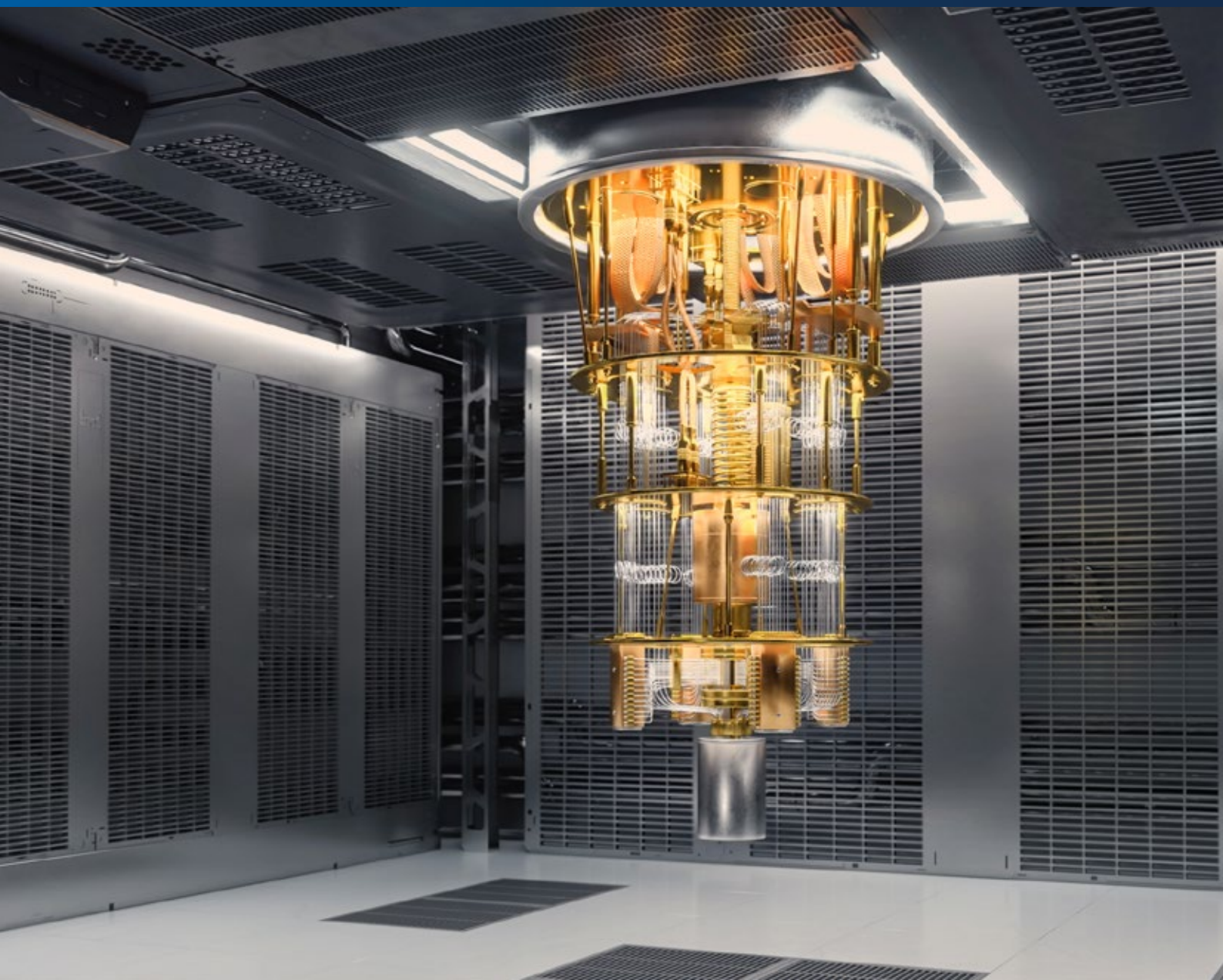
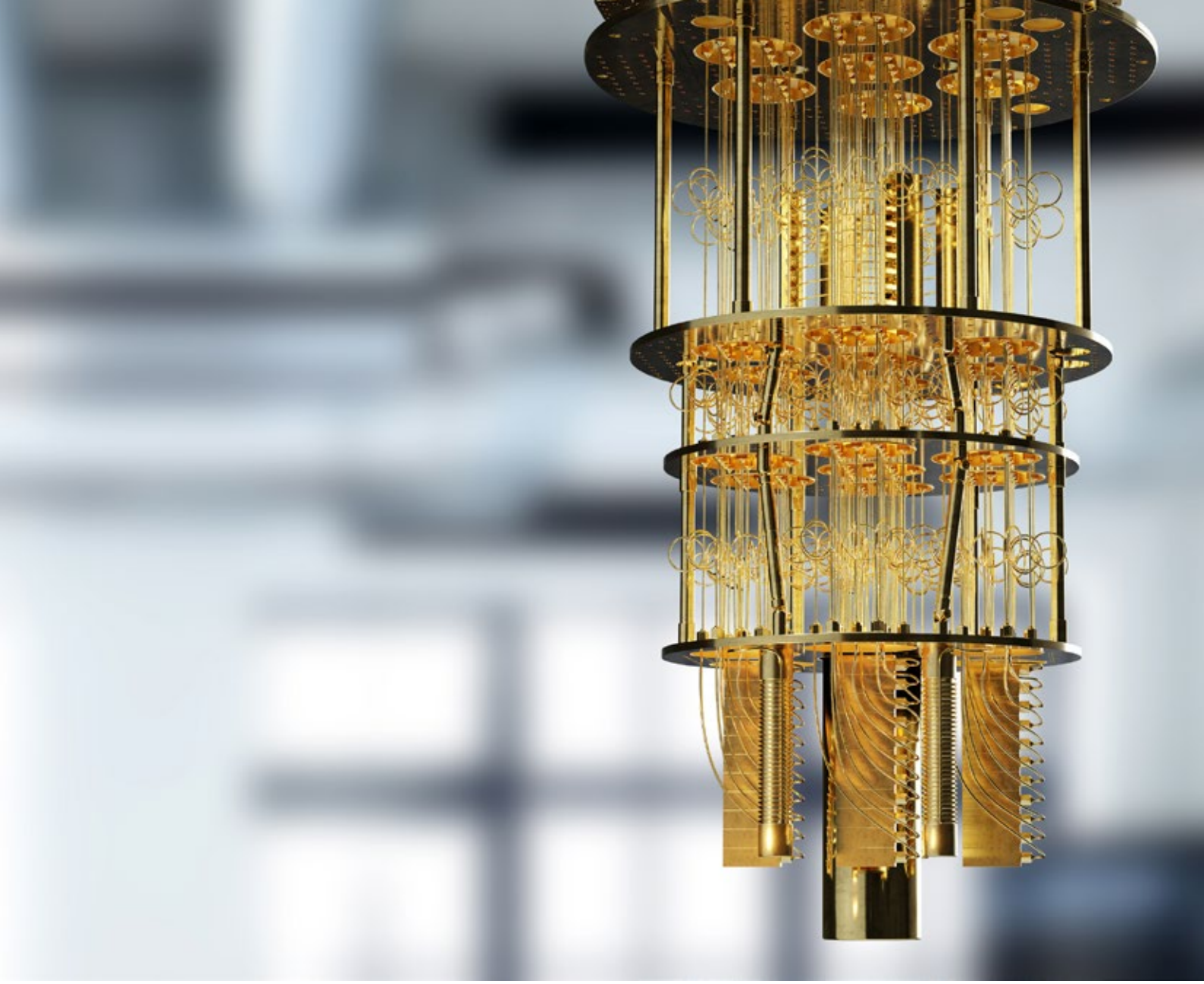
Rosenberger

