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# OPTIBEAM

**optimale Kurzwellen-Antennen**

**computer-designed / computer-optimiert**

**entwickelt von Funkamateuren für Funkamateure**

**optimum short-wave antennas**

**computer-designed / computer-optimized**

**developed by hams for hams**



## **O B 16 - 3**

### **16 Element Yagi 20/15/10**

***!!! Quality made in Germany !!!***

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## 1. Introduction

The OB16-3 is a high performing Triband Antenna for the 14, 21 and 28 MHz amateur radio bands.

OptiBeam shortwave antennas are designed and optimized by support of modern techniques such as computerized antenna simulation and are finally adjusted by extensive tests in practice.

The core of the antenna consists of a direct coupled 3-element-drivercell, where the drivers are connected with a phase line of square tubes. There is a separate reflector for each of the three bands. Furthermore there are two separate directors for each of the 20m and the 15m band and six separate directors for the 10m band.

By this new concept of feeding in combination with a special order of all elements and the exclusive use of full size elements highest efficiency, optimum bandwidth concerning high gain, clear pattern and low SWR together with unlimited power handling are achieved.

In the following table the essential electrical and mechanical data can be seen:

| Bands  | 20m / 15m / 10m                                       |
|--|---|
| Gain (dbd)*  | 7,1 / 7,5 / 8,5                                       |
| Gain (dbi)**   | 14,5 / 15,1 / 16,3                                    |
| F/B (db)   | 20 / 22 / 25  |
| SWR: 14,00 - 14,19 - 14,35<br>21,00 - 21,25 - 21,45<br>28,00 - 28,50 - 29,00 | 1,3 - 1,0 - 1,3<br>1,4 - 1,1 - 1,5<br>1,4 - 1,0 - 1,5 |
| Impedance (Ohm)  | 50  |
| Elements   | 16  |
| Active elements 20/15/10   | 4 / 4 / 8   |
| Max. element length (m)  | 10,92   |
| Boom length (m)  | 10,10   |
| Weight (kg)  | 48  |

- \* = average gain over a dipole in free space  
gain of monobanders for comparison: 2-element Yagi: 4 dbd, 3-element Yagi: 5-6 dbd  
\*\* = average gain at 20m above ground

## 2. Assembly

The included schematic diagram is needed for the assembly and the following information is given:

- > type of element (R=Reflector, S=Driver, D = Director) and the position on the boom
- > measurements of the element sections (length and diameter)
- > lengths of the element halves
- > distances between the elements.

The lengths are given in m (meters) and the diameters are given in mm (millimeters).

### 2.1 Sorting the parts

The antenna partly consists of already pre assembled parts.

All parts of the antenna are marked.

For faster and easier assembly it is recommended to sort the parts per band.



## 2.2 Assembly of boom

The boom consists of five parts, a middle section with a diameter of 75mm, two connecting sections of 70mm in diameter and two outer sections with a diameter of 65 mm.

The sections have to be put in following the **markings** which are located at the transitions between the boom sections. They have to be fixed with two screws and self securing nuts each. Concerning the later anchoring of the boom the two steal ropes have to be inserted with their metal loops into the **inner** connecting screw of the outer boom segments simultaneously.

The **shorter** steal rope has to run towards the rear, the **longer** one to the front of the boom. All markings which define the element positions finally have to be at **one** side of the boom.

## 2.3 Construction of the elements

For the element to boom brackets 4-cornered plates are used and the insulation of the elements is done by 2 (driver platform = 4, see below) special plastic tube holders.

According to the diameters of the elements there are 4 plates with 30mm (S20/R20/D20a,b), 4 plates with 20mm (S15/R15/D15a,b) and 8 plates with 16mm (S10/R10/D10a-f) tube holders.

The driver element platforms are a bit longer. On them you find a pair of tube holders left and right plus the bottom half of a tube holder in the middle to reinforce the centre of the driven element which is split with the insulator.

