

# E-242



|                                                                              |
|------------------------------------------------------------------------------|
| <p><b>OPERATOR AND MAINTENANCE MANUAL<br/>SPARE PARTS LISTS INCLUDED</b></p> |
|------------------------------------------------------------------------------|

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Printed in Canada

## MOTREC INTERNATIONAL LIMITED WARRANTY



EFFECTIVE ON ORDERS RECEIVED STARTING JANUARY 1<sup>st</sup>.

### 3-YEAR LIMITED WARRANTY ON AC PRODUCTS, STOCK CHASER AND TRAILERS 2-YEAR LIMITED WARRANTY ON DC PRODUCTS AND OTHER MOTREC PRODUCTS

Motrec warrants to the original purchaser that its products are free from defects in parts and workmanship.

**STARTING DATE OF WARRANTY.** The present terms and conditions of the Motrec Limited Warranty apply to new Motrec products only and do not replace any pre-existing warranty. The warranty period is effective from the date the purchaser registers the product, provided it is registered within thirty (30) days of reception and in conformity with Motrec's registration process.

**REGISTRATION.** IMPORTANT: AS A PURCHASER OF A MOTREC PRODUCT, IT IS IMPORTANT THAT YOUR PRODUCT BE REGISTERED UNDER YOUR NAME AS REQUIRED BY MOTREC'S PRODUCT REGISTRATION PROCEDURE. PLEASE ASK YOUR MOTREC DEALER TO REGISTER YOUR PRODUCT. MOTREC'S LIMITED WARRANTY WILL BECOME EFFECTIVE AT THE TIME OF PRODUCT REGISTRATION. IF YOU FAIL TO REGISTER YOUR PRODUCT WITHIN THE THIRTY (30) DAYS, THE WARRANTY WILL NOT BE APPLICABLE. IF YOU PURCHASED THE PRODUCT DIRECTLY FROM MOTREC AND NOT FROM A MOTREC DEALER, YOU MUST REGISTER YOUR PRODUCT FOLLOWING THE INSTRUCTIONS BELOW (CLAUSE 3)

<https://www.motrec.com/registration/>

**DEFECTS.** Subject to the terms and conditions described below, parts, components or accessories installed on the product by Motrec which fail under normal usage within the warranty period, and that are proven to be defective, will be repaired or replaced without charge for parts or labor unless stated otherwise herein. This is Motrec's sole liability under this Warranty. The warranty excludes items described in (Clause 6). Motrec reserves the right to require that all parts or components claimed to be defective be returned for inspection and verification of defect. The purchaser is responsible for any and all shipping fees of any and all parts or components that it alleges to be defective. In the event the part is still under warranty and confirmed defective after inspection by Motrec, freight would be credited.

**WARRANTY SERVICES.** All warranty services must be rendered by authorized Motrec distributors and approved in writing by Motrec prior to initiating any repairs or adjustments. Motrec parts must also be used when performing the warranty otherwise the warranty will be voided. All approved warranty services will be paid for based on standard rates established by Motrec. Rather than replace or repair parts or components, Motrec may, at its discretion, replace the product or refund a prorated amount of its purchase price (based on service time, wear and tear) upon return of the defective product.

**AUTHORIZATION PROCESS.** No product shall be returned to Motrec without its prior authorization. All warranty claims must be disclosed to Motrec or its authorized distributor as soon as the purchaser is aware of a suspected defect or any event susceptible to give rise to a claim under the Motrec Limited Warranty. All claims must be processed through an authorized Motrec distributor using the warranty claim procedure approved by Motrec.

THE ABOVE TERMS AND CONDITIONS REPRESENT THE ONLY REPRESENTATIONS MADE BY MOTREC IN RELATION TO ITS PRODUCTS. MOTREC DOES NOT PROVIDE ANY OTHER PARTICULAR WARRANTY TO THE USER OF ITS PRODUCTS. MOTREC DOES NOT MAKE ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATION WITH RESPECT TO ANY RESULT, PERFORMANCE OR DURABILITY EXPECTED FROM THE USE OF ANY OF ITS PRODUCTS. MOTREC EXCLUDES AND DECLINES ANY OTHER WARRANTY OF SUITABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, WOULD THEY BE PROVIDED BY LAW, BY CONTRACT OR OTHERWISE.

**PRODUCT MODIFICATIONS ARE PROHIBITED.** Motrec prohibits and disclaims any and all liability for any modification made to the product, including but not limited to, modifications that are susceptible to alter the weight distribution and stability of the product, increase its speed or affect its safety. Such modifications can cause serious personal injury or property damage for which Motrec disclaims and excludes any and all responsibility. It is the purchaser's responsibility to ensure that any technicians servicing the product are properly trained as required by OSHA (Occupational Safety and Health Administration: <https://www.osha.gov/>) and ANSI-B56 (American National Standards Institute: <https://webstore.ansi.org/default.aspx>). Service technicians shall read, understand and follow the instructions in the Motrec Owner's Manual before servicing the product. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect the product.

**TRAINING.** It is the purchaser's responsibility to ensure that the driver or any person operating, using, maintaining or handling the product (or its accessories) is properly trained and instructed on the product's safety features and operation, including its stability. Operators shall read, understand and follow the safety and operating instructions in the Motrec Owner's Manual before driving the vehicle. Operators shall not be permitted to operate the product unless a complete and adequate training has been provided by the purchaser. Driving an electrical vehicle constitutes a hazard. The driver is responsible for the control of the product while driving and must always evaluate all unusual or particular situations that he or she may encounter while driving. The driver assumes the inherent hazards related to this activity. Motrec products are designed for off-road use only.



**EXCLUSION OF LIABILITY.** Motrec disclaims any liability for incidental or consequential damages, including, but not limited to, personal injury or property damage arising from misuse of the product, lack of maintenance or any defect in the vehicle.

UNDER NO CIRCUMSTANCE WILL MOTREC BE LIABLE FOR ANY DAMAGE, WHETHER DIRECT, INDIRECT OR OTHERWISE, RESULTING FROM THE USE OF ITS PRODUCTS, EVEN IF MOTREC OR ONE OF ITS REPRESENTATIVES WAS AWARE OF THE POSSIBILITY OF SUCH DAMAGE. ANY LIABILITY FOR LATENT DEFECT IS LIMITED TO THE PRICE OF THE PRODUCT.

#### 1. Definitions

**“Product”**: the complete vehicle manufactured and/or assembled by Motrec, including its parts, components and accessories installed by Motrec. **“Purchaser”**: The party in whose name the product is originally registered at the time of purchase pursuant to the product registration procedure maintained by Motrec at that time, either: (a) the party to whom Motrec sold the product, if that party purchased the product for its own use, or (b) the customer of a Motrec dealer, who bought the product directly from such dealer.

#### 2. Warranty Period

Your Motrec product using the AC technology is covered by the Motrec Limited Warranty for a period of three (3) years or 3,000 hours of use, whichever comes first. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec stock chaser is covered by the Motrec Limited Warranty for a period of three (3) years or 3,000 hours of use, whichever comes first. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec trailer is covered by the Motrec Limited Warranty for a period of three (3) years. This period of three (3) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

Your Motrec product using DC or other technology is covered by the Motrec Limited Warranty for a period of two (2) years or 2,000 hours of use, whichever comes first. This period of two (2) years starts on the date the product is registered, as mentioned hereinabove. This coverage does not apply to wearable parts, normal use or abusive usage of the product.

#### 3. Warranty Registration

The warranty registration must be completed within thirty (30) days of purchase of the product. If registration is not completed within this time, the warranty will be voided. If you purchased the product from a Motrec dealer, please make sure the dealer has completed the registration. If you purchased the product directly from Motrec, please make sure to go to this link (<https://www.motrec.com/registration/>) and register your vehicle. In case of registration problems, please contact your Motrec representative.

#### 4. Maintenance

Motrec requires that scheduled maintenance be performed at the times shown in the Owner's Manual (Refer to the “Preventive Maintenance Schedule”). If this scheduled maintenance is not done and the product fails as a result of a failure to properly maintain it, repairs will not be covered under any warranty.

#### 5. Warranty will be void if:

- The product has been modified in any manner not approved in writing by Motrec
- The product has been overloaded beyond its rated capacity
- The product's maximum speed has been increased
- The product's motor controller parameters have been tampered without Motrec's authorization
- The product has been used abusively (including, but not limited to: improper use; twisted, bent, misaligned front or rear axles; any signs of abusive use)
- The product has been involved in an accident
- The product has been transferred to a second owner without Motrec's authorization
- The product has been used in extreme environments (including, but not limited to: freezers, excessive moisture areas, corrosive environments, etc.)
- The product has had its serial number modified or altered
- The product has been repaired with non-Motrec parts without Motrec's authorization
- The preventive maintenance schedule was not followed as specified in the Motrec Owner's Manual

#### 6. The following items are not covered by the Motrec limited warranty:

- Batteries, charger, wheels (which are covered by warranties from manufacturers)
- Internal combustion engines (which are covered by warranties from manufacturers)
- Wearable parts (diodes & fuses, filters & spark plugs, lubricants, seals, switch, horn, tires, wheel bearings, seats, brake pads and shoes)
- Tear and wear resulting from normal use
- Adjustments, including field set-up
- Damage or defects caused by using non-Motrec parts, components or accessories
- Shipping damage caused by the freight carrier
- Shipping fees for warranty parts (if proven not admissible, refer to Defects section)
- Travel fees for technical support and repair

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**INSTRUCTIONS**

## **SAFETY WARNINGS FOR OPERATORS**

- FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAY RESULT IN SEVERE INJURY.
- It is the responsibility of the owner of this vehicle to train operators to ensure that they understand the operating characteristics of this vehicle, including training in vehicle stability, and obey the following safety rules and guidelines. Owner shall comply with OSHA and ANSI/ITSDF B56.8 & B56.9 Standards for vehicle use, safety rules, operator training and certification. Do not drive this vehicle unless you are a qualified operator.
- Do not drive this vehicle under the influence of drugs or alcohol.
- Do not drive this vehicle on public roads and highways. This vehicle is designed to be driven in buildings.
- The electrical system of this vehicle will make sparks which can ignite inflammable materials. Never use the vehicle in hazardous areas where there are inflammable materials, explosive dust or fumes in the air.
- Have your vehicle inspected regularly by trained personnel, and cease operation if a malfunction occurs.
- Do not open battery compartment to prevent battery explosion, acid splashing, severe damage to eyes or skin.
- Do not open motor compartment. Keep clear from moving, rotating(wheels, sheaves, etc) or lifting parts.
- Never carry more passengers than number allowed for this vehicle. Wait until all occupants are seated and holding on before moving. Always keep all body parts inside vehicle. Keep both hands on steering wheel.
- Transporting an extra passenger is dangerous and not recommended while towing equipment. Motrec International Inc. cannot be held responsible for any injuries or accidents caused by improper use of the product.
- Do not exceed the vehicle cargo load capacity and gross trailing weight capacity, rated for flat hard even surface. Different operating conditions such as loose terrain or ramps reduce vehicle capacity.
- Avoid loose, unbalanced or top-heavy loads to keep a good stability and prevent overturn. Do not load cargo that can fall off the vehicle. Do not carry cargo that is longer, wider or higher than this vehicle.
- Always depress slowly the accelerator for smooth acceleration. Avoid stunt driving or horseplay.
- Avoid sharp turns, always slow down before turning, to prevent vehicle overturn or trailer jack knife. Vehicle is more sensitive to overturn and jack knife when traveling on inclines or when carrying a heavy load.
- Always drive straight up and down the face of an incline, never across the face, to prevent overturn and trailer jack knife. Drive slower and start applying brakes sooner on inclines to adjust for longer stopping distance.
- Use extra care and drive slowly in reverse, in congested areas or on wet or slippery ground.
- Keep to the right under normal conditions. Maintain a safe distance from all objects.
- Slow down and sound the horn when approaching a corner or other blind intersections.
- Before leaving the vehicle, park on a level ground flat surface, turn off all switches, set the forward/reverse switch to neutral, set the parking brake, remove the key. Do not park the vehicle on an incline.
- Before battery charging, park the vehicle in a well ventilated area set for. Do not operate it when charging. To interrupt a charging cycle, disconnect the AC plug; disconnecting the DC plug or a battery terminal, or operating the vehicle, could damage the charger and produce a spark, battery explosion and acid splashing.
- Use another driver to steer this vehicle while it is towed. Be sure the driver uses brakes when you slow or stop the towing vehicle. Do not exceed 5 MPH or carry any passenger while towing this vehicle.

## **OPERATING INSTRUCTIONS**

It is the responsibility of the owner of this vehicle to ensure that the operator understands the operating characteristics of this vehicle, and obeys the safety instructions in this manual and ANSI/ITSDF B56.8 & 9 Standards. Do not drive this vehicle unless you are a certified operator as required by OSHA.

### **BEFORE TURNING ON KEYSWITCH**

Set to neutral, set parking brake, check for visible damage, check brake pedal.

### **AFTER TURNING ON KEYSWITCH**

Check safety devices: seat switch, reverse alarm, motion beeper, strobe light, and all other safety devices.

### **BATTERIES**

Never open the battery compartment unless you have received proper training for battery maintenance.

Batteries emit explosive hydrogen gas that can be ignited by a spark or loose terminal. Battery acid causes severe damage to eyes or skin. Flush the contaminated area immediately with water. Park the vehicle in a well ventilated area for battery charging. Most battery chargers come with an electronic control that starts when the charger is plugged and stop when the battery is fully charged. To interrupt the charging cycle, disconnect the AC-plug, do not disconnect the DC plug.

### **BATTERY DISCHARGE INDICATOR**

The green light moves from right to left as batteries are being discharged. When the green light is at the last position on the left the batteries must be recharged. A flashing light warns the operator that further discharge will damage batteries. See HOBBS indicator instructions.

### **EMERGENCY SAFETY DEVICE**

The emergency push button or battery disconnect handle, when present, should only be used in case of emergency. Use the key switch for normal ON/OFF control.

### **KEYSWITCH**

Depress brake pedal and turn the key switch clockwise for on position. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

### **HORN**

Depress the horn button on the steering column or handle bar.

### **F/R SWITCH**

Three positions with neutral at center. Depress the front part of the rocker switch for forward direction. Depress the rear part of the rocker switch for reverse direction. Always set switch to neutral, turn off all switches, set the parking brake, remove the key before leaving the vehicle.

### **ACCELERATOR PEDAL**

It is designed for right foot operation only, and controls the speed of the vehicle. Apply slowly.

### **FOOT BRAKE PEDAL**

It is designed for right foot operation only. The brake force is proportional to the pressure on the pedal.

### **PARKING BRAKE**

Pull handbrake lever to apply. Never park the vehicle on an incline. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

**MAINTENANCE**

## **SAFETY WARNINGS FOR SERVICE TECHNICIANS**

FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAIN RESULT IN SEVERE INJURY.

Owner shall comply with OSHA and ANSI/ITSDF B56.8 & B56.9 Standards for vehicle maintenance.

Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect carriers, vehicles, tractors, and batteries.

Before any maintenance work, park the vehicle on flat level surface, turn off all switches, remove key, lift wheels off the ground and secure with jack stands of adequate capacity. Don't connect charger.

Keep clear from moving parts such as tires, sheaves and motor.

Follow the maintenance instructions applicable to the type of repair, maintenance, or service.

Always wear a face shield and gloves when working around batteries.

Before opening the battery compartment, disconnect the charger, turn off all switches and remove the key. Batteries emit highly explosive gases which greatly increase when charging; do not disturb connections or produce sparks around batteries to avoid a battery explosion and acid splashing. Battery acid causes severe damage to eyes or skin. Flush contaminated area immediately with water.

Use insulated tools to avoid sparks that can cause battery explosion and acid splashing.

Use two counteracting tools, double-wrench technique, when disconnecting or tightening terminals on the battery and the speed controller to avoid cracking the terminal or battery post welds.

Before cleaning or replacing a battery, charger, speed controller, contactor, relay, diode, or any other component in the power circuit, always disconnect the charger, turn off all switches, remove the key, wear a face shield and gloves, identify battery polarity and disconnect battery leads, discharge the capacitor in the controller with a 10 ohms, 25 W resistor for a few seconds across B+ and B-.

After cleaning, the power must not be reapplied until terminal areas are thoroughly dry.

On EE-Rated vehicles make sure that the control box is sealed, the static strap makes good contact with the ground, the motor is sealed by bands, the cable protectors are properly installed.

Keep cables and wires clear from mechanical and rubbing action. Make sure that cable insulation is free from cutting or visible damage. Make sure that EE-Rated cable protectors are properly installed.

Before replacing a fuse or circuit breaker, identify the cause of failure and repair.

Programmable controllers must be programmed using the parameter settings in this service manual, before connecting the motor, to avoid sudden vehicle movement and accident.

Do not try to increase motor speed by changing parameter settings in the speed controller; it can cause accident and severe damage to the motor.

SEPEX speed controls are protected by a diode in the power circuit to filter inductive loads in the event of a sudden power interrupt. Some speed controllers require a diode to filter inductive loads on the KSI input. Removing the diodes will cause the speed control failure.

Before resuming maintenance operations, inspect safety warnings stickers and replace any if damage is found and part of the text can't be read.

Check decals and labels, see "DECAL AND LABELS" page.

## DECALS AND LABELS

### ! CAUTION !

The images included in this section depict the decals/markings installed on the vehicle. It is of the utmost importance that these decals/markings remain unaltered and readable. Else, the sticker or the part bearing the marking has to be replaced.

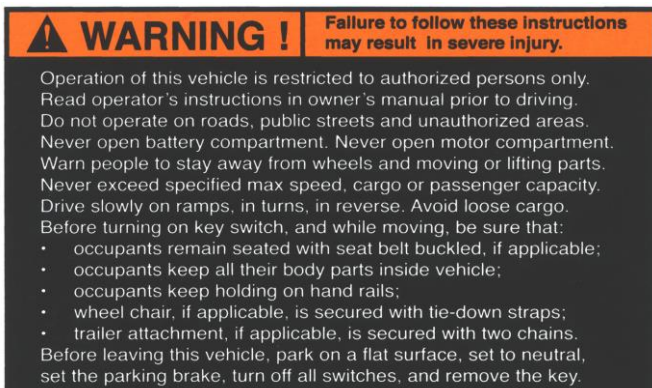
Dashboard security warning label:  
# 5100000002



When an emergency push button is installed, this label is required (located under push button): # 3109800006



General security warning label:  
# 5100000001



When a disconnect handle is installed, this label is required (located in front of handle):  
# 4800012J



Respectively, key switch markings, forward/reverse selector markings and light switch marking:



# 266211



# 2819321003



# 1269004

## **PREVENTIVE MAINTENANCE SCHEDULE**

### **FOR MODELS WITH DC DRIVE**

#### **! WARNING!**

Maintenance operations must be made by properly trained service technicians.

