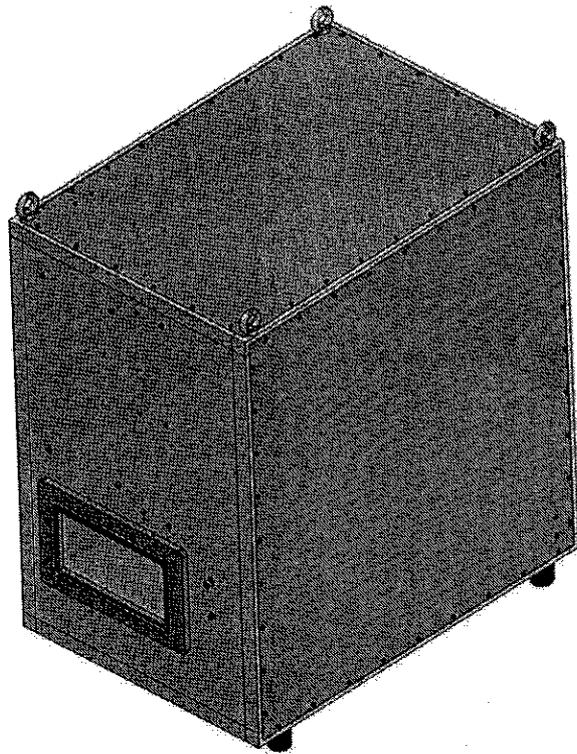


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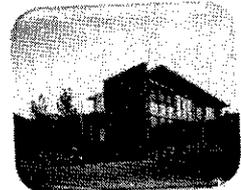
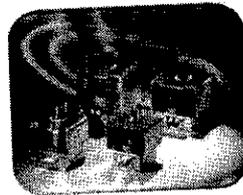
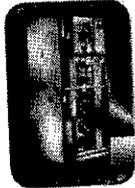
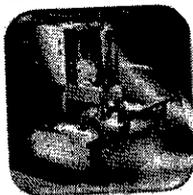
Magnetron Head MH075KS-510BU

Compact Microwave Power Head, MH-Series

Instruction Manual / Rev. 00



English / Translated from the Original Language



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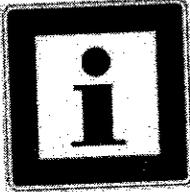
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1 Safety

1.1 For your safety

This section refers to measures for avoiding possible dangers. The overview of residual dangers includes measures on the part of the owner to reduce residual dangers.



NOTE

The owner must comply with the valid safety and accident prevention laws of the country and region to which the product is delivered!

1.2 Warnings and danger signs

Certain activities can cause hazards during operation. Warnings corresponding to the danger precede the activity instructions. There are danger signs on the product.

A warning contains signal words that are explained in the table below:

Signal word	Description
DANGER	Indicates a significant danger. If it is not avoided severe injury or death are the consequences.
WARNING	Indicates a dangerous situation. If it is not avoided, serious injuries can be the consequences.
CAUTION	Indicates a possible dangerous situation. If it is not avoided, injuries can be the consequences.
NOTE	If such a situation is not avoided, material damage can be the consequences.

Symbol	Description
	This symbol warns of hazards due to electrical voltage.
	This symbol warns of hazards due non-ionising radiation.

1.3 Use of the product

1.3.1 Typical application areas

The product is designed to generate microwaves.

Typical application areas are:

- Warming, drying and melting lossy dielectric materials
- Generation of microwave plasmas

1.3.2 Exclusion of liability

Any use that is not cited under "Typical application areas" is non-intended use. In particular, the company MUEGGE GmbH accepts no liability whatsoever for personal injury, material damage or production downtimes that results from non-intended use of the product. That risk is borne solely by the owner. The warranty is rendered null and void. Any non-intended use of the equipment may impair the protection provided by the equipment.

1.4 Approved personnel

Installation, operation, adjustment and maintenance tasks must only be executed by approved, trained and instructed personnel.

Approved personnel must be capable of understanding their task and recognising potential dangers. Consequently, the approved persons must be trained and must be familiar with the standards and directives that are relevant for their tasks.

It is the owner's task and responsibility to maintain the qualifications of the approved personnel. Consequently the approved personnel must be trained on a regular basis.

The following tasks must only be executed by approved persons:

- Setting up the product
- Connecting the product
- Operating the product
- Dismantling the product

1.5 Danger of injury due to electrical shock



DANGER

Life-threatening high voltage!

The voltages occurring on the product are life-threatening.

- Only have tasks on the product performed by trained personnel.

The product generates voltages that can be hazardous for human life and health. These voltages occur in the product and on the power output of the product.

The lines that supply power to the product also carry life-threatening voltages.

A person who comes into contact with energized parts of the product can be seriously or fatally injured.

1.5.1 Protective measures on the part of the manufacturer

The product is installed in an enclosed metal housing.

1.6 Danger of injury due to electromagnetic fields



DANGER

Danger due to electromagnetic fields!

High-frequency electromagnetic fields that can impair health occur in the area of the product.

- Only have tasks on the generator performed by trained personnel.

Electromagnetic fields occur in the product and on the power output of the product.

Electromagnetic fields can have interfering effects on the environment. Strong electromagnetic fields can influence electrical devices, e.g. cardiac pacemakers, or other assistive devices in the human body.

Implants inserted in the human body can be damaged through heating.

1.6.1 Protective measures on the part of the manufacturer

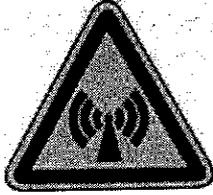
The product is installed in an enclosed metal housing.

However, this measure cannot prevent high electromagnetic fields from occurring in the connected load, e.g. on the process chamber.

The effective restriction of this danger is the responsibility of the owner, **in other words it is your responsibility.**

1.7 Limit values for scattered microwave radiation

Based on today's level of knowledge and until conclusion of the ongoing investigations in various countries, the microwave scattered radiation density at a distance of 0.05 m from each accessible system part must not exceed 50 Wm^{-2} (5 mWcm^{-2}) under normal operating conditions.



 **DANGER**

Personnel must not be exposed to microwave energy radiated from a microwave generator.

1.8 Danger due to mass (weight)



⚠ CAUTION

Product can result in injuries when it is lifted and carried!

- Do not carry or lift the product by yourself.

The handles on the front panel are not designed for transport with a transport aid. The handles are only suitable for manual transport.

Components on the rear of the product, e.g. water connections, must not be used as lifting points.

1.9 Danger due to aggressive cooling water



⚠ WARNING

Danger due to aggressive cooling water

Skin and eye injuries are possible.

- Avoid direct skin contact with cooling water and cooling water additives.
- Wear protective goggles when handling cooling water and cooling water additives.

1.10 What you as owner must pay attention to

1.10.1 Ensure safe operation of the product

1. The product must only be used within the conditions that are described in the "Technical specifications" section.
2. The product must not be opened.
3. Only assign personnel without cardiac pacemakers and without implants to work in the operating location of the product.
4. Only use a faultless high-voltage cable for the connection of the high voltage input.
5. The high-voltage cable must be properly connected on both sides.
6. The shielding of the high voltage cable must be grounded on both sides.
7. The housing of the product must be grounded.
8. The HF output must be safely connected to the applicator.

1.11 Measures in an emergency

1.11.1 In an emergency, immediately implement the following measures

1. Disconnect the product from the mains supply via the mains disconnect device without delay.
2. Shut-off the cooling water supply of the product.

2 Description

2.1 Classification

DIN EN 55011 (VDE 0875-11) 2018-05/ Radio-frequency disturbance characteristics – Limits and methods of measurement. Classification: Group 2 / Class A

Class A devices are designed for operation in an industrial environment. Due to the radio-frequency disturbance characteristics that occur, law prohibits operation outside the industrial environment.

2.2 Functional description

The product converts electrical power into microwave power. The product supplies adjustable microwave power of maximum 75000 W.

2.3 Structure of the product

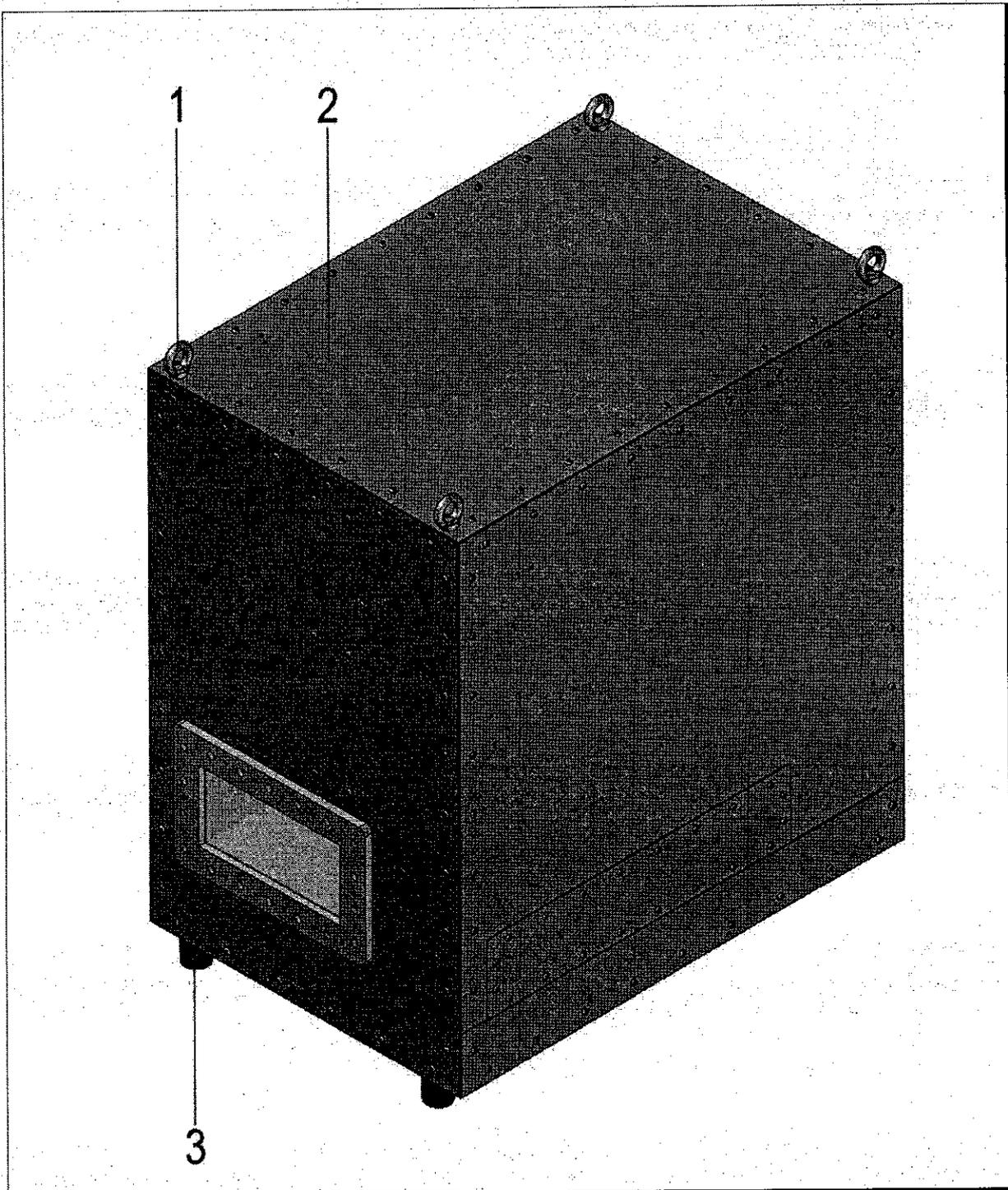


Fig. 1: View

1. Transport lugs (4x)
2. Housing
3. Rubber buffers D40 x 40 M8 i (4x)

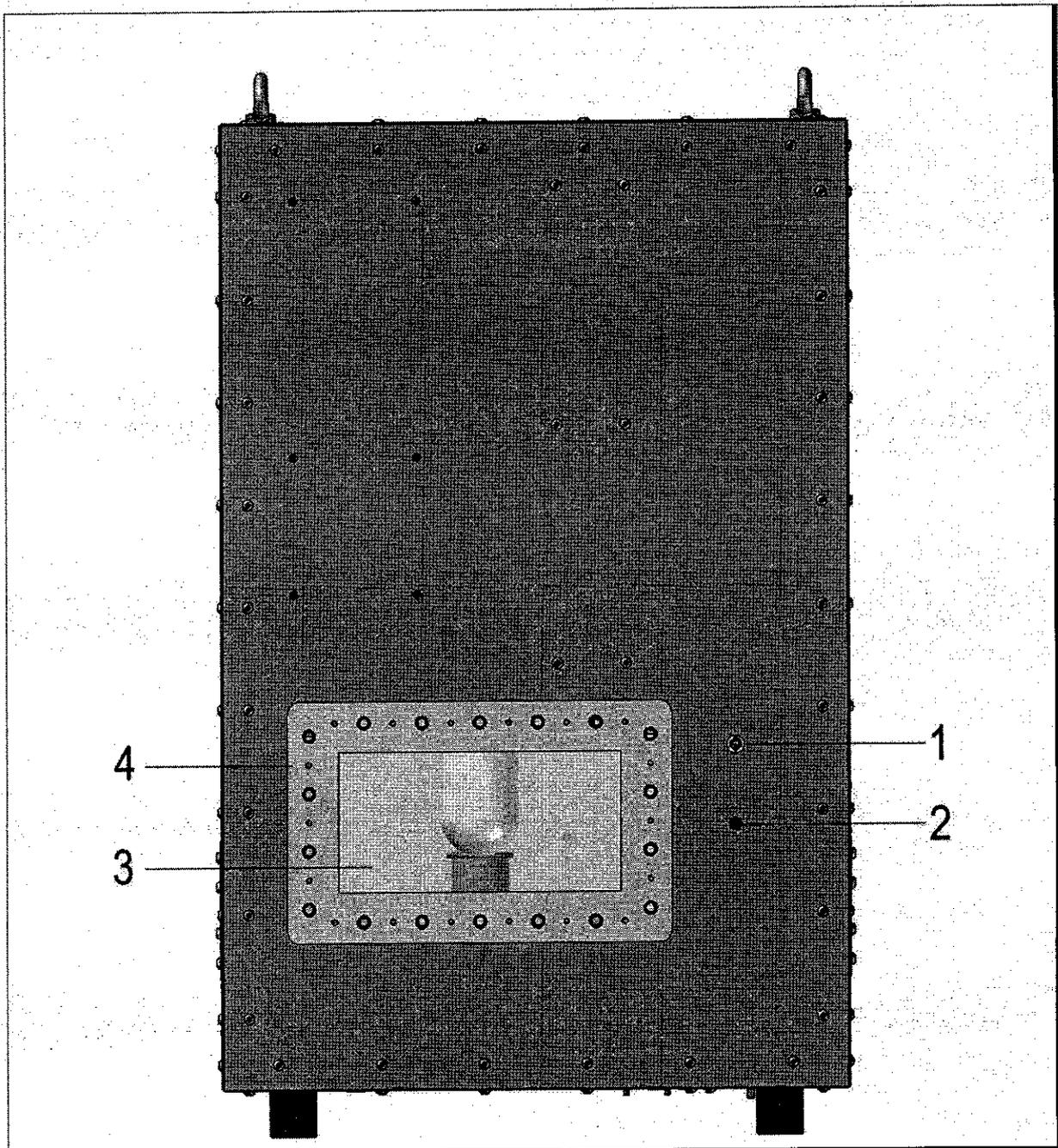


Fig. 2: Front view

1. BNC connector for measuring the reflected power
2. Optical waveguide connector for isolator ARC signal
3. Quartz glass window
4. Waveguide flange WR 975

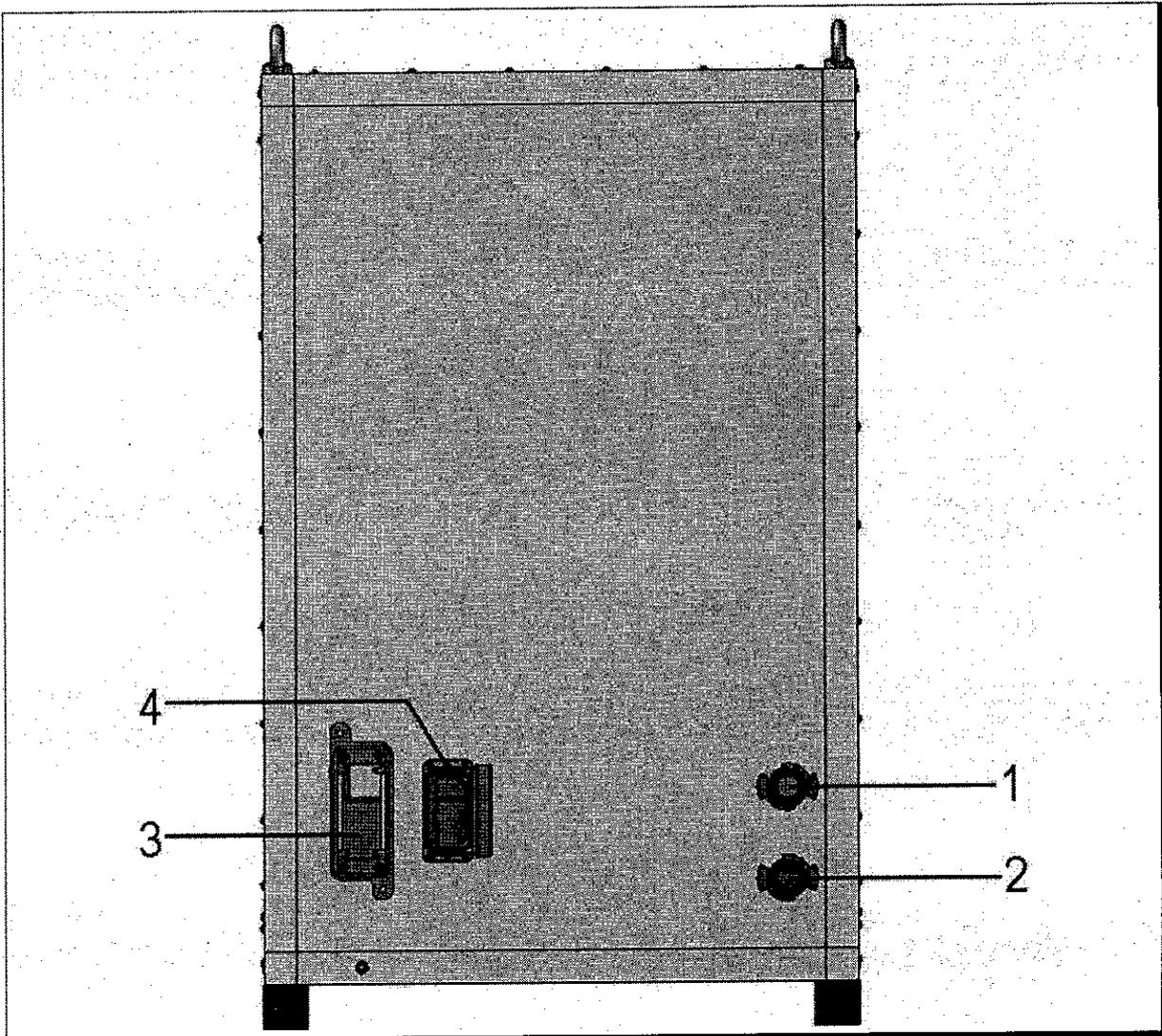


Fig. 3: Rear view

1. Cooling water inlet, inner thread $\frac{3}{4}$ "
2. Cooling water outlet, inner thread $\frac{3}{4}$ "
3. Connector X1 to MW power supply
4. Connector X2 to MW power supply

3 Technical specification

3.1 Electrical data

3.1.1 Primary high-voltage power circuit

Type	Value	Unit
Mains voltage nominal	-17000	V
Mains voltage maximum	-18000	V
Mains voltage minimum	-17000	V
HV current nominal effective value	5	A
HV current maximum peak value	5	A
High-voltage frequency	DC	Hz
High-voltage power	85000	W

3.1.2 Primary main circuit

Type	Value	Unit
Mains connection	3~ (L1 / L2 / L3 / PE)	-
Mains voltage nominal	400	V
Mains voltage maximum	440	V
Mains voltage minimum	360	V
Mains current, nominal	3,36	A
Mains current maximum	3,62	A
Mains frequency	50 / 60	Hz
Mains power	1344	VA

3.1.3 Primary control current circuit

Type	Value	Unit
Mains voltage	230	V
Mains frequency	50 / 60	Hz
Mains current	0,4	A
Mains power	92	VA

3.1.4 HF data

Type	Value	Unit
HF connection	WR975 / R9	-
Fastening	18x through bore ø 12	-

3.1.5 Microwave data

Type	Value	Unit
MW power CW maximum	75000	W
MW power CW minimal	7500	W
Frequency	915	MHz

3.2 Housing

3.2.1 Dimensions

Product dimensions	values	Unit
Width	550 (21,65)	mm (inch)
Depth	847 (33,34)	mm (inch)
Height	885 (34,84)	mm (inch)

Space requirements of the product	values	Unit
Width	650 (25,59)	mm (inch)
Depth	1050 (41,34)	mm (inch)
Height	940 (37,01)	mm (inch)

	values	Unit
Mass (weight)	210 (462,97)	kg (lbs)

3.2.2 Protection rating

The product has the protection rating IP20.

