



# SPINNER || PRODUCT MANUAL

## SPINNER Loop Couplers

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## 1. Safety

### 1.1 About this product documentation

The Spinner group makes every effort to keep the safety standard of our products up to date to be able to offer our customers the highest possible degree of safety. Our products are designed and tested in accordance with the relevant safety standards. There is, however, still a danger of personal injury or damage to equipment if this chapter and the safety instructions in this documentation are not complied with. This documentation aims at persons commissioned with the transport, assembly, commissioning, operation, adjustment, disassembly and disposal of SPINNER loop couplers. Read this documentation completely and particularly the chapter 1. "Safety", before working with the product. Keep this product documentation available at the site and pass it on to the subsequent users. For all questions regarding the safety you can contact SPINNER at any time.

### 1.2 Intended use

Measuring of forward and reflected power within RF-systems in operating rooms with restricted access. Access for authorized persons shall be regulated by the operator. The intended use of the product is assumed, if it is used in accordance with the requirements of the applicable product documentation and within its performance limits (see appendices, block diagram, drawings, circuit diagram, measurement protocols and the following safety instructions). Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed in conjunction with the product.

### 1.3 Improper use

The improper use of the product involves the use of the product:

- in operating rooms with unrestricted access
- unprotected in corrosive atmosphere
- in explosion-prone atmosphere
- to support mechanical loads e.g. rigid lines or cables
- with modifications not authorized by SPINNER
- in damaged condition
- for private purposes
- in conditions and environments beyond the limits given in this product documentation

Any other use than described in the chapter intended use and in this product documentation is improper use and therefore inadmissible.

### 1.4 Qualifications of personnel













Installation, commissioning, operation, adjustment and disassembly of the product require electrical and mechanical specialized knowledge. In order to ensure the safe use, these activities may therefore only be carried out by qualified technical personnel or an instructed person under the direction and supervision of qualified personnel. Qualified personnel are those who, due to professional training, knowledge and experience as well as their understanding of the relevant regulations, are able to assess the work assigned, to recognize possible hazards and to institute appropriate safety measures.

Qualified personnel must have appropriate safety equipment and must be trained in first aid.

The use of the product requires special training and a high level of concentration. It must be ensured that persons who use the product are physically, mentally and emotionally able to comply with the requirements, otherwise injuries or material damage may occur. The employer or operator must choose suitable personnel for use of the product.

## 1.5 Safety signs and symbols

Safety signs are used on warning labels, stickers, in the product documentation and on the packaging of the product.

					
Warning! General hazard	Warning! Danger of electric shock	Warning! Hot surface	PE terminal	Earth	Warning! High weight
					
Warning! Non-ionised electromagnetic radiation	No access for persons with pacemakers	Use safety shoes	Use safety helmet	Use safety gloves	Observe product documentation

## 1.6 Signal words for hazard seriousness

Signal words are used on warning labels, stickers, in the product documentation, on specific danger spots and on the packaging of the product. They indicate the hazard seriousness in safety instructions.

- DANGER** Indicates a hazardous situation conveying great risk which, if not avoided, will result in death or serious injury.
- WARNING** Indicates a hazardous situation conveying moderate risk which, if not avoided, could result in death or serious injury.
- CAUTION** Indicates a hazardous situation conveying minor risk which, if not avoided, may result in minor or moderate injury.
- NOTICE** Indicates the possibility of faulty operation that can damage the product.

It is essential to make sure that the signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and thus contribute to personal injury or material damage.

## 1.7 Grouped safety instructions for SPINNER broadcast products

### Entire or multiple phases of product lifecycle

- Unless otherwise specified, these products are not protected against penetration of liquids, gases, steam, etc. Failure to comply could result in electric shock or product damage, which could also lead to serious injury.
- Blocking of constructive openings on the product (ventilation slots, fine leaks etc.) must be prevented, because these are necessary for product operation. Failure to comply could lead to overheating and could result in burns, fire and electric shock.
- Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and could result in electric shock, fire or injury.
- Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
- As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a SPINNER product, consult a physician immediately to determine the cause and to prevent health problems or stress.
- Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

### Transport

- The product may be very heavy. In some cases, the user may require suitable lifting gear and means of transportation to avoid back or other physical injuries.
- Transport the product only in the original packaging. Do not unpack until immediately prior to installation. Failure to comply could result in death or serious injury.

### Installation

- Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating could result in burns, fire and electric shock.
- Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the installation instructions of the manufacturer when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in death or serious injury.
- All externally connected circuits for controlling, alerting and signalling have to be fed from SELV sources acc. to DIN EN 60950-1 only. The current in these circuits has to be externally limited by means of fuses to values indicated in the product documentation. Failure to comply could result in fire and electric shock.
- Dangerous voltage must not reach the product over the outer conductor/waveguide. Failure to comply could result in electric shock.
- If the product is equipped with a ground terminal connection (equipotential connection), the ground terminal must be connected sufficiently dimensioned to earth. Failure to comply could result in electric shock.

### **Commissioning / Operation**

- Products in operation may be hot. Touching them could result in burns.
- Before applying RF-power to the product, ensure proper connection and matching (load, line, etc.) of all RF-connectors. Ensure sufficient mechanical rigidity of the RF-connections. Failure to comply could result in serious injuries by non-ionised electromagnetic radiation.
- Operation of the product with a damaged cable is not permitted. All cables must be checked on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt or suffer an electric shock by e.g. tripping over the cable.
- Front panels, lids and covers must not be removed during operation. Otherwise, live components can be accessible. This could result in electric shock, fire and serious injury.
- If the product is subjected to pressure, the locally and nationally applicable guidelines for pressure vessels must be applied. Failure to comply could result in death or serious injury.

