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PEBS



Mont Terri
PEBS: HE-E Experiment

Monitoring and maintenance

D.2.2-8 HE-E annual monitoring report

Monitoring period: 01/03/13 – 28/02/14

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CONTENTS

1	INTRODUCTION	4
2	FIELD ACTIVITIES	5
3	DATA ACQUISITION SYSTEM (DAS)	5
4	SENSORS IN MICROTUNNEL SECTIONS	6
4.1	PORE PRESSURE AND TEMPERATURE MEASUREMENTS IN SECTIONS SA1 TO SA4, SA20 AND SD20	6
4.1.1	Section SA1	6
4.1.2	Section SA2	6
4.1.3	Section SA3	6
4.1.4	Section SA4	7
4.1.5	Section SA20	7
4.1.6	Section SD20	7
4.2	ROCK DISPLACEMENT SENSORS INCLUDING TEMPERATURE MEASUREMENTS	7
4.2.1	Section SD1	7
4.2.2	Section SD2	7
4.3	ROCK WATER CONTENT MEASUREMENTS	7
4.3.1	Capacitive Sensors including Temperature in Section SB1	8
4.3.2	Capacitive Sensors including Temperature in Section SB2	8
4.3.3	Psychrometers in Section SB1 and SB2	8
4.4	PORE PRESSURE MEASUREMENTS IN THE BOREHOLES FROM THE GALLERY GA98	8
5	SENSORS IN THE EBS AND THE EBS/HOST ROCK INTERFACE	9
6	SUMMARY	9
7	REFERENCES	9

APPENDIX A

- *Field activity logbook*
- *Data acquisition logbook*

APPENDIX B

- *List of sensors installed at the HE-E experiment*
- *Sensor locations*

APPENDIX C

- *Data plots of the sensor in microtunnel sections*

APPENDIX D

- *Data plots of the sensors in the boreholes from Gallery 98*

APPENDIX E

- *Data plots for the sensors installed in the EBS and at the EBS-host rock interface*

1 INTRODUCTION

According to the DOW “description of work” Task 2.2 of the PEBS grant agreement, Solexperts is responsible for the monitoring and maintenance of the experiment HE-E as part of the PEBS project.

The HE-E Experiment is performed in the 50 m long microtunnel which has a diameter of 1.3 m. The 10 m test section of the microtunnel was characterised in detail during the Ventilation (VE) Experiment (Figure 1). Table 1 shows the task overview for the project identification and responsibility partners.

A series of annual monitoring reports is planned to document the data set recorded by the HE-E data acquisition system (DAS). In addition, the monitoring reports summarise the site activities, indicate DAS incidents and describe the measurements taken to guarantee a proper function of the DAS and the corresponding sensors. The first monitoring report describes the period between the 1st March 2011 and the 28th February 2012 (Grava et al., 2012). The monitoring period from the 1st March 2012 to the 28th February 2013 is documented in Gräfe and Rösli (2013).

This report covers the period between the 1st March 2013 and the 28th February 2014.

To monitor the engineered barrier system (EBS) and host rock behaviour during the HE-E Experiment, specific sensors were installed in three main zones and can therefore be divided in three different groups: (1) The engineered barrier system (EBS) and EBS/host rock interface, (2) the Opalinus clay host rock in the microtunnel sections and (3) the Opalinus Clay host rock in boreholes drilled from the Gallery 98. The monitoring of the two heater elements is not included in this report as the sensors are connected to another data acquisition system.

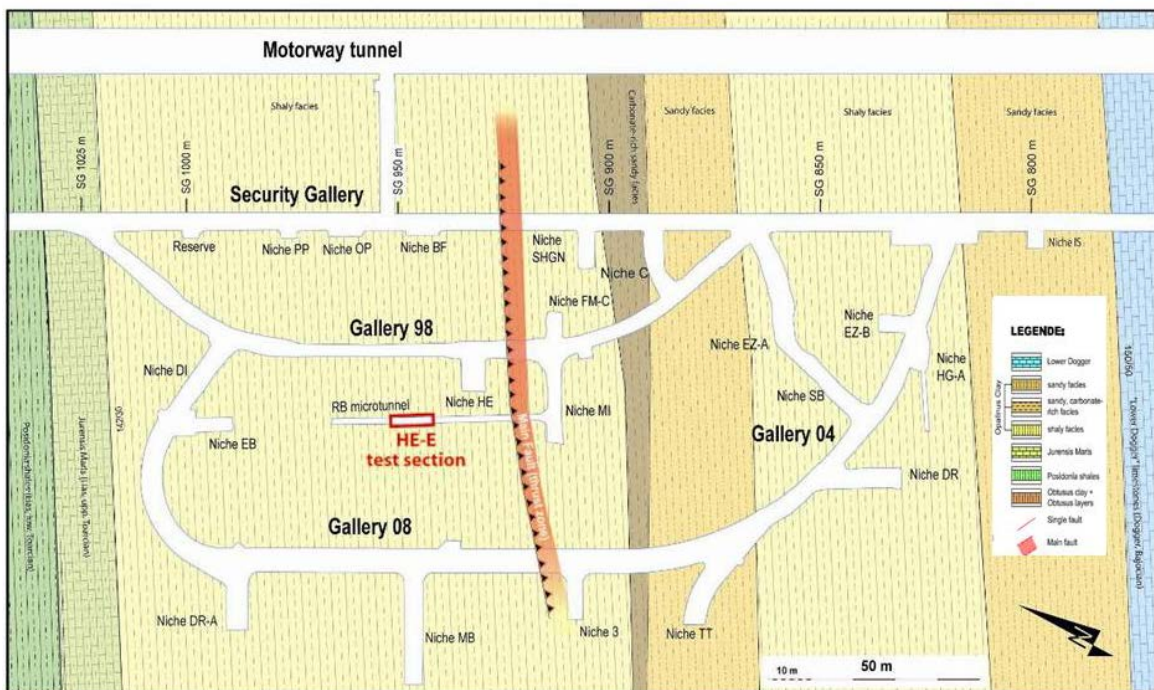


Figure 1: Location of the HE-E test section in the Mont Terri rock laboratory

DAS related work is described in Chapter 3. The field activity logbook and the data acquisition logbook are included in Appendix A. A list with all the sensors and their specifications and the schematic drawings of the sensor locations are included in Appendix B. The graphs of the measurements are shown in Appendices C, D and E.

Table 1: Task Overview

Project Identification	PEBS: HE-E		
Experiment Task	HE-E annual monitoring report		
Reference Document	DOW "description of work" Task 2.2 of the PEBS grant agreement"		
Responsibilities	Project Manager:	Irina Gaus, Nagra	
	Deputy:	Paul Marschall, Nagra	
	Reporting:	Kirsten Gräfe, Solexperts	
	Manager master-database:	Ursula Rösli, Solexperts	

2 FIELD ACTIVITIES

The construction and instrumentation works took place between January and May 2011. The experiment layout is described in detail in the as-built report (Teodori S. & Gaus I., 2012).

No field activities were performed during the monitoring period between the 1st March 2013 and the 28th February 2014.

3 DATA ACQUISITION SYSTEM (DAS)

The data acquisition system (DAS) worked fine for the entire monitoring period. During instrumentation, all sensors of the previous VE Experiment were connected to the DAS of the HE-E Experiment. However, several sensor signals were already erroneous during the last observation period of the VE Experiment. To check the performance of these sensors, they were also connected to the HE-E DAS. Most of these sensors proved to be defective and were disconnected after the end of the instrumentation.

Table 3 summarises the main DAS problems and the defective sensors. A detailed DAS logbook with all sensor malfunctions, failures or removals is shown in Appendix A. A list with all sensors and their status at the end of the monitoring period is given in Appendix B.

The CR7 logger which monitors the psychrometers was removed on the 22nd May 2012. Therefore no psychrometer data are available for the entire observation period.

Table 3: DAS interruptions and defective sensors

Date	Sensor name and type		Section	Events
Since 22.05.2012	All sensors	Psychrometers	SB1 and SB2	CR7 logger removed, no data
Since 23.03.2013	HC-B64	Humidity	SB1	Defective
Since 06.07.2013	HC-B10	Humidity	SB2	Defective
24.05. -19.08.2013	HC-SB2	Humidity	SB2	Mostly error measurements
08.11.2012 – 04.08.2013	HC-B14	Humidity	SB2	Error measurements
12.06.2013 – 19.08.2013	HC-SB2	Humidity	SB2	Error measurements
Since 14.09.2013	HC-B66	Humidity	SB1	Defective

Date	Sensor name and type		Section	Events
17.10. – 20.11.2013	P-B40	Pressure	SA3	Noisy or erroneous measurements
05.11.2012 - 20.10.2013 11.12.2013 – 28.02.2014	HC-B71	Humidity	SB1	Error measurements
09.01.2013 – 01.01.2014	HC-B20	Humidity	SB2	Error measurements

4 SENSORS IN MICROTUNNEL SECTIONS

Six sections perpendiculars to the microtunnel axis are equipped with 24 Mini-Piezometer systems, humidity sensors, temperature sensors and extensometers. A great part of these sensors were already installed during the previous VE Experiment. The instrumentation is described in detail in the as-built report (Teodori & Gaus, 2012). An overview of the sections relative to the tunnel and their layouts are included in Appendix B.

4.1 PORE PRESSURE AND TEMPERATURE MEASUREMENTS IN SECTIONS SA1 TO SA4, SA20 AND SD20

The Mini-Piezometers in sections SA1, SA2, SA3 and SA4 were installed during the VE Experiment. The two sections SA20 and SD20 were equipped in the framework of the HE-E Experiment.

4.1.1 Section SA1

The corresponding data plot is included in Appendix C1. Pressure sensor P-B81 reflected atmospheric conditions during the entire monitoring period whereas the other sensors in section SA1 showed increasing pressures. Since the 5th September 2013 sensor P-B80 increased from atmospheric pressures to about 150 kPa at the end of the observation period. Sensor P-B79 continuously increased from 125 kPa to about 250 kPa since the 23rd April. Sensor P-B78 decreased at the beginning of the observation period, followed by a pressure increase and stable pressure measurements at about 380 kPa since the 21st August.

4.1.2 Section SA2

The corresponding data plot is included in Appendix C2. The pressure sensors P-B59, P-B58 and P-B57 in section SA2 reflected atmospheric conditions throughout the observation period. The pressures measured with sensors P-B60 and P-B61 steadily increased to maximum pressures of 276 and 332 kPa, respectively. The pressure measurements of sensors P-B56 and P-B62 increased until April 2013 to pressures of about 720 kPa and 780 kPa followed by a slight decrease to pressures of about 700 kPa and 760 kPa. Pressures measured by sensor P-B55 showed a slight increase to about 980 kPa until April 2013 and then decreased to about 940 kPa.

4.1.3 Section SA3

The corresponding data plot is included in Appendix C3. The pressures of all sensors were increasing to pressures between about 400 kPa and 750 kPa until April 2013, followed by a slight decrease to pressures between 360 kPa and 730 kPa. On the 18th February 2014 the pressure measurements of sensor P-B40 started to decrease to about 217 kPa at the end of the observation period.

4.1.4 Section SA4

The corresponding data plot is included in Appendix C4. Except for sensor P-B7 the pressure sensors in section SA4 reflected atmospheric conditions. The pressure measured with sensor P-B7 stayed at about 760 kPa until the 7th August 2013 when it started to decrease to pressures below atmospheric conditions at the end of the observation period.

4.1.5 Section SA20

These sensors are located in section SA2 (see Appendix B). The corresponding data plot is included in Appendix C5. The pressure sensors in section SA20 reflected about atmospheric conditions.

The measured temperatures were mostly constant with a maximum temperature of about 42 °C (T-BESA25).

4.1.6 Section SD20

These sensors are located in section SD2 (see Appendix B). The corresponding data plot is included in Appendix C6. All pressure sensors in section SA20 reflected about atmospheric conditions. The pressure measured with sensor P-BESD25 showed some minor variations between about 92 and 97 kPa.

The temperatures were mostly constant with a maximum temperature of about 40 °C.

4.2 ROCK DISPLACEMENT SENSORS INCLUDING TEMPERATURE MEASUREMENTS

The Solexperts displacement sensors (mini-extensometers) including temperature measurements were installed in sections SD1 and SD2 during the VE Experiment.

4.2.1 Section SD1

The corresponding data plot is included in Appendix C7. The values of rock displacement of sensors RD-B46, RD-B47 and RD-B49 were mostly stable throughout the observation period.

The temperatures were mostly constant with a maximum temperature of about 43 °C.

4.2.2 Section SD2

The corresponding data plot is included in Appendix C8. The values of rock displacement of sensors RD-B25, RD-B26 and RD-B28 were mostly stable throughout the observation period.

The temperatures were constant with a maximum temperature of about 93 °C (T-B25).

4.3 ROCK WATER CONTENT MEASUREMENTS

The capacitive relative humidity and temperature sensors and the psychrometers were installed in boreholes in the profiles SB1 and SB2 during the VE Experiment. The relative humidity sensor mostly gave measurements of 100 % RH or negative values, except for a few sensors mentioned below. The measurements of 100 % RH might therefore be an artefact, but are displayed in the graphs for completeness.

4.3.1 Capacitive Sensors including Temperature in Section SB1

The corresponding data plot is included in Appendix C9. The measured relative humidity values of sensor HC-B73 was constant at 100 %. The other sensors HC-B64, HC-B66 and HC-B71 partially measured humidity values of 100 % (see Appendix A) but gave negative measurements at the end of the observation period and seem to be defective.

The temperatures were mostly constant with a maximum temperature of about 43 °C (T-SB1).

4.3.2 Capacitive Sensors including Temperature in Section SB2

The corresponding data plot is included in Appendix C10. The measured relative humidity values for sensor HC-B92, HC-B93, HC-B94, HC-B95, HC-B14, were at 100 % throughout the observation period. Sensor HC-B12 measured relative humidities of over 98 % until May 2013 and then 100 % until the end of the observation period. The measurements of sensor HC-B20 were erroneous from the beginning of the observation period until the 31st December 2013. After that date the sensor measured relative humidities of 100 %.

The temperatures were mostly constant with a maximum temperature of about 44 °C (T-SB2).

4.3.3 Psychrometers in Section SB1 and SB2

During the entire observation period, the CR7 logger was removed and no data were recorded.

4.4 PORE PRESSURE MEASUREMENTS IN THE BOREHOLES FROM THE GALLERY GA98

4 multi-packer systems were installed from Gallery 98 for far-field pore pressure measurements. Borehole BVE-1 and BVE-91 were drilled and equipped with a triple and a quadruple packer system during the VE Experiment. Borehole BHE-E1 was installed on 30th March 2011 and borehole BHE-E2 on 4th May 2011, both equipped with a quadruple packer system. An overview of the borehole instrumentation is shown in Appendix B. Data plots are included in Appendices D1 to D4.

Generally, most pressure data of interval and packer pressures show only small changes or variations in the measurements throughout the observation period.

In borehole BHE-E1, the pressure sensors for the packers and intervals worked fine during the entire observation period. The interval pressure sensor P-BE1-I1 showed a continuous pressure increase. The pressure measurements of interval pressure sensors P-BE1-I2, P-BE1-I3 and P-BE1-I4 showed only small variations throughout the observation period. The packer pressure measurements remained constant except for packer pressure sensor P-BE1-P3 which continuously decreased from the 7th July 2013 to about 1000 kPa.

The packer and interval pressure sensors of borehole BHE-E2 worked fine. Sensor P-BE2-I4 gave noisy measurements throughout the observation period. On the 29th January 2014 all interval pressure sensor measurements started to decrease.

The interval pressures of the packer systems installed during the VE experiment (BVE-1 and BVE-91) worked fine during the entire observation period. The pressure measurements generally were slightly decreasing.

5 SENSORS IN THE EBS AND THE EBS/HOST ROCK INTERFACE

The EBS and the host rock/EBS interface were instrumented with temperature and relative humidity sensors. An overview of sensor locations is shown in Appendix B and data plots are in Appendices E1 to E6.

All sensors worked fine for the entire observation period. The sensors T-G3-R, HC-G3-R, T-N1-R and HC-N1-R are installed inside the railroad under the plug. Therefore, the measurements represent the climatic conditions of the cable channel.

In general, the temperatures stayed constant throughout the observation period.

The humidity measurements at middle and centre positions and within the bentonite blocks remained mostly constant with maximum relative humidity values of about 30 %. The humidity at the EBS-host rock interface was almost or at 100 %. Sensors HC-N3-9H and HC-N1-3H measured about 90 % humidity for the entire observation period. On the 28th April 2014 the measurements of sensor HC-G1-3H start to decrease from initially 100 % to about 90 % humidity with an increasing trend at the end of the observation period. All relative humidity sensors measuring 100 % humidity are noted in Appendix B.

