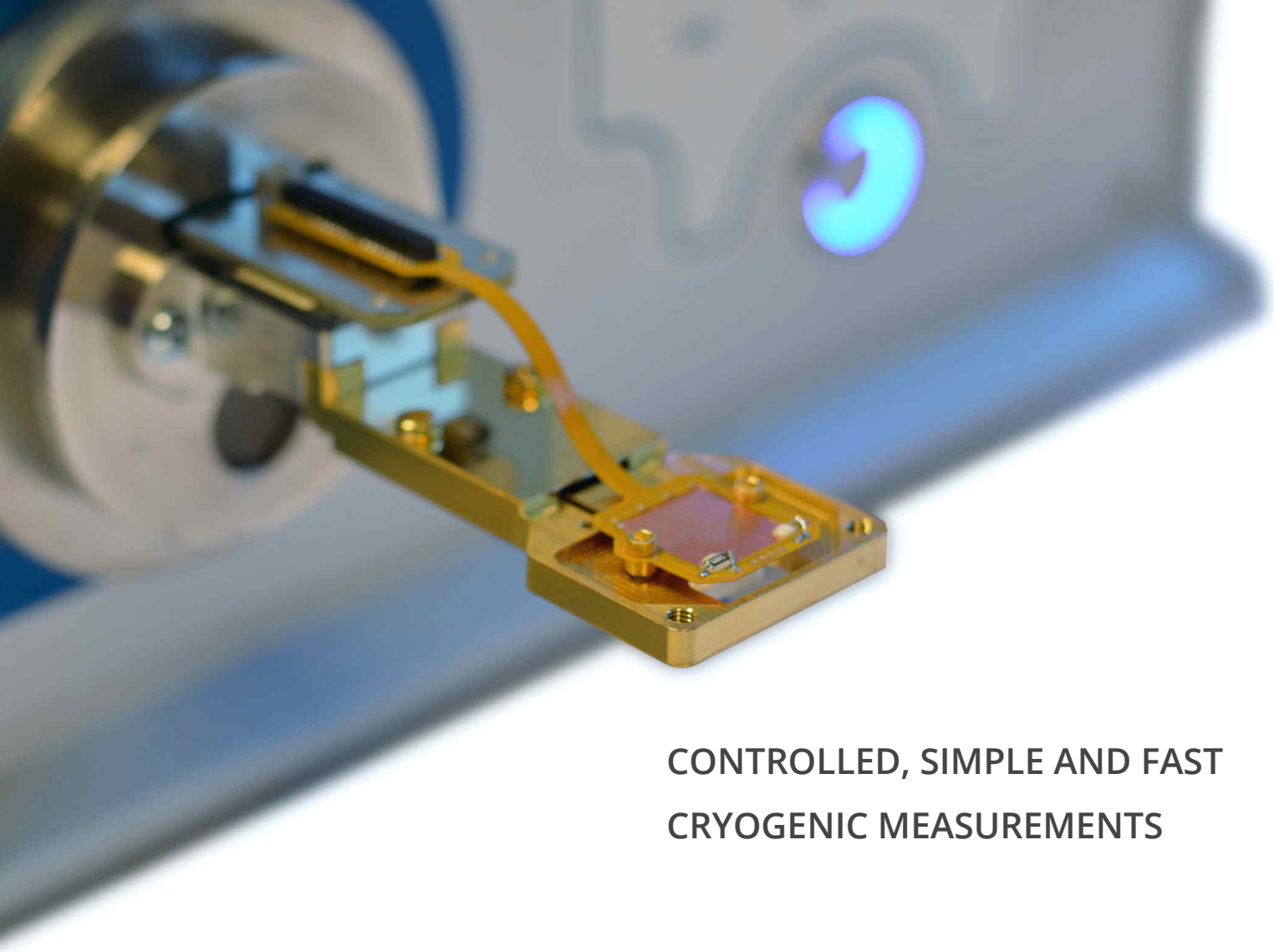


CONTROLLED, SIMPLE AND FAST
CRYOGENIC MEASUREMENTS

Product Guide

Thin film characterization
Seebeck coefficients
Sensor calibration
SQUID sensors
Solar Cells

KRYOZ technologies

Edition June 2015

High value at low temperatures.

KRYOZ technologies

Making cryogenics easy

Kryoz has developed cryocooling platforms that make cryogenics accessible to a wide market in a plug-and-play manner. Our desktop systems focus on the rapid and extremely easy measurements of a single electronic circuit or small sample at low temperatures.

We create high-end products that make sense and the use of cryogenics extremely easy. Even if its user has no background or knowledge in this field whatsoever.

