

WE ARE SUPER COOL

CRYOGENIC SYSTEMS & ACCESSORIES

LOW TEMPERATURE SOLUTIONS TO
BOOST YOUR EXPERIMENT

Photon Technology Italy SRL

Via G. Gigante 174, 80128 Naples (Italy)

Mobile phone: + 39 3500151403
Email: europe@cnphotec.com



Photon Technology Italy SRL



2

CRYOGENIC SYSTEMS

- 01 Special Cryogenic Systems And Fully Customizable Options

6

LOW TEMPERATURE ELECTRONICS

- 01 Cryogenic Thermometer
- 02 Capitalize F Radio-Frequency
- 03 Cryogenic Amplifier

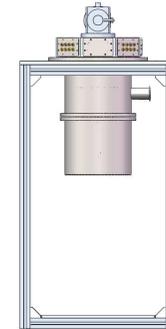
14

VACUUM ACCESSORIES

- 01 Vacuum Sealing SMA Flange
- 02 Fiber-optic Feedthroughs

CONTENTS

CRYOGENIC SYSTEMS



Our cryostats cover the temperature range from 0.3 K to 4.2 K, and customizable services for special equipment requirements are also supplied. For the G-M cryocooler, the products of P-CS-4K provides the cooling power from 0.1W to 1W with base temperature in the range 2 K- 4.2 K. For the G-M cryocooler and sorption cooling module, the products P-CS-0.3 K and P-CS-0.3 K reach the temperature of 300 mK and 850 mK, respectively.

| Performance parameters | P-CS-4K-Mini | P-CS-4K | | P-CS-1K | P-CS-0.3K |
|---------------------------------------|---|--------------------------------|--|---|---------------------------------|
| Lowest temperature | 2 K~4.2 K | 2 K~ 4.2 K | | 850 mK | 300 mK |
| Cryocooler | G-M | G-M | | G-M and sorption | G-M and sorption |
| Cooling power | 0.1~1 W @4.2 K | 0.1~1 W @4.2 K | | 30 μ W/50 μ W/100 μ W @850 mK | 50 μ W @350 mK |
| Temperature oscillation | ± 5 mK | ± 5 mK | | ± 25 mK | ± 25 mK |
| Continuous operations 7 \times 24H | Yes | Yes | | Optional | Optional |
| Numbers of RF channel | Up to 4 | 4/8/16/32 | | Up to 16 | Up to 16 |
| RF | SMA | SMA | | SMA | SMA |
| DC interface | Optional | Optional | | Optional | Optional |
| Optical interface and channel numbers | Fiber, up to 100 channels/Free space window | | | Fiber, up to 100 channels/Free space window | |
| Standard sample holder | $\varnothing 68 \times 59$ mm | $\varnothing 130 \times 56$ mm | | $\varnothing 190 \times 135$ mm | $\varnothing 190 \times 135$ mm |
| Fully customizable service | Yes | Yes | | Yes | Yes |

SPECIAL CRYOGENIC SYSTEMS & FULLY CUSTOMIZABLE SERVICE



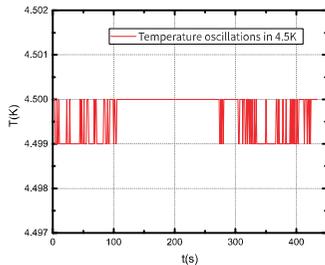
Ultra low-vibration cryostat

The ultra-low vibration is achieved through the design of the vibration isolation structure located between the cryocooler and the sample holder on an air floating platform.

| | |
|------------------------------|----------------------------|
| Installation prerequisite | Passive air floating table |
| Lowest temperature | ≤ 3.0 K |
| Vibration degree in Z-axis | < 100 nm |
| Vibration degree in X/Y-axis | < 100 nm |

FULLY CUSTOMIZATION SERVICE

For special and unique requirements, we have room for customization, some of the options are listed in what follows.



