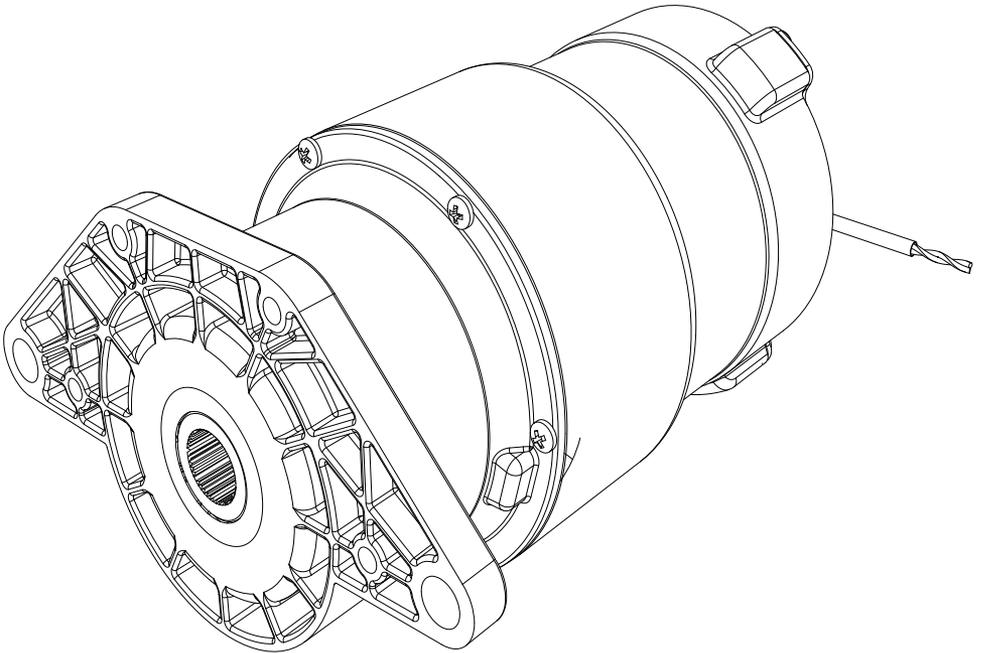


**LEWMAR®**

# Autopilot Drive Product manual



**Owner's Installation, Operation & Servicing manual**

## 1- Introduction

Dear Customer,

Thank you for choosing Lewmar. Lewmar products are world renowned for their quality, technical innovation and proven performance. With a Lewmar product you will be provided with many years of outstanding service.

### Product support

Lewmar products are supported by a worldwide network of distributors and Authorised Service Representatives. If you encounter any difficulties with this product, please contact your national distributor, or your local Lewmar dealer. Details are available at: [www.lewmar.com](http://www.lewmar.com)

### CE Approvals

For CE approval certificates contact Lewmar.

### Important information about this manual

Throughout this manual, you will see safety and product damage warnings. You must follow these warnings carefully to avoid possible injury or damage.

## 2- Safety Notice

 WARNING!

### IMPORTANT: Read these notes before continuing.

- ▶ Responsibility for the safe and prudent operation of a vessel rests with the owner and/or operator of the vessel. The Integra drive is one of many devices to aid in the general operation of a vessel, it does not relieve the operator from the responsibility of safety or maritime procedures of the vessel.
- ▶ Avoid navigational hazards and never leave the helm unattended.
- ▶ Always be prepared to immediately regain manual control of the vessel.
- ▶ Learn to operate the autopilot in calm open water with minimum hazards.
- ▶ Use caution when the vessel is at high speeds near hazards in the water, such as pilings, docks and other vessels.
- ▶ Keep up to date with any product safety information published at [Lewmar.com](http://Lewmar.com)
- ▶ This equipment must be installed and operated in accordance with the instructions contained in this manual. Failure to do so could result in poor product performance, personal injury and/or damage to your boat.
- ▶ Always wear safety goggles, ear protection and a dust mask when using power tools. When drilling or cutting check the opposite side of the surface. Be aware of fuel tanks, electrical cables, hydraulic hoses etc.
- ▶ Consult the boat manufacturer if you have any doubt about the strength or suitability of the mounting location.
- ▶ Make sure you have switched off the power before you start installing this product.
- ▶ If in doubt about installing electrical equipment please seek advice from a suitably qualified electrical engineer.