6 SUMMARY

The sensor measurements in the microtunnel sections worked without problems throughout the observation period. Three sensors, sensors HC-B64 and HC-B66 in section SB1 and sensor HC-B10 in section SB2 were found to be defective. During the monitoring period, the heater temperatures sensors of the three heaters measured constant temperatures which were in the range of 175°C to 190 °C, depending on the heater.

7 REFERENCES

Gräfe, K., Rösli, U. (2013): PEBS: Deliverable (D-N°:2.2-8) D.2.2-8 HE-E annual monitoring report.

Grava, E., Achtziger, P. & Rösli, U. (2012): PEBS: Deliverable (D-N°:2.2-8) D.2.2-8 HE-E annual monitoring report.

Rösli U. (2010): Mont Terri Project: VE experiment long term monitoring data report phase 15. TN 2010-12.

Teodori S.P. & Gaus I. (2012): PEBS: Deliverable (D-N°: 2.2-3) Report of the construction of the HE-E experiment.

Appendix A:

- *Data acquisition logbook*
- *Field activity logbook*

Data Acquisition Logbook

DATE AND TIME	SENSOR	GEO-MONITOR CH.	BOREHOLE/SECTION	TYPE	ACTIONS/PROBLEMS
Status 28.02.2013	P-BE2-I4	49	Gallery 98	Pressure	Noisy measurements
	P-BE2-P2	55	Gallery 98	Pressure	Defective
	P-BE2-P3	55	Gallery 98	Pressure	Defective
	RD-B27	75	SD2	Displacement	Defective and removed
	RD-B48	79	SD1	Displacement	Defective and removed
	HC-B18	85	SB2	Humidity	Defective
	T-B18	86	SB2	Temperature	Defective
	HC-B75	87	SB1	Humidity	Defective
	HC-B23	97	SB2	Humidity	Defective
	T-B23	98	SB2	Temperature	Defective
	HC-B77	105	SB1	Humidity	Defective
	HC-B69	111	SB1	Humidity	Defective
	HC-SB1	surface	SB1	Humidity	Defective
	T-B26	122	SD2	Temperature	Defective
	T-B46	125	SD1	Temperature	Defective
	T-B47	126	SD1	Temperature	Noisy measurements
	T-B48	127	SD1	Temperature	Noisy measurements
	T-B49	128	SD1	Temperature	Defective
	HC-N3-5BI	278	Nagra carrier 3	Humidity	Defective
	T-N3-5BI	279	Nagra carrier 3	Temperature	Defective
	T-G1-12H	317	GRS carrier 1	Temperature	Defective
	HC-G1-9H	320	GRS carrier 1	Humidity	Defective
	T-G1-9H	321	GRS carrier 1	Temperature	Defective
	T-G2-3H	358	GRS carrier 2	Temperature	Defective
	HC-G3-9H	366	GRS carrier 3	Humidity	Defective
	T-G3-9H	367	GRS carrier 3	Temperature	Defective
Psychrometers 1-25	Psychrometers 1-25	SB1 and SB2	Humidity	No data, CR7 logger disconnected	
08.11.2012 – 04.08.2013	HC-B14	93	SB2	Humidity	Error measurements
Since 23.03.2013	HC-B64	109	SB1	Humidity	Defective

DATE AND TIME	SENSOR	GEO-MONITOR CH.	BOREHOLE/SECTION	TYPE	ACTIONS/PROBLEMS
09.01.2013 – 01.01.2014	HC-B20	81	SB2	Humidity	Error measurements
Since 01.01.2014		81	SB2	Humidity	Humidity = 100 %
Since 06.07.2013	HC-B10	95	SB2	Humidity	Defective
24.05. -19.08.2013	HC-SB2	83	SB2	Humidity	Mostly error measurements
Since 14.09.2013	HC-B66	107	SB1	Humidity	Defective
17.10. – 20.11.2013	P-B40	23	SA3	Pressure	Error measurements
01.10. – 27.11.2013	HC-N2-9C	254	Nagra carrier 2	Humidity	Noisy measurements
27.04. -17.07.2013	HC-N1-9M	262	Nagra carrier 1	Humidity	Noisy measurements
05.12.2013 – 03.02.2014	HC-N1-7BI	272	Nagra carrier 1	Humidity	
23.04.2013 -28.02.2014	HC-G1-3H	340	GRS carrier 1	Humidity	Humidity < 100 %
05.11.2012 - 20.10.2013 11.12.2013 – 28.02.2014	HC-B71	103	SB1	Humidity	Error measurements

Field Activity Logbook

No field activities were performed during the observation period.

Appendix B:

- *List of sensors for the HE-E Experiment*
- *Sensor locations*

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
n/a	1	BVE-1	P-B1-13m	kPa	13.00	100-2100	PAA-23	4-20mA			Gallery 98	
	2		P-B1-11m	kPa	11.00	100-2100	PAA-23	4-20mA			Gallery 98	
	3		P-B1-09m	kPa	9.00	100-2100	PAA-23	4-20mA			Gallery 98	
	4		P-B1-07m	kPa	7.00	100-2100	PAA-23	4-20mA			Gallery 98	
SA4	5	BVE-2	P-B2	kPa	1.55	0-2000	PAA-23	4-20mA	42183		SA4	88.2
	6	BVE-3	P-B3	kPa	1.04	0-2000	PAA-23	4-20mA	42194		SA4	92.8
	7	BVE-4	P-B4	kPa	1.05	0-2000	PAA-23	4-20mA	42172		SA4	102.2
	8	BVE-5	P-B5	kPa	0.55	0-2000	PAA-23	4-20mA	42180		SA4	92.6
	9	BVE-6	P-B6	kPa	1.63	0-2000	PAA-23	4-20mA	42181		SA4	119.0
	10	BVE-7	P-B7	kPa	2.06	0-2000	PAA-23	4-20mA	42182		SA4	97.3
	11	BVE-8	P-B8	kPa	0.50	0-2000	PAA-23	4-20mA	42188		SA4	92.2
	12	BVE-9	P-B9	kPa	1.40	0-2000	PAA-23	4-20mA	42196		SA2	92.4
SA2	13	BVE-55	P-B55	kPa	2.11	0-2000	PAA-23	4-20mA	42169		SA2	94.3
	14	BVE-56	P-B56	kPa	2.11	0-2000	PAA-23	4-20mA	42167		SA2	93.7
	15	BVE-57	P-B57	kPa	1.80	0-2000	PAA-23	4-20mA	?		SA2	97.9
	16	BVE-58	P-B58	kPa	1.12	0-2000	PAA-23	4-20mA	42184		SA2	98.1
	17	BVE-59	P-B59	kPa	2.12	0-2000	PAA-23	4-20mA	42193		SA2	101.2
	18	BVE-60	P-B60	kPa	1.50	0-2000	PAA-23	4-20mA	42170		SA2	95.3
	19	BVE-61	P-B61	kPa	1.80	0-2000	PAA-23	4-20mA	42185		SA2	95.3
	20	BVE-62	P-B62	kPa	2.13	0-2000	PAA-23	4-20mA	42195		SA2	93.5
SA1&SA3	21	BVE-38	P-B38	kPa	2.10	0-2000	PAA-23	4-20mA	42191		SA3	93.5
	22	BVE-39	P-B39	kPa	2.11	0-2000	PAA-23	4-20mA	42176		SA3	93.5
	23	BVE-40	P-B40	kPa	1.80	0-2000	PAA-23	4-20mA	42177	Occasional error measurements	SA3	95.2
	24	BVE-41	P-B41	kPa	1.81	0-2000	PAA-23	4-20mA	42187		SA3	98.8
	25	BVE-78	P-B78	kPa	2.10	0-2000	PAA-23	4-20mA	42173		SA1	93.6
	26	BVE-79	P-B79	kPa	2.10	0-2000	PAA-23	4-20mA	42175		SA1	84.6
	27	BVE-80	P-B80	kPa	1.81	0-2000	PAA-23	4-20mA	42192 (?)		SA1	96.1

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	28	BVE-81	P-B81	kPa	1.80	0-2000	PAA-23	4-20mA	42189 (?)		SA1	93.6
421038.182	29	BVE-91	P-B91-10m	kPa	10.00	0-3000	PAA-33X	4-20mA	65014		Gallery 98	108.3
	30		P-B91-08m	kPa	8.82	0-3000	PAA-33X	4-20mA	65269		Gallery 98	100.2
	31		P-B91-07m	kPa	7.66	0-3000	PAA-33X	4-20mA	47458		Gallery 98	109.4
n/a	32	BHE-ESA21	P-BESA21	kPa	0.60	0-5000	PAA-23X	4-20mA	146519		SA20	92.4
n/a	33	BHE-ESA22	P-BESA22	kPa	1.00	0-5000	PAA-23X	4-20mA	146520		SA20	92.0
n/a	34	BHE-ESA23	P-BESA23	kPa	0.60	0-5000	PAA-23X	4-20mA	146521		SA20	92.0
n/a	35	BHE-ESA24	P-BESA24	kPa	1.00	0-5000	PAA-23X	4-20mA	146522		SA20	92.0
n/a	36	BHE-ESA25	P-BESA25	kPa	0.30	0-5000	PAA-23X	4-20mA	146523		SA20	92.0
n/a	37	BHE-ESD21	P-BESD21	kPa	0.60	0-5000	PAA-23X	4-20mA	146514		SD20	92.9
n/a	38	BHE-ESD22	P-BESD22	kPa	1.00	0-5000	PAA-23X	4-20mA	146515		SD20	92.9
n/a	39	BHE-ESD23	P-BESD23	kPa	0.60	0-5000	PAA-23X	4-20mA	146516		SD20	92.5
n/a	40	BHE-ESD24	P-BESD24	kPa	1.00	0-5000	PAA-23X	4-20mA	146517		SD20	92.0
n/a	41	BHE-ESD25	P-BESD25	kPa	0.30	0-5000	PAA-23X	4-20mA	146518		SD20	90.1
421038.182	42	BHE-E1	P-BE1-I1	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	43	BHE-E1	P-BE1-I2	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	44	BHE-E1	P-BE1-I3	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	45	BHE-E1	P-BE1-I4	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	46	BHE-E2	P-BE2-I1	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	47	BHE-E2	P-BE2-I2	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	48	BHE-E2	P-BE2-I3	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	49	BHE-E2	P-BE2-I4	kPa		0-5000	PAA-23X	4-20mA		Noisy	Gallery 98	
	50	BHE-E1	P-BE1-P1	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	51	BHE-E1	P-BE1-P2	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	52	BHE-E1	P-BE1-P3	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	53	BHE-E1	P-BE1-P4	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
	54	BHE-E2	P-BE2-P1	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	55	BHE-E2	P-BE2-P2	kPa		0-5000	PAA-23X	4-20mA		Defective	Gallery 98	
	56	BHE-E2	P-BE2-P3	kPa		0-5000	PAA-23X	4-20mA		Defective	Gallery 98	
	57	BHE-E2	P-BE2-P4	kPa		0-5000	PAA-23X	4-20mA			Gallery 98	
ATEMIN Humidity cabinet	65	BVE-95	HC-B95	%RH		0-100	Rotronic	4-20mA	-	Humidity = 100%	SB2	-
	66	BVE-95	T-B95	°C		-40-180	Pt100	4-20mA				-
	67	BVE-92	HC-B92	%RH		0-100	Rotronic	4-20mA	-	Humidity = 100%	SB2	-
	68	BVE-92	T-B92	°C		-40-180	Pt100	4-20mA				-
	69	BVE-94	HC-B94	%RH		0-100	Rotronic	4-20mA	-	Humidity = 100%	SB2	-
	70	BVE-94	T-B94	°C		-40-180	Pt100	4-20mA				-
	71	BVE-93	HC-B93	%RH		0-100	Rotronic	4-20mA	-	Humidity = 100%	SB2	-
	72	BVE-93	T-B93	°C		-40-180	Pt100	4-20mA				-
n/a	73	BVE-25	RD-B25	mm	0.0-2.0	25	displacement	0-5 V	-		SD2	-
n/a	74	BVE-26	RD-B26	mm	0.0-2.0	25	displacement	0-5 V	-		SD2	-
n/a	75	BVE-27	RD-B27	mm	0.0-2.0	25	displacement	0-5 V	-	Defective and removed	SD2	-
n/a	76	BVE-28	RD-B28	mm	0.0-2.0	25	displacement	0-5 V	-		SD2	-
n/a	77	BVE-46	RD-B46	mm	0.0-2.0	25	displacement	0-5 V	-		SD1	-
n/a	78	BVE-47	RD-B47	mm	0.0-2.0	25	displacement	0-5 V	-		SD1	-
n/a	79	BVE-48	RD-B48	mm	0.0-2.0	25	displacement	0-5 V	-	Defective and removed	SD1	-
n/a	80	BVE-49	RD-B49	mm	0.0-2.0	25	displacement	0-5 V	-		SD1	-
ATEMIN Humidity cabinet	81	BVE-20	HC-B20	%RH	0.78	0-100	Rotronic	0-5 V	23786 008	Humidity = 100%	SB2	-
	82	BVE-20	T-B20	°C		-40-180°C	Pt100	0-5 V				-
	83	surface	HC-SB2	%RH	0.00	0-100	Rotronic	0-5 V	23786 007	Humidity = 100%	SB2	-
	84	surface	T-SB2	°C		-40-180°C	Pt100	0-5 V				-
	85	BVE-18	HC-B18	%RH	0.35	0-100	Rotronic	0-5 V	23786 006	Defective	SB2	-
	86	BVE-18	T-B18	°C		-40-180°C	Pt100	0-5 V				Defective
	87	BVE-75	HC-B75	%RH	0.52	0-100	Rotronic	0-5 V	23786 005	Defective	SB1	-
	88	BVE-75	T-B75	°C		-40-180°C	Pt100	0-5 V				-

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	89	BVE-16	HC-B16	%RH	1.50	0-100	Rotronic	0-5 V	23786 004	Humidity = 100%	SB2	-
	90	BVE-16	T-B16	°C		-40-180	Pt100	0-5 V		Occasionally noisy		-
	91	BVE-12	HC-B12	%RH	1.25	0-100	Rotronic	0-5 V	23786 003	Humidity = 100%	SB2	-
	92	BVE-12	T-B12	°C		-40-180	Pt100	0-5 V		-		-
	93	BVE-14	HC-B14	%RH	0.53	0-100	Rotronic	0-5 V	23786 002	Humidity = 100%	SB2	-
	94	BVE-14	T-B14	°C		-40-180	Pt100	0-5 V		-		-
	95	BVE-10	HC-B10	%RH	0.27	0-100	Rotronic	0-5 V	23786 001	Defective since 06.07.2013	SB2	-
	96	BVE-10	T-B10	°C		-40-180	Pt100	0-5 V		-		-
	97	BVE-23	HC-B23	%RH	1.05	0-100	Rotronic	0-5 V	23786 009	Defective	SB2	-
	98	BVE-23	T-B23	°C		-40-180	Pt100	0-5 V		Defective		-
	99	surface	HC-SB1	%RH	0.00	0-100	Rotronic	0-5 V	23786 010	Defective	SB1	-
	100	surface	T-SB1	°C		-40-180	Pt100	0-5 V		-		-
	101	BVE-73	HC-B73	%RH	1.25	0-100	Rotronic	0-5 V	23786 011	Humidity = 100%	SB1	-
	102	BVE-73	T-B73	°C		-40-180	Pt100	0-5 V		-		-
	103	BVE-71	HC-B71	%RH	0.27	0-100	Rotronic	0-5 V	23786 012	Humidity = 100%	SB1	-
	104	BVE-71	T-B71	°C		-40-180	Pt100	0-5 V		-		-
	105	BVE-77	HC-B77	%RH	1.54	0-100	Rotronic	0-5 V	23786 013	Defective	SB1	-
	106	BVE-77	T-B77	°C		-40-180	Pt100	0-5 V		-		-
	107	BVE-66	HC-B66	%RH	0.78	0-100	Rotronic	0-5 V	23786 014	Defective since 14.09.2013	SB1	-
	108	BVE-66	T-B66	°C		-40-180	Pt100	0-5 V		-		-
109	BVE-64	HC-B64	%RH	0.37	0-100	Rotronic	0-5 V	23786 015	Defective since 23.03.2013	SB1	-	
110	BVE-64	T-B64	°C		-40-180	Pt100	0-5 V		-		-	
111	BVE-69	HC-B69	%RH	1.02	0-100	Rotronic	0-5 V	23786 016	Defective	SB1	-	
112	BVE-69	T-B69	°C		-40-180	Pt100	0-5 V		-		-	
n/a	121	BVE-25	T-B25	°C	0.10	0-100	Pt100	Pt100	-		SD2	-
n/a	122	BVE-26	T-B26	°C	0.10	0-100	Pt100	Pt100	-	Defective	SD2	-
n/a	123	BVE-27	T-B27	°C	0.10	0-100	Pt100	Pt100	-		SD2	-

