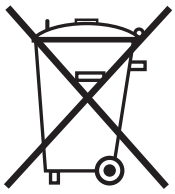
FS5 & FS9
XHF Series Charger
Operator / Installer Manual

⚠ WARNINGS

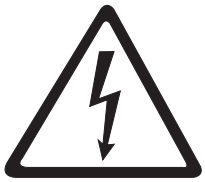
Keep open flames away from batteries on charge.

Risk of battery explosion.

Be aware of battery fumes and electrolyte.



Do not dispose of batteries in the garbage.



Electrical hazard exists inside the charger, do not remove the side cover.

Always recycle lead acid batteries.

Battery electrolyte is highly corrosive.

Wear eye protection when working near batteries.

CAUTION

Risk of Fire
Use only on circuits with 35A (FS5) or 50A (FS9) branch circuit protection in accordance with the National Electric Code NFPA 70.

Contents

Charger Serial Number	
Charger Part Number	
Date Supplied	
Vehicle Model	
Purchaser	
Purchase Invoice Number	
Fleet Number	

Overview

1. Controller Display
2. Controller Push Buttons
3. AC Input (Rear)
4. Mini USB Port
5. STOP Switch
6. Small LED Indicators
7. READY/CHARGING Indicator Lights
8. Filter Cover Assembly
9. DC Output

FS5 & FS9 XHF Series Charger

Installation

Location

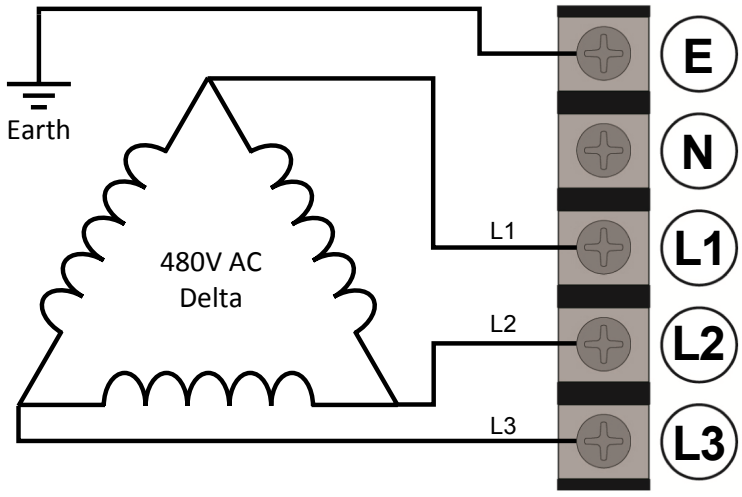
The recommended installation is where the charger(s) can be located at ground level or on a raised platform, protected against accidental contact with the lift truck or its forks. Installation above ground level is recommended to reduce the level of dust ingested by the charger.

AC Input

The FS5 and FS9 chargers require 480V, 3 phase AC supply. Care must be taken to install your charger with the appropriate rated AC supply cable.

Refer to the rating label on your charger for AC supply requirements specific to your configuration.