- Keep clear from moving parts such as tires, sheaves and motor.
- Batteries contain Sulphur acid that can cause severe burns on skin or eyes.
- When working around batteries, wear acid proof protective equipment: face shield and gloves.
- Use electrically insulated tools to avoid sparks that can cause battery explosion.
- Before any maintenance work, park the vehicle on a flat level surface, turn off all switches, remove the key, lift the wheels off the ground and secure with jack stands of adequate capacity, identify and disconnect battery leads. Don't connect the charger.

|                                                                                                                                  |                      | <b><u>ESTIMATED TIME (MINUTES)</u></b> |                    |                    |                    |                      |                      |                     |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------|--------------------|--------------------|--------------------|----------------------|----------------------|---------------------|
| <b><u>DESCRIPTION</u></b>                                                                                                        | <b><u>PERIOD</u></b> | <b><u>SHIFT</u></b>                    | <b><u>WEEK</u></b> | <b><u>250H</u></b> | <b><u>500H</u></b> | <b><u>1000 H</u></b> | <b><u>2000 H</u></b> | <b><u>CHECK</u></b> |
| Check for visible damage                                                                                                         |                      | <b>1</b>                               |                    |                    |                    |                      |                      |                     |
| Examine floor around and beneath unit for signs of differential and brake fluid leaks.                                           |                      | <b>1</b>                               |                    |                    |                    |                      |                      |                     |
| Turn steering, check for hard steering, excessive free play, or unusual sound when turning.                                      |                      | <b>1</b>                               |                    |                    |                    |                      |                      |                     |
| Check accelerator for free & smooth movement.                                                                                    |                      | <b>1</b>                               |                    |                    |                    |                      |                      |                     |
| Check reverse alarm, horn, strobe light.                                                                                         |                      | <b>1</b>                               |                    |                    |                    |                      |                      |                     |
| Check brake pedal travel and parking brake for secure hold. Start slowly and check service brake.                                |                      |                                        | <b>1</b>           |                    |                    |                      |                      |                     |
| Check tire pressure, see pressure rating on tire                                                                                 |                      |                                        | <b>1</b>           |                    |                    |                      |                      |                     |
| Check & fill batteries (add distilled water to cover plates. Fill to recommended level after batteries have been fully charged.) |                      |                                        | <b>15</b>          |                    |                    |                      |                      |                     |
| Check deadman switch and static strap ( min 2`` contact with the floor)                                                          |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check warning decal & marking                                                                                                    |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Clean battery with water                                                                                                         |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check master cylinder fluid level (DOT 3)                                                                                        |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check brake pedal travel                                                                                                         |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Turn front wheels straight, check steering play                                                                                  |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check parking brake, requires 30-40 lbs. force to apply                                                                          |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check brake lines for leaks                                                                                                      |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check drive for leaks                                                                                                            |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Inspect steering suspension linkages                                                                                             |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Inspect the frame for damage                                                                                                     |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |
| Check pedal & master cylinder linkages for wear                                                                                  |                      |                                        |                    | <b>1</b>           |                    |                      |                      |                     |

|                                                                                                                                                                                   |        | ESTIMATED TIME (MINUTES) |      |      |      |        |        |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------|------|------|------|--------|--------|-------|
| DESCRIPTION                                                                                                                                                                       | PERIOD | SHIFT                    | WEEK | 250H | 500H | 1000 H | 2000 H | CHECK |
| Adjust belt 10 lbs force to produce 1/8 deflexion                                                                                                                                 |        |                          |      |      |      |        |        |       |
| Inspect rear wheel bearings for play                                                                                                                                              |        |                          |      |      | 3    |        |        |       |
| Inspect front wheel bearings and kingpins for play                                                                                                                                |        |                          |      |      | 3    |        |        |       |
| Inspect rear brake lining for wear<br>1/16” (2 mm) minimum lining thickness.                                                                                                      |        |                          |      |      | 3    |        |        |       |
| Check service brake linings and linkages for wear                                                                                                                                 |        |                          |      |      | 12   |        |        |       |
| Check parking brake linings and linkages for wear                                                                                                                                 |        |                          |      |      | 5    |        |        |       |
| Check power circuit connections                                                                                                                                                   |        |                          |      |      | 5    |        |        |       |
| Check motor bushes for wear (brushes must exceed holder)                                                                                                                          |        |                          |      |      | 25   |        |        |       |
| Check motor brushes & commutator                                                                                                                                                  |        |                          |      |      | 5    |        |        |       |
| Check accelerator pot and switch adjustment<br>-1/8” (3 mm) travel to activate micro-switch;<br>-0 to 50 ohms when micro-switch activated;<br>-4500 to 5500 ohms with pedal down. |        |                          |      |      | 10   |        |        |       |
| Lubricate the vehicle                                                                                                                                                             |        |                          |      |      | 5    |        |        |       |
| Change differential oil (SAE 30)                                                                                                                                                  |        |                          |      |      | 15   |        |        |       |
| Check and tighten all electrical connections                                                                                                                                      |        |                          |      |      |      | 15     |        |       |
| Tighten all nuts and bolts                                                                                                                                                        |        |                          |      |      |      | 15     |        |       |
| Clean & repack front Wheel Bearing                                                                                                                                                |        |                          |      |      |      | 15     |        |       |
| Flush the hydraulic brake system (DOT 3), if appl.                                                                                                                                |        |                          |      |      |      |        | 60     |       |
| Replace differential oil seals & wheel bearings.                                                                                                                                  |        |                          |      |      |      |        | 90     |       |
| TOTAL TIME (MINUTES)                                                                                                                                                              |        | 5                        | 17   | 12   | 91   | 60     | 150    |       |

Date: \_\_\_\_\_ Hour Meter Reading: \_\_\_\_\_

Inspected By: \_\_\_\_\_ Unit Number: \_\_\_\_\_

**Any deficiencies found during inspection must be corrected before the unit is returned to service.****PDF available for printing (contact manufacturer)**

## ACCELERATOR

### GEAR

- Remove the cover.
- Backlash between gears must be reduced to a minimum by sliding holder; use locktite 262 to lock the three screws.
- When the plastic gear is fully depressed a small backlash must remain between the gears.
- When the plastic gear is released its rear portion must not exceed the pedal case.

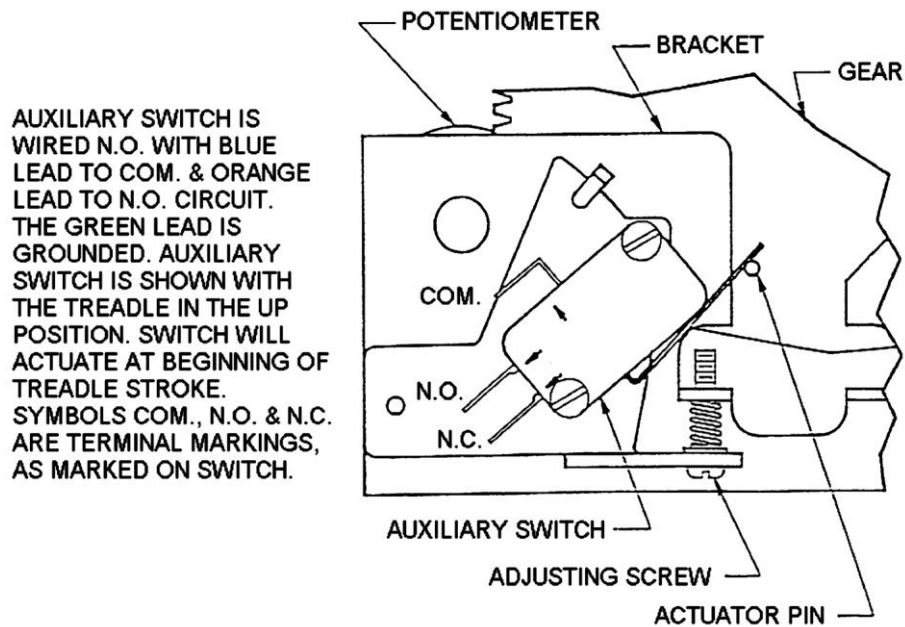
### MICRO-SWITCH

The micro-switch must deactivate the on/off solenoid when the accelerator is released; turn the adjusting screw (shown on figure below) to adjust the micro-switch height.

### POT

- Remove the terminals 2 and 3 on PMC to measure resistance signal.
- When the micro-switch is activated the signal must be less than 50 ohms. When the front portion of the pedal is fully depressed the signal must be more than 4600 ohms.
- To modify the resistance, turn the adjusting screw to change the micro-switch height (see figure below).

Proceed with the same verifications after the accelerator cover is on and then connect terminals 2 and 3.



### **FOOT PEDAL FP-6 MAINTENANCE GUIDELINES**

#### **FEATURES -**

- FP 6 is designed for IP rating 64
  - It can work in dusty atmosphere.
  - It has sealing against splashing and spraying water from all side.
  - We do not recommend low pressure or high pressure washing.

#### **SPECIFICATIONS -**

- Pedal high point is pedal free condition
- 1<sup>st</sup> Microswitch Setting ;
  - a) First micro switch should operate at  $3^\circ \pm 1^\circ$  (i.e. between  $2^\circ$  to  $4^\circ$ ) from free condition
- Pot setting
  - a) Operate pedal slowly; find reading at which first Microswitch operates.
  - b) Pot resistance reading across pot low and wiper (i.e. black and white) must be within 100 $\Omega$  to 400 $\Omega$ .
- 2nd Micro switch setting
  - a) 2<sup>nd</sup> micro switch should operate between 4600  $\Omega$  and *pot max* resistance, across *pot low and wiper* (i.e. black and white)

#### **INSTALLATION PROCEDURE**

*Terminology* - "**Pot low**", "**wiper**" and "**pot high**" are pot terminals. (Black, white and red cables respectively) "**Pot max resistance**" is the resistance value across pot low and pot high. (Black and Red cables)

##### **1. MICRO SWITCHES AND POT SETTING**

For Foot Pedal FP-6, use pot low and wiper (black and white) for setting micro switches.

- Set Pedal at free condition.
- Adjust pedal at  $3^\circ$  deflection. Set first micro switch to operate about set deflection.
- Adjust pot resistance from high valve to get (100 to 400 $\Omega$ ) across *pot low and wiper* (i.e. black and white).
- Set 2<sup>nd</sup> micro switch between 4600  $\Omega$  and *pot max* resistance.

**CHECK LIST / CAUTION**

- Pedal angle must be within 30 +/- 3 degree. Check freeness of pedal.
- Select 'resistance' measurement range in as per requirement on the Multi meter.  
Minimum resistance between pot low and wiper must be less than 10 ohms. Pot Max Resistance (between pot low and pot high) must be within 4500 to 5500 ohms.
- Confirm that micro switch settings are as per specifications.
- Measure the resistance between each of the seven wires and the housing of the Foot Pedal. It should measure "Infinity"
- Visually check the insulating sleeves are put around the soldered side of all seven cables, and that the sleeves are firmly in place.

**YEARLY MAINTENANCE**

- Remove cover of Pedal.
- Apply 3 to 5 drops oil on pedal return spring.
- Apply 2 drops oil in the slot of front bush.
- Do not apply oil on shaft from outside. It is of no use, due to sealing on the shaft.
  - i. Oil Specification
  - ii. 20W Motor Oil (Or 3 in one motor oil)
  - iii. 20 stand for weight of motor oil.
  - iv. W Stands for winter grade.

## **MECHANICAL BRAKES**

**Revision 2012-01-10**

### **REPLACING THE BRAKE SHOES ON SELF ADJUSTING DRUM BRAKES:**

- raise the vehicle until the rear tires lift-off the floor and install two jack stands on rear;
- remove drums;
- replace brakes shoes and springs if linings are 1/16" (2mm) thick or less
- disassemble and clean the adjusting screw assembly;
- check brake lever and replace lever and pin if there is wear in the pivot;
- replace all spring parts;
- apply Hi-Temp grease on mechanisms and install the adjusting screw assembly;
- check pulling rods, make sure that they are of the same length;
- install drums and make sure that there is no contact with brake shoes;
- depress and release the brake pedal until the brakes are adjusted;
- drive the vehicle to check brakes.

### **ADDITIONAL INFORMATION FOR MANUALLY ADJUSTED DRUM BRAKES.**

Before any brake adjustment, check the brake levers on the inboard side of the backing plates. The levers must be equally pulled . Adjust pulling rods if necessary. The shoes are adjusted by turning the stud (17mm key) located on the inboard side of the backing plate. Turning the stud clockwise will reduce the drum to shoe clearance. Properly adjusted shoes will equally brake the rear wheels. Avoid Shoe contact with drum when the pedal is released.

### **PARKING BRAKE**

Replace cables and stoppers if cable play exceeds 1/8" (4mm).

To install new cables and stoppers:

- insert the new cable through the hand lever end;
- pull the cable out from the brake assembly or brake pedal end;
- insert the stopper on the cable and leave a maximum play of 1mm;
- for a two-cable system, make sure that cable length is the same at hand lever end;
- tighten 1/4-ncx3/4 grade-5 bolt in stopper at 8 LbFt (11NM) torque;
- cable must extend 1.5" (4cm) out of the cable stopper, cut cable excess.

Once cable play has been checked and/or adjusted, turn the knob on the brake lever until a force of 65-75 Lbs or 30-34 kg is required on the handle to set the parking brake.

## **BATTERY MAINTENANCE**

### **! WARNING !**

- It is the responsibility of the owner of this vehicle to ensure that the service technicians are properly trained, read and obey the safety rules and guidelines in this manual (ANSI B56).
- Maintenance operations must be made by properly trained service technicians only.
- Before any maintenance work, park the vehicle on a flat level surface, turn off all the switches, set to neutral, remove the key, lift the wheels off the ground and secure with jack stands of adequate capacity.
- Keep charger disconnected while doing any maintenance work.
- Always wear a face shield and scarf when working around batteries.
- Battery emits highly explosive gases; do not produce sparks to avoid battery explosion and acid splashing. Battery acid causes severe damage to eyes or skin. Flush contaminated area immediately with water.
- Use insulated tools to avoid sparks that can cause battery explosion and acid splashing.
- Use two counteracting tools, double-wrench technique, when disconnecting or tightening battery posts.
- Before cleaning or replacing a battery, discharge the capacitor in the controller with a 10 ohms, 25 W resistor for a few seconds across B+ and B-, identify battery polarity and disconnect battery leads.
- After cleaning, the power must not be reapplied until terminal areas are thoroughly dry.

### **BATTERY LEADS AND CONNECTORS**

Check for loose connections, damaged cables, acid spill, loose terminal posts, quarterly.

### **BATTERY POST CORROSION**

If corrosion is present on battery posts, remove the cable connectors, use a wire brush to remove particles, and then clean them with a cloth that has been moistened with ammonia.

### **ELECTROLYTE LEVEL**

Does not apply to sealed battery.

- Disconnect battery connectors on roll-out or lift-out installations.
- Make sure the battery roll-out tray is provided with stops before rolling out.
- Fill with distilled water.
- Daily charged batteries normally require watering once a week. Under watering leads to a shortened battery life. Over watering leads to battery corrosion. Be careful not to overfill any cell to avoid electrolyte to be forced out while charging.
- Fill each cell to plate level with distilled or de-ionized water, before battery charging. When the battery is charged, the fluid expands and can seep out if overfilled. Refill each cell after full charge, when the fluid has expanded to its maximum level.
- Reinstall battery caps before charging.

## **BATTERY MOUNTING**

A loose battery increases damaging effects of vibrations and is more prone to short out.

## **BATTERY DISCHARGE LIMIT**

Discharging below a 20% state of charge cuts down the battery life and the number of cycles available. At 20% state of charge, specific gravity of 6V battery should be 1180; and 1220 for industrial battery.

## **CHARGING AREA**

- Always charge battery in a well ventilated area set for and approved for charging.
- Never leave a charger connected for more than 20 hours.

## **FREQUENCY OF CHARGE**

- When a battery is discharged to its 20% state of charge, it is best to charge immediately.
- Batteries require a low current equalization charge (min 4 hours) at least every week, to equalize battery cells, improve battery performance and life in number of cycles.
- Never leave a charger connected for more than 20 hours.

## **STORAGE**

- Keep the battery from getting cold, it would lose its capacity.
- Let the battery warm up before charging.
- Charge batteries in “stored” vehicles every month.

## **DEFECTIVE BATTERY**

Check specific gravity of each cell; if a cell is shorted, voltage drop may occur only when there is current.

## **BATTERY CHARGER**

### **! WARNING !**

Always unplug the AC and DC electrical cords before attempting any repairs to the charger.

#### **CHARGER DOES NOT TURN ON:**

- Dc cord of portable chargers must be disconnected from batteries after every charge to restart.
- Check dc fuse links;
- Check battery voltage at the battery connector;
- Check ac outlet and cord set;
- Replace electronic control;

#### **RELAY CLOSSES AND TRANSFORMER HUMS BUT AMMETER DOES NOT REGISTER:**

- Check dc fuse links;
- Check the continuity of the dc output cord, ammeter, diodes and all connections in the dc circuit;
- Check diodes;
- Check capacitor(rapidely increasing resistance);

#### **SINGLE CHARGER FUSE BLOWS:**

- Disconnect and check diodes;

#### **BOTH FUSE LINKS BLOW:**

- Check the battery pack and battery connector polarity;
- Disconnect and check diodes.

#### **CHARGER OUTPUT IS LOW:**

- Disconnect and check diodes;
- Can be caused by a transformer failure.

#### **AMMETER READS 30 AMPS FOR MORE THAN 30 MINUTES:**

- Check the battery pack;

#### **CHARGER DOES NOT TURN OFF:**

- Check specific gravity in each battery cell;
- As much as 16 hours may be required to properly charge heavily discharged new or cold batteries;
- Replace electronic control.

#### **AC LINE FUSE OR CIRCUIT BREAKER BLOWS:**

- Check ac cordset;
- Check ac line fuse rating;
- Replace electronic control;
- Can be caused by a transformer failure.

## **ELECTRICAL TROUBLESHOOTING**

### **! WARNING !**

Maintenance work must be performed by trained service technicians only.