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
n/a	124	BVE-28	T-B28	°C	0.10	0-100	Pt100	Pt100	-		SD2	-
n/a	125	BVE-46	T-B46	°C	0.10	0-100	Pt100	Pt100	-	Defective	SD1	-
n/a	126	BVE-47	T-B47	°C	0.10	0-100	Pt100	Pt100	-	Noisy	SD1	-
n/a	127	BVE-48	T-B48	°C	0.10	0-100	Pt100	Pt100	-	Noisy	SD1	-
n/a	128	BVE-49	T-B49	°C	0.10	0-100	Pt100	Pt100	-	Defective	SD1	-
n/a	129	BHE-ESA21	T-BESA21	°C	0.40	0-100	Pt100	Pt100	-	Noisy	SA20	-
n/a	130	BHE-ESA22	T-BESA22	°C	0.80	0-100	Pt100	Pt100	-		SA20	-
n/a	131	BHE-ESA23	T-BESA23	°C	0.40	0-100	Pt100	Pt100	-		SA20	-
n/a	132	BHE-ESA24	T-BESA24	°C	0.80	0-100	Pt100	Pt100	-		SA20	-
n/a	133	BHE-ESA25	T-BESA25	°C	0.10	0-100	Pt100	Pt100	-		SA20	-
n/a	134	BHE-ESD21	T-BESD21	°C	0.40	0-100	Pt100	Pt100	-		SD20	-
n/a	135	BHE-ESD22	T-BESD22	°C	0.80	0-100	Pt100	Pt100	-		SD20	-
n/a	136	BHE-ESD23	T-BESD23	°C	0.40	0-100	Pt100	Pt100	-		SD20	-
n/a	137	BHE-ESD24	T-BESD24	°C	0.80	0-100	Pt100	Pt100	-		SD20	-
n/a	138	BHE-ESD25	T-BESD25	°C	0.10	0-100	Pt100	Pt100	-		SD20	-
INTERFACE Humidity Nagra Zone SN 421119.255	202	NSC3	HC-N3-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 3	-
	203	NSC3	T-N3-12H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 3	-
	204	NSC3	HC-N3-3H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 3	-
	205	NSC3	T-N3-3H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 3	-
	206	NSC3	HC-N3-9H	%RH	0.00	0-100	IST humidity	digital	-		Nagra carrier 3	-
	207	NSC3	T-N3-9H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 3	-
	208	NSC3	HC-N3-5Bt	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 3	-
	209	NSC3	T-N3-5Bt	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 3	-
	210	NSC2	HC-N2-5Bt	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 2	-
	211	NSC2	T-N2-5Bt	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 2	-
	212	NSC2	HC-N2-5Bt	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 2	-
213	NSC2	T-N2-5Bt	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 2	-	

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	214	NSC3	HC-N3-12C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 3	-
	215	NSC3	T-N3-12C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 3	-
	216	NSC3	HC-N3-12M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 3	-
	217	NSC3	T-N3-12M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 3	-
	218	NSC3	HC-N3-3M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 3	-
	219	NSC3	T-N3-3M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 3	-
	220	NSC3	HC-N3-3C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 3	-
	221	NSC3	T-N3-3C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 3	-
	222	NSC1	HC-N1-3M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 1	-
	223	NSC1	T-N1-3M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 1	-
	224	NSC1	HC-N1-3C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 1	-
	225	NSC1	T-N1-3C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 1	-
	226	NSC3	HC-N3-9M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 3	-
	227	NSC3	T-N3-9M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 3	-
	228	NSC1	HC-N1-5Bt	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 1	-
	229	NSC1	T-N1-5Bt	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 1	-
	230	NSC2	HC-N2-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 2	-
	231	NSC2	T-N2-12H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 2	-
	232	NSC2	HC-N2-3M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 2	-
	233	NSC2	T-N2-3M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 2	-
	234	NSC2	HC-N2-3H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 2	-
	235	NSC2	T-N2-3H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 2	-
	238	NSC2	HC-N2-3C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 2	-
	239	NSC2	T-N2-3C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 2	-
	240	NSC1	HC-N1-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 1	-
	241	NSC1	T-N1-12H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 1	-
	242	NSC1	HC-N1-3H	%RH	0.00	0-100	IST humidity	digital	-		Nagra carrier 1	-

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	243	NSC1	T-N1-3H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 1	-
	244	NSC1	HC-N1-9H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 1	-
	245	NSC1	T-N1-9H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 1	-
	246	NSC2	HC-N2-9H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	Nagra carrier 2	-
	247	NSC2	T-N2-9H	°C	0.00	0-165	Pt1000	digital	-		Nagra carrier 2	-
	248	NSC2	HC-N2-12M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 2	-
	249	NSC2	T-N2-12M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 2	-
	250	NSC3	HC-N3-9C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 3	-
	251	NSC3	T-N3-9C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 3	-
	252	NSC2	HC-N2-7BI	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 2	-
	253	NSC2	T-N2-7BI	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 2	-
	254	NSC2	HC-N2-9C	%RH	-0.35	0-100	IST humidity	digital	-	Occasionally noisy	Nagra carrier 2	-
	255	NSC2	T-N2-9C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 2	-
	256	NSC3	HC-N3-7BI	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 3	-
	257	NSC3	T-N3-7BI	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 3	-
	258	NSC2	HC-N2-9M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 2	-
	259	NSC2	T-N2-9M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 2	-
	260	NSC1	HC-N1-12C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 1	-
	261	NSC1	T-N1-12C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 1	-
	262	NSC1	HC-N1-9M	%RH	-0.20	0-100	IST humidity	digital	-	Occasionally noisy	Nagra carrier 1	-
	263	NSC1	T-N1-9M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 1	-
	264	NSC1	HC-N1-12M	%RH	-0.20	0-100	IST humidity	digital	-		Nagra carrier 1	-
	265	NSC1	T-N1-12M	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 1	-
	266	NSC3	HC-N3-7BI	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 3	-
	267	NSC3	T-N3-7BI	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 3	-
	268	NSC2	HC-N2-7BI	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 2	-
	269	NSC2	T-N2-7BI	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 2	-

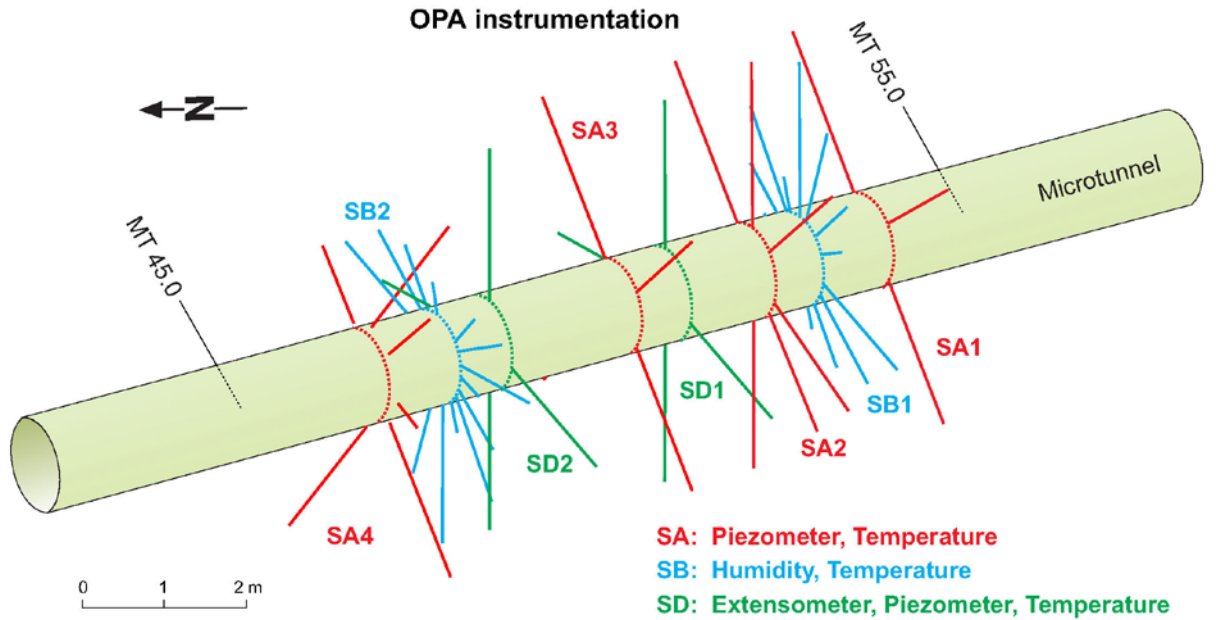
INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	270	NSC1	HC-N1-9C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 1	-
	271	NSC1	T-N1-9C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 1	-
	272	NSC1	HC-N1-7BI	%RH	-0.20	0-100	IST humidity	digital	-	Occasionally noisy	Nagra carrier 1	-
	273	NSC1	T-N1-7BI	°C	-0.20	0-165	Pt1000	digital	-		Nagra carrier 1	-
	274	NSC1	HC-N1-7BI	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 1	-
	275	NSC1	T-N1-7BI	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 1	-
	276	NSC2	HC-N2-12C	%RH	-0.35	0-100	IST humidity	digital	-		Nagra carrier 2	-
	277	NSC2	T-N2-12C	°C	-0.35	0-165	Pt1000	digital	-		Nagra carrier 2	-
	278	NSC3	HC-N3-5BI	%RH	-0.20	0-100	IST humidity	digital	-	Defective	Nagra carrier 3	-
	279	NSC3	T-N3-5BI	°C	-0.20	0-165	Pt1000	digital	-	Defective	Nagra carrier 3	-
	280	NSC1	HC-N1-R	%RH	-0.10	0-100	IST humidity	digital	-		Nagra carrier 1	-
281	NSC1	T-N1-R	°C	-0.10	0-165	Pt1000	digital	-		Nagra carrier 1	-	
INTERFACE Humidity GRS Zone	302	GSC3	HC-G3-7BI	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 3	-
	303	GSC3	T-G3-7BI	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 3	-
	304	GSC2	HC-G2-9M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 2	-
	305	GSC2	T-G2-9M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 2	-
	306	GSC1	HC-G1-7BI	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 1	-
	307	GSC1	T-G1-7BI	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 1	-
	308	GSC1	HC-G1-9M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 1	-
	309	GSC1	T-G1-9M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 1	-
	310	GSC1	HC-G1-5BI	%RH	-0.10	0-100	IST humidity	digital	-		GRS carrier 1	-
	311	GSC1	T-G1-5BI	°C	-0.10	0-165	Pt1000	digital	-		GRS carrier 1	-
	312	GSC1	HC-G1-12M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 1	-
	313	GSC1	T-G1-12M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 1	-
	314	GSC2	HC-G2-12C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 2	-
	315	GSC2	T-G2-12C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 2	-
	316	GSC1	HC-G1-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 1	-

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	317	GSC1	T-G1-12H	°C	0.00	0-165	Pt1000	digital	-	Defective	GRS carrier 1	-
	318	GSC1	HC-G1-7Bt	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 1	-
	319	GSC1	T-G1-7Bt	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 1	-
	320	GSC1	HC-G1-9H	%RH	0.00	0-100	IST humidity	digital	-	Defective	GRS carrier 1	-
	321	GSC1	T-G1-9H	°C	0.00	0-165	Pt1000	digital	-	Defective	GRS carrier 1	-
	322	GSC2	HC-G2-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 2	-
	323	GSC2	T-G2-12H	°C	0.00	0-165	Pt1000	digital	-		GRS carrier 2	-
	324	GSC2	HC-G2-7Bt	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 2	-
	325	GSC2	T-G2-7Bt	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 2	-
	326	GSC2	HC-G2-9C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 2	-
	327	GSC2	T-G2-9C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 2	-
	328	GSC2	HC-G2-7Bt	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 2	-
	329	GSC2	T-G2-7Bt	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 2	-
	332	GSC3	HC-G3-7Bt	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 3	-
	333	GSC3	T-G3-7Bt	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 3	-
	334	GSC3	HC-G3-9C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 3	-
	335	GSC3	T-G3-9C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 3	-
	336	GSC1	HC-G1-9C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 1	-
	337	GSC1	T-G1-9C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 1	-
	338	GSC3	HC-G3-12H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 3	-
	339	GSC3	T-G3-12H	°C	0.00	0-165	Pt1000	digital	-		GRS carrier 3	-
	340	GSC1	HC-G1-3H	%RH	0.00	0-100	IST humidity	digital	-		GRS carrier 1	-
	341	GSC1	T-G1-3H	°C	0.00	0-165	Pt1000	digital	-		GRS carrier 1	-
	342	GSC3	HC-G3-9M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 3	-
	343	GSC3	T-G3-9M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 3	-
	344	GSC3	HC-G3-12C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 3	-
	345	GSC3	T-G3-12C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 3	-

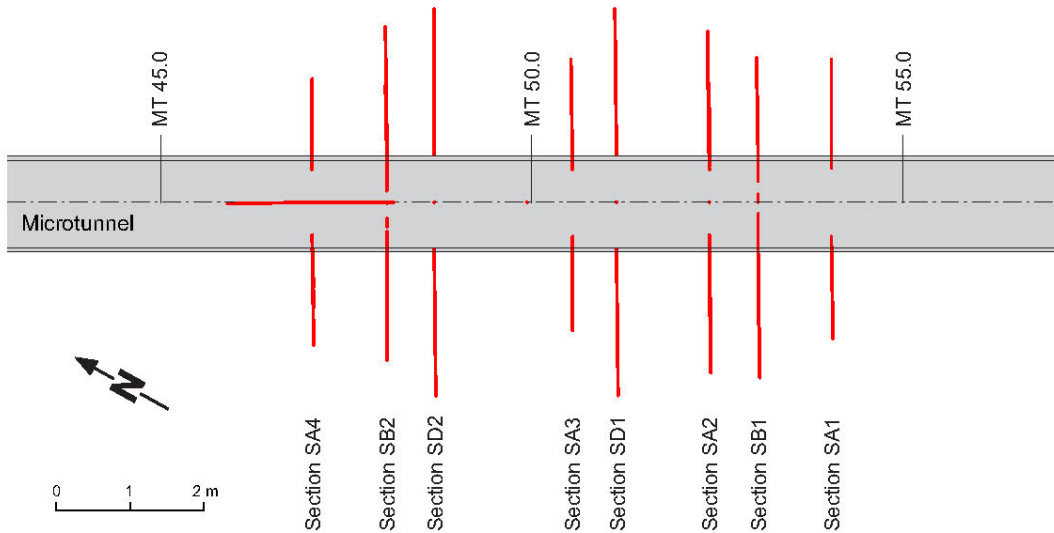
INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	346	GSC1	HC-G1-3M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 1	-
	347	GSC1	T-G1-3M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 1	-
	348	GSC1	HC-G1-3C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 1	-
	349	GSC1	T-G1-3C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 1	-
	350	GSC3	HC-G3-12M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 3	-
	351	GSC3	T-G3-12M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 3	-
	352	GSC2	HC-G2-12M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 2	-
	353	GSC2	T-G2-12M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 2	-
	354	GSC1	HC-G1-12C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 1	-
	355	GSC1	T-G1-12C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 1	-
	356	GSC1	HC-G1-5Bt	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 1	-
	357	GSC1	T-G1-5Bt	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 1	-
	358	GSC2	HC-G2-3H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 2	-
	359	GSC2	T-G2-3H	°C	0.00	0-165	Pt1000	digital	-	Defective	GRS carrier 2	-
	360	GSC2	HC-G2-9H	%RH	0.00	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 2	-
	361	GSC2	T-G2-9H	°C	0.00	0-165	Pt1000	digital	-		GRS carrier 2	-
	362	GSC2	HC-G2-3C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 2	-
	363	GSC2	T-G2-3C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 2	-
	364	GSC2	HC-G2-3M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 2	-
	365	GSC2	T-G2-3M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 2	-
	366	GSC3	HC-G3-9H	%RH	0.00	0-100	IST humidity	digital	-	Defective	GRS carrier 3	-
	367	GSC3	T-G3-9H	°C	0.00	0-165	Pt1000	digital	-	Defective	GRS carrier 3	-
	368	GSC3	HC-G3-5Bt	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 3	-
	369	GSC3	T-G3-5Bt	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 3	-
	370	GSC3	HC-G3-R	%RH	-0.10	0-100	IST humidity	digital	-		GRS carrier 3	-
	371	GSC3	T-G3-R	°C	-0.10	0-165	Pt1000	digital	-		GRS carrier 3	-
	372	GSC3	HC-G3-3M	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 3	-