### **Cleaning**

- Prior to cleaning, turn off all feeding transmitters and disconnect them from the power supply. Use a soft, lint-free, dry cloth for cleaning. Do not use chemical cleaners. Perform cleaning only after cooling-down. Failure to comply could result in electric shock and burns.

### **Repair**

- Troubleshooting and repairs should only be carried out by qualified technical personnel or an instructed person under the direction and supervision of qualified personnel (see chapter 1.4 "Qualifications of personnel"). Observe the safety instructions and in particular chapter 1. "Safety" of this product manual. Failure to comply could result in death or serious injury.
- Do not modify the product and use only spare parts tested and approved by SPINNER. Failure to comply could result in death or serious injury.

### **Disposal**

- The operator is responsible for disposing of the product according to national waste disposal regulations. Improper disassembly or disposal may be hazardous.
- If hazardous substances or operation materials are used for operation of the product, which must be periodically disposed of (e.g. coolant), these materials must be treated in accordance with the safety instructions of the hazardous substance or operating material manufacturer and the national waste disposal regulations. Also observe the relevant safety instructions in this product documentation. Failure to comply could result in serious injury and environmental damage.

## 2. General

SPINNER loop couplers are suitable for use in a wide frequency range and feature compact design, variable coupling, low VSWR and high directivity.

This manual generally describes the adjustment of a typical loop coupler. Not applicable work steps are to be skipped. Details of the individual product are given in the documents attached to this manual.

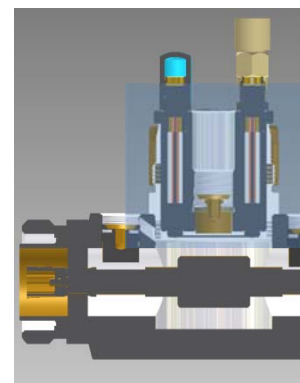
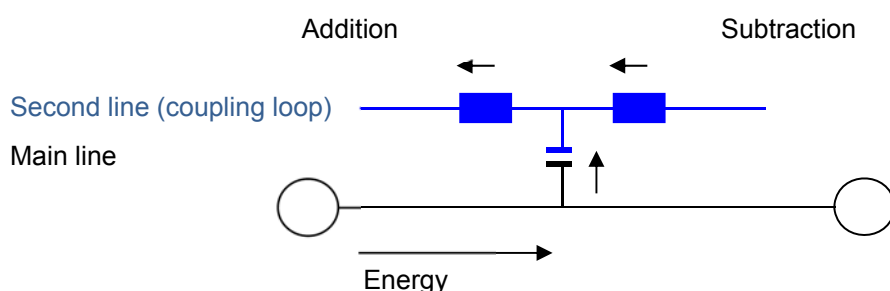


All qualified personnel working with SPINNER loop couplers are required to read and observe the safety instructions and in particular chapter 1. "Safety" of this product manual. In principle, all activities associated with SPINNER loop couplers must be carried out by qualified personnel. Additional required qualifications are indicated in the appropriate places in the manual.

SPINNER loop couplers may only be installed and taken into operation in locked operating rooms with restricted access not accessible for the general public. Access for authorized qualified personnel shall be regulated by the operator. SPINNER loop couplers meet the requirements of the standards EN 60215 (electrical safety) and ETSI EN 300 019-1-3 V2.2.2 (2004-07) Class 3.1 N (environmental conditions).

## 3. Functional description

Directional couplers are used to couple a small amount of the RF signal from a coaxial line or a waveguide run. Directional couplers consist of a main line, i.e. the actual power transmission line, and at least one secondary line, where the small part of the coupled forward or returning power flows. Forward and returning power are coupled separately. The scheme below explains in a simplified way the function:



The capacitive and inductive part must have the same value to get a good directivity.

For physical reasons, the couplers have frequency-dependent coupling attenuation. The coupling attenuation at a specified frequency is given in chapter 8.1

Exception: Frequency response compensated couplers. They feature constant coupling attenuation in a specified frequency range.

## 4. Transport / Storage



### WARNING

Crushing and Impact Hazard

Unsuitable or incorrect use of means of transportation could result in death or serious injury. Use only transportation gear approved for the weight indicated on the packaging and the delivery note.



Observe the safety instructions of the selected transportation gear.

Move couplers mounted on pallets only with a suitable forklift or pallet truck.

Observe all transport instructions indicated on the packaging.

Transport couplers only in the position indicated on the packaging.



Do not stand under suspended loads.

Pay attention to loads with off-centre center of gravity

Wear safety shoes and safety helmet.

### NOTICE

Do not change the position of the adjustment elements during transport. Displaced adjustment elements can cause malfunction and damage to the couplers. Protect from shock.

Do not open the product packaging until immediately prior to installation.

Ensure dry transport and storage. Observe the transport and storage conditions.

Transport conditions: ETSI EN 300 019-1-2 V2.1.4 (2003-04) class 2.2

Storage conditions: ETSI EN 300 019-1-1 V2.1.4 (2003-04) class 1.2

## 5. Mechanical installation



Before you start, ensure to read and understand the safety instructions and in particular chapter 1. "Safety" of this product manual. Only electrically skilled persons may install SPINNER couplers in accordance with the national safety and accident prevention regulations. Failure to comply could result in death or serious injury.