### EMC Recommended guidelines

All Lewmar equipment and accessories are designed to conform to the appropriate Electromagnetic Compatibility (EMC) standards. Correct installation is required to ensure that performance is not compromised. The guidelines given here describe the conditions for optimum EMC performance, but it is recognised that it may not be possible to meet all of these conditions in all situations. To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment. For optimum EMC performance, it is recommended that wherever possible Lewmar equipment and cables connected to it are:

- ▶ At least 3ft (1m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas.
- ▶ In the case of SSB radios, the distance should be increased to 7ft (2m).

- ▶ More than 7ft (2m) from the path of a radar beam. A radar beam can normally be assumed to spread 20° above and below the radiating element
- ▶ The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10V, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.
- ▶ Other information Protected for use in engine compartments CE approvals conforms to:
  - 89/336/EC (EMC)
  - BS EN60945:1997
  - 94/25/ec (RCD)
  - BS EN28846:1993

## 3- Installation

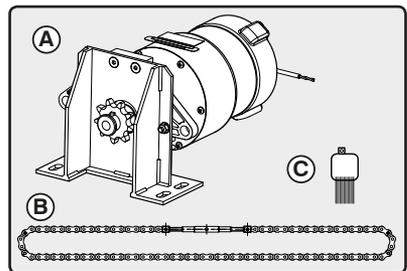
### 3.1 Overview

#### 1- Bavaria & Constellation drive

89300136 Bavaria Kit

This drive kit is suitable for Constellation and Bavaria single helm systems and consists of the following:

- A. Drive unit
- B. Constellation: 2m chain  
Bavaria: Custom chain length
- C. Autopilot drive clutch relay 12V
- D. Clutch relay instruction leaflet

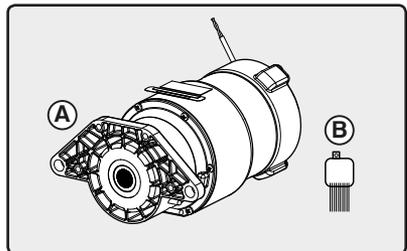


#### 2- Mamba drive

89300137 Mamba kit

This drive kit directly couples to gearboxes and consists of the following:

- A. Drive unit
- B. Autopilot drive clutch relay 12V
- C. Clutch relay instruction leaflet

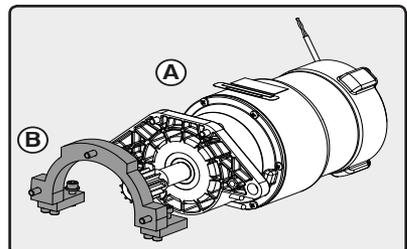


#### 3- Cobra drive

89300203 Cobra Pedestal Kit

This drive kit directly couples to Integra Pedestal and consists of the following:

- A. Drive unit
- B. Interface plate
- C. Autopilot clutch relay 12V
- D. Clutch relay installation leaflet



## 3.2 Preparation

### General position:

- ▶ Refer to the EMC installation guidelines.
- ▶ Make sure the drive will be accessible for future servicing.
- ▶ Mamba drives can be installed in any orientation directly onto the mounting flange on the bevel head or reduction gearbox.

### Environment:

- ▶ The drive should be mounted in a dry location, clear of any bilge water.
- ▶ Potentiometer (if installed) is not waterproof

### Constellation ® Bavaria drive structural strength:

- ▶ This drive produces a considerable amount of force, so you must mount it on a solid structure (i.e. a substantial frame member) in the boat. In some cases you may need to build a special frame to mount the drive unit.
- ▶ To prevent excess noise and vibration, do not attach this drive to any structures that support cabins.

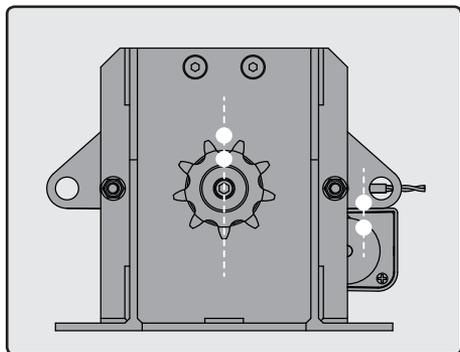
### Mamba drive Structural strength:

The Mamba drive is designed for mounting directly onto a bevel head or reduction gearbox in the steering system, structural mounting instructions will apply chiefly to the gearbox that the autopilot is mounted to.