- Protection against penetration of foreign objects with a diameter greater than 12.5 mm
- No protection against water

3.2.3 Dimension drawing

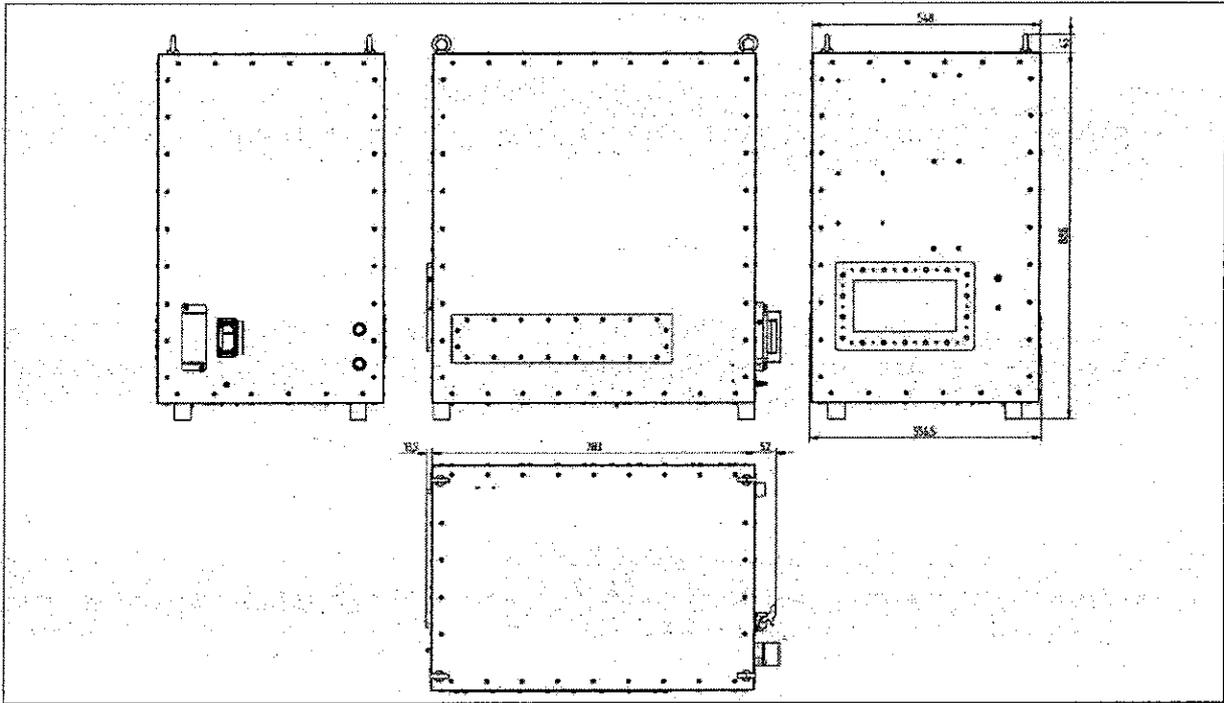


Fig. 4: Dimension drawing, all dimensions in mm (1 mm = 0.039 inch)

3.3 Ambient conditions

Out of service: (IEC 60721-3-1, IEC 60721-3-2, EN50178)

Storage: Climate class 1K3

Transport: Climate class 2K3

- Drain water out of the cooling circuit
- Humidity and temperature of the environment must not be condensing.

Temperature, air pressure	- 25°C (-13°F) - + 70°C (158°F), 70 kPa – 106 kPa
Relative humidity	80% to 30°C (86°F), above this linear reduction to 50%, non-condensing

In operation: (IEC 60721-3-3, EN50178) Climate class 3K3

Temperature	5°C (41°F) – 40°C (104°F)
Relative humidity	80% to 30°C (86°F), above this linear reduction to 50%, non-condensing

3.4 Cooling requirements

3.4.1 Cooling water

Type	Value	Unit
Flow	≥ 25 (6,60)	l/min. (US gal/min.)
Pressure	≤ 4 (58,02)	bar (psi)
Temperature	20 - 25 (68 - 77)	°C (°F)
Connection	3/4" female thread	-
Connection – manufacturer	R+F	-

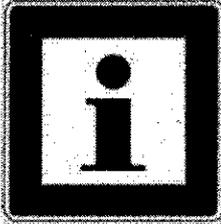
Cooling water quality

Requirements, i.e. treatment of the water in cooling circuits!

To protect the system parts against corrosion and deposits, it is always recommended to add a suitable additive to the water in closed circuits (corrosion protection with non-ferrous metal protection and hardness stabilisation). Moreover, in open and closed circuits the following water values must be maintained.

Water values	Max.	Unit
pH value	7.5 – 8.5	-
Conductivity	50 – 150	mS/m
Total hardness	<15	°dH
Carbonate hardness	<4	°dH
Carbonate hardness at hardness stabilisation	<20	°dH
Chloride Cl	<100	mg/l
Sulphate SO ₄	<150	mg/l
Ammonium NH ₄	<1	mg/l
Iron Fe	<0.2	mg/l
Manganese	<0.1	mg/l
Free of solids		

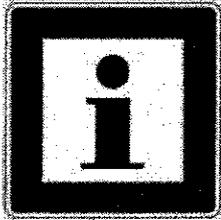
Systems made of aluminium:	pH value	Min. 7.0	Max. 8.0
Systems made of stainless steel:	Chloride Cl	max. 100 mg/l	



NOTE

Substances such as GWK CL13 AL or Aquatrol 13210 can be used as inhibitors to protect aluminium or galvanised steel elements.

No system adjustment is required for concentrations of up to one percent by volume.



NOTE

Glysantin, monoethylene glycol or propylene glycol can be used as antifreeze agents.

No system adjustment is required for concentrations below 10% by volume.

4 Interfaces

4.1 Description of the connections

4.1.1 Description of the MW-Power supply interconnection plug X1

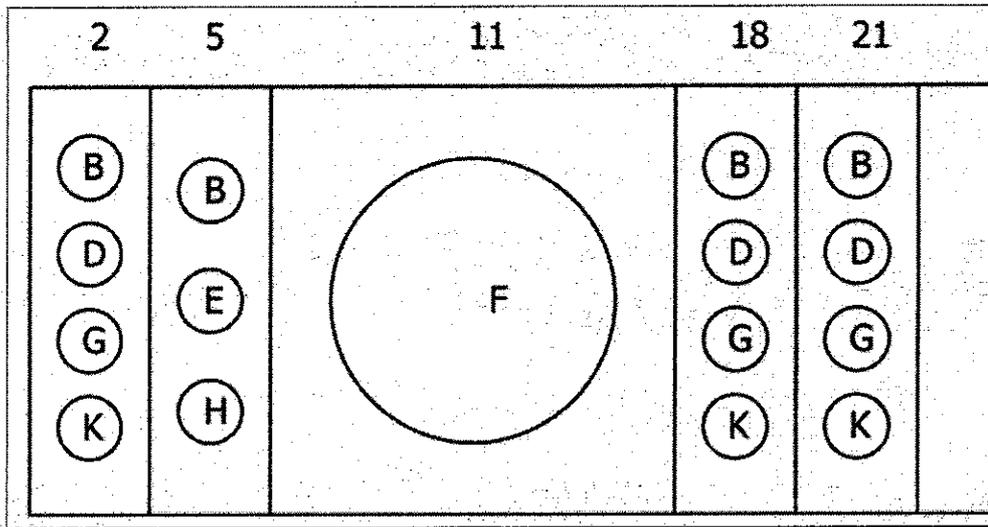


Fig. 5: MW-power supply interconnection plug X1

Pin	Description
B2	Mains connection, phase conductor L1, 400 V AC
D2	Mains connection, phase conductor L2, 400 V AC
G2	Mains connection phase conductor L3, 400 V AC
B18	Auxiliary power supply, phase conductor L, 230 V AC / 10 A
D18	Auxiliary power supply, neutral conductor N, 230 V AC / 10 A
G18	Filament power supply, phase conductor R, 400 V AC
K18	Filament power supply, phase conductor S, 400 V AC
B21	E-magnet power supply +72 V DC
D11	E-magnet power supply GND 72 V DC
F11	High voltage magnetron
B5	GND magnetron
PE ODU Frame	PE-protectiveearth magnetron

4.1.2 Description of the mw-power supply interconnection plug X2

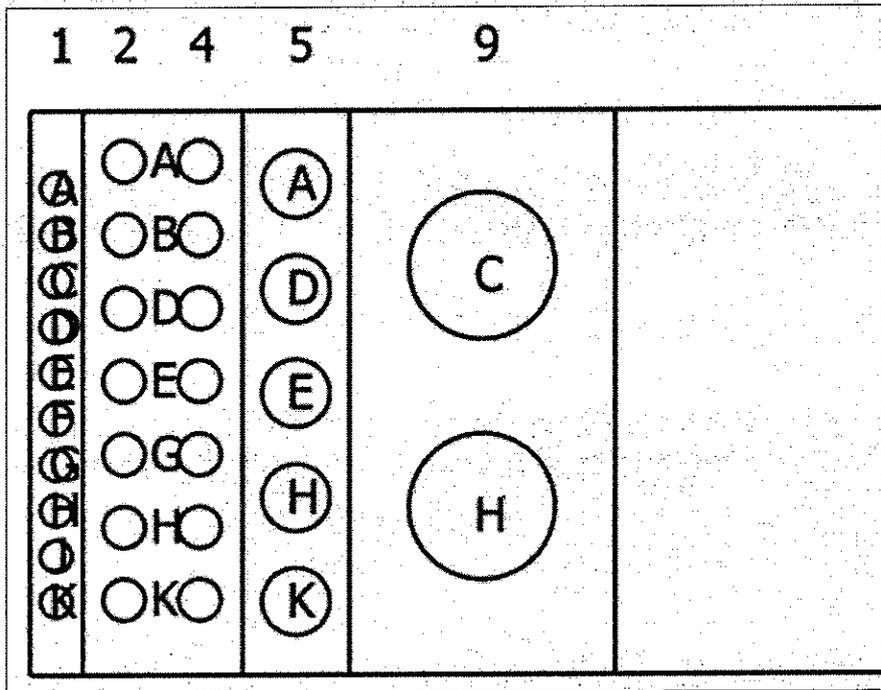


Fig. 6: MW-power supply interconnection plug X2

Pin	Description
J1	+24 V DC for magnetron temperature switch
K1	+24 V DC Feedback signal from magnetron temperature switch
A2	+15 V DC ARC 1
B2	+15 V DC ARC 1
D2	Signal ARC 1
A5	+24 V DC ARC 2
D5	GND 24 V DC ARC 2
E5	+15 V DC ARC 2
H5	Signal ARC 2
K5	GND 15 V DC ARC 2
A1	Output Interlock 1
B1	Input Interlock 1
C1	Output Interlock 2
D1	Input Interlock 2
E1	Blower monitor 1, normally closed contact K1 pin 11
F1	Blower monitor 1, normally closed contact K1 pin 11
G1	Blower monitor 2, normally closed contact K2 pin 11
H1	Blower monitor 2, normally closed contact K2 pin 11
A4	+24 V DC flow monitor

B4	GND 24 V DC flow monitor
D4	Normally open contact signal flow monitor
E4	Normally closed contact signal flow monitor
C9	Refection

4.1.3 Description of the protective conductor connection X3

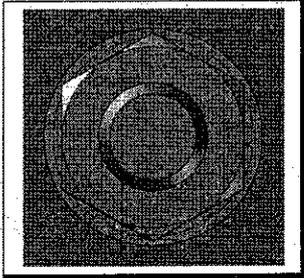
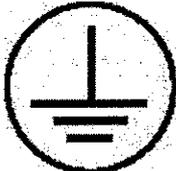


Fig. 7: Pin assignment of the protective earth connection X3

Pin	Description
 X3:PE	Connection for the protective conductor PE of the magnetron head

4.1.4 Description of isolator ARC connector X4

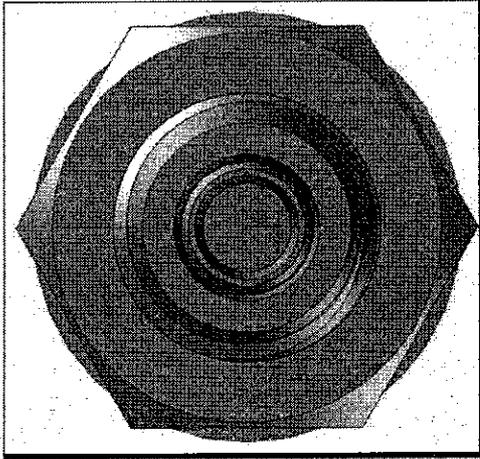


Fig. 8: Pin assignment of isolator ARC connector X4

Pin	Description
X4:optical wave guide	Input for the isolator ARC signal

4.1.5 Description of the connection for measuring the reflected power X5

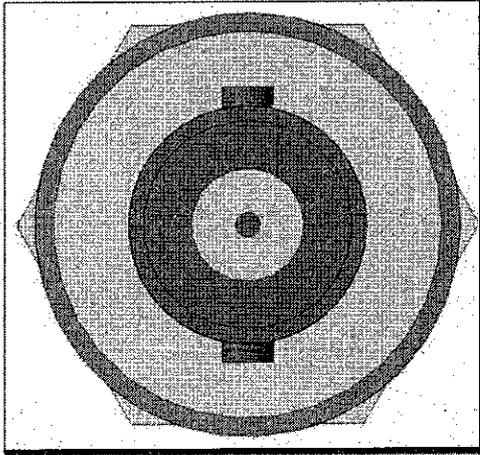


Fig. 9: Pin assignment of the connector for measuring the reflected power X5

Pin	Description
X5:BNC	Input for the signal to measure the reflected power

4.1.6 Description of the cooling water inlet (IN)

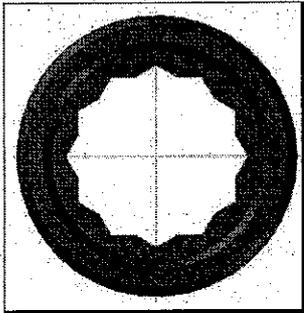


Fig. 10: Cooling water inlet IN

Pin	Description
In	Connector for the cooling water inlet, inner thread 3/4"

4.1.7 Description of the cooling water outlet (OUT)

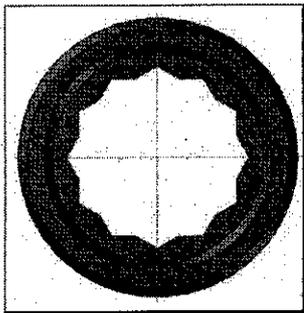


Fig. 11: Cooling water outlet OUT

Pin	Description
OUT	Connector for the cooling water outlet, inner thread 3/4"

5 Standards and directives

5.1 EC Declaration of Incorporation

Manufacturer: Muegge GmbH
Address Hochstrasse 4-6
64385 Reichelsheim, Germany
Tel.: +49 6164 9307 0
Fax: +49 6164 9307 93
Email: info@muegge.de
Internet: www.muegge.de

Product designation: Magnetron Head
Type designation / article number: MH075KS-510BU
Serial number:

The product designated above (the incomplete machine) complies with the essential requirements of the directive(s) cited below and with their amending directives.

2006/42/EC Machinery Directive Annex I, Article 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 and 1.5.1.
2014/30/EU EMC Directive (electromagnetic compatibility)
2014/35/EU Low Voltage Directive

The following relevant standards were used for the evaluation of compliance:

DIN EN ISO 12100:2011-03 DIN EN 60204-1:2007-06 DIN EN 61000-6-2:2006-03
DIN EN 61000-6-4:2011-09

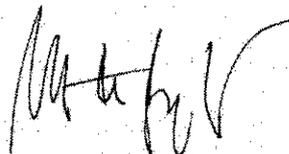
Commissioning is prohibited until it has been determined that the machine into which the incomplete machine cited above should be installed complies with the provisions of the Machinery Directive 2006/42/EC.