“The CryoLab:
Simply Click & Cool”

Table of contents

Visit our website and find a comprehensive source of information including:

- Product demo video's
- Application examples
- **WebShop**
- Manual downloads
- Software downloads

Cryocooler Comparison Matrix

“ Which system suits your cooling requirements best? ”

	LN2 **Cryostats**	Mechanical **Cryocoolers**	The Kryoz **CryoLab**
Plug-and-Play operation (no experience with cryogenics required)	✖	✖	✔
Cryogen free (no LN2 handling or infrastructure required)	✖	✔	✔
Vibration & EM noise free (does not interfere with sensitive devices)	✔	✖	✔
Desktop setup	✖	✖	✔
Included gas supply hardware (no additional equipment required)	✖	✔	✔
Software & LabView support (system operation via PC & SubVI DAQ support)	✖	✖	✔
Closed-loop (cooling fluid is re-used)	✖	✔	✖
No acoustic noise (generates no/low noise while operating)	✔	✖	✔
Integrated electrical wiring (signal in/output wiring is included with system)	✖	✖	✔
High cooling power use (requirement of >> 0.3 W of cooling power)	✔	✔	✖
Integrated & accurate full range temperature control	✖	✔	✔
One system - various uses (Seebeck, Van der Pauw, Sensor Calibration, etc)	✖	✖	✔

The CryoLab

Low-temperature analysis of

"An elegant way to perform
all your low-temperature characterization measurements"

The CryoLab

CONTROLLED, SIMPLE AND FAST CRYOGENIC MEASUREMENTS.

The CryoLab is a cryogenic test-platform specifically designed to perform rapid material or circuit **measurements from room temperature down to cryogenics** in a fully automated and plug-and-play manner.

Doing measurements doesn't require any experience or know-how on cryogenics, vacuum technology or thermodynamics from the user.

The CryoLab Series

The CryoLab **S & SP**		The CryoLab **MSG**
90 - 373 Kelvin	*Temperature range*	75 - 298 Kelvin
100 mW @ 95 Kelvin	*Cooling power*	75 mW @ 80 Kelvin
25 min. to 90 Kelvin	*Cool-down time (unloaded)*	30 min. to 75 Kelvin

The setup

The CryoLab is a **desktop plug-and-play system** where all the required hardware is fully integrated inside a very small casing. All connections to and from the CryoLab, both gas and electrical, are made using quick connects.

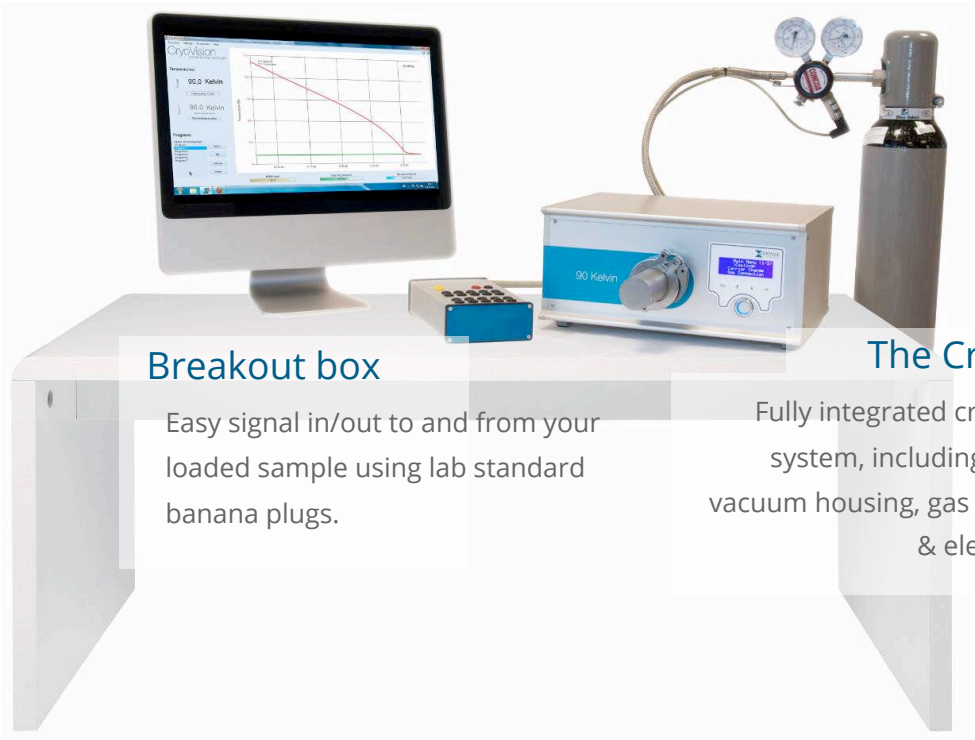
The CryoLab is designed in such a way that its user requires absolutely no know-how on cryogenics or vacuum technology to operate this system. All procedures including cool-down, sample exchange and bottle replacement are **fully automated and controlled** by the system. The wiring to and from your sample is integrated within the flexible sample carrier so the user doesn't have to worry about any parasitic heat losses.

PC

Running CryoVision for full system control and optionally LabView for DAQ using the included SubVIs.

N_2 bottle - gas supply

Standard Nitrogen 5.0 gas, non-toxic, non-flammable and cheap. With a single (50L) bottle the system can run about 1 week continuously.



Breakout box

Easy signal in/out to and from your loaded sample using lab standard banana plugs.

