

**Test data:**

Customer: .....

Test Engineer: .....

Date: .....

Serial number: .....

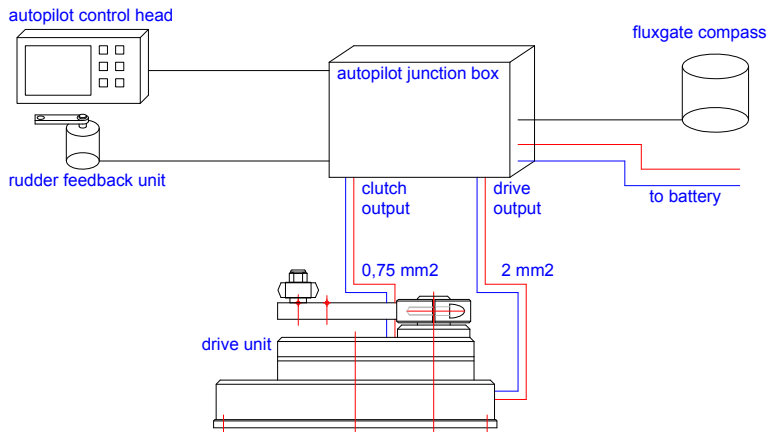
Output torque 150 KgM:

Motor Voltage: 12 Volts

Clutch voltage: 12 Volts

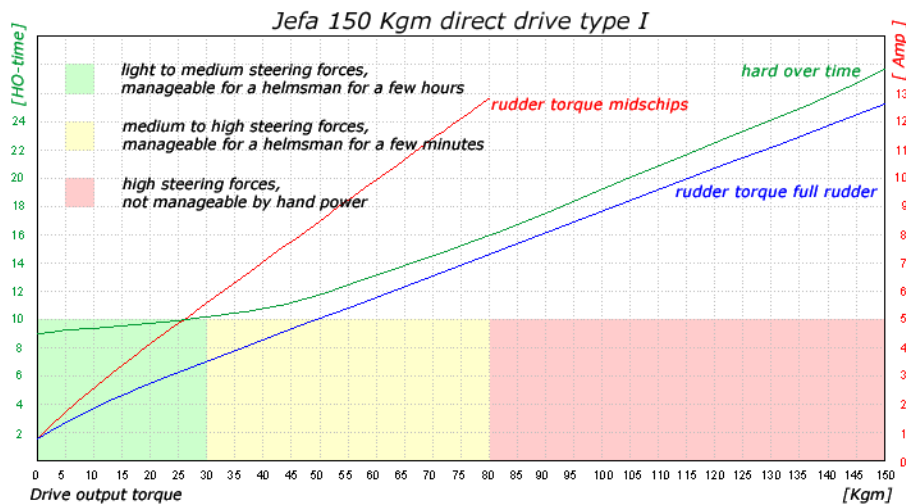
Insulation test:

**Electrical Connections:**



This illustration shows the minimal components for a working autopilot configuration. Jefa autopilot drives work together with all major autopilot electronics. The connection of the Jefa autopilot drive to the autopilot junction box is quite simple. The two 0.75 mm<sup>2</sup> red and black wires have to be connected to the plus and minus of the autopilot clutch line. This will make sure that when the autopilot user engages the autopilot on the control screen, the clutch will engage and allow the autopilot motor to drive the steering system. The two 2 mm<sup>2</sup> red and black wires have to be connected to the autopilot drive output connection.

**Performance table:**



This performance table shows the relation between the consumed power and the output power. The red line shows the output torque against the needed amperage at midships rudder and the blue line shows the output torque against the needed amperage at full rudder. The green line shows the hard over time (time to travel 72° of rudder travel) of the drive relative to the output torque. Also visible is the strength of the drive unit related to man power. The unit is much stronger than a human being and can last much longer but one should note that when the unit is operated in the red zone, something is wrong with the trim of the boats and the sails should be adjusted to achieve lower rudder torques. The above table shows that the Jefa direct drive type I will steer the yacht even in the worst possible conditions. As the drive will mostly operate in the left green zone and will not continuously rotate, the average power consumption on 12 volts is 2 amps.