It is the responsibility of the owner of this vehicle to ensure that the services technicians are properly trained, understand and obey the safety rules and guidelines (ANSI B56).

All service technicians must read and understand the maintenance warning section in this manual.

### **! WARNING !**

Before any maintenance work, park the vehicle on a flat level surface, turn off all switches, remove the key, lift the wheels off the ground, secure with jack stands of adequate capacity, disconnect charger.

Always wear safety glasses.

Batteries emit highly explosive gases that can be ignited by a spark. Before disconnecting a high current terminal, turn off all switches, disconnect battery charger, disconnect batteries.

Keep clear from moving parts such as tires, sheaves and motor.

### **PMC SELF DIAGNOSTIC**

If your PMC comes with a status led, use the flashing code to help troubleshooting.

### **BATTERY VOLTAGE**

Make sure batteries are securely connected. Measure voltage between + and - terminals. We will call this value B+ or full battery voltage.

### **ACCESSORIES NOT WORKING**

- Check the fuses on the batteries and the DC/DC converter.
- Check voltage across + and – terminals on the battery gage; if not B+, check wiring.
- Turn the key switch ON, check voltage between output terminal on the key switch and the - terminal on the battery gage; if not B+, replace the key switch.
- Check voltage across DC/DC converter output terminals; if not 12-Volt, replace the converter.
- Depress the accessory switch, check voltage across accessory terminals. If not 12-Volt, replace the switch. If 12-Volt, replace the accessory.

### **FORWARD ONLY**

On a SEPEX motor control, check the reverse signal input on the controller.

On a series wound motor control, a bad reverse contactor is the most probable cause of the problem.

Switch to reverse and check voltage on the reverse control wire. If not B+, replace the F/R switch. If B+, turn off the key switch, disconnect batteries, disconnect power terminals on the F/R contactors, check the resistance across N.C. power terminals of the reverse contactor. If not 0 ohm, change the reverse contactor. If 0 ohms, switch to forward and check the resistance across the forward N.O. power terminals. If not 0 ohms, change the forward contactor.

## REVERSE ONLY

On a SEPEX motor control, check the forward signal input on the controller.

On a series wound motor control, a bad forward contactor is the most probable cause of the problem. Switch to forward and check the voltage on the forward control wire. If not B+, replace the F/R switch. If B+, turn off the key switch, disconnect batteries, disconnect power terminals on the F/R contactors, check the resistance across N.C. power terminals of the forward contactor. If not 0 ohm, change the forward contactor. If 0 ohms, switch to reverse and check the resistance across the reverse N.O. power terminals. If not 0 ohms, change the reverse contactor.

## TRAVEL AT REDUCED SPEED

### *Check batteries.*

Turn off all switches and disconnect charger. Wear face shield and gloves. Do not disturb any battery connection to avoid sparks. Check the specific gravity of each cell. Cold batteries, highly discharged batteries or dead cells are the most frequent causes of reduced travel speed.

### *Check potentiometer.*

Turn off the key switch, disconnect potentiometer terminals. Check the resistance between terminals.

Other causes of lower speed:

- dragging brakes;
- cold temperature (higher differential oil viscosity).

## INTERMITTENT OPERATION

A bad potentiometer is the most probable cause of the following:

- acceleration is not constant;
- maximum speed is erratic;
- sudden stop after a bump or shock;
- erratic starts, requiring several pedal cycles.

A bad F/R contactor is also a probable cause of the following:

- sudden stop after a bump or shock;
- would not start to move at times.

Erratic starts could also be the cause of a misadjusted potentiometer or micro-switch; the pot signal must be less than 50 ohms when the micro-switch turns on.

PMC has an HPD safety feature that prevents the vehicle from moving if the accelerator pedal is depressed before the key switch is ON and seat switch is activated.

PMC may also have an SRO safety feature that prevents the vehicle from moving if the F/R switch is activated before turning on the key switch and activating the seat switch.

The vehicle stops on a steep and long ramp or while towing a heavy load: the circuit breaker has open to prevent motor overheating and will reset automatically after one minute. The PMC is also equipped with an internal thermal protection that cutback the current until the PMC has cooled down.

## **NO MOTION**

Make sure that the PMC surface is clean and dry; check the terminal areas. Dust Particles or acid contamination, can create current leaks and cause a PMC malfunction.

### *Check F/R switch*

Turn on the key switch and set to forward. Check voltage between the forward terminal and the – terminal on the battery gage, check voltage between the reverse terminal and the – terminal on the battery gage; if both B+, replace the F/R switch.

### *Check switches and wiring*

Disconnect control terminals on the PMC and check all control signals. If a switch pin does not read B+, check wiring or replace the switch.

### *Check potentiometer*

Turn the key switch to OFF, disconnect potentiometer terminals. Check the resistance across terminals: if not within the recommended limits, adjust or replace the potentiometer. Check for shorts between potentiometer wires and vehicle frame; resistance should read at least 1 megohm.

### *Check main contactor or solenoid*

Check voltage across power terminals; if not B+, check circuit breaker or replace the solenoid. Turn to on the key switch and activate the seat switch. Check voltage across the coil terminals; if not B+, check wiring and interlock switches. Check resistance across power terminals; if not 0 ohms, replace the solenoid.

### *Check circuit breaker and SEPEX DIODE*

Before replacing the circuit breaker, check for shorts in the power circuit and check the SEPEX diode in the power circuit using a diode tester. If no such instrument is at hand, use an ohmmeter: the reading should be weak in one direction and strong in the other way.

Check the resistance across the circuit breaker. If not 0 ohms, replace the circuit breaker.

### *Check PMC*

First disconnect battery B+ and B-, then PMC B+ and M-. Check the internal diode between B+ and M- terminals using a diode tester. If no such instrument is at hand, use an ohmmeter: the reading should be weak in one direction and strong in the other way. If the internal diode is defective, the PMC must be replaced.

### *Check the Motor*

First disconnect battery B+ and B-, disconnect power terminals and check the motor armature and field for opens.

**CURTIS SPEED CONTROLLER 1243**

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# MANUAL

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MODEL **1 2 4 3**  
**Generation 2**

**MultiMode™**  
**MOTOR CONTROLLER**

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DESIGN OF CURTIS PMC 1200 SERIES  
CONTROLLERS PROTECTED BY U.S.  
PATENT NO. 4626750.

**CURTIS**

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1243GEN2 Manual, p/n 37044  
Rev. A: October 2002

## WIRING : STANDARD CONFIGURATION

2 — INSTALLATION & WIRING: Controller

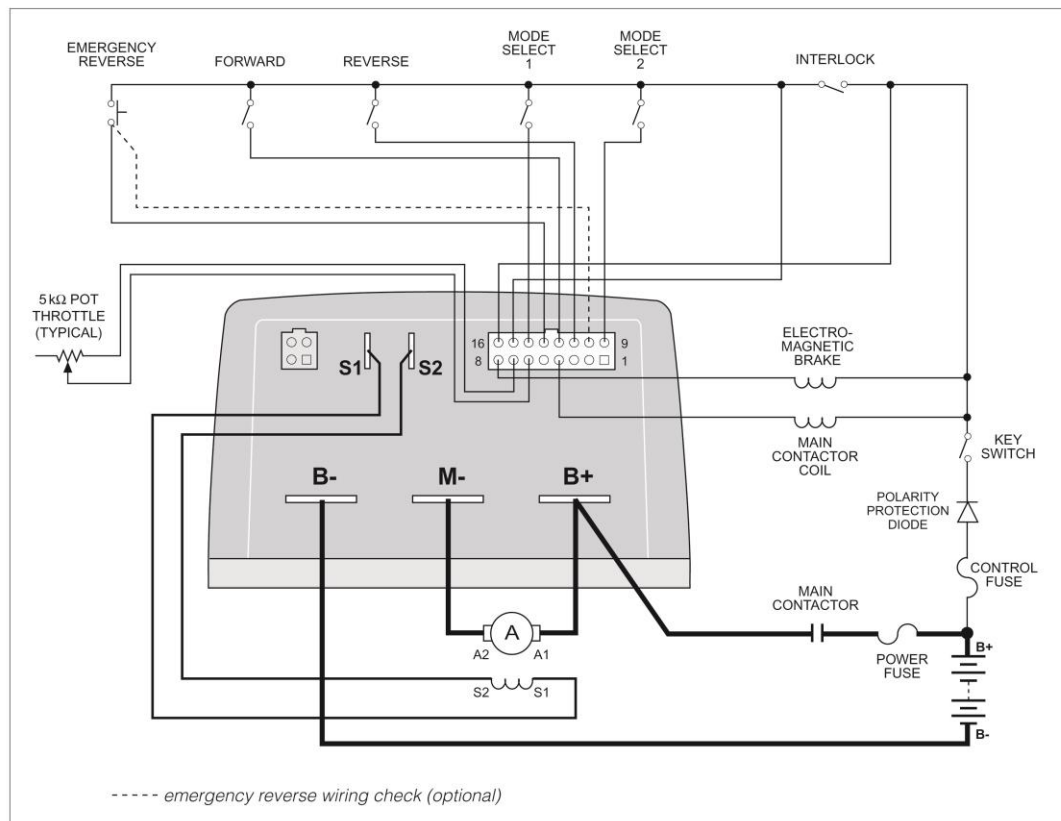
for the M8 bolts. The maximum bolt insertion depth below the surface of the bus bar is 1.3 cm (1/2"). Bolt shafts exceeding this length may damage the controller. The torque applied to the bolts should not exceed 16.3 N·m (12 ft-lbs).

Two 1/4" quick connect terminals (**S1** and **S2**) are provided for the connections to the motor field winding.

### WIRING: Standard Configuration

Figure 3 shows the typical wiring configuration for most applications. **For walkie applications** the interlock switch is typically activated by the tiller, and an emergency reverse switch on the tiller handle provides the emergency reverse signal.

**For rider applications** the interlock switch is typically a seat switch or a foot switch, and there is no emergency reverse.



**Fig. 3** Standard wiring configuration, Curtis 1243GEN2 controller.

## DIAGNOSTICS AND TROUBLESHOOTING

7 — DIAGNOSTICS & TROUBLESHOOTING

# 7

## DIAGNOSTICS AND TROUBLESHOOTING

The 1243GEN2 controller provides diagnostics information to assist technicians in troubleshooting drive system problems. The diagnostics information can be obtained by observing the appropriate display on the handheld programmer, the fault message displayed on the Spyglass gauge, the fault codes issued by the Status LED, or the fault display driven by the controller's fault outputs (Fault 1 and Fault 2). Refer to the troubleshooting chart (Table 7) for suggestions covering a wide range of possible faults.

### PROGRAMMER DIAGNOSTICS

The handheld programmer presents complete diagnostic information in plain language. Faults are displayed in the System Faults Menu, and the status of the controller inputs/outputs is displayed in the Monitor Menu.

Accessing the programmer's Fault History Menu provides a list of the faults that have occurred since the fault history file was last cleared. Checking (and clearing) the fault history file is recommended each time the vehicle is brought in for maintenance.

For information on 1311 programmer operation, see Appendix B. If you are using the older 1307 programmer, refer to existing documentation.

### SPYGLASS DIAGNOSTICS

The eight-character LCD on the Spyglass displays a continuous sequence of hourmeter, battery state-of-charge, and fault messages.

Fault messages are displayed using the same codes that are flashed by the LED (see Table 8). For example, the LED flashes 3,2 for a welded main contactor:

|                     |                     |                     |
|---------------------|---------------------|---------------------|
| □□□ □□<br>( 3 , 2 ) | □□□ □□<br>( 3 , 2 ) | □□□ □□<br>( 3 , 2 ) |
|---------------------|---------------------|---------------------|

and the corresponding Spyglass message is:

|         |
|---------|
| CODE 32 |
|---------|

When a fault message is being displayed, the red Fault LED (labeled with a wrench symbol) flashes to catch the operator's attention.

The LCD also displays a warning when either service timer expires. The service warning is not considered a fault and the red Fault LED does not flash. The word SERVICE is displayed for about 20 seconds on each key-on, after the hourmeter is displayed.

The Spyglass is available in 3-LED and 6-LED models; see Figure 21.

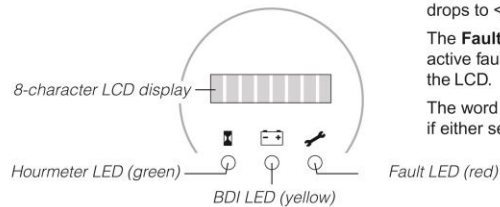
## TROUBLESHOOTING CHART

7 — DIAGNOSTICS &amp; TROUBLESHOOTING

| Table 7 TROUBLESHOOTING CHART |                        |                |                                                                                                                                                                                                                              |                                                                                                    |
|-------------------------------|------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| LED CODE                      | PROGRAMMER LCD DISPLAY | FAULT CATEGORY | POSSIBLE CAUSE                                                                                                                                                                                                               | FAULT CLEARANCE                                                                                    |
| 0,1                           | NO KNOWN FAULTS        | 0              | n/a                                                                                                                                                                                                                          | n/a                                                                                                |
| 1,1                           | CURRENT SHUNT FAULT    | 1              | 1. Abnormal vehicle operation causing high current spikes.<br>2. Current sensor out of range.<br>3. Controller failure.                                                                                                      | Cycle KSI. If problem persists, replace controller.                                                |
| 1,2                           | HW FAILSAFE            | 1              | 1. Noisy environment.<br>2. Self-test or watchdog fault.<br>3. Controller failure.                                                                                                                                           | Cycle KSI. If problem persists, replace controller.                                                |
| 1,3                           | M- SHORTED             | 1              | 1. Internal or external short of M- to B-.<br>2. Incorrect motor wiring.<br>3. Controller failure.                                                                                                                           | Check wiring; cycle KSI. If problem persists, replace controller.                                  |
| 1,4                           | SRO                    | 3              | 1. Improper sequence of KSI, interlock, and direction inputs.<br>2. Interlock or direction switch circuit open.<br>3. Sequencing delay too short.<br>4. Wrong SRO or throttle type selected.<br>5. Misadjusted throttle pot. | Follow proper sequence; adjust throttle if necessary; adjust programmable parameters if necessary. |
| 2,1                           | THROTTLE WIPER HI      | 1              | 1. Throttle input wire open or shorted to B+.<br>2. Defective throttle pot.<br>3. Wrong throttle type selected.                                                                                                              | When Throttle Wiper High input returns to valid range.                                             |
| 2,2                           | EMR REV WIRING         | 1              | 1. Emergency reverse wire or check wire open.                                                                                                                                                                                | Re-apply emergency reverse or cycle interlock.                                                     |
| 2,3                           | HPD                    | 3              | 1. Improper sequence of KSI, interlock, and throttle inputs.<br>2. Misadjusted throttle pot.<br>3. Sequencing delay too short.<br>4. Wrong HPD or throttle type selected.<br>5. Misadjusted throttle pot.                    | Follow proper sequence; adjust throttle if necessary; adjust programmable parameters if necessary. |
|                               | SRVC TOTAL             | 3              | 1. Total maintenance timer expired.                                                                                                                                                                                          | Reset with programmer.                                                                             |
|                               | SRVC TRAC              | 3              | 1. Traction maintenance timer expired.                                                                                                                                                                                       | Reset with programmer.                                                                             |
|                               | TOTAL DISABLED         | 3              | 1. Total disable timer expired.                                                                                                                                                                                              | Reset with programmer.                                                                             |
|                               | TRAC DISABLED          | 3              | 1. Traction disable timer expired.                                                                                                                                                                                           | Reset with programmer.                                                                             |
| 2,4                           | THROTTLE WIPER LO      | 1              | 1. Throttle pot wire open or shorted to B+.<br>2. Wrong throttle type selected.<br>3. Defective throttle pot.                                                                                                                | When Throttle Wiper Low input returns to valid range.                                              |
| 3,1                           | FIELD SHORT            | 1              | 1. Main contactor coil shorted.<br>2. Field winding shorted to B+ or B-.<br>3. Field resistance too low.                                                                                                                     | Check contactor coil and field winding; cycle KSI.                                                 |
| 3,2                           | MAIN CONT WELDED       | 1              | 1. Main contactor stuck closed.<br>2. Main contactor driver shorted.                                                                                                                                                         | Check wiring and contactor; cycle KSI.                                                             |
| 3,3                           | FIELD OPEN             | 1              | 1. Field winding connection open.<br>2. Field winding open.                                                                                                                                                                  | Check wiring and cycle KSI.                                                                        |
| 3,4                           | MISSING CONTACTOR      | 1              | 1. Main contactor coil open.<br>2. Main contactor missing.<br>3. Wire to main contactor open.                                                                                                                                | Check wiring and cycle KSI.                                                                        |

**Table 7 TROUBLESHOOTING CHART, cont'd**

| LED CODE | PROGRAMMER LCD DISPLAY | FAULT CATEGORY | POSSIBLE CAUSE                                                                                                          | FAULT CLEARANCE                                                      |
|----------|------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 4,1      | LOW BATTERY VOLTAGE    | 2              | 1. Battery voltage < undervoltage cutback.<br>2. Corroded battery terminal.<br>3. Loose battery or controller terminal. | When voltage rises above undervoltage cutoff point.                  |
| 4,2      | OVERVOLTAGE            | 2              | 1. Battery voltage > overvoltage shutdown limit.<br>2. Vehicle operating with charger attached.                         | When voltage falls below overvoltage cutoff point.                   |
| 4,3      | THERMAL CUTBACK        | 2              | 1. Temperature >85°C or < -25°C.<br>2. Excessive load on vehicle.<br>3. Improper mounting of controller.                | Clears when heatsink temperature returns to within acceptable range. |
| 4,4      | ANTI-TIEDOWN           | 3              | 1. Mode switches shorted to B+.<br>2. Mode Select 1 "tied down" to select Mode 2 or Mode 4 permanently.                 | Release Mode Select 1.                                               |
|          | MOTOR HOT              | 3              | 1. Field resistance > motor hot setpoint.                                                                               | When resistance < setpoint.                                          |
|          | MOTOR WARM             | 3              | 1. Field resistance > motor warm setpoint.                                                                              | When resistance < setpoint.                                          |

**Fig. 21** *Curtis 840 Spyglass, 3-LED and 6-LED models.***3-LED Spyglass**

The **hourmeter LED** lights when the LCD is displaying hourmeter data.

The **BDI LED** lights when the LCD is displaying BDI%. It flashes when BDI% drops to <10%.

