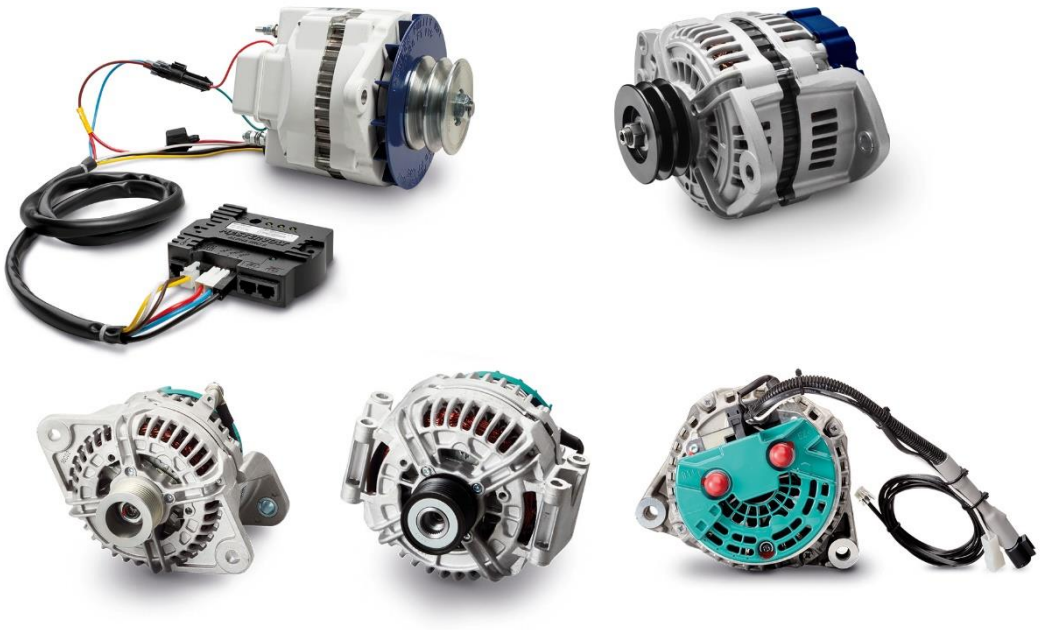
MASTERVOLT

THE POWER TO BE INDEPENDENT

MASTERVOLT ALTERNATORS

12V AND 24V SERIES

HIGH PERFORMANCE ALTERNATORS



USER AND INSTALLATION MANUAL

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1 GENERAL INFORMATION

WARNING!

Read the entire manual before using the Mastervolt Alternator.
Keep this manual in a secure place.

1.1 Use of this manual

A Mastervolt Alternator can be purchased individually, or as part of a kit that includes the Alpha Pro regulator and/or a pulley. This manual serves as a guideline for the safe and effective operation and maintenance of the following Mastervolt Alternator models:

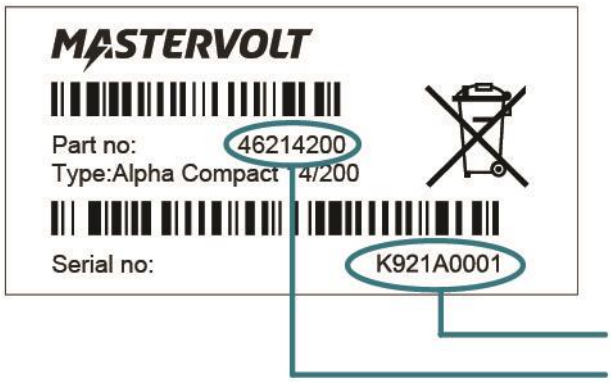
- Alpha 12/130
- Alpha 24/75
- Alpha 24/110
- Alpha 24/150 Evo
- Alpha Compact 14/200
- Alpha Compact 28/110
- Alpha Compact 28/150
- Alpha Compact 14/120 for Mercedes-Benz N62
- Alpha Compact 14/200 for Mercedes-Benz N62
- Alpha Compact 28/200 for Mercedes-Benz N62
- Alpha Compact 14/140 for Volvo Penta*
- Alpha Compact 28/80 for Volvo Penta*
- Alpha Compact 28/110 for Volvo Penta*
- Alpha Compact 28/150 for Volvo Penta*

** This alternator is only compatible with Volvo Penta models D4 – D13.*

These models are further referred to as “Mastervolt Alternator”.

1.2 Identification label

The following picture is only an example!



Part number

Serial number K921**A**0001, device version "A".

Figure 1: Identification label

CAUTION!

Important information required for service or maintenance can be derived from the identification label. Never remove the identification label. This will void the warranty.

1.3 Liability

Mastervolt can accept no liability for:

- Consequential damage resulting from the use of the Mastervolt Alternator.
- Possible errors in the included manual and the consequences of these.
- Use that is inconsistent with the purpose of the product.

1.4 Warranty

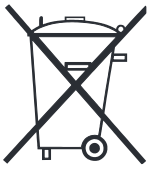
Mastervolt assures the product warranty of the Mastervolt Alternator during two years after purchase, on the condition that the product is installed and used according to the instructions in this manual.

Installation or use not according to these instructions may result in under performance, damage or failure of the product and may void this warranty. The warranty is limited to the cost of repair and/or replacement of the product. Costs of labor or shipping are not covered by this warranty.

1.5 Disclaimer

Our products are subject to continual development and improvement. Therefore, additions or modifications to the products may cause changes to the technical data and functional specifications. No rights can be derived from this document. Please consult our most current Terms & Conditions of Sale.

1.6 Correct Disposal of This Product



This product is designed and manufactured with high quality materials and components, which can be recycled and reused. Please be informed about the local separate collection system for electrical and electronic products.

Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

2 SAFETY INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

Warnings and symbols

Safety instructions and warnings are marked in this manual and on the product by the following pictograms:



CAUTION!

Special information, commands and prohibitions in order to prevent damage.



WARNING!

A WARNING refers to possible injury to the user or installer or significant material damage to the Mastervolt Alternator if the installer / user does not (carefully) follow the stated procedures.



WARNING!

The addition of this symbol to a warning indicates that a potential hazard exists caused by moving parts.

This chapter describes important safety and operating instructions for use of a Mastervolt Alternator.

Use the Mastervolt Alternator only:

- for the charging of lead acid or Li-Ion batteries and the supply of loads connected to these batteries, in permanent systems;
- with fuses, protecting the wiring between alternator/regulator output and battery;
- in a technical correct condition;
- in a closed, well-ventilated area, protected against rain, moist, dust, condensation and (sea)water.

Warning regarding life support applications

Mastervolt products are not designed to be used as component of medical equipment, unless negotiated in the form of a written agreement between customer and/or manufacturer and Mastervolt. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the Mastervolt parts and/or to commit to undertake such testing as a part of the manufacturing process. In addition, the manufacturer must agree to indemnify and not hold Mastervolt responsible for any claims arising from the use of the Mastervolt parts in the life support equipment.

Personal precautions

Remove the keys from the ignition and disconnect all batteries in the system which is being worked on.

During installation or maintenance:

- stick to tools and methods recommended in the manual;
- work in a well-ventilated area;
- wear safety glasses and remove loose fitting clothing and jewelry;
- be aware of hot surfaces: both engine parts as well as the alternator.

Working procedures

If the alternator, regulator and engine are switched off during maintenance and/or repair activities, they should be secured against unexpected and unintentional switching on.

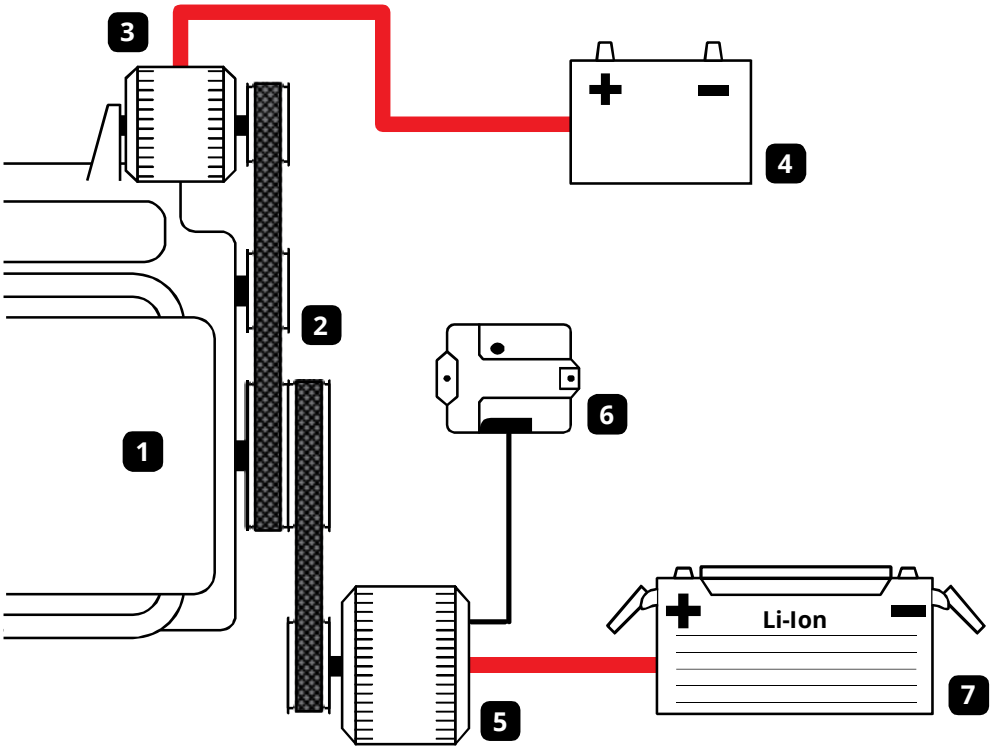


WARNING!

When service has to be carried out while the engine is running,
be aware of moving parts like V-belts.

3 SYSTEM EXAMPLE

Mastervolt Alternators can be used as main or as 2nd alternator. The following figure shows a typical example of a Mastervolt Alternator that is used as 2nd alternator in a power system. Please note that this figure is simplified and does not reflect the actual placement of all devices nor the complete connections. For each device, refer to the corresponding installation manual and follow the given instructions.



1. Engine
2. Drive belt
3. Main alternator
4. Start battery
5. 2nd Mastervolt Alternator
6. Alpha Pro Regulator
7. Service battery (bank)

Figure 2: Simplified architecture of a typical dual alternator configuration

Mastervolt Alternator

Mastervolt Alternators transform your engine into a high-power energy source for electrical on-board consumers and guarantee a quick charge of your service and starter batteries. Mastervolt Alternators are built to operate continuously under the high temperatures of an engine room and can be used either as an upgrade to the main alternator or as a secondary alternator.

Alpha Pro regulator

The Mastervolt Alternator is designed for use in conjunction with the Alpha Pro charge regulator, which controls the alternator's output voltage and current. Together with the Alpha Pro regulator, the Mastervolt Alternator is capable of fast and safe charging of lead-acid and Li-Ion batteries, following the Mastervolt 3-Step charge process.

This manual should be read in combination with the Alpha Pro manual.

4 BEFORE YOU START THE INSTALLATION

4.1 Mounting bracket

Mastervolt has no brackets in its portfolio. You could opt for the following to make the alternator fit on the engine:

1. Order the engine with pre-installed alternator bracket (also known as PTO or Generator option).
2. Consult your dealer/distributor for the availability of an aftermarket 2nd alternator mounting kit.
3. Construct your own bracket. You need a solid mounting bracket which must be resistant to strong vibrations. This is specialist work and should be carried out by qualified personnel only.

4.2 Rotation direction

Alpha Compact alternator: When selecting the installation location, you must consider the rotation direction. For the internal fans to work properly, the rotation direction should be clockwise, viewed from the pulley side of the Alpha Compact.

Alpha alternator: The Alpha alternator is equipped with a bidirectional fan. Therefore, it may rotate in either a clockwise or counterclockwise direction.

4.3 Isolating bushings (Alpha Compact only)

Alpha Compact alternators are non-isolated, meaning the negative output is connected to the metal enclosure. Engine manufacturers may stipulate isolated mounting of the alternator, e.g. to protect sensitive engine electronics. Mastervolt can provide optional isolating bushings suitable for this purpose. For each mounting hole of the alternator, order one set of isolating bushings. See also Figure 4 on page 11, and Figure 11 on page 15.

Notes:
- The mounting hole diameters may vary in size, even within a single model. Make sure to order the correct bushing.
- Using the bushings reduces the diameter of the hole! From M10 to M8 and from M12 to M10.

Product code Isolating Kit	Suitable for Alpha Compact model:
48420242	Alpha Compact 28/150 & 28/110
48420241	Alpha Compact Mercedes-Benz 14/120 & 14/200 **Note:** with insulation sockets not suited for alternator holder N62!
48420240	Alpha Compact Volvo Penta

4.4 Drive belt

Mastervolt Alternators can be combined with multigroove pulleys and corresponding multirib belt (also known as multibelt or serpentine belt) with profile “PK”; further referred to as “drive belt” or “belt” for short. The drive belt must be capable of driving the total mechanical load of all power consumers on the belt, including the alternator. Please note that Mastervolt does not supply the drive belt.

4.5 Engine load

Mastervolt Alternators draw a certain amount of power from the engine. The drive belt and pulley add mechanical losses. As a rule of thumb, the total mechanical-to-electrical power conversion efficiency can be assumed as 50%. Check if the engine has enough power reserve to produce the additional power drawn at nominal alternator rpm. Refer to section 10.2 on page 21 for the Power Take-Off values.

4.6 Pulleys

Depending on the order, the Mastervolt Alternator is delivered without a pulley, with a double V-belt pulley, or with a multi-groove pulley.

The Alpha 12/130, 24/75, 24/110, and 24/150 Evo, are fitted with a double V-belt pulley as standard but can be ordered with a multigroove pulley.

The Alpha Compact 14/200 and Alpha Compact VP models are fitted with a multi-groove pulley as standard. Other Alpha Compact models come without pulley. Mastervolt provides 6-rib and 8-rib pulleys in various diameters and with or without clutch (also called “overrunning“ or “freewheeling” pulleys). The pulley must match the alternator. For available models, see section 10.4 on page 26.

4.6.1 Pulley type selection

The standard pulley is recommended for most situations. In case of a long drive belt and/or if many power consumers are attached to the belt, the use of a clutch pulley is recommended. This will minimize wear and tear of the belt and belt tensioner.

4.6.2 Pulley size selection

To choose the correct size of the alternator pulley, you must consider many variables:

- engine size (kW);
- engine idle speed;
- engine cut-off point (= max. rpm);
- alternator maximum rpm;
- diameter of the crank shaft pulley which will be used to drive the alternator.

General rules:

1. At the engine idle speed (A), the alternator idle speed (B) should be 1800rpm or higher.
2. B / A = minimum pulley ratio.
3. At the engine max speed (D), the alternator speed should be below the maximum alternator speed (E).
4. E / D = maximum pulley ratio.
5. Choose a pulley ratio within these extremes.

Example: Assumptions: Engine idle speed = 800rpm, Engine cut-off point = 5000rpm, crank shaft pulley diameter = 160 mm. Alternator: Alpha Compact 28/110 (refer to section 10.2 for specifications):

Engine idle speed		A	800	rpm
Alternator idle speed		B	1800	rpm
Minimum pulley ratio	(= B / A)	C	2.25	x
Engine max speed		D	5000	rpm
Alternator maximum speed		E	15000	rpm
Maximum pulley ratio	(= E / D)	F	3.0	x
Crank shaft pulley diameter		G	160	mm
Max. alternator pulley diam.	(= G / C)	H	71.1	mm
Min. alternator pulley diam.	(= G / F)	I	53.3	mm
Selected pulley diameter		J	55	mm
Actual Pulley ratio	(= G / J)	K	2.9	x

It follows that the pulley diameter must be in the range of 53.3mm to 71.1mm. Selecting a relatively small diameter has the advantage of high output power at idle and full power reached at low rpm. Selecting a small pulley also means the alternator represents a higher mechanical load to the engine at idle speed. For a powerful engine, you may select a 55mm pulley. For a smaller engine, a larger diameter such as 66mm may be optimal.

4.6.3 Calculating alternator output

Once the pulley size is known, you can use the output curves given in section 10.4 to look up the charge current at idle speed. Multiplying the engine idle speed with the pulley ratio will give you the alternator speed at idle: 800 x 2.9 = 2327rpm. From the performance curve of the Alpha Compact 28/110, we read approximately 60A of output.

To calculate the engine speed where the alternator reaches full output, simply divide the nominal alternator speed by the pulley ratio. In this example, the alternator will reach its full capacity at engine speed: 6000 / 2.9 = 2060rpm.

Note: No rights can be derived from this example!

4.6.4 Pulley alignment

For different pulleys, the distance between the inside of the mounting foot to the first rib of the drive belt can be different. Choose an optimal distance as to minimize the pulley offset.

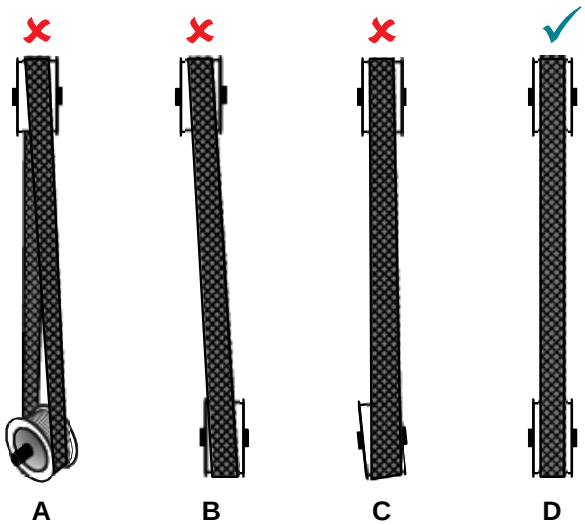


Figure 3: Pulley alignment errors

Note: Depending on the mounting method, alternative adjustments to the offset may be possible such as adding spacers between the bracket and the alternator mounting foot

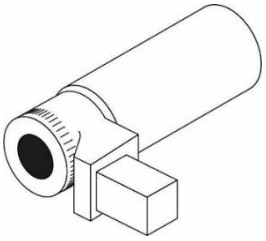
A. axial twist
B. offset
C. angular differential
D. correct alignment

4.7 Pulley installation (Alpha Compact only)

Special tools are needed to mount a pulley. These tools are not delivered by Mastervolt. The following tools are manufactured by MAN Trucks and can be obtained from a local vendor or ordered online.

CAUTION!

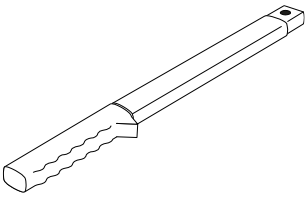
Damage as a result of the use of incorrect tools may result in loss of warranty.



ADJUSTING WRENCH SW22 (Y1)

To remove/install multigroove pulley, in combination with handle (Y2) and TORX screwdriver insert (X2) and torque wrench (X3).

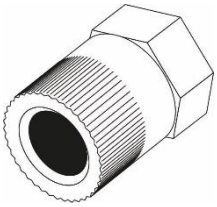
[22mm deep socket with external drive; e.g. MAN 80.99603-6029]



HANDLE 14X18X630 (Y2)

To remove/install standard multigroove pulley, in combination with adjusting wrench (Y1)

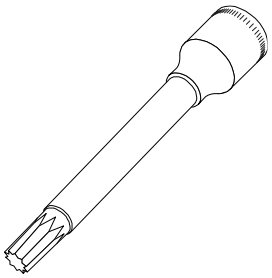
[MAN 08.06460-0002]



Adapter (X1)

To remove/install clutch pulley, in combination with TORX screwdriver insert (X2) and torque wrench (X3).

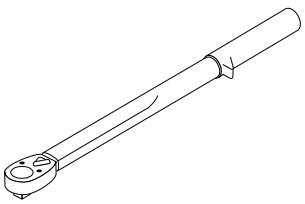
[Clutch pulley removal tool, spline 33 teeth, outer diameter 19,6mm, 22HEX drive; e.g. MAN 80.99603-0423]



TORX SCREWDRIVER INSERT (X2)

To remove/install standard or clutch pulley, in combination with adapter (X1) and torque wrench (X3).

[XZN M10 x 102mm/140mm, ½"; e.g. MAN 80.99603-0318 or Stahlwille 03261410]



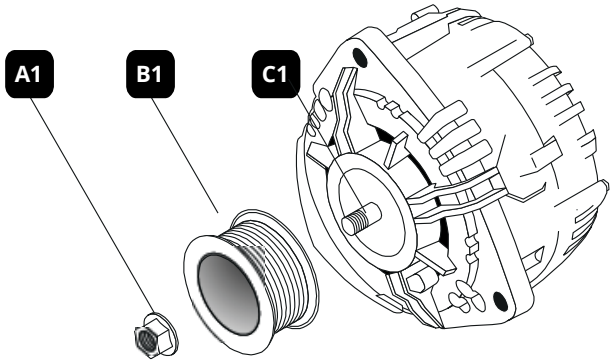
TORQUE WRENCH 20-100Nm (X3)

To remove/install standard or clutch pulley, in combination with adapter (X1) or (Y1) and TORX screwdriver insert (X2).