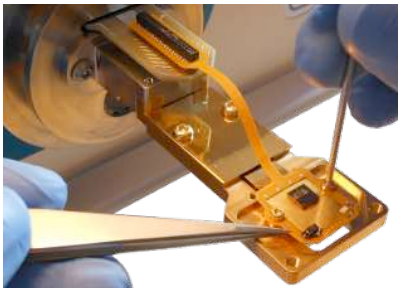
The CryoLab

Fully integrated cryocooler system, including pumps, vacuum housing, gas handling & electronics.

CryoLab - Click & Cool Principle

Independent on the type, the loading principle of a sample is similar for all measurements.

1. **Attach your sample** to one of the included flexible sample carriers. All electrical connections can be made to the pads using either bond-wiring or soldering.



2. Connect the flexible sample carrier to the CryoLab using two screws. Once connected, the electrical connections are automatically re-routed to the back of the system.

3. Start cooling by choosing a setpoint temperature or a custom temperature program from the menu.

Vacuum & gas connections

Vacuum pump connection.

The CryoLab S & MSG have no internal vacuum pump. This can be convenient if a pump is already available or to minimize noise induced by a pump. An external pump can be connected to the back of the system using the KF40 flange.

Gas connections are made to the system using simple push-and-click quick connects.

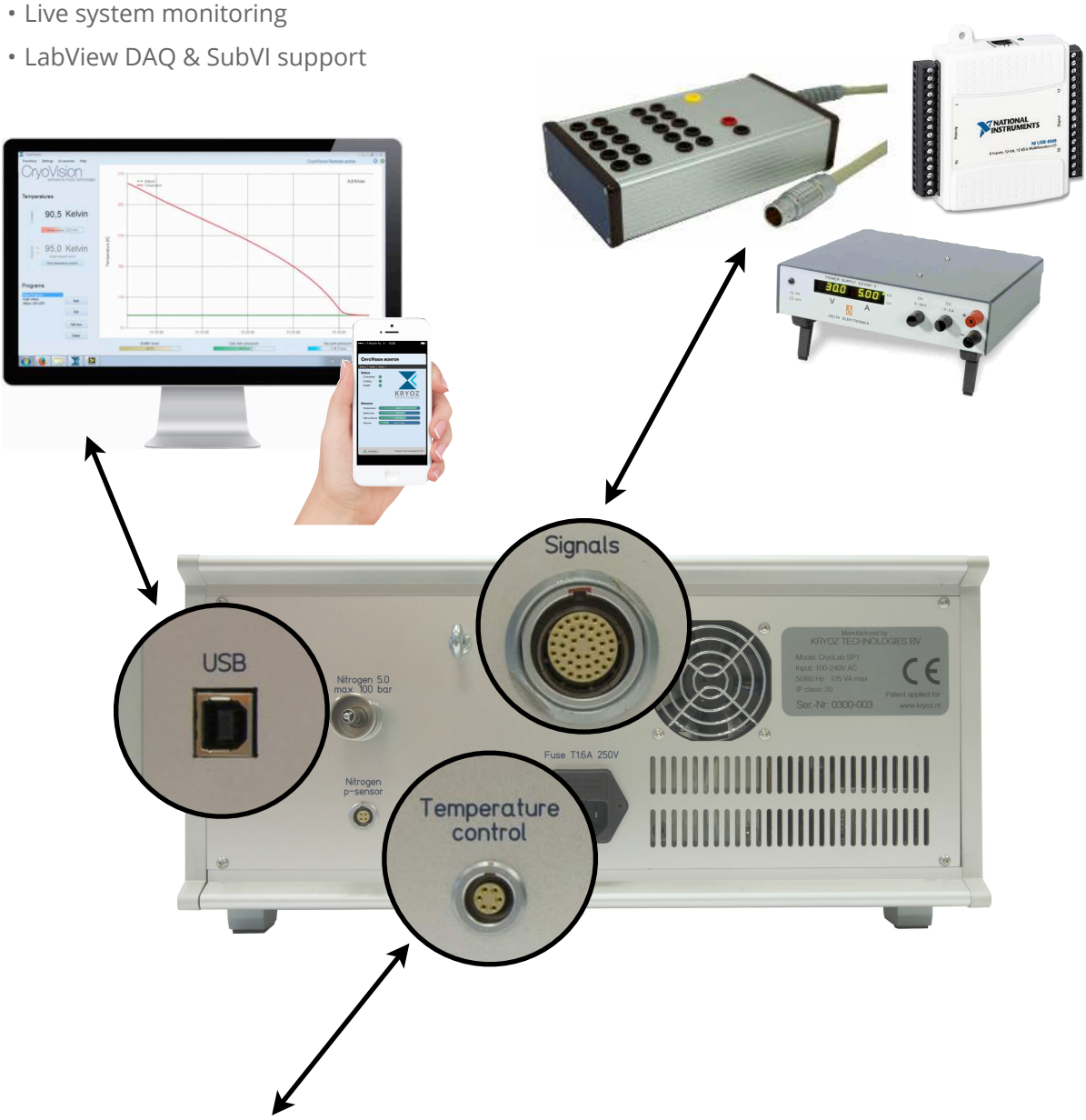
Signals In/Out

Full PC control via USB

- Included CryoVision software
- Single set-point or program setting
- Data saving and exporting
- Live system monitoring
- LabView DAQ & SubVI support

Easy signal routing

- Use own routing or **Kryoz break-out box**
- Connect your preferred DAQ cards
- Attach power supplies



External T-control

Even higher temperature stability when required.

