

## Important safety information:

Please note that a combustion engine with built-in electronic on-board starter is not a toy. The combustion engine might start suddenly due to an unintentional activation. Please read the safety information in the assembly instructions and in the appendix thoroughly.

## Recommended starter battery:

Only high-amperage (16A) NC, NiMh and LiPo batteries (as used for electronic flying models) are suitable as starter batteries.

## Information on the operation of the on-board starter:

The maximum operating time of the on-board starter is 10 secs. The maximum operating temperature of the on-board starter must not exceed 70°C.

## Warranty

Our electric on-board starters are shipped as kits. The professional assembly and normal operation is beyond our influence. Therefore the warranty is limited to components included in the kit as well as their functioning. We assume no liability for damages resulting from improper assembly or operation.

## Recommendation for the running-in of the on-board starter:

After the complete assembly of the on-board starter on the internal combustion engine we recommend to disassemble the glow plug and to let the on-board starter run in for approx. 3 minutes. Then you can put the on-board starter into operation.

## Assembly instructions for:

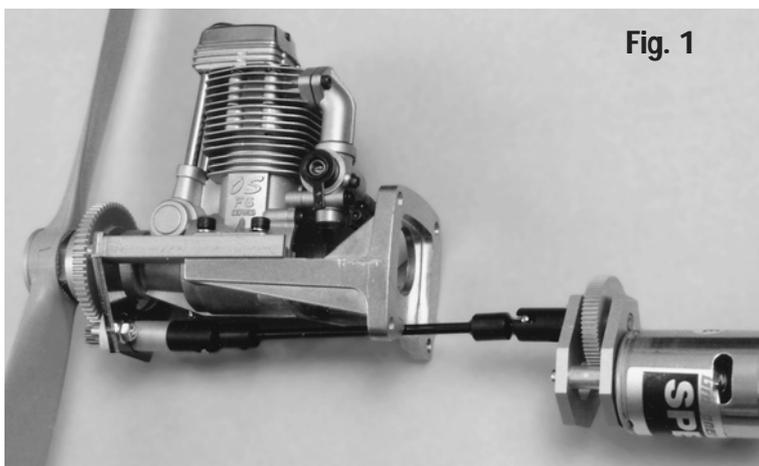


Fig. 1



Fig. 2

Stock number 9500 Basic kit for 7.5-14 cc engines  
 Stock number 9512 Basic kit for 15-35 cc engines  
 Stock number 9514 Complete kit for OS-Max BGX-1, OS-Max 160 FX, Moki-25, Magnum XL180AR, Laser 200, MVVS-35 (Glow)

## General information:

The universal on-board starting system in Fig. 1 for aircraft engines can be attached to all common single cylinder glow plug engines.

## Not included in the kit:

In addition to the basic kit each engine type requires an **adapter kit**. You find the available adapter kits in our catalog and price list.

When using the **Glow-Control** you only need a storage battery for the operation of the on-board starter, which supplies the starter engine and the glow plug

The universal on-board starting system can also be attached as a compact version (see Fig 2). The holder plate is not included in the delivery, you can build it on your own.

Basically, the electronic on-board starting system can run in two operation modes:

## Starting of the internal combustion engine via the radio control

At this operation mode, the internal combustion engine can be started on the ground as well as in the air via the radio control. Here, the NC-storage battery is placed inside the model.

## Safe starting of the internal combustion engine is only possible on the ground

This operating mode only requires the attachment of the starting device with the starter engine inside the model. The starter storage battery and the **Glow-Control** are placed inside a starting box. The on-board starter is manually switched on and off via micro switches.

## Control of electric on-board starting system

The electric on-board starter is controlled via micro switches operated from an IC-servo.

For the secure starting of the internal combustion engine it is necessary that, at the activation of the engine, the starter engine starts immediately with full power to prevent the kick-back of the combustion engine. (Please do not use electric controllers.)

## Power supply of the electric on-board starter

The power supply of the starter engine and of the heater plug only requires a storage battery to which also the **Glow-Control** is connected.

## Recommendation for starting storage batteries:

9.6 - 12 Volt, min. 1.8 Ah.

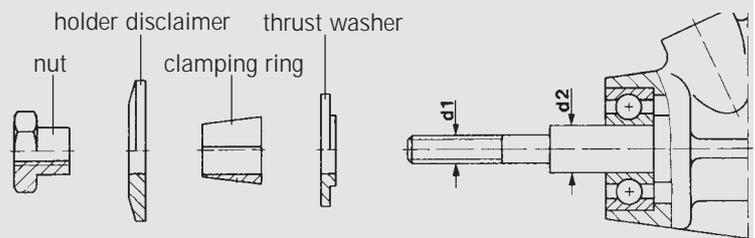
## Adapters for 7.5 - 35 cc aircraft engines

In addition to the basic kit, an adapter is necessary for each engine type. Adapters can be combined individually for internal combustion engines that are not listed above. Please specify with your order thread = d1 and diameter = d2.

### Available clamping rings and thrust washers:

d2: 6.0; 7.0; 8.0; 9.5; 10; 12 (mm)

Available nuts: d1: M6; M7; M8; 1/4-28UNF, 5/16-24UNF, 3/8-24UNF, M8x1, M10x1



## Instructions for the installation of the mechanical components

### Assembly of the freewheeling gear

First, remove the nut, holder disc and propeller adapter from the combustion engine. During the mounting of the freewheeling gear please stick exactly to **Fig. 3**. Lubricate the inside and the front side of the freewheel generously with the enclosed **high pressure grease**.

Make sure that the rollers don't fall out of the freewheel. The adapter can be easily inserted into the freewheel by turning it clockwise. The flange of the thrust washer is turned towards the combustion engine. The mounted freewheeling gear has an axial tolerance and can be easily cranked against the starting direction, but immediately engages in starting direction.