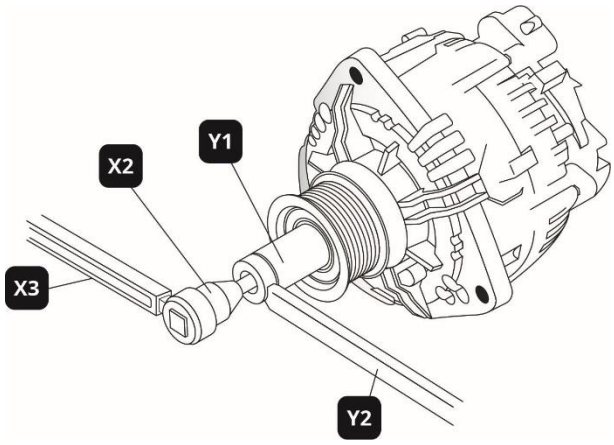
[Torque wrench 20-100Nm 1/2"; e.g. MAN 08.06450-0002]

4.7.1 Standard pulley

1. Slide the multigroove pulley (B1) onto the alternator shaft (C1).
2. Thinly apply retaining compound (LOCTITE® 648) on the thread and contact surface of the new lock nut (A1).
3. Mount the new lock nut.

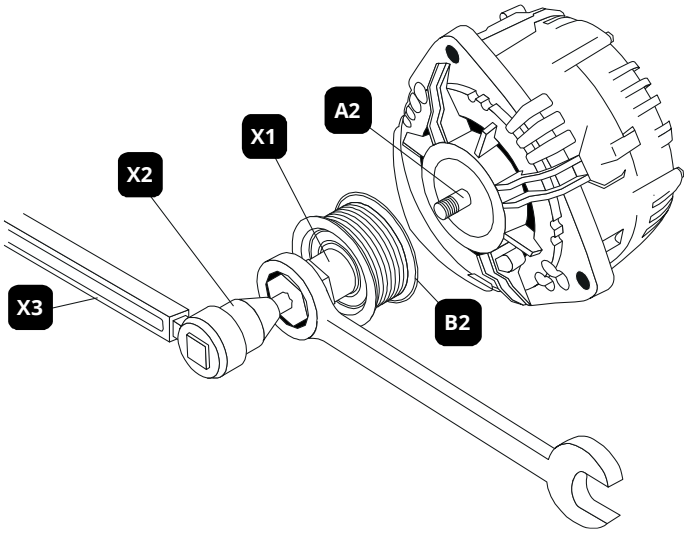


4. Fit the adjusting wrench (Y1) with handle (Y2) on the lock nut of the multigroove pulley.
5. Place the torque wrench (X3) and torx insert (X2) in the alternator shaft.
6. Hold the torque wrench (X3) and handle (Y2) and tighten the lock nut (anti-clockwise) to a **torque of 80 Nm**.

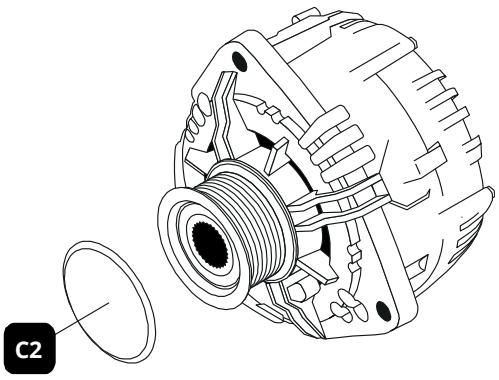


4.7.2 Clutch pulley

1. Thinly apply threadlocking compound (LOCTITE® 270) on the alternator shaft (A2).
2. Place the adapter (X1) on the clutch pulley (B2) and slide onto the alternator shaft (A2).
3. Insert the torx insert (X2) into clutch pulley (B2).
4. Hold the adapter (X1) and use the torque wrench (X3) and torx insert (X2) to tighten the clutch pulley (B2) to **a torque of 85 Nm**.



5. Remove the special tools.
6. Add a protection cover (C2).



5 MECHANICAL INSTALLATION

During installation and commissioning of the Mastervolt Alternator, the Safety Instructions are applicable at all times. See chapter 2 of this manual.

5.1 Preparations

Turn off all switches and electrical loads. Disconnect the battery. It is advised to make pictures of the current situation, showing how the belt is routed around the pulleys.

5.2 Prepare mounting location

5.2.1 Main alternator upgrade

1. Remove the drive belt. Loosen the alternator bolts and tilt it forward to create slack in the belt. If there is an auto-tensioner pulley, use a socket wrench to loosen it. Now you can remove the belt from the pulleys.
2. Remove the old alternator.
3. Clean and check the condition of mechanical parts and mounting points. Carefully check the belt and tensioner (if applicable) for signs of wear. Replace both if necessary.

5.2.2 Secondary alternator installation

Remove the main drive belt according to section 5.2.1. Attach the mounting bracket to the engine. Install other parts of the alternator mounting kit, such as idler pulleys, double pulleys, belt tension adjuster according to the instructions of the manufacturer.

5.3 Alternator mounting

Saddle mount: (Figure 5)	Foot mount: (See Figure 6)	Pad mount: (Figure 7 & Figure 8)
Alpha 12/130	Alpha Compact 28/110	Alpha Compact 14/200
Alpha 24/75	Alpha Compact 28/150	
Alpha 24/110	Alpha Compact 14/120 Mercedes-Benz	
Alpha 24/150 Evo	Alpha Compact 14/200 Mercedes-Benz	
Alpha Compact 14/140 Volvo Penta	Alpha Compact 28/200 Mercedes-Benz	
Alpha Compact 28/80 Volvo Penta		
Alpha Compact 28/110 Volvo Penta		
Alpha Compact 28/150 Volvo Penta		

- **Isolated Mounting**

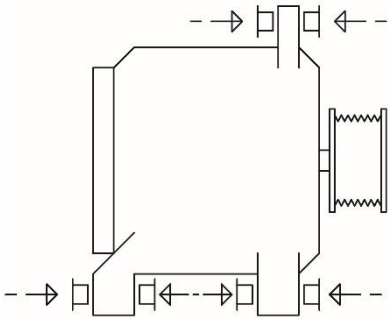
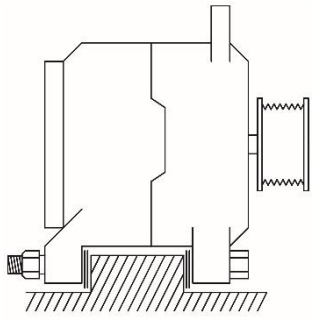


Figure 4: Inserting isolation bushings

If isolated mounting is required, insert isolating bushings (Alpha Compact only) on either side of each mounting hole. Slide the cable lug of the ground cable (discussed in section 6.3) between one of the isolating bushing and the alternator. Cut the bushings to size. Example: for an alternator model with 3 mounting positions, insert 6 bushings.

- **Saddle Mount**

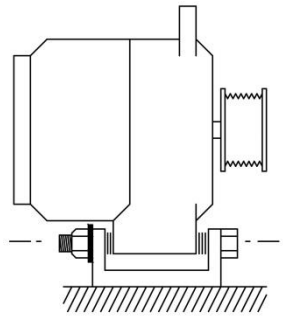


Position the alternator mounting ears over the mounting foot and slide in the alternator mounting bolt. Check for backlash. Align the pulley with the crank shaft pulley and fill any empty space on either side of the mounting foot with shims. Loosely attach the alternator, adding a spring washer and locking nut to the other end of the bolt.

Saddle mount is also known as dual foot mount.

Figure 5: Alternator mounting – saddle mount

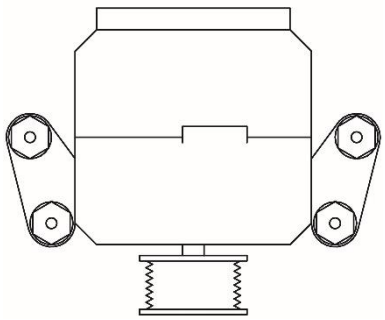
- **Foot Mount**



Position the alternator mounting foot between the two ears of the mounting bracket and slide in the alternator mounting bolt. Check for backlash. Align the pulley with the crank shaft pulley and fill up any empty space on either side of the mounting foot with shims. Loosely attach the alternator, adding a spring washer and locking nut to the other end of the bolt.

Figure 6: Alternator mounting – foot mount

- **Pad Mount**



Slide the alternator into the correct position. Apply a thin layer of threadlocking compound (LOCTITE® 270) on the alternator mounting bolts and tighten the bolts.

Pad mount is also known as direct mount.

Figure 7: Alternator mounting – pad mount, front view

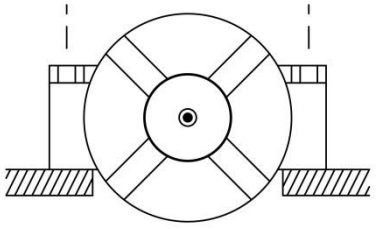


Figure 8: Alternator mounting – pad mount, top view

5.4 Drive belt re-installation

5.4.1 With auto-tensioner pulley

1. Run the drive belt through the pulleys, skipping the auto-tensioner (item 1 in Figure 9).
2. Loosen the auto-tensioner using a wrench (item 2 in Figure 9).
3. With the belt around all the other pulleys, slide it over the auto-tensioner (item 1 in Figure 9) while still holding pressure on the wrench.
4. Once the belt is in place, slowly reduce the pressure on the wrench, allowing the tensioner pulley to tighten the belt.

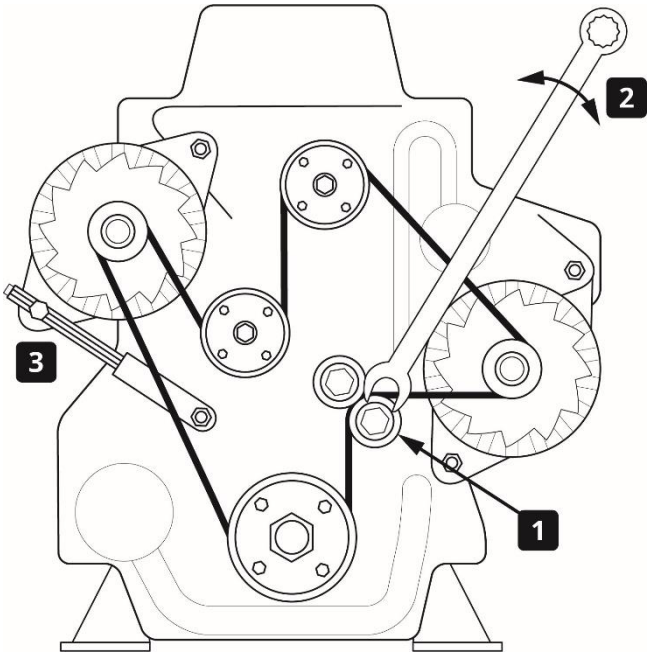


Figure 9: Re-installation with auto-tensioner

5.4.2 No auto-tensioner pulley

1. Run the drive belt through the pulleys, skipping the alternator.
2. Tip the alternator forward and loosely fix the adjustment ear to the adjustment arm (item 3 in Figure 9).
3. Now slide the belt over the alternator pulley.
4. Tighten the belt by pulling the alternator backward, applying force to the front of the alternator housing only.
5. Set the belt tension per manufacturer's recommendations. Use a belt tension gauge to verify the tension.

5.4.3 Final check

Double check the belt alignment. Firmly tighten all alternator mounting bolts.

6 ELECTRICAL INSTALLATION

WARNING
Installation work should be carried out by qualified personnel only.

CAUTION!
Short circuiting or reversing polarity may lead to serious damage to the batteries, the alternator, the Alpha Pro regulator, the cabling and/or the terminal connections. Fuses cannot prevent damage caused by reversed polarity. Damage caused by reverse polarity is not covered by the warranty.

Interrupting current from a running alternator may lead to a significant voltage surge, with damage to the alternator and/or connected equipment and loss of warranty as a result. Carefully follow the instructions in this chapter regarding wiring, fuse size and fuse position.

CAUTION!
Too-thin cables and/or loose connections can cause dangerous overheating of the cables and/or terminals. Tighten all connections well, in order to limit transition resistance as far as possible. Use cables of the correct size. Refer to technical specifications (section 10.2) for recommended wire sizes.

6.1 Precautions

Make sure that everything is switched off:

- remove the engine ignition key;
- disconnect all batteries or remove the DC fuse(s);
- make sure that third parties cannot reverse the measures taken.

6.2 Fuse

The alternator is connected to the battery via an alternator fuse, located as close as possible to the battery. Refer to section 10.2 on page 21, for more information.

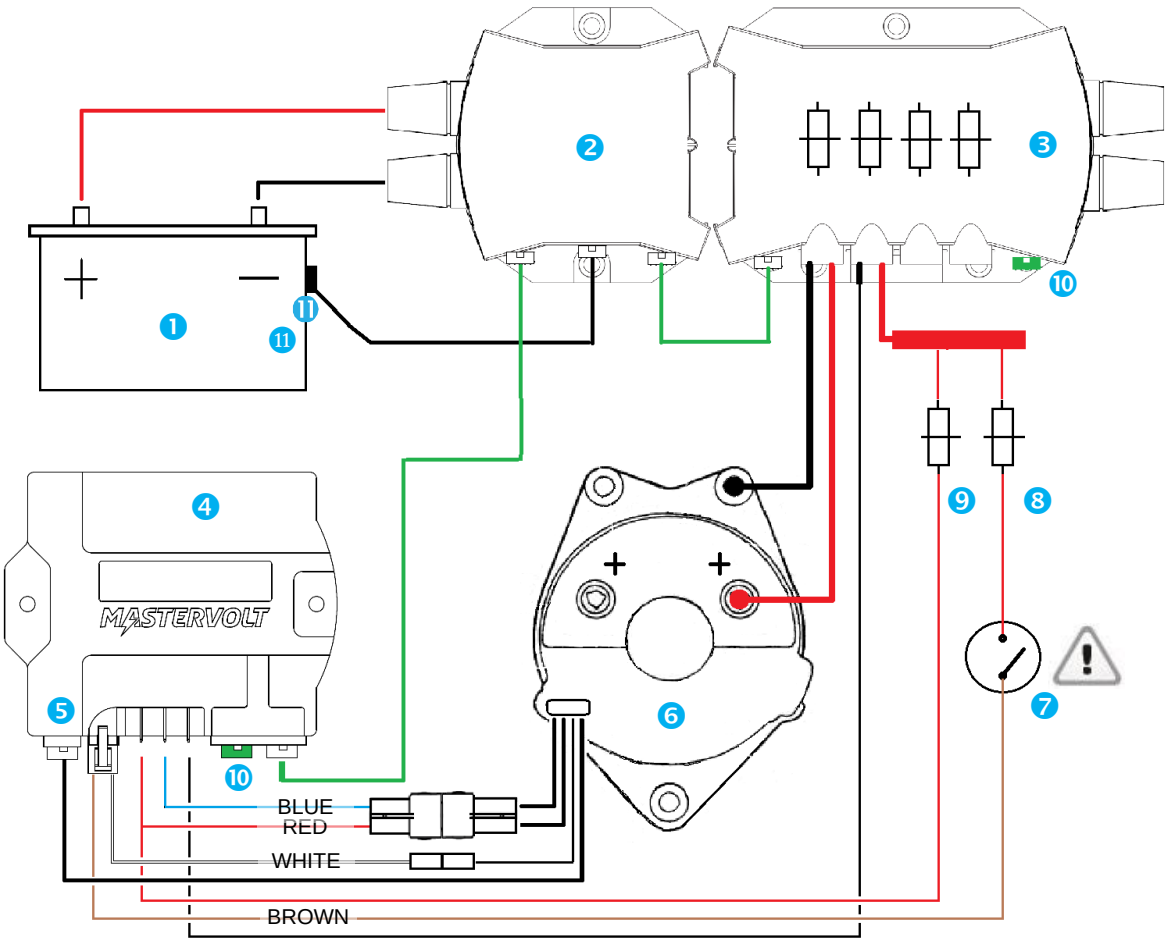
6.3 Wiring

For Alpha Compact models refer to Figure 10 on page 15. For other Alpha models refer to Figure 12 on page 16.

Notes:

- In case of an Alpha Compact alternator: whether the alternator is mounted in an isolated or a non-isolated way, it is OBLIGATORY to route a ground conductor from one of the alternator mounting points to electrical ground. If isolating bushings are not used, one of the mounting bolts can be used for this purpose. If isolating bushings are used, refer to Figure 11 on page 15.
- The current rating of the positive and negative alternator wiring must be higher than the fuse size.
- Use the supplied cable assembly for connection of the Alpha Pro regulator.
- For detailed information on how to connect a tachometer, indication lamp, oil pressure switch or battery isolator, refer to the Alpha Pro manual.
- For Alpha Compact models, the alternator temperature sensor must be connected to the temperature input of the Alpha Pro charge regulator. In case lead acid batteries are used, it is advised to install a MasterShunt with battery temperature sensor and make a MasterBus connection to the Alpha Pro to use automatic temperature compensation.

CAUTION!
Point 7 in Figure 10 and in Figure 12 should NOT be connected to engine ignition. Refer to the Alpha Pro manual, which explains how to obtain a proper “engine run” signal. **Failure to do so may lead to overcharging of the batteries and / or overheating of the alternator field winding, which is not covered by warranty.**



1 Lead acid battery with battery temperature sensor (11)
2 MasterShunt
3 DC distribution with dedicated alternator fuse
4 Alpha Pro charge regulator
5 Alternator temperature sensor
6 Alpha Compact alternator
7 Engine Run Contact (reg on) - refer to Alpha Pro manual
8 Fuse - refer to Alpha Pro manual
9 Fuse (included in Alpha Pro wiring loom)
10 MasterBus Terminator

Figure 10: Wiring diagram Alpha Compact models, with lead acid battery

If isolating bushings are used (Alpha Compact only), mount the ground conductor between the bushing and a mounting point.

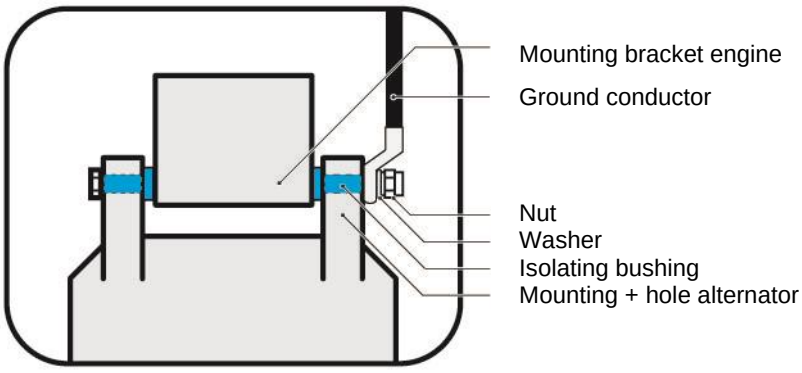
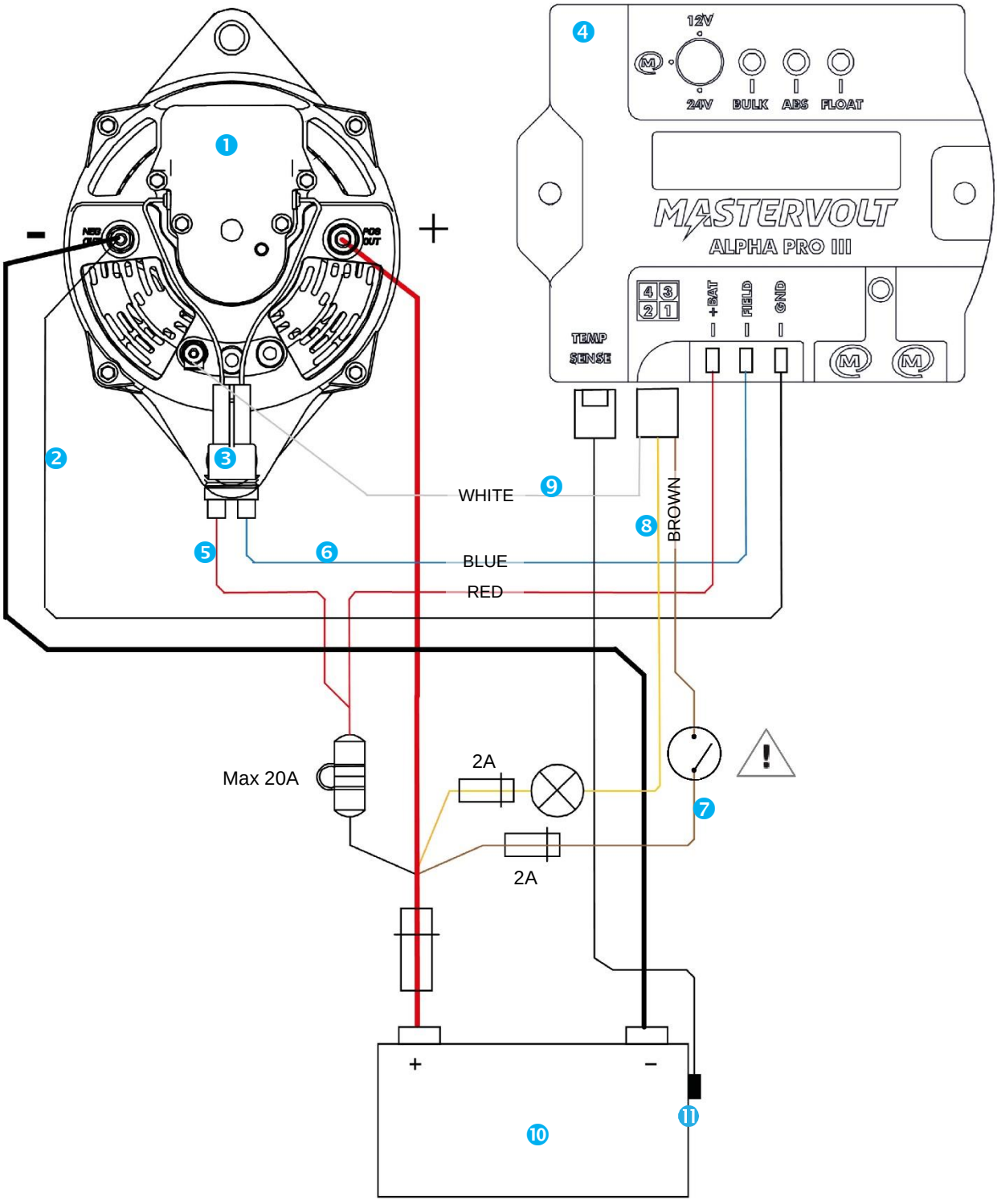


Figure 11: Detailed view of the connection



1 Alpha alternator

2 Black (GND) wire

3 Field connector
(model 24/150 Evo is connected in a similar way but requires the specialty adapter that is included in the delivery)

4 Alpha Pro charge regulator

5 Red (+ field) wire

6 Blue (– field) wire

7 Engine Run Contact (reg on) - refer to Alpha Pro manual

8 Yellow (D+ lamp) wire

9 White (RPM) wire

10 Lead acid battery with temperature sensor (11)

Figure 12: Wiring diagram other Alpha models, with lead acid battery

7 COMMISSIONING

7.1 Preparations

1. Wear safety glasses and remove loose fitting clothing and jewelry.
2. Clear the area around moving parts. Remove loose wires and tools.
3. Double check all electrical connections.
4. Reconnect the battery.
5. Switch on the DC power.