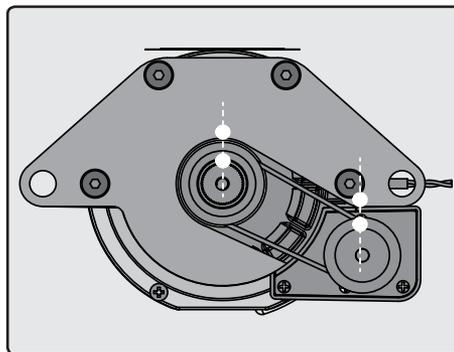
### Cobra drive Structural strength:

The Cobra drive retrofits directly into the Integra Pedestal.

## 3.3 Optional rudder reference unit setup



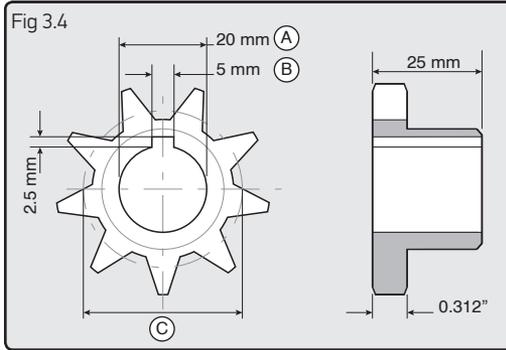
**Constellation / Bavaria Drive**



**Mamba Drive**

- ▶ Before installation of the autopilot, ensure the potentiometer used for rudder referencing is set to the middle point of its total range (5 turns from either stop).
- ▶ To do this, align the white marks on each pulley with the corresponding marks on the bracket/faceplate. Be aware that the potentiometer will only turn 5 rotations in either direction from its centre point. If any resistance is felt from the potentiometer do not apply force. Turn the sprocket in the opposite direction until the white markings are aligned.
- ▶ When both sets of markings are aligned the potentiometer should be at its mid point and ready for installation. Note the markings will only line up at the mid point of the potentiometers range.

### 3.4 Constellation chain and sprockets



NUMBER OF TURNS LOCK TO LOCK	STANDARD DRIVING SPROCKET NUMBER OF TEETH	DRIVEN SPROCKET NUMBER OF TEETH
1	9	15
1.2		13
1.5		11

**Table 3.4**

A. Bore  
 B. Keyway  
 C. 1.8" PCD - 9 tooth, 5/8" pitch

#### Chain size

The chain kit, 5/8" pitch is suitable for most applications.

#### Sprocket sizes

To stop the drive sprocket rotating on the drive shaft, the shaft has a 5 mm square key that fits into a keyway at the centre of the sprocket. Use only Lewmar approved drive sprockets, its bore and keyway dimensions must fall within the ranges specified in Fig.3.4 for it to lock correctly to the drive shaft.

#### Sprocket for steering shaft

- ▶ If the steering shaft does not already have a second, or assigned, autopilot sprocket then an additional sprocket will be required, size 5/8" pitch, number of teeth to be determined depending upon steering system.
- ▶ Due to the large variation in sprocket sizes, Lewmar recommends obtaining a steering sprocket from the steering manufacturer. The sprocket will have to be attached to the steering shaft, in vertical alignment to the sprocket on the autopilot drive.

To determine the sprocket size required for the steering shaft, follow this procedure:

- ▶ Count the number of times the steering shaft turns when the rudder is moved from hard over to hard over.
- ▶ Use the table 3.4 (above) to determine the sprocket size required at the steering shaft by matching number of turns hard over to hard over.

#### Note:

- ▶ The Integra drive unit is supplied with a chain kit suitable for a sprocket centre distance of 560- 600mm. If the distance between your two sprockets is greater you will need to increase the chain length by inserting extra links.
- ▶ The sprocket sizes shown in table 3.4 provide good steering performance for most boats. If you think your boat may have unusual steering characteristics, contact Lewmar's Technical Services or an authorized service representative for advice.
- ▶ The additional sprocket must be keyed and screwed to the shaft with a grub screw and secured with thread-locking compound.

