WEATHER CLIMATE WATER
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WMO OMM
World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

1950-2025 SCIENCE for ACTION

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Ref.: 00001/2025-LT1

Our ref.: 00001/2025/I/MQC/ILC-RA-IV-Inv 21 January 2025

Annexe: 1 (available in English only)

Subject: WMO interlaboratory comparison in the Regional Association IV

Action required: To express your readiness to take part in the interlaboratory comparison and to nominate a laboratory and its point of contact, by **28 February 2025**

Dear Sir/Madam,

I am pleased to inform you that WMO is organizing, under the auspices of its Commission for Observation, Infrastructure and Information Systems (INFCOM) and its Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT), an interlaboratory comparison (ILC) for the Members from the WMO Regional Association IV (RA IV) (North America, Central America and the Caribbean). The ILC will be conducted in the course of 2025 and will be directly supervised by the SC-MINT Expert Team on Quality, Traceability and Calibration (ET-QTC).

ILC exercises represent an efficient tool for demonstrating technical competencies and capabilities of the laboratories, to ensure fulfilment of one of the basic criteria for achieving or maintaining accreditation according to ISO/IEC 17025, but these events also contribute to the capacity development through gathering and sharing experience and knowledge. Furthermore, by taking part in ILC, the laboratories leverage the roles and contribute to worldwide confidence in the traceable measurements.

The ILC in RA IV will be built upon the ILCs that were successfully completed in RA II (Asia), RA V (South-West Pacific) and RA VI (Europe). The results were published in *Instruments and Observing Methods Report No. 128* and the *Instruments and Observing Methods Report No. 134*, and will soon be completed for RA I and RA III. The ILC will be conducted in the domains of temperature, pressure and relative humidity.

The ILC is aimed at the laboratories of the National Meteorological and Hydrological Services (NMHSs), or other public or private laboratories that calibrate NMHS's instruments and thus ensure traceability of the measurements under the NMHS's responsibility.

Among laboratories from RA IV, the ILC will also include the participation of the Regional Instrument Centre (RIC) of Ljubljana and University of Ljubljana (Slovenia), which were the organizers and supporters to the previous events. Their set of instruments will be used as ILC test items while their valuable experience is expected to contribute to the overall success of the planned event, and to provide support for the evaluation of the results. It is anticipated that the results of the ILC will be published as a WMO Instruments and Methods of Observation report.

To: Permanent Representatives of Members of Regional Association IV with WMO

cc: President of INFCOM
President of RA IV
Chair of INFCOM Standing Committee on Measurement, Instrumentation and Traceability

I have the pleasure to inform you that the University of Ljubljana, supported by the Slovenian Environment Agency that is hosting a RIC, has kindly agreed to act as an ILC pilot laboratory and coordinator, and to make all the necessary arrangements for the ILC. Further organizational details and tentative timelines are presented in a draft ILC protocol that is available in the annex. The protocol and the timelines will be finalized upon agreement of all selected participants.

I would kindly encourage you to make use of this excellent opportunity and to nominate a laboratory (or laboratories), preferably those that ensure traceability of your measurements, together with their point of contact (first name, family name, job title, institution, email) for this event. The nominations should be sent by email to the contact point of the ILC pilot laboratory, Mr Gaber Beges (gaber.beges@fe.uni-lj.si) from the University of Ljubljana, with a copy to the WMO Secretariat, Ms Isabelle Rüedi, Head, Measurement, Quality and Compliance Unit (iruedi@wmo.int), at your earliest convenience, but preferably not later than **28 February 2025**.

I wish to take this opportunity to express my appreciation for your continued contribution to WMO, and the activities of its Instruments and Methods of Observation Programme.

Yours faithfully,

Ms Ko Barrett
for the Secretary-General

WORLD METEOROLOGICAL ORGANIZATION

WMO Commission for Observation, Infrastructure and Information Systems

Standing Committee on Measurements, Instrumentation and Traceability

Expert Team on Quality, Traceability and Calibration

in cooperation with

UNIVERSITY OF LJUBLJANA
Faculty of Electrical Engineering

REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
SLOVENIAN ENVIRONMENT AGENCY

METEOMET
Metrology for Meteorology

Draft ILC protocol

INSTRUCTION FOR THE PARTICIPANTS IN THE INTERLABORATORY COMPARISON IN THE WMO REGIONAL ASSOCIATION IV

Title: **Intercomparison in the field of temperature, humidity and pressure**

MM-ILC-2025-THP-RA IV

Date of approval of the protocol:

XX.XX.XXXX

Items:

- Two Pt-100 resistance thermometers ELPRO type 2210 4700/X in combination with Keysight/Agilent/Hewlett Packard 34420A
- Capacitive hygrometer Vaisala HMP155, A2GB11A0A1A1A0A
- Barometer Vaisala PTB220, ACA2A3A1AB

CONTENTS

1. INTRODUCTION

Interlaboratory comparison (ILC) serves as a tool for comparison of measurement results carried out by accredited or non-accredited calibration laboratories in the relevant field of measurement. ILC represents very effective means to demonstrate the technical competence of the participants and serves as a technical base for accreditation. Furthermore, it is the most important element for the monitoring of quality of measurement results as required by ISO/IEC 17025:2017 standard for laboratories in part 7.2.2 and 7.7.

This ILC will be organized by the OSE-SOI (Observing Systems Engineering) – ECCC (Environment and Climate Change Canada) in close cooperation with the RIC Ljubljana (Environment Agency, Slovenia), University of Ljubljana, Faculty of Electrical Engineering, Laboratory of Metrology and Quality (UL-FE/LMK, Slovenia) and the National Metrology Institute of Italy (Istituto Nazionale di Richerca Metrologica – INRIM, Italy). This ILC will be supervised by the SC-MINT Expert Team on Quality, Traceability and Calibration (ET-QTC).