## Assembly of the support, plate and bearing with gear

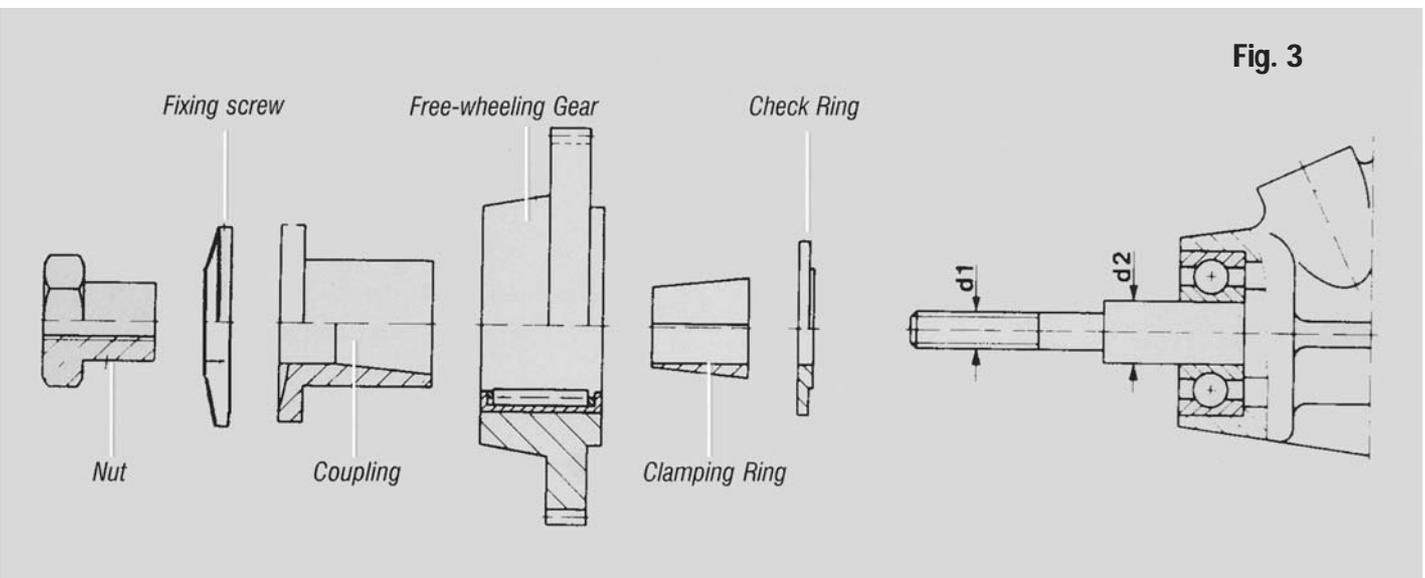
When the gearwheel is mounted, the support and the bearing with gear are attached. (**Fig. 4.**)

The plate and the attached bearing with gear are temporarily screwed to both supports with the supports evenly placed. Then put the combustion engine onto the support so that the gearwheel and gear are exactly on top of each other. Now the fixing holes for the combustion engine can be drilled into both supports (firmly clamp the supports to the combustion engine). When the combustion engine is

screwed to the supports of the intended engine support, the mounting bolts of the plate are finally tightened.

### Note:

The gear (10 teeth) must not exert edgewise pressure on the freewheeling gear as this would destroy the freewheel. Please adjust the tooth tolerance carefully. The maximum operating temperature at the freewheel must not exceed +70°C.



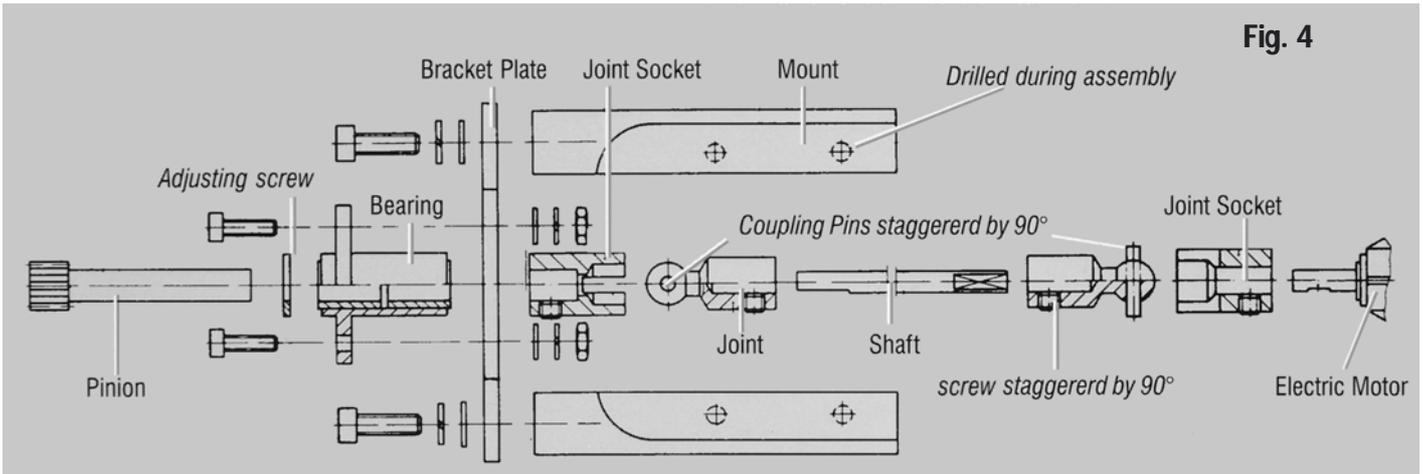


Fig. 4

**Assembly of the Cardan shaft**

The Cardan shaft (Fig.5) helps you significantly with the installation of the starter engine as no alignment works are necessary. The maximum deflection is approx. 30 mm on a length of 100 mm. During the assembly, stick exactly to Figure 5. If required, the shaft can be shortened which allows for an ideal adaption to the particular fitting conditions. After the shortening, hone the surface of the adapter to ensure a secure power transmission. The Cardan shaft has a predetermined breaking point in the shape of a cut notch to protect the gear wheels. When shortening the Cardan shaft make sure that the notch is preserved.