Solutions for Extreme Cold Environments

Cryogenic and Quantum Technology

SEMICON & TEST





Introduction

With extensive expertise in RF technologies, Rosenberger understands the current and future challenges of quantum computing. To mitigate the effects of thermal fluctuations, electromagnetic radiation and magnetic fields within cooling systems, we provide a comprehensive range of solutions for cryogenic applications.

Beyond our robust product portfolio, we leverage state-of-the-art precision manufacturing capabilities to offer virtually unlimited customization options.

As the demand for higher connection densities, smaller connectors and multi-channel solutions grows, we continuously develop innovative technologies to meet the evolving requirements of quantum computer manufacturers and research institutions.

Rosenberger is committed to delivering high-performance components and complete subsystems for every dilution refrigerator system.



About Rosenberger

Rosenberger is a global leader in high-precision connectivity solutions for high-frequency, high-voltage and fiber optic technologies. Our advanced products ensure the reliable transmission of signals, data and power in demanding applications, including mobile and telecommunications, data centers, test and measurement, automotive electronics, industrial automation, medical technology and aerospace and defense.

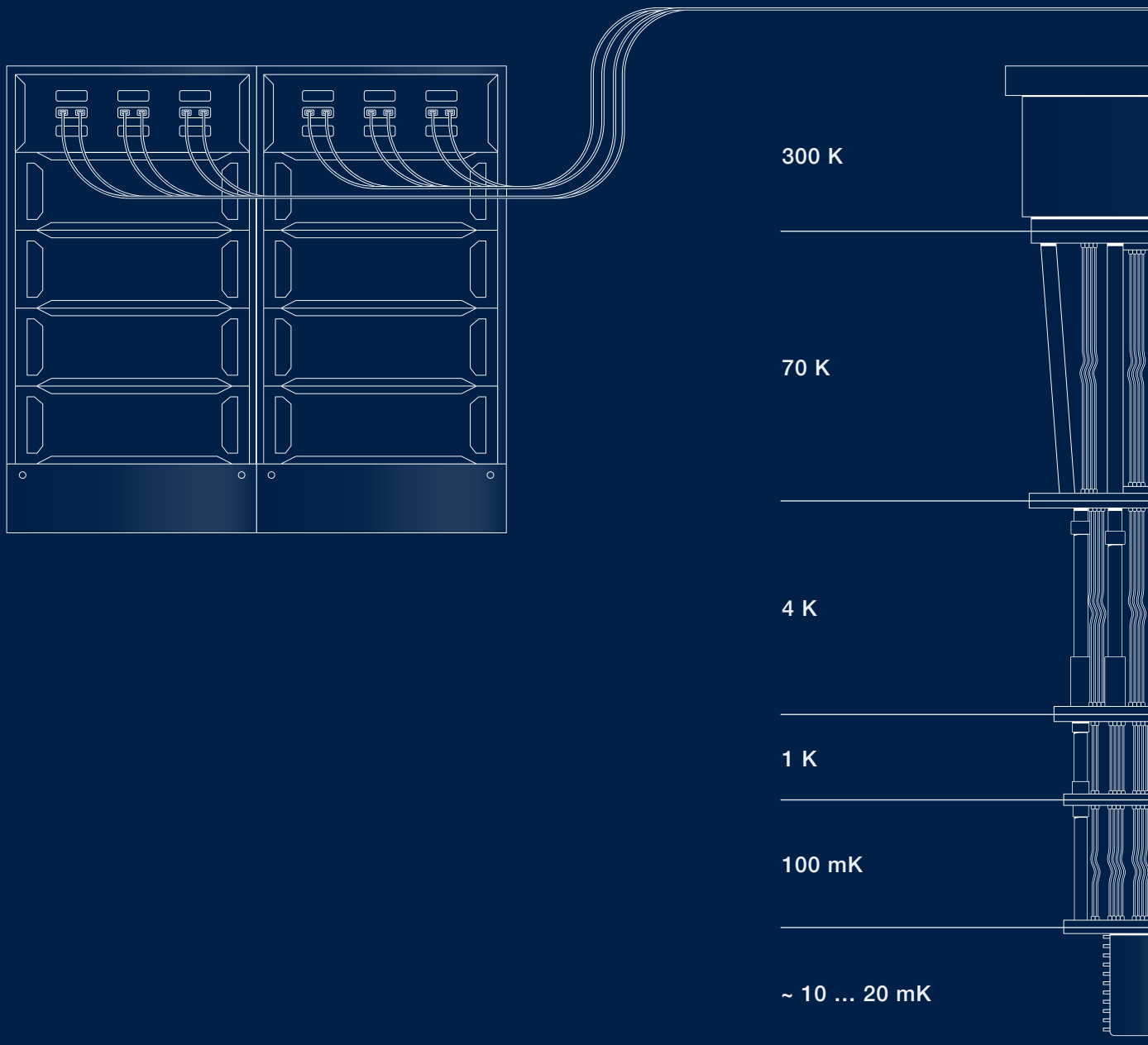
At Rosenberger, we bring technology competencies together under one roof – from the initial concept and prototyping to full-scale series production. Our highly automated manufacturing processes enable the large-scale production of innovative, high-quality products.

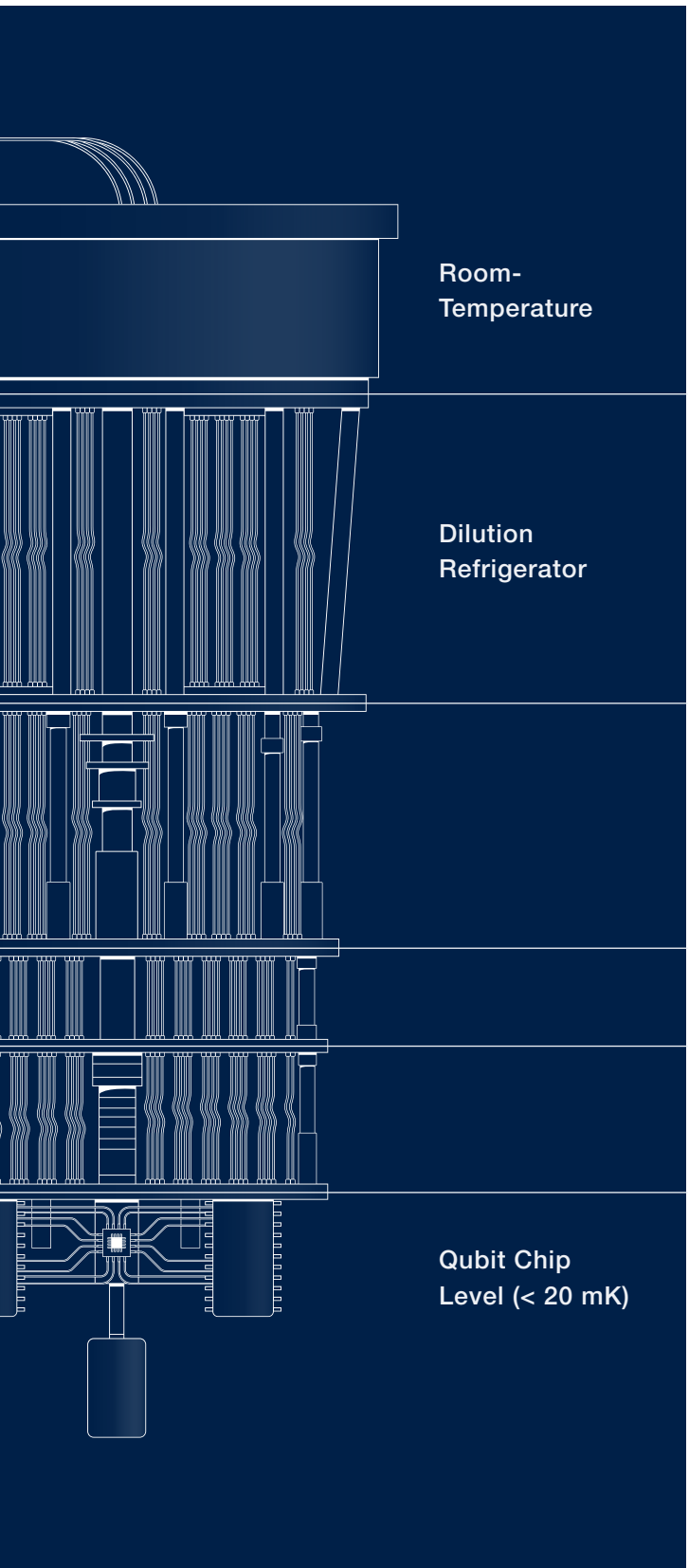
Since our founding in 1958, Rosenberger has remained dedicated to innovation, precision and quality.