AC Supply Wiring Configuration



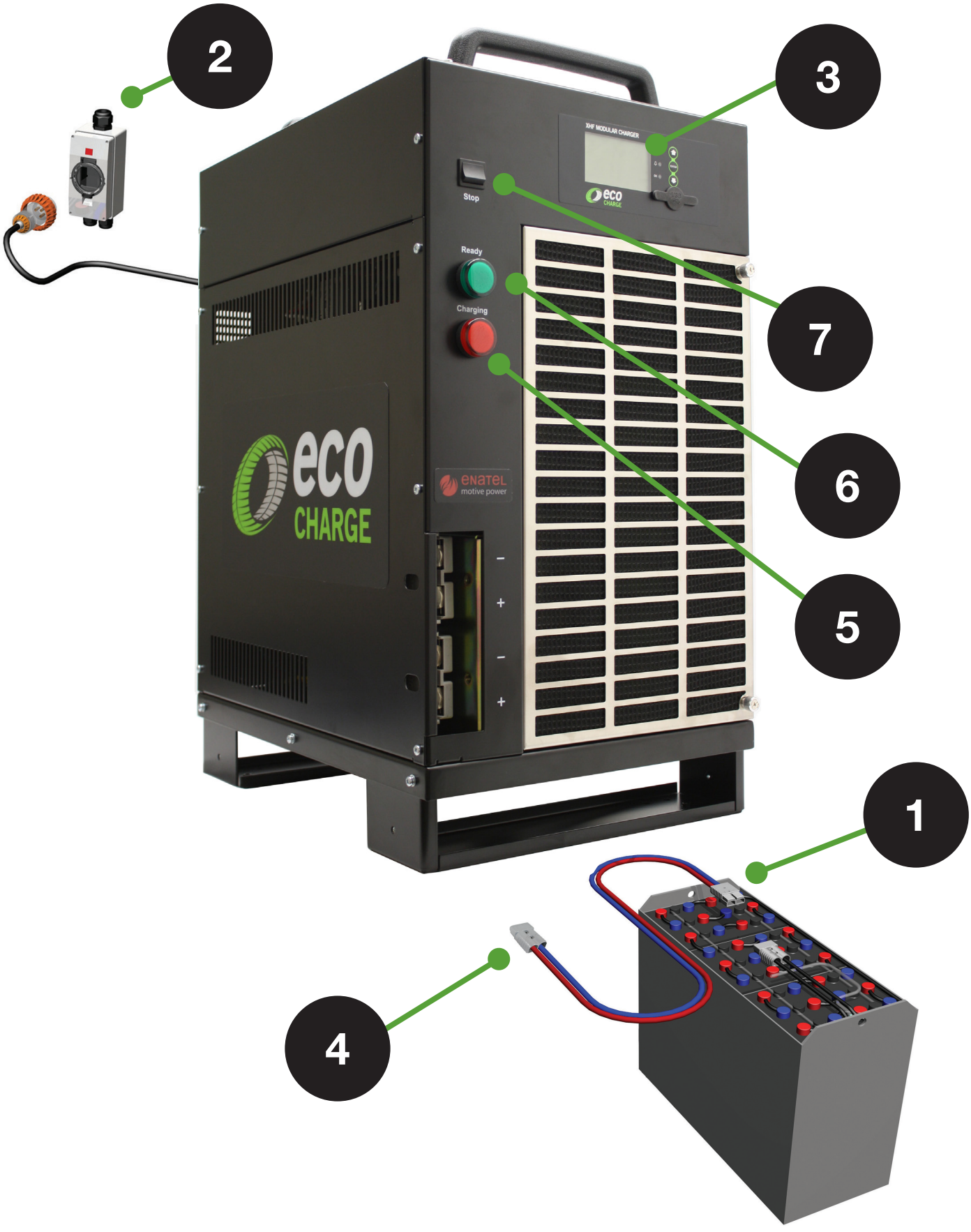
Note: It is common in the US that a fourth wire (neutral) be used in a triple phase circuit. If present, it should be attached to the “E” terminal.

Operation

The XHF Series charger can be paired with a battery-mounted module* allowing automatic charge-configuration of the charger as well as additional data logging features. The battery module is required for any FS9 charger, or any charger configured for Fast or High Rate charging. Refer to your battery module manual for correct installation and operation of your battery module with this charger.

1. Check the battery leads are in good condition before proceeding.
2. Plug the charger in and turn on the AC supply.
3. Check that the Voltage, Ampere-Hr and Battery Type indicated on the charger display is appropriate for the battery to be charged. BMID equipped batteries will automatically configure the charger provided the charger has APC configuration enabled.
4. Connect the battery to the charger using the correct cable.
5. The red ***CHARGING*** light will illuminate to indicate charging has commenced.
6. When the green ***READY*** light illuminates, charging is complete.
7. Press the ***STOP*** switch at any time to stop the currrent charge.

