two (2) bolts that hold the pump to the housing.
5. Remove the pump.

## INSTALL

1. Install drive hub onto pump shaft. Torque bolt to 45 Ft. Lbs. (61 Nm).
2. Position the pump next to the housing. Turn the pump until the splines on the hub align allowing the pump to become flush with the housing.
3. Turn the pump until the bolt holes align with the mounting holes on the housing and install the bolts. Torque to 25-28 Ft. Lbs. (35-38 Nm).
4. Install the hydraulic hoses.
5. Turn the Battery Disconnect Switch to the ON position.
6. Check for leaks and check all hydraulic pressures

***Figure 1-3:*** Hydraulic Pump - 3084RT



# HYDRAULIC PUMP SEALS - 3084RT

## DRIVE SHAFT SEAL REPLACEMENT

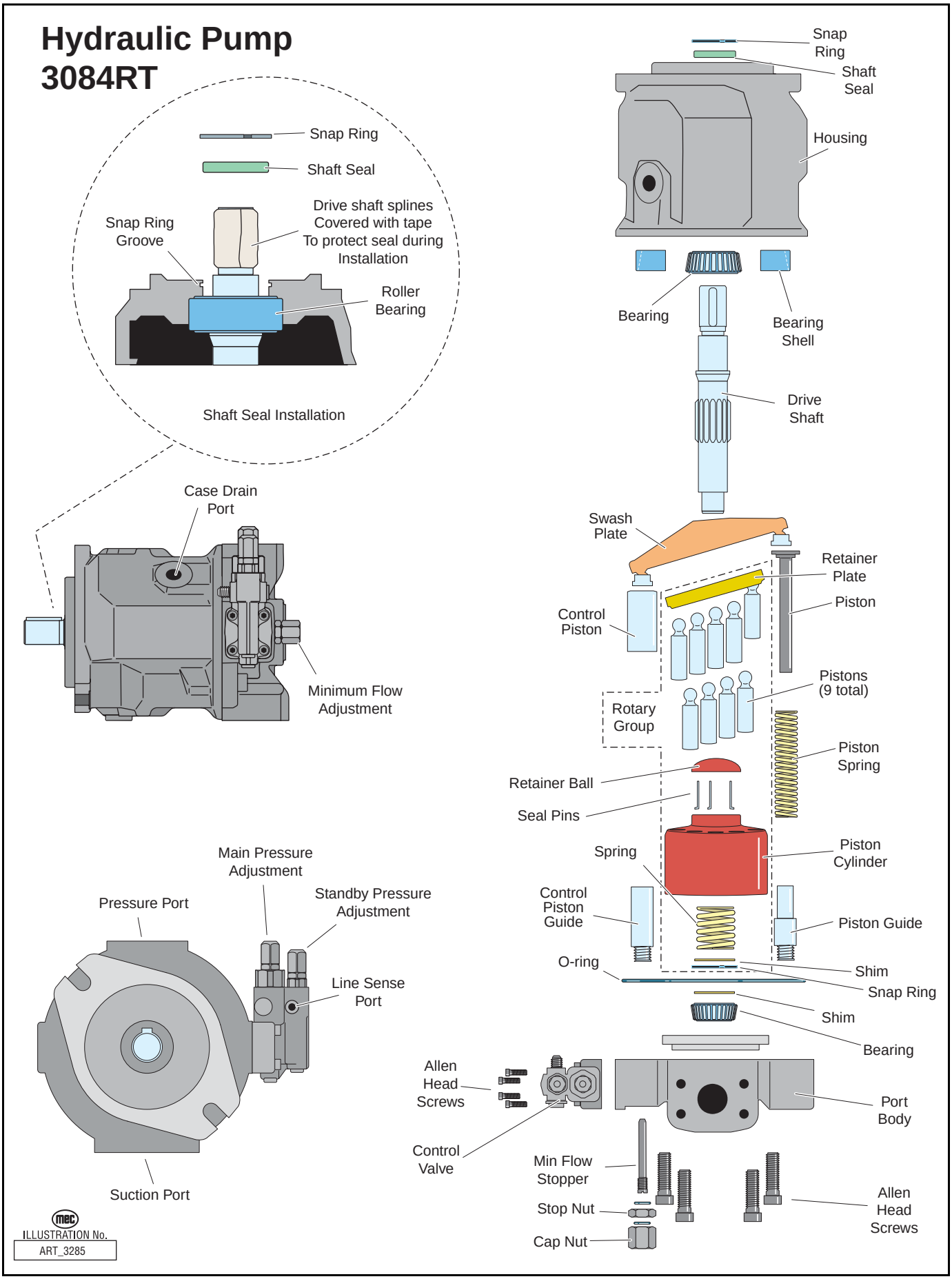
**Caution:** Be careful not to damage the drive shaft when removing the old seal.

1. Remove the shaft key.
2. Remove the snap ring.
3. Remove the shaft seal.
   - Check the surface of the shaft and the housing for imperfections.
4. Install new shaft seal.
   - Cover the keyway portion of the drive shaft with tape to prevent damage to the seal during installation.
   - Coat the shaft seal with grease.
   - Seat the shaft seal with a seal setting tool.
5. Install the snap ring.
6. Install the shaft key.

## HYDRAULIC PUMP REBUILD

Pump rebuild should be performed only by a qualified mechanic. Contact MEC Technical Support before attempting to rebuild the pump.

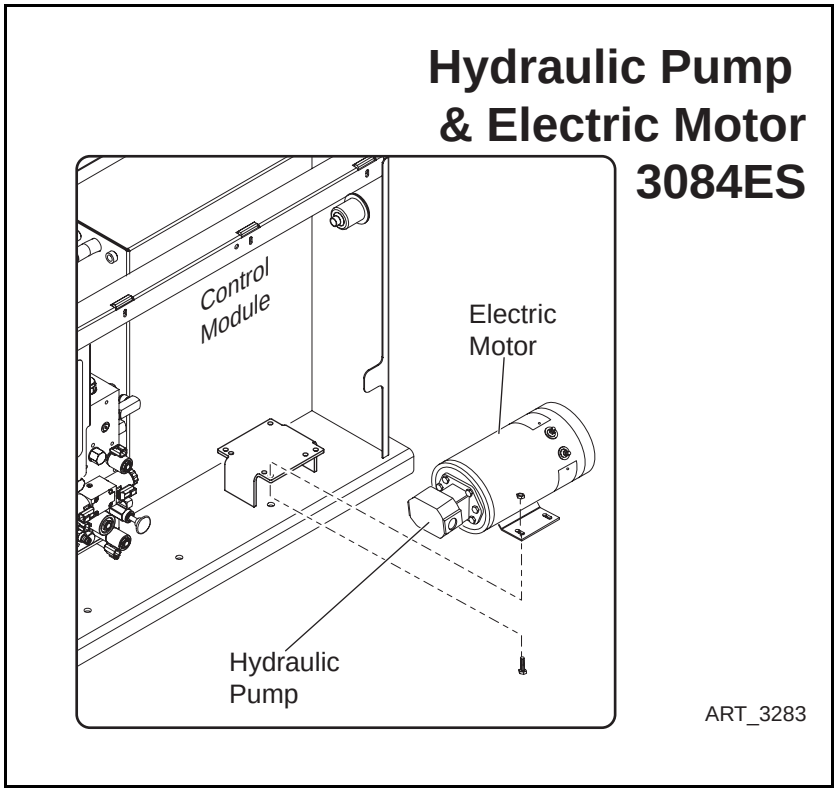
***Figure 1-4:*** Hydraulic Pump Seals - 3084RT



# HYDRAULIC PUMP - 3084ES

The hydraulic pump and electric motor used on the 3084ES model contain no serviceable parts, and must be replaced rather than repaired. See the Parts section of this manual for more information.

***Figure 1-5:*** Hydraulic Pump & Electric Motor, 3084ES



# HYDRAULIC MANIFOLD

**NOTE: Refer to *Parts Section E*.**
**Tag all components as they are removed to aid in reassembly.**

## HYDRAULIC MANIFOLD REMOVAL

1. Disconnect the negative battery terminal.
2. Tag and disconnect the solenoid valve leads.
3. Tag and disconnect hydraulic hoses, and IMMEDIATELY cap the openings to prevent contamination.
4. Remove the bolts that hold the manifold to the mounting bracket.
5. Remove the manifold block.

## DISASSEMBLY

1. Remove coils from solenoid valves.
2. Mark and remove valves.
3. Mark and remove fittings, plugs, springs, balls, and orifices.

## CLEANING AND INSPECTION

1. Wash the manifold in cleaning solvent to remove built-up contaminants, then blow out all passages with clean compressed air.
2. Inspect the manifold for cracks, thread damage and scoring where O-rings seal against internal and external surfaces.
3. Wash and dry each component and check for thread damage, torn or cracked O-rings, and proper operation.
4. Replace defective parts and O-rings.

## ASSEMBLY

**NOTE: Lubricate all O-rings before installation to prevent damage to the O-ring. Seat balls in manifold block by lightly tapping on the ball with a brass drift punch.**

1. Install fittings, plugs, springs, balls, and orifices. Use one drop of Loctite #424 or equivalent thread locker on each screw-in orifice.
2. Install valves.

## INSTALLATION

1. Attach manifold assembly to mounting plate with mounting bolts.
2. Connect solenoid leads (as previously tagged).
3. Connect hydraulic hoses (as previously tagged). Be certain to tighten hoses.
4. Connect the battery.
5. Operate each hydraulic function and check for proper operation and leaks.
6. Adjust valve pressures.

***Figure 1-6:*** Main Hydraulic Manifold - 3084RT

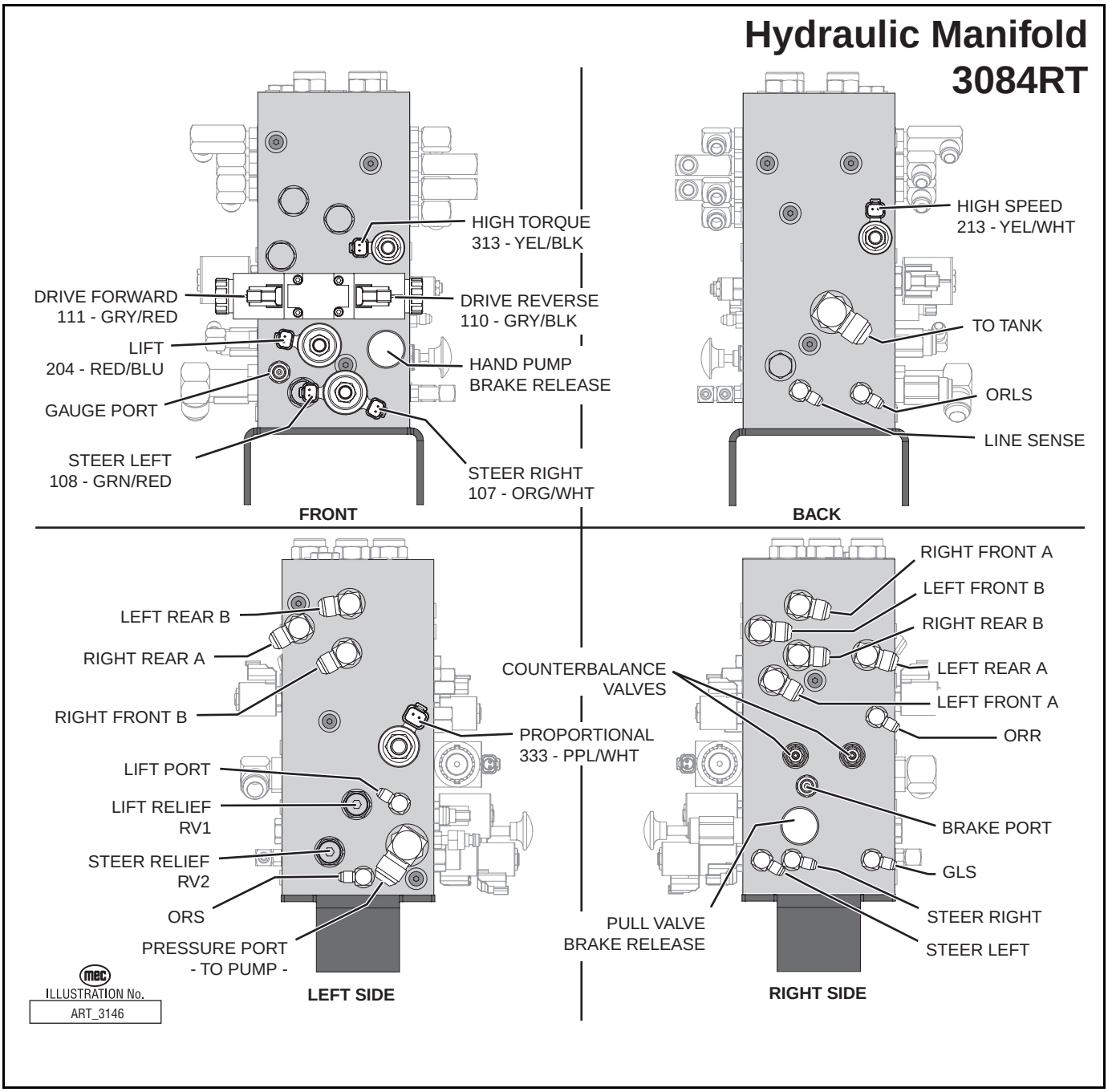


***Figure 1-7:*** Main Hydraulic Manifold - 3084ES

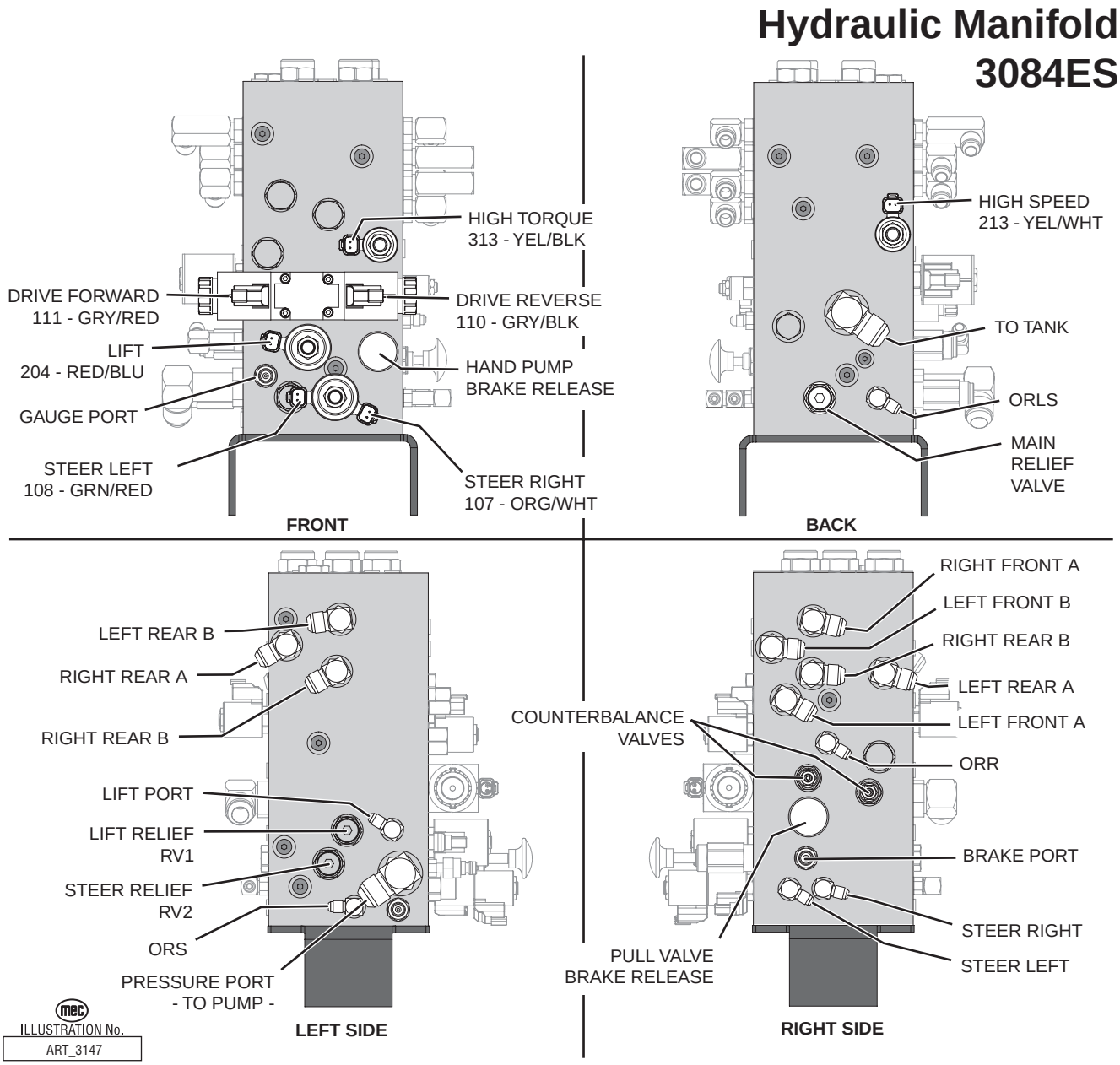


***Figure 1-8:*** Main Hydraulic Manifold - 3084ES Alternate Configuration

# Hydraulic Manifold - Alternate Configuration 3084ES

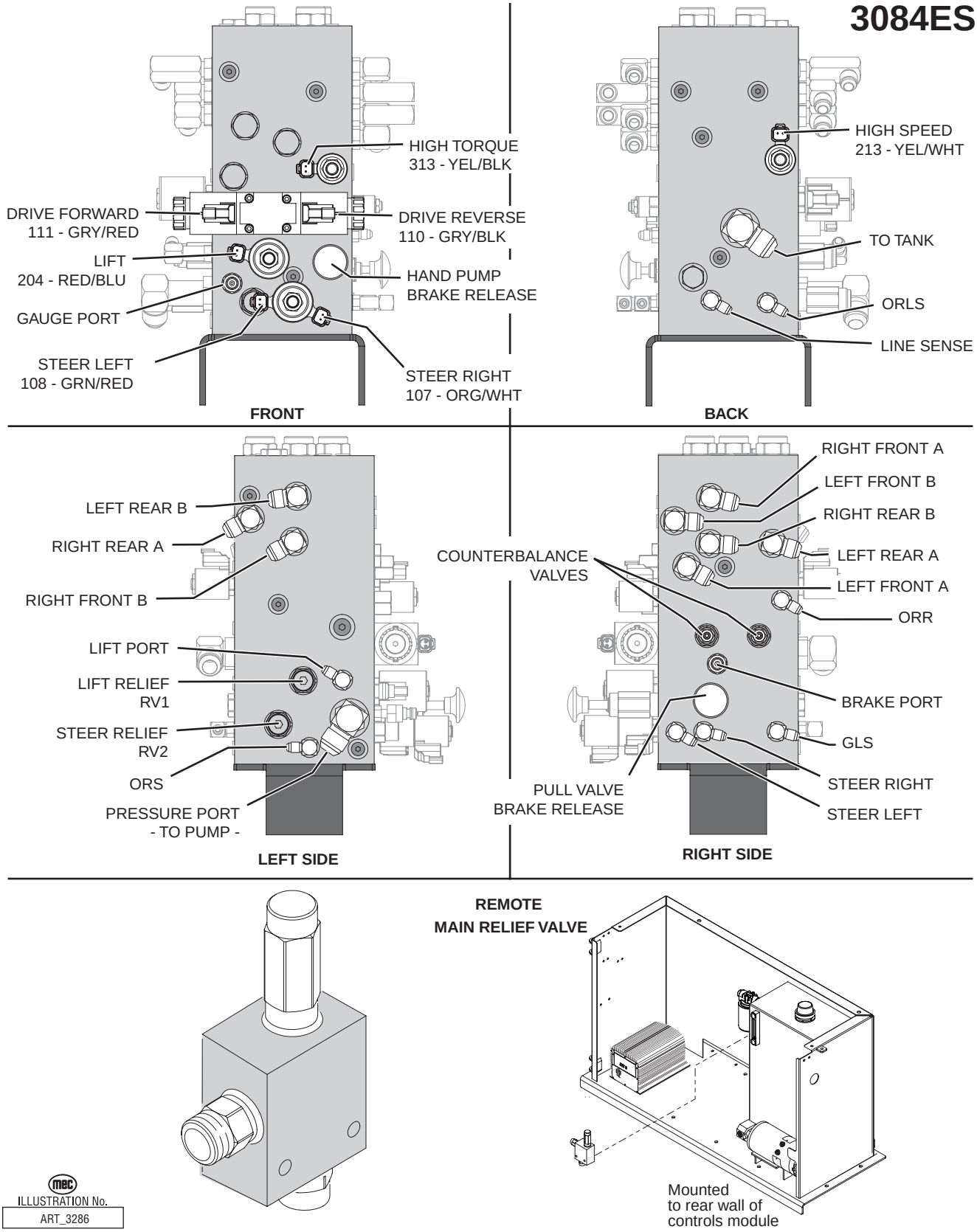
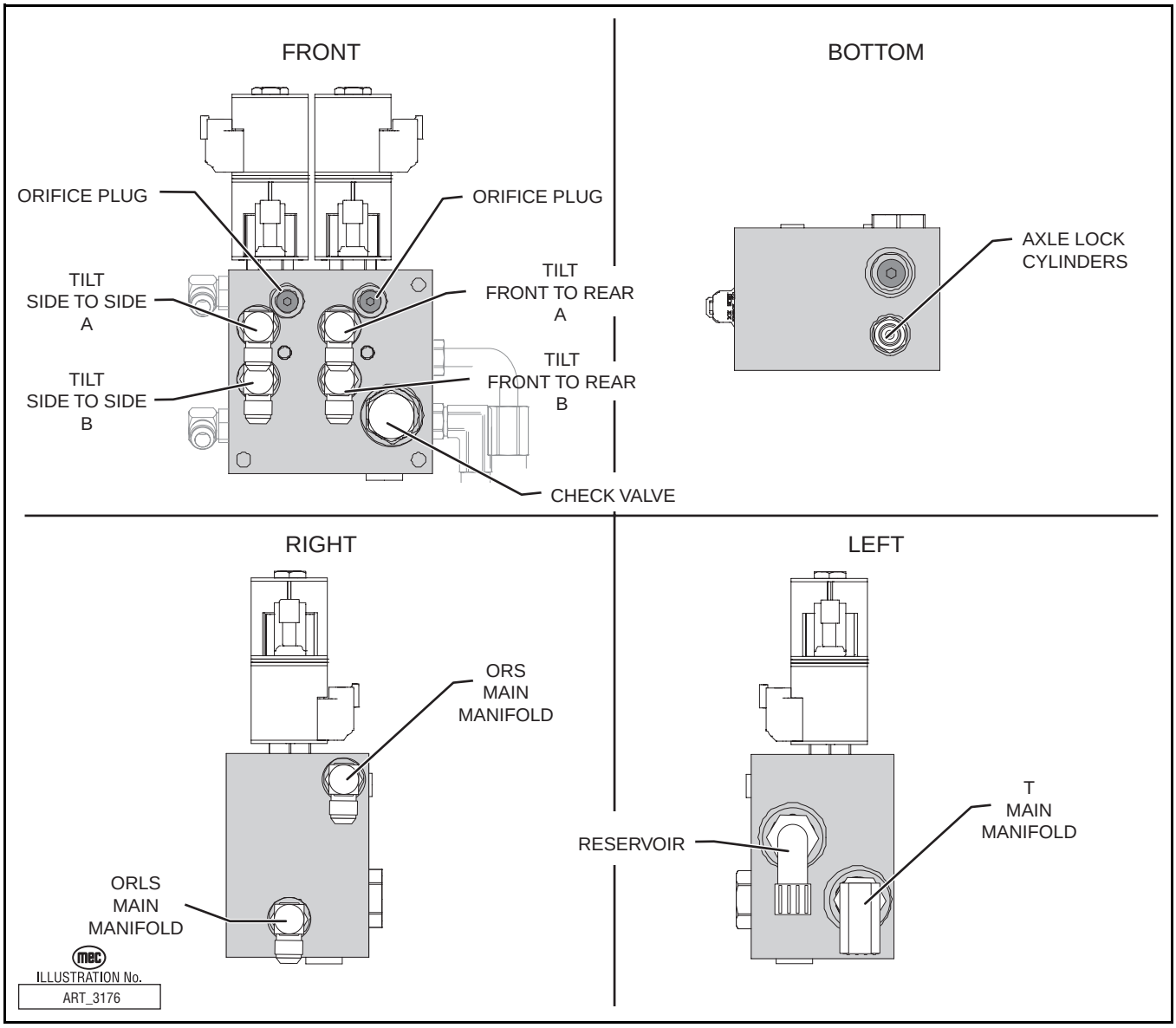


***Figure 1-9:*** Hydraulic Manifold, Leveling



# DRIVE AND BRAKE SYSTEM

## WHEEL DRIVE

**NOTE: Refer to *Section 3* for Remove and Install instructions.**
**Refer to *Parts Section D*.**

There are four (4) hydraulic fixed-displacement gear wheel motors to provide power to all four wheels.

### DYNAMIC BRAKING CIRCUIT

The two (2) rear wheel motors have integral spring-held brakes. Hydraulic pressure developed in the drive circuit during drive mode releases the brakes. A fixed orifice in the brake circuit controls the brake application to provide a smooth stop.

# FRONT WHEEL MOTORS (DT-701)

Refer to Figure 1-10.

## HOUSING AND SHAFT DISASSEMBLY

1. Remove all shaft-related components from the shaft. Secure the motor housing in a vise.
   - Remove the retaining ring from the grove in the pilot of the housing.
   - Remove the spacer from the housing.
   - Remove the shaft from the housing.
   - Remove the bearing, thrust bearing, and two (2) thrust washers from the shaft.
2. Being careful not to drop bearing rollers,

   Pry out the shaft seal, backup seal, and dust seal from the bearing assembly.

**NOTE: It is not necessary to remove the metal backup ring from the bearing to service the motor.**

   - Remove the high pressure seal from the groove in the pilot of the housing.
   - Discard shaft seal, backup seal and high pressure seal.
3. Clean all parts in an oil-based solvent and dry using compressed air.

## HOUSING AND SHAFT ASSEMBLY

1. Apply a light coating of fluid to all new seals prior to installation.
   - Install the high pressure seal into the groove in the pilot of the housing.
2. Place the shaft on a clean, flat surface with the output end facing up.
   - Place the first thrust washer, thrust bearing and second thrust washer over the shaft.
   - Using plastic installation sleeve, place the shaft seal over the shaft with the lip facing down.
   - Repeat for the backup seal, making sure the lip faces down.
   - If the metal backup ring came out in *Step 2* above, place it over the shaft with the large O.D. facing down.
   - Lightly grease the bearing and place it over the shaft with the large O.D. facing down.
   - Use an arbor press to carefully press the bearing down to press the seal assembly into the bearing.
3. Place the shaft assembly into the housing.
   - Place the dust seal over the shaft with the lip facing up.
   - Place the bearing spacer and retaining snap ring over the shaft.

**NOTE: It may be necessary to lightly tap the snap ring and bearing spacer to allow the retaining ring to seat properly.**

   - Replace all shaft-related components (i.e. keys, wire rings, nuts).

## MOTOR SECTION DISASSEMBLY

1. Make a “V” shaped set of alignment marks on the end-cover and housing to aid in the reassembly process.
   - Clamp the motor housing in a vise with the shaft facing down.
2. Remove the seven (7) bolts that hold the motor assembly together.
   - Carefully remove the end-cover - *be aware that the piston and spring may fall out*.
   - Carefully remove the piston from the end-cover and set it aside.
   - Remove and discard the O-ring seal and backup seal.
   - Remove the spring and set it aside.
3. Lift commutator container and commutator from the motor and set aside.
   - Place commutator on a flat, clean surface with the seal facing up.
   - Gently tap on the seal with a small screwdriver until the opposite side of the seal lifts from the groove. Remove the seal and discard.
4. Remove the manifold, rotor set, and divider plate. Remove all seals and discard.

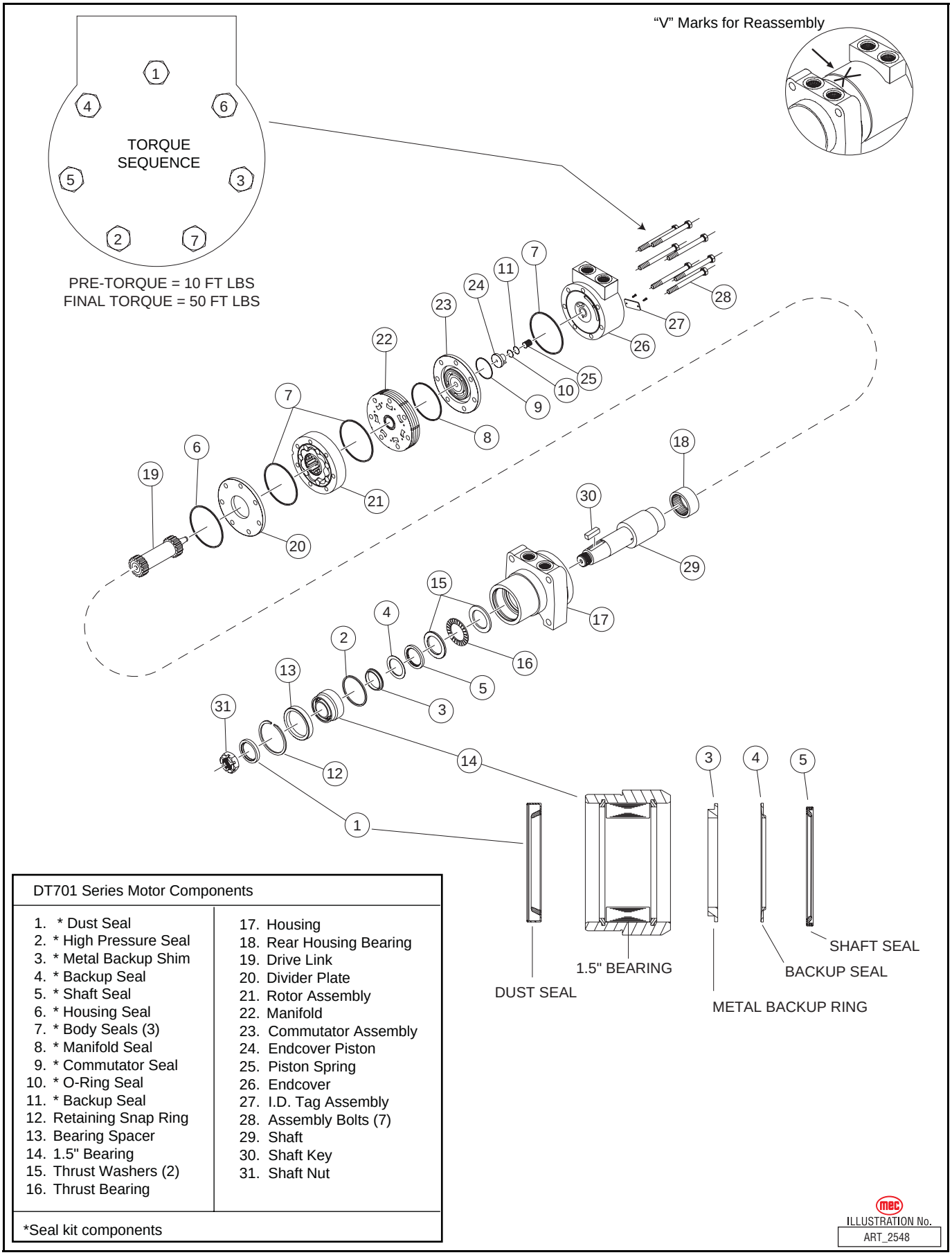
***CAUTION –*** Do not allow rollers to drop from the rotor assembly when removing the rotor from the motor.

   - Remove the drive link from the motor and set aside.
5. Clean all parts in an oil-based solvent and dry using compressed air.

## MOTOR SECTION ASSEMBLY

1. Apply a light coating of fluid to all new seals prior to installation.
2. Install the drive link into the end of the shaft with the tapered end facing up.
   - Place the rear housing seal in the groove in the housing.
   - Place the divider plate onto the housing.
   - Place body seals in grooves in both sides of the rotor.
   - Place the rotor onto the housing with the side of the rotor with chamfer in splines facing the housing.
   - Place the manifold over the rotor with the seal-groove side up.
   - Install the manifold seal
3. Install the commutator seal into the commutator with the metal side facing up.
   - Use finger pressure to press the seal down flush with the surface of the commutator.
   - Place the commutator onto the manifold and then place the commutator onto the protruding end of the drive link. Make sure that the seal side is facing up.
4. Install the remaining body seal in the groove on the end-cover.
   - Install the piston spring into the end-cover, then the white backup seal followed by the O-Ring seal.
   - Line up the alignment pin with the hole in the end-cover and press the piston into the end-cover.
   - While holding the piston in place, lower the end-cover assembly onto the motor. Align the “V” shaped marks that were made on the housing and end-cover before disassembly.
5. Install the seven (7) assembly bolts.
   - Tighten bolts in sequence (see illustration)
   - Pre-torque to 10 ft. lbs. (13.6 Nm). Final torque to 50 ft. lbs. (67.8 Nm).

***Figure 1-10:*** Front Wheel Motor (DT701) Exploded View




| DT701 Series Motor Components | |
|---|---|
| 1. * Dust Seal | 17. Housing |
| 2. * High Pressure Seal | 18. Rear Housing Bearing |
| 3. * Metal Backup Shim | 19. Drive Link |
| 4. * Backup Seal | 20. Divider Plate |
| 5. * Shaft Seal | 21. Rotor Assembly |
| 6. * Housing Seal | 22. Manifold |
| 7. * Body Seals (3) | 23. Commutator Assembly |
| 8. * Manifold Seal | 24. Endcover Piston |
| 9. * Commutator Seal | 25. Piston Spring |
| 10. * O-Ring Seal | 26. Endcover |
| 11. * Backup Seal | 27. I.D. Tag Assembly |
| 12. Retaining Snap Ring | 28. Assembly Bolts (7) |
| 13. Bearing Spacer | 29. Shaft |
| 14. 1.5" Bearing | 30. Shaft Key |
| 15. Thrust Washers (2) | 31. Shaft Nut |
| 16. Thrust Bearing | |
| *Seal kit components | |

ILLUSTRATION No.
ART_2548

# REAR WHEEL MOTORS WITH BRAKES (DT-710)

Refer to Figure 1-11.

## DISASSEMBLY

1. Make a "V" shaped set of alignment marks on the end-cover and housing to aid in the reassembly process.
   - Clamp the motor housing in a vise with the shaft facing down.
2. Remove the seven (7) bolts that hold the motor assembly together.
   - Carefully remove the end-cover - *be aware that the piston and spring may fall out*.
   - Carefully remove the piston from the end-cover and set it aside.
   - Remove and discard the O-ring seal and backup seal.
   - Remove the spring and set it aside.
3. Lift commutator container and commutator from the motor and set aside.
   - Place commutator on a flat, clean surface with the seal facing up.
   - Gently tap on the seal with a small screwdriver until the opposite side of the seal lifts from the groove. Remove the seal and discard.
4. Remove the manifold, rotor set, and divider plate. Remove all seals and discard.

***CAUTION:*** **–** Do not allow rollers to drop from the rotor assembly when removing the rotor from the motor.

   - Remove the drive link from the motor and set aside.
5. Clean all parts in an oil-based solvent and dry using compressed air.

## ASSEMBLY

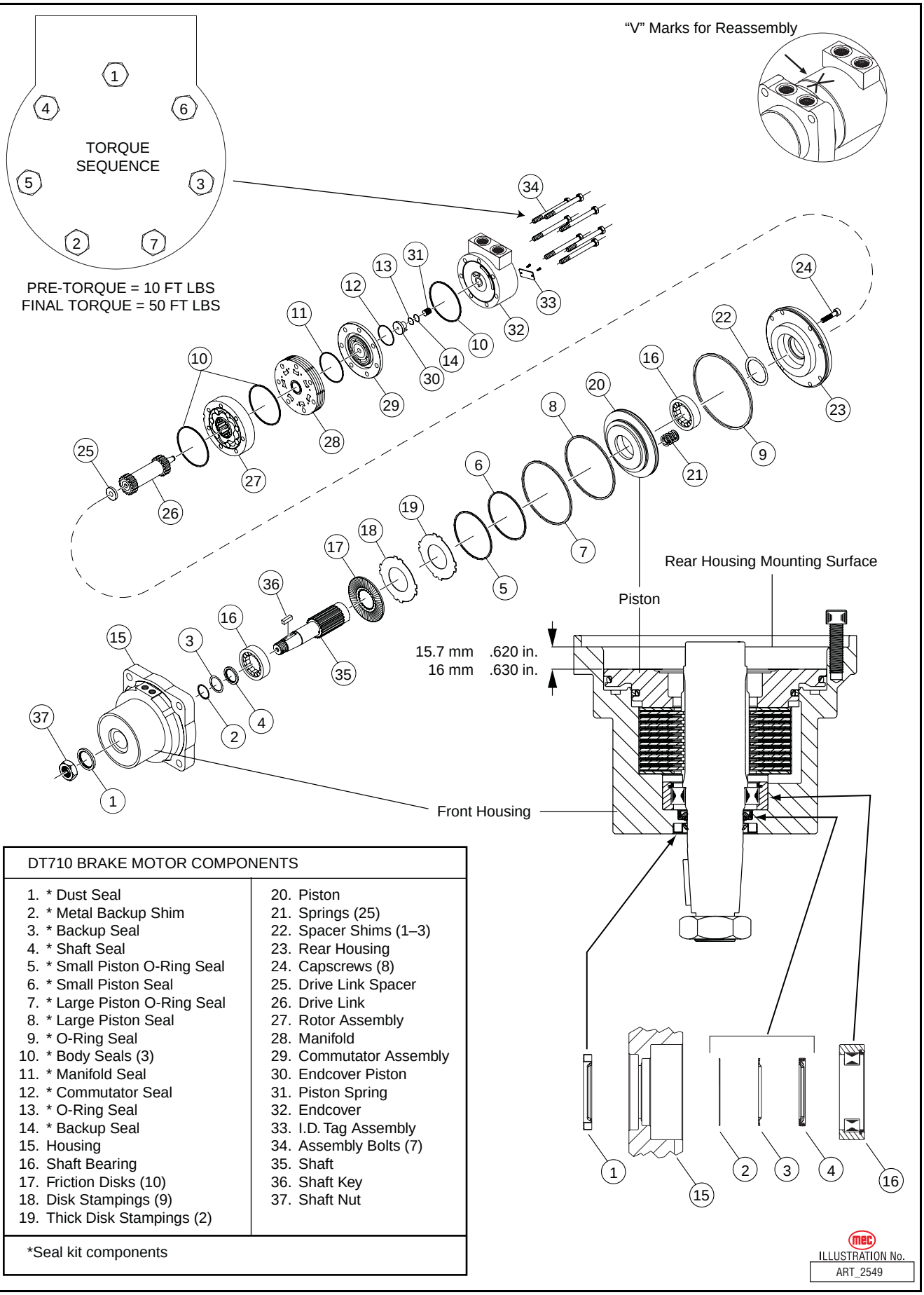
1. Apply a light coating of fluid to all new seals prior to installation.
2. Place the housing on a clean, flat surface with the output end facing up.
   - Install the dust seal with the lip on the seal facing up.
   - Clamp the housing in a vise with the pilot on the housing facing down.
   - Install the metal backup shim into the bore.
   - Install the backup seal into the housing bore with the lip on the seal facing up.
   - Install the shaft seal into the housing bore with the lip on the seal facing up.
   - Refer to illustration for seal orientation.
3. Install the bearing shims (not shown in illustration) in housing.
   - Install housing bearing.
   - Install the shaft being careful not to cut seal lip with the shaft keyway.
4. Locate the 2 thick disk stampings and set them aside.
   - Install one (1) thick disk stamping into the housing. Make sure that lugs or splines engage those in the housing.
   - Install one (1) friction disk engaging splines on the disk with those on the shaft.
   - Alternate disk stampings and friction disks until all disks except the thick disk stamping are installed.
   - Install the second thick disk stamping on top of the disk assembly.

5. Install the small O-Ring seal and large O-Ring seal into corresponding groves in the piston.
   - Install small seal and large seal in corresponding groves over the O-Ring seals.
   - Thoroughly coat the seals and sealing surfaces of the housing with clean fluid.
   - Install the piston into the housing with the large O.D. side facing up.
   - Evenly press the piston down. Be careful not to pinch the seals.

***IMPORTANT: –*** If replacing the disks and disk stampings, the new stack must be between .620 and .630 in. thick (15.7 mm and 16 mm) (see illustration).

6. Install spring on top of the piston.
   - Install O-Ring seal in groove in the rear surface of the housing.
   - Install the rear shaft bearing. Make sure that the snap ring that retains the bearing rolls faces out.
   - Place the rear housing onto the front housing and line up bolt holes.
   - Hold the motor assembly together, remove from the vise and place in an arbor press.
   - Press down on the rear housing until it contacts the front housing and lock the press
   - Install eight (8) cap-screws and torque to 45 ft. lbs. (61 Nm).
7. Install the drive link into the end of the shaft with the tapered end facing up.
   - Place the body seals in the grooves in both sides of the rotor.
   - Place the rotor onto the housing with the side of the rotor with the chamfer in the splines facing the housing.
   - Place the manifold over the rotor with the seal groove side up.
   - Install the manifold seal.
8. Install the commutator seal into the commutator with the metal side facing out.
   - Use finger pressure to press the seal down flush with the surface of the commutator.
   - Place the commutator onto the manifold and then place the commutator onto the protruding end of the drive link. Make sure that the seal side is facing up.
9. Install the remaining body seal in the groove on the end-cover.
   - Install the piston spring into the end-cover, then the white backup seal followed by the O-Ring seal.
   - Line up the alignment pin with the hole in the end-cover and press the piston into the end-cover.
   - While holding the piston in place, lower the end-cover assembly onto the motor. Align the “V” shaped marks that were made on the housing and end-cover before disassembly.
10. Install the seven (7) assembly bolts.
    - Tighten bolts in sequence (see illustration)
    - Pre-torque to 10 ft. lbs (13.6 Nm).
    - Final torque to 50 ft. lbs (67.8 Nm).

***Figure 1-11:*** Rear Wheel Motor (DT-710) Exploded View




| DT710 BRAKE MOTOR COMPONENTS | |
|---|---|
| 1. * Dust Seal | 20. Piston |
| 2. * Metal Backup Shim | 21. Springs (25) |
| 3. * Backup Seal | 22. Spacer Shims (1–3) |
| 4. * Shaft Seal | 23. Rear Housing |
| 5. * Small Piston O-Ring Seal | 24. Capscrews (8) |
| 6. * Small Piston Seal | 25. Drive Link Spacer |
| 7. * Large Piston O-Ring Seal | 26. Drive Link |
| 8. * Large Piston Seal | 27. Rotor Assembly |
| 9. * O-Ring Seal | 28. Manifold |
| 10. * Body Seals (3) | 29. Commutator Assembly |
| 11. * Manifold Seal | 30. Endcover Piston |
| 12. * Commutator Seal | 31. Piston Spring |
| 13. * O-Ring Seal | 32. Endcover |
| 14. * Backup Seal | 33. I.D. Tag Assembly |
| 15. Housing | 34. Assembly Bolts (7) |
| 16. Shaft Bearing | 35. Shaft |
| 17. Friction Disks (10) | 36. Shaft Key |
| 18. Disk Stampings (9) | 37. Shaft Nut |
| 19. Thick Disk Stampings (2) | |
| *Seal kit components | |

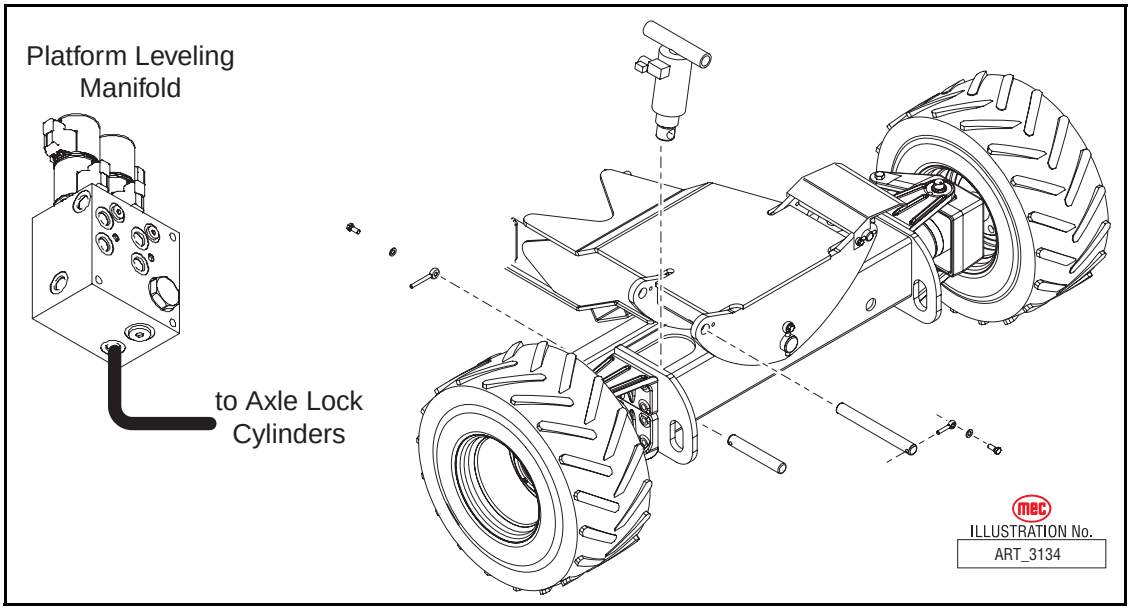
ILLUSTRATION No.
ART_2549

# FLOATING AXLE LOCK CYLINDERS

**NOTE: Refer to *Cylinder Repair*.**
**Refer to *Section 3* for Remove and Replace instructions.**
**Refer to the *Parts Manual, Section E* for parts list.**

There are two (2) cylinders in the floating axle system. These cylinders allow fluid to transfer from one side to the other while the platform is in the stowed position. When the platform is elevated, the electrically operated valve closes, preventing fluid flow and thereby locking the cylinders.

***Figure 1-12:*** Axle Lock Cylinder



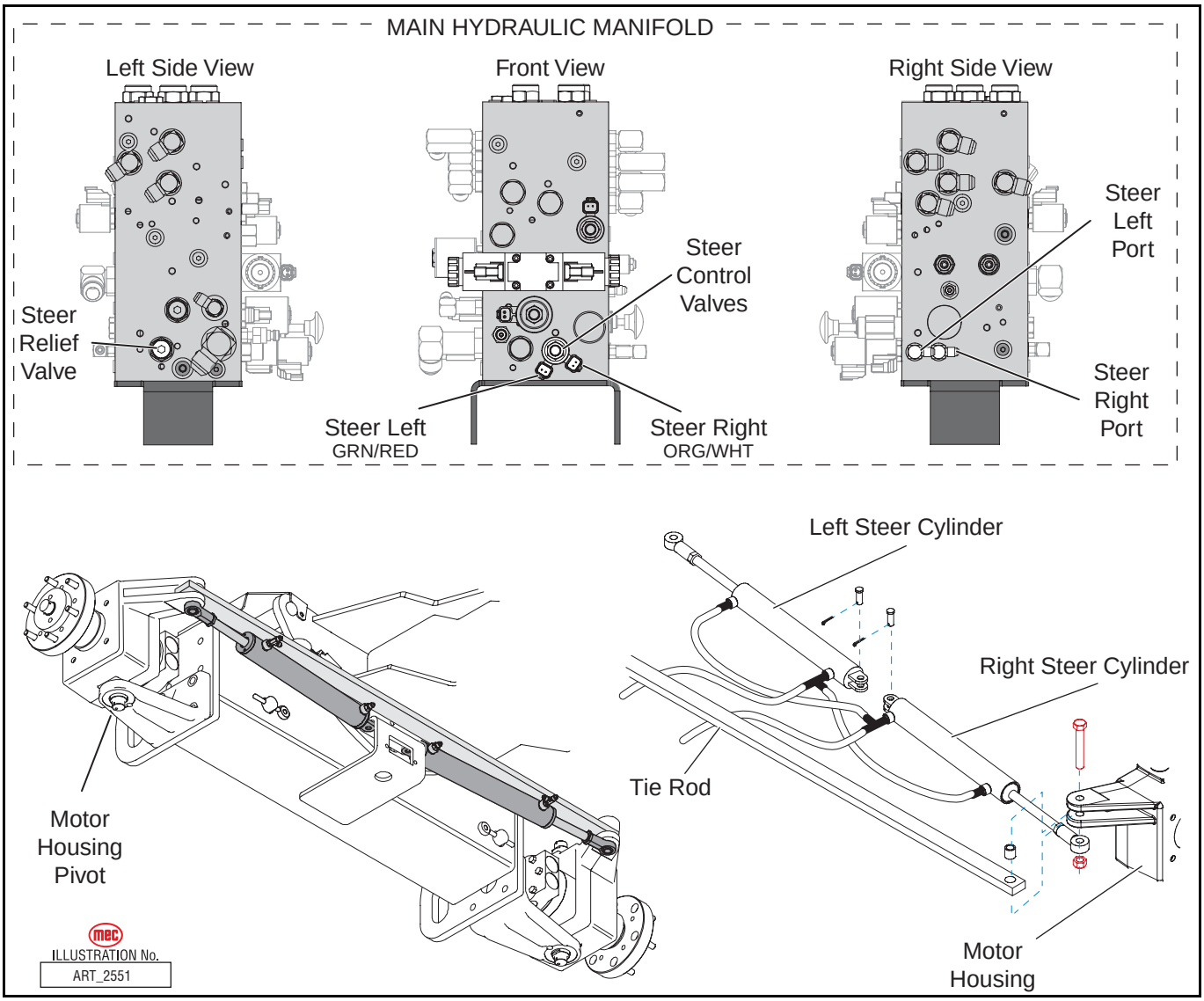
# STEERING CIRCUIT

**NOTE: Refer to *Hydraulic Manifold* and *Relief Pressure Adjustment Procedure*.**
**Refer to *Section 3* for Remove and Replace instructions.**
**Refer to *Parts Section E* for hose routing.**

The steering system consists of the following components:

- The wheel motor housings have pivots on the top and bottom, and are mechanically linked together via a tie-rod.
- Steering is accomplished hydraulically by using two (2) double-acting cylinders, and a 4-way 3-position solenoid-operated, hydraulic directional control cartridge valve.
- Maximum steering pressure is limited by the steering relief valve (refer to *Relief Pressure Adjustment Procedure*).

***Figure 1-13:*** Steering Circuit

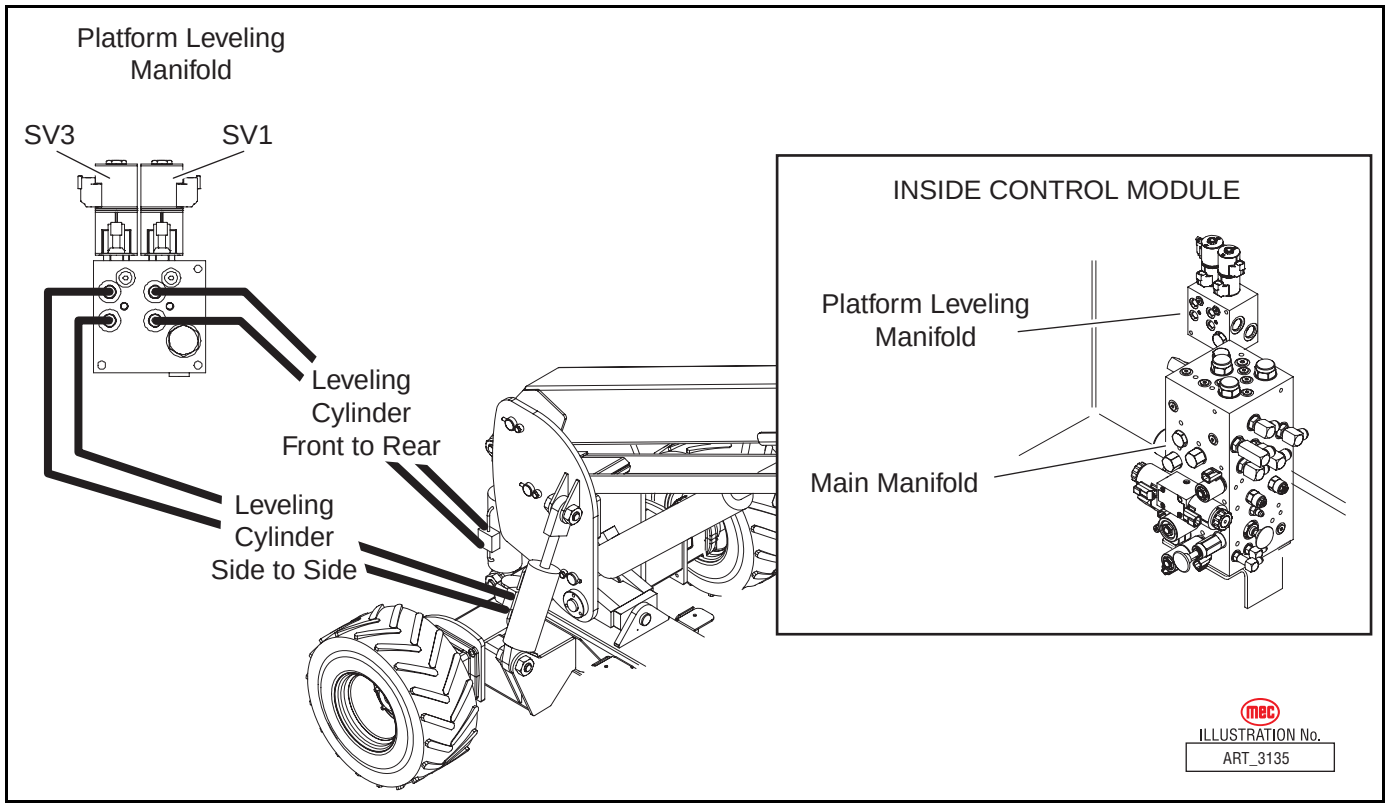


# PLATFORM LEVELING SYSTEM

There are two (2) hydraulic cylinders in the platform leveling system. These cylinders work in conjunction with a pivot mount to allow the platform and boom to tilt front-to-rear and side-to-side in order to provide a level work platform.

Automatic leveling is controlled by the GP400 processor.

***Figure 1-14:*** Platform Leveling Manifold and Cylinders

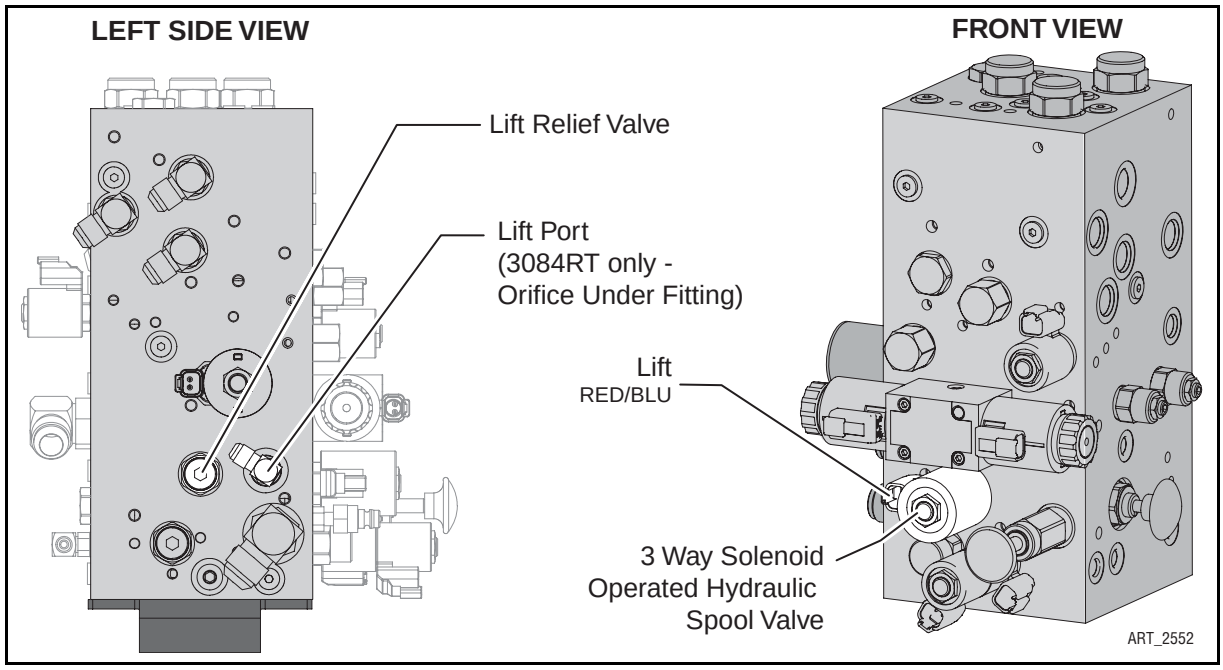


# PLATFORM LIFT CIRCUIT

**NOTE: Refer to *Hydraulic Manifold* and *Relief Pressure Adjustment Procedure*.**
**Refer to *Section 3* for Remove and Replace instructions.**

- On model 3084RT, the lift system uses the hydraulic pump to obtain proportional lifting function controlled by the lift valve and proportional valve.
- On model 3084ES, the lift system uses the electric motor to obtain proportional lifting function controlled by the lift valve.
- Lowering is single speed. When lowering, the holding valve on the lift cylinder opens allowing gravity to lower the platform. Lowering speed is regulated by a fixed orifice located on the lift cylinder.
- **ANSI:** Platform capacity is limited by a hydraulic relief valve in the lift circuit. (Refer to Machine Specifications or the Hydraulic Schematic for proper setting).
- **CE:** Lift capacity is controlled by the Overload System.