Name and address of the person authorized to compile the technical documents: Boris Ihrig, see the manufacturer's address

This declaration certifies compliance with the directive(s) cited, however it does not contain any assurance of characteristics. The safety instructions and installation instructions in the provided product documentation must be complied with.

City and date
Reichelsheim, 2021-07-07

Signer and signer information
Dr. Klaus Martin Baumgärtner, CEO



6 Installation

6.1 After receipt of the product



NOTE

The product must not be commissioned until the temperature of the product meets the temperature specifications in the "Ambient conditions (in operation)" section.

6.1.1 Checking the delivery

1. Immediately after delivery, check the product for completeness as specified on the delivery note, and for apparent transport damage.
2. Report, in writing, any transport damage from which recourse claims can be derived, immediately to the freight forwarder, the insurance company and Muegge GmbH.

6.2 Unpacking

6.2.1 Disposing of packaging material

If you do not want to store the packaging material for later transport:

- Dispose of all packaging materials in accordance with regional disposal regulations.

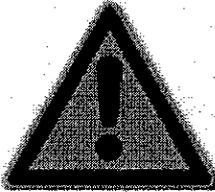


NOTE

The packaging material will be required to properly place the product in storage, or to send back the product.

6.3 Transport, storage

6.3.1 Transport



▲ CAUTION

Danger of injury due to the mass (the weight) of the product

- Do not carry or lift the product by yourself.
- Do not lift the product via the components, e.g. water connections.

6.3.2 Storage conditions

If you do not install the product directly after delivery:

1. Store the product in the original packaging
2. Humidity and temperature of the environment must not be condensing.
3. Ensure the following ambient conditions: (IEC 60721-3-1, EN50178) Climate class 1K3

Temperature, air pressure	- 25°C (-13°F) - + 70°C (158°F), 70 kPa – 106 kPa
Relative humidity	80% to 30°C (86°F), above this linear reduction to 50%

6.4 Installing

6.5 Connection sequence

6.5.1 Connecting the product

Comply with the following sequence when connecting the product:

1. Connect HF output.
2. Connect equipotential bonding conductor.
3. Connect cooling water.
4. Connect heating voltage and control lines.
5. Connect high voltage.

6.6 Cooling water

6.6.1 Connecting the cooling water



NOTE

The product's cooling water circuit consists of copper components.
Use of cooling water from aluminium systems damages the product.

- Ensure strict separation of the cooling water of the product from cooling water from aluminium systems.

6.6.2 Connecting the cooling water lines

The connection for the cooling water pipes on the product consists of a connector with inner thread of $\frac{3}{4}$ ". As mating connectors, connectors with external thread of $\frac{3}{4}$ " are included. The connectors with external thread have a connecting piece for a hose with a diameter of $\frac{3}{4}$ ".

Auxiliary materials, tools, supplies

- 2 connectors with external thread $\frac{3}{4}$ "
- Hose with an inner diameter of $\frac{3}{4}$ "
- 2 hose clamps suitable for the selected hose
- Screwdriver suitable for the hose clips

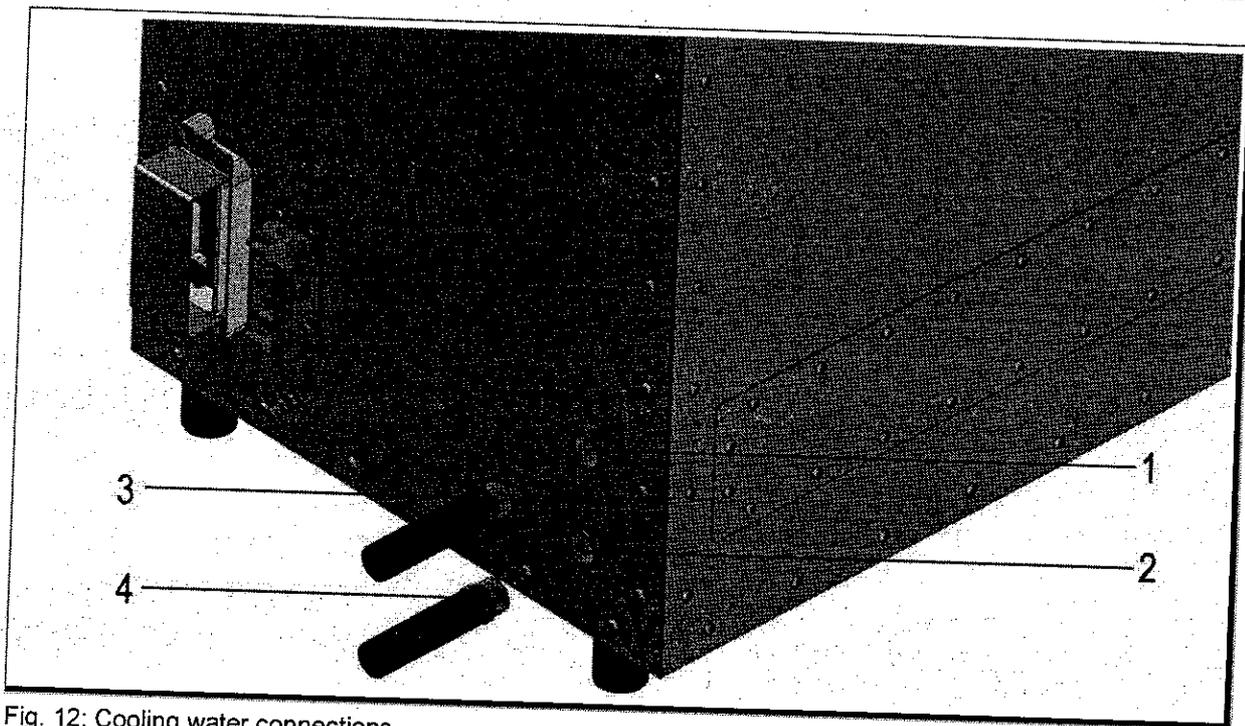


Fig. 12: Cooling water connections

1. Connector with inner thread of 3/4" for cooling water supply on the product
2. Connector with inner thread of 3/4" for cooling water return on the product
3. Mating connector, connector with external thread of 3/4" with hose from cooling water supply
4. Mating connector, connector with inner thread of 3/4" with hose from cooling water supply

Procedure for connecting the cooling water

1. Slide a hose clip onto the hose.
2. Attach the hose to the connection piece of the connector with external thread.
3. Tighten the hose clamp above the connection piece of the connector with external thread with a screwdriver.
4. Place the connector with external thread on the connector with inner thread of the product and tighten to the right.

6.6.3 Checking for leaks

1. Carefully switch on the cooling water supply.
2. Avoid pressure surges.
3. Check lines and plug connectors for leaks.
4. Switch off the cooling water supply.
5. Only switch the cooling water supply back on, just before start-up.

6.6.4 Definition of open system / closed system

Open system

A coolant circuit is referred to as an "open system", if the cooling water within the cooling circuit comes into contact with the surrounding atmosphere or external water from a different cooling system. Through contact with the surrounding atmosphere the water parameters can change.

Example:

- Cooling tower
- Cooling water basin
- Central cooling water circuits in plants.

Closed system

A coolant circuit is referred to as a "closed system", if the cooling water circulates in a closed circuit and thus does not come into contact with the surrounding atmosphere or with external water from different cooling systems. Thus a change of the cooling parameters through the atmosphere or through external water is not possible.

6.6.5 Preparing cooling water

The system owner ensures the cooling water quality

Required measures are the responsibility of the system owner. The system owner must ensure the cooling water quality, which prevents corrosion.

Initial filling

For initial filling of the product in the closed cooling water circuit, the cooling water must have the quality of a de-mineralised, de-ionised or distilled water, and must be filled in the cooling water circuit with a suitable corrosion inhibitor. Any supplemental to compensate for evaporation losses must likewise be completely de-mineralised and introduced into the cooling water circuit with an appropriate corrosion inhibitor.

6.7 Equipotential bonding

In some install situations connection of an equipotential bonding conductor can be necessary. As the owner you must make this decision. Comply with the national regulations in this regard.

6.7.1 Connecting the equipotential bonding conductor

Requirements

- On the rear panel of the product is a stud bolt for connecting the equipotential bonding cable.
- The equipotential bonding cable of the magnetron head is also connected on this stud bolt.
- Screw cable lug with equipotential bonding cable onto the stud bolt.
 - Minimum cross section: 6 mm²
 - Torque: 5 Nm

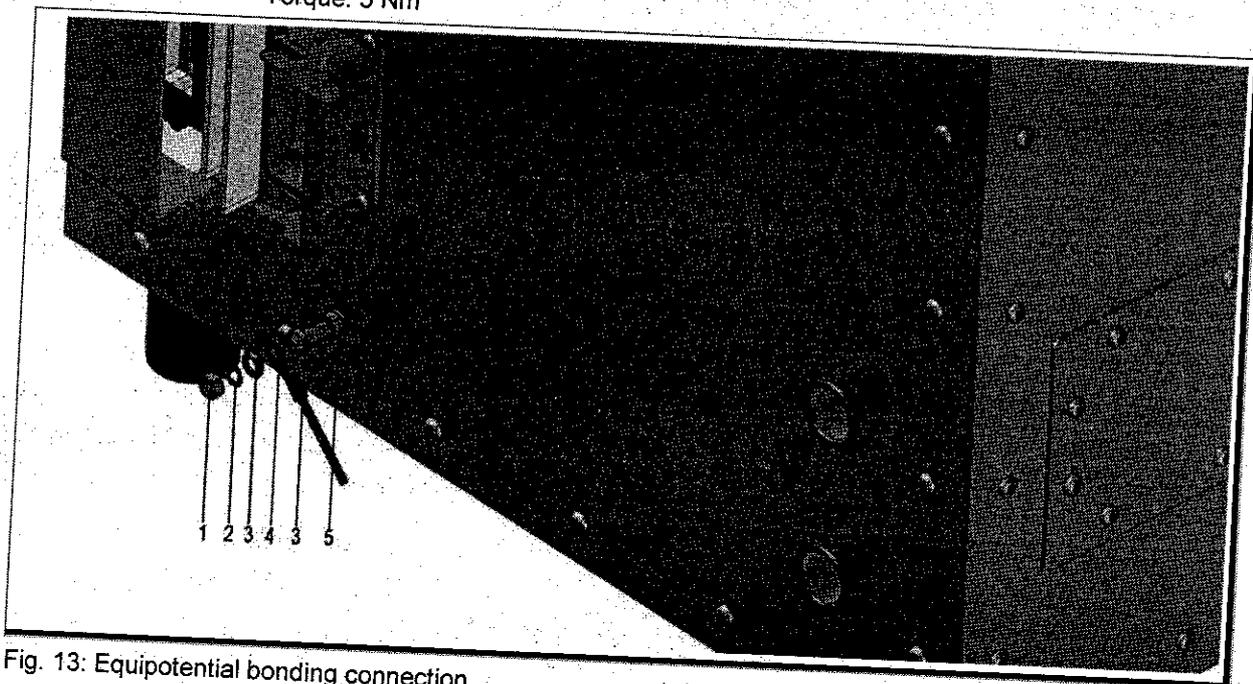


Fig. 13: Equipotential bonding connection

1. Hex nut for fastening the equipotential bonding cable
2. Crown gear
3. Washer
4. Cable lug with equipotential bonding cable
5. Equipotential bonding bolt on the product

6.8 Magnetron ground

The magnetron ground is the reference potential for the high voltage of the magnetron.