INTERFACE Sensor assembling box	DAS - Channel	Borehole	Sensor name	Unit	Depth [m]	Range	Sensor type	Output signal	Sensor SN	Status 28.02.2014	Profile	Atmos- pheric pressure
	373	GSC3	T-G3-3M	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 3	-
	374	GSC3	HC-G3-3C	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 3	-
	375	GSC3	T-G3-3C	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 3	-
	376	GSC2	HC-G2-5Bl	%RH	-0.20	0-100	IST humidity	digital	-		GRS carrier 2	-
	377	GSC2	T-G2-5Bl	°C	-0.20	0-165	Pt1000	digital	-		GRS carrier 2	-
	378	GSC2	HC-G2-5Bl	%RH	-0.35	0-100	IST humidity	digital	-		GRS carrier 2	-
	379	GSC2	T-G2-5Bl	°C	-0.35	0-165	Pt1000	digital	-		GRS carrier 2	-
	380	GSC3	HC-G3-3H	%RH	0.040	0-100	IST humidity	digital	-	Humidity = 100%	GRS carrier 3	-
	381	GSC3	T-G3-3H	°C	0.00	0-165	Pt1000	digital	-		GRS carrier 3	-
ATEMIN Humidity CR7 system	Psychro-01	BVE-11	HC-B11	%RH	0.77	95-99.96	Wescor PST-55	digital	-	Humidity > 99.96%	SB2	-CR 7 logger removed on 22.05.2012
	Psychro-02	BVE-13	HC-B13	%RH	1.76	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB2	
	Psychro-03	BVE-17	HC-B17	%RH	2.00	95-99.96	Wescor PST-55	digital	39870	Wrong humidity, not used	SB2	
	Psychro-04	BVE-19	HC-B19	%RH	1.25	95-99.96	Wescor PST-55	digital	-	Defective	SB2	
	Psychro-06	BVE-21	HC-B21	%RH	0.26	95-99.96	Wescor PST-55	digital	-	Defective	SB2	
	Psychro-08	BVE-24	HC-B24	%RH	0.52	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB2	
	Psychro-09	BVE-65	HC-B65	%RH	1.31	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB1	
	Psychro-11	BVE-67	HC-B67	%RH	0.27	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB1	
	Psychro-13	BVE-74	HC-B74	%RH	1.75	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB1	
	Psychro-16	Not identified	1	%RH		95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	n/a	
	Psychro-17	BVE-63	HC-B63	%RH	2.02	95-99.96	Wescor PST-55	digital	39884	Wrong humidity, not used	SB1	
	Psychro-18	-	Long green	%RH		95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	n/a	
	Psychro-20	Not identified	2	%RH		95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	n/a	
	Psychro-21	BVE-22	HC-B22	%RH	1.50	95-99.96	Wescor PST-55	digital	39867	Wrong humidity, not used	SB2	
	Psychro-22	BVE-68	HC-B68	%RH	1.53	95-99.96	Wescor PST-55	digital	-	Wrong humidity, not used	SB1	
Psychro-23	-	Short green	%RH		95-99.96	Wescor PST-55	digital	-	Humidity > 99.96%	n/a		
Psychro-25	BVE-76	HC-B76	%RH	1.07	95-99.96	Wescor PST-55	digital	-	Humidity < 95%	SB1		

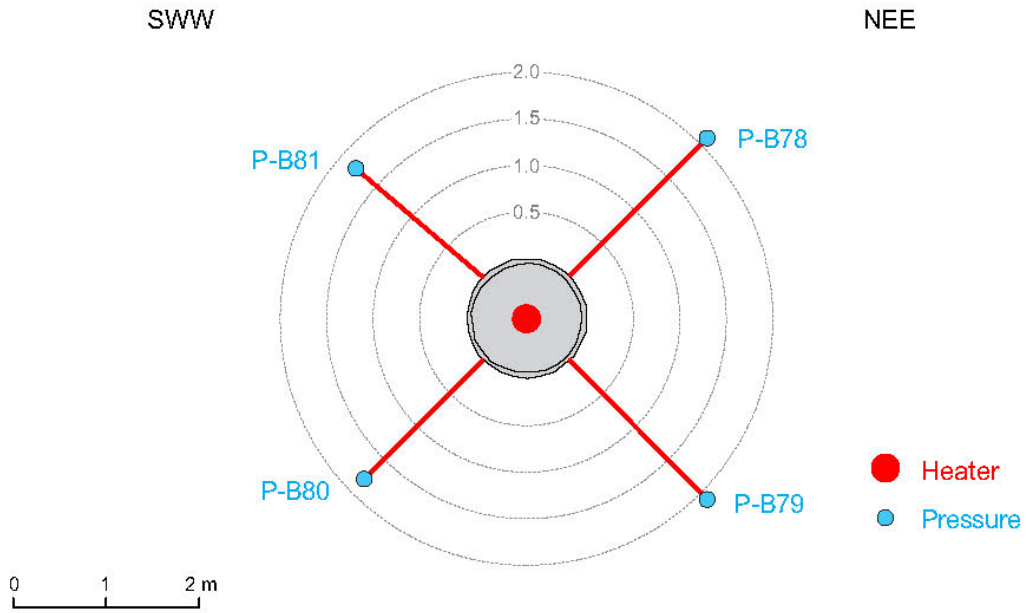
OPA Instrumentation - microtunnel sections