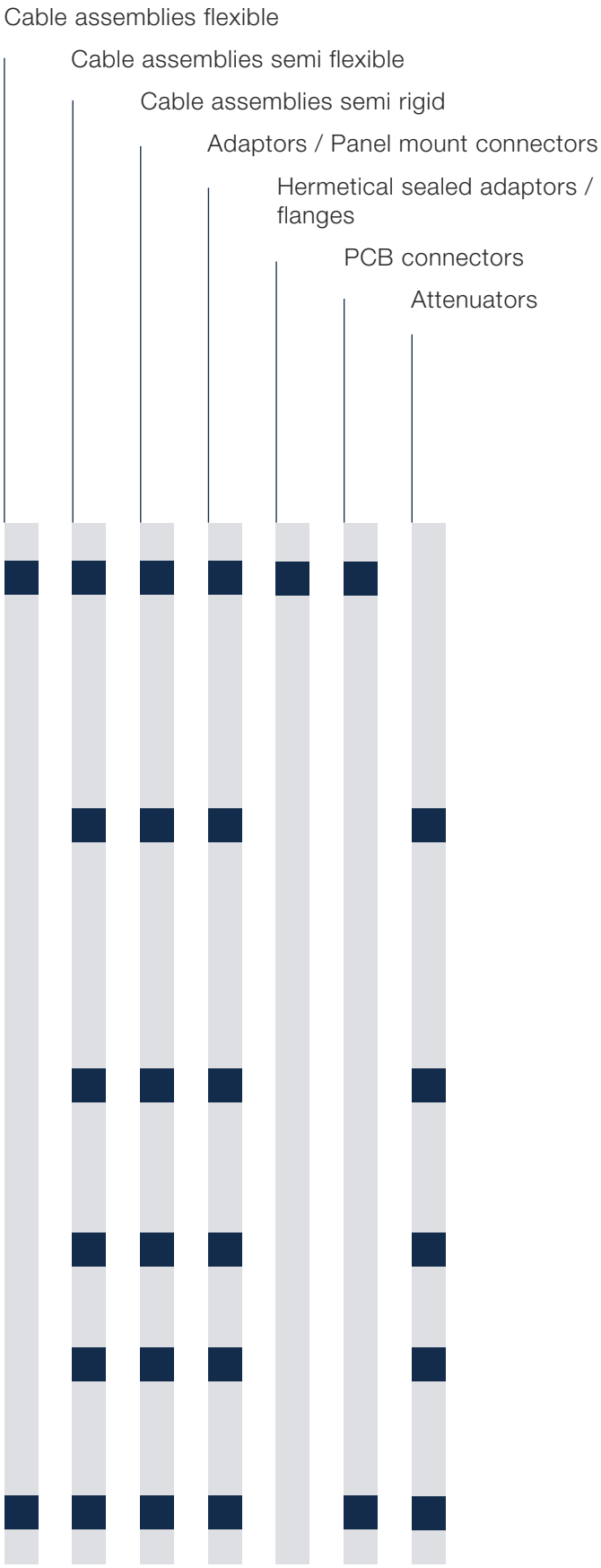
As a family-owned company, we prioritize long-term reliability, technical excellence, and customer-driven solutions.