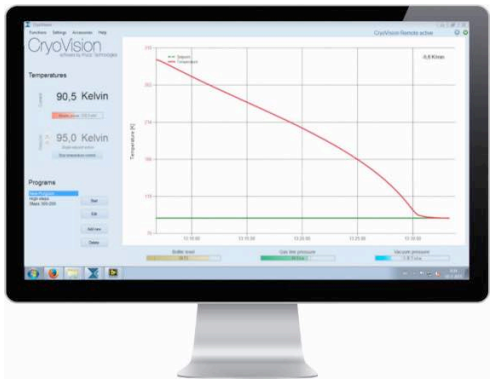
CryoVision software

CryoVision is the software package to **control The CryoLab from a PC** and is included with all systems. Although The CryoLab can be fully operated as a stand-alone apparatus, with CryoVision you are able to control the system in more detail. You can see all parameters in a glance, switch between single set-point and programs. Create, edit and save programs and export your data.

powered by CryoVision© software by Kryoz Technologies

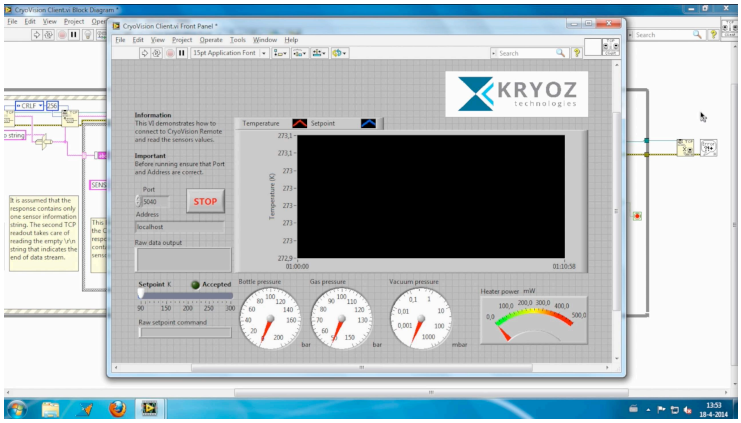
Some functions...

- Temperature control: single setpoint / programs / external
- Manual or automated PID tuning
- Direct bottle-, vacuum- and gas-line pressure monitoring
- CryoVision Monitor via TCP/Web Server
- LabView subVIs to read or read/control current temperature
- Automated software and firmware internet updates



CryoVision Monitor

Keep track of your live cool-down measurements via a web browser using CryoVision Monitor.



LabView support

Use the included LabView VI's or create your own LabView interface to control The CryoLab's temperature or monitor other parameters and integrate the temperature control in your DAQ work-flow.

CryoLab systems

CryoLab S & SP 90 Kelvin

Specifications

Temperature and power

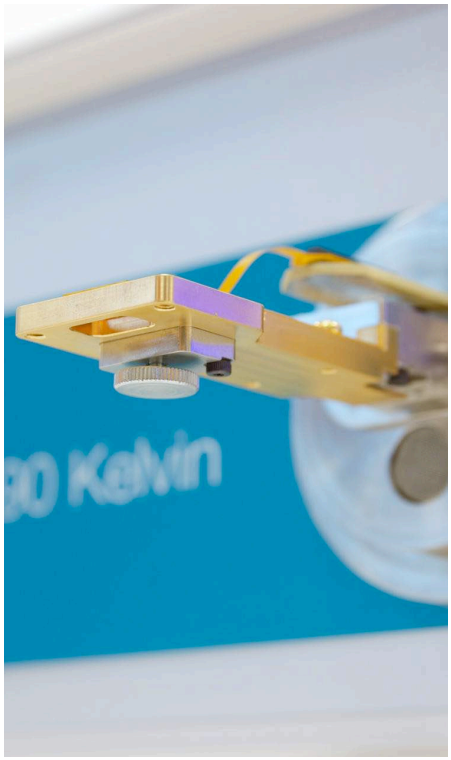
Minimum temperature of temperature platform:
90 K (-183 ℃)

Maximum temperature of temperature platform:
373 K (100 ℃)

Temperature stability:
± 100 mK

Maximum net cooling power:
100 mW @ 95 K

Approximate cool-down time (unloaded):
300 to 90 K: 25 min.



Sample to be cooled

Maximum sample footprint:
10 mm (0.4”) x 10 mm (0.4”)

Maximum sample weight:
1.5 grams

Flexible Sample Carrier

Flexible carrier with 8 user leads & bond/solder pads. More leads possible on request.

Sample to carrier thermal connection via glueing (e.g. GE varnish) or soldering.