6.8.1 Connecting the connector X1 for MW power supply

6.9

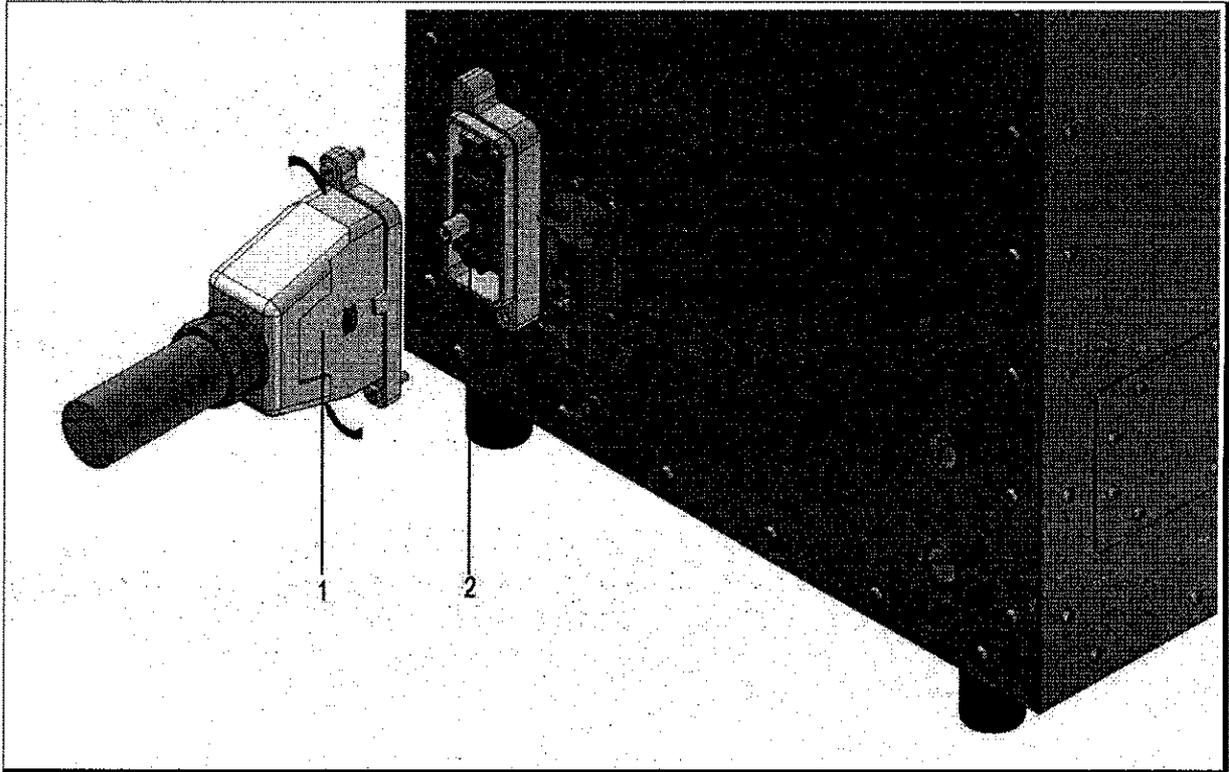


Fig. 14: Connection of the connector X1 for MW power supply

1. Connector X1 for MW power supply
2. Connection socket for the connector X1 for the MW power supply on the product

6.9.1 Connecting the connector X2 for MW power supply
6.9.2

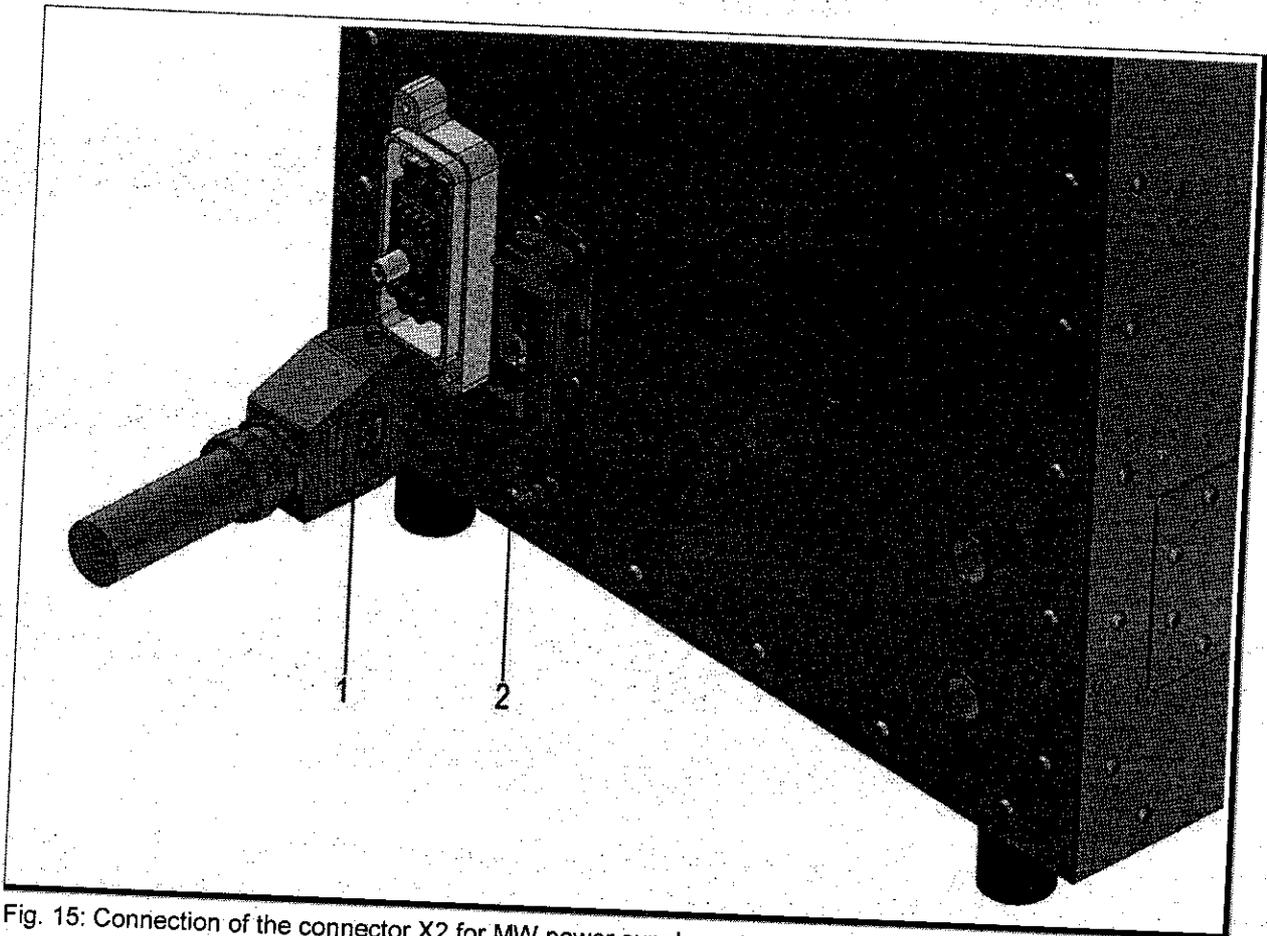


Fig. 15: Connection of the connector X2 for MW power supply

1. Connector X2 for MW power supply
2. Connection socket for the connector X2 for the MW power supply on the product

6.9.3 Connecting the external ARC sensor to the isolator

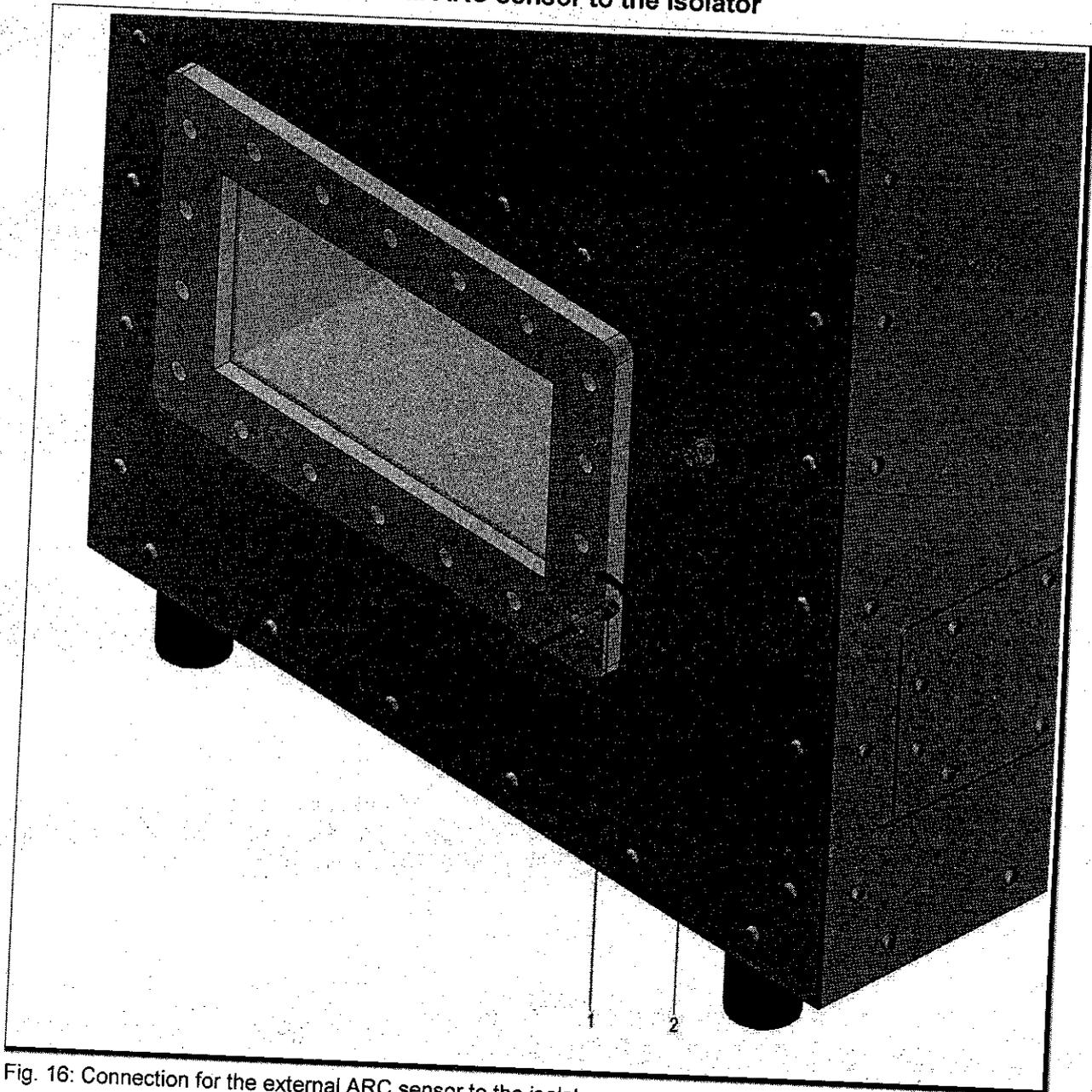


Fig. 16: Connection for the external ARC sensor to the isolator

1. Connector of optical waveguide with cable of optical waveguide for external ARC sensor to the isolator
2. Connection for the external ARC sensor to the isolator on the product

6.9.4 Connecting the signal of the reflected power

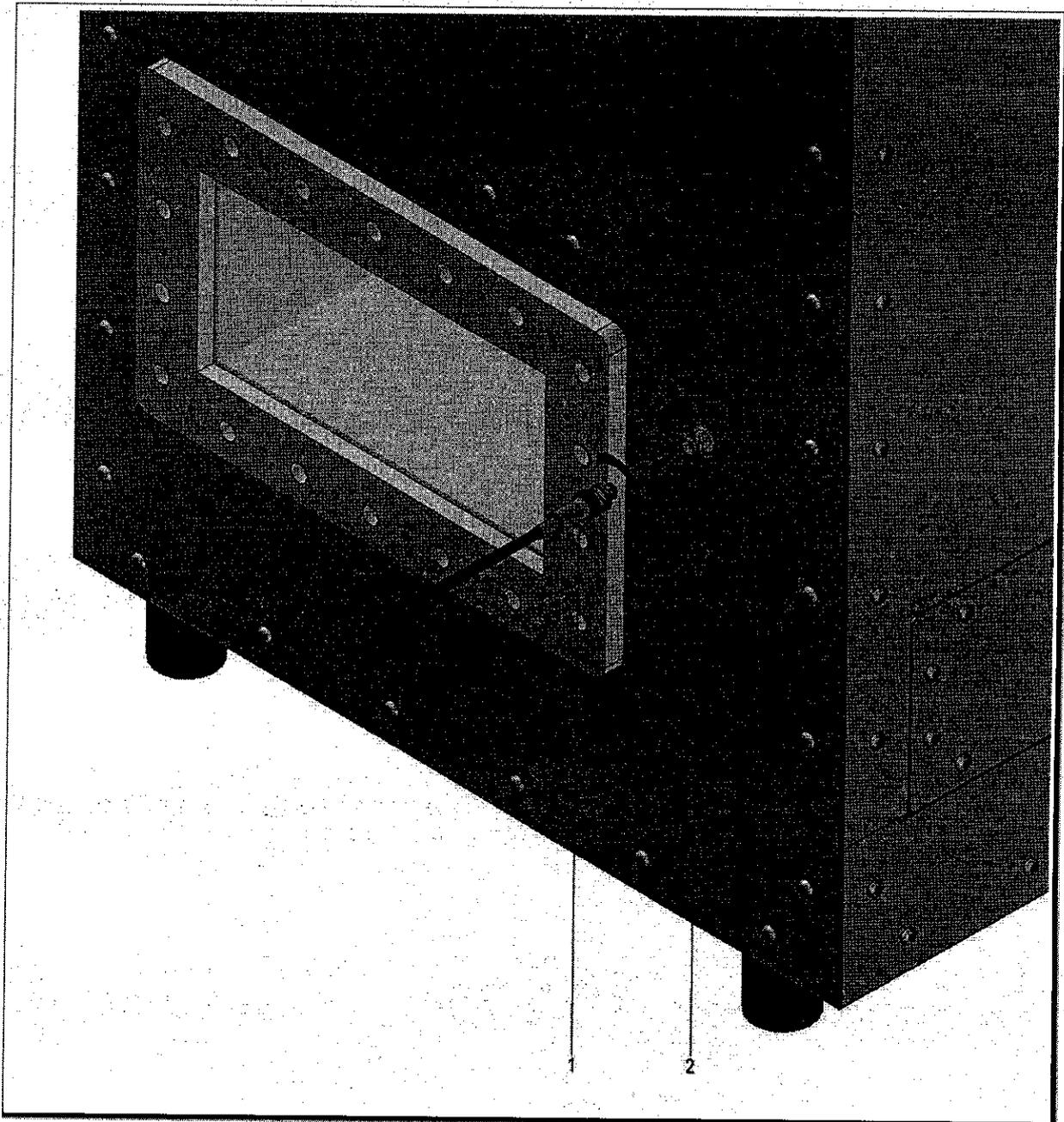
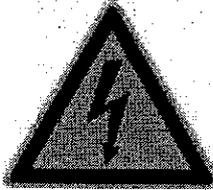


Fig. 17: Connection for the signal of the reflected power

1. BNC connector with coaxial cable
2. BNC connector on the product for the signal of the reflected power

6.10 Dismantling

6.10.1 Dismantling the product

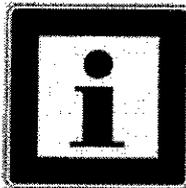


⚠ DANGER

Life-threatening high voltage!

The high voltage input carries life-threatening high voltage

- Prior to disconnecting the high voltage cable, switch off the MW power supply, the all-pole disconnection device and disconnect the mains cable.



NOTE

The product's cooling water circuit consists of copper components.

Use of cooling water from aluminium systems damages the product.

- Ensure strict separation of the cooling water of the product from the cooling water from aluminium systems.

Comply with the following sequence when dismantling the product.

1. Switch off the power supply on the external all-pole disconnection device.
2. Remove the mains cable of the MW power supply.
3. Remove all other electrical lines from the product.
4. Switch off the cooling water supply.
5. Remove the cooling water lines.
6. Allow the cooling water circuit of the product to run empty.
7. Empty the cooling water circuit of the product by blowing it out with compressed air.
8. Dry the cooling water circuit so that there are no cooling water residues.
9. Disconnect the HF output connection and in this process lift the product off of the applicator
Comply with the instructions in chapter "1.9 "Danger due to mass (weight)!"
10. Clean the product with a dry ESD cloth.

6.11 Dispatch

6.11.1 Packing the product

Use suitable material to send the product (such as the packaging material that it was delivered in).

6.12 Disposal

6.12.1 Customer information concerning product disposal

The Electrical and Electronic Equipment Act (ElektroG) implements the following EU directives:

- 2012/19/EU on waste electrical and electronic equipment (WEEE) and
- 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

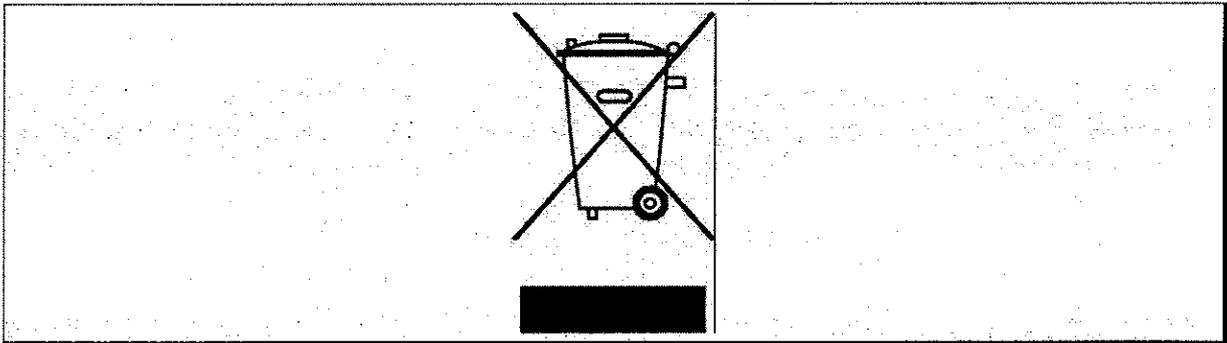


Fig. 18: Product marking in accordance with EN 50419

At the end of the product's service life, this product must not be disposed of via normal domestic waste. Also disposal via the municipal collection points for old electrical devices is not suitable.

For environmentally responsible disposal or return into the material cycle, the product must be sent back to Muegge GmbH. Muegge GmbH fulfils the obligations for manufacturers to take back and dispose of the electrical device as stipulated in the German Electrical and Electronic Equipment Act (ElektroG) in full scope.

If there are questions or problems please contact your local Muegge contact person to dispose of the product.

6.12.2 Customer information concerning the Battery Ordinance (BattV)

This device can contain a battery that contains harmful substances. These substances must not be disposed of with domestic waste.

After the end of the battery service life disposal must occur only via a suitable collection point.

If there are questions or problems please contact your local Muegge contact person to dispose of the product.

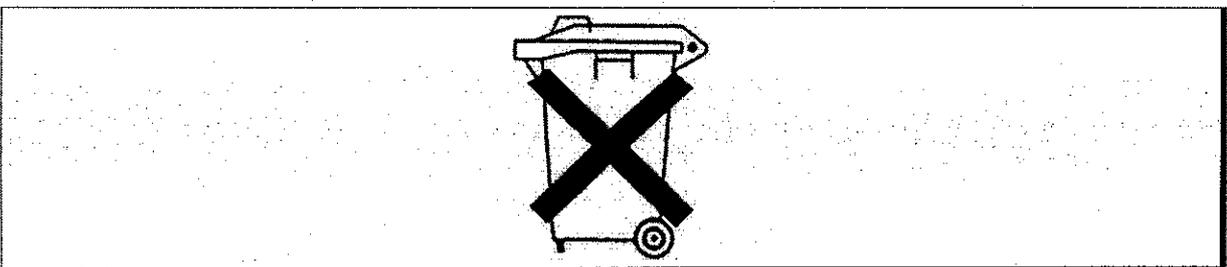


Fig. 19: Note concerning the Battery Ordinance

7 Maintenance

7.1 Contact data for customer service

Europe:

Address: Muegge GmbH
Hochstrasse 4-6
64385 Reichelsheim, Germany

Tel.: +49 6164 9307 0

Fax: +49 6164 9307 93

Email: info@muegge.de

Internet: www.muegge.de

In emergency cases you can reach us via our 24-hour hotline.

24-hour hotline: +49 171 3121892

North America:

Address: Muegge-Gerling
1064 Woodland Avenue, Suite U
Modesto, CA 95351, USA

Tel.: +1-209-527-8960

Fax: +1-209-527-5385

Email: sales@muegge-gerling.com

Internet: www.muegge-gerling.com

Hotline: +1-209-527-8960

7.2 Maintenance cycles for safe operation

To ensure safe operation the system must be inspected once a year by customer service.

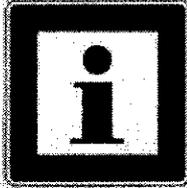
7.2.1 Maintenance schedule for operating and maintenance personnel

Measures	Comments	Maintenance interval			Operating personnel	Maintenance personnel
		Weekly	Monthly	Yearly		
*Check the connecting cables for mechanical damage and tightly seated.	Visual inspection		X		X	
Check the coolant system for leaks	Visual inspection		X		X	
Check the safety switch for function			X			X

* Not necessary if cable is laid out in the cable duct or cable bridge.

7.3 Check connection cables and connecting cables and HF output

Maintenance tasks must only be executed on a de-energized product.



NOTE

Comply with the safety rules.

- De-energize
- Safeguard the product from being switched on again
- Verify de-energized status
- Ground and short-circuit
- Cover or shield any adjacent live components



⚠ DANGER

NON-IONIZING RADIATION

At contact there is danger of internal injuries, danger of burning injuries and life-threatening danger.

If there is an error radiation can escape from the device

- Before maintenance, switch off the system and safeguard it from being switched on again.



⚠ DANGER

Life-threatening high voltage!

The voltages occurring on the product are life-threatening.

- Only have tasks on the product performed by trained personnel.

Every 12 months:

After the safety rules have been executed, all connection cables and connecting cables must be checked for wear and damage (visual inspection).

7.4 Check cooling water circuit

Check water lines regularly for wear and aging.

7.5 Cooling water parameters

Check cooling water for cooling water parameters that are defined in the section "Technical specification / Cooling water".

If when checking the cooling water there are deviations to the specified cooling water parameters, the cooling water must be topped up with fresh water.

7.6 Cleaning and care of the cooling water

Every 6 months:

The interval for checking the cooling water should be approximately 6 months. The check parameters are:

- Appearance is clear, without suspended matter.
- No odour.
- pH value.
- Conductivity.
- If there are irregularities have a cooling water sample analysed.

Every 12 months:

- Once a year the cooling water circuit must be cleaned and the cooling water must be replaced.
- If at the check interval the limit values of the check parameters are already exceeded, the cooling circuit must be cleaned and the cooling water must be replaced.

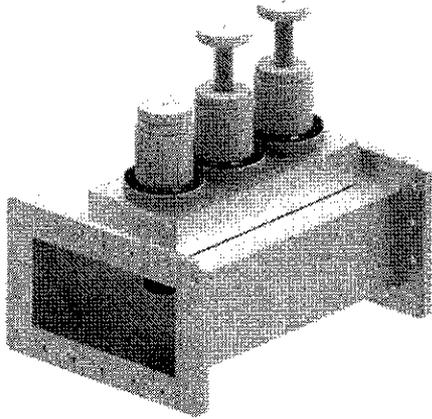
Open system:

- Cleaning and care should occur in accordance with the directives or standards VDI 6022, DIN 3803 or other valid statutory regulations.

Disposal:

- Local or national wastewater regulations at the installation site of the generator must be complied with when disposing of the cooling water.





