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E-12

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PARTS:
It is recommended that part numbers be confirmed with Motrec International Inc. before ordering by providing the serial number of the vehicle requiring the part. In some cases, the part installed on the vehicle may differ from the manual depending on the options chosen.

Publication date:
July 1, 2015

Edition for vehicles with
a serial number higher than:
1080355

For additional information,
please contact our customer service:

MOTREC INTERNATIONAL INC.
200 Des PME Street
Sherbrooke, Quebec J1C 0R2
Canada
1-866-846-3558

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PIÈCES:
Il est recommandé de valider les numéros de pièces avec Motrec International Inc. avant de commander, en fournissant le numéro de série du véhicule pour lequel la pièce est requise. Dans certains cas, il est possible que la pièce installée sur le véhicule diffère du manuel en fonction des options choisies.

Date de publication:
1er juillet 2015

Édition destinée aux véhicules ayant
un numéro de série supérieur à:
1080355

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MOTREC

E-12

OPERATOR AND MAINTENANCE MANUAL
SPARE PARTS LISTS INCLUDED

SERIAL NUMBER : 1080355 & UP

Printed in Canada

One Year Limited Warranty

Effective April 25, 2005, MOTREC, Inc. (MOTREC) hereby warrants to the Original Retail Purchaser (Owner) that any of its vehicles shall be free from any defect in materials for a period of 90 DAYS while in the possession of such Original Retail Purchaser. This warranty IS NOT TRANSFERABLE to any subsequent Buyer.

The warranty period is extended to one year or one thousand (1,000) hours, which ever first occurs, on the electric motor, differential (parts that bathe in oil) and the electronic speed controller. MOTREC makes no warranty or representation with respect to the internal combustion engine, tires and batteries, since their respective manufacturers cover such parts. Accessories (light, gage, horn, etc), electrical contacts (switch, solenoid, contactor, relay), diodes & fuses, belts & pulleys, filters & spark plugs, lubricants, brake linings & shoes, brake drums & discs, seals, seats, trim and other items subject to wear are not included in this warranty; nor is any item that in MOTREC sole opinion, shows evidence of neglect, misuse, abuse, collision or alteration.

This warranty shall not apply to normal maintenance requirements as described in the User Manual, and to damages during shipment. The latter is the carrier's responsibility. No compensation will be allowed for delays.

To initiate warranty coverage on any MOTREC vehicle, the Dealer must complete and return the “Sales/Installation Report” to MOTREC within 30 days after delivery to the Original Retail Purchaser; or within 90 days after the delivery date to the Dealer, which ever occurs first. Failure to follow these procedures will result in considering the warranty coverage effective as of the shipment date from the factory.

The defective vehicle must be returned, at the Owner's expense, to an authorised MOTREC Dealer within 30 days after failure. The Owner will not be charged for parts and labour required for warranty repairs, which must be performed by an authorised MOTREC Dealer only. The vehicle will be returned at the owner’s expense. The Warranty Claim Forms must be completed and returned with the defective part(s) to MOTREC within 30 days after repair was done. No compensation will be allowed for damages caused by vehicle downtime.

It is the responsibility of the owner of the vehicle to make sure that the driver is properly trained and instructed in the safety features and operation of the vehicle, including vehicle stability, as required by OSHA and ANSI-B56. Operators shall read, understand and follow the safety and operating instructions in MOTREC Manual before driving the vehicle. Operators shall not be permitted to drive the vehicle unless a complete and adequate training has been provided. Driving a vehicle constitutes a hazard. The driver is responsible for the control of the vehicle while driving and must always evaluate and care for all peculiar situations that he or she may meet while driving. The driver assumes the inherent hazards related to this activity. The vehicle is designed for off-road use only. MOTREC disclaims any liability for incidental or consequential damages, to include, but not be limited to, personal injury or property damage arising from vehicle misuse, lack of maintenance or any defect in the vehicle.

It is the responsibility of the Owner of the vehicle to make sure that the service technicians are properly trained as required by OSHA and ANSI-B56. Service technicians shall read, understand and follow instructions in the MOTREC manual before servicing the vehicle. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect the vehicle.

MOTREC prohibits, and disclaims responsibility for, any vehicle modification altering the weight distribution and stability, increasing the speed or affecting the safety of the vehicle. Such modifications can cause serious personal injury or property damage for which MOTREC disclaims any responsibility.

For Owners that are located outside North America, the warranty period starts the date of shipment from the factory, and the defective parts must be returned at the Owner's expense to MOTREC prior to warranty repair.

TABLE OF CONTENTS

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.
- 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.

! WARNING ! Do not operate on ramps. Operate on flat leveled surface only.

! WARNING ! Always park on a flat leveled surface, with front wheel turned.

BEFORE USING VEHICLE.

Before turning on key switch: set to neutral, check for any visible damage, check brake pedal.

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.

BATTERY CHARGER:

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:

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

HORN:

Depress the horn button on the 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, remove the key before leaving the vehicle.

FOOT BRAKE PEDAL:

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

ACCELERATOR THROTTLE HANDLE.

Depress the foot switch and turn hand grip to increase speed.

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.

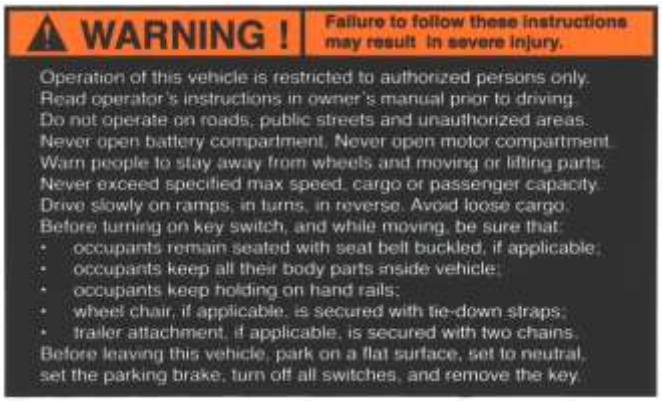
DECALS AND LABELS

! CAUTION !

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

Dashboard security warning label:
5100000002

General security warning label:
5100000001



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

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

PERIODIC MAINTENANCE CHECKLIST

! WARNING !

- Maintenance operations must be made be properly trained service technicians.
- Keep clear from moving parts such as tires, sheaves and motor.
- Check for all EE protections, when applicable, and keep cables and wires clear from mechanical and rubbing action
- 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 key switch to OFF, lift the wheels off the ground and secure with jack stands of adequate capacity, identify and disconnect battery leads.

