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
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Our ref.: 12561/2021/I/ONM/MQC/ILC-RA-III-Inv 9 June 2021

Annex: 1 (available in English only)

Subject: WMO interlaboratory comparison in Regional Association III

Action required: To express your readiness to take part in the interlaboratory comparison (ILC) and to nominate a laboratory and its point of contact, by informing the ILC pilot laboratory and the WMO Secretariat not later than **30 June 2021**

Dear Sir/Madam,

I am pleased to inform you that the World Meteorological Organization (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 Members of the WMO Regional Association III (RA III). The ILC will be conducted in the second half of 2021 and over the course of 2022 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 the technical competencies and capabilities of 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 capacity development through gathering and sharing experience and knowledge. Furthermore, by taking part in the ILC, the laboratories leverage their roles and contribute to a global confidence in traceable measurements.

The ILC in RA III will be built upon the ILCs that were successfully completed in RA II, V and VI and will be conducted in the domains of temperature, pressure and relative humidity.

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

Among laboratories from RA III, the ILC will also include the participation of the Regional Instrument Centre (RIC) Ljubljana and the University of Ljubljana (Slovenia), the organizers and supporters of 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 III (South America)

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

I have the pleasure to inform you that the National Metrology Institute of Argentina (Instituto de Tecnología Industrial - INTI), supported by the National Meteorological Service of Argentina (Servicio Meteorológico Nacional - SMN) which hosts the Regional Instrument Centre, 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 present 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 address) for this event. The nominations should be sent by email to the contact point of the ILC pilot laboratory, Mr Javier García Skabar (jskabar@inti.gob.ar) from INTI, with a copy to Ms Natalí Aranda (naranda@smn.gov.ar) from SMN, and a copy to the WMO Secretariat, Mr Krunoslav Premec, Scientific Officer, Measurement, Quality and Compliance Unit (kpremec@wmo.int), at your earliest convenience, but not later than **30 June 2021.**

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,

Dr Wenjian Zhang
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

METEOMET
Metrology for Meteorology

INTI

Ministerio de Desarrollo Productivo Argentina

University of Ljubljana
Faculty of electrical engineering

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

Servicio Meteorológico
INRiM
ISTITUTO NAZIONALE DI RICERCA METROLOGICA

Draft ILC protocol

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

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

MM-ILC-2021-THP-RA-III

Date of approval of the protocol:

DD.MM.2021

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

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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 technical competence of the participants and serves as a technical base for accreditation. Furthermore, it is the most important element for 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 National Metrology Institute of Argentina (Instituto Nacional de Tecnología Industrial – INTI) in collaboration with Regional Instrument Centre (RIC) Buenos Aires (Servicio Meteorologico Nacional (SMN), Argentina), with the support of 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).

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 17043:2010.

1.1 Overall coordinator and pilot laboratory

Instituto Nacional de Tecnología Industrial (INTI)
Metrología Física, Departamento de Termodinámica
Colectora Norte de, Av. Gral. Paz 5445, B1650 San Martín, Buenos Aires, Argentina

Contact person in case of technical and administrative questions:

Mr Javier García Skabar
Tel.: +54 11 4724-6200
Email:jgarcia@inti.gob.ar

In collaboration with:

Servicio Meteorológico Nacional (SMN) Argentina
RIC Buenos Aires
Ms Natalí Aranda
Av. Dorrego 4019, C1425GBE, Ciudad Autónoma de Buenos Aires, Argentina
Tel: +54 11 5167-676767 interno:18761
Email: naranda@smn.gov.ar

1.2 Laboratories contributing to the reference values

The reference value will be determined by the UL-FE/LMK, RIC Ljubljana and INTI.