### WARNING

Crushing and Impact Hazard

Unsuitable or incorrect use of means of transportation could result in death or serious injury.



Use only lifting belts or slings and no chains for lifting. Use only lifting and transportation gear approved for the weight indicated on the packaging and the delivery note. Observe the safety instructions of the selected lifting and transportation gear.

Do not stand under suspended loads.

Pay attention to loads with off-centre center of gravity.

Wear safety shoes and safety helmet.



### WARNING

High Weight

The couplers can be heavy. Improper transport could result in back or other physical injuries. Distribute the weight among several people and use suitable lifting gear.



### CAUTION

Sharp Edges

Sharp edges may cause cuts and needle stick injuries.

Use safety gloves and handle carefully



## 6. Commissioning



### WARNING

Radio Frequency Hazard

Radio Frequency Power can cause burns, eye injuries and electric shock.

Perform commissioning only by electrically skilled persons who have been trained for the installation and cabling of RF systems. Commission the couplers only with connected or terminated inputs and outputs.



### WARNING

Radio Frequency Hazard

RF Systems may cause pacemakers and similar devices to fail.

The operator has to ensure that patients with pacemakers or similar devices cannot enter the pacemaker radiation hazard area.

### NOTICE

If the environmental conditions before initial commissioning or after shutdown and cooling of the system are not in accordance with ETSI EN 300 019-1-3 V2.2.2 (2004-07) class 3.1 N, the system may not be operated immediately with the full transmission power specified.

- Operate with 50% of the transmission power for at least 2 hours.
- Increase the transmission power to 75% for additional 2 hours.
- Then increase the transmission power to 100%.

## 7. Measurement setups

### 7.1 Directional loop coupler circuit symbol

Figure 1 shows the symbol for a directional loop coupler with termination at one end.

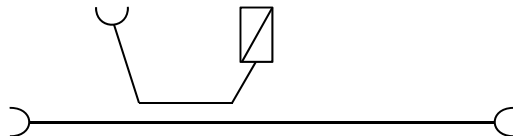


Figure 1: Symbol for directional loop coupler with termination

### 7.2 Setup for measuring forward power

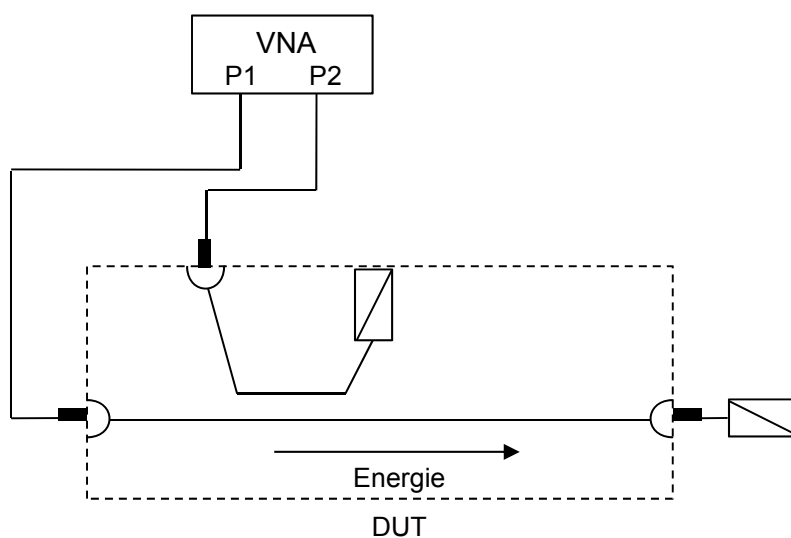


Figure 2: Schematic for measuring forward power

### 7.3 Setup for measuring returning power

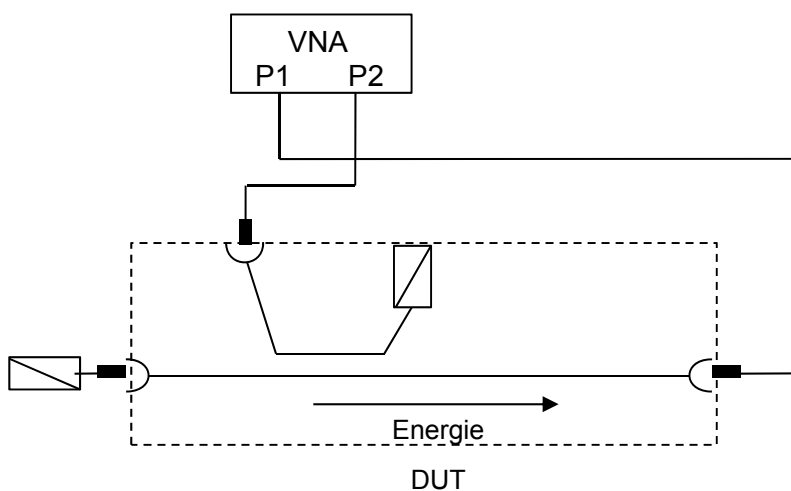


Figure 3: Schematic for measuring returning power

## 8. Adjustment instructions



### WARNING

Radio Frequency Hazard

Radio Frequency Power can cause burns, eye injuries and electric shock.

Before demounting couplers, ensure to disconnect your entire system from the power supply.

Utilize appropriate devices and methods to prevent accidental energizing

Perform demounting only by electrically skilled persons who have been trained for the installation and cabling of RF systems.