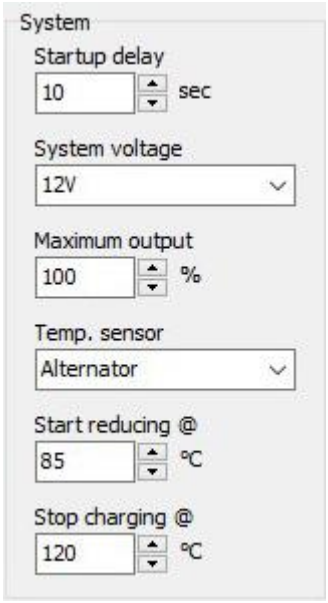
7.2 Regulator configuration with MasterAdjust

The installer must be familiar with the configuration tool MasterAdjust. Refer to the Alpha Pro manual for details.

The Alpha Pro will be disabled until it is configured and locked via MasterAdjust.

On the MasterAdjust configuration tab:

1. For Alpha Compact models only: go to the **System** section and set the **Temp. sensor** to **Alternator**.
   a) Set **Start reducing** @ to **85 °C**.
   b) Set **Stop charging** @ to **120 °C**.
2. Double check the settings and keep a record of them in this manual.



7.3 First operation and testing



WARNING
When the engine is running, be aware of moving parts like V-belts.

1. Measure and record the battery voltage before starting the engine.
2. Bridge the engine run contact by connecting a jump wire, see fig. 13.
   The three LEDs on the Alpha Pro should blink to indicate startup mode.
   The Bulk LED will go on.
3. Check whether the alternator field coil is energized, by touching the shaft of the alternator with a screwdriver. You should notice a strong magnetic pull. Or measure the field current.
4. Remove the jump wire. The three LEDs on the Alpha Pro will go out.
5. Start the engine. Check for abnormal noise or vibration.
   After 10 seconds, the yellow (bulk) LED will illuminate, indicating that the charge cycle begins.
6. Measure and record the battery voltage. It should be higher than measured in step 2, indicating that the alternator is charging.
7. Run the engine at cruising speed for 15 minutes, switching on loads to apply maximum load to the alternator.
8. Stop the engine and check the belt tension. Adjust if necessary.

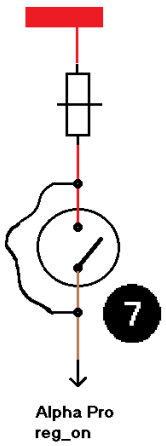


Figure 13: jump wire

7.4 Normal operation

If installed correctly, the Mastervolt alternator and the Alpha Pro regulator will switch on and off automatically when the engine starts and stops. There is no need for adjustment or operation.

8 MAINTENANCE

Alternator maintenance can be part of the overall maintenance of the engine. Alternator parts are subject to wear. To ensure reliable functionality, inspection and maintenance have to be carried out at regular intervals. At least every 500 service hours, the bearings, brushes, and belt(-tension) are to be checked, and replaced if necessary, by a competent specialist. For better cooling it helps to keep the alternator clean.

8.1 Mounting points

Check the mounting of the alternator after the first 50 running hours. Then every 150 running hours or at least every year, whichever comes first. Make sure that the alternator is securely mounted to its applicable brackets. The brackets, in turn, need to be bolted securely to the engine. Poor or loose mountings may lead to damaging vibration as well as reduced belt drive performance.

8.2 Cleaning



CAUTION!

Use only non-aggressive detergents.

The cleaning interval of the alternator strongly depends on environmental conditions but should be maximum six months. Prevent build-up of dirt, grease or dust. If you notice significant build-up of black dust on your alternator and surrounding engine area, check belt tension.

Air flow passages must also be clear so that air can easily pass through the unit. The alternator’s bearings are greased for life and cannot be degreased.

8.3 Check tension and condition of the drive belt

An under-tensioned belt will slip on the pulley, fail to turn the alternator’s rotor and as a result of the friction, overheat the alternator. An over-tensioned belt causes reduced belt life. The tension of new belts must be checked after the first 50 running hours; then every 150 running hours or at least every year.

Before adjusting the belt tension, inspect it for glazing, cracks, or dryness. A worn or damaged belt should be replaced, including the tensioner (if applicable). If the belt is in satisfactory condition, check the belt tension with cricket belt tension gauge. Refer to the manufacturer's specifications for proper belt tension.

If you replace a worn or damaged drive belt, the new belt should be checked for proper tension as well. A new drive belt loses up to 60% of its tension during the first few hours of operation. If a new belt has been installed, run the engine with full load connected to the alternator for approximately 15 minutes. Then check the belt tension again and adjust it if necessary.

9 TROUBLESHOOTING

9.1 Trouble shooting hints

- Check if 12-14V is present at alternator output
- Check if 12-14V is available at field current input. When field current is present, hold a Ferro-metallic object near the shaft of the alternator. The field coil functions correctly if a strong magnetic pull is observed.

9.2 Fault finding table

Problem	Possible cause	Action
Battery loses charge or Insufficient charge output	Defective battery.	Check battery, replace if necessary.
	Slipping alternator drive belt.	Check belt condition and tension.
	Battery terminals loose or corroded.	Clean, grease and tighten battery terminals.
	Alternator internal fault.	Test and repair if necessary.
	Regulator fault.	Refer to regulator manual.
	Engine run signal contact not working.	Jump wire engine run signal contact. Repair if necessary.
	Bad electric connection in main charging circuit.	Check cables for damage. Check ground wire.
	Short circuit component causing battery drain even when switches are off.	Measure battery output current drain and check system.
	Blown alternator fuse.	Verify fuse value. Replace with fuse according to specifications (section 10.2).
	Battery temperature sensor not correctly configured.	Check MasterBus configuration.
Charge current higher or lower than expected	Charge current can be up to 20% higher when cold. Charge current can be up to 15% lower when hot.	No action required.
Charge voltage too high / low	Wrong battery sense voltage.	Check battery voltage sense wiring.
Noise	Belt misalignment.	Make sure the pulleys are aligned.
	Anti-clockwise rotation direction (Alpha Compact only).	Check the rotation direction (Alpha Compact only).
	Belt tension too high.	Check belt tension.
	Pulley mounting.	Fasten pulley, using special tools.
	Worn or misaligned tensioner pulley.	Check tensioner pulley.
Pivot bushing worn down	Belt misalignment.	Make sure the pulleys are aligned.
Alternator is getting hot while engine is **NOT** running	Rotor field windings are excited while engine is not running. Regulator is still on (BULK/ABS/FLOAT LED is on).	Switch off DC immediately to avoid field winding damage due to overheating. Check engine run contact for correct operation. Check wiring between battery and [reg on] terminal.
Alternator is getting hot while engine **IS** running	A loose, under-tensioned belt.	Check the tension of the belt.
	Anti-clockwise rotation direction (Alpha Compact only).	Check correct rotation direction (Alpha Compact only).
	Loose plus or minus cable, or ground cable not connected.	Check cables.

10 TECHNICAL DATA

10.1 General specifications

Alpha Compact	14/200	28/110	28/150
Product code	46214200	46228110	46228150
Mounting*	Pad mount	Foot mount	Foot mount
Pulley included	Yes	No	No
Alpha Pro III charge regulator included	#46214200 no #46614200 yes	#46228110 no #46628110 yes	#46228150 no #46628150 yes
Weight	7.5 kg [16.5 lb.]	7.4 kg [16.3 lb.]	7.9 kg [17.4 lb.]
Isolated operation	yes, with optional isolation bushings		
Rotational direction	clockwise (viewed from pulley side)		
Cooling	integrated dual fan		

Alpha Compact	14/140 Volvo Penta	28/80 Volvo Penta	28/110 Volvo Penta	28/150 Volvo Penta
Product code	46214142	46228082	46228112	46228152
Mounting*	Saddle mount	Saddle mount	Saddle mount	Saddle mount
Pulley included	Yes	Yes	Yes	Yes
Weight	6.9 kg [15.2 lb.]	6.9 kg [15.2 lb.]	7.4 kg [16.3 lb.]	7.9 kg [17.4 lb.]
Isolated operation	yes, with optional isolation bushings			
Rotational direction	clockwise (viewed from pulley side)			
Cooling	integrated dual fan			

Alpha Compact	14/120 Mercedes-Benz N62	14/200 Mercedes-Benz N62	28/200 Mercedes-Benz N62
Product code	46214120	46214203	46228203
Mounting*	Foot mount	Foot mount	Foot mount
Pulley included	No	No	No
Weight	6.7 kg [14.8 lb.]	7.5 kg [16.5 lb.]	7.5 kg [16.5 lb.]
Isolated operation	yes, with optional isolation bushings		
Rotational direction	clockwise (viewed from pulley side)		
Cooling	integrated dual fan		

Alpha	12/130	24/75	24/110	24/150 Evo
Product code	48212130	48224075	48224110	48224152
Mounting*	Saddle mount	Saddle mount	Saddle mount	Saddle mount
Pulley included	Yes **	Yes **	Yes **	Yes **
Weight	10.1 kg [22.3 lb.]	10.1 kg [22.3 lb.]	10.1 kg [22.3 lb.]	12 kg [26.5 lb.]
Isolated operation	yes, isolated from ground			
Rotational direction	clockwise or counterclockwise			
Cooling	external bidirectional fan	external bidirectional fan	external bidirectional fan	integrated bidirectional fan

* Refer to section 5.3 on page 11.

** Double V-belt pulley.

10.2 Technical specifications

Alpha Compact model	14/200	28/110	28/150
System voltage	12 V	24 V	24 V
Battery capacity	400 – 2000 Ah	220 – 1100 Ah	300 – 1500 Ah
Nominal current[1)] @ 6000rpm	200 A	110 A	150 A
Recommended DC fuse	250 A	160 A	200 A
Recommended DC wire size (up to 3m / 10ft)	70 mm^2 [AWG3|0]	35 mm^2 [AWG2]	50 mm^2 [AWG0]
Recommended wire size (3 to 5m / 10 to 16ft)	95 mm^2 [AWG4|0]	50 mm^2 [AWG0]	70 mm^2 [AWG2|0]
Cut-in speed	1350 rpm	1400 rpm	1700 rpm
Max. rotational speed	20.000 rpm	15.000 rpm	16.000 rpm
Power Take-Off (kW/hp)	5.6 / 7.6	6.2 / 8.3	8.4 / 11.4
Number of pole pairs	6	6	6
Max. operating temperature [4)]	120 °C [248 °F]		
Connections	positive output stud = 2x M8; W (rpm) signal connection = isolated fast-on; field current connection = Mastervolt plug		
Temperature sensor	integrated, RJ12 connector		
Reduce charging at	85 °C [185 °F]		
Stop charging at	120 °C [248 °F]		

Alpha Compact model	14/140VP	28/80VP	28/110VP	28/150VP
System voltage	12 V	24 V	24 V	24 V
Battery capacity	280 – 1400 Ah	160 – 800 Ah	220 – 1100 Ah	300 – 1500 Ah
Nominal current[1)] @ 6000rpm	140 A	85 A	110 A	150 A
Recommended DC fuse	175 A	125 A	160 A	200 A
Recommended DC wire size (up to 3m / 10ft)	50 mm^2 [AWG0]	35 mm^2 [AWG2]	35 mm^2 [AWG2]	50 mm^2 [AWG0]
Recommended wire size (3 to 5m / 10 to 16ft)	70 mm^2 [AWG2|0]	50 mm^2 [AWG0]	50 mm^2 [AWG0]	70 mm^2 [AWG2|0]
Cut-in speed	1400 rpm	1400 rpm	1400 rpm	1700 rpm
Max. rotational speed	15.000 rpm	15.000 rpm	15.000 rpm	16.000 rpm
Power Take-Off (kW/hp)	4.8 / 6.4	4.8 / 6.4	6.2 / 8.3	8.4 / 11.4
Number of pole pairs	6	6	6	6
Max. operating temperature [4)]	120 °C [248 °F]			
Connections	positive output stud = 2x M8; W (rpm) signal connection = isolated fast-on; field current connection = Mastervolt plug			
Temperature sensor	integrated, RJ12 connector			
Reduce charging at	85 °C [185 °F]			
Stop charging at	120 °C [248 °F]			

Alpha Compact model	14/120 Mercedes-Benz	14/200 Mercedes-Benz	28/200 Mercedes-Benz
System voltage	12 V	12 V	24 V
Battery capacity	240 – 1200 Ah	400 – 2000 Ah	400 – 2000 Ah
Nominal current[1] @ 6000rpm	120 A	200 A	200 A
Recommended DC fuse	160 A	250 A	250 A
Recommended DC wire size (up to 3m / 10ft)	50 mm² [AWG0]	70 mm² [AWG3|0]	70 mm² [AWG3|0]
Recommended wire size (3 to 5m / 10 to 16ft)	70 mm² [AWG2|0]	95 mm² [AWG4|0]	95 mm² [AWG4|0]
Cut-in speed	1300 rpm	1350 rpm	1300 rpm
Max. rotational speed	20.000 rpm	20.000 rpm	20.000 rpm
Power Take-Off (kW/hp)	3.4 / 4.5	5.6 / 7.6	3.4 / 4.5
Number of pole pairs	6	6	6
Max. operating temperature [4]	120 °C [248 °F]		
Connections	positive output stud = 2x M8; W (rpm) signal connection = isolated fast-on; field current connection = Mastervolt plug		
Temperature sensor	integrated, RJ12 connector		
Reduce charging at	85 °C [185 °F]		
Stop charging at	120 °C [248 °F]		

Alpha	12/130	24/75	24/110	24/150 Evo
System voltage	12 V	24 V	24 V	24 V
Battery capacity	400 Ah [3]	225 Ah	350 Ah	500 Ah
Nominal current @3500rpm	130 A	75 A	110 A	150 A
Recommended DC fuse	160 A	100 A	160 A	200 A
Recommended DC wire size (up to 3m / 10ft)	50 mm² [AWG 0]	25 mm² [AWG 3]	35 mm² [AWG 2]	50 mm² [AWG 0]
Recommended wire size (3 to 5m / 10 to 16ft)	70 mm² [AWG 2/0]	35 mm² [AWG2]	50 mm² [AWG 0]	70 mm² [AWG 2/0]
Cut-in speed	750 rpm	750 rpm	1000 rpm	1300 rpm
Max. rotational speed	8000 rpm	8000 rpm	8000 rpm	10000 rpm
Power Take-Off (kW/hp)	2.1 / 2.8	2.3 / 3.1	3.3 / 4.5	5.4 / 7.3
Number of pole pairs	8	8	8	6
Max. operating temperature [4]	200 °C [392 °F]			
Connections				
- positive output stud B+	M8	M8	M8	M8
- positive output stud B–	M6	M6	M6	M8
- W (rpm) signal	M5	M5	M5	Faston 6.3 mm male[2]
- Field current	Mastervolt plug	Mastervolt plug	Mastervolt plug	Mastervolt plug

1) Nominal charge current is specified at 6000rpm, 25°C / 77 °F *ambient temperature and a "warm" alternator. When the alternator is cold, charge currents can be up to 20% higher. At high ambient temperature (80°C / 176* °F*), charge currents can be up to 15% lower.*

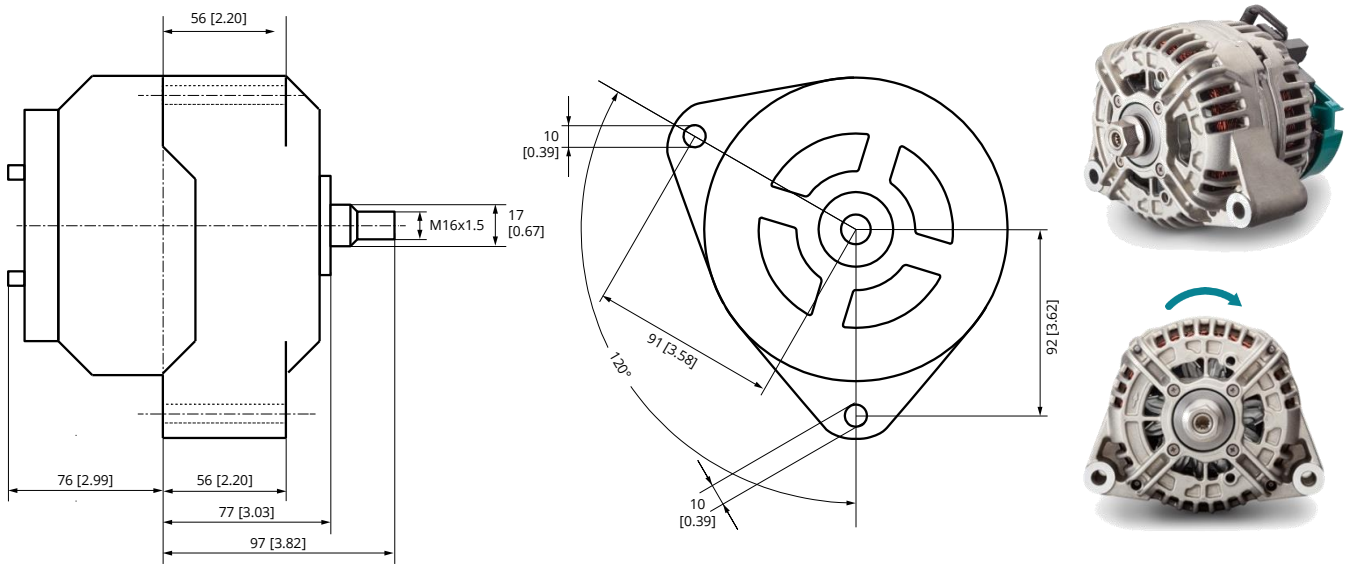
2) if not used, ensure to insulate the faston!

3) Based on Mastervolt gel batteries.

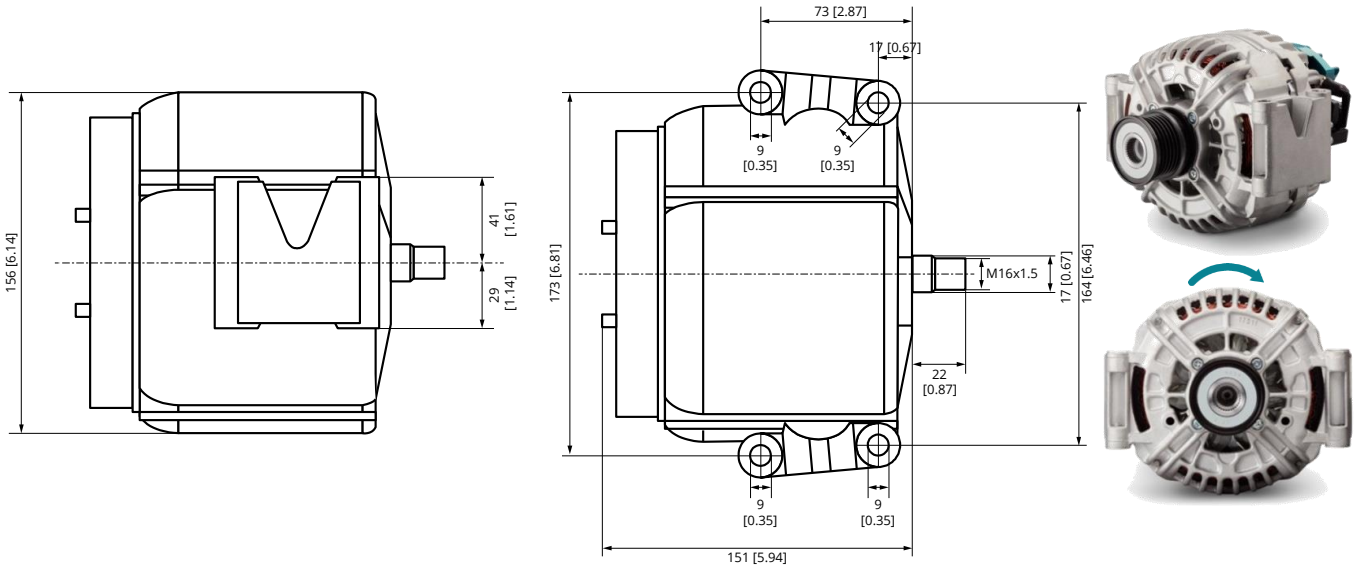
4) Temperature of the alternator housing.