## 3.5 Typical Constellation drive installation

### 1. Mounting the drive and connecting to the steering system

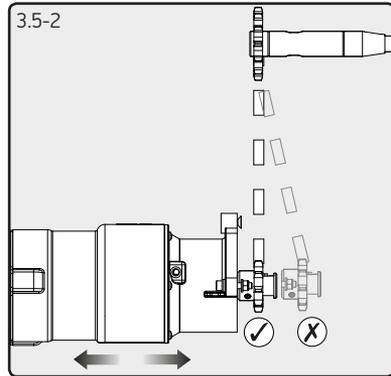
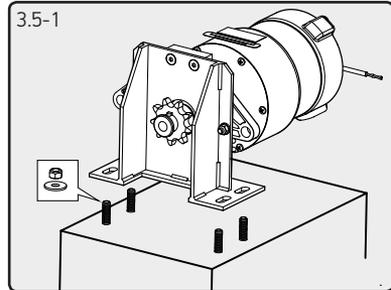
- ▶ Complete a steering check
- ▶ Before you secure the drive to your boat, you must first check the suitability of the mounting location.
- ▶ Attach the drive to a suitable mounting position with M8 bolts, washers and lock nuts
- ▶ Use Loctite™ or similar on threads.

### 2. Sprocket alignment

- ▶ Attach chain.
- ▶ Both sprockets must be accurately aligned to run in the same plane when viewed from the side. Check for correct alignment by holding a 'straight edge' between the edges of the sprockets.
- ▶ The Drive Unit can slide Fore and Aft +/- 6 mm to align the chain sprockets.

### Adjusting the chain tension

- ▶ Adjust the chain tension until it is just tight, so there is minimal lost motion between the drive sprocket and the rudder stock.
- ▶ To adjust chain tension use the turnbuckle to take up the slack. Ensure the locknuts are tightened afterwards to maintain this position  
Note: If the chain tension is not set correctly, the resulting lost motion will impair steering performance.  
Over tension will diminish drive performance and reduce feel when manual helming.



## 3.6 Bavaria drive installation

### Single wheel yachts post 2005

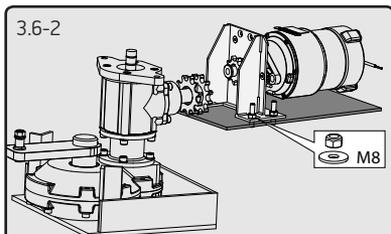
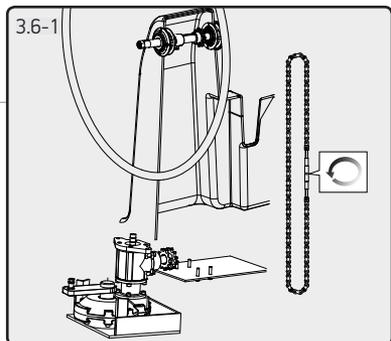
Ensure rudder is at Mid-Ship position and locked in place.

#### 1. Disconnect steering chain.

Remove control panel & pedestal head from console. Disconnect the steering chain by slackening the chain tensioner and removing the chain completely from the steering unit.

#### 2. Mount drive to base.

Position the mounting bracket over the studs on the base plate & secure lightly with M8 nuts and washers.



### 3. Drive chain installation

Assemble the chain by looping round the spare sprocket on the helm and the 9T sprocket on the Drive Unit.

### 4. Re-assemble steering chain.

Re-assemble the steering chain by looping round the 11T sprocket on the helm & the 11T sprocket on the base unit.

Note: For both chains ensure that the chain tensioners sit central between the two sprockets so there is an equal amount of chain between the two sprockets.

### Drive adjustment.

- ▶ While no chain tension is present ensure both locking bolts are loosened before adjusting drive position within mounting slot.
- ▶ The drive unit can slide Fore and Aft +/- 6 mm to align the chain sprockets.
- ▶ Once aligned the fasteners can be secured. Use Loctite™ or similar on threads.

### Chain tensioning

Both chain tensioners are tightened by turning the central body anticlockwise then secure with the locknuts on each side of the tensioner body.

Proceed to section 3.9

## 3.7 Mamba drive installation

### Parts Supplied

- ▶ Mamba drive

### Further requirements:

- ▶ A Mamba system bevelhead or reduction gearbox with the relevant drive interface plate.  
(Return gearbox for conversion if necessary.)
- ▶ Suitable securing bolts with washers and lock-nuts
- ▶ Suitable cable and electrical connectors for the drive motor and clutch (see Section 4.2)
- ▶ Before installation a smear of grease onto the drive output shaft, is recommended.  
Note: Make sure you have obtained these additional parts before you start installation.

