BOR format documentation

The Bor Format consists of two parts:

- the specification of the storage format
- the specification of the field type

Introduction

First, it is assumed that a file matches a recording as an independant logical unit. The file is named with a **.bor** extension.

File name example

```
500002407051406O1D.bor
```

Table 1. File name structure

5	**0001**	**24070514060 1**	**D**	**.bor**
Generation	Serial	Date	Domain	Format

Table 2. Domain ID

ID	**Domain**
D	Drilling parameters
G	Grouting parameters
J	JetGrouting parameters
P	Ménard Pressuremeter Test
A	Continuous Flight Auger Pile (CFA)
L	Lugeon Test
V	Vibroflotation
Y	Dynamic probing

Abilities

The file has the following abilities:

- recording description
- data logs

- non-modification source-file guarantee

Format specification

The bor file is a zip format archive containing the files below:

- A file description that contains technical informations non-specific to the recording type and field properties, references to data file: *description.xml*
- Data file, example: *data.nc*

Data file

Data file use the netCDF (3.6+) format. It contain data logs and each variable.

Description file

The description file contains 2 different types of information:

- non-specific technical information
- field-specific properties

Example of Description file

Example of description.xml file (drilling parameters)

```
<?xml version="1.0" encoding="UTF-8"?>
<description xmlns="http://www.lim.eu/description"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.lim.eu/description description.xsd">
  <filename>50000240705140601D</filename>
  <creation>2024-07-05T14:06:01+02:00</creation>
  <modification>2024-07-05T14:08:02+02:00</modification>
  <project_ref>Bor-Format</project_ref>
  <borehole_ref>BH1</borehole_ref>
  <operator>GASTON</operator>
  <device>
    <serial>50000</serial>
    <version>1.0</version>
    <build>20190104</build>
  </device>
  <position>
    <longitude unit="degree">4.9187880</longitude>
    <latitude unit="degree">45.7597504</latitude>
    <altitude unit="m">192.000000</altitude>
    <epv unit="m">655.35</epv>
    <eph unit="m">655.35</eph>
  </position>
  <cell>
```

```
    <mcc>208</mcc>
    <mnc>01</mnc>
    <cellid>00B2350F</cellid>
    <lac>00000884</lac>
  </cell>
  <borehole>
    <borehole_diameter unit="mm">160</borehole_diameter>
    <borehole_inclination unit="degree">0</borehole_inclination>
    <water_depth unit="m">0.1</water_depth>
  </borehole>
  <drilling>
    <machine_ref>DCH 218</machine_ref>
    <method>DRLMTD_RTR</method>
    <tool>DRLBIT_CNTCI</tool>
    <tool_diameter unit="mm">150</tool_diameter>
    <fluid>DRLFLD_WTR</fluid>
    <rod_length unit="m">4.5</rod_length>
  </drilling>
  <convention version="1.1">
    <parameters phase="DRILL">
      <inclination>
        <X unit="degree">171.9</X>
        <Y unit="degree">86.3</Y>
      </inclination>
      <effective_duration unit="s">59.40</effective_duration>
      <logfile>data.nc</logfile>
    </parameters>
  </convention>
</description>
```

Non-specific technical information

Table 3. Non-specific technical information

Property	Description	Type	Required	Example
borehole_ref	Borehole reference	text	required [1]	BH1
borehole	Borehole information	structure (see below)	optional	
cell	Cell position	structure (see below)	optional	
creation	Creation date	iso8601	required	2024-07-05T14:06:01+02:00
device	Device information	structure (see below)	required	
drilling	Drilling information	structure (see below)	required	
filename	File name	text	required	50000240705140601D

Property	Description	Type	Required	Example
modification	Modification date	iso8601	required	2024-07-05T14:08:02+02:00
operator	Operator name	text	optional	ROBERT
position	GPS measurement	structure (see below)	optional	
project_ref	File reference	text	required	Bor-Format