Solutions for Dilution Refrigerators

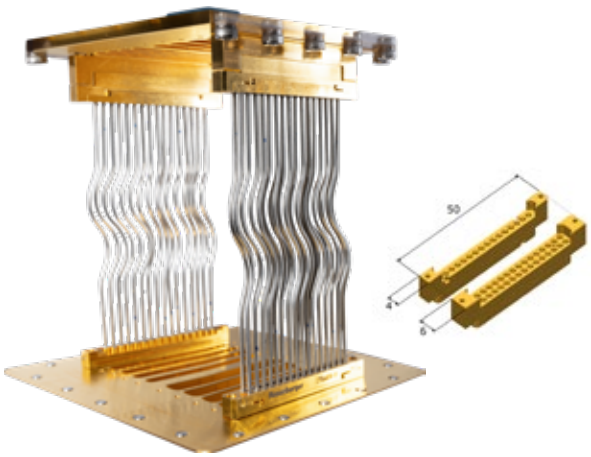
For all cryogenic conditions, Rosenberger provides high-precision connectivity solutions designed to ensure reliable signal transmission.




Room-
Temperature
Dilution
Refrigerator
Qubit Chip
Level (< 20 mK)


Cable assemblies flexible
Cable assemblies semi flexible
Cable assemblies semi rigid
Adaptors / Panel mount connectors
Hermetical sealed adaptors / flanges
PCB connectors
Attenuators

Multichannel Connectors for Quantum Computing



Multichannel WSMP®

Specifications

Frequency Range:	DC to 65 GHz
Interface:	WSMP® (SMP3, IEC 61169-69 in progress)
Dimensions:	1 x 16 (single row) – 4 mm x 50 mm
	2 x 16 (double row) – 6 mm x 50 mm
Pitch:	2.45 mm
Mating cycles:	≥ 500

Features

- Additional mechanical fixing via screws
- Thermal coupling at each temperature stage with adaptors
- Copper based non-magnetic materials with AuroDur® plating
- Channel 1 marking
- Anti-rotation protection

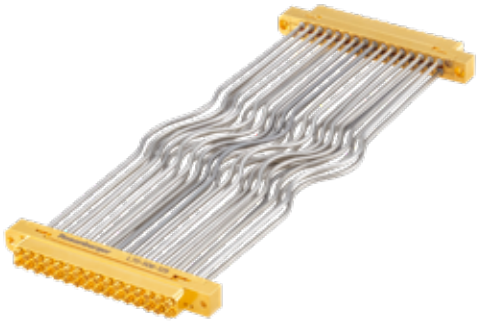
Cable Assemblies

Rosenberger offers high-quality cable assemblies for quantum computing applications, including flexible, semi-flexible and semi-rigid variants, as well as custom solutions.

For cryogenic environments and superconducting systems, we develop semi-rigid assemblies with optimized soldering processes to ensure maximum electrical and mechanical stability. Our connectivity technologies provide minimal signal attenuation, excellent shielding and maximum reliability – even under extreme temperature conditions.

Features

- Available in 16- and 32-channel versions
- Customizable cable lengths for various applications
- High-quality soldered connectors for reliable signal transmission
- Single coaxial lines in a multichannel housing allows replacement of individual lines or mixed configurations
- 100% RF performance testing of each individual line at room temperature
- Ensuring highest signal quality and operational reliability



Semi Rigid Cables

- UT-047 (1.19 mm) as standard
- S-shape bending for length compensation during temperature changes
- Variety of different materials available
  - Stainless steel
  - Silver plated stainless steel
  - CuproNickel
  - Silver plated CuproNickel
  - BerylliumCopper
  - NiobiumTitantium



Semi Flexible Cables

- Non-magnetic RTK-FS 047-SPC (1.19 mm) as standard
- Hand-formable cable, with tin dipped braid
- Different fan-out solutions possible (e.g. SMA, SMP)



Flexible Cables

- Non-magnetic RTK 047-F2-18 (1.19 mm) as standard
- Flexible cable with FEP jacket
- Different fan-out solutions possible (e.g. SMA, SMP)

Multichannel Connectors for Quantum Computing

Connectors, Adaptors, Attenuators and PCB Connectors

Rosenberger offers high-quality connectivity solutions designed for demanding applications. Engineered for precision and reliability, our solutions ensure minimal signal loss, excellent shielding and maximum performance in critical environments.

Available in 16- and 32-channel versions, our products meet the highest industry standards for high-frequency applications, cryogenic systems and custom requirements, delivering exceptional electrical and mechanical stability.