Instituto Nacional de Tecnología Industrial (INTI)
Metrología Física, Departamento de Termodinámica
Colectora Norte de, Av. Gral. Paz 5445, B1650 San Martín, Buenos Aires, Argentina
Mr Javier García Skabar
Tel.: +54 11 4724-6200
Email: jgarcia@inti.gob.ar

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

Phone: +386 1 478 4100
Fax: -
GSM: +386 31 655 216
Email: drago.groselj@gov.si

University of Ljubljana, Faculty of Electrical Engineering (Slovenia - SI2) (only temperature and humidity)
Tržaška cesta 25, 1000, Ljubljana, Slovenia
Izr. Prof. Dr Gaber Beges
Phone: +386 1 4768 224
Fax: +386 1 4264 633
GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si or info@lmk.fe.uni-lj.si

1.3 Data analysis coordinator and contributing laboratories

Instituto Nacional de Tecnología Industrial (INTI)
Metrología Física, Departamento de Termodinámica
Colectora Norte de, Av. Gral. Paz 5445, B1650 San Martín, Buenos Aires, Argentina
Mr Javier García Skabar
Tel.: +54 11 4724-6200
Email:jgarcia@inti.gob.ar

Servicio Meteorológico Nacional (SMN) Argentina
RIC Buenos Aires
Ms Natalí Aranda
Av. Dorrego 4019, C1425GBE, Ciudad Autónoma de Buenos Aires, Argentina
Tel: +54 11 5167-676767 interno:18761
Email: naranda@smn.gov.ar

Institutions providing assistance in data analysis:

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

University of Ljubljana, Faculty of Electrical Engineering (Slovenia - SI2) (only temperature and humidity)
Tržaška cesta 25, 1000, Ljubljana, Slovenia

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

1.4 Participants

TO BE DEFINED

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

Participating laboratory: Instituto Nacional de Tecnología Industrial (INTI), (AR-INTI)
Contact person: Mr Javier García Skabar
Address: Colectora Norte de, Av. Gral. Paz 5445,
Zip: B1650
City: San Martín, Buenos Aires
Country: Argentina
Phone: +54 11 4724-6200

Participating laboratory: Servicio Meteorologico Nacional (SMN) Argentina, (AR-SMN)
Contact person: Ms Natalí Aranda
Address: Av. Dorrego 4019
Zip: C1425GBE
City: Ciudad Autónoma de Buenos Aires
Country: Argentina
Phone: +54 11 5167-676767 interno:18761
Fax:
Email: naranda@smn.gov.ar

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
Fax:-
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: Izr. Prof. Dr Gaber Beges
Address: Tržaška cesta 25
Zip: 1000
City: Ljubljana
Country: Slovenia
Phone: +386 1 4768 224
Fax: +386 1 4264 633
GSM: +386 40 327 071
Email: gaber.beges@fe.uni-lj.si or info@lmk.fe.uni-lj.si