**Important:**

The adapter pins have to be twisted by 90°. This has to be considered when honing the surface of the adapter.

**Assembly of the starter engine with gearbox for stock number 9500**

The assembly of the starter engine with gearbox is clearly outlined in Fig. 6 . Lubricate the shaft and the gear wheel prior to the assembly. Examine the smooth operation of the complete unit.

**Assembly of the starter engine with gearbox for stock numbers 9512 and 9514**

The gearbox for this design is pre-assembled. You just have to screw it to the starter engine (Fig. 7).

The mechanical assembly of the on-board starter is now completed.

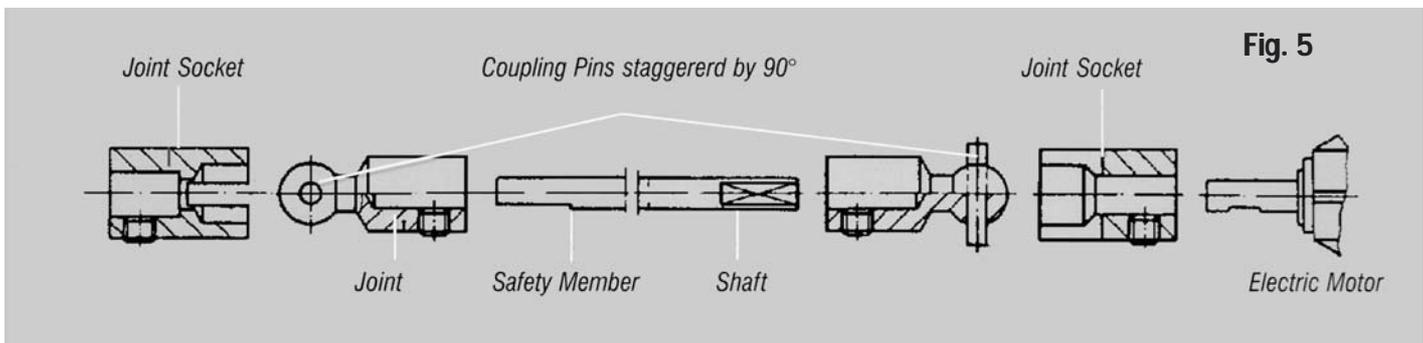


Fig. 5

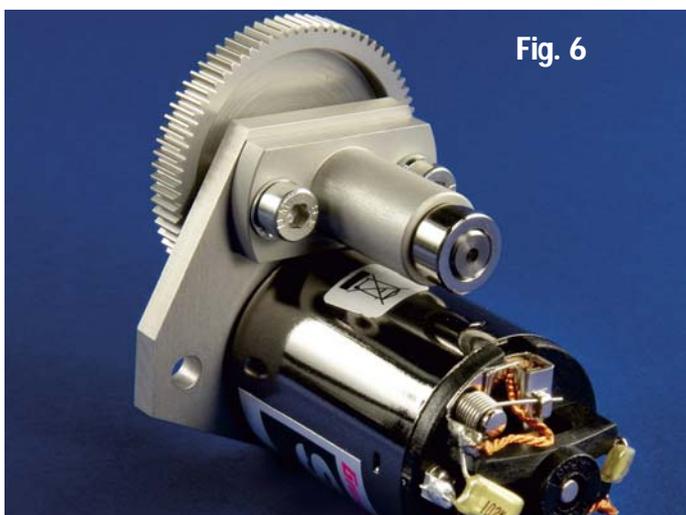


Fig. 6

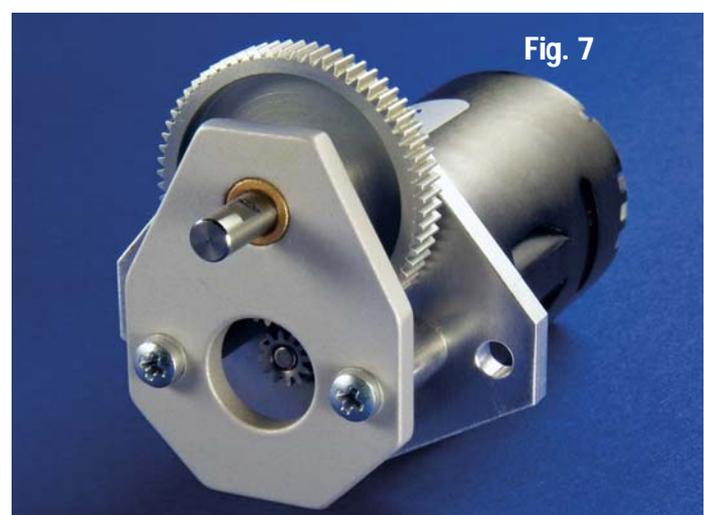


Fig. 7

| Spare parts for                             | 9500    | 9512    | 9514    |
|---|---------|---------|---------|
| Support, 2 units                            | 9500/01 | 9512/01 | 9512/01 |
| Plate                                       | 9500/02 | 9512/02 | 9514/01 |
| Bearing                                     | 9500/03 | 9500/03 | 9500/03 |
| Freewheeling gear, 60/76/92 teeth, m=0.8    | 9500/05 | 9512/05 | 9712/04 |
| Gear, 10 teeth, m=0.8                       | 9500/06 | 9500/06 | 9500/06 |
| Adapter                                     | 9500/07 | 9518/07 | 9712/07 |
| Cardan shaft                                | 9515/07 | 9515/07 | 9515/07 |
| Starter engine with gearbox                 | 9580/01 | 9570/01 | 9570/01 |
| Gearbox, single                             | 9580/02 | 9570/02 | 9570/02 |
| Starter engine with gear, 12 teeth, m = 0.5 | 9580/05 | 9575/03 | 9575/03 |
| Aluminium gear with output shaft, 66 teeth  | 9580/04 | 9570/04 | 9570/04 |