## Compatibility in 12 Volts:

Following table shows the maximum rudder torques at midships and full rudder that can be generated by the Jefa 150 KgM direct drive type 1 in combination with various autopilot junction boxes. The hard over time (HO-time) states the time it takes the drive to travel the full 72 degrees of rudder travel when the speed control of the pilot is set to maximum speed.

Autopilot junction box 12 Volt version.	Max. output (Amp.)	Rudder torque midships (KgM)	Rudder torque full rudder (KgM)
Simrad AC12	12	90	140
Simrad AC20	20	90	150
Simrad AC40	fully functional, but smaller autopilot is advisable (money can be saved by choosing smaller autopilot)		
B&G h1000 (*1)	25	90	150
B&G h2000 ACP-1	25	90	150
B&G h2000 ACP-2	fully functional, but smaller autopilot is advisable (money can be saved by choosing smaller autopilot)		
Nexus-Silva A-1510 (*2)	15	80	150
NKE gyropilot 2 RVP (*3)	25	80	150
Navman G-Pilot (*4)	20	80	150
Northstar MCU600 (*4)	20	80	150
Furuno Navpilot 500/511/520	25	80	150
Raymarine X-10 (*5)(*6)	10	80	150
Raymarine X-30	30	80	150

(\*1) Please use part number h1000-CUW specially made for Jefa drives, equipped with dynamic braking. Don't use the standard h1000.

(\*2) Please read the special installation instructions for the clutch available on our FTP server via [this direct link](#).

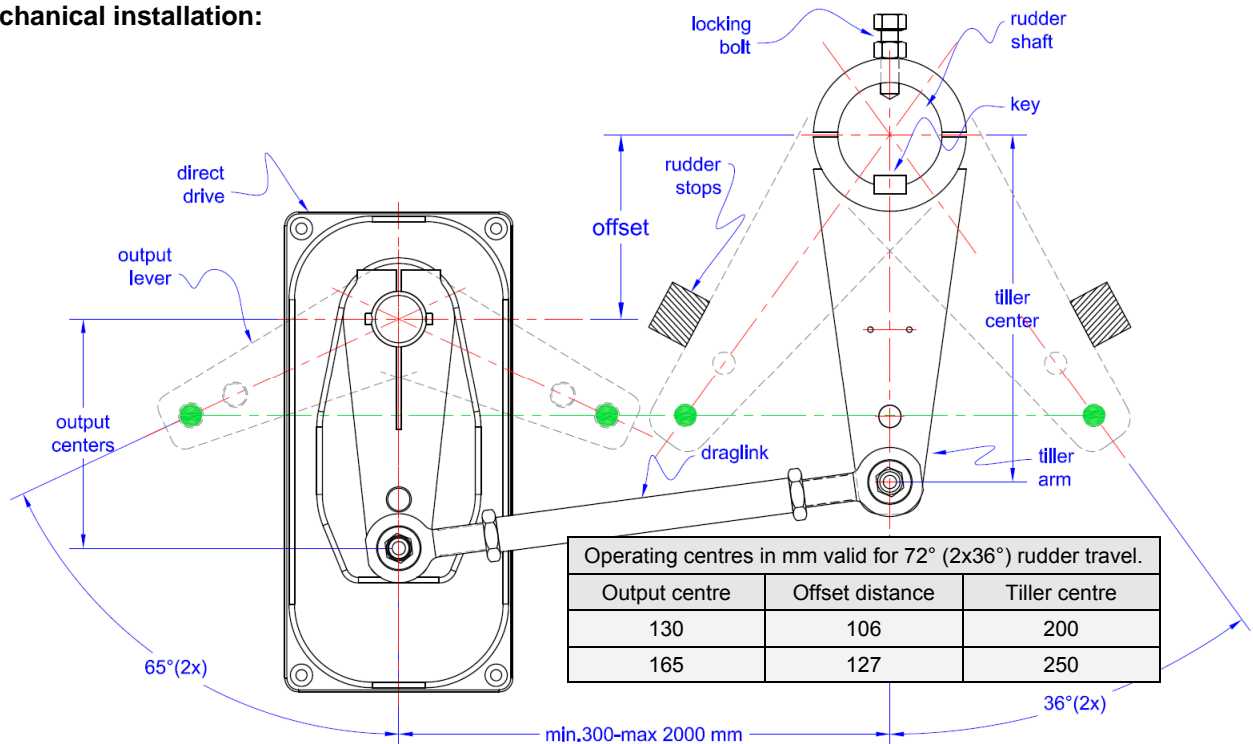
(\*3) Please read the special installation instructions for the clutch available on our FTP server via [this direct link](#).