10.3 Mechanical specifications – Alternators

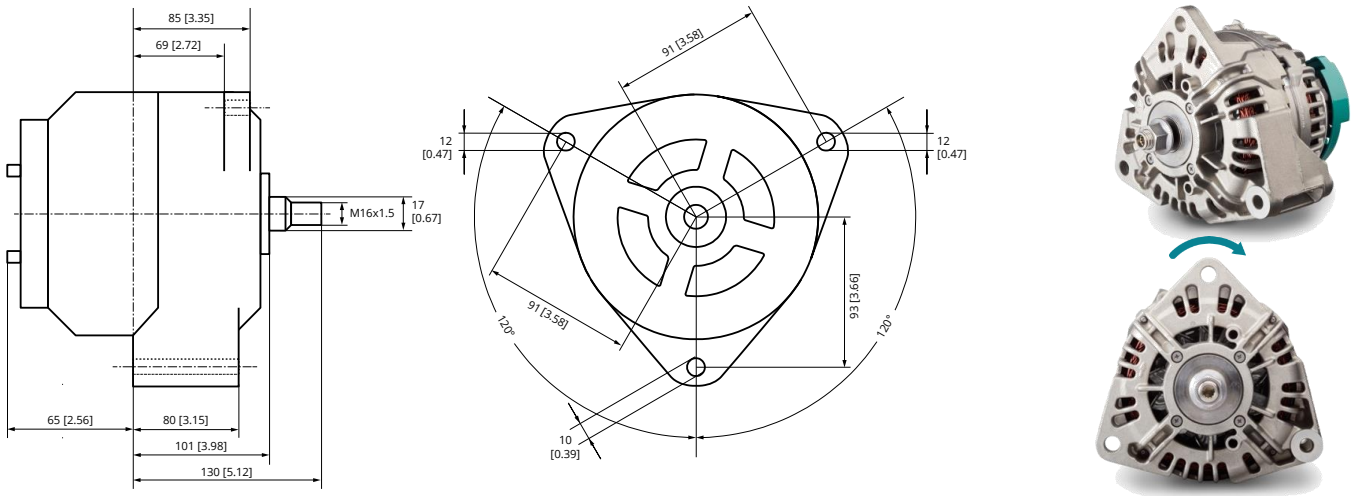
Alpha Compact 14/120 Mercedes-Benz & 14/200 Mercedes-Benz & 28/200 Mercedes-Benz (dimensions in mm [inch])



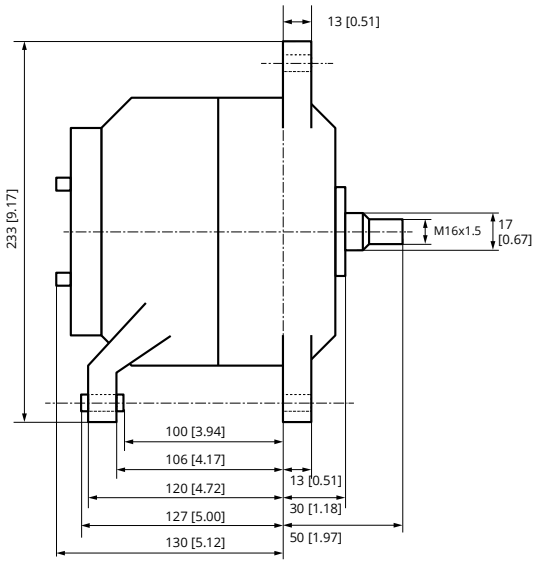
Alpha Compact 14/200 (dimensions in mm [inch])

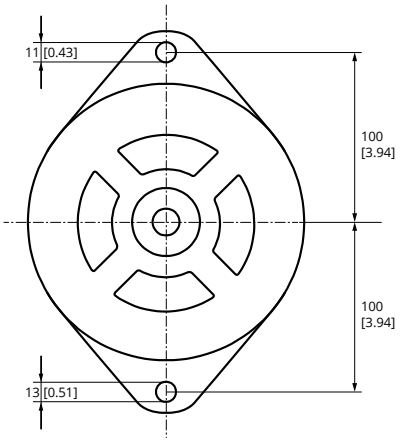


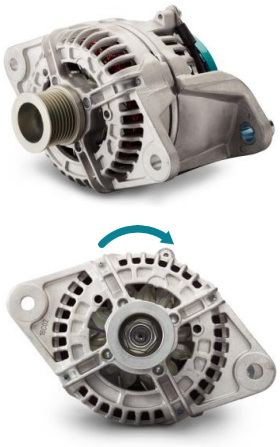
Alpha Compact 28/110 & 28/150 (dimensions in mm [inch])



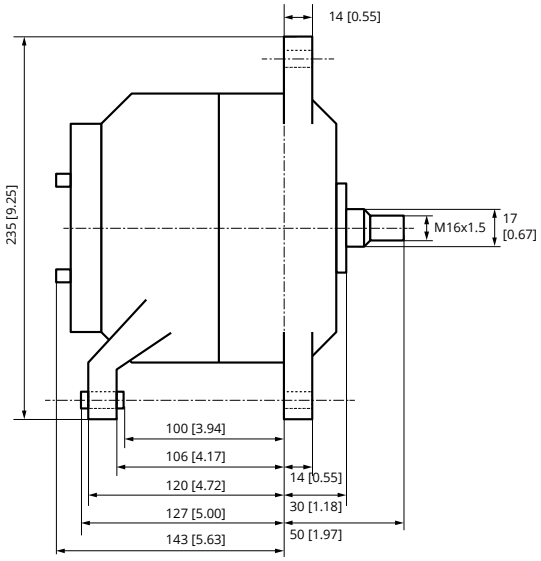
Alpha Compact 14/140 Volvo Penta & 28/80 Volvo Penta & 28/110 Volvo Penta (dimensions in mm [inch])

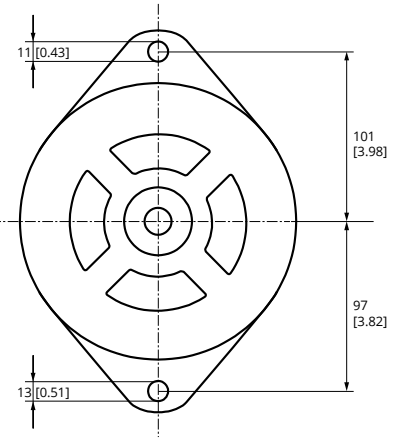


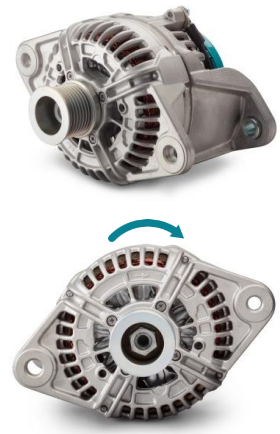




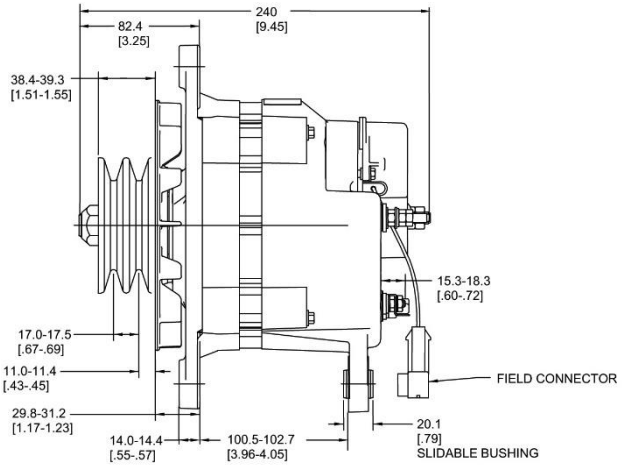
Alpha Compact 28/150 Volvo Penta (dimensions in mm [inch])

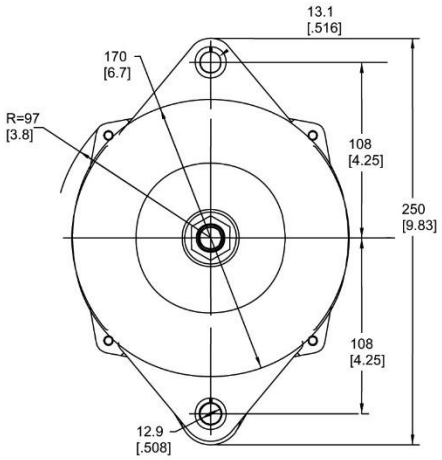






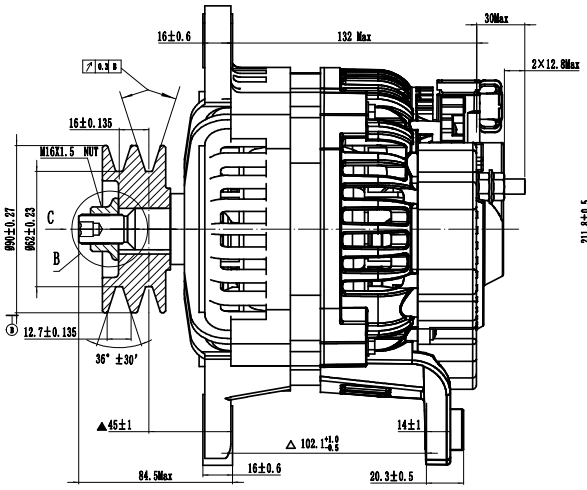
Alpha 12/130 & 24/75 & Alpha 24/110 (dimensions in mm [inch])

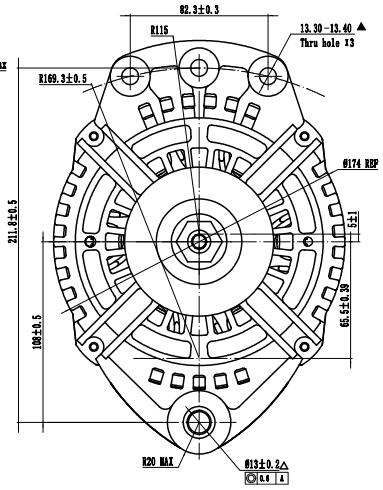






Alpha 24/150 Evo (dimensions in mm)

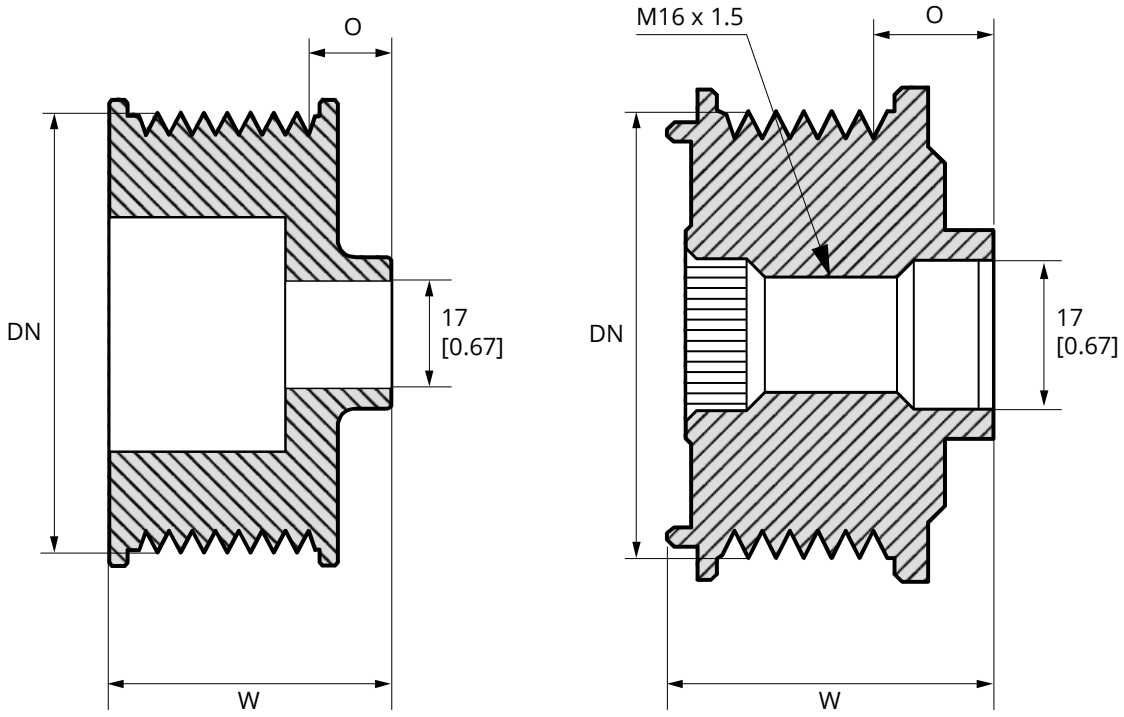






10.4 Mechanical specifications – Pulleys

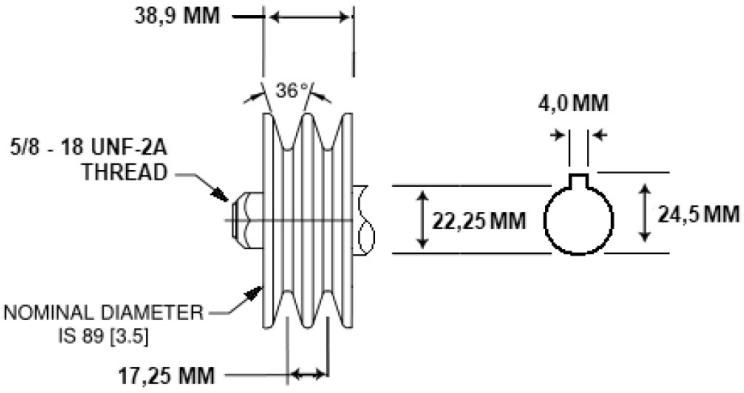
10.4.1 For Alpha Compact models



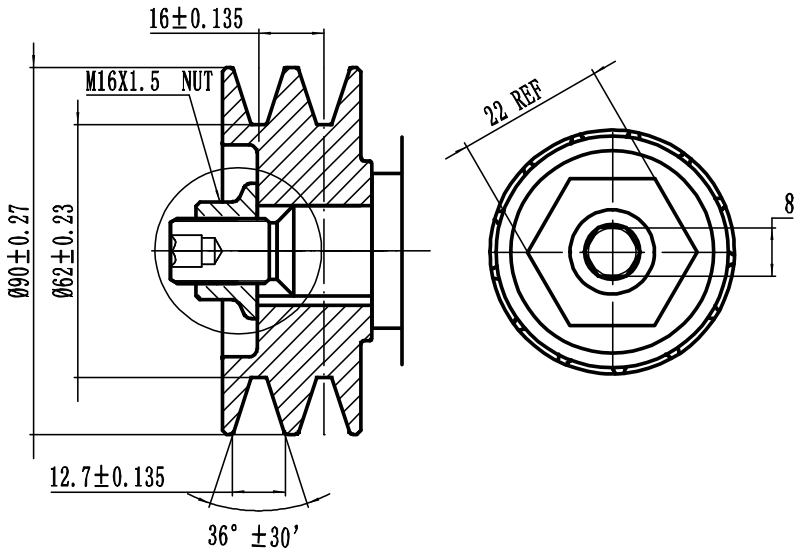
Product code	Type	Grooves	Offset (O)	Width (W)	Diameter (DN)
48420100	Clutch	8	3.9 [0.15]	37.4 [1.47]	57.4 [2.26]
48420110	Clutch	6	15.2 [0.60]	40.3 [1.59]	49.8 [1.96]
48420120	Clutch	6	14.5 [0.57]	42.8 [1.69]	56.2 [2.21]
48420130	Clutch	6	9.9 [0.39]	36.1 [1.42]	55.0 [2.17]
48420140	Clutch	8	4.5 [0.18]	38.9 [1.53]	56.0 [2.20]
48420150	Clutch	8	19.4 [0.76]	49.3 [1.94]	50.0 [1.97]
48420160	Standard	8	5.5 [0.22]	34.6 [1.36]	66.1 [2.60]
48420170	Standard	8	10.0 [0.39]	39.4 [1.55]	48.1 [1.89]
48420180	Standard	2 x 8	5.5 [0.22]	68.7 [2.70]	66.1 [2.60]

Dimensions in mm [inch]

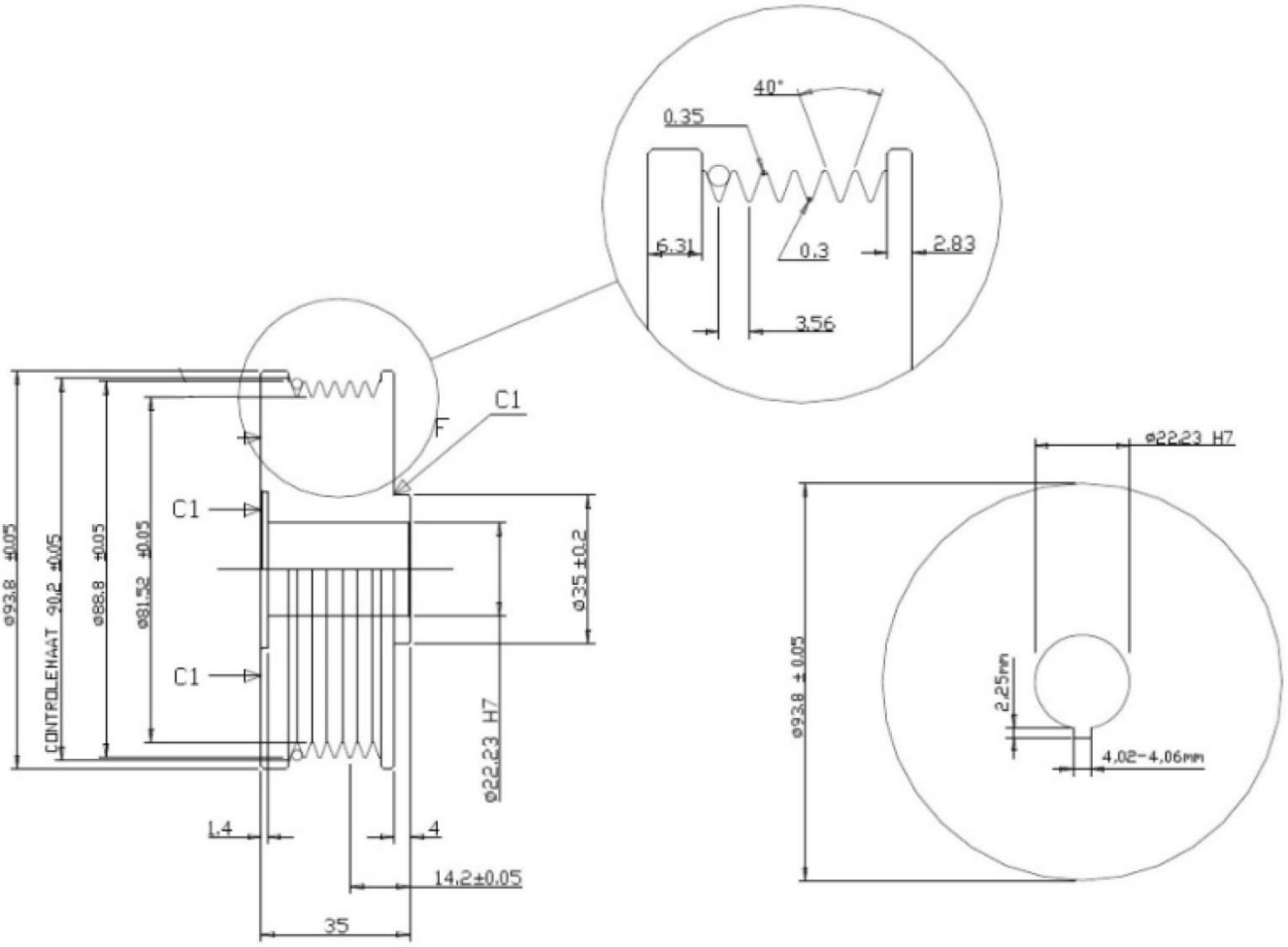
10.4.2 For Alpha models (12/130, 24/75, 24/110, 24/150 Evo)