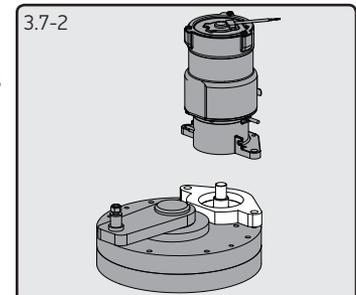
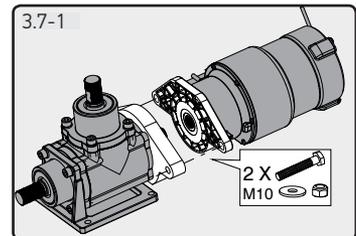
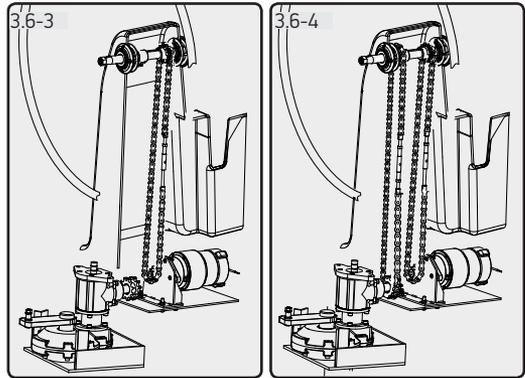
### 1. Mounting the drive and connecting the steering system

The autopilot drive connects to the steering system via the splined output shaft of a bevel-head or gearbox. The autopilot pushes over this shaft and is fixed in place with two M10 bolts.

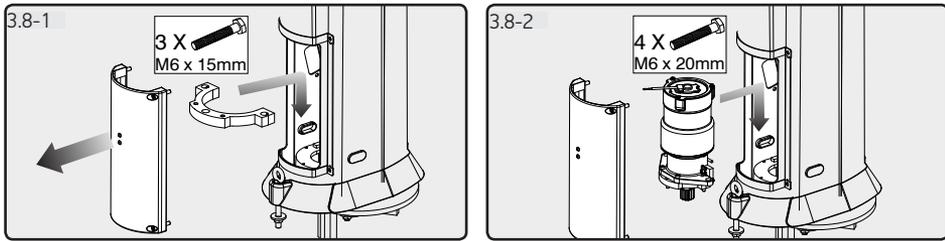
### 2. Gearbox mounting

The gearbox onto which the drive is to be attached must be fitted with the drive interface plate. If there is no interface plate already included in the steering system, the gearbox can be returned to our factory for adaptation at the owner's cost.

Proceed to section 3.9



### 3.8 Cobra drive installation



The Cobra drive unit mounts directly inside the Integra Pedestal.

#### Basic requirements:

- ▶ Suitable cable and electrical connectors for the drive motor and clutch (see Section 4.2)
- ▶ Apply a smear of grease onto the drive output shaft before installation.  
Note: Make sure you have obtained these additional parts before you start installation.

#### Mounting the drive and connecting the steering system

1. Remove the 4 bolts on the Integra Pedestal drive cover.  
Insert the interface plate into the pedestal and secure with three M6 x 15mm screws supplied. Tighten to 8-9Nm
2. Insert autopilot drive and secure with four M6x20 screws supplied, ensuring the gear pinion is correctly nestled with the gear in the pedestal. Tighten to 8-9Nm

### 3.9 Final checks all models

#### Complete a steering check

- ▶ When you have tensioned the chain correctly, turn the steering wheel from hard over to hard over to check that the chain and sprockets move freely and are correctly aligned.
- ▶ Check that the rudder can travel lock to lock freely and that the chain tensioning tumble does not interfere with either the driving or driven sprocket.
- ▶ Is the drive securely mounted?
- ▶ Are the drive and steering sprockets in line when viewed side-on?
- ▶ Have you securely locked both sprockets to the shafts?
- ▶ Have you tensioned the chain correctly?
- ▶ Have you tightened the chain tensioner locking nuts?
- ▶ Are the motor and clutch cables correctly routed and securely connected to the course computer?
- ▶ Complete a hand-steering check: Do the chain and sprockets move freely and in correct alignment from hard-over to hard-over?
- ▶ Complete an autopilot steering check. (Refer to the course computer handbook for details).

#### ⚠ WARNING!

- ▶ Keep clear of moving steering systems at all times.
- ▶ Protect moving parts from access during normal use.

## 4- Electrical Wiring

### 4.1 Generally

The wiring system should be of the fully insulated type, which avoids possible electrolytic corrosion problems. We recommend the use of type III stranded, tinned copper wire with copper crimp terminals. Most modern installations are negative return (negative ground) but polarity should be checked.

Overload protection, in the form of the circuit breaker (not supplied), must be built into the wiring circuit of both the motor and clutch. Refer to table 5.4 for circuit breaker specification requirement.