Borehole information (optional)

Table 4. Borehole information

Property	Description	Type	Required	Example
borehole_diameter	Borehole diameter	length	optional	66 (mm)
borehole_inclination	Borehole inclinaison	angle	optional	0 (degree)
water_depth	Depth of water level [2]	level	optional	0.1 (m)

Cell position (optional)

See http://www.opencellid.org

Table 5. Cell position

Property	Description	Type	Required	Example
cellid	Cell ID	integer	required	00B2350F
lac	Local area code	integer	required	00000884
mcc	Mobile country code	integer	required	208
mnc	Mobile network code	integer	required	01

GPS position (optional)

Table 6. GPS position (WGS84)

Property	Description	Type	Required	Example
altitude	Altitude	length	required	192.000000 (m)
eph	Standard deviation of horizontal position error	length	required	655.35 (m)
epv	Standard deviation of vertical position error	length	required	655.35 (m)
latitude	Latitude	angle	required	45.7597504 (degree)
longitude	Longitude	angle	required	4.9187880 (degree)

Device information

Table 7. Device information

Property	Description	Type	Required	Example
build	Build version	text	optional	20190104
serial	Serial number	integer	required	50000
version	Hardware version	text	optional	1.0

Drilling information

Table 8. Drilling information

Property	Description	Type	Required	Example
bit_mass	Drilling tool mass	mass	optional	10 (kg)
fluid	Drilling fluid	code (see below)	optional	DRLFLD_WTR
holdback_area	Surface of holdback pressure	area	optional	301 (cm2)
machine_ref	Drilling machine	text	optional	DCH 218
method	Drilling method	code (see below)	optional	DRLMTD_RTR
rod_mass	Drilling rod mass	mass	optional	20 (kg)
rod_length	Drilling rod length	length	optional	4.5 (m)
thrust_area	Surface of thrust pressure	area	optional	401 (cm2)
tool	Drilling tool	code (see below)	optional	DRLBIT_CNTCI
tool_diameter	Drilling tool diameter	length	optional	150 (mm)
torque_factor	Torque factor	decimal	optional	112

Table 9. Drilling method codes

Drilling method	Description
DRLMTD_HA	Auger
DRLMTD_CFA	Continuous flight auger
DRLMTD_ADM	Auger with drilling mud
DRLMTD_AUG	Auger
DRLMTD_HSA	Hollow Stem Auger
DRLMTD_OHD	Open hole drilling

Drilling method	Description
DRLMTD_DTM	Disintegrating tool with mud circulation
DRLMTD_COR	Core drilling
DRLMTD_RTR	Rotary drilling
DRLMTD_RRFFM	Rotary reverse flow of flushing medium
DRLMTD_RTRPRC	Rotary percussion
DRLMTD_RPM	Rotary percussion with mud
DRLMTD_DTH	Downhole hammer
DRLMTD_DRI	Driving
DRLMTD_DS	Driven sampler
DRLMTD_PT	Pushed tube
DRLMTD_TWT	Thin wall tube, pushed
DRLMTD_DST	Driven slotted tube
DRLMTD_STDTM	Slotted tube with inside disintegrating tool and mud circulation
DRLMTD_CPD	Cable percussion drilling
DRLMTD_VDS	Vibro driven sampler
DRLMTD_VDT	Vibro driven tube
DRLMTD_VD	Vibration drilling
DRLMTD_VS	Vibro-sinking
DRLMTD_PS	Push sampler
DRLMTD_DT	Driven tube
DRLMTD_GRAB	Grabbing Cable with grab
DRLMTD_TP	Trial-pit
DRLMTD_SHFT	Shaft

Table 10. Drilling tool (bit) codes

Drilling tool	Description
DRLBIT_BLD	Blade bit
DRLBIT_BLD2	2 Blades bit
DRLBIT_BLD3	3 Blades bit
DRLBIT_BLD4	4 Blades bit
DRLBIT_BLDTIP	Bladed tool tip
DRLBIT_BLDTUB	Bladed tool with tube topped
DRLBIT_JET	Jet bit

