# MOTREC

# E-100



# OPERATOR AND MAINTENANCE MANUAL SPARE PARTS LISTS INCLUDED

SERIAL NUMBER : 1032544 & UP

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# **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.

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# **INSTRUCTIONS**

#### SAFETY WARNINGS FOR OPERATORS

- FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAIN 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 ASME/ANSI B56.8 & B56.9 regulations 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**

The owner shall ensure that the operator understands the operating characteristics of this vehicle, and obeys the safety instructions in this manual and ANSI B56 standard. Do not drive this vehicle unless you are a certified operator as required by OSHA.

#### **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

#### **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.

#### FOOT BRAKE PEDAL:

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

#### PARKING BRAKE:

Depress brake pedal and pivot to lock brakes. Check pedal lock. Never park the vehicle on an incline. Turn off switches, set to neutral, set parking brake, remove 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 ASME/ANSI B56.8 & B56.9 regulations 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.

# **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:



General security warning label:

<b>A</b> WARNING !	Failure to follow these instructions may result in severe injury.
Operation of this vehicle is rest	tricted to authorized persons only.
Read operator's instructions in	owner's manual prior to driving.
Do not operate on roads, public	c streets and unauthorized areas.
Never open battery compartme	ent. Never open motor compartment.
Warn people to stay away from	n wheels and moving or lifting parts.
Never exceed specified max sp	peed, cargo or passenger capacity.
Drive slowly on ramps, in turns	6, in reverse. Avoid loose cargo.
Before turning on key switch, a	and while moving, be sure that:
• occupants remain seated v	with seat belt buckled, if applicable;
• occupants keep all their bo	dy parts inside vehicle;
• occupants keep holding on	hand rails;
• wheel chair, if applicable, if	s secured with tie-down straps;
• trailer attachment, if applic	able, is secured with two chains.
Before leaving this vehicle, par	ck on a flat surface, set to neutral,
set the parking brake, turn off a	all switches, and remove the key.

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









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

#### **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.



#### MECHANICAL BAND BRAKES

When the brakes are properly adjusted, the clearance under the pedal should be 2 inches from the floor when the brakes are applied. The rear wheels will also brake equally. To adjust the brakes, turn the yoke (13) as required.



# **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 PMC MOTOR CONTROLLER

# MANUAL

# CURTISPIC 1204/5 MOTOR CONTROLLERS

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

# CURTIS

#### **CURTIS PMC**

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1204 / 1205 Manual p/n 98690, Rev. B: May 1999

# WIRING

#### **CONNECTIONS: Low Current**

Three 1/4" push-on terminals are provided for the low current connections to the KSI and throttle inputs.

For the control wiring, 0.75 mm<sup>2</sup> (#18 AWG) vinyl insulated stranded wire is recommended.



#### **CONNECTIONS: High Current**

Four tin-plated solid copper bus bars are provided for the high current connections to the battery and motor:



( M-	output to motor field
В-	negative connection to battery
B+	positive connection to battery and to motor armature
A2	plug diode to motor armature

The cables used for the battery and motor connections must be heavy enough to carry

the high current required. A minimum size of 25 mm<sup>2</sup> (#4 AWG) is recommended. Rubber insulated welding cable is convenient to work with because of its flexibility.

Connections to the controller bus bars should be made with lugs suitable for the cable used, fastened by M8 (5/16") bolts and nuts. When tightening the bolts, two opposing wrenches should be used. Failure to use the double-wrench technique could cause undue strain to be placed on the internal connections, and could also result in cracked seals around the bus bars.



**Fig. 6** *Basic wiring configuration, Curtis PMC 1204/1205 controller.* 

#### WIRING: SERIES MOTORS

Figure 6 is a schematic of the configuration shown in Figure 5. Wired this way, the vehicle will plug brake if the direction is changed with the vehicle moving and the throttle applied. Reversing is accomplished via two single-pole, double-throw (2×SPDT) contactors. Coil suppression diodes should be used on the main and forward/reverse contactors.

#### KSI Wiring

The keyswitch input (KSI) circuit includes input from the keyswitch and from the various interlocks. The controller KSI is used to turn the controller on and off. KSI is turned on by connecting it to battery B+. Any positive voltage greater than about 8 volts will turn on the controller, but usually the full vehicle battery voltage is used. KSI draws only a very small current (a few mA).

In its simplest form, KSI is operated by a keyswitch that turns the vehicle off and prevents unauthorized use. The keyswitch should also

# 4

# **MAINTENANCE & ADJUSTMENT**

Curtis 1204/1205 controllers and potboxes require only minimal maintenance if properly installed. NOTE: The controllers are sealed and thus are not field serviceable.