OTHERS

1.5 Time schedule and deadlines

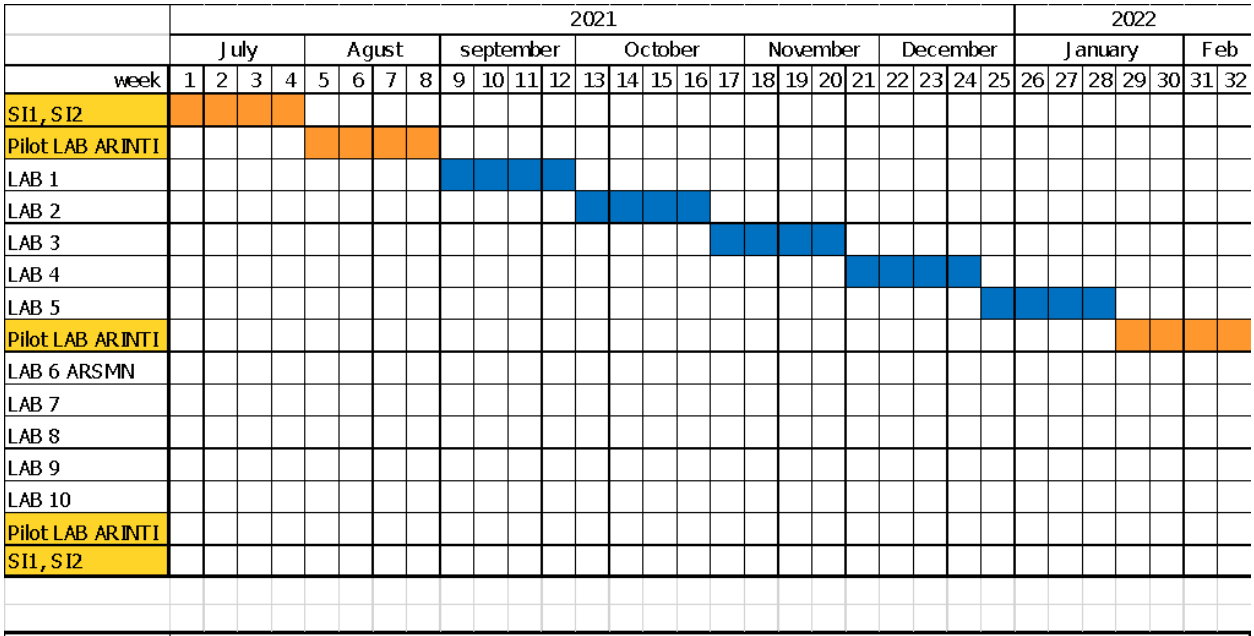
The intercomparison is organized in a loop. All participating laboratories have four weeks for calibration including transport to the next laboratory. The transport must be planned for each of the participating laboratories, so that the subsequent laboratory receives the equipment no later than on Monday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

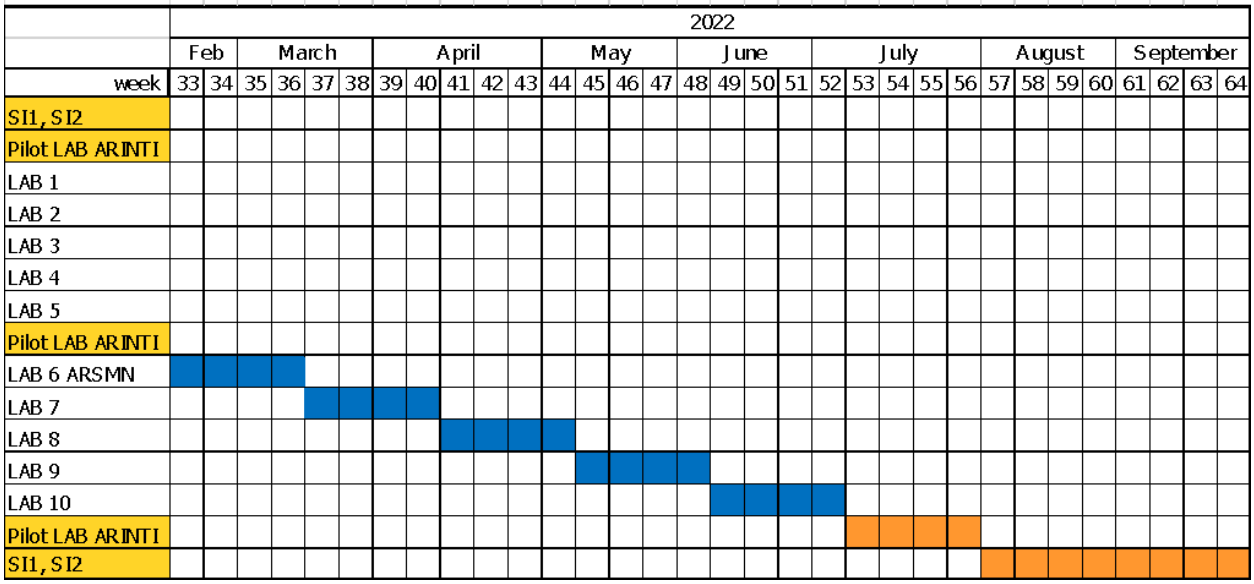
If a participant anticipates difficulties in keeping the deadlines, the coordinator must be contacted immediately. In such a case the other participants will be contacted as soon as possible and be informed about eventual changes.