The **Fault LED** flashes to indicate an active fault, and the fault code appears on the LCD.

The word **SERVICE** is displayed at key-on if either service timer has expired.

**6-LED Spyglass**

The three green **BDI LEDs** function as a bargraph showing BDI% between 52% and 100%.

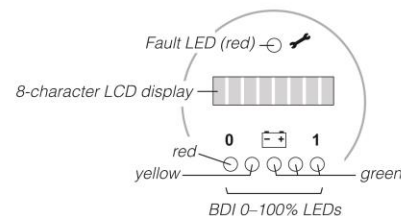
Yellow LED = 36% – 51% BDI.

Red LED steady = 20% – 35% BDI.

Red LED flashing = 0 – 19% BDI.

The **Fault LED** flashes to indicate an active fault, and the fault code appears on the LCD.

The word **SERVICE** is displayed at key-on if either service timer has expired.



## LED DIAGNOSTICS

### STATUS LED DIAGNOSTICS

A Status LED is built into the 1243GEN2 controller. It is visible through a window in the label on top of the controller. This Status LED displays fault codes when there is a problem with the controller or with the inputs to the controller. During normal operation, with no faults present, the Status LED flashes steadily on and off. If the controller detects a fault, a 2-digit fault identification code is flashed continuously until the fault is corrected. For example, code “3,2”—main contactor welded—appears as:

|                     |                     |                     |
|---------------------|---------------------|---------------------|
| □□□ □□<br>( 3 , 2 ) | □□□ □□<br>( 3 , 2 ) | □□□ □□<br>( 3 , 2 ) |
|---------------------|---------------------|---------------------|

The codes are listed in Table 8.

| Table 8 STATUS LED FAULT CODES |           |                                                     |
|--------------------------------|-----------|-----------------------------------------------------|
| LED CODES                      |           | EXPLANATION                                         |
| <i>LED off</i>                 | ████████  | no power or defective controller                    |
| <i>solid on</i>                | □□□□□□    | controller or microprocessor fault                  |
| 0,1                            | ■ □       | controller operational; no faults                   |
| 1,1                            | □ □       | current sensor error                                |
| 1,2                            | □ □□      | hardware failsafe fault                             |
| 1,3                            | □ □□□     | M- fault or motor output short                      |
| 1,4                            | □ □□□□    | static return to off (SRO)                          |
| 2,1                            | □□ □      | throttle wiper high                                 |
| 2,2                            | □□ □□     | emergency reverse circuit check fault               |
| 2,3                            | □□ □□□    | high pedal disable (HPD), or expired timer          |
| 2,4                            | □□ □□□□   | throttle wiper low                                  |
| 3,1                            | □□□ □     | contactor driver overcurrent or field winding short |
| 3,2                            | □□□ □□    | main contactor welded                               |
| 3,3                            | □□□ □□□   | field winding open                                  |
| 3,4                            | □□□ □□□□  | missing contactor                                   |
| 4,1                            | □□□□ □    | low battery voltage                                 |
| 4,2                            | □□□□ □□   | overvoltage                                         |
| 4,3                            | □□□□ □□□  | thermal cutback, due to over/under temp             |
| 4,4                            | □□□□ □□□□ | anti-tiedown fault, or overheated motor             |

Note: Only one fault is indicated at a time, and faults are not queued up. Refer to the troubleshooting chart (Table 7) for suggestions about possible causes of the various faults. Operational faults—such as a fault in SRO sequencing—are cleared by cycling the interlock switch or keyswitch.

**PROGRAMMING PARAMETERS – E-242, E-242HD, E-250****! WARNING !**

The owner of this vehicle shall ensure that the service technicians are qualified, properly trained and obey the safety rules and guidelines in OSHA and ANSI B56 regulations, and in this manual.

Before installing and/or programming the PMC, park the vehicle on a flat level surface, lift the wheels off the ground and secure with jack stands of adequate capacity. Don't connect charger.

Programmable controllers must be programmed using the parameter settings in this service manual, before connecting the motor, to avoid sudden vehicle movement and accident.

Do not try to increase motor speed by changing parameter settings in the speed controller; it can cause accident and severe damage to the motor.

|                 |                                                     |     |                 |                                          |      |
|-----------------|-----------------------------------------------------|-----|-----------------|------------------------------------------|------|
| VOLTAGE         | NOMINAL BATTERY VOLTAGE, IN VOLTS                   | 2   | HPD             | HIGH PEDAL DISABLE (HPD) TYPE            | 1    |
| M1 DRIVE C/L    | MODE 1 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | SRO             | STATIC RETURN TO OFF (SRO) TYPE          | 1    |
| M2 DRIVE C/L    | MODE 2 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | SEQUENCING DLY  | SEQUENCING DELAY, IN SEC.                | 1    |
| M3 DRIVE C/L    | MODE 3 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | MAIN CONT INTR  | MAIN CONTACTOR INTERLOCK: ON OR OFF      | ON   |
| M4 DRIVE C/L    | MODE 4 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | MAIN OPEN DELAY | MAIN CONTACTOR DROPOUT DELAY, IN SEC.    | 1    |
| M1 BRAKE C/L    | MODE 1 BRAKING CURRENT LIMIT, IN AMPS               | 100 | CONT DIAG       | CONT DIAG, ON OR OFF                     | ON   |
| M2 BRAKE C/L    | MODE 2 BRAKING CURRENT LIMIT, IN AMPS               | 100 | AUX TYPE        | AUXILIARY TYPE, 0 TO 5                   | 0    |
| M3 BRAKE C/L    | MODE 3 BRAKING CURRENT LIMIT, IN AMPS               | 100 | AUX DELAY       | AUXILIARY DRIVER DROPOUT DELAY, IN SEC.  | 0.0  |
| M4 BRAKE C/L    | MODE 4 BRAKING CURRENT LIMIT, IN AMPS               | 100 | EMR REV C/L     | EMERGENCY REVERSE CURRENT LIMIT, IN AMPS | 50.0 |
| M1 ACCEL RATE   | MODE 1 ACCELERATION RATE, IN SEC.                   | 3   | EMR REV CHECK   | EMERGENCY REV. WIRING CHECK : ON OR OFF  | OFF  |
| M2ACCEL RATE    | MODE 2 ACCELERATION RATE, IN SEC.                   | 3   | EMR DIR INTR    | EMR DIR INTR: ON OR OFF                  | OFF  |
| M3 ACCEL RATE   | MODE 3 ACCELERATION RATE, IN SEC.                   | 3   | VARIABLE BRAKE  | VARIABLE BRAKE : ON OR OFF               | OFF  |
| M4 ACCEL RATE   | MODE 4 ACCELERATION RATE, IN SEC.                   | 3   | ANTI-TIEDOWN    | ANTI-TIEDOWN: ON OR OFF                  | OFF  |
| M1 DECEL RATE   | MODE 1 DECELERATION RATE, IN SEC.                   | 3.4 | POT LOW FAULT   | POT LOW FAULT: ON OR OFF                 | ON   |
| M2 DECEL RATE   | MODE 2 DECELERATION RATE, IN SEC.                   | 3.4 | FULL VOLTS      | FULL VOLTS: 174 TO 211                   | 204  |
| M3 DECEL RATE   | MODE 3 DECELERATION RATE, IN SEC.                   | 3.4 | EMPTY VOLTS     | EMPTY VOLTS : 0 TO 211                   | 174  |
| M4 DECEL RATE   | MODE 4 DECELERATION RATE, IN SEC.                   | 3.4 | RESET VOLTS     | RESET VOLTS: 174 TO 300                  | 210  |
| THROTTLE DECEL  | THROTTLE DECEL, IN SEC.                             | 0.3 | BATTERY ADJUST  | BATTERY ADJUST : 0.1 TO 20.0             | 20   |
| M1 BRAKE RATE   | MODE 1 BRAKING RATE, IN SEC.                        | 2   | BDI LOCKOUT     | BDI LOCKOUT : ON OR OFF                  | OFF  |
| M2 BRAKE RATE   | MODE 2 BRAKING RATE, IN SEC.                        | 2   | BDI DISABLE     | BDI DISABLE: ON OF OFF                   | OFF  |
| M3 BRAKE RATE   | MODE 3 BRAKING RATE, IN SEC.                        | 2   | ADJ HRS LOW     | ADJ HRS LOW: 0 TO 99                     | 0    |
| M4 BRAKE RATE   | MODE 4 BRAKING RATE, IN SEC.                        | 2   | ADJ HRS MID     | ADJ HRS MID: 0 TO 99                     | 0    |
| INT BRAKE RATE  | INT BRAKE RATE, IN SEC.                             | 2   | ADJ HRS HIGH    | ADJ HRS HIGH: 0 TO 99                    | 0    |
| QUICK START     | QUICK START THROTTLE FACTOR                         | 1   | SET TOTAL HRS   | SET TOTAL HRS: ON OR OFF                 | OFF  |
| TAPER RATE      | Regen brak. Decrease rate when apporch. 0spd, 1/32s | 20  | SET TRAC HRS    | SET TRAC HRS: ON OR OFF                  | OFF  |
| M1 MAX FWD SPD  | MODE 1 MAX. FWD SPEED, AS % PWM OUTPUT              | 40  | HOURLMETER TYPE | HOURLMETER TYPE: ON OR OFF               | OFF  |
| M2 MAX FWD SPD  | MODE 2 MAX. FWD SPEED, AS % PWM OUTPUT              | 72  | SRVC TOTAL HRS  | SRVC TOTAL HRS: 0.0 TO 50.0              | 0.0  |
| M3 MAX FWD SPD  | MODE 3 MAX. FWD SPEED, AS % PWM OUTPUT              | 86  | SRVC TRAC HRS   | SRVC TRAC HRS: 0.0 TO 50.0               | 0.0  |
| M4 MAX FWD SPD  | MODE 4 MAX. FWD SPEED, AS % PWM OUTPUT              | 100 | SRVC TOTAL      | SRVC TOTAL : ON OR OFF                   | OFF  |
| M1 MAX REV SPD  | MODE 1 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | SRVC TRAC       | SRVC TRAC: ON OR OFF                     | OFF  |
| M2MAX REV SPD   | MODE 2 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | DIS TOTAL HRS   | DIS TOTAL HRS: 0 TO 250                  | 0    |
| M3 MAX REV SPD  | MODE 3 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | DIS TRAC HRS    | DIS TRAC HRS: 0 TO 250                   | 0    |
| M4 MAX REV SPD  | MODE 4 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | TRAC FAULT SPD  | TRAC FAULT SPEED: 0 TO 100               | 100  |
| CREEP SPEED     | CREEP SPEED, AS % PWM OUTPUT                        | 0   | BDI LIMIT SPD   | BDI LIMIT SPEED: 0 TO 100                | 100  |
| THROTTLE TYPE   | THROTTLE TYPE                                       | 3   | WARM SPD        | WARM SPEED : 0 TO 100                    | 100  |
| THRO. DEADBAND  | Thr. Neutral deadband % of 5kohms pot               | 6   | MOT WARM        | MOT WARM X 10 m : 10 TO 250              | 250  |
| THROTTLE MAX    | Thr. Input req'd for 100%PWM %5kohm pot             | 90  | MOT HOT         | MOT HOT X 10 m : 10 TO 250               | 250  |
| THRTL MAP       | THROTTLE MAP, AS %                                  | 30  | MOTOR COMP      | MOTOR COMP: ON OR OFF                    | OFF  |
| FIELD MIN       | MIN. FIELD CURRENT, IN AMPS                         | 6   | MAX REV REGEN   | MAX REV REGEN : 100 TO 300               | 100  |
| FIELD MAX       | MAX. FIELD CURRENT, IN AMPS                         | 20  | MAX FWD REGEN   | MAX FWD REGEN: 100 TO 300                | 100  |
| FIELD MAP START | Arm. current at wich FIELD MAP takes effect, amps   | 70  | MIN REV REGEN   | MIN REV REGEN: 100 TO 300                | 25   |
| FIELD MAP       | Field winding current, as % armature current        | 50  | MIN FWD REGEN   | MIN FWD REGEN: 100 TO 300                | 25   |
| CURRENT RATIO   | CURRENT RATIO:FACTOR OF 1, 2, 4 OR 8                | 1   | MAX LOAD VOLTS  | MAX LOAD VOLTS: 0.2 TO 5.5               | 0.2  |
| M1 RESTRAINT    | MODE 1 RAMP RESTRAINT: 1 TO 10                      | 6   | MIN LOAD VOLTS  | MIN LOAD VOLTS: 0.2 TO 5.0               | 0.2  |
| M2 RESTRAINT    | MODE 2 RAMP RESTRAINT: 1 TO 10                      | 6   | INT BRAKE DLY   | INT BRAKE DLY : 0.0 TO 8.0               | 0.0  |
| M3 RESTRAINT    | MODE 3 RAMP RESTRAINT: 1 TO 10                      | 6   | FAULT CODE      | ON OR OFF                                | ON   |
| M4 RESTRAINT    | MODE 4 RAMP RESTRAINT: 1 TO 10                      | 6   | EMR BRAKE PWM   | EMR BRAKE PWM : ON OR OFF                | OFF  |
| LOAD COMP       | LOAD COMPENSATION: 0 TO 25                          | 0   | FIELD CHECK     | FIELD CHECK: ON OR OFF                   | ON   |
|                 |                                                     |     | PUMP METER      | PUMP METER : ON OR OFF                   | OFF  |

**6 MPH MAX : disconnect wire MODE-2-B (PIN 9)**

**8 MPH MAX : disconnect wire MODE-1-A (PIN 14)**

**PROGRAMMING PARAMETERS – E-242-36V, E-276, E-280****! WARNING !**

The owner of this vehicle shall ensure that the service technicians are qualified, properly trained and obey the safety rules and guidelines in OSHA and ANSI B56 regulations, and in this manual.

Before installing and/or programming the PMC, park the vehicle on a flat level surface, lift the wheels off the ground and secure with jack stands of adequate capacity. Don't connect charger.

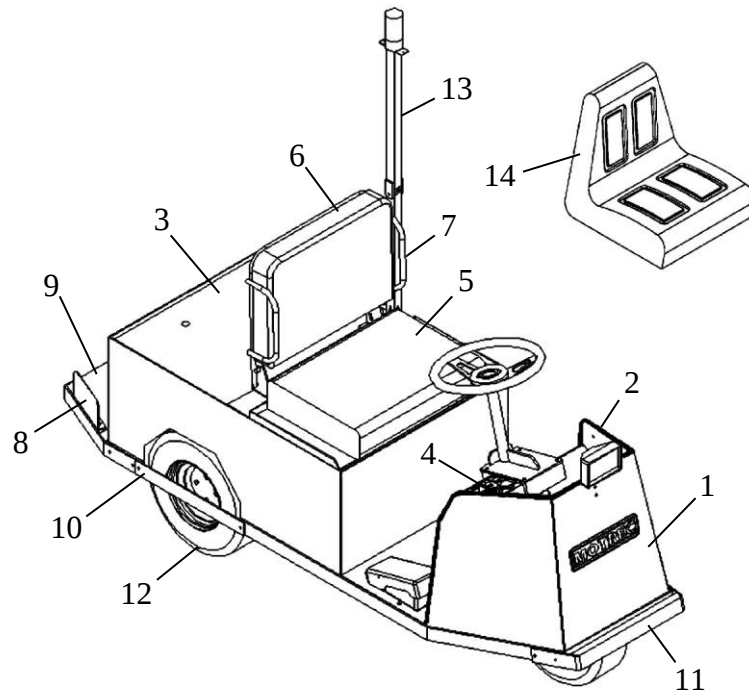
Programmable controllers must be programmed using the parameter settings in this service manual, before connecting the motor, to avoid sudden vehicle movement and accident.

Do not try to increase motor speed by changing parameter settings in the speed controller; it can cause accident and severe damage to the motor.