***Figure 1-15:*** Platform Lift, Main Hydraulic Manifold



## LIFT CYLINDER

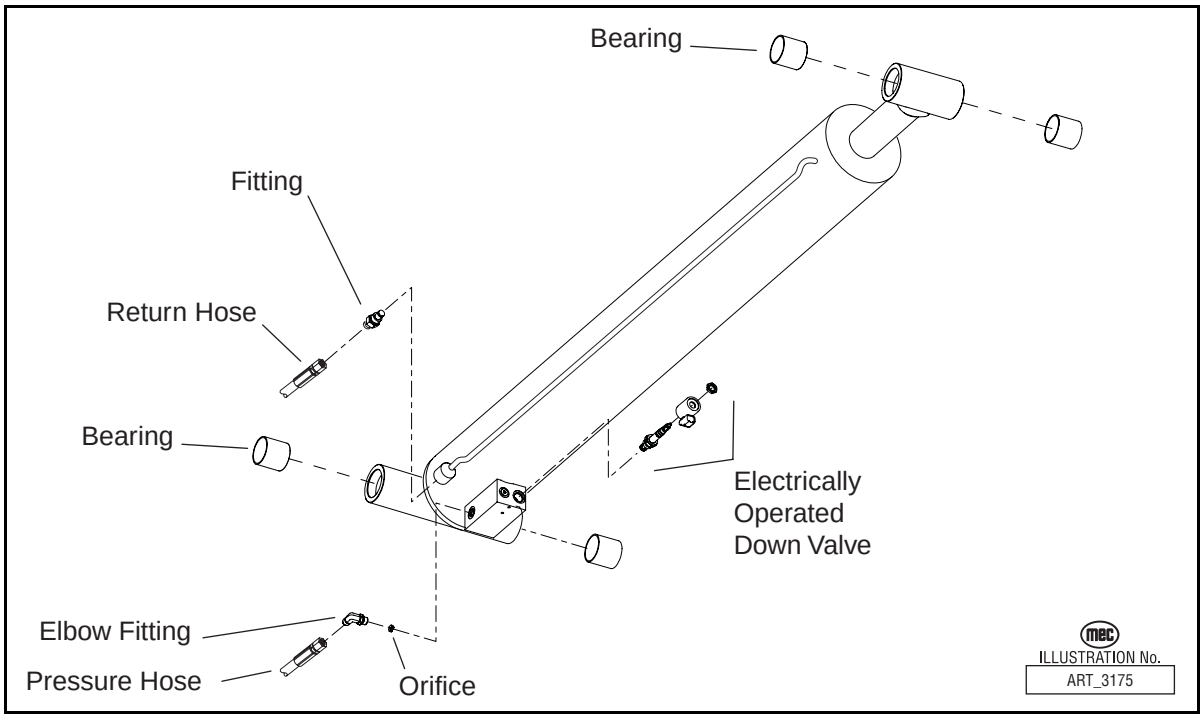
**NOTE:** Refer to ***Cylinder Repair***.

One (1) single acting type hydraulic cylinder.

The cylinder has an integrated 2-position, 2-way solenoid operated platform lower valve for holding the platform in position. The valve is also electrically actuated via a toggle switch for manually lowering the platform.

The normally-closed holding valve prevents retraction of the cylinder rod should a hydraulic line rupture or a leak develop between the cylinder and its related control valve.

***Figure 1-16:*** Lift Cylinder

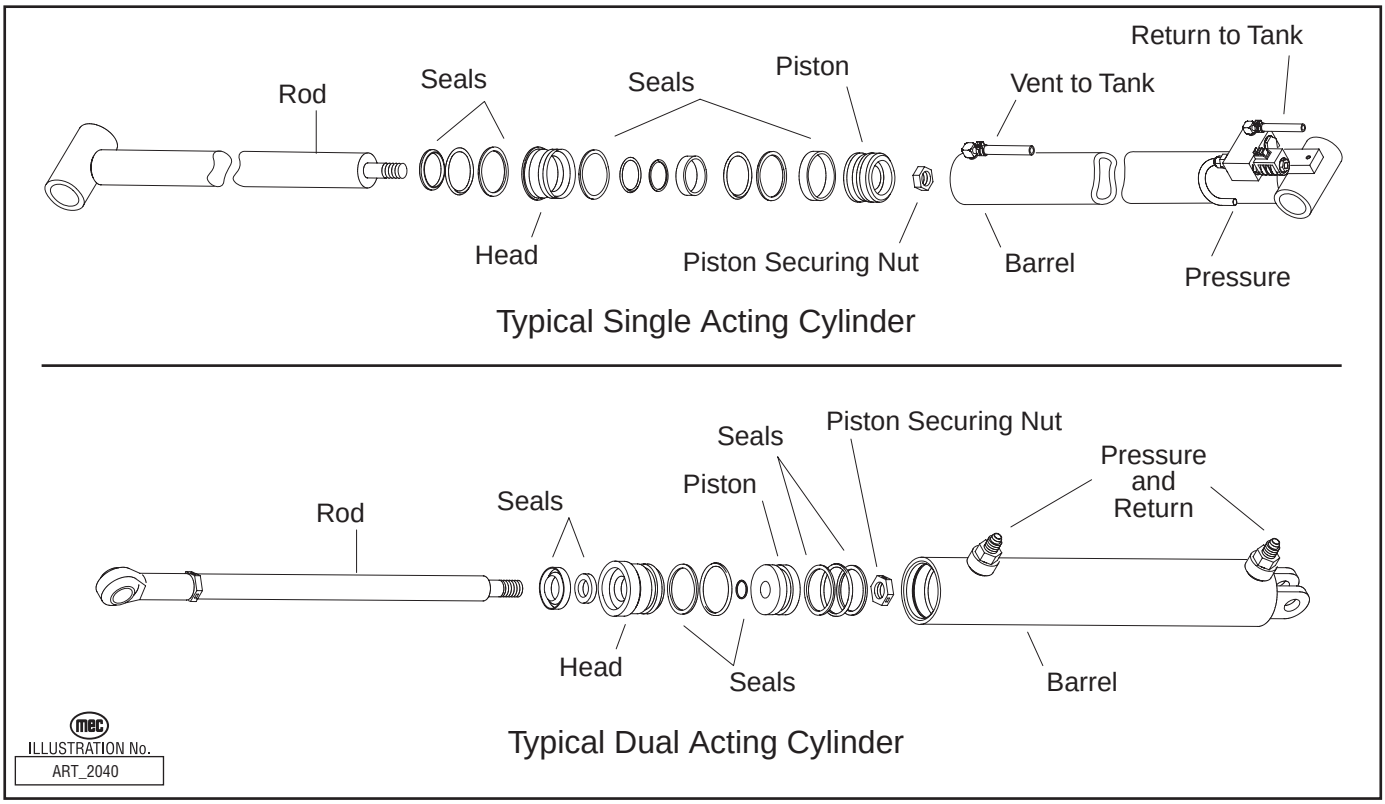


# GENERAL CYLINDER REPAIR

**WARNING**

**CYLINDERS ARE HEAVY. SUPPORT CYLINDERS BEFORE REMOVING HARDWARE THAT SECURES THE CYLINDER TO THE MACHINE.**

***Figure 1-17:*** Typical Cylinders, Exploded View




## REMOVAL

**NOTE: Refer to *Section 3* for Remove and Replace instructions, and the *Parts Manual* for a list of hardware specific to the cylinder being repaired.**

1. Tag hoses for proper reassembly.
2. Disconnect hoses and IMMEDIATELY cap the openings to prevent contamination.
3. Remove cylinder from the machine as described in *Section 3*.

## PREPARATION

**CAUTION**

**Take precautions to protect the rod surface. Guard against dirt or other foreign objects entering system.**

1. Drain all fluid from cylinder.
2. Clean all dirt and grit from outside of cylinder.
3. Insert cylinder into vise.

## CYLINDER DISASSEMBLY

1. Remove the head from the cylinder body.
2. Remove the shaft assembly from the barrel, pulling in a straight line, so as not to scar the internal parts.
3. Insert shaft into a **soft jawed** vise so that the head and piston can be removed. Be sure the shaft and vise are both clean before using.
4. Remove nut at the end of the shaft and pull head and piston off of the rod.
5. Remove all seals from the head and piston using a non-sharp seal tool. These tools are available from various seal suppliers.
6. Clean all fluid and debris off of the head, piston, shaft, collar and barrel using solvent, rags, and an air hose.
7. Inspect parts for scratches, pits or polishing. Check seal groves and sealing surfaces.
   a. Scratches or pits deep enough to catch the fingernail are unacceptable; replace the cylinder.
   b. Polishing is a sign of uneven loading. Check for roundness. If a polished surface is not round within .007 in. (0.18 mm) replace the cylinder.

# CYLINDER ASSEMBLY

**CAUTION:**

- To insure a quality repair, cylinder parts must be thoroughly cleaned, dry, and free of solvents, and assembly must be performed in a clean area free of dust and contamination.
- Do not use sharp edged tools during seal replacement. After installing seals wait at least one hour before assembling the cylinder to allow the seals to return to their original shape.
- Torque all hardware according to the Hydraulic Components Torque Table unless otherwise specified.

1. Lubricate all components with clean hydraulic fluid.
2. Install new seal kit components. Install all seals on the head and piston using the non-sharp seal tool.
3. Place a small amount of fluid on the inside head seals. Reinstall the head on the shaft by slipping head over the piston end of the shaft. Be very careful not to damage the inside seals.
4. Place a small amount of fluid on the inside seals of the piston. Reinstall the piston on the shaft by slowly twisting the piston onto the threads of the shaft. Be very careful not to damage the inside seals.
5. Reinstall the shaft nut. Torque 1 ½" nut to 160 ft. lbs. (216 Nm).
6. Grease the outside seals of the head and piston.
7. Reinstall the shaft into the barrel of the cylinder and push in until groove of the head lines up with the slot in the barrel.
8. Reinstall the cylinder retainer. Installation is reverse of removal.
9. Cycle the cylinder using air to check for proper operation.

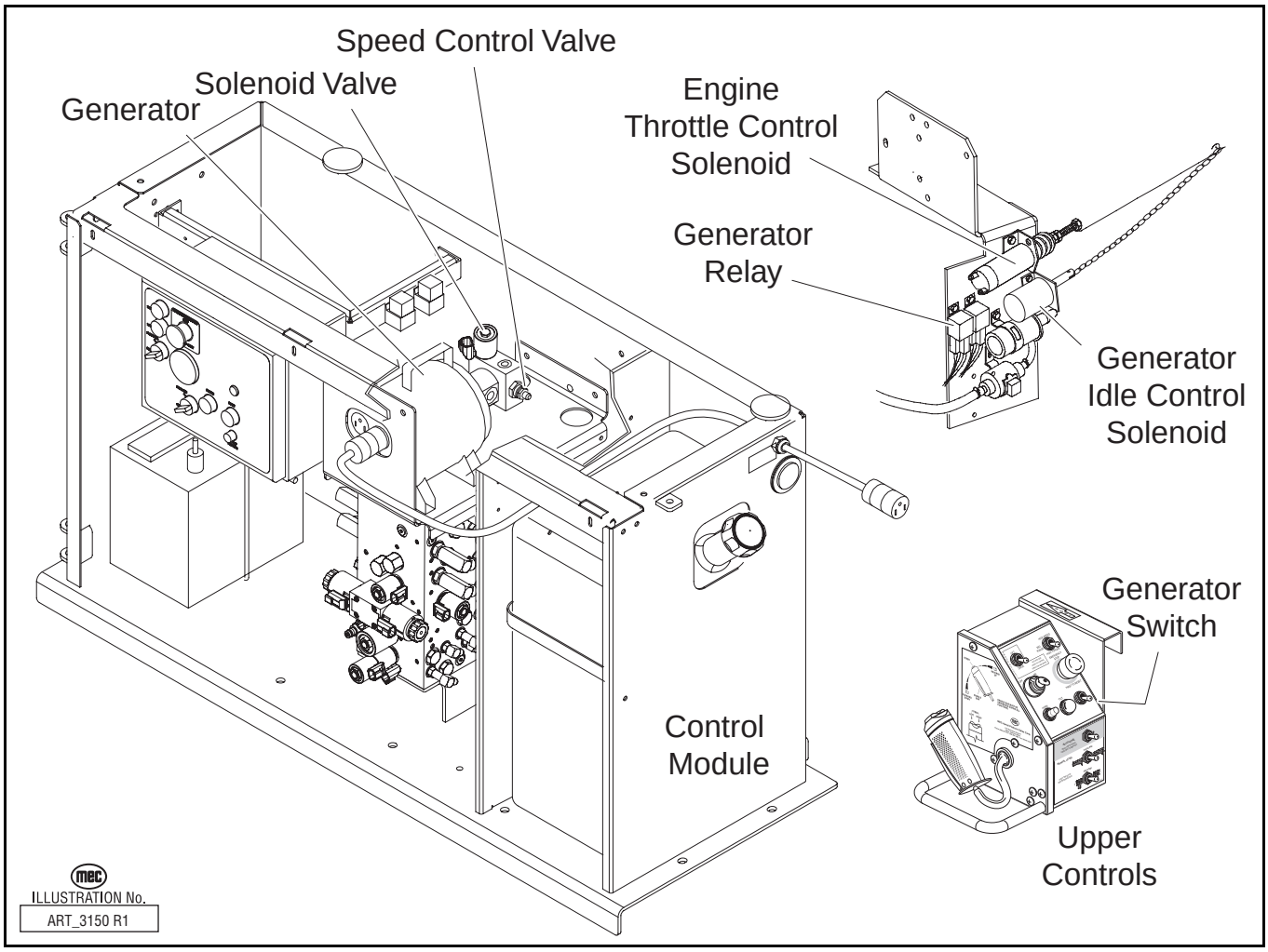
**NOTE: Keep all parts clean when working with hydraulic cylinders. Even one small piece of dirt or grit can damage the cylinder.**

# GENERATOR OPTION - 3084RT

**NOTE:** **Refer to *Section 6,***
**Refer to *Parts Sections E and F***

This option is available only on model 3084RT.

***Figure 1-18:*** Optional Generator Connections



## NOTES:

# Section 2

# Electrical System

## Contents

## FIGURES PAGE

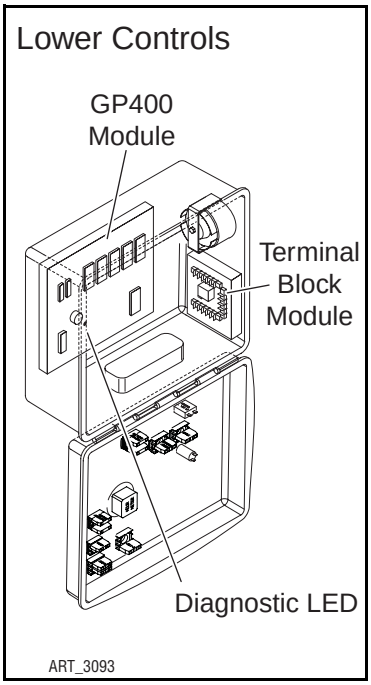


## TABLES PAGE

# ELECTRICAL SYSTEM – GENERAL

The electrical control system consists of lower controls located on the machine base and upper controls located on the machine platform. Emergency lowering controls are also located on the machine base.

***Figure 2-1:*** Diagnostic LED




## LOWER CONTROLS

The lower controls will operate all functions except the steer, drive and level functions.

## UPPER CONTROLS

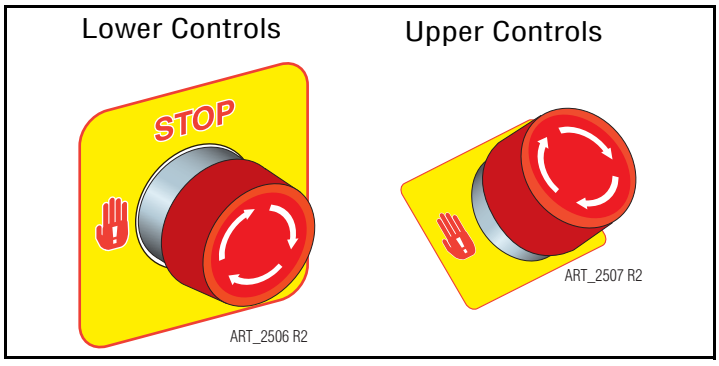
The upper controls will operate all functions including drive, steer, lift, and lower. A momentary bi-directional rocker switch on the joystick provides the steering function. The control system for operation of drive, steer, lift, and lower are electric-over-hydraulic type. The drive system is a proportional system controlled by position and direction of the upper controls joystick.

## EMERGENCY STOP

There are two red Emergency Stop switches: One located on the upper controls and one on the lower controls. Activation of either Emergency Stop switch will immediately cut electrical power to all controls, thereby stopping all machine functions. Press the switch to stop all electrical power and turn the switch clockwise to reset.

When both Emergency Stop switches are “set”, the controls have electrical power and the machine will operate.

***Figure 2-2:*** Emergency Stop Switches




**NOTE: Both switches must be set or the machine will not operate.**
**The electric Emergency Lowering switch will continue to function when the Emergency Stop switches are depressed.**

## EMERGENCY LOWERING

The machine utilizes a toggle switch to open the down valve on the lift cylinder, allowing hydraulic fluid to return to the hydraulic reservoir at a controlled rate.

## DIAGNOSTIC LED

If the machine fails to operate, inspect the GP400 Module located inside the control box. The LED located on the processor should be *ON*. If the LED is *OFF* or FLASHING, refer to *Section 4: Troubleshooting*.

## START DELAY LIGHT - 3084RT

The START DELAY light is located on the Lower Control box (see Figure 2-4 on Page 2-8).

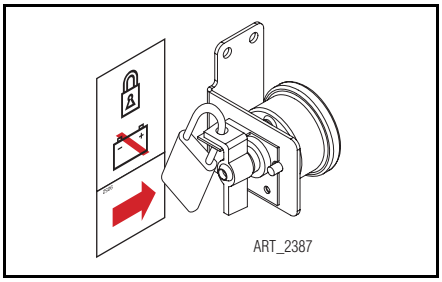
The machine is equipped with a start system protective device, controlled by the GP400. This protects the starter and related parts from damage caused by over-cranking in hard starting situations.

- Maximum starter operation time is 10 seconds.
- If no start, the START DELAY light will illuminate and the starter will be disabled for 35 seconds.
- When the START DELAY light goes OFF the starter will operate.

## BATTERY DISCONNECT SWITCH

All electrical power is routed through the Master Disconnect switch located in the Control Module. The switch can be locked in the OFF position with a padlock to prevent unauthorized use.

***Figure 2-3:*** Master Disconnect Switch



# BATTERIES

**CAUTION**

**Discharged batteries can freeze, causing damage to the battery and/or battery case. A broken battery case will allow electrolyte to leak out.**

**WARNING**

**CHARGING BATTERIES CREATE EXPLOSIVE HYDROGEN GAS. KEEP SPARKS, FLAMES AND SMOKING MATERIALS AWAY FROM BATTERIES.**

**ALWAYS WEAR SAFETY GLASSES WHEN WORKING WITH BATTERIES.**

**BATTERY FLUID IS CORROSIVE. THOROUGHLY RINSE SPILLED FLUID WITH CLEAN WATER.**

**REPLACE ONLY WITH MANUFACTURER-APPROVED BATTERIES.**

**BEFORE DISCONNECTING THE BATTERY NEGATIVE (–) LEAD, MAKE SURE THAT ALL SWITCHES ARE OFF. IF ON, A SPARK WILL OCCUR AT THE GROUND TERMINAL THAT COULD IGNITE HYDROGEN GAS OR FUEL VAPORS.**

***3084RT –*** One (1) battery (12 Volts DC) supplies the electrical power required to start the engine and operate the electrical circuits.

***3084ES –*** Eight (8) batteries (6 Volts DC) supply power required to operate the machine.

## BATTERY MAINTENANCE (IN STORAGE)

Follow these procedures for maintenance of battery on a machine not in use:

- Keep battery clean. Electrolyte of batteries should be checked regularly and kept at proper level.
- Never stack one battery directly on top of another because post or container damage can result. If batteries are stored individually, place supporting boards between layers. Rotate stock so that the oldest batteries are used first.
- Batteries should be kept fully charged. A battery, while in storage, should be recharged to full charge at recommended intervals.

### A BATTERY FULLY (100%) CHARGED AT 80°F (26.6°C)

- drops to 65% at 32°F (0°C)
- drops to 40% at 0°F (-32°C)

***Table 2-1:*** Recommended Battery Charge Intervals

| If Stored At | Recharge |
|---|---|
| Below 40°F (4°C) | Every week |
| 40°-60°F (4°-15°C) | Every 2 weeks |
| Above 60°F (15°C) | Every month |

## BATTERY MAINTENANCE (IN USE)

Check battery and surrounding area for signs of damage or corrosion.

Check battery terminals for:

- **Corrosion:** Regularly clean connections and apply a nonmetallic grease or protective spray to retard corrosion.
- **Loose connections:** Be sure all cable connections are tightly secured, and that good contact is made with terminals.
- **Broken or frayed cables:** Be sure all connections are good and that no loose or broken wires are exposed. Replace as necessary.

Check battery electrolyte level. Replenish the electrolyte, if necessary. Remove vent caps before filling, and USE ONLY DISTILLED WATER. DO NOT OVERFILL. Fill to level indicator (or ½ inch over the top of separators, if there is no level indicator). Fill after charging to prevent overflow of acid due to expansion. Do not use a hose to add water to batteries.

Allowing the electrolyte level to drop below the top of the separators will lead to shortened battery life.

Excessive water usage can indicate that a battery has been overcharged, has been subjected to excessively high temperatures, or is nearing the end of its service life.

### BATTERY PREVENTATIVE MAINTENANCE:

Every 15 hours (after battery has been charged), spot-check the specific gravity of two or more cells. A fully charged battery should indicate 1.28 specific gravity. If low readings are noted, check the following:

- Check terminals for corrosion, loose connections and broken or frayed cables.
- Check all cells with a hydrometer for variance in specific gravity. A variation of 0.03 points or more between cells is a cause for concern. Mark the low cells.

Recheck specific gravity of all cells after recharging. Wash the top of the battery, making sure all vents are in place. Do not allow cleaning water or other foreign matter to enter the cells. Use a solution of bicarbonate soda (5 tsp. of baking soda per quart of warm water) and water to wash the battery if there is an accumulation of acid.

***Table 2-2:*** Battery Specific Gravity and Voltage

| Specific Gravity | | Volts DC | | |
|---|---|---|---|---|
| | Each Cell | Per Cell | 6V Battery | 12V Battery |
| Fully Charged | 1.280 | 2.10 | 6.30 | 12.60 |
| Fully Discharged | 1.130 | 1.75 | 5.19 | 10.50 |

# BATTERY REPLACEMENT

**WARNING**

**TURN OFF THE BATTERY DISCONNECT SWITCH BEFORE REMOVING ANY BATTERY FROM THE MACHINE.**

**CAUTION**

**Prevent damage to the battery and/or electrical system;**

- **Always disconnect the negative battery cable first.**
- **Always connect the positive battery cable first.**

### TO REMOVE A BATTERY;

1. Turn the Battery Disconnect switch to OFF.
2. Disconnect the battery cables and remove battery hold-down hardware.
3. Lift the battery from the compartment, put the battery aside and dispose of properly.

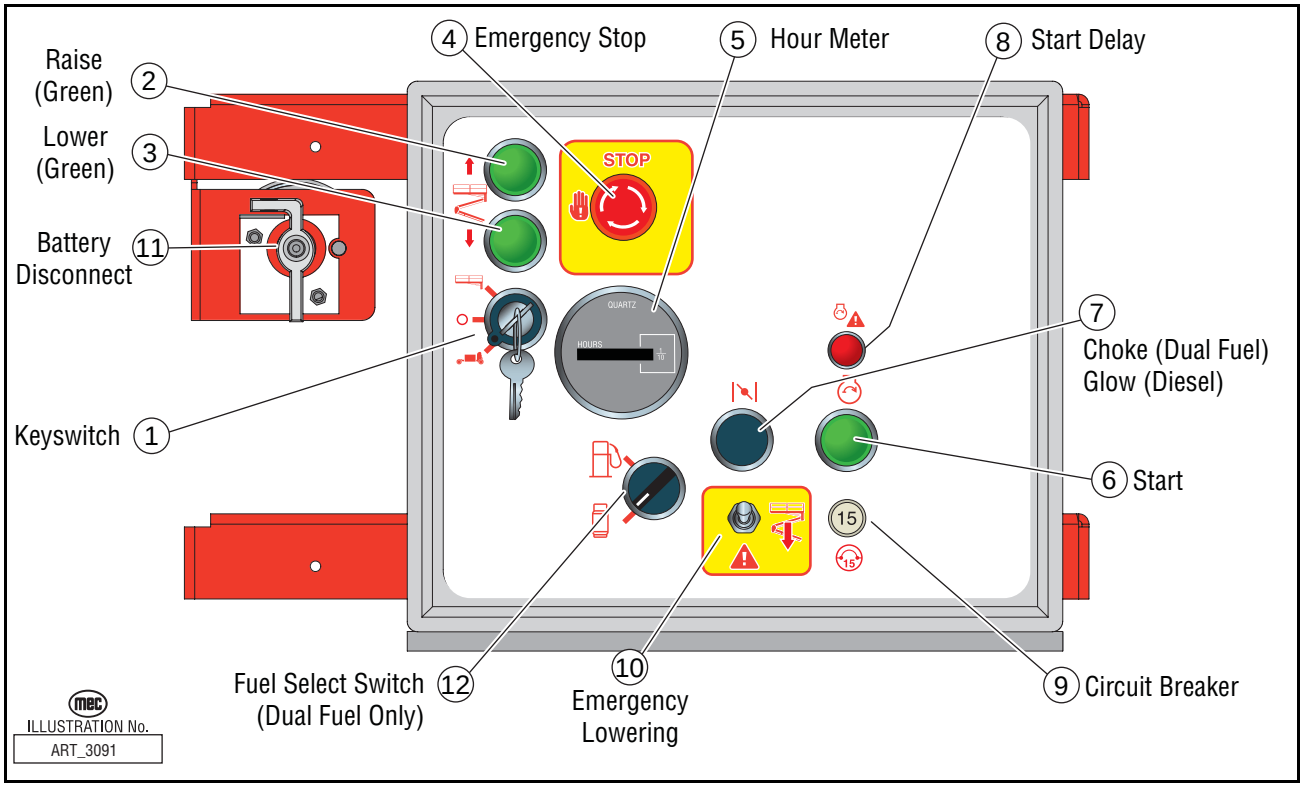
### TO INSTALL A BATTERY;

1. Position the battery in the compartment and secure with hold-down hardware.
2. Connect battery cables.

# CONTROLS

## LOWER CONTROLS - 3084RT DUAL FUEL/DIESEL

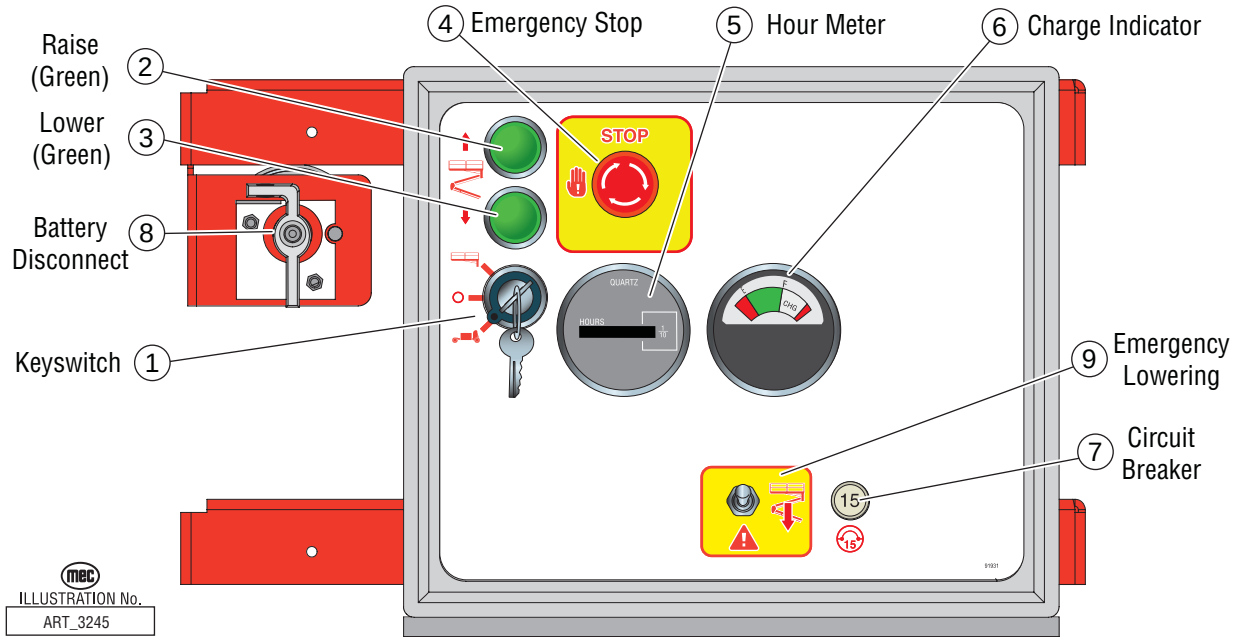
***Figure 2-4:*** Lower Controls--Dual Fuel




| | CONTROL | DESCRIPTION | |
|---|---|---|---|
| 1 | Selector Switch (key can be removed in any position) | PLATFORM | Select to operate from the platform control panel. |
| | | BASE | Select to operate from the base control panel. |
| | | OFF | Select to stop operation from either control panel. |
| 2 | RAISE Button | Press and hold to elevate the platform. Release to stop elevation. Throttle activation is automatic. | |
| 3 | LOWER Button | Press and hold to lower the platform. Release to stop lowering. | |
| 4 | EMERGENCY STOP Switch | Press to stop all machine functions.<br>Turn *clockwise* to reset. | |
| 5 | Hour Meter | Indicates total elapsed time of machine operation. | |
| 6 | Start Button | Press to start engine. Release when engine starts. | |
| 7 | Choke/Glow | Operate when starting in cold start conditions. | |
| 8 | Start Delay Light | Prevents over-cranking of engine. When lit, starter is disabled. After approximately 35 seconds the light will go out and starter will operate. | |
| 9 | Circuit Breaker | Trips when there is excessive electrical load. Push to reset. | |
| 10 | EMERGENCY LOWERING Switch | Push and hold the toggle switch Down to fully lower the platform. | |
| 11 | Battery Disconnect | Battery power supply. Turn OFF and padlock to secure machine from unauthorized use. | |
| 12 | Fuel Selector (Dual Fuel Only) | Turn switch to select Gasoline or Propane. | |

# LOWER CONTROLS - 3084ES ELECTRIC

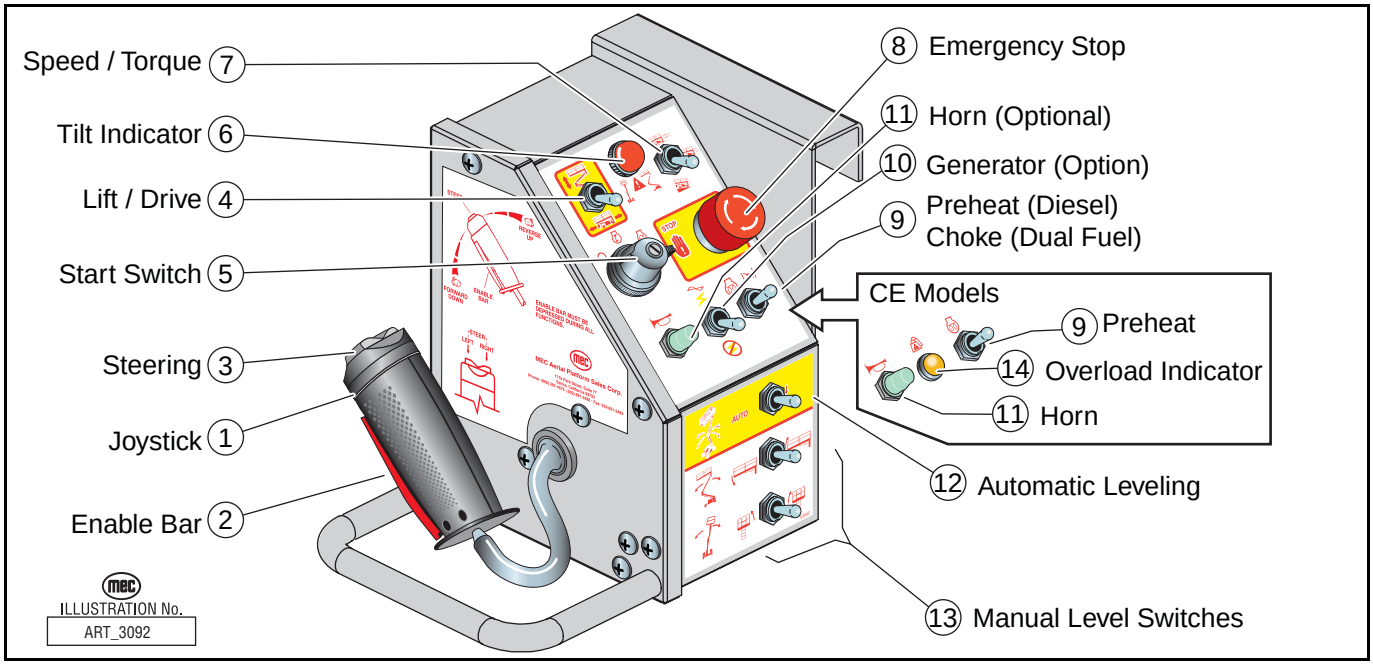
***Figure 2-5:*** Lower Controls--Electric




| | CONTROL | DESCRIPTION | |
|---|---|---|---|
| 1 | Selector Switch (key can be removed in any position) | PLATFORM | Select to operate from the platform control panel. |
| | | BASE | Select to operate from the base control panel. |
| | | OFF | Select to stop operation from either control panel. |
| 2 | RAISE Button | Press and hold to elevate the platform. Release to stop elevation. Throttle activation is automatic. | |
| 3 | LOWER Button | Press and hold to lower the platform. Release to stop lowering. | |
| 4 | EMERGENCY STOP Switch | Press to stop all machine functions.<br>Turn *clockwise* to reset. | |
| 5 | Hour Meter | Indicates total elapsed time of machine operation. | |
| 6 | Charge Indicator | Indicates state of battery charge. | |
| 7 | Circuit Breaker | Trips when there is excessive electrical load. Push to reset. | |
| 8 | Battery Disconnect | Battery power supply. Turn OFF and padlock to secure machine from unauthorized use. | |
| 9 | EMERGENCY LOWERING Switch | Push and hold the toggle switch Down to fully lower the platform. | |

# UPPER CONTROLS - 3084RT DUAL FUEL/DIESEL

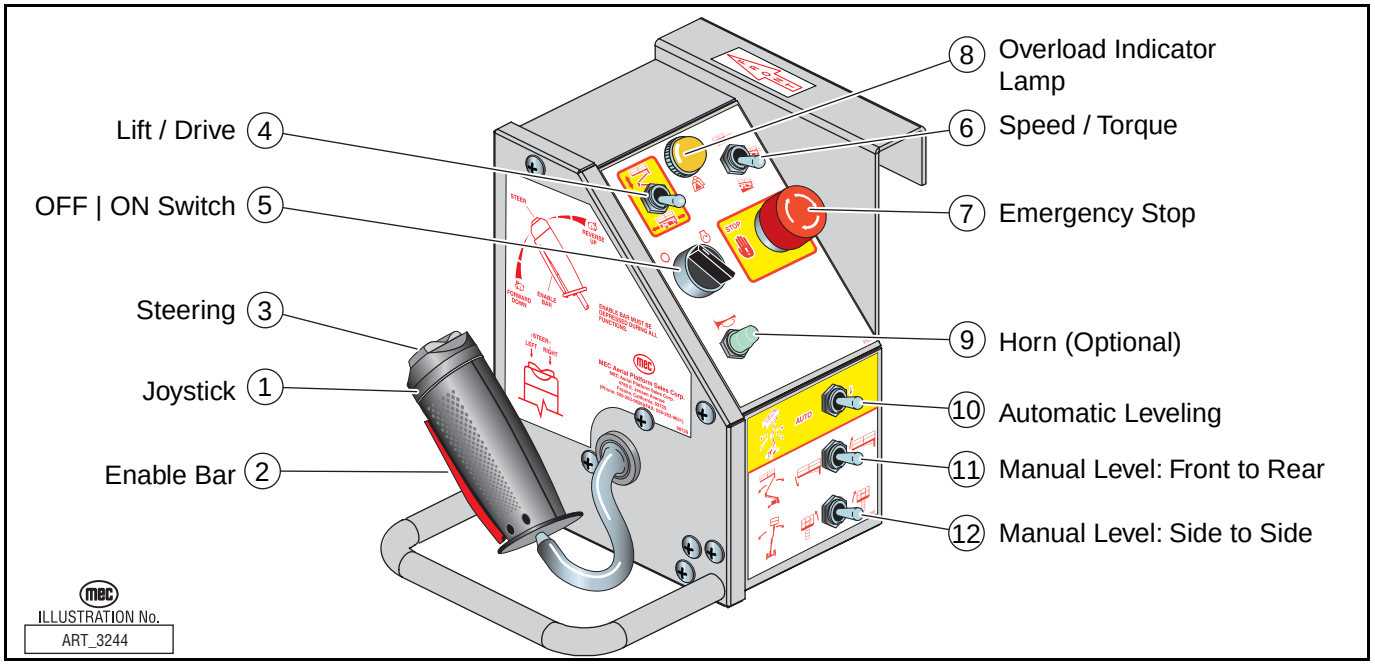
***Figure 2-6:*** Upper Controls--Dual Fuel




| | CONTROL | DESCRIPTION | |
|---|---|---|---|
| 1 | Joystick | DRIVE | Controls Forward and Reverse travel at variable speeds. |
| | | LIFT | Move toward operator to elevate platform. Lift speed increases proportional to the joystick movement. Will not function if TILT light is *ON*.<br>Move away from operator to lower platform. Speed is fixed. |
| 2 | Enable Bar | Squeeze to enable DRIVE, STEER, and LIFT from joystick. | |
| 3 | Steering Switch | Using thumb, press and hold the rocker switch to steer Left or Right. | |
| 4 | Lift/Drive Selector | Select LIFT or DRIVE function for joystick. | |
| 5 | Start Switch | Turn to start engine. Switch will return to RUN position for normal operation.<br>Turn to *OFF* to shut engine down. Anti-restart switch must be turned OFF before attempting to start. | |
| 6 | Tilt Indicator Light | Light *ON* indicates platform out of level. Platform will not elevate when TILT light is *ON*. | |
| 7 | Speed / Torque Switch | HIGH TORQUE | Slow speed. Provides maximum torque for rough terrain and climbing. |
| | | MID RANGE | Mid speed. Provides medium torque for smooth to moderate terrain. |
| | | HIGH SPEED | Provides high speed when platform height is below 10 feet (3 m). |
| 8 | EMERGENCY STOP Switch | PUSH to stop all machine functions.<br>TURN CLOCKWISE to reset. | |
| 9 | Choke/Preheat | Operate when starting in cold start conditions. | |
| 10 | Generator (option) | Turn switch ON to engage optional AC generator. Drive and Lift are disabled while the generator is on. | |
| 11 | Horn (option) | Press to sound warning horn. | |
| 11 | Automatic Level Switch | Move switch DOWN and hold until automatic leveling is complete.<br>Tilt Light will turn *OFF* when platform is level. | |
| 12 | Manual Level Switch Front to Rear | Move switch to the left to LOWER the front of the platform.<br>Move the switch to the right to RAISE the front of the platform. | |
| 13 | Manual Level Switch Side to Side | Move the switch to the left to move the platform to the LEFT.<br>Move the switch to the right to move the platform to the RIGHT. | |
| 14 | Overload Indicator | Platform overloaded when light is ON. Alarms will sound in Upper and Lower Control boxes. | |

# UPPER CONTROLS - 3084ES ELECTRIC

***Figure 2-7:*** Upper Controls-Electric




| | CONTROL | DESCRIPTION | |
|---|---|---|---|
| 1 | Joystick | DRIVE | Controls Forward and Reverse travel at variable speeds. |
| | | LIFT | Move toward operator to elevate platform. Lift speed increases proportional to the joystick movement. Will not function if TILT light is *ON*.<br>Move away from operator to lower platform. Speed is fixed. |
| 2 | Enable Bar | Squeeze to enable DRIVE, STEER, and LIFT from joystick. | |
| 3 | Steering Switch | Using thumb, press and hold the rocker switch to steer Left or Right. | |
| 4 | Lift/Drive Selector | Select LIFT or DRIVE function for joystick. | |
| 5 | Off/On Switch | Turn power ON or OFF at the platform. Does not affect lower controls. | |
| 6 | Tilt Indicator Light | Light *ON* indicates platform out of level. Platform will not elevate when TILT light is *ON*. | |
| 6 | Speed / Torque Switch | HIGH TORQUE | Slow speed. Provides maximum torque for rough terrain and climbing. |
| | | MID RANGE | Mid speed. Provides medium torque for smooth to moderate terrain. |
| | | HIGH SPEED | Provides high speed when platform height is below 10 feet (3 m). |
| 8 | EMERGENCY STOP Switch | PUSH to stop all machine functions.<br>TURN CLOCKWISE to reset. | |
| 9 | Choke/Preheat | Operate when starting in cold start conditions. | |
| 10 | Generator (option) | Turn switch ON to engage optional AC generator. Drive and Lift are disabled while the generator is on. | |
| 11 | Horn (option) | Press to sound warning horn. | |
| 11 | Automatic Level Switch | Move switch DOWN and hold until automatic leveling is complete.<br>Tilt Light will turn *OFF* when platform is level. | |
| 12 | Manual Level Switch Front to Rear | Move switch to the left to LOWER the front of the platform.<br>Move the switch to the right to RAISE the front of the platform. | |
| 13 | Manual Level Switch Side to Side | Move the switch to the left to move the platform to the LEFT.<br>Move the switch to the right to move the platform to the RIGHT. | |
| 14 | Overload Indicator | Platform overloaded when light is ON. Alarms will sound in Upper and Lower Control boxes. | |

# ALARMS AND SWITCHES

## MOVEMENT ALARM

The Movement Alarm is activated as soon as the DOWN operation is activated from either control station. This is the default setting. If desired, the movement alarm setting can be modified to activate the alarm during other functions (refer to *Section 4: Troubleshooting)*.

**WARNING**

**THE MOVEMENT ALARM IS PROVIDED FOR YOUR PROTECTION, AND PROTECTION OF PERSONS WORKING IN THE IMMEDIATE AREA. DISABLING THIS IMPORTANT SAFETY DEVICE MAY RESULT IN SERIOUS INJURY OR DEATH.**

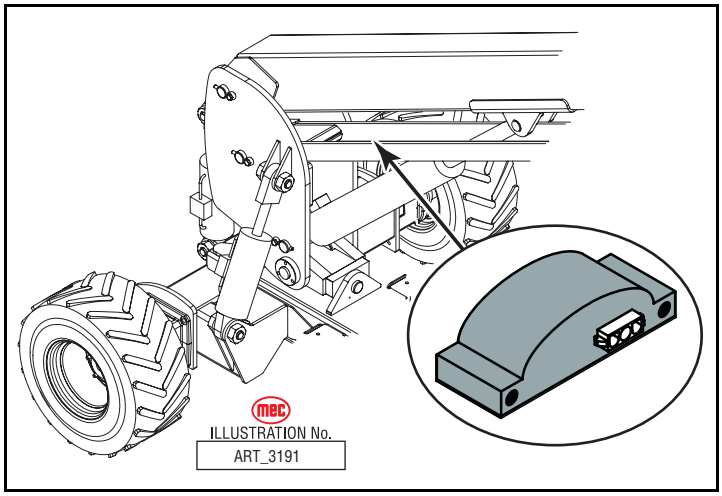
## EZFIT ANGLE SENSOR

The Angle Sensor provides platform elevation information to the GP400 control module. When the GP400 reads a certain output from the angle sensor it will:

- disable tilt operation.
- enable tilt sensor cutout operation.
- reduce drive speed.

On CE models, the Angle Sensor works in conjunction with the Pressure Transducer and a second redundant Angle Sensor located beside the first.

***Figure 2-8:*** EZfit Angle Sensor




## PRESSURE TRANSDUCER (CE ONLY)

The Pressure Transducer provides lift cylinder pressure information to the GP400. It works in conjunction with the Angle Sensor. Excessive pressure indicates platform overload. When the GP400 reads a certain output from the angle sensor it will:

- disable lift, lower and drive operation.
- sound audible alarms.
- turn ON the OVERLOAD light on the upper control panel.

***Figure 2-9:*** Pressure Transducer (CE Models)

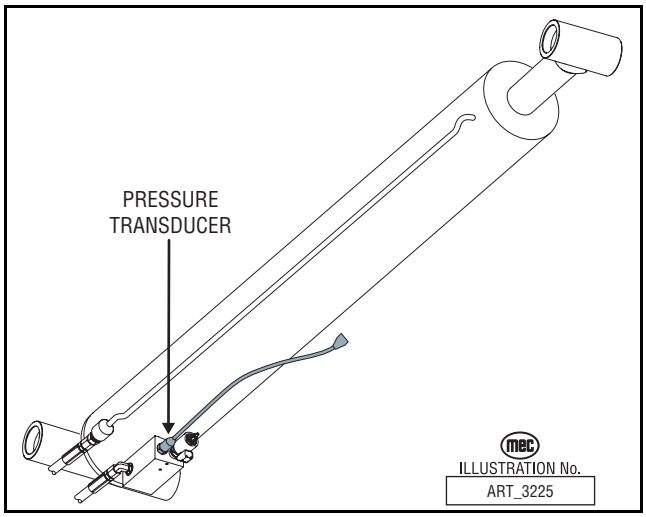
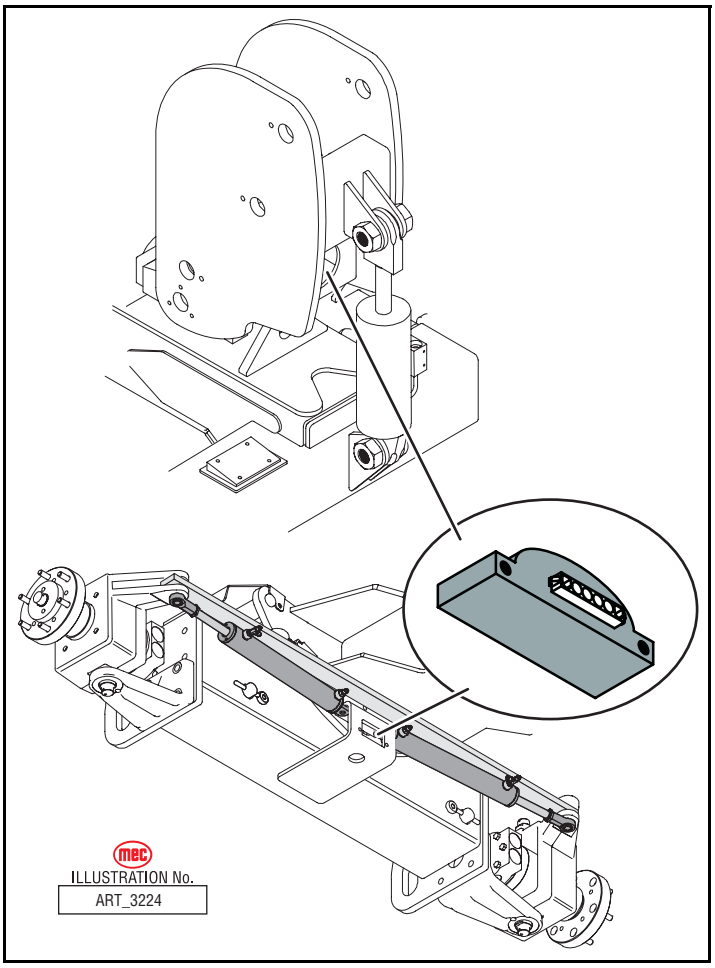


*Figure 2-10:* CAN Tilt Angle Transducer

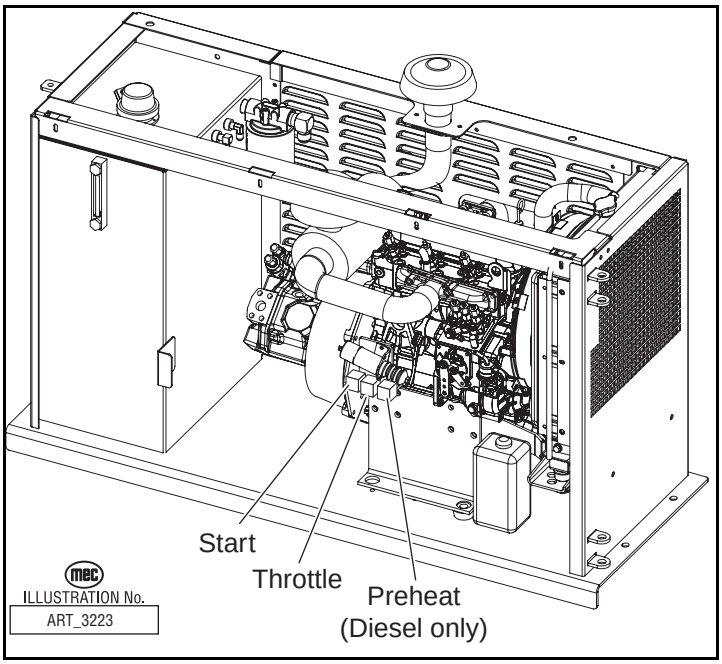



## CAN TILT ANGLE TRANSDUCER

Provides level information to GP400.

- **Platform Level** located on the mast assembly, accessible through the rear of the mast.
  Provides platform level information to the GP400 through the CAN-bus system.
- **Axle Level** located on the front axle near the steer cylinder mount.
  Provides axle position information to the GP400 through the CAN-bus system.

*Figure 2-11:* Relay Locations




## RELAYS - 3084RT ONLY

Relays are located on the engine inside the power module. These relays reduce the current flow through the GP400 Control Module. Refer to the Section 5 for relay functions and interconnect.

### START RELAY

Provides power to the starter solenoid.

### THROTTLE RELAY

Provides power to the electric throttle solenoid.

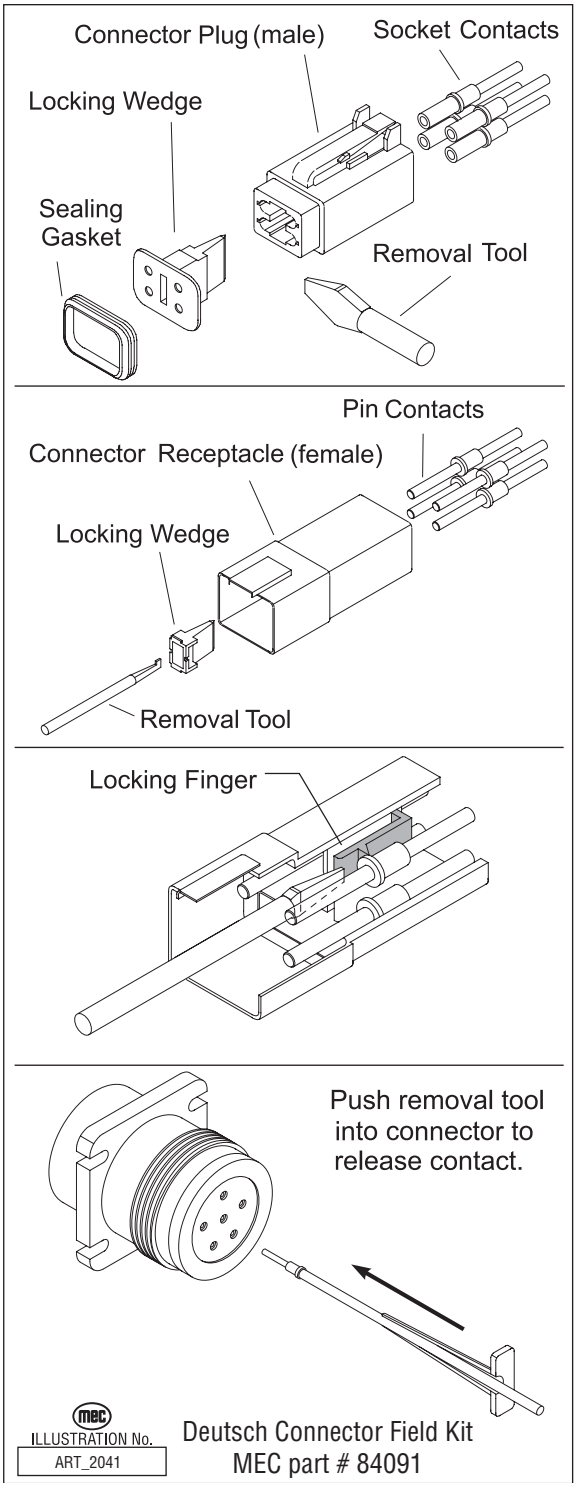
### PREHEAT RELAY (DIESEL ONLY)

Provides power to the diesel engine glow plugs.

# DEUTSCH CONNECTORS

Deutsch connectors used on MEC equipment are designed so that individual parts may be replaced without replacing the entire component. Special tools and detailed instructions are provided in Deutsch Connector field kits, MEC part no. 84091.

***Figure 2-12:*** Deutsch Connectors




## MALE PLUG CONNECTOR

- Use the flat end of the Removal Tool or a flat blade screwdriver to pry the locking wedge from the connector, taking care not to damage the Sealing Gasket.
- Inspect and replace damaged parts.
- Replace or re-crimp wires and contacts.

## FEMALE RECEPTACLE CONNECTOR

- Use the notched end of the removal tool or a wire hook to pull the locking wedge from the connector
- Replace worn or damaged parts
- Replace or re-crimp wires and contacts.

## LOCKING FINGERS

- Remove the locking wedge as outlined above.
- Using the removal tool or a flat blade screwdriver, push the Locking Fingers aside to release the contact.
- Pull the wire and contact out of the connector.

## HEAVY DUTY PLUG

- Slide the removal tool along the wire to be replaced and push into the connector to release the contact.
- Pull the wire and contact out of the plug.

## CRIMPING

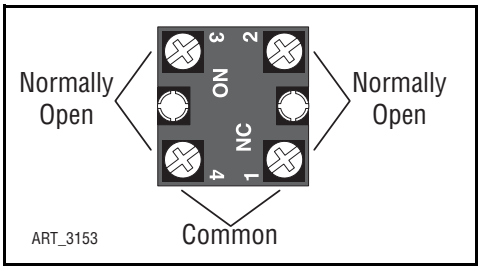
- Strip 1/4 in. (6 mm) insulation from the wire.
- Insert the contact into the crimping tool and insert the stripped wire into the contact making sure no wires are outside the contact barrel.
- Close the handles of the crimping tool, then release the handles to remove the crimped contact.

# CONTINUITY CHECKS

### SELECTOR SWITCH – ON-OFF

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to any normally open terminal.
- With switch OFF (open) there should be no reading.
- With the switch ON (closed) there should be a low reading.
- Repeat for each normally open terminal.