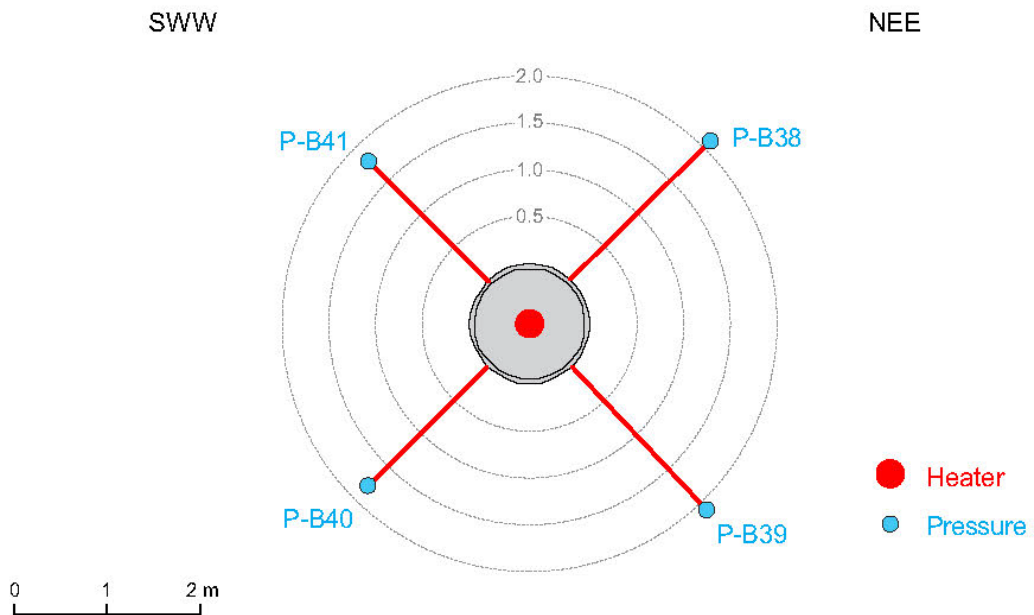
Horizontal section



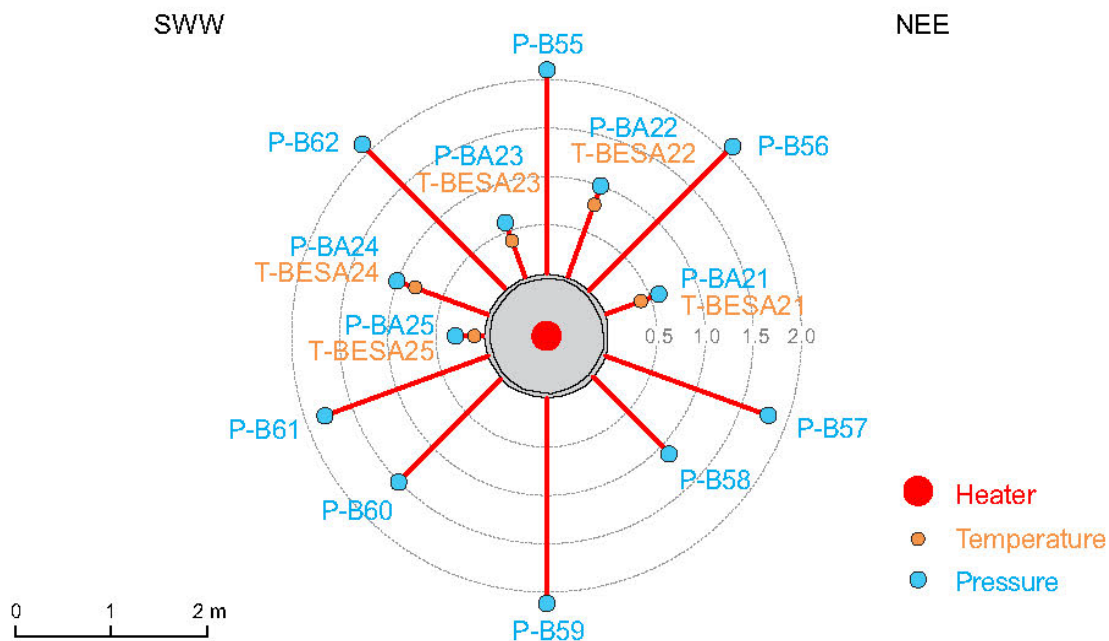
Section SA1



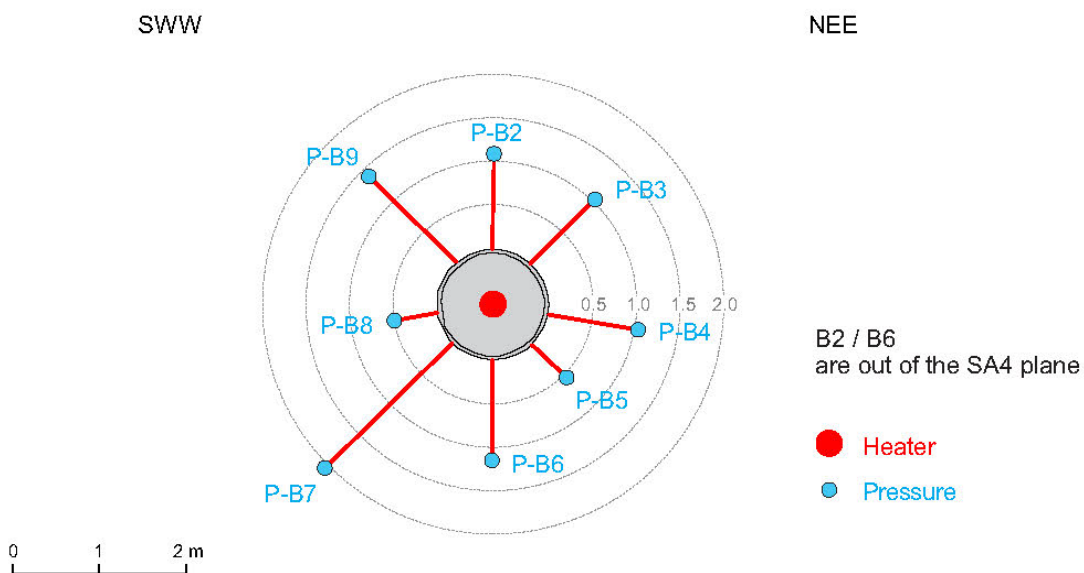
Section SA3



Section SA2



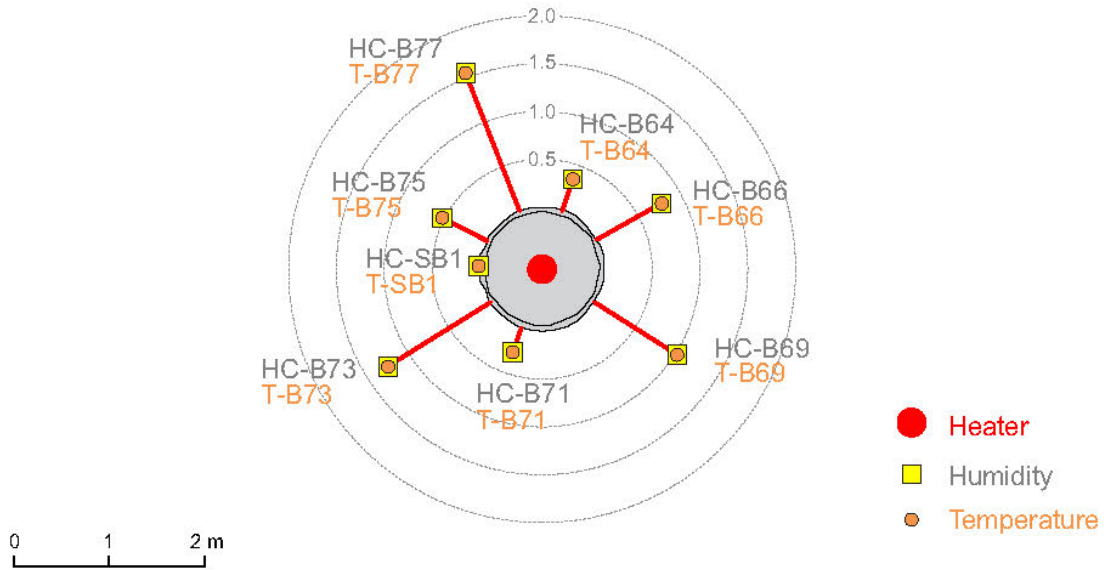
Section SA4



Section SB1

SWW

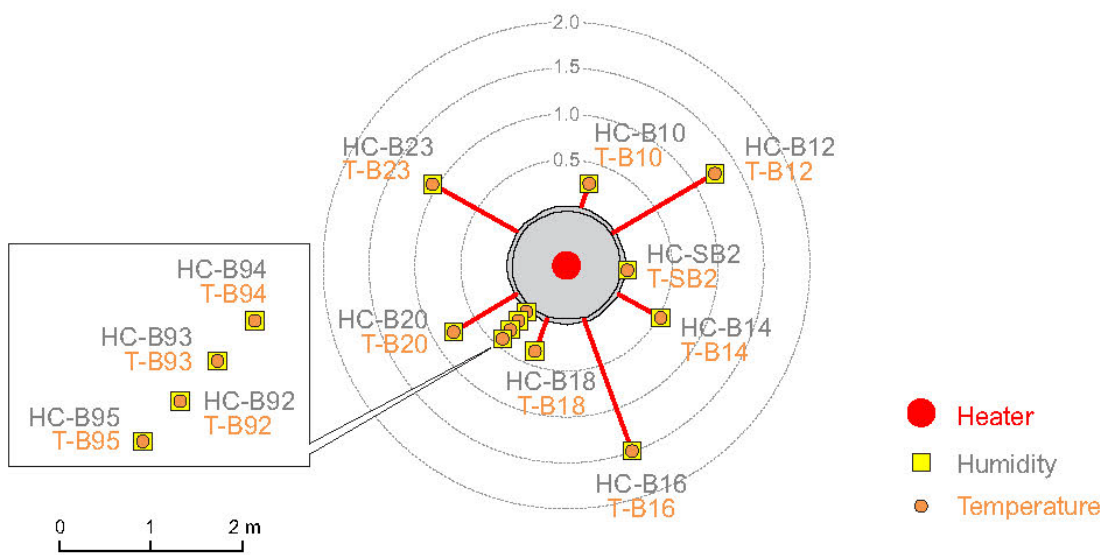
NEE



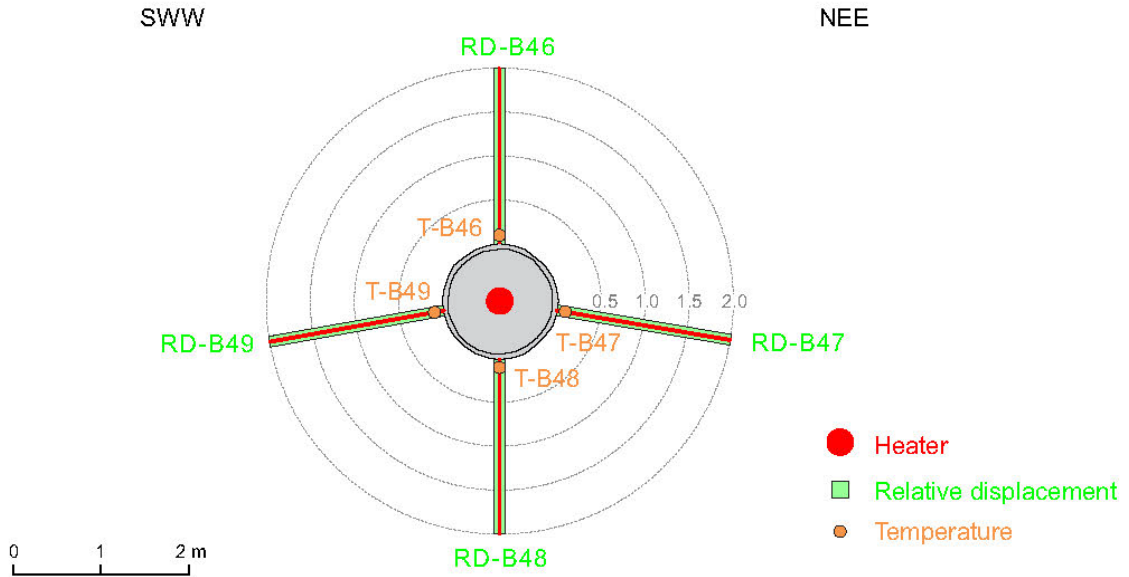
Section SB2

SWW

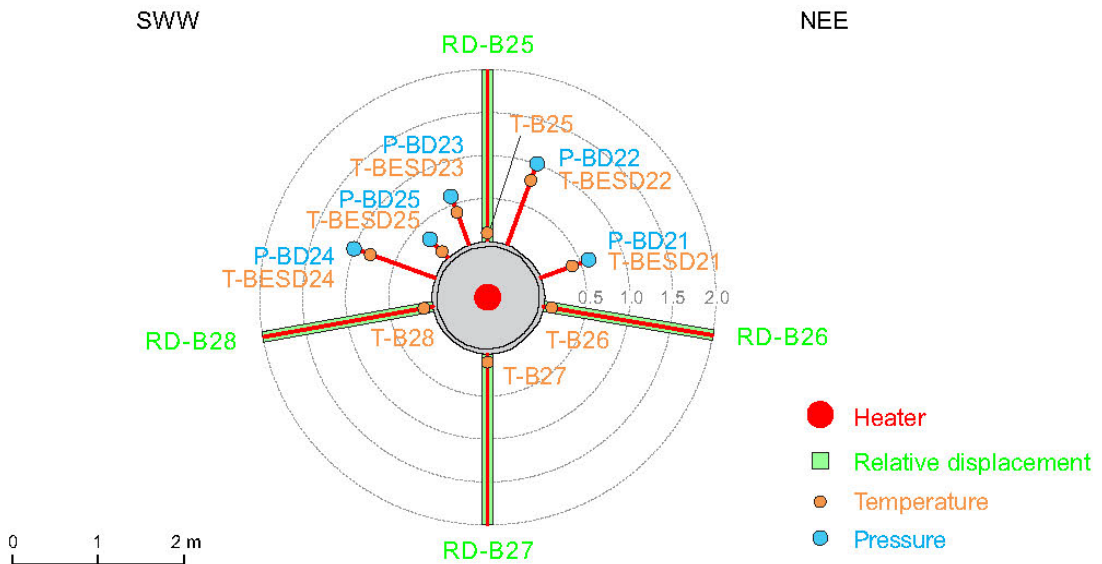
NEE



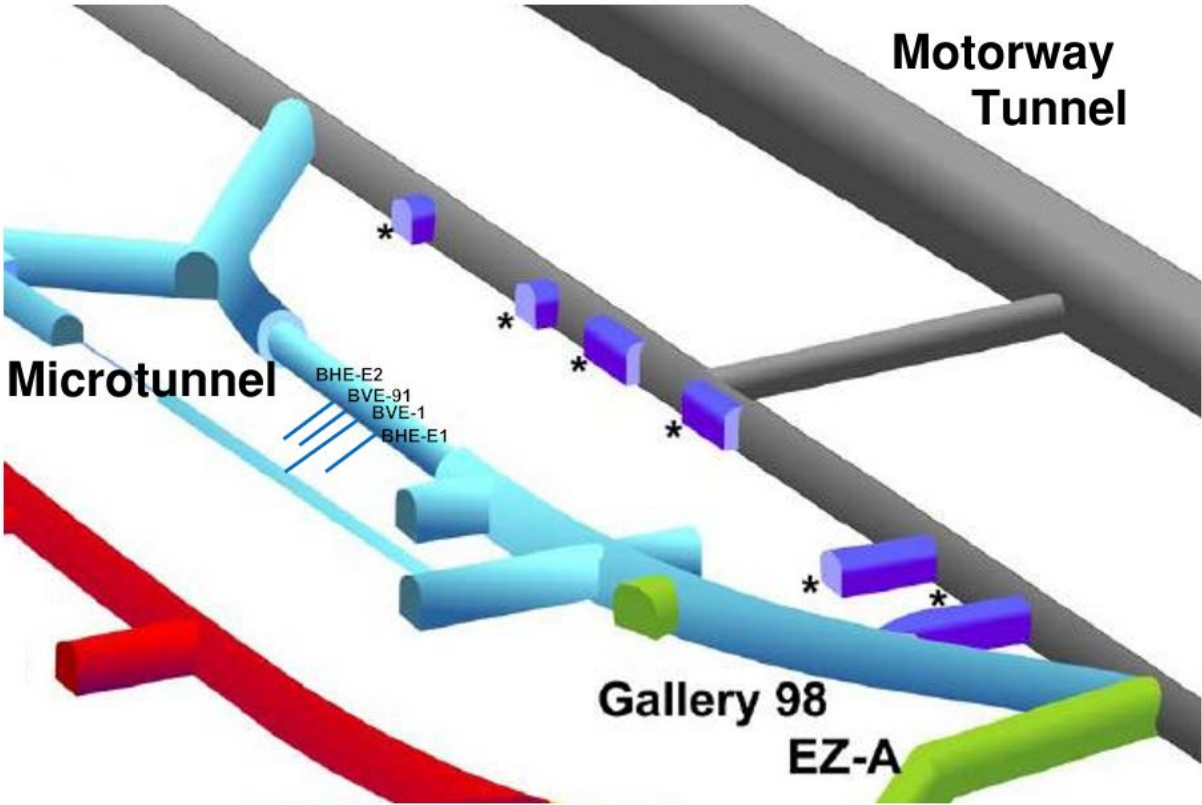
Section SD1



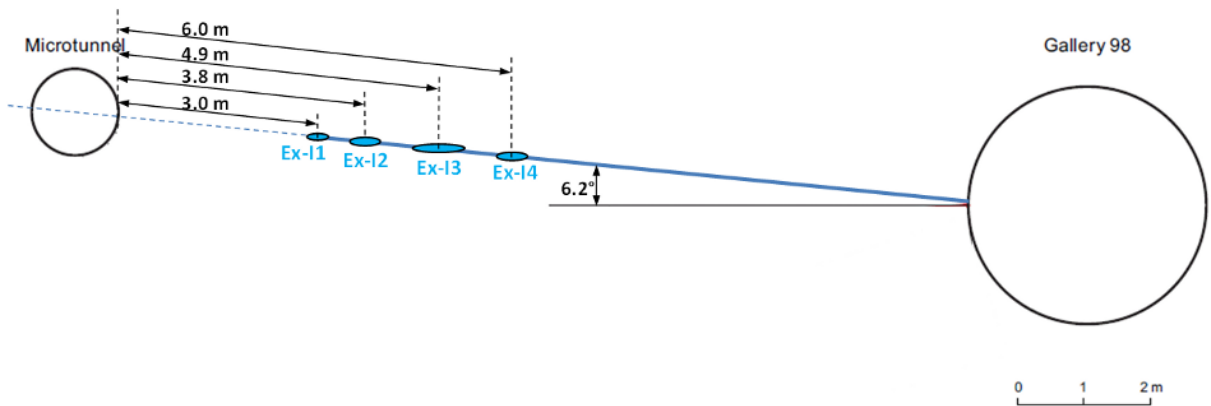
Section SD2



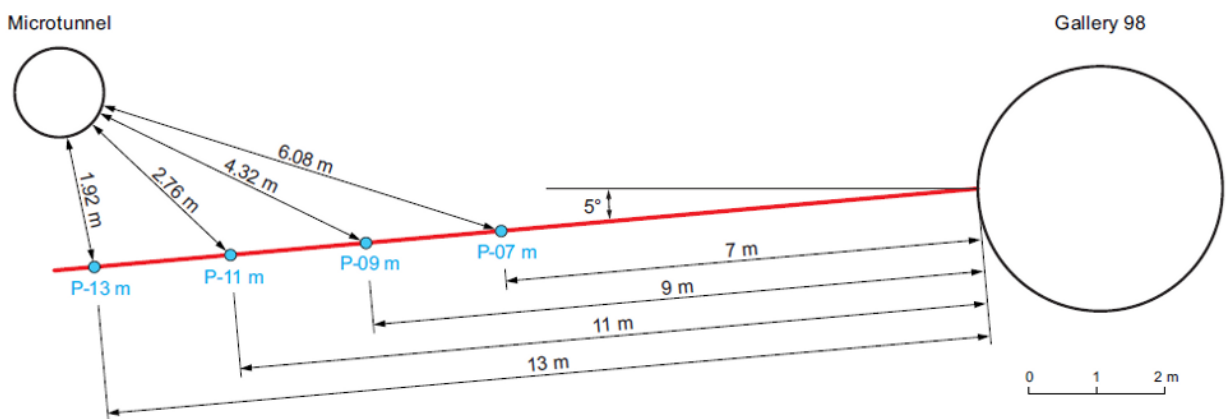
OPA instrumentation - gallery boreholes



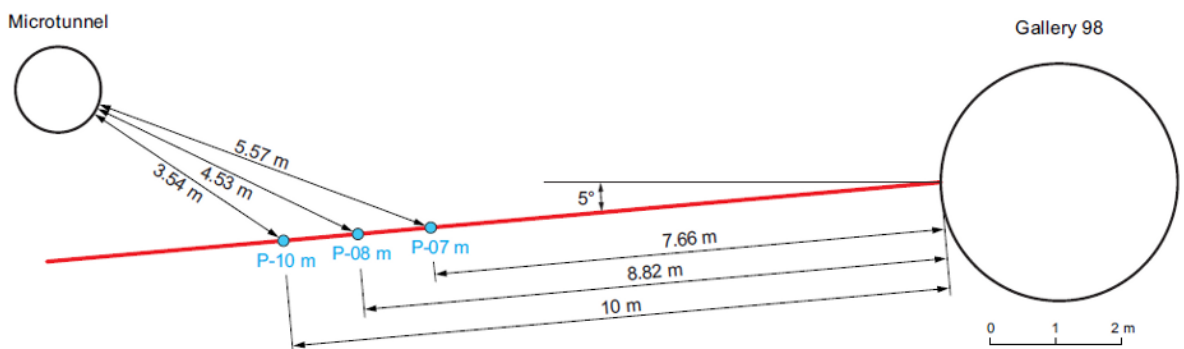
Borehole BHE-E1 and BHE-E2



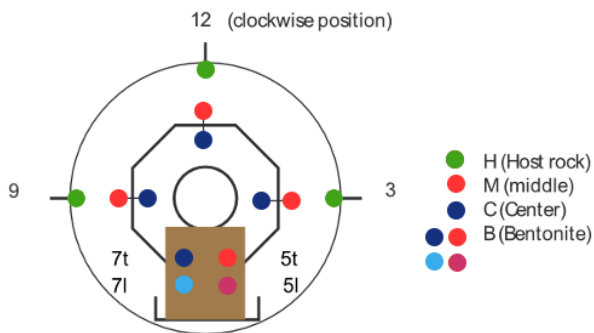
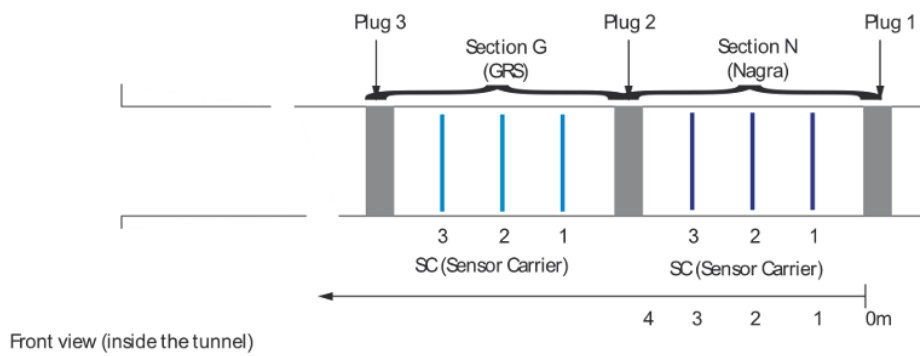
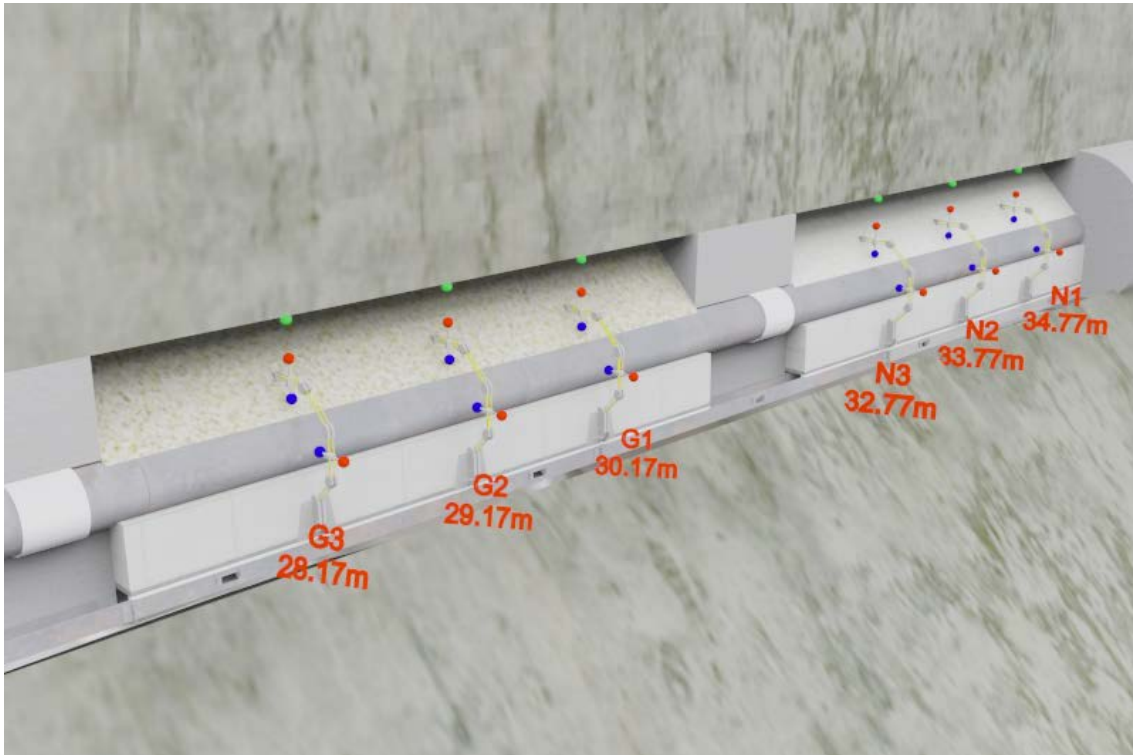
Borehole BVE-1