Comparision of Density at Same Dimensions



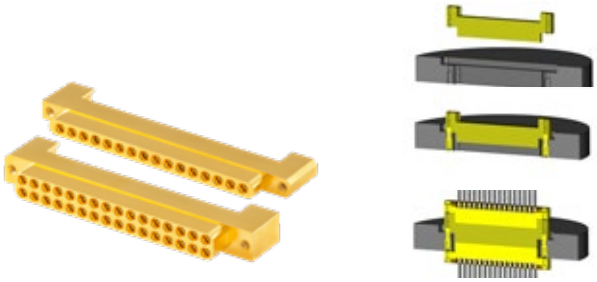
SMA
25 channels
(5 x 5)



SMP
81 channels
(9 x 9)



Multichannel WSMP®
240 channels
(5 x 16 + 5 x 32)



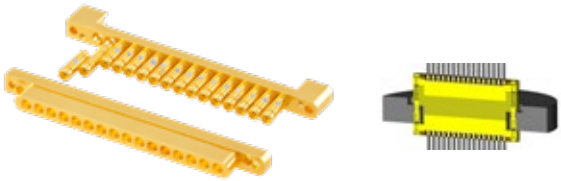
Hermetical Sealed Adaptor

- Leakage rate ≤ 10^{-8} mbar * l/s (qualified at room temperature), 100 % tested
- Each channel is completely sealed using an epoxy potting, with excellent RF performance
- Fixed to flange with screws in blind holes from the inside of the vacuum, then potted



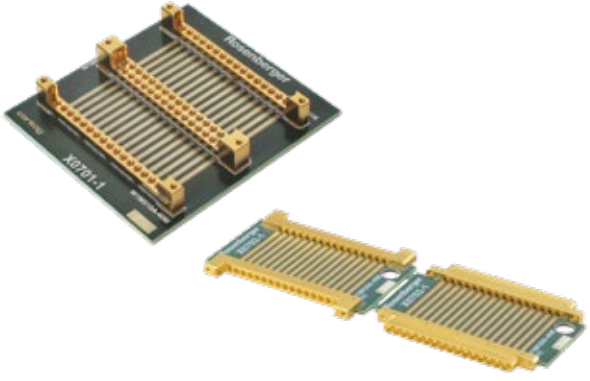
Adaptor

- Heat dissipation from the coax cable to the thermal anchor
- Fixed to the thermal stages with screws from cable assembly



Attenuator

- Heat dissipation from the coax cable center conductor to the thermal anchor
- Same form factor as adaptor
- Fixed to the thermal stages with screws from cable assembly
- 0 dB / 3 dB / 6 dB / 10 dB / 20 dB available
- Single attenuator per channel, which allow mixed configurations
- NiCr on AL_2O_3 substrate
- Substrate is solderd to center conductors and outer conductor for good thermalization



PCB Connectors

- Straight PCB connectors
  - Additional screws for better mechanical stability
- Edge-mount PCB connectors
  - 16 channel version
  - Male and female interface
  - Additional screws for better mechanical stability

Standard Interfaces for Quantum Computing

Rosenberger's standardized connectors ensure maximum signal stability and minimal loss – essential for the next generation of computing technology.

SMA

Cable - Panel - PCB connectors
Cable assemblies
Adaptors and attenuators

- Impedance 50 Ω
- Interface according to IEC 60169-15, EN 122110, MIL-STD-348A, fig. 310
- Frequency range DC to 18 GHz
- Return loss (cable connector straight) ≥ 30 dB (typ.)
- Mating cycles CuBe/stainless steel ≥ 500; CuZn ≥ 100
- Coupling test torque: CuBe/stainless steel ≥ 1.7 Nm; CuZn ≥ 0.6 Nm
- Coupling torque recommended: CuBe/stainless steel 0.8 Nm to 1.1 Nm; CuZn ≥ 0.5 Nm
- Screw-on locking mechanism
- Butted outer contact



SMP

Cable - Panel - PCB connectors
Cable assemblies
Adaptors, attenuators and bullets in diff. lengths

- Impedance 50 Ω
- Interface according to MIL-STD-348, mateable with GPOTM (Gilbert Engineering Co. Inc)
- Frequency range DC to 40 GHz
- Return loss: ≥ 23 dB @ DC to 20 GHz; ≥ 14 dB @ 20 GHz to 40 GHz
- Minimum board-to-board distance 9.05 mm
- Axial misalignment ± 0.3 mm
- Radial misalignment 4°
- Mating cycles: full detent: ≥ 100; limited detent: ≥ 500; Smooth bore: ≥ 1000
- Snap-on locking mechanism
- Different detent types: smooth bore, limited detent and full detent



Mini-SMP

Cable - Panel - PCB connectors
Cable assemblies
Adaptors and bullets in diff. lengths

- Interface according to MIL-STD 348A, fig. 328
- Frequency range DC up to 65 GHz
- Return loss: ≥ 26 dB @ DC to 26.5 GHz;
  ≥ 17 dB @ 26.5 GHz to 50 GHz;
  ≥ 14 dB @ 50 GHz to 65 GHz
- Impedance 50 Ω
- Mating cycles full detent ≥ 100 smooth bore ≥ 500
- Minimum board-to-board distance 7.94 mm
- Axial misalignment ± 0.1 mm
- Radial misalignment 4°
- Snap-on locking mechanism