### CAUTION

Hot surface

Depending on the operating conditions of the couplers, the surface can reach high temperatures.

Contact may cause burns.

Demount only when cooled-down.



### CAUTION

High weight

The couplers may have a high weight. Improper transportation can lead to backache or other physical injuries.

Distribute the weight onto several persons or use suitable lifting gear.

### 8.1 Introduction

Directional couplers are used for directional coupling of RF-signals from a waveguide. The strength of the coupling and the directivity is dependent on the distance and orientation of the secondary line (measuring line) in relation to the main line (energy line).

Loop couplers feature a frequency dependent coupling. The desired value can be tuned only at single frequency. At other frequencies the value is calculated from the formula  $20 \cdot \log\left(\frac{f_{ref}}{f}\right)$ , where  $f_{ref}$  is the frequency at known coupling attenuation and at  $f$  the value is to be calculated.

Example:

Calculating the coupling attenuation  $x$  at frequency  $f$  for the desired coupling attenuation  $a$  at frequency  $f_{ref}$ :

$$x = a(dB)@f_{ref} + 20 \cdot \log\left(\frac{f_{ref}}{f}\right)$$

Given values:  $f = 860 \text{ MHz}$   
 $f_{ref} = 666 \text{ MHz}$   
 $a@f_{ref} = 60 \text{ dB}$

$$x = 60 \text{ dB} + 20 \cdot \log\left(\frac{666 \text{ MHz}}{860 \text{ MHz}}\right) = 57.78 \text{ dB}$$

Exception: Frequency response compensated couplers. Here, the coupling loss in the specified frequency range is constant.

The coupling attenuation must be chosen so that the coupled power does not exceed the permissible power handling of the termination. The adjustment range of the coupling is indicated in the corresponding data sheets. The depth of the coupling loop adjusts the coupling attenuation. Small depth results in a high coupling attenuation (less signal), big depth results in low coupling attenuation (more signal). The directivity is adjusted by rotating the loop. Refer to Figure 4 and Figure 5.