Double V-belt pulley for Alpha 12/130, 24/75, 24/110, dimensions in mm

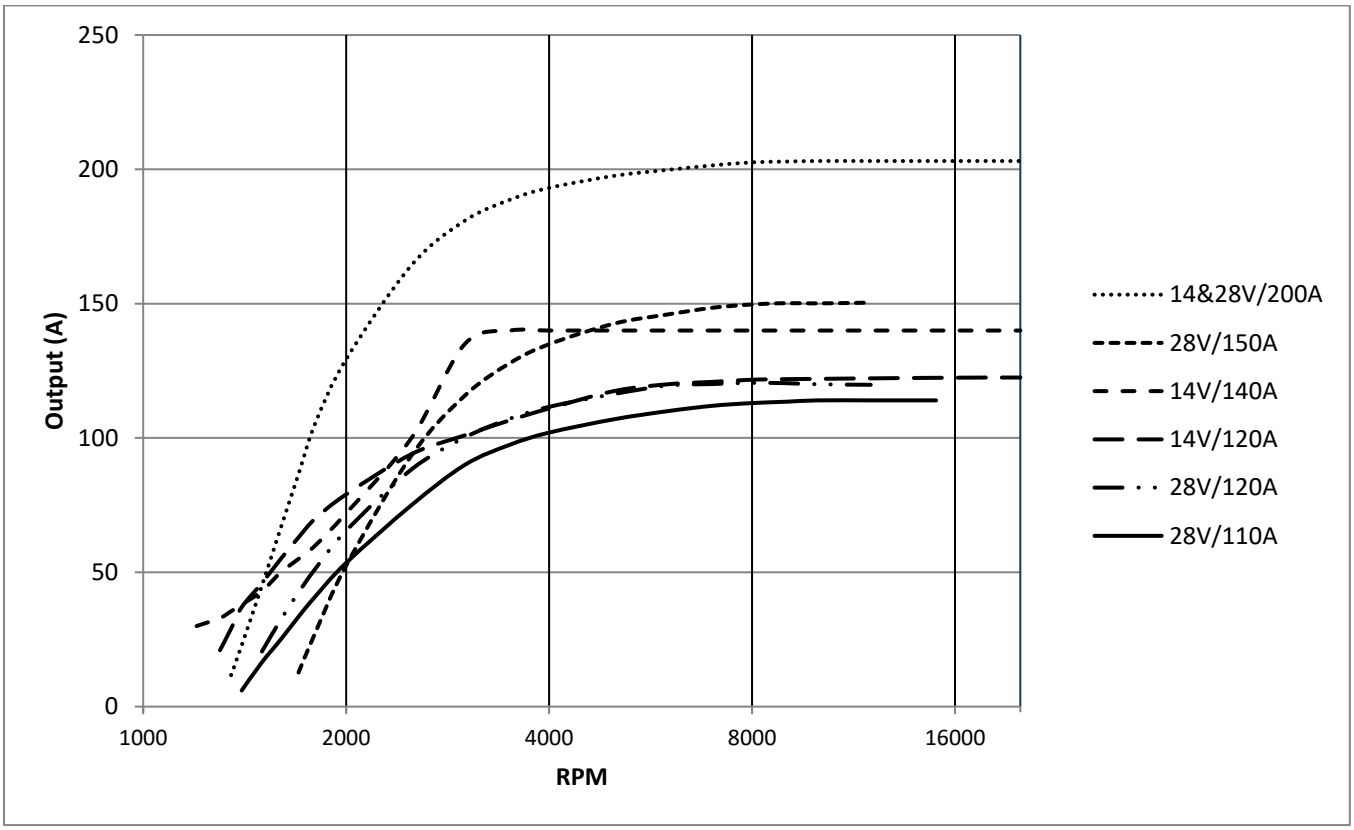


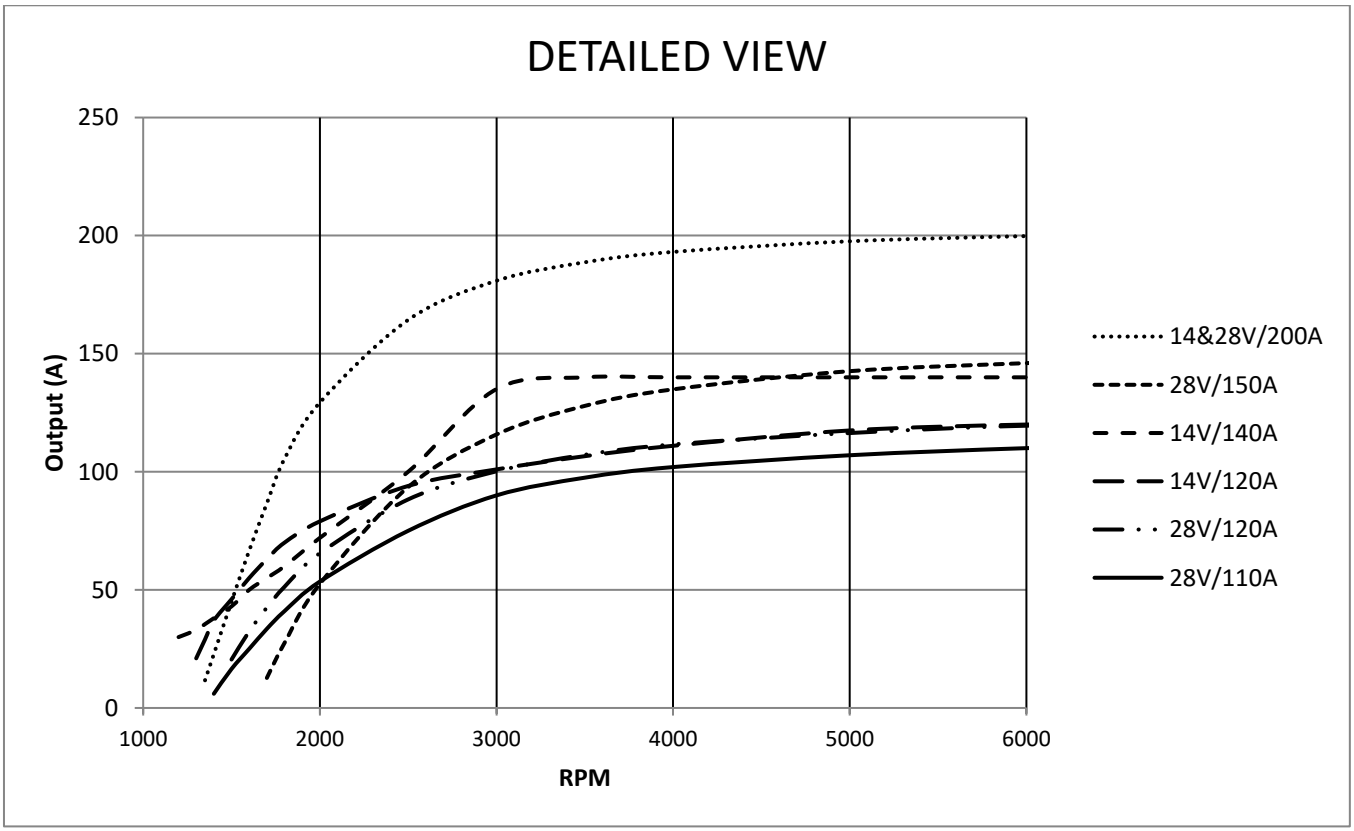
Double V-belt pulley for Alpha 24/150 Evo, dimensions in mm

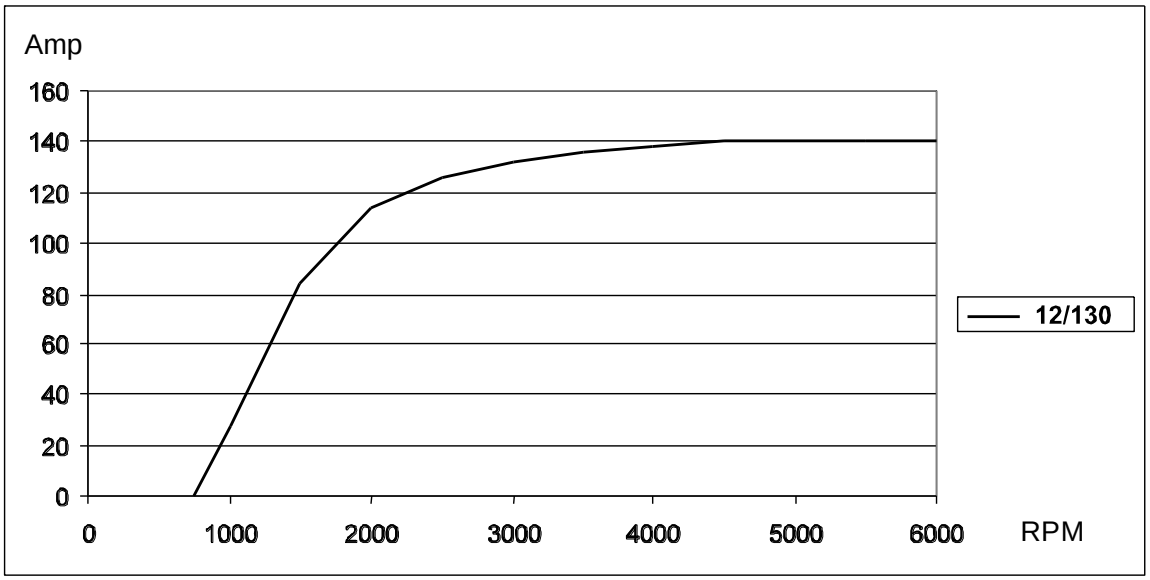


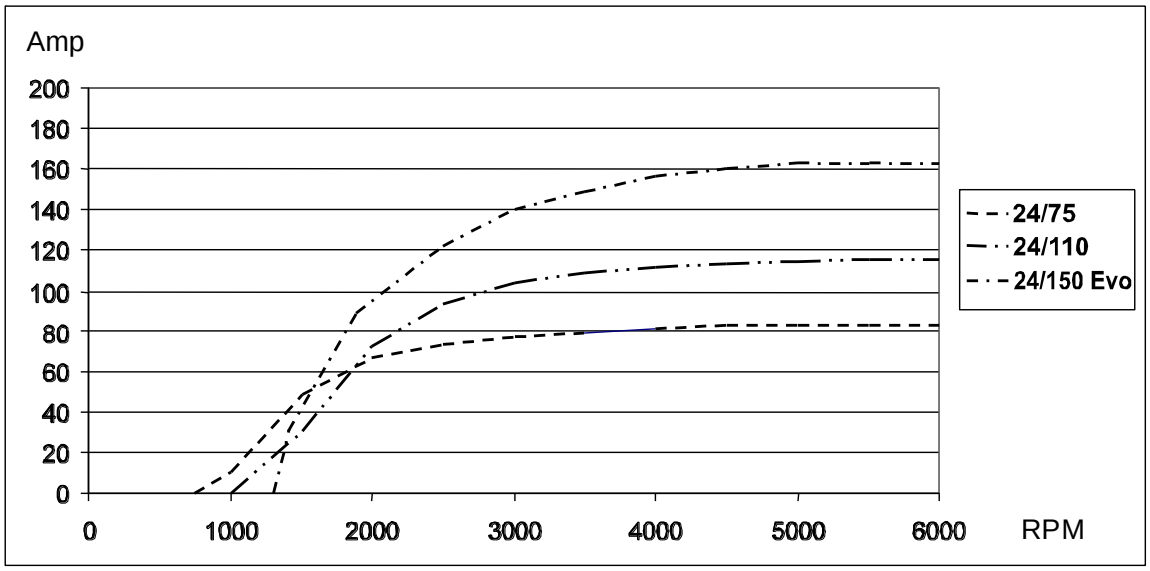
Multigroove pulley dimensions in mm (product code 48400030)

10.5 Output curves









Output power is measured in combination with Alpha Pro III regulator at nominal voltage (25°C)

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MASTERVOLT

THE POWER TO BE INDEPENDENT

ALPHA PRO

Firmware Version 4.0 and higher

ADVANCED 3-STEP CHARGE REGULATOR FOR STANDARD AND HIGH-PERFORMANCE ALTERNATORS



CE

USER AND INSTALLATION MANUAL

For the latest version of this manual, visit our website

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www.mastervolt.com

THIS MANUAL HAS TO BE READ IN COMBINATION WITH THE "MASTERVOLT ALTERNATORS" MANUAL

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1 SAFETY INSTRUCTIONS

READ AND SAVE THESE INSTRUCTIONS

Installation of, and work on the Alpha Pro charge regulator, must be carried out by qualified, authorized and trained personnel, consistent with the locally applicable standards and taking into consideration the safety instructions.

1.1 WARNINGS AND SYMBOLS

Safety instructions and warnings are marked in this manual and on the product by the following pictograms:



CAUTION!
Special information, commands and prohibitions in order to prevent damage.



WARNING!
The addition of this symbol to a warning indicates the risk of electric shock and danger to personal health if the guideline is not followed..



WARNING!
The addition of this symbol to a warning indicates that a potential hazard exists caused by moving parts.

1.2 USE FOR INTENDED PURPOSE

1 The Alpha Pro charge regulator is constructed as per the applicable safety-technical guidelines.

2 Use the Alpha Pro charge regulator only:
- for the charging of lead acid or Lithium-ion batteries and the supply of loads connected to these batteries, in permanent systems;
- with fuses, protecting the wiring between alternator / Alpha Pro charge regulator output and battery;
- in a technical correct condition;
- protected from rain, moist, dust and condensation;
- observing the instructions in this user manual.



WARNING!
Never use the Alpha Pro charge regulator in locations where there is danger of gas or dust explosion or potentially flammable products!

3 Use of the Alpha Pro charge regulator other than mentioned in point 2 is not considered to be consistent with the intended purpose. Mastervolt is not liable for any damage resulting from the above.

1.3 MAINTENANCE & REPAIR

1 If the Alternator, Alpha Pro charge regulator and engine are switched off during maintenance and/or repair activities, they should be secured against unexpected and unintentional switching on:
- remove the key from the engine ignition switch;
- switch off the connection with the batteries or remove the DC fuse(s);
- ensure that third parties cannot reverse the measures taken.



WARNING!
When service must be carried out while the engine is running, be aware of moving parts like V-belts.

2 If maintenance and/or repairs are required, only use original spare parts.

1.4 GENERAL SAFETY AND INSTALLATION PRECAUTIONS

- Before using the Alpha Pro charge regulator, read all instructions and cautionary markings on the Alternator / Alpha Pro charge regulator, the batteries, and all appropriate sections of this manual.
- The Alpha Pro charge regulator is designed to be permanently connected to your DC electrical systems. Mastervolt recommends that all wiring be done by a certified technician or electrician to ensure that adherence to proper electrical wiring regulations.
- Wrong use of the charging mode selector will lead to serious damage to batteries, the Alternator, the Alpha Pro charge regulator charge regulator and the cabling.
- Wrong MasterBus settings will lead to serious damage to batteries, the Alternator, the Alpha Pro charge regulator and the cabling.
- Selection of a MasterShunt connected to a battery with a different nominal voltage will lead to serious damage to batteries, the Alternator, the Alpha Pro charge regulator and the cabling.
- Be aware of parts that can be hot: not only engine parts, but the alternator as well.
- In case of fire, you must use the fire extinguisher which is appropriate for electrical equipment.
- Short circuiting or reversing polarity will lead to serious damage to batteries, the Alternator, the Alpha Pro charge regulator and the cabling. Fuses between the batteries and the electrical installation cannot prevent damage caused by reversed polarity and the warranty will be void.
- Secure the DC wiring with a fuse, according to the guidelines in this manual. Connection and protection must be done in accordance with local standards.
- Do not work on the Alternator, Alpha Pro charge regulator or parts of the electrical system if it is still connected to a power source.

1.5 WARNING REGARDING THE USE OF BATTERIES

1 Someone should be within range of your voice or close enough to come to your aid when you work near a battery.
2 Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3 Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
4 If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and get medical attention immediately.
5 NEVER smoke or allow a spark or flame in vicinity of battery or engine.
6 Do not short circuit batteries, as this may result in explosion and fire hazard! Be extra cautious to reduce risk of dropping a metal tool onto a battery. It might spark or short-circuit battery or other electrical part that may cause explosion.
7 Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.
8 Do not use the Alpha Pro charge regulator for charging non-rechargeable batteries that are commonly used with home appliances. These batteries may burst and cause injury to persons and damage to property.
9 NEVER charge a frozen battery.
10 Excessive battery discharge and/or high charging voltages can cause serious damage to batteries. Do not exceed the recommended limits of discharge level of your batteries.
11 If it is necessary to remove a battery, always remove grounded terminal from battery first. Ensure that all accessories are off, so as not to cause an arc.
12 Ensure that the area around battery is well ventilated while battery is being charged. Refer to the recommendations of the battery manufacturer.
13 Batteries are heavy! It may become a projectile if it is involved in an accident! Ensure that adequate and sure mounting and always use suitable handling equipment for transportation.

1.6 WARNING REGARDING LIFE SUPPORT APPLICATIONS

Do not use the Alpha Pro charge regulator for applications in any medical equipment intended for use as a component of a life support system. For this type of use a specific written agreement between the customer and Mastervolt is required.

2 GENERAL INFORMATION

2.1 USE OF THIS MANUAL

This manual serves as a guideline for the safe and effective operation and maintenance of the following Alpha Pro charge regulator models:

Model	Product code / Part no.
Alpha Pro III	45513000
Alpha Pro II	45512000

Note: This manual applies to Alpha Pro charge regulators running on Firmware Version 4.0 and higher. For older firmware versions, some of the described settings in section 6.3 may look different.

These models are further referred to as "Alpha Pro charge regulator" or "Alpha Pro".

The Alpha Pro charge regulator can be purchased individually, or as part of a kit that includes a Mastervolt alternator and/or a pulley. For available models or other accessories, see the Mastervolt website.

2.2 LIABILITY

Mastervolt can accept no liability for:

- Consequential damage resulting from the use of the Alpha Pro charge regulator.
- Possible errors in the included manual and the consequences of these.
- Use that is inconsistent with the purpose of the product.

2.3 WARRANTY

The Mastervolt product warranty covers the Alpha Pro charge regulator for the first two years after the purchase date, on the condition that the product is installed and used according to the instructions in this manual.

Installation or use that does not comply with these instructions may result in under performance, damage or failure of the product and may void this warranty. The warranty is limited to the cost of repair and/or replacement of the product. Costs of labor or shipping are not covered by this warranty.

2.4 DISCLAIMER

Our products are subject to continual development and improvement. Therefore, additions or modifications to the products may cause changes to the technical data and functional specifications. No rights can be derived from this document. Please consult our most current Terms & Conditions of Sale.

2.5 IDENTIFICATION LABEL

Important technical information required for service, maintenance & secondary delivery of parts can be derived from the identification label.

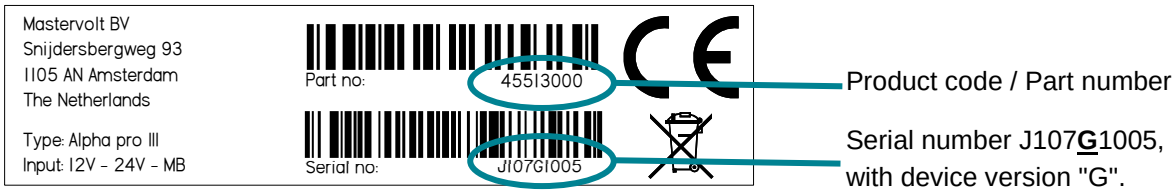


Figure 1: Identification label

CAUTION!

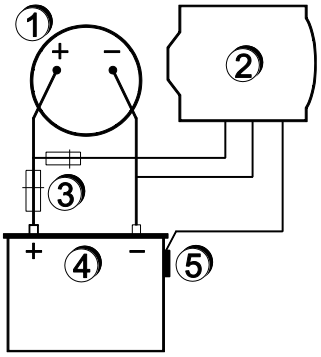
Never remove the identification label. This will void the warranty.

2.6 CORRECT DISPOSAL OF THIS PRODUCT

This product is designed and manufactured with high quality materials and components, which can be recycled and reused. Please be informed about the local separate collection system for electrical and electronic products. Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

3 PRODUCT DESCRIPTION

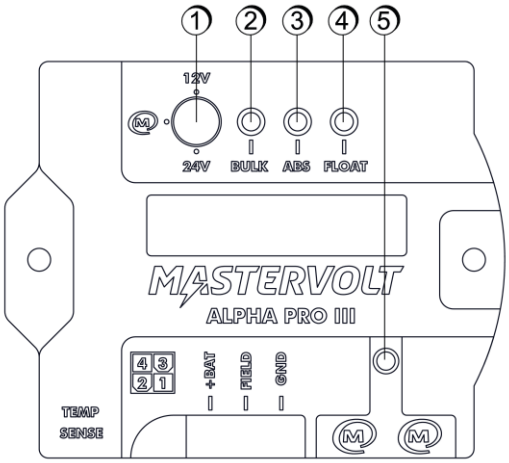
This user manual describes the installation and operation of the Alpha Pro charge regulator. Together with the Mastervolt alternators, this charging regulator is designed to provide a high output power at low RPM, which is typical for marine applications. It consists of the following main components (See Figure 2):



1 Mastervolt alternator
2 Alpha Pro charge regulator
3 Battery fuses
4 Batteries (not included)
5 Battery temperature sensor

Figure 2: Basic charging system consisting of an alternator and the Alpha Pro charge regulator

3.1 OVERVIEW OF THE ALPHA PRO CHARGE REGULATOR



1 Charging mode selector switch
2 Yellow LED to indicate Bulk phase
3 Yellow LED to indicate Absorption phase
4 Yellow LED to indicate Float phase
5 Green LED to indicate MasterBus traffic

When LEDs 2, 3 and 4 are all on, the battery is in float phase.

Figure 3: Overview of the Alpha Pro charge regulator (front view)

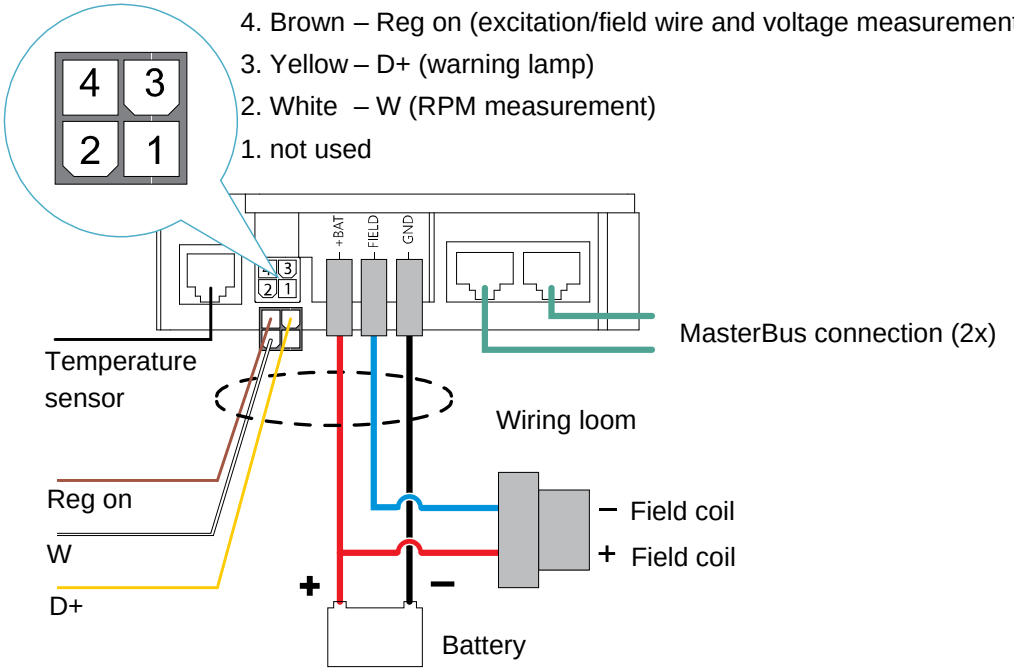


Figure 4: Connections of the Alpha Pro charge regulator (bottom view)

3.2 THE 3-STEP+ CHARGE PROCESS

The Alpha Pro charge regulator controls the alternator's output voltage. It is designed for optimal charging of flooded, GEL, AGM and Lithium-ion batteries. Battery charging is accomplished in three automatic stages: BULK, ABSORPTION and FLOAT.