Industrial Microwave +
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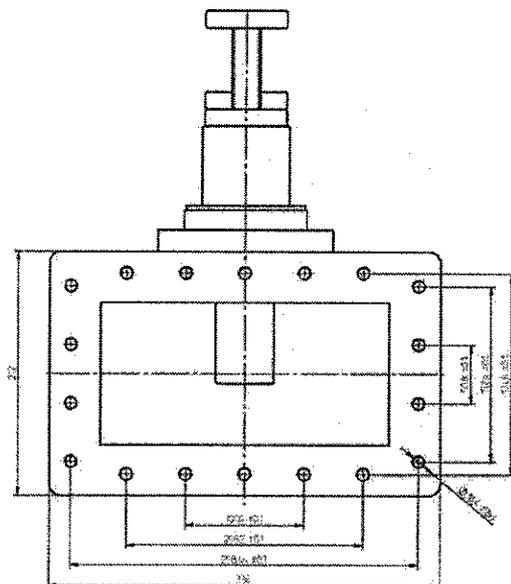
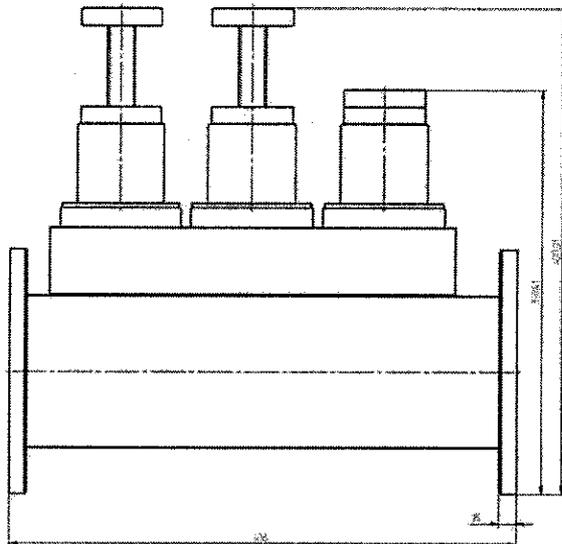
3-Stub-Tuner MW2006A-260CC

Waveguide Components (896/915/922 MHz; WR 975)

Features:

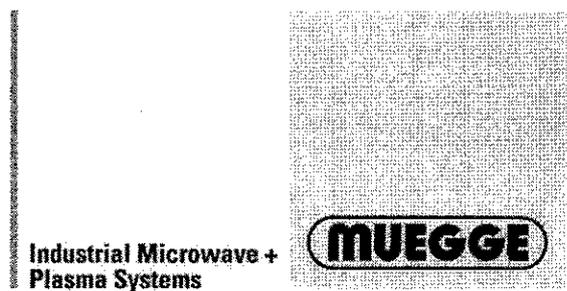
- Reduction of VSWR
- Contactless
- Compact design
- High-Quality waveguide
- Rugged design
- Locking brake
- Prepared for UDR/PDR 9 connection (18x Ø 10.4 mm)

Outline Dimensions (mm):



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Fon +49 (0) 6164 - 93 07 0 · Fax +49 (0) 6164 - 93 07 93
info@muegge.de · www.muegge.de

3-Stub-Tuner MW2006A-260CC

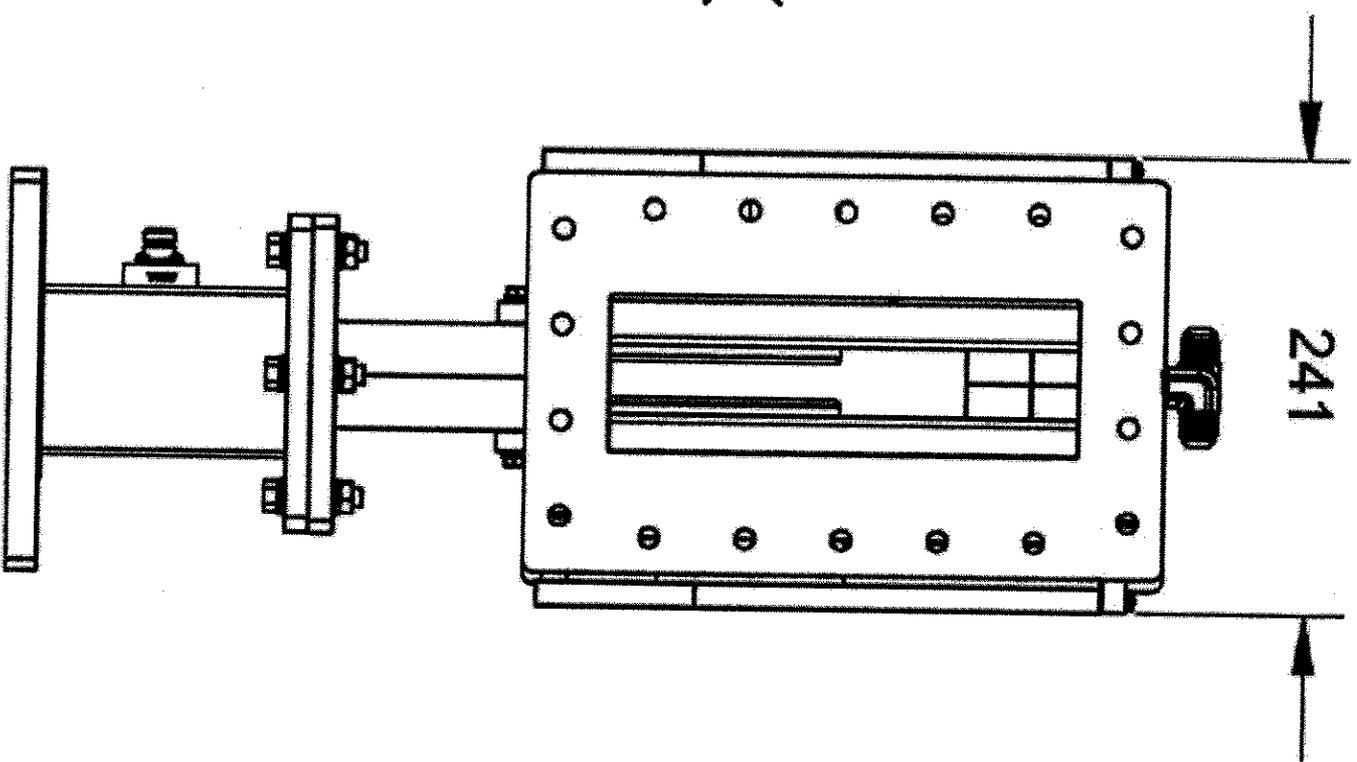


Specifications:	
Frequency:	896 MHz +/- 25 MHz; 915 MHz +/- 25 MHz; 922 MHz +/- 25 MHz
Power:	Max. 100 kW <small>(Notice: A large depth of tuning stub immersion during high power microwave operation leads to field strength maxima on the tuning-stubs!)</small>
Tuning capacity:	VSWR 10 : 1
Waveguide:	WR 975
Waveguide flange:	PDR 9 (18x Ø 10.4 mm)
Material:	Aluminum
Dimensions (L x W x H):	Approx. 438 mm x 336 mm x 421 mm

Options:

- Material: e. g.: copper, brass
- Special flanges
- Special finishing

Outline Dimensions (mm(inch))



Zirkulátor - MW1001B-260CC

Cikkszám MW1001B-260CC

Hullámvezető alkatrészek

Frekvencia [Mhz] 915

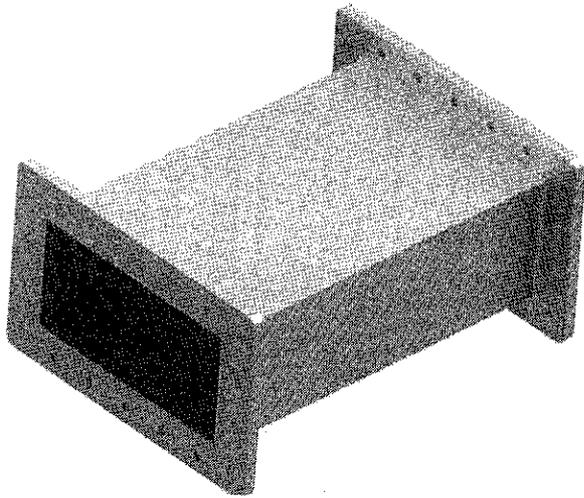
Kimeneti teljesítmény [W] 100000

Hullámvezető mérete WR975 / R9

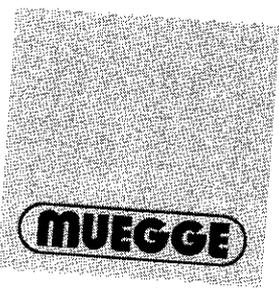
Karimá UDR

Termékcsoport Iso- / Cirkulátor

FIGYELŐLISTA



Industrial Microwave +
Plasma Systems



Waveguide 1532701

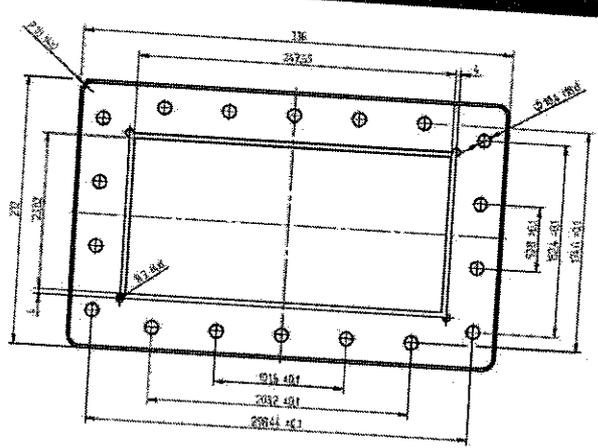
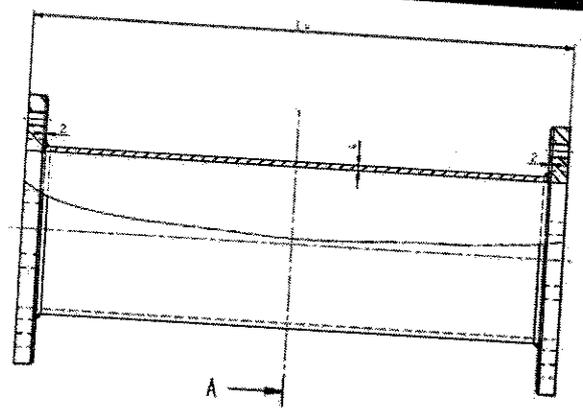
Waveguide Components

In industrial microwave heating systems, waveguides are designed to direct microwave power from generator to the application.

Characteristics:

- Low VSWR
- Low transition losses
- Coverage of the entire L-band (915 MHz \pm 50 MHz)

Exterior dimensions:



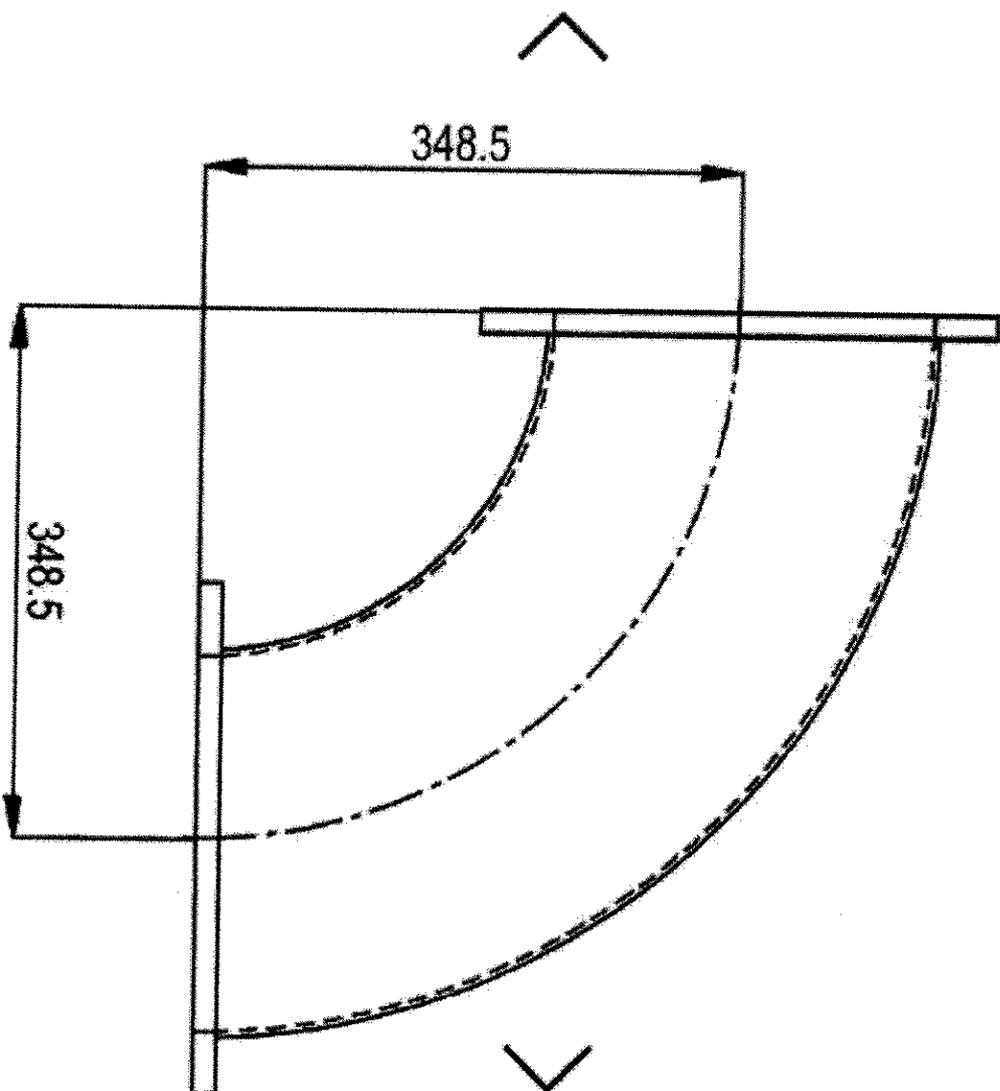
Rev: 00

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info@muegge.de · www.muegge.de

Specifications:

Frequency:	915 MHz ± 50 MHz	
HF power max:	100000	MHz
Waveguide type, port 1:	Waveguide	W
Waveguide type, port 2:	Waveguide	
Waveguide type, port 3:	-	
Waveguide size, port 1:	WR975 / R9	
Waveguide size, port 2:	WR975 / R9	
Waveguide size, port 3:	-	
Waveguide flange, port 1:	UDR	
Waveguide flange, port 2:	UDR	
Waveguide flange, port 3:	-	
Waveguide mounting, port 1:	18x through bore ø 10.5	
Waveguide mounting, port 2:	18x through bore ø 10.5	
Waveguide mounting, port 3:	-	
Waveguide material, port 1:	Aluminum chromated	
Waveguide material, port 2:	Aluminum chromated	
Waveguide material, port 3:	-	

Outline Dimensions (mm/finch)



H-Kanyar - MW3002B-260CC

Cikkszám : MW3002B-260CC

Hullámvezető alkatrészek

Frekvencia [Mhz] 915

Teljesítmény [W] 100 000

Hullámvezető
mérete WR975 / R9

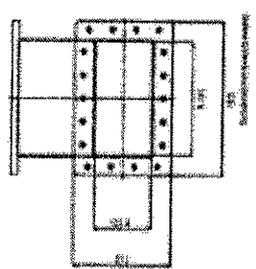
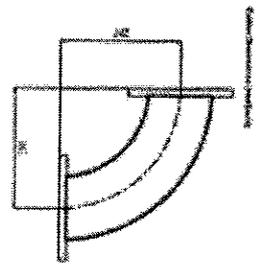
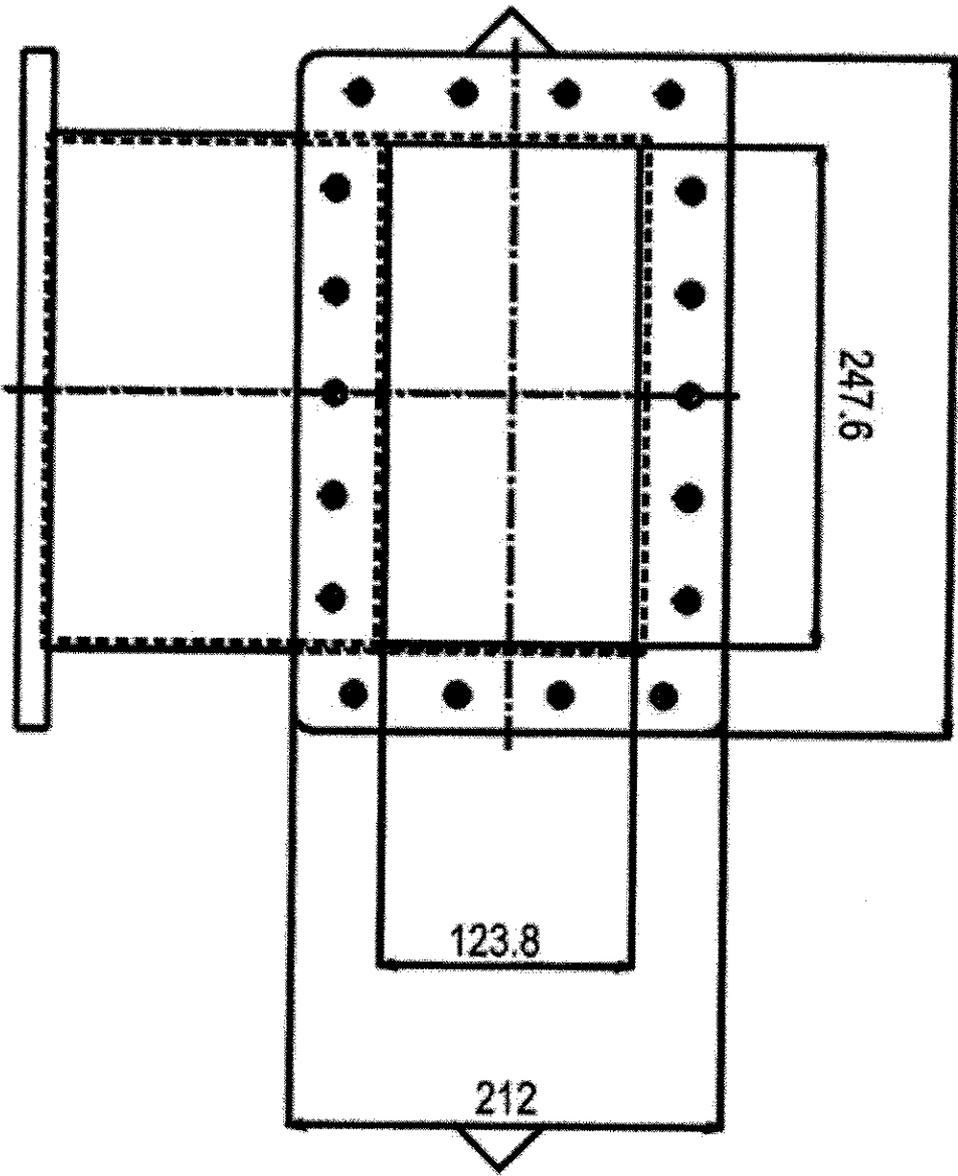
Karima UDR

Termékcsoport Hullámvezető

KÖNYVELZŐK

Outline Dimensions (mm(inch))