It is recommended that the participants use their standard procedures during the temperature, humidity and pressure calibrations and, if possible, avoid making extra time-consuming measurements. The proficiency test will be carried out in accordance with ISO/IEC 17043:2023.

1.1 Overall coordinator and pilot laboratory

Due to the current availability of resources within the WMO RA IV participating institutions in this ILC and connection to ILCs in other WMO Regions, the coordinator will be:

University of Ljubljana, Faculty of Electrical Engineering
Trzaska street 25, 1000, Ljubljana, Slovenia
Assoc. Prof. Dr Gaber Beges
Phone: +386 1 4768 224 GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si

with local support for any organizing, transport, customs and similar issues

OSE-SOI (Observing Systems Engineering) - ECCC (Environment and Climate Change Canada)
4905 Dufferin St, M3H 5T4 Toronto, Ontario, Canada
Phone: 416–664–5384
Email: hagop.mouradian@ec.gc.ca

1.2 Laboratories contributing to the reference values

Environmental Agency (Slovenia – SI)
Vojkova 1b, 1000, Ljubljana, Slovenia
Mr Drago Groselj
Phone: +386 1 478 4100 GSM: +386 31 655 216
Email: drago.groselj@gov.si

University of Ljubljana, Faculty of Electrical Engineering (Slovenia – SI2) (only temperature and humidity)
Trzaska street 25, 1000, Ljubljana, Slovenia
Assoc. Prof. Dr Gaber Beges
Phone: +386 1 4768 224 GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si

TO ADD LABORATORIES (e.g. local NMIs or high level RIC laboratories)

1.3 Data analysis coordinator and contributing laboratories

University of Ljubljana, Faculty of Electrical Engineering (Slovenia – SI2) (only temperature and humidity)
Trzaska street 25, 1000, Ljubljana, Slovenia
Assoc. Prof. Dr Gaber Beges
Phone: +386 1 4768 224 GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si

Institutions providing assistance in data analysis:

Environmental Agency (Slovenia – SI1)
Vojkova 1b, 1000, Ljubljana, Slovenia

Istituto Nazionale di Richerca Metrologica (INRIM).
Str. delle Cacce, 91, 10135 Torino TO, Italy

1.4 Participants

Following are the participants to this intercomparison. Contact details are as listed alphabetically:

Participating laboratory: Environmental Agency (Slovenia – SI1)
Contact person: Mr Drago Groselj
Address: Vojkova 1b Zip: 1000
City: Ljubljana
Country: Slovenia
Phone: +386 1 478 4100 GSM: +386 31 655 216
Email: drago.groselj@gov.si

Participating laboratory: University of Ljubljana, Faculty of Electrical Engineering (Slovenia – SI2) (only temperature and humidity)

Contact person: Assoc. Prof. Dr Gaber Beges
Address: Trzaska street 25, Zip: 1000
City: Ljubljana
Country: Slovenia
Phone: +386 1 4768 224 GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si

TO ADD OTHER LABORATORIES

Participating laboratory:
Contact person:
Address: Zip:
City:
Country:
Phone: GSM:
Email:

1.5 Time schedule and deadlines

The intercomparison is organized in a loop. All participating laboratories have four weeks for calibration including transport to the next laboratory. The transport must be planned for each of the participating laboratories, so that the subsequent laboratory receives the equipment no later than on Monday of the first week, in which the calibration is planned to be carried out.

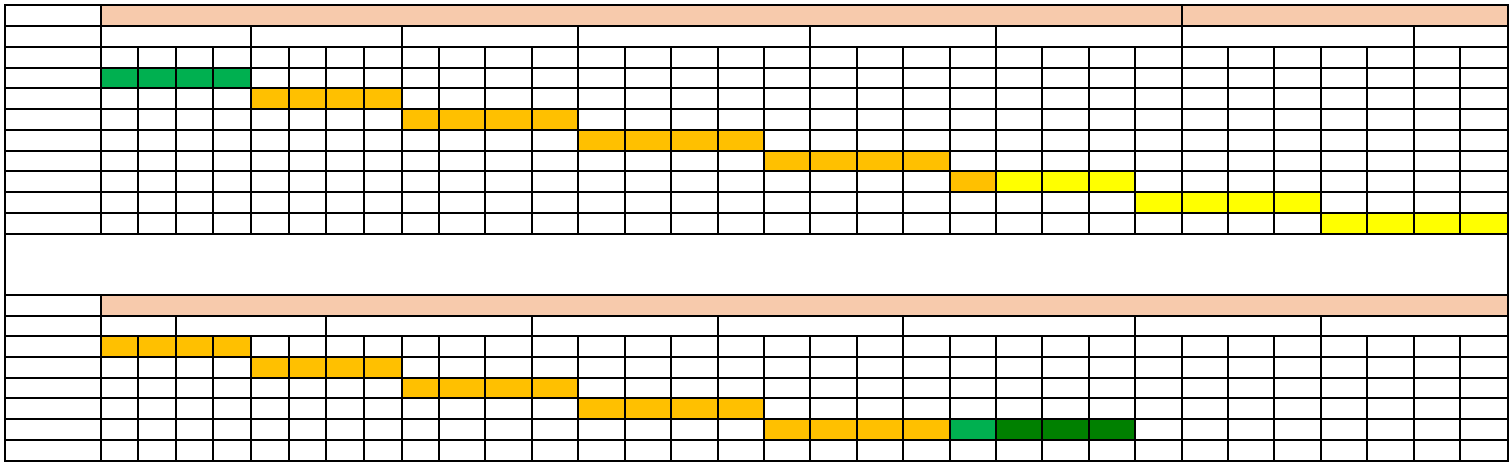
If a participant anticipates difficulties in keeping the deadlines, the coordinator must be contacted immediately. In such a case the other participants will be contacted as soon as possible and be informed about eventual changes.