Borehole BVE-91

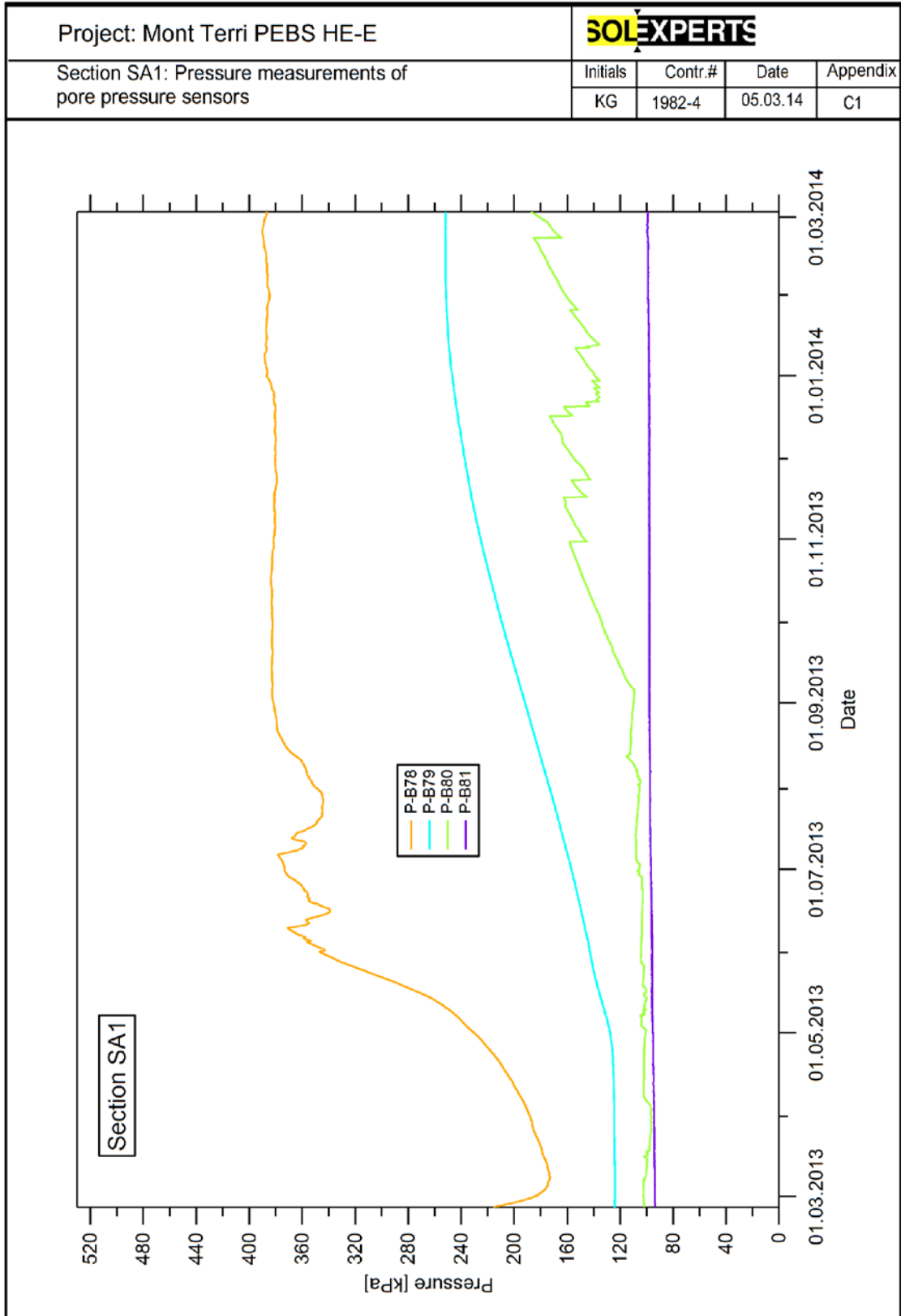


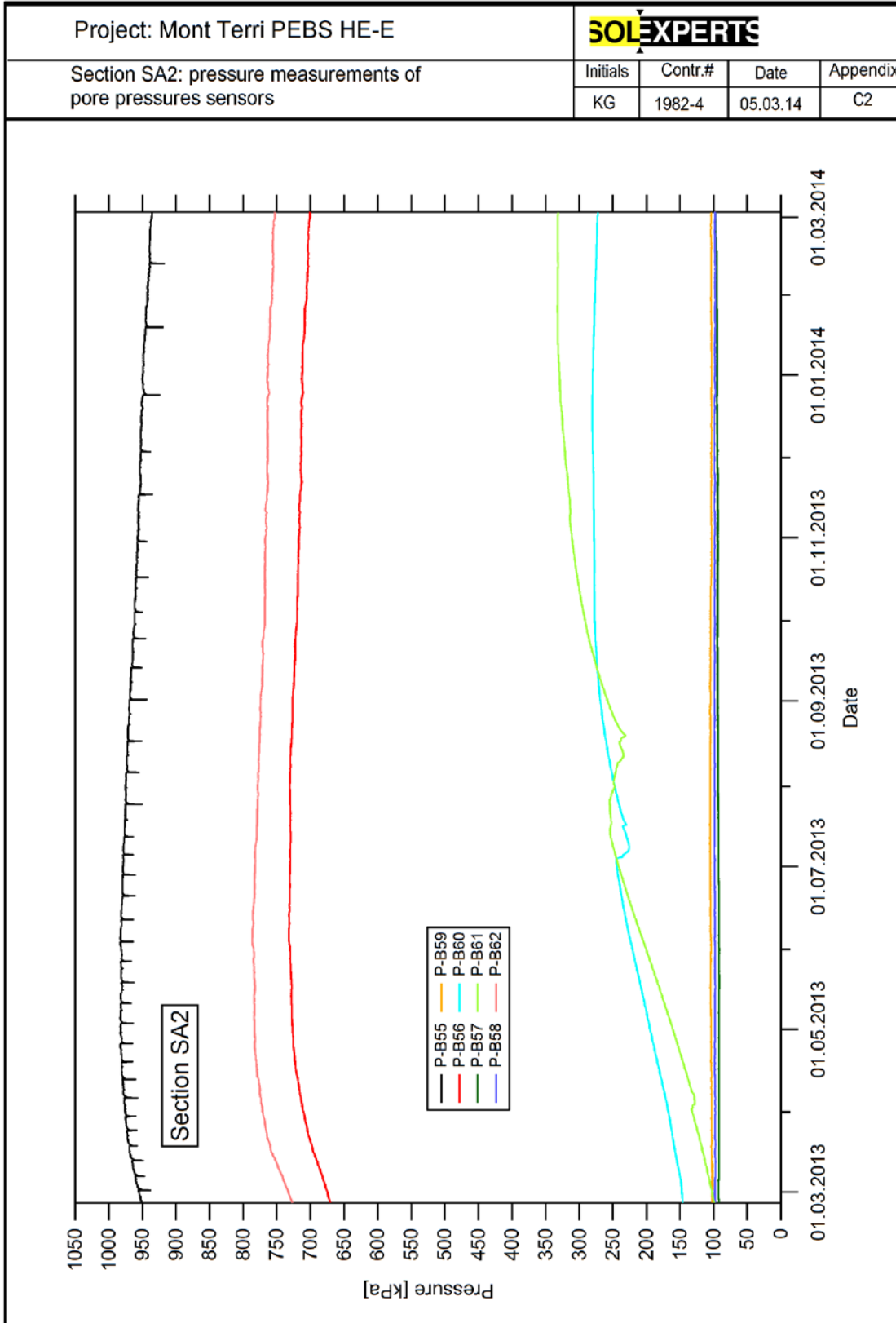
Engineered barrier instrumentation

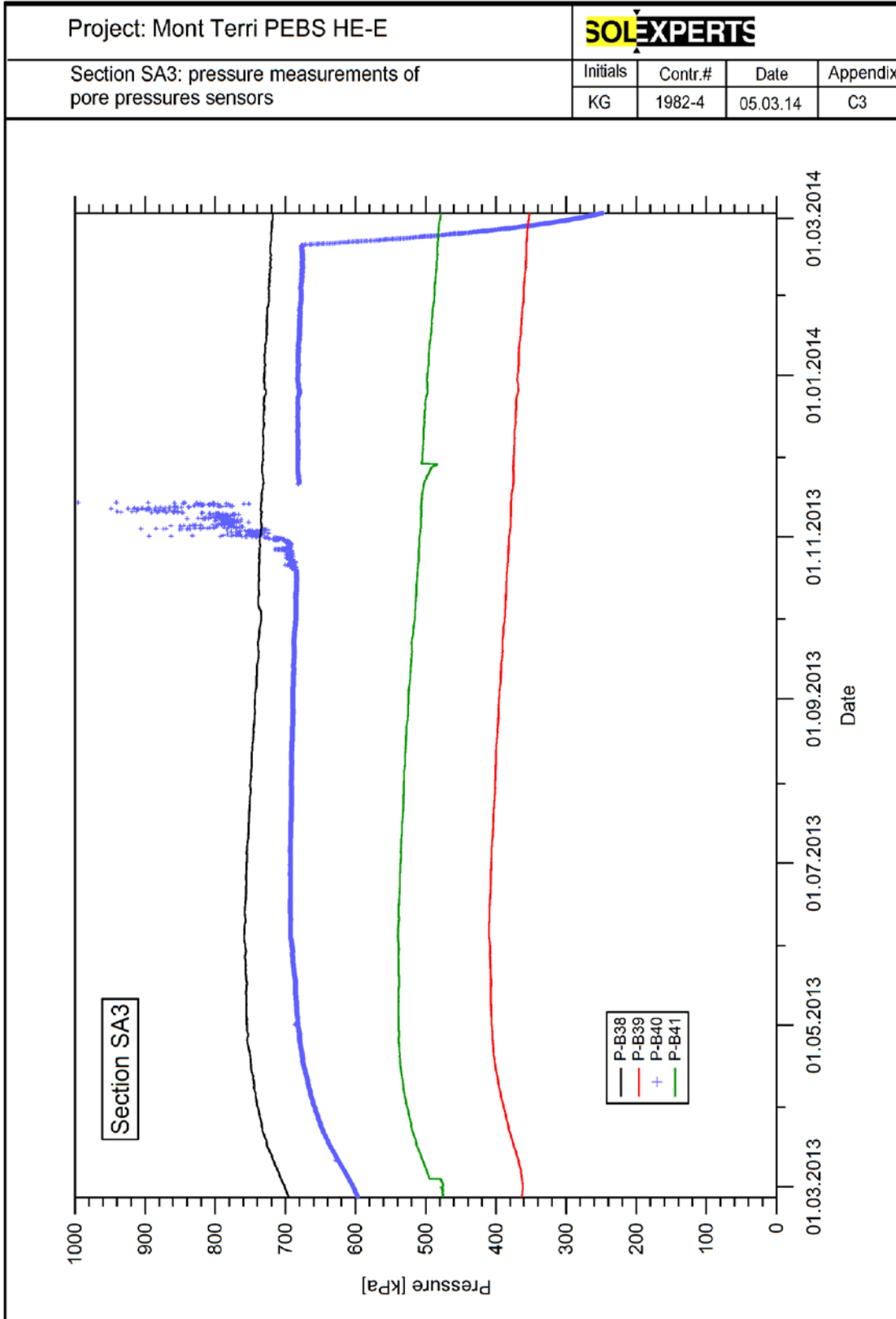


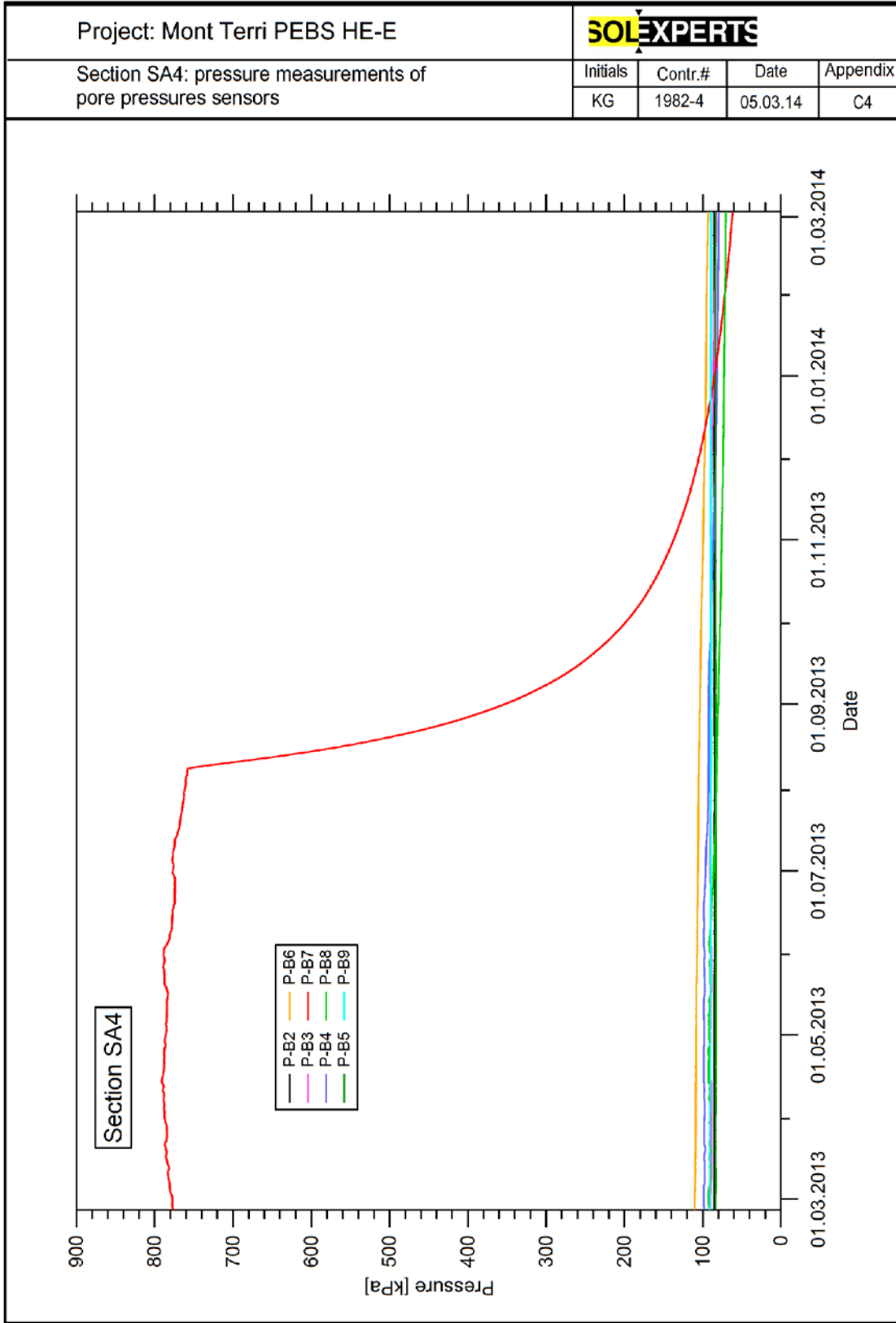
Appendix C:

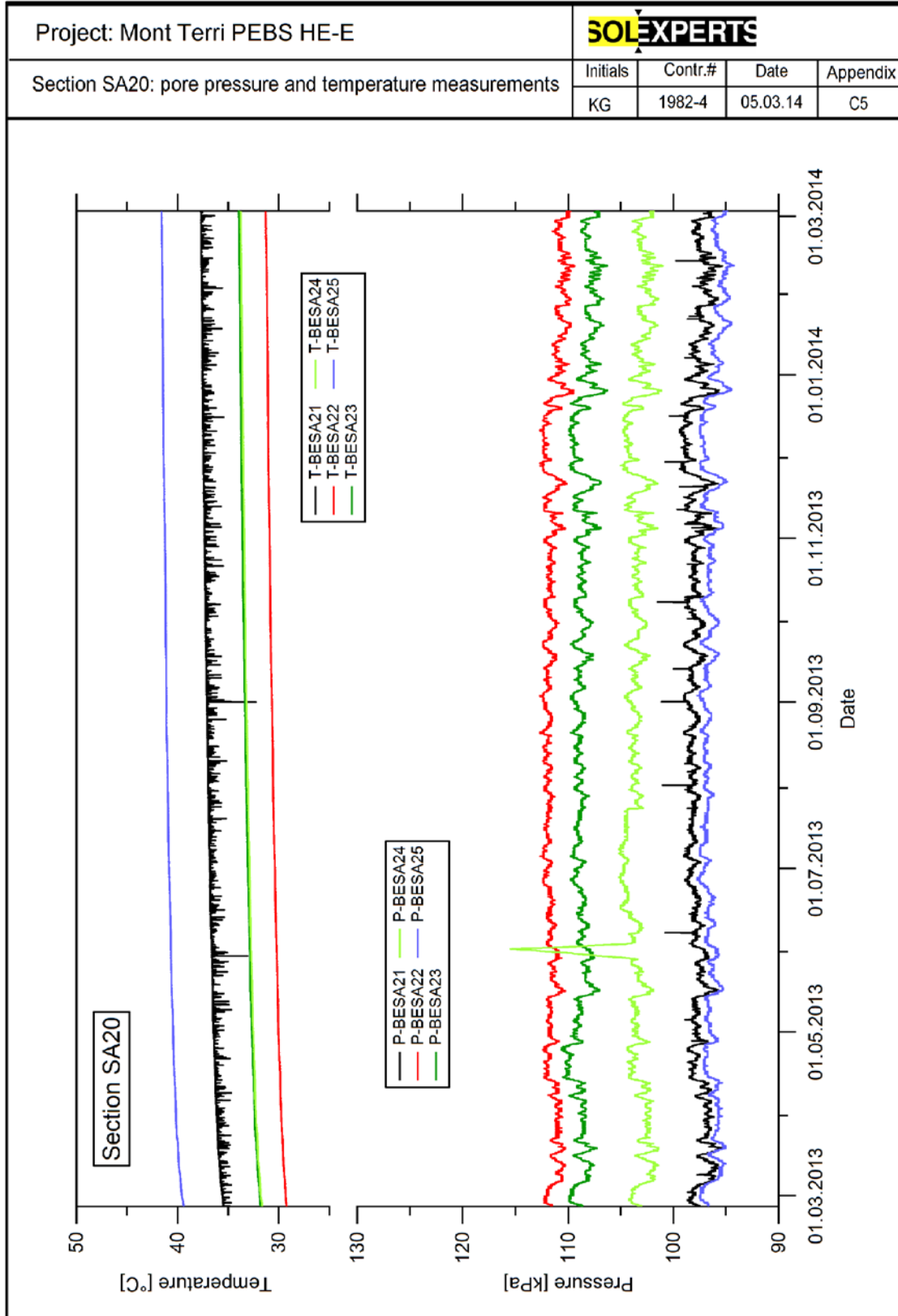
- *Data plots of the sensor in microtunnel sections*