Sample to carrier electronic lead connections via soldering, bonding or glueing.

Sample carrier to CryoLab thermal connection via indium sheet (consumable)

Signal routing

Resistance from signal connector to sample carrier bond/solder pad:
~ 3.3 Ω

Maximum allowable voltage:
10 V

Maximum allowable current:
20 mA

Channel for analog external T-readout

Output voltage:
0 - 5V

Maximum allowable current:
50 mA

IP class

IP 20

Sound Level

max 67 dB (A)

Vacuum - **CryoLab S**

No integrated vacuum pump
(external pump can be located further from sample)

Vacuum connection:
KF40 flange

Maximum allowed vacuum pressure during operation:
1 x 10e-3 mbar

Vacuum - **CryoLab SP**

Integrated internal vacuum pumps.

Minimum pressure:
1 x 10e-5 mbar

Max. allowed vacuum pressure during operation:
1 x 10e-3 mbar

Supply gas specifications

Required gas:
Nitrogen (N_2)

Minimum gas purity:
5.0

Minimum gas cylinder pressure:
95 bar (1400 psi)

Maximum gas cylinder pressure:
210 bar (3046 psi)

Gas connection:
quick-connect ¼" male, black sleeve

Software - CryoVision

System requirements:
Windows™ 7 (64 bit) or higher

LabView Sub-VI:
LabView 8.0 or higher

Power supply

Voltage: 100 -240V AC
Frequency: 50/60Hz

Power consumption:
max. 125VA

Ambient conditions

Indoors operation only

Relative humidity max. 80% up to 31 °C
Linearly decreasing to 50% at 35 °C

Storage / transport temperatures:
-25 ... +60 ℃

Max. installation height:
2000m above sea level

Dimensions and weight

Dimensions: approx.
380 mm (15") x 280 mm (11") x 180 mm (7")

Weight:
Approx. 14.5 kg

Shipping weight:
Approx. 21 kg

CryoLab MSG (for SQUIDs) 75 Kelvin

Specifications

Temperature and power

Minimum temperature of temperature platform:
75 K (-198 ℃)

Maximum temperature of temperature platform:
298 K (27 ℃)

Temperature stability:
± 100 mK

Maximum net cooling power:
75 mW @ 80 K

Approximate cool-down time (unloaded):
300 to 75 K: 30 min.

Sample to be cooled

Maximum sample footprint:
10 mm (0.4”) x 10 mm (0.4”)

Maximum sample weight:
1.5 grams

Flexible Sample Carrier

Sample carrier with 4 user leads & bond/solder pads. More leads possible on request.

Sample to carrier thermal connection via glueing (e.g. GE varnish) or soldering.

Sample to carrier electronic lead connections via soldering, bonding or glueing.

Sample carrier to CryoLab thermal connection via glueing (e.g. silver paint)

Signal routing

Resistance from signal connector to sample carrier bond/solder pad:
~ 7 Ω

Maximum allowable voltage:
10 V

Maximum allowable current:
20 mA

Channel for analog external T-readout (not available for SQUID version)

Output voltage:
0 - 5V

Maximum allowable current:
50 mA

IP class

IP 20

Sound Level

max 67 dB (A)

Vacuum

No integrated vacuum pump

Vacuum connection:
KF40 flange

Maximum allowed vacuum pressure during operation:
1 x 10e-3 mbar

Software - CryoVision

System requirements:
Windows™ 7 (64 bit) or higher

LabView Sub-VI:
LabView 8.0 or higher

Supply gas specifications

Required gas:
Nitrogen (N_2)

Minimum gas purity:
5.0

Minimum gas cylinder pressure:
95 bar (1400 psi)

Maximum gas cylinder pressure:
210 bar (3046 psi)

Gas connection:
quick-connect ¼" male, black sleeve

Power supply

Voltage: 100 -240V AC
Frequency: 50/60Hz

Power consumption:
max. 100VA

Ambient conditions

Indoors operation only

Relative humidity max. 80% up to 31 °C
Linearly decreasing to 50% at 35 °C

Storage / transport temperatures:
-25 ... +60 ℃

Max. installation height:
2000m above sea level

Dimensions and weight

Dimensions: approx.
450 mm (18") x 280 mm (11") x 180 mm (7")

Weight:
Approx. 12 kg

Shipping weight:
Approx. 21 kg

Easy, fast and controlled measurements at liquid nitrogen temperatures...

... without the hassle of liquid nitrogen.

CryoLab add-ons

for the latest add-on overview please refer to www.kryoz.nl

Seebeck kit

Combining your CryoLab with a Seebeck kit, your instantly able to measure the Seebeck coefficient of a sample from 373 Kelvin down to cryogenic temperatures.