Deadline for reporting the results is four weeks after the equipment has left the laboratory. It is important that the deadline is met since the results are being analysed continuously by the reference laboratory. If there are any problems or doubt regarding the results of the participant laboratory, the laboratory will be contacted immediately. Any suspicion that the equipment is defect or drifted, will lead to a return of the equipment to the reference laboratory, which will then make an extra check and take appropriate action.

The measurements in the first laboratory are tentatively scheduled to start in TBD XXXX 2025. The time schedule will be finalized upon agreement of all selected participants.

Date	Lab
March 2025 4 weeks	SI1, SI2
4 weeks	LAB 1
4 weeks	LAB 2
4 weeks	LAB 3
4 weeks	LAB 4
4 weeks	…
4 weeks	LAB N
8 weeks	SI1, SI2

Time schedule yet to be defined.



1.6 Transportation of the equipment

As soon as the equipment is delivered/sent, the coordinator shall be informed (e.g. by email). The equipment is then unpacked, and an inspection is carried out. If the equipment has any

visible damage due to transportation, this must be reported to the coordinator before the calibration begins.

The equipment can be sent via registered mail (DHL, UPS, etc.) or hand carried (personal transport) to the next laboratory (preferably hand carried).

The participating laboratory covers expenses of transportation to the next laboratory. The participating laboratory must ensure that the equipment is covered by insurance from the moment it arrives to the laboratory until it is delivered to the next laboratory (i.e. including the transportation to the next laboratory).

For border crossings and customs purposes, equipment will be accompanied with ATA CARNET forms and/or temporal import/export documents. Please, do not forget to fill them in when crossing borders. If your country is not a signatory of the ATA CARNET convention, please follow the temporary import/export procedure.

2. DESCRIPTION OF THE EQUIPMENT

2.1 General

Measuring quantity	**Temperature**	**Relative humidity**	**Air pressure**
Measuring instrument	Keysight/Agilent Hewlett Packard 34420A digital readout, 2 x Pt100	Capacitive hygromete	Barometer
Manufacturer	HP, ELPRO	Vaisala	Vaisala
Type	34420A, 2210 4700/X	HMP155 A2GB11A0A1A1A0A	PTB220 ACA2A3A1AE
Serial number	34420A: MY42002060 Thermometers: 395090316 395100316	K2250040	W4230005
Measuring range	(-200 – 450) °C	(0.8 – 100) %RH	(500 – 1100) hPa
Output	Temperature; Digital display, GPIB	Voltage (0...1V); Analog output	Pressure; Digital display, GPIB
Accuracy	0.05°C at 20°C	1%RH	15 Pa
Uncertainty	0.03°C	-	-
Minimum immersion depth	150 mm	-	-
			

The instrument’s owner: UL/FE-LMK and RIC Ljubljana.

For transportation purposes the measuring instruments will be placed in a protecting case.

If any of the above-mentioned equipment is missing on receipt, the coordinator must be contacted.

2.2 Environmental conditions

Calibration is carried out at an ambient temperature of (20 ± 5) °C and relative humidity of (30 – 60)%. The ambient conditions shall be reported.

Barometer stabilization (warm-up) before measurements should be made according to the common laboratory practice, but at least for two hours in the laboratory environment.

2.3 Handling

2.3.1 Packing and unpacking

Procedure for unpacking is as follows:

1. Inspect the transportation boxes for damage. If the boxes are damaged, the coordinator shall be contacted before continuing.

2. Unpack the equipment and check that all equipment mentioned in the section "Description of equipment" is present. Please, fill in "Instrument Check List" – Appendix F and send it to gaber.beges@fe.uni-lj.si.

3. If any equipment is missing, the coordinator shall be contacted.

4. Inspect the equipment. If any of the equipment shows visible signs of damage, the coordinator shall be contacted.

The packing procedure is as follows:

1. Before packing, slowly cool down the equipment (thermometers) to room temperature and clean them with pure alcohol. Clean also other calibrated items if necessary.

2. Check that all equipment mentioned in the section "Description of equipment" is packed before the equipment is transported to the next participant. For details of packing, please see Appendix E: Packaging instructions.

2.3.2 Mounting

1. The Pt100 are cleaned before use with pure alcohol. Other instruments should be cleaned only if necessary.

2. Thermometers are carefully placed in the calibration media (bath, climatic chamber). Relative humidity sensor is carefully placed in the calibration media (climatic chamber or humidity generator). The barometer is carefully connected to the barometric pressure system.

2.3.3 Precautions

- Pt100 are very sensitive device to vibrations and mechanical shocks
- When not in use, it should be stored in a safe place in the provided transport boxes
- Check that the thermometers are completely clean and dry before placing them in the calibration media

- Ensure that the thermometers are cooled down and cleaned with pure alcohol before placing them in the transportation box

- Do not expose relative humidity sensor to temperatures higher than 25°C and lower than 15°C

- **Do not expose barometers to pressures other than barometric!**

Contact the coordinator in case of doubt about the above-mentioned precautions.