|                 |                                                     |     |                 |                                          |      |
|-----------------|-----------------------------------------------------|-----|-----------------|------------------------------------------|------|
| VOLTAGE         | NOMINAL BATTERY VOLTAGE, IN VOLTS                   | 3   | HPD             | HIGH PEDAL DISABLE (HPD) TYPE            | 1    |
| M1 DRIVE C/L    | MODE 1 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | SRO             | STATIC RETURN TO OFF (SRO) TYPE          | 1    |
| M2 DRIVE C/L    | MODE 2 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | SEQUENCING DLY  | SEQUENCING DELAY, IN SEC.                | 1    |
| M3 DRIVE C/L    | MODE 3 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | MAIN CONT INTR  | MAIN CONTACTOR INTERLOCK: ON OR OFF      | ON   |
| M4 DRIVE C/L    | MODE 4 DRIVE CURRENT LIMIT, IN AMPS                 | 250 | MAIN OPEN DELAY | MAIN CONTACTOR DROPOUT DELAY, IN SEC.    | 1    |
| M1 BRAKE C/L    | MODE 1 BRAKING CURRENT LIMIT, IN AMPS               | 100 | CONT DIAG       | CONT DIAG, ON OR OFF                     | ON   |
| M2 BRAKE C/L    | MODE 2 BRAKING CURRENT LIMIT, IN AMPS               | 100 | AUX TYPE        | AUXILIARY TYPE, 0 TO 5                   | 0    |
| M3 BRAKE C/L    | MODE 3 BRAKING CURRENT LIMIT, IN AMPS               | 100 | AUX DELAY       | AUXILIARY DRIVER DROPOUT DELAY, IN SEC.  | 0.0  |
| M4 BRAKE C/L    | MODE 4 BRAKING CURRENT LIMIT, IN AMPS               | 100 | EMR REV C/L     | EMERGENCY REVERSE CURRENT LIMIT, IN AMPS | 50.0 |
| M1 ACCEL RATE   | MODE 1 ACCELERATION RATE, IN SEC.                   | 3   | EMR REV CHECK   | EMERGENCY REV. WIRING CHECK : ON OR OFF  | OFF  |
| M2ACCEL RATE    | MODE 2 ACCELERATION RATE, IN SEC.                   | 3   | EMR DIR INTR    | EMR DIR INTR: ON OR OFF                  | OFF  |
| M3 ACCEL RATE   | MODE 3 ACCELERATION RATE, IN SEC.                   | 3   | VARIABLE BRAKE  | VARIABLE BRAKE : ON OR OFF               | OFF  |
| M4 ACCEL RATE   | MODE 4 ACCELERATION RATE, IN SEC.                   | 3   | ANTI-TIEDOWN    | ANTI-TIEDOWN: ON OR OFF                  | OFF  |
| M1 DECEL RATE   | MODE 1 DECELERATION RATE, IN SEC.                   | 3.4 | POT LOW FAULT   | POT LOW FAULT: ON OR OFF                 | ON   |
| M2 DECEL RATE   | MODE 2 DECELERATION RATE, IN SEC.                   | 3.4 | FULL VOLTS      | FULL VOLTS: 174 TO 211                   | 204  |
| M3 DECEL RATE   | MODE 3 DECELERATION RATE, IN SEC.                   | 3.4 | EMPTY VOLTS     | EMPTY VOLTS : 0 TO 211                   | 174  |
| M4 DECEL RATE   | MODE 4 DECELERATION RATE, IN SEC.                   | 3.4 | RESET VOLTS     | RESET VOLTS: 174 TO 300                  | 210  |
| THROTTLE DECEL  | THROTTLE DECEL, IN SEC.                             | 0.3 | BATTERY ADJUST  | BATTERY ADJUST : 0.1 TO 20.0             | 20   |
| M1 BRAKE RATE   | MODE 1 BRAKING RATE, IN SEC.                        | 2   | BDI LOCKOUT     | BDI LOCKOUT : ON OR OFF                  | OFF  |
| M2 BRAKE RATE   | MODE 2 BRAKING RATE, IN SEC.                        | 2   | BDI DISABLE     | BDI DISABLE: ON OF OFF                   | OFF  |
| M3 BRAKE RATE   | MODE 3 BRAKING RATE, IN SEC.                        | 2   | ADJ HRS LOW     | ADJ HRS LOW: 0 TO 99                     | 0    |
| M4 BRAKE RATE   | MODE 4 BRAKING RATE, IN SEC.                        | 2   | ADJ HRS MID     | ADJ HRS MID: 0 TO 99                     | 0    |
| INT BRAKE RATE  | INT BRAKE RATE, IN SEC.                             | 2   | ADJ HRS HIGH    | ADJ HRS HIGH: 0 TO 99                    | 0    |
| QUICK START     | QUICK START THROTTLE FACTOR                         | 1   | SET TOTAL HRS   | SET TOTAL HRS: ON OR OFF                 | OFF  |
| TAPER RATE      | Regen brak. Decrease rate when apporch. 0spd, 1/32s | 20  | SET TRAC HRS    | SET TRAC HRS: ON OR OFF                  | OFF  |
| M1 MAX FWD SPD  | MODE 1 MAX. FWD SPEED, AS % PWM OUTPUT              | 40  | HOURLMETER TYPE | HOURLMETER TYPE: ON OR OFF               | OFF  |
| M2 MAX FWD SPD  | MODE 2 MAX. FWD SPEED, AS % PWM OUTPUT              | 72  | SRVC TOTAL HRS  | SRVC TOTAL HRS: 0.0 TO 50.0              | 0.0  |
| M3 MAX FWD SPD  | MODE 3 MAX. FWD SPEED, AS % PWM OUTPUT              | 86  | SRVC TRAC HRS   | SRVC TRAC HRS: 0.0 TO 50.0               | 0.0  |
| M4 MAX FWD SPD  | MODE 4 MAX. FWD SPEED, AS % PWM OUTPUT              | 100 | SRVC TOTAL      | SRVC TOTAL : ON OR OFF                   | OFF  |
| M1 MAX REV SPD  | MODE 1 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | SRVC TRAC       | SRVC TRAC: ON OR OFF                     | OFF  |
| M2MAX REV SPD   | MODE 2 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | DIS TOTAL HRS   | DIS TOTAL HRS: 0 TO 250                  | 0    |
| M3 MAX REV SPD  | MODE 3 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | DIS TRAC HRS    | DIS TRAC HRS: 0 TO 250                   | 0    |
| M4 MAX REV SPD  | MODE 4 MAX. REV SPEED, AS % PWM OUTPUT              | 40  | TRAC FAULT SPD  | TRAC FAULT SPEED: 0 TO 100               | 100  |
| CREEP SPEED     | CREEP SPEED, AS % PWM OUTPUT                        | 0   | BDI LIMIT SPD   | BDI LIMIT SPEED: 0 TO 100                | 100  |
| THROTTLE TYPE   | THROTTLE TYPE                                       | 3   | WARM SPD        | WARM SPEED : 0 TO 100                    | 100  |
| THRO. DEADBAND  | Thr. Neutral deadband % of 5kohms pot               | 6   | MOT WARM        | MOT WARM X 10 m : 10 TO 250              | 250  |
| THROTTLE MAX    | Thr. Input req'd for 100%PWM %5kohm pot             | 90  | MOT HOT         | MOT HOT X 10 m : 10 TO 250               | 250  |
| THRTL MAP       | THROTTLE MAP, AS %                                  | 30  | MOTOR COMP      | MOTOR COMP: ON OR OFF                    | OFF  |
| FIELD MIN       | MIN. FIELD CURRENT, IN AMPS                         | 8   | MAX REV REGEN   | MAX REV REGEN : 100 TO 300               | 100  |
| FIELD MAX       | MAX. FIELD CURRENT, IN AMPS                         | 20  | MAX FWD REGEN   | MAX FWD REGEN: 100 TO 300                | 100  |
| FIELD MAP START | Arm. current at wich FIELD MAP takes effect, amps   | 70  | MIN REV REGEN   | MIN REV REGEN: 100 TO 300                | 25   |
| FIELD MAP       | Field winding current, as % armature current        | 50  | MIN FWD REGEN   | MIN FWD REGEN: 100 TO 300                | 25   |
| CURRENT RATIO   | CURRENT RATIO:FACTOR OF 1, 2, 4 OR 8                | 1   | MAX LOAD VOLTS  | MAX LOAD VOLTS: 0.2 TO 5.5               | 0.2  |
| M1 RESTRAINT    | MODE 1 RAMP RESTRAINT: 1 TO 10                      | 8   | MIN LOAD VOLTS  | MIN LOAD VOLTS: 0.2 TO 5.0               | 0.2  |
| M2 RESTRAINT    | MODE 2 RAMP RESTRAINT: 1 TO 10                      | 8   | INT BRAKE DLY   | INT BRAKE DLY : 0.0 TO 8.0               | 0.0  |
| M3 RESTRAINT    | MODE 3 RAMP RESTRAINT: 1 TO 10                      | 8   | FAULT CODE      | ON OR OFF                                | ON   |
| M4 RESTRAINT    | MODE 4 RAMP RESTRAINT: 1 TO 10                      | 8   | EMR BRAKE PWM   | EMR BRAKE PWM : ON OR OFF                | OFF  |
| LOAD COMP       | LOAD COMPENSATION: 0 TO 25                          | 0   | FIELD CHECK     | FIELD CHECK: ON OR OFF                   | ON   |
|                 |                                                     |     | PUMP METER      | PUMP METER : ON OR OFF                   | OFF  |

**SPARE PARTS**

## **BODY**

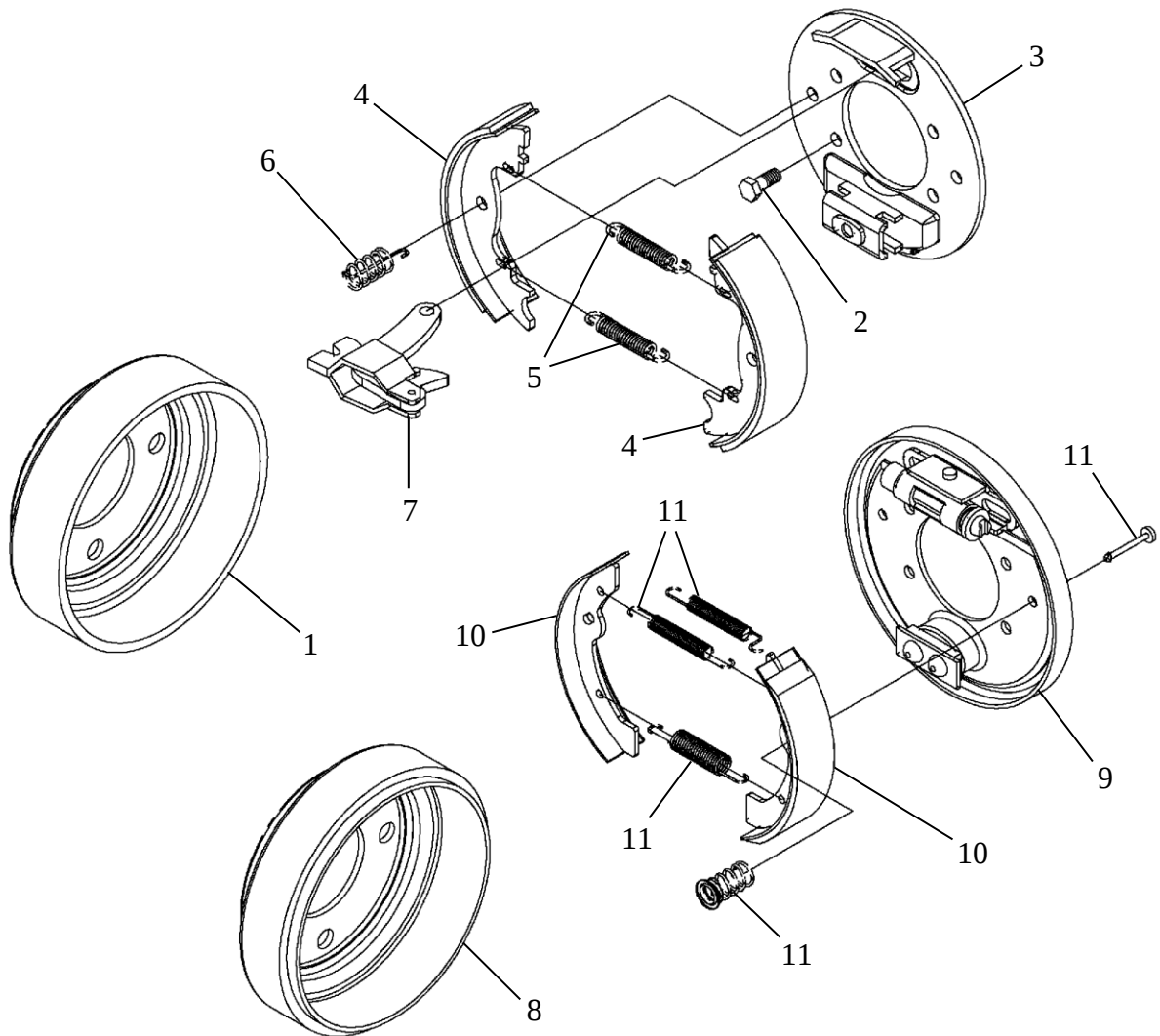


| <b>REF.</b> | <b>PART NO.</b> | <b>DESCRIPTION</b>                 |
|-------------|-----------------|------------------------------------|
| <b>1</b>    | 240001          | BODY                               |
| <b>2</b>    | 120003          | TRIM                               |
| <b>3</b>    | 2332240001      | CARGO DECK                         |
| <b>4</b>    | 2500240001      | INSTRUMENT PANEL                   |
| <b>5</b>    | 2383240002      | SEAT CUSHION                       |
| <b>6</b>    | 2382240002      | BACKREST CUSHION                   |
| <b>7</b>    | 2384240001      | FRAME                              |
| <b>8</b>    | 2401017         | GUARD                              |
| <b>9</b>    | 2312240001      | 7" REAR FOOTSTEP                   |
|             | 2312240021      | 12" REAR FOOTSTEP                  |
|             | 2312240004      | 12" REAR FOOTSTEP WITH CLEVIS      |
|             | 2401005         | 12" REAR FOOTSTEP, CLEVIS & SPRING |
| <b>10</b>   | 2319240001      | BAR                                |
| <b>11</b>   | 2314240001      | FRONT BUMPER                       |
| <b>12</b>   | 2223240001      | 4.80 X 8 PNEUMATIC WHEEL, 4 BOLT   |
| <b>13</b>   | 2800009         | FOLDING LIGHT POLE                 |
| <b>14</b>   | 2385100002      | BUCKET SEAT WITH SLIDE ADJUSTERS   |



| <b>REF.</b> | <b>DESCRIPTION</b>                    | <b>QTY.</b> | <b>PART NO</b>    |
|-------------|---------------------------------------|-------------|-------------------|
|             | <u>Kit Assembly, Differential</u>     | 1           | <u>2170230001</u> |
| 1           | Housing, Axle, Service                | 1           | 2171242001        |
| 2           | Bolt, Bearing Cap                     | 4           | 2179300001        |
| 3           | Gear, Input                           | 1           | 2116242001        |
| 4           | Ring, Retaining                       | 3           | 2179300002        |
| 5           | "O" Ring                              | 3           | 2104300002        |
| 6           | Bearing, Ball                         | 1           | 2102300001        |
| 7           | Bearing, Ball                         | 1           | 2102300002        |
| 8           | Plug, End Cap                         | 2           | 2179300003        |
| 9           | Bearing, Ball                         | 2           | 2102000003        |
| 10          | Assembly, Gear, Intermediate          | 1           | 2116242002        |
| 11          | "O" Ring                              | 2           | 2104300003        |
| 12          | Gear, Final Drive                     | 1           | 2116242003        |
| 13          | Bearing, Ball                         | 2           | 2102000004        |
| 14          | Assembly, Differential                | 1           | 2117242001        |
| 15          | Bolt, Hex                             | 4           | 2179000003        |
| 16          | Nut, Lock                             | 4           | 2179000004        |
| 17          | Plate, Cover                          | 1           | 2179300004        |
| 18          | Plug, Hex Head                        | 1           | 2179300005        |
| 19          | Screw, Tapping                        | 10          | 2179300006        |
| 21          | Screw, Flange Head                    | 8           | 2179242001        |
| 22          | Nut, Lock                             | 8           | 2179242002        |
| 23          | Assembly, Brake                       | 1           | 2124242001        |
| 24          | Assembly, Brake                       | 1           | 2124242002        |
| 25          | Shaft, Axle                           | 1           | 2173242001        |
| 26          | Shaft, Axle                           | 1           | 2173242002        |
| 27          | Pin, Cotter                           | 2           | 2179242003        |
| 28          | Seal, Oil                             | 2           | 2104242001        |
| 29          | Ring, Retaining                       | 4           | 2179242004        |
| 30          | Bearing, Ball                         | 2           | 2102242001        |
| 31          | Assembly, Hub 4 holes, Wheel          | 2           | 2224230001        |
|             | Assembly, Hub 5 holes, Wheel          | 2           | 2224262002        |
| 32          | Bolt, Wheel                           | 8           | 2179242005        |
| 33          | Drum 4 holes, Brake                   | 2           | 2123242001        |
|             | Drum 5 holes, Brake                   | 2           | 2123240001        |
| 34          | Nut, Hex Flange                       | 2           | 2179242006        |
| 35          | Sealant, cover plate                  | A/R         | 2179242007        |
| 36          | Kit, Input Gear (Inc. 3, 4, 5, 6, 7)  | *           | 2116242004        |
| 37          | Kit, Internal Gears (Inc. 3, 10, 12)  | *           | 2116242005        |
| 38          | Kit, Ball Bearings (Inc. 6, 7, 9, 13) | *           | 2102300005        |
| 39          | Vent                                  | 1           | 2179000005        |