#### CONTROLLER

#### Maintenance



It is recommended that the following two steps be performed occasionally. **First remove power by disconnecting the battery, and discharge the capacitors in the controller** (with a light bulb or a 2–10  $\Omega$ , 25 W resistor connected for a few seconds across B+, B-). Follow good safety practices: get the vehicle drive wheels off the ground, wear safety glasses, and use insulated tools (*see page 2*).

- Make sure the electrical connections to the controller (and to the motor, contactors, etc.) are tight. When checking the controller bus bar connections for tightness, use two opposing wrenches. This double-wrench technique will help avoid putting stress on the bus bars, which could crack the seals. Always use insulated wrenches.
- 2. Inspect all seals at the front and back of the controller. If necessary, use a moist rag to wipe these areas clean enough so that you can see the seals. Look for cracks and other signs of seal damage.

If the seals are intact, clean the controller thoroughly either by washing it off or by wiping it clean with a moist rag. **Power must not be reapplied until the controller terminal area is completely dry.** 

If the seals have been damaged, there are several possible causes. Perhaps the double-wrench technique was not used when the cables were installed. Perhaps the vehicle's environment requires that the controller be better protected: either by mounting it in a different location, or by installing a protective cover.

**Damaged seals can lead to faulty operation.** We strongly recommend replacing controllers that have faulty seals.

#### **Adjustment**

pots.

On some models, the plug braking current and acceleration rate settings are adjustable. On these adjustable controllers, the adjustment pots are located as shown in Figure 18.



Use the following adjustment procedure. The keyswitch should be off during adjustment.

- 1. Remove the socket head screw (1/8" Allen) for the adjustment you want to make.
- 2. Adjust the internal potentiometer using a small insulated screwdriver (available from Curtis).
- 3. Replace the socket head screw and nylon seal washer. To prevent stripping, do not over-tighten.

### SPARE PARTS





REF	PART NO	DESCRIPTION
NLT.		DESCRIPTION

- **2** 120003 TRIM
- **3** 2339100001 REAR COVER
- 4 1005003 BUCKET SEAT WITH SLIDE ADJUSTERS
- **5** 1007001 FRONT 410-6 WHEEL 4P, SPLIT RIM
  - 1207001 REAR 410-6 WHEEL 4P, SPLIT RIM
- 6 2500250002 DASH PLATE

# **BRAKE CONTROLS**



REF	PART NO	DESCRIPTION
1	242800	RUBBER PEDAL
2	242802	LATCH
3		COTTER PIN
4		CLEVIS PIN 1/4 X 1 1/2
5		COTTER PIN
6	242806	SPRING
7	242807	LEVER
8	242808	PIVOT
9		BOLT 1/4-NC X 3/4
10		LOCKNUT 1/4-NC
13	122813	YOKE 3/8

REF	PART NO	DESCRIPTION
14		BOLT 5/16-NC X 1
15		FLAT WASHER 5/16
16	242816	SPRING
17	242817	LUBRIFICATION FITTING
18		LOCKNUT 5/16-NC
19		CLEVIS PIN 3/8 X 1
20		COTTER PIN
21	122821	ROD
25	122825	BAND BRAKES
26	122826	ADJUSTING SCREW

# FRONT AXLE



REF.	PART NO	DESCRIPTION
5	123008	BALL BEARING
22	123017	FRONT SPLIT RIMS
23	121410	FRONT SPACERS KIT
24	121409	BOLT 5/8-NC X 7
25	123007	TIRE AND TUBE
27		LOCKNUT 5/8-NC

HANDLE BAR



REF.	PART NO	DESCRIPTION
1	121401	HANDLE BAR
2	241402	HANDGRIPS
4		BOLT 3/8-NC X 2
5		LOCKNUT 3/8-NC
6	210000002	BUSHING
7	121407	WASHER
8	121408	FORK

# **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
6	123007	TIRE AND TUBE
7	2224012001	HUB
8	1010001	DRUM
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)

#### **MOTOR AND DRIVE**



#### REF. PART NO DESCRIPTION

1	1250001	TWO MOTOR BRUSHES
	1250002	TWO MOTOR SPRINGS
	124002	1/2 HP MOTOR 24V.
	124001A	3/4 HP MOTOR 24V.
2	122422	DRIVE MOUNT
3	122423	SHAFT
4	122424	PILLOW BLOCK
5	122405	SQUARE KEY 3/16
6	122425	SQUARE KEY 3/16
7	122426	SPROCKET, TO SPECIFY
8	122427	PULLEY, SPECIFY DIA.
9	122428	PULLEY, SPECIFY DIA.
10	122429	BELT, SPECIFY PULLEY
11		BOLT 3/8-NC X 1 1/4
12		LOCKNUT 3/8-NC
13	1022002	CHAIN