* A battery module may be either an Automatic Profile Configuration (APC) module or a Battery Monitoring Module (BMM).


2
3
7
6
5
1
4
XHF MODULAR CHARGER
eco CHARGE
Stop
Ready
Charging
enatel motive power
eco CHARGE
−
+
−
+

Front Panel

1 **Controller display**
Displays information depending on the status of the charger.

2 **Controller push buttons (Set Equalize Charge)**
To enable equalize next cycle, plug in the battery but stop the charge by pressing the STOP Switch:
- Press ⬆ button to set equalize next cycle
- Press ENTER to allow changing
- Press ⬆ to select “Enable”
- Press ENTER to accept change
- Press ⬇ to select “Store”
- Press ENTER to accept
- Press ⬇ to return to “Connect Battery”
- Press the main switch to start the charge.

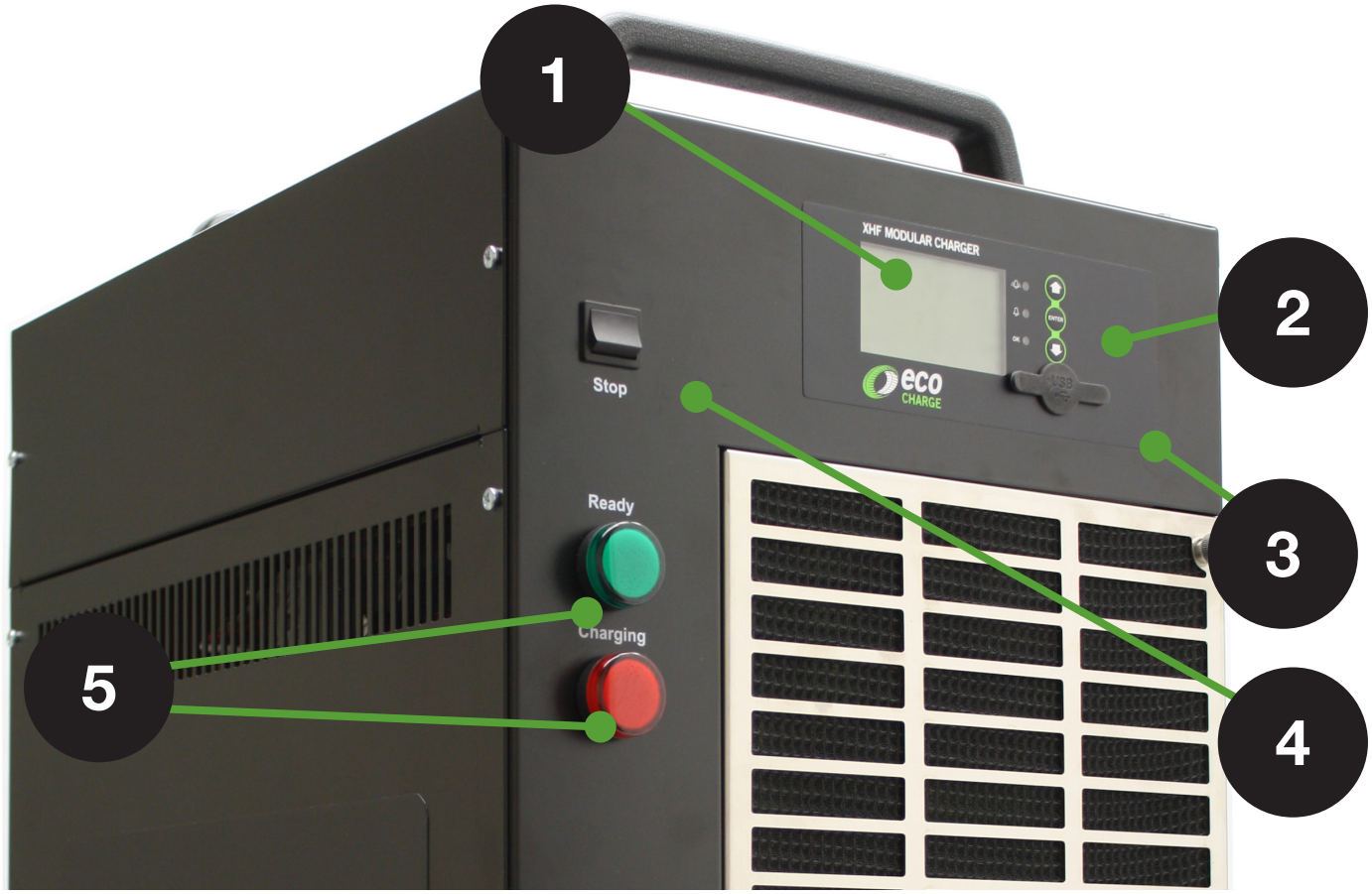
3 **Mini USB port**

4 ***STOP* momentary switch**
Press to Stop/Start.
Default position: Start.

5 ***READY/CHARGING* indicator lights**
RED steady on, GREEN off = Charging.
RED off, GREEN steady on = Charge complete.
RED flashing, GREEN off = Non-Urgent Alarm.
RED flashing, GREEN flashing = Urgent Alarm.

When a Non-Urgent Alarm is indicated the charge cycle has still completed and in most cases can be disregarded.

When an Urgent Alarm is indicated, the charge cycle has not been completed and the occurrence should be reported to a supervisor.



RED LED same as RED indicator.