Drilling tool	Description
DRLBIT_RTDK	Rotary disk bit
DRLBIT_FLTCHS	Flat chisel
DRLBIT_CRSCHS	Cross chisel
DRLBIT_STPCHS	Cross Cut Step bit with TCI
DRLBIT_BTT	Buttons bit (Rotary percussion)
DRLBIT_BTTDTH	Buttons bit DTH
DRLBIT_BTTODX	Button bit ODEX
DRLBIT_CTTPDC	Cutter bit PDC (polycrystalline diamond compact)
DRLBIT_CTTGHI	Cutter bit GHI (grit hotpressed inserts)
DRLBIT_STBB	Stubber (heavy tool)
DRLBIT_CACH	California chisel bit
DRLBIT_BICN	Bicone bit
DRLBIT_TRCN	Tricone bit
DRLBIT_CNST	Tricone Steeltooth bit
DRLBIT_CNTCI	Tricone TCI (Tungsten Carbide Insert)
DRLBIT_SPRL	Spiral bit
DRLBIT_AUG	Auger
DRLBIT_ABCK	Auger with bucket
DRLBIT_HA	Hand Auger
DRLBIT_HSA	Hollow Stem Auger
DRLBIT_CFA	Continuous Flight Auger
DRLBIT_COR	Core bit
DRLBIT_TC	Tungsten carbide set
DRLBIT_GTS	Geotechnical saw-tooth carbide set
DRLBIT_PCD	Polycrystalline diamond core bit
DRLBIT_TSP	Thermally stable polycrystalline set
DRLBIT_STCB	Single-tube corebarrel
DRLBIT_DTCB	Double-tube corebarrel
DRLBIT_TTCB	Triple-tube corebarrel
DRLBIT_DTCBXT	DD/TT corebarrel with extended inner tube
DRLBIT_OSTW	Open-sampler thin-walled (Shelby)
DRLBIT_OSTKW	Open-sampler thick-walled
DRLBIT_HPS	Hydraulic Piston samplers

Drilling tool	Description
DRLBIT_PSTKW	Piston samplers, thick-walled
DRLBIT_PSTW	Piston samplers, thin-walled
DRLBIT_CPDS	Bit with shell (or bailer)
DRLBIT_CPDC	Bit with clay cutter
DRLBIT_CPSS	Sectional shell

Table 11. Drilling fluid codes

Drilling fluid	Description
DRLFLD_AIR	Air
DRLFLD_WTR	Water
DRLFLD_AIRWTR	Air-Water
DRLFLD_AIRPLM	Air-Polymer
DRLFLD_WBM	Water-based mud
DRLFLD_WBMSHL	Water-Shale-based mud
DRLFLD_WBMPLM	Dry-polymer-based mud
DRLFLD_WBMLSF	Lignosulfonate-based mud
DRLFLD_WBMSEA	Sea-Water-based mud
DRLFLD_WBMNACL	Saturated-Salt-based mud
DRLFLD_WBMLIM	Lime-based mud
DRLFLD_WBMCLC	Calcium-based mud
DRLFLD_OBM	Oil-based mud
DRLFLD_SBM	Synthetic-based mud

Field types (convention)

- Drilling Parameters convention
- Ménard Pressuremeter Test convention

Drilling Parameters convention

Definition

Drilling Parameters convention combine drilling parameters recorded during drilling tool movement according to time or depth.

The convention is simply named *parameters*.

Three different field types are actually supported by this format. Each field type can have different

phases.