## MECHANICAL DRUM BRAKES

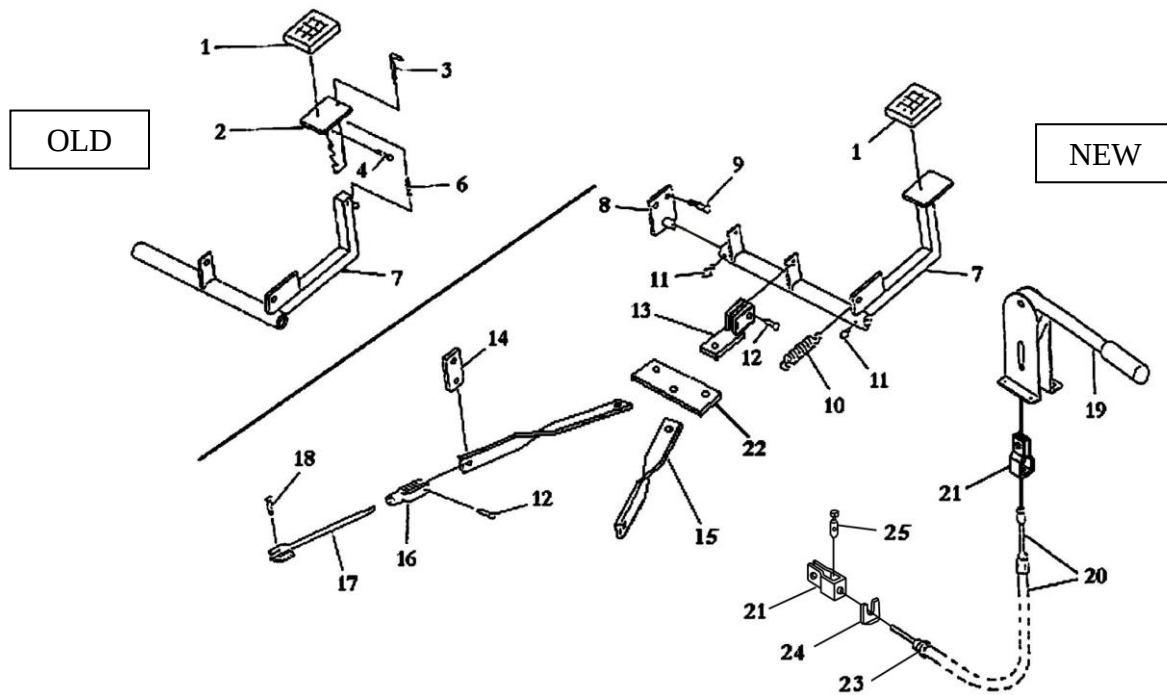


### MANUAL ADJUSTEMENT, OLD

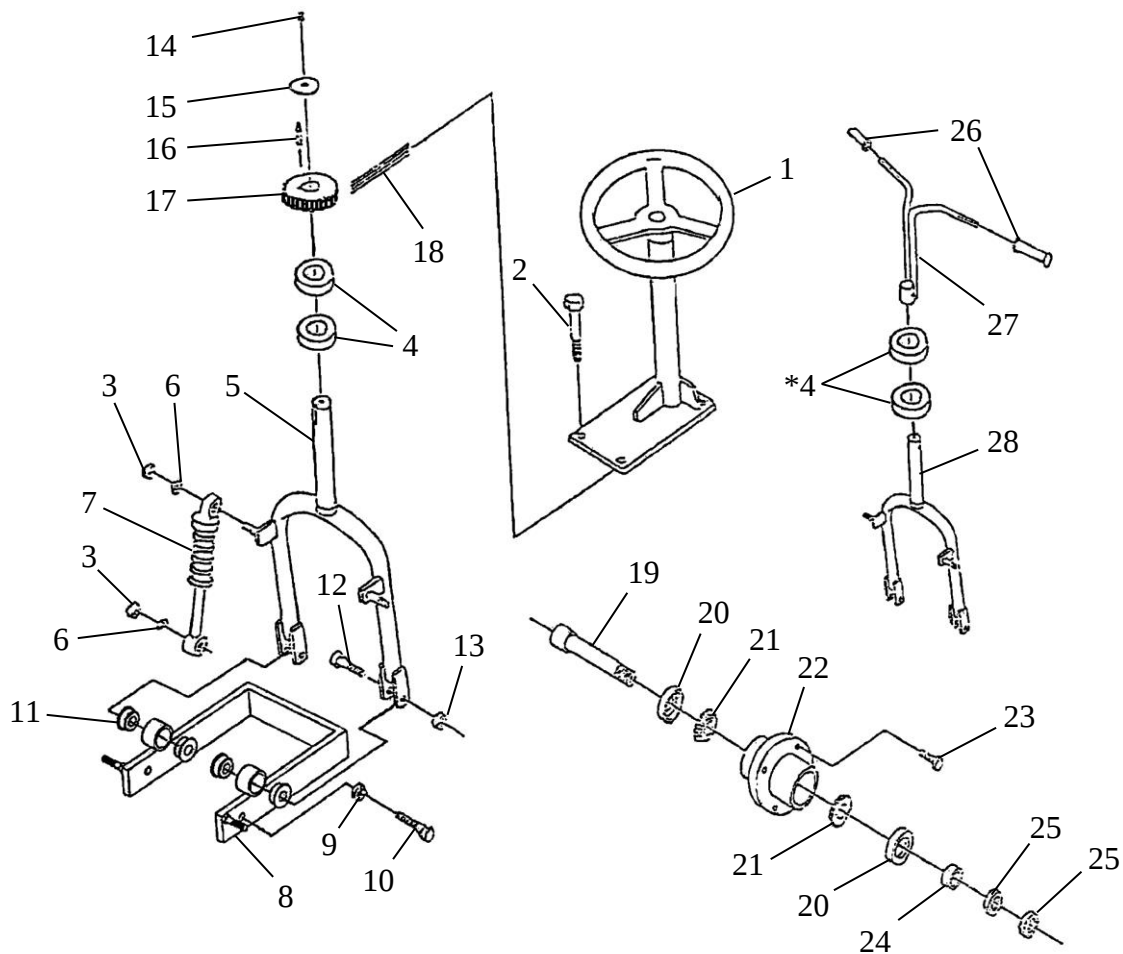
| REF. | PART NO | DESCRIPTION         |
|------|---------|---------------------|
| 1    | 242051  | DRUM                |
| 2    |         | BOLT, 5/16-NC X 3/4 |
| 3    | 242841  | BACK PLATE          |
| 4    | 242842  | BRAKE SHOE          |
| 5    | 242844  | EXT. SPRING         |
| 6    | 242845  | HOLD SPRING         |
| 7    | 242846  | LEVER               |

### SELF ADJUSTEMENT, NEW SERIAL NUMBER 0707070 & +

| REF. | PART NO    | DESCRIPTION      |
|------|------------|------------------|
| 8    | 2123242001 | DRUM 4-BOLT      |
|      | 2123240001 | DRUM 5-BOLT      |
| 9    | 2413002    | BACKING PLATE LH |
|      | 2413010    | BACKING PLATE RH |
| 10   | 2413003    | BRAKE SHOE       |
| 11   | 2413004    | SPRING KIT (5)   |

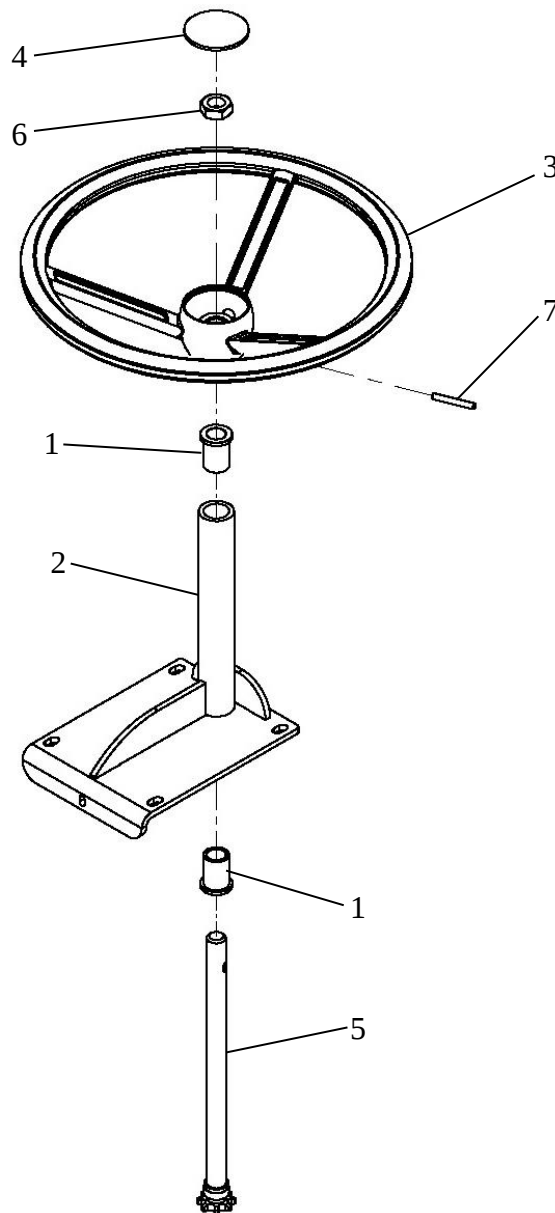
**BRAKE CONTROLS**

| REF. | PART NO    | DESCRIPTION                |
|------|------------|----------------------------|
| 1    | 2131100002 | PEDAL RUBBER               |
| 2    | 2131100008 | PARKING BRAKE CONTROL      |
| 3    | 242803     | COTTER PIN                 |
| 4    |            | PIN 1/4 X 2                |
| 6    | 242806     | SPRING 1 1/2               |
| 7    | 2131240003 | OLD BRAKE LEVER            |
|      | 2131240004 | NEW BRAKE LEVER            |
| 8    | 2132240017 | PIVOT                      |
| 9    |            | BOLT 3/8-NC X 3            |
| 10   | 2190000003 | SPRING                     |
| 11   | 2930000012 | LUBRICATION FITTING        |
| 12   | 2910000028 | CLEVIS PIN 3/8 X 1-3/32    |
| 13   | 2132240010 | PIVOT, DRAWBAR             |
| 14   | 2132240018 | BAR                        |
| 15   | 2130240010 | DRAWBAR                    |
| 16   | 2910000015 | YOKE                       |
| 17   | 2130240008 | ROD                        |
| 18   |            | PIN 5/16 X 3/4             |
| 19   | 2139240002 | 8 IN. HAND BRAKE LEVER     |
| 20   | 2129000002 | CABLE & CONDUIT            |
| 21   | 2910000013 | YOKE                       |
| 22   | 2130240007 | BAR                        |
| 23   | 2416012    | END BUSHING,CABLE W/O CLIP |
| 24   | 2129000001 | CLIP                       |
| 25   | 2921000001 | CABLE STOP                 |

**STEERING ASSEMBLY**

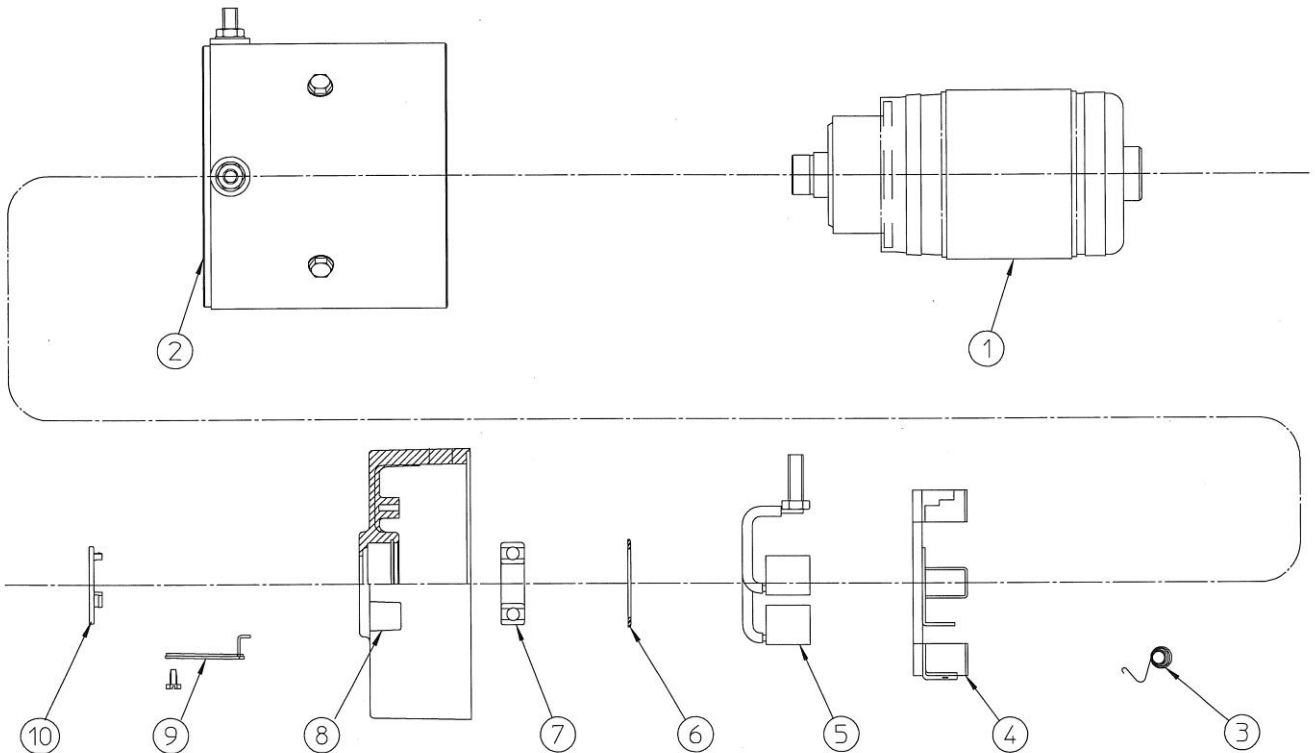
| REF. | PART NO.   | DESCRIPTION                  | REF. | PART NO.   | DESCRIPTION              |
|------|------------|------------------------------|------|------------|--------------------------|
| 1    | 241430     | STEERING WHEEL ASS.          | 17   | 241431     | SPROKET                  |
| 2    |            | BOLT 3/8-NC X 3              | 18   | 2430010    | CHAIN                    |
| 3    |            | LOCKNUT 7/16-NC              | 19   | 241001     | AXLE                     |
| 4    | 241406     | BALL BEARING (2.44 O.D.)     | 20   | 2104300005 | SEAL                     |
|      | 281406     | BALL BEARING (3.31 O.D.)     | 21   | 2103300007 | TAPER BEARING            |
| 5    | 241427     | FORK (2.44 BEARING O.D.)     | 22   | 241004     | HUB, 4 BOLT              |
|      | 2203280001 | FORK (3.31 BEARING O.D.)     |      | 2224280001 | HUB, 5 BOLT              |
| 6    |            | WASHER 7/16                  | 23   | 2910000019 | WHEEL BOLT               |
| 7    | 2180240001 | SHOCK ABSORBER               | 24   | 2109240001 | BUSHING                  |
| 8    | 2182280001 | SUSPENSION ARM               | 25   | 2910000012 | JAM NUT 1-14-NF          |
| 9    |            | LOCK WASHER ½                | 26   | 241402     | HANDGRIPS, RIGHT & LEFT  |
| 10   |            | BOLT ½-NF X 1 ½              | 27   | 2204240006 | HANDLE BAR               |
| 11   | 2440007    | NYL-OIL ½ BUSHING, SET FOR 4 | 28   | 241407     | FORK (2.44 BEARING O.D.) |
| 12   |            | BOLT 5/8-NC X 3              |      | 2203240002 | FORK (3.31 BEARING O.D.) |
| 13   |            | LOCKNUT 5/8-NC               |      |            |                          |
| 14   |            | BOLT ¼-NC X ¾                |      |            |                          |
| 15   | 281424     | FLAT WASHER                  |      |            |                          |
| 16   |            | KEY ¼                        |      |            |                          |

### STEERING WHEEL



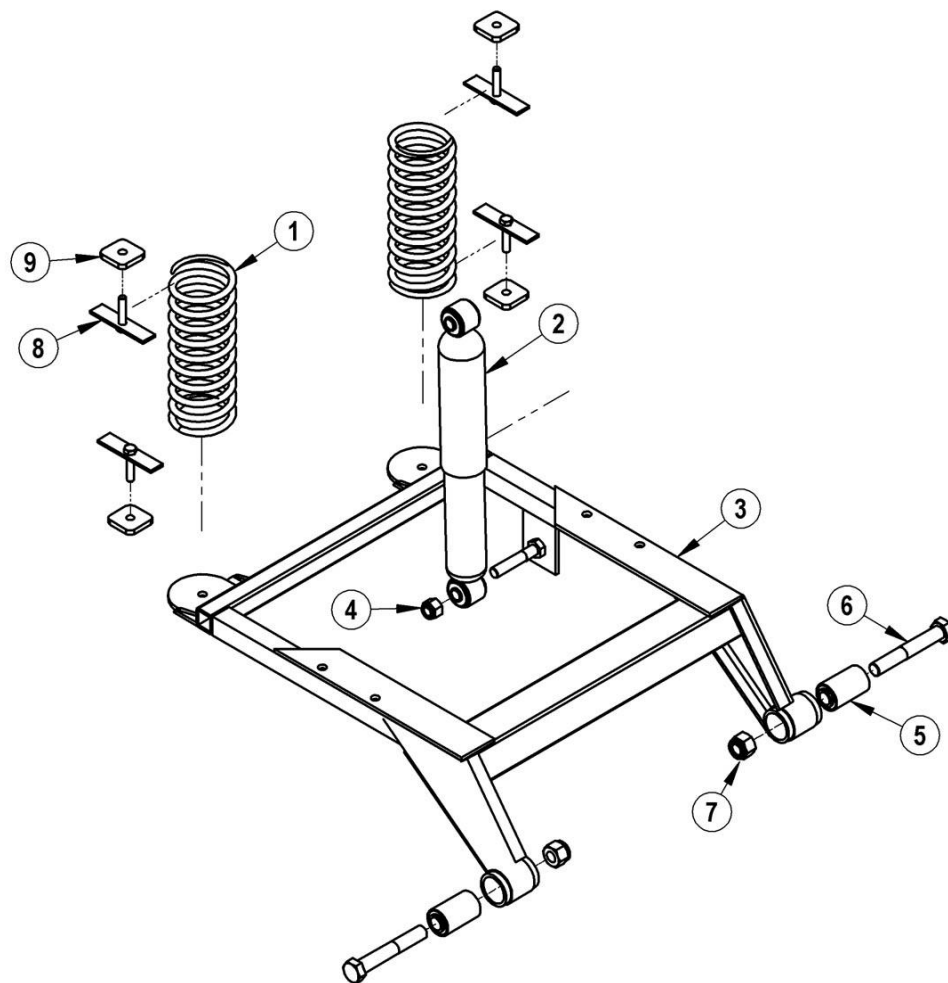
| REF. | PART NO.       | DESCRIPTION     |
|------|----------------|-----------------|
| 1    | 2100121624-Q2F | BUSHING         |
| 2    | 2206280027     | STEERING COLUMN |
| 3    | 2208240001     | STEERING WHEEL  |
| 4    | 2208240002     | COVER           |
| 5    | 2209280001     | SHAFT           |
| 6    | 2910000022     | NUT             |
| 7    | 2910000023     | SPRING PIN      |