3. CALIBRATION/TEST METHOD

It is recommended that the participants use their standard procedure during temperature, humidity and pressure calibration and avoid making extra time-consuming measurements, if possible. For accredited laboratories it will be advantageous to apply the accredited procedures in preparation for later use of the report in relation with documentation to the accreditation body.

Details about the applied procedure have to be stated in the report form.

3.1 Start-up and initial inspection

The Keysight/Agilent/Hewlett Packard 34420A instrument can measure 1 Pt 100 at a time. Connect first Pt100 to the Keysight/Agilent/Hewlett Packard 34420A instrument as described in Appendix B. Before start of the measurement, you can set up automatic acquisition of temperature measurement for Keysight/Agilent/Hewlett Packard 34420A instrument using GPIB communication bus. Needed commands are available in the User's Guide (see pages 71 and 72).

BE CAREFUL NOT TO CHANGE ANY OF PRESET COEFFICIENTS!

After setting up the equipment for the calibration, take the first measurements as follows:

1. For temperature, after the stabilization take the first measurements in the triple point of water, or the ice-point, or in the thermal bath at 0°C. Note the readings of both thermometers as well as the laboratory’s reference thermometer and report all these values to the coordinator/reference laboratory, immediately.

2. For relative humidity, after the stabilization take the first measurements at relative humidity of about 55%. Note the readings of the hygrometer as well as the laboratory’s reference hygrometer and report all these values to coordinator/reference laboratory, immediately.

3. For atmospheric pressure, after the stabilization take the first measurements at atmospheric pressure of about 950 hPa. Note the readings of the barometer as well as laboratory’s reference barometer and report all these values to the coordinator/reference laboratory, immediately.

The coordinator will check your initial measurements and send you confirmation that you can start with the measurements for ILC.

3.2 Measuring points

Laboratories shall perform measurements only in measurement points that they are able to do with their equipment. If a laboratory cannot measure one or more points, laboratory should omit them and should not add extra points.

- Temperature

The subject of the ILC is the calibration of two Pt100 in combination with Keysight/Agilent/Hewlett Packard 34420A. The calibration shall be performed in the following measurement points within tolerances ±0.2°C using standard laboratory procedures:

-30	**-20**	**-10**	**0**	**10**	**20**	**30**	**40**	°C

- Relative humidity

The subject of the ILC is the calibration of the capacitive hygrometer Vaisala HMP155. The calibration shall be made in the following measurement points within tolerances ±3 %RH at temperature of 20°C using standard laboratory procedures:

10	**20**	**35**	**55**	**75**	**90**	**95**	%RH

In the case of salt solution calibration other calibration points can be used covering as wide measuring range as possible.

- Air pressure

The subject of the ILC is the calibration of the digital barometer Vaisala PTB220 ACA2A3A1AB. The calibration shall start at a minimum calibration point followed by increasing pressure and return steps by decrease of pressure. The calibration shall be made in the following measurement points within tolerances 20 hPa using standard laboratory procedures:

800	**850**	**900**	**950**	**1000**	**1050**	**1100**	hPa

Warning	For the purposes of this ILC it is strictly forbidden to make any adjustments to the measuring instrument – test item, especially to activate the calibration regime! The only actions permitted are the movement among functions and operations described in the enclosed instruction manual.

3.3 Reporting of results

The results are reported electronically in the forwarded Excel spreadsheet. The green fields of the spreadsheet should be filled in, if possible. Please send your results only to the data analysis coordinator (gaber.beges@fe.uni-lj.si).

The results shall be sent to the coordinator no later than **four weeks** after having finalized the calibration. Electronic reporting by email is preferred.

The Excel spreadsheet form and the calibration certificate for each quantity shall be sent to the ILC coordinator as results of measurements.

Outline of statistical analysis

The assigned values are to be determined by the coordinator as the arithmetic mean of measurements made as in 1.2. Any outliers are detected by Cochran's test and Grubbs' test (ISO 5725–2).

Information to be returned to participants

Final results of the participants will be un-anonymized (as it has been the case in all WMO RA ILCs). The participants will receive a summary of all measurements, assigned values and uncertainties of assigned values, and evaluation of the performance.

The evaluation of measurement results will be made on the basis of E_n number:

$$E_n = \frac{x_{\text{lab}} - x_{\text{ref}}}{\sqrt{U^2_{\text{lab}} + U^2_{\text{ref}}}}$$

where x_{lab} is the participant's result, x_{ref} is the assigned value, U_{lab} is the expanded (k=2) uncertainty of a participant's result and U_{ref} is the expanded (k=2) uncertainty of the assigned value.

The assigned value x_{ref} will be calculated as mean of reference laboratories (as in 1.2). The uncertainty of the assigned value U_{ref} will be calculated as uncertainty of mean, with uncertainties of reference laboratories at each calibration point.

Criteria for performance evaluation will be based on statistical determination for E_n number:

$$|E_n| \leq 1 \;=\; \text{satisfactory}$$
$$|E_n| > 1 \;=\; \text{unsatisfactory}$$

Complaints and appeals

Participants may file a complaint or appeal to the data analysis coordinator (UL-FE/LMK, PT provider) in 60 days after they receive the final PT report.

3.4 Measurement uncertainties

The measurement results should be stated with their associated uncertainties, the evaluation of uncertainties should be done according to the document EA 4/02 M, ILAC P14 ILAC Policy for Uncertainty in Calibration. The interlaboratory comparison should be made according to the best laboratory measurement practice.

4. APPENDIX A: REPORT FORM

Standard forms for the reporting of results and uncertainties for temperature, relative humidity and pressure. The form will be forwarded electronically.