| Gear for starter engine, 12 teeth, m = 0.5  | 9570/03 | 9570/03 | 9570/03 |
| Micro switch, single                        | 9560/04 | 9560/04 | 9560/04 |
| Board switch, 16A                           | 9560/07 | 9560/07 | 9560/07 |
| Small parts kit (not shown)                 | 9500/12 | 9512/12 | 9514/12 |
| Thrust washer                               |         |         | 9530/35 |
| Cone ring                                   |         |         | 9530/26 |

## Spare parts for 9500, 9512, 9514



## Dimensional drawing: Basic kit, stock number 9500/9512/9514

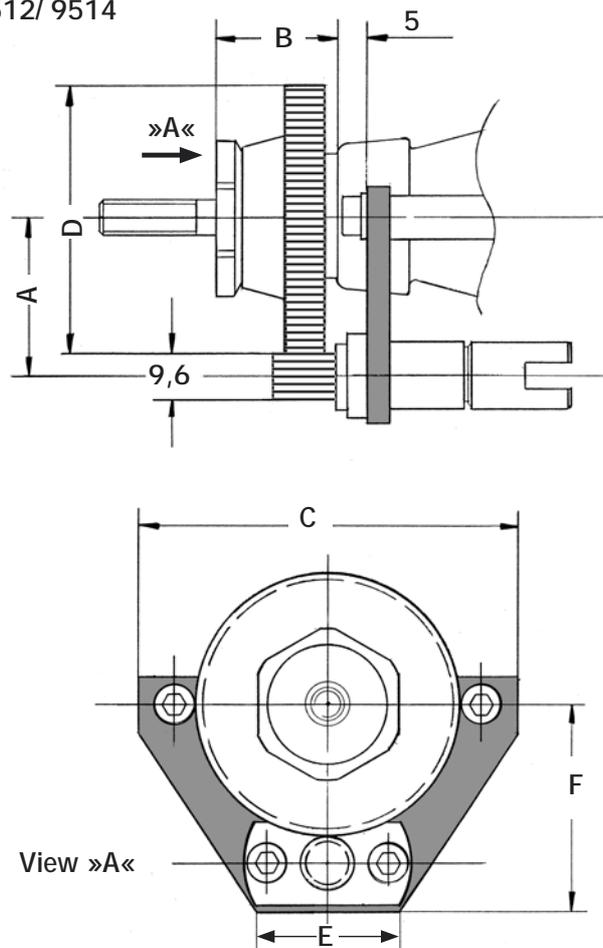


Table with dimensions (dimensions in mm) / weight (without starter storage battery)

| type | A    | B    | C    | D    | E    | F    | weight  |
|------|------|------|------|------|------|------|---------|
| 9500 | 29,0 | 24,0 | 68,0 | 48,0 | 25,0 | 37,0 | 320 gr. |
| 9512 | 35,0 | 24,0 | 76,0 | 60,8 | 25,0 | 40,0 | 380 gr. |
| 9514 | 42,0 | 26,0 | 90,0 | 73,6 | 30,0 | 50,0 | 440 gr. |

## Control of the electronic on-board starter

### General information

As shown in the **circuit diagram**, three switches are required for the controlling of the on-board starter which are connected in series. We recommend mounting the airborne starter countersunk to avoid an unintentional operation.

The »on-off« position of the switch has to be marked distinctly (**Fig. I**). The safety switch additionally prevents the starting while the throttle lever of the radio control is not in the position of idle speed. The safety switch is operated via the gas servo and is only closed in idle speed position. Keep the actuating cams on the cam plate as short as possible (**fig. II**).

The micro switch for the starting and stopping of the starter engine is operated via the starter servo (**fig. III**). For this