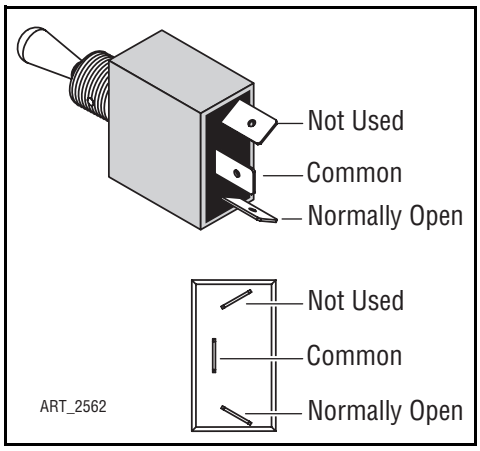
***Figure 2-13:*** Selector Switch




### TOGGLE SWITCH – ON-OFF

- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to normally open terminal.
- With the switch turned OFF there should be no reading.
- With the switch turned ON there should be a low resistance.

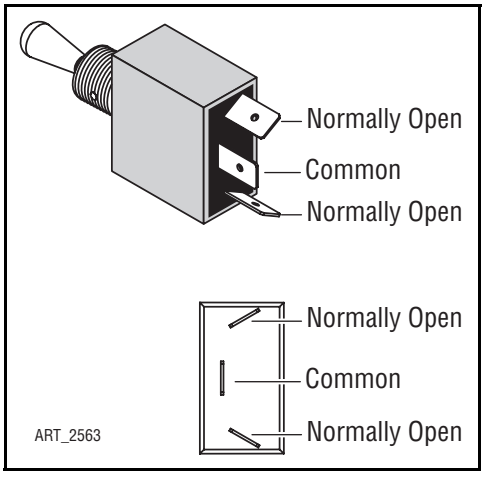
***Figure 2-14:*** Toggle Switch, ON-OFF




### TOGGLE SWITCH – 1-POLE 2-POSITION

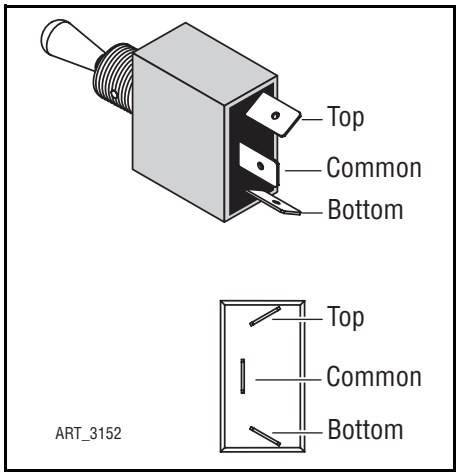
- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe to *top* normally open terminal.
- With toggle DOWN there should be no reading.
- With the toggle UP there should be a low resistance.
- Move second probe to *bottom* normally open terminal.
- With toggle UP there should be no reading.
- With the toggle DOWN there should be a low resistance.

***Figure 2-15:*** Toggle Switch, 1-Pole 2-Position



## TOGGLE SWITCH – 1-POLE 3-POSITION

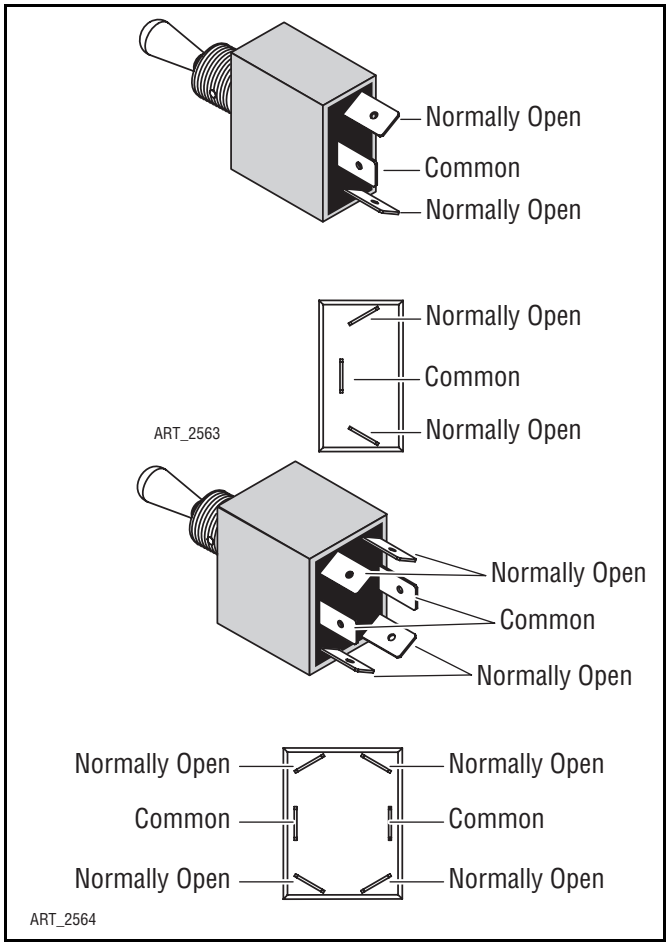
***Figure 2-16:*** Toggle Switch, 1-Pole 3-Position




- Disconnect wires.
- Connect first probe of ohm meter to *common* terminal.
- Connect second probe of ohm meter to *top* terminal.
- With the toggle UP or MIDDLE there should be a low resistance.
- Move second probe to *bottom* terminal.
- With the toggle DOWN or MIDDLE there should be a low resistance.
- Connect first probe of ohm meter to *top* terminal.
- Connect second probe of ohm meter to *bottom* terminal.
- With toggle in ANY POSITION there should be no reading.

## TOGGLE MOMENTARY SWITCH

***Figure 2-17:*** Toggle Switch, Momentary




- Disconnect wires.
- Connect first probe of ohm meter to common terminal.

### *Test top position*

- Connect second probe to *top* normally open terminal.
- With the toggle in the neutral (open) position there should be no reading.
- With the toggle UP (closed) there should be a low resistance.
- With the toggle DOWN (closed) there should be no reading.

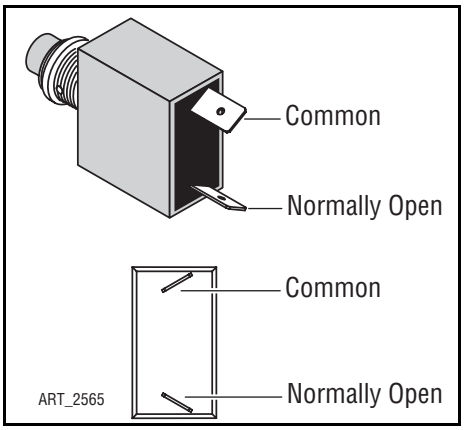
### *Test bottom position*

- Move second probe to *bottom* normally open terminal.
- With the toggle in the neutral (open) position there should be no reading.
- With the toggle DOWN (closed) there should be a low resistance.
- With the toggle UP (closed) there should be no reading.
- Repeat for both rows of two-row switch.

## MOMENTARY BUTTON SWITCH

- Disconnect wires.
- Connect one probe of ohm meter each terminal.
- With the button in the neutral (open) position there should be no reading.
- With the button pushed (closed) there should be a low resistance

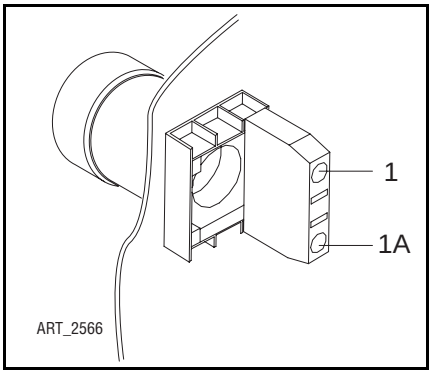
***Figure 2-18:*** Button Switch, Momentary




## EMERGENCY STOP BUTTON

- Disconnect wires.
- Connect one probe of ohm meter each terminal.
- With the button PRESSED there should be no reading.
- With the button RESET there should be a low resistance.

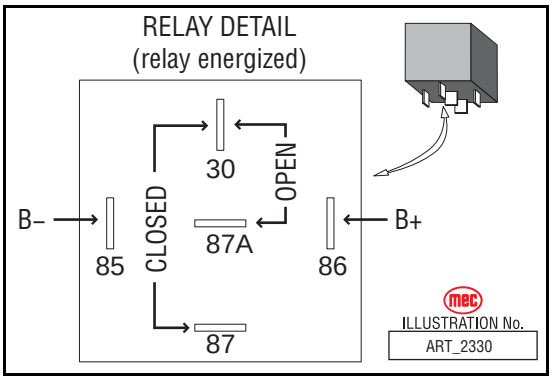
***Figure 2-19:*** Emergency Stop Switch




## RELAY

- With the #85 terminal grounded, apply voltage to #86 terminal connection.
- Confirm normally closed (#87A) contacts are opening. Continuity with #30 will be broken.
- Confirm normally open (#87) contacts are closing. Continuity with #30 will be made.

***Figure 2-20:*** Relay Operation



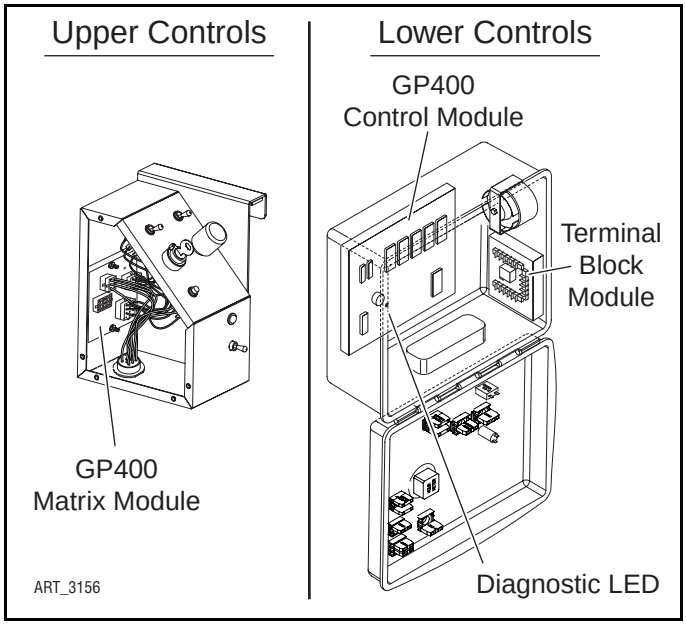
# GP400 CONTROL MODULE SETUP

## LOCATION

- The GP400 Control Module processor is located in the lower control box.
- The GP400 Matrix Module is located in the upper control box.

Diagnostic information *can be found in Section 4: Troubleshooting.* Wiring information can be found in *Section 5: Schematics*.

***Figure 2-21:*** GP400 Module Locations



## GENERAL DESCRIPTION

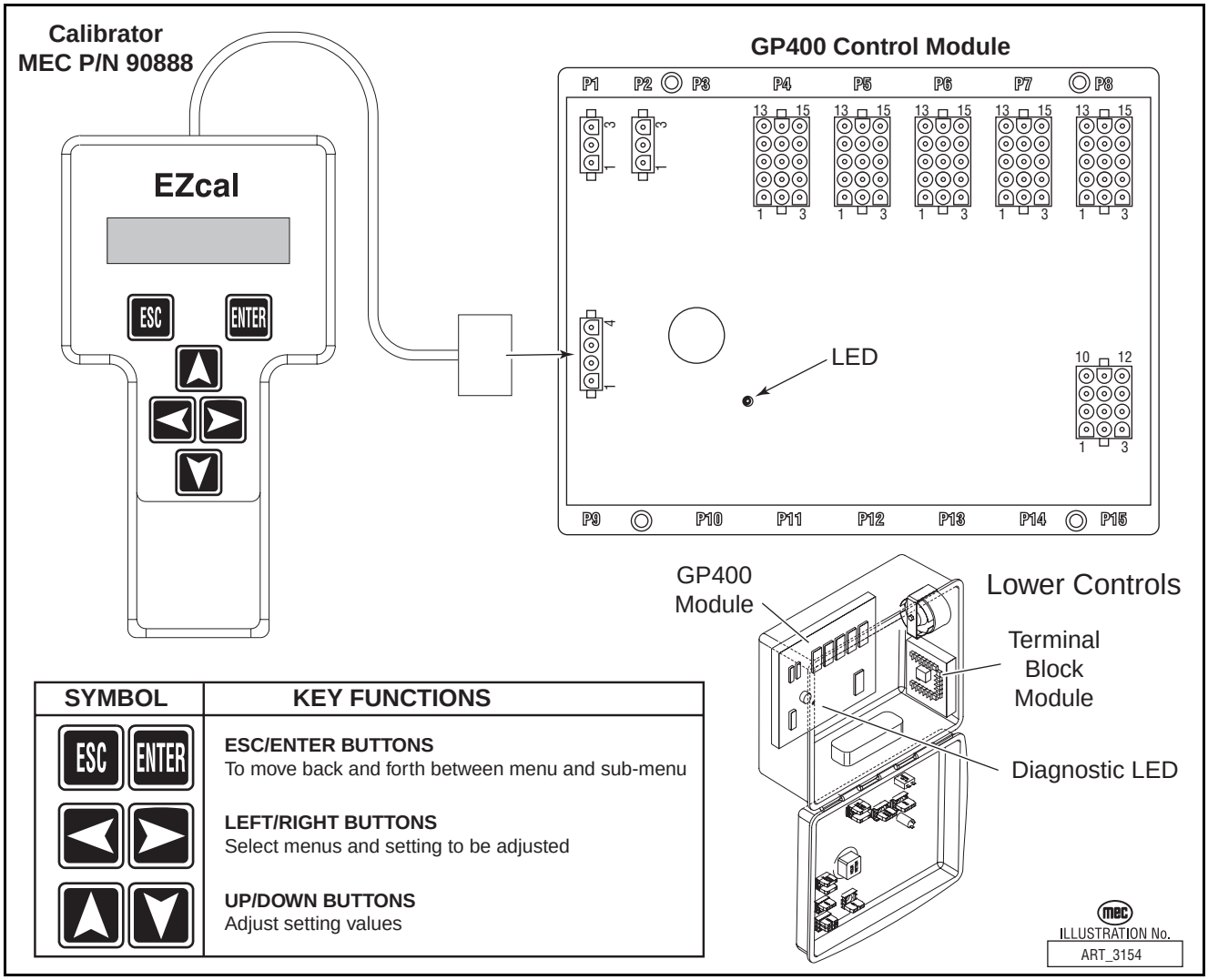
The GP400 control module uses a variety of sensors to maintain proper and safe operation of the machine. This machine may be sold into many different countries that require a variety of monitoring equipment. For example, the CE equipped machine, designed for European (and many other) countries, is equipped with a Load Sensing system that uses a Pressure Transducer to monitor oil pressure in the lift circuit and an Angle Transducer to monitor platform elevation. ANSI models use an Angle Transducer, and only monitor platform elevation.

In the event the GP400 requires replacement, a calibration process must be performed before the machine can be operated. The GP400 will operate initially in an “assembly mode” to provide basic machine operation. However, it will divert to a failure mode if not properly calibrated within a few start-up cycles.

**WARNING**

**ONLY TRAINED AND AUTHORIZED PERSONNEL SHALL BE PERMITTED TO CALIBRATE THE PLATFORM OVERLOAD SENSING SYSTEM. READ ALL INSTRUCTIONS CLOSELY BEFORE ATTEMPTING EACH STEP OF THE CALIBRATION PROCEDURE.**

***Figure 2-22:*** EZ-Cal Connection




| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER | **ESC/ENTER BUTTONS** To move back and forth between menu and sub-menu |
| ◀ ▶ | **LEFT/RIGHT BUTTONS** Select menus and setting to be adjusted |
| ▲ ▼ | **UP/DOWN BUTTONS** Adjust setting values |

# GP400 CALIBRATION

The EZ-Cal hand held device (MEC part # 90888) is required to access the GP400 for troubleshooting and calibration.

The GP400 processor relies on angle and pressure sensors to monitor machine position at all times. These sensors send varied voltages to the GP400 that relate directly to their respective position. The calibration process is the means by which the GP400 equates these voltages to actual machine position.

For example, the Angle Transducer, used to monitor platform elevation, varies its output between 1 and 4 volts through a 140 degree rotation. During calibration the GP400 may learn that 1.8 volts (fictional number used for explanation) represents the fully stowed position and 3.6 volts represents the fully elevated position and therefore voltages between those figures relate to various heights in between.

All machines are calibrated at the factory and should not require calibration unless the GP400 is replaced or if the GP400 displays a code that alerts to the need to recalibrate.

Tilt Sensor calibration is required on all machines regardless of destination or certification (ANSI or CE) and must be performed first.

ANSI calibration follows Tilt calibration for machines not equipped with an overload protection system and consists of only height calibration.

CE calibration is required of all machines outfitted with an Overload Protection System as required for CE certification. All steps in the CE calibration must be performed in the proper sequence before the GP400 will recognize complete and proper calibration. Begin with the ANSI/CE Tilt Sensor Calibration, then proceed to the CE Calibrations section.

If the calibration procedure is performed incorrectly or there is a failure in one of the monitored circuits during the calibration, the GP400 will not allow the operator to continue with the calibration process. An error message will display on the EZ-cal indicating the reason for the interruption.

Additional details of these error messages can be found at the end of the calibration instructions.

This and other procedures can only be performed using an EZ-Cal scan tool. If you do not have an EZ-Cal, please contact MEC to obtain one.

### *ANSI/CE Tilt Sensor Calibration*

Correctly performing the following procedure will ensure that your machine will continue to auto-level correctly and operate safely.

The automated leveling system relies on the information provided by three sensors:

- The platform tilt sensor (Platform CAN Tilt Angle Transducer) is used to level the platform to within 0.2 degrees of absolute level when auto-leveling. It is also use by the control system to monitor platform level status for enhanced unit stability. The platform tilt sensor is located inside the Lower Boom Mount.
- The axle sensor (Axle CAN Tilt angle transducer) which is mounted to the front oscillating axle provides information as to the position of the axle relative to the chassis. This information is used to allow or disallow drive when the platform is in the elevated position. If the front axle is more then 3 degrees out of parallel with the chassis, drive will be turned off to prevent the loss of stability.
- The third level sensor is located inside the GP400 and monitors the chassis angle. All three sensors will calibrate at one time during the calibration procedure.

1. Park machine on a flat level surface.
2. Be sure that all tires are properly inflated to the same pressure and that the tires are all the same size.
3. Ensure that the platform is perfectly level side-to-side and front-to-rear by using the two Manual Level Switches located in the upper control box and a spirit level. Use a framers level if necessary.
4. Open the lower control box and plug the EZ-cal into plug J-9 (4-pin connector) on the GP400. The display should light up and read "HELP - PRESS ENTER.
   a. Press the right arrow to access "ACCESS LEVEL 3", press ENTER.
      - The display reads CODE 0000 with the cursor flashing.
   b. Press the Up and Right arrows to enter code 2222, Press Enter
      - Display reads "ACCESS LEVEL 2"
      - On later models, the display may continue to read “ACCESS LEVEL 3”. Repeat step b. and enter code 1775.
   c. Right arrow to SETUPS, Press Enter
      - Display reads ‘CHANGE DEFAULTS"
   d. Right arrow to TILT SETUPS, Press Enter
      - Display reads "CALIBRATE LEVEL".
   e. Press Enter
      - Display reads "CALIBRATE LEVEL YES: ENTER NO: ESC"
   f. Press Enter
      - Display reads "CALIBRATE LEVEL YES: ENTER NO: ESC" plus has actual tilt percentages.
   g. Press Enter again.
      - The percentage numbers should be 0.0 - 0.0 (or very close).
   h. Level calibration is complete. Unplug the EZ-Cal or press ESC, ESC, ESC.

### *ANSI Height Calibration*

Height calibration must be performed if the GP400 is replaced. For this procedure it is not necessary to place any load in the platform.

1. Drive machine to level ground, in area where it can reach full elevation.
2. Turn selector switch to Base controls.
3. Plug **EZ-Cal** into connector P9 on GP400 Control Module. **EZ-Cal** display reads HELP: PRESS ENTER
4. Press right arrow to ACCESS LEVEL 3, Press Enter.
   - Display reads CODE 0000
5. Press Up and Right Arrow to enter code 2222. Press Enter.
   - Display reads ACCESS LEVEL 2.
   - On later models, the display may continue to read “ACCESS LEVEL 3”. Repeat step b. and enter code 1775.
6. Press Right Arrow to SETUPS, Press Enter.
   - Display reads CHANGE DEFAULTS
7. Press Right Arrow to HEIGHT SETUPS, Press Enter.
   - Display reads CALIBRATE HEIGHT
8. Press Enter.
   - Display reads PLATFORM DOWN? Verify that platform is fully lowered.

9. Press Enter.
   - Display reads PLEASE LIFT.
10. Hold lower controls switch in the up position until machine is fully elevated, then release switch.
    - Display reads PLEASE LOWER.
11. Hold switch in down position until platform is in the fully lowered position. Release switch.
    - Display reads FINISHED.

## CE CALIBRATIONS

### *CE Platform Load Calibration*

Perform the tilt sensor calibration outlined at the beginning of this section (" ANSI/CE Tilt Sensor Calibration" on page 2-20).

Platform Load calibration must be performed any time:

- significant repairs are made to the elevating assembly
- the lift cylinder is removed and serviced or replaced
- any Platform Overload System component is replaced

During the calibration procedure the platform is fully raised and lowered three times:

1. “DYNAMIC” calibration – fully loaded platform raised & lowered in one continuous movement. DYNAMIC measurements are taken.
2. “LOADED” calibration – fully loaded platform raised & lowered with stops to take measurements. STATIC measurements are taken.
3. “EMPTY” calibration – unloaded platform raised & lowered with stops to take measurements. STATIC measurements are taken.

The following procedure must be followed COMPLETELY to calibrate the **GP400 Overload System**. If any problem is detected, the procedure stops and an Error Message will display on the EZ-Cal. Explanations of each message and suggested corrections can be found in the section of this manual following the calibration procedure.

**NOTE: If the calibration procedure is interrupted, completed phases do not need to be repeated. A “REDO” prompt will appear – answer “NO” if there is no reason to repeat the phase, or “YES” if the phase must be repeated (for example because the wrong platform load was used on the previous phase).**

1. Drive machine to a flat, level surface where it can reach full elevation. Choose a place where the rated load can be placed in the platform and later removed **without** moving the machine.
2. Place rated load in platform (see platform labels or serial plate).
3. Turn selector switch to Base controls.
4. Plug **EZ-Cal** into connector P9 on GP400 Control Module. **EZ-Cal** display reads HELP: PRESS ENTER
5. Press right arrow to ACCESS LEVEL 3, Press Enter.
   - Display reads CODE 0000
6. Press up and right arrow to enter code 2222, Press Enter.
   - Display reads ACCESS LEVEL 2.
   - On later models, the display may continue to read “ACCESS LEVEL 3”. Repeat step b. and enter code 1775.

7. Press Right Arrow to SETUPS, Press Enter.
   - Display reads CHANGE DEFAULTS
8. Press Right Arrow to LOAD SETUPS. Press Enter.
   - Display reads CALIBRATE LOAD
9. Press Enter.
   - Display reads PLATFORM DOWN? Verify that platform is fully lowered.
10. Press Enter.
    - Display reads PLATFORM LOADED? Verify that rated load is in platform.
11. Press Enter.
    - Display reads PLEASE LIFT.
12. Hold lower controls switch in the up position until machine is fully elevated, then release switch.
    - Display reads PLEASE LOWER.
13. Hold switch in down position until platform is in the fully lowered position. Release switch.
    - Display reads PLATFORM LOADED?
14. Ensure that the rated load is distributed evenly in the platform, then press Enter.
    - Display reads PLEASE LIFT.
15. Hold lower controls switch in the up position until machine is fully elevated, then release switch.
    - Display reads TOTAL DATA #XX, then PLEASE LOWER.

**NOTE: The platform will rise incrementally during this phase on the calibration. Do not release the switch until fully elevated.**

16. Hold switch in down position until platform is in the fully lowered position.

**NOTE: The platform will lower incrementally during this phase on the calibration. Do not release the switch until fully lowered.**

17. Release switch.
    - Display reads TOTAL DATA #XX, then PLATFORM EMPTY?
18. Remove the load from the platform.

**NOTE: If you must switch to platform controls to move the machine, steps 1.] through 7.] must be repeated. Steps 12.] through 20.] will generate the REDO prompt. Answer NO. If machine was not moved, proceed to step 22.].**

19. Press Enter.
    - Display reads PLEASE LIFT.
20. Hold lower controls switch in the up position until machine is fully elevated, then release switch.
    - Display reads TOTAL DATA #XX, then PLEASE LOWER.
21. Hold switch in down position until platform is in the fully lowered position.
    - Display reads TOTAL DATA #XX, then BUILDING TABLES, then CALDATE mm/dd/yy.
22. Enter current date using Up, Down and Right Arrows.
    - Display reads FINISHED.
23. Disconnect **EZ-Cal**.

The Platform Overload Sensing System is now calibrated.

### *CE Height Calibration*

For this procedure it is **not** necessary to place any load in the platform.

1. Drive machine to a flat, level surface where it can reach full elevation.
2. Turn selector switch to Base controls.
3. Plug **EZ-Cal** into connector P9 on GP400 Control Module.
   - Display reads HELP: PRESS ENTER
4. Press right arrow to ACCESS LEVEL 3. Press Enter.
   - Display reads CODE 0000
5. Press Up and Right Arrow to enter code 2222. Press Enter.
   - Display reads ACCESS LEVEL 2.
   - On later models, the display may continue to read “ACCESS LEVEL 3”. Repeat step b. and enter code 1775.
6. Press Right Arrow to SETUPS. Press Enter.
   - Display reads CHANGE DEFAULTS
7. Press Right Arrow to HEIGHT SETUPS. Press Enter.
   - Display reads CALIBRATE HEIGHT
8. Press Enter.
   - Display reads PLATFORM DOWN?
9. Verify that platform is fully lowered. Press Enter.
   - Display reads PLEASE LIFT.
10. Hold lower controls switch in the up position until machine is fully elevated, then release switch.
    - Display reads PLEASE LOWER.
11. Hold switch in down position until platform is in the fully lowered position. Release switch.
    - Display reads FINISHED.

# CALIBRATION PROBLEMS

## FAILURE MESSAGES

Various problems can be detected by the EZ-Cal that prevent successful calibration. These problems are reported with a flashing message including an “F” code. The following descriptions are helpful in solving the problem. References in parentheses refer to electrical schematic points.

### F01:CHECK HWFS

This message is given if the startup tests have not completed.

Check HELP message for more information.

### F02:NOT GROUND MODE

This message is given if the machine is not in ground mode (P7-2 must be high). Calibration can only be carried out in ground mode.

### F03:NOT STOPPED

This message is given if any function switch is closed. Check DIAGNOSTICS / SWITCHES to see which function switch is closed.

### F04:TILTED

This message is given if the machine is tilted. Calibration must be carried out with the machine level. If the machine is level, perform the Tilt Calibration procedure above.

### F05:BAD HEIGHT

This message is given if the height sensor output (P8-2 and P8-6) is out of range at the start of calibration. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

### F06:CHECK ELEV

This message is given if the elevation switch (P7-5) is open at the start of calibration, when the operator has confirmed the “PLATFORM DOWN?” question.

If the platform is down, check the elevation switch wiring.

### F08:CHECK ELEV

This message is given if the elevation switch (P7-5) is closed at the end of the DYNAMIC lift, when the platform should be fully raised.

This message would occur if the UP switch was accidentally opened near the start of the DYNAMIC lift.

If the platform is fully raised, check the elevation switch wiring.

### F09:BAD HEIGHT

This message is given if the height sensor output (P8-2 and P8-6) is out of range at the start of the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. This is usually due to a wiring problem.

### F10:BAD HEIGHT

This message is given if the height sensor output (P8-2 and P8-6) is out of range at the end of the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

### F11:NOT UP

This message occurs at the start of the DYNAMIC lift if the operator selects a function other than UP.

**F12:TOO MANY**

This message occurs if the DYNAMIC lift takes too long.

This message could occur if the UP switch was not released at the end of the dynamic lift.

**F13:LOW HEIGHT RANGE**

This message occurs at the end of the DYNAMIC lift if the height sensor output did not change sufficiently to give a reasonably accurate platform height estimate. DIAGNOSTICS / ANALOGS can be used to check the height sensor output (P8-2 and P8-6) when the platform is fully lowered and fully raised; a difference of at least 1V is to be expected.

This message could occur if the UP switch was accidentally opened too early (when the platform is not fully raised).

**F14:BAD HEIGHT**

This message occurs if the height sensor output (P8-2 and P8-6) is out of range during the DYNAMIC lift. The height sensor output must be between 1.0V and 4.0V. Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

**F15:CHECK ELEV**

This message is given if the elevation switch (P7-5) is open when the platform has been fully lowered after the DYNAMIC lift.

This message would occur if the DOWN switch was accidentally opened before the platform was fully lowered.

If the platform is fully lowered, check the elevation switch.

**F16:LOW ELEV.OPEN**

This message is given if the elevation switch (P7-5) opened during lift at too low of a height (below 5%). Check CALIBRATIONS / HEIGHT CALS. The “ElevUp” value shows the recorded height where the switch opened.

**F17:HIGH ELEV.OPEN**

This message is given if the elevation switch (P7-5) opened during lift at a too high height (above 25%).

Check CALIBRATIONS / HEIGHT CALS; the “ElevUp” value shows the recorded height where the switch opened.

**F18:LOW ELEV.CLOSE**

This message is given if the elevation switch (P7-5) closed during lower at a too low height (below 5%).

Check CALIBRATIONS / HEIGHT CALS; the “ElevDown” value shows the recorded height where the switch opened.

**F19:HIGH ELEV.CLOSE**

This message is given if the elevation switch (P7-5) closed during lower at a too high height (above 25%).

Check CALIBRATIONS / HEIGHT CALS; the “ElevUp” value shows the recorded height where the switch opened.

**F20:HEIGHT<>0%**
**F21:HEIGHT<>0%**

This message occurs if the platform height is not 0% after the platform has been fully lowered at the end of a calibration step. The platform must return to the same height each time it is fully lowered.

Check DIAGOSTICS / SYSTEM to check the height.

**F22:HEIGHT<>100%**
**F23:HEIGHT<>100%**

This message occurs if the platform height is not 100% after the platform has been fully raised during a calibration step. The platform must return to the same height each time it is fully raised. Check DIAGNOSTICS / SYSTEM to check the height.

**F24:TOO MANY**

This message occurs if too many static measurements are taken during a calibration step. In the rare event that this occurs, please call MEC for assistance.

**F25:CHECK ELEV**
**F26:CHECK ELEV**

This message indicates a problem with the elevation switch (P7-5) during the STATIC phases.

The switch is either staying closed to a higher height, or staying open to a lower height, than that recorded during the DYNAMIC phase.

**F27:BAD HEIGHT**

This message indicates a problem with the height sensor output (P8-2 and P8-6) during the STATIC calibration phases.

The height sensor output must be between 1.0V and 4.0V at all times.

Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

**F30:BAD HEIGHTS**

This message indicates that the recorded heights are not increasing during STATIC lift, or are not decreasing during STATIC lower.

This problem may be caused by repeatedly opening and closing the UP or DOWN switch during the STATIC phases.

**F31:REJECT CURVE**

The DYNAMIC pressure curve is unacceptable.

An initial pressure peak when the platform lifted cannot be found between 0% and 15% height.

Check for proper weight in the platform and check pressure sensor and lift cylinder hydraulics.

**F32:REJECT CURVE**

The DYNAMIC pressure curve is unacceptable.

There should be a lowest pressure about halfway through the lift (i.e.: near 50% height); the lowest pressure measured is at too low a height.

Check for proper weight in the platform and check pressure sensor and lift cylinder hydraulics.

**F33:REJECT CURVE**

The DYNAMIC pressure curve is unacceptable.

There should be a lowest pressure about halfway through the lift (i.e.: near 50% height); the lowest pressure measured is at too high a height.

Check for proper weight in the platform and check pressure sensor and lift cylinder hydraulics.

**F34:REJECT CURVE**

The DYNAMIC pressure curve is unacceptable.

There is not enough difference between the initial pressure peak and the minimum pressure.

Check for proper weight in the platform and check pressure sensor and lift cylinder hydraulics.

### F40:REJECT DELTA

This message indicates that there is not enough difference between the loaded & empty pressure.

This message could occur if the platform were not properly loaded during the STATIC LOADED phase, or if the platform were not properly empty during the STATIC EMPTY phase.

This message could also occur if the wrong pressure sensor was fitted (e.g.: a 5000psi sensor when a 3000psi one is needed).

Check CALIBRATIONS / HEIGHT CALS; the “Height” indicates the first height at which there was insufficient difference and the “Up” and “Down” values show the loaded pressure (first) and the difference between loaded and empty pressure (second).

### F42:LOW PRESSURE

This message indicates that the pressure is too low (0.5V or less) when the elevation switch opens during the DYNAMIC lift.

This message would occur if the pressure sensor was disconnected, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

### F43:HIGH PRESSURE

This message indicates that the pressure is too high (4.5V or more) when the elevation switch opens during the DYNAMIC lift.

This message would occur if the wrong pressure sensor was fitted, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

### F44:LOW PRESSURE

This message indicates that the pressure is too low (0.5V or less) at a STATIC measurement point.

This message would occur if the pressure sensor was disconnected, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

### F45:HIGH PRESSURE

This message indicates that the pressure is too high (4.5V or more) at a STATIC measurement point.

This message would occur if the wrong pressure sensor was fitted, or if there were some other wiring error.

Check DIAGNOSTICS / SENSORS to check the pressure.

### F46:CHECK ELEV

This message indicates that the elevation switch opened more than once during the DYNAMIC lift.

### F47:CHECK ELEV

This message indicates that the elevation switch closed more than once during the DYNAMIC lower.

### F48:BAD PRESSURE

This message is given if the pressure sensor output (P8-2 and P8-6) is out of range at the start of calibration.

The height sensor output must be between 0.5V and 4.5V.

Check DIAGNOSTICS / SENSORS to see the output. A reading of 0V or 5V is probably due to a wiring problem.

### F52:NOT CALIBRATED

This message is a catch-all code which indicates an improper calibration sequence or that one of the phases of calibration was not completed. The skipped phase must be completed or the calibration sequence must be passed through in proper sequence before this message will clear. Re-start the calibration sequence and proceed through each sequence in the specified order.

A “Redo” prompt will appear before each sequence. Answer “NO” if there is no reason to repeat or “YES” if the phase must be completed.

## INFORMATION MESSAGES

During calibration the following messages will be displayed. They are informational prompts only and do not indicate a failure.

**BUILDING TABLES**

This message indicates that the STATIC measurements are being used to build calibration data - the process should take no more than 5s.

**CALDATE:**

This message is prompting for the date to be entered; it is stored to identify when the machine was calibrated.

The last calibrate date can be viewed in DIAGNOSTICS / LOG.

Press LEFT & RIGHT to select the flashing digits.

Press UP & DOWN to change the flashing digits.

Press ENTER when the entry is complete.

IMPORTANT: The date 00/00/00 is not allowed!

**FINISHED**

This message confirms that calibration is complete and successful.

**GO DOWN MORE!**

This message occurs if the DOWN switch is released during either STATIC lowering phase, when more measurements are needed (before the platform is fully lowered).

**GO UP MORE!**

This message occurs if the UP switch is released during either STATIC lifting phase, when more measurements are needed (before the platform is fully raised).

**LIFT EMPTY**

This message is displayed during the STATIC empty phase while the platform is being raised to the next measurement height.

**LIFT LOADED**

This message is displayed during the STATIC loaded phase while the platform is being raised to the next measurement height.

**LIFTING**

This message is displayed during the DYNAMIC phase while the platform is being raised.

**LOWER EMPTY**

This message is displayed during the STATIC empty phase while the platform is being lowered to the next measurement height.

**LOWER LOADED**

This message is displayed during the STATIC loaded phase while the platform is being lowered to the next measurement height.

**LOWERING**

This message is displayed during the DYNAMIC phase while the platform is being lowered.

**MEASURING #**

This message is displayed when the platform is stopped during either STATIC phase, when the GP400 takes a measurement.

There will be a short delay while the machine is allowed to stabilize after movement is stopped.

**MUST GO DOWN!**

This message occurs if the wrong switch is operated when the GP400 is waiting for the platform to be lowered.

**MUST GO UP!**

This message occurs if the wrong switch is operated when the GP400 is waiting for the platform to be raised.

**PLATFORM DOWN?**

This message is prompting for confirmation that the platform is fully lowered. If necessary the DOWN switch can be activated to lower the platform.

Press ENTER to confirm when the platform is fully lowered.

**PLATFORM EMPTY?**

This message is prompting for confirmation that the platform is completely empty.

Press ENTER to confirm when the platform is empty.

**PLATFORM LOADED?**

This message is prompting for confirmation that the platform is loaded to rated load: 1500 lbs (US/CSA), 680 Kgs (CE/AU). (100% of the load rating listed on the serial plate).

Press ENTER to confirm when the platform is loaded.

**PLEASE LIFT ...**

This message is prompting for the platform to be raised.

The UP switch should be operated.

**PLEASE LOWER ...**

This message is prompting for the platform to be lowered.

The DOWN switch should be operated.

**PLEASE WAIT**

This message indicates that the is busy; the delay will be short (no more than 5s).

**REDO DYNAMIC:**

This message is displayed if the DYNAMIC phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the DYNAMIC phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the DYNAMIC phase.

If the previous DYNAMIC calibration was in error, or if the height or pressure sensor is replaced, it will be necessary to redo the DYNAMIC phase.

**REDO EMPTY:**

This message is displayed if the EMPTY phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the EMPTY phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the EMPTY phase.

If the previous EMPTY calibration was in error, or if the pressure sensor is replaced, it will be necessary to redo the EMPTY phase.

**REDO LOADED:**

This message is displayed if the LOADED phase of load calibration has previously been completed.

Press ENTER when “NO” is displayed if there is no need to redo the LOADED phase.

Press UP or DOWN to display “YES” then press ENTER if it is necessary to redo the LOADED phase.

If the previous LOADED calibration was in error, or if the pressure sensor is replaced, it will be necessary to redo the LOADED phase.

**TOTAL DATA:**

This message is displayed at the end of each phase, to confirm the number of measurements recorded by the GP400. No operator input is required during this process.

# Section 3

# Mechanical Components

## Contents

## FIGURES PAGE

# MECHANICAL COMPONENTS

This section describes the major components of the machine and the steps required to service them.

## BASE

**CAUTION**

**When steam cleaning the base/undercarriage, cover electrical components to prevent water penetration.**

Steam clean the base as necessary, and inspect all welds and brackets. Check for cylinder pins that have turned in their mounting, which may indicate sheared retaining pins.

## TIRES AND WHEELS

Inspect for cuts, chunking, side-wall damage, or abnormal wear. Any tire faults MUST BE CORRECTED before further machine operation. Refer to Parts sections for replacement tires.

**DANGER**

***FAILURE TO USE APPROVED PARTS MAY CAUSE DEATH OR SERIOUS PERSONAL INJURY.***

***REPLACE TIRES WITH THE CORRECT TIRES TO MAINTAIN THE RATING OF THE EQUIPMENT.***

***IF FOAM FILLED TIRES WERE FITTED AS ORIGINAL EQUIPMENT THEY MUST BE REPLACED WITH EQUIVALENT SPECIFICATION TIRES AND FOAM-FILL WEIGHT.***

### CHANGING TIRES

Refer to *"Lift and Support The Machine"* in the *Introduction* section for instructions and safety precautions.

**CAUTION**

**Always block the wheels before lifting the machine.**

1. Chock tires on the end of machine opposite the tire to be changed.
2. Break loose but ***do not remove*** lug nuts before raising the machine.
3. Lift the end of machine requiring a tire change and support with jackstands of adequate capacity.
4. Remove lug nuts and pull the wheel off.
5. Install the replacement wheel.
6. Install lug nuts and tighten.
7. Lower the machine.
8. Tighten lug nuts to proper torque (Refer to machine specifications).
9. Remove the chocks.

# DRIVE MOTORS

Refer to *Section 1* for repair information.

There are two (2) hydraulic drive motors on the front axle and two (2) hydraulic drive motors on the rear drive axle. Repair or replace as necessary when damage or leaks occur.

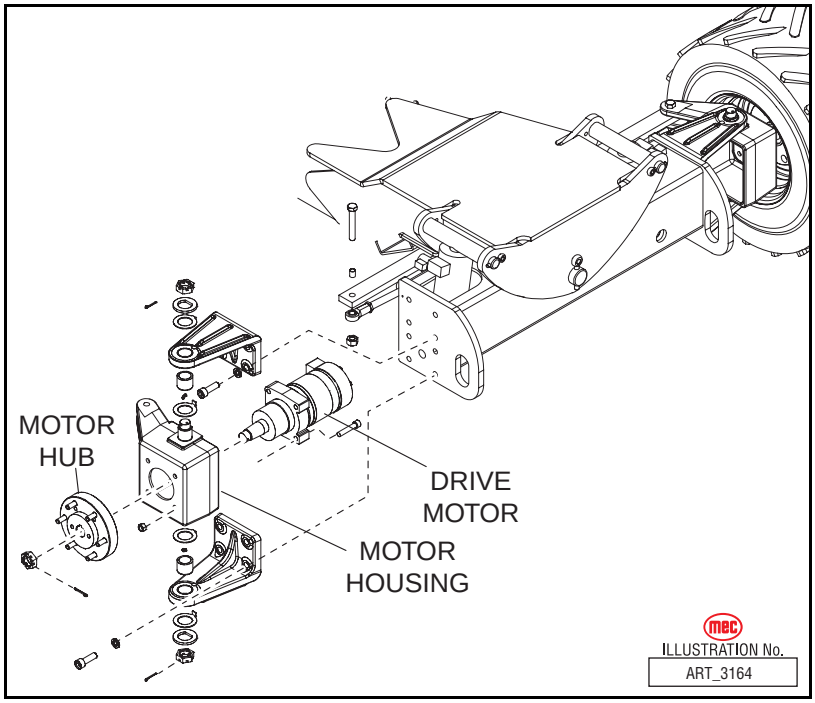
**CAUTION**

- **Clean all fittings before disconnecting hoses.**
- **Tag hoses for proper reassembly.**
- **Plug all openings immediately to prevent contamination.**

## FRONT DRIVE MOTORS

Refer to *"Lift and Support The Machine"* in the *Introduction* section for instructions and safety precautions.

***Figure 3-1:*** Front Drive Motor




### Remove

1. Raise and support the front end of machine.
2. Remove the wheel and tire assembly to access drive motor.
3. Remove the hub from the drive motor shaft using a suitable hub pulling tool. DO NOT use a hammer on the shaft or hub as this will damage the motor.
4. Disconnect the cylinder end and tie-rod from the motor housing.
5. Turn the motor housing to gain access to the motor and hose assemblies.
6. Disconnect hose assemblies from drive motor. Immediately cap and plug all openings to prevent contamination.
7. Remove the cap screws and remove the drive motor.

### Replace

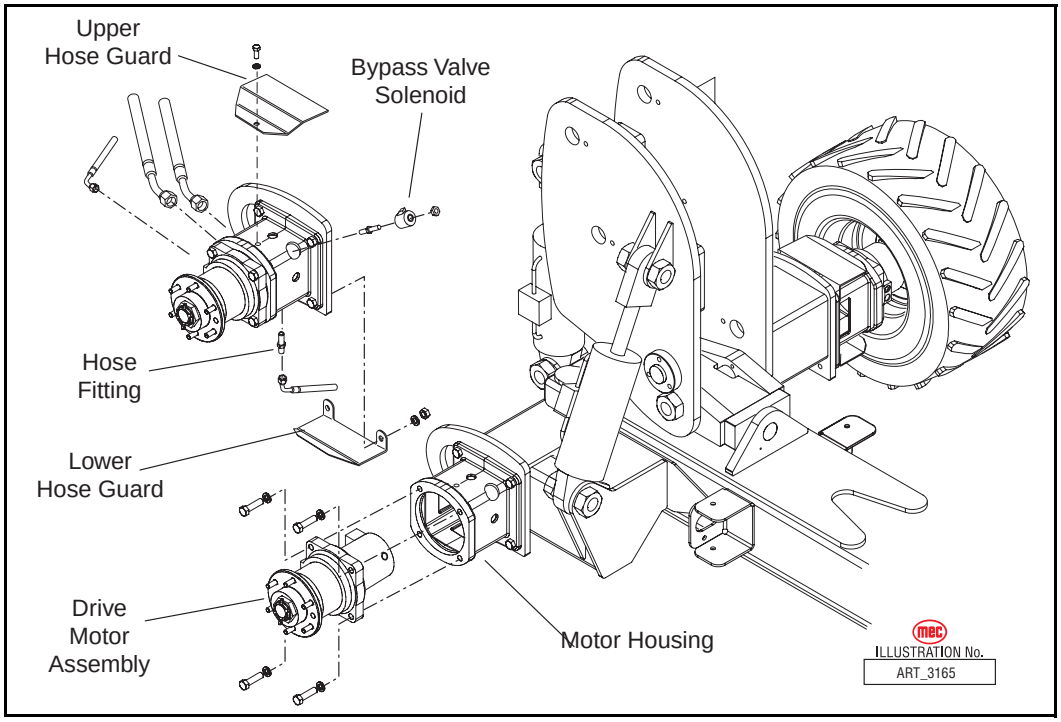
Installation is reverse of removal.

- Use Loctite® on mounting bolts.

## REAR DRIVE MOTOR

Refer to *"Lift and Support The Machine"* in the *Introduction* section for instructions and safety precautions.

***Figure 3-2:*** Rear Drive Motor




### Remove

1. Raise and support the rear end of machine (see *Raising the Machine*).
2. Remove the wheel and tire assembly to access drive motor.
3. Remove the upper and lower hose guards.
4. Disconnect hose assemblies from drive motor. Immediately cap and plug all openings to prevent contamination.
5. Remove the hose fitting and the bypass valve solenOId from the motor.

**NOTE: The bypass valve solenoid is mounted UP on the left side motor, and mounted DOWN on the right side motor.**

6. Remove the cap screws and remove the drive motor from the housing.

### Replace

Installation is reverse of removal.

- Use Loctite® on mounting bolts.

## STEER CYLINDER

There are two (2) double acting type steer cylinders on this machine. During operation, cylinder(s) should not leak, but a slight damping at the rod seal is acceptable. The pins should be checked for wear.

### TO REPLACE STEER CYLINDER:

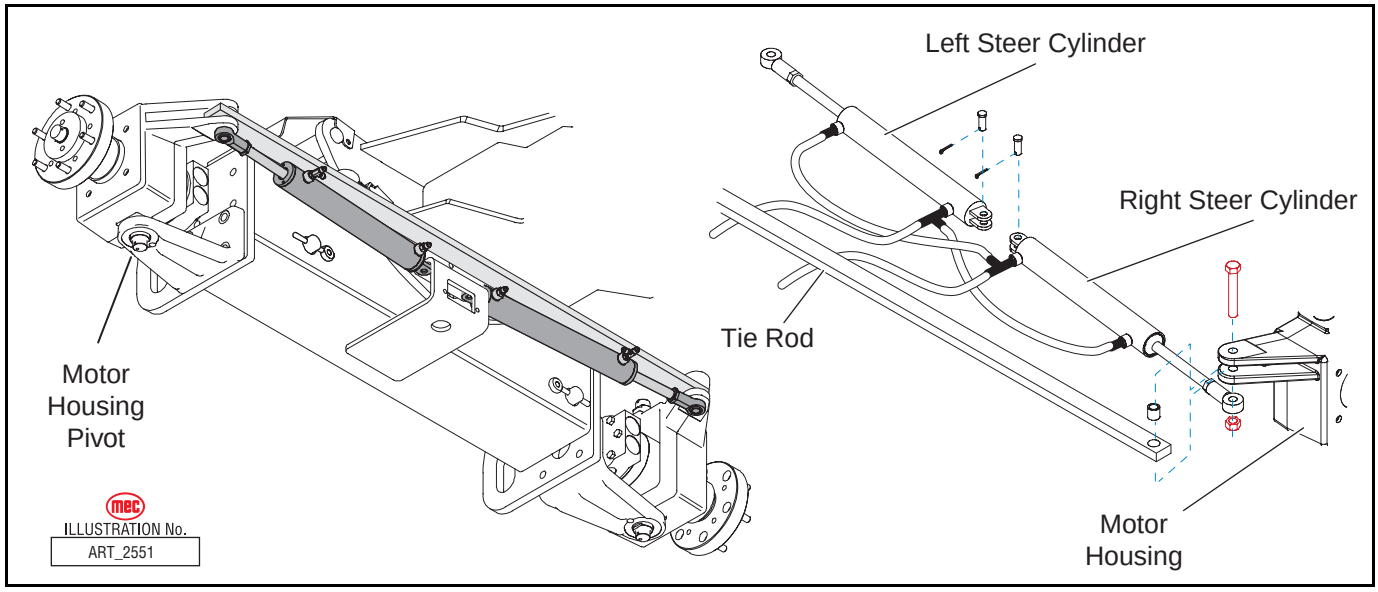
**CAUTION**

- **Clean all fittings before disconnecting hoses.**
- **Tag hoses for proper reassembly.**
- **Plug all openings to prevent contamination.**

1. Raise and support the front end of machine (see *Intro Section - Rai*sing the Machine).
2. Disconnect hydraulic hoses. Immediately cap and plug all openings to prevent contamination.
3. Remove the nut and bolt holding the steer cylinder to the motor mounting bracket.
4. Remove the pin and cotter pin holding the steer cylinder to the front axle.
5. Carefully lift off the steer cylinder.
6. Position the new steer cylinder and install pin and cotter pin to hold cylinder to the front axle.
7. Install nut and bolt to hold cylinder to motor mounting bracket.
8. Connect hydraulic hoses.
9. To purge air from cylinder, cycle the steering system fully left and right 4-5 times.

**NOTE: Refer to *Section 1* for seal replacement instructions.**

***Figure 3-3:*** Steering Cylinder Installation



# FLOATING AXLE LOCK CYLINDERS

There are two Floating Axle Lock Cylinders located at the front of the machine.

### REMOVE

1. Raise and support the front end of machine.
2. Disconnect hydraulic hoses. Immediately cap and plug all openings to prevent contamination.
3. Remove the bolt and banjo pin that secures the pivot pin to the frame and remove the pivot pin.
4. Remove the bolt and banjo pin that secures the pivot pin to the floating axle and remove the pivot pin.

### REPLACE

Installation is reverse of removal. Apply one (1) drop of Loctite® to the bolts that secure clevis pins.

### BLEED PROCEDURE - 3084RT

Use this procedure for machine model 3084RT.

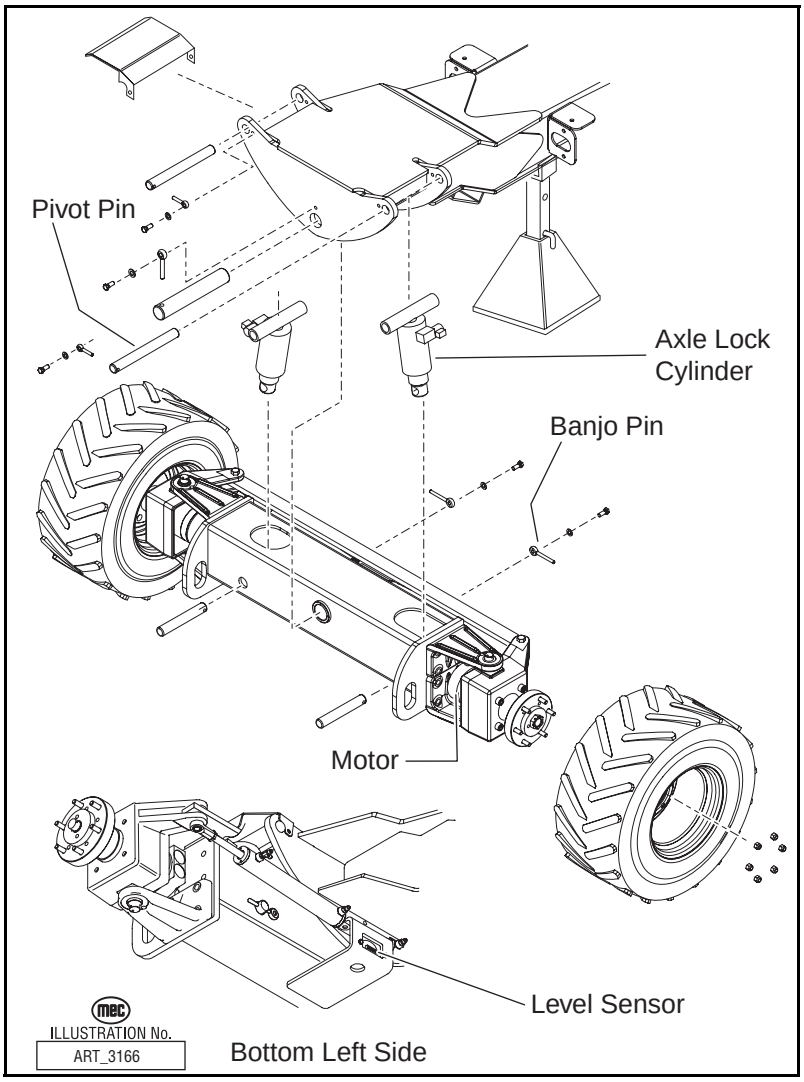
1. Start engine.
2. Loosen the bleed valve located on the top of the cylinder.
3. Watch as air escapes from valve.
4. Once a steady stream of fluid runs from the valve, tighten the valve.
5. Repeat on opposite side.

### BLEED PROCEDURE - 3084ES

Use this procedure for machine model 3084ES.

1. Loosen the bleed valve located on top of the cylinder
2. Drive the machine very slowly while watching as air escapes from the valve.
3. Once a steady stream of fluid runs from the valve, tighten the valve.
4. Repeat on opposite side.

***Figure 3-4:*** Floating Axle Lock Cylinder




## TEST LOCKING AND CENTER POSITION

1. Place a block approximately 4 inches (10 cm) high behind one of the front tires.
2. Elevate the platform to10-11 feet (3-3.4 m).
3. Slowly drive the tire onto the block.
   - The axle lock cylinders should be locked (no movement).
   - The opposite tire should be off the ground.
4. Lower the platform.
   - The axle lock cylinders should release.
   - The suspended tire should lower to the ground.

# PLATFORM LEVELING CYLINDERS

There are two Tilt Cylinders located at the rear of the machine.

**DANGER**

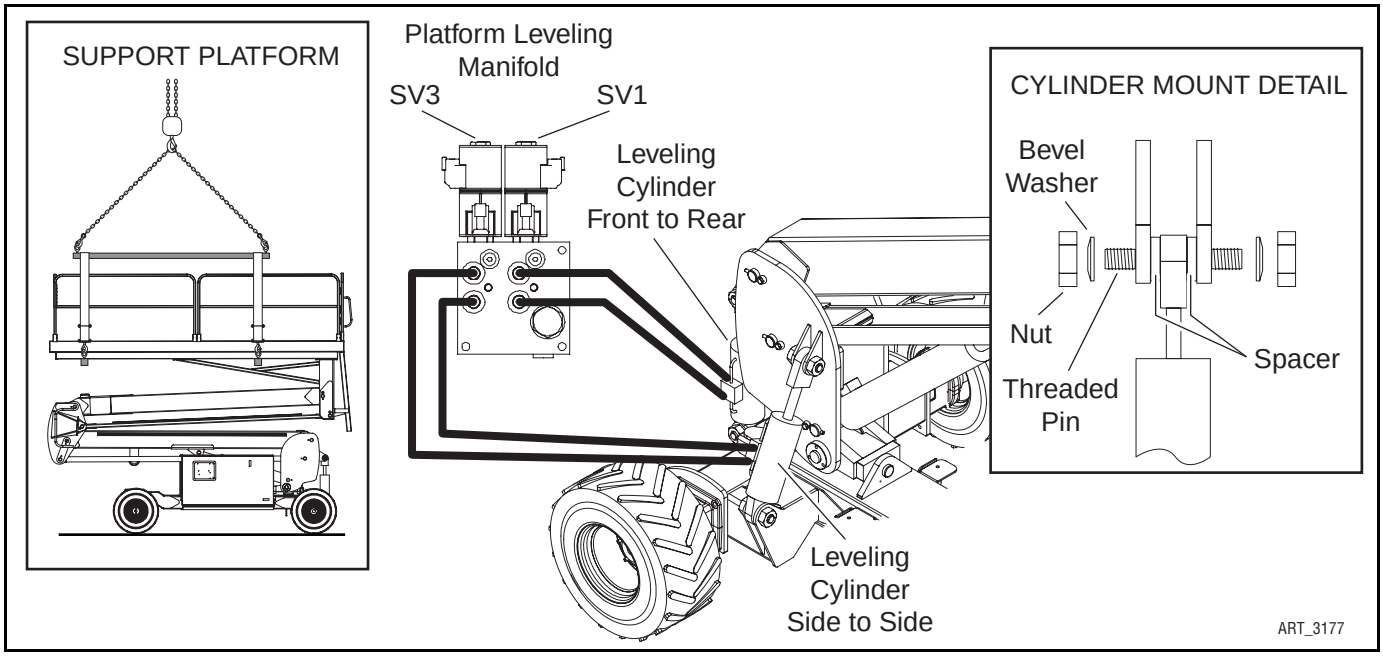
***NEVER PERFORM SERVICE ON THE MACHINE WITH THE PLATFORM ELEVATED WITHOUT FIRST SUPPORTING THE PLATFORM/BOOM ASSEMBLY.***

- Use a crane with chains and straps of adequate lifting capacity to support the platform.