PERIOD **CHECK/PERFORM HOURS**	**DAY**	**WEEK** **20**	**MONTH** **50**	**QUART.** **200**	**YEAR** **1000**	**2 YEARS** **2000**
MECHANICAL DAMAGE, OIL LEAKS	**X**					
REVERSE ALARM, DEADMAN SWITCH	**X**					
TIRE PRESSURE, pressure rating on tire		**X**				
CHECK/FILL BATTERIES, add distilled water to cover plates. Fill to the recommended level after the batteries have been fully charged.		**X**				
BRAKE PEDAL TRAVEL Check brake adjustment instructions		**X**				
STEERING FOR PLAY				**X**		
BELTS AND PULLEYS -10 lbs. force to produce 1/8 deflexion; -pulleys alignment.				**X**		
CHAIN AND SPROCKETS -require approximately 1/4 deflexion; -sprockets alignment.				**X**		
CLEAN/TIGHTEN WIRE TERMINALS				**X**		
WASH BATTERY TOP WITH WATER				**X**		
MOTOR BRUSHES FOR WEAR -brushes must exceed holders				**X**		
ACCELERATOR ADJUSTMENT see accelerator instructions.				**X**		
BRAKE MECHANICAL LINKAGES for wear & play				**X**		
BRAKE LININGS FOR WEAR 0.05 in. minimum lining thickness.				**X**		
LUBRICATE brake pedal, steering column, chain drive.				**X**		
WHEEL BEARINGS PLAY				**X**		
TIGHTEN NUTS/BOLTS electric terminals; drive; steering; brakes; suspension; body.				**X**		

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 distillated 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 loose 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 cordset;
- Replace electronic control ;

RELAY CLOSES 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 heavely 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.

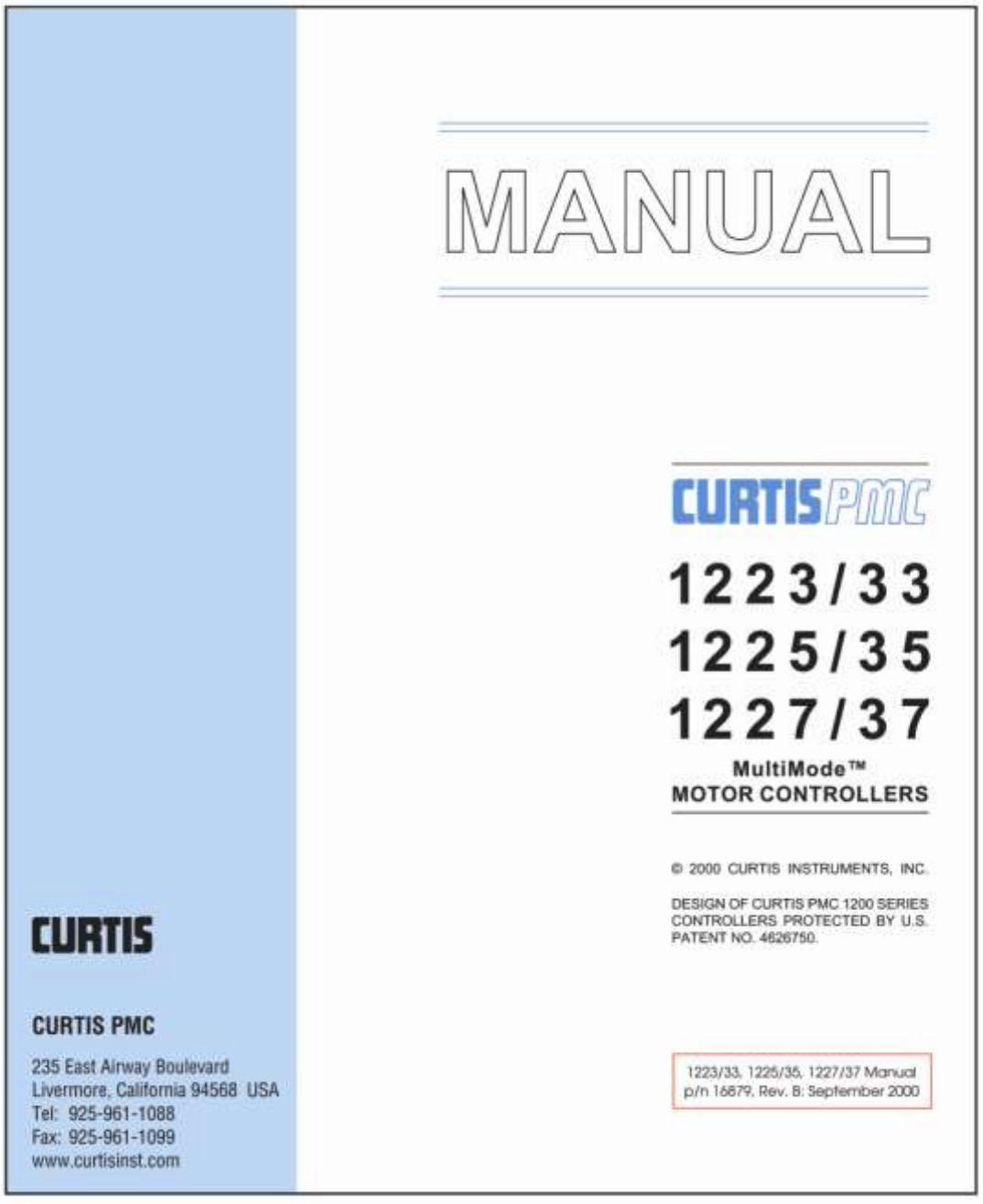
Check PMC

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



MANUAL

CURTIS PMC

1223/33
1225/35
1227/37

MultiMode™
MOTOR CONTROLLERS

© 2000 CURTIS INSTRUMENTS, INC.

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

1223/33, 1225/35, 1227/37 Manual
p/n 16879, Rev. B: September 2000

CURTIS

CURTIS PMC

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www.curtisinst.com

WIRING : STANDARD CONFIGURATION

1225/35 Wiring Configurations

The 1225/35 controller can be configured to work with either on/off or momentary switches for selecting direction and mode. If a power enable switch is used, it must be momentary style. For more information on control switches, see p. 24.

With on/off switches

Typical wiring for the 1225/35 controller with on/off switches is presented in Figure 6. This diagram shows the controller configured with the program 1 driver as an electromagnetic brake, the program 2 driver as a brake light driver, and two SPST switches used for selecting direction. NOTE: In the configuration shown, the power enable pin is an output that drives the Status LED. With on/off switches, the power enable function is performed by the keyswitch and a power enable switch is not used.