RPC-2.92

Cable - Panel - PCB connectors
Cable assemblies
Adaptors

- Impedance 50 Ω
- Interface according to IEC 60169-35
- Frequency range DC up to 40 GHz, extended for 5G up to 43.5 GHz
- Return loss > 23 dB @ DC – 40 GHz
- Mating cycles > 500
- Air dielectric with PS/PTFE bead
- Stainless steel outer contact



Standard Interfaces for Quantum Computing

WSMP®

Cable - Panel - PCB connectors
Cable assemblies
Adaptors and bullets in diff. lengths

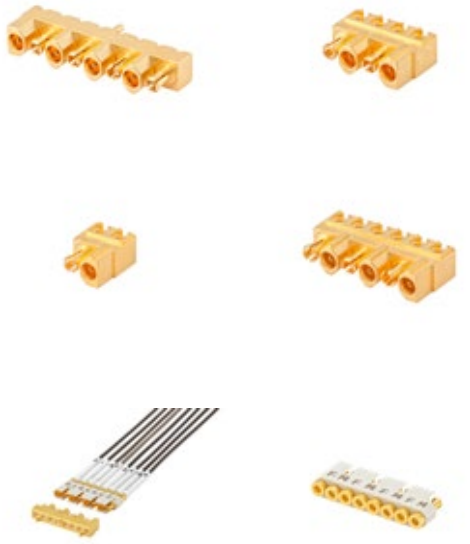
- Impedance 50 Ω
- Interface according to Rosenberger WSMP® (SMP3, IEC 61169-69 in progress)
- Frequency range DC up to 65 GHz
- Return loss: ≥ 26 dB @ DC to 26.5 GHz, ≥ 19 dB @ 26.5 to 65 GHz
- Mating cycles full detent ≥ 100, smooth bore ≥ 500
- Minimum board-to-board distance 3.05 mm
- Axial misalignment ± 0.13 mm
- Radial misalignment ± 0.25 mm
- Push/snap-on locking mechanism



Multiport Mini-Coax

Multiport PCB w/ 2, 4, 6, 8 Channels
Multiport cable assemblies

- Impedance 50 Ω
- Interface according to Rosenberger Mini-Coax
- Frequency range DC to 20 GHz and DC to 40 GHz
- Return loss > 16 dB @ DC to 20 GHz
- Mating cycles > 500
- 2, 4, 6 and 8 channels

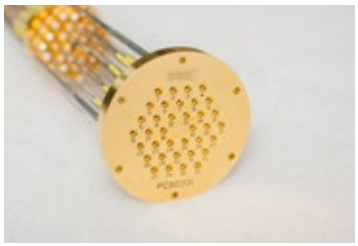


Customized Hermetical Sealed Adaptor Flange

Hermetically sealed adapter flanges made of Kovar with gold plating – with glass-to-metal gasket – to ensure high vacuum, can be designed and manufactured according to customer requirements.

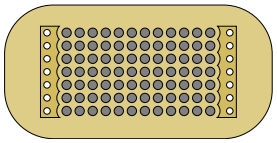
A specified leakage rate up to ≤ 10^{-8} mbar * l/s and 100% fine leakage tests are possible as well as multiport flanges.

- 36 SMPs
- ø 73 mm
- Material: Kovar with gold plating
- Corning 7070 or equivalent direct glassing



Hermetical Sealed Adaptor Flange (Concept)

- 84 Mini-SMPs
- Size: 41x82 mm
- Material: Kovar with gold plating
- Corning 7070 direct glassing



Capabilities Cable Assemblies

Rosenberger offers a large portfolio of standard cable assemblies (flexible, semi-flex, semi-rigid) and manufactures also customer-specific cable assemblies on request.

In addition to standard cable assemblies, Rosenberger is also able to manufacture special semi-rigid cable assemblies for cryogenic applications and superconducting cable assemblies using special soldering processes.

The results are cable assemblies that show excellent electrical and mechanical properties at the solder joints.

- Non-Magnetic cable assemblies
- Stainless Steel cable assemblies
- CuproNickel cable assemblies
- Niobium Titanium cable assemblies
- BerylliumCopper cable assemblies



Sponsored by the

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quanten technologien



Advancing Innovation Through Collaboration and Standardization

Participation in German government-funded projects enables Rosenberger to collaborate with leading research institutions and jointly develop cabling solutions tailored to user requirements.

Rosenberger actively contributes to standardization efforts to establish a long-term standardized portfolio, offering users greater planning reliability, faster availability and more competitive pricing.