Deadline for reporting the results is 4 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 return of the equipment to the reference laboratory, which then will make an extra check and take an appropriate action.

The measurements in the first laboratory are tentatively scheduled to start in July 2021. The time schedule will be finalized upon agreement of all selected participants.

Date	Lab
July 2021 4 weeks	SI1, SI2
4 weeks	Pilot lab AR-INTI
4 weeks	LAB 1
4 weeks	LAB 2
4 weeks	LAB 3
4 weeks	LAB 4
4 weeks	LAB 5
8 weeks	Pilot lab AR-INTI, LAB AR-SMN
4 weeks	LAB 6
4 weeks	LAB 7
4 weeks	...
4 weeks	LAB N
4 weeks	Pilot lab AR-INTI
8 weeks	SI1, SI2





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 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).

Equipment will be accompanied with ATA CARNET forms. Please, don’t forget to fill them when crossing border. In case that your country is not signatory of ATA CARNET convention, please perform 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 ACA2A3A1A
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.

In a case any of the above-mentioned equipment is missing at the 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 have been made according to the common laboratory practice, but at least for 2 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 up "Instrument Check List" – Appendix F and send it to: jgarcia@inti.gob.ar.**

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). Barometer is carefully connected to the barometric pressure system.

2.3.3 Precautions

- Pt100 are very sensitive device to vibration and mechanical shock.
- 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.
- Don't expose relative humidity sensor to temperatures higher than 25 °C and lower than 15 °C.
- **Don't expose barometer to pressures other than barometric!**

Contact the coordinator in a 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 the both thermometers as well as 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 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 coordinator/reference laboratory, immediately.

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. In case 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 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. **Send your results only to the data analysis coordinator (jgarcia@inti.gob.ar).**

The results shall be sent to the coordinator no later than **4 weeks** after having finalized the calibration. Electronic reporting by email is preferred.

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

Outline of statistical analysis

The assigned values are to be determined as the arithmetic mean of measurements made by the coordinator. 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 anonymized (each laboratory with different code). Coding system will be known to the data analysis coordinator only. The participants will receive 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:

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

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 (SI1, SI2 and AR-INTI for temperature and humidity; SI1 and AR-INTI for pressure). 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:

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

Complaints and appeals

Participants may file a complaint or appeal to the data analysis coordinators (INTI and RIC Buenos Aires) 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 reporting of results and uncertainties for temperature, relative humidity and pressure. The form will be forwarded electronically.

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] °C	Read temperature PT100-1 [2] °C	Read temperature Pt100-2 [2] °C	Reference temperature 1[3] °C	Reference temperature 2[4] °C	Correction 1 [5] °C	Correction 2 [6] °C	*U1 (95%)* [7] °C	*U2 (95%)* [8] °C	CMC 1 [9] °C	CMC 2 [10] °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

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

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.

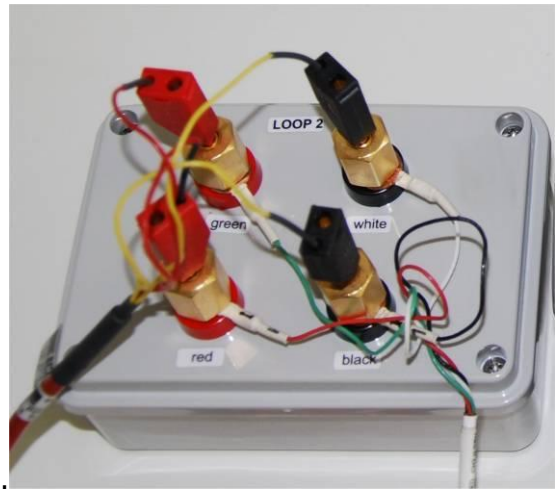
The ILC kit for temperature measurements consists of:

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

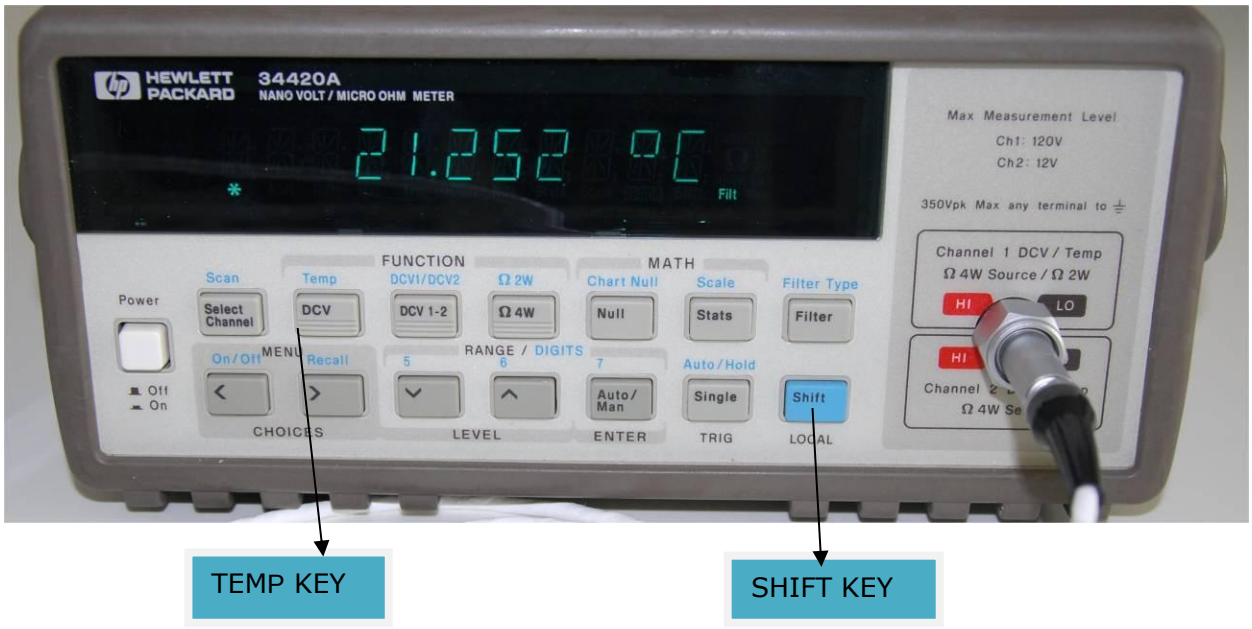
The Pt100 is connected to the connection unit as shown in the following picture.

CONNECTION UNIT

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.



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.**

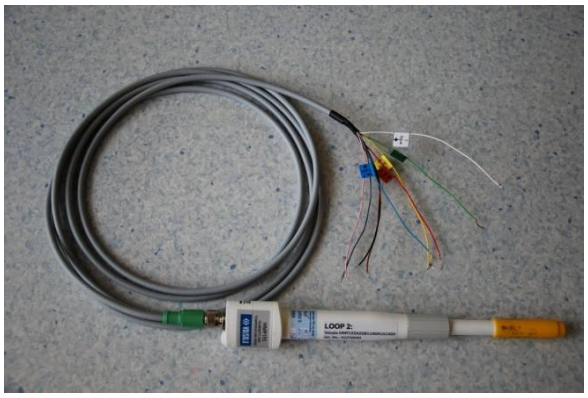
6 Appendix C: User's Guide for Vaisala HMP155

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 analog outputs (voltage) for relative humidity and air temperature:

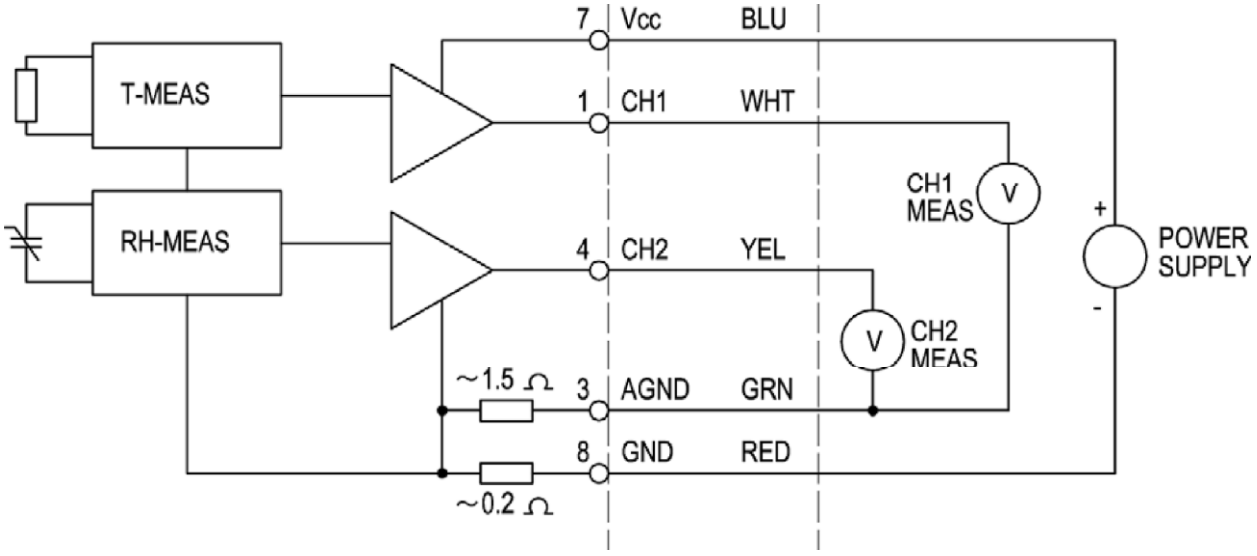
- relative humidity: 0 – 1V corresponds 0 to 100 %RH Multiplying by 100 is needed to calculate relative humidity.
- air temperature: 0 – 1V corresponds -40 to +60 °C. Multiplying by linear function y=100·x-40 is needed to calculate air temperature.

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

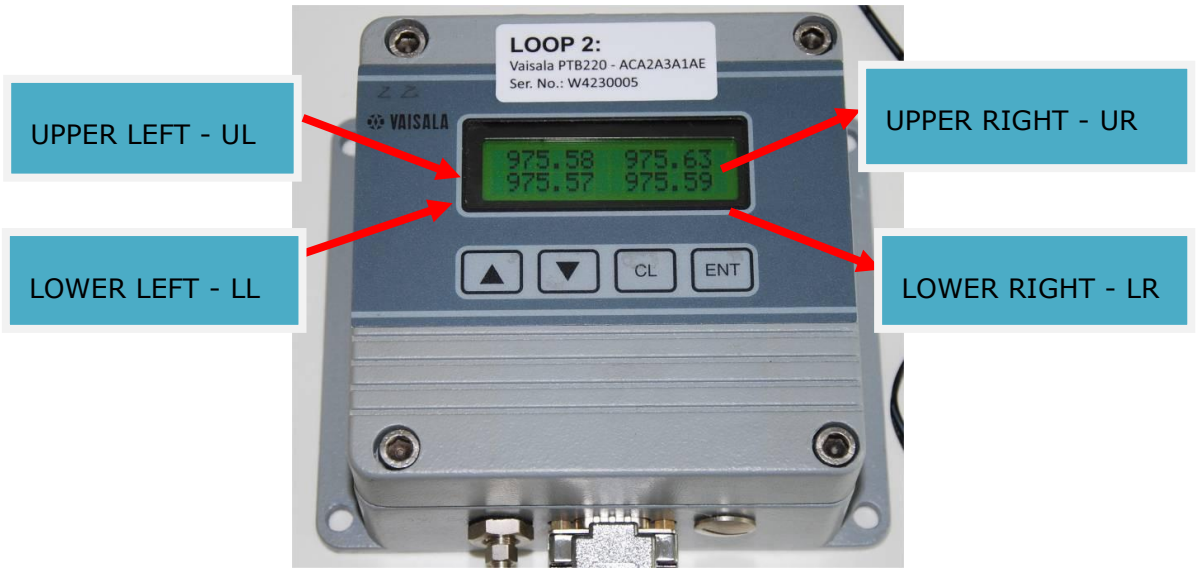


Note: Please, remove sensor protection cap before use and return it back after use.