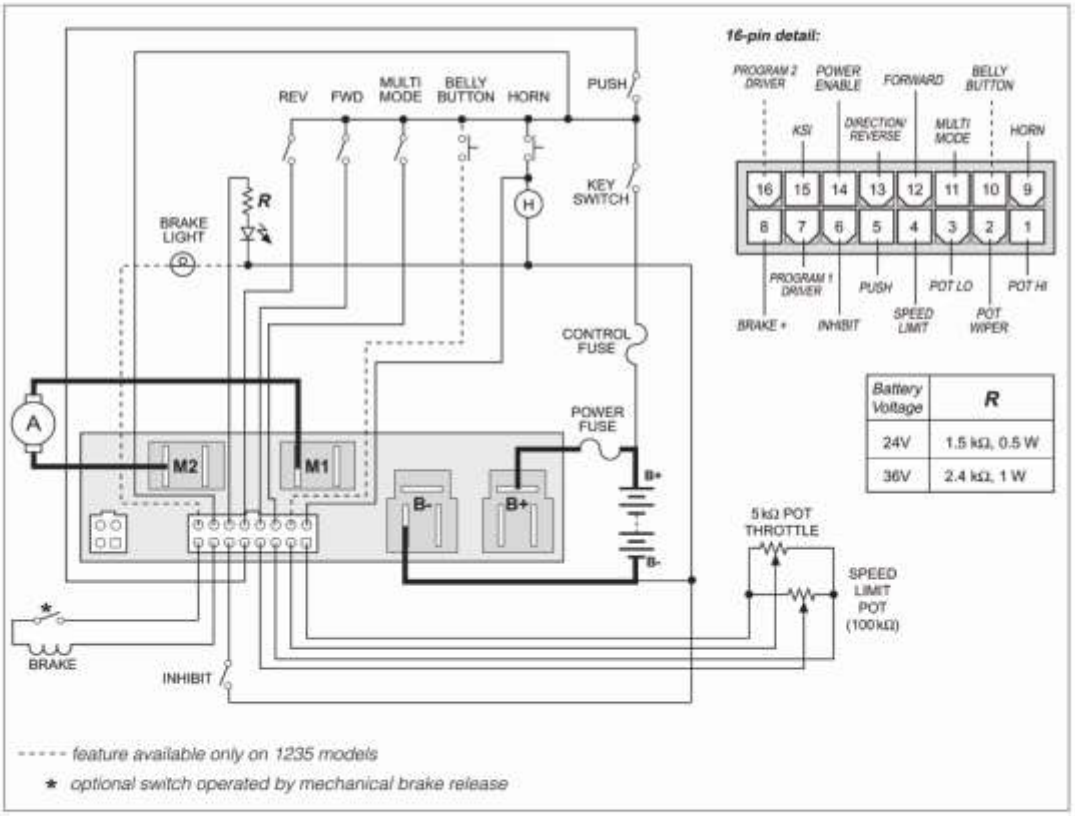


Fig. 6 *Basic wiring configuration using on/off switches, Curtis PMC 1225/35 controller.*

DIAGNOSTICS AND TROUBLESHOOTING

7

DIAGNOSTICS AND TROUBLESHOOTING

The 1223/33, 1225/35, and 1227/37 controllers provide diagnostics information to assist technicians in troubleshooting drive system problems. The diagnostics information can be obtained in two ways: observing the fault codes issued by the Status LED or reading the appropriate display on the handheld programmer.

PROGRAMMER DIAGNOSTICS

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

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

The following 4-step process is recommended for diagnosing and troubleshooting an inoperative vehicle: (1) visually inspect the vehicle for obvious problems; (2) diagnose the problem, using the programmer; (3) test the circuitry with the programmer; and (4) correct the problem. Repeat the last three steps as necessary until the vehicle is operational.

> **Example:** A vehicle that does not operate in "forward" is brought in for repair.
>
> STEP 1: Examine the vehicle and its wiring for any obvious problems, such as broken wires or loose connections.
>
> STEP 2: Connect the programmer, select the Diagnostics Menu, and read the displayed fault information. In this example, the display shows "No Known Faults," indicating that the controller has not detected anything out of the norm.
>
> STEP 3: Select the Test Menu, and observe the status of the inputs and outputs in the forward direction. In this example, the display shows that the forward switch did not close when "forward" was selected, which means the problem is either in the forward switch or the switch wiring.
>
> STEP 4: Check or replace the forward switch and wiring and repeat the test. If the programmer shows the forward switch closing and the vehicle now drives normally, the problem has been corrected.

Refer to the troubleshooting chart (Table 8) for suggestions covering a wide range of possible faults.

TROUBLESHOOTING CHART

Table 8 TROUBLESHOOTING CHART

LED CODE	PROGRAMMER LCD DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,1	HARDWARE FAILSAFE 2	output fault	1. Short in motor or in motor wiring. 2. Controller failure.
	HARDWARE FAILSAFE 4	overcurrent fault	1. Short in motor or in motor wiring. 2. Controller failure.
1,2	HARDWARE FAILSAFE 1	EEPROM fault	1. EEPROM failure or fault.
	HARDWARE FAILSAFE 3	main contactor fault	1. Main contactor welded. 2. Main contactor driver fault. 3. Main contactor coil fault.
	PRECHARGE FAULT	precharge fault	1. Internal controller fault. 2. Low battery voltage.
	HW FAILSAFE	motor voltage fault	1. Motor voltage does not correspond to throttle request. 2. M1 or M2 output shorted to B- or B+. 3. Internal motor short. 4. Controller failure.
2,1	SRO	SRO fault	1. Improper sequence of KSI, power enable, and direction inputs. 2. Wrong SRO type selected. 3. Direction switch circuit open.
2,2	HPD	HPD fault	1. Improper sequence of KSI, power enable, and throttle inputs. 2. Misadjusted throttle pot.
2,3	PROC/WIRING FAULT	HPD fault present for >5 sec	1. Misadjusted throttle. 2. Broken throttle pot. 3. Broken throttle mechanism.
2,4	SPD LIMIT POT FAULT	speed limit pot fault	1. Speed limit pot wiper wire broken. 2. Broken speed limit pot.
3,1	BB WIRING CHECK	emerg. reverse wiring fault	1. BB wire open. 2. BB check wire open.
3,2	EM BRAKE DRVR FAULT	electromag. brake driver fault	1. Electromagnetic brake coil shorted or open. 2. Electromagnetic brake wiring open.
3,3	THROTTLE FAULT 1	throttle fault	1. Throttle input wire open. 2. Throttle input wire shorted to B- or B+. 3. Throttle pot defective. 4. Wrong throttle type selected.
4,1	LOW BATTERY VOLTAGE	low battery voltage	1. Battery voltage <16 volts (24V models), <21V (36V models), or <27V (48V models). 2. Corroded or loose battery terminal. 3. Loose controller terminal.
4,2	OVERVOLTAGE	overvoltage	1. Battery voltage >36 volts (24V models), >48V (36V models), or >60V (48V models). 2. Vehicle operating with charger attached.
4,3	THERMAL CUTBACK	over-/under-temp. cutback	1. Temperature >95°C or < -25°C. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. Operation in extreme environments.

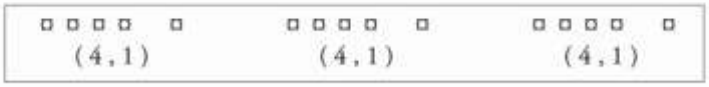
Curtis PMC 1223/33, 1225/35, 1227/37 Manual

LED DIAGNOSTICS

LED DIAGNOSTICS

During normal operation, with no faults present, the Status LED is steadily on. If the controller detects a fault, the Status LED provides two types of information. First, it displays a slow flash (2 Hz) or a fast flash (4 Hz) to indicate the severity of the fault. Slow-flash faults are self-clearing; as soon as the fault is corrected, the vehicle will operate normally. Fast-flash faults ("✻" in Table 9) are considered to be more serious in nature and require that the keyswitch (or power enable switch, if one is used) be cycled to resume operation after the fault is corrected.

Then, after the severity indication has been active for 5 seconds, the Status LED flashes a 2-digit fault identification code continuously until the fault is corrected. For example, code "4,1"—low battery voltage—appears as:



The codes are listed in Table 9.