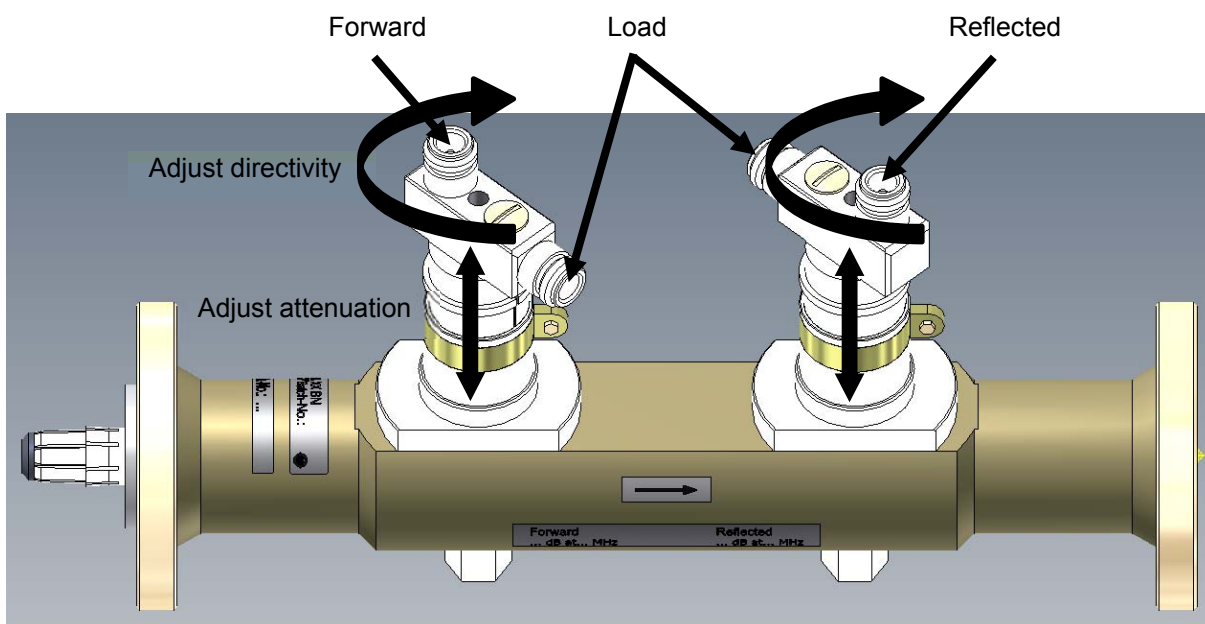


Figure 4: Adjustments exemplary shown for BN 800264

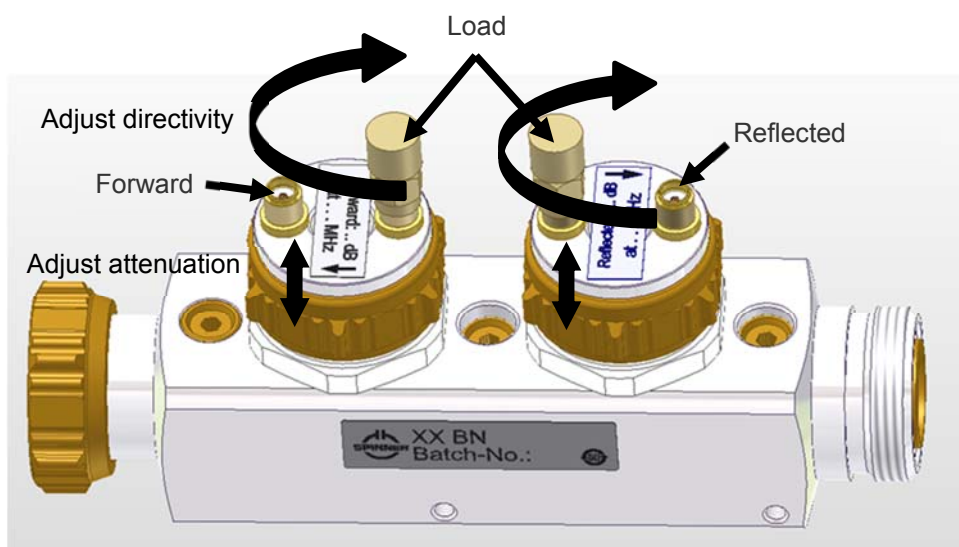


Figure 5: Adjustments exemplary shown for BN 800468

## 8.2 Adjustment procedure for various loop couplers

1. First adjust coupling attenuation to the desired value see Figure 4 and/or Figure 5
2. Then adjust directivity see Figure 4 and/or Figure 5
3. If available, use adjustment screws to minimize the VSWR of the main line, refer to figures 6 - 8

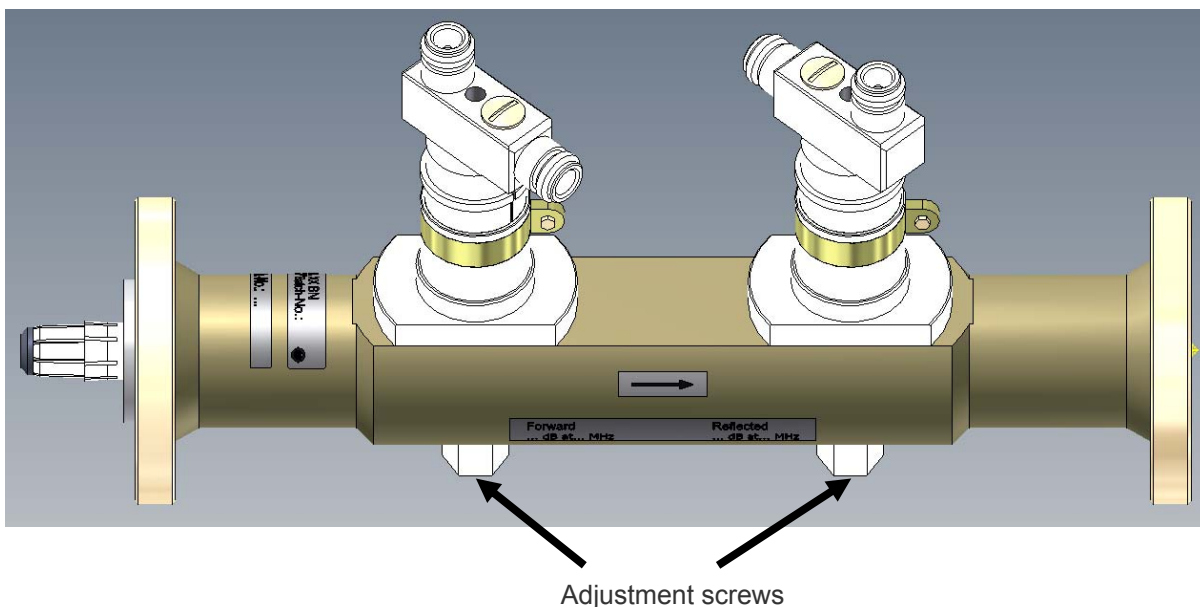


Figure 6: Adjustment screws to minimize the VSWR of the main line, shown for BN 800264

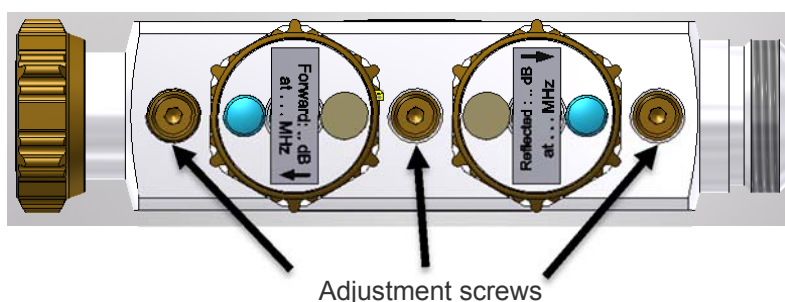


Figure 7: Adjustment screws to minimize the VSWR of the main line, shown for BN 800468 (top view)