The middle sections of the elements have to be fixed **exactly centred** on the plates (orientation = black middle line on parasites / insulator middle piece on driven elements which finally has to sit centred in the pre assembled bottom half of the support tube holder). For that the element middle sections have to be put in to the tube holders (only concerning the driven elements the tube holders at one side have to be opened for this process). Then the screws of the tube holders have to be **tightened solidly**. The screws of the driver middle sections divided with the insulators have to point **straight upwards**.

Next the other element sections have to be assembled. Insert the following sections in the previous sections with their side which has two drill-holes **equal in size**. The tubes have to be put in until the drill-holes of both sections overlap perfectly (concerning the outer 12mm tubes of the driven elements the **middle one** of the three drill-holes has to be chosen).

Then the corresponding screws (30mm tube = longest screw / 25mm tube = second longest screw / 20mm tube = third longest screw / 16mm tube = shortest screw) have to be pushed through **from the side of the enlarged drill-hole** of the previous segment. On the opposite side the washers have to be inserted and the self securing nuts have to be screwed on and **tightened solidly** (hold the screw heads with the included special screw-driver against turning, the screw heads dive into the enlarged drill-hole, see picture page). This method results in an extremely solid mechanical connection and rattle sounds inside the segment overlaps are totally avoided.

By this way of assembling the element sections the required lengths of the sections and the element halves are achieved automatically.

While mounting the elements pay attention that all screw heads show **upwards**. Keep in mind that the elements hang below the boom. Therefore the screw heads have to be on the same side of the elements where the plates are located at.

## 2.4 Attaching the elements to the boom

The elements fixed on the plates have to be mounted on the **underside** of the boom at the marked positions.

The plates are attached to the boom by 2 U-bolts which embrace the boom from the top and 4 self securing nuts (see picture page). When tightening the U-bolts finally pay attention that all elements are **parallel** in the vertical and horizontal plane.

The driven elements (from the rear S10, S20, S15) should **not** be tightened **before the installation of the phase line** is done (see fig. 2.5) as they might have to be moved slightly on the boom.

The plates of the outer elements end just closely before the tips boom.



In case the antenna cannot be reached easily while assembling or even for more convenience in general we recommend to assemble the driver cell together with the phase line and the coax connector separately and then mount it below the boom in one piece.

## 2.5 Installation of the phase line

The driven elements (S10, S20, S15) are connected with 2 parallel 20mm square tubes (=phase line).

The square tubes have to be in **direct contact** to the elements (put the washers only below the screws). First remove the element screws and washers. Then insert the predrilled square tubes (move the elements slightly if needed) by means of the element screws. Likewise insert the coax connector at the bottom of the phase line (=elements below boom) directly with the screws of S20 (see picture page). Be sure that the screw at the backside of the connector which holds the strap is **tightened solidly**.

Finally the phase line square tubes have to be **tightened really solidly** together with the driven elements (=important electrical contact) and the driven elements have to be mounted below the boom by means of the element plates (see fig. 2.4).

## 2.6 Installation of the boom to mast plate

The boom to mast plate is a completely pre assembled part (see picture page). It has to be attached between **D10b** and **D20a** at the centre point of gravity.

## 2.7 Installation of the boom truss

The boom of the completed antenna mounted at the mast has to be trussed by two included stainless steel ropes of 4mm in diameter. A turn buckle is inserted into each steel rope at one side and a metal loop for the fixing onto the boom at the other side. The steel ropes had already to be inserted with their metal loops into the **inner** screws of the outer 65mm boom sections by assembling the boom. Keep in mind that the **shorter** steel rope has to be fixed at the rear part, the **longer** one at the front part of the boom.

The two turn buckles, turned out by about 2/3 of their lengths, are already connected by us to the centre piece of the boom truss. Fasten this centre piece by means of the corresponding U-bolt to the mast and push it up to about one meter until the truss ropes are pre tensioned and then fix it solidly.

Finally the steel ropes have to be tightened by means of the turn buckles until the boom is stable in the horizontal **without any sag**.

The entire installation can be seen on the picture pages.

## 3. Connection of coax cable

The feeding of the antenna is done by 50 Ohm coax cable.

For connection a PL-259 connector is required. The connector should be sealed against water entry.