01 / Accurate Temperature Control

Installed with a combination of passive and active Temperature Control Systems to accurately control temperature in the range of 3 K~60 K.

| | |
|---------------------------------|--------------|
| Heater | HTR-50 |
| Range of temperature control | 3 K~60 K |
| Accuracy of temperature control | ± 0.5 mK |

02 / Sample holder with magnetic shield

To further reduce the magnetic remanence, a special permalloy sample holder with high permeability at cryogenic temperature can be mounted.



| | | | |
|-----------------------------|---------------------------|---------------------|-------------------|
| Sample holder material | Oxygen-free Copper | Material of DC wire | NbTi twisted pair |
| Surface treatment | Non-magnetic gold plating | Remanence | ≤ 100 nT |
| Material of magnetic shield | Cryoperm | | |

03 / Flanges for electric access

| | | |
|-----------------------|--------------|--------------|
| Flange specification | KF25/40 | CF35 |
| Vacuum degree | 1E-8 mbar | 1E-12 mbar |
| Channels number of DC | ≤ 32 | ≤ 32 |
| Operating temperature | -20°C~80°C | -20°C~80°C |
| Connection method | Soldering | Soldering |
| Pin Diameter | 0.9 mm | 0.9 mm |
| Pin Resistance | < 4.8 mOhm | < 4.8 mOhm |

04 / Optical window

Vacuum sealed windows and low-temperature filtering are adopted to ensure a good coupling between the user's optical path and the sample on the cold stage.

| | |
|------------------|------------------------|
| Window Material | Coated viewport |
| Window size | Typical 2 inch |
| Window type | Detachable flange |
| Filters material | User needs |
| Filter band | Terahertz/Mid-infrared |

05 / DC wire performance parameters

| | | | |
|----------------------|------------------|-----------------|----------------|
| Materials | Manganese bronze | Phosphor bronze | NbTi |
| Resistance@293K | 61 Ω /m | 8.7 Ω /m | 52 Ω /m |
| Wire diameter | 0.1 mm | 0.12 mm | 0.1 mm |
| Voltage Withstand | 600 V | 600 V | / |
| Thermal conductivity | 4 K | 0.5 W/(K·m) | 1.6 W/(K·m) |
| | 10 K | 2 W/(K·m) | 4.6 W/(K·m) |

To provide the solution for DC readout in cryogenic system, our 12 pairs DC wire assembly, which is exclusively used in high vacuum cryogenic systems, matches DC wires with high integration and low heat leakage, vacuum sealed connectors, and standard high vacuum flange.

A person wearing a white hairnet, glasses, and a light blue face mask is working in a cleanroom. They are wearing blue gloves and using a purple-handled tool to work on a complex, gold-colored electronic component. The background is a blurred cleanroom environment with overhead lights.

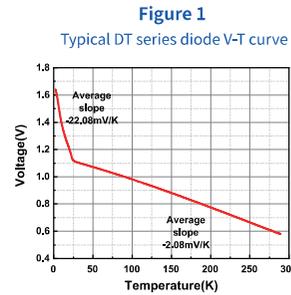
LOW TEMPERATURE ELECTRONICS

THERMOMETERS

PHOTEC DT-Series cryogenic thermometers are based on silicon diodes, and they offer excellent stability in a wide range of temperature. Following the standard V-T curve, the DT series has higher temperature sensitivity below 30 K. Easy sensor interchangeability, no need for individual calibration in general applications.