## REMOVE

1. Support the platform.
2. Disconnect hydraulic hoses. Immediately cap and plug all openings to prevent contamination.
3. Remove the nuts and beveled washers from the mounting pins.
4. Carefully remove the mounting pins.
5. Carefully lift the cylinder.
6. Installation is reverse of removal.

***Figure 3-5:*** Platform Leveling Manifold and Cylinders



## HOSES AND CABLES

**NOTE: Refer to *Parts Section E* for detailed hydraulic hose diagrams.**

Inspect all hoses and electrical cables for security and damage. Hoses and cables should be examined for rubbing and chafing.

Check all ties and clamps that keep hoses secure.

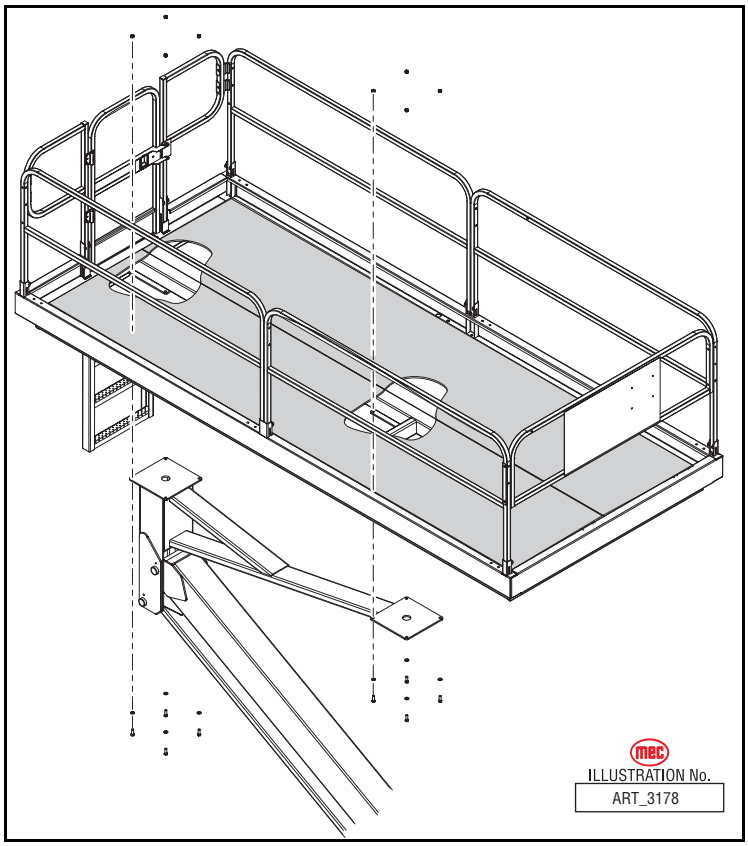
Check for leaks at fittings. Replace any damaged hose or cable.

1. Tag hoses for proper reassembly.
2. Disconnect hydraulic hoses. Immediately cap and plug all openings to prevent contamination.
3. Torque hose fittings according to the Hydraulic Torque Specification Table.

## PLATFORM REMOVAL

1. Connect overhead crane or appropriate lifting device to the platform.
2. Disconnect cables that go to the platform.
3. Remove the bolts that secure the platform to the boom assembly.
4. Lift the platform away from the boom assembly.
5. Installation is reverse of removal.

***Figure 3-6:*** Platform Removal



# LIFT CYLINDER REMOVAL AND INSTALLATION

**NOTE: Refer to *Section 1* for seal replacement instructions.**
**Refer to *Parts Section C* for detailed parts list and illustration.**

**WARNING**

**CLEAN ALL FITTINGS BEFORE DISCONNECTING HOSES.**

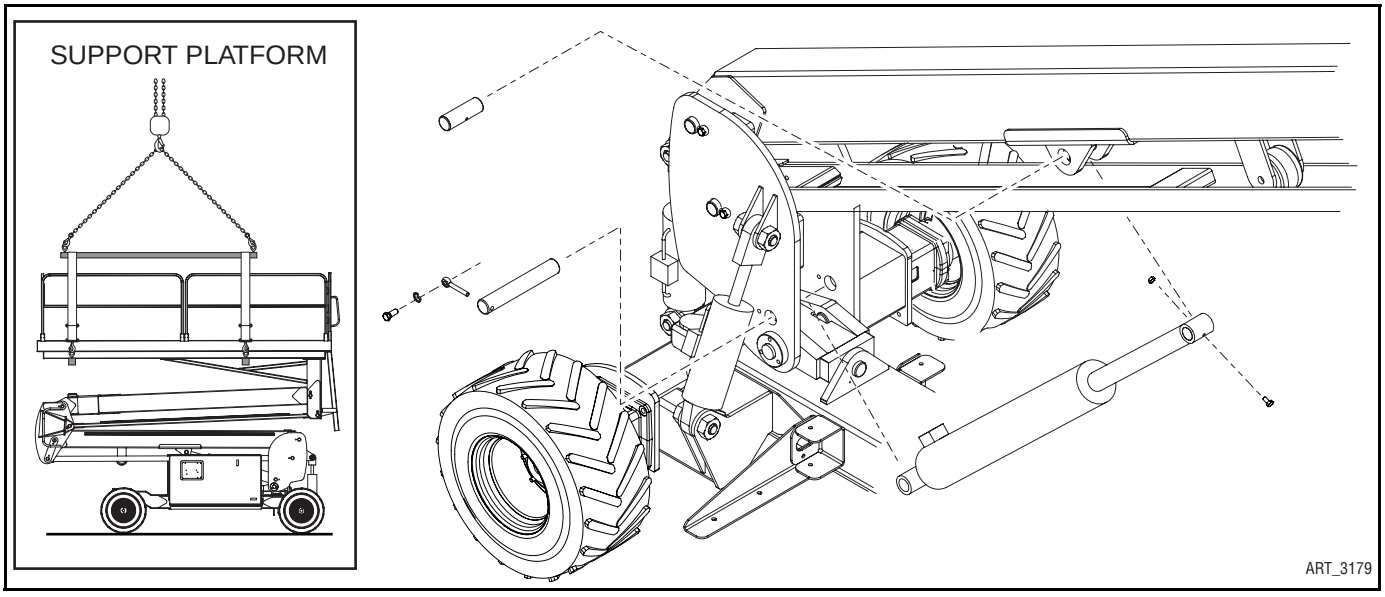
**CYLINDERS ARE HEAVY. PROVIDE PROPER SUPPORT *BEFORE* REMOVING PINS.**

**ATTACH THE LIFTING DEVICE TO THE CYLINDER BODY. LIFTING BY EITHER END WILL CAUSE THE CYLINDER TO EXTEND.**

1. Raise the platform.
2. Connect overhead crane by appropriate lifting device to the platform.
3. Tag wiring and hoses for proper reassembly.
4. Disconnect wires from the cylinder.
5. Disconnect hydraulic hoses. Immediately cap and plug all openings to prevent contamination.
6. Remove the bolt and nut that secure the cylinder head to the mounting pin on the boom assembly.
7. While supporting the cylinder, carefully remove the mounting pin and lower the cylinder to the chassis.
8. Remove the bolt, lock washer and banjo pin from the lower mounting pin, then remove the mounting pin.
9. Remove the cylinder.
10. Installation is reverse of removal.

**NOTE: Apply one (1) drop of Loctite® to all bolts.**

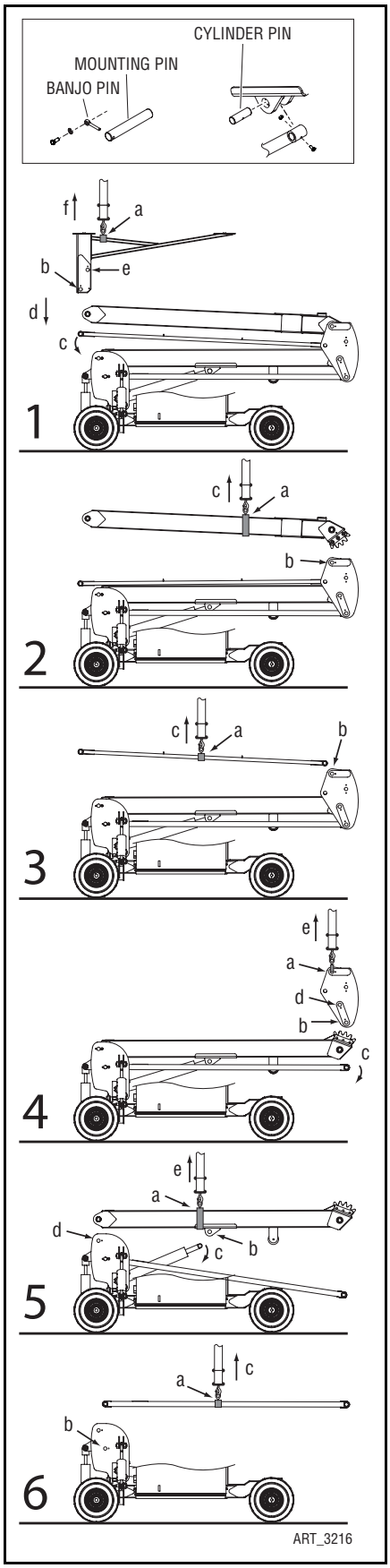
***Figure 3-7:*** Lift Cylinder Removal



# BOOM - ELEVATING ASSEMBLY

Remove the platform (see "Platform Removal" on page 3-10).

***Figure 3-8:*** Elevating Assembly Removal

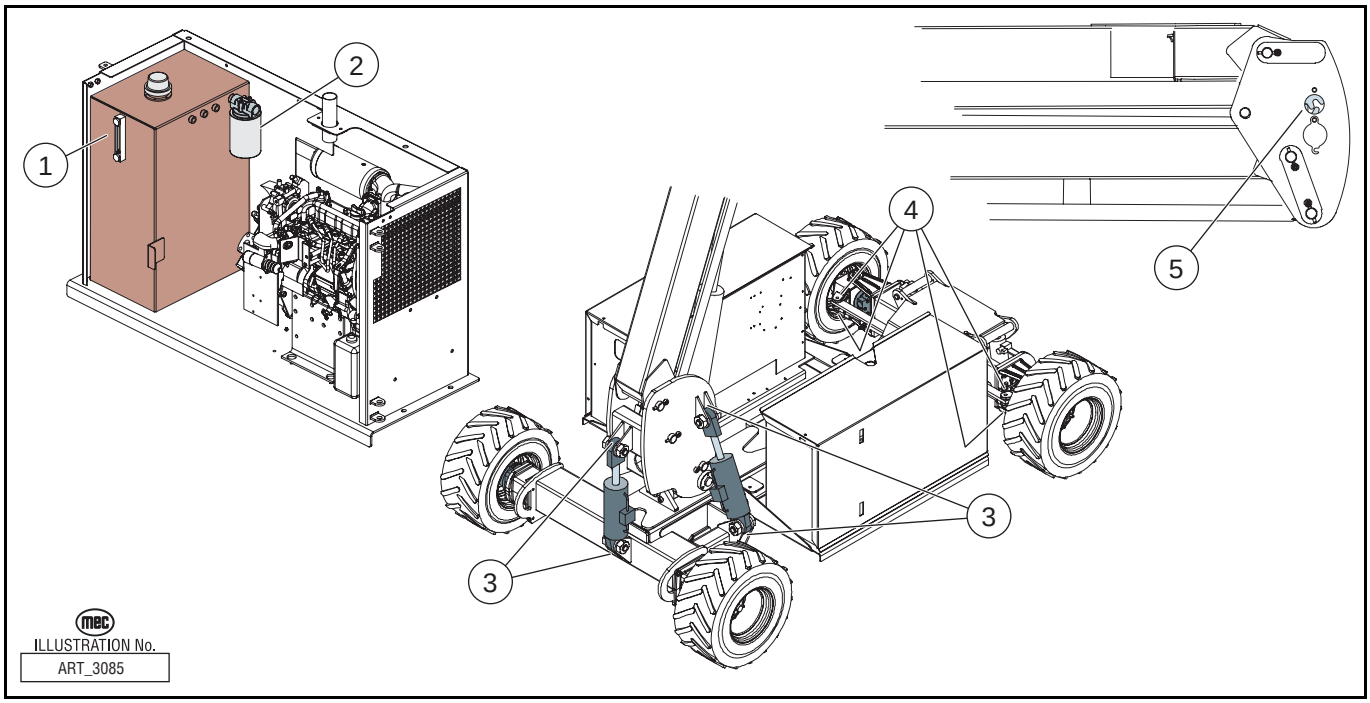



1. Remove the platform pivot.
   a. Attach a crane to the platform pivot and apply enough lift to provide support.
   b. While supporting the tension beam, remove the lower bolt, washer and banjo pin.
   c. Lower the tension beam to rest on the lower boom.
   d. Using the crane, lower the platform pivot and upper boom to rest on the lower boom.
   e. Remove the upper bolt, washer and banjo pin.
   f. Lift the platform pivot up and away.
2. Remove upper boom
   a. Attach a crane to the upper boom and apply enough lift to provide support.
   b. Remove the bolt, washer and banjo pin.
   c. Lift the upper boom up and away.
3. Remove upper tension beam.
   a. Attach a crane to the upper tension beam.
   b. Remove the bolt, washer and banjo pin.
   c. Lift the upper tension beam up and away.
4. Remove boom pivot.
   a. Attach a crane to the boom pivot through the top holes and apply enough lift to provide support.
   b. While supporting the tension beam, remove the lower bolt, washer and banjo pin.
   c. Lower the tension beam to rest on the chassis.
   d. Remove the upper bolt, washer and banjo pin.
   e. Lift the boom pivot up and away.
5. Remove the lower boom.
   a. Attach a crane to the upper boom and apply enough lift to provide support.
   b. While supporting the lift cylinder remove the cylinder pin.
   c. Lower the lift cylinder to rest on the chassis.
   d. Remove the bolt, washer and banjo pin.
   e. Lift the lower boom up and away.
6. Remove lower tension beam.
   a. Attach a crane to the lower tension beam.
   b. Remove the bolt, washer and banjo pin.
   c. Lift the lower tension beam up and away.
7. Installation is reverse of removal.

**Apply one (1) drop of Loctite® to all bolts.**

# LUBRICATION

***Figure 3-9:*** Lubrication Points




| No. | ITEM | SPECIFICATION | FREQUENCY |
|---|---|---|---|
| 1 | Hydraulic Reservoir | **Mobile Fluid DTE 10, DTE 13 M, or AW32 M**<br>***Do not substitute with lower grade fluids as pump damage may result.***<br>Fill to the middle of the sight gauge with platform in the stowed position. | **Routine Maintenance**<br>Check Daily<br>**Scheduled Maintenance**<br>Change yearly or every 1000 hours, whichever occurs first |
| 2 | Hydraulic Filter | Filter Element | **Scheduled Maintenance**<br>**Normal Conditions**<br>Change every six months or 500 hours, whichever occurs first<br>**Severe Conditions**<br>Change every three months or 300 hours, whichever occurs first |
| 3 | Tilt Cylinders Pivot Points | **Lithium N.L.G. #2 EP**<br>Purge old grease | **Scheduled Maintenance**<br>**Normal Conditions**<br>Apply every 6 months or 500 hours, whichever occurs first<br>**Severe Conditions**<br>Apply every 3 months or 250 hours, whichever occurs first |
| 4 | Steering Pivot Points | **Lithium N.L.G. #2 EP**<br>Purge old grease | **Scheduled Maintenance**<br>**Normal Conditions**<br>Apply every 6 months or 500 hours, whichever occurs first<br>**Severe Conditions**<br>Apply every 3 months or 250 hours, whichever occurs first |
| 5 | Boom Gear | **High copper content Anti-Seize compound**<br>Apply through access port or from front when platform is fully elevated | **Scheduled Maintenance**<br>**All Conditions**<br>Apply every 1 months or 100 hours, whichever occurs first |

# ENGINE MAINTENANCE

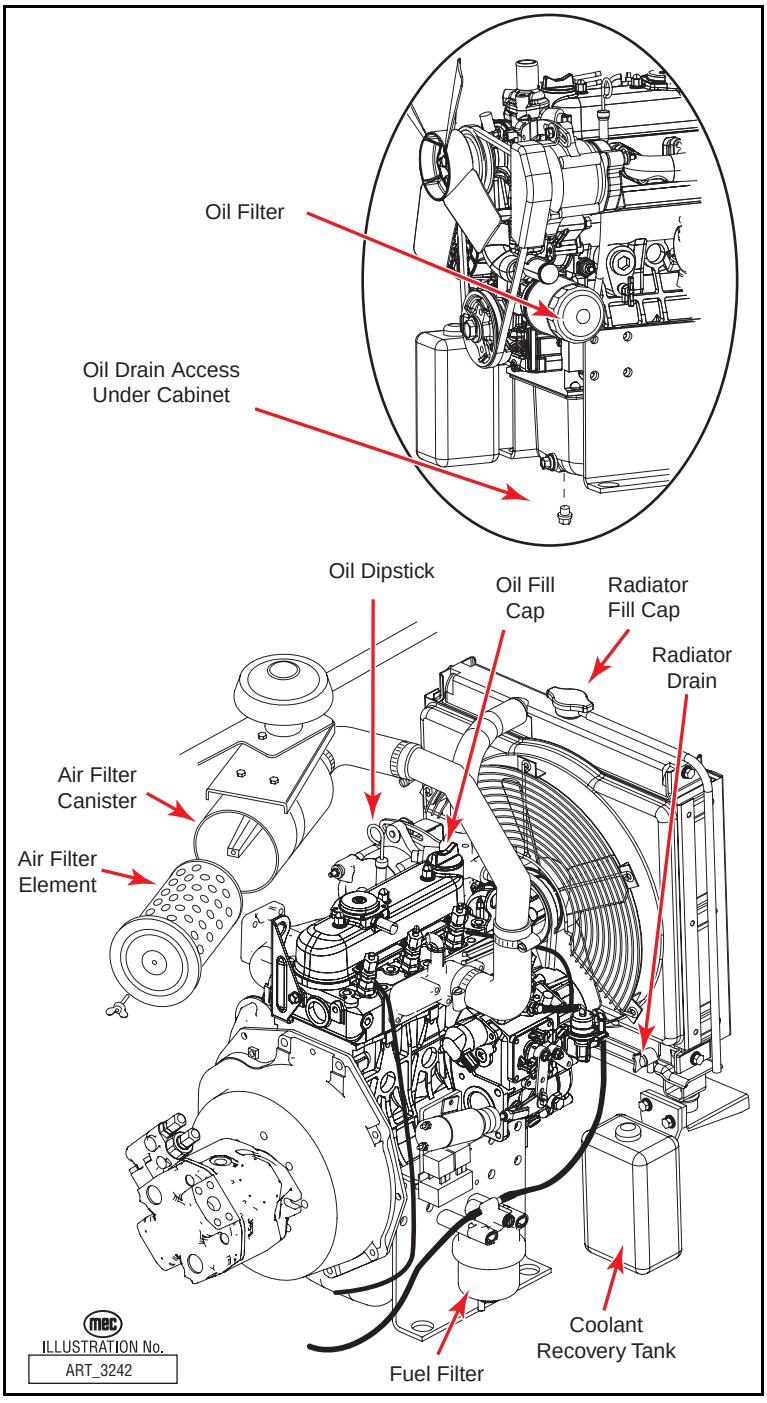
## DIESEL ENGINE MODELS

For complete service information consult the engine manual that came with the machine.

**CAUTION**

**Always wear protective eye-wear when working with fuel and oil.**
**Engine should be OFF when replacing filter elements.**

***Figure 3-10:*** Diesel Engine – Oil Filter and Air Filter




### OIL AND OIL FILTER, DIESEL

**Dispose of used oil and filters properly.**

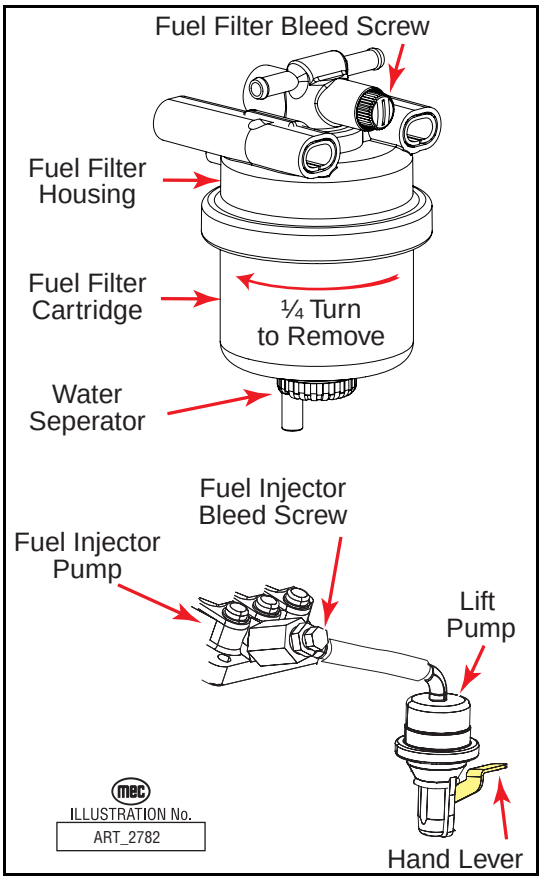
1. Use a suitable container to catch drained oil. Remove the drain plug. After oil has drained, replace the drain plug.
2. Remove the old filter and wipe the filter seal contact surface with a clean towel. Coat the seal on the new filter with clean oil, then install and tighten by hand.
3. Fill engine with 10w-30 motor oil until the dipstick indicates FULL. Capacity is 5.4 US quarts (5,1 l).
4. Recheck dipstick after running engine. Fill as necessary.

### AIR FILTER ELEMENT, DIESEL

1. Remove the wing-bolt
2. Remove old filter and replace with a new filter.
3. Replace and tighten the wing-bolt. ***Do not run the engine with the air filter element removed.***

## FUEL FILTER, DIESEL

***Figure 3-11:*** Diesel Engine Fuel Filter




1. Turn OFF valve on bottom of fuel tank.
2. Place a suitable container beneath the fuel filter assembly to catch spilled fuel. Clean the filter area.
3. Turn filter cartridge ¼ counterclockwise remove. Wipe the filter seal contact surface with a clean towel and install a new filter.
4. Open valve at fuel tank and check for leaks.
5. Purge the air from the fuel system as follows;
   - Fill fuel tank to the fullest extent. Open valve on bottom of fuel tank.
   - Loosen bleed screw on top of fuel filter housing a few turns.
   - Close the bleed screw when there are no more bubbles.
   - Open the bleed screw on the fuel injector pump. Use the lift pump hand lever to pump fuel to the injectors. Close the bleed screw when there are no more bubbles.

**NOTE: Do not attempt to start the engine until Step 5 has been performed.**

6. If fuel becomes contaminated with water, use the Water Separator Valve at the bottom of the fuel cartridge to drain water.

## IDLE SPEED ADJUSTMENT, DIESEL

1. Bring engine to operating temperature.
2. Slow engine to complete idle.
3. Adjust the Idle Stop Screw until the RPM is 950. Adjust slightly up or down to avoid vibrations.
4. Hold the Idle Stop Screw while tightening the jam nut to prevent change in adjustment.

## HIGH SPEED ADJUSTMENT, DIESEL

***IMPORTANT:*** – In order to prevent electrical system damage, check the Throttle Solenoid Adjustment after this procedure.

1. Bring engine to operating temperature.
2. Disconnect the Throttle Solenoid linkage at the clevis.
3. Manually pull the Throttle Lever until it contacts the High Speed Stop Screw.
4. Adjust the High Speed Stop Screw until the RPM is 3000 with the Throttle Lever against the High Speed Stop Screw.
5. Turn off the engine and reconnect the Throttle Solenoid linkage at the clevis.
6. Hold the High Speed Stop Screw while tightening the jam nut to prevent change in adjustment.

## THROTTLE SOLENOID ADJUSTMENT, DIESEL

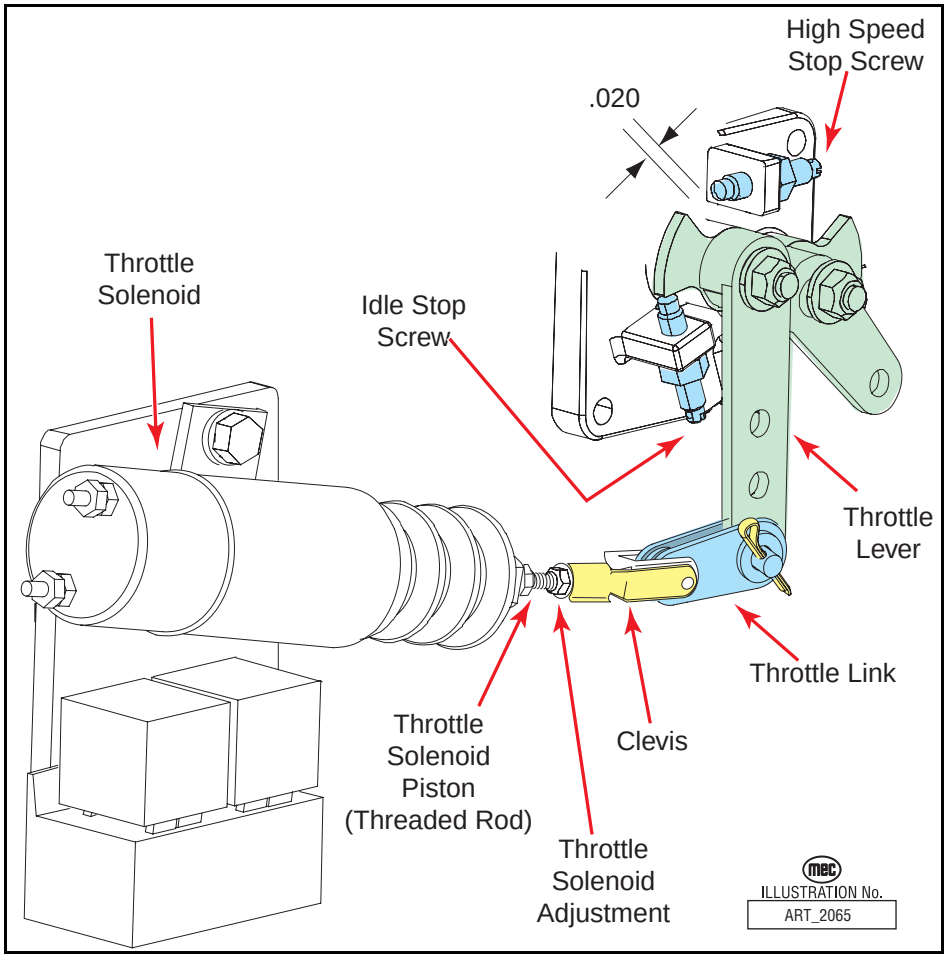
***IMPORTANT:* –** This final adjustment must be made after all other throttle speed adjustments. The solenoid must be free to retract fully in order to turn OFF the High Amperage Pull Circuit. Improper adjustment will result in solenoid failure and may damage the electrical system.

1. With the engine OFF, manually retract the solenoid by grasping the piston, just ahead of the boot, and pull to the fully retracted position.

**NOTE: The solenoid must retract and extend smoothly. If movement is impaired it may be necessary to reposition the solenoid to improvement alignment.**

2. With the solenoid piston fully retracted measure the distance between the High Speed Stop Screw and the Throttle linkage using a .020 feeler gauge.
3. Adjust clearance at the Throttle Solenoid linkage only.
   *Do not adjust the High Speed Stop Screw.*
   - Disconnect the linkage at the clevis and turn the clevis to lengthen or shorten as necessary.
   - Reconnect the clevis and measure again. Repeat until the measurement is correct.

***Figure 3-12:*** Diesel Engine Throttle Adjustments



# GASOLINE & DUAL FUEL ENGINE MODELS

For complete service information consult the engine manual that came with the machine.

**CAUTION**

**Always wear protective eye-wear when working with fuel and oil. Engine should be OFF when replacing filter elements.**

## OIL AND OIL FILTER - GASOLINE & DUAL FUEL

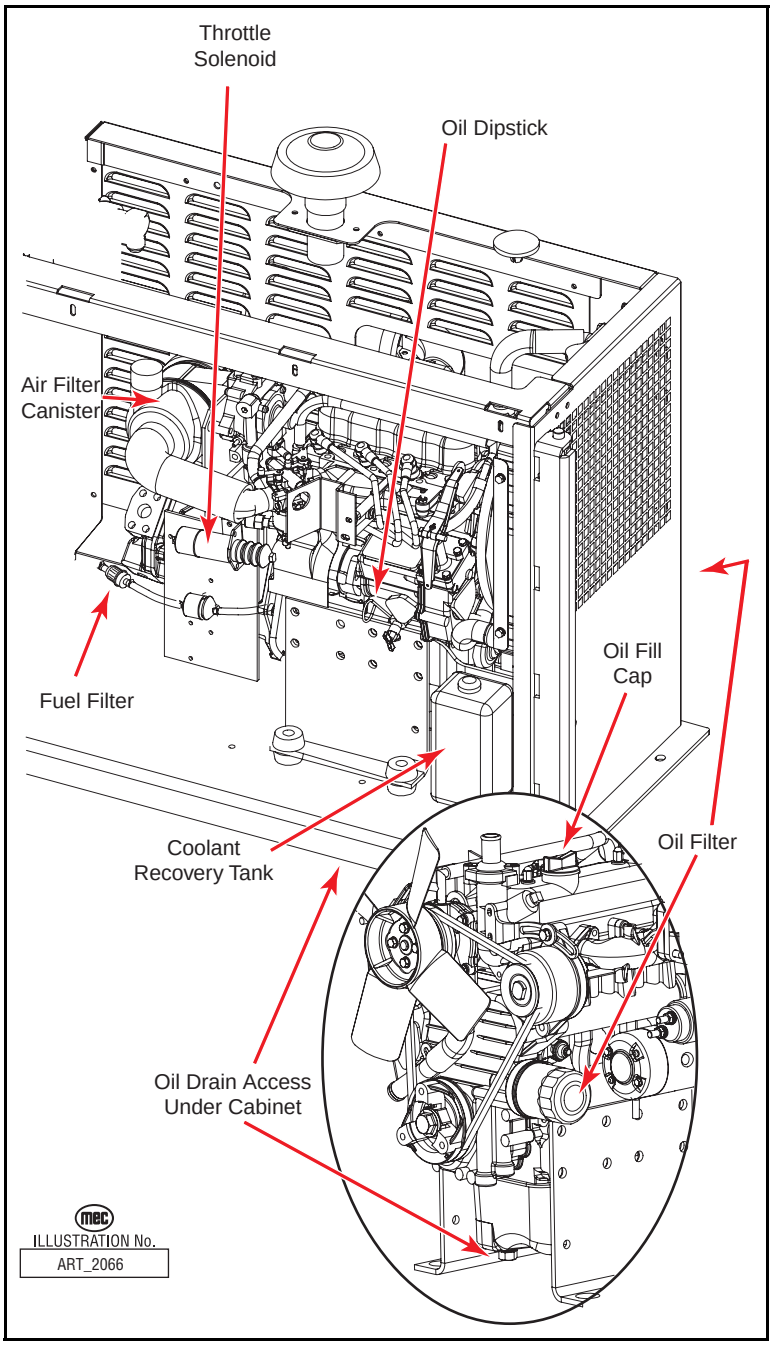
***Dispose of used oil and filters properly.***

1. Use a suitable container to catch drained oil. Remove the drain plug. After oil has drained, replace the drain plug.
2. Remove the old filter. Coat the seal on the new filter with clean oil, then install and tighten by hand.
3. Fill engine with 10w-30 motor oil until the dipstick indicates FULL. Capacity is 3.4 US quarts (3,25 l).
4. Recheck dipstick after running engine. Fill as necessary.

## FUEL FILTER - GASOLINE

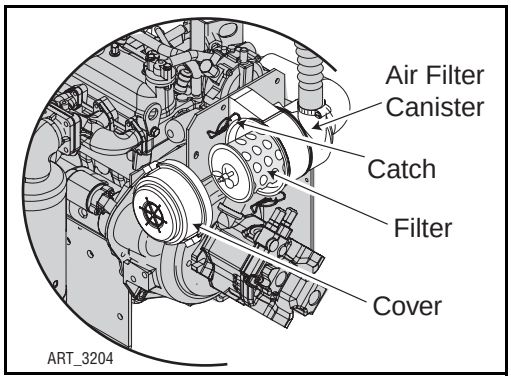
1. Turn OFF valve at fuel tank.
2. Loosen the hose clamps on the fuel lines and slide them away from the in-line fuel filter.
3. Remove the in-line fuel filter from the fuel lines.
4. Install a new in-line fuel filter.
   - There is an arrow, indicating direction of flow, on the body of the in-line fuel filter. Make sure that the arrow points ***from*** the fuel tank and ***to*** the engine.
5. Reposition and tighten the hose clamps.
6. Open valve at fuel tank and check for leaks.

***Figure 3-13:*** Dual Fuel Engine - Oil and Fuel Filter



## AIR FILTER ELEMENT - GASOLINE & DUAL FUEL

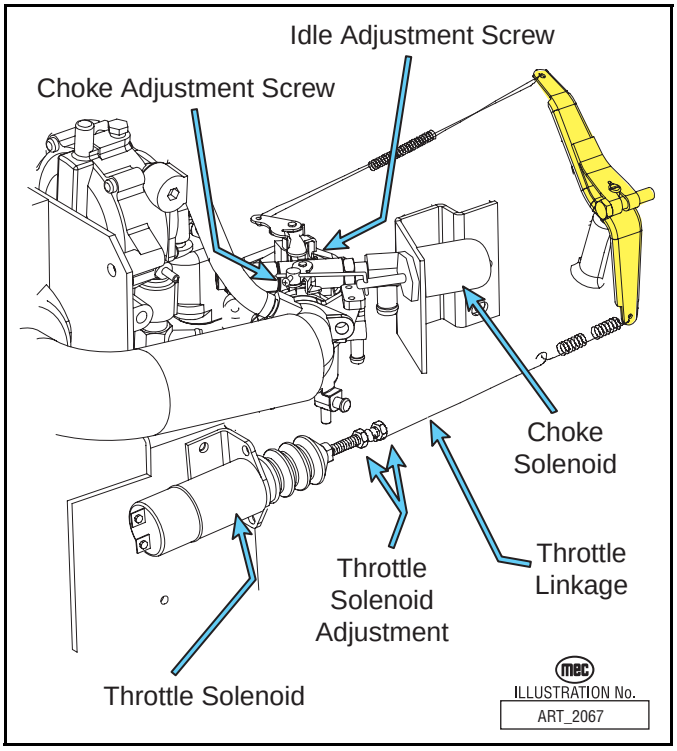
***Figure 3-14:*** Dual Fuel Engine Air Filter Element




1. Unlock the catches holding the filter canister cover.
2. Remove the wing-nut from the filter assembly and remove the filter element.
3. Inspect the canister for debris and clean as necessary.
4. Install a new filter element and tighten the wing-nut.
5. Replace the canister cover and lock the catches.

## ENGINE ADJUSTMENT - GASOLINE & DUAL FUEL

***Figure 3-15:*** Dual Fuel Engine Adjustments




The following adjustment points are sealed by the factory and cannot be adjusted.

- Carburetor Pilot Screw
- LPG Main Pressure Adjustment Screw
- LPG Idle Pressure Adjustment Screw
- Distributor Ignition Timing Adjustment Screw

### CHOKE ADJUSTMENT - GASOLINE & DUAL FUEL

1. Loosen the Choke Adjustment Screw until the linkage rod can move freely.
2. Manually retract the Choke Solenoid Piston until it stops.
3. While holding the solenoid fully retracted, close the choke plate until it stops in the fully closed position.
4. Allow the choke plate to open slightly and tighten the Choke Adjustment Screw.
5. Check Choke Solenoid operation to ensure that the choke plate travel does not prevent the Choke Solenoid from retracting fully.

## IDLE SPEED ADJUSTMENT - GASOLINE & DUAL FUEL

1. Bring the engine to operating temperature.
2. With the engine at idle, adjust the Throttle Stop Screw until the engine RPM is 1350±50.

## HIGH SPEED ADJUSTMENT - GASOLINE & DUAL FUEL

1. Bring the engine to operating temperature.
2. Loosen the adjusting nuts on the Throttle Solenoid.
3. Have an assistant press the enable trigger on the Upper Controls joystick.
4. Adjust the nuts on the Throttle Solenoid Piston until the engine RPM is 3400±50.
5. Tighten the nuts to secure the adjustment.

## NOTES:

SERVICE

# Section 4a

# TROUBLESHOOTING - 3084RT MODELS

## CONTENTS

## FIGURES PAGE



## TABLES PAGE

# GENERAL TROUBLESHOOTING TIPS

## HYDRAULIC FLUID PUMP - 3084RT MODELS

The Hydraulic Pump used in this model is a Variable Displacement, Pressure Compensated, Piston type pump. Proper adjustment is critical for normal operation of the machine. Refer to "Hydraulic Pressure Adjustment - 3084RT" on page 4a-33.

### *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 in the 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 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 - 3084RT

The electronic control system used on the 3084RT 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.

**WARNING**

**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.**

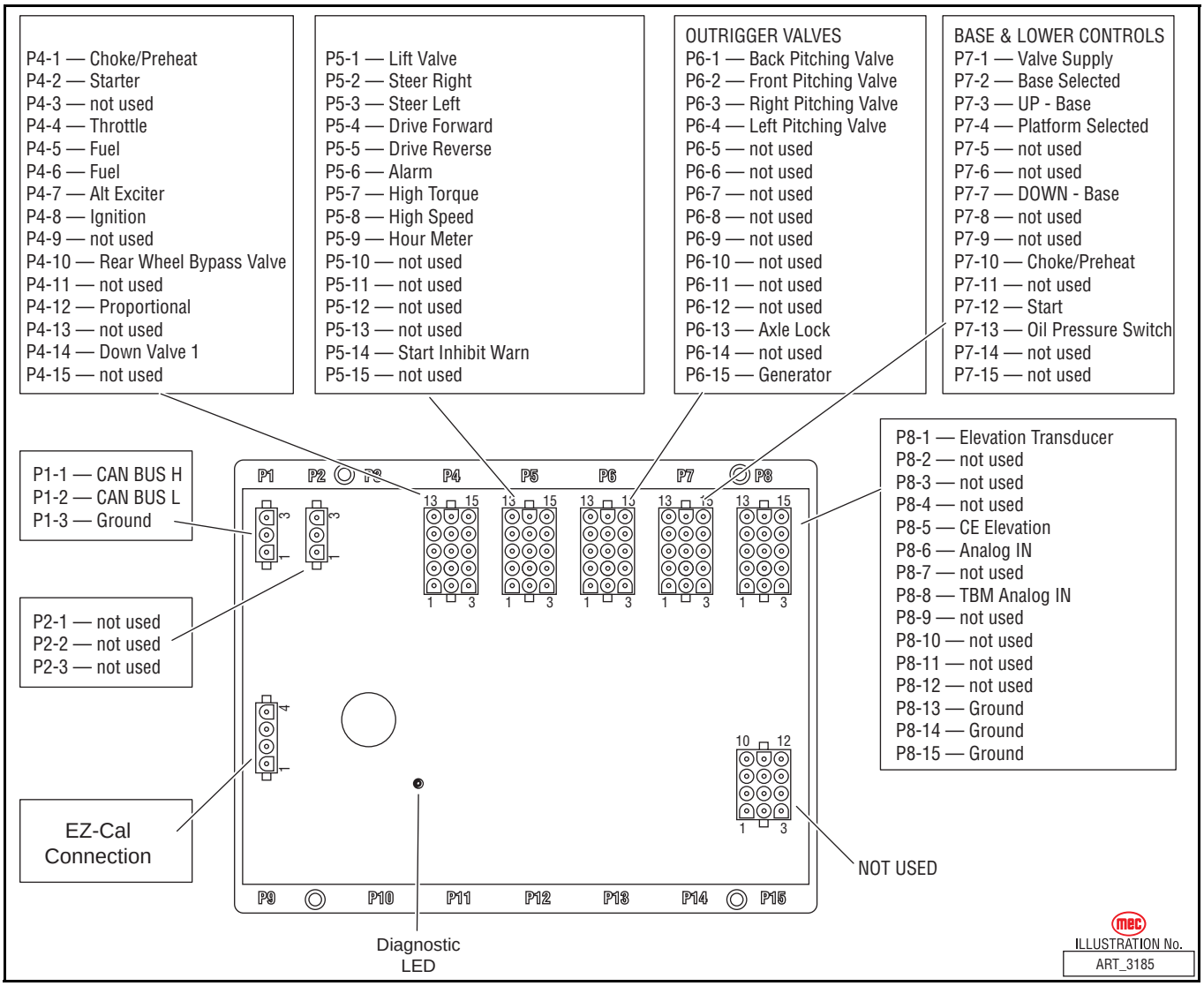
# GP400 MODULE

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

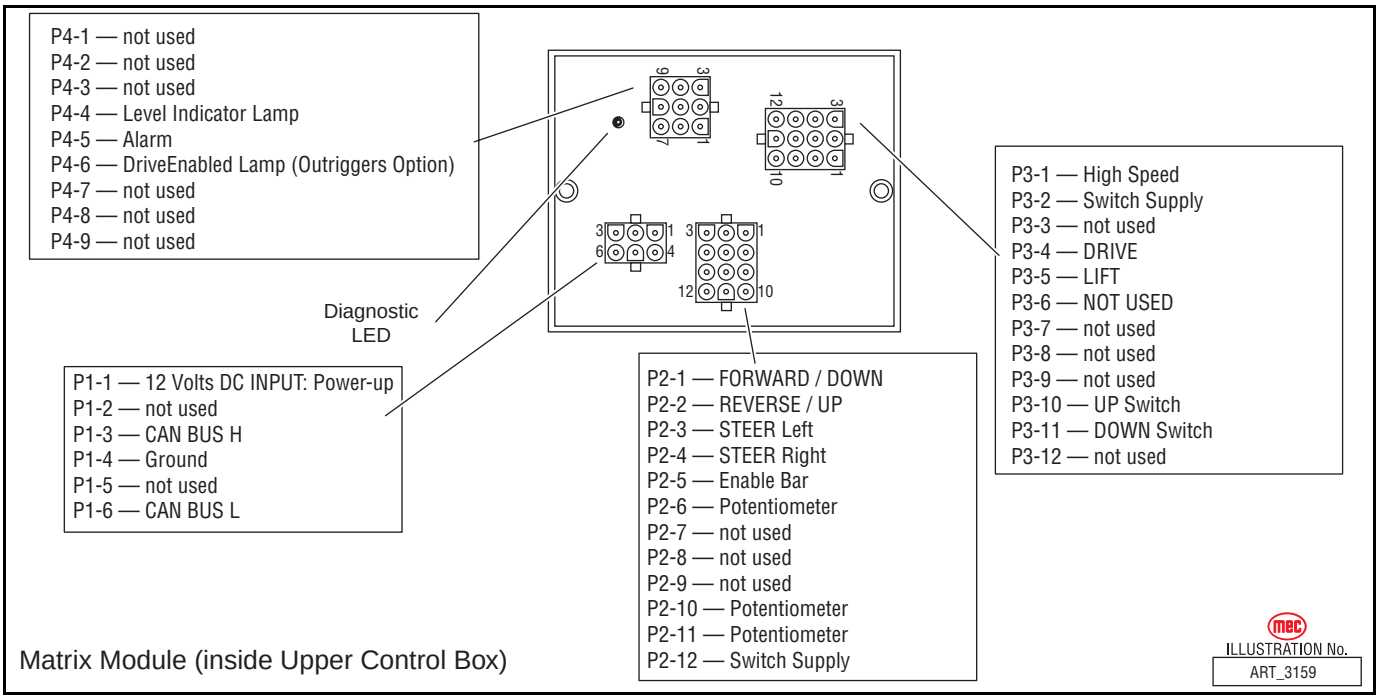
***Figure 4a-1:*** GP400 Module



# 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 4a-2:*** Matrix Module

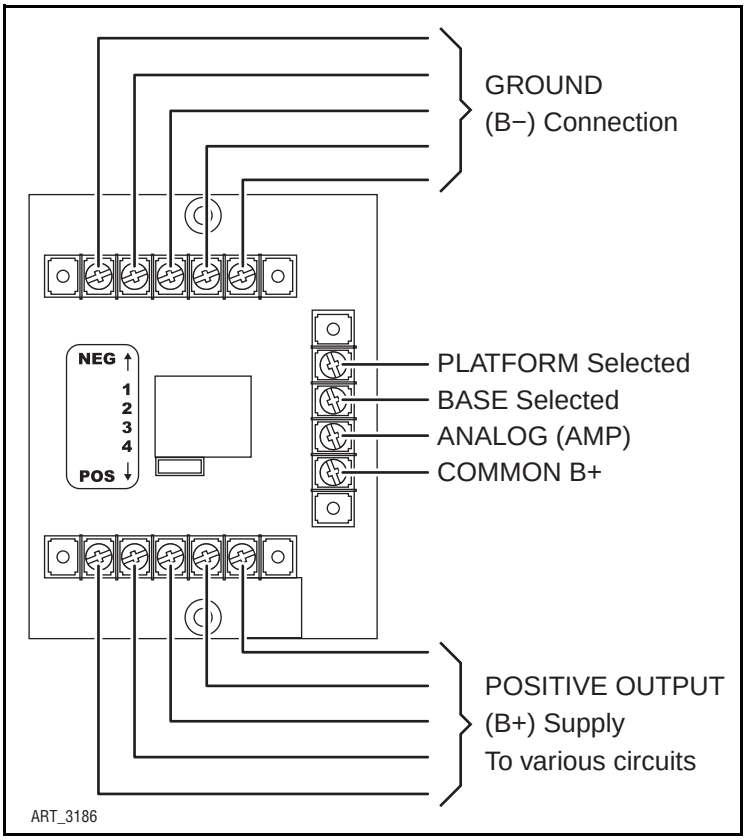



Matrix Module (inside Upper Control Box)

# TERMINAL BLOCK MODULE (TBM)

***Figure 4a-3:*** 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.



# EZ-CAL SCAN TOOL

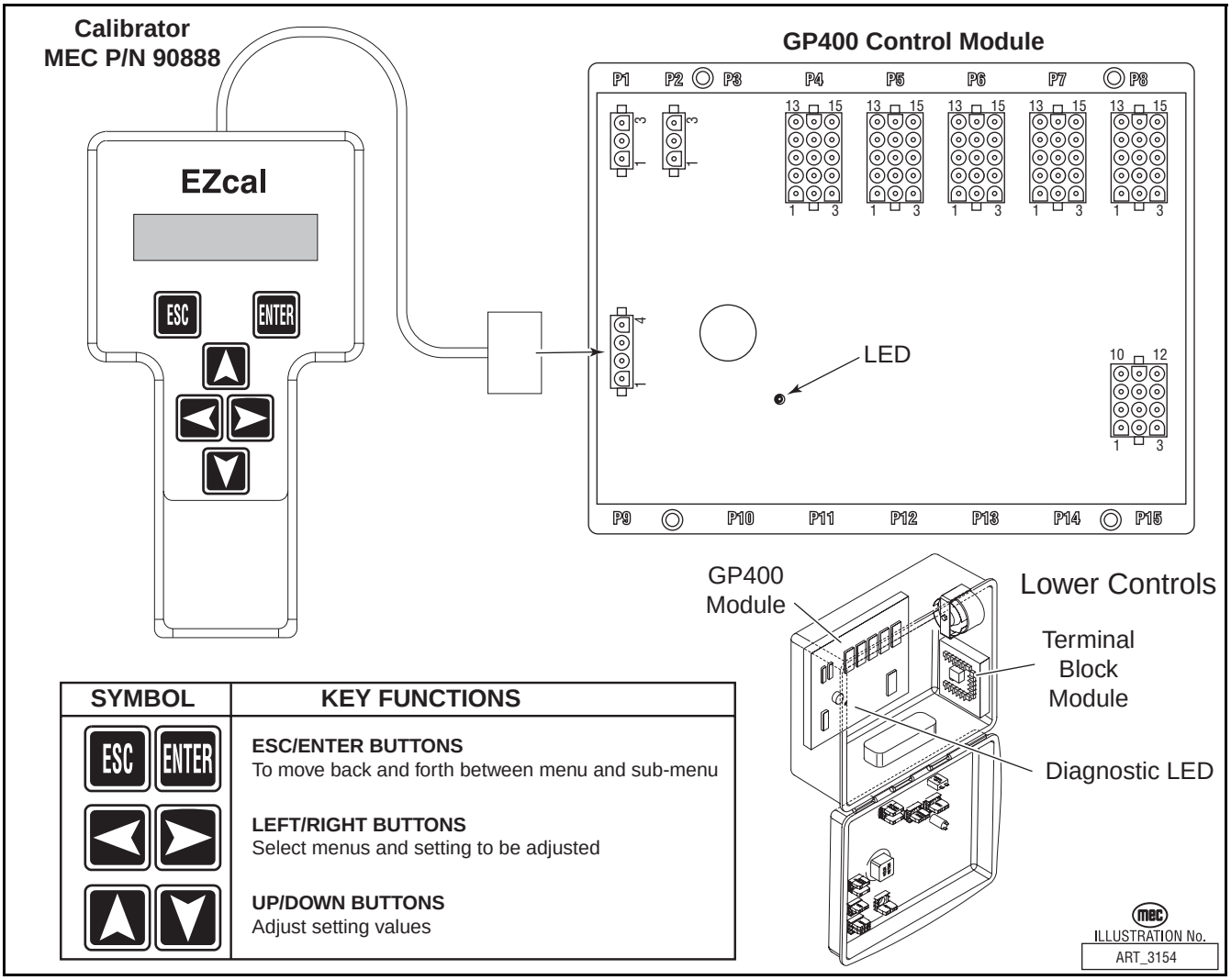
The EZ-Cal (MEC part # 90888; not part of the machine) is a hand-held scan tool that interfaces with the system to provide various information and adjustments. The EZ-cal receives its power from the GP400 when connected. The system must be powered up by closing the Battery disconnect switch and pulling 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 4a-4:*** EZ-Cal Scan Tool Connections - GP400 Module

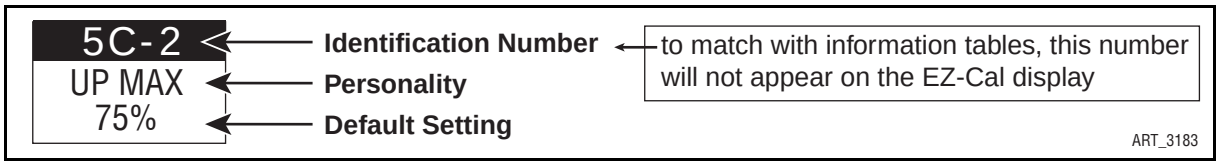



| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER | **ESC/ENTER BUTTONS**<br>To move back and forth between menu and sub-menu |
| ◀ ▶ | **LEFT/RIGHT BUTTONS**<br>Select menus and setting to be adjusted |
| ▲ ▼ | **UP/DOWN BUTTONS**<br>Adjust setting values |

# 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 4a-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.

**WARNING**

**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.

## 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 4a-19.

## 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 4a-22* for flash coded error messages.

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

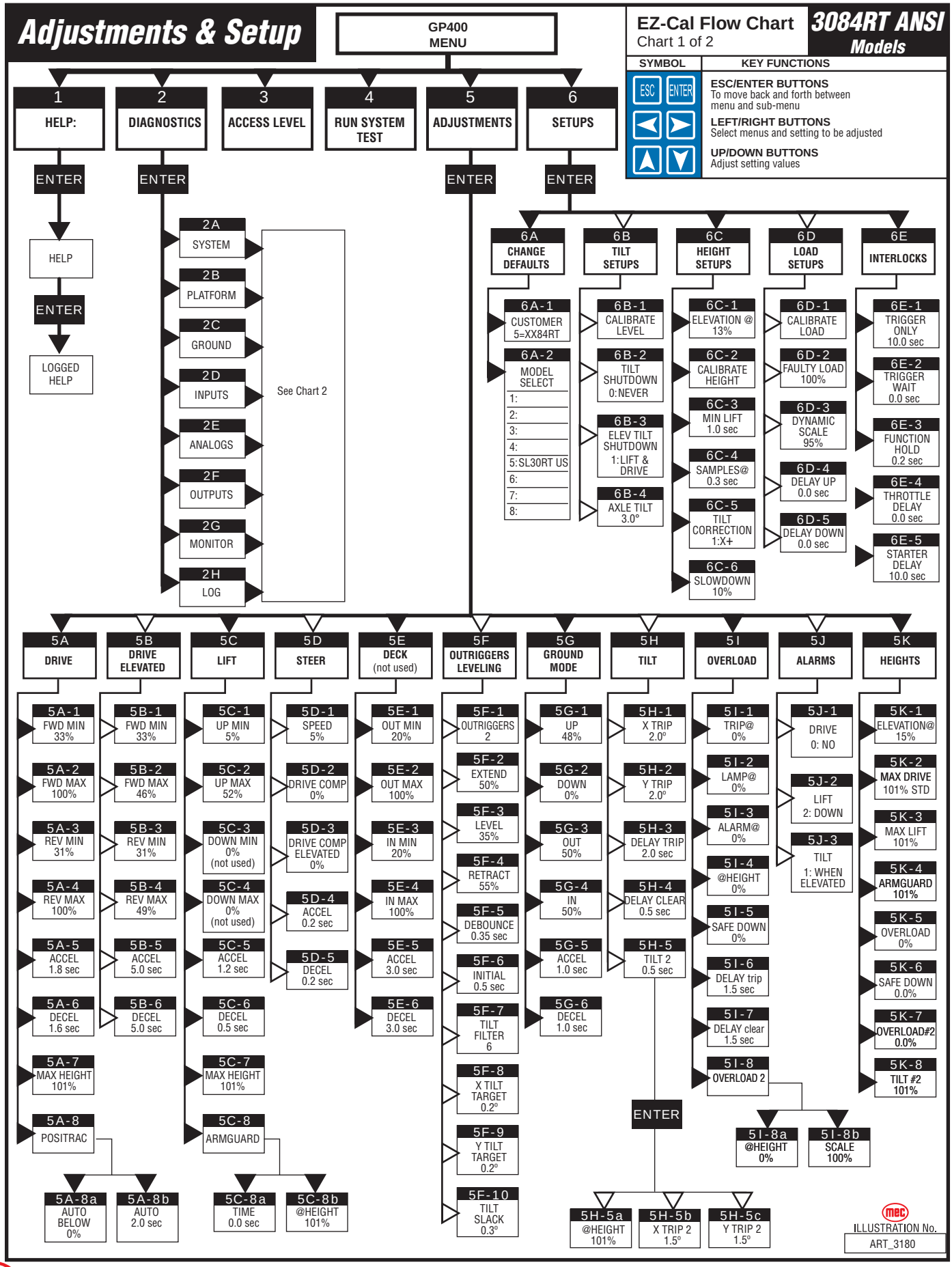


***Figure 4a-7:*** EZ-Cal Flow Chart: Diagnostic, ANSI Models

# DIAGNOSTIC

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

GP400 MENU → 2 DIAGNOSTICS → ENTER

**EZ-Cal Flow Chart** Chart 2 of 2 — **3084RT ANSI Models**

| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER ◀ ▶ ▲ ▼ | **ESC/ENTER BUTTONS** To move back and forth between menu and sub-menu<br>**LEFT/RIGHT BUTTONS** Select menus and setting to be adjusted<br>**UP/DOWN BUTTONS** Adjust setting values |