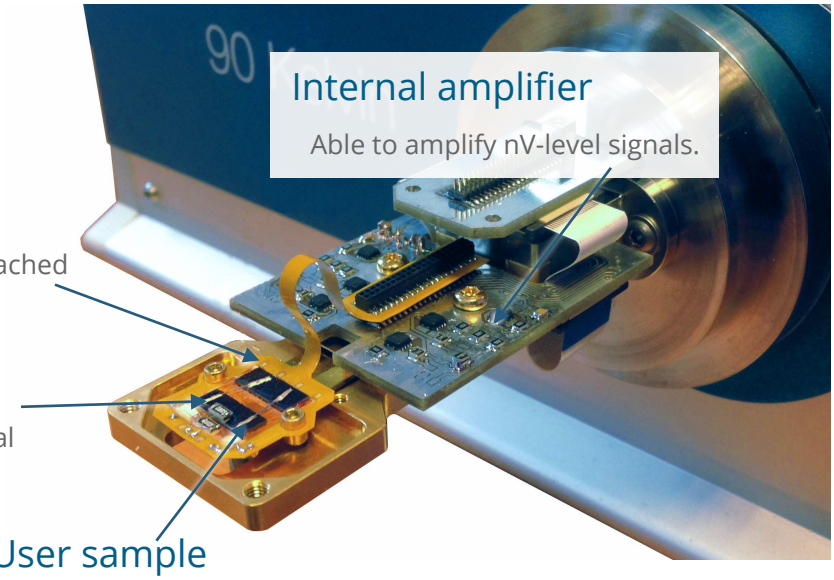
Using the specific Seebeck carrier it is easy to prepare your samples and rapidly perform measurements in series. The Seebeck coefficient is determined very accurately (± 0.1 µV K^{-1}) by comparing the loaded sample to a calibrated reference sample.

$S_{sample} = S_{ref} \times V_{sample} / V_{ref}$

The Seebeck kit includes:

- Ultra sensitive integrated amplifier
- A break-out box, DAQ card and cables
- CryoVision / LabVIEW Seebeck SubVIs
- Seebeck carrier with reference material (max. sample size: 5x5x8mm)

" No additional hardware is required to perform full temperature range Seebeck characterization measurements. "



Specifications

Measurement accuracy

± 0.1 µV K^{-1}

Kit compatible with

CryoLab S, SP & MSG

Sample attachment

Sample is “glued” using included silver paint

Sample specs

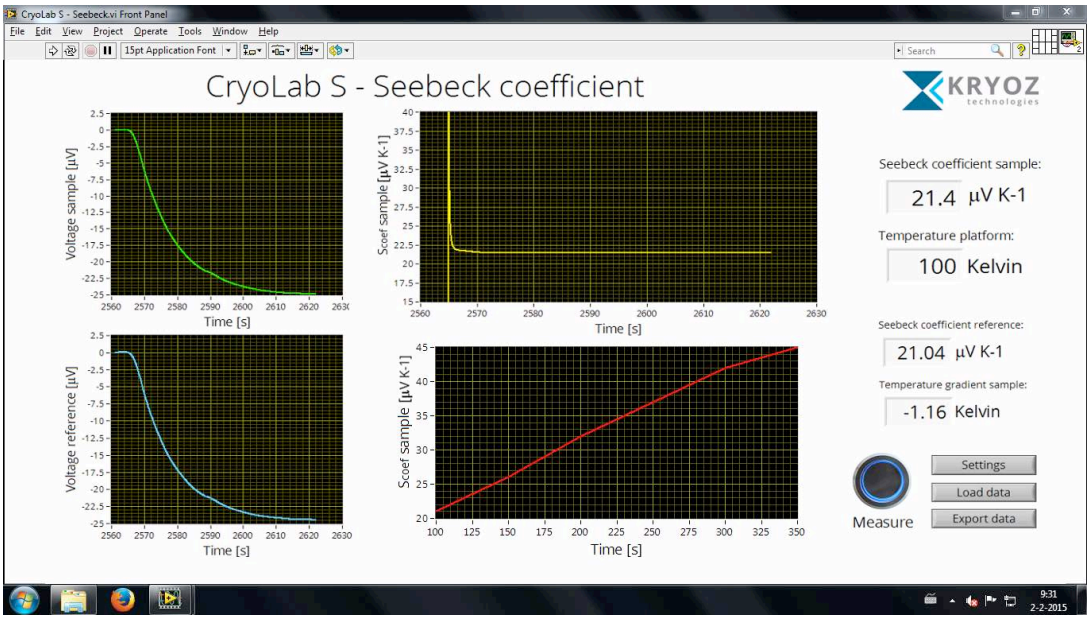
Max. dimensions: 5mm x 5mm x 8mm

Sample can be a wire, small sample or thin film.