Ref.: 00001/2025-LSI

Results for MM-ILC-..... -THP - ILC with digital thermometer

Name of Laboratory:	
Equipment received (Date):	
Equipment calibrated (Date):	
Equipment shipped to next laboratory (Date):	

Calibration (according measurement instructions):

Set[1]	Read temperature PT100-1 [2]	Read temperature Pt100-2 [2]	Reference temperature 1[3]	Reference temperature 2[4]	Correction 1 [5]	Correction 2 [6]	*U1 (95%)* [7]	*U2 (95%)* [8]	CMC 1 [9]	CMC 2 [10]
°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
start-up measurement (3.1 of protocol) 0.0					0	0				
-30.0					0	0				
-20.0					0	0				
-10.0					0	0				
0.0					0	0				
10.0					0	0				
20.0					0	0				
30.0					0	0				
40.0					0	0				
0.0					0	0				

Ambient temperature (range)		°C
Ambient relative humidity (range)		% r.h.
Ambient air pressure (range)		hPa

Notes

1) Set-value, typed in on the calibration medium
2) Read-value, read on the display of digital thermometer for Pt100-1 and Pt100-2
3) Reference temperature when calibrating Pt100-1, measured by the laboratory
4) Reference temperature when calibrating Pt100-2, measured by the laboratory
5) Correction 1 = reference temperature - Pt100-1 of digital thermometer
6) Correction 2 = reference temperature - Pt100 2 of digital thermometer
7) Expanded uncertainty of the correction (=uncertainty of the calibration) - Pt100-1 of digital thermometer
8) Expanded uncertainty of the correction (=uncertainty of the calibration) - Pt100-2 of digital thermometer
9) Calibration and measurement capability (only if the laboratory is accredited for the measurement) - Pt100-1 of digital thermometer
10) Calibration and measurement capability (only if the laboratory is accredited for the measurement) - Pt100-2 of digital thermometer

Additional information

State, if required, details concerning the used calibration procedure

Used reference standards and traceability

Standards	Traceability

Ref.: 00001/2025-LSI

Results for MM-ILC-..... -THP - ILC with relative humidity meter

Name of Laboratory:	
Equipment received (Date):	
Equipment calibrated (Date):	
Equipment shipped to next laboratory (Date):	

Calibration (according measurement instructions):

Set[1]	Read relative humidity [2]	Read air temperature[2]	Reference relative humidity [3]	Reference air temperature[4]	Correction [5]	Correction [5]	*U (95%)* [7]	*U (95%)* [8]	CMC [9]	CMC [9]
% r.h.	% r.h.	°C	% r.h.	°C	% r.h.	°C	% r.h.	°C	% r.h.	°C
start-up measurement (3.1 of protocol) 55,0					0	0				
10,0					0	0				
20,0					0	0				
35,0					0	0				
55,0					0	0				
75,0					0	0				
90,0					0	0				
95,0					0	0				
55,0					0	0				

Ambient temperature (range)		°C
Ambient relative humidity (range)		% r.h.
Ambient air pressure (range)		hPa

Notes
1) Set-value, typed in on the calibration medium
2) Read-value, read on the ILC relative humidity meter
3) Reference relative humidity, measured by the laboratory
4) Reference temperature, measured by the laboratory
5) Correction = reference relative humidity - relative humidity meter
6) Correction = reference temperature - temperature if ILC relative humidity meter
7) Expanded uncertainty of the correction (= uncertainty of the calibration) - relative humidity
8) Expanded uncertainty of the correction (=uncertainty of the calibration) - OPTIONAL for temperature
9) Calibration and measurement capability (only if the laboratory is accredited for the measurement) - relative humidity and OPTIONAL for temperature

Additional information

State, if required, details concerning the used calibration procedure

Used reference standards and traceability

Standards	Traceability

Ref.: 00001/2025-LSI

Results for MM-ILC····· -THP - ILC with barometer

Name of Laboratory:	
Equipment received (Date):	
Equipment calibrated (Date):	
Equipment shipped to next laboratory (Date):	

Calibration (according measurement instructions):

Set [1]	Reference pressure [2]	Read pressure (upper left) [3]	Read pressure (upper right) [3]	Read pressure (lower left) [3]	Read pressure (lower right) [3]	Correction (upper left) [4]	Correction (upper right) [4]	Correction (lower left) [4]	Correction (lower right) [4]	*U (95%) (upper left)* [5]	*U (95%) (upper right)* [5]	*U (95%) (lower left)* [5]	*U (95%) (lower right)* [5]	CMC (lower right) [6]
hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa	hPa
start-up measurement (3.1 of protocol) 950						0,00	0,00	0,00	0,00					
800						0,00	0,00	0,00	0,00					
850						0,00	0,00	0,00	0,00					
900						0,00	0,00	0,00	0,00					
950						0,00	0,00	0,00	0,00					
1000						0,00	0,00	0,00	0,00					
1050						0,00	0,00	0,00	0,00					
1100						0,00	0,00	0,00	0,00					
1050						0,00	0,00	0,00	0,00					
1000						0,00	0,00	0,00	0,00					
950						0,00	0,00	0,00	0,00					
900						0,00	0,00	0,00	0,00					
850						0,00	0,00	0,00	0,00					
800						0,00	0,00	0,00	0,00					

Ambient temperature (range)		°C
Ambient relative humidity (range)		% r.h.
Ambient air pressure (range)		hPa

Notes

1) Set-value, typed in on the calibration medium
2) Reference pressure, measured by the laboratory
3) Read-value, read on the ILC barometer
4) Correction = reference pressure - ILC barometer display value
5) Expanded uncertainty of the correction (= uncertainty of the calibration)
6) Calibration and measurement capability (only if the laboratory is accredited for the measurement)