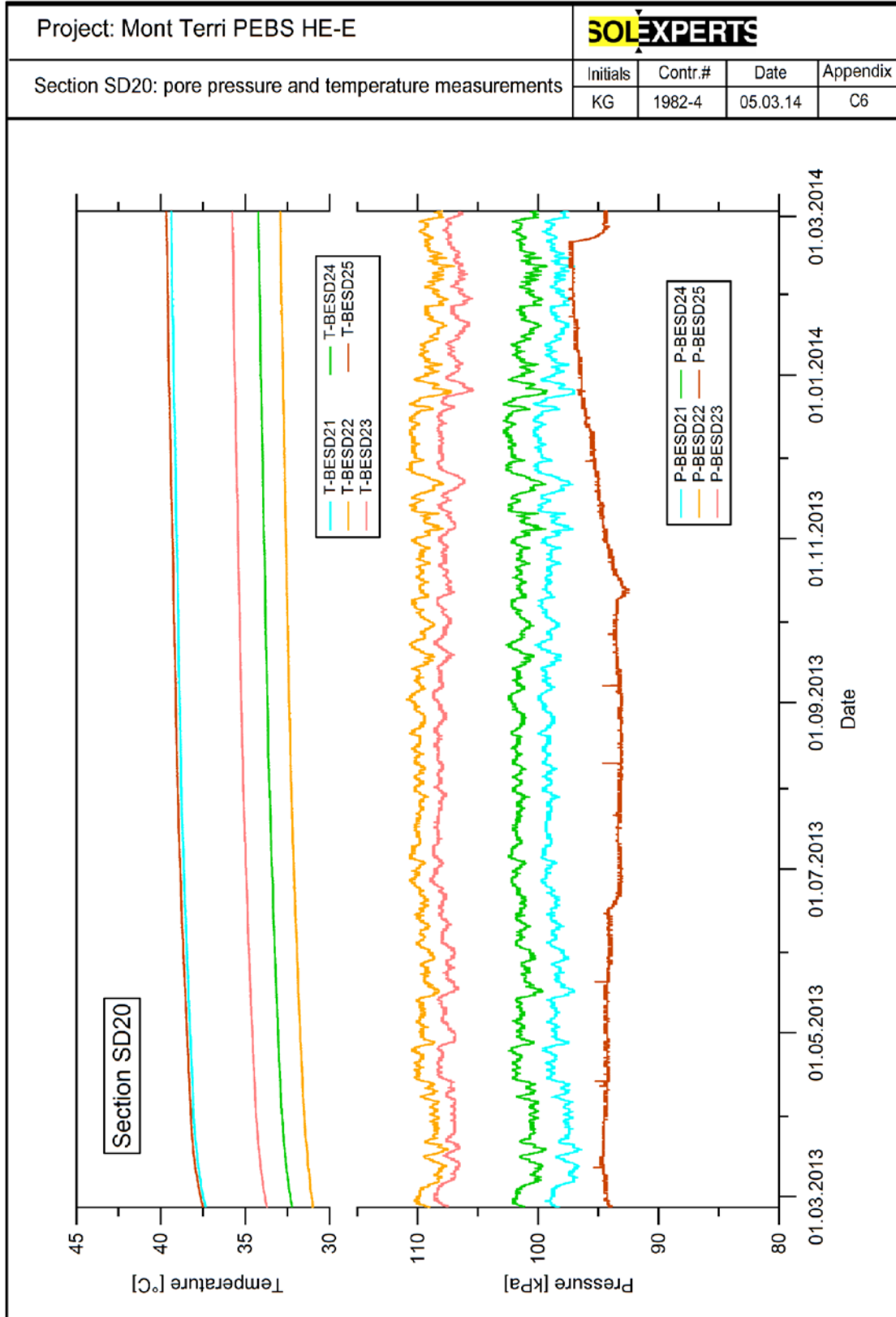


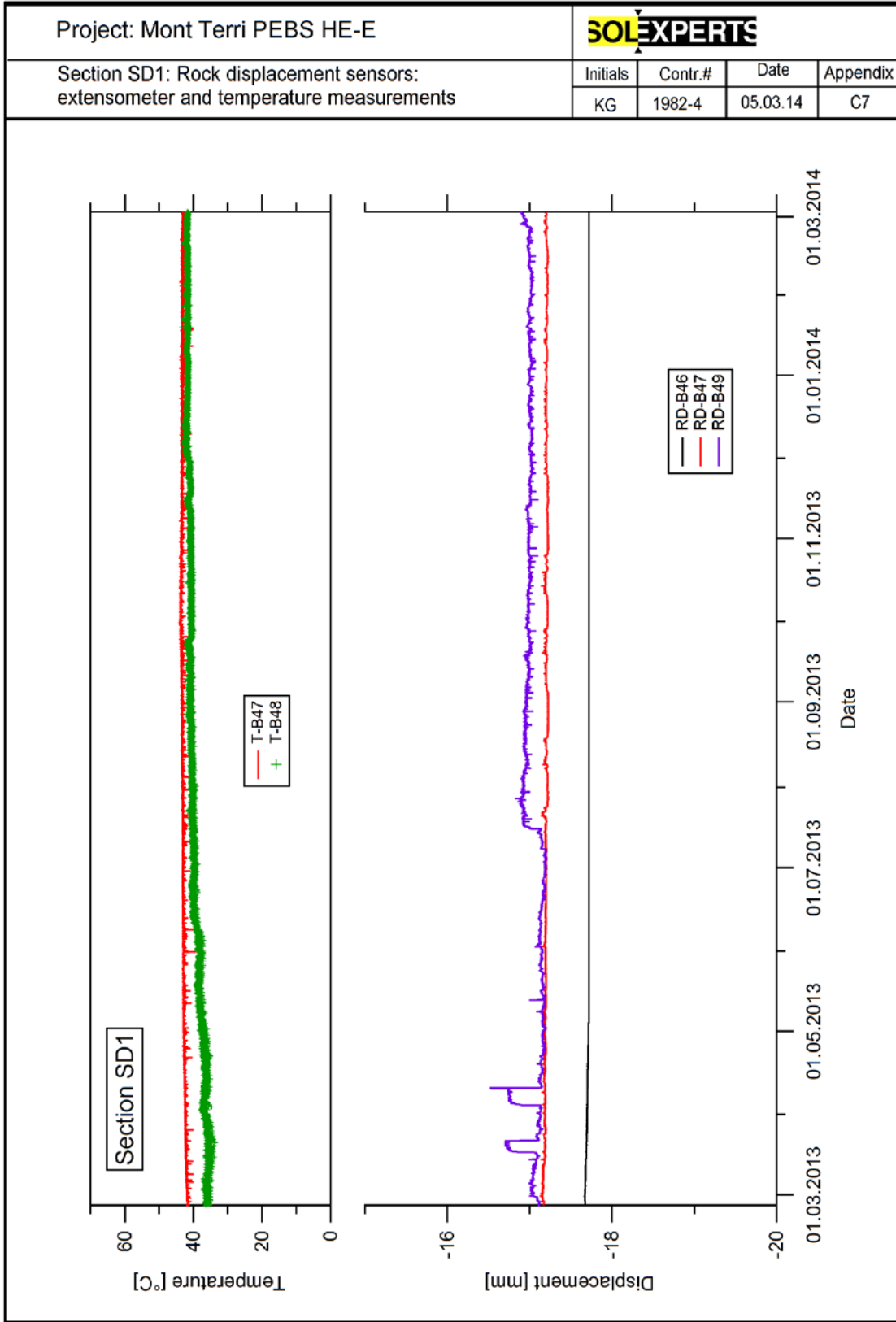


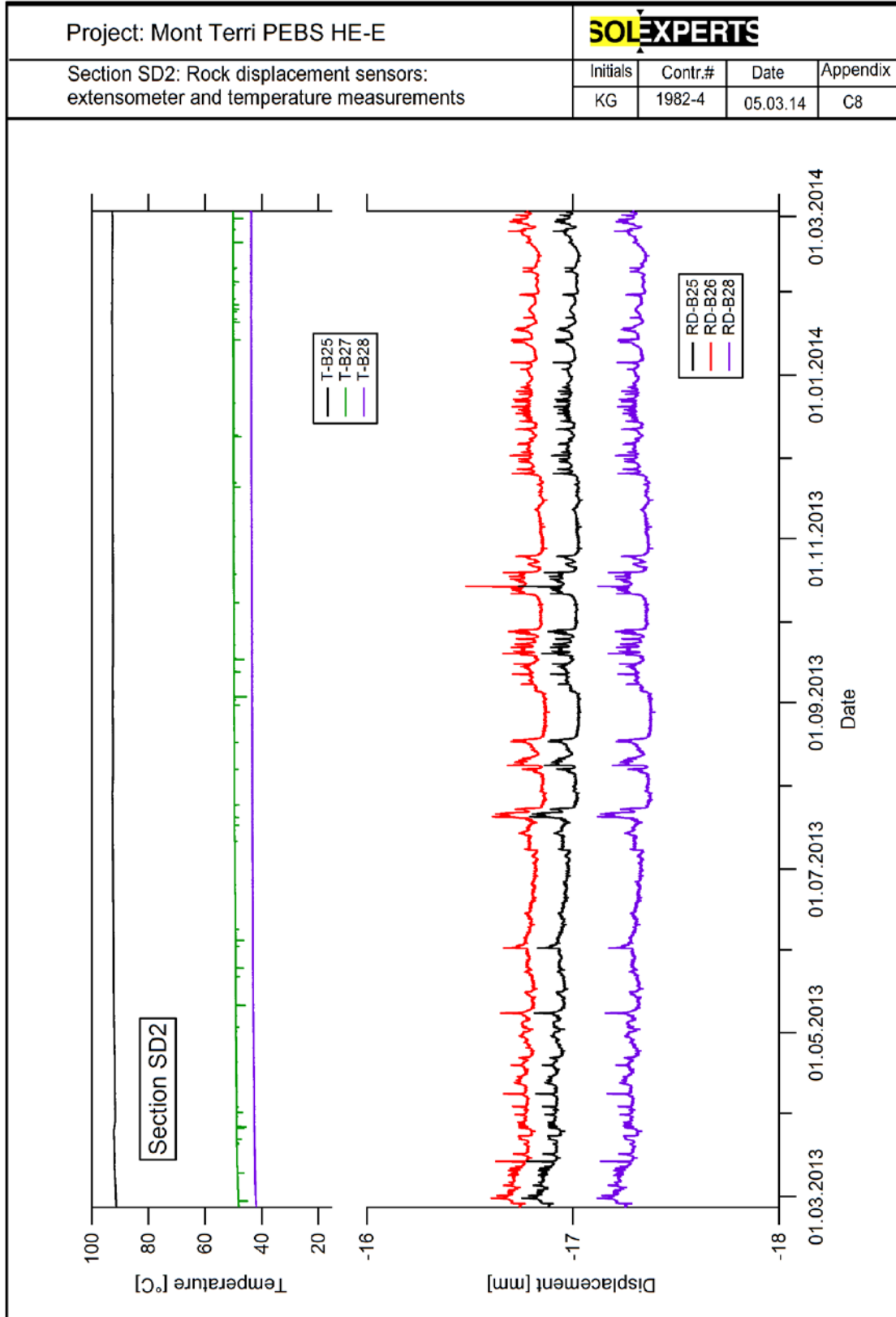


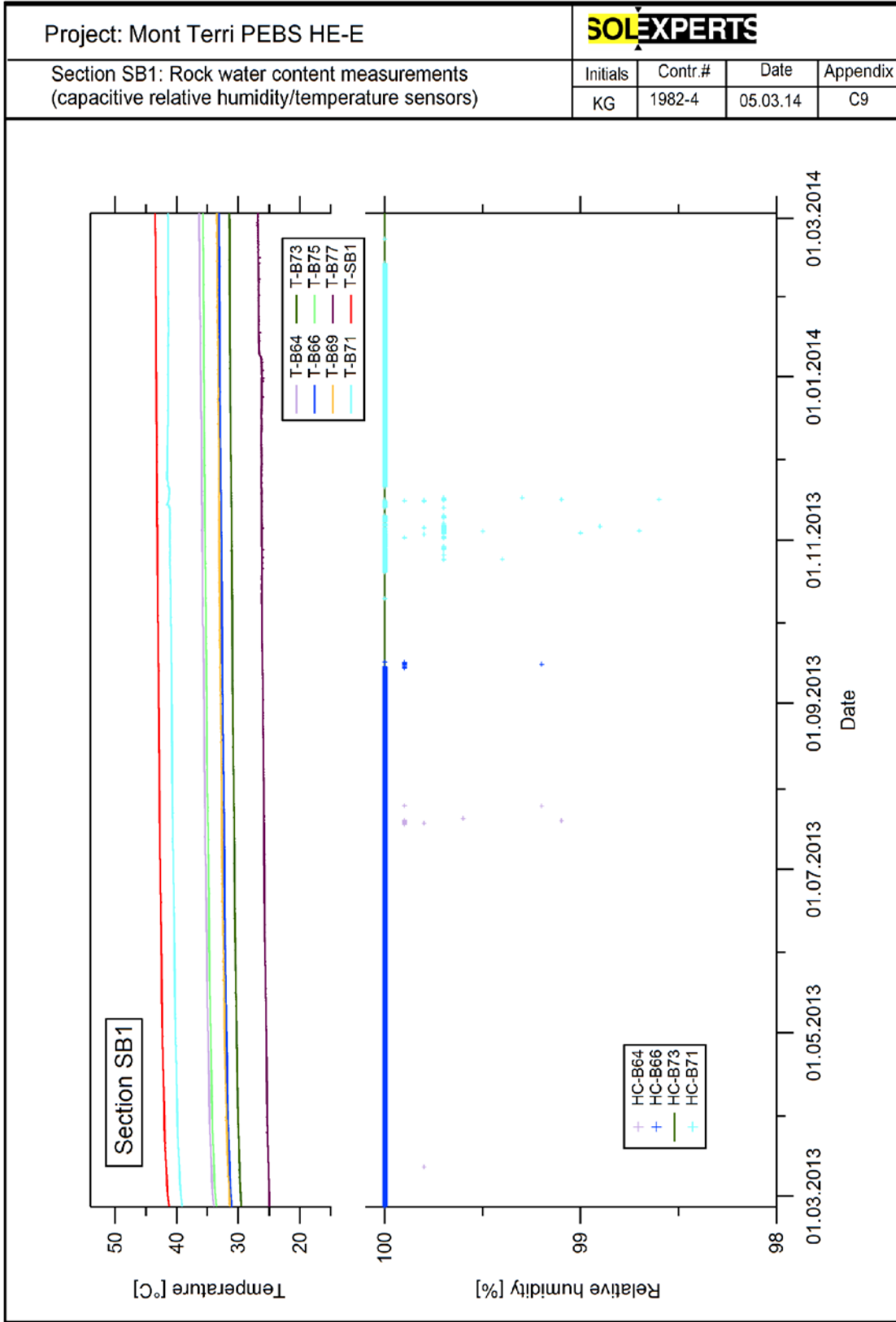


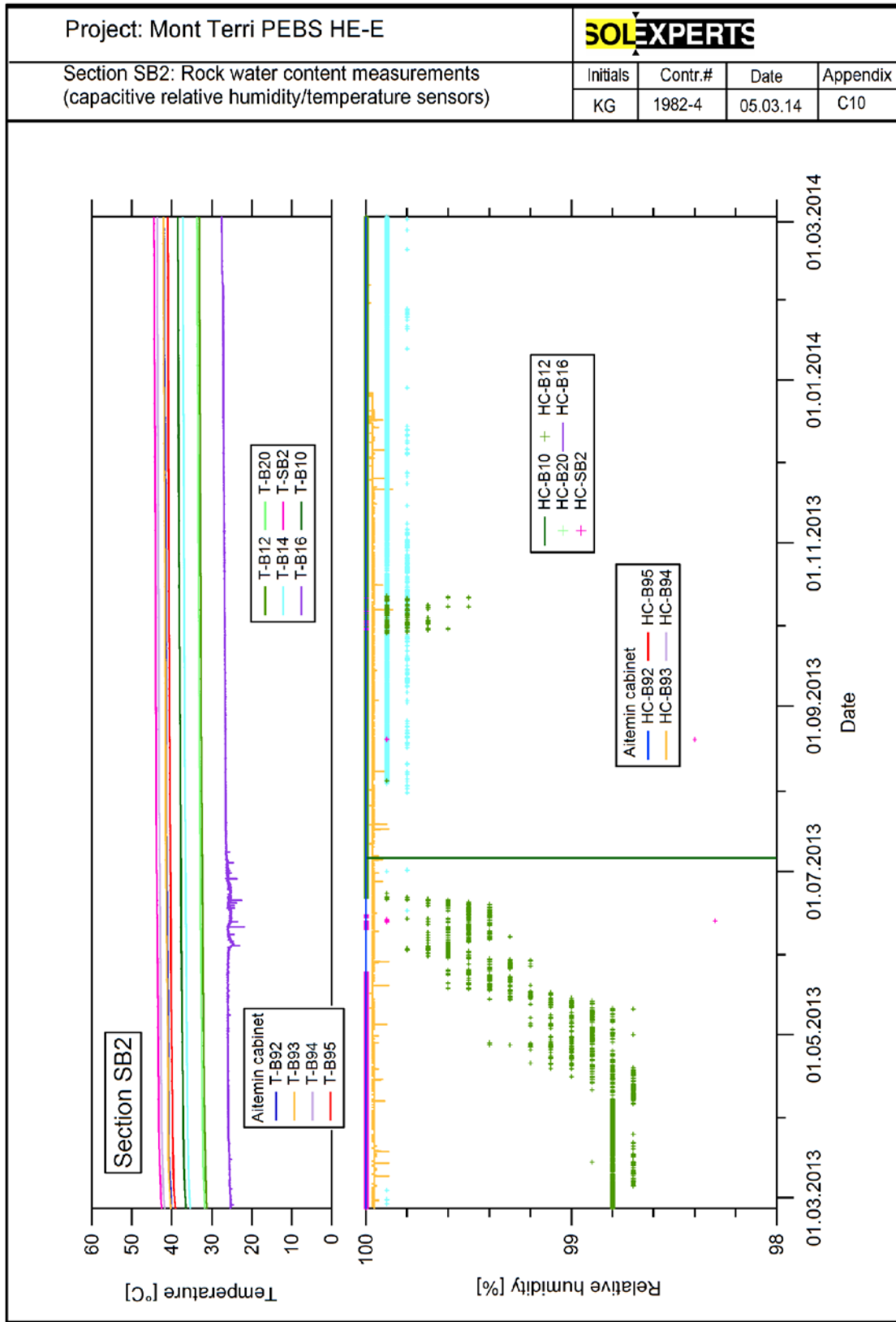






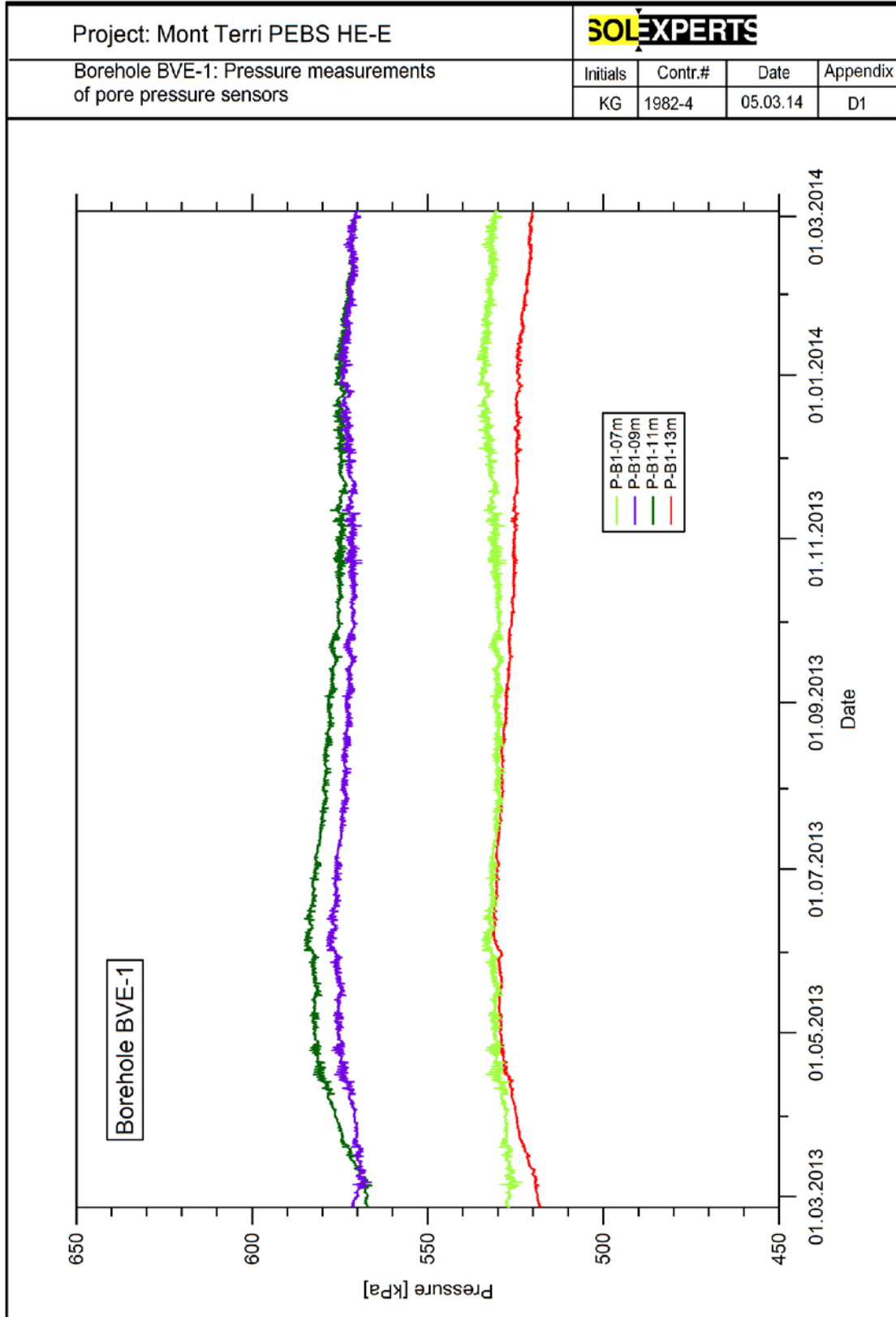


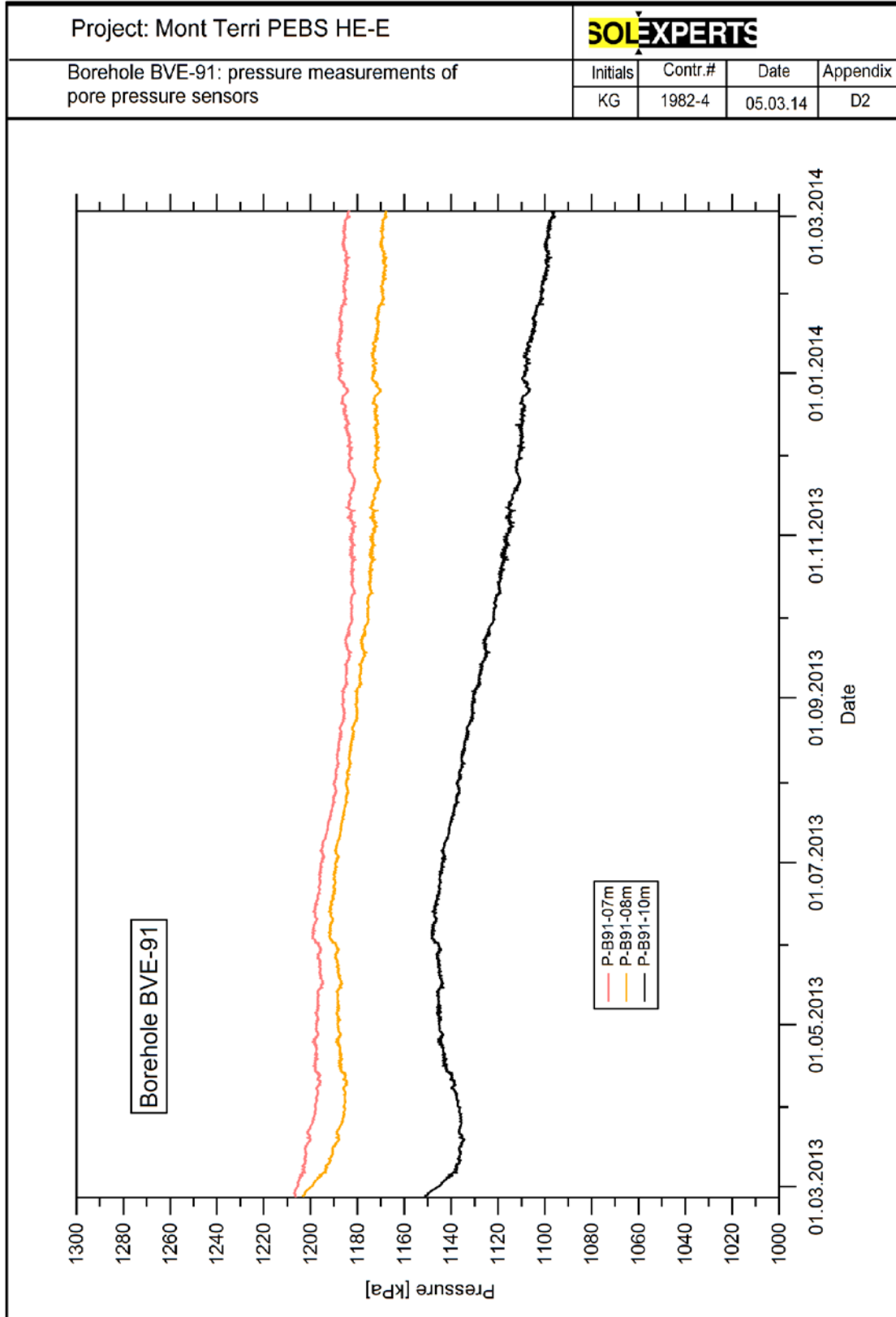