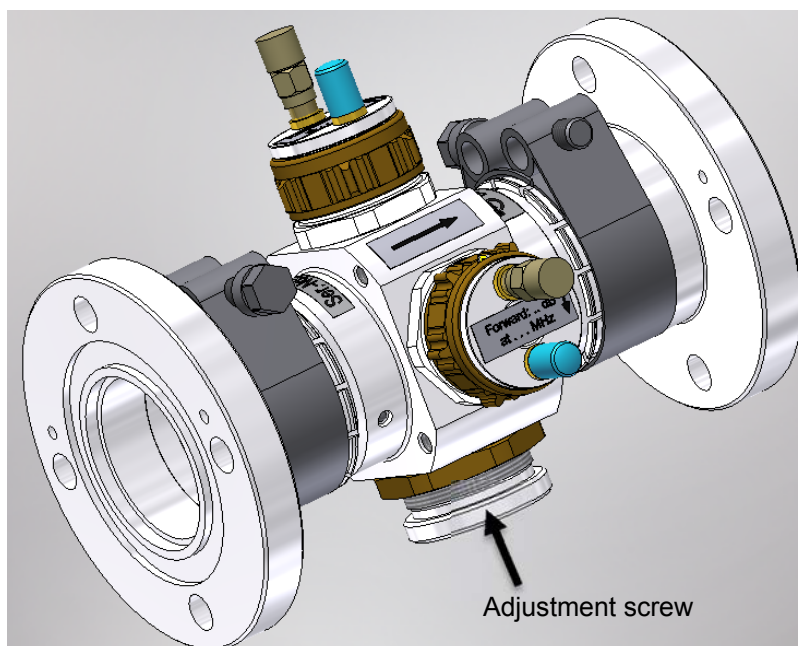


Figure 8: Adjustment screw to minimize the VSWR of the main line, shown for BN 800265

4. Repeat steps 1. to 3. until the desired values are achieved
5. Fix the coupling loops, refer to Figure 9 and/or Figure 10



Figure 9: Fixing screw, exemplary shown for BN 800264

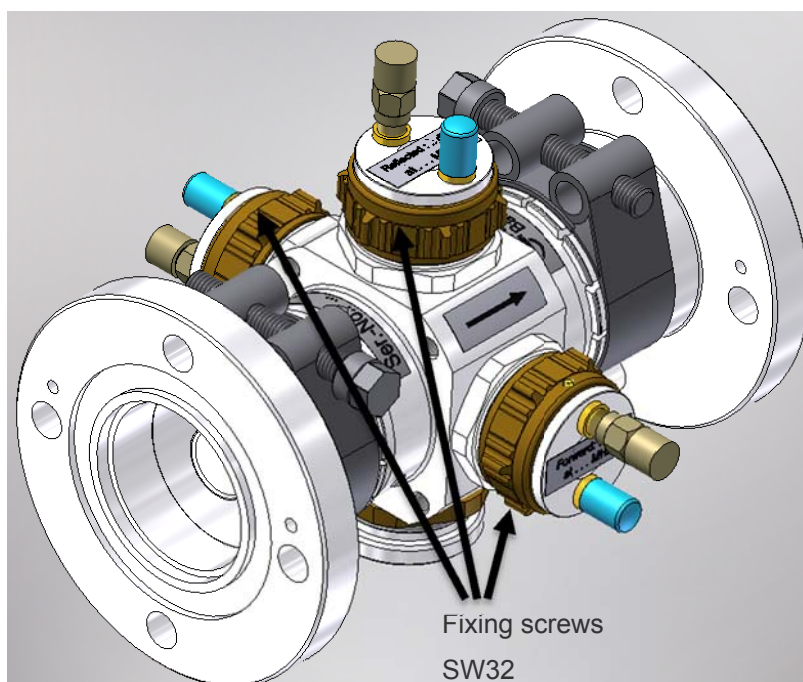


Figure 10: Fixing screws, exemplary shown for BN 800265

6. Update the marking

### 8.3 Angular range of coupling loops

Figure 11 and Figure 12 below show the angular tuning range of different loop couplers.