Software - Seebeck LabView VI

System requirements:
Windows™ 7 (64 bit) or higher

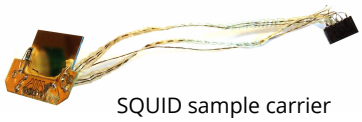
LabView Sub-VI:
LabView 8.0 or higher



CryoLab MSG SQUID edition

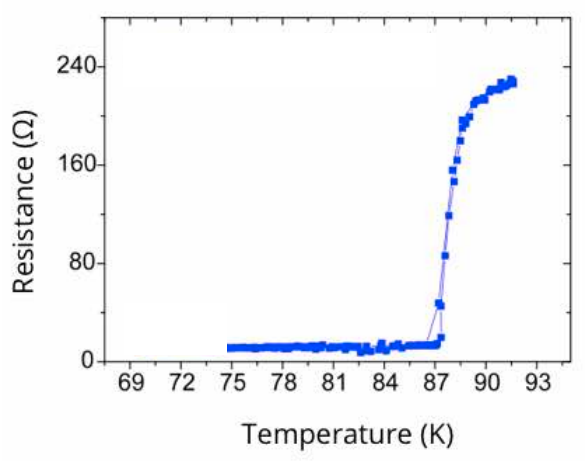
The CryoLab MSG for SQUIDs is a special edition of the Cryolab MSG with which you can cryocool **HTS SQUIDs and gradiometers** to below their critical temperature **without any interference from the cooling system**. Both cool-down (< 30 min.) and heat-up (< 20 min.) of your SQUID is extremely fast and controlled. Using a special SQUID sample carrier it is very easy and secure to prepare and install your sample.

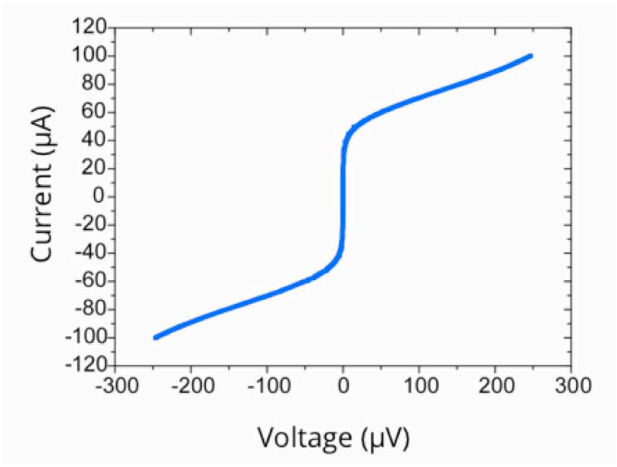
CryoLab MSG for SQUIDs


SQUID sample carrier

The read-out device of the SQUID electronics system is simply slit into the back of the system where it is internally routed to the carrier of the mounted SQUID. This way the distance from electronics to SQUID is minimized. Both the cable from the flange to the slider and the carrier PCB are shielded and twisted (in pairs) to minimize noise.

The CryoLab MSG is compatible with the SQUID Electronics from both **Supracon and Magnicon**. *(Compatibility with other SQUID electronics is available on request)*



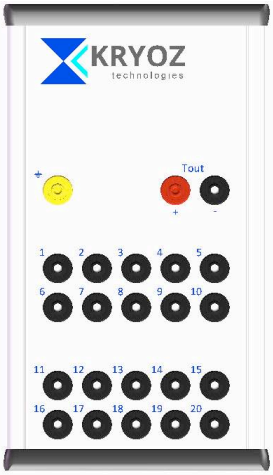
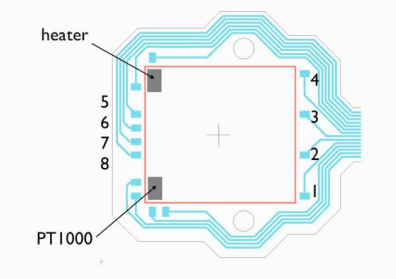


Characterizing a SQUID was never this easy and fast...

Break-out Box

The Breakout box is designed to be used in combination with all CryoLab systems to easily connect to the user channels of the flexible PCB using the 40 pole connector at the back of the CryoLab system.

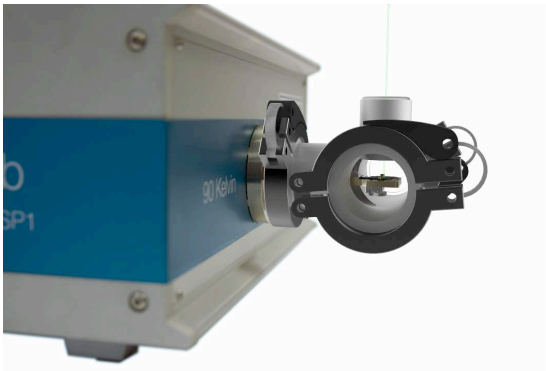
Specifications

Item	Specifications
Dimensions and weight	Dimensions: approx. 230 mm (9”) x 130 mm (5”) x 55 mm (2”) Weight: approx. 1 kg
Connector 1-20 in/outputs	4 mm banana plug connector, Max. current/voltage: 200 mA/100V ⚠ **Max. current/voltage in combination with 8-channel flex PCB: 20 mA/10V**
Connector, T readout + (red), - (black)	Output voltage 0-5V Maximum allowable current: 50 mA
	4 mm banana plug connectors: ⏚: Ground fixed to cable shield & CryoLab ground when cable is connected. Tout: analog signal output (0 - 5V) of flex PCB carrier temperature read-out + (red) - (black). Signal conform **ITS-90**, please visit www.kryoz.nl for voltage to temperature conversion tables. 1 ... 20: user channels
	Breakout box banana plug connector 1 ... 8 are routing to flexible sample carrier user channel 1 to 8 as shown in the left picture. 