Close to the feed point the cable should be winded to a choke coil with 5 to 6 turns of about 20 cm of diameter. Hereby the antenna is electrically balanced and unwanted radiation of the cable itself is prevented.

Instead of the choke coil a 1:1 balun can be used as well.

#### 4. Adjustment of the antenna

An adjustment of the antenna is not necessary if the given dimensions are exactly observed.

By some influences of the direct surroundings it may happen that the resonance of the antenna (=point of best SWR) shifts on one or several bands.

By minimum changes of the according driver lengths (=shortening or lengthening of the outer 12mm sections) the resonant frequency of the according band can be shifted to the desired point.

By a slight decrease of the lengths of both element halves (put outer section in to the last drill-hole) the resonant frequency will be shifted upwards, by an increase (pull final section out to the first drill-hole) it will be shifted downwards.

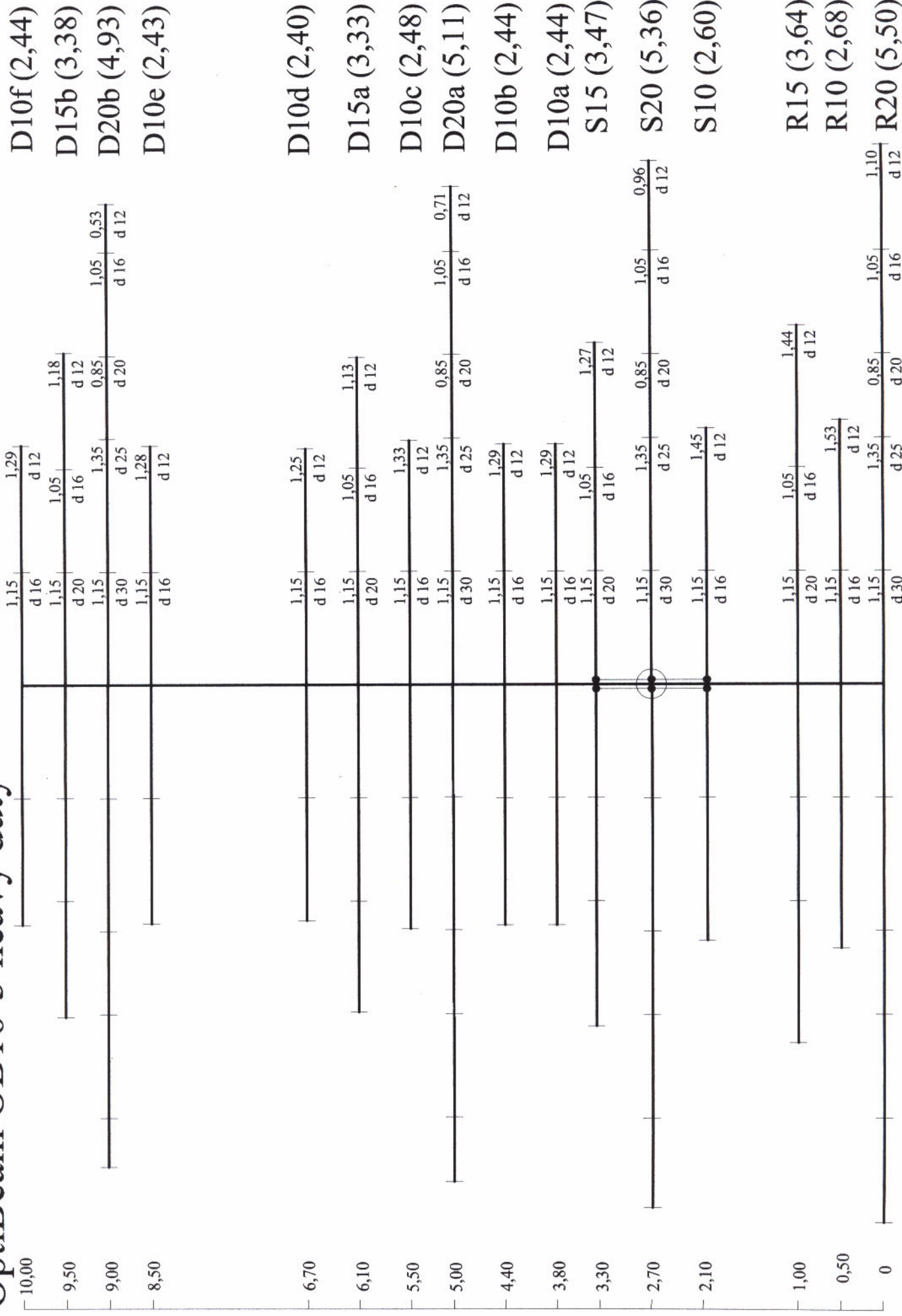
Normally these adjustments don't have to be done as the antenna does not react very sensitive against influences of the surroundings and the SWR curve is flat anyway.