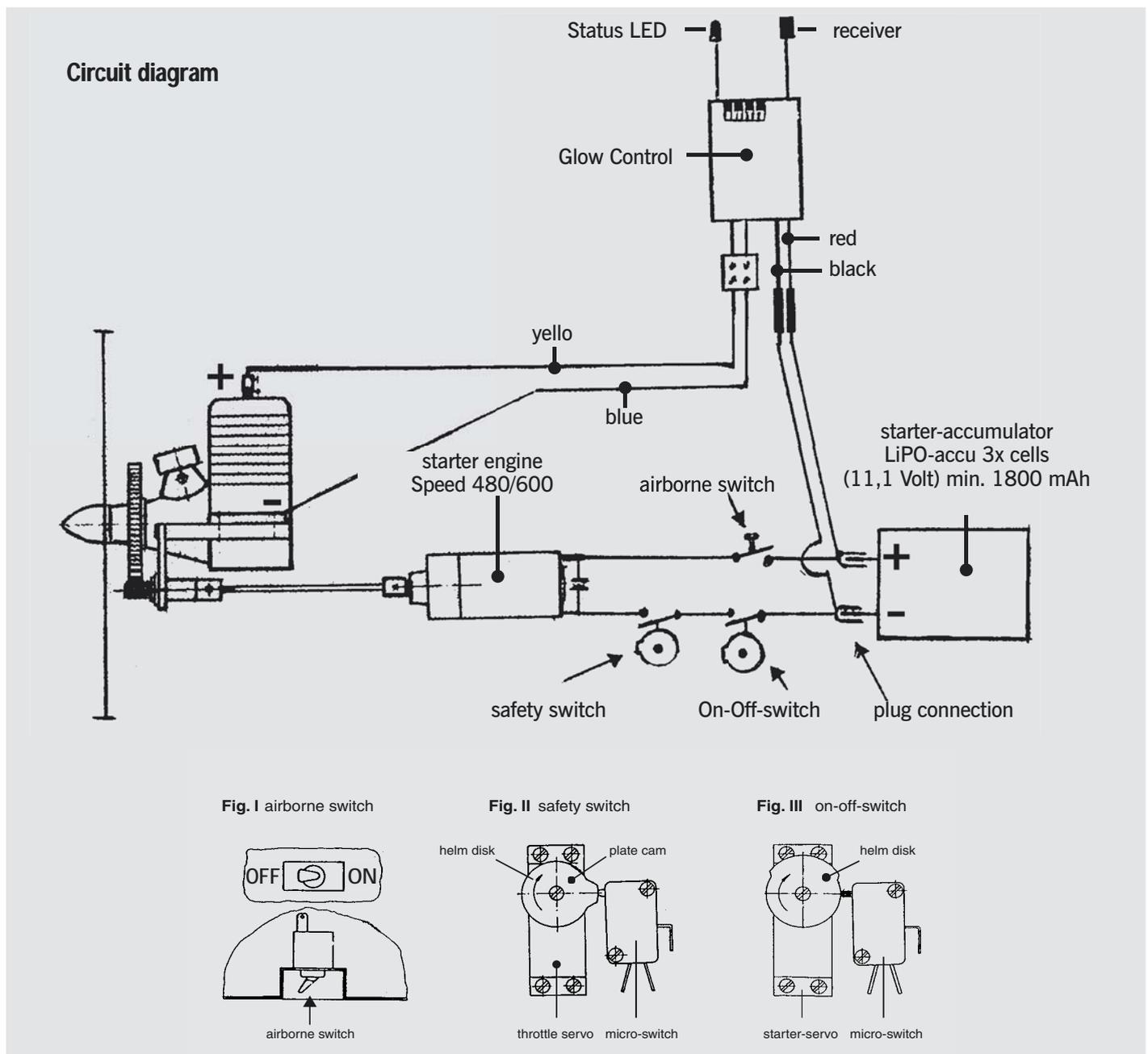
function we recommend an IC servo with put-on polarity-reversal switch (f. ex. Graupner C 508 with polarity-reversal switch stock number 3945).

Attach the starter battery and the switches as near as possible to the combustion engine. Make sure that the cables between the starter battery, safety switch, on-off switch and starter engine are as short as possible. They should have a minimal distance of 100 mm to receiver and antenna in order to avoid radio interferences.

We recommend soldered junctions for wiring (plug connections cause an unnecessary transfer resistance).

Tin-plate the flexible wires prior to soldering them. After cooling check each soldering by shaking it. The starter battery is connected via high-quality plugs.

Basically, the electronic on-board starting systems can run in two operation modes.



## 1. Starting of the internal combustion engine via the radio control on ground and in air

With this operation mode, the internal combustion engine can be started via the radio control on the ground as well as in the air. The starter battery is placed inside the model (see circuit diagram).

### Operation sequence:

- On-board switch in position **ON**.
- Use the starter servo to switch on the starter engine until the combustion engine has taken in enough fuel.
- Use the radio control and the **Glow-Control** to switch on the glow plug until the combustion engine runs safely in free-wheel.
- Switch off the starter engine and, if required, continue pre-glowing, to avoid the stalling of the combustion engine during acceleration. Full throttle, switch off the glow plug when the combustion engine runs safely.
- As a precaution, you can pre-glow during the landing approach with a reduced speed of the combustion engine to avoid the stalling of the combustion engine.
- Stick to this order when starting in the air.

## 2. Safe starting of the combustion engine is only possible on ground.

You can also use the electronic on-board starter to just start the combustion engine accident-proof and without help from the ground. For this operation mode, we recommend to assemble just the starting device with the starter engine into the model and place the starter battery and the **Glow-Control** in a starter box and connect it with a board connector. The switch is operated manually. The cable between starter box and model should not exceed a length of 150 cm to avoid a high power loss. Wire cross section at least 1.5 mm<sup>2</sup>.

### Initial operation

It is purposeful to secure all screw connections (Loctite, alternatively an all-purpose adhesive). Generously lubricate the freewheel with the enclosed high pressure grease. Prior to the initial operation, lubricate the inside of the gear bearing, the joints of the Cardan shaft and the gearwheel and the gear (only use high-quality ball-bearing grease).

After fully tightening and securing all screw connections, you can now try a take-off.

First, screw off the glow plug; it must be possible to easily turn the combustion engine into rotating direction, when turned against rotating direction, the freewheel engages and the starter engine is also turning.

If the combustion engine wasn't run for a long time, inject some fuel. Now switch on the starter engine. If the starter engine rotates into the wrong direction, you have to exchange the engine connections. When the glow plug is screwed in and connected you are ready to test the device. Prior to the first start, turn the combustion engine slowly twice by hand, with the carburettor kept shut until the fuel reaches the carburettor. This procedure is required just once a flying day.

The engine starts reliably as long as there is fuel in the carburettor. Then switch on the starter engine and the glow plug. The position of the throttle stick is a slightly increased neutral gear. Switch off the starter engine and the glow plug when the combustion engine runs safely.