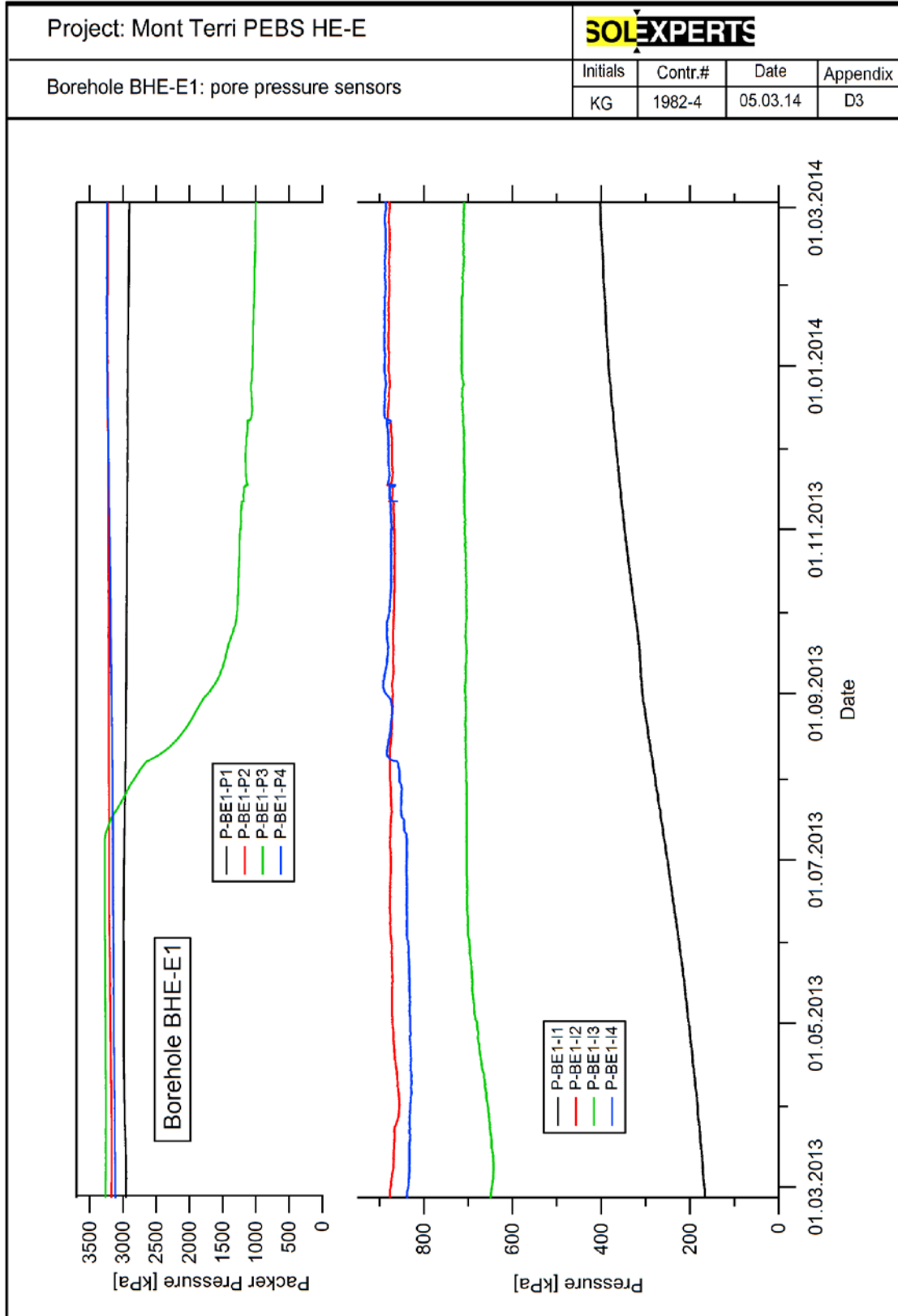


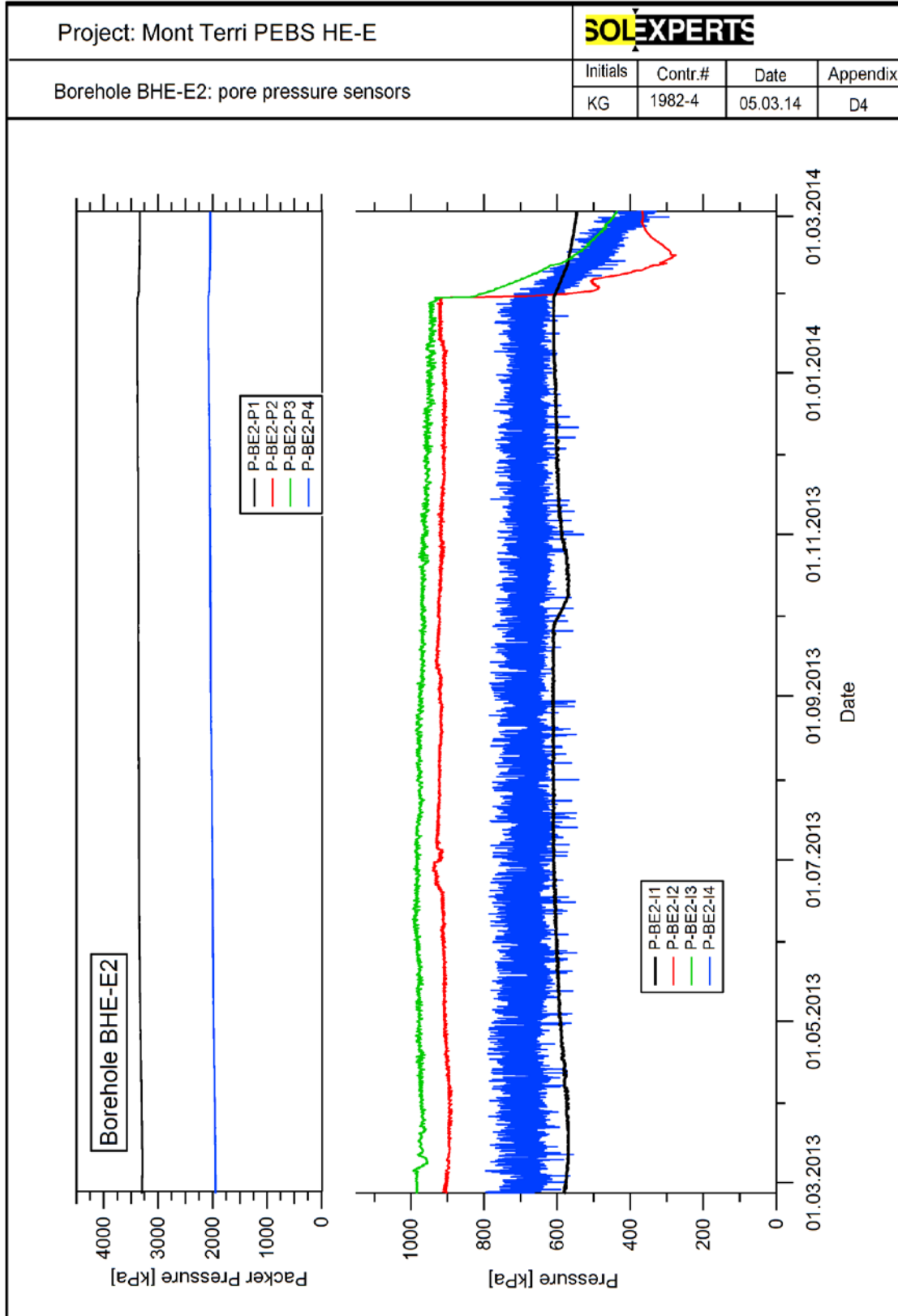
Appendix D:

- *Data plots of the sensors in the boreholes from Gallery 98*









Appendix E:

- *Data plots for the sensors installed in the EBS and at the EBS-host rock interface*