#### 5. Position of the antenna at strong winds

At strong winds the antenna should be placed in a way that the tips of the elements **show straight into the wind** which means that the boom stands broadside to it.

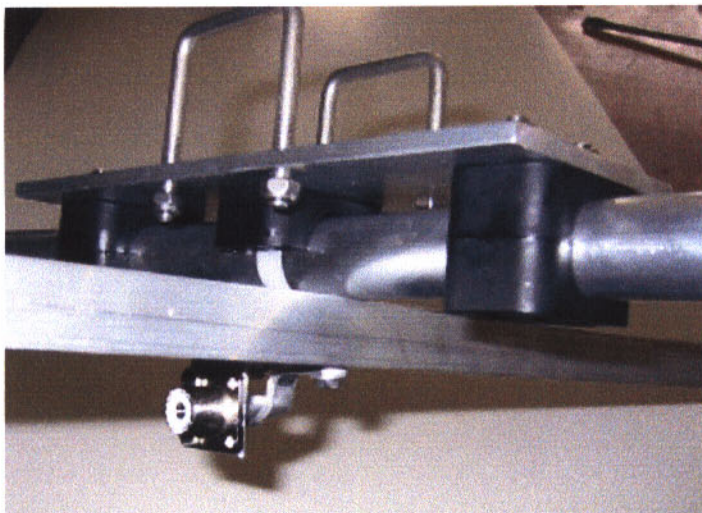
Hereby physical stress to the full size elements is avoided and their duration is enlarged.

# OptiBeam OB16-3 heavy duty

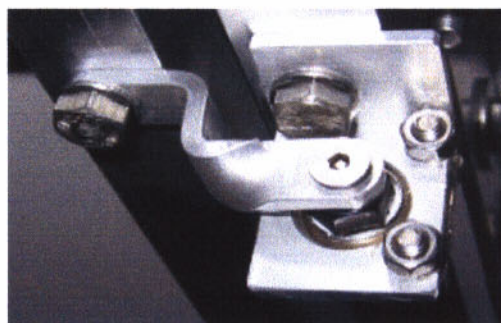
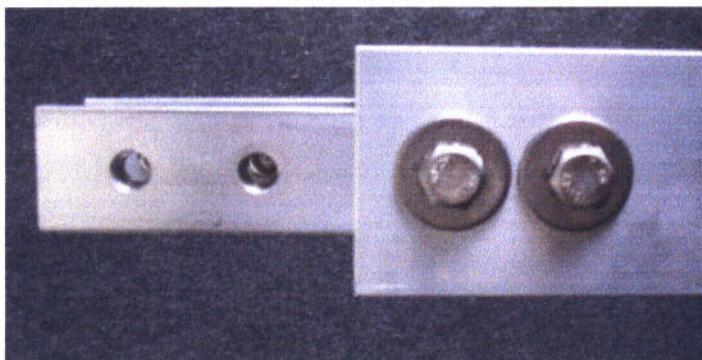


alle Längenmaße in m ; alle Durchmesser in mm





Ansicht Element-Plattform Strahlerelement  
mit Phasenleitung und Mittenunterstützung /  
view element platform driven element with  
phaseline and centre support