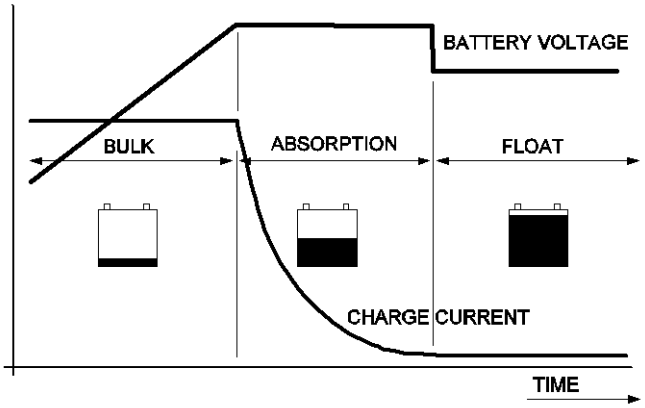


Figure 5: 3-step+ charge system

See Figure 5. The first step of the 3-step+ charge process is the BULK phase, in which the output current of the charging system is limited by the maximum output current of the alternator and the engine RPM. At this stage, the greater part of the battery capacity is rapidly charged. The current charges the batteries and the voltage will rise to the absorption voltage. Refer to the specifications for the charging voltages for different batteries.

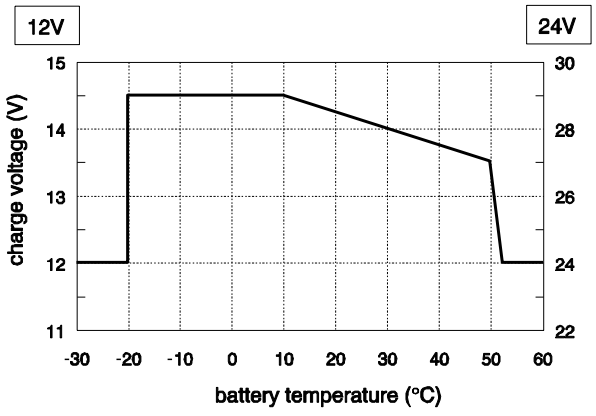
The duration of this phase depends on the ratio of charging capacity to battery capacity and on the degree to which the batteries were discharged to begin with.

The bulk phase is followed by the absorption phase. The absorption charge starts when the voltage on the batteries has reached the absorption voltage and ends when the battery is fully charged. Battery voltage remains constant throughout this stage, and the charge current decreases during charging of the battery. With a flooded battery, this stage lasts about four hours, with GEL and AGM around three, and with Lithium-ion batteries about 30 minutes.

Once the maximum absorption timer has passed, the Alpha Pro charge regulator automatically switches over to the float phase. During the float phase the Alpha Pro charge regulator switches to float voltage, refer to specifications, and stabilizes this voltage to maintain the batteries in an optimum condition. Connected loads are powered directly by the charging system. If the load is higher than capacity of the charging system, the required additional power comes from the battery, which will be progressively discharged. The Alpha Pro charge regulator will start a new cycle when the engine is started again or when the battery voltage drops below a predefined threshold.

3.3 TEMPERATURE COMPENSATED CHARGING

A battery temperature sensor is included in the delivery of the Alpha Pro charge regulator. By installing this battery temperature sensor, the charge voltages are automatically adapted for deviating temperatures. When the temperature-sensor is not connected, the 25°C [77°F] settings are taken.



When the battery temperature is low, the charge voltage increases. On the other hand, when the battery temperature is high, the charge voltage is decreased. This will extend the life of your batteries. Consult your battery manufacturer for recommended charging voltages.

Notes: - Temperature compensated charging does not prevent the batteries from overcharging situations.

- Lithium-ion batteries do not require the external temperature sensor or temperature compensation!

Figure 6: Temperature compensated charging

CAUTION!

High temperatures are destructive to batteries. If your batteries are regularly subjected to temperatures above 30°C [100°F], you should relocate them, or supply forced fresh air ventilation.

3.4 ALTERNATORS FROM OTHER BRANDS

You may want to equip a non-Mastervolt alternator with the optional temperature sensor (Product code: 41500400) that measures the housing temperature of the alternator. The MasterAdjust Temperature feature in MasterBus keeps track of the housing temperature and reduces and stops the charge of the alternator, if necessary, see section 5.4. The configuration can be done in MasterAdjust, from a PC connected to the Alpha Pro charge regulator via a Mastervolt USB Interface. MasterAdjust software is available as free to download software on the Mastervolt website: www.mastervolt.com.

CAUTION!

The alternator must be suitable to handle its power continuously. Refer to the alternator supplier for details regarding maximum allowed temperature and the best spot to place this sensor. Mastervolt does not accept any liability for consequential damage.

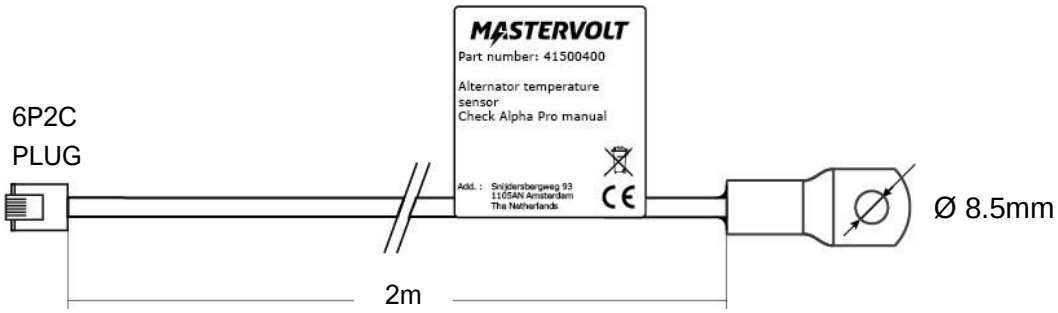


Figure 7: Alternator temperature sensor

The alternator temperature sensor is potted in a metal cable lug to make it more resistant for higher temperatures and provide a way to attach it to the alternator housing. The installer should find a way where and how to attach the sensor to the alternator housing.

CAUTION!

Do not attach the cable lug to one of the alternator connection bolts. These bolts are often located in the airflow of the alternator and this will affect the measurement.

4 INSTALLATION

During installation and commissioning of the Alpha Pro charge regulator, the Safety Guidelines & Measures are applicable at all times. See section 1 of this manual.

4.1 UNPACKING

The Alpha Pro charge regulator ships with the following items:

- Wiring loom for Mastervolt alternators
- Battery temperature sensor
- MasterBus terminator
- User manual

After unpacking, check the contents for possible damage. Do not use the product if it is damaged. If in doubt, contact your Mastervolt dealer.

4.2 WIRING INSTRUCTIONS

4.2.1 General



WARNING!

Let installation work be done by a licensed electrician. Before beginning with the connection of the wiring, make the DC distribution voltage free and ensure that the engine is off.



CAUTION!

Short circuiting or reversing polarity may lead to serious damage to the batteries, the alternator, the Alpha Pro charge regulator, the cabling and/or the terminal connections. Fuses cannot prevent damage caused by reversed polarity. The damage as a result of reverse polarity is not covered by the warranty.



CAUTION!

Too-thin cables and/or loose connections can cause dangerous overheating of the cables and/or terminals. Therefore, tighten all connections well, in order to limit transition resistance as far as possible. Use cables of the correct size. See specifications (Chapter 9) for recommended wire sizes and torque values.

- Use the supplied wiring loom for connection of the Alpha Pro charge regulator.
- DC Cables to connect the battery to the alternator are not included in the delivery.
- The Mastervolt alternator wiring is electrically isolated from ground.
- A DC-fuse must be integrated in the positive cable between the battery and the alternator (see section 9 for specifications). Do not install the DC-fuse of the DC-distribution before the entire installation is completed.
- The two-pole connector of the wiring loom goes into the field connector of the alternator. Take adequate measures to ensure a strain relief for this connector.

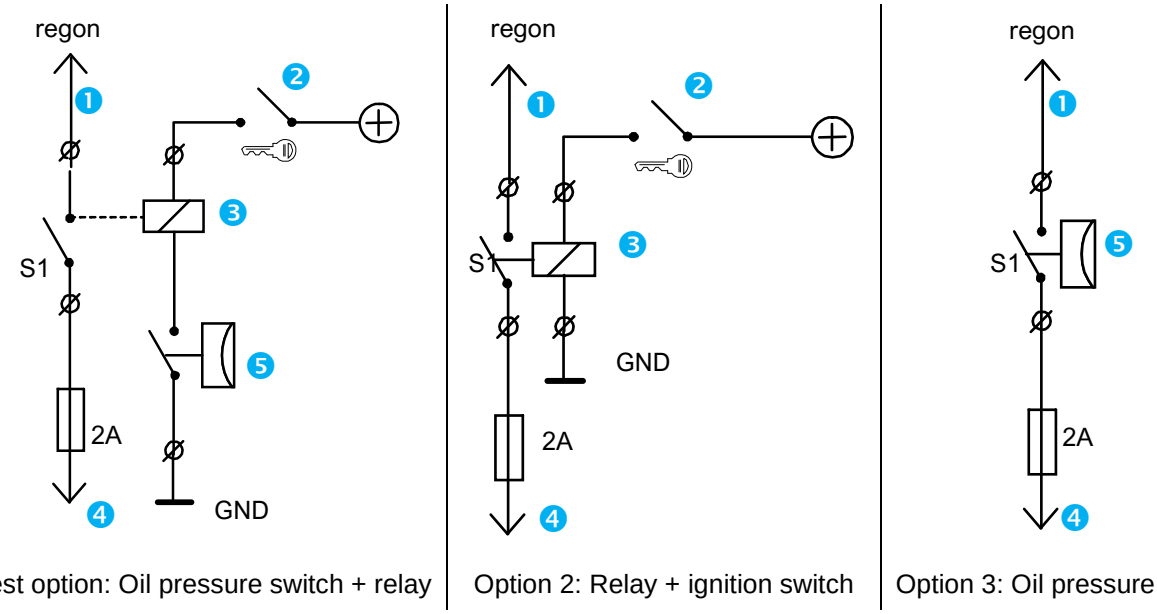
4.2.2 Reg on

The "reg on" wire should be interrupted with a relay or an ungrounded oil pressure switch. If you use a relay, this relay can be powered from the ignition switch.

CAUTION!

The "reg on" wire should run to the positive pole of the battery being charged, as this is also the voltage measurement for the regulator. Otherwise, the batteries may be overcharged and damaged. See Figure 8.

If the engine is not running switch "S1" must be open, otherwise the field windings of the alternator will be damaged due to overheating by lack of cooling-air flow.



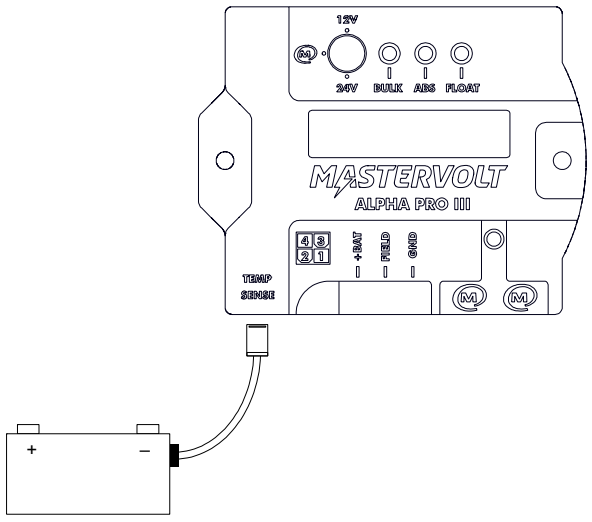
Best option: Oil pressure switch + relay | Option 2: Relay + ignition switch | Option 3: Oil pressure switch

1 Brown wire
2 Ignition switch
3 Relay
4 Positive battery pole of the battery being charged
5 Normally open oil pressure switch

Figure 8: Connection options

4.2.3 Connection of the battery temperature sensor (included)

Attach the temperature sensor on the battery and connect to the Alpha Pro charge regulator as indicated.



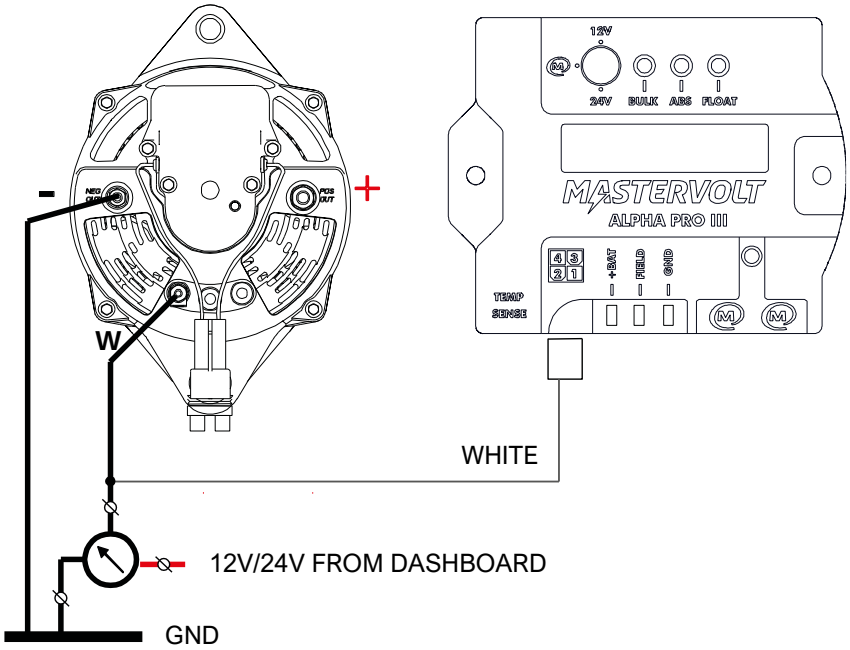
Notes:
- If there are multiple batteries, attach the sensor to the main battery, or to the one that will run the warmest.
- High temperatures are destructive to batteries. If your batteries are regularly subjected to temperatures above 30°C [100°F], you should relocate them or supply forced fresh air ventilation.
- Lithium-ion batteries do not require the external temperature sensor or temperature compensation!

Figure 9: Installation of the battery temperature sensor

4.2.4 Connection of a tachometer (optional)

If a tachometer is used, it should be connected between the W terminal of the alternator and the B– terminal of the alternator (or the negative battery pole). See Figure 10.

The Alpha Pro charge regulator has the same function integrated in its MasterBus functionality, so the number of revolutions per minute (revs or RPM) can be shown on a MasterBus connected display too. To enable this, connect the white wire from the cable loom to the alternator, and set the number of pole pairs in MasterAdjust.

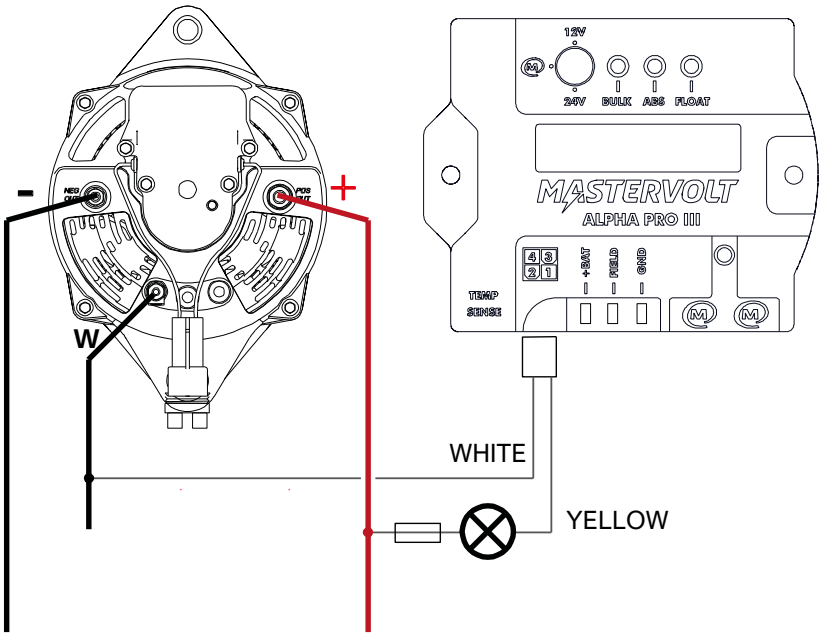


Note: With some alternators the W terminal is marked by an "R" instead of a "W".

Figure 10: Connection of a tachometer

4.2.5 Connection of a D+ lamp (optional)

A standard alternator and engine have a charge indicator lamp. This lamp will go off when the alternator is charging. The Alpha Pro charge regulator offers the same function. To enable this, connect the yellow and white wires from the cable loom to the alternator, and select the RPM option in MasterAdjust.



Note: With some alternators the W terminal is marked by an "R" instead of a "W".

The D+ control is also used for alarm indications:

- 3 short blinks every 2 seconds: field current too high
- 2 short blinks every 2 seconds: battery voltage too high
- 1 short blink every 2 seconds: field current too low

Figure 11: Connection of a D+ lamp

(see the "Mastervolt Alternators" manual for detailed installation drawings)

4.2.6 Connection of a battery isolator (optional)

When two or more battery banks (of the same chemistry) need to be charged simultaneously, a battery isolator is recommended. See Figure 12 for installation details. Also see the "Mastervolt Alternators" manual for installation examples.

CAUTION!

If there is a standard battery isolator between the B+ terminal of the alternator and the positive (+) pole of the battery, both the red [+bat] wire and the brown [reg on] lines must be connected to the positive (+) pole of the battery. Do not connect these wires to the input of the battery isolator.

Note: As battery voltage sensing is performed by the Alpha Pro charge regulator, you can use a battery isolator that has no voltage sense connection.

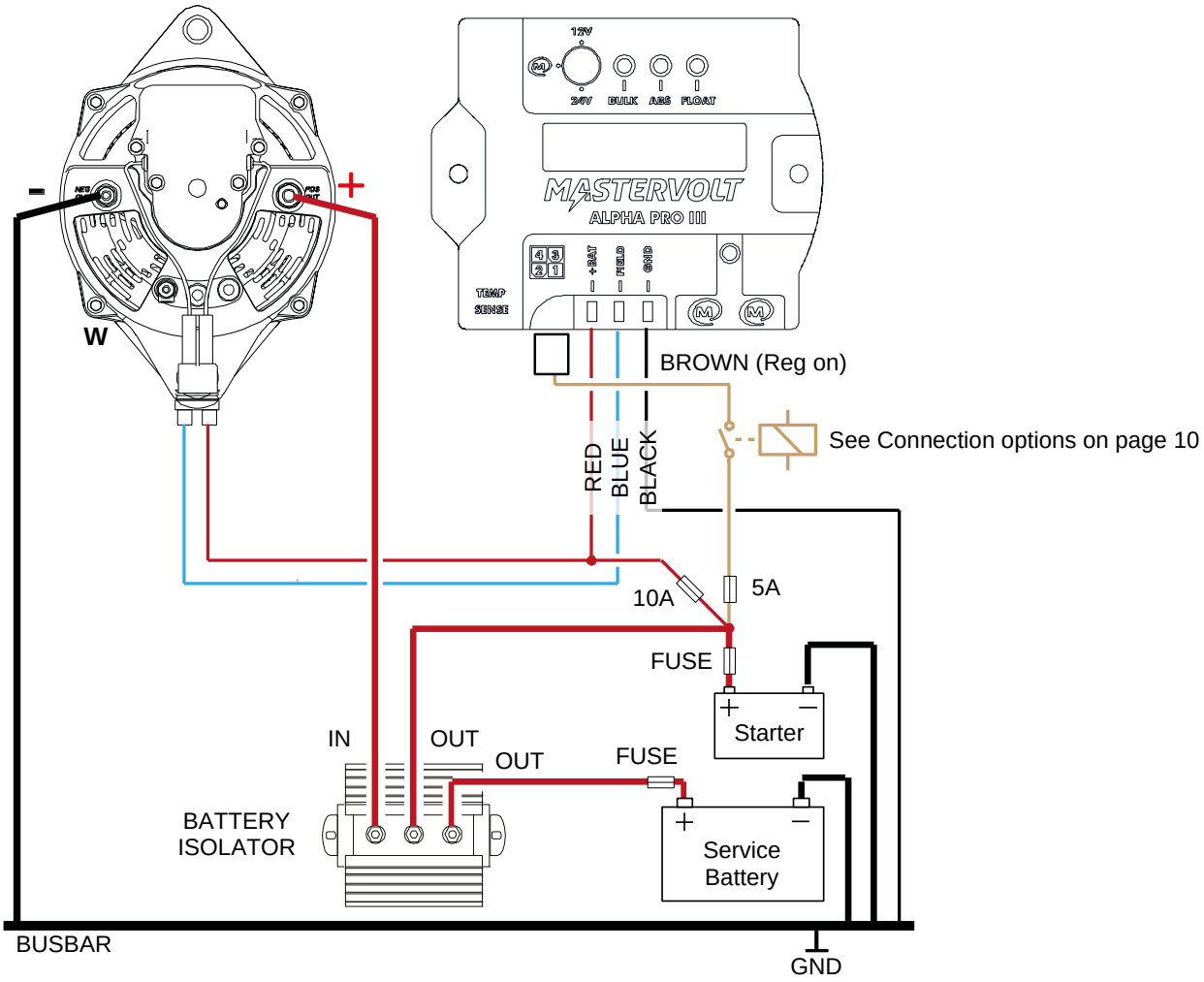


Figure 12: Connection of a battery isolator

5 COMMISSIONING

CAUTION!