### Important information:

If the combustion engine is started manually although an on-board starter is installed, you have to disconnect the starter engine from the Cardan shaft. The combustion engine tends to kick back when started manually. The occurring forces are so great that the Cardan shaft breaks at the predetermined breaking point or the gearwheels may be damaged. If the freewheel does not engage after a longer period without operation, it is usually due to resinification. It has to be cleaned (petrol or spirit) and lubricated with the included high pressure grease. Make sure that the rollers don't fall out of the freewheel during the cleaning. If this is the case, just put them back.

If too much fuel is taken in, the combustion engines tend to kick back. These kick-backs may damage the on-board starter. Therefore, fuel should only be taken in until it reaches the carburettor. If too much fuel is taken in, firmly turn the combustion engine for a couple of times by hand until the excess fuel leaks out. Only now activate the starter engine and the glow plug.

We hope you have a lot of fun with our on-board starter system and wish you many successful starts – and as many happy landings.

## Additional assembly instructions for OS-Max FT 160 »Gemini«

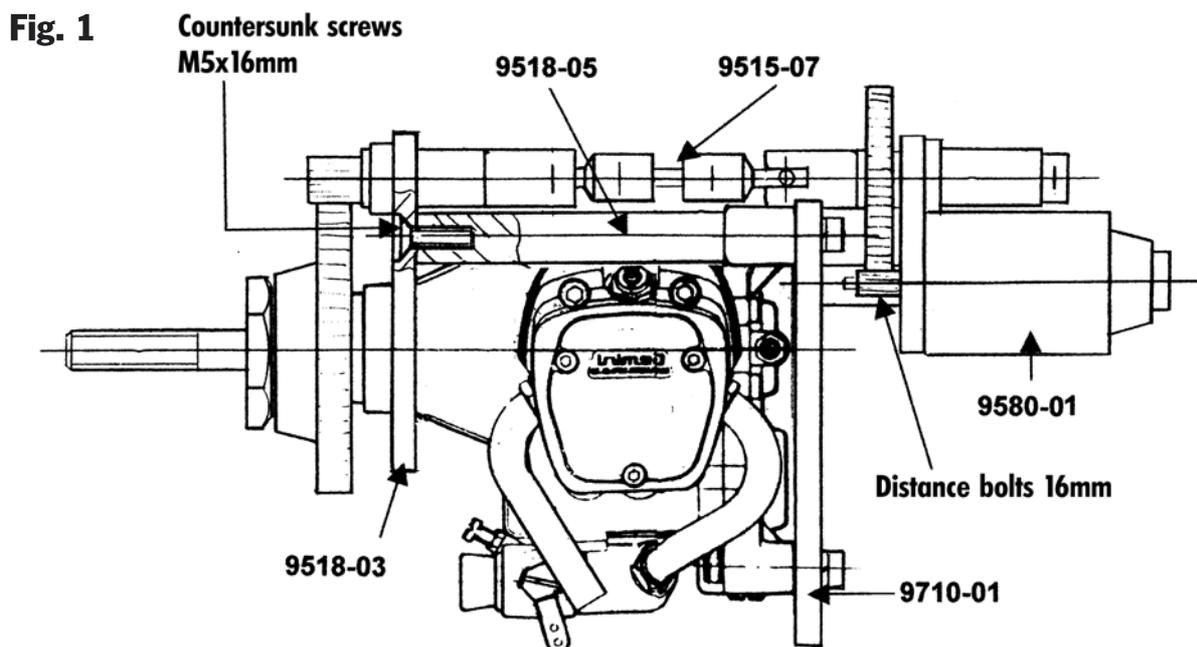
### Stock number 9710A Compact on-board starter

First, disassemble the original OSMax engine support from the combustion engine. The enclosed engine support plate with stock number 9710-01 has the same drilling pattern as the original engine support. The starter engine with gear-box (stock number 9580-01) is attached directly to the engine

support plate (see Fig. 1). Use the screws M 4x25 mm with retaining ring and the distance bolts with a length of 16 mm.

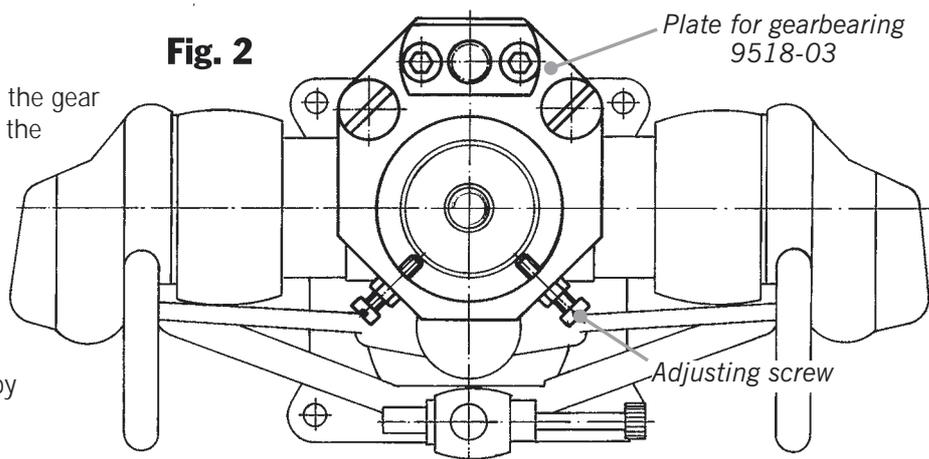
For the fixing of the OS-Max FT-160 and the dowel pins with stock number 9518-05 on the engine support plate, use the screws M 4x30 mm with retaining ring and the nuts M 4.

The plate with stock number 9518-03 for the gear bearing is screwed to the dowel pins with the countersunk screws M 5x16 mm.