Customized vacuum chambers

Need an optical window in your vacuum chamber?
A specific electrical feedthrough?

Kryoz provides full design and fabrication services for user defined vacuum housings for CryoLab usage.



Using The CryoLab as a cryogenic cooling platform, a user can built up a fully customized setup to perform any desired measurements.

Connect optical feedthroughs, specific sensors, power inputs or any other device that's required for your setup.

The flange size on all CryoLab systems is a **KF40 market standard**. This makes is easy to connect your own vacuum equipment.

Parts and consumables

Kryoz Technologies provides a wide variety of parts and consumables. You can access an up to date overview of all parts and consumables in our web-shop at **www.kryoz.nl**

Flexible PCB for loading a sample into a CryoLab. Please request a quote if more than 8 user channels are required.

40 pins circular push-pull connector with 1m shielded cable for usage with CryoLab signal output. Compatible with all CryoLab series. The cable is provided with stripped and tinned cable ends.

SQUID carrier for loading a SQUID into a CryoLab MSG. Please request a quote if more than 4 user channels are required.

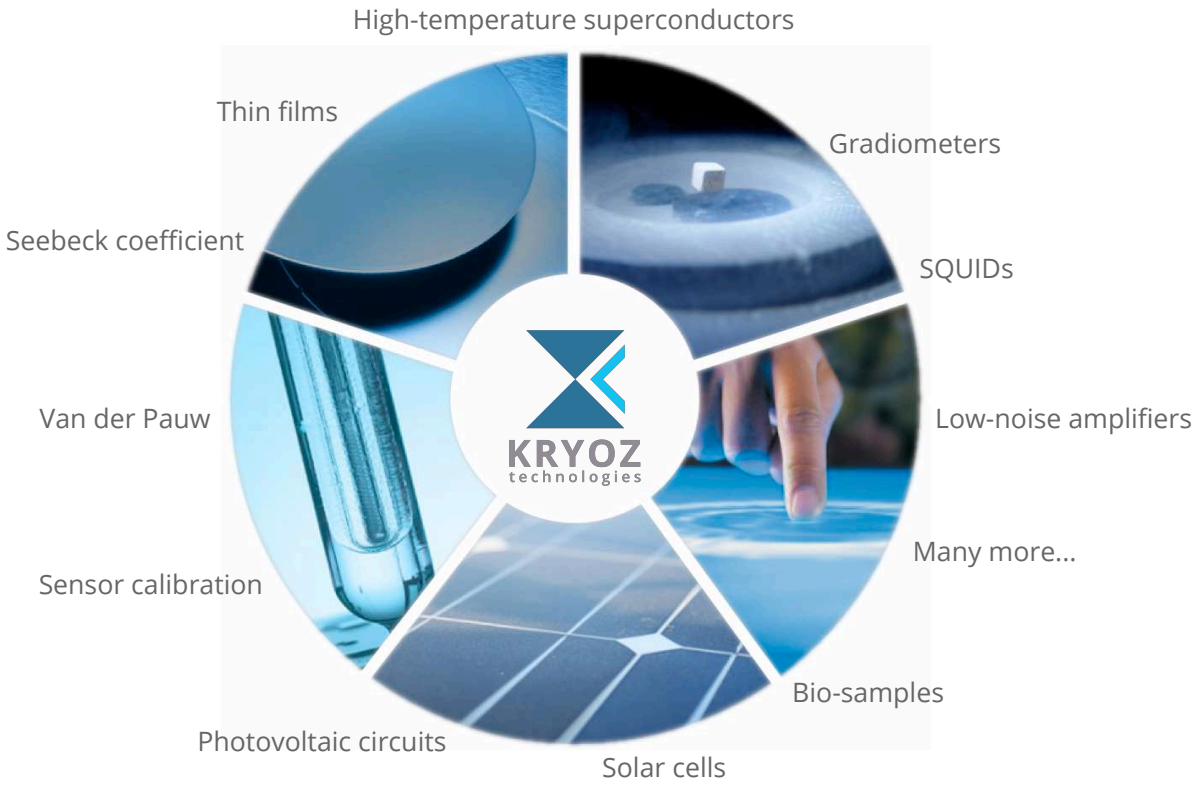
6 pins circular push-pull connector with 1m shielded cable for usage with CryoLab external temperature control. Compatible with all CryoLab series. The cable is provided with stripped and tinned cable ends.

Pressure reducer set – compatible with CryoLab.

Heat sink i**ndium foils** for measurements. Compatible with all CryoLab series.

The CryoLab

Low-temperature analysis of



Find your local distributor on **www.kryoz.nl**

KRYOZ
technologies

Kryoz Technologies BV
Pantheon 18-22
7521 PR Enschede
The Netherlands

T: +31 53 203 0995
F: +31 53 203 0996
E: info@kryoz.nl

"An elegant way to perform
all your low-temperature characterization measurements"