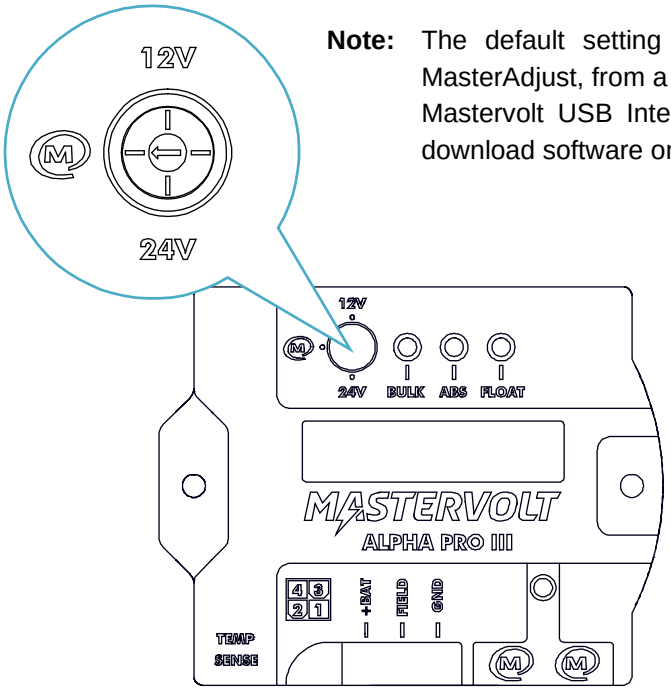
Fuses between the batteries and the Alpha Pro charge regulator cannot prevent damage caused by reversed polarity. The damage as a result of reverse polarity is not covered by the warranty.

Commissioning of the Mastervolt alternator and the Alpha Pro charge regulator involves two major parts:

- Selecting the charging mode
- Testing and adjusting

5.1 SELECTING THE CHARGING MODE

The Alpha Pro charge regulator has a three positions selector switch featuring standard settings for a 12V or 24V (lead acid) system and advanced settings via MasterBus.



Note: The default setting is MasterBus. The configuration can be done in MasterAdjust, from a PC connected to the Alpha Pro charge regulator via a Mastervolt USB Interface. MasterAdjust software is available as free to download software on the Mastervolt website: www.mastervolt.com.

Figure 13: Three positions charging mode selector switch

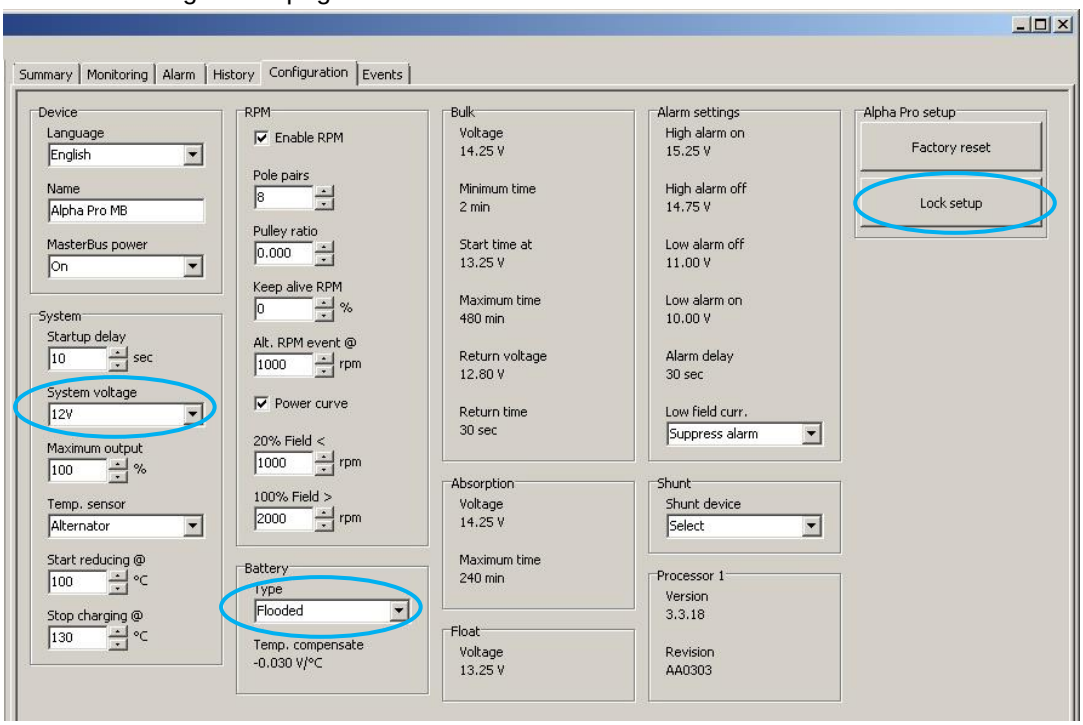
CAUTION!

Invalid settings can cause serious damage to your batteries. Adjustments of settings may be undertaken by authorized personnel only! Keep a record of setting changes in this manual.

When MasterBus is selected, by default the configuration of the Alpha Pro charge regulator will be unlocked, resulting in a device that *remains inactive* (shown by LEDs blinking twice, one after the other). Two parameters need to be selected via MasterAdjust before the configuration can be locked and the Alpha Pro charge regulator made operational (see Chapter 6 for more extensive explanation on using MasterBus).

The following procedure describes how to commission with MasterAdjust.

1 Go to the Configuration page.



2 Go to group "System" and select the "System voltage" present in your system.

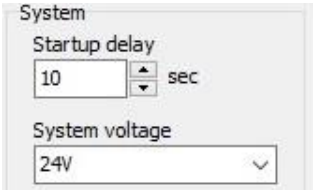


*Figure 14: Selecting "*System *voltage" through MasterAdjust*

3 Go to group "Battery" and select the "Battery type" present in your system.



Figure 15: Selecting "Battery type" through MasterAdjust

4 Go to group "Alpha Pro setup" and select "Lock setup".



Figure 16: Selecting "Lock setup" via MasterAdjust

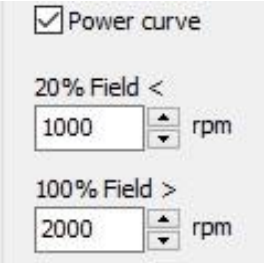
Now the Alpha Pro charge regulator is ready for testing. Or configure the following optional setting(s) first.

5.2 KEEP ALIVE FUNCTION (OPTION)

This feature can keep a connected RPM meter functional if the alternator field current drops. It will only function if the White wire is connected to the W or R point of the alternator. Two situations can override this feature:

- if the alternator temperature reaches its "Stop charging @" temperature or
- if the charger receives a "Stop charge" event.

5.3 POWER CURVE (OPTION)



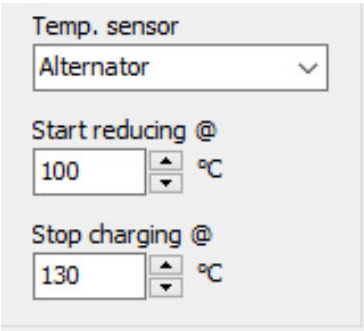
This option limits the charge current in a selected number of revs intervals. This prevents slipping as a result of the high torque required to provide the charge current. Up to the lower rev limit, the charge current will not exceed 20%. From the higher rev limit, it allows a maximum charge current of 100%. Revs in between the limit, result in a proportional maximum charge current.

Note: All RPMs here are Alternator RPMs.

5.4 TEMPERATURE CONFIGURATION (OPTION)

There are two options in the Alpha Pro temperature settings: "Battery" and "Alternator".

- By selecting "Battery", the Alpha Pro expects the (lead acid) battery temperature sensor to be connected to its temperature input. The measured temperature will be used to compensate the voltage output of the alternator. When charging batteries that need temperature compensated charge (like lead acid), this temperature sensor always has the priority, in order to charge the batteries in a save and efficient way. The battery temperature sensor (Product code: 41500500) is included in the delivery of the Alpha Pro.
- By selecting "Alternator", two temperature levels can be entered. At the first temperature level, the alternator will start reducing its output power. At the second temperature level, the alternator will stop charging. Reducing will follow a linear line between the two temperature levels. The alternator temperature sensor (Product code: 41500400) is optional. It can be used to measure the housing temperature of an alternator.
  For non-Mastervolt alternators, consult the manufacturer to discuss the correct temperature values to reduce and stop the charge, considering a difference in temperature between the temperatures given by the manufacturer and the spot where the sensor will be installed.



Note: The Alpha Pro has one temperature input. If both temperatures need to be measured, a MasterShunt (Product code: 77020100) could be added to the system. The MasterShunt temperature sensor input can be used to measure the batteries and this data can be used by the Alpha Pro, see sections 6.3.1, 6.3.4 and 6.3.8.



CAUTION!

Please note that this solution will not protect the alternator against damage due to overheating.

Mastervolt cannot be held responsible for any damage to a third-party alternator!

The only accurate measurement is on the internal windings and this can in no way be covered by this sensor. Therefore, this measurement is only an indication!

5.5 TESTING

5.5.1 Test prior to starting engine

Before starting the engine, follow all steps in order of succession as described below:

1 Check whether all indication lights on the Alpha Pro charge regulator are off.

2 Energize the [reg on] terminal by either turning on the ignition switch (DO NOT START THE ENGINE) or by putting a jumper across switch S1 (see Figure 17). Check whether the 3 yellow LEDs start to blink. After approximately 10 seconds, the yellow bulk led will illuminate.

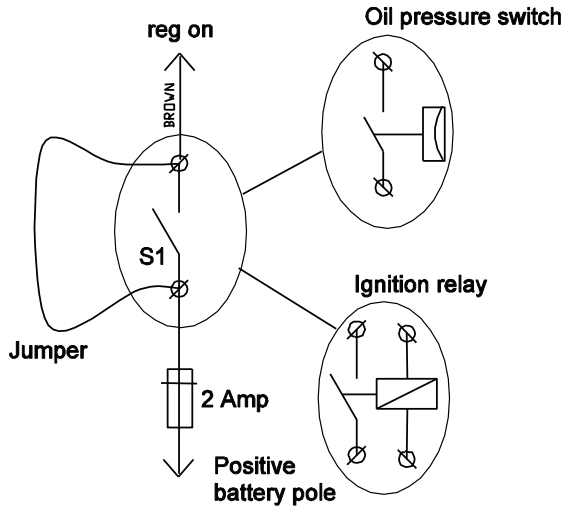


Figure 17: Jumper across switch S1

3 Check whether the alternator field is energized by touching the shaft of the alternator with a screwdriver. It should be strongly magnetic.

4 De-energize the [reg on] terminal by turning off the ignition switch or by removing the jumper across switch S1 again. All LEDs should go off and the field should no longer be strongly magnetic.

CAUTION!

If you fail to de-energize the [reg on] terminal, the field windings of the alternator will be damaged due to overheating.

If you cannot pass the tests mentioned above, remove the DC-fuses and double check the wiring. Refer to the Trouble shooting section (section 8).

5.5.2 In operation test

To check for proper operation, you will need a handheld digital meter. If you have installed a battery monitor such as the *MasterShunt* or any other digital voltage measuring device, you can use this as well.



WARNING!

When the engine is running, be aware of moving parts like V-belts.

Note: See section 3.2 for explanation of the bulk, absorption and float mode.

- Ensure that no loads or any other charging sources are on!
- Ensure that the battery is (almost) fully charged. This will keep the duration of the test as short as possible.

Follow all steps in order of succession as described below:

1 Measure and record the battery voltage before starting the engine.
2 Start the engine. The three LEDs on the Alpha Pro charge regulator blink together to indicate the startup mode.
3 Check for abnormal noise or vibration.
4 The yellow [BULK] LED on the Alpha Pro charge regulator (see Figure 3) illuminates, indicating that the charge-cycle begins. Rev up the engine so the alternator rotates at 3000 rpm.
5 Measure and record the battery voltage. The battery voltage should be higher than measured before at step 1. The battery voltage rises until the yellow [ABS] LED illuminates.
6 When the yellow [ABS] LED illuminates, the absorption mode starts. Disconnect the temperature sensor and measure the voltage at which the battery stabilizes. When installed correctly, the result should equal the specified voltage at 25°C [77°F]. Reconnect the temperature sensor.
7 Option: An absorption timer starts to keep the Alpha Pro charge regulator in the absorption mode. The factory setting of this timer is 4 hours. For testing you might want to reduce the absorption time temporarily.

  When absorption time has elapsed, the yellow [FLOAT] LED will illuminate. This means that the float mode has started.

If the above-mentioned tests are successfully completed, the charging system is ready for operation. Otherwise, check the troubleshooting table.

5.5.3 Voltage sensing

The Alpha Pro charge regulator uses the [reg on] terminal (Figure 4, connection 4) and the [gnd] terminal for measurement of the battery voltage. Measure this voltage, then measure the voltage at the battery terminals. When installed correctly, the difference will never exceed 0.01 V.

See Chapter 9 for correct wire sizes.

5.6 OPERATION

After starting the engine, the alternator and the Alpha Pro charge regulator will switch on automatically. The regulator will wait for the engine to rev up before it starts charging the battery. Refer to section 5.5.2. Start Up mode. There is no need for adjustment or operation. If the engine is stopped the alternator and the Alpha Pro charge regulator will switch off again. When switched off, all LEDs of the Alpha Pro charge regulator are off.



CAUTION!

Never disconnect any wiring during operation of engine.

6 MASTERBUS

6.1 WHAT IS MASTERBUS?

All devices that are suitable for MasterBus are marked by the MasterBus symbol.

MasterBus is a fully decentralized data network for communication between the different Mastervolt system devices. It is CAN-bus based. MasterBus is used as power management system for all connected devices, such as the inverter, battery charger, generator and many more. This enables communication between the connected devices, for instance to start the generator when the batteries are low.

MasterBus reduces complexity of electrical systems by using UTP patch cables. All system components are simply chained together. Therefore, each device is equipped with two MasterBus data ports. New devices can be added to the existing network easily. Consequently, the MasterBus network is highly flexible for extended system configuration. All monitoring panels can be used for monitoring, control and configuration of all connected MasterBus equipment.

CAUTION!

Never connect a non-MasterBus device to the MasterBus network directly! This can damage the MasterBus and the connected devices**.**

6.2 HOW TO SET UP A MASTERBUS NETWORK

Every MasterBus device is equipped with two data ports (RJ-45). When two or more devices are connected via these ports, a local data network called the MasterBus is formed. Keep the following rules in mind:

- Connections between the devices are made by standard straight MasterBus cables. Mastervolt can supply these cables.
- Up to 63 MasterBus devices can be interconnected.
- MasterBus needs a MasterBus Terminator on both ends of the network.
- The electric power for the network comes from the connected devices according to the rule: 1 powering / 3 non-powering. Spread the powering devices over the network.
- Do not make ring networks.
- Do not make T-connections in the network.

For more details on MasterBus, please contact your Mastervolt dealer.

6.3 MASTERBUS FUNCTIONS

Note: This manual applies to Alpha Pro charge regulators running on Firmware Version 4.0 and higher. For older firmware versions, some of the described settings may look different.

Adjustment of the settings of the Alpha Pro charge regulator can be made via the MasterBus network by means of a MasterBus-USB interface connected to a PC with MasterAdjust.

Ensure that the mode selector is in the MasterBus position. See item 1 in *Figure 3* on page 6 for the position of the switch.

CAUTION!

Invalid settings of the Alpha Pro charge regulator can cause serious damage to your batteries and/or the connected load! Adjustments of settings may be undertaken by authorized personnel only.

6.3.1 Monitoring

Value	Meaning
General	
Device state	Shows the state of the Alpha Pro: Standby/ Charging/ Alarm
Charger state	Shows the state of the regulator: Off/ Bulk/ Absorption/ Float/ Stopped
Battery	
Battery voltage	Battery voltage measured by the Alpha Pro charge regulator [V] By default this is sense voltage, see below. When a shunt device is selected, this is the voltage on that shunt device.
Battery temp.	Battery temperature measured by the by the Alpha Pro charge regulator [°C].
Alternator	
Alternator volt.	Voltage measured between +Bat (red wire) and GND (black wire) of the Alpha Pro charge regulator's cable loom
Sense voltage	Battery voltage measured by the Alpha Pro charge regulator [V] on 'reg on' (brown wire)
Field current	Current through the alternator field coil [A]
Alternator temp.	Alternator temperature (with installed sensor on the alternator). Refer to section 6.3.4 for settings
Alternator shaft	Number of revolutions alternator [rpm]
Engine shaft	Number of revolutions engine [rpm] (only if a pulley ratio is entered in Configuration tab)
Shunt	
Status	Not selected/Connected/Connection lost
State of charge	Battery state of charge (SOC) calculated by the shunt [%]
Battery voltage	Battery voltage [V] measured by the MasterShunt
Battery current	Battery current [A] measured by the MasterShunt
Battery temp.	Battery temperature measured by the MasterShunt temperature sensor [°C]

Notes: - When the configuration is unlocked, only Device state and Charger state will be shown.
- "Alternator shaft" and "Engine shaft" will not be shown if the RPM group is disabled in the Configuration tab.

6.3.2 Alarms

Value	Meaning
Temp.sense error	Temperature compensation error
Bat. temp. high	The battery temperature sensor measures a high temperature
APR. temp. high	Alpha Pro charge regulator device temperature too high
Battery high	Battery high voltage warning, generated by the Alpha Pro
Battery low	Battery low voltage warning, generated by the Alpha Pro
High field curr.	Field current too high, Alpha Pro charge regulator stops regulating and retries after 5 seconds repeatedly
Low field curr.	Field current too low, there is a disconnection in the field wiring
+D overload	Overload of the lamp connection (current too high)
Cable losses	Voltage drop is higher than 0.9 V. The cable between alternator and battery is too thin.
Shunt mismatch	Different voltage settings of MasterShunt and Alpha Pro
Invalid system	This alarm is only applicable for the Alpha Pro II. It indicated that the charging mode selector is on a blank spot. The selector has two blank spots to separate 12V, MasterBus, 24V. The yellow LEDs will blink twice, one after the other.

6.3.3 History

Value	Meaning
Total run time	Total regulator charge time since commissioning
# APR temp. high	Number of temperature alarms
# High DC alarms	Number of high DC voltage alarms
# Low DC alarms	Number of low DC voltage alarms

6.3.4 Configuration

The configuration can be done in MasterAdjust. When the Alpha Pro charge regulator is connected, open MasterAdjust on a Windows computer, connected to the MasterBus network via a Mastervolt USB Interface. MasterAdjust software is available as free to download software on the Mastervolt website: www.mastervolt.com.

Note: To be able to change the configuration of the Alpha Pro charge regulator, the configuration must be unlocked. This is done by pressing the "Unlock setup" button in the "Configuration" tab in MasterAdjust. When the configuration is unlocked, the regulator will stop regulating and its LEDs will blink twice, one after the other. When the configuration is finished, press the "Lock setup" button and the regulator starts regulating again.