336



E-kanyar - MW3007A-260C

Cikkszám : MW3007A-260CC

Hullámvezető alkatrészek

Frekvencia [Mhz] 915

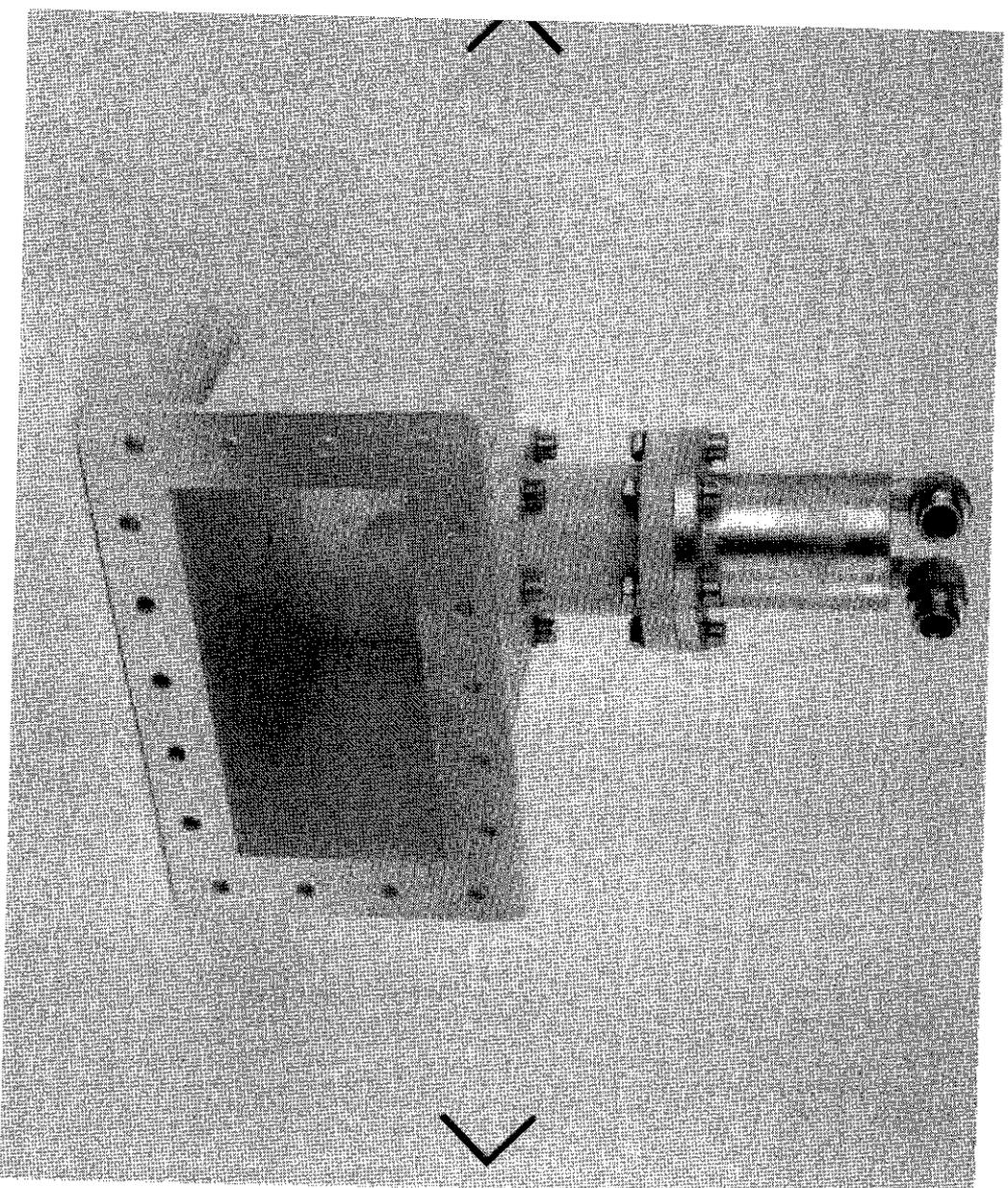
Teljesítmény [W] 100 000

Hullámvezető mérete WR975 / R9

Karima UDR

Termékcsoport Hullámvezető

KÖNYVELZŐK



Vízterhelés - MW1018E-230C

Cikkszám MW1018E-230CD

Hullámvezető alkatrészek

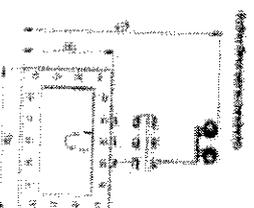
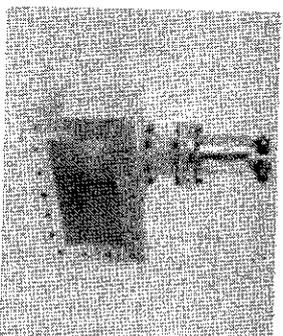
Frekvencia [Mhz] 915

Kimeneti teljesítmény [W] 100000

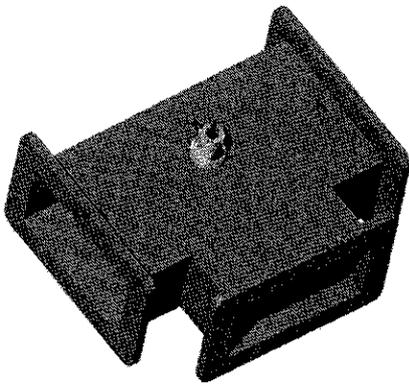
Hullámvezető mérete WR975 / R9

Karima UDR

Termékcsoport Vízterhelés



FIGYELŐLISTA



Industrial Microwave +
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MUEGGE

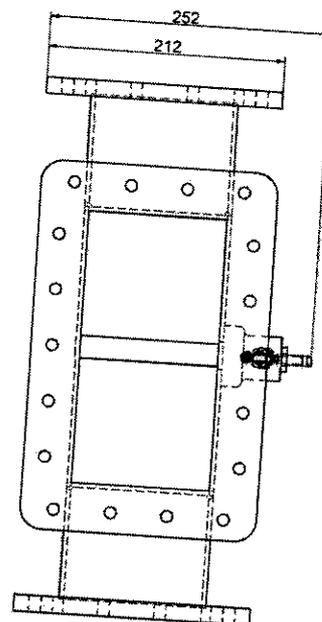
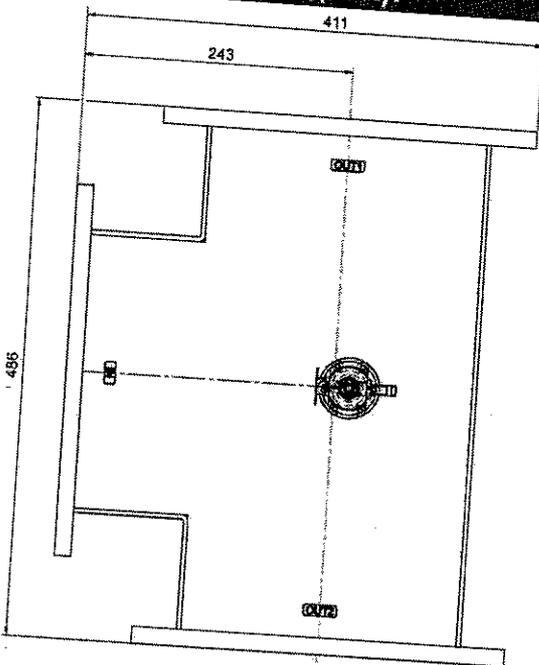
Power Splitter MW3010K-260CC

Waveguide Components (915 MHz / WR 975)

Features:

- H-Power splitter
- Low VSWR
- Low insertion loss
- Full waveguide band performance
- Prepared for UDR/PDR 9 connection

Outline Dimensions (mm):



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Power Splitter MW3010K-260CC

Industrial Microwave +
Plasma Systems



Specifications:

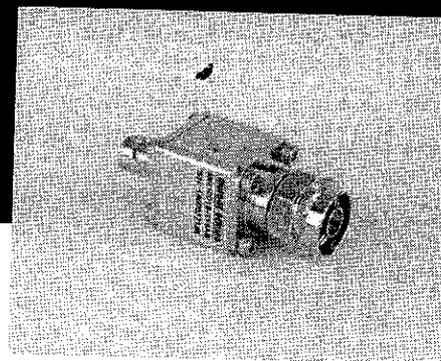
Frequency:	896 - 922 MHz +/-10 MHz
VSWR:	Max. 1.15 : 1
HF-Power:	Max. 100 kW cw
Power splitting:	50 % : 50 %
Tolerance:	+/-5 %
Cooling water:	Flow 3 - 4 l/min, Inlet temperature 20- 25 °C
Temperature monitoring:	Thermo switch 80 °C
Waveguide:	WR 975
Waveguide flange:	UDR 9 (18x 10.4 mm through holes)
Material:	Aluminum
Finish:	Untreated
Dimensions (L x W x H):	486 mm x 411 mm x 252 mm
Weight:	Approx. 12 kg

Options:

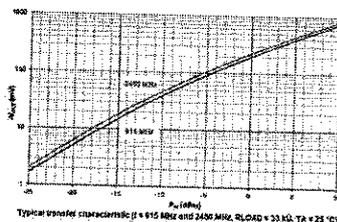
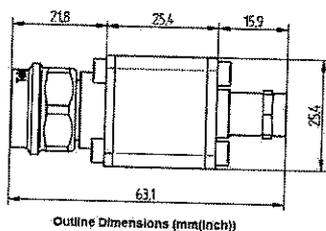
- Material (e. g.: copper, brass, stainless steel)
- Special finish (e. g.: chromated, etched, silver plated, painted)
- Special flanges

DIODS - MM1001B-IIIAB

Category: Waveguide components



GALLERY IMAGES



ADDITIONAL INFORMATION

Frequency [MHz]	915 & 2450
Product group	Detectors / Diodes

BPM214: Bidirectional Power Meter for WR-975 Waveguide

General Description

BPM214 (Fig. 1) is a bidirectional power meter serving for accurate simultaneous measurement of incident and reflected powers up to 100 kW in high-power 900 MHz industrial applications using WR-975 (R-9) rectangular waveguide. Each power meter is calibrated individually.

The BPM integrates a four-port directional coupler with the following components in each of its two channels:

- Zero-bias Schottky diode detector
- Low noise amplifier
- 16-bit A/D converter for sampling detector voltages
- 12-bit D/A converter providing the analog output
- Microcontroller unit (MCU)
- Optional display (common for both channels)

The MCU:

- Controls A/D and D/A conversions.
- Performs detector nonlinearity and temperature dependence correction.
- Generates the following simultaneous outputs:
 - ✓ Two analog outputs, one (FWD) corresponding to the forward (incident) power; one (RFL) to the reflected power.
 - ✓ One digital output (RS232 or RS422 or CAN Bus).

The two analog outputs can be

- voltage output 0 – 10 V; or
- current output 4 – 20 mA.

The desired output type can be switched by the user. Both FWD and RFL outputs are of the same type. The output voltages/currents are linear functions of the microwave powers propagating in the forward and reverse directions of the parent waveguide. The digital outputs provide also internal power sensors temperatures. The RS232 and RS422 outputs have the form of easily readable text streams.

Note: The desired *digital* output type must be specified in the purchase order.

The optional LCD display shows the incident (FWD) and reflected (RFL) powers as well as the internal power sensors temperatures. The powers are displayed both numerically and by bar indicators (see the inset in Fig. 1).

BPM is accompanied by simple Windows-based visualization software **BPM_Monitor**. LabVIEW instrument drivers are also available.

The BPM module is fastened to a parent waveguide by means of eight M3 or similar-diameter screws after machining of appropriate holes in the waveguide wall. As an option, a calibrated assembly consisting of a BPM fixed to a precisely machined parent waveguide with standard or customized length can be provided (Fig. 2). The standard length is 300 mm.

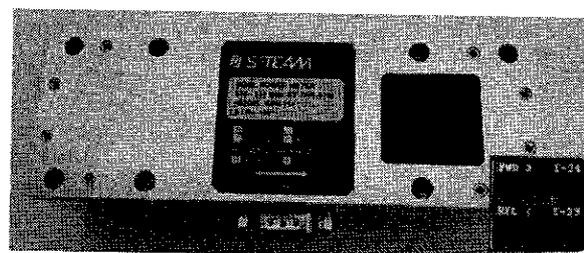


Fig. 1. BPM214 version with LCD display.

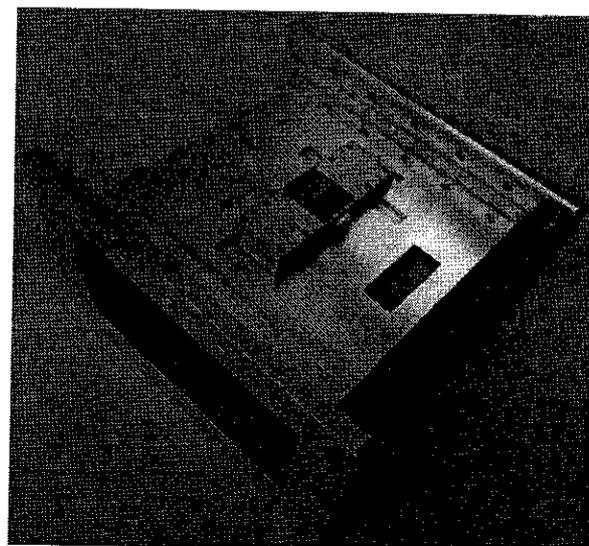


Fig. 2. BPM214 (version without LCD display) installed on the standard-length waveguide.

Specifications

Waveguide of destination	WR-975, R-9 (247.65 mm x 123.825 mm)
Waveguide wall thickness	4 mm (optionally 0.125") \pm 0.025 mm
Waveguide surface flatness at BPM interface	0.04 mm
Frequency range	895 – 925 MHz
Peak working power	1 kW, 3 kW, 5 kW, 10 kW, 30 kW, 100 kW (Note 1)
Directivity	25 dB min
Output voltage polarity	Positive
Power supply voltage	24 V \pm 10% DC
Power consumption	4 W / 6 W (without/with LCD display)
Power supply, analog & digital connector	D-sub 9-pin male
Operating temperature range	-10 °C to +60 °C
Default measurement rate	5 points/s
Max measurement rate	100 points/s (Note 2)
Max sampling duration	5 s (Note 3)

Notes:

1. Peak working power must be specified in the purchase order.
2. Max measurement rate can be reached with high sampling rates and short sampling durations. Details about sampling see in section [Sampling](#).
3. Sampling duration or integration time is the sampling time for obtaining one measurement data point.

Pin Assignment

Pin	Signal	Description
1	VRFL	RFL Power – analog voltage output
2	RX/B-/H	RX (RS232); B- (RS422); H (CAN Bus)
3	TX/A+/L	TX (RS232); A+ (RS422); L (CAN Bus)
4	IFWD	FWD Power – analog current output
5	GND	Negative DC power supply input (0 V)
6	VFWD	FWD Power – analog voltage output
7	IRFL	RFL Power – analog current output
8	SHLD	Shielding, Mass
9	VDC	Positive DC power supply input (+24 V)

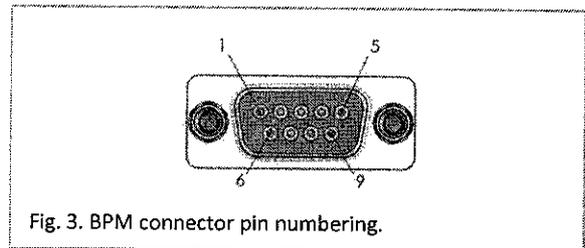


Fig. 3. BPM connector pin numbering.

Notes:

- FWD = incident (forward) power.
- RFL = reflected (reverse) power.
- GND = signal ground.
- GND (pin 5) is isolated from SHLD (pin 8).
- All outputs are referred to GND.
- FWD wave is supposed to propagate in the direction of the arrow on the nameplate.
- Although the pins for the analog voltage output and the analog current output are separate, only one output type can be active at a time.

Nominal Transfer Curves for Analog Outputs 0 – 10 V, 4 – 20 mA

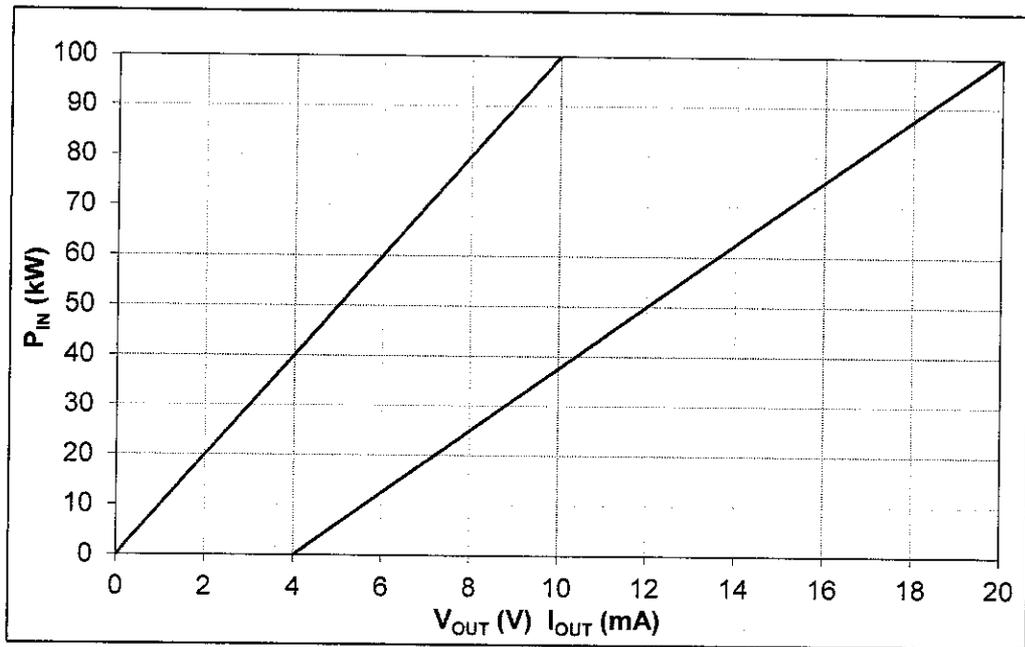


Fig. 4. Nominal BPM transfer curves for analog outputs 0 – 10 V, 4 – 20 mA.

Typical Directivity

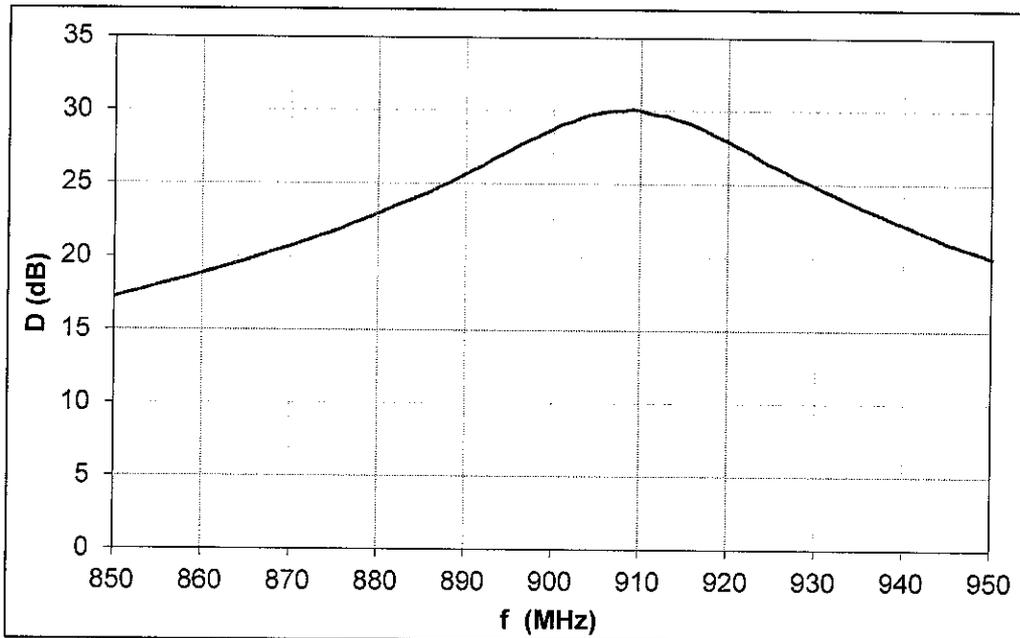


Fig. 5. Typical BPM directivity (both directions).