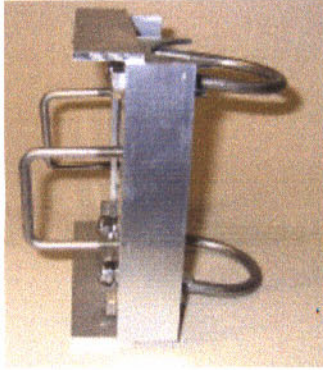
Ansicht Koax-Anschlußbuchse SO239 mit Strahler-  
element und Phasenleitung /  
view coax connector SO239 with driven element  
and phaseline

Ansicht Boomkopplung bei Vierkantboom /  
view boom coupler at square boom

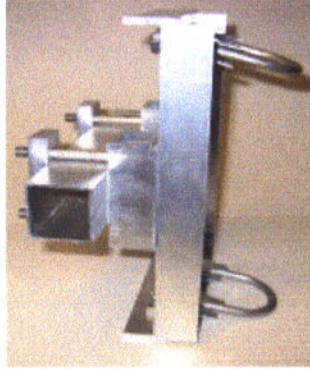


Detailansicht Elementübergänge / close up view element transitions





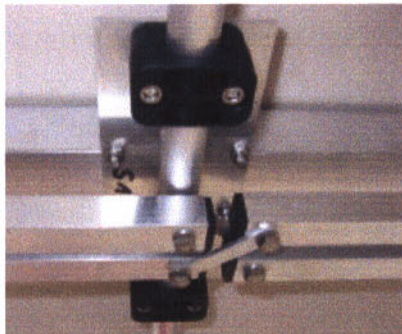
Boom-Masthalterung für kleinere Modelle /  
 boom to mast mounting for smaller models



Boom-Masthalterung für mittlere Modelle /  
 boom to mast mounting for medium size models



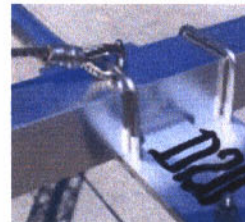
Boom-Masthalterung für große Modelle /  
 boom to mast mounting for big models



Seitenansicht Überkreuzung Phasenleitung bei Modell 9-5 u. 4-40 /  
 side view crossing of phase line at model 9-5 and 4-40



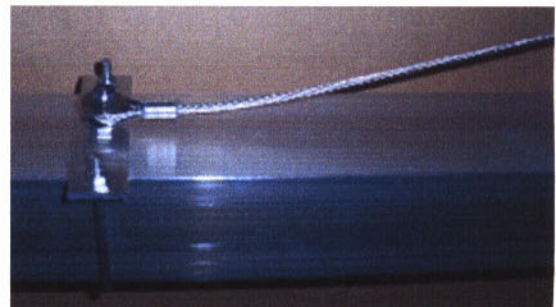
Ansicht zentrale und äußere Boomabspannung für OB11-3 /  
 view centre and outer boom truss for OB11-3



Ansicht variable äußere Boomabspannung div. Modelle /  
 view variable outer boom truss diverse models



Gesamtansicht Abschlußstüb mit Isolatoraufhängung an Boom bei diversen Modellen /  
 total view termination stub with insulated fixing to the boom at diverse models



Äußere Seilabspannung für große Modelle, Rundboom dto. /  
 outer boom truss for big models, round boom equivalent