AMBER LED same as GREEN indicator.

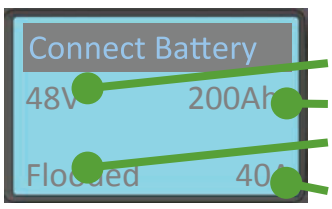
GREEN LED illuminates when charger is powered up.

UP button.

ENTER button.

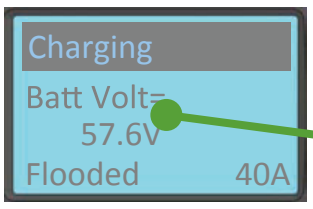
DOWN button.

Display when no battery connected or charge has been stopped with switch.



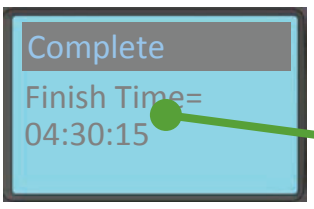
Config:
Voltage
Amphrs
Profile
Current

Display when charging.



Rolling Display:
Current=
Amphr=
Charge Time=
State=
Batt Volt=
Cell Volt=

Display when charge complete.



Rolling Display:
Charge Time=
Bulk Time=
Finish Time=
Termination=
Batt Volt=
Cell Volt=
Finish Volt=
Amphrs=

Configuration Settings

Charge Profiles Available:

Conventional Charge IUIa/IEI
Opportunity Charge
Fast Charge (battery module required)

Battery Types: Flooded, Sealed, Gel.

Environments: Standard, Freeze/cold condition.

Cable Length: Combined charger and battery cable length in metres.

Equalize Charge Settings:

Cycle count: Adjustable to any number. Default setting is to equalize charge after every 5 complete charge cycles.

Day/time: Select day and time of the week to trigger an equalize charge on the next charge cycle. Can also select to have it equalize charge every other week.

Manual equalize: Select to have an equalize charge run from the display panel.

Contact your local EcoCharge Dealer for assistance with the adjustment of these settings.