Additional information

State, if required, details concerning the used calibration procedure

Used reference standards and traceability

Standards	Traceability

5. APPENDIX B: USER'S GUIDE FOR KEYSIGHT/AGILENT/HEWLETT PACKARD 34420A

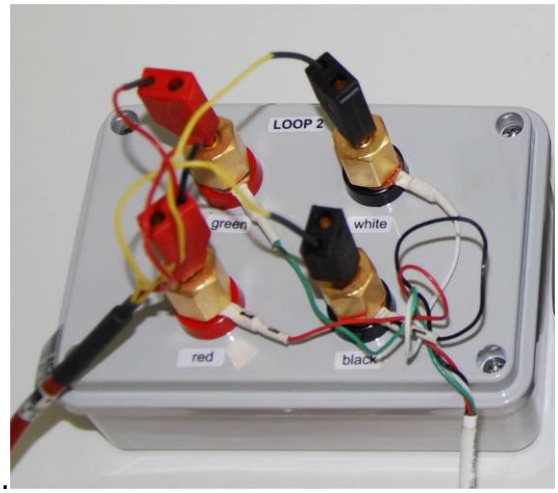
The original User's Guide for Keysight/Agilent/Hewlett Packard 34420A is appended to the ILC protocol and provided in the ILC kit. Only one thermometer Pt100 can be measured by the Keysight/Agilent/Hewlett Packard 34420A at a time.

The ILC kit for temperature measurements consists of:

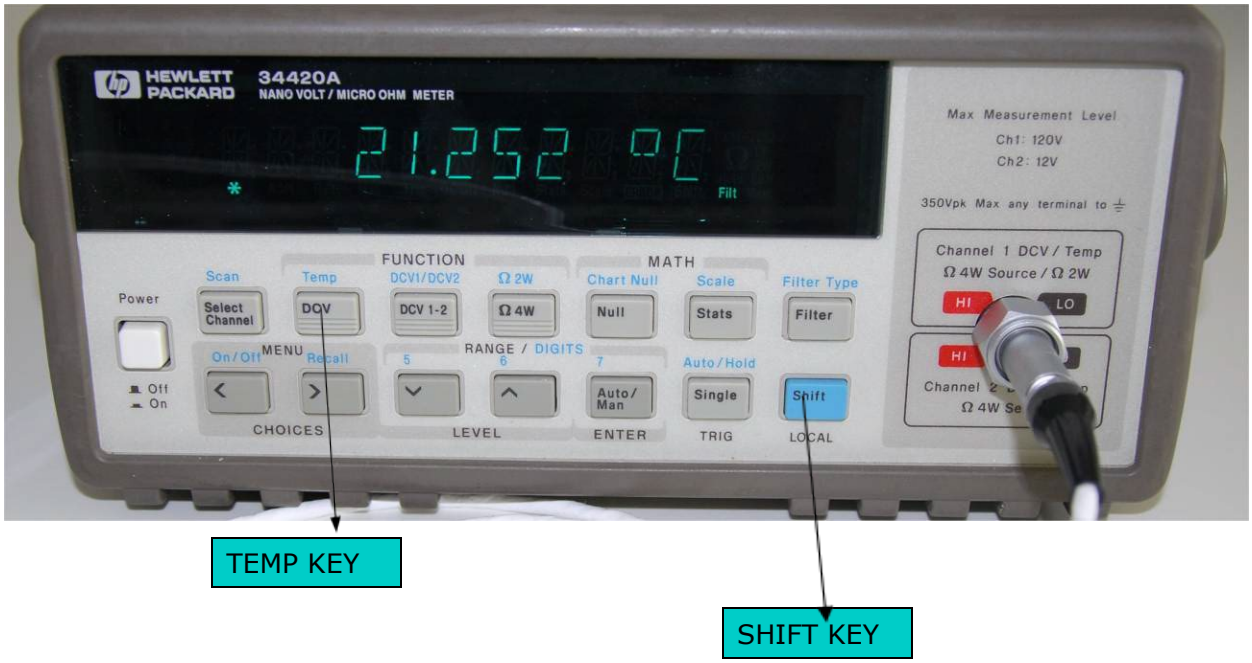
- Keysight/Agilent/Hewlett Packard 34420A
- Two identical thermometers Pt100
- Connection unit
- Connection cable (34420A – connection unit)

The Pt100 is connected to the connection unit as shown in the following picture.

The thermometer is connected (4 wire) to the connection unit as follows:



The connection unit is connected to the front connection of 34420A. Measured values can be read on display or via GIPB interface bus. When thermometer is connected and 34420A switched on, the temperature of the thermometer can be observed by pressing SHIFT and TEMP key. The display shows temperature of Pt100 in degrees Celsius.



TEMP KEY

SHIFT KEY

If thermometers reading via GPIS is preferred, following setup for 34420A is used:

- Loop 1: GPIB address 27
- Loop 2: GPIB address 20

Command string is <read?> to read value.

Warning	For the purposes of this ILC it is strictly forbidden to make any adjustments to the measuring instrument. The only actions permitted are the movement among functions.