- **2A SYSTEM**
  - 2A-1 MODE
  - 2A-2 SUPPLY
    - 2A-2a SUPPLY 12 V DC
    - 2A-2b SUPPLY CAP BANK
  - 2A-3 VALVE SUPPLY
  - 2A-4 MOTOR VOLTS (ES ONLY)
  - 2A-5 MOTOR AMPS (ES ONLY)
  - 2A-6 TEMPERATURE (ES ONLY)
  - 2A-7 TILT
    - 2A-7a TILT FILTERED
    - 2A-7b TILT LOCAL
  - 2A-8 TILTED Y or N
  - 2A-9 HEIGHT (CE ONLY)
    - 2A-9a HEIGHT 1%
    - 2A-9b HEIGHT 2%
  - 2A-10 LOAD (CE ONLY)
  - 2A-11 OVERLOADED Y or N (CE ONLY)
  - 2A-12 NOT USED
  - 2A-13 ELEVATED Y or N
  - 2A-14 OUTRIGGER Y or N
    - 2A-14a RETRACTED Y or N
    - 2A-14b EXTENDED Y or N
    - 2A-14c STATUS
    - 2A-14d OUTRIGGER TEST
    - 2A-14e AUTO RETRACT
  - 2A-15 AXLE
    - 2A-15a LEVEL / OFF LEVEL
    - 2A-15b LOCKED Y or N
    - 2A-15c ANGLE
- **2B PLATFORM**
  - 2B-1 TRIGGER ON / OFF
  - 2B-2 DLD
  - 2B-3 JOYSTICK
  - 2B-4 FWD / DWN OFF / ON
  - 2B-5 REV / UP OFF / ON
  - 2B-6 LEFT OFF / ON
  - 2B-7 RIGHT OFF / ON
  - 2B-8 POSITRAC Y or N
  - 2B-9 NOT USED
- **2C GROUND**
  - 2C-1 UP ON / OFF
  - 2C-2 DOWN ON / OFF
  - 2C-3 NOT USED
  - 2C-4 NOT USED
  - 2C-5 NOT USED
- **2D INPUTS**
  - 2D-1 P7-1 12 V SUPPLY
  - 2D-2 P7-2 BASE SELECTED
  - 2D-3 P7-3 UP SELECTED
  - 2D-4 P7-4 PLATFORM SELECTED
  - 2D-5 P7-5 LIMIT SWITCH
  - 2D-6 P7-7 DOWN SELECTED
  - 2D-7 P7-9 THROTTLE
  - 2D-8 P7-10 CHOKE
  - 2D-9 P7-11 AXLE SWITCH
  - 2D-10 P7-12 START
  - 2D-11 P7-13 OIL PRESSURE SWITCH
- **2E ANALOGS LOAD SENSE**
  - 2E-1 P8-2 ANGLE TRANSDUCER
  - 2E-2 P8-6 PRESS TRANSDUCER
  - 2E-3 TBM AMPERAGE
- **2F OUTPUTS**
  - 2F-1 P4-1 CHOKE/PREHEAT
  - 2F-2 P4-2 START
  - 2F-3 P4-4 THROTTLE
  - 2F-4 P4-5 FUEL
  - 2F-5 P4-6 FUEL
  - 2F-6 P4-7 ALT EXCITE
  - 2F-7 P4-8 IGNITION
  - 2F-8 P4-10 REAR WHEELS
  - 2F-9 P4-12 PROPORTIONALS
  - 2F-10 P4-14 DOWNS
  - 2F-11 P5-1 LIFTS
  - 2F-12 P5-2 STEER RIGHT
  - 2F13 P5-3 STEER LEFT
  - 2F-14 P5-4 DRIVE FWD
  - 2F-15 P5-5 DRIVE REV
  - 2F-16 P5-6 ALARM
  - 2F-17 P5-7 HIGH TORQUE
  - 2F-18 P5-8 HIGH SPEED
  - 2F-19 P5-9 HOUR METER
  - 2F-20 P5-12 POWER OUT
  - 2F-21 P6-1 BACK PITCH
  - 2F-22 P6-2 FRONT PITCH
  - 2F-23 P6-3 RIGHT ROLLING
  - 2F-24 P6-4 LEFT ROLLING
  - 2F-25 P6-13 AXLE LOCK
  - 2F-26 P6-15 GENERATOR
- **2G LOG**
  - 2G-1 CAL DATE (CE ONLY)
  - 2G-2 SOFTWARE
  - 2G-3 POWERED

**P4**

| | | |
|---|---|---|
| P4-1 | *CHOKE/PREHEAT* | ON = activated |
| P4-2 | *START SWITCH* | ON = Starter activated |
| P4-4 | *THROTTLE SOLENOID* | ON = Solenoid pulled in |
| P4-5 | *FUEL SELECT SWITCH* | ON = Fuel System activated |
| P4-6 | *FUEL SELECT SWITCH* | ON = Fuel System activated |
| P4-7 | *ALTERNATOR EXCITE* | ON = Alternator activated |
| P4-8 | *IGNITION SWITCH* | ON = Power |
| 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 |
| P5-12 | *LIMIT SWITCH POWER SUPPLY B+* | ON = System powered-up |

**P6 OUTRIGGER MANIFOLD**

| | | |
|---|---|---|
| P6-1 | *REAR PITCH VALVE* | ON = Valve activated |
| P6-2 | *FRONT PITCH VALVE* | ON = Valve activated |
| P6-3 | *RIGHT ROLLING VALVE* | ON = Valve activated |
| P6-4 | *LEFT ROLLING VALVE* | ON = Valve activated |
| P6-13 | *AXLE LOCK VALVES* | ON = Valve powered |
| P6-15 | *GENERATOR RELAY SIGNAL* | ON = Generator activated |

**P7 BASE & LOWER CONTROLS**

| | | |
|---|---|---|
| P7-1 | *BATTERY VOLTAGE from TBM* | ON = Voltage, OFF = No Voltage |
| P7-2 | *BASE SELECTED* | ON = Base Controls |
| P7-3 | *UP SWITCH (BASE CONTROLS)* | ON = Up activated |
| P7-4 | *PLATFORM SELECTED* | ON = Platform Controls |
| P7-5 | *LIMIT SWITCH* | ON = Lowered, OFF = elevated |
| P7-7 | *DOWN SWITCH (BASE CONTROLS)* | ON = Down activated |
| P7-9 | *THROTTLE SOLENOID* | ON = Throttle |
| P7-10 | *CHOKE/PREHEAT* | ON = activated |
| P7-11 | *AXLE CENTER SWITCH* | ON = Drive enabled |
| P7-12 | *START* | ON = Start Switch activated |
| P7-13 | *OIL PRESSURE SWITCH* | |

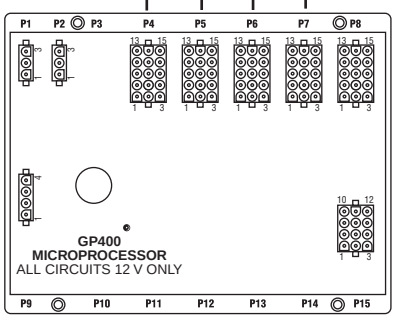



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***Figure 4a-8:*** EZ-Cal Flow Chart: Adjustments and Setup, CE Models

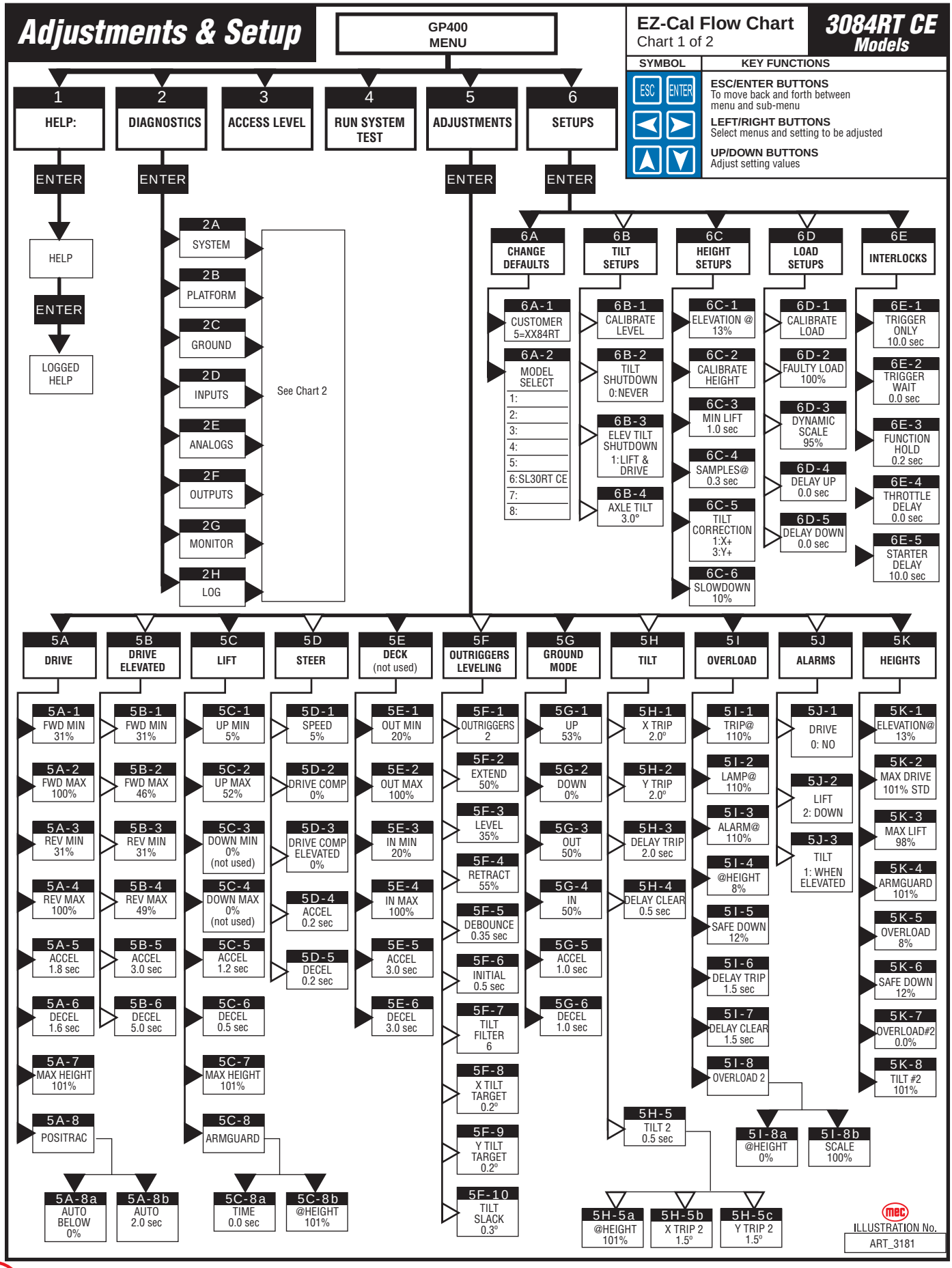


***Figure 4a-9:*** "EZ-Cal Flow Chart: Diagnostic, CE Models

# DIAGNOSTIC

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

GP400 MENU → 2 DIAGNOSTICS → ENTER

**EZ-Cal Flow Chart** Chart 2 of 2 — **3084RT CE Models**

| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER ◀ ▶ ▲ ▼ | **ESC/ENTER BUTTONS** To move back and forth between menu and sub-menu<br>**LEFT/RIGHT BUTTONS** Select menus and setting to be adjusted<br>**UP/DOWN BUTTONS** Adjust setting values |

- **2A SYSTEM**
  - 2A-1 MODE
  - 2A-2 SUPPLY
    - 2A-2a SUPPLY 12 V DC
    - 2A-2b SUPPLY CAP BANK
  - 2A-3 VALVE SUPPLY
  - 2A-4 MOTOR VOLTS (ES ONLY)
  - 2A-5 MOTOR AMPS (ES ONLY)
  - 2A-6 TEMPERATURE (ES ONLY)
  - 2A-7 TILT
    - 2A-7a TILT FILTERED
    - 2A-7b TILT LOCAL
  - 2A-8 TILTED Y or N
  - 2A-9 HEIGHT (CE ONLY)
    - 2A-9a HEIGHT 1%
    - 2A-9b HEIGHT 2%
  - 2A-10 LOAD (CE ONLY)
  - 2A-11 OVERLOADED Y or N (CE ONLY)
  - 2A-12 NOT USED
  - 2A-13 ELEVATED Y or N
  - 2A-14 OUTRIGGER Y or N
    - 2A-14a RETRACTED Y or N
    - 2A-14b EXTENDED Y or N
    - 2A-14c STATUS
    - 2A-14d OUTRIGGER TEST
    - 2A-14e AUTO RETRACT
  - 2A-15 AXLE
    - 2A-15a LEVEL / OFF LEVEL
    - 2A-15b LOCKED Y or N
    - 2A-15c ANGLE
- **2B PLATFORM**
  - 2B-1 TRIGGER ON / OFF
  - 2B-2 DLD
  - 2B-3 JOYSTICK
  - 2B-4 FWD / DWN OFF / ON
  - 2B-5 REV / UP OFF / ON
  - 2B-6 LEFT OFF / ON
  - 2B-7 RIGHT OFF / ON
  - 2B-8 POSITRAC Y or N
  - 2B-9 NOT USED
- **2C GROUND**
  - 2C-1 UP ON / OFF
  - 2C-2 DOWN ON / OFF
  - 2C-3 NOT USED
  - 2C-4 NOT USED
  - 2C-5 NOT USED
- **2D INPUTS**
  - 2D-1 P7-1 12 V SUPPLY
  - 2D-2 P7-2 BASE SELECTED
  - 2D-3 P7-3 UP SELECTED
  - 2D-4 P7-4 PLATFORM SELECTED
  - 2D-5 P7-5 LIMIT SWITCH
  - 2D-6 P7-7 DOWN SELECTED
  - 2D-7 P7-9 THROTTLE
  - 2D-8 P7-10 CHOKE
  - 2D-9 P7-11 AXLE SWITCH
  - 2D-10 P7-12 START
  - 2D-11 P7-13 OIL PRESSURE SWITCH
- **2E ANALOGS LOAD SENSE**
  - 2E-1 P8-2 ANGLE TRANSDUCER
  - 2E-2 P8-6 PRESS TRANSDUCER
  - 2E-3 TBM AMPERAGE
- **2F OUTPUTS**
  - 2F-1 P4-1 CHOKE/PREHEAT
  - 2F-2 P4-2 START
  - 2F-3 P4-4 THROTTLE
  - 2F-4 P4-5 FUEL
  - 2F-5 P4-6 FUEL
  - 2F-6 P4-7 ALT EXCITE
  - 2F-7 P4-8 IGNITION
  - 2F-8 P4-10 REAR WHEELS
  - 2F-9 P4-12 PROPORTIONALS
  - 2F-10 P4-14 DOWNS
  - 2F-11 P5-1 LIFTS
  - 2F-12 P5-2 STEER RIGHT
  - 2F13 P5-3 STEER LEFT
  - 2F-14 P5-4 DRIVE FWD
  - 2F-15 P5-5 DRIVE REV
  - 2F-16 P5-6 ALARM
  - 2F-17 P5-7 HIGH TORQUE
  - 2F-18 P5-8 HIGH SPEED
  - 2F-19 P5-9 HOUR METER
  - 2F-20 P5-12 POWER OUT
  - 2F-21 P6-1 BACK PITCH
  - 2F-22 P6-2 FRONT PITCH
  - 2F-23 P6-3 RIGHT ROLLING
  - 2F-24 P6-4 LEFT ROLLING
  - 2F-25 P6-13 AXLE LOCK
  - 2F-26 P6-15 GENERATOR
- **2G LOG**
  - 2G-1 CAL DATE (CE ONLY)
  - 2G-2 SOFTWARE
  - 2G-3 POWERED

**P4**

| | | |
|---|---|---|
| P4-1 | *CHOKE/PREHEAT* | ON = activated |
| P4-2 | *START SWITCH* | ON = Starter activated |
| P4-4 | *THROTTLE SOLENOID* | ON = Solenoid pulled in |
| P4-5 | *FUEL SELECT SWITCH* | ON = Fuel System activated |
| P4-6 | *FUEL SELECT SWITCH* | ON = Fuel System activated |
| P4-7 | *ALTERNATOR EXCITE* | ON = Alternator activated |
| P4-8 | *IGNITION SWITCH* | ON = Power |
| 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 |
| P5-12 | *LIMIT SWITCH POWER SUPPLY B+* | ON = System powered-up |

**P6 OUTRIGGER MANIFOLD**

| | | |
|---|---|---|
| P6-1 | *REAR PITCH VALVE* | ON = Valve activated |
| P6-2 | *FRONT PITCH VALVE* | ON = Valve activated |
| P6-3 | *RIGHT ROLLING VALVE* | ON = Valve activated |
| P6-4 | *LEFT ROLLING VALVE* | ON = Valve activated |
| P6-13 | *AXLE LOCK VALVES* | ON = Valve powered |
| P6-15 | *GENERATOR RELAY SIGNAL* | ON = Generator activated |

**P7 BASE & LOWER CONTROLS**

| | | |
|---|---|---|
| P7-1 | *BATTERY VOLTAGE from TBM* | ON = Voltage, OFF = No Voltage |
| P7-2 | *BASE SELECTED* | ON = Base Controls |
| P7-3 | *UP SWITCH (BASE CONTROLS)* | ON = Up activated |
| P7-4 | *PLATFORM SELECTED* | ON = Platform Controls |
| P7-5 | *LIMIT SWITCH* | ON = Lowered, OFF = elevated |
| P7-7 | *DOWN SWITCH (BASE CONTROLS)* | ON = Down activated |
| P7-9 | *THROTTLE SOLENOID* | ON = Throttle |
| P7-10 | *CHOKE/PREHEAT* | ON = activated |
| P7-11 | *AXLE CENTER SWITCH* | ON = Drive enabled |
| P7-12 | *START* | ON = Start Switch activated |
| P7-13 | *OIL PRESSURE SWITCH* | |

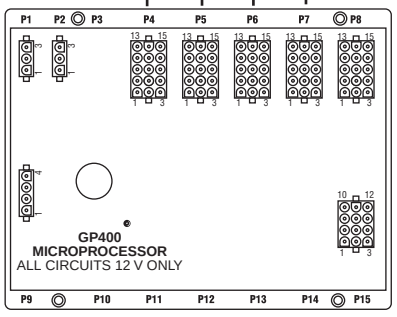



ILLUSTRATION No. ART_3184

# EZ-CAL ADJUSTMENT

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

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **5A DRIVE** (PLATFORM STOWED) | 5A-1 | FWD Min | 33% | Slowest speed possible |
| | 5A-2 | FWD Max | 100% | Maximum speed potential |
| | 5A-3 | REV Min | 31% | Slowest speed possible |
| | 5A-4 | REV Max | 100% | Maximum speed potential |
| | 5A-5 | ACCEL | 1.8 sec | Ramp-up time to maximum |
| | 5A-6 | DECEL | 1.6 sec | Ramp-down time to stop |
| | 5A-7 | MAX Height | 101% | Maximum drivable height |
| **POSITRACK** | 5A-8 | Positrack | — | Sub category, press ENTER to access |
| **Sub Menu** | 5A-8a | AUTO below | 0% | Not Used |
| | 5A-8b | AUTO | Not Used | Not Used |
| **5B DRIVE ELEVATED** | 5B-1 | FWD Min | 33% | Slowest speed possible |
| | 5B-2 | FWD Max | 46% | Maximum speed potential |
| | 5B-3 | REV Min | 31% | Slowest speed possible |
| | 5B-4 | REV Max | 49% | Maximum speed potential |
| | 5B-5 | ACCEL | 5.0 sec | Ramp-up time to maximum |
| | 5B-6 | DECEL | 5.0 sec | Ramp-down time to stop |
| **5C LIFT** | 5C-1 | UP Min | 5% | Slowest speed possible |
| | 5C-2 | UP Max | 52% | 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 time to stop |
| | 5C-7 | MAX Height | **ANSI:** 101% \|\| **CE:** 98% | Maximum height potential |
| **ARMGUARD (CE)** | 5C-8 | Armguard | — | Sub category, press ENTER to access |
| **Sub Menu** | 5C-8a | Armguard Time | 0.0 sec | CE Option Only |
| | 5C-8b | Armguard @ Height | 101% | CE Option Only |
| **5D STEER** | 5D-1 | Speed | 0% | Maximum speed potential |
| | 5D-2 | Drive Compensation | 0% | Adds additional to drive speed |
| | 5D-3 | Drive Comp Elevated | 0% | 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 |
| **5E - DECK** | 5E- | Not Used | Not Used | Power-out deck (not used) |

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **5F OUTRIGGERS** Called *"Outriggers"* on the EZ-Cal, these personalities effect ***Auto-level*** function | 5F-1 | Outriggers | 2 | Not Used |
| | 5F-2 | Extend | 50% | O/R speed before all legs down |
| | 5F-3 | Level | 35% | O/R speed after all legs touch down |
| | 5F-4 | Retract | 55% | Maximum speed potential |
| | 5F-5 | Debounce | 0.35 | Compensates for switch bounce |
| | 5F-6 | Initial | 0.5 | Not Used |
| | 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 | Not Used |
| **5G GROUND MODE** Lower Control Operations | 5G-1 | UP | 53% | 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 drive output |
| **5H TILT** | 5H-1 | X Trip | 2.0 degrees | Angle tilt sensor signals Out Of Level |
| | 5H-2 | Y Trip | 2.0 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 Tip and Signal OFF |
| **TILT 2** | 5H-4 | Tilt 2 | — | Sub category, press ENTER to access |
| **Sub Menu** | 5H-5A | At Height | 101% | Point where lesser tilt angle used |
| | 5H-5B | X Trip 2 | 1.5 sec | Not Used |
| | 5H-5C | Y Trip 2 | 1.5 sec | Not Used |
| **5I OVERLOAD** **ANSI:** values = 0 **CE:** values apply | 5I-1 | Trip @ | **ANSI:** 0% \|\| **CE:** 110% | % of weight over maximum to trigger overload |
| | 5I-2 | Lamp @ | **ANSI:** 0% \|\| **CE:** 0% | % of weight over maximum to trigger lamp |
| | 5I-3 | Alarm @ | **ANSI:** 0% \|\| **CE:** 0% | % of weight over maximum to trigger alarm |
| | 5I-4 | @ Height | **ANSI:** 0% \|\| **CE:** 8% | % of elevation load sense starts monitoring weight |
| | 5I-5 | Safe Down | **ANSI:** 0% \|\| **CE:** 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 |
| **OVERLOAD 2** | 5I-8 | Overload # 2 | — | Sub category, press ENTER to access |
| **Sub Menu** | 5I-8a | @ Height | 0% | % of height for secondary overload valve |
| | 5I-8b | Scale | 100% | % of reduced overload valve |
| **5J ALARMS** | 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 |
| **5K HEIGHTS** | 5K-1 | Elevation | 15% | Point at which machine enters elevated mode |
| | 5K-2 | Maximum Drive | 101% | Maximum drivable height |
| | 5K-3 | Maximum Lift | **ANSI:** 101% \|\| **CE:** 98% | Maximum elevated height potential |
| | 5K-4 | Armguard | 101% | Stops descent for 5 sec |
| | 5K-5 | Overload | **ANSI:** 0% \|\| **CE:** 8% | % of elevation load sense starts monitoring weight |
| | 5K-6 | Safe Down | **ANSI:** 0% \|\| **CE:** 12% | % of elevation lift-down still operates in overload |
| | 5K-7 | Overload # 2 | 0% | Not Used |
| | 5K-8 | Tilt # 2 | **ANSI:** 0% \|\| **CE:** 0% | Reduced degree of tilt at % elevation |

# EZ-CAL SETUP

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

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **6A CHANGE DEFAULTS** | 6A-1 | Customer | 5: XX84RT | Identifies Base Model<br>Must be set when GP400 is Replaced |
| | 6A-2 | Model | 5 = ANSI<br>6 = CE | Select from these choices only |
| **6D TILT SETUPS** | 6B-1 | Calibrate Level? | Y = ENTER N = ESC | Follow instructions in<br>Section 2 - Level Sensor Calibration |
| | | **WARNING! Refer to Tilt Sensor Calibration instructions before attempting calibration** | | |
| | 6B-2 | Tilt Shutdown | 0 = Never | 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 |
| **6C HEIGHT SETUP**<br>(CE OPTION ONLY) | 6C-1 | Elevation @ | 13% | |
| | 6C-2 | Calibrate Height | Start Calibration | See Section 2 for calibration of Height Sensor |
| | 6C-3 | Minimum Lift | 1.0 sec | Calibration setting - do not change |
| | 6C-4 | Samples | 0.10 sec | Calibration setting - do not change |
| | 6C-5 | Tilt Correction | Disabled | Calibration setting - do not change |
| | 6C-6 | Slow Down | 10% | Calibration setting - do not change |
| **6D LOAD SETUPS**<br>(CE OPTION ONLY) | 6D-1 | Calibrate Load | Start Calibration | See Section 2 for calibration of<br>CE Overload System |
| | 6D-2 | Faulty Load | 100% | Calibration setting - do not change |
| | 6D-3 | Dynamic Scale | 95% | Calibration setting - do not change |
| | 6D-4 | Delay Up | 0.0 sec | Not Used |
| | 6D-5 | Delay Down | 0.0 sec | Not Used |
| **6E INTERLOCKS** | 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 |
| **Delays** | 6E-4 | Delays | — | Sub category, press ENTER to access |
| **Sub Menu** | 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 Chart with this table for additional information.

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

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

| SELECTION | ID | EZ-cal READOUT | EXPLAINATION |
|---|---|---|---|
| **2A SYSTEM** | 2A-1 | MODE | Current operation - Press ENTER to read interlock when 2-2 flash is present |
| | 2A-2 | Supply | Voltage through EMS circuit to either Base or Platform input. 12 - 13.5 volts |
| **Sub Menu** | 2A-2a | Supply | Voltage through EMS circuit to either Base or Platform input. 12 - 13.5 volts |
| | 2A-2b | Cap Bank Voltage | Capacitor bank charge voltage, should be around 35 volts - Electric models only |
| | 2A-3 | Valve Supply | 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 4-way e-z fit sensor located in elevating linkage |
| **Sub Menu** | 2A-7a | Tilt Filtered | Slowed tilt value used for O/R or Auto-level |
| | 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. All motorized functions stop above limit, lift disabled in stowed |
| | 2A-9 | Height | Current state of platform elevation in %. (CE overload option only) |
| **Sub Menu** | 2A-9a | Height 1 % | Reading in % from Angle Transducer #1 - relates directly to degree of elevation |
| | 2A-9b | Height 2 % | Reading in % from Angle Transducer #2 - CE Equipped units only |
| | 2A-10 | Load | Current load on platform in %. (CE overload option only) |
| | 2A-11 | Overloaded Y/N | Platform overloaded. (CE overload option only) |
| | 2A-12 | Last Moved | Not used |
| | 2A-13 | Elevated Y/N | Shows platform elevation above/below limit switch, test limit switch operation |
| | 2A-14 | Outriggers Y/N | Turns the auto-level feature on/off |
| **Sub Menu** | 2A-14a | Retracted Y/N | All Retract switches closed - For outrigger equipped units only. |
| | 2A-14b | Extended Y/N | All pressure switches closed - For outrigger equipped units only. |
| | 2A-14c | Status | For outrigger equipped units only |
| | 2A-14d | Outrigger Test | Follow instructions on EZ-cal to test O/R circuits - For outrigger equipped units only. |
| | 2A-14e | Auto-retract 15s | Retract in drive mode - auto-retract feature used on 5492 models only |
| | 2A-15 | Axle | Press ENTER for Axle sub menus |

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

| SELECTION | ID | EZ-cal READOUT | EXPLAINATION |
|---|---|---|---|
| **Sub Menu** | 2A-15a | Level / Off Level | Status of axle position as read by GP400 - Not used on all models |
| | 2A-15b | Locked Y/N | Status of oscillating axle lock valves, locked = no oscillation - Not used on all models |
| | 2A-15c | Angle | Position of oscillating Axle relative to the chassis - Not used on all models |
| **2B PLATFORM** | 2B-1 | Trigger ON/OFF | Current status of enable trigger - upper controls |
| | 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/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 | Status of rear wheel solenoids activation. Activated in high speed or elevated drive |
| | 2B-9 | EMSG OFF/ON | Not used |
| **2C GROUND** | 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 |
| **2D INPUTS** | 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 | P7-5 | Limit Switch. ON= limit switch closed - platform low enough to be in stowed position |
| | 2D-6 | P7-7 | Down. ON= Down switch activated for platform lower operation |
| | 2D-7 | P79 | Throttle Solenoid. ON= Throttle requested by function operation |
| | 2D-8 | P7-10 | Choke (gas engine) or pre-heat (diesel). ON= Choke or Pre-heat switch activated |
| | 2D-9 | P7-11 | Axle Center Switch. ON= Front axle parallel with chassis - Elevated drive enabled |
| | 2D-10 | P7-12 | Start. ON= input from engine-start switch |
| | 2D-11 | P7-13 | Oil Pressure Switch |
| **2E ANALOGS** | | Not used | Not used |

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

| SELECTION | ID | EZ-cal READOUT | EXPLAINATION |
|---|---|---|---|
| **2F OUTPUTS** | 2F-1 | P4-1 | Choke (gas engine) or pre-heat (diesel). ON= Choke or 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 | P4-5 | Fuel to fuel select switch. ON= fuel system activated |
| | 2F-5 | P4-6 | Fuel to fuel select switch. ON= fuel system activated |
| | 2F-6 | P4-7 | Alternator Excite. ON= power to activate alternator charge |
| | 2F-7 | P4-8 | Ignition. ON= power to ignition coil (gas) or fuel hold solenoid (diesel) |
| | 2F-8 | P4-10 | Rear Wheel Bi-pass Valves. ON= Valves powered, rear wheels in bi-pass |
| | 2F-9 | P4-12 | Proportional Valve. ON= Proportional valve activated for lift and drive operation |
| | 2F-10 | P4-14 | Down Valves. ON= Down valves activated for platform lower operation |
| | 2F-11 | P5-1 | Lift Valve. ON= Lift valve activated for platform Lift |
| | 2F-12 | P5-2 | Steer Right. ON= steer right valve activated |
| | 2F-13 | P5-3 | Steer Left. ON= steer left valve activated |
| | 2F-14 | P5-4 | Drive Forward. ON= drive forward valve activated |
| | 2F-15 | P5-5 | Drive Reversed. ON= drive reverse valve activated |
| | 2F-16 | P5-6 | Alarm. ON= alarm activated (default alarm in Down, may be selected for other modes) |
| | 2F-17 | P5-7 | High Torque. ON= high torque valve activated (drive range toggle in down position) |
| | 2F-18 | P5-8 | High Speed. ON= high speed valve activated (drive range toggle in up position) |
| | 2F-19 | P5-9 | Hour Meter. ON= Meter powered up |
| | 2F-20 | P5-12 | Power Supply to limit switch and TBM module - should be ON when system powered |
| | 2F-21 | P6-1 | Rear Pitching Valve. ON= rear pitching valve activated for Platform Rear Leveling |
| | 2F-22 | P6-2 | Front Pitching Valve. ON= Front Pitching valve activated for Platform forward Level |
| | 2F-23 | P6-3 | Outrigger – Not used |
| | 2F-24 | P6-4 | Left Rolling Valve. ON= Left valve activated for platform Level Left |
| | 2F-25 | P6-11 | Axle Lock Valves. ON= Axle valves powered, front axle will oscillate |
| **2G LOG** | 2G-1 | Cal Date | Date of Load Sense calibration (CE option 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# 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 4a-10 – CE Page 4a-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. **(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)

## 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.
- 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 (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 time-out).

***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.

***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.

***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/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.

## 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. 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 is 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.

## 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.

# 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 proceeding to use 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 4a-4:*** Troubleshooting Chart

| PROBLEM | POSSIBLE CAUSE | REMEDY/SOLUTION |
|---|---|---|
| **General Power Issue** | | |
| **No operation from Upper or Lower control station** | Main Battery Switch turned OFF | Located left of Lower Control Box |
| | Emergency Stop Switch pushed or Ignition Switch turned OFF | 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.<br>Clean, service and charge battery - repair cables |
| | Circuit Breaker Tripped | Located in Lower Control Box Panel<br>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 |
| **Functions from Lower Controls but not from Upper Controls** | Interlock Switch (Joystick) | Check power to red wire (power to switch)<br>and power to purple wire (power out of switch)<br>at the joystick plug |
| **Lift/Lower** | | |
| **Platform will not raise** | Excessive weight on platform | Reduce weight to within platform capacity |
| | Lift Relief Valve out of adjustment | Adjust Relief Valve to rated platform capacity |
| | Lift Valve SV-1 not energized | Check wiring to lift valve<br>Check for EZ-cal message or flash code |
| | Lowering valve SV-5 stuck open (located at base of lift cylinder | Check and remove contamination from valve |
| | Level sensor out of level (platform elevated above 10') | Reposition machine to firm level surface<br>Check level sensor function using EZ-cal |
| | Main system pressure inadequate | Check pump output pressure |
| | Battery discharged - no charge output | Check battery voltage, alternator output (14.5 volts)<br>Clean, service and charge battery |
| | System interruption | Check HELP messages using EZ-cal |

*Table 4a-4:* Troubleshooting Chart

| PROBLEM | POSSIBLE CAUSE | REMEDY/SOLUTION |
|---|---|---|
| **Platform will not lower or lowers slowly** | Maintenance lock in maintenance position | Return maintenance lock to the stowed position |
| | Lowering valve not energized | Check wiring to lowering valve located on Lift Cylinder |
| | Lowering valve not shifting | Clean debris, check for damage, replace |
| | Lowering orifice/s plugged | Clean orifice/s located inside hose fitting on lift cylinder |
| | System interruption | Check HELP messages using EZ-cal |
| **Lowers but not completely** | Down valve on lift cylinder inoperative | Check lift valve coil |
| **Emergency lowering not working** | Lowering valve not shifting | Clean debris, check for damage, replace |
| | Lowering orifice plugged | Clean orifice/s located inside hose fitting on the lift cylinder |
| | E-down battery discharged | Charge, check charge diode & connections |
| | Valve coil failed on cylinder | Test (6-8 ohms), replace |
| **Drive** | | |
| **No drive function** | Lift/Drive select switch not in Drive position or not operational | Select Drive position (upper control box), Check switch<br>Check switch position from GP400 with EZ-cal<br>(see EZ-cal ID# 2b-2) DLD |
| | Drive valve not shifting (SVD1) | Check connections at valve<br>Check Drive Valve for contamination<br>Check Drive output from GP400 (See EZ-cal chart ID# 2b-4 & 2b-5 also 2f1-4 & 2f-15) |
| | Proportional Valve not shifting (SP1) | Check connections at valve<br>Check Proportional valve for contamination<br>Check proportional output from GP400<br>(see EZ-cal ID# 2f-9 & 2b-3) |
| | Drive system shut down (interlock) | Check HELP and MODE message on EZ-Cal |
| **No drive elevated** | Unit out of level | Lower and operate Auto-level |
| | System Interruption (interlock) | Check HELP messages using EZ-Cal |
| **Slow drive with platform stowed** | High torque enabled | Check Speed/Torque switch on upper controls |
| | Malfunctioning rear wheel bypass valve | Located on rear wheel motors only<br>Check electrical by disconnecting valves<br>Check function by replacing valves |
| | Wheel motors not functioning correctly | Inspect wheel motors for excessive bypass |
| **Poor gradeability or drive performance** | High or mid speed enabled | Check Speed/Torque switch on upper controls |
| | Batteries discharged | Check battery voltage with multi-meter or EZ-Cal<br>Clean, service, charge batteries |
| | Wheel motors not functioning correctly | Inspect wheel motors for excessive bypass |
| | Malfunctioning rear wheel bypass valve | Located on rear wheels only<br>Check electrical by disconnecting valves<br>Check function by replacing valves |
| | Malfunctioning series parallel valves | Located on top of main hydraulic manifold PD1, PD2 & PD3<br>Remove and inspect |
| | Incorrectly adjusted or worn hydraulic pump | See Hydraulics section for pump adjustment<br>Inspect or replace pump |
| **Drive in one direction only** | Drive valve SVD1 not energized in one direction | Check 12 volts to appropriate coil<br>Check coil<br>Check valve function |
| | Counterbalance valve CBV1 or CBV2 not functioning correctly | Swap counterbalance valves to see if functioning direction changes |
| | No output from GP400 | Check switch position output from GP400<br>(see EZ-Cal ID# 4f-7 – FWD or 2f-9 – Reverse) |

*Table 4a-4:* Troubleshooting Chart

| PROBLEM | POSSIBLE CAUSE | REMEDY/SOLUTION |
|---|---|---|
| **No low speed (high torque mode)** | 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<br>Check for faulty valve spool<br>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) |
| **No Mid Speed** | SV3 or SV4 powered and/or shifted | These valves should not have 12 volts<br>In mid-speed, check valve function |
| | Speed/Torque selector switch malfunction | Terminals 1 or 3 are common with terminal 2 when switch is in mid position |
| **No High Speed** | Speed/Torque selector switch inoperative | Check continuity through Speed Select switch with wires disconnected terminals 2 & 3 |
| | Valve SV4 not functioning | Check voltage and ground to valve<br>Check for faulty valve spool<br>Check switch position output from GP400 (See EZ-cal ID# 2f-18) |
| | EP2 poppet valve not functioning | Check or replace valve |
| **No Speed Selection** | Limit switch not functioning | Check limit switch located on left rear of base<br>Check limit switch input with EZ-Cal (EZ-Cal ID# 2d5) |
| **Steer** | | |
| **No steer in either direction** | Lift/Drive selector switch in the Lift position | Switch must be in Drive position for steer operation |
| | Joystick rocker switch inoperative | Check continuity through rocker switch on green and yellow wires (right & left) with blue wire (input). |
| | Steering valve inoperative | Check steering valve for power or damage<br>Check switch position output from GP400 (see EZ-cal ID # 2f-12 & 2f-13) |
| | System Interruption | Check HELP messages using EZ-Cal |
| | Hoses connected incorrectly | See hydraulic section for proper connection |
| | Pressure relief valve set too low | Set steer relief valve to 2000 p.s.i. |
| **Steers in one direction only** | Steering valve inoperative or stuck | Inspect – replace steering valve |
| | No power to steering coil | Check for power and ground in both directions.<br>Repair wiring<br>Check switch position output from GP400 (see EZ-cal ID#s 2f-12 right & 2f-13 left) |
| | System Interruption | Check HELP and MODE message on EZ-Cal |
| **Steers, but not fully, or steers slowly** | One or both steering cylinder seals failed | Check steering cylinder seals – replace |
| | Pressure relief valve set too low | Set steer relief valve to 2000 p.s.i. |
| | King pin/s seizing in the bore | Disassemble and inspect<br>Repair<br>Replace bushings |

*Table 4a-4:* Troubleshooting Chart

| PROBLEM | POSSIBLE CAUSE | REMEDY/SOLUTION |
|---|---|---|
| **Level (Auto and Manual)** | | |
| **No Auto - level operation** | System senses platform elevation above 10 feet (3.2m) | Check elevation status using the EZ-cal (see ID# 2a-13)<br>Recalibration of Height may be necessary<br>(see Calibration section for instruction. |
| | System interruption | Check HELP messages using EZ-cal |
| | Level switch inoperative | Check level switch located in the upper control box,<br>Check switch position input to GP400 (see EZ-calID# 2a-14) |
| | Level Valves not functioning | Located behind lower control box<br>Inspect valve for power or damage<br>Check switch position output from GP400<br>(see EZ-cal ID# 2f-21 through 2f-24) |
| **Auto-level operates but platform is not level when cycle is complete** | Level sensor not properly calibrated | See Calibration section for proper level sensor calibration |
| | Unit on too extreme angle | Relocate unit to more level ground |
| | A level valve is sticking | Located behind lower control box<br>Inspect valve for power or damage<br>Check switch position output from GP400<br>(see EZ-cal ID# 2f-21 through 2f-24) |
| | Level cylinder hoses not connected in correct location | See hydraulic section for correct location |
| | Level valves wired incorrectly | See Electrical section for proper plug connection. |
| | Relief valve out of adjustment | Re-set Steer relief valve to 2000 PSI |
| **No Manual level operation** | See "No Auto-level Operation" for information | |

# HYDRAULIC PRESSURE ADJUSTMENT - 3084RT

- 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 4a-5:*** Hydraulic Pressure Adjustment

| Model | Main | | Lift | | Steer | | Stand-by | |
|---|---|---|---|---|---|---|---|---|
| **3084RT** | 2800 PSI | 193 bar | 2500 PSI | 172.4 bar | 2000 PSI | 137.9 bar | 500-550PSI | 35-38 bar |

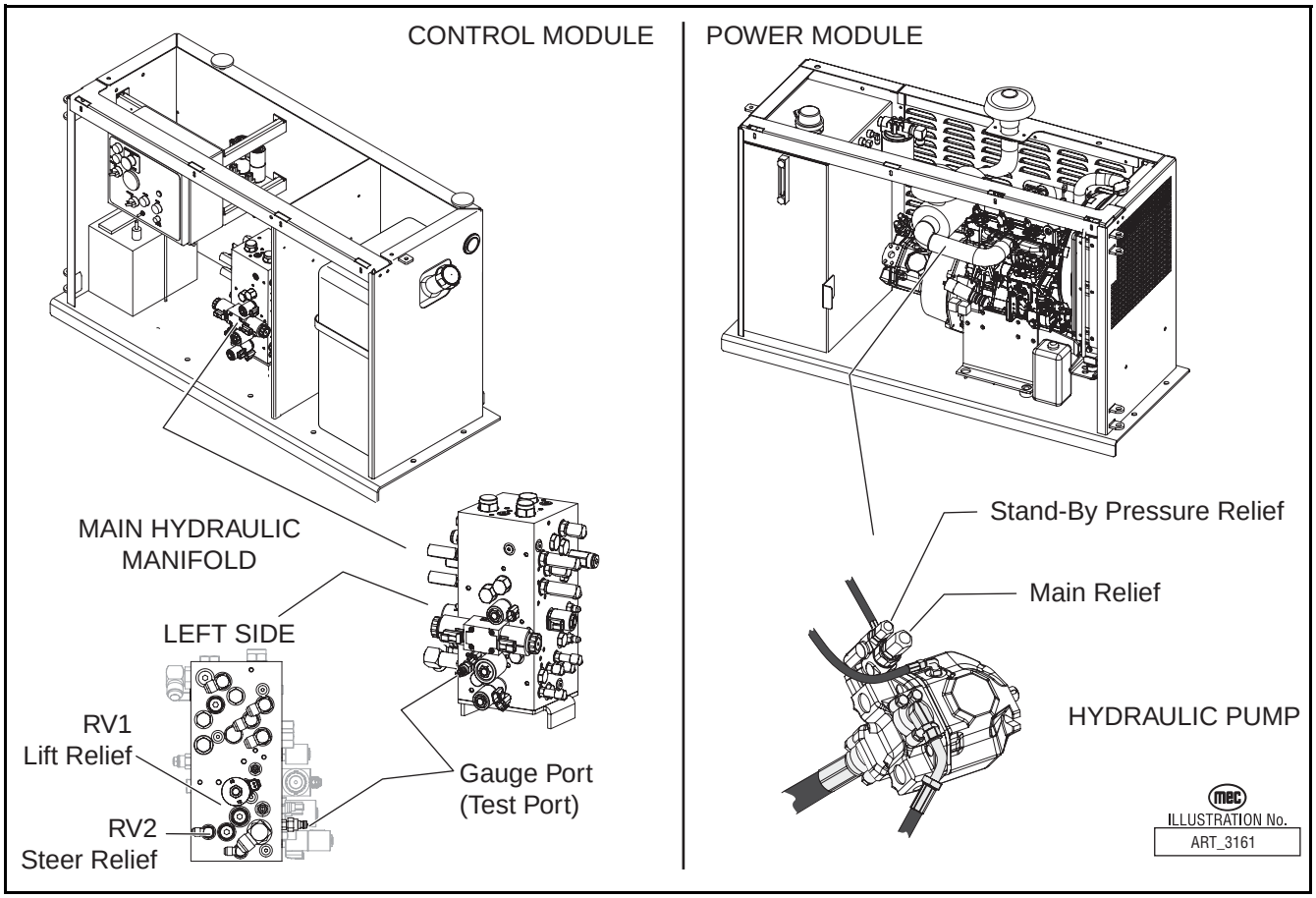
## ADJUSTING RELIEF VALVES

- 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.

**CAUTION**

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

***Figure 4a-10:*** Adjustable Valves Location - 3084RT



# ADJUSTMENTS - 3084RT

This machine uses a variable displacement, pressure compensated, piston type hydraulic pump. Proper adjustment is critical for normal operation of the machine.

All of the following steps must be performed in sequence to achieve proper adjustment and machine performance.

Refer to "Adjustable Valves Location - 3084RT" on page 4a-33.

See Section 5 - Schematics for correct pressure settings.

### *Main Relief and Standby Pressure Adjustments*

- Start engine and operate the unit for 15 minutes or until the hydraulic fluid is warm.
- Insert a 0 – 5000 PSI (0-345 bar) gauge onto the manifold pressure gauge port.
- Remove the acorn nut from the Main Relief adjustment screw. Loosen the jam nut and turn the screw counterclockwise 3 turns. Tighten the jam nut and install the acorn nut.
- Remove the acorn nut from the Standby adjustment screw and loosen the jam nut. Turn the screw clockwise 3 turns or until the needle on the gauge stops climbing. At this point the gauge is reading full main relief pressure.
- Access the Main Relief screw again and adjust it until the gauge settles at 2800 PSI (193.5 bar). Tighten the jam nut and install the acorn nut.
- Check the gauge reading again to ensure the setting did not change.
- Turn the Standby adjustment screw counterclockwise until the gauge reads 550 PSI (38 bar). Tighten the jamb nut and install the acorn nut.
- Check the gauge reading again to ensure the setting did not change.

### *Pump Displacement Adjustment*

This adjustment is set at the factory and should not be altered. The displacement adjustment controls the maximum amount of fluid flow that the pump will produce per revolution. Excessive flow will result in severe engine loading and stalling. Reduced flow will result in slower functions with no engine loading. If you suspect that the setting is incorrect, please call MEC Product Support at (800) 387-4575 for assistance.

### *Lift Relief (RV1)*

The Lift Relief valve is located on the left-side, center of the valve manifold. 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.

- 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)*

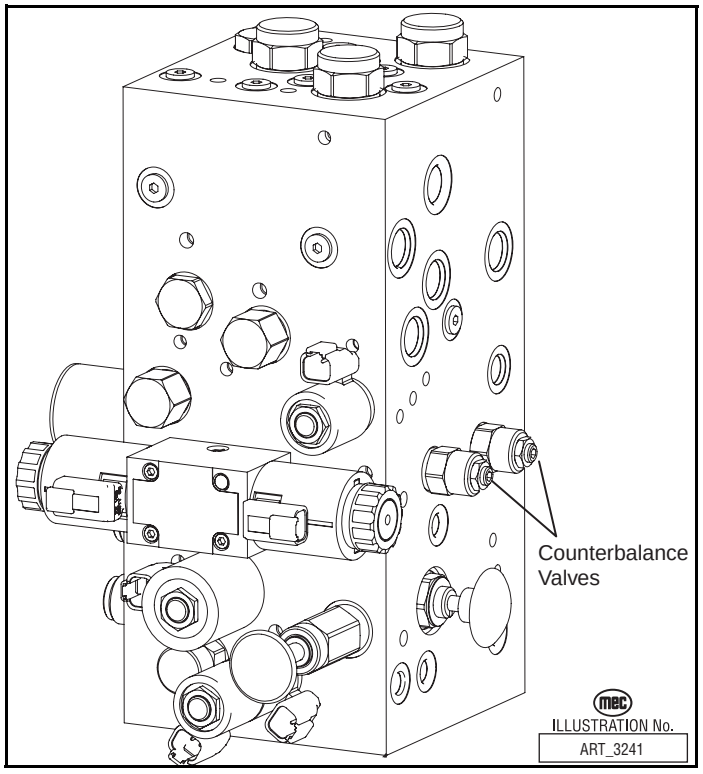
The steering Relief valve is located on the lower left side of the valve manifold. It is necessary to remove the cap from the relief valve if adjustment is necessary. REMOVING THE CAP WHILE THE ENGINE IS RUNNING WILL RESULT IN FLUID LEAKAGE.

- 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.

## COUNTERBALANCE VALVES

1. Loosen the locknut on one of the valves.
2. Turn the adjustment screw counter-clockwise (to the left) until it reaches the internal stop and the screw will turn no further.
3. Turn the adjustment screw clock-wise (to the right) 3¼ turns.
4. Tighten the locknut while holding the adjustment screw in position to prevent it from rotating.
5. Repeat steps 1 through 4 on the other Counterbalance valve.
6. Adjustment is complete.

***Figure 4a-11:*** Counterbalance Valves



# COMPONENT ILLUSTRATIONS

***Figure 4a-12:*** Controls and Switches

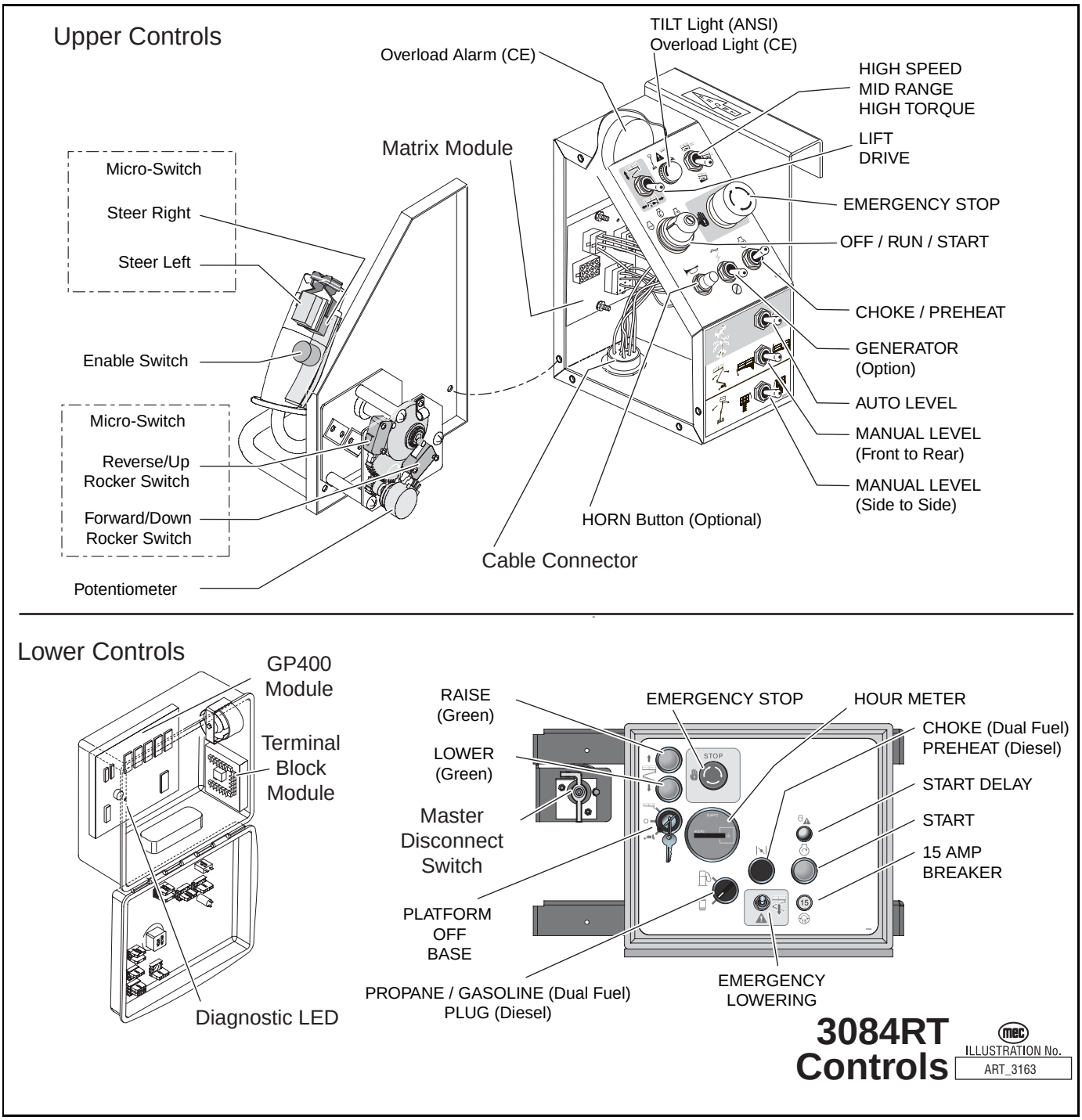
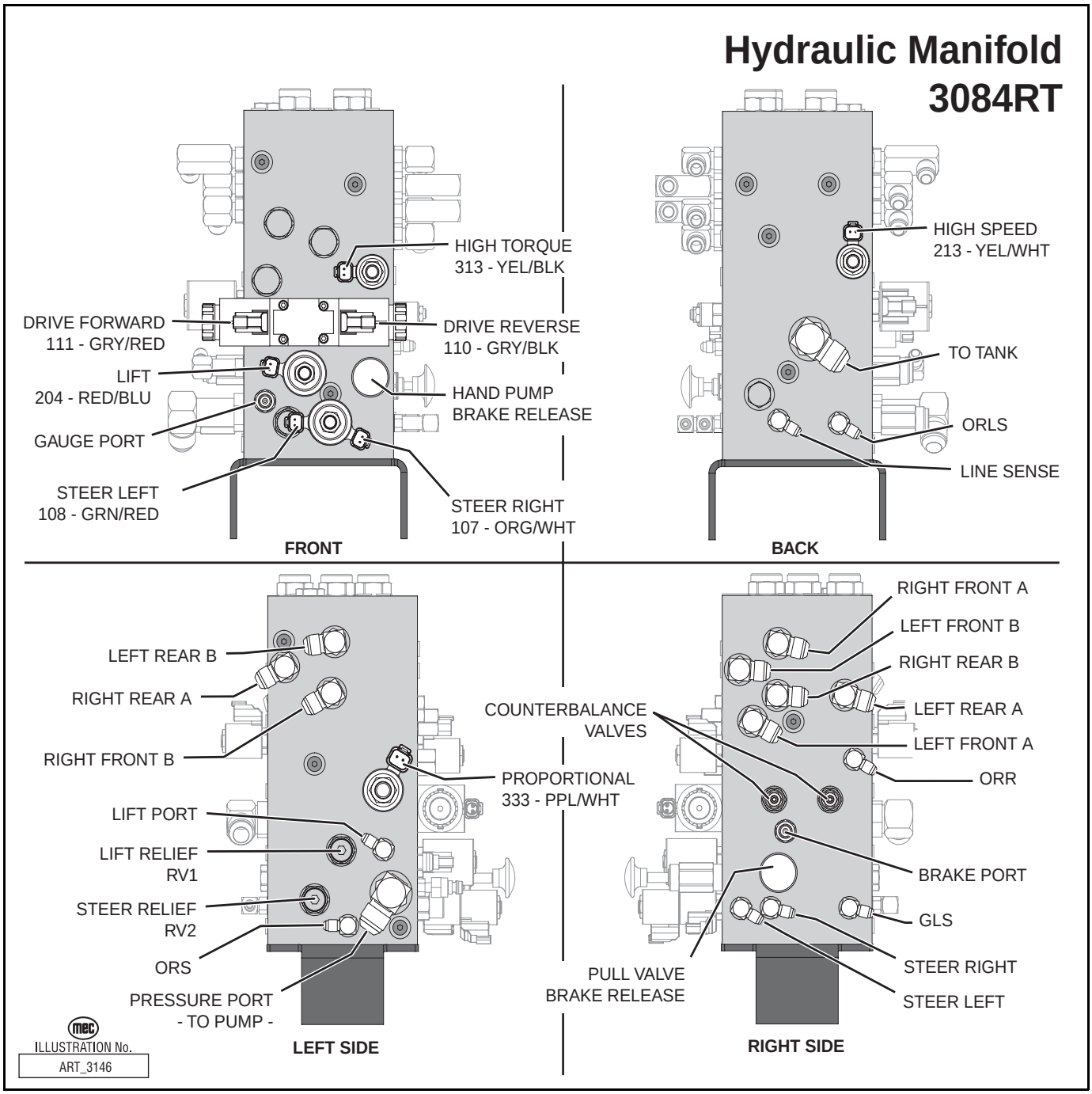


***Figure 4a-13:*** Hydraulic Manifold,



## NOTES:

SERVICE

# Section 4b

# TROUBLESHOOTING - 3084ES MODEL

## CONTENTS

## FIGURES PAGE



## TABLES PAGE

# GENERAL TROUBLESHOOTING TIPS

## HYDRAULIC FLUID PUMP: 3084ES MODELS

The 3084ES Aerial Work Platforms operate on a “Motor Control” theory in which fluid flow volume is controlled by varying the speed of the DC electric motor driving a fixed displacement pump. 100% of the fluid produced by the pump goes to the selected function.

## BATTERY CHARGE STATE: 3084ES MODELS

Before you begin troubleshooting this model, check the battery state of charge and inspect the battery connections for looseness or corrosion. A fully charged battery pack on a 48 Volts DC system will have a nominal voltage of 52.5–54 Volts DC.