Features

- Low excitation current, negligible self-heating effect
- Conformance to the standard V-T curve, good interchangeability
- High accuracy in the temperature range of 1.8 K~325 K
- Individual calibrations available
- Compatible with temperature controllers from Lakeshore, Cryocon, Oxford and other manufacturers



Technical Specifications

| | |
|---------------------------|--|
| Standard V-T curve | DT series, Figure 1 |
| Recommended excitation | 10 ± 0.1% μA |
| Max reverse voltage | 70 V |
| Max current before damage | 1 mA DC or 100 mA AC |
| Dissipation (@10μA) | 16 μW@4.2 K, 10 μW@77 K, 5 μW@300 K |
| Thermal response time | 10 ms@4.2 K, 100 ms@77 K, 200 ms@305 K |
| Repeatability | ±15 mK@77 K |
| Use in magnetic fields | Not recommended for use in magnetic field applications |
| Use in radiation | Recommended for use only in low level radiation |



TO and CU Package

Temperature Response

| Temperature (K) | Voltage (V) | dV/dT(mV/K) |
|-----------------|-------------|-------------|
| 1.8 | 1.66 | -13.2 |
| 4.2 | 1.59 | -30.6 |
| 10 | 1.39 | -27.1 |
| 77 | 1.02 | -2.0 |
| 305 | 0.55 | -2.3 |

Type

| Type | Mass | Wire type | Sensor material |
|-------------------|--------|------------------------------|--|
| DT-TO | 400 mg | Phosphor bronze twisted pair | Ceramic Gold Plated Package |
| DT-BR (bare chip) | 85 μg | N/A | Silicon wafer |
| DT-SD | 40 mg | Phosphor bronze twisted pair | Sapphire base, goldplated ceramic body cover |

Tolerance Bands And Temperature Accuracy

| Tolerance bands | 2 K~77 K | 77 K~305 K |
|------------------------|----------|------------|
| C | ±1 K | ±1 K |
| B | ±0.5 K | ±0.5 K |
| A | ±0.25 K | ±0.25 K |
| Individual calibration | ±20 mK | ±40 mK |

Note:

- ① Short term repeatability is obtained by repeatedly conducting thermal shock experiments from 305 K to 4.2 K on the sensor
- ② Long term repeatability is obtained by applying 200 thermal shocks to the sensor from 305 K to 77 K
- ③ Sensor accuracy $(\pm \text{calibration uncertainty}^2 + \text{repeatability}^2)^{0.5}$

Figure 2

Typical DT series diode sensitivity

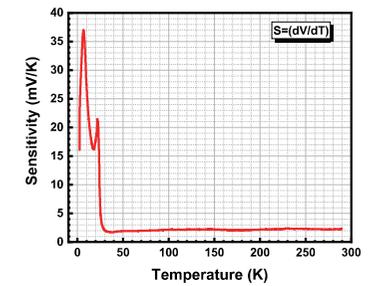
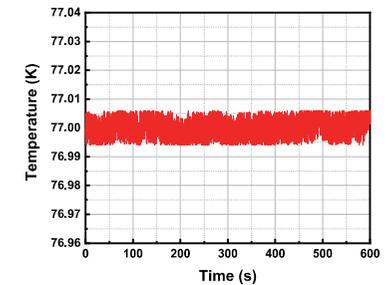


Figure 3

Accuracy at 77 K liquid nitrogen bath



LOW TEMPERATURE RF CABLES

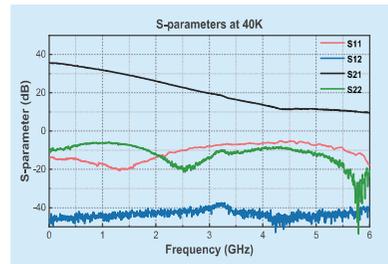
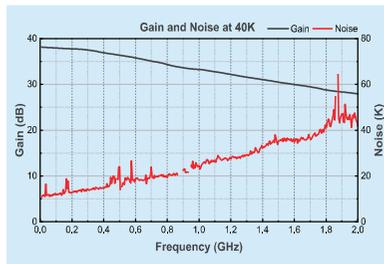