**SEPEX MOTOR DD4-4005, KIT No. 3112230001**



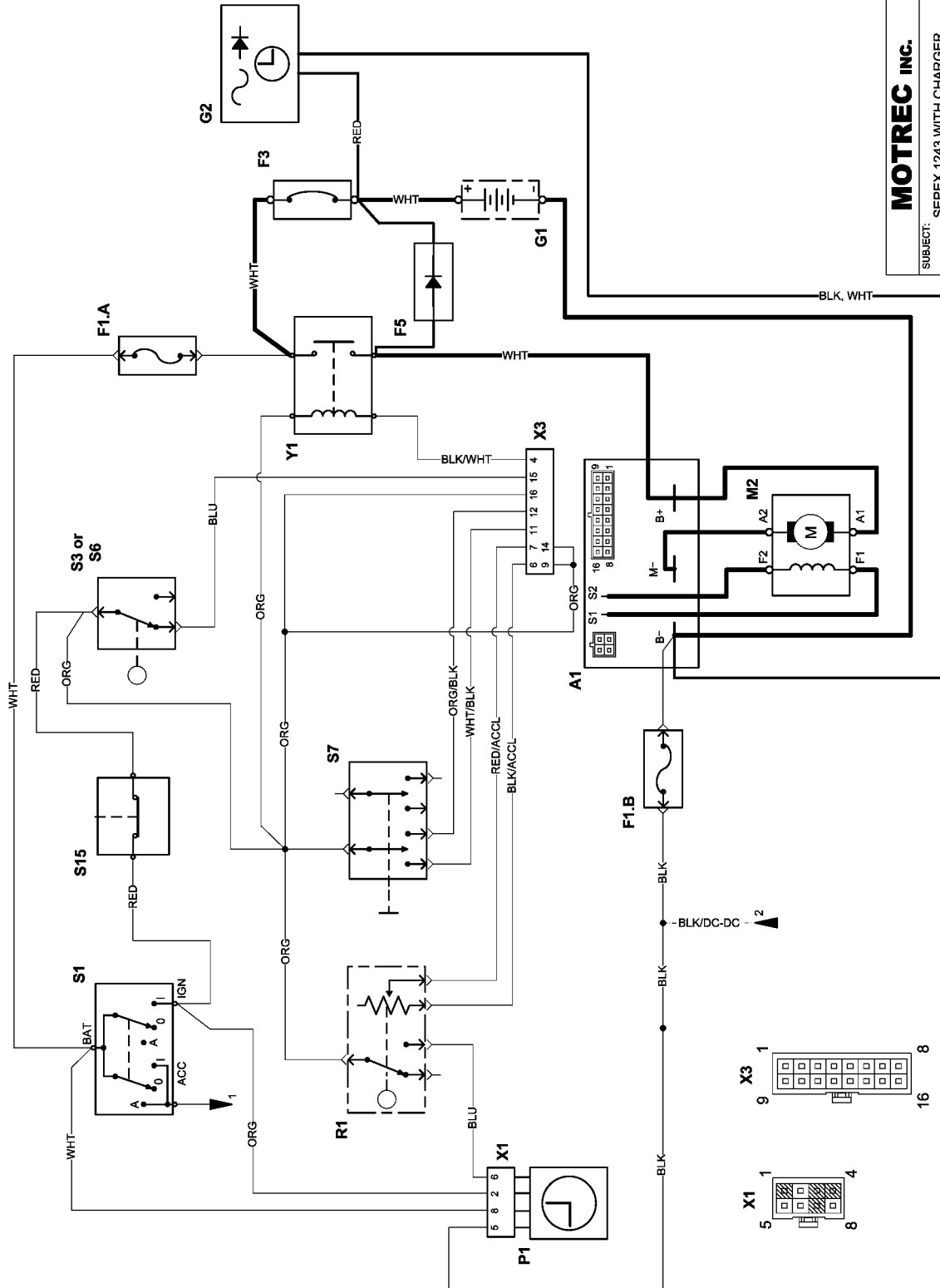
| ITEM No. | PART No.   | DESCRIPTION            |
|----------|------------|------------------------|
| 1        | 3112230002 | ARMATURE               |
| 2        | 3112230004 | FRAME & FIELD ASSEMBLY |
| 3        | 2450006    | BRUSH SPRING           |
| 4        | 2450007    | BRUSH BOX ASSEMBLY     |
| 5        | 3112210004 | BRUSH ASSEMBLY KIT     |
| 6        | 484004     | RETAINING RING         |
| 7        | 484003     | BEARING                |
| 8        | 3112230003 | COMMUTATOR END HEAD    |
| 9        | 3112230005 | COVER PLATE ASSEMBLY   |
| 10       | 2450010    | HOLE PLUG              |

## REAR AXLE FRAME



| REF. | PART NO    | DESCRIPTION                  |
|------|------------|------------------------------|
| 1    | 242622     | COIL SPRING                  |
| 2    | 2180240002 | SHOCK ABSORBER               |
| 3    | 2182242001 | REAR AXLE FRAME 24V DC       |
|      | 2182242012 | REAR AXLE FRAME 36V DC       |
|      | 2182242018 | REAR AXLE FRAME 24V AC       |
| 4    |            | LOCK NUT ½-NC                |
| 5    | 242602     | BUSHING                      |
| 6    |            | BOLT 5/8-NC X 4              |
| 7    |            | LOCK NUT 5/8-NC              |
| 8    |            | SPRING RETAINER              |
|      | 242623     | BEFORE SERIAL # 1012672 & UP |
|      | 2440008    | SERIAL # 1012672 & UP        |
| 9    | 2440010    | CENTERING PLATE              |

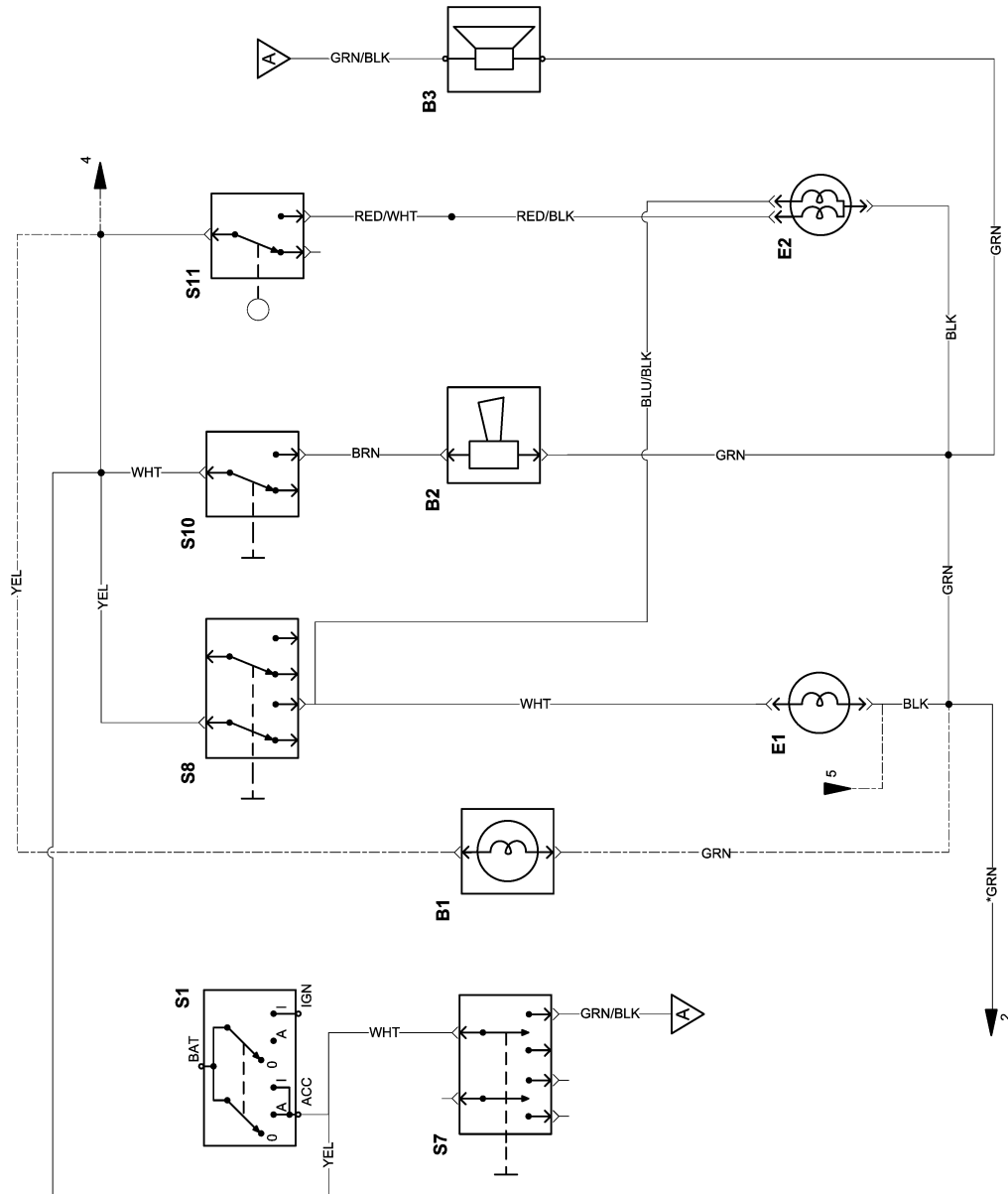
# **ELECTRICAL DIAGRAM – SEPEX MAIN CIRCUIT** **DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL SEPEX**



|                    |                          |           |            |
|--------------------|--------------------------|-----------|------------|
| <b>MOTREC INC.</b> |                          |           |            |
| SUBJECT:           | SEPEX 1243 WITH CHARGER  |           |            |
| TITLE:             | MAIN CIRCUIT SEPEX       |           |            |
| VERSION:           | 01                       | DATE:     | 2010-10-18 |
| AUTHOR:            | J. GAGNON                | APPROVED: |            |
| DRAWING #:         | SEPEX 1243 - CHARGER.VSD |           |            |

## ACCESSORIES – NO DC/DC CONVERTER

## ACCESSOIRES – SANS CONVERTISSEUR DC/DC



|                    |                                |           |            |
|--------------------|--------------------------------|-----------|------------|
| <b>MOTREC INC.</b> |                                |           |            |
| SUBJECT:           | ACCESSORIES - 1HL1TL1SL        |           |            |
| TITLE:             | ACCESSORIES                    |           |            |
| VERSION:           | 01                             | DATE:     | 2006-04-11 |
| AUTHOR:            | J. GAGNON                      | APPROVED: |            |
| DRAWING #:         | ACC - NO DC-DC - 1HL1TL1SL.VSD |           |            |

\* Accessories ground is connected at an intermediate post relative to vehicle battery set positive post when DC-DC converter option is not taken.  
The relative voltage is either 12V or 24V depending on accessories

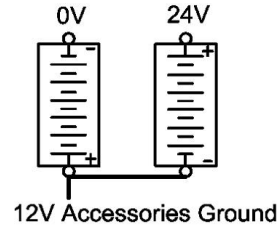
**PARTS LIST**

| <b>NO</b> | <b>DESIGNATION</b>          | <b>REF</b> | <b>QTY</b> |
|-----------|-----------------------------|------------|------------|
| A1        | SEPEX SPEED CONTROL         | 1243-4320  | 1          |
| B1        | STROBE LIGHT                | *          |            |
| B2        | HORN                        | *          | 1          |
| B3        | REVERSE ALARM               | *          | 1          |
| E1        | HEADLIGHT, SQUARE           | *          | 1          |
| E2        | TAIL/BRAKE LIGHT            | *          | 2          |
| F1.A,B    | FUSE, 15A                   | 246108K    | 2          |
| F3        | CIRCUIT BREAKER, 150A       | 3107000002 | 1          |
| F5        | DIODE BRIDGE                | 3669027    | 1          |
| G1        | BATTERY                     |            | 4          |
| M2        | SEPEX MOTOR                 |            | 1          |
| P1        | HOUR METER, BATTERY GAUGE   | *          | 1          |
| R1        | ACCELERATOR                 | 2142100001 | 1          |
|           | PLASTIC GEAR                | 367015     | 1          |
|           | MICROSWITCH                 | 367002     | 1          |
|           | POTENTIOMETER               | 367003     | 1          |
|           | SPRING                      | 2462008    | 1          |
| S1        | KEY SWITCH                  | 246205     | 1          |
| S3        | SEAT SWITCH, MICRO-SWITCH   | 3109100002 | 1          |
|           | SEAT SWITCH, SEAT MOUNTED   | 3109000003 | 1          |
|           | CONNECTOR                   | 3109000004 | 1          |
| S7        | FOWARD/REVERSE SELECTOR     | 266211     | 1          |
| S8        | LIGHT SWITCH                | 1269004    | 1          |
| S10       | HORN BUTTON, COLUMN MOUNT   | *          | 1          |
| S12       | BRAKE LIGHT SWITCH          | 246207     | 1          |
| S15       | EMERGENCY PUSH BUTTON       | 3109800001 | 1          |
|           | EMERGENCY PUSH BUTTON LABEL | 3109800006 | 1          |
| X1        | HOUR METER CONNECTOR        |            | 1          |
| X3        | SPEED CONTROL CONNECTOR     |            | 1          |
| Y1        | MAIN CONTACTOR              | 246111     | 1          |
|           | STATIC STRAP                | 2450001    | 1          |

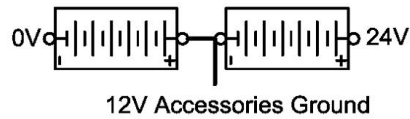
\* Consult Motrec Illustrated Parts

## BATTERY CONFIGURATIONS - 24V CONFIGURATIONS DES BATTERIES – 24V

E-12



E-100



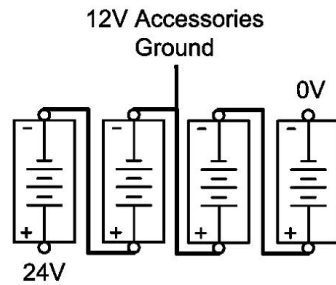
E-250EE

E-260

E-262

E-270

E-272



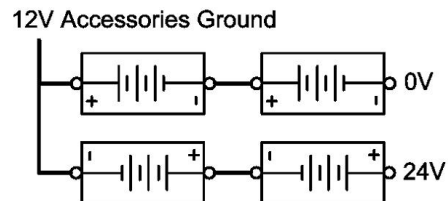
E-240

E-242

E-242 HD

E-250

E-250HD



**DELTA-Q HF CHARGER**

\* NOT ILLUSTRATED

| NO | DESCRIPTION                       | PART NO    |                        |                         |
|----|-----------------------------------|------------|------------------------|-------------------------|
|    |                                   | BUILT-IN   | PORTABLE<br>WITH SB-50 | PORTABLE<br>WITH SB-350 |
| 1  | 24V CHARGER ( U.S. BATTERY )      | 3102240002 | 3102240009             | 3102240013              |
|    | 24V CHARGER ( LIFELINE BATTERY )  | 3102240003 | 3102240010             | 3102240014              |
|    | 24V CHARGER ( GEL 180AH BATTERY)  | 3102240004 | 3102240011             | 3102240015              |
|    | 24V CHARGER ( 27TM BATTERY )      | 3102240005 | 3102240012             | 3102240016              |
|    | 36V CHARGER ( U.S. BATTERY )      | 3102302010 | -                      | 3102302007              |
|    | 36V CHARGER ( LIFELINE BATTERY )  | 3102302002 | 3102302005             | 3102302008              |
|    | 36V CHARGER ( GEL 180AH BATTERY)  | 3102302003 | 3102302006             | 3102302009              |
|    | 48V CHARGER ( U.S. BATTERY )      | 3102480011 | -                      | 3102480008              |
|    | 48V CHARGER ( LIFELINE BATTERY )  | 3102480003 | 3102480006             | 3102480009              |
|    | 48V CHARGER ( GEL 180AH BATTERY ) | 3102480004 | 3102480007             | 3102480010              |
|    | 72V CHARGER (U.S. BATTERY)        | 3102720001 |                        |                         |
| 2  | CONNECTOR C13                     | 3119000011 |                        |                         |
| *  | PORTABLE CHARGER AC CORD          |            | 3120000001             | 3120000001              |
| *  | BUILT-IN CHARGER AC CORD          | 3120000002 |                        |                         |
| *  | CORDSET, YELLOW PLUG & SB-50G     |            | 3120000003             |                         |
| 3  | SOCKET 120VAC MALE FLANGE MOUNT   | 3119700001 |                        |                         |
| 4  | 36V CHARGER (TPPL BATTERY)        | 3102360002 | -                      |                         |
|    | 48V CHARGER (TPPL BATTERY)        | 3102480012 |                        |                         |
| 5  | CORD (12in) NEMA 5-15P TO IEC C13 | 3131314012 |                        |                         |



HF/PFC Battery Charger

**Product Manual for:****QuiQ 912-24xx | 36xx | 48xx | 72xx**

Unit 3 – 5250 Grimmer St.  
Burnaby, BC, Canada V5H 2H2  
Tel: 604.327.8244 Fax: 604.327.8246  
www.delta-q.com

## SAVE THESE IMPORTANT SAFETY INSTRUCTIONS



This manual contains important safety, operating, and installation instructions – read before using charger.

### Battery Safety Information

**Warning:** Use charger only on battery systems with an algorithm selected that is appropriate to the specific battery type. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal operation. Keep sparks, flames, and smoking materials away from batteries. Provide adequate ventilation during charging. Never charge a frozen battery. Study all battery manufacturers' specific precautions such as recommended rates of charge and removing or not removing cell caps while charging.

### Electrical Safety Information

**Danger:** Risk of electric shock. Connect charger power cord to an outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded outlet is required to reduce risk of electric shock – do not use ground adapters or modify plug. Do not touch uninsulated portion of output connector or uninsulated battery terminal. Disconnect the AC supply before making or breaking the connections to the battery while charging. Do not open or disassemble charger. Do not operate charger if the AC supply cord is damaged or if the charger has received a sharp blow, been dropped, or otherwise damaged in any way – refer all repair work to qualified personnel. Not for use by children.

## INFORMATIONS IMPORTANTES DE SÉCURITÉ

Conserver ces instructions. Ce manuel contient des instructions importantes concernant la sécurité et le fonctionnement.

### Information de Sécurité de la Batterie

**Attention:** Utiliser seulement sur les batteries 72V avec un algorithme approprié au type spécifique de batterie – voir le manuel. D'autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batteries peuvent produire des gaz explosifs en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flamme nue à proximité de ces derniers. Fournir la bonne ventilation lors du chargement. Ne jamais charger une batterie gelée. Prendre connaissance des mesures de précaution spécifiées par le fabricant de la batterie, p. ex., vérifier s'il faut enlever les bouchons des cellules lors du chargement de la batterie, et les taux de chargement recommandés.

### Information de Sécurité Électrique

**Danger:** Risque de chocs électriques. Ne pas toucher les parties non isolées du connecteur de sortie ou les bornes non isolées de la batterie. Toujours connecter le chargeur à une prise de courant mise à la terre. Ne pas ouvrir ni désassembler le chargeur – référer toute réparation aux personnes qualifiées. Pas à l'usage des enfants.