### <u>ELECTRICAL DIAGRAM – SERIES MAIN CIRCUIT</u> <u>DIAGRAMME ÉLECTRIQUE – CIRCUIT PRINCIPAL SERIES</u>



**ACCESSORIES – NO DC/DC CONVERTER** 

\* 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
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	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	310900003	1
	CONNECTOR	3109000004	1
S6 (E-12)	FOOT SWITCH	1269003	1
<b>S</b> 7	FOWARD/REVERSE SELECTOR	266211	1
S8	LIGHT SWITCH, ROCKER TYPE	1269004	1
S10	HORN BUTTON	*	1
S12	BRAKE LIGHT SWITCH	246207	1
S15	EMERGENCY PUSH BUTTON	3109800001	1
	EMERGENCY PUSH BUTTON, LABEL	3109800006	1
X1	HOUR METER 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	0V 24V 111111111111111111111111111111111111
E-100	0Vofi
E-260 E-262 E-270 E-272	12V Accessories Ground 0V 12V Accessories 0V 12V Accessories 12V Access
E-240 E-242 E-242 HD E-250 E-250HD	12V Accessories Ground $ \begin{array}{c}                                     $



#### **BUILT-IN OR PORTABLE 15A CHARGER**

#### Parts list for LESTRONIC II charger MODEL 09678 TYPE 24LC15-2ET 115 VAC 60 Hz

#### PART NO DESCRIPTION

09625S	CASE ASSEMBLY
09262S	TRANSFORMER ASSEMBLY
16354S	HEATSINK ASSEMBLY, WITH DIODES
02563S	AMMETER
09662S	ELECTRONIC TIMER ASSEMBLY (RELAY – 04483S)
04142S	CAPACITOR, 3.0 MFD, 660 VAC
03837S	FUSE ASSEMBLY
03894S	BUSHING, 7W-2, INSULATOR FOR CORDSETS
03822S	CORDSET, AC 102"
07239S	CORDSET, AC 15"
20324S	CORDSET, DC, NO PLUG 44"
08513S	CORDSET, DC, NO PLUG 108"
14973S	CORDSET, DC, WITH SILICONE PLUG
09331S	CORDSET, DC, WITH LESTER PLUG
09491S	CORDSET, DC, WITH 50 AMP ANDERSON PLUG, GREY
12041S	CORDSET, DC, WITH 50 AMP ANDERSON PLUG, RED
08695S	CORDSET, DC, WITH 175 AMP ANDERSON PLUG
16106S	CORDSET, DC, WITH 30 AMP POWER POLE PLUG
08313S	PLUG ASSY, DC, 50 AMP ANDERSON PLUG, GREY
04087S	PLUG ASSY, DC, 50 AMP ANDERSON PLUG, RED
02957S	PLUG ASSY, DC, 175 AMP ANDERSON PLUG

#### **DELTA-Q HF CHARGER**





#### NO PART NO DESCRIPTION

- 1
   3102240002
   24V CHARGER (U.S. BATTERY)

   3102240003
   24V CHARGER (LIFELINE BATTERY)

   3102302001
   36V CHARGER (U.S. BATTERY)

   3102302002
   36V CHARGER (LIFELINE BATTERY)

   3102480002
   48V CHARGER (U.S. BATTERY)

   3102480003
   48V CHARGER (LIFELINE BATTERY)
- 2 3119000011 CONNECTOR C13



**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.deita-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

- Always use a grounded outlet. When using an extension cord, avoid excessive voltage drops by using a grounded 3-wire 12 AWG cord.
- 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 2 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).
- 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).
- 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 4. 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.
- A low current "finish-charge" phase is next applied to return and maintain maximum battery capacity (Models 912-xx0x will flash the '100%' LED). 5
- 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.
- 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

- 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.
- Make sure charger connections to battery terminals are tight and clean. 2.
- 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	Spe	ecific to sel	ected algorit	hm	
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 (1	0 LED)	xx1x (*	1 LED)	
AC ON	Solid YI	ELLOW	LED #	Active	
AC LOW	Flash Y	ELLOW	Flash YELLOW		
Thermal Cutback	Flash B	argraph	1 Flash YELLO		
<80% Charge Indicator			Short Flash GR		
>80% Charge Indicator	Solid YI	ELLOW	Long Flash GR		
100% Charge Indicator	Solid GREEN So			REEN	
Fault Indicator	Flash RED Flash F			RED	
DC Ammeter	LED Bargraph -				
Bat Temp Compensation	Automatic Optional				
Advision and Advide	Auto rea	1011010	11/2 00 -	on means the state	

#### 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/

#### 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  $\pm$ ) 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.

#### Mechanical

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				



#### 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.

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.

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.					

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.

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. Aug 2006 © Delta-Q Technologies Corp. All rights reserved. PN: 710-00xx Rev 1 V1.16

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#### **MOTREC ILLUSTRATED ACCESSORIES**





#### **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.

А	В	С	D	E	F	G	Н	Ι	J	Κ
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.