| | | Semi-rigid Coaxial cable | | | | Superconducting Coaxial cable | Flexible Microstrip cable | |
|--------------------------|----------|--------------------------|----------------------|-----------------|-----------------|-------------------------------|--|-----------------------|
| Performance parameters | | CC-200-BeCu | CC-100-BeCu | CC-076-BeCu | CC-086-SUS | SC-210-Nb | Flexible microstrip cable ¹ | Low pass filter cable |
| Outer conductor | Diameter | 2.00±0.025 mm | 1.00±0.025 mm | 0.86±0.025 mm | 0.86±0.025 mm | 2.1±0.025 mm | / | / |
| | Material | BeCu | BeCu | BeCu | Stainless steel | Nb | / | / |
| Dielectrial layer | Diameter | 1.6±0.025 mm | 0.80±0.025 mm | 0.66±0.0254 mm | 0.66±0.0254 mm | 1.6±0.025 mm | / | / |
| | Material | PTFE | PTFE | PTFE | PTFE | PTFE | / | / |
| Inner conductor | Diameter | 0.5±0.013 mm | 0.29±0.013 mm | 0.20±0.013 mm | 0.20±0.013 mm | 0.5±0.013 mm | / | / |
| | Material | Silver plated copper | Silver plated copper | BeCu | BeCu | Nb | / | / |
| Thermal conductivity@3K | | / | / | 1.0E-5 W/(cm*K) | 7.0E-6 W/(cm*K) | / | / | / |
| Impedance characteristic | | 50±2.5 Ω | 50±2.5 Ω | 50±2.5 Ω | 50±2.5 Ω | 50±2.5 Ω | 50±2.5 Ω | 50±2.5 Ω |
| Medium withstand voltage | | > 1000 V | > 1000 V | > 1000 V | > 1000 V | > 1000 V | > 1000 V | > 1000 V |
| Transmission loss | 1.0 GHz | 2 dB/m | 2 dB/m | 3.7 dB/m | 4.6 dB/m | / | -2.8 dB/40 cm | <-3 dB/40 cm |
| | 5.0 GHz | 3 dB/m | 3.8 dB/m | 9 dB/m | 11 dB/m | / | -7.8 dB/40 cm | <-3 dB/40 cm |
| | 10.0 GHz | 5 dB/m | 6 dB/m | 13 dB/m | 16 dB/m | / | -12 dB/40 cm | <-3 dB/40 cm |
| | 20.0 GHz | <10 dB/m | 10 dB/m | 23 dB/m | 28 dB/m | / | / | >-30 dB/40 cm |
| Operating temperature | | mK ~ 350 K | mK ~ 350 K | mK ~ 350 K | mK ~ 350 K | mK ~ 4 K | mK ~ 350 K | mK ~ 350 K |
| Minimum bending radius | | 5 mm | 3.5 mm | 3.5 mm | 3.5 mm | 3.5 mm | 3.5 mm | / |
| Length | | ≤ 150 cm | ≤ 150 cm | ≤ 150 cm | < 150 cm | < 100 cm | 25 cm | 25 cm |

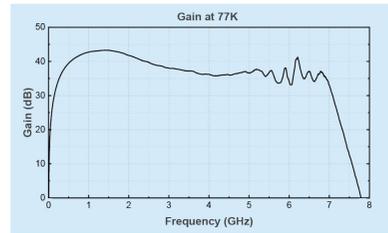
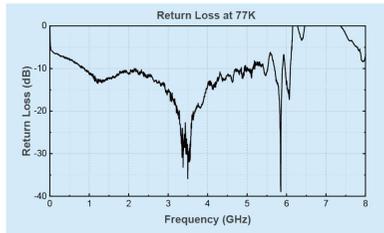
Note: A customizable service is supplied according to the user's working circumstances, such as cable operating frequency, connector type, physical specification, and so on.