***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 in the 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 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 - 3084ES

The electronic control system used on the 3084ES is designed for very low maintenance and long trouble free operation. The system consists of three electronic microprocessor controlled modules; the Matrix Module, P600 Motor Control Module and the GP400 Processor. They communicate through low voltage digital signal technology called **CANBUS** communication.

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

**WARNING**

**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.**

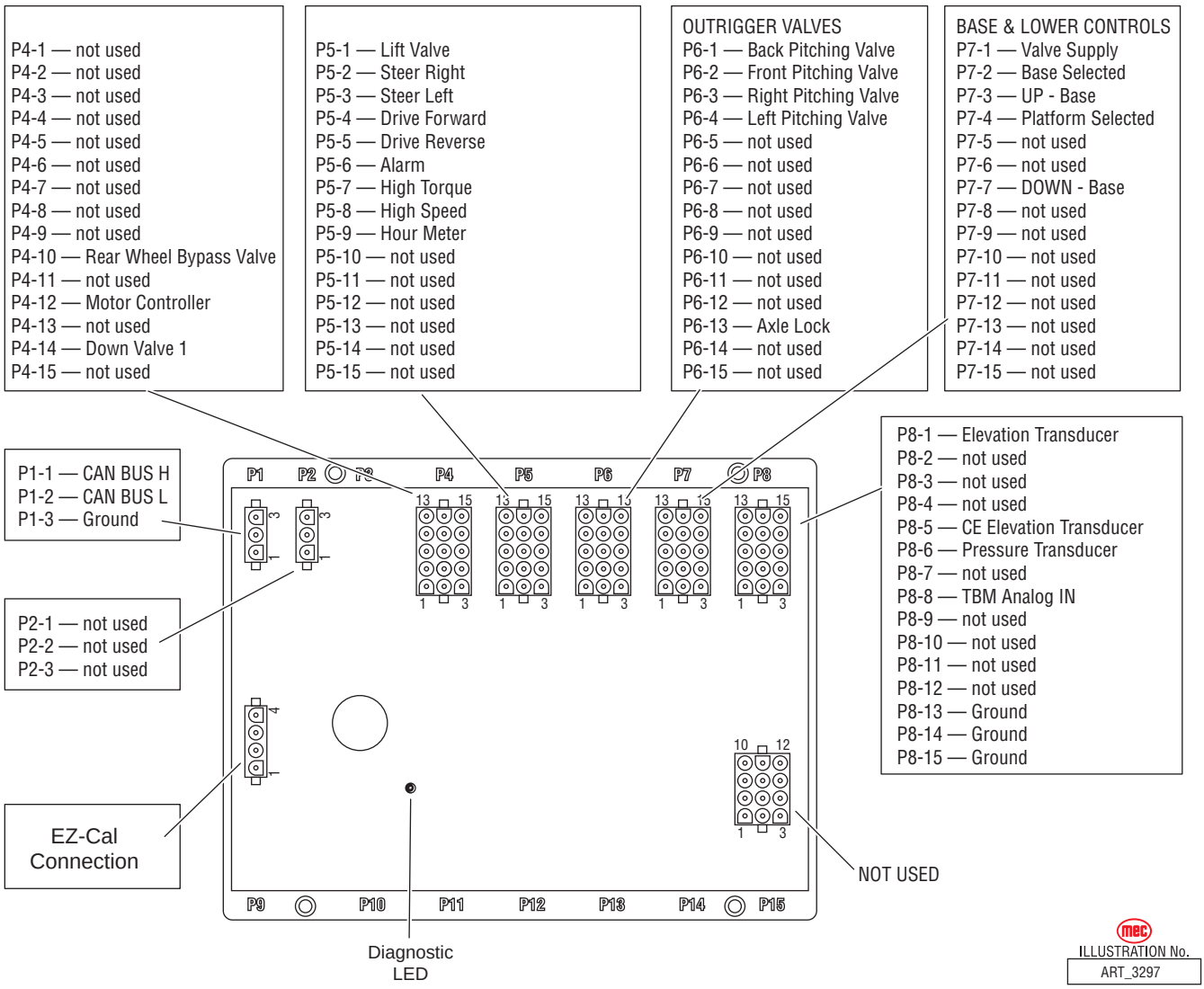
# GP400 MODULE

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.

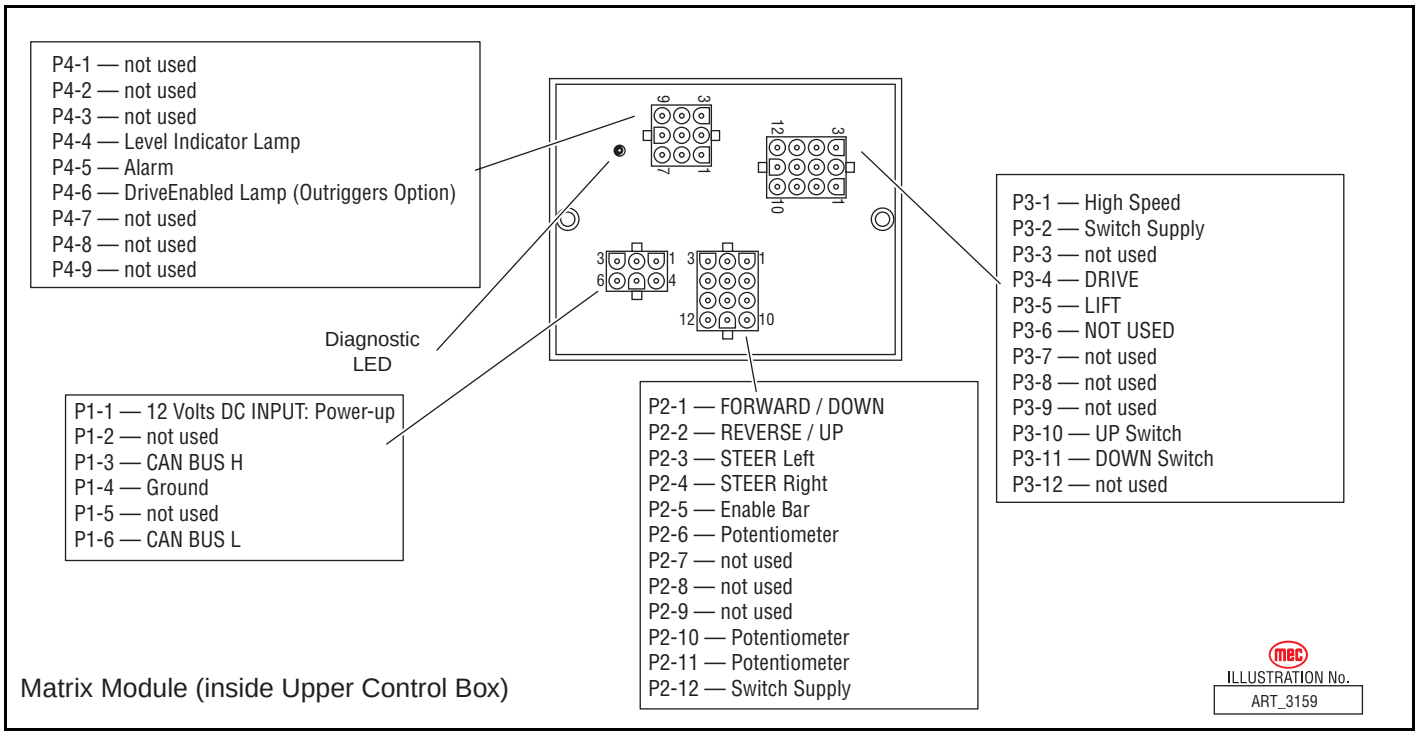
***Figure 4b-1:*** GP400 Module



# 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 4b-2:*** Matrix Module

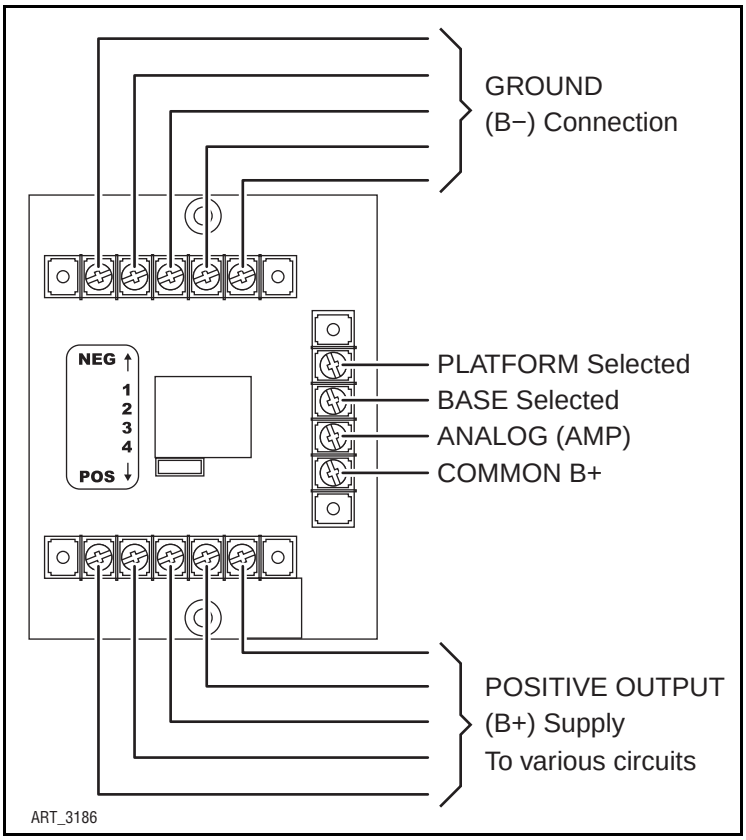



Matrix Module (inside Upper Control Box)

# TERMINAL BLOCK MODULE (TBM)

***Figure 4a-3:*** Terminal Block Module (TBM)

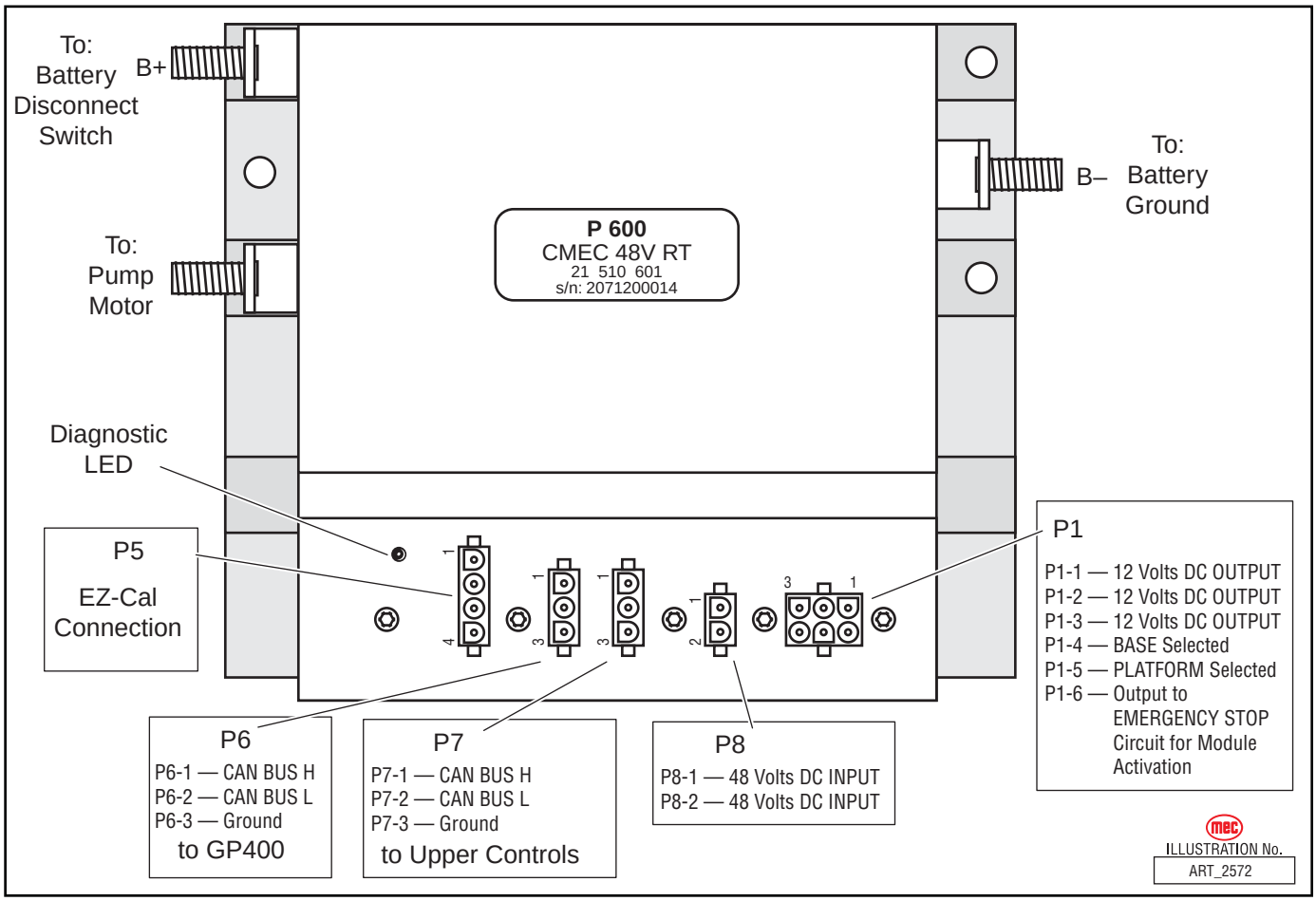
There is a module inside the lower control box, called a TBM (Terminal Block Module) that provides terminal point connections for both positive and ground circuits. A signal from the Emergency Stop circuit activates a load-reduction relay within the TBM that provides ample power to the B+ (positive)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



# 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.

***Figure 4b-4:*** P600 Motor Control Module



# EZ-CAL SCAN TOOL

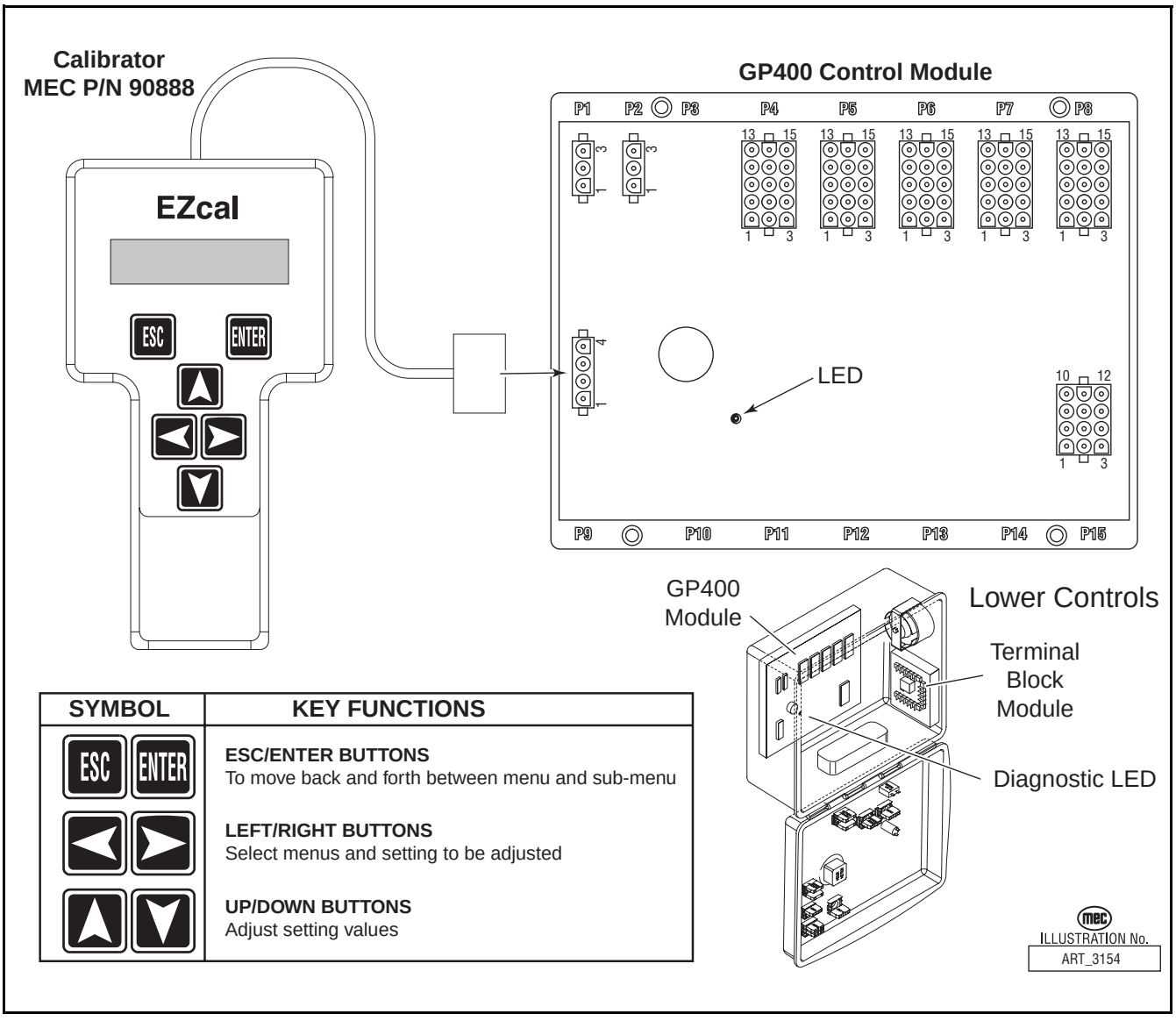
The EZ-Cal (MEC part # 90888; not part of the machine) is a hand-held scan tool that interfaces with the system to provide various information and adjustments. The EZ-cal receives its power from the GP400 when connected. The system must be powered up by closing the Battery disconnect switch and pulling 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 4b-5:*** EZ-Cal Scan Tool Connections - GP400 Module

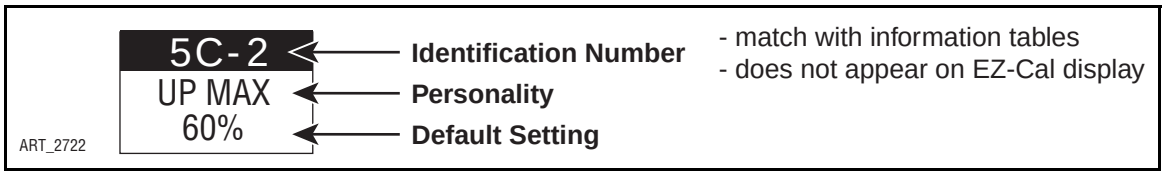



| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER | **ESC/ENTER BUTTONS**<br>To move back and forth between menu and sub-menu |
| ◀ ▶ | **LEFT/RIGHT BUTTONS**<br>Select menus and setting to be adjusted |
| ▲ ▼ | **UP/DOWN BUTTONS**<br>Adjust setting values |

# 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 4b-6:*** 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.

**WARNING**

**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.

## 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 4b-19.

## 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 4b-22 for flash coded error messages.

***Figure 4b-7:*** EZ-Cal Flow Chart: Adjustments and Setup, ANSI Models

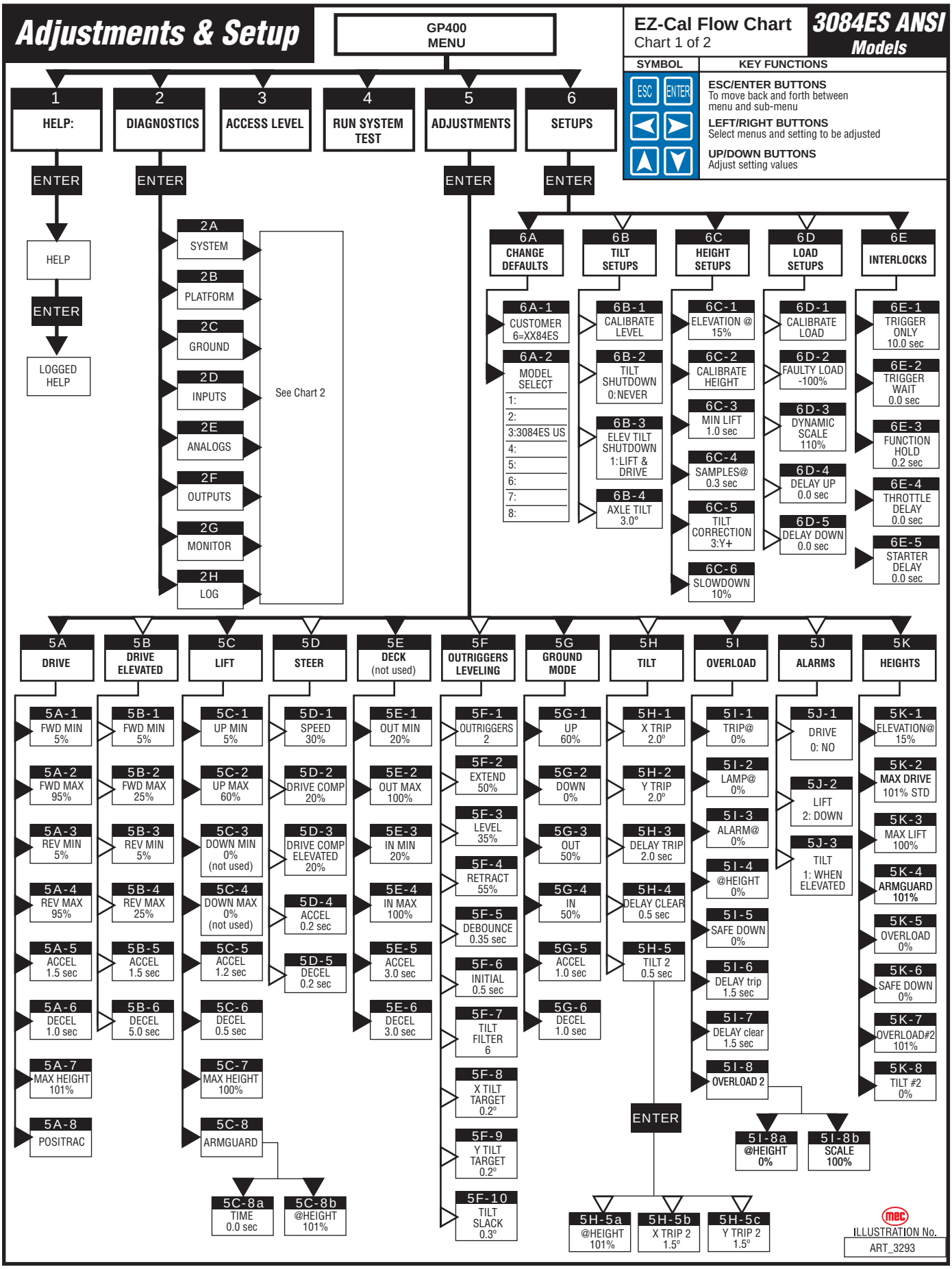


***Figure 4b-8:*** EZ-Cal Flow Chart: Diagnostic, ANSI Models

# DIAGNOSTIC

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

GP400 MENU

2 DIAGNOSTICS

ENTER

**EZ-Cal Flow Chart**
Chart 2 of 2

**3084ES ANSI Models**

| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC ENTER | **ESC/ENTER BUTTONS** To move back and forth between menu and sub-menu |
| ◀ ▶ | **LEFT/RIGHT BUTTONS** Select menus and setting to be adjusted |
| ▲ ▼ | **UP/DOWN BUTTONS** Adjust setting values |

- **2A SYSTEM**
  - 2A-1 MODE
  - 2A-2 SUPPLY
    - 2A-2a SUPPLY 12 V DC
    - 2A-2b SUPPLY CAP BANK
  - 2A-3 VALVE SUPPLY
  - 2A-4 MOTOR VOLTS (ES ONLY)
  - 2A-5 MOTOR AMPS (ES ONLY)
  - 2A-6 TEMPERATURE (ES ONLY)
  - 2A-7 TILT
    - 2A-7a TILT FILTERED
    - 2A-7b TILT LOCAL
  - 2A-8 TILTED Y or N
  - 2A-9 HEIGHT (CE ONLY)
    - 2A-9a HEIGHT 1%
    - 2A-9b HEIGHT 2%
  - 2A-10 LOAD (CE ONLY)
  - 2A-11 OVERLOADED Y or N (CE ONLY)
  - 2A-12 NOT USED
  - 2A-13 ELEVATED Y or N
  - 2A-14 OUTRIGGER Y or N
    - 2A-14a RETRACTED Y or N
    - 2A-14b EXTENDED Y or N
    - 2A-14c STATUS
    - 2A-14d OUTRIGGER TEST
    - 2A-14e AUTO RETRACT
  - 2A-15 AXLE
    - 2A-15a LEVEL / OFF LEVEL
    - 2A-15b LOCKED Y or N
    - 2A-15c ANGLE
- **2B PLATFORM**
  - 2B-1 TRIGGER ON / OFF
  - 2B-2 DLD
  - 2B-3 JOYSTICK
  - 2B-4 FWD / DWN OFF / ON
  - 2B-5 REV / UP OFF / ON
  - 2B-6 LEFT OFF / ON
  - 2B-7 RIGHT OFF / ON
  - 2B-8 POSITRAC Y or N
  - 2B-9 NOT USED
- **2C GROUND**
  - 2C-1 UP ON / OFF
  - 2C-2 DOWN ON / OFF
  - 2C-3 NOT USED
  - 2C-4 NOT USED
  - 2C-5 NOT USED
- **2D INPUTS**
  - 2D-1 P7-1 12 V SUPPLY
  - 2D-2 P7-2 BASE SELECTED
  - 2D-3 P7-3 UP SELECTED
  - 2D-4 P7-4 PLATFORM SELECTED
  - 2D-5 P7-5 NOT USED
  - 2D-6 P7-7 DOWN SELECTED
- **2E ANALOGS** LOAD SENSE
  - 2E-1 P8-2 ANGLE TRANSDUCER
  - 2E-2 P8-6 PRESS TRANSDUCER
  - 2E-3 TBM AMPERAGE
- **2F OUTPUTS**
  - 2F-1 P4-10 REAR WHEELS
  - 2F-2 P4-12 PROPORTIONAL
  - 2F-3 P4-14 DOWN
  - 2F-4 P5-1 LIFT
  - 2F-5 P5-2 STEER RIGHT
  - 2F-6 P5-3 STEER LEFT
  - 2F-7 P5-4 DRIVE FWD
  - 2F-8 P5-5 DRIVE REV
  - 2F-9 P5-6 ALARM
  - 2F-10 P5-7 HIGH TORQUE
  - 2F-11 P5-8 HIGH SPEED
  - 2F-12 P5-9 HOUR METER
  - 2F-13 P5-12 POWER OUT
  - 2F-14 P6-1 BACK PITCH
  - 2F-15 P6-2 FRONT PITCH
  - 2F-16 P6-3 RIGHT ROLLING
  - 2F-17 P6-4 LEFT ROLLING
  - 2F-18 P6-13 AXLE LOCK
- **2G LOG**
  - 2G-1 CAL DATE
  - 2G-2 SOFTWARE
  - 2G-3 POWERED

**P4**

| | | |
|---|---|---|
| P4-10 | *REAR WHEEL BYPASS VALVE* | ON = Powered - Rear Wheels in bypass |
| P4-12 | *MOTOR CONTROLLER* | 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 |
| P5-12 | *Power Supply B+* | ON=System powered up |

**P6 OUTRIGGER MANIFOLD**

| | | |
|---|---|---|
| P6-1 | *REAR PITCH VALVE* | ON = Valve activated |
| P6-2 | *FRONT PITCH VALVE* | ON = Valve activated |
| P6-3 | *RIGHT ROLLING VALVE* | ON = Valve activated |
| P6-4 | *LEFT ROLLING VALVE* | ON = Valve activated |
| P6-13 | *AXLE LOCK VALVES* | ON = Valve powered |

**P7 BASE & LOWER CONTROLS**

| | | |
|---|---|---|
| P7-1 | *BATTERY VOLTAGE from TBM* | ON = Voltage, OFF = No Voltage |
| P7-2 | *BASE SELECTED* | ON = Base Controls |
| P7-3 | *UP SWITCH (BASE CONTROLS)* | ON = Up activated |
| P7-4 | *PLATFORM SELECTED* | ON = Platform Controls |
| P7-5 | *LIMIT SWITCH* | NOT USED |
| P7-7 | *DOWN SWITCH (BASE CONTROLS)* | ON = Down activated |

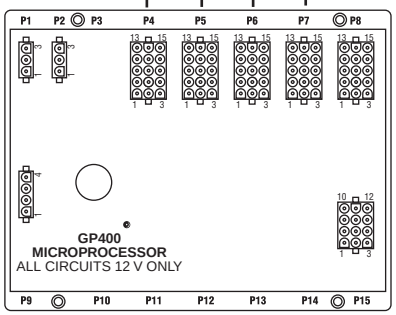



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***Figure 4b-9:*** EZ-Cal Flow Chart: Adjustments and Setup, CE Models

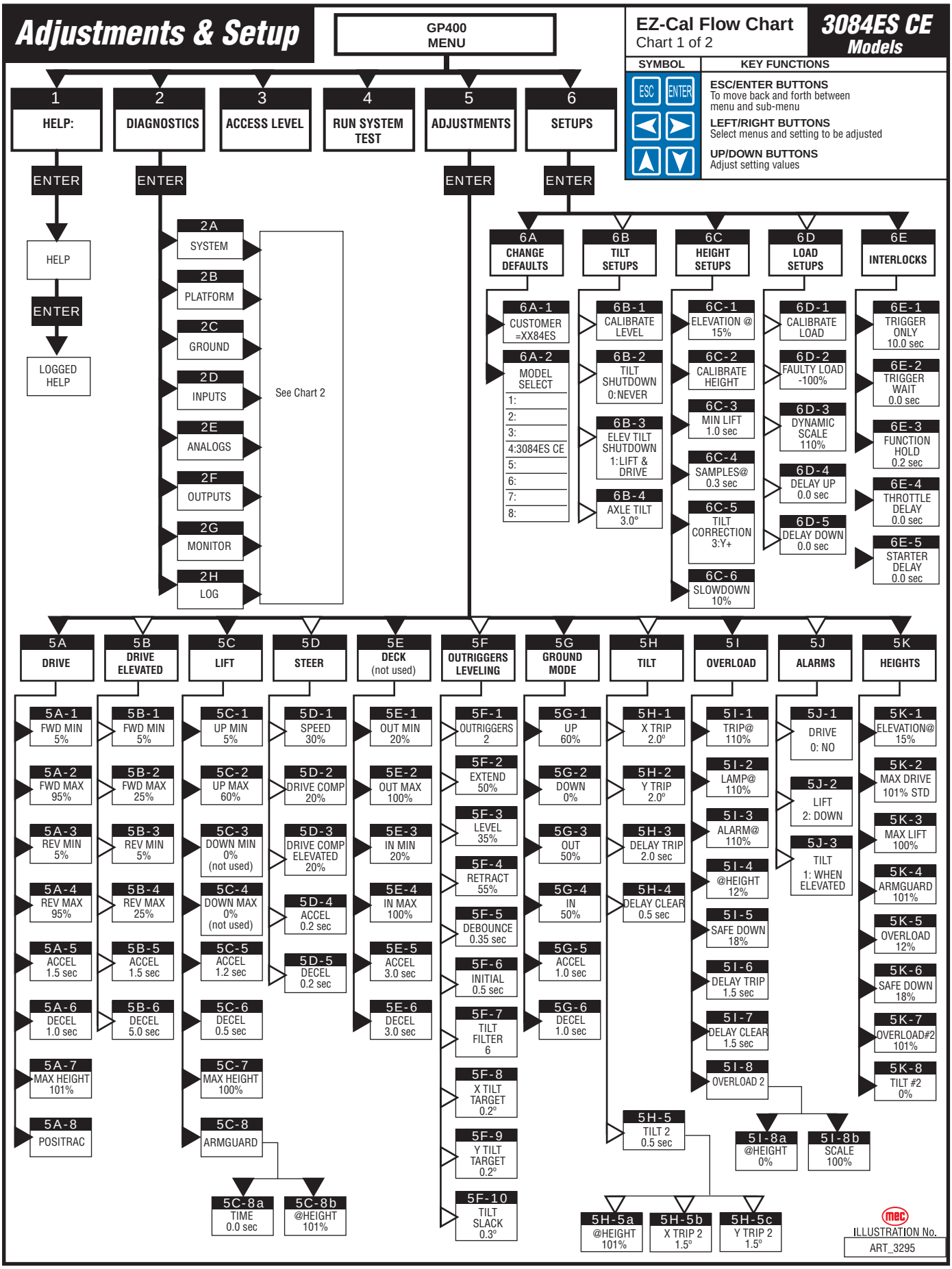


***Figure 4b-10:*** "Outriggers" EZ-Cal Flow Chart: Diagnostic, CE Models

# DIAGNOSTIC

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

GP400 MENU → 2 DIAGNOSTICS → ENTER

**EZ-Cal Flow Chart** Chart 2 of 2 — **3084ES CE Models**

| SYMBOL | KEY FUNCTIONS |
|---|---|
| ESC, ENTER, ◀ ▶ ▲ ▼ | **ESC/ENTER BUTTONS** To move back and forth between menu and sub-menu<br>**LEFT/RIGHT BUTTONS** Select menus and setting to be adjusted<br>**UP/DOWN BUTTONS** Adjust setting values |

- **2A SYSTEM**
  - 2A-1 MODE
  - 2A-2 SUPPLY
  - 2A-3 VALVE SUPPLY
  - 2A-4 MOTOR VOLTS (ES ONLY)
  - 2A-5 MOTOR AMPS (ES ONLY)
  - 2A-6 TEMPERATURE (ES ONLY)
  - 2A-7 TILT
  - 2A-8 TILTED Y or N
  - 2A-9 HEIGHT (CE ONLY)
  - 2A-10 LOAD (CE ONLY)
  - 2A-11 OVERLOADED Y or N (CE ONLY)
  - 2A-12 NOT USED
  - 2A-13 ELEVATED Y or N
  - 2A-14 OUTRIGGER Y or N
    - 2A-14a RETRACTED Y or N
    - 2A-14b EXTENDED Y or N
    - 2A-14c STATUS
    - 2A-14d OUTRIGGER TEST
    - 2A-14e AUTO RETRACT
  - 2A-15 AXLE
    - 2A-15a LEVEL / OFF LEVEL
    - 2A-15b LOCKED Y or N
    - 2A-15c ANGLE
  - 2A-2a SUPPLY 12 V DC
  - 2A-2b SUPPLY CAP BANK
  - 2A-7a TILT FILTERED
  - 2A-7b TILT LOCAL
  - 2A-9a HEIGHT 1%
  - 2A-9b HEIGHT 2%
- **2B PLATFORM**
  - 2B-1 TRIGGER ON / OFF
  - 2B-2 DLD
  - 2B-3 JOYSTICK
  - 2B-4 FWD / DWN OFF / ON
  - 2B-5 REV / UP OFF / ON
  - 2B-6 LEFT OFF / ON
  - 2B-7 RIGHT OFF / ON
  - 2B-8 POSITRAC Y or N
  - 2B-9 NOT USED
- **2C GROUND**
  - 2C-1 UP ON / OFF
  - 2C-2 DOWN ON / OFF
  - 2C-3 NOT USED
  - 2C-4 NOT USED
  - 2C-5 NOT USED
- **2D INPUTS**
  - 2D-1 P7-1 12 V SUPPLY
  - 2D-2 P7-2 BASE SELECTED
  - 2D-3 P7-3 UP SELECTED
  - 2D-4 P7-4 PLATFORM SELECTED
  - 2D-5 P7-5 NOT USED
  - 2D-6 P7-7 DOWN SELECTED
- **2E ANALOGS** LOAD SENSE
  - 2E-1 P8-2 ANGLE TRANSDUCER
  - 2E-2 P8-6 PRESS TRANSDUCER
  - 2E-3 TBM AMPERAGE
- **2F OUTPUTS**
  - 2F-1 P4-10 REAR WHEELS
  - 2F-2 P4-12 PROPORTIONAL
  - 2F-3 P4-14 DOWN
  - 2F-4 P5-1 LIFT
  - 2F-5 P5-2 STEER RIGHT
  - 2F-6 P5-3 STEER LEFT
  - 2F-7 P5-4 DRIVE FWD
  - 2F-8 P5-5 DRIVE REV
  - 2F-9 P5-6 ALARM
  - 2F-10 P5-7 HIGH TORQUE
  - 2F-11 P5-8 HIGH SPEED
  - 2F-12 P5-9 HOUR METER
  - 2F-13 P5-12 POWER OUT
  - 2F-14 P6-1 BACK PITCH
  - 2F-15 P6-2 FRONT PITCH
  - 2F-16 P6-3 RIGHT ROLLING
  - 2F-17 P6-4 LEFT ROLLING
  - 2F-18 P6-13 AXLE LOCK
- **2G LOG**
  - 2G-1 CAL DATE
  - 2G-2 SOFTWARE
  - 2G-3 POWERED

**P4**

| | | |
|---|---|---|
| P4-10 | *REAR WHEEL BYPASS VALVE* | ON = Powered - Rear Wheels in bypass |
| P4-12 | *MOTOR CONTROLLER* | 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 |
| P5-12 | *POWER SUPPLY B+* | ON = System powered up |

**P6 OUTRIGGER MANIFOLD**

| | | |
|---|---|---|
| P6-1 | *REAR PITCH VALVE* | ON = Valve activated |
| P6-2 | *FRONT PITCH VALVE* | ON = Valve activated |
| P6-3 | *RIGHT ROLLING VALVE* | ON = Valve activated |
| P6-4 | *LEFT ROLLING VALVE* | ON = Valve activated |
| P6-13 | *AXLE LOCK VALVES* | ON = Valve powered |

**P7 BASE & LOWER CONTROLS**

| | | |
|---|---|---|
| P7-1 | *BATTERY VOLTAGE from TBM* | ON = Voltage, OFF = No Voltage |
| P7-2 | *BASE SELECTED* | ON = Base Controls |
| P7-3 | *UP SWITCH (BASE CONTROLS)* | ON = Up activated |
| P7-4 | *PLATFORM SELECTED* | ON = Platform Controls |
| P7-5 | *LIMIT SWITCH - NOT USED* | NOT USED |
| P7-7 | *DOWN SWITCH (BASE CONTROLS)* | ON = Down activated |

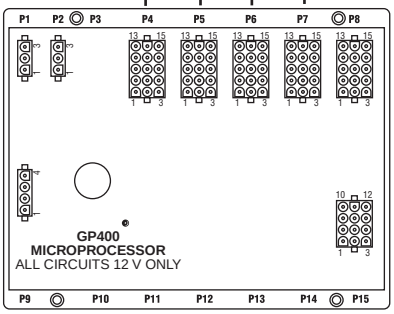



ILLUSTRATION No. ART_3296

# EZ-CAL ADJUSTMENT

Refer to "EZ-Cal Scan Tool" on page 4b-8.

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **5A DRIVE - PLATFORM STOWED** | 5A-1 | FWD Min | 5% | Slowest speed possible |
| | 5A-2 | FWD Max | 95% | Maximum speed potential |
| | 5A-3 | REV Min | 5% | Slowest speed possible |
| | 5A-4 | REV Max | 95% | Maximum speed potential |
| | 5A-5 | ACCEL | 1.5 sec | Ramp-up time to maximum |
| | 5A-6 | DECEL | 1.0 sec | Ramp-down time to stop |
| | 5A-7 | MAX Height | 101% | Maximum drivable height |
| | 5A-8 | Positrack | Not Used | Not Used |
| | 5A-9 | Positrack | Not Used | Not Used |
| **5B DRIVE PLATFORM ELEVATED** | 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 | 5.0 sec | Ramp-down time to stop |
| **5C LIFT** | 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 time to stop |
| | 5C-7 | MAX Height | **ANSI:** 101% \|\| **CE:** 100% | Maximum elevated height potential |
| | 5C-8 | Armguard --> Time | 0.0 sec | CE Spec. Machines Only |
| | 5C-9 | Armguard --> @ Height | 101% | CE Spec. Machines Only |
| **5D STEER** | 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 time to stop |
| **5E - DECK** | 5E- | Not Used | Not Used | Power-out deck (not used) |

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **5F OUTRIGGERS**<br><br>Called *"Outriggers"* on the EZ-Cal, these personalities control ***SPEED-LEVEL™*** functions | 5F-1 | Outriggers | 2= drive i lock | Outrigger program controls level operation |
| | 5F-2 | Extend | 50% | Maximum speed potential |
| | 5F-3 | Level | 35% | Extend speed after all legs touch down |
| | 5F-4 | Retract | 55% | Maximum speed potential |
| | 5F-5 | Debounce | 0.35 | Compensates for switch bounce |
| | 5F-6 | Initial | 0.5 | Minimum level operating time |
| | 5F-7 | Tilt filter | 6 | Compensates for tilt sensor free movement |
| | 5F-8 | X Tilt target | 0.2 deg | Target level stops movement - side/side |
| | 5F-9 | Y Tilt target | 0.2 deg | Target level stops movement - fore/aft |
| | 5F-10 | Tilt Slack | 0.3 deg | Variance to tilt target |
| | 5F-11 | Not Used | Not Used | Not Used |
| **5G GROUND MODE** Lower Control Operations | 5G-1 | UP | 65% | Maximum speed potential |
| | 5G-2 | DOWN | 0% | Gravity down (not used) |
| | 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 drive output |
| **5H TILT** | 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 Tip and Signal OFF |
| | 5H-5 | Tilt 2 | — | Second tilt setting used for increased stability. Press ENTER to access |
| **5H-5 Sub Menu** | 5H-5A | @ Height | 101% | Point where lesser tilt angle used |
| | 5H-5B | X Trip 2 | 1.5 sec | Secondary tilt angle - see 5H-5 |
| | 5H-5C | Y Trip 2 | 1.5 sec | Secondary tilt angle - see 5H-5 |
| **5I OVERLOAD**<br><br>**ANSI:** values = 0<br><br>**CE:** values apply | 5I-1 | Trip @ | **ANSI:** 0% \|\| **CE:** 110% | % of weight over maximum to trigger overload |
| | 5I-2 | Lamp @ | **ANSI:** 0% \|\| **CE:** 0% | % of weight over maximum to trigger lamp |
| | 5I-3 | Alarm @ | **ANSI:** 0% \|\| **CE:** 0% | % of weight over maximum to trigger alarm |
| | 5I-4 | @ Height | **ANSI:** 0% \|\| **CE:** 8% | % of elevation load sense starts monitoring weight |
| | 5I-5 | Safe Down | **ANSI:** 0% \|\| **CE:** 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 |
| **5I-8 Sub Menu** | 5I-8a | Height 0% | 0% | % of height for secondary overload valve |
| | 5I-8b | Scale | 100% | % of reduced overload valve |
| **5J ALARMS** | 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 |
| **5K HEIGHTS** | 5K-1 | Elevation @ | 15% | Point at which machine enters elevated mode |
| | 5K-2 | Maximum Drive | 101% | Maximum drivable height |
| | 5K-3 | Maximum Lift | **ANSI:** 101% \|\| **CE:** 98% | Maximum elevated height potential |
| | 5K-4 | Armguard | 101% | Stops descent for 5 sec |
| | 5K-5 | Overload | **ANSI:** 0% \|\| **CE:** 12% | % of elevation load sense starts monitoring weight |
| | 5K-6 | Safe Down | **ANSI:** 0% \|\| **CE:** 18% | % of elevation lift-down still operates in overload |
| | 5K-7 | Overload # 2 | 0% | Not Used |
| | 5K-8 | Tilt # 2 | **ANSI:** 0% \|\| **CE:** 0% | Reduced degree of tilt at % elevation |

# EZ-CAL SETUP

Refer to "EZ-Cal Scan Tool" on page 4b-8.

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

| OPERATION | ID | PERSONALITY | FACTORY SETTING | EXPLAINATION |
|---|---|---|---|---|
| **6A CHANGE DEFAULTS** | 6A-1 | Customer | 5=xx84ES | Choose basic model and power source |
| | 6A-2 | Model Select | 3 = 3084ES ANSI<br>4 = 3084ES CE | Choose model and certification |
| **6D TILT SETUPS** | 6B-1 | Calibrate Level? | Y = ENTER N = ESC | Follow instructions in Section 2 - Level Sensor Calibration |
| | | **WARNING! Refer to Tilt Sensor Calibration instructions before attempting calibration** | | |
| | 6B-2 | Tilt Shutdown | 0 = Never | Function shutdown tilted when platform stowed |
| | 6B-3 | Elev Tilt Shutdown | 1 = Lift & Drive | Function shutdown tilted when platform elevated |
| | 6B-4 | Axle Tilt | 3.0 deg | Oscillating axle maximum interlock angle |
| **6C HEIGHT SETUP** | 6C-1 | Elevation @ | 15% | % of maximum height when system goes into elevated mode |
| | 6C-2 | Calibrate Height | Start Calibration | See Section 2 for calibration of Height Sensor |
| | 6C-3 | Min Lift | 1.0 sec | Calibration setting - do not change |
| | 6C-4 | Samples | 0.30 sec | Calibration setting - do not change |
| | 6C-5 | Tilt Correction | 3=Y+ | Calibration setting - do not change |
| | 6C-6 | Slow Down | 10% | Calibration setting - do not change |
| **6D LOAD SETUPS** (EUROPEAN OPTION ONLY) | 6D-1 | Calibrate Load | Start Calibration | See Section 2 for calibration of CE Overload System |
| | 6D-2 | Faulty Load | -100% | calibration setting - do not change |
| | 6D-3 | Dynamic Scale | 110% | calibration setting - do not change |
| **6E INTERLOCKS** | 6E-1 | Trigger Only | 10.0 sec | Time that the enable bar can be held without operation before timeout |
| | 6E-2 | Trigger Wait | 0.0 sec | Delay before function after enable bar is actuated |
| | 6E-3 | Function hold | 0.2 sec | Function enabled after operator release |
| | 6E-4 | Throttle Delay | 0.0 sec | Delay before throttle enabled (not used) |
| | 6E-5 | Starter Delay | 10.0 sec | Starter over-crank feature; time starter is off (not used) |

# 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.**

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

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

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

| SELECTION | ID | READOUT | EXPLAINATION |
|---|---|---|---|
| **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 Can-tilt angle transducer in degrees |
| | 2A-8 | Tilted Y/N | Indicates tilted state. All motorized functions interlocked above @ height (15% elevation) |
| | 2A-9 | Height | Current state of platform elevation in %. |
| | 2A-10 | Load | Current load on platform in %. (Over load option only) |
| | 2A-11 | Overloaded Y/N | Platform overload status. (Over load option only) |
| | 2A-12 | Last Moved | Not used |
| | 2A-13 | Elevated Y/N | Shows platform elevation is above 15% (@ height setting). Elevated settings apply. |
| | 2A-14 | Outrigger (leveling function) | Press ENTER for outrigger sub categories. |
| **SUB CATEGORIES** | 2A-14a | O/R Retracted Y/N | Not used |
| | 2A-14b | O/R Extended Y/N | Not used |
| | 2A-14c | O/R Status | Current state of level will be displayed, |
| | 2A-14d | O/R Test Y/N | Not used |
| **2B PLATFORM** | 2B-1 | Trigger ON/OFF | Current status of enable trigger; pulled =ON @ platform 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 | Status of rear wheel solenoids activation. Activated in high speed or elevated drive |
| | 2B-9 | EMSp OFF/ON | Not used |

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

| SELECTION | ID | READOUT | EXPLAINATION |
|---|---|---|---|
| **2C GROUND** | 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 |
| **2D INPUTS**<br><br>READOUT = plug and Pin<br><br>example: P7-1 = Plug 7 Pin 1<br><br>refer to schematic | 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 upper controls |
| | 2D-5 | P7-5 | Platform Down limit switch. Not used. |
| | 2D-6 | P7-7 | Down selected from lower controls, ON= Down activated |
| | | P7-6 & P7-8–P7-15 | Not used |
| | | P15-1 - P15-15 | Not used |
| **2E ANALOGS** | 2E-1 | P8-2 | State of angle #2 in %, relates directly to the degree of platform elevation. |
| | 2E-2 | P8-5 | State of angle #1 in %, relates directly to the degree of platform elevation. |
| | 2E-3 | P8-6 | Measues pressure in lift cylinder for load sense system. CE only. |
| **2F OUTPUTS**<br><br>READOUT = plug and Pin<br><br>example: P7-1 = Plug 7 Pin 1<br><br>refer to schematic | | Numbers not listed in this table but that are displayed by EZ-Cal ***are not used.*** | |
| | 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 activated |
| | 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-15 | P5-12 | Power supply to valves. Should be ON when system is powered up |
| | 2F-16 | P6-1 | Back Pitching Valve. ON= valve activated |
| | 2F-17 | P6-2 | Front Pitching Valve. ON= valve activated |
| | 2F-18 | P6-3 | Left Rolling Valve. ON= valve activated |
| | 2F-19 | P6-4 | Right Rolling Valve. ON= valve activated |
| | 2F-20 | P6-13 | Axle Lock Valves. ON= Valves activated (axles can oscillate) |
| **2H LOG** | 2H-1 | Cal Date | Date of last calibration (height or load) |
| | 2H-2 | Software | MEC specific software |
| | 2H-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# 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 4b-11 – CE Page 4b-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 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. **(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)

## 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.
- 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 (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 time-out).

***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.

***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.

***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/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 duty cycling 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 is 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 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.

## 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.

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

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 4b-4:*** Troubleshooting Chart

| Problem | Possible Cause | Remedy/Solution |
|---|---|---|
| **General Power Issue** | | |
| **No operation from upper or lower control station; no red LED at GP400.** | Main battery switch turned off | Located left of lower control box. |
| | Emergency switch pushed in or ignition switch turned off or defective | Upper or lower e-stop switch will cut all power, as will the ignition switch in the platform control box. |
| | Batteries discharged | Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge batteries.<br>Battery charger may not operate if battery voltage drops below 20 volts. |
| | Blown 30 amp fuse | Located just below the battery cutoff switch |
| | Circuit breaker tripped | Located in lower control box panel |
| **No functions; LED illuminated or flashing on GP400** | Blown 300 amp fuse | Located just to the left of lower control station.<br>Check for excessive motor amperage draw.<br>Will receive a 7-7 flash code on GP400. |
| | Batteries discharged | Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge batteries.<br>Battery charger may not operate if battery voltage drops below 20 volts |
| | Damaged upper control box harness | Inspect from harness plug to terminal strip under platform.<br>May receive 6-6 flash code on GP-400 (CAN bus) |
| | Other fault in system monitored by GP400 | Check Help message on EZ-Cal or check flash code for error |
| **Functions from lower controls but not from upper controls** | Interlock switch (joystick) | Check power to red wire (power to switch) and power to purple wire (power out of switch) at joystick plug |
| | Loose plug connections on Matrix module | Check plug connections |
| | Damaged upper control box harness | Inspect from harness plug to terminal strip under platform.<br>May receive 6-6 flash code on GP-400 (CAN bus) |
| | System interlock | Check HELP messages using EZ-Cal |

| | | |
|---|---|---|
| **LIFT/LOWER** | | |
| **Platform will not raise; electric motor operating.** | Excessive weight on platform | Reduce weight to rated platform capacity |
| | Lift Relief Valve RV-1 out of adjustment | Adjust relief valve to rated platform capacity |
| | Lift Valve SV-1 not energized | Check wiring to lift valve. Check for EZ-Cal message or flash code |
| | Lowering Valve SV-5 stuck open (located at base of lift cylinder) | Check and remove contamination from valve |
| | Main system pressure inadequate | Check pump output pressure |
| **Platform will not raise; electric motor NOT operating.** | Level sensor out of level (platform elevated above10') | Reposition machine to firm level surface. Check level sensor function using EZ-Cal See Diagnostic chart 2e1 |
| | Batteries discharged | Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge batteries<br>Battery charger may not operate if battery voltage drops below 20 volts |
| | System interlock | Check HELP messages using EZ-Cal |
| **Platform raises uncommanded when operating other functions** | Lift Valve SV-1 sticking | Clean or replace SV-1 valve |
| | Shuttle Valve LS-2 damaged or contaminated | Clean or replace LS-2 valve. See hydraulic diagram for location |
| **Platform will not lower or lowers slowly** | Maintenance lock in maintenance position | Return maintenance lock to the stowed position |
| | Lowering valve not energized | Check wiring to lowering valve located on Lift Cylinder. Check for EZ-Cal message or Flash code |
| | Lowering valve not shifting | Clean debris. Check for damage, replace |
| | Lowering orifice plugged | Clean orifice located inside hose fitting on lift cylinder |
| | System interruption | Check HELP messages using EZ-Cal |
| **Platform lowers uncommanded (drift down)** | Lowering Valve SV-5 sticking or contaminated | **Deploy Maintenance Lock!**<br>Remove and clean or replace lowering valve SV5 |
| | Cylinder internal seal failure | Check, repair seals |
| **Emergency lowering not working** | Lowering valve not shifting | Clean debris, check for damage, replace |
| | Lowering Orifice ORF-3 plugged | Clean orifice, located in Lift cylinder hose port. |
| | Emergency Down battery discharged | Charge, check charge diode & connections |
| | Emergency Down supply fuse blown | Replace fuse, check for shorts in wire and coil |
| | Valve coil failed on cylinder | Test, replace |
| **DRIVE:** | | |
| **No drive function** | Drive Valve not shifting | Check electrical connections at drive valve, check drive valve for contamination. |
| | Lift/Drive select switch malfunction | Check continuity through switch |
| | Drive system interlock | Check HELP and MODE messages on EZ-Cal |
| **Drive operates uncommanded when operating other functions** | Drive Valve SVD-1 sticking or damaged | Clean, replace SVD-1 valve. See hydraulic diagram. |
| | Shuttle Valve LS-3 damaged or contaminated | Clean or replace LS-3 valve. See hydraulic diagram for location |

| | | |
|---|---|---|
| **No drive elevated** | Unit out of level | Lower and re-position the machine. |
| | Batteries discharged | Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge batteries.<br>Battery charger may not operate if battery voltage drops below 20 volts |
| | System interlock | Check HELP messages using EZ-Cal |
| **Slow drive with platform in stowed position** | High torque enabled | Check Speed/Torque Switch at platform controls |
| | Elevation sensor out of calibration | Use EZ-Cal to monitor platform state of elevation. See Diagnostic chart I.D. 2a13 for elevated status and 2e1 for platform % of elevation input. Failure of the angle transducer will trigger a fault code. |
| | Malfunctioning rear wheel bypass valve | Located on rear wheel motors only. Check by replacing valves. |
| | Wheel motor/s not functioning correctly | Inspect wheel motors for excessive bypass |
| **Poor gradability performance** | High or Mid Speed enabled | Check Speed/Torque Switch |
| | Batteries discharged | Will receive 4-4 or 7-7 flash on GP400, Clean, service and charge batteries.<br>Battery charger may not operate if battery voltage drops below 20 volts |
| | Wheel motor/s not functioning correctly | Inspect wheel motors for excessive bypass |
| | Malfunctioning Rear wheel bypass valve | Located on rear wheel motors only. Check electrical by disconnecting valves or function by replacing valves |
| | Malfunctioning Series/Parallel Valves | Located on top of main hydraulic Manifold |
| | Worn hydraulic pump | Check with flow meter or replace pump |
| **Drive in one direction only** | Drive Valve SVD1 not energizing in one direction | Check 12 volts to appropriate coil, check coil, check valve function |
| | Counterbalance Valve CBV1 or CBV2 malfunction | Swap counterbalance valves to see if functioning direction changes. |
| | No output from GP400 | Scan using EZ-Cal and troubleshooting charts. EZ-cal chart I.D 4f-7 - Fwd or 2f-9 - Reverse |
| **No Low Speed (high torque mode)** | Speed/torque selector switch inoperative | Check continuity of Speed/Torque switch in platform control box |
| | Valve SV3 not functioning | Check for 12 volts and ground to valve check for faulty valve spool |
| | EP1 poppet valve not functioning | Check or replace valve |
| **No Mid Speed** | SV3 or SV4 powered and/or shifted | These valves should not have 12 volts, in mid-speed, check valve function |
| | Speed/torque selector switch malfunction | Check continuity through switch |
| **No High Speed** | Speed/torque selector switch inoperative | Check continuity of Speed/Torque switch in platform control box |
| | Valve SV4 not functioning | Check voltage and ground to valve check for faulty valve spool |
| | EP2 poppet valve not functioning | Check or replace valve |
| **No brake effectiveness** | Brake Orifice OD-1 obstructed | Remove, clean orifice. See hydraulic diagram for location in manifold. |
| | Brake discs worn past service limit | Replace brake discs located inside rear wheel motors. |

| | | |
|---|---|---|
| **LIFT AND DRIVE** | | |
| **No drive or lift operation motor operates** | Main Relief Valve RV-3 out of adjustment | For test purposes, swap RV-3 with RV-2. |
| | Pump or pump coupler failure | Inspect, replace as necessary |
| | Diverter Valve EC-1 malfunction | Inspect, replace as necessary |
| | Hydraulic tank empty | Check, fill with approved oil |
| **No drive or lift operation motor does not operate** | Motor malfunction | Inspect, replace as necessary |
| | System interlock | Check HELP messages using EZ-Cal |
| | Battery discharged | Will receive 4-4 or 7-7 flash on GP400. Clean, service and charge batteries. Battery charger may not operate if battery voltage drops below 20 volts. |
| **STEER** | | |
| **No steer in either direction** | Joystick rocker switch inoperative | Check rocker switch output on green and yellow wires, input on blue wire. |
| | Steering Valve SV-2 inoperative | Check steering valve for power or damage. |
| | System interlock | Check HELP messages using EZ-Cal |
| | Hoses connected incorrectly | See hydraulic section for correct connection. |
| | Pressure Relief Valve RV-2 set too low | Set steer relief valve to 2000 PSI |
| **Steers in one direction only** | Steering Valve inoperative or stuck | Inspect; replace steering valve |
| | No power to steering coil | Check for power and ground in both directions, repair wiring |
| | System interlock | Check HELP messages using EZ-Cal |
| **Steers but not fully or steers slowly** | One or both steering cylinder internal seal failure | Check steering cylinder seals, replace |
| | Pressure relief valve set too low | Set steer relief valve to 2000 PSI |
| | King pin/s seizing in the bore | Disassemble and inspect, repair, replace bushings |
| **Wheels do not stay in position while driving** | One or both steering cylinder internal seal failure | Check steering cylinder seals, replace |
| **Steers uncommanded** | Steering Valve SV-2 sticking or damaged | Remove and inspect for visible debris and stem straightness, clean with solvent and air |
| | Check Valve CV-1 or CV-2 damaged or contaminated with debris | Remove and clean or replace check valves see hydraulic diagram for manifold location |
| **LEVEL, AUTO & MANUAL** | | |
| **No level operation** | Platform is in elevated position or is perceived to be in the elevated position. Elevation is monitored by a sensor located on left-rear portion of the scissor stack. | Use EZ-Cal to monitor platform state of elevation. See Diagnostic chart I.D. 2a13 for elevated status and 2e1 for platform % of elevation input. Failure of the angle transducer will trigger a fault code. |
| | System interlock | Check HELP messages using EZ-Cal |
| | Level switch/s inoperative | Check level switch located in the upper control box |
| | Directional pressure valve not functioning | Located behind lower control box. Inspect valve for loss of power, ground or damage. |

| | | |
|---|---|---|
| **No auto-level operation; manual level operates** | Switch or switch wiring problem. Located inside upper control box | Check switch and wiring |
| | Level Sensor not calibrated | See Tilt Sensor Calibration instructions found earlier in this section. |
| | System Interlock | Check HELP messages using EZ-Cal |
| **Unit will not accurately level platform** | Unit on too extreme an angle | Relocate unit to more level ground |
| | Level valve sticking | Inspect/replace valves located behind lower control box |
| | Excessive weight on platform | Reduce weight to 1500 lbs max (680Kg) |
| | Pressure relief valve out of adjustment | Set steering relief valve SV-2 to 2000 PSI (138 bar) |
| | Tilt sensor not calibrated or not calibrated properly | See Tilt Sensor Calibration instructions found earlier in this section. |
| | Level cylinder valves wired incorrectly | Refer to schematic diagram for correct wiring. |
| | Level cylinder hoses connected incorrectly | See Hydraulic section for hose routing detail |
| **Will not stay level; drifts down** | Counterbalance valve adjustment or failure | Located on the outrigger cylinder, not adjustable. If valve is suspect it must be replaced |
| | Failure of cylinder internal seals | Inspect and repair as necessary |

# TROUBLESHOOTING BATTERY CHARGER: ELECTRIC MODELS

Insufficient AC power systems, poor connections, bad batteries or low electrolyte in batteries may result in poor charger performance. Refer to *Section 2: Electrical System* for electrical requirements, and charger and battery maintenance instructions.