For the assembly of the freewheeling gear, the gear bearings with gears, the Cardan shaft and the starter engine with gearbox, please see the enclosed assembly instructions for single cylinder engines. When the on-board starter is completely assembled, the adjustment screws M 3x16 mm are screwed to the plate. Turn the screws into the plate until they touch the casing. Don't forget to secure the screws by firmly tightening the nut M 3 (see Fig. 2).

**Fig. 2**



### Important:

After tightening the nut, make sure if the tooth tolerance is still adjusted correctly.

The assembly of the on-board starter is now completed.

For the control of the on-board starter and the initial operation, please read the enclosed assembly instructions for single cylinder engines and the operating instructions for the Glow-Control.

| Spare parts for                           | 9710    | 9711    | 9712    |
|---|---------|---------|---------|
| Thrust washer                             | 9530/33 | 9530/33 | 9530/35 |
| Clamping ring                             | 9530/23 | 9530/23 | 9530/26 |
| Plate for gear bearing                    | 9518/03 | 9711/01 | 9712/02 |
| Engine support plate                      | 9710/01 | 9710/01 |         |
| Carrier for electric motor (not shown)    |         |         | 9712/05 |
| Dowel pin/bearing, 2 units                | 9518/05 |         | 9712/03 |
| Freewheeling gear 76/92 teeth, m=0.8      | 9512/05 | 9512/05 | 9712/04 |
| Adapter, width across flats 32mm/38mm     | 9518/07 | 9518/07 | 9712/07 |
| Bearing                                   | 9500/03 | 9500/03 | 9500/03 |
| Gear with 10 teeth, m=0.8                 | 9500/06 | 9500/06 | 9500/06 |
| Cardan shaft                              | 9515/07 | 9515/07 | 9515/07 |
| Starter engine with gearbox               | 9580/01 | 9570/01 | 9570/01 |
| Gearbox single                            | 9580/02 | 9570/02 | 9570/02 |
| Starter engine with gear, 12 teeth, m=0.5 | 9580/05 | 9575/03 | 9575/03 |
| Aluminium gear with output shaft          | 9580/04 | 9570/04 | 9570/04 |
| Micro switch, single                      | 9560/04 | 9560/04 | 9560/04 |
| On-board switch, 16A                      | 9560/07 | 9560/07 | 9560/07 |
| Small parts kit (not shown)               | 9710/12 | 9711/12 | 9712/12 |

## Dimensional drawings: 9710 / 9711 / 9712

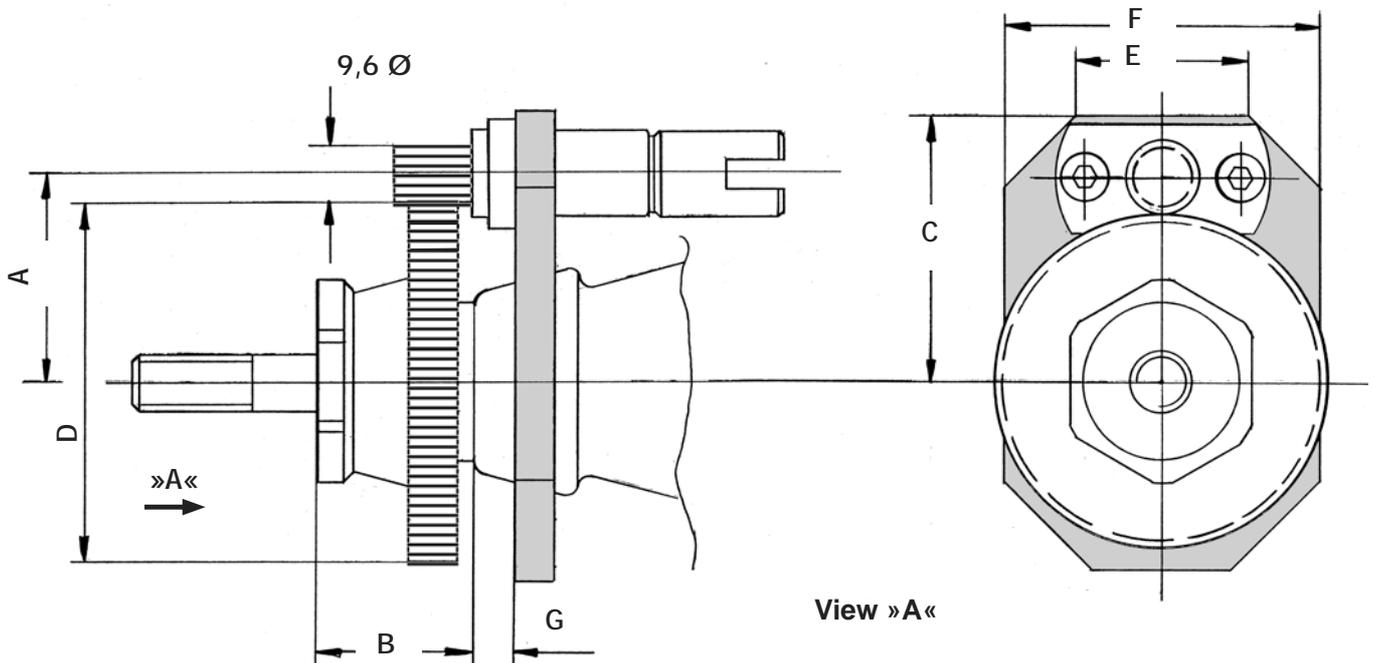


Table with dimensions (dimensions in mm)  
weight (without starter storage battery)