Ampere-Hour Ranges:

	FS5		FS9	
	Low limit (Ah)	**Upper Limit (Ah)**	**Low limit (Ah)**	**Upper Limit (Ah)**
Conventional Profile (16A/100Ah)				
24V	300	1875	300	3375
36V	300	1875	300	3375
48V	300	1575	300	2810
72V	300	940	300	1690
80V	300	940	300	1690
Opportunity Profile (25A/100Ah)				
24V	300	1200	300	2160
36V	300	1200	300	2160
48V	300	1000	300	1800
72V	300	600	300	1080
80V	300	600	300	1080
Fast Profile (40A/100Ah)				
24V	300	750	300	1350
36V	300	750	300	1350
48V	300	625	300	1125
72V	300	375	300	675
80V	300	375	300	675

Charger Alarms

Main Switch	Inlet Filter	Low Mains	Mains Fail
Non-Urgent Module Fail	Urgent Module Fail	Module Fan Fail	Module Over Temperature
Configuration Error	Output Fuse	No Output Current	Monitor ADC Fail
APC Communications Fail	APC Water Level Low	APC Voltage Imbalance	

Main Switch. Urgent Alarm, shows the status of the front panel STOP switch.

Inlet Filter. Non-Urgent Alarm, can give warning as to when the inlet filter needs servicing but is not enabled by default.

Low Mains. Non-Urgent Alarm, gives an indication of variation in the input mains voltage without actually affecting the ability of the charger to provide rated output. Can also indicate a charger module being overloaded.

Mains Fail. Urgent Alarm, a mains loss situation and the charge cannot proceed.

Non-Urgent Module Fail. Non-Urgent Alarm, there is a charger module that is not providing output but the charger is still operating, but redundancy has been lost.

Urgent Module Fail. Urgent Alarm, if the number of charger modules not providing output equals or exceeds the setting for urgent module count in the monitor tab then the charger will stop. If urgent module count is set to one then the charger is configured without redundancy and a single fault will interrupt the charge cycle.

Module Fan Fail. Non-Urgent Alarm, in the event of a complete failure of the cooling fans the effected module will back off the maximum output current available to level where natural convection of heat will allow the module to continue operating.

Module Over Temperature. Urgent Alarm, normally related to a blocked filter or restricted exhaust air or installation in an inappropriate location.
Configuration Error. Urgent Alarm, the charger cannot meet the target current

required by the controller even with all fitted charger modules operating or the configuration does not meet the limits set for the selected AC supply.

Output Fuse. Urgent Alarm, a blown fuse in nearly all cases is caused by connecting a reverse polarity battery to the charger. When a fuse is blown, check all batteries for reverse cable connection. A common problem is with first charge of shift batteries that have not been previously tested in a lift truck. After replacing a battery or charger cable always closely check the polarity before plugging the battery onto the charger.

No Output Current. Urgent Alarm, the charger is not providing the expected output current. Generally related to a premature disconnection of the battery, but also could be an incorrectly inserted charger module.

Monitor ADC Fail. Urgent Alarm, internal watchdog of the controller's micro-controller indicating a major fault and potentially unpredictable behaviour if the charger is left running.

APC Communications Fail. Urgent Alarm, the APC module has failed to communicate with the charger.

APC Incorrect Voltage. Urgent Alarm, the charger cannot produce the voltage required by the APC.

APC Unknown Charger. Urgent Alarm, the charger cannot find the required profile required by APC.

APC Water Level Low. Non-Urgent Alarm, for APC equipped batteries, indicates the APC Electrolyte Sensor has detected a low level of electrolyte.

APC Voltage Imbalance. Non-Urgent Alarm, for APC equipped batteries, indicates the midpoint voltage varies from nominal by more than 0.5V. APC will schedule an equalize charge to rectify this variation.

Battery Alarms

Over Discharged Battery	Bulk Charge Timeout	Minimum dV/dt	+dI/dt
Deeply Discharged Battery	Finishing Charge Timeout	Maximum Cell Voltage	Minimum Current
Sulphated Battery	Battery Disconnected	Batt Over Temp - Start	EQ/Refresh Timeout
Incorrect Battery	Reversed Battery	Batt Over Temp - Charge	

Over Discharged Battery. Urgent Alarm, the battery is still under 1.9V per cell after 30 seconds of charge which indicates a faulty battery that needs investigation.

Deeply Discharged Battery. Non-Urgent Alarm, the battery at start is under 1.9V per cell but recovers within 30 secs of charge, normally comes up when the battery is quickly unplugged from the lift truck and plugged into the charger.