- ▶ The circuit breaker should be positioned close to the battery in a dry, readily accessible place.
- ▶ The breaker must be manually reset should an overload occur that causes it to trip to the off position.
- ▶ Lewmar recommends to source and install cable that meets the requirements of the standards and regulations relevant to the installation and codes of practice.
- ▶ The cable sizes are calculated in order to maintain a maximum overall voltage drop of 10% supply over whole cable installation at max load current as per ISO10133.
- ▶ If you are not sure you understand these guidelines, seek professional help. Ensure that the installation complies with USCG, ABYC, NMMA or other local regulations.

### 4.2 Electric cable selection

Lewmar recommends the installer source and install cable that meets the requirements of the standards and regulations relevant to the installation and codes of practice.

The cable table gives recommended cable sizes based on total length of cable required, from the battery, following the route of the cables.

CABLE SIZING FOR LENGTH OF CABLE RUN

up to 2 m	up to 40 ft	4 m	41 - 66 ft
6 mm <sup>2</sup>	10 AWG	10 mm <sup>2</sup>	8 AWG

⊘ DO NOT confuse cable length with the length of the vessel

### 4.3 Electrical wiring

⚠ **WARNING!** All electrical work must be carried out with the power OFF. Isolate using circuit breaker/isolator.

NOTE! If Raymarine SPX10 go directly to 4.4

#### 1. The Integra drive has electrical connections for:

- ▶ Drive motor: two single-core cables, twisted as a pair, sleeved with Black (+) and Blue (-) cores
- ▶ Clutch: a two core cable with Black (+) and White (-) cores.

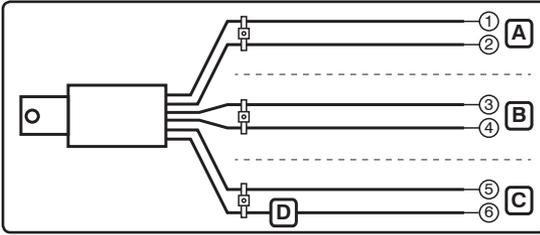
#### 2. Follow these steps to connect the drive to the course computer:

- ▶ Connect cables to the Integra drive cables using appropriate electrical connectors or junction boxes at the correct power rating.
- ▶ Route the cables back to the course computer, taking into account the EMC installation guidelines
- ▶ Fit circuit breakers as specified on page 8 between the Course Computer and the Drive Unit.

#### 3. Connect the cables to the course computer

- ▶ (See manufacturer's manual for full information)
- ▶ Clutch terminals: black core to +VE, white core to -VE.
- ▶ Motor terminals: at this stage you can connect either motor cable to either terminal.

#### 4.4 Electrical wiring for Raymarine SPX10



89300148 - Relay and loom assembly for connection to Raymarine SPX10 course computer:

Install in suitable dry location close to the course computer and power supply.

Connect as per above figure extending wires as necessary matching size and grade where appropriate.

A. Connect to course computer clutch control output. (1) BLUE -VE (2) RED +VE.

B. Connect to Lewmar autopilot drive clutch. (3) BLACK -VE (4) BROWN +VE.

C. Connect to battery power 12VDC 5A. (5) BLACK -VE (6) ORANGE +VE.

D. In-line fuse ATO Blade 5A (tan)

NOTE: Refere to installation manuals of all equipment involved and perform work to meet all relevant standards.

### 5- Servicing

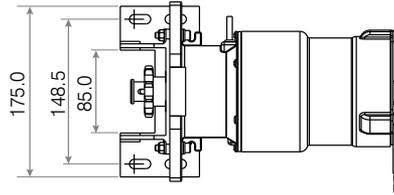
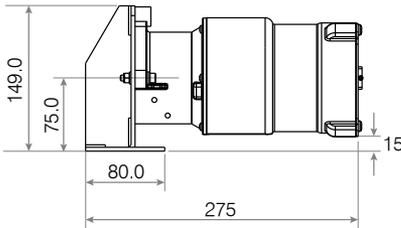
⚠ WARNING! Isolate using circuit breaker/isolator when not in use.

⚠ WARNING! Electric motors become hot during and for some time after use.