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, don't 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 barometer is switched on, the pressure can be observed on display. The display shows pressure in hectopascal.

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:

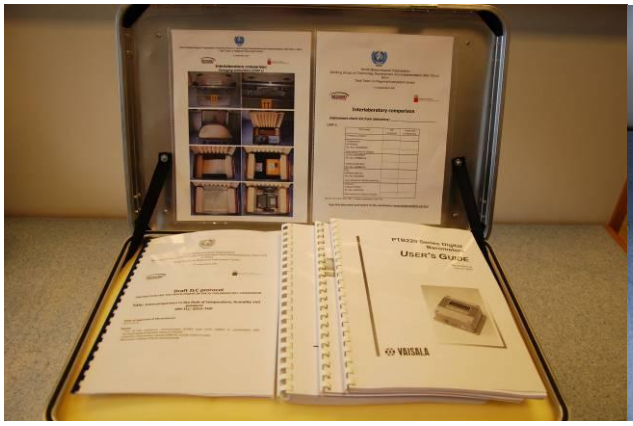
>send <cr>

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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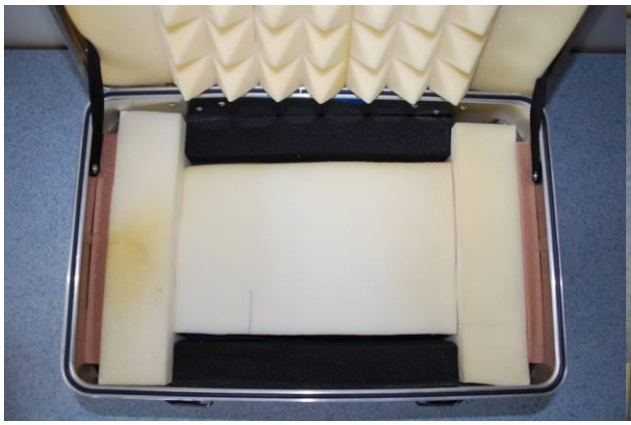
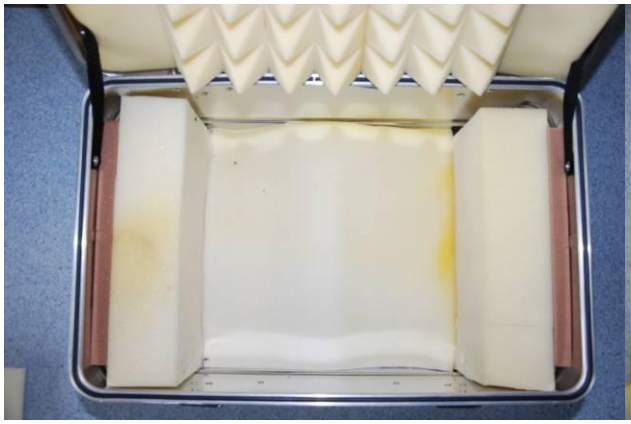
USER'S GUIDE
VAISALA


K22-5040





9 Appendix F: Instrument Check List from Laboratory: _____

Instrument	OK on arrival	Packed OK on departure
Printed ILC protocol		
Temperature: HP 34420A Ser. No.: **MY42002060**		
User manual for HP 34420A		
ELPRO 22104700/X Ser. No.: 395**09**0316 ELPRO 22104700/X Ser. No.: 395100316		
RH: VAISALA HMP155 Ser. No.: K2250040		
User manual for VAISALA HMP155		
Pressure: VAISALA PTB220 Ser. No.: **W4230005**		
User manual for VAISALA PTB220		

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

Scan this document and send it to the coordinator: jgarcia@inti.gob.ar

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