Sulphated Battery. Urgent Alarm, deactivated by default.

Incorrect Battery. Urgent Alarm, the battery voltage is inappropriate for the configuration of the charger and cannot be charged without reconfiguring the charger to suit the battery. Note: An incorrectly configured APC can cause this alarm.

Bulk Charge Timeout. Urgent Alarm, the battery has exceeded the maximum time allowed for the initial constant current bulk charge phase. Could indicate a faulty battery or the charger configuration is not correct for the size of battery to be charged. May need additional charger modules added to the charger.

Finishing Charge Timeout. Non-Urgent Alarm, the battery has exceeded the maximum time allowed for the finishing part of the charge cycle. Generally not a major problem and indicates the battery did not quite perform as expected. Not uncommon with new batteries that are still cycling up to full capacity (allow 10 cycles) however if the alarm is a regular occurrence it needs investigation and possible adjustment of the charger or service of the battery.

Battery Alarms - continued

Battery Disconnected. Urgent Alarm, the battery has been unplugged before charge cycle has completed. This can damage the battery connector and increase risks of battery explosions as sparks around batteries at their top of charge whilst gassing can be very dangerous. If the battery needs to be disconnected during a charge cycle, the switch must be pressed to STOP. This will stop the charge and log a partial cycle in the charge log but allows safe disconnection of the battery.

Reversed Battery. Urgent Alarm, a battery with positive and negative cables reversed has been connected to the charger. Generally this will also cause an output fuse alarm and the need to replace the charger's DC output fuse(s). Such a situation is not covered by warranty as new batteries should always first be checked for correct polarity BEFORE plugging onto the lift truck or a charger.

Minimum dV/dt. Non-Urgent Alarm, details the change in battery voltage over time. The alarm occurs when the change in voltage exceeds the value set in profile settings. This alarm also indicates the termination of a successful charge.

Maximum Cell Voltage. Non-Urgent Alarm, occurs when the voltage per cell exceeds the value set in the profile settings. Typically 2.7V per cell for lead acid batteries.

Batt Over Temp - Start. Urgent Alarm, occurs when the battery temperature measured before a charge profile starts exceeds the value set in the controller settings. This alarm will not allow the charge profile to continue.

Batt Over Temp - Charge. Non-Urgent Alarm, occurs when the battery temperature measured during a charge profile exceeds the value set in the controller settings. This alarm will not allow the charge profile to continue.

+dI/dt. Urgent Alarm, occurs when the measured current in the constant voltage stage is rising instead of falling. This alarm will terminate the charge profile.

Minimum Current. Non-Urgent Alarm, occurs when using a IU profile and the current in the constant voltage stage falls below the value set in the profile settings. This alarm will not stop a profile and is considered normal for some types of batteries.

Troubleshooting

Problem	Possible Cause	Remedy
Inlet Filter Alarm	Air inlet filter blocked.	Clean the filter.
Low Mains Alarm	AC mains supply is low or charger modules may be overloaded.	Check configuration of the charger suits the application.
Non-Urgent Module Fail Alarm	Charger module not providing output, there is capacity to charge at a reduced rate.	Replace the faulty charger module(s).
Urgent Module Fail Alarm	Faulty charger modules are affecting the ability of the charger to charge the battery.	Replace the faulty charger module(s).
Module Fan Fail	Faulty charger module fan.	Replace charger module.
Module Over Temperature	Charger module is overheating.	Check air inlet filter is not blocked, check the charger is installed without any obstructions to air inlet and outlet.
Configuration Error	Charger cannot provide the target output current.	Check the controller configuration matches the quantity of power modules installed, add charger modules if necessary. BMID/battery requires more current than modules or AC supply can support.
Output Fuse	Blown output fuse.	Check battery polarity. Replace blown fuse.
No Output Current	Charger failing to provide the required current.	Check operator has not been unplugging battery mid charge cycle or the charge profile has allowed the battery current to fall below 0.7A.
Monitor ADC Fail	Faulty MPC35 controller module.	Replace the MPC35 controller module ensuring the replacement is correctly configured.