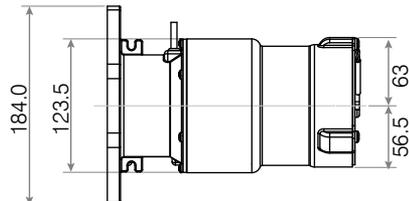
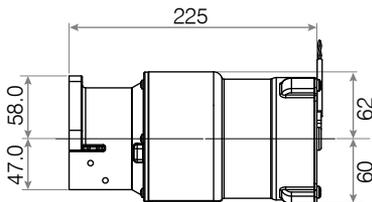
#### On a regular basis

- ▶ Check all connections and mountings are secure.
- ▶ Check chain and sprockets are correctly aligned and tensioned.
- ▶ Lightly grease chain and sprockets.
- ▶ Check cables for signs of wear or damage.

#### 5.1 Integra Bavaria & Constellation dimensions

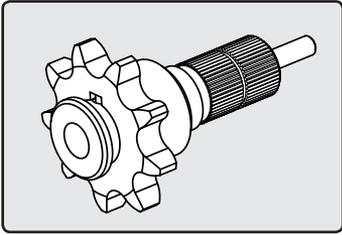


#### 5.2 Integra Mamba dimensions

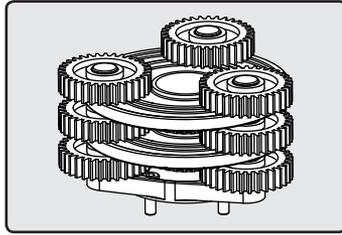


**5.3 Spares**

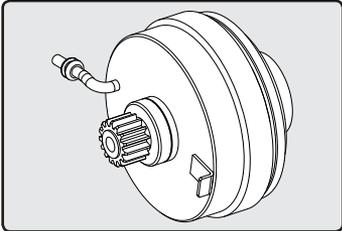
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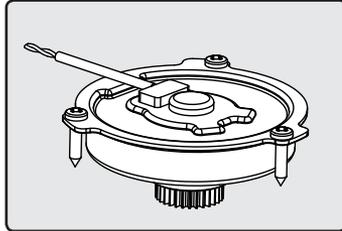
**89300212: Constellation sprocket Kit**



**89300211: Gear Kit**



**Shimmed clutch kit:12V - 89300213  
24V - 89300215**



**Motor Kit:12V - 89300210  
24V - 89300214**

## 5.4 Bavaria G Constellation drives specifications

PART NO	DESCRIPTION	SPROCKET SIZE	POWER		VOLTAGE	MAXIMUM OUTPUT		LOAD SPEED	AVERAGE CURRENT CONSUMPTION	MOTOR CIRCUIT BREAKER	CLUTCH CIRCUIT BREAKER	WEIGHT		MAX BOAT SIZE	
			kW	HP		ft lbs	Nm					rpm	A	kg	lb
89300136	Integra base drive unit 12V (Bavaria)	9T/5-8P	0.186	1/4	12	169	125	10	6	16	3	10	16.7	60	
89300176	Integra base drive unit with rudder feedback system & bracket 12V	9T/5-8P	0.186	1/4	12	169	125	10	6	16	3	10	16.7	60	
89300145	Integra base drive unit 24V	9T/5-8P	0.186	1/4	24	169	125	10	3	10	2	10	16.7	60	
89300164	Integra base drive unit with rudder feedback system & bracket 24V	9T/5-8P	0.186	1/4	24	169	125	10	3	10	2	8.5	16.7	60	
89300137	Integra Mamba drive unit 12V	N/A	0.186	1/4	12	169	125	10	6	16	3	8.5	16.7	60	
89300177	Integra Mamba drive unit with rudder feedback system 12V	N/A	0.186	1/4	12	169	125	10	6	16	3	8.5	16.7	60	
89300204	Integra Mamba drive unit with rudder feedback system 24V	N/A	0.186	1/4	24	169	125	10	3	10	2	8.5	16.7	60	
89300207	Integra Mamba drive unit 24V	N/A	0.186	1/4	24	169	125	10	3	10	2	8.5	16.7	60	
89300203	Integra drive for integra pedestal 12V	N/A	0.186	1/4	12	169	125	10	6	16	3	8.5	13.7	45	
89300216	Integra drive for integra pedestal 24V	N/A	0.186	1/4	24	169	125	10	3	10	2	8.5	13.7	45	
89300217	Integra drive for integra pedestal with rudder feedback system 12V	N/A	0.186	1/4	12	169	125	10	6	16	3	8.5	13.7	45	
89300218	Integra drive for integra pedestal with rudder feedback system 24V	N/A	0.186	1/4	24	169	125	10	3	10	2	8.5	13.7	45	
89300170	Integra drive unit and bracket (Dufour)	9T/5-8P	0.186	1/4	12	169	125	10	6	16	3	10	16.7	60	

## 6- Warranty

### Limited Warranty and Key Terms of Supply by Lewmar

Lewmar warrants that in normal private pleasure boat usage and with proper maintenance its products will conform with their specification for a period of three years from the date of purchase by the end user, subject to the conditions, limitations and exceptions listed below. Any product, which proves to be defective in normal usage during that three-year period, will be repaired or, at Lewmar's option, replaced by Lewmar.