(\*4) Please read the special installation instructions for the clutch available on our FTP server via [this direct link](#).

(\*5) Please read the special installation instructions for the clutch available on our FTP server via [this direct link](#).

(\*6) We strongly advise to not use the standard X10 autopilot as it delivered without rudder feedback unit. Without rudder feedback unit the autopilot is not aware of actual rudder angle. In very slow speed conditions or in conditions of a stalling rudder blade, the autopilot doesn't stop with powering the drive unit, running it against the rudder stops and still continuing to power the drive. In time the drive fuse will blow, but mechanical damage can occur in the drive unit which will not be covered under our warranty terms as we can identify this specific damage. We strongly advise only to use the X10 unit in combination with the optional rudder feedback unit or use the X30 unit.

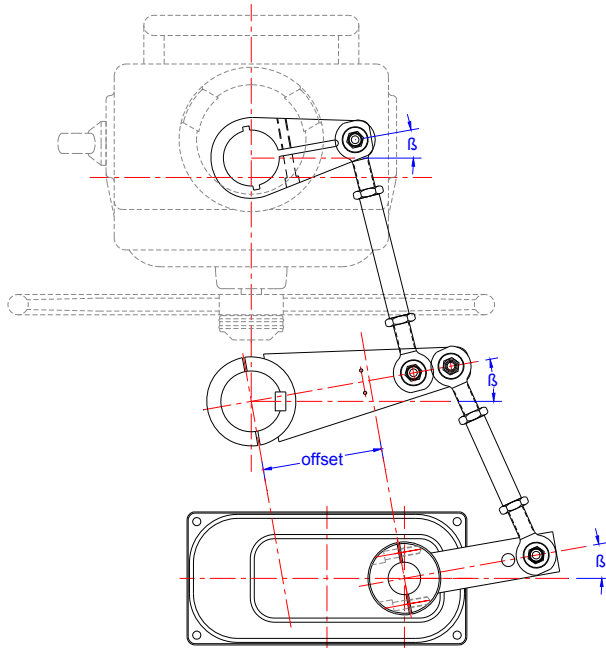
## Mechanical installation:



The direct drive uses “wide angle geometry”. The result of this is 128° travel of the output lever and 72° travel of the tiller lever. To achieve an equal travel of the drive in port and starboard, the centre point of the output lever needs an offset to the rudderstock centre. The offset depends on the used lever centres. The above table shows the correct offset distances:

A good installation check is to make sure all end-position points are in one line (see green line in illustration).