Troubleshooting - continued

Problem	Possible Cause	Remedy
Low Output Current	Only one battery cable connected (FS9).	Ensure two battery cables are connected (FS9 only).
Over Discharged Battery	Battery is <1.9Vpc at connection but recovers within 30 seconds of charge.	Allow approximately 1 minute between truck-battery disconnect and charger-battery connect. Regular occurrences might need investigation of work practices.
No Output Current	Battery unplugged during charge. Charge profile allows current to fall below 0.7A	Ensure battery has not been unplugged before charge completion. Check that the charge profile is appropriate for the battery type.
Deeply Discharged Battery	Battery is still <1.9Vpc after 30 seconds of charge.	Check battery for faults.
Incorrect Battery	Battery is not the correct voltage for the charger.	Check the configuration matches the battery.
Bulk Charge Timeout	The bulk charge part of the cycle is longer than expected.	Check the charger configuration matches the battery, check the battery for problems.
Finishing Charge Timeout	The finishing charge part of the cycle is longer than expected.	Check that the charger configuration matches the battery, regular timeouts may indicate a problem with the battery.
Battery Disconnected	Battery has been disconnected during a charge cycle.	Charge must be stopped using the main STOP switch.
Reversed Battery	A reverse polarity battery has been connected to the charger.	Correct the incorrect battery wiring and replace the blown charger output fuse(s).

Maintenance

Provided it is correctly installed in an appropriate location and is not abused, the charger will require little maintenance. The only requirement is to monitor the air inlet filter at the front of the charger for dirt accumulation. The charger modules internal to the charger housing require a good supply of cooling air during the charge cycle and a blocked filter will affect the cooling. A blocked filter could lead to the charger turning down its maximum output to prevent overheating of the charger modules. An extremely blocked filter could cause longer charge times, inability to charge the battery correctly or premature wear of the charger modules.

Service Interval

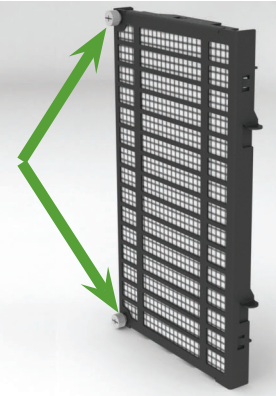
The recommended service interval is 6 months but this will vary depending on the location of the charger and the number of charge cycles performed. The fans in the charger modules only run during charging and are speed controlled. If the charger output is small the fans will only be turning slowly. At full power there is a considerable requirement for cooling air and the fans will be working hard with considerable hot air being exhausted from the rear of the charger. The exhaust air from the rear of the charger should never be restricted. The intermittent nature of the fans results in a long fan service with no scheduled replacement of fans being required.

Intake Filter

The filter material is an electrostatic polypropylene type that is easy to clean with compressed air to blow out any accumulated dirt and dust. Before attempting to clean the filter it is necessary to remove it from the housing by unscrewing the two captive screws and unhinging the filter from the housing. The electrostatic filters provide a good compromise between filtering and clogging, but a small quantity of dust will enter the charger modules during normal operation. A small quantity of dust in the charger modules will generally not cause problems, however excessive accumulation or where the material ingested is corrosive, conductive or wet will cause issues, resulting in premature wear of the charger modules.

Removing the filter from the housing.