#### A CONDITIONS AND LIMITATIONS

- i Lewmar's liability shall be limited to the repair or replacement of any parts of the product which are defective in materials or workmanship.
- ii Responsibility for the selection of products appropriate for the use intended by the Buyer shall rest solely with the Buyer and Lewmar accepts no responsibility for any such selection.
- iii Lewmar shall not be liable in any way for Product failure, or any resulting loss or damage that arises from:
  - a. use of a product in an application for which it was not designed or intended;
  - b. corrosion, ultra violet degradation or wear and tear;
  - c. a failure to service or maintain the product in accordance with Lewmar's recommendations;
  - d. faulty or deficient installation of the product (unless conducted by Lewmar);
  - e. any modification or alteration of the product;
  - f. conditions that exceed the product's performance specifications or safe working loads.
  - g. Abuse
- iv Product subject to a warranty claim must be returned to the Lewmar outlet that supplied the product for examination unless otherwise approved by Lewmar in writing.
- v This warranty does not cover any incidental costs incurred for the investigation, removal, carriage, transport or installation of product.
- vi Service by anyone other than authorized Lewmar representatives shall void this warranty unless it accords with Lewmar guidelines and standards of workmanship.
- vii Lewmar's products are intended for use only in the marine environment. Buyers intending to use them for any other purpose should seek independent professional advice as to their suitability. Lewmar accepts no liability arising from such other use.

#### B EXCEPTIONS

Cover under this Warranty is limited to a period of one year from the date of purchase by the end user in the case of any of the following products or parts of products:

- Electric motors and associated electrical equipment
- Electronic controls
- Hydraulic pumps, valves and actuators
- Hatch & Portlight weather seals
- Products used in "Grand Prix" racing applications
- Products used in commercial or charter applications
- Anchor rode

#### C LIABILITY

- i Lewmar's liability under this warranty shall be to the exclusion of all other warranties or liabilities (to the extent permitted by law). In particular (but without limitation):

a. Lewmar shall not be liable for:

- Any loss of anticipated turnover or profit or indirect, consequential or economic loss;
- Damages, costs or expenses payable to any third party;
- Any damage to yachts or equipment;
- Death or personal Injury (unless caused by Lewmar's negligence).

Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you

- b. Lewmar grants no other warranties regarding the fitness for purpose, use, nature or satisfactory quality of the products.
- ii Where applicable law does not permit a statutory or implied warranty to be excluded, then such warranty, if permitted by that state or country's law, shall be limited to a period of one year from the date of purchase by the end user. Some states and countries do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you.

#### D PROCEDURE

Notice of a claim for service under this warranty shall be made promptly and in writing by the end user to the Lewmar outlet that supplied the product or to Lewmar Limited at Southmoor Lane, Havant, Hampshire PO9 1JJ, England.

#### E SEVERANCE CLAUSE

If any clause of this warranty is held by any court or other competent authority to be invalid or unenforceable in whole or in part, the validity of the remaining clauses of this warranty and the remainder of the clause in question shall not be affected.

#### F OTHER RIGHTS

This warranty gives you specific legal rights, and you may also have other legal rights, which vary from state to state and country to country.

In the case of European States a Consumer customer (as defined nationally) has legal rights under the applicable national law governing the sale of Consumer Goods; this Warranty does not affect those rights.

#### G LAW

This warranty shall be governed by and read in accordance with the laws of England or the state or country in which the first end user is domiciled at the time of purchase of the product.

#### H DISPUTES

Any dispute arising under this warranty may, at the option of the end-user, be referred to alternative dispute resolution under the rules of the British Marine Federation or to the Courts of the State whose law shall govern the warranty or to the Courts of England and Wales.

The British Marine Federation may be contacted at Marine House, Thorpe Lea Road, Egham, England, TW20 8BF

## **UK & International Distribution**

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England

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**Fax:** +44 (0)23 9248 5720

**Email:** [info@lewmar.com](mailto:info@lewmar.com)

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# **LEWMAR®**

**[www.lewmar.com](http://www.lewmar.com)**

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