**Direct drive type I in combination with rack and pinion system:**

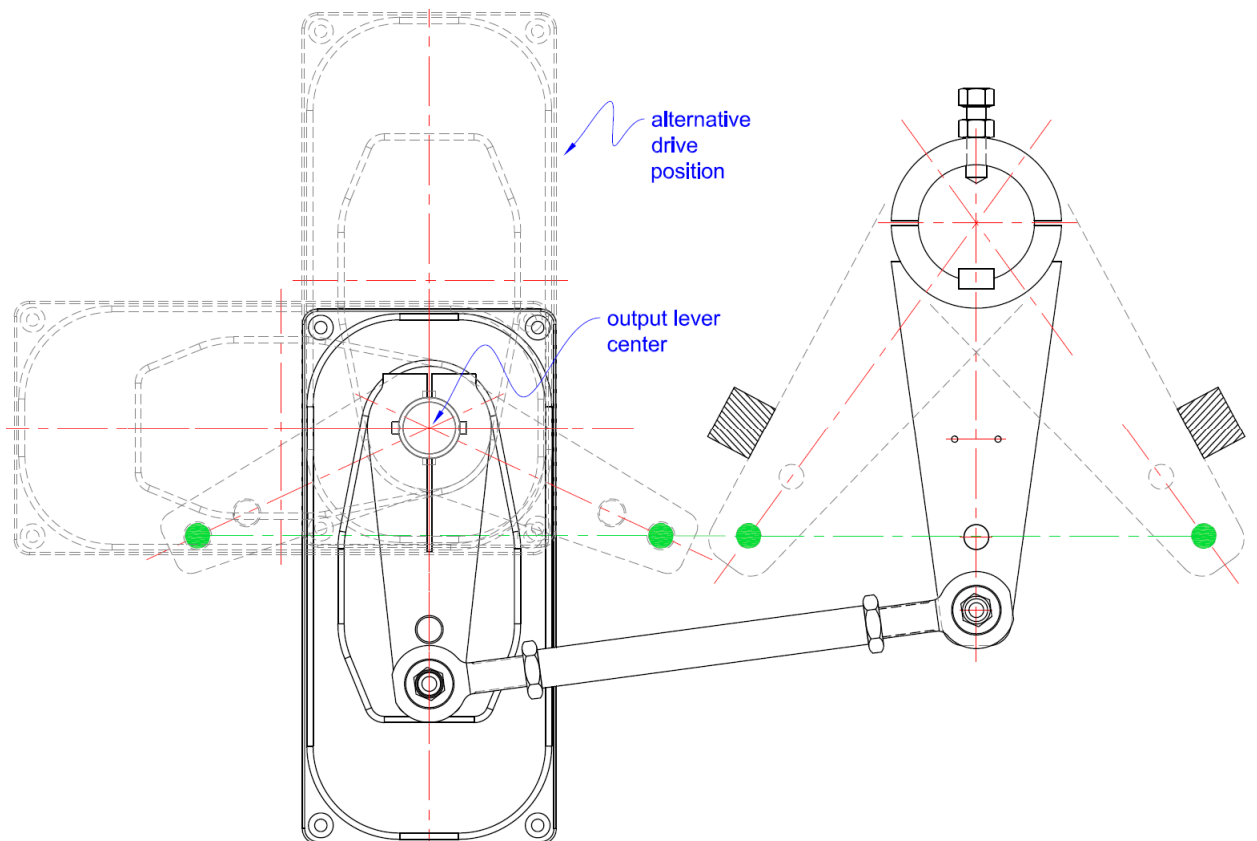


In principle the installation in combination with a rack and pinion system is the same as the standard installation except for the fact that the complete setup is rotated with the steering offset angle  $\beta$ .

First install the rack and pinion system with the correct geometry, put the steering midships and find the line perpendicular to the tiller lever centre line. Put the drive on a parallel line with an offset distance as in below table. Rotate the drive lever to the same offset angle than the steering system offset angle  $\beta$  and mount the draglink.