1. Unscrew the 2x captive screws and unhinge the filter from the housing.



2. Blow out any dirt & dust buildup with compressed air to clean the filter.

Spare Parts

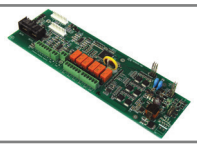
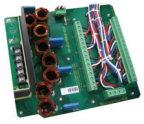
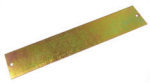
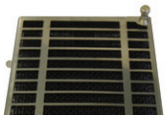
Image	Description
	MP330 Module
	SM31 Large Display Assembly
	MPC35 Main Board Assembly
	300A Current Shunt
	Current Sense Loom
	Voltage Sense Loom
	FS5-9 AC Filter Board
	Auxiliary PSU
	Stud Diode 240A 400V
	Fuse HRC180A 150VDC 240VAC
	Front Control Panel Membrane
	USB Hole Plug

Image	Description
	FS5 Cabinet
	FS9 Cabinet
	Blanking Plate - Module Bay
	Welded Filter Assembly
	Front Panel Green Indicator
	Front Panel Red Indicator
	Front Panel Switch - Momentary
	Front Panel Switch - Toggle

Service & Warranty

Service

If both the RED and GREEN indicators are flashing there has been an Urgent Alarm that has prevented the charge cycle from completing. Take note of the error displayed on the display and contact your nearest EcoCharge Dealer for instruction.

If the RED indicator is flashing, but the GREEN indicator is on steadily, the charge has completed satisfactorily but with a Non-Urgent Alarm. Contact your local EcoCharge Dealer only if this is occurring on a regular basis.

Warranty

EMP warrants that the product is free from defects in material and workmanship and agrees to remedy any defect (or at its option replace the product) for a period of one year from the date of purchase. This warranty covers both parts and labour. Parts may be replaced under this warranty with new or remanufactured parts.

This warranty will not apply to any product that has been improperly installed, misused, abused, used in ways the product was not designed, altered or repaired in any way which may affect the performance or reliability of operation, sustained damage by power surges or electrical storms, or sustained shipping damage, or repaired by any unauthorised repair centre.

Please contact EMP Customer Service to obtain a Returned Materials Authorisation (RMA) prior to shipping any products for repair. All shipments must be shipped prepaid and include proof of the date of your original purchase. Please include your name, address, phone number, email address and a brief description of the problem.

EMP makes no other warranties, express or implied, including any warranty of fitness for a particular purpose. In no event shall EMP be responsible for indirect or consequential damages or lost profi ts even if EMP Ltd has been advised of the possibility of such damages. EMP's sole obligation shall be the repair or replacement of a nonconforming product.

Specifications

FS5 & FS9 Cabinet

Dimensions (in / cm): 13.40W x 18.0D x 26.00H / 340W x 45.7D x 66.0H

Weight (lbs / kg):

Empty:	71.0	/ 32.2 (approx.)
FS5 (5 modules)	95.4	/ 43.3
FS9 (9 modules)	123.0	/ 55.8

Charger Modules

	MP130	MP133	MP330	MP333
AC Input Voltage				
Single Phase, Nominal:	208/278V AC		-	
Three Phase, Nominal:	208/278V AC		380/480V AC	
Operating Voltage Range:	150-300V AC		340-580V AC	
Frequency Range:	45-65Hz >0.99PF		45-65Hz >0.94PF	
Maximum Efficiency:	93.5%		94.5%	

DC Output				
Range (VDC):	25-65	70-130	25-65	70-130
MP130/MP330:	60A DC output at 50V 52A DC output at 57.6V			
MP133/MP333:	30A DC output at 100V 26A DC output at 115.2V			

Environmental Requirements

Ambient Temp. Range: -50ºF to 104ºF
(max. output power is derated above 122ºF)

Storage Temperature: -68ºF to 158ºF

Humidity: 5-95% RH
(non-condensing)

Compliances

UL Listed: E333392 - UL 1564

California Appliance Efficiency Program: Large Battery Charger Systems*

UL LISTED

CALIFORNIA ENERGY COMMISSION COMPLIANT BC *

* FS5L, FS9L models only. The Automatic Module Shutdown Control option must be set to Max Efficiency (this is a factory set default).

Notes

Notes

Contact Your Local Dealer:

Manufactured by:

Enatel Motive Power Ltd
66 Treffers Road, Christchurch 8042, New Zealand.
Ph +64-3-366 4550 Fax +64-3-366 0884
info@enatel-mp.com
www.enatel-mp.com

Drawing No. 130391B