

**CONTRACT FOR THE PURCHASE OF SPECIFIED EQUIPMENT**

**Key Terms**

<b>Purchaser</b> Address: Contact: Email:	<b>CESNET, zájmové sdružení právnických osob</b> Generála Píky 430/26, 160 00 Prague 6, Czech Republic Ing. Ondřej Havliš, Ph.D. <a href="mailto:havlis@cesnet.cz">havlis@cesnet.cz</a>
<b>Supplier</b> Address: Contact: Email:	<b>Menlo Systems GmbH</b> Bunsenstrabe 5, D-82152 Martinsried, Germany Dr. Ida Z. Kozma <a href="mailto:sales@menlosystems.com">sales@menlosystems.com</a>
<b>Project Registration Number</b>	<b>CZ.02.01.01/00/22_008/0004649</b>
<b>Deliverables</b>	ORS-Mini Ultrastable Laser System - Ultrastable optical cavity for increasing the coherence of intercity photonic link transmission lasers
<b>Specifications</b>	The specifications provided in the Supplier's tender offer (Annex of this Contract)
<b>Contract Price</b>	142,824.00 EUR
<b>Delivery Terms</b>	The delivery period is 25 weeks after signing of contract DDP (under the Incoterms) for delivery at the delivery dock at CESNET, Generála Píky 430/26, 160 00 Prague 6
<b>Payment Terms</b>	N30 days upon delivery
<b>Warranty Period</b>	36 (thirty-six) months after final acceptance testing is passed
<b>Training and Support Requirements</b>	Remote support for the initialization of the system and operator training for one workday
<b>Installation Requirements</b>	Supplier's installation protocol that will be provided to the Purchaser at time of delivery
<b>Specialized Maintenance Equipment, Tools or Test Equipment required</b>	If there is a longer delay (> 4-5 days) between the system delivery and the installation, a turbo pump will be required prior to restore the vacuum level at which the system was delivered
<b>Other terms and additional documentation</b>	The Supplier confirms to accept the Terms and Conditions of the contracting authority, set out in article 7. of the Tender Documentation  All the services required in Articles 3.4 and 3.5 of the tender documentation will be provided to the contracting authority under the warranty and technical support services

The Supplier agrees to supply the Deliverables on the terms of this Contract. The parties agree to be bound by this Contract.

<b>SIGNED for and on behalf of CESNET by:</b>	<p><b>Ing. Jakub Papírník</b> Digitálně podepsal Ing. Jakub Papírník Datum: 2025.02.18 09:20:31 +01'00'</p> <hr/> <p>Ing. Jakub Papírník, director Authorized Signatory</p> <p>Date – see digital signature</p>
<b>SIGNED for and on behalf of Menlo Systems GmbH by:</b>	<p>Dokument unterschrieben von: Dr. Ida Zsuzsanna Kozma am: 14.02.2025 15:43</p> <hr/> <p>Dr. Michael Mei, managing director Authorized Signatory</p> <p>Date – see digital signature</p> 

## To the public contract "Ultrastable optical cavity for increasing the coherence of intercity photonic link transmission lasers" ID No.: 63839172



### 1 Summary

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Menlo Systems GmbH offers the ORS-Mini Ultrastable Laser System: ultrastable laser system based on a CW laser locked to an ultrastable high-finesse optical reference cavity.

The cavity design of the ORS-Mini is licensed by National Physical Laboratory, UK.

Includes: CW ECL (external cavity laser) at 1542.14 nm (ITU #44), high-finesse reference cavity with ULE (ultra-low expansion glass) spacer and cavity mirrors with ion beam sputtered (IBS) highly reflective coatings, conflat flange (CF) vacuum system, temperature stabilization, and Pound-Drever-Hall servo electronics.

Performance: stability (MADEV at 1 s) of  $< 3e-15$  and linewidth of  $< 1$  Hz with the linear shrinking drift removed. Fiber coupled (PM fibre, FC/APC connector, linearly polarized) output power  $> 10$  mW.

### 2 General System Description

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The Optical Reference System ORS-Mini delivers ultra-narrow linewidth laser light with outstanding frequency stability.

The system's centre piece is a high-finesse Fabry-Pérot cavity (cubic spacer with a length of 5 cm) serving as a reference for a CW laser. The cavity is made out of ultra-low expansion glass (ULE 7973 from Corning) and is operated in vacuum at the point of zero thermal expansion.

The reference cavity is decoupled from vibrations and acoustically isolated allowing for ultimate performance also in rough laboratory environments. Rigid mounting of the cavity ensures portability without realignment of the optical paths. The ORS-Compact is a complete 19" rack solution (8U).

### 3 Specifications

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- Complete system consisting of high-finesse Fabry-Perot cavity, temperature-controlled vacuum housing, ion getter vacuum pump, telecom-grade laser source, optics, and control electronics.