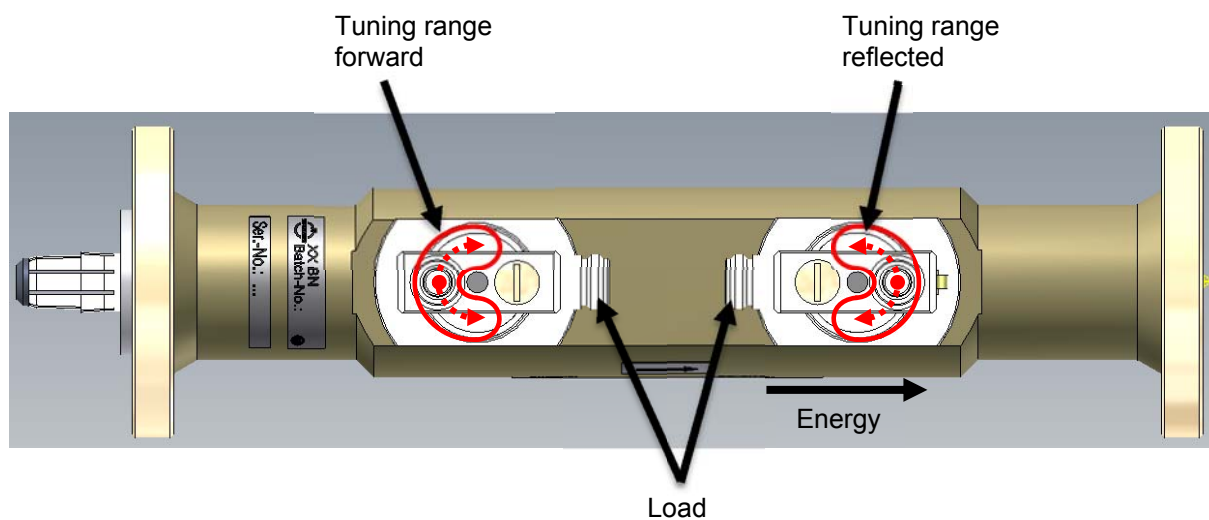


Figure 11: Exemplary shown for BN 800829

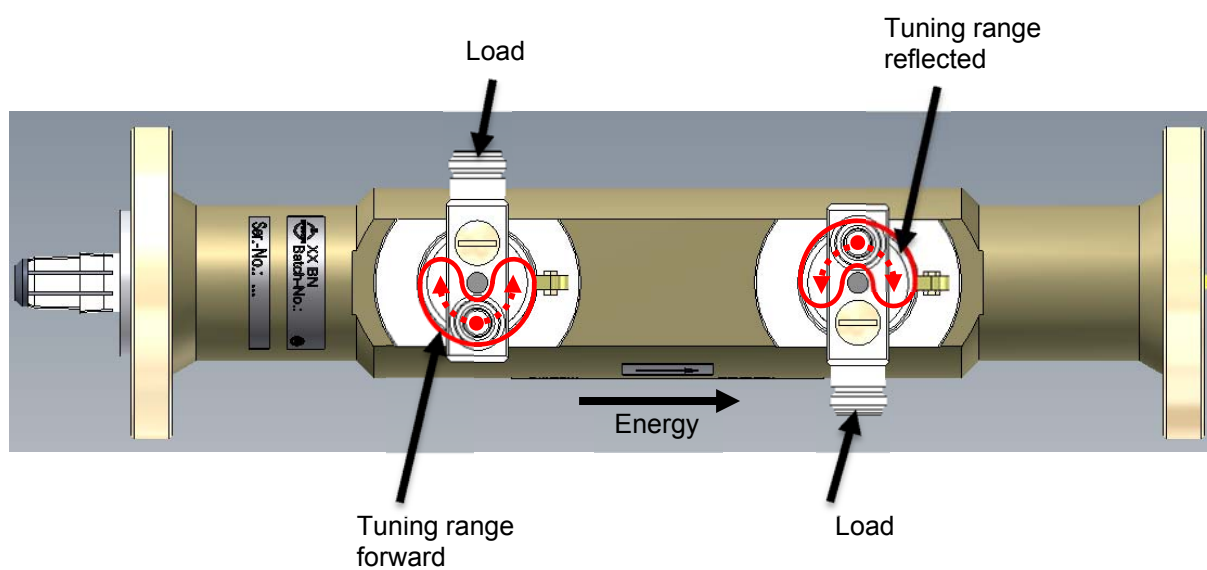


Figure 12: Only for coupling loop BN 521908

#### 8.4 Permissible tightening torques for screws and flange connections

The table below shows torques for often used interfaces of directional loop couplers.

Rigid line size	Screw size	Torque A2-70 screws
Flange connection		
1 5/8"	M8	20 Nm
3 1/8"	M10	40 Nm
4 1/2"	M10	40 Nm
6 1/8"	M10	40 Nm
52-120	M10	40 Nm
SMS connection		
1 5/8"	Clamping joint M8	20 Nm
1 5/8"	Clip joint M7	15 Nm
3 1/8"	Clamping joint M10	30 Nm
3 1/8"	Clip joint M10	30 Nm
4 1/2"	Clamping joint M12	60 Nm
4 1/2"	Clip joint M12	60 Nm
6 1/8"	Clip joint M8	12 Nm
52-120	Clip joint M6	4 Nm
52-120	Clamping joint M12	60 Nm



## 9. Correction tables for loop couplers

The coupling attenuation of the directional couplers is frequency dependent and valid only for the specified reference frequency.

For other frequencies, the coupling attenuation can be calculated using the formula in chapter 8.1 or the enclosed correction tables.

The coupling attenuation is higher at lower frequency (less signal) and lower at higher frequency (more signal).

The correct signal level is obtained by adding the correction value from the following table and the measurement reading. For all non indicated frequencies the correction factor can be calculated as follows:

$$\text{Correction factor} = 20 \cdot \log\left(\frac{f_{ref}}{f}\right) \quad (\text{Refer to chapter 8.1 "Introduction"})$$

Set to 100 MHz	
Frequency MHz	Correction factor dB
88	1.11
89	1.01
90	0.92
91	0.82
92	0.72
93	0.63
94	0.54
95	0.45
96	0.35
97	0.26
98	0.18
99	0.09
100	0.00
101	-0.09
102	-0.17
103	-0.26
104	-0.34
105	-0.42
106	-0.51
107	-0.59
108	-0.67

Set to 200 MHz	
Frequency MHz	Correction factor dB
170	1.41
172	1.31
174	1.21
176	1.11
178	1.01
180	0.92
182	0.82
184	0.72
186	0.63
188	0.54
190	0.45
192	0.35
194	0.26
196	0.18
198	0.09
200	0.00
202	-0.09
204	-0.17
206	-0.26
208	-0.34
210	-0.42
212	-0.51
214	-0.59
216	-0.67
218	-0.75
220	-0.83
222	-0.91
224	-0.98
226	-1.06
228	-1.14
230	-1.21
232	-1.29
234	-1.36
236	-1.44
238	-1.51
240	-1.58

Set to 666 MHz	
Frequency MHz	Correction factor dB
470	3.03
480	2.84
490	2.67
500	2.49
510	2.32
520	2.15
530	1.98
540	1.82
550	1.66
560	1.51
570	1.35
580	1.20
590	1.05
600	0.91
610	0.76
620	0.62
630	0.48
640	0.35
650	0.21
660	0.08
670	-0.05
680	-0.18
690	-0.31
700	-0.43
710	-0.56
720	-0.68
730	-0.80
740	-0.92
750	-1.03
760	-1.15
770	-1.26
780	-1.37
790	-1.48
800	-1.59
810	-1.70
820	-1.81
830	-1.91
840	-2.02
850	-2.12
860	-2.22

## 10. Measuring adapters for commissioning and adjustment

The SPINNER loop couplers mainly use EIA- and SMS-interfaces.