## Operating Instructions

1. Always use a grounded outlet. When using an extension cord, avoid excessive voltage drops by using a grounded 3-wire 12 AWG cord.
2. The charger will automatically turn on and go through a short LED indicator self-test (Models 912-xx0x will flash all LED's in an up-down sequence and Models 912-xx1x will alternatively flash its LED RED-GREEN) for two seconds. If the charger is connected to battery pack, a trickle current will be applied until a minimum voltage is reached. If the charger is used in an off-board application and the charger is waiting to be plugged into a battery pack, the charging algorithm number will be displayed for 11 seconds (see "Check / Change Charging Algorithm") before ultimately displaying an under-voltage fault (fault disappears when plugged into battery pack).
3. Once a minimum battery voltage is detected, the charger will enter the bulk charging constant-current stage. Models 912-xx0x will display the current to the battery on the bargraph and Model 912-xx1x will flash its LED GREEN off more than on to indicate <80% charge status. The length of charge time will vary by how large and how depleted the battery pack is, the input voltage (the higher, the better), and ambient temperatures (the lower, the better). If the input AC voltage is low (below 104VAC), then the charging power will be reduced to avoid high input currents (Models 912-xx0x 'AC' LED and Models 912-xx1x single LED both flash YELLOW). If the ambient temperature is too high, then the charging power will also be reduced to maintain a maximum internal temperature (Models 912-xx0x bargraph flashes and Models 912-xx1x single LED flashes YELLOW).
4. When the battery is at approximately 80% state of charge, the bulk stage has completed and an >80% charge indication is given (Models 912-xx0x turn on the '80%' LED and Models 912-xx1x will flash its LED GREEN on more than off). In the next phase known as the absorption or constant-voltage phase, the last 20% of charge is then returned to the battery. The charging could be terminated at this point if the vehicle requires immediate usage, however, it is highly recommended to wait until 100% charge indication is given to ensure maximum battery capacity and life.
5. A low current "finish-charge" phase is next applied to return and maintain maximum battery capacity (Models 912-xx0x will flash the '100%' LED).
6. When Models 912-xx0x '100%' LED or Models 912-xx1x single LED is continuously GREEN, the batteries are completely charged. The charger may now be unplugged from AC power (always pull on plug and not cord to reduce risk of damage to the cord). If left plugged in, the charger will automatically restart a complete charge cycle if the battery pack voltage drops below a minimum voltage or 30 days has elapsed.
7. If a fault occurred anytime during charging, a fault indication is given by flashing RED with a code corresponding to the error. There are several possible conditions that generate errors. Some errors are serious and require human intervention to first resolve the problem and then to reset the charger by interrupting AC power for at least 15 seconds. Others may be simply transient and will automatically recover when the fault condition is eliminated. To indicate which error occurred, a fault indication will flash RED a number of times, pause, and then repeat.
  - [1 FLASH] Battery Voltage High: auto-recover
  - [2 FLASH] Battery Voltage Low: auto-recover
  - [3 FLASH] Charge Timeout: the charge did not complete in the allowed time. This may indicate a problem with the battery pack (voltage not attaining the required level), or that the charger output was reduced due to high ambient temperatures.
  - [4 FLASH] Check Battery: the battery pack could not be trickle charged up to the minimum level required for the charge to be started. This may indicate that one or more cells in the battery pack are shorted or damaged.
  - [5 FLASH] Over-Temperature: auto-recover. Charger has shutdown due to high internal temperature which typically indicates there is not sufficient airflow for cooling – see Installation Instructions 1). Charger will restart and charge to completion if temperature comes within accepted limits.
  - [6 FLASH] QuiQ Fault: an internal fault has been detected. If Fault 6 is again displayed after interrupting AC power for at least 15 seconds, the charger must be brought to a qualified service depot.

## Maintenance Instructions

1. For flooded lead-acid batteries, regularly check water levels of each battery cell after charging and add distilled water as required to level specified by battery manufacturer. Follow the maintenance and safety instructions recommended by the battery manufacturer.
2. Make sure charger connections to battery terminals are tight and clean.
3. Do not expose charger to oil, dirt, mud or to direct heavy water spraying when cleaning vehicle.

See flip side for **Product Specifications and Installation Instructions** for qualified personnel.

## Specifications

### DC Output – see Operating Instructions

| QuiQ Model: 912- | 24xx                               | 36xx | 48xx | 72xx |
|------------------|------------------------------------|------|------|------|
| Voltage-nom (V)  | 24                                 | 36   | 48   | 72   |
| Voltage-max (V)  | 33.6                               | 50.4 | 67.2 | 100  |
| Current-max (A)  | 25                                 | 21   | 18   | 12   |
| Battery Type     | Specific to selected algorithm     |      |      |      |
| Reverse Polarity | Electronic protection – auto-reset |      |      |      |
| Short Circuit    | Electronic current limit           |      |      |      |

### AC Input

| All models               |                                 |
|--------------------------|---------------------------------|
| Voltage-max (Vrms)       | 85 – 265                        |
| Frequency (Hz)           | 45 - 65                         |
| Current-max (Arms)       | 12A @ 104VAC (reduced 20%<104V) |
| Current – nominal (Arms) | 10A @ 120VAC / 5A @ 230VAC      |
| AC Power Factor          | >0.98 at nominal input current  |

### Operation

| Charger Model: 912-   | xx0x (10 LED)                              | xx1x (1 LED)      |
|-----------------------|--------------------------------------------|-------------------|
| AC ON                 | Solid YELLOW                               | LED Active        |
| AC LOW                | Flash YELLOW                               | Flash YELLOW      |
| Thermal Cutback       | Flash Bargraph                             | Flash YELLOW      |
| <80% Charge Indicator | -                                          | Short Flash GREEN |
| >80% Charge Indicator | Solid YELLOW                               | Long Flash GREEN  |
| 100% Charge Indicator | Solid GREEN                                | Solid GREEN       |
| Fault Indicator       | Flash RED                                  | Flash RED         |
| DC Ammeter            | LED Bargraph                               | -                 |
| Bat Temp Compensation | Automatic                                  | Optional          |
| Maintenance Mode      | Auto-restart if V<2.1Vpc or 30 days elapse |                   |

## Installation Instructions



**WARNING:** The output of chargers with greater than 48V may pose an energy and/or shock hazard under normal use. These units must be installed in the host equipment in such a manner that the output cable and battery connections are only accessible with the use of a tool by qualified personnel.

### 1) Determine Mounting Location:

While its sealed nature allows the charger to be mounted virtually anywhere, the choice of mounting location and orientation is extremely important. For optimum performance and shortest charge times, mount the charger in an area with adequate ventilation. The charger should also be mounted in an area that will be relatively free of oil, dirt, mud, or dust since accumulations within the fins of the charger will reduce their heat-dissipating qualities. Optimal cooling also occurs when the charger is mounted on a horizontal surface with the fins vertical. More airflow from below the charger will help cool the fins, so mounting above open areas or areas with cut-outs for airflow is desirable. Contact Delta-Q for information on other mounting orientations. As the charger may get hot in operation, the charger must be installed such that risk of contact by people is reduced. The charger's AC plug must be located at least 18" above the floor/ground surface and the status display must be visible to the user.

### 2) Mounting Procedure:

Mount the charger by the mounting plate using appropriate fasteners (i.e. 1/4" or M6 with locking hardware). For UL2202 compliance, a 12AWG green bonding wire with ring terminals must be attached from the bonding stud located on the front of the charger (identified by ) to the vehicle frame. The vehicle connection must be made using corrosion resistant hardware (e.g., a #10 stainless steel machine screw with at least two threads of engagement and, if required, a paint piercing washer).

### 3) DC Battery Connection Procedure:

- The green wire outputs battery voltage when the charger is not plugged into AC to provide an interlock function – see Fig. 1. If used, a user-supplied 1A fast-blow external fuse must be installed inline to prevent damage. Shorting or drawing more than 1A may damage charger and void the warranty.
- Securely fasten the black ring terminal from the charger to the negative terminal ("–", "NEG", "NEGATIVE") of the battery pack.
- Check that the correct charge algorithm is being used – refer to section 4). Securely fasten the red ring terminal to the positive terminal ("+", "POS", "POSITIVE") of the battery pack.

### Mechanical

| All models            |                                                                |
|-----------------------|----------------------------------------------------------------|
| Dimensions            | 28.0 x 24.5 x 11.0 cm (11 x 9.7 x 4.3")                        |
| Weight                | <5 kg (<11 lbs) w/ standard output cord                        |
| Environmental         | Enclosure: IP46                                                |
| Operating Temperature | -30°C to +50°C (-22°F to 122°F), derated above 30°C, below 0°C |
| Storage Temperature   | -40°C to +70°C (-40°F to 158°F)                                |
| AC input connector    | IEC320/C14 (require ≥1.8m localized cord)                      |
| DC output connector   | OEM specific w/ 12AWG wire                                     |

### Regulatory

| Safety               |                                             |
|----------------------|---------------------------------------------|
| EN 60335-1/2-29      | Safety of Appliances/ Battery Chargers      |
| UL2202               | EV Charging System Equipment                |
| UL1564 2nd Edition   | Industrial Battery Charger                  |
| CSA-C22.2 No. 107.2  | Battery Chargers- Industrial                |
| Emissions            |                                             |
| FCC Part 15/ICES 003 | Unintentional Radiators Class A             |
| EN 55011             | Radio disturbance characteristics (Class A) |
| EN 61000-3-2         | Limits for harmonic current emissions       |
| EN 61000-3-3         | Limits of voltage fluctuations and flicker  |
| Immunity             |                                             |
| EN 61000-4-2         | Electrostatic discharge immunity            |
| EN 61000-4-3         | Radiated, radio-frequency, EMF immunity     |
| EN 61000-4-4         | Electrical fast transient/burst immunity    |
| EN 61000-4-5         | Surge immunity                              |
| EN 61000-4-6         | Conducted Immunity                          |
| EN 61000-4-11        | Voltage variations immunity                 |

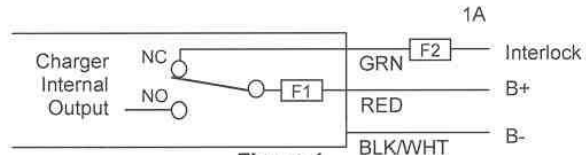


Figure 1

### 4) Check / Change Charging Algorithm:

The charger comes pre-loaded with algorithms for batteries as detailed in Table 1. If your specific battery model is not listed, please contact Delta-Q.

Each time AC power is applied with the battery pack NOT connected, the charger enters an algorithm select/display mode for approximately 11 seconds. During this time, the current Algorithm # is indicated on the '80%' LED (Models 912-xx0x) or on the single LED (Models 912-xx1x). A single digit Algorithm # is indicated by the number of blinks separated by a pause. A two digit Algorithm # is indicated by the number of blinks for the first digit followed by a short pause, then the number of blinks for the second digit followed by a longer pause.

To check / change the charging algorithm:

- Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
- To change algorithm, touch positive connector during the 11 second display period to the battery pack's positive terminal for 3 seconds and then remove – the Algorithm # will advance after 3 seconds. Repeat until desired Algorithm # is displayed. A 30 second timeout is extended for every increment. Incrementing beyond the last Algorithm moves back to the first Algorithm. After desired Algorithm # is displayed, touch the charger connector to the battery positive until the output relay is heard to click (~10 seconds) – algorithm is now in permanent memory.
- Remove AC power from the charger and reconnect the charger positive connector to the battery pack. It is highly recommended to check a newly changed algorithm by repeating step 4) above.

| Alg # | Battery Type             |
|-------|--------------------------|
| 35    | Concorde 2xxAh AGM       |
| 27    | Crown CR325 dv/dt        |
| 26    | Deka 8GGC2 Gel           |
| 11    | generic flooded CP dv/dt |
| 8     | Concorde 1xxAh AGM       |
| 7     | Trojan J305 dv/dt        |
| 6     | DEKA 8G31 Gel            |
| 5     | Trojan 30XHS             |
| 4     | US Battery US2200        |
| 1     | Trojan T-105             |

Table 1.

Product warranty is two years - please contact dealer of original equipment for warranty service.

Note: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

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**MOTREC ILLUSTRATED ACCESSORIES**

|                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Strobe light, pole mount<br/>Amber 12-80V: 3116000002<br/>Red 12-80V: 2469001<br/>Blue 12-80V: 3690008</p>                                                                                    |  <p>Red Tail/Brake light<br/>Grommet: 3269001<br/>Plug: 246012A<br/>12V : 2469021<br/>24V : 2469022</p>                                                          |  <p>Red Tail/Turn LED light<br/>12-24V: 3111000037</p>  <p>Clear lamp Incandescent<br/>12V: 3111000039<br/>Clear lamp LED 12V:<br/>3111000042</p> |  <p>Multi-LED Back-up<br/>Light: 3111000007<br/>Strobe light: 3111000013<br/>Grommet: 3111000008<br/>Plug: 3119000009</p> |
|  <p>Strobe light, cab mount<br/>Amber 12-48V: 3116250001<br/>Red 12-48V: 3069026<br/>Blue 12-48V: 3069014<br/>Amber 72-80V: 3116720001<br/>Red 72-80V: 3116720002<br/>Blue 72-80V: 3116720003</p> |  <p>Red Tail/Brake light<br/>** Model EE **<br/>Assembly: 3111000030<br/>Housing: 3111000027<br/>Plug: 3111000029<br/>12V : 3111000028</p>                       | <p>Bulb incandescent 12V :<br/>1269008<br/>Bulb 12V LED:<br/>3117000001</p>                                                                                                                                                                                                                                           |  <p>Back-up lamp<br/>Grommet: 3269001<br/>12V: 3669012<br/>24V: 3669012A</p>                                              |
|  <p>Amber turn lamp<br/>12V: 3111000022<br/>Bulb 12V: 3069021<br/>Multi-LED amber turn lamp<br/>Round Light: 3111000010<br/>Grommet: 3111000008<br/>Plug: 3119000009</p>                         |  <p>Red Tail/Brake light<br/>Housing: 3111000041<br/>Red Tail/Brake light<br/>Housing LED: 3111000044<br/>Bulb 12V: 3117240001<br/>Bulb 12V LED: 3117000010</p> |  <p>Oval lamp<br/>12V: 3111330001</p>  <p>LED Headlight<br/>12V: 3111000036</p>                                                                 |  <p>Pedestal head lamp<br/>12V: 3111240001<br/>Bulb 12V: 2569001B<br/>Bulb 24V: 2169001B</p>                              |
|  <p>Amber turn lamp 2"<br/>12V : 3111330002</p>                                                                                                                                            |  <p>Multi-LED Red Tail/Brake<br/>Light: 3111000006<br/>Grommet: 3111000008<br/>Plug: 3119000009</p>                                                            |  <p>Headlight<br/>Left: 3111480003<br/>Right: 3111480004<br/>Bulb H/L: 3111480006<br/>Bulb Turn: 3111480008<br/>Bulb Mark: 3111480007</p>                                                                                         |  <p>Pedestal head lamp - LED<br/>12-48V: 3111000034</p>                                                                 |
|  <p>Amber turn lamp 2" LED<br/>white background<br/>12V : 3111330003</p>                                                                                         |  <p>Red Tail/Brake light<br/>12V: 386002</p>                                                                                                                   |  <p>Headlight<br/>Left: 3111480003<br/>Right: 3111480004<br/>Bulb H/L: 3117480001<br/>Bulb Turn: 3117480003<br/>Bulb Mark: 3117480002</p>                                                                                         |  <p>Headlamp 12V: 3111250007</p>                                                                                        |
|  <p>Red Tail/Turn/Rev light<br/>12V: 3111000002</p>                                                                                                                                             |  <p>Red Tail/Turn LED light<br/>12-24V: 3111000037</p>                                                                                                         |                                                                                                                                                                                                                                                                                                                       |  <p>Headlamp<br/>12V: 3111300001<br/>Bulb 12V: 3111300002</p>                                                           |

|                                                                                                                                                                                    |                                                                                                                                                          |                                                                                                                                                                           |                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Analog Voltmeter<br/>12V : 3069007<br/>24V : 2469002<br/>36-48V : 3669002</p>                 |  <p>Wiper motor<br/>12V: 3113000001<br/>24V: 486211</p>                 |  <p>Cab heater<br/>12V: 3103300001<br/>36V: 3669008<br/>48V: 4869020</p>                |  <p>Horn<br/>12V: 246003<br/>24V: 246013</p>     |
|  <p>HOBBS Gauge<br/>24V: 2469026<br/>36V: 3069038<br/>48V: 4869037</p>                            |  <p>Wiper arm 2800000001</p>                                            |  <p>12V Dome light 3669006</p>                                                          |  <p>Horn button VIP<br/>2208224002</p>           |
|  <p>DC-DC converter, 10A<br/>12-48V: 3069019</p>                                                 |  <p>Wiper blade<br/>14" Blade: 2800000002<br/>18" Blade: 2800000003</p> |  <p>12V Fan 3669013</p>                                                                 |  <p>Horn button, column mount<br/>3109000011</p> |
|  <p>DC-DC Converter, 25A<br/>12-48V: 3124000002<br/>72-80V: 3124880001</p>                      |  <p>Pantograph wiper arm<br/>246233A</p>                              |  <p>Back-up alarm or Motion beeper<br/>12-48V : 3100000001<br/>72-80V : 3105720001</p> |  <p>Horn button, dash mount<br/>266210</p>      |
|  <p>DC-DC Converter, 300W<br/>24V: 3124224001<br/>36-48V: 3124280001<br/>72-80V: 3124880001</p> |  <p>Pantograph wiper blade<br/>246233</p>                             |  <p>12-24V Adjustable ECCO:<br/>3100000002</p>                                        |  <p>Horn button 3109250001</p>                 |
|  <p>CONNECTOR:3124280002</p>                                                                    |  <p>Limit switch 3109000029</p>                                       |  <p>12-48V Adjustable PRECO:<br/>3100000004</p>                                       |  <p>Turn signal switch 246050</p>              |
|                                                                                                                                                                                    |                                                                                                                                                          |  <p>Red Pilot light<br/>12V: 246212<br/>Bulb 12V: 246212B</p>                         |                                                                                                                                     |

## **BATTERY DISCHARGE INDICATOR (HOBBS)**

This indicator monitors :

- the residual capacity of batteries;
- operating hours;
- status of service down counter.

The residual capacity of the battery is monitored via an 8-LED bar display. When the left red LED lights, the batteries must be charged to avoid damage. The LED display starts flashing as a pre-warning signal. The lower voltage limit is adjustable via potentiometer “M” on the rear.

| A    | B    | C    | D    | E    | F    | G    | H    | I    | J    | K    |
|------|------|------|------|------|------|------|------|------|------|------|
| 1,57 | 1,63 | 1,68 | 1,73 | 1,78 | 1,82 | 1,84 | 1,86 | 1,89 | 1,91 | 1,93 |

In order to activate a new adjustment, the unit has to be reset :

- 2.35V/cell reset voltage with battery remaining in vehicle;
- 2,09V/cell reset voltage after battery has been disconnected.

To maintain a good battery performance, it is recommended to limit the discharging to 80% of the battery capacity. The recommended setting for 6V batteries is F and the recommended setting for an industrial battery is K.

An internal relay can prevent overdischarging and damaging the batteries. The relay can be wired to cut off the reverse direction, or energize an N.C. relay and alarm.

Turning off and on the vehicle will override the protection for 30 sec.

The current status (remaining operating hours before maintenance) of the service down counter is indicated for a period of 5 seconds after the key switch is turned on. When it is down to 0, the display flashes. After the maintenance, reset the counter: depress the button “R” on the rear. The service counter is factory programmable only.

24V UNIT #: 2469026

36V UNIT #: 3069038

48V UNIT #: 4869037

2- Orange, key switch

3- Relay +

4- Relay -

5- Black, battery –

6- Blue, hour counter

8- White, battery +