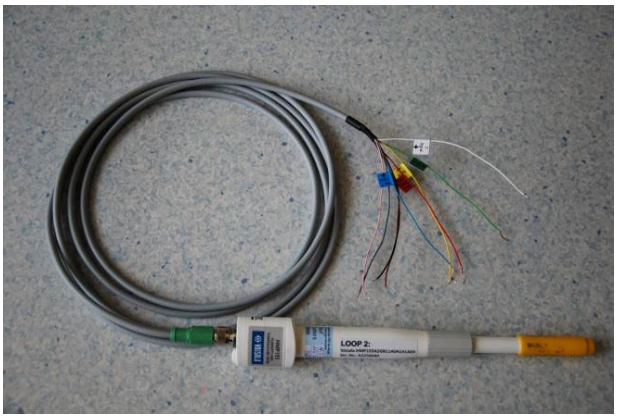
6. APPENDIX C: USER'S GUIDE FOR VAISALA HMP155

The original User's Guide for Vaisala HMP155 is appended to the ILC protocol and provided in the ILC kit. The Vaisala HMP155 type A2GB11A0A1A1A0A is subject for the ILC. The instrument has analogue outputs (voltage) for relative humidity and air temperature:

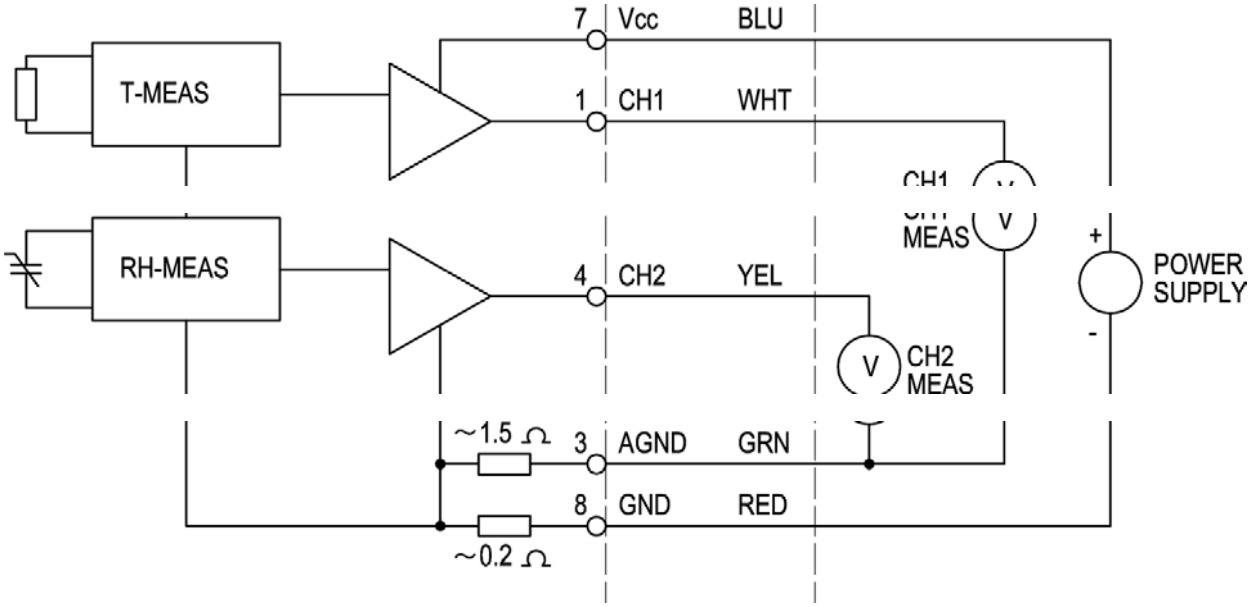
- Relative humidity: 0 – 1V corresponds 0 to 100% RH Multiplying by 100 is needed to calculate relative humidity.
- Air temperature: 0 – 1V corresponds -40 to +60°C. Multiplying by linear function $y=100 \cdot x-40$ is needed to calculate air temperature.

Power supply: although power supply in the range from 7 to 28 VDC may be used, please, use 12V ± 2V in order to minimize power supply impact.

Vaisala HMP155 connections and wiring diagram:



BLUE	Vcc (12V DC)
RED	GND
YELLOW	
WHITE	V out2 (temperature)
GREEN	A $_{GND}$ (analog ground)
PINK	Not used
GREY	Not used
BROWN	Not used

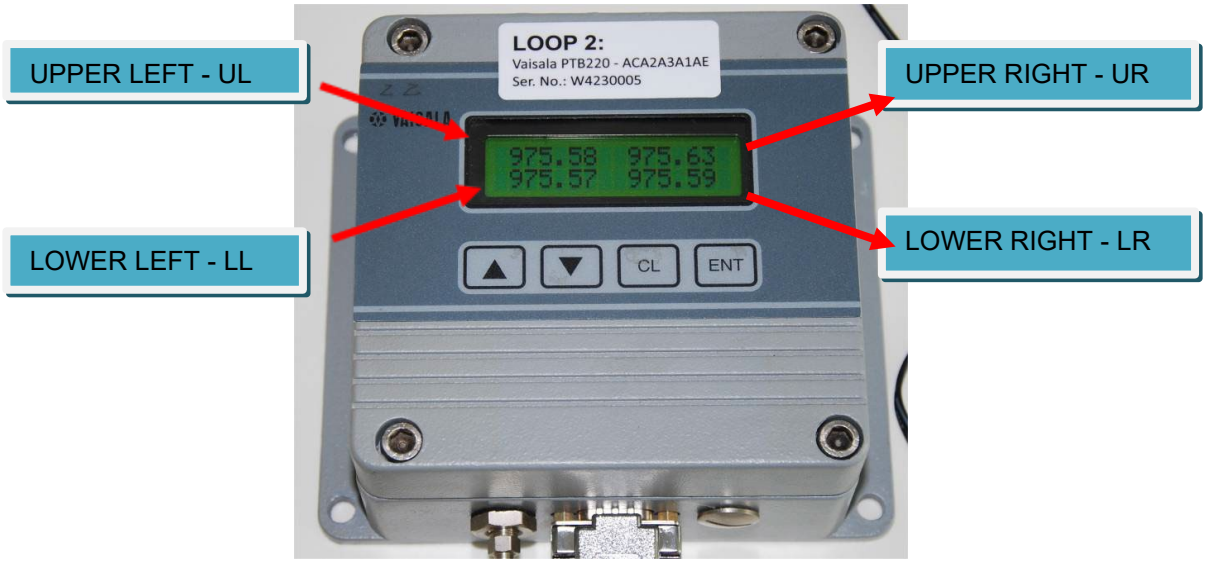


Note: Please, remove sensor protection cap before use and return it back after use.