For the EIA-interfaces precision measuring adapters to 7-16 with very low VSWR are available. If a Type N test port is needed, the precision adapter BN 194403 is additionally required. The precision termination BN 193690 is needed for termination of open ports during the measurements.

SPINNER part number	Description
BN 909200	1 5/8" EIA → 7-16 female
BN 909308	3 1/8" EIA → 7-16 female
BN 728900	4 1/2" EIA → 7-16 female
BN 909404	6 1/8" EIA with coupling element → 7-16 female
BN 528118	52-120 BT-D → 4 1/2 " EIA
BN 194403	Precision adapter 7-16 male → Type N female
BN 193690	Precision termination 7-16 male, 1 W

For the connection of 52-120 BT-D with EIA an adapter ring BN 049919 is required (not for CCS combiners with 52-120 BT-D connection with permanently built-in coupling element).

SPINNER part number	Description
BN 528101	Coupling element 52-120 BT
BN 528117	Adapter 52-120 BT without coupling element → 6 1/8" EIA
BN 528118	Adapter 52-120 BT without coupling element → 4 1/2" EIA

### Measuring adapters for patch panels

For all SPINNER patch panels measuring adapters to 7-16 female with very low VSWR are available.

Size	Measuring adapter to 7-16 female	SMS adapter to 1 5/8" EIA
7-16	Not required	
1 5/8" USL-D	BN 553048	BN B13487C1000
68 USL-D	BN 553348	
98 USL-D	BN 553648	
120 USL	BN 539648	
6 1/8" USL	BN 539647	

## 11. Repairs

Troubleshooting and repairs must be only carried out by qualified technical personnel or an instructed person under the direction and supervision of qualified personnel (refer to chapter 1.4 "Qualifications of personnel"). The safety instructions and in particular chapter 1. "Safety" of this product manual must be observed.



Do not open components to avoid the risk of electric shock and personal injury.

## 12. Cleaning



### WARNING

Electric Shock Hazard

Electric shock can cause severe burns and fatal injuries.

Do not remove any covers. Do not use liquids for cleaning.



### WARNING

Radio Frequency Hazard

Radio Frequency Power can cause burns, eye injuries and electric shock.

Do not loosen any RF connections or fastenings of RF lines.



### CAUTION

Hot surface

Depending on the operating conditions of the couplers, the surface can reach high temperatures.

Contact may cause burns.

Clean the system only when sufficiently cooled down.

Periodic cleaning is not required. Use a soft, but not damp duster, if cleaning is required.

## 13. Demounting



Before you start, ensure to read and understand the safety instructions and in particular chapter 1. "Safety" of this product manual. Only electrically skilled persons may demount SPINNER couplers in accordance with the national safety and accident prevention regulations. Failure to comply could result in death or serious injury.



### WARNING

Crushing and Impact Hazard

Unsuitable or incorrect use of means of transportation could result in death or serious injury.

Use only lifting belts or slings and no chains for lifting.

Use only lifting and transportation gear approved for the weight indicated on the packaging and the delivery note. Observe the safety instructions of the selected lifting and transportation gear.

Do not stand under suspended loads.

Pay attention to loads with off-centre center of gravity.

Secure head heavy racks against tilting over.

Repair damaged racks before lifting.

Wear safety shoes and safety helmet.



### WARNING

High Weight

The couplers can be heavy. Improper transport could result in back or other physical injuries.

Distribute the weight among several people and use suitable lifting gear.



**WARNING**

Radio Frequency Hazard

Radio Frequency Power can cause burns, eye injuries and electric shock. Before demounting couplers, ensure to disconnect your entire system from the power supply. Utilize appropriate devices and methods to prevent accidental energizing. Perform demounting only by electrically skilled persons who have been trained for the installation and cabling of RF systems. Do not damage the RF connections.



**WARNING**

Electric Shock Hazard

Electric shock can cause severe burns and fatal injuries. Electrically skilled persons may only carry out demounting. Observe local and national safety and accident prevention regulations.



**CAUTION**

Hot surface

Depending on the operating conditions of the coupler, the surface can reach high temperatures. Contact may cause burns. Demount only when cooled-down.



**CAUTION**

Sharp Edges

Sharp edges may cause cuts and needle stick injuries. Use safety gloves and handle carefully.

## 14. Disposal



**WARNING**

Risk of poisoning from decomposed PTFE.

RF overload can lead to formation of decomposed PTFE.

Wear safety gloves and filtering facepiece (FFP2, EN149: 2001).

Do not burn PTFE to avoid toxic fumes





### **WARNING**



**Crushing and Impact Hazard**

Unsuitable or incorrect use of lifting gear could result in death or serious injury.

Use only suitable lifting and transportation gear for disassembly. Observe the safety instructions of the selected lifting and transportation gear.

Do not stand under suspended loads.

Secure modules and components against tipping or falling.

Wear safety shoes and safety helmet.



Observe the applicable national or local regulations when disposing of the product and the packaging. SPINNER couplers meet the requirements of RoHS and REACH (SVHC list based on the date of this document).

Loads and attenuators may contain beryllium oxide. RF overload can lead to formation of toxic dusts. Before opening contact SPINNER or return the product.

Forward these safety instructions to the disposer.

## **15. Contacts**

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