



PRODUCT DATASHEET

263 GHz Klystron Assembly

The klystron is a microwave source for DNP in solid-state NMR at 400 MHz. Its high power and frequency stability allow ultrasensitive experiments from simple 1D to extended multidimensional studies. The klystron assembly consists of:

1. Extended interaction klystron oscillator,
2. high-voltage power supply and distribution units,
3. low-loss microwave transmission line with optimized taper coupling to Bruker DNP NMR probes,
4. compact, air-cooled chiller,
5. safety interlocks,
6. control system with detailed system monitoring and performance logging,
7. graphical user interface for straightforward operation,
8. mounting and rail system to underside of magnet for convenient positioning of klystron (fine adjustments with precision xyz and tilting stages) and for parking klystron aside during probe exchange.

The klystron is compatible with 400WB Ascend DNP magnets and Bruker DNP probes.

Safety interlocks are included to ensure microwaves are on only for cold sample conditions (for sample safety), with closed transmission line (for personal safety), and under appropriate operating conditions of the chiller and power supply. For certain cases, an interlock bypass may be provided, e.g., to enable microwave operation for cases where DNP is effective with a warm sample.

Model:

263 GHz Klystron Assembly, BH4100

DNP Efficiency:

DNP signal enhancement ≥ 150 on 250 mM ($U\text{-}^{13}\text{C},^{15}\text{N}$) proline in glycerol- d_8 /D₂O/H₂O (60/30/10 by volume) with 12 mM of AMUPol biradical, as packed in 3.2 mm sapphire rotor with 25 μl sample volume and with a Bruker DNP probe.

Enhancement measured as microwave on/off ratio of $\{^1\text{H}\}^{13}\text{C}$ CPMAS spectra collected at 8 kHz MAS frequency, ≤ 100 K sample temperature, with 8 scans, 2 dummy scans, and 10 s recycle delay.

DNP signal enhancements on other samples depend on experimental conditions, such as polarizing agent, sample preparation, spinning frequency, sample temperature, rotor material, and microwave power.



Klystron DNP installation, with control cabinet in left foreground, in front of chiller (not visible) and 2-bay solids NMR console and NMR magnet (both sold separately). The klystron mounts to a 400 MHz WB Ascend DNP magnet, highlighted at right inset.





Specifications and Requirements:

Microwave source type	Klystron (Extended Interaction Klystron / EIK) oscillator
Mode of operation	Minimum 10-day continuous operation
Operation frequency	263 GHz, frequency matched for DNP NMR applications
Frequency stability	$\leq (\pm 15 \text{ ppm})$ over 12 h, after initial warmup of $\geq 3 \text{ h}$. Observed frequency stability may vary depending on environmental factors impacting HV power supply and temperature regulation by the chiller.
Output power range	1 - 5 W in discrete steps
EIK input power requirements	Three phase, 380 to 415 VAC, 16 A, 47 to 63 Hz (voltage L-L with Neutral and separate protective earth)
Microwave output	Linearly polarized, WR4.3 flange
Transmission line	Overmoded Gaussian beam/HE11 and coupling into 7.6 mm ID probe waveguide (as standard on Bruker DNP probes)
Control system	Single-bay console with control electronics for monitoring, safety interlocks, user GUI, high-voltage power supply and chiller
Chiller for EIK circuit	Air-cooled chiller included with system <ul style="list-style-type: none">• Single phase 208 to 230 VAC, 16 A, 50 Hz or 20 A, 60 Hz• Dimensions: 74 cm x 44 cm x 68 cm (H x W x D); D = 84 with added filters, etc. Heat dissipation: 3.5 kW total from EIK and chiller
Compatibility	400 MHz WB Ascend DNP NMR magnet 400 MHz/263 GHz Bruker DNP probes
Power supply for NMR sweep coil	For operation of NMR sweep coil on Ascend DNP WB magnets
Site requirements	Contact Bruker for detailed site planning
System maintenance	Required basic system maintenance includes periodic exchange of chiller particle and de-ionization filters, cleaning or replacement of air-intake filters on chiller and control system electronics. LabScape service & maintenance plans are available which include the above activities and inspections of the high-voltage system, the chiller, and inspection and exchange of hoses and fittings, as well as interlock systems and performance checks.

Specifications are valid as of June 13, 2024. Technical data and specifications subject to change without notice.