Typical Linearity Error for Analog Outputs 0 – 10 V, 4 – 20 mA

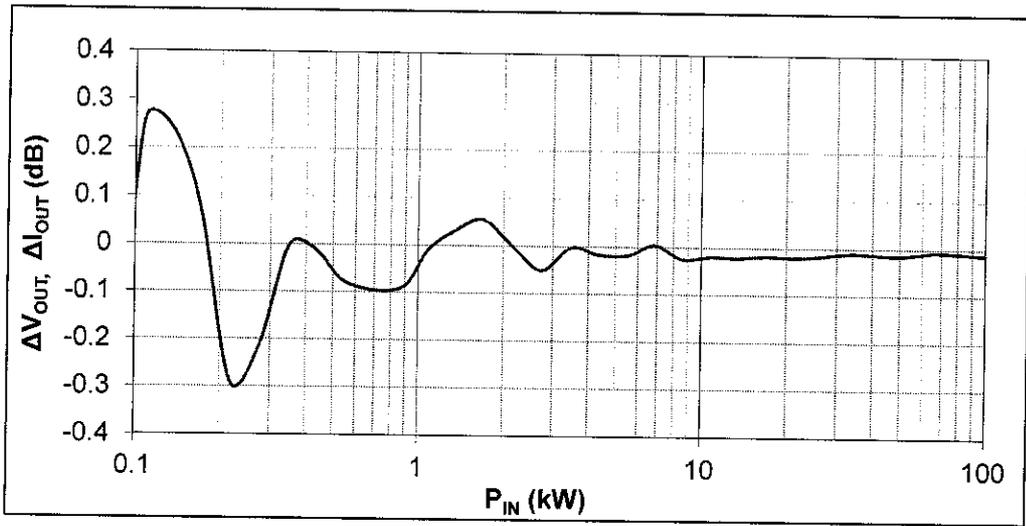


Fig. 6. Typical BPM linearity error for analog outputs 0 – 10 V, 4 – 20 mA.

Typical Linearity Error for Digital Outputs

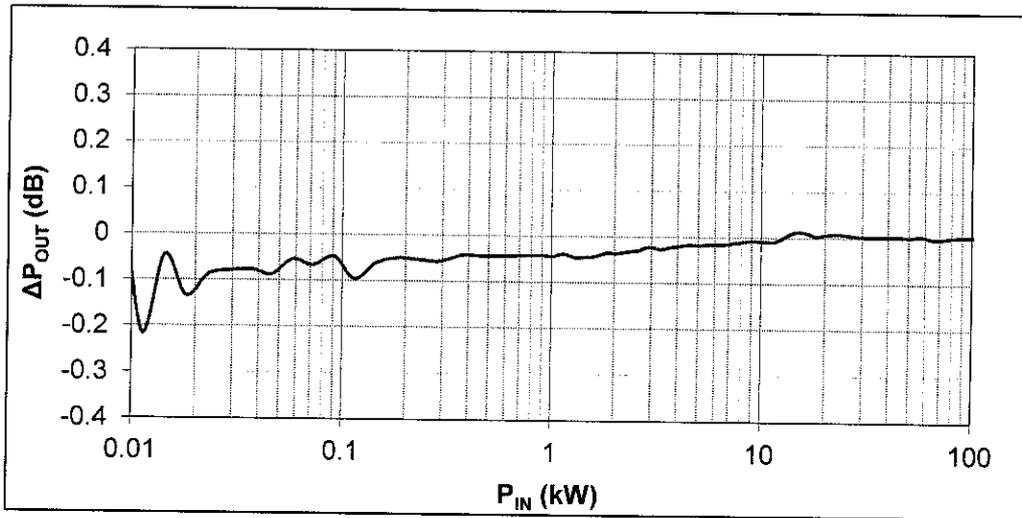


Fig. 7. Typical BPM linearity error for digital outputs.

Sampling

Both analog and digital outputs are obtained as a result of averaging over a number N_s of signal samples taken with a specific *sampling rate* f_s over a specified time T_s (sampling duration, integration time). The quantities governing the sampling are constrained by the relation

$$T_s = \frac{1}{f_s} (N_s - 1) = \Delta t_s (N_s - 1)$$

where $\Delta t_s = 1/f_s$ is *sampling period* (time distance between two consecutive samples). The user controls sampling by defining Δt_s and N_s ; the resulting sampling duration T_s is then computed using the above equation.

The values of Δt_s and N_s can be set by either of these two methods:

- Via any RS232 terminal installed in a PC (see section [BPM User Menu](#))
- Using the **Terminal** window in the auxiliary [BPM Monitor](#) application

The sampling period Δt_s can be varied in the range 12 μ s to 10 ms with 1 μ s step.

Sample count N_s is defined indirectly in terms of *averaging exponent* E_s where $N_s = 2^{E_s}$. The exponent can assume the values $E_s = 0, 1, 2, \dots, 11$. Consequently, $N_s = 1, 2, 4, \dots, 2048$.

To prevent the built-in watchdog activation (occurring after 8 seconds of master MCU inactivity), the maximum allowable integration time T_s is 5 seconds. The user is automatically prevented from entering values of Δt_s and N_s that would result in higher T_s .

Sampling Rules. If the signal level is not stable but fluctuates (e.g. due to ripples in magnetron power supply voltage and/or periodically varying load), two rules in choosing Δt_s and N_s should be adhered to for accurate and stable mean power display:

1. If the slowest oscillations (ripples) observed in the signal have period $T_{r\max}$, sampling time T_s should be equal to an integral multiple of $T_{r\max}$, i.e.

$$T_s = n T_{r\max}, \quad n = 1, 2, \dots$$

Alternatively, T_s can be chosen much (at least ten times) higher than $T_{r\max}$:

$$T_s \geq 10 T_{r\max}$$

2. Sampling rate f_s should be at least ten times higher than the *highest* ripple frequency observed in the signal. The minimal sampling period is 12 μ s (the maximal sampling rate 83 kHz), which enables to cover amplitude- or pulse-modulated signals with modulation frequencies up to about 10 kHz.

If the signal level is stable (CW, low-ripple), any sampling settings will theoretically do. To reduce noise and interference, however, N_s and T_s should not be needlessly low. The default settings below are a good compromise.

Default Settings. The default sampling period is $\Delta t_s = 100 \mu$ s. This corresponds to sampling rate $f_s = 1$ kHz, ensuring correct sampling of signals with ripple frequencies up to about 100 Hz. The default averaging exponent is $E_s = 11$, hence $N_s = 2048$. These default settings result in integration time $T_s = 204.8$ ms.

Results Refresh Rate. Due to the data processing overhead, maximal cadence of results production is limited to approximately 100 measurements per second even if sampling with the highest rate f_s and lowest sample count N_s .

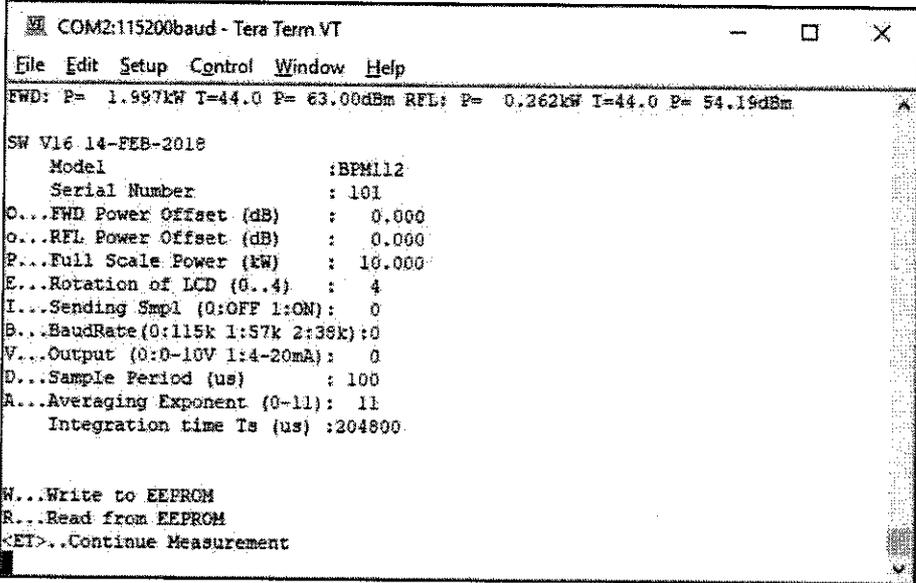
BPM User Menu

The BPM User Menu serves for:

- Configuring the signal sampling.
- Switching the type of analog output.
- Setting of RS232 baud rate.
- Changing orientation of the LCD display.
- Scaling the analog outputs.
- Introducing power offset to measured data (e.g. to correct for a waveguide wall thickness differing from the nominal).

An RS232 terminal installed in your PC is needed for this. The BPM User Menu is invoked by transmitting ASCII character x (ASCII #32) from the terminal (pressing the lower-case x key on the PC keyboard). Example of BPM User Menu is shown in Fig. 9. For details, see the application note [AN1601-BPM_UserMenu.pdf](#).

An alternative approach is using the auxiliary BPM Monitor application.



```

COM2:115200baud - Tera Term VT
File Edit Setup Control Window Help
EWD: P= 1.997kW T=44.0 P= 63.00dBm RFL: P= 0.262kW I=44.0 P= 54.19dBm

SW V16 14-FEB-2018
  Model          :BPM112
  Serial Number  : 101
O...FWD Power Offset (dB) : 0.000
o...RFL Power Offset (dB) : 0.000
P...Full Scale Power (kW) : 10.000
E...Rotation of LCD (0..4) : 4
I...Sending Smpl (0:OFF 1:ON): 0
B...BaudRate(0:115k 1:57k 2:38k):0
V...Output (0:0-10V 1:4-20mA): 0
D...Sample Period (us) : 100
A...Averaging Exponent (0-11): 11
  Integration time Ts (us) :204800

W...Write to EEPROM
R...Read from EEPROM
<ET>..Continue Measurement
  
```

Fig. 9. BPM User Menu (Model differs in case of BPM214).

BPM Monitor

The BPM is accompanied by a simple LabVIEW-based Windows visualization application **BPM_Monitor**. An example of the program window is shown in Fig. 10.

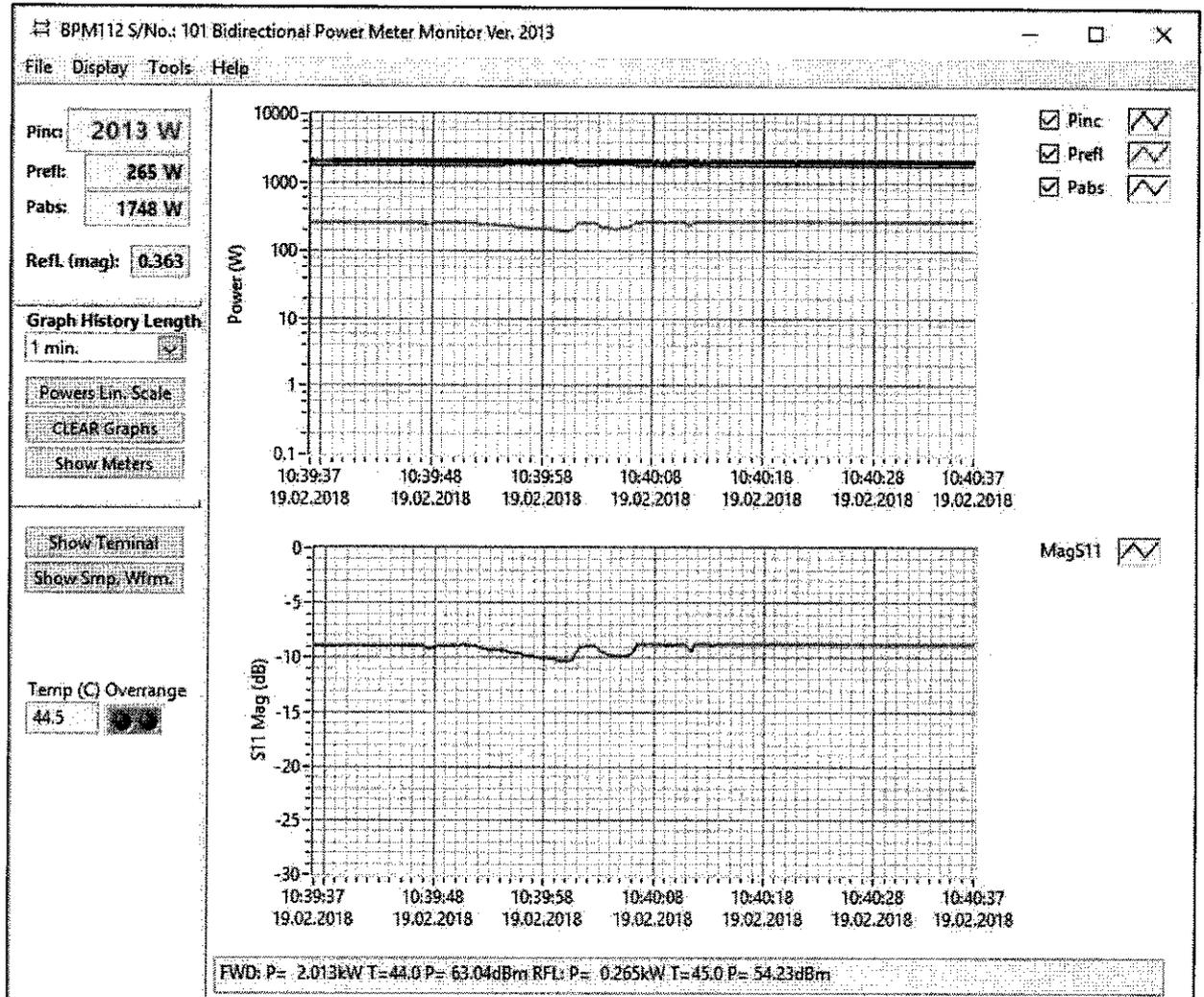


Fig. 10. BPM Monitor screen example.

The **BPM Monitor** is a program for monitoring and controlling BPM devices. It displays the incident, reflected and absorbed powers as time dependence graphs. Reflection coefficient magnitude is also displayed in a separate graph. The history of the graphs can be extended to up to 24 hours. All data on graphs can be easily exported to Excel for analysis.

The BPM Monitor also contains a simple RS232 **Terminal** dialog (Fig. 11) for setting the internal BPM parameters in a more user-friendly way compared to the [BPM User Menu](#).

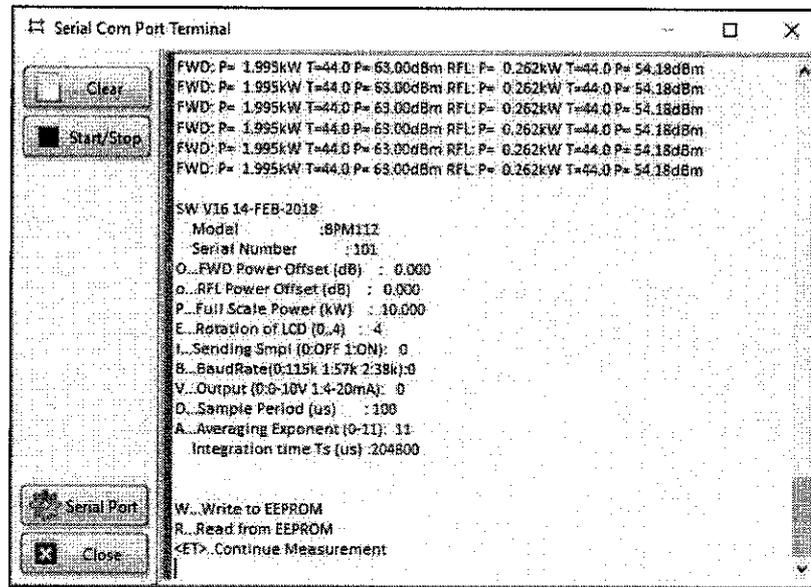


Fig. 11. Serial COM Port Terminal window of the BPM Monitor. The example displays BPM User Menu.

A more detailed analysis of the generator output waveform can be performed with help of Samples Waveform and FFT Dialog windows, showing, in turn, the output power time dependence and its power spectrum (Fig. 12).

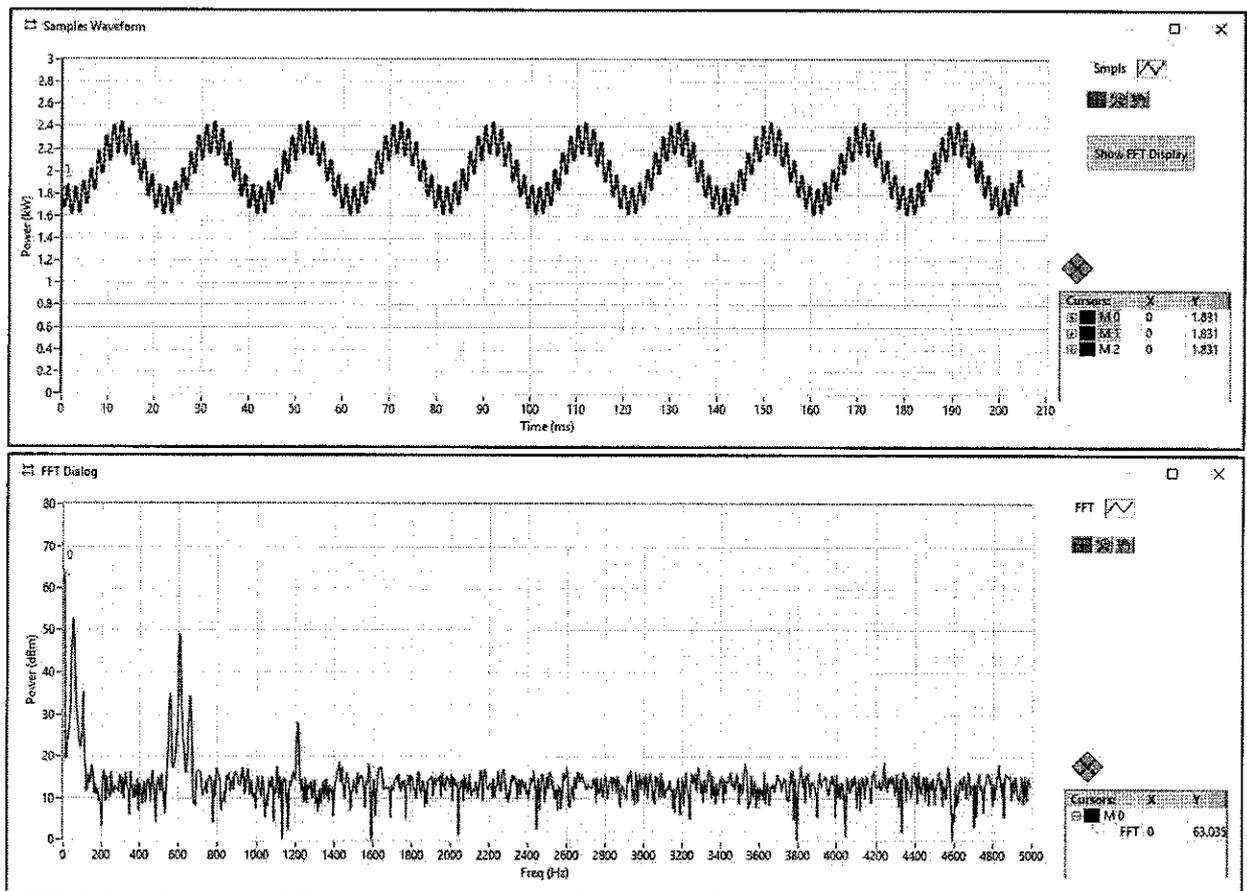


Fig. 12. The BPM Samples Waveform and FFT Dialog windows for a twelve-pulse bridge rectifier.