Refer to the *Operator's Manual* for detailed charging instructions.

To be able to use the trouble shooting guide safely and effectively, it is important to read through this guide before beginning any tests.

**CAUTION**

**Do not operate the charger if it is malfunctioning. Personal injury or property damage may result.**

**Do not disassemble charger. Return to MEC when service or repair is required.**

**To reduce the risk of fire, only use AC circuits and extension cords in accordance with all National and Local Electrical Codes for the location of use.**

**Only use MEC approved lead acid type flooded batteries. Use of GEL type batteries may damage the charger and cause machine instability due to decreased weight.**

**WARNING**

**TO REDUCE THE RISK OF ELECTRIC SHOCK, ALWAYS DISCONNECT BOTH THE POWER SUPPLY CORD AND THE OUTPUT WIRES BEFORE ATTEMPTING MAINTENANCE.**

**THE CHARGER SURFACE CAN GET HOT WHILE OPERATING. CONTACT WITH THE SKIN OR SURROUNDING MATERIALS SHOULD BE AVOIDED.**

**TO REDUCE THE RISK OF AN ELECTRIC SHOCK, CONNECT ONLY TO A PROPERLY GROUNDED SINGLE-PHASE (3 WIRE) OUTLET.**

Incorrect assembly may result in a risk of electric shock or fire. The following procedures are intended only to determine if a malfunction may exist in the charger. As most returned chargers test good, it is very important that this procedure is followed and that other problems are corrected before assuming the charger has failed.

The MEC battery charger is a fully automatic type with a maintenance feature that will maintain battery voltage indefinitely when connected to an AC power source. The battery charger should be plugged into an un-switched AC power source if the machine is stored for long periods of time.

***IMPORTANT:* –** All MEC electric aerial lifts are equipped with lead acid type flooded batteries. The yellow wire loop on the back of the charger must be intact. If it is cut, broken or damaged the charger may go into GEL charging mode, causing damage to the machine and/or batteries.

# BATTERY CHARGER, HB1500-48

***Figure 4b-11:*** Battery Charger

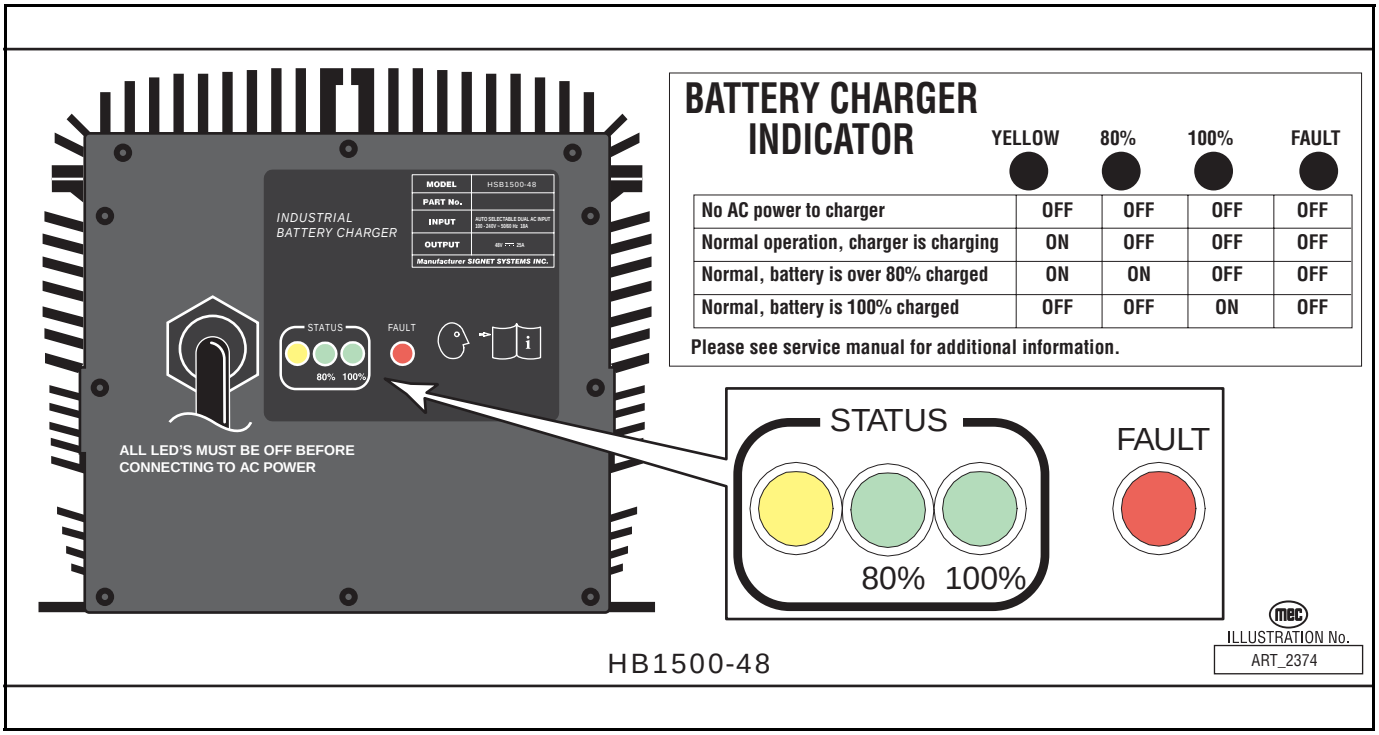



***Table 4b-5:*** Battery Charger Fault Codes

| CHG YELLOW LED | 80% GREEN LED | 100% GREEN LED | Fault RED LED | Condition |
|---|---|---|---|---|
| X | X | X | ON | • Battery pack probably bad<br>• Weak or bad cell<br>• Batteries excessively discharged |
| OFF | OFF | OFF | ONE FLASH | • Output open circuit or short circuit or reverse polarity connection of battery to charger<br>• Battery voltage is too high (may be connected to wrong voltage battery) |
| OFF | OFF | OFF | TWO FLASH | • Charger has timed-out at 22 hours (battery pack probably bad or bad cell) |
| **X = "don't care"** LED may be ON or OFF | | | | |

To determine if a charger is malfunctioning, identify the problem from the following list and refer to the Trouble Table for instructions.

1. Charger does not turn ON -or- no yellow LED
2. Red FAULT LED is ON or BLINKING
3. Batteries do not fully charge
4. The AC supply circuit breaker is tripped or fuse is blown

If the problem is not listed above, refer the problem to a qualified service agent for additional trouble shooting procedures.

**NOTE: Over 1/2 of all battery chargers returned as "failed" are good. Please follow the troubleshooting procedures carefully and check all other items before returning the charger.**

***Table 4b-6:*** Trouble Table - HB1500-48 Battery Charger

| PROBLEM | DIAGNOSIS |
|---|---|
| **Charger does not turn ON - no LEDs** | **The AC plug must be disconnected and reconnected to start the charger once it has turned-off from a charge cycle.**<br>• Connect the AC supply cord securely to a live AC outlet (minimum 20-amp circuit)<br>• Check the AC outlet to ensure it is working and has 20-amp supply.<br>• Check that DC output wires and connections are in good working condition.<br>• Replace charger if everything else is correct. |
| **Red FAULT LED is ON or BLINKING** | **The faults identified below cause the FAULT LED to turn ON or BLINK. If the cause of the fault is removed the charger restarts automatically.**<br>• LED is ON<br>Weak or bad battery pack, bad cell, low electrolyte level or batteries excessively discharged.<br>• LED blinks once: OUTPUT CONNECTION ERROR<br>Check Battery and Charger Connection<br>- Connection may be corroded or loose<br>- Check for pinched or broken wires (may cause a short)<br>- Output may be connected in reverse polarity to batteries<br>(the charger is not damaged by any of these problems.) |
| **Red FAULT LED BLINKS twice: charger has Timed-Out** | **The charger has a 22 hour timer - if charge cycle is not complete within 22 hours the charger will stop charging.**<br>• Possible Causes:<br>- Batteries are extremely discharged - unplug for 30 seconds then plug charger back in to restart and complete charging.<br>- Electrolyte is low in one or more cells.<br>- Batteries are weak, old, or have one or more bad cells. Batteries will still charge but in a weakened capacity - they should be replaced. |
| **Batteries do not fully charge** | • Overnight Charging<br>- Make sure AC power supply is not being switched OFF at night<br>• NEW batteries<br>- New batteries sometimes require 20 to 30 charge/discharge cycles before they charge normally. 80% LED after overnight charging is normal. Within a few weeks the 100% LED should light after overnight charge.<br>• OLD batteries<br>- Check for dead cells or reduced capacity. |
| **AC Line circuit breaker tripped or fuse blown** | • Overloaded Circuit<br>Minimum 20-amp service required. Plug charger into a different AC outlet on a different circuit. If charger operates properly the AC line may require repair. If charger fails and AC line checks "good" the charger should be replaced. |

# HYDRAULIC PRESSURE ADJUSTMENT - 3084ES

- 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 4b-7:*** Hydraulic Pressure Adjustment

| Model | Main | | Lift | | Steer | | Stand-by | |
|---|---|---|---|---|---|---|---|---|
| **3084ES** | 2800 PSI | 193 bar | 2500 PSI | 172.4 bar | 2000 PSI | 137.9 bar | not used | not used |

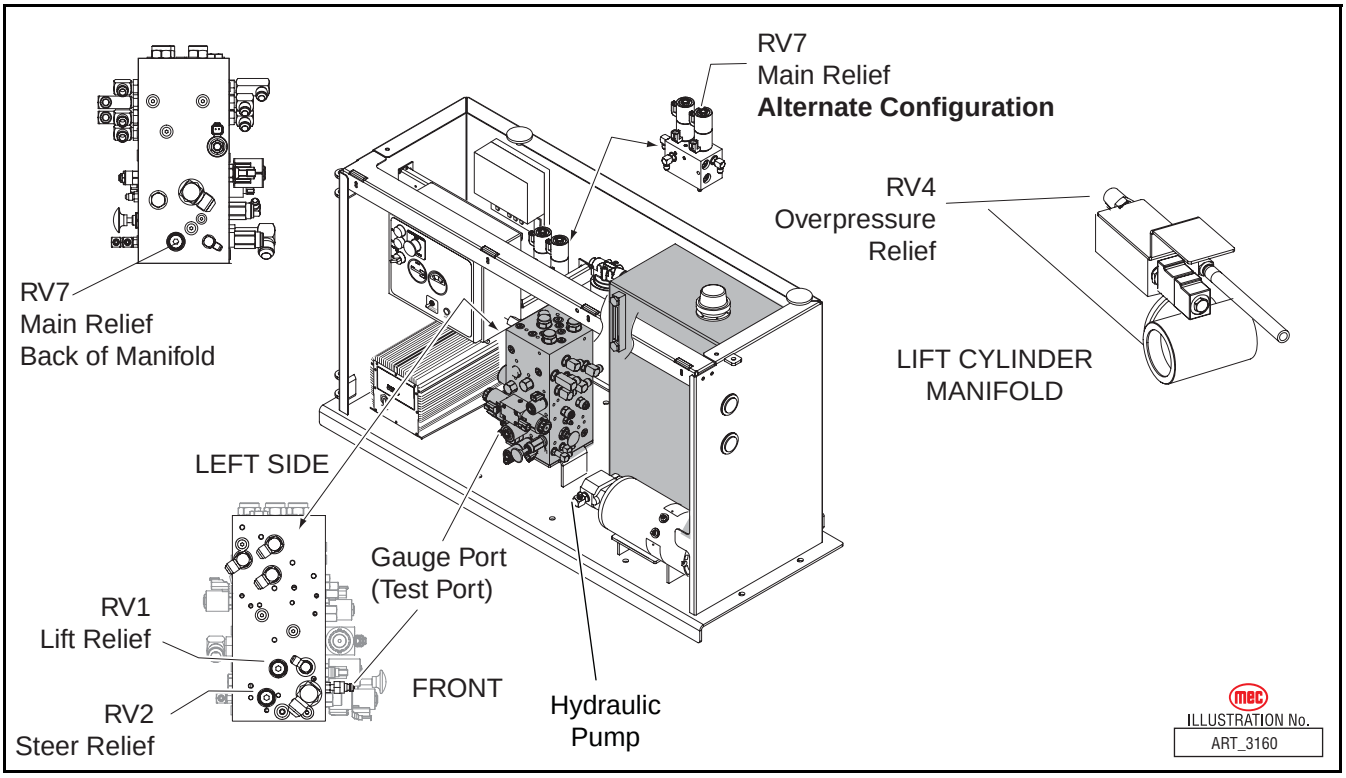
## ADJUSTING RELIEF VALVES

- 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.

**CAUTION**

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

***Figure 4b-12:*** Adjustable Valves Location - 3084ES



# ADJUSTMENTS - 3084ES

The Hydraulic Pump used in this model is not adjustable.

Refer to "Figure 4b-12:Adjustable Valves Location - 3084ES" on page 4b-37.

See Section 5 - Schematics for correct pressure settings.

### *Main Relief (RV7)*

- Disconnect forward or reverse coil of drive valve.
- Energize drive function by moving joystick in the direction of the already disconnected coil.
- Hold the switch for 10 seconds to get an accurate reading on the pressure gauge.
- If pressure is LOW, adjust main relief valve ¼ turn clockwise and recheck.
- If pressure is HIGH, adjust main relief valve ¼ turn counterclockwise and recheck.
- Repeat until correct.

### *Lift Relief (RV1)*

- Move 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.

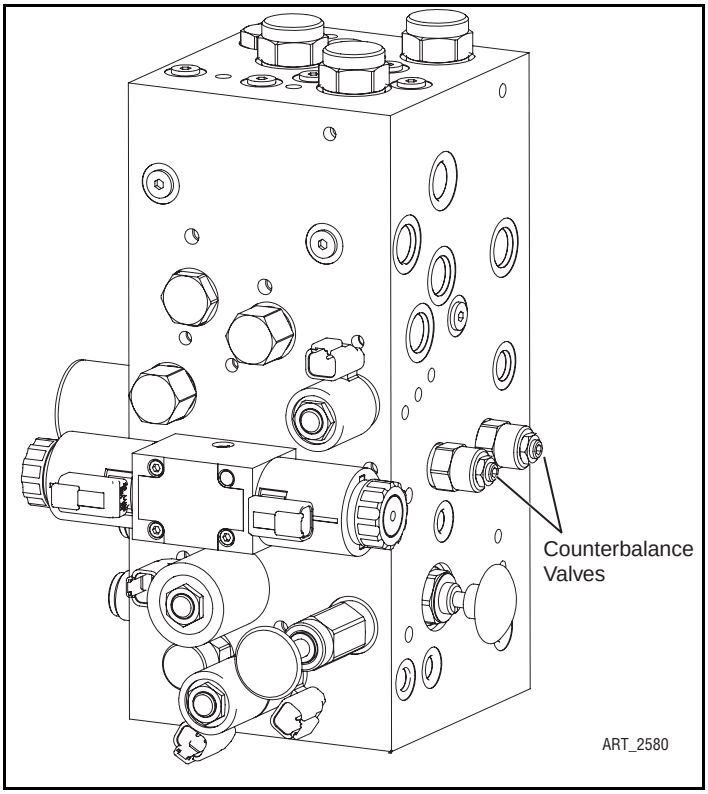
### *Steering Relief (RV2)*

- 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.

# COUNTERBALANCE VALVES

1. Loosen the locknut on one of the valves.
2. Turn the adjustment screw clockwise (to the right) until it reaches the internal stop and the screw will turn no further.
3. Turn the adjustment screw clockwise (to the right) 3¼ turns.
4. Tighten the locknut while holding the adjustment screw in position to prevent it from rotating.
5. Repeat steps 1 through 4 on the other Counterbalance valve.
6. Adjustment is complete.

***Figure 4b-13:*** Counterbalance Valves



# COMPONENT ILLUSTRATIONS

***Figure 4b-14:*** Controls and Switches, ES

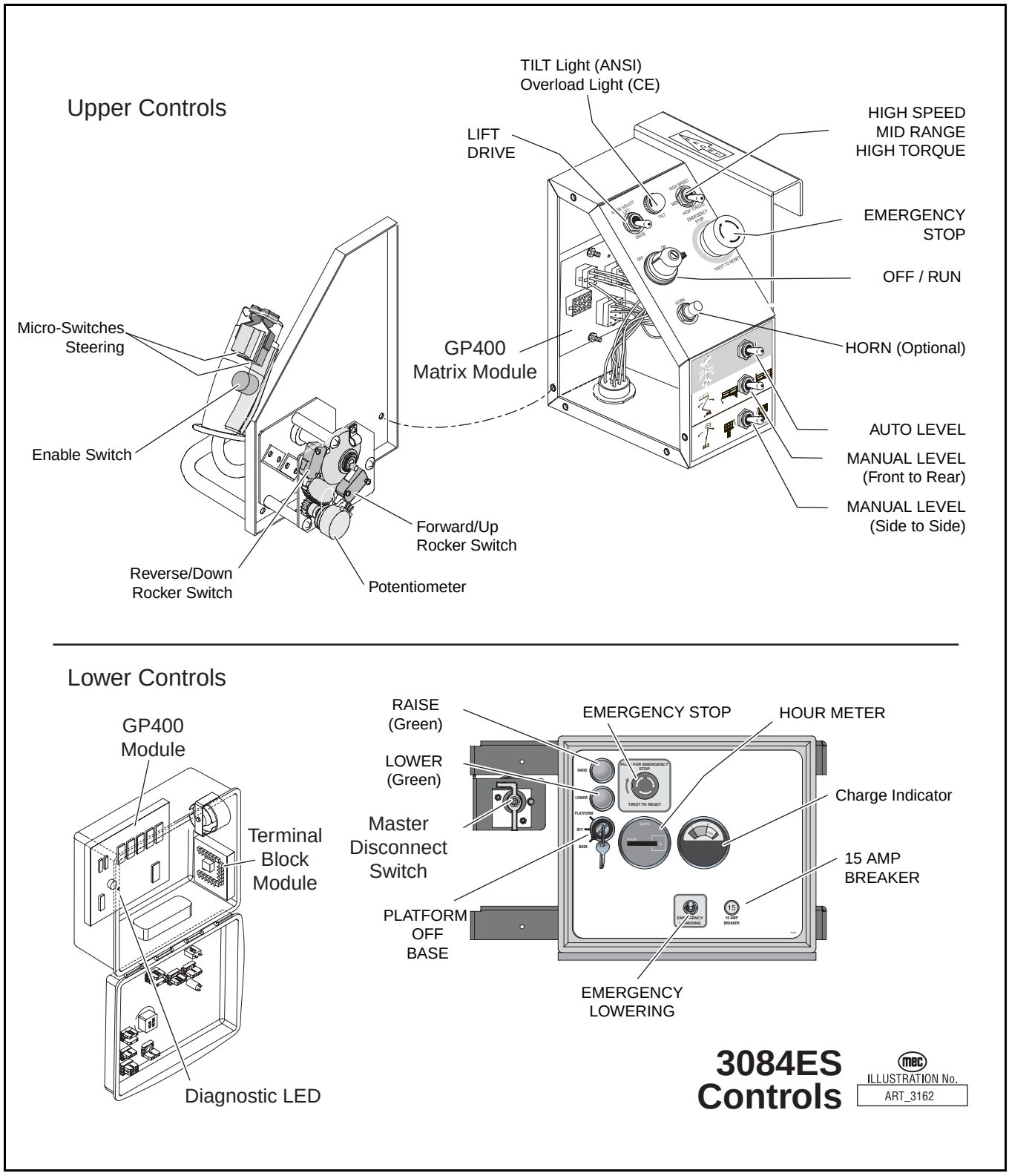


***Figure 4b-15:*** Hydraulic Manifold, ES

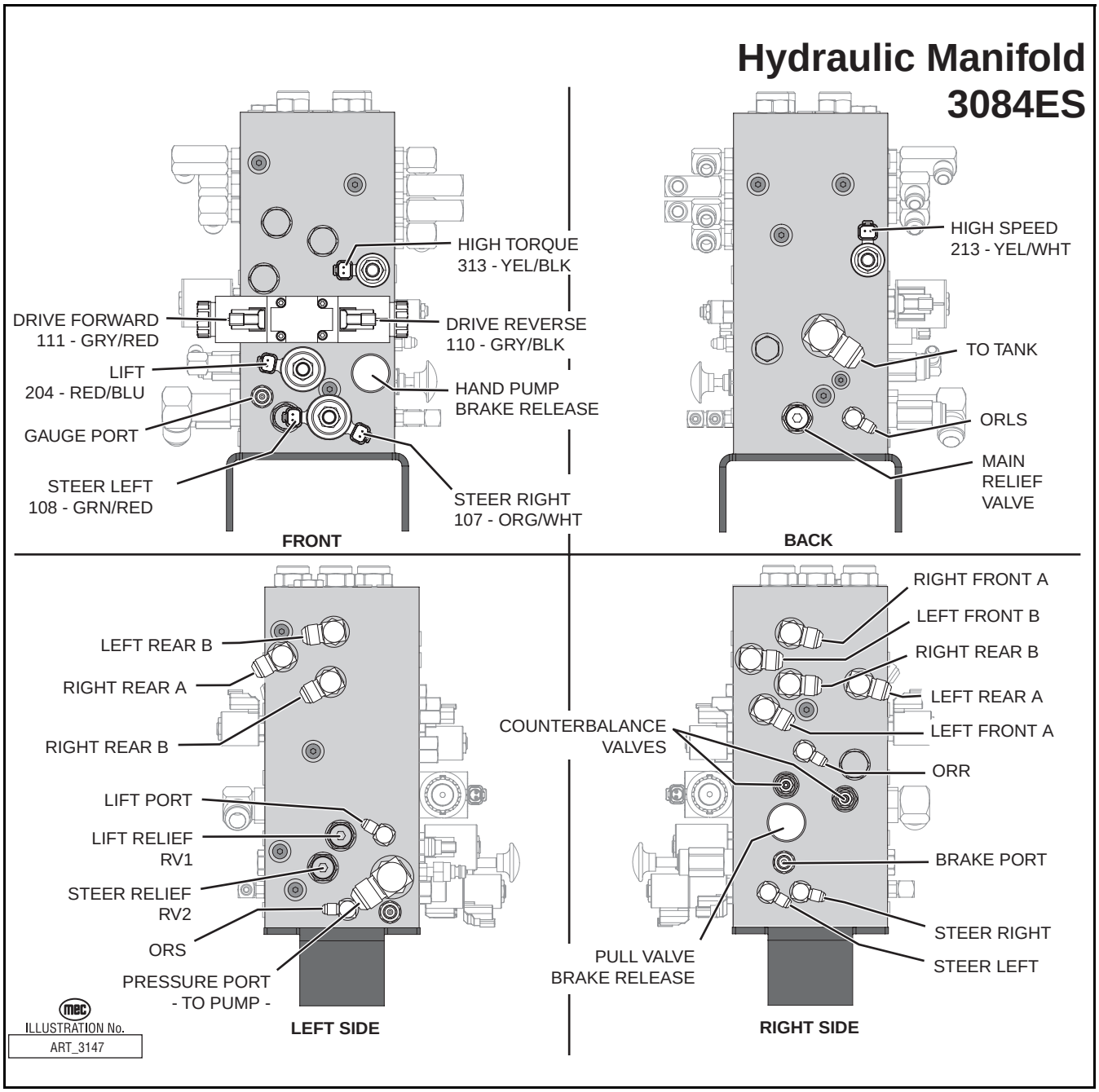
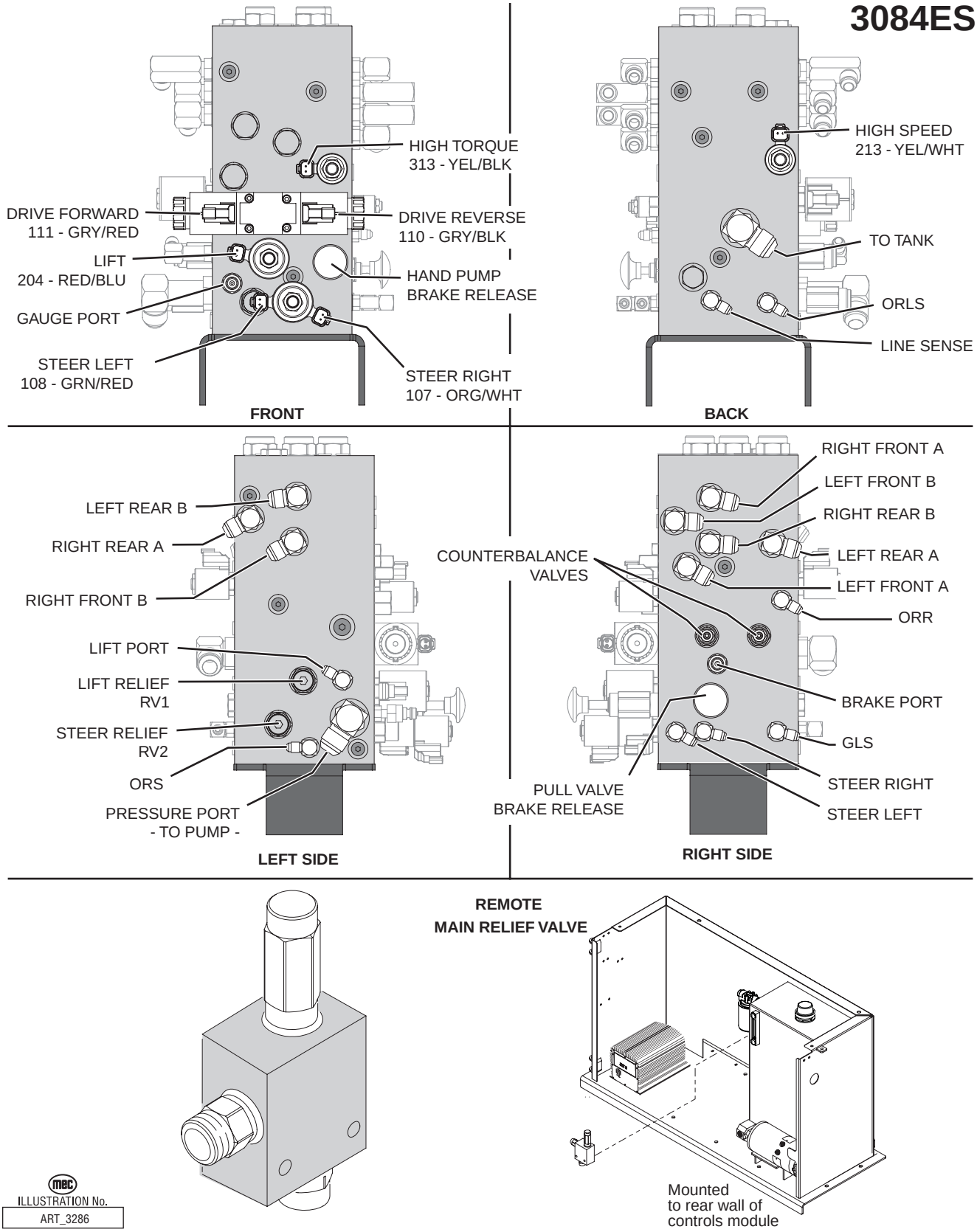


***Figure 4b-16:*** Main Hydraulic Manifold - 3084ES Alternate Configuration

# Hydraulic Manifold - Alternate Configuration 3084ES



# Section 5

# SCHEMATICS

## CONTENTS



## FIGURES

# 3084RT DIESEL/DUAL FUEL MODELS

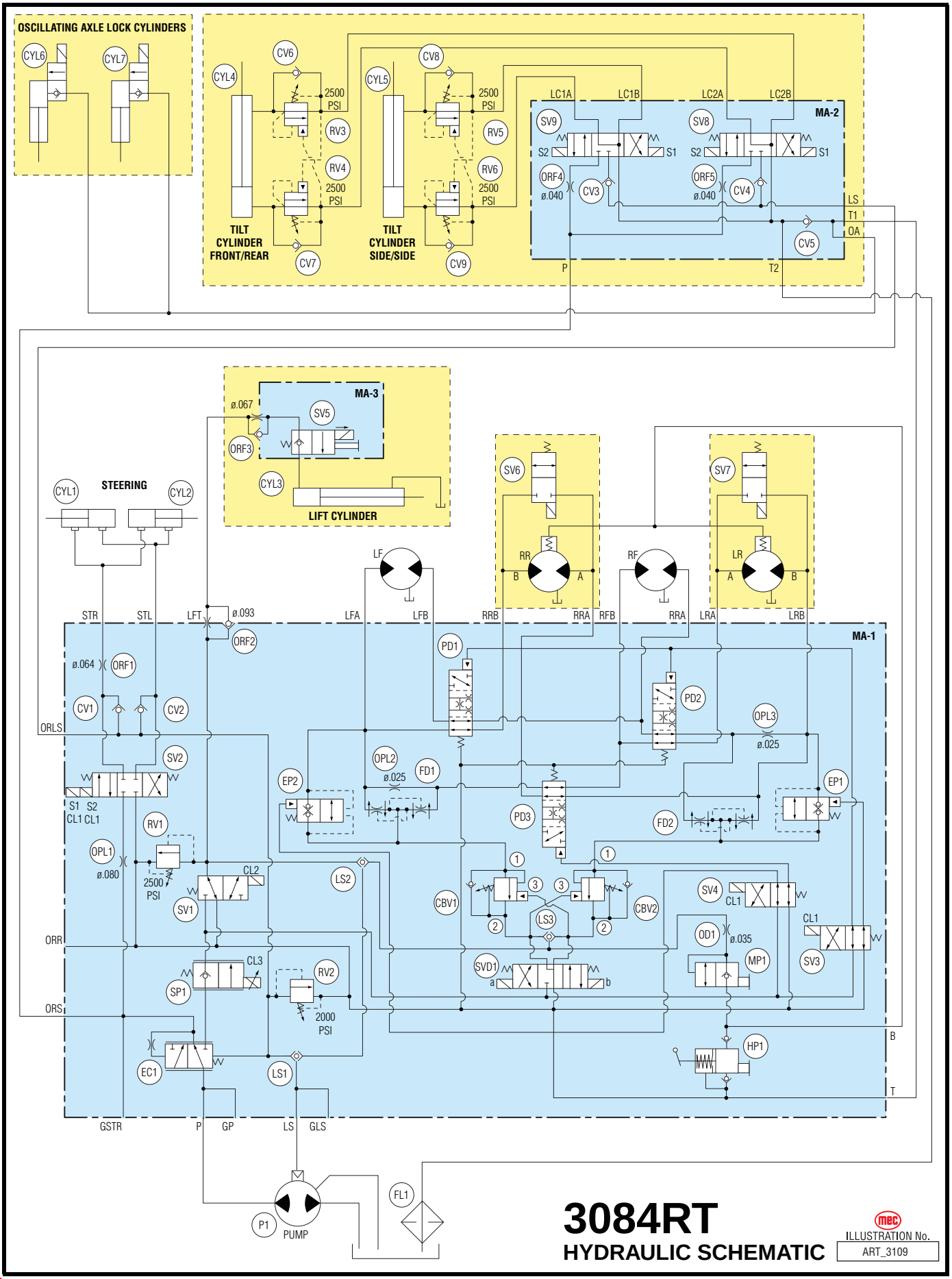
## HYDRAULIC - 3084RT

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

| Callout | Description |
|---|---|
| **MA-1** | **MAIN MANIFOLD** |
| CBV1 | Counter Balance Valve, Drive |
| CBV2 | Counter Balance Valve, Drive |
| CL1 | Coil - Speed/Torque/Steer Valves #8 |
| CL2 | Coil - Lift Valve #10 |
| CV1 | Check Valve, Load Sense Steer Left |
| CV2 | Check Valve, Load Sense Steer Right |
| EC1 | Priority Flow Control |
| EP1 | Piloted Poppet Valve - Torque/Speed |
| EP2 | Piloted Poppet Valve - Torque/Speed |
| FD1 | Flow Divider/Combiner |
| FD2 | Flow Divider/Combiner |
| HP1 | Hand Pump, Brake Release |
| LS1 | Load Sense Shuttle Valve |
| LS2 | Load Sense Shuttle Valve |
| LS3 | Load Sense Shuttle Valve |
| MP1 | Manual Push Brake Release Valve |
| OD1 | Orifice Disc, Brakes, 0.035 |
| OPL1 | Orifice Plug, Steering, 0.087 |
| OPL2 | Orifice Plug, Flow Divider Bleed, 0.025 |
| OPL3 | Orifice Plug, Flow Divider Bleed, 0.025 |
| ORF1 | Orifice, Steering, 0.064 |
| ORF2 | Orifice, Lift, 0.093 |
| PD1 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PD2 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PD3 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PLG4 | Port Plug |
| PLG6 | Port Plug |
| RV1 | Relief Valve, Lift, 2500 PSI |
| RV2 | Relief Valve, Steering, 2000 PSI |
| SP1 | Proportional Valve |
| SV1 | Spool Valve, Lift, 3-Way |
| SV2 | Spool Valve, Steer, 4-Way / 3-Position |
| SV3 | Spool Valve, Series Parallel, 4-Way / 3-Position |
| SV4 | Spool Valve, Series Parallel, 4-Way / 3-Position |
| SVD1 | Spool Valve, Drive, 4-Way / 3-Position |

| Callout | Description |
|---|---|
| | **STEERING COMPONENTS** |
| CYL1 | Steer Cylinder, Right |
| CYL2 | Steer Cylinder, Left |
| | **TILT COMPONENTS** |
| MA-2 | Combination Valve Manifold - Tilt |
| CV3 | Check Valve, Tilt, Side/Side Load Sense |
| CV4 | Check Valve, Tilt, Front/Rear Load Sense |
| CV5 | Check Valve, 10 PSI Oscillating axle |
| CV6 | Check Valve, Tilt Cyl, Front/Rear |
| CV7 | Check Valve, Tilt Cyl, Front/Rear |
| CV8 | Check Valve, Tilt Cyl, Side/Side |
| CV9 | Check Valve, Tilt Cyl, Side/Side |
| CYL4 | Tilt Cylinder, Front/Rear |
| CYL5 | Tilt Cylinder, Side/Side |
| CYL6 | Axle Lock Cylinder |
| CYL7 | Axle Lock Cylinder |
| ORF4 | Orifice, 0.040, Tilt, Side/Side |
| ORF5 | Orifice, 0.040, Tilt, Front/Rear |
| RV3 | Relief Valve, Tilt Cyl Front/Rear, 2500 PSI |
| RV4 | Relief Valve, Tilt Cyl Front/Rear, 2500 PSI |
| RV5 | Relief Valve, Tilt Cyl Side/Side, 2500 PSI |
| RV6 | Relief Valve, Tilt Cyl Side/Side, 2500 PSI |
| SV8 | Spool Valve, Tilt Front/Rear |
| SV9 | Spool Valve, Tilt Side/Side |
| | **LIFT COMPONENTS** |
| MA-3 | Lift Cylinder Manifold |
| CYL3 | Lift Cylinder |
| ORF3 | Orifice, 0.067 Descend |
| SV5 | Solenoid Valve, 12V, Dual Coil |
| | **Wheel Motors** |
| LF | Wheel Motor - Left Front |
| LR | Wheel Motor w/ Brake - Left Rear |
| RF | Wheel Motor - Right Front |
| RR | Wheel Motor w/ Brake - Right Rear |
| SV6 | Spool Valve - Right Wheel Motor Bypass |
| SV7 | Spool Valve - Left Wheel Motor Bypass |
| | **RESERVOIR** |
| FL1 | Filter, 10 Micron, Fluid Return |
| P1 | Pump, Hydraulic Fluid |

***Figure 5-1:*** Hydraulic Schematic - 3084RT




# 3084RT
## HYDRAULIC SCHEMATIC

ILLUSTRATION No.
ART_3109

***Figure 5-2:*** Hydraulic Manifold, Main M1 - 3084RT

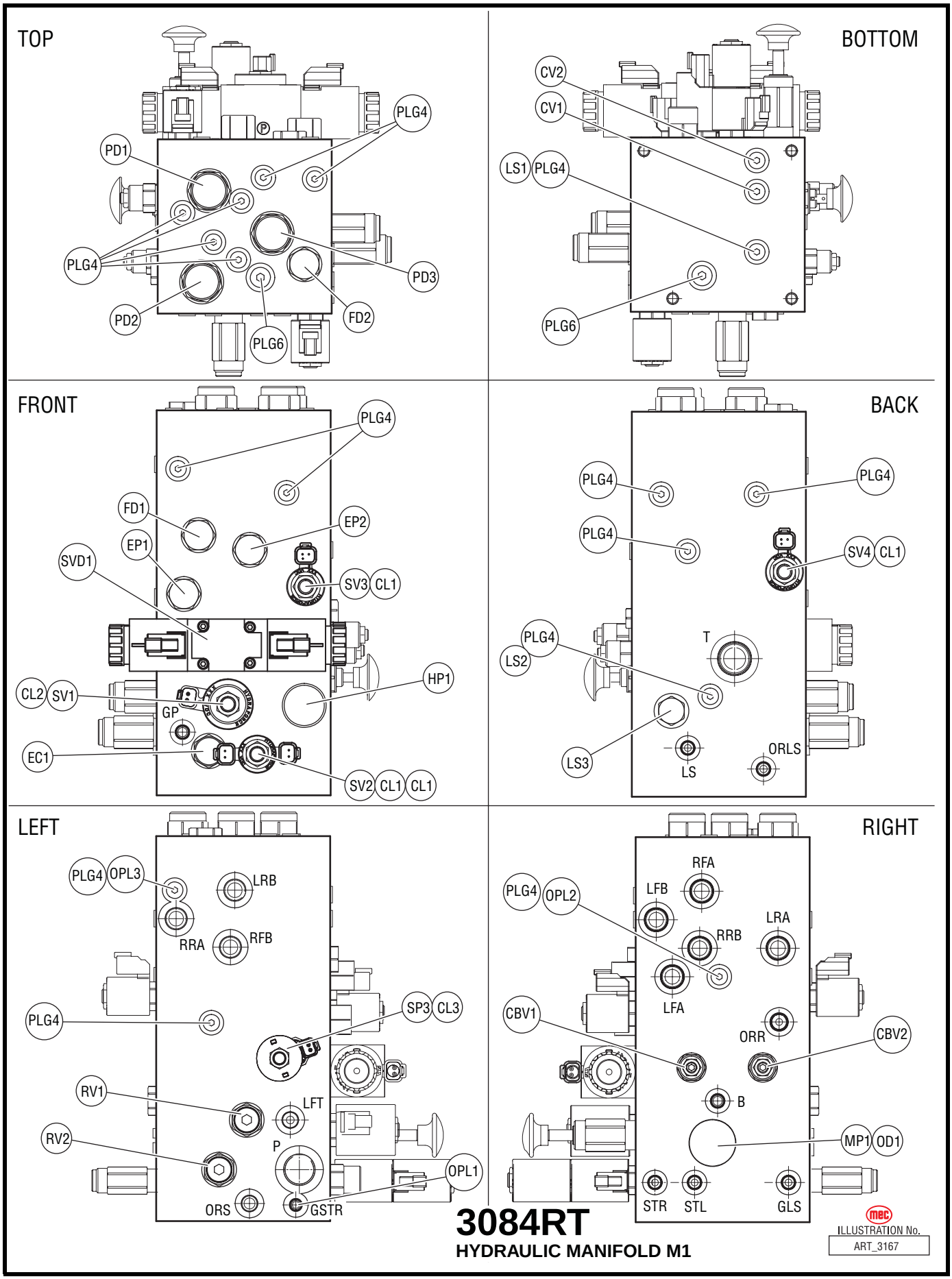
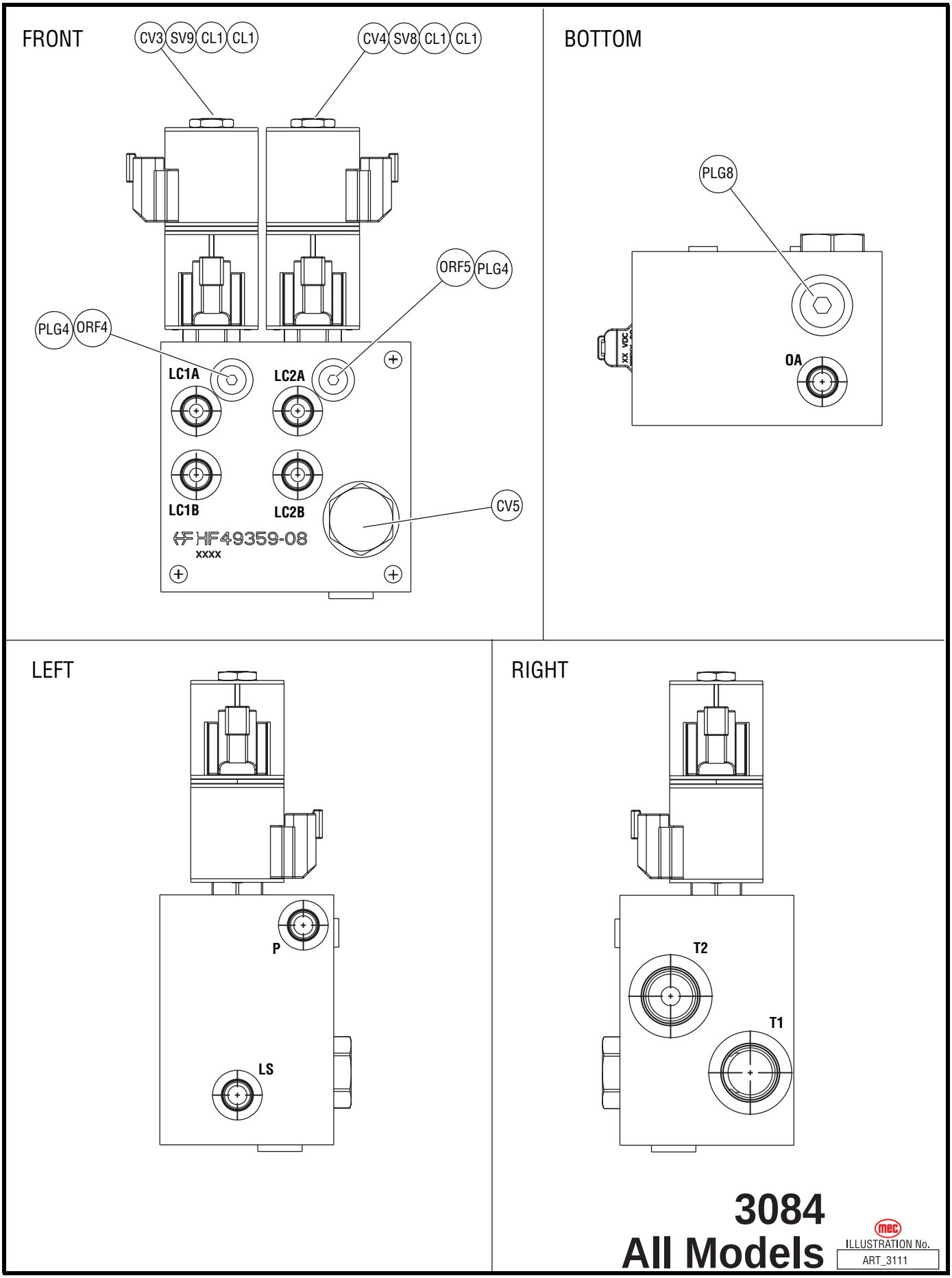


***Figure 5-3:*** Hydraulic Manifold, Tilt M2 - All Models



# ELECTRICAL - 3084RT

***Figure 5-4:*** Electric Schematic, Upper Controls - 3084RT

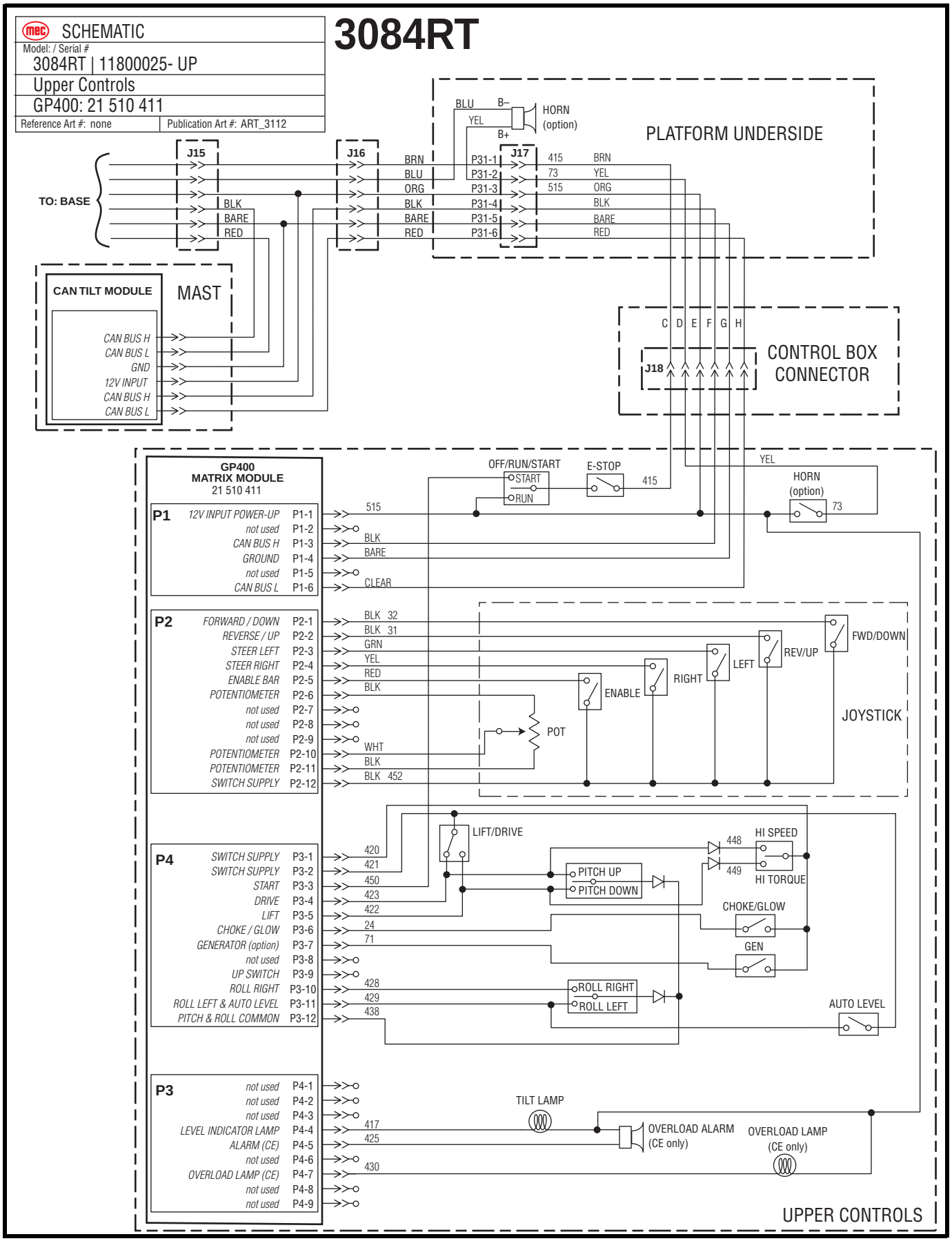
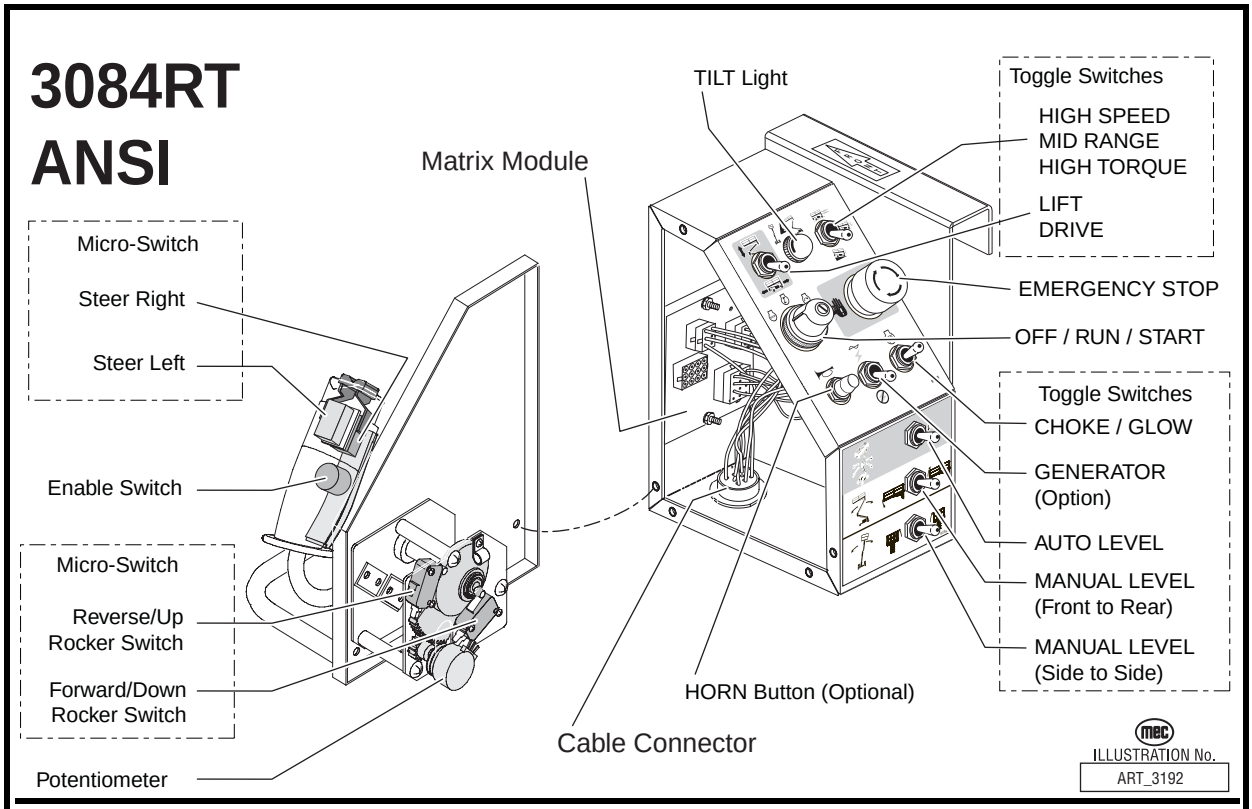


***Figure 5-5:*** Upper Controls Components - 3084RT



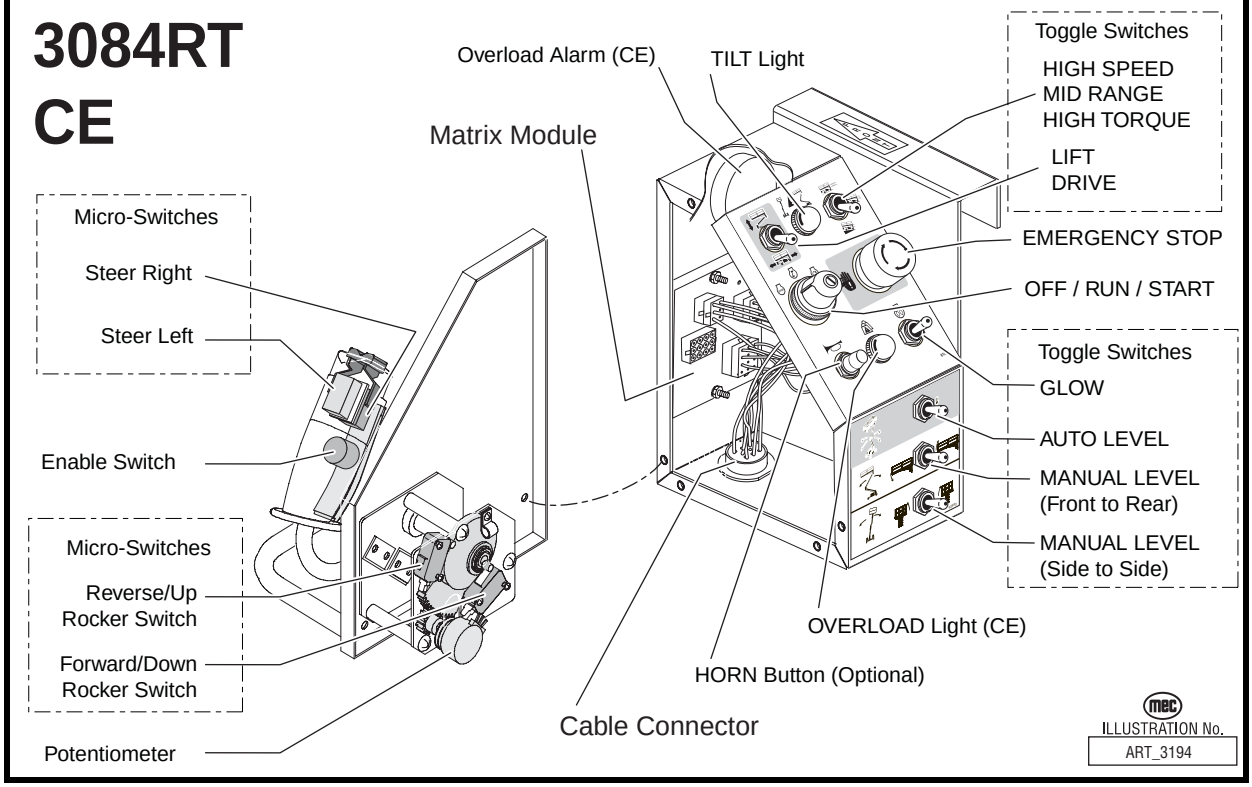



***Figure 5-6:*** Electric Schematic, Lower Control Box - 3084RT Dual Fuel

SCHEMATIC
Model: / Serial #
3084 | Serial #11800025 - UP
Lower Control Box - Dual Fuel