- Output wavelength: 1542.14 nm (ITU channel #44), PM fiber with FC/APC optical connector
- Linewidth <1 Hz
- Allan deviation at 1 s with no drift removal:  $<3 \times 10^{-15}$
- Daily laser drift <13 kHz after settling of cavity
- Daily frequency variation with linear drift removed less than 500 Hz in stable lab environment where the surrounding lab temperature drifts less than 0.25°C daily.
- 19" rack, 8U device
- Power supply AC 230 V

## 4 List of parts

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- Reference cavity with ULE spacer
- Cavity mirrors with highly reflective IBS coating on ULE substrate, backside AR coated
- Input coupling platform with fiber collimator, PDH optics including electro optical modulator, polarizing beam splitter, half-wave plate, quarter-wave plate, photodiode, and optics for modematching
- Output coupling platform with CCD camera and monitor photodiode
- CW ECL at 1542.14 nm
- Vacuum system, DN16 viewports, 5 l/s ion getter pump with controller, two thermal shields, and metal-sealed valve for connecting external turbo pump
- Peltier elements for intra-vacuum cavity temperature stabilization and for EOM temperature stabilization
- Acoustic isolation
- SYNCRO platform (remotely controllable) including: high bandwidth PI<sup>2</sup>D loop filter, TEC controllers, DDS, function generator, and PDH locking electronics

## Checklist of technical requirements for the Equipment

<b>Supplier:</b>	<b>Menlo Systems GmbH</b>
<b>Public contract:</b>	Ultrastable optical cavity for increasing the coherence of intercity photonic link transmission lasers

<b>Technical requirements for the Equipment</b>			
		YES / NO	Value / Details
1	Complete system consisting of high-finesse Fabry-Perot cavity, temperature-controlled vacuum housing, vacuum pump, laser source, optics, and control electronics	YES	<p>Ultrastable laser system based on a CW laser locked to an ultrastable high-finesse optical reference cavity.</p> <p>The cavity design of the ORS-Compact is licensed by National Physical Laboratory, UK.</p> <p>Includes: CW ECL (external cavity laser) at 1542.14 nm, high-finesse reference cavity with ULE (ultra-low expansion glass) spacer and cavity mirrors with ion beam sputtered (IBS) highly reflective coatings, conflat flange (CF) vacuum system, temperature stabilization, and PDH locking electronics.</p>
2	Output wavelength 1542 nm with PM fibre optical connector FC/APC	YES	Standard.
3	Linewidth 1 Hz	YES	Linewidth <1 Hz.
4	Allan Deviation at 1 s with no drift removal smaller than $3 \times 10^{-15}$	YES	Stability (MADEV at 1 s, no drift removal): $<3 \times 10^{-15}$ .
5	Daily laser drift less than 20 kHz	YES	Daily laser drift less than 13 kHz (after the cavity settles).
6	Daily frequency variation with linear drift removed less than 500 Hz.	YES	Daily frequency variation with linear drift removed, less than 500 Hz (if the product is placed in a stable lab environment and the surrounding temperature varies less than 0.25°C daily).
7	Mounting 19" rack max. 14U	YES	19" rack, 8U device.
8	Power supply AC 230V	YES	Standard.

\* Please indicate in the empty cells whether the offered Equipment meets the technical requirements and, where applicable, the value according to the Equipment characteristics.

## Warranty

*Menlo Systems provides*

- ✓ *Transparent and timely communication*
- ✓ *Lifelong initial remote support and diagnosis free of charge*
- ✓ *10-year availability of spare parts*

### *Warranty*

Warranty period offered for the Public contract: „Ultrastable optical cavity for increasing the coherence of intercity photonic link transmission lasers“ Contracting authority: CESNET, interest association of legal entities Generála Píky 430/26, 160 00 Prague 6 ID No.: 63839172 is: **36 (thirty-six) months.**

Standard warranty includes in-depth remote support, full failure diagnosis, and repair or replacement of defect parts.

### *Warranty Extensions*

Menlo Systems offers warranty extensions for all its products. The warranty extension is available before the expiration of the original warranty period. The coverage is the same as during the standard warranty: remote support, failure diagnosis, and repair or replacement of defect parts.

The annual fee for the warranty extension is 5% of the system price.

Martinsried, September 2, 2024

# Technical Support Menlo Systems

For after sales service or repair Menlo Systems counts on a Service and Support department that is available via videocall, email, telephone or service visit. Together with the product specialist they will determine if the equipment requires service, repair, calibration or replacement.

In case your system has to be returned to Menlo Systems for service or repair, we will provide an RMA number to you. For more information about the RMA procedure please read the online information at:

<http://www.menlosystems.com/legals/service-plans-returns-rma/>

## Contact information:

Menlo Systems GmbH, Bunsenstr a e 5, 82152 Martinsried, Germany

Phone: +49 89 189166 0

Fax: +49 89 189166 111

Email: [service@menlosystems.com](mailto:service@menlosystems.com)

Timezone: CET (UTC+1) / CEST (UTC+2)

If telephone is preferred, our office hours are typically: 9am - 5pm (CET/CEST).

## Menlo System's technical support includes:

- Provision of documentation for hardware and software operation (e.g. test reports, user manuals etc.)
- A repose time for remote support within one week (or 5 business days)
- One- time service meeting upon request available for testing system functionality or to perform e.g. software upgrades, if needed
- Remote support and operator training is part of the delivery frame and installation service