Table 9 STATUS LED FAULT CODES

	LED CODES		EXPLANATION
	LED off	▬▬▬	no power or defective controller
	solid on	▭	controller operational; no faults
✻	1,1	□ □	output fault or overcurrent fault
✻	1,2	□ □□	EEPROM, main contactor, precharge, or motor voltage fault
	1,3	□ □□□	[not used]
	1,4	□ □□□□	[not used]
	2,1	□□ □	static return to off (SRO) fault
	2,2	□□ □□	high pedal disable (HPD) fault
✻	2,3	□□ □□□	HPD latching (HPD fault for >5 sec)
	2,4	□□ □□□□	speed limit pot fault
	3,1	□□□ □	emerg. rev. wiring fault (BB wiring check)
	3,2	□□□ □□	electromagnetic brake driver fault
	3,3	□□□ □□□	throttle fault
	3,4	□□□ □□□□	[not used]
	4,1	□□□□ □	battery undervoltage
	4,2	□□□□ □□	battery overvoltage
	4,3	□□□□ □□□	thermal cutback, due to over/under temp
	4,4	□□□□ □□□□	[not used]

✻ = *"Fast-flash" fault—must cycle keyswitch or power enable switch to clear.*

NOTE: Only one fault is indicated at a time, and faults are not queued up.

Refer to the troubleshooting chart (Table 8) for suggestions about possible causes of the various faults.

SPEED LIMIT POT FAULT

The controller will not display a fault if there is a problem with the speed limit pot or its wiring. However, if the speed limit pot is broken or if any of its wires is open, the vehicle drive speed will be limited to the specified minimum speed in the selected mode. Open circuit faults can be verified by observing the speed limit pot display in the Test Menu of the handheld programmer as this pot is adjusted. If the speed limit pot display does not change as the pot is adjusted, there is a problem with the pot wiring or the pot itself.

PROGRAMMING PARAMETERS – E-12, E-100

! 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.

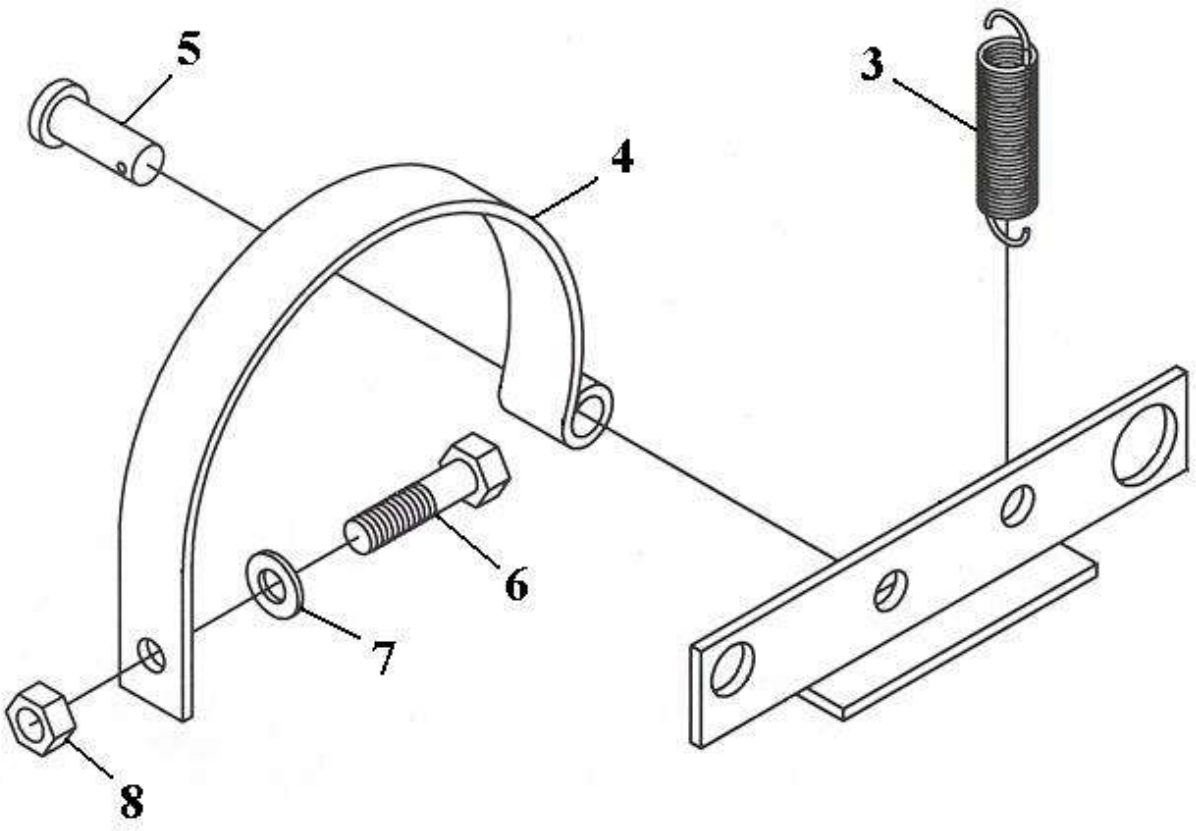
THRTL AUTOCAL	WIGWAG THROTTLE CENTERING UTILITY, ON OR OFF	OFF
M1 ACCEL RATE	MODE 1 ACCELERATION RATE, IN SEC.	1.0
M2 ACCEL RATE	MODE 2 ACCELERATION RATE, IN SEC.	1.0
M1 DECEL	MODE 1 DECELERATION RATE, IN SEC.	2.0
M2 DECEL	MODE 2 DECELERATION RATE, IN SEC.	2.0
M1 REV DECEL	MODE 1 DECELERATION RATE, IN SEC.	2.0
M2 REV DECEL	MODE 2 DECELERATION RATE, IN SEC.	2.0
M1 MAX SPEED	MODE 1 MAXIMUM SPEED, AS % PWM OUTPUT	100
M2 MAX SPEED	MODE 2 MAXIMUM SPEED, AS % PWM OUTPUT	100
M1 MIN SPEED	MODE 1 MINIMUM SPEED, AS % PWM OUTPUT	0
M2 MIN SPEED	MODE 2 MINIMUM SPEED, AS % PWM OUTPUT	0
M1 MAIN C/L	MODE 1 MAIN CURRENT LIMIT	70
M2 MAIN C/L	MODE 2 MAIN CURRENT LIMIT	70
M1 IR COEFF	MODE 1 IR COMPENSATION FACTOR, IN MΩ	0
M2 IR COEFF	MODE 2 IR COMPENSATION FACTOR, IN MΩ	0
REVERSE SPEED	MAXIMUM REVERSE SPEED, AS % PWM OUPUT	40
RAMP SHAPE	THROTTLE MAP	50
CREEP SPEED	CREEP SPEED, AS % PWM OUTPUT	0
BRAKE DLY	ELECTROMAGNETIC BRAKE TIME DELAY	0.0
EMR REV C/L	EMERGENCY REVERSE CURRENT LIMIT, IN AMPS	30.0
EMR REV SPEED	EMERGENCY REVERSE SPEED, AS % PWM OUTPUT	0
THROTTLE TYPE	THROTTLE TYPE	2
DIRECTION	DIRECTION INPUT TYPE	2
THRTL GAIN	RESTRICTED RANGE THROTTLE ADJUSTMENT, AS % 5KΩ POT	100
THRTL DEADBAND	NEUTRAL DEADBAND ADJUSTMENT, AS % OF THROTTLE GAIN	8
HIGH PEDAL DIS	HIGH PEDAL DISABLE (HPD), ON OR OFF	ON
SRO	STATIC RETURN TO OFF (SRO) TYPE	1
PROGRAM 1	PROGRAM 1 DRIVER TYPE	6
PROGRAM 2	PROGRAM 2 DRIVER TYPE	7
PROGRAM 4	BRAKE COIL HOLDING VOLTAGE, AS % NOMINAL V_{BAT}	0
CALIBRATION 5	REGEN CURRENT LIMIT BOOST, AS % > MAIN C/L	0.0
CALIBRATION 4	IR STIFFNESS	0