Reference Art #: none | Publication Art #: ART_3195

# 3084RT DUAL FUEL

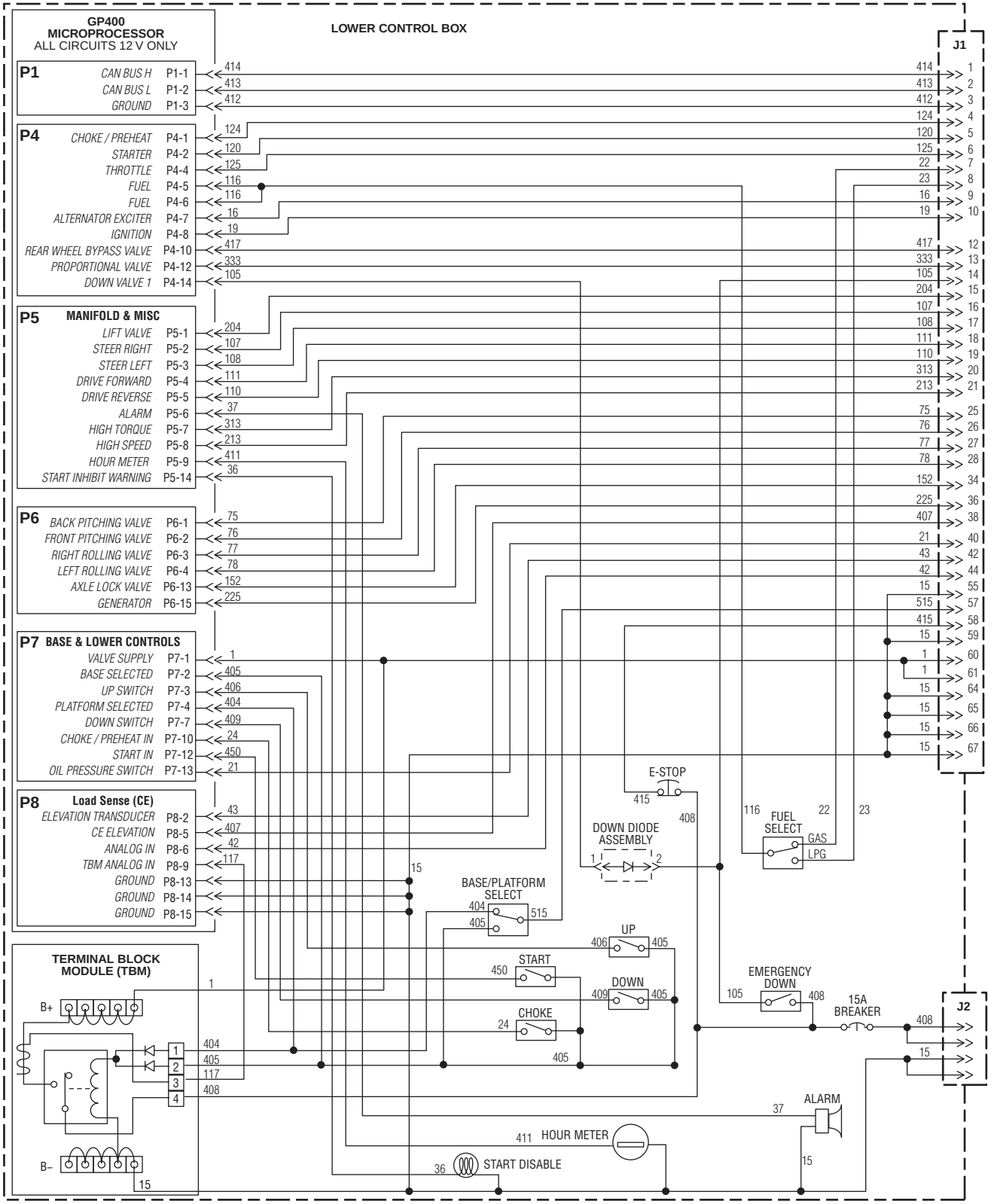


***Figure 5-7:*** Electric Schematic, Base - 3084RT Dual Fuel

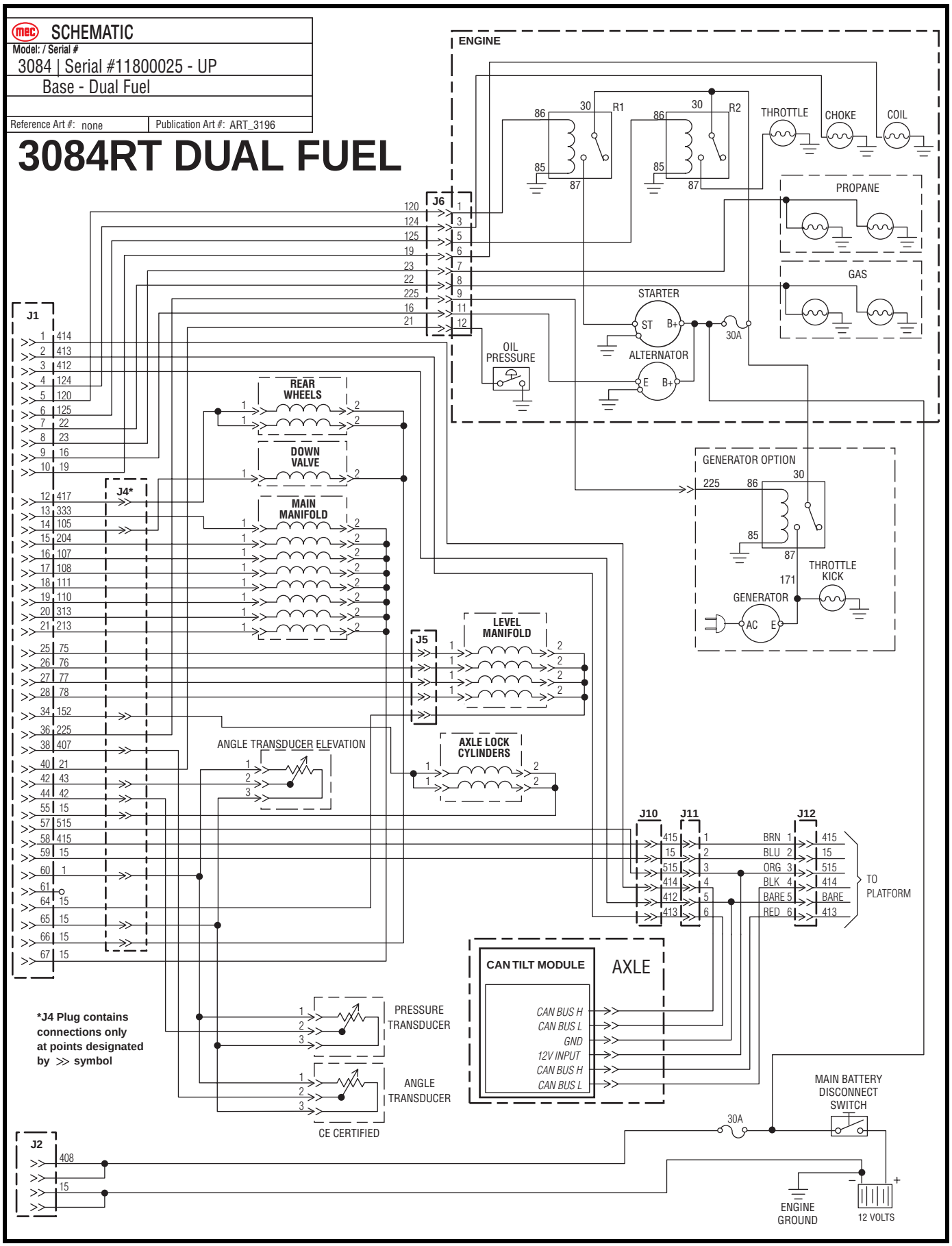


***Figure 5-8:*** Electric Schematic, Lower Control Box - 3084RT Diesel

SCHEMATIC

Model: / Serial #

3084 | Serial #11800025 - UP

Lower Control Box - Diesel

Reference Art #: none

Publication Art #: ART_3197

# 3084RT DIESEL

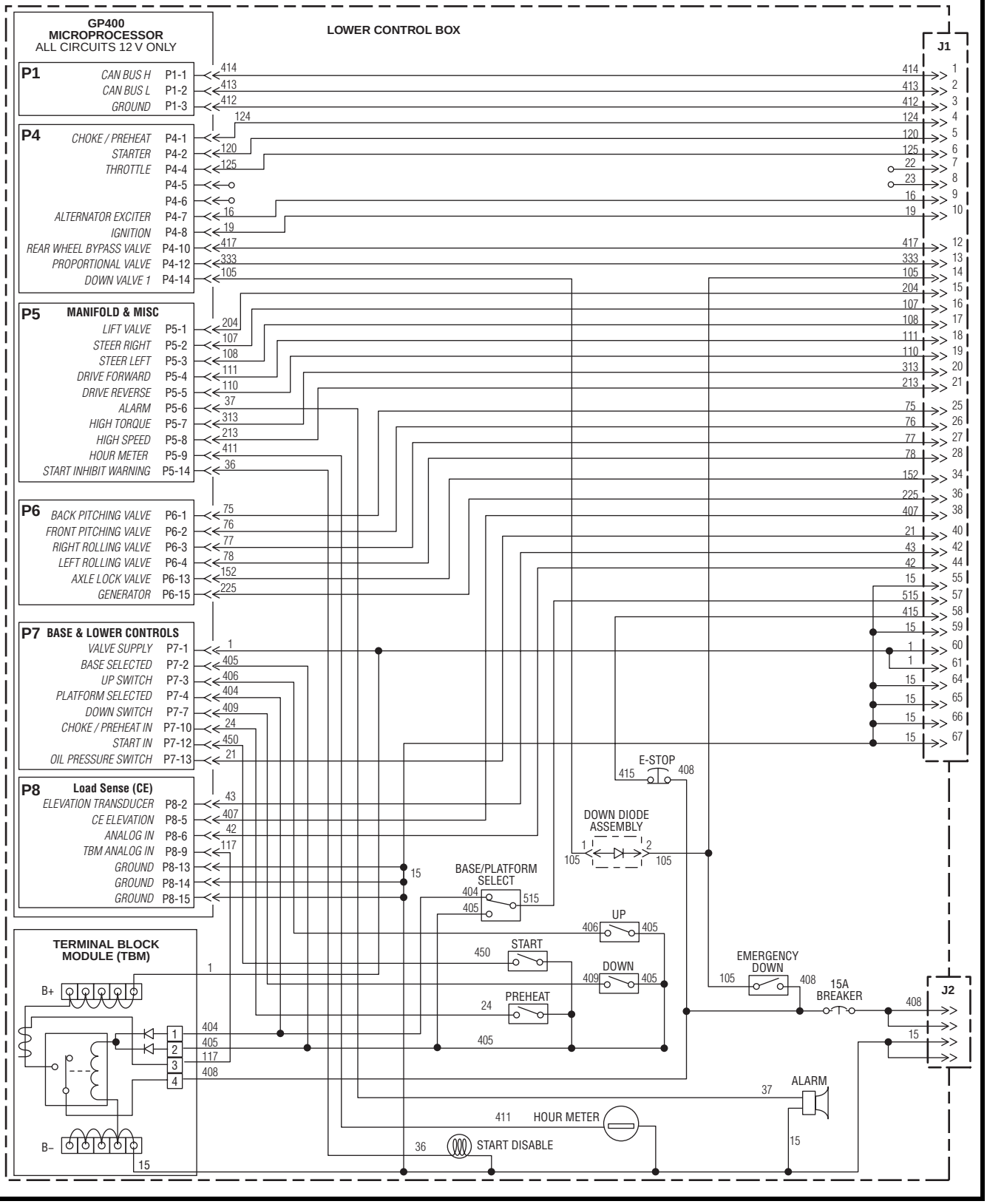


***Figure 5-9:*** Electric Schematic, Base - 3084RT Diesel

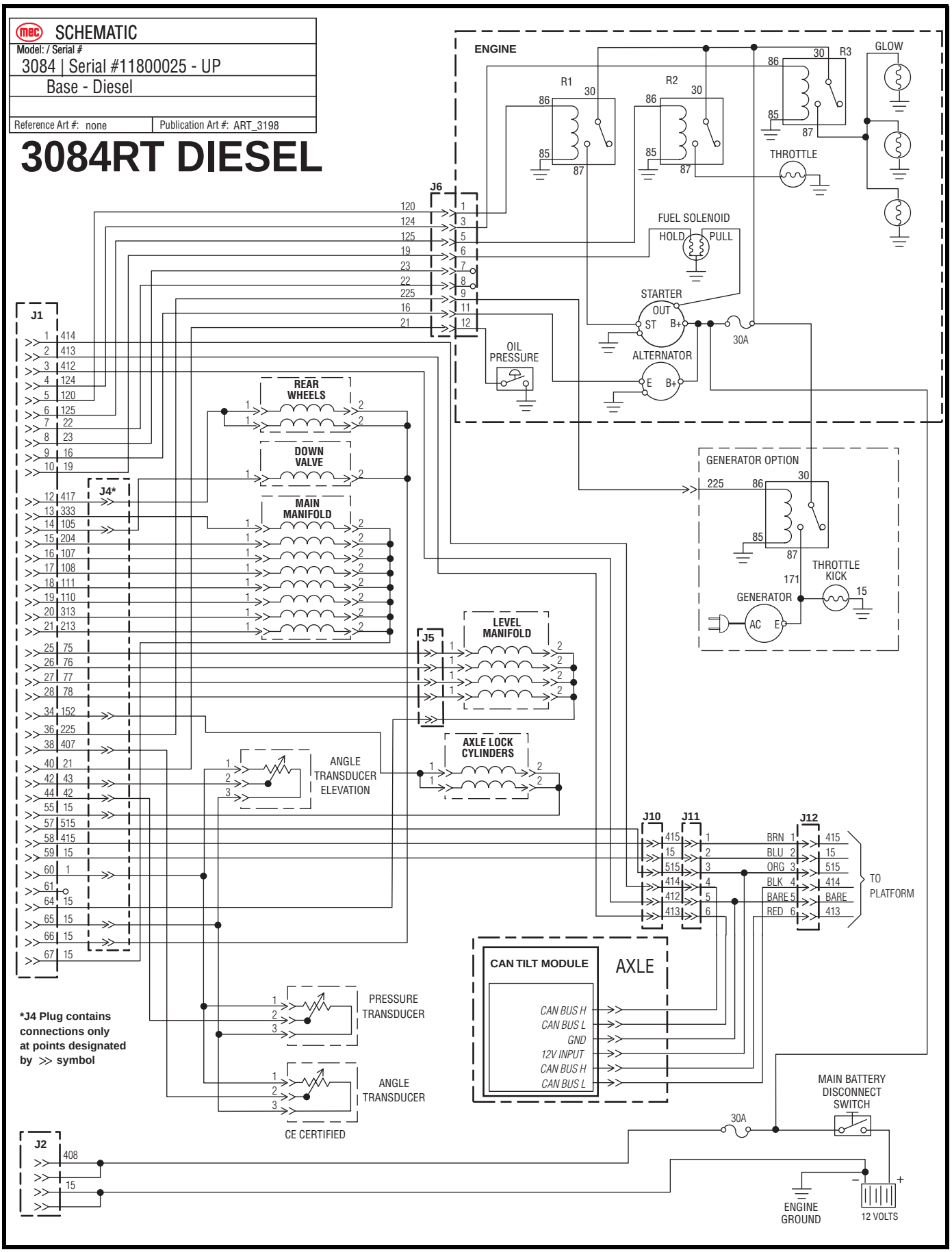
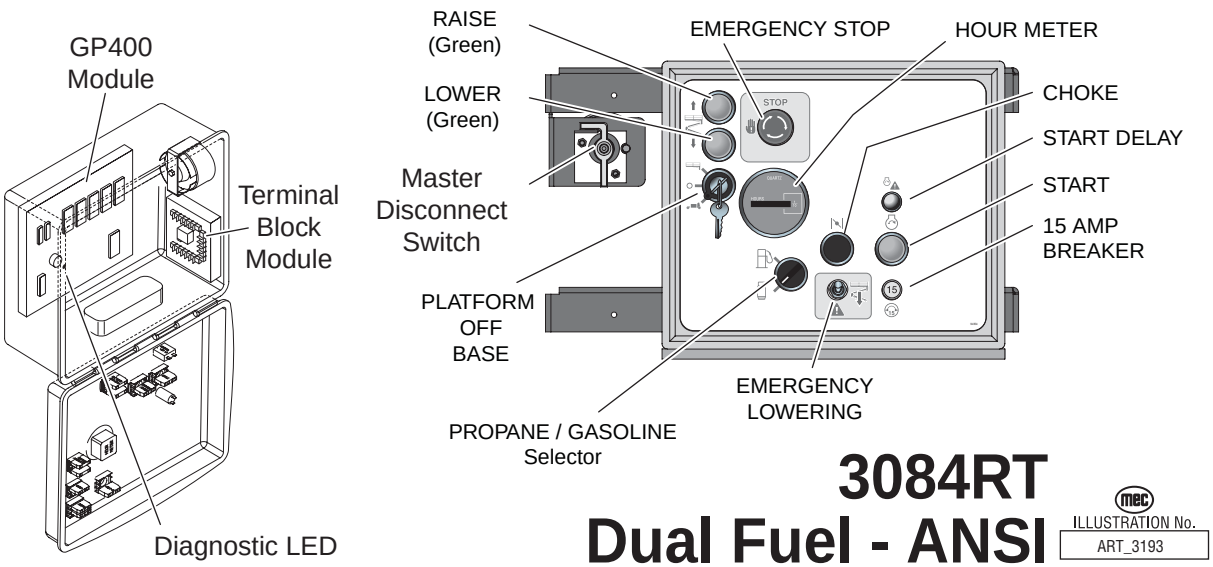
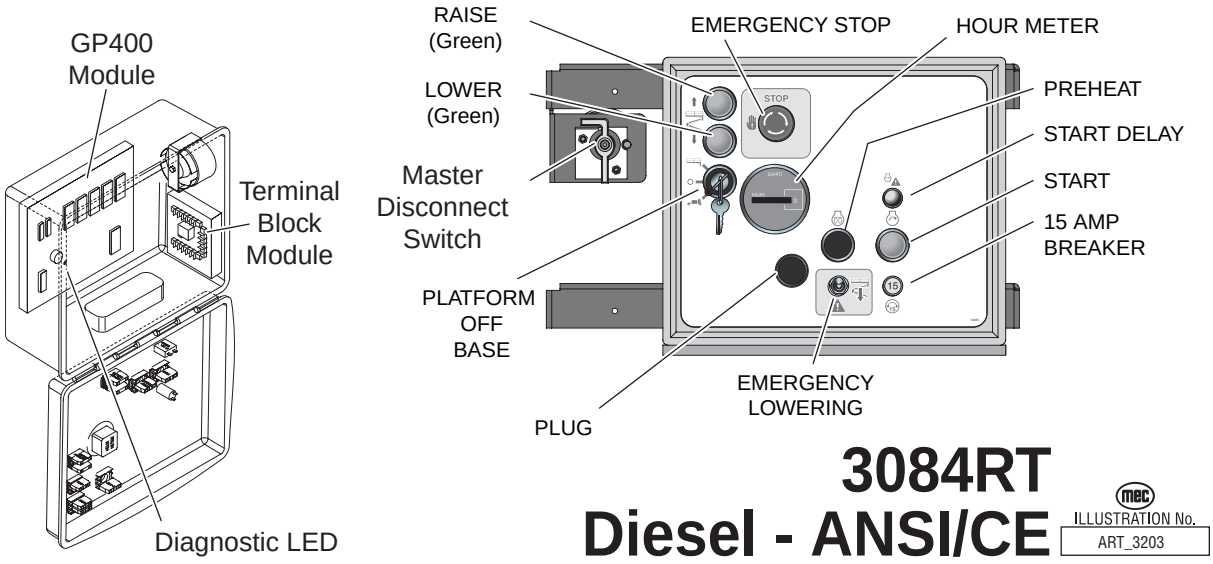


***Figure 5-10:*** Lower Controls Components - 3084RT




**3084RT**
**Dual Fuel - ANSI**

ILLUSTRATION No.
ART_3193




**3084RT**
**Diesel - ANSI/CE**

ILLUSTRATION No.
ART_3203

## NOTES:

# 3084ES ELECTRIC MODEL

## HYDRAULIC - 3084ES

The following table applies to Figure 5-11, Figure 5-12 and Figure 5-13.

| Callout | Description |
|---|---|
| **MA-1** | **MAIN MANIFOLD** |
| CBV1 | Counter Balance Valve, Drive |
| CBV2 | Counter Balance Valve, Drive |
| CL1 | Coil - Speed/Torque/Steer #8 |
| CL2 | Coil - Lift Valve #10 |
| CL3 | Coil - Proportional |
| CP1 | Cavity Plug, Stopped |
| CV1 | Check Valve, Load Sense Steer |
| EC1 | Priority Flow Control |
| EP1 | Piloted Poppet Valve - Torque/Speed |
| EP2 | Piloted Poppet Valve - Torque/Speed |
| FD1 | Flow Divider/Combiner |
| FD2 | Flow Divider/Combiner |
| HP1 | Hand Pump, Brake Release |
| LS1 | Load Sense Shuttle |
| MP1 | Manual Push Brake Release Valve |
| OD1 | Orifice Disc, Brakes, 0.035 |
| OPL1 | Orifice Plug, Steering, 0.087 |
| OPL2 | Orifice Plug, Flow Divider Bleed, 0.025 |
| OPL3 | Orifice Plug, Flow Divider Bleed, 0.025 |
| OPL4 | Orifice Plug, Stopped |
| OPL5 | Orifice Plug, Stopped |
| PD1 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PD2 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PD3 | Pilot Valve, Series Parallel, 4-Way / 3-Position |
| PLG4 | Port Plug |
| PLG6 | Port Plug |
| RV1 | Relief Valve, Lift, 2500 PSI |
| RV2 | Relief Valve, Steering, 2000 PSI |
| RV7 | Relief Valve, 3000 PSI Main |
| SV1 | Spool Valve, Lift, 3-Way |
| SV2 | Spool Valve, Steer, 4-Way / 3-Position |
| SV3 | Spool Valve, Series Parallel, 4-Way / 3-Position |
| SV4 | Spool Valve, Series Parallel, 4-Way / 3-Position |
| SVD1 | Spool Valve, Drive, 4-Way / 3-Position |

| Callout | Description |
|---|---|
| | **STEERING COMPONENTS** |
| CYL1 | Steer Cylinder, Right |
| CYL2 | Steer Cylinder, Left |
| | **TILT COMPONENTS** |
| MA-2 | Combination Valve Manifold - Tilt |
| CV3 | Check Valve, Tilt, Side/Side Load Sense |
| CV4 | Check Valve, Tilt, Front/Rear Load Sense |
| CV5 | Check Valve, 10PSI Oscillating Axle |
| CV6 | Check Valve, Tilt Cyl, Front/Rear |
| CV7 | Check Valve, Tilt Cyl, Front/Rear |
| CV8 | Check Valve, Tilt Cyl, Side/Side |
| CV9 | Check Valve, Tilt Cyl, Side/Side |
| CYL4 | Tilt Cylinder, Front/Rear |
| CYL5 | Tilt Cylinder, Side/Side |
| CYL6 | Axle Lock Cylinder |
| CYL7 | Axle Lock Cylinder |
| ORF4 | Orifice, 0.040, Tilt, Side/Side |
| ORF5 | Orifice, 0.040, Tilt, Front/Rear |
| RV3 | Relief Valve, Tilt Cyl Front/Rear, 2500 PSI |
| RV4 | Relief Valve, Tilt Cyl Front/Rear, 2500 PSI |
| RV5 | Relief Valve, Tilt Cyl Side/Side, 2500 PSI |
| RV6 | Relief Valve, Tilt Cyl Side/Side, 2500 PSI |
| SV8 | Spool Valve, Tilt Front/Rear |
| SV9 | Spool Valve, Tilt Side/Side |
| | **LIFT COMPONENTS** |
| MA-3 | Lift Cylinder Manifold |
| CYL3 | Lift Cylinder |
| ORF3 | Orifice, 0.067 Descend |
| SV5 | Solenoid Valve, 12V, Dual Coil |
| | **Wheel Motors** |
| LF | Wheel Motor - Left Front |
| LR | Wheel Motor w/ Brake - Left Rear |
| RF | Wheel Motor - Right Front |
| RR | Wheel Motor w/ Brake - Right Rear |
| SV6 | Spool Valve - Right Wheel Motor Bypass |
| SV7 | Spool Valve - Left Wheel Motor Bypass |
| | **RESERVOIR** |
| FL1 | Filter, 10 Micron, Fluid Return |
| P1 | Pump, Hydraulic Fluid |

***Figure 5-11:*** Hydraulic Schematic - 3084ES

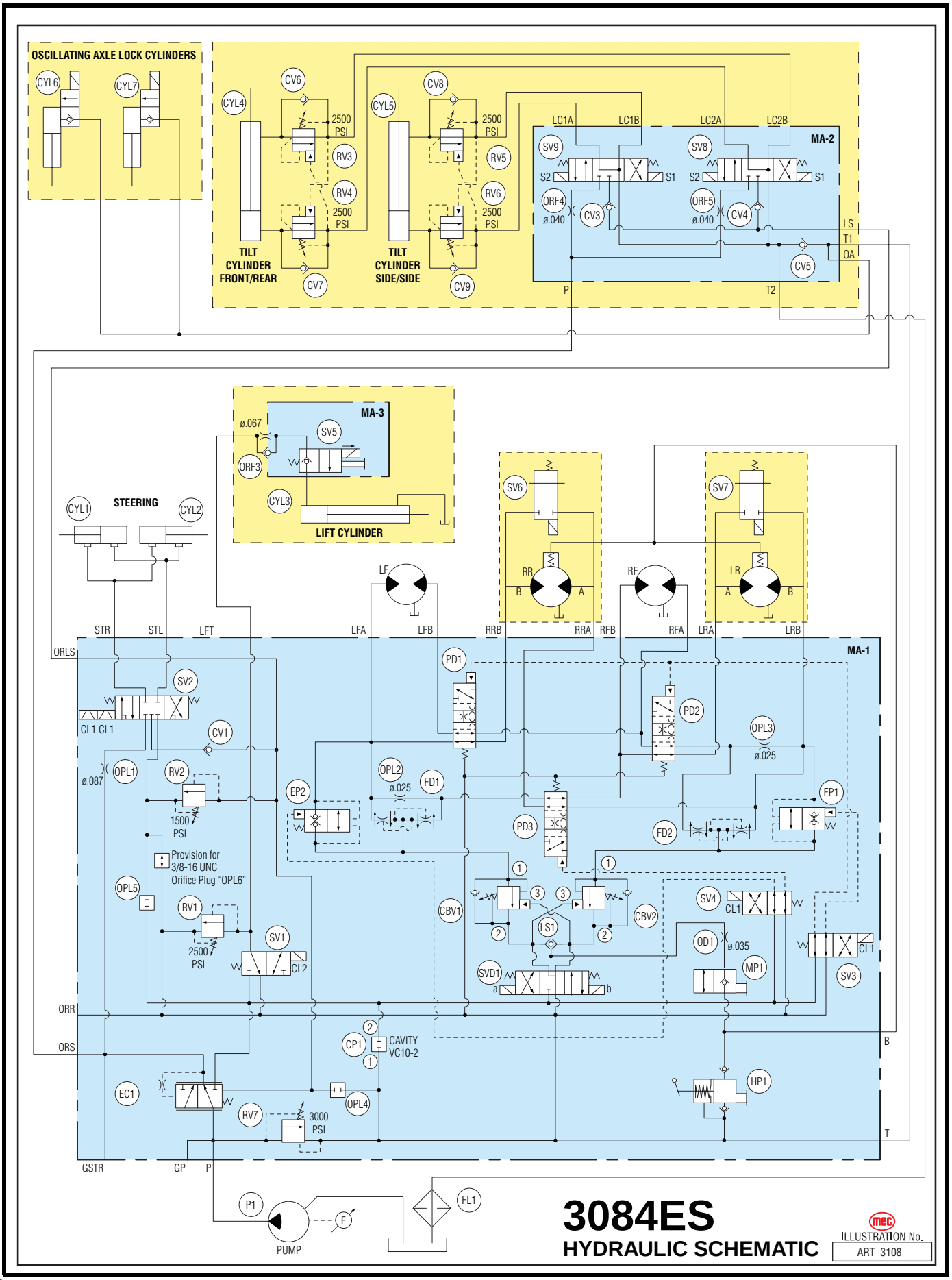


***Figure 5-12:*** Hydraulic Manifold, Main M1 - 3084ES

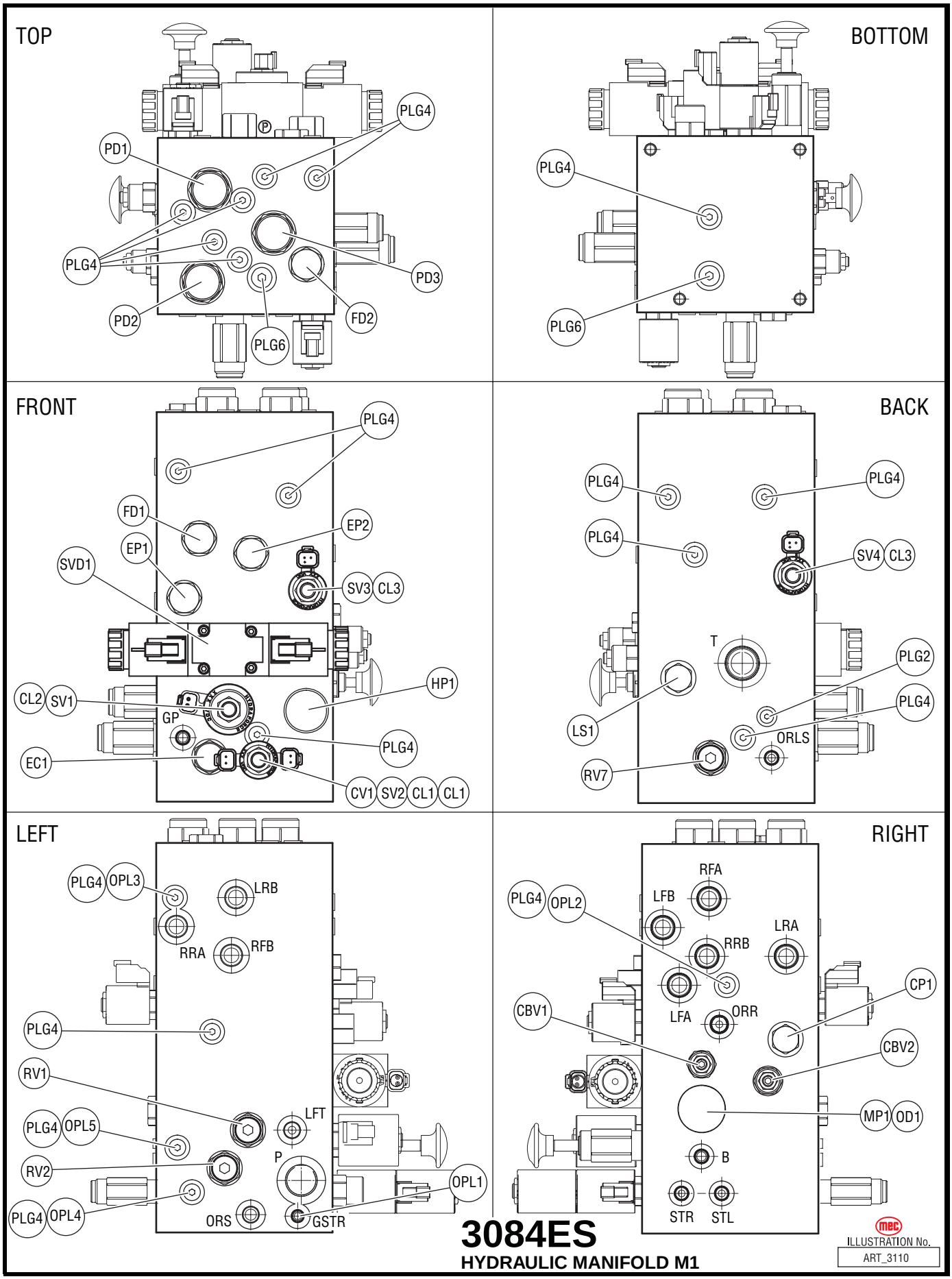
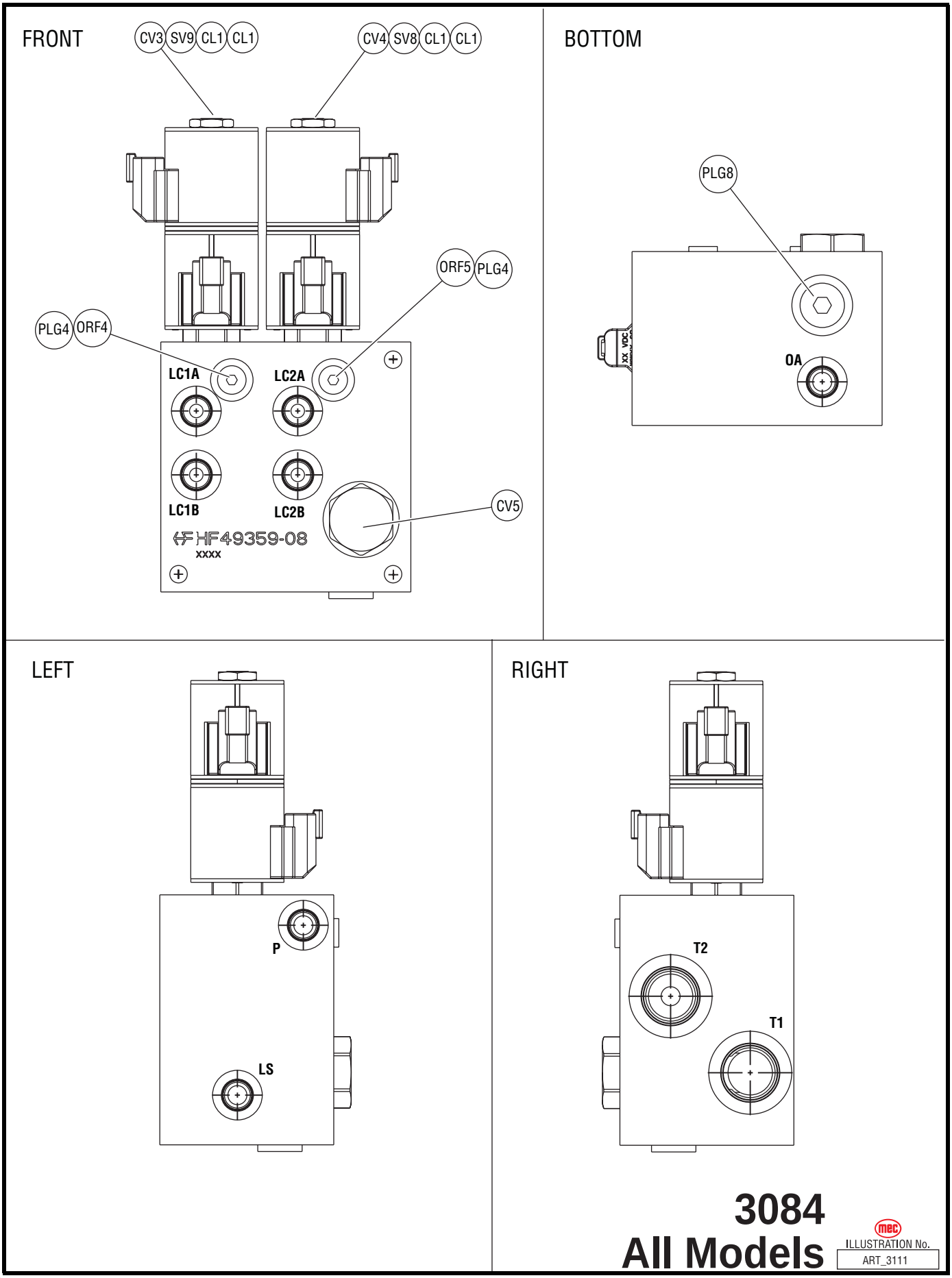


***Figure 5-13:*** Hydraulic Manifold, Tilt M2 - All Models



# ELECTRICAL - 3084ES

***Figure 5-14:*** Electric Schematic, Upper Controls - 3084ES

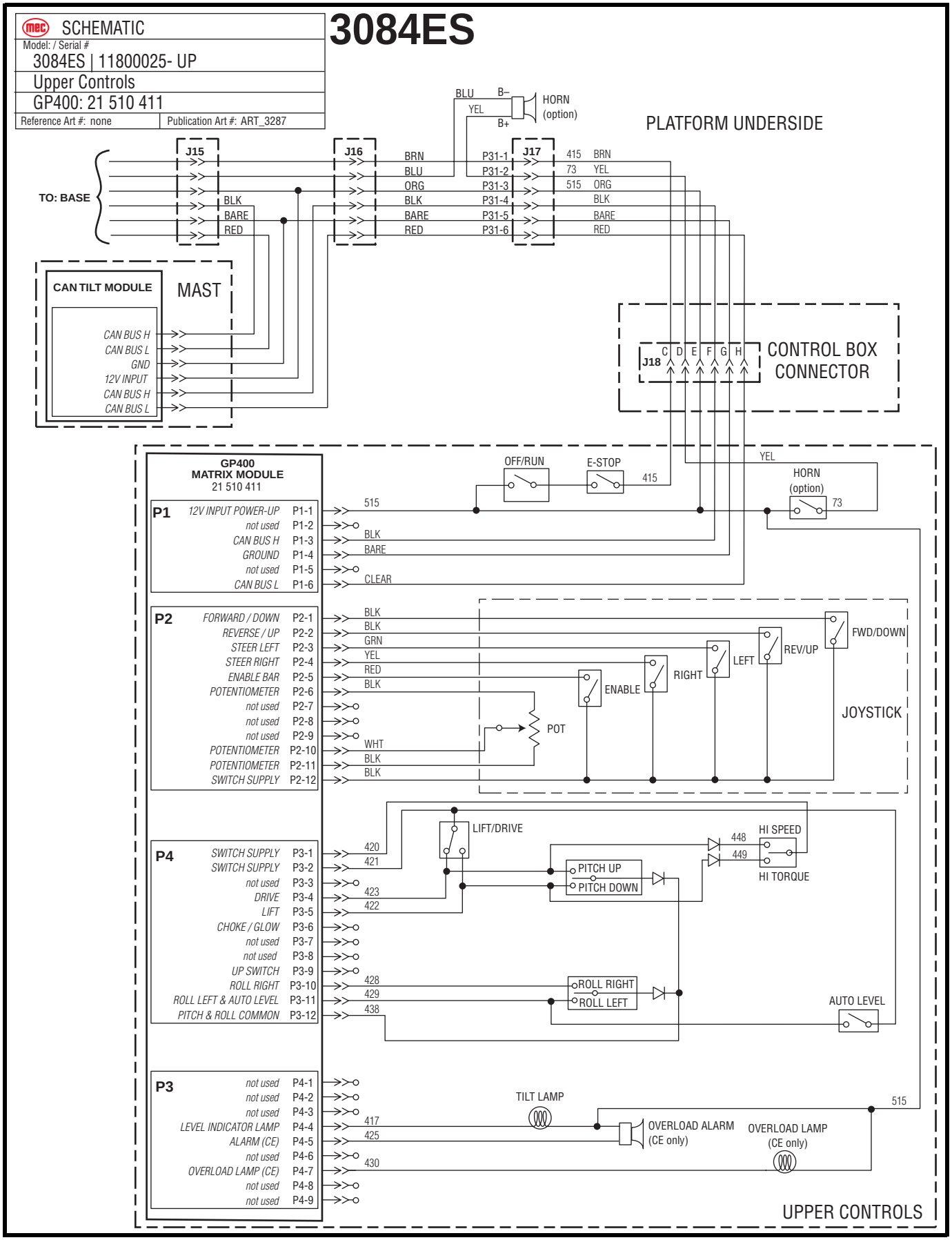


***Figure 5-15:*** Upper Controls Components - 3084ES

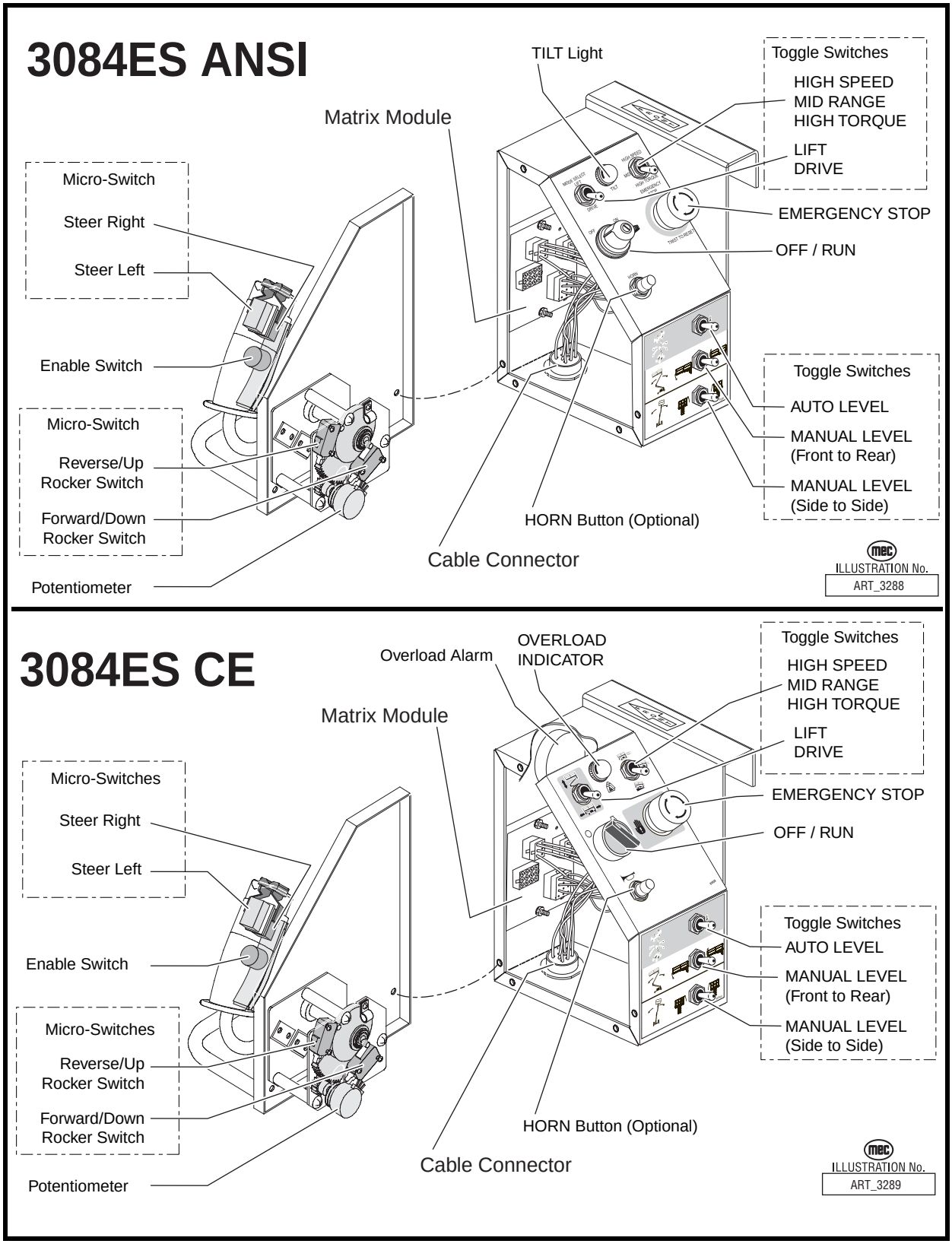


***Figure 5-16:*** Electric Schematic, Lower Control Box - 3084ES

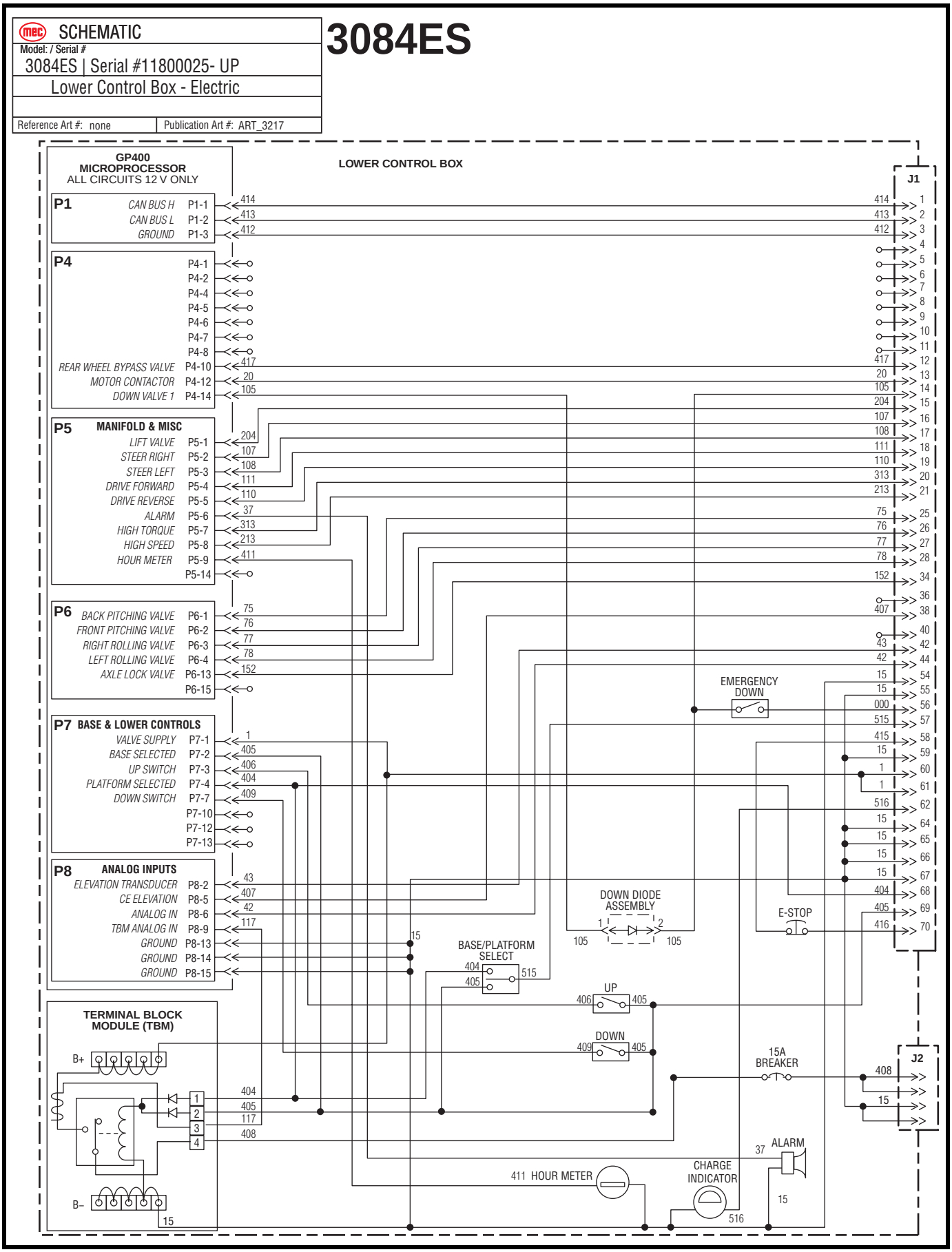


***Figure 5-17:*** Electric Schematic, Base - 3084ES

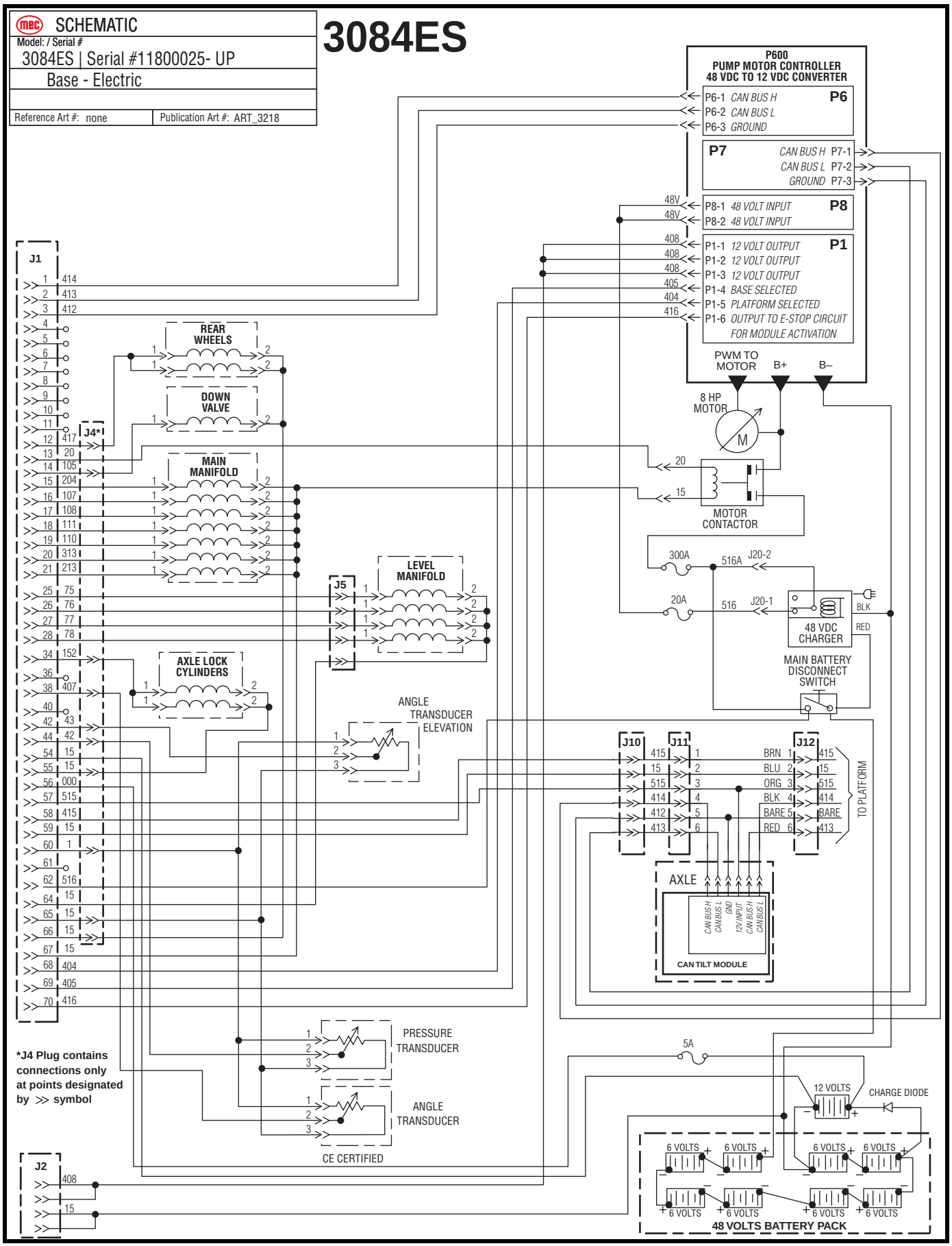
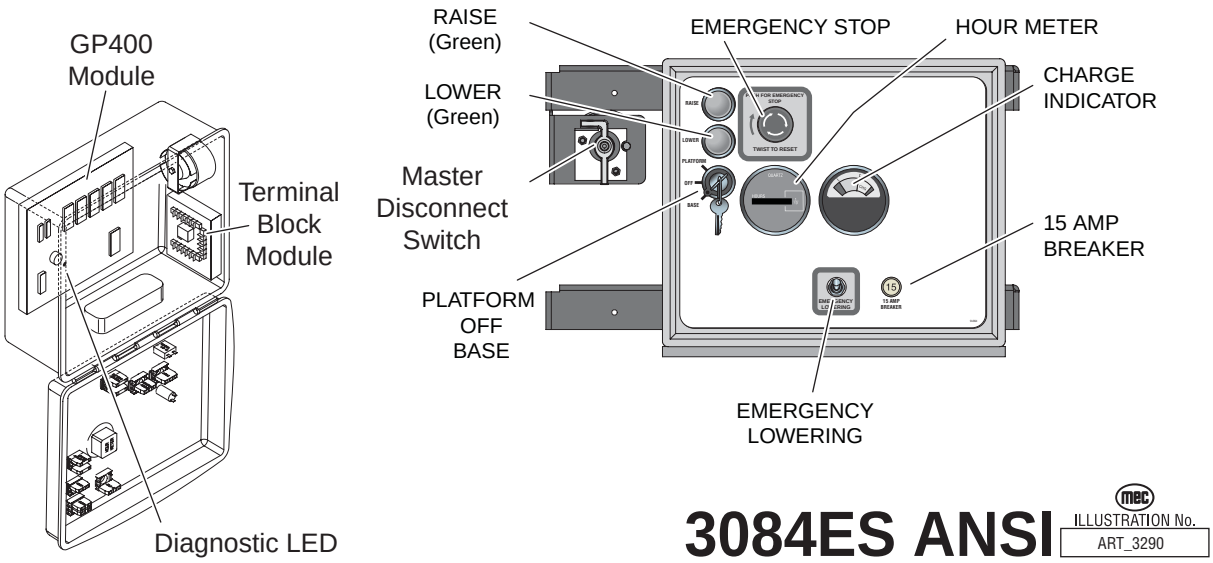
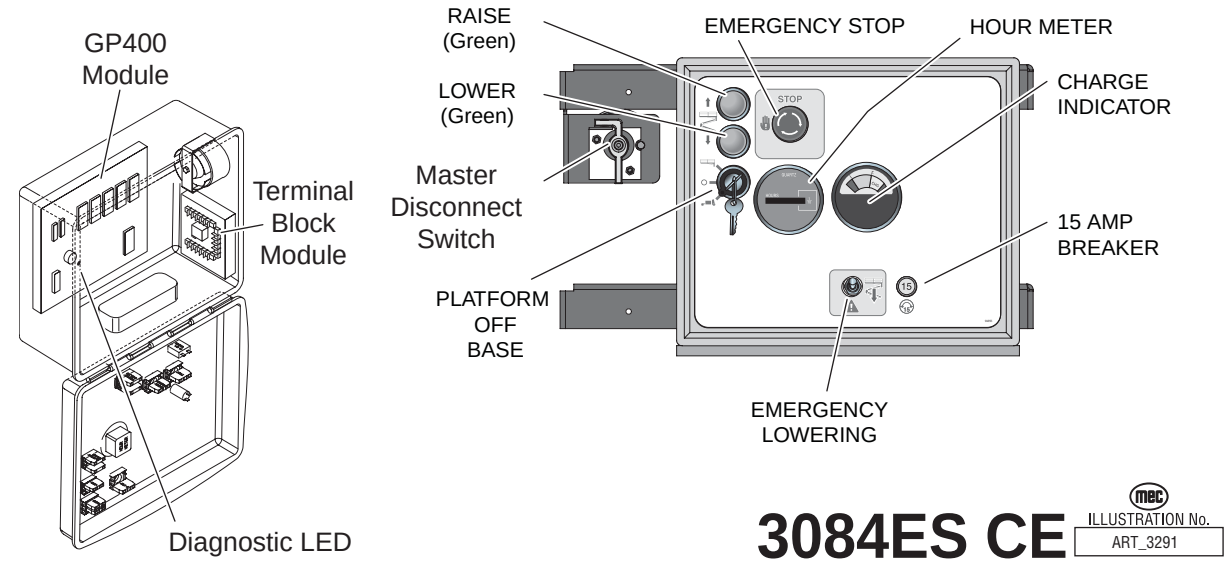


***Figure 5-18:*** Lower Controls Components - 3084ES




**3084ES ANSI** ILLUSTRATION No. ART_3290




**3084ES CE** ILLUSTRATION No. ART_3291