7. APPENDIX D: USER'S GUIDE FOR VAISALA PTB220

The original User's Guide for Vaisala PTB220 is appended to the ILC protocol and provided in the ILC kit. The Vaisala PTB220 type ACA2A3A1AE is subject for the ILC. The Vaisala PTB220 type ACA2A3A1AE has three pressure transducers (upper left – UL, upper right- UR, lower left – LL) and fourth value is average value (lower right – LR). The pressure connector is barbed fitting 1/8".

Please, do not expose barometer to pressures other than barometric!



The barometers are supplied with RS232 communication cable combined with power supply. **Please, use supplied power supply for the purpose of ILC.**

Measured values can be read on display or via RS232C. When the barometer is switched on, the pressure can be observed on display. The display shows pressure in hecto Pascal.

If reading via RS232C is preferred, following setup for barometers is used:

Baud rate	9600
Data bits	7
Parity	Even
Stop bits	1
Duplex	Full duplex

Command string is <send> to read value. The read string holds all four pressures.

Example:

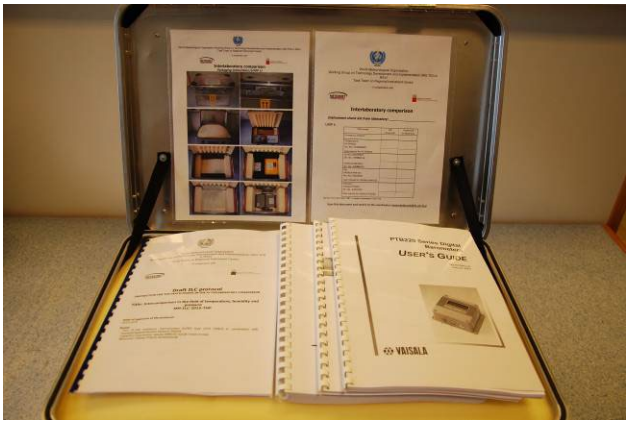
>send <cr>

1020.31 1020.32 1020.33 1020.32 hPa

Warning	For the purposes of this ILC it is strictly forbidden to make any adjustments to the measuring instrument. The only actions permitted are the movement among functions.

8. APPENDIX E: PACKAGING INSTRUCTIONS

LOOP 1



LOOP 2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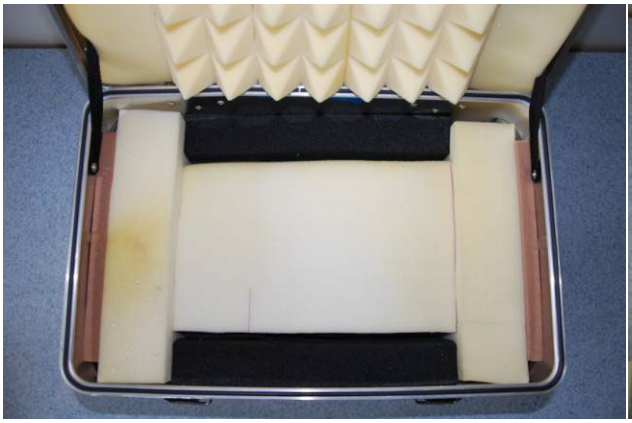
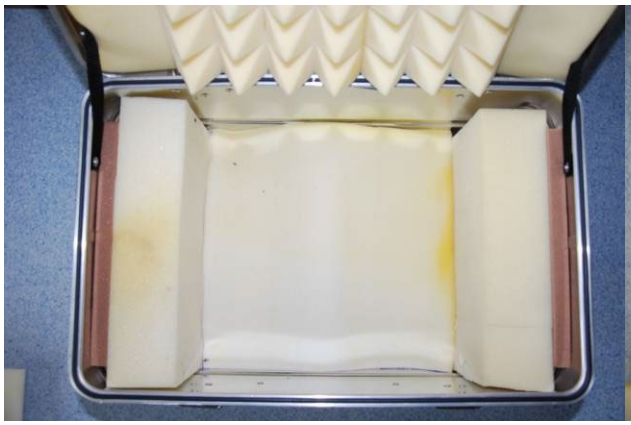
USER'S GUIDE
VAISALA


K2250 40





9. APPENDIX F: INSTRUMENT CHECK LIST FROM LABORATORY: _____

Instrument	OK on arrival	Packed OK on departure
Printed ILC protocol		
Temperature: HP 34420A Ser. No.: US34000601 User manual for HP 34420A		
ELPRO 22104700/X Ser. No.: 395**05**0316 ELPRO 22104700/X Ser. No.: 395060316		
RH: VAISALA HMP155 Ser. No.: K2250039 User manual for VAISALA HMP155		
Pressure: VAISALA PTB220 Ser. No.: A4610018 User manual for VAISALA PTB220		

NOTE: Put in the table "OK" or write a comment if NOT OK.

Please scan this document and send it to the coordinator: gaber.begs@fe.uni-lj.si

_____