SPARE PARTS

BODY

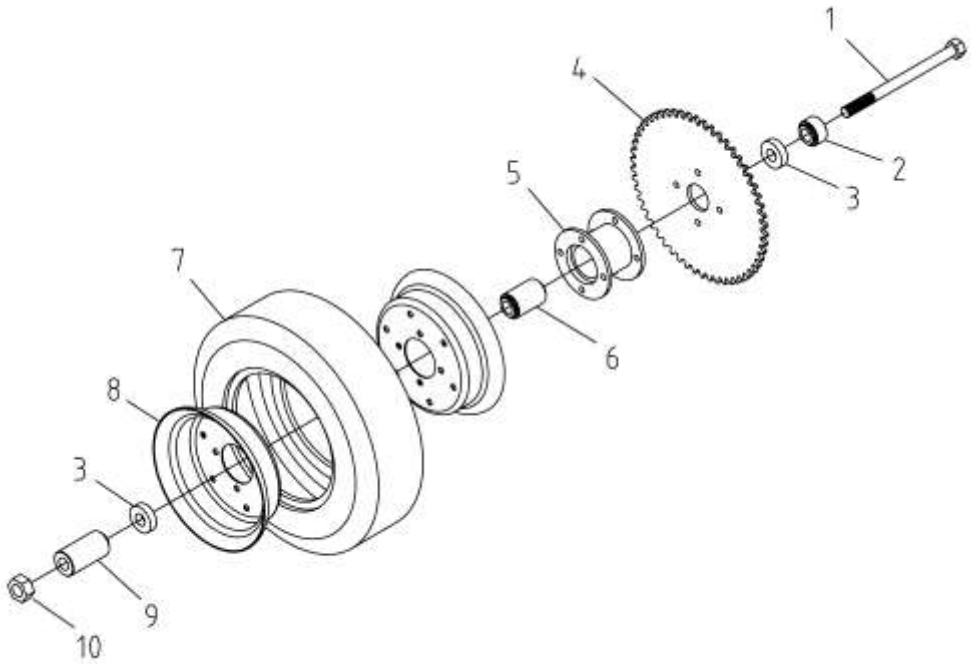
REF.	*PART NO*	*DESCRIPTION*
1	6108012001	BODY
2	1200011	CARGO DECK
3	1207001	WHEEL 410 X 6 ASSEMBLY
4	2500250002	DASHBOARD
5	2100021	SUPPORT, FOOTSWITCH
	2100027	SPACER, FOOTSWITCH

BRAKE CONTROLS



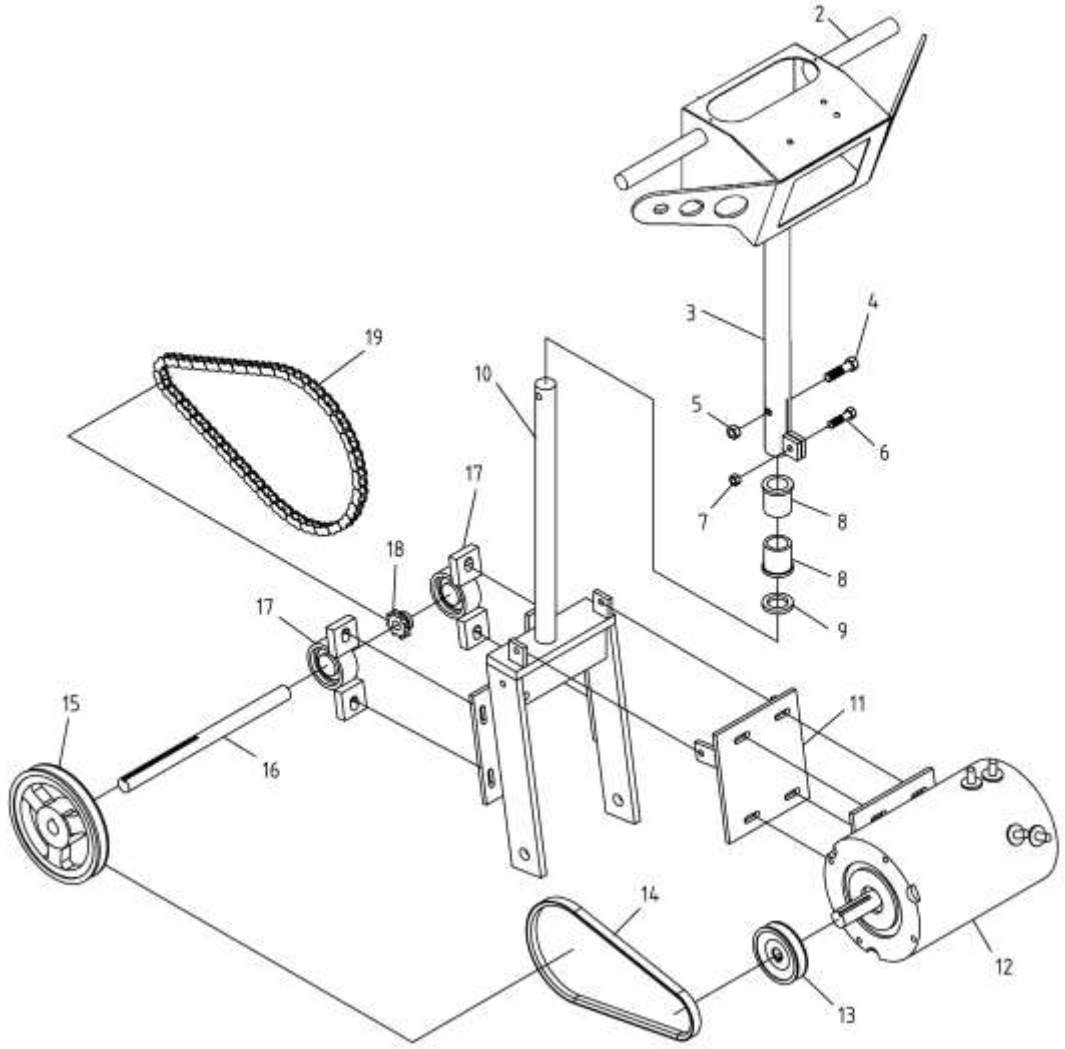
REF.	*PART NO*	*DESCRIPTION*
3	247019	SPRING
4	122825	BRAKE BAND
5		CLEVIS PIN 3/8
6		BOLT 5/16 -NC X 1 ¼
7		FLAT WASHER 5/16
8		NUT 5/16 -NC