LOW TEMPERATURE AMPLIFIER

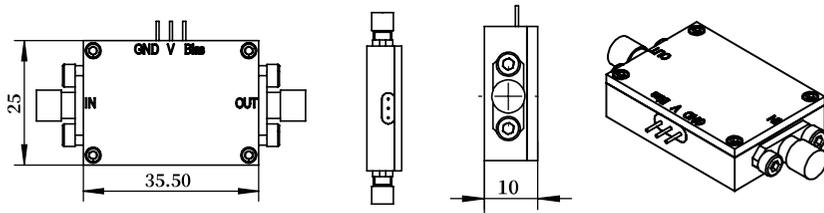
LTA 1: 0.1 MHz~1 GHz



LTA 2: 0.3 MHz~5 GHz



Low temperature amplifier size Note: Dimensions are in millimeter [mm]



| Product Features | LTA 1: 0.1 MHz~1 GHz | LTA 2: 0.3 MHz~5 GHz |
|-----------------------|--------------------------|----------------------|
| RF Bandwidth | 0.1 MHz~1 GHz | 0.3 MHz~5 GHz |
| Noise Temperature | 25 K@40 K, 15 K@4 K | 150 K@300 K |
| Noise Figure | 0.36 dB@40 K, 0.2 dB@4 K | 1.8 dB@300 K |
| Gain | 35 dB@4 K, >30 dB@77 K | 35 dB@77 K |
| Operating Temperature | 4 K to 325 K | 4 K to 325 K |
| Typical DC Power | 3.5 V/6 mA | 3 V/25 mA |
| RF Connectors | SMA (Female) | SMA (Female) |
| DC Connectors | 3-pin, 2.54 mm | 3-pin, 2.54 mm |

| Parameters | | LTA 1 : 0.1 MHz~1 GHz | LTA 2: 0.3 MHz~5 GHz |
|-----------------------|---------|-----------------------|----------------------|
| V_{ds} | Min | 0 | 0 |
| | Max | 4 V | 4 V |
| | Typical | 3.5 V | 3 V |
| I_{ds} | Min | / | / |
| | Max | 30 mA | 40 mA |
| | Typical | 6 mA @3.5 V | 25 mA@3 V |
| V_{gs} | Min | / | / |
| | Max | / | / |
| | Typical | / | / |
| RF Input Power | | -10 dBm | -10 dBm |
| Operating Temperature | Min | 4 K | 4 K |
| | Max | 325 K | 325 K |
| ESD Rating (HBM) | | +2000 V (Class 2) | +2000 V (Class 2) |

VACUUM ACCESSORIES

D6116192



HERMETICALLY SEALED SMA ADAPTER

HA1108 Technical Data Sheet

| | |
|-----------------------------|----------------------------|
| Connector type | SMA(Female) to SMA(Female) |
| Installation form | Bulkhead Mount |
| Outer size(length*diameter) | L*Dia=27*13 mm |
| Helium gas leak rate | <1E-11 cc/sec@1 atm helium |
| Operating temperature | -65 to +165 deg C |

Electrical Specifications

| | |
|--------------------------|-----------------|
| Frequency range | DC-18 GHz |
| Characteristic impedance | 50 Ω |
| VSWR | <1.4: 1@ 18 GHz |

Material Specifications

| | |
|------------------|---------------------------------------|
| Inner conductor | Beryllium Copper |
| Insulating layer | PTFE |
| Outer conductor | Stainless Steel (Gold Plating Option) |

The vacuum sealing adapter/connector HA1108 was designed to achieve RF interconnect between various applications requiring very low temperature, high vacuum, and so on.



FIBER FEED-THROUGH FLANGE

High vacuum fiber feed-through flange is typically used to make the optical signal exchange between high vacuum and low vacuum. We invented the "high vacuum four-wire feed-through technique", which allows one HA1108 to reach hundred optical fibers feed-through, resulting in a highly integrated fiber feed-through flange.

Performance parameters

| | |
|--------------------|--|
| High vacuum degree | Lower than 1E-8mbar |
| Fiber | Single Mode Fiber(SMF)/Multi Mode Fiber(MMF) |
| Feed number | 1-100 fiber channels |
| Low insertion loss | Insertion loss \leq 0.01 dB |
| Fiber | User specified |
| Flange type | KF/CF/User specified |