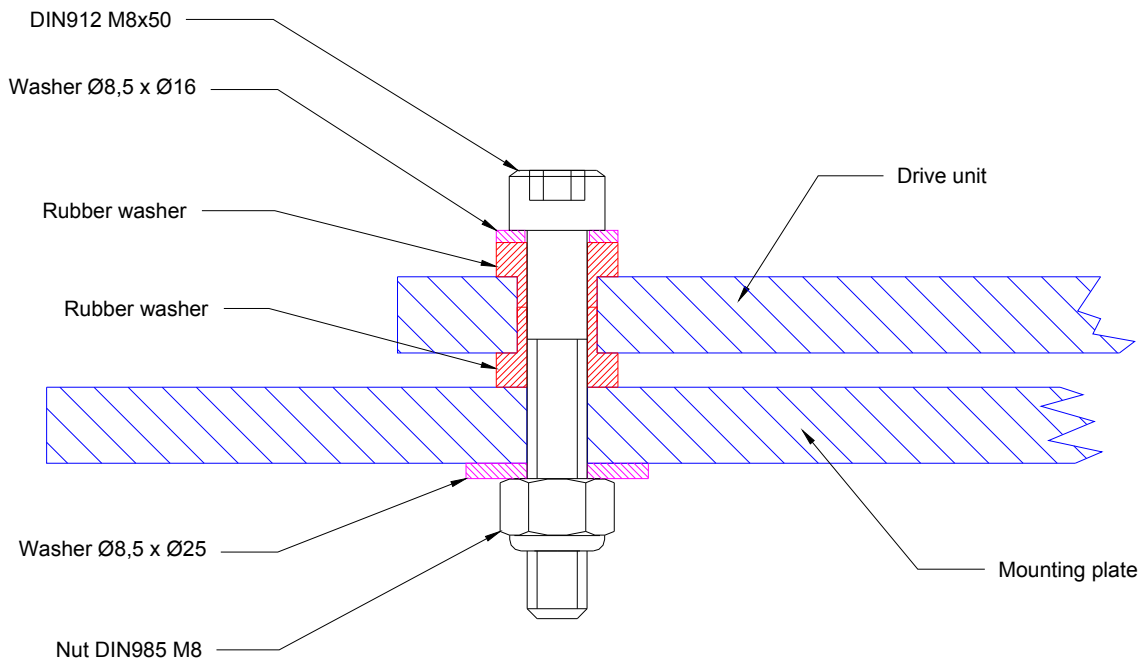
Operating centres in mm valid for 72° (2x36°) rudder travel.		
Output centre	Offset distance	Tiller centre
130	106	200
165	127	250

**Alternative drive positions.**



When another drive orientation is easier to install, one can rotate the drive motor in another direction, as long as the geometry between the center of the output lever and the rudder is kept the same,

## Reducing noise level and vibrations:



The vibrations from the autopilot drive motor and gears are often amplified multiple times by the deck or hull. This noise can be dramatically decreased by using the special bolts, rubber washers and bushes one can find in the bag supplied with the drive unit. When mounted like in the above illustration, the vibrations will be limited to the absolute minimum and a smooth and silent installation is guaranteed.

## Test the system:

Before you can test the system, make sure following things are correct:

- Solid rudder stops should be fitted limiting the rudder travel to an equal travel of 36 degrees from midships to port and starboard.
- Make sure all bolted parts (tiller pins, rosejoints, draglinks, tillerarm, etc) are firmly tightened and will not come loose even when exposed to heavy vibrations. Use loctite when necessary.
- Move the complete system from port to starboard making sure the rosejoints don't hit the output lever and tiller lever.
- Make sure the drive output lever rotates equally around 65 degrees to both sides and there is no risk for the output lever to go "over dead centre" so it can't return to the initial position any more, blocking the system.

Connect the electronics. Make absolutely sure the autopilot is set to "reversible drive" or equivalent. Don't use settings like "solenoid" or "hydraulic drive" as these settings will disable the speed control of the autopilot leaving the drive running at 100% speed or 0%, but nothing in between. Make sure the clutch voltage is set to 12 volts. Some brands like B&G have default clutch voltage of 9 volts. This should be adjusted to 12 volts to guarantee a proper working of the clutch. Always fit the delivered fuse into the power feed line. Failing to install this fuse could mechanically overload the drive causing severe damage inside the drive unit.

When the drive doesn't react to the electronics, test the drive by bypassing the electronics: Connect a plus and minus wire to the battery or fuse box and first connect the clutch, one should hear a click when connecting and disconnecting. With the clutch under power, connect power for a short time to the motor cables. The system should get in motion now. Don't connect the cables too long as the drive will try to continue, even when the rudder stops are reached, with potential damage to the structure. If motion is detected, one can rule out the drive causing the malfunction.

**Maintenance:**

The direct drive is “greased for life”, so should no be opened. No maintenance is required except for periodic checks of all bolted connections. As the rudder system, the steering system and the autopilot drive is exposed to heavy vibrations (mainly by cruising on motor), all bolted connections should be yearly checked. The only parts that could wear in time are the balls of the draglink. These balls are easy exchangeable and available for around 10 € each from any Jefa distributor.