Value	Meaning	Default	Adjustable range
Device			
Language	Language displayed on a MasterBus monitoring device	English	See specifications
Name	Name of this device. This name will be recognized by all devices connected to the MasterBus.	Alpha Pro MB	0-12 chars
MasterBus power	Option to let the Alpha Pro charge regulator power MasterBus and keep it visible on MasterBus when engine is off	On	Off, On
Unlock setup	Button to unlock the configuration settings		
System		*System*	
Startup delay	Delay in seconds to allow the engine revving up before the alternator starts loading it	10 sec	0-60
System voltage	Nominal system voltage	12V	12V, 24V
Maximum output	To prevent overloading a small alternator	100%	30-100%
Temp. sensor	Location of the Alpha Pro charge regulator temperature sensor. If "Alternator" is selected, then the following 2 fields are enabled	Battery	Battery, Alternator
Start reducing @ [1]	To prevent overheating a small alternator, enter the temperature at which the Alpha Pro charge regulator must reduce charging	100°C [212°F]	0-120 [32-248°F]
Stop charging @ [1, 5]	To prevent damaging a small alternator, enter the temperature at which the Alpha Pro charge regulator must stop charging	130°C [266°F]	20-140 [68-284°F]
RPM *(requires installer rights)*			
Enable RPM	Option to enable the following fields	Not checked	
Pole pairs [3]	Number of alternator pole pairs	8	1-16, alternator dependent
Pulley ratio	Motor pulley diameter relative to the alternator pulley diameter	0.000	0.000-4.000
Keep alive RPM	The field current is not to drop below this percentage of maximum to keep the rpm meter functioning well. See also section 5.2	0 %	0-15%
Alt. RPM event @	Number of revs at which an event takes place	1000 rpm	200 - 10000 rpm
Power curve	Option to minimize torque load by decreasing charging current. This prevents slipping. If this option is selected, then the following 2 fields are enabled	Not checked	
20% Field <	Field current turns to 20 % below X rpm	1000 rpm	0-20000
100% Field >	Field current may turn to 100 % above Y rpm	2000 rpm	0-20000
Battery			
Type	Battery type selection	Flooded	User defined, Flooded, Gel, AGM, Lithium-ion

Value	Meaning	Default	Adjustable range
Temp. compensate [4]	Voltage change at temperature rise/decrease	-0.030V/°C	-1.000 - +1.000
Bulk [4]			
Voltage	Bulk voltage	14.25V[6]	8-16V[6]
Minimum time	Minimum bulk voltage timer	2 min	0-600 min
Start time at	Voltage at which to start the minimum bulk voltage timer	13.25V[6]	8-16V[6]
Maximum time	Maximum bulk voltage timer	480 min	0-600 min
Return voltage	Return to bulk voltage	12.80V[6]	8-16V[6]
Return time	Adjustable Return to Bulk time after the Return to Bulk voltage has been reached.	30 sec	0-255 sec
Absorption [4]			
Voltage	Absorption voltage; Do not adjust the charge voltage above the recommended limits of the battery manufacturer.	14.25V[6]	8-16V[6]
Maximum time	Maximum absorption timer Examples of cases when to adjust: • Extension of the absorption time to do some intentional overcharging to regain lost capacity. • Shorten the time if you stop and start the engine often each day. • Temporary time reduction for testing purposes.	240 min	0-600 min
Float [4]			
Voltage	Float voltage; If the float voltage is set near 13.0V, you may have to switch on some DC loads to get the alternator to turn on because it takes some time for the voltage to settle from the higher absorption voltage.	13.25V[6]	8-16V[6]
Alarm settings [4]			
High alarm on	Alarm DC High on	15.25V[6]	8.30-16.00V[6]
High alarm off	Alarm DC High off	14.75V[6]	8.20-15.90V[6]
Low alarm off	Alarm DC low off	11.00V[6]	8.10-15.80V[6]
Low alarm on	Alarm DC low on	10.00V[6]	8.00-15.70V[6]
Alarm delay	Alarm delay time	30 sec	0-240 sec
Low field curr.	Option to allow or suppress the "low field current"-alarm	Suppress alarm	Allow alarm/ Suppress alarm
Shunt			
Shunt device	Selection of the shunt to measure the battery voltage, see Section 6.3.8.		
Alpha Pro setup			
Factory reset	Option to reset to factory settings		
Lock setup	Button to lock the configuration settings. With the configuration locked, only the language and device name can be changed.		

[1] Only in combination with alternator temperature sensor.

[2] All RPMs in this group are Alternator RPMs.

[3] The number of Pool pairs is only needed if RPM values are required in MasterBus.

[4] Can be modified if battery type is "User defined".

*[5] This will force the field current to 0%. **Note:** with older firmware it would not drop below 20%. Therefore, the new behavior of this setting may affect existing installations. An external tachometer would read 0 RPM while the alternator is still spinning!*

[6] For a 24V system, multiply the voltages by two.

6.3.5 Events

Field	Meaning	Default	Adjustable. range
Event x source	An event by the Alpha Pro charge regulator that triggers an action on another device in the MasterBus network.	Disabled	See Event source list
Event x target	The device that should act due to the Alpha Pro charge regulator event.	Select…	Selectable targets are system dependent.
Event x command	Action to be taken by the target device.	Select…	See Event target list in manual of the selected device.
Event x data	Data is linked to the command. See also Figure 18.	Off	Off, On, Copy, Copy Invert, Toggle.

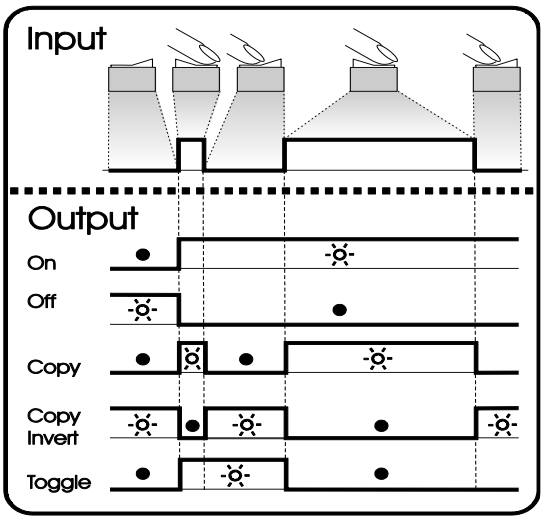


Figure 18: Event data

Input is a pulse followed by a longer signal (1/0).

On changes the status to On at the first signal.

Off changes the status to Off at the first signal.

Copy lets the status follow the input.

Copy Invert lets the status follow the opposite of the input.

Toggle changes the status at the first signal and back at the second signal. It is often used in combination with a pulse switch.

6.3.6 Event source list (Alpha Pro as event source)

Event source	Meaning
Device state	A change in device state
Bulk	The charging process switches to Bulk phase
Absorption	The charging process switches to Absorption phase
Float	The charging process switches to Float phase
RPM event	The alternator number of revs reaches a certain level, based on the alternator shaft revs
Low field curr.	Low field current alarm has been triggered

6.3.7 Event target list (Alpha Pro as event target)

Event command	Meaning
Bulk	The charging process switches to Bulk phase
Absorption	The charging process switches to Absorption phase
Float	The charging process switches to Float phase
Stop charge	This event pauses the charging process and forces the field current to 0%. This event is used in combination with the stop charge event of Lithium-ion batteries. When charging can be resumed, the process continues from this point forward.

6.3.8 MasterShunt connected to Alpha Pro

You can select a MasterShunt or an MLI Ultra battery in the MasterAdjust configuration menu. When this selection is active the Alpha Pro receives important data from the battery via MasterBus. This will improve the charging system and protects the battery by means of the following the data:

- **Battery full determination**
  The MasterShunt or MLI Ultra battery measures the actual current that goes into the battery. When only a small percentage of current is measured, the Alpha Pro considers the battery to be full and switches to the float phase.
- **Starting in Float**
  Thanks to the above-mentioned mechanism the Alpha Pro will start directly with float charging if the SOC is 100%.
- **Use of the temperature sensor**
  The MasterShunt is installed closer to the battery than the alternator. The battery temperature sensor can now be connected to the MasterShunt. The MasterShunt will pass the measured battery temperature on to the Alpha Pro. This value is being used to compensate the charge voltage as described in Section 3.3.
- **Compensation for the voltage losses**
  The Alpha Pro now uses the voltage of the MasterShunt to determine the voltage loss between the battery and the alternator. The Alpha Pro will compensate for these losses by rising the charge voltage evenly. Cable losses for MLI Ultra batteries are not compensated.

Note: The Alpha Pro uses both the shunt data and its own data (via Reg on) for determination of voltage losses. Therefore, Mastervolt advises to mount the reg on wire (brown) as close to the battery as possible on the load side of the fuse.

With a MasterShunt connected, the following is different in the use of the Alpha Pro:

- There are two options to place a temperature sensor. The MasterShunt temperature sensor is preferably placed onto the battery, the optional sensor (Product code: 41500400) onto the alternator.
- Absorption Return Amp is added in the configuration. This is the charge current at which the regulator starts the minimum absorption timer. This value is calculated from the MasterShunt Amp=Full percentage, multiplied by its entered Battery capacity.
- The MasterShunt may have a battery voltage setting that differs from the Alpha Pro voltage setting. In this case a MasterShunt Mismatch alarm is shown on MasterBus.



CAUTION!

If the Battery voltage was set to User defined, there will be no MasterShunt Mismatch alarm when the MasterShunt has different voltage settings!

7 MAINTENANCE

During maintenance, the Safety Guidelines & Measures are applicable at all times. See section 1 of this manual.

No specific maintenance to the Alpha Pro charge regulator is required. Examine your electrical installation on a regular basis, at least every six months. Defects such as loose connections, damaged wiring etc. must be corrected immediately.

8 TROUBLESHOOTING

In case of any issue, we recommend consulting the Maintenance section first (see section 7). If you cannot solve a problem with the aid of the table below, contact your local Mastervolt dealer. See www.mastervolt.com.

ISSUE	POSSIBLE CAUSE	SOLUTION
The three LEDs of the Alpha Pro are blinking together.	• This is the start-up mode of the Alpha Pro. After this the Alpha Pro starts regulating.	This is a normal situation. Wait until the LEDs stop blinking.
The three LEDs of the Alpha Pro are blinking twice, one after the other.	• The Alpha Pro MasterBus configuration was unlocked, it has stopped regulating. Or unit has not been setup.	Adjust the settings if needed and lock the configuration. The Alpha Pro enters the start-up mode after this.
No voltages at all. All LEDs of the Alpha Pro are off.	• Battery fuse has blown.	Investigate the cause of this malfunction. Then replace the fuse.
	• Battery connections are corroded or bad.	Clean and tighten the connections. If the cables are damaged, replace them.
	• Black [gnd] wire is loose. • Reg on wire does not get voltage	Check black [gnd] wire. See next issue and solutions
No output power, all LEDs of the Alpha Pro are off. Voltage on the [+bat] terminal is 12/24V. Voltage on the [reg-on] terminal of the regulator is 0V.	• Engine is not running.	Start the engine.
	• 2 Amps fuse in brown wire is blown.	Check the 2 Amps fuse and replace if necessary.
	• Problem with the oil pressure switch or ignition relay (S1) or brown [reg on] wire is loose.	Check brown [reg on] wire. Check the oil pressure contact or ignition relay for correct operation.
No output power, one of the LEDs of the Alpha Pro is on. Voltage on the [field] terminal of the regulator is 0V.	• Fuse in the red wire blown.	Check the fuse and replace if necessary. Alpha Pro II = 10A Alpha Pro III = 20A
	• Two pole field connector of the wiring loom is loose (red and blue wire).	Check field connector on the alternator.
	• Problem in the wiring.	Check red and blue wires to the field connector.
	• Blue [field] wire is loose.	Check blue wire.
	• Field windings of the alternator are defective.	Check resistance of field windings. Replace alternator.
No output power. Voltage on the [reg on] and the [+bat] terminal of the regulator are both 12/24V.	• The Stop charge event has been triggered.	No action required. This is normal behavior.
No output power, All LEDs of the Alpha Pro are off. Voltage on the [reg on] and the [+bat] terminal of the regulator are both 12/24V.	• Black [gnd] wire is loose.	Check black [gnd] wire.
	• Alpha Pro defective.	Replace Alpha Pro.

ISSUE	POSSIBLE CAUSE	SOLUTION
Tachometer indication is too low or fluctuates.	• An alternator driven tachometer may reduce its reading or fluctuate when the Alpha Pro makes a transition from absorption to float if the battery is fully charged with no loads	Connect the W to the Alpha Pro. See Figure 10.
	• Engine speed is too low.	Increase engine speed.
	• Wrong calibration of the tachometer.	Adjust tachometer according to pulley ratio.
Regulator stays in bulk mode all the time (Bulk LED stays on).	• Alternator is overloaded.	Switch off a load; (part off) consumers.
	• Defective batteries, short-circuit between cells.	Check batteries and replace if necessary.
	• Defective alternator	Check alternator and replace if necessary.
	• Capacity of the Alternator is too low.	Use an alternator with more capacity or increase charging capacity by using an additional charger. Consult your Mastervolt representative for advice.
Alpha Pro does not return to bulk mode when a high load is switched on	• Once the regulator is in absorption mode a timer is started and after this time the regulator switches to float and will stay in this mode.	No action required. It will go back to Bulk when the voltage drops below 12.8V/25.6V
Alternator is getting hot while engine is not running	• Rotor field windings are still excited while engine is not running. • Regulator is still on (bulk/abs/flo led is on)	Switch off DC immediately to avoid field windings of the alternator being damaged due to overheating. Check the oil pressure contact or ignition relay for correct operation. This switch (S1) must be open when the engine is not running. Check wiring between battery and [reg on] terminal.
Output voltage too high	• The regulator measures a too low battery voltage and tries to compensate it.	Check wiring between battery and [reg on] terminal for corrosion. Check for voltage drop across the oil pressure switch (S1) (if applied). The line between battery and [reg on] should not be used by other loads.
	• Wrong setting of the charge voltage.	Adjust the charge voltage.
	• Reg on is connected to the wrong battery	Connect the reg on wire to the battery being charged
	• With non-Mastervolt alternators: field terminal connected to the field connection of the regulator [D–] is not isolated from ground.	Check if field is isolated voltage on terminal [D–] It should measure nominal battery voltage. If this voltage is 0V, check whether the terminal [D–] is isolated from ground.
Charge voltage stays in absorption mode too long / too short	• Wrong setting of the absorption timer.	Adjust the absorption timer (see section MasterBus settings
Alpha Pro is in float mode, but battery voltage is still at absorption or bulk level	• Any other device is charging the batteries.	Switch off all other charging devices and check battery voltage again.

9 TECHNICAL DATA

9.1 SPECIFICATIONS ALPHA PRO CHARGE REGULATOR

	Alpha Pro
Product code/Part number	45513000 Alpha Pro III 45512000 Alpha Pro II
Suitable for alternator type	Alternators with negative field control (N-type alternators)
Nominal operation voltage (Lead acid by default)	12V / 24V selectable (Battery type selectable via MasterBus)
Bulk / absorption voltage 12V	14.25V *
Float voltage 12V	13.25V *
Adjustable range – bulk	8–16V *
Adjustable range – absorption	8–16V *
Adjustable range – float	8–16V *
Battery temperature compensation	– 30mV/°C@12V *
Absorption time	4 hours, adjustable range: 0 min up to 10 hours
Wiring loom	1.5 m oil resistant connection cable
Battery temperature sensor	Included
Dimensions (hxwxd)	See Figure 20
Weight	0.4 kg [0.9 lbs]

** Voltage at 25°C [77°F]. For a 24V system, multiply the voltages by two*

Charging specifications	**Battery type**		
	Flooded (default)	**Gel / AGM**	**Lithium-ion (MLI)**
Bulk voltage	14.25 V*	14.25 V*	14.25 V*
Max bulk time	480 min	480 min	480 min
Min bulk time	120 s	120 s	120 s
Start bulk time	13.25 V*	13.25 V*	13.25 V*
Return to bulk voltage	12.80 V*	12.80 V*	13.25 V*
Return to bulk time	30 s	30 s	240 s
Abs. voltage	14.25 V*	14.25 V*	14.25 V*
Max absorp. time	240 min	240 min	240 min
Min absorp. time	15 min	15 min	15 min
Return amps(battery full current)	6.0 % IMAX	6.0 % IMAX	6.0 % IMAX
Float voltage	13.25 V*	13.80 V*	13.50 V*

** For a 24 V battery charger, multiply the voltages by two*

9.2 CHARACTERISTICS

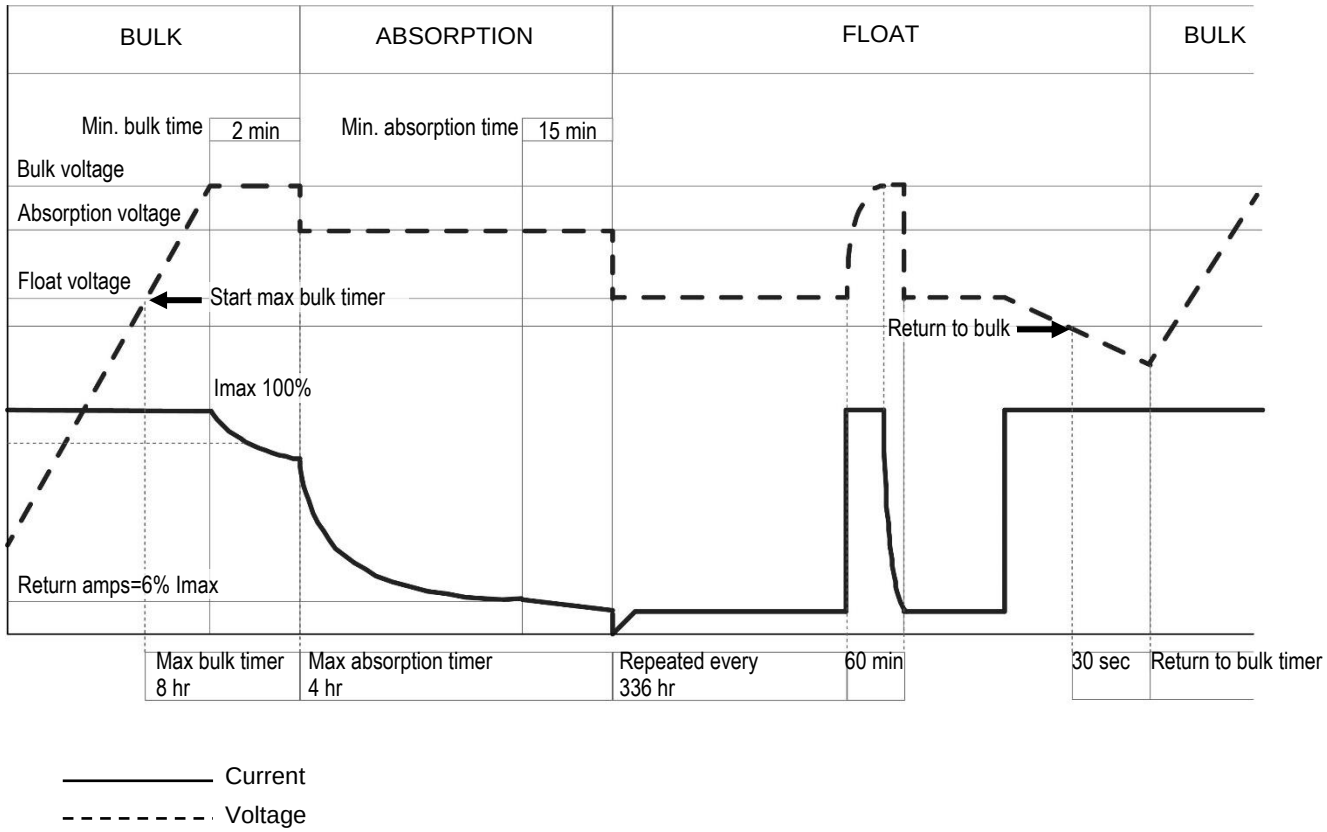


Figure 19: 3-step+ charging characteristics

9.3 DIMENSIONS

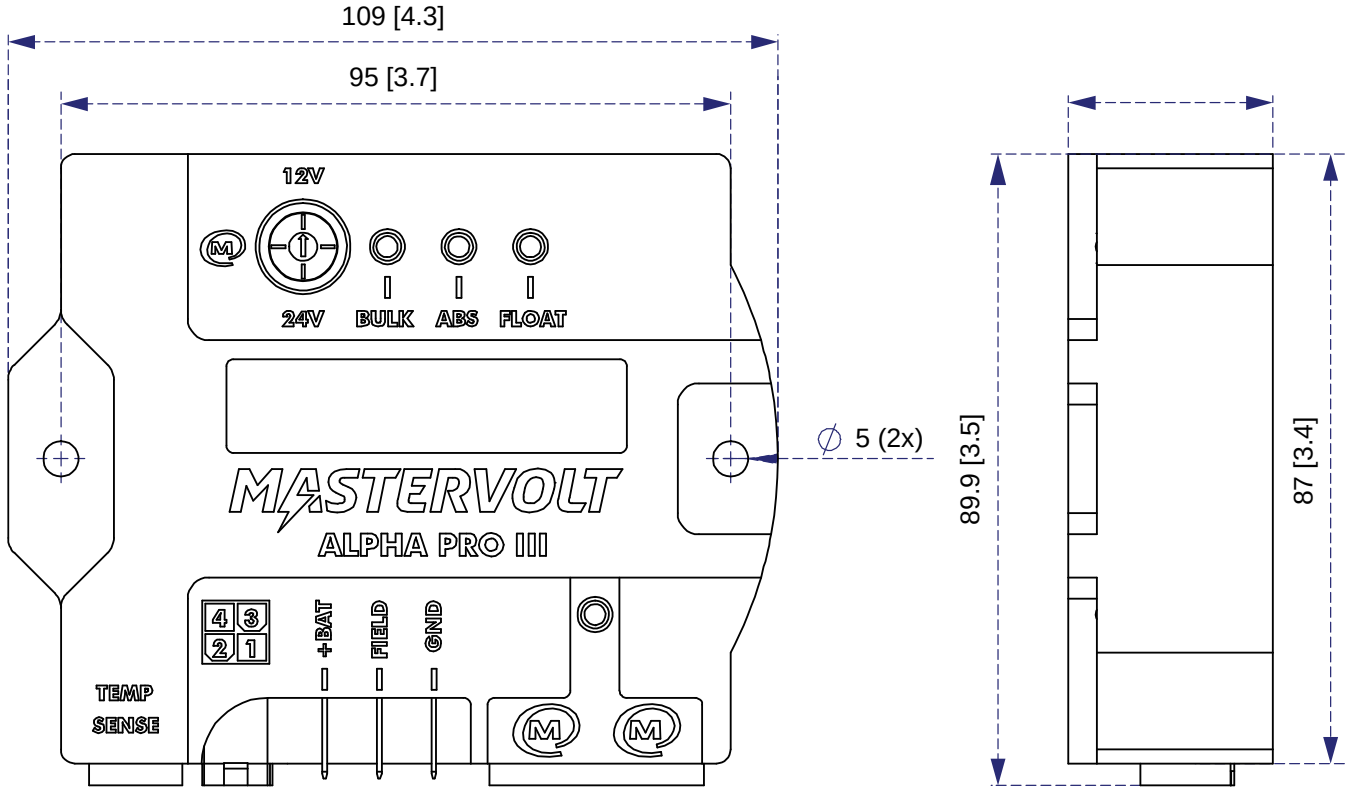


Figure 20: Dimension drawings of the Alpha Pro in mm [inch]



We welcome your feedback and suggestions!

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