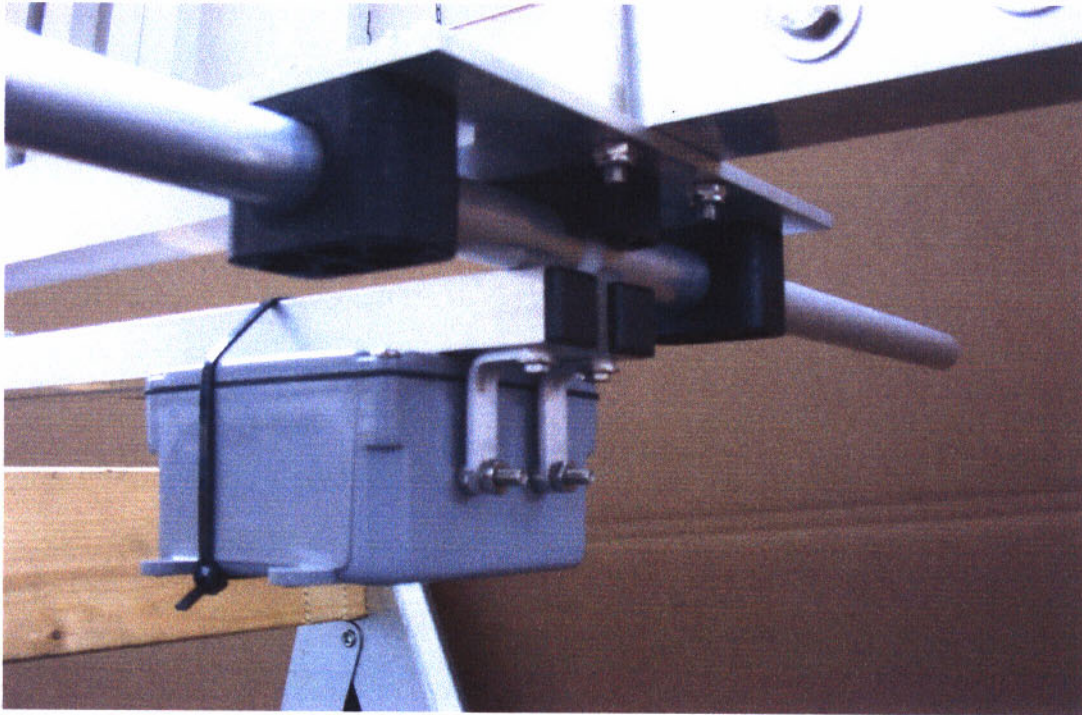


Zentrale Seilabspannung für Modelle über 6 Meter Boomlänge /  
 centre boom truss for models over 6 meter boom length





## Installation des 5 KW Baluns / Installing the 5 KW balun



Durch die Verwendung des beigefügten 50 Ohm 1:1 5 KW Baluns (Design nach WX0B) am Speisepunkt wird die Antenne elektrisch symmetriert und Eigenstrahlung des Koaxkabels wird unterbunden.

### Installation

1. Zuerst sind die zwei Schrauben des Strahlerelementes zu entfernen, an dem die Antenne gespeist wird und die auch die Phasenleitungsrohre halten.
2. Der Balun läßt sich aufgrund seiner Flachstruktur gut unter den beiden Phasenleitungsrohren befestigen. Er ist mit seinen beiden Aluminium-Anschlußbügeln und den vorher entfernten Strahlerschrauben am Strahler zu befestigen.
3. Das Einschmieren der Balun-Anschlüsse mit einer Konduktionspaste kann den einwandfreien Kontakt zwischen Balun und Element dauerhaft fördern.
4. Der Balun ist mittels des beiliegenden Kabelbinders an der Unterseite der Phasenleitungsrohre abschließend zu fixieren.  
Die Details gehen aus obigem Photo hervor.
5. Das Koaxkabel ist am SO239 Anschluß des Baluns zu befestigen und sollte hier gegen Wassereindringen geschützt werden (z.B. mit selbstverschweißendem Klebeband oder Silikon).

The antenna is electrically balanced and unwanted radiation of the coax cable itself is prevented by the use of the attached high quality 50 Ohm 1:1 5 KW balun (design by WX0B) at the feed point.

### Installation

1. Un-screw the two bolts of the driven element where the source is located at and which hold the two square tube transmission lines.
2. Due to the flat structure the balun can easily be mounted below the two square phase line tubes. It has to be connected to the driver by means of the two aluminium straps and the driver screws.
3. You may want to put some anti-oxidant paste such as No-Alox, or Penetrox on the terminal connection before you tighten the bolts.
4. Use the included plastic ty-wrap to finally secure the balun to the transmission line.  
The entire installation can be seen on the above added picture.
5. Attach your feedline jumper to the balun's SO239 connector and weather proof this connection to protect it from water.