| type | A    | B    | C    | D    | E    | F    | G    | weight  |
|------|------|------|------|------|------|------|------|---------|
| 9710 | 35,0 | 24,0 | 44,0 | 60,8 | 28,0 | 60,0 | 8,0  | 400 gr. |
| 9711 | 35,0 | 24,0 | 44,0 | 60,8 | 28,0 | 60,0 | 8,0  | 450 gr. |
| 9712 | 42,0 | 26,0 | 50,0 | 73,6 | 35,0 | 70,0 | 16,0 | 500 gr. |



| Spare parts for                           | 9710    | 9711    | 9712    |
|---|---------|---------|---------|
| Thrust washer                             | 9530/33 | 9530/33 | 9530/35 |
| Clamping ring                             | 9530/23 | 9530/23 | 9530/26 |
| Plate for gear bearing                    | 9518/03 | 9711/01 | 9712/02 |
| Engine support plate                      | 9710/01 | 9710/01 |         |
| Carrier for electric motor (not shown)    |         |         | 9712/05 |
| Dowel pin/bearing, 2 units                | 9518/05 |         | 9712/03 |
| Freewheeling gear 76/92 teeth, m=0.8      | 9512/05 | 9512/05 | 9712/04 |
| Adapter, width across flats 32mm/38mm     | 9518/07 | 9518/07 | 9712/07 |
| Bearing                                   | 9500/03 | 9500/03 | 9500/03 |
| Gear with 10 teeth, m=0.8                 | 9500/06 | 9500/06 | 9500/06 |
| Cardan shaft                              | 9515/07 | 9515/07 | 9515/07 |
| Starter engine with gearbox               | 9580/01 | 9570/01 | 9570/01 |
| Gearbox single                            | 9580/02 | 9570/02 | 9570/02 |
| Starter engine with gear, 12 teeth, m=0.5 | 9580/05 | 9575/03 | 9575/03 |
| Aluminium gear with output shaft          | 9580/04 | 9570/04 | 9570/04 |
| Micro switch, single                      | 9560/04 | 9560/04 | 9560/04 |
| On-board switch, 16A                      | 9560/07 | 9560/07 | 9560/07 |
| Small parts kit (not shown)               | 9710/12 | 9711/12 | 9712/12 |

## Dimensional drawings: 9710 / 9711 / 9712

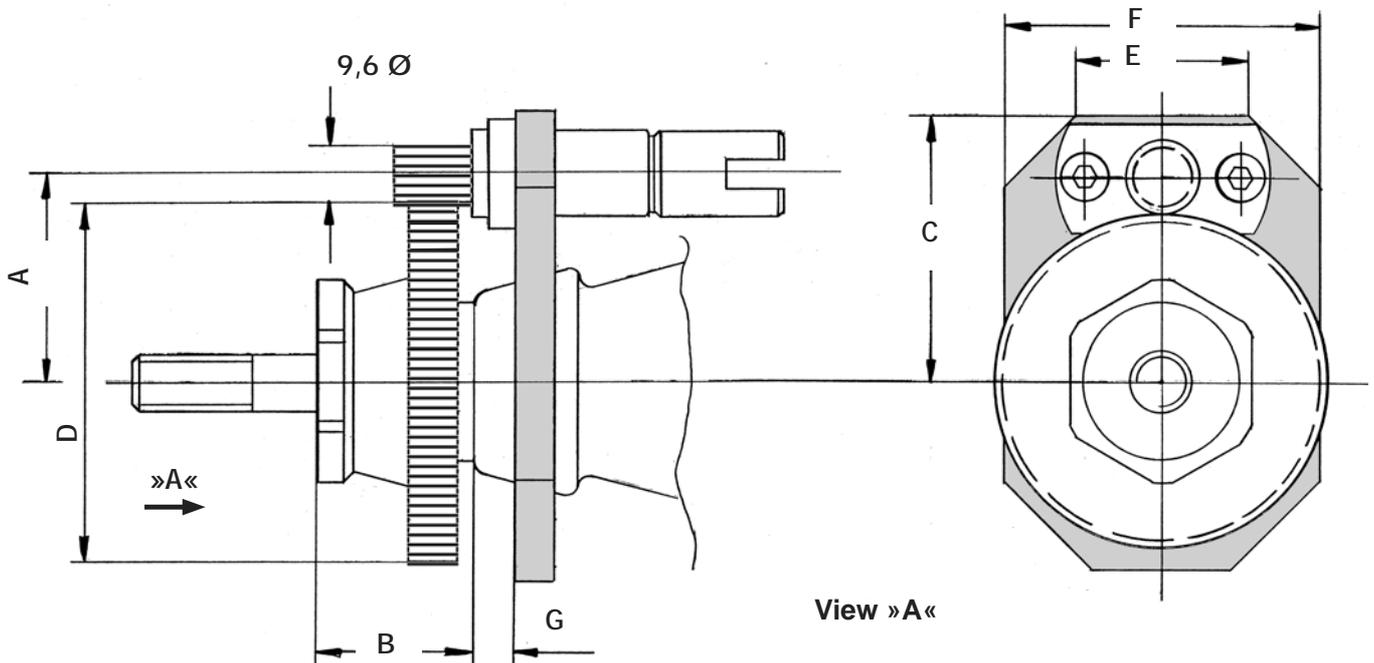


Table with dimensions (dimensions in mm)  
weight (without starter storage battery)

| type | A    | B    | C    | D    | E    | F    | G    | weight  |
|------|------|------|------|------|------|------|------|---------|
| 9710 | 35,0 | 24,0 | 44,0 | 60,8 | 28,0 | 60,0 | 8,0  | 400 gr. |
| 9711 | 35,0 | 24,0 | 44,0 | 60,8 | 28,0 | 60,0 | 8,0  | 450 gr. |
| 9712 | 42,0 | 26,0 | 50,0 | 73,6 | 35,0 | 70,0 | 16,0 | 500 gr. |