FRONT WHEEL



REF.	*PART NO*	*DESCRIPTION*
1	121411	BOLT 5/8-NC X 8
2	2914012001	RIGHT SPACER
3	261403	BALL BEARING
4	2110012003	SPROCKET 54T
		BOLT 5/16-NC X 1
		LOCKWASHER 5/16
		NUT 5/16-NC
5	2224012001	HUB
	112422	WHEEL STUD + NUT
6	2914012002	CENTRAL SPACER
7	2223000003	TIRE AND TUBE
8	123004	SPLIT RIMS
		BOLT 5/16-NF X 5/8
		LOCKWASHER 5/16
		NUT 5/16-NF
9	2914012003	LEFT SPACER
10		LOCK NUT 5/8

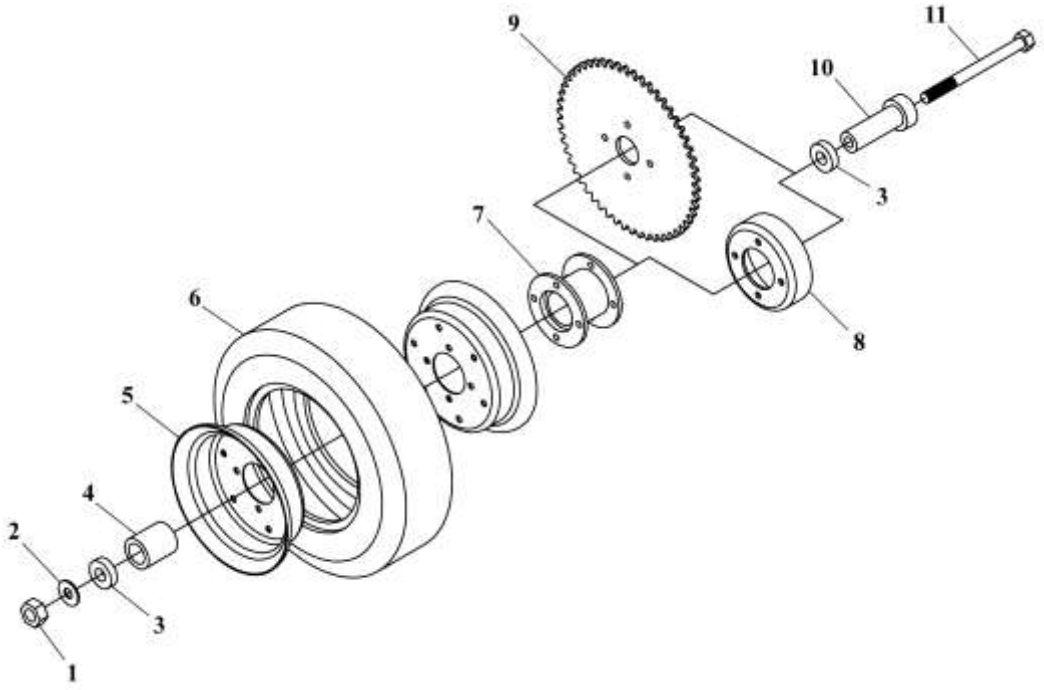
DIRECTION



REF.	*PART NO.*	*DESCRIPTION*
2	241403	HAND GRIP
		ACCELERATOR
3	2204012009	HANDLEBAR
4		BOLT 5/16-NC X 2
5		LOCK NUT 5/16-NC
6		BOLT 1/4-NC X 1 1/4
7		LOCK NUT 1/4-NC
8	121406	BUSHING
9	121407	WASHER
10	112403	FORK
11	112404	MOTOR BASE

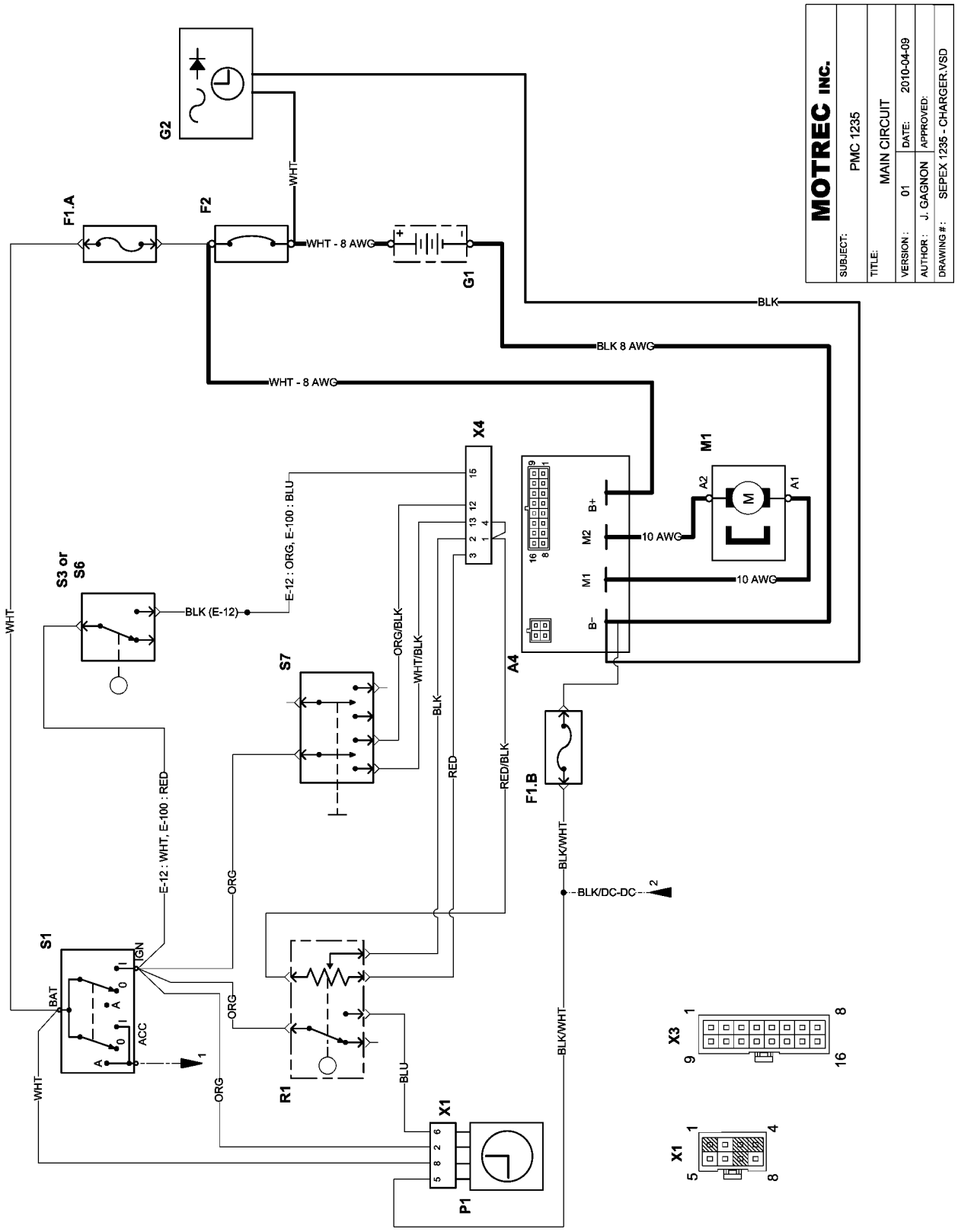
REF.	*PART NO.*	*DESCRIPTION*
12	112406	MOTOR 1/3 HP
	1250001	BRUSHES
	1250002	SPRINGS
13	122427	PULLEY, SPÉCIFY DIA.
14	122429	BELT, SPÉCIFY DIA.
15	112409	PULLEY, SPÉCIFY DIA.
16	112410	SHAFT
17	2105000001	PILLOW BLOCK
18	112411	SPROCKET, SPÉCIFY DIA.
19	1022002	CHAIN