For LabVIEW programmers wishing to build their own applications, there is a BPM library of virtual instruments available. The library is a part of the BPM Monitor installation package.

If you wish to use the Monitor, please proceed as follows:

- Locate the installation on the CD accompanying the product. Alternatively, download the latest installation from http://www.s-team.sk/files/?target=BPM_Monitor (zipped in a file such as **BPM_MonitorV2031.ZIP**).
- In case of zipped installation, unpack the zip file.
- Run the installation (**setup.exe**).
- After installing, connect the BPM to your PC. You will need:
 - 24V DC power supply.
 - Extension cable, branching the DC power supply inputs VDC and GND to the power supply and TX, RX, GND pins to standard D9 RS232 connector. You have to make this extension yourself.
 - Standard RS232 cable (a null modem, i.e. a type with crossed RX/TX leads).
 - RS232-to-USB adapter. In case of problems, we recommend the Brainboxes US-101 (supplied worldwide e.g. by Farnell).

An example of the BPM connection with a PC is shown in Fig. 15. The same connection applies to the COM Port Terminal emulator.

- On the PC, run **BPM_Monitor.exe** (shortcut  found on the PC desktop). In the program, you will be asked to choose an appropriate COM Port. Then the measurement should start.

Analog Voltage Outputs Wiring

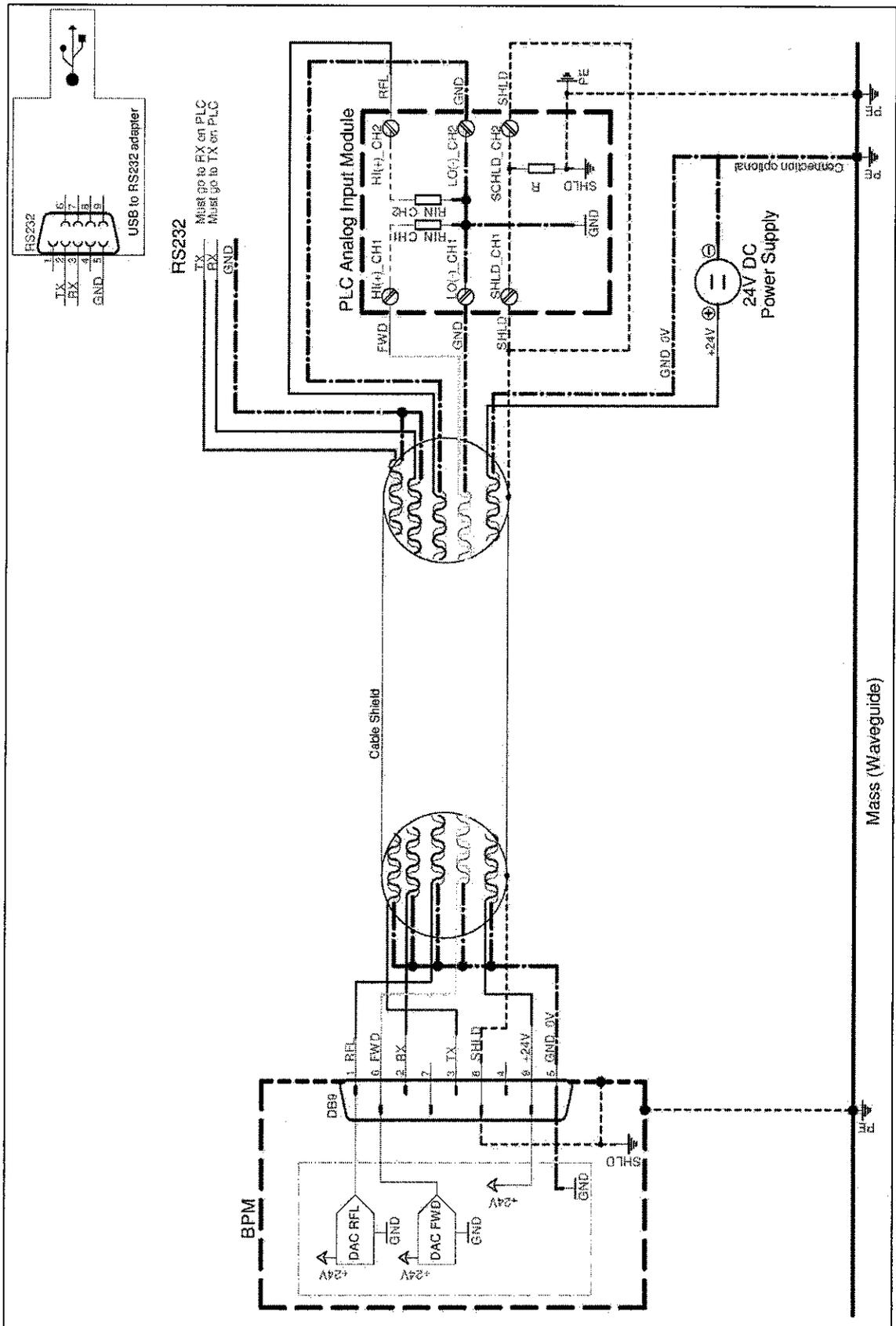


Fig. 13. Example of BPM – PLC wiring for the analog voltage outputs.

Analog Current Outputs Wiring

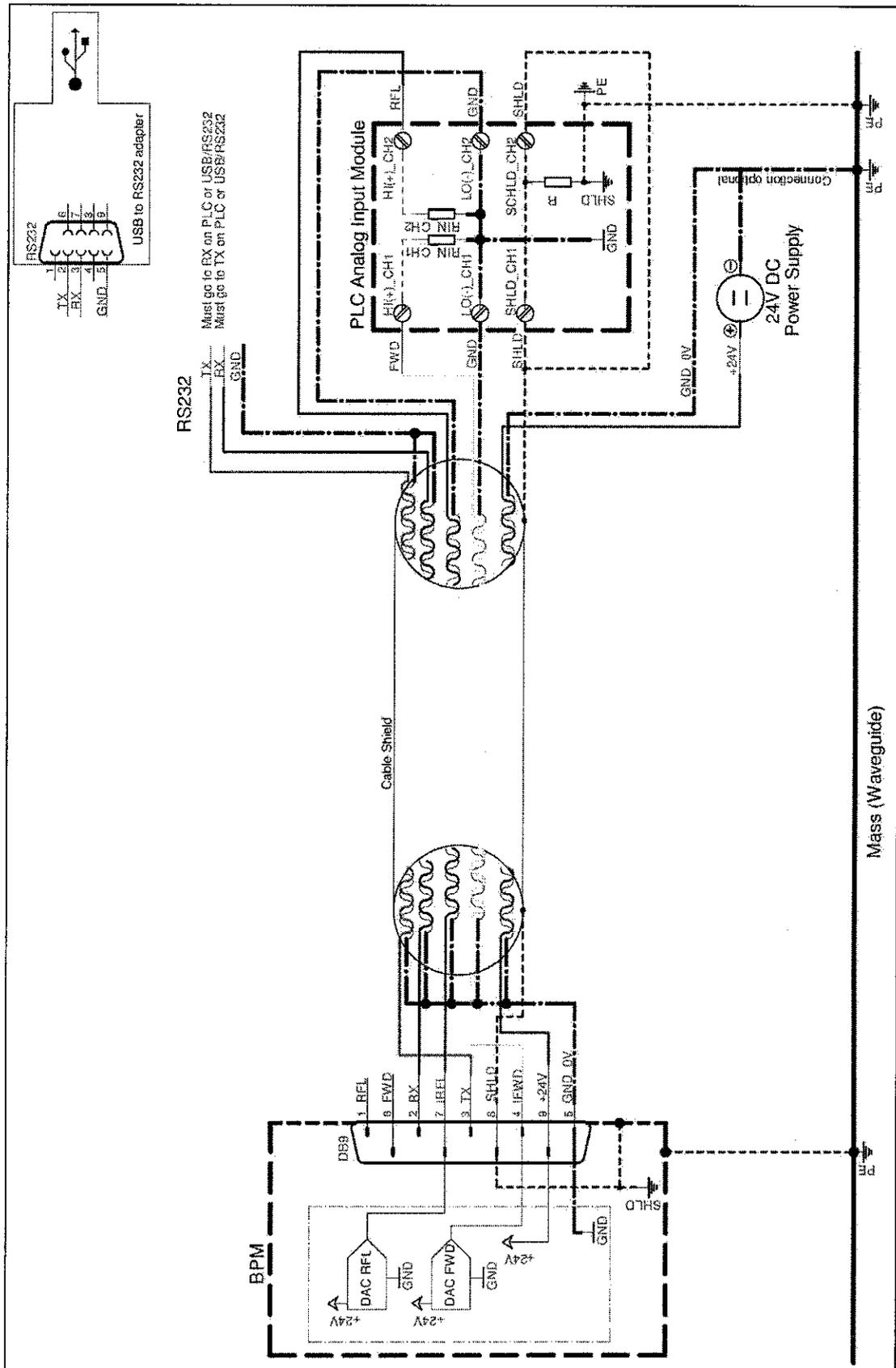


Fig. 14. Example of BPM – PLC wiring for the analog current outputs.

Example of BPM Connection

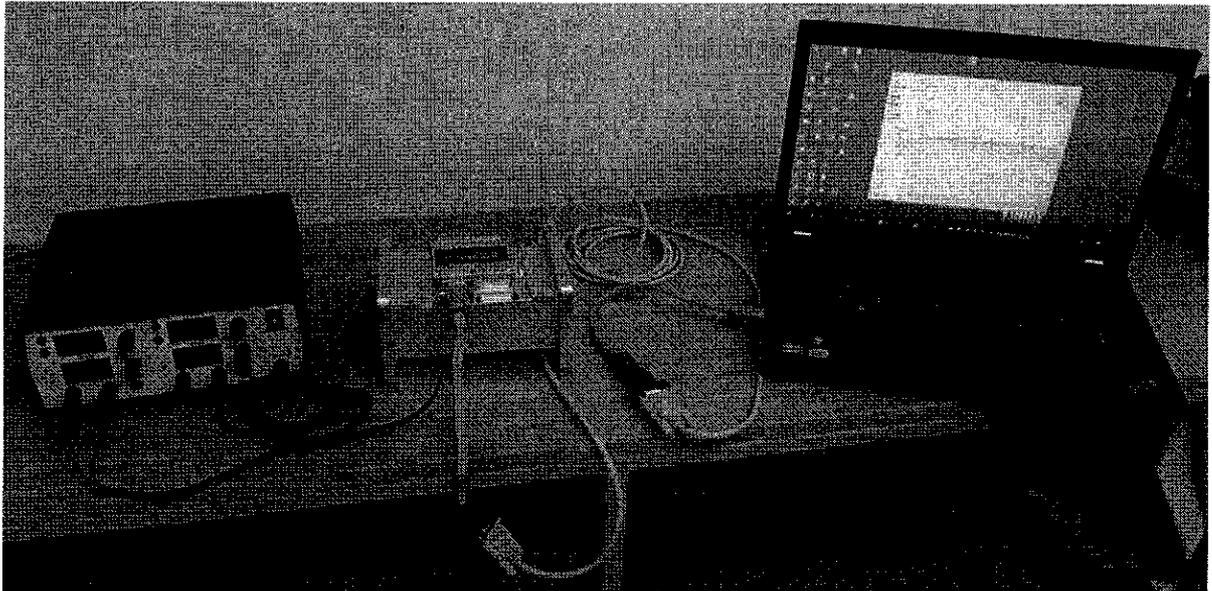


Fig. 15. Illustration of BPM – PC connection.

Dimensional Drawing

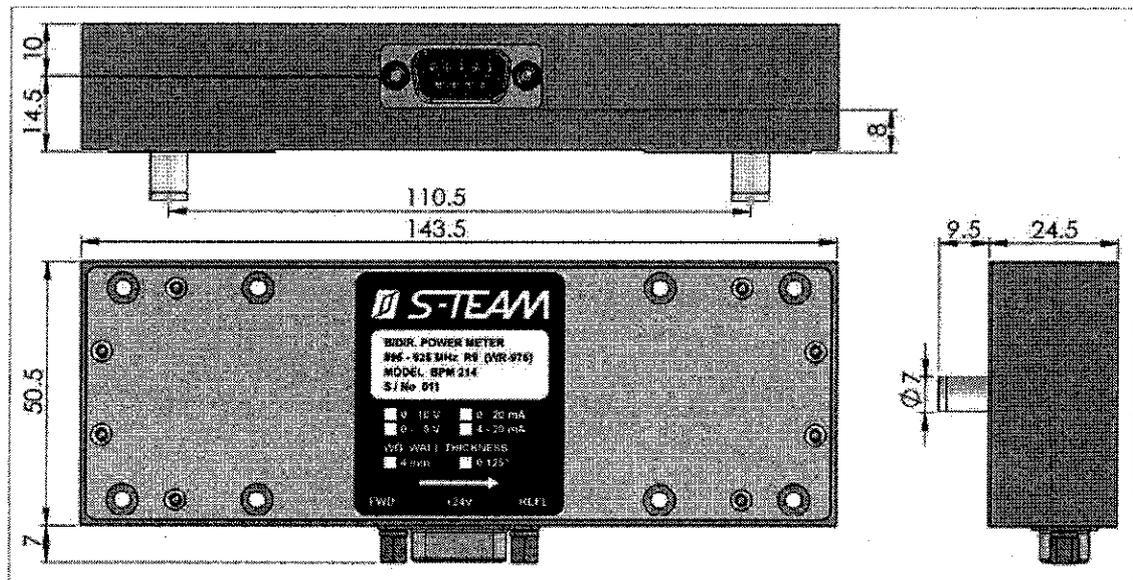


Fig. 16. Basic BPM214 dimensions. All dimensions are in millimeters.

Waveguide Machining Template

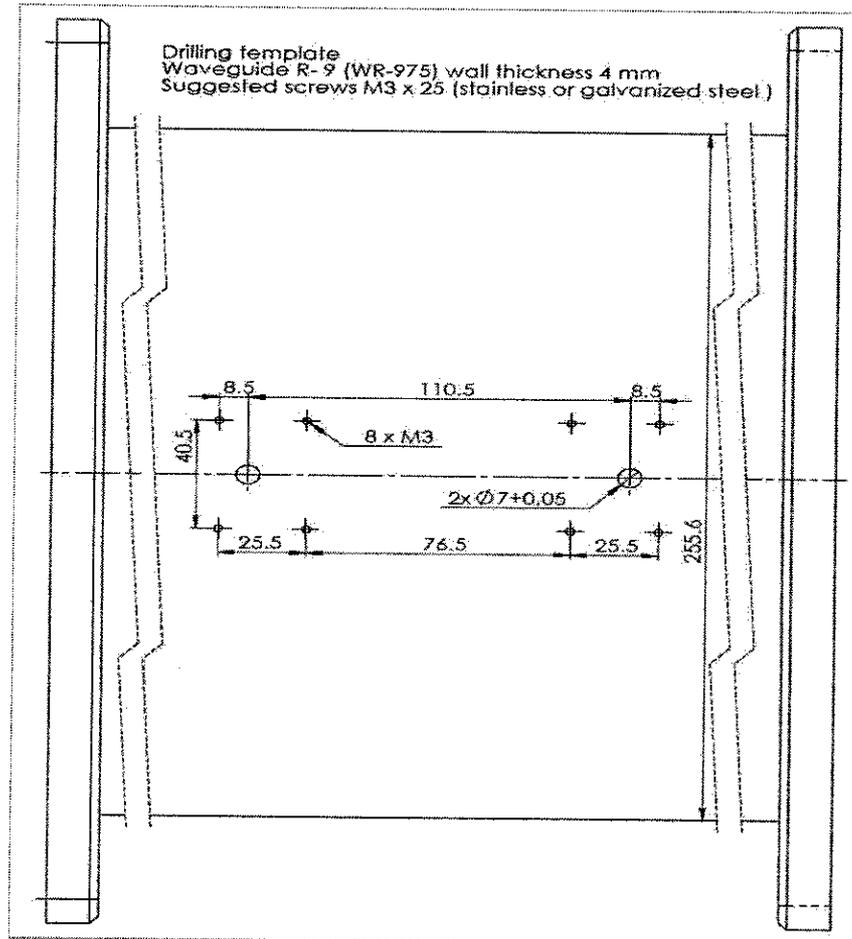


Fig. 17. Waveguide machining template. All dimensions are in millimeters. The pattern is centered about the waveguide axis. Unless the option 0.125" is requested, the waveguide wall thickness must be 4 mm.

Important Note

Complying with the specified waveguide wall thickness and flatness of its surface interfacing with the BPM is essential for the specified measurement accuracy. The slope of the coupling factor as a function of the wall thickness is about -0.6 dB/mm (increasing the wall thickness decreases the output power readings).

If the wall thickness differs from the specified figure but is known, a user-defined correction based on the above slope can be applied. Nevertheless, the wall thickness should not deviate from the specification by more than ± 0.3 mm, otherwise the BPM directivity will deteriorate.

To avoid problems with manufacturing precision waveguide components, a calibrated assembly consisting of a BPM module fixed to a parent waveguide can be ordered. Standard waveguide length is 300 mm; customizing the length is possible.