**Declaration of conformity:**

I, Stig Jensen of Jefa Marine Steering ApS, Nimbusvej 2, 2670 Greve, Denmark, confirm that the Jefa direct drive type I, when fitted in accordance with these installation instructions, will meet the requirements of the Electro Magnetic Compatibility Directive Standard contained within Standard No. 60945/A1.

Signed:.....

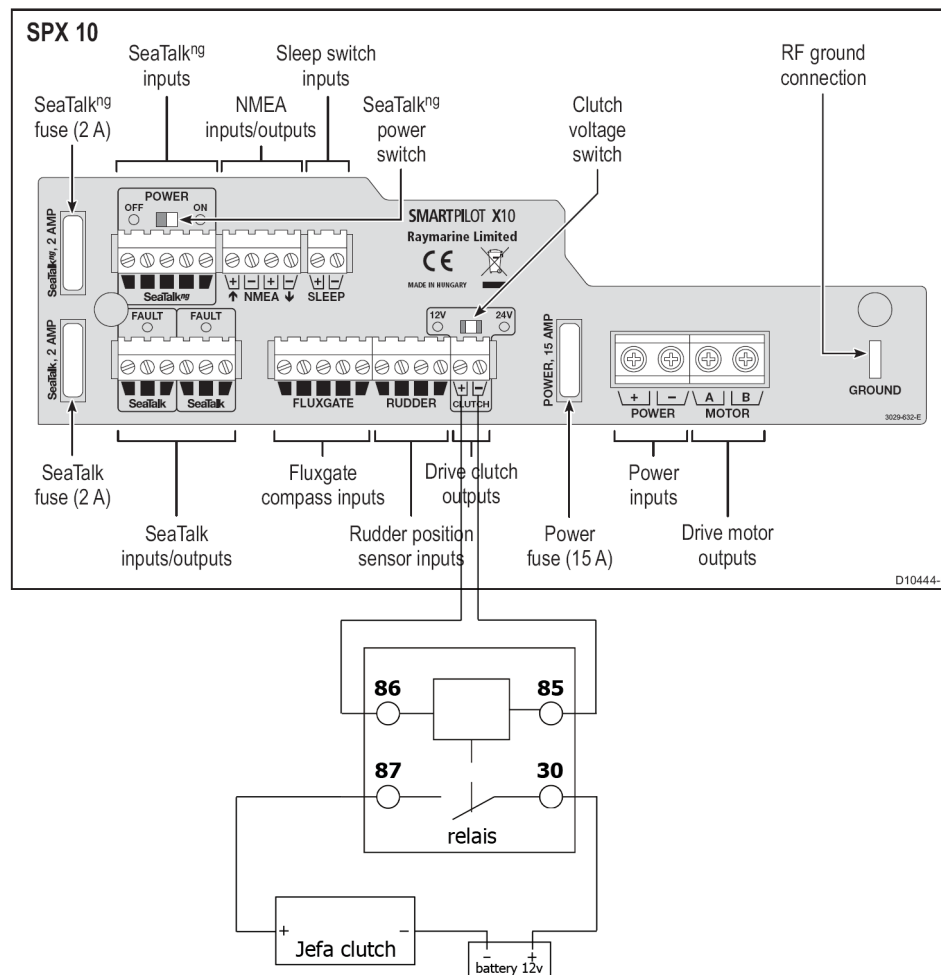
Date: 26-2-2004

  
Stig Jensen

*For more information please visit our website [www.jefa.com](http://www.jefa.com)*

## Special installation instructions for low power clutch lines

The Jefa drive unit Direct drive type 1 (DU-DD1-12) can operate with a relatively small course computer. This is due to the high efficiency of the drive unit. The direct drive unit require a current of 1,4 Amps to contract the clutch and to keep it contracted. Many small course computers can't deliver this power. To overcome this, a car contactor (relais) between the clutch ports and the clutch of the drive unit has to be installed. This contactor has to be ordered separately with the code number DU-RE-12 or could be purchased in a local car shop.



Example of the wiring diagram for the contactor.

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[www.jefa.com](http://www.jefa.com)

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