REAR WHEEL

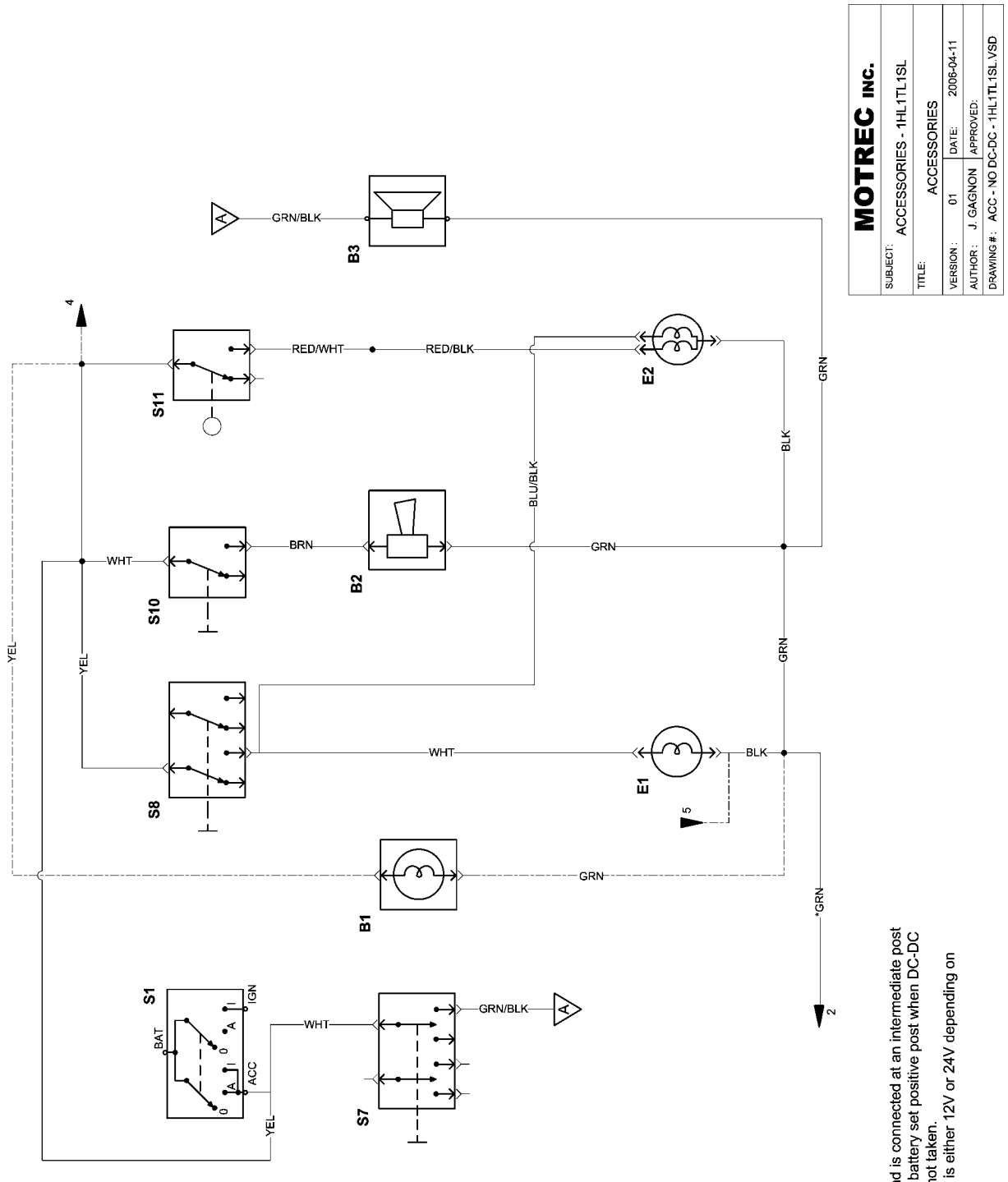


REF.	*PART NO*	*DESCRIPTION*
1		LOCK NUT 1/2-NC
2		FLAT WASHER 1/2
3	261403	BALL BEARING
4	2100012001	SPACER
5	123004	SPLIT RIM
		BOLT 5/16-NF X 5/8
		LOCKWASHER 5/16
		NUT 5/16-NF
6	123007	TIRE AND TUBE
7	2224012001	HUB
	112422	WHEEL STUD + NUT
8	1010001	DRUM
		BOLT 5/16-NC X 1
		LOCKWASHER 5/16
		NUT 5/16-NC
9	1222002	SPROCKET 54T (E-100 ONLY)
10	2201012002	SHAFT
11		BOLT 1/2-NC X 5 1/2 (E-12)
		BOLT 1/2-NC X 6 1/2 (E-100)

ELECTRICAL DIAGRAM – PMC MAIN CIRCUIT
DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL



ACCESSORIES – NO DC/DC CONVERTER
ACCESSOIRES – SANS CONVERTISSEUR DC/DC



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

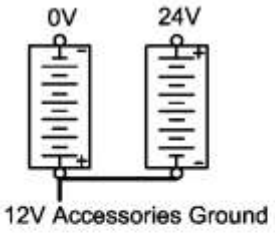
PARTS LIST

NO	DESIGNATION	REF	QTY
A3	SERIES SPEED CONTROL, 275A	367010	1
A4	1235 PM MOTOR SPEED CONTROL	3105012002	1
B1	STROBE LIGHT	*	
B2	HORN	*	1
B3	REVERSE ALARM	*	1
E1	HEADLIGHT	*	1
E2	TAIL/BRAKE LIGHT	*	1
F1.A,B	FUSE, 15A	246108K	2
F2	CIRCUIT BREAKER, 50A	106110	1
F4.A,B,C	DIODE	3107000001	3
G1	BATTERY		
G2	BATTERY CHARGER		1
M1 (E-12)	PERMANENT MAGNET MOTOR, 1/3HP	112406	1
(E-100)	PERMANENT MAGNET MOTOR, 1/2HP	124002	1
P1	INDICATOR (BDI), HOUR METER	*	1
R1 (E-12)	HANDLE ACCELERATOR	3125012001	1
(E-100)	FOOT PEDAL ACCELERATOR	2142100001	1
	MICROSWITCH	367002	1
	POTENTIOMETER	367003	1
	PLASTIC GEAR	367015	1
	SPRING	2462008	1
R4	RESISTANCE, 250 OHMS	367014	1
R5	RESISTANCE, 5 KOHMS	2869003	1
S1	KEY SWITCH	246205	1
S3 (E-100)	SEAT SWITCH	3109000003	1
	CONNECTOR	3109000004	1
S6 (E-12)	FOOT SWITCH	1269003	1
S7	FOWARD/REVERSE SELECTOR	266211	1
S8	LIGHT SWITCH, ROCKER TYPE	1269004	1
S10	HORN BUTTON	*	1
S11	BRAKE LIGHT SWITCH	246207	1
S15	EMERGENCY PUSH BUTTON	3109800001	1
	EMERGENCY PUSH BUTTON, LABEL	3109800006	1
S16	SPEED 1	3109100002	
S17	SPEED 2	3109100002	
X1	HOUR METER CONNECTOR		1
X4	PMC 1235 CONNECTOR		1
Y1	MAIN CONTACTOR – 24V	246111	1
Y2.A,B	F/R CONTACTOR – 24V	246230	2
	F/R BUSSBARS	2469003	1
	STATIC STRAP	2450001	1

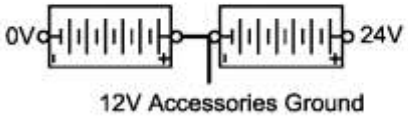
* Consult Motrec Illustrated parts

BATTERY CONFIGURATIONS - 24V
CONFIGURATIONS DES BATTERIES – 24V

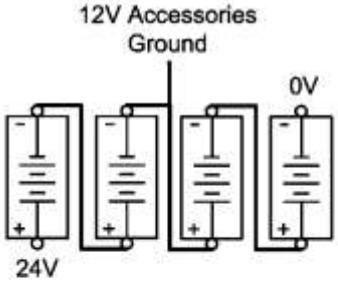
E-12



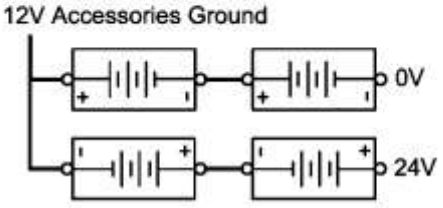
E-100



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

NO	*PART NO*	*DESCRIPTION*
1	3102240002	24V CHARGER (U.S. BATTERY)
	3102240003	24V CHARGER (LIFELINE BATTERY)
	3102240004	24V CHARGER (GEL 180AH BATTERY)
	3102240005	24V CHARGER (27TM BATTERY)
	3102302001	36V CHARGER (U.S. BATTERY)
	3102302002	36V CHARGER (LIFELINE BATTERY)
	3102302003	36V CHARGER (GEL 180AH BATTRY)
	3102480002	48V CHARGER (U.S. BATTERY)
	3102480003	48V CHARGER (LIFELINE BATTERY)
	3102480004	48V CHARGER (GEL 180AH BATTERY)
	3102720001	72V CHARGER (U.S. BATTERY)
2	3119000011	CONNECTOR C13
*	3120000001	PORTABLE CHARGER AC CORD
*	3120000002	BUILT-IN CHARGER AC CORD

* NOT ILLUSTRATED

QuiQ™ HF/PFC Battery Charger

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

delta-q TECHNOLOGIES
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 – voire le manuel. D'autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batteries peuvent produire des gaz explosives en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flame nue à proximité de ces derniers. Fournisser 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 desassembler le chargeur – referer toute reparations aux personnes qualifiés. 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	

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

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:
a) 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.**
b) Securely fasten the black ring terminal from the charger to the negative terminal ("-", "NEG", NEGATIVE") of the battery pack.
c) 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.

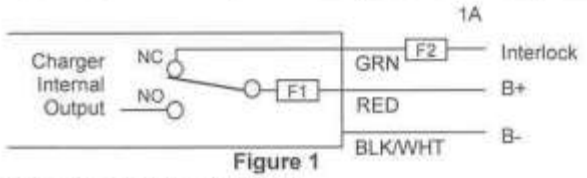


Figure 1

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:
a) Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
b) 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.
c) 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

Strobelight, polemount
Amber 12-80V: 3116000001
Red 12-80V: 2469001
Blue 12-80V: 3690008

Strobelight, cab mount
Amber 12-48V: 3116250001
Red 12-48V: 3069026
Blue 12-48V: 3069014
Amber 72-80V:3116720001
Red 72-80V: 3116720002
Blue 72-80V: 3116720003

Amber turn lamp
12V: 3111000022
Bulb 12V: 3069021
Multi-LED amber turn lamp
Round Light: 3111000010
Grommet: 3111000008
Plug: 3111000009

Red Tail/Brake light
Grommet: 3269001
Plug: 246012A
12V : 2469021
24V : 2469022

Red Tail/Brake light
** Model EE **
Assembly: 3111000030
Housing: 3111000027
Plug: 3111000029
12V : 3111000028

Red Tail/Brake light
Housing: 3069012R
Bulb 12V: 3117240001

Back-up lamp
Grommet: 3269001
12V: 3669012
24V: 3669012A

Clear lamp
12V: 3069012
Bulb 12V: 1269008

Pedestral head lamp
12V: 3111240001
Bulb 12V: 2569001B
Bulb 24V: 2169001B

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3111480006
Bulb Turn: 3111480008
Bulb Mark: 3111480007

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3117480001
Bulb Turn: 3117480003
Bulb Mark: 3117480002

Turn signal switch
246050

Multi-LED Red Tail/Brake
Light: 3111000006
Grommet: 3111000008
Plug: 3119000009

Multi-LED Back-up
Light: 3111000007
Strobe light: 3111000013
Grommet: 3111000008
Plug: 3119000009

Red Tail/Brake light
12V: 386002

Horn button VIP
2208224002

Horn button, column mount
3109000011

Horn button, dash mount
266210

Horn button 3109250001

Horn
12V: 246003
24V: 246013

Analog Voltmeter
12V : 3069007
24V : 2469002
36-48V : 3669002

HOBBS Gauge
24V: 2469026
36V: 3069038
48V: 4869037

DC-DC converter, 10A
12-48V: 3069019

DC-DC Converter, 25A
12-48V: 3124000002
72-80V: 3124880001

DC-DC Converter, 300W
24V: 3124224001
36-48V: 3124280001
72-80V: 3124880001

CONNECTOR:3124280002

Wiper motor
12V: 3113000001
24V: 486211

Wiper arm 2800000001

Wiper blade
14" Blade: 2800000002
18" Blade: 2800000003

Pantograph wiper arm
246233A

Pantograph wiper blade
246233

Cab heater
12V: 3103300001
36V: 3669008
48V: 4869020

12V Dome light 3669006

12V Fan 3669013

Limit switch
3109000029

Headlamp 12V:3111250007

Headlamp
12V: 3111300001
Bulb 12V: 3111300002

Red Pilot light
12V: 246212
Bulb 12V: 246212B

Back-up alarm or
Motion beeper
12-48V : 3100000001
72-80V : 3105720001

12-24V Adjustable ECCO:
3100000002

12-48V Adjustable PRECO:
3100000004

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 +