Quantum Technology Projects

qBriqs – Cornerstones of Cryogenic Quantum Technology

BRIQS

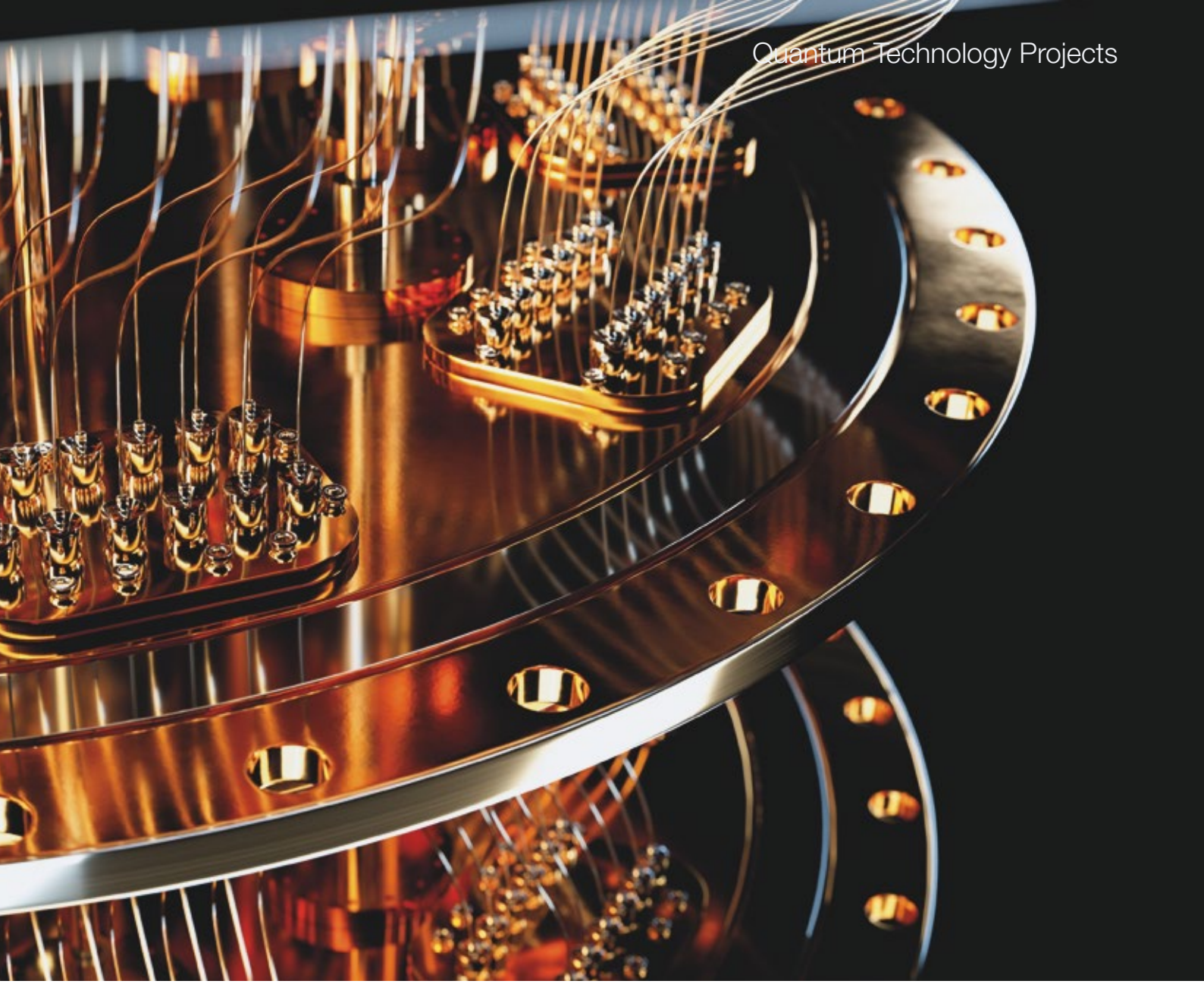
Project Duration: November 2021 – October 2024

Rosenberger's role in this project was the investigation and development of the measurement chain for superconducting qubits.

The objective was to overcome several bottlenecks through innovative approaches, assess the commercial potential of the enhanced measurement chain and leverage it effectively.

Rosenberger's Portfolio

- Multichannel connectors with low pitch (< 3 mm)
- Hermetically sealed adaptors
- Adaptors
- Attenuators
- Cable assemblies
- PCB connectors



QSolid – Quantum Computer in the Solid State

Project duration: January 2022 – December 2026

Twenty-six German companies from science and industry are collaborating to develop a quantum computer with enhanced error correction, aiming to establish a comprehensive ecosystem that will be integrated into the JUNIQ supercomputing infrastructure at Forschungszentrum Jülich and made accessible to external users.

Rosenberger's Portfolio

- Multichannel connectors
- Hermetically sealed adaptors
- Additive manufactured cables with special materials

Website

For further informationen please visit us online:
www.rosenberger.com/quantum

Rosenberger
Hochfrequenztechnik GmbH & Co. KG
Hauptstraße 1 | 83413 Fridolfing
P.O. Box 1260 | 84526 Tittmoning
Germany
Phone +49 8684 18-0
info@rosenberger.com
www.rosenberger.com
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