Table 12. Parameters phases

Field type	Phase
Parameters recorded during drilling	`DRILL`
Jet grouting parameters recorded during drilling and injection	`JETDOWN, JETUP, PREJETDOWN, PREJETUP`
CFA Pile parameters recorded during drilling and concreting	`PILEDOWN, PILEUP`

Example of parameters convention

Example of parameters convention

```
<convention version="1.1">
  <parameters phase="DRILL">
    <inclination>
      <X unit="degree">171.9</X>
      <Y unit="degree">86.3</Y>
    </inclination>
    <effective_duration unit="s">59.40</effective_duration>
    <logfile>data.nc</logfile>
  </parameters>
</convention>
```

Properties

Table 13. Parameters information

Property	Description	Type	Required	Example
`effective_duration`	Drilling effective duration (out of break)	duration	required	59.40 (s)
`inclination`	Tilt of the drill mast	structure (see below)	optional	
`initial_volume`	Volume taken into account before starting the pile.	volume	optional	12 (l)
`logfile`	Name of data file	text	required	data.nc

Table 14. (Inclination) Tilt X encoder / Y encoder of the drilling machine mast (optional)

Property	Description	Type	Required	Example
`X`	inclination according to the X plane of the encoder	angle	required	171.9 (degree)
`Y`	inclination according to the Y plane of the encoder	angle	required	86.3 (degree)

Data file (logfile)

Data file is made with the netCDF (3.6+) format. They contain data logs and log names declarations (variables).

Example of data.nc dump

Example of data file from 50000240705140601D.bor (data.nc dump to data.cdl format)

Data.cdl example

```
netcdf data {
dimensions:
    time = UNLIMITED ; // (42 currently)
variables:
    float time(time) ;
        time:unit = "s" ;
        time:label = "Temps" ;
    float DEPTH(time) ;
        DEPTH:unit = "m" ;
        DEPTH:label = "Prof." ;
    float AS(time) ;
        AS:unit = "m/h" ;
        AS:label = "VA" ;
        AS:scale_max = 800.f ;
    int EVP(time) ;
        EVP:label = "evt-part" ;
    int EVR(time) ;
        EVR:label = "evt-new-rod" ;
    float TP(time) ;
        TP:unit = "bar" ;
        TP:label = "PO" ;
        TP:scale_max = 200.f ;
    float IP(time) ;
        IP:unit = "bar" ;
        IP:label = "PI" ;
        IP:scale_max = 20.f ;
    float TQ(time) ;
        TQ:unit = "bar" ;
        TQ:label = "CR" ;
        TQ:scale_max = 200.f ;
    float SP(time) ;
        SP:unit = "bar" ;
        SP:label = "PF" ;
        SP:scale_max = 0.f ;
data:

 time = 0, 11.8, 12.6, 12.8, 13.8, 14, 14.2, 15.2, 15.4, 16, 16.2, 16.4,
    16.8, 17.2, 17.4, 17.6, 17.8, 18.6, 19, 19.6, 20.2, 20.6, 21, 21.6, 22.2,
    22.6, 23.2, 23.6, 24.2, 24.6, 25.2, 25.6, 26, 26.2, 26.4, 26.8, 27, 27.2,
    27.4, 27.8, 48, 330.4 ;
```

```
 DEPTH = 0, 0.03, 0.04, 0.08, 0.09, 0.11, 0.12, 0.14, 0.16, 0.18, 0.2, 0.22,
    0.23, 0.24, 0.27, 0.3, 0.32, 0.34, 0.36, 0.37, 0.38, 0.39, 0.4, 0.41,
    0.42, 0.44, 0.45, 0.46, 0.47, 0.48, 0.5, 0.52, 0.53, 0.54, 0.55, 0.59,
    0.6, 0.63, 0.65, 0.66, 0.68, 0.7 ;

 AS = 0.6613566, 8.576679, 45.18072, 686.747, 39.75904, 445.7831, 192.7711,
    65.06024, 343.3735, 90.36144, 439.759, 391.5663, 93.3735, 99.39759,
    463.8554, 524.0964, 421.6867, 91.86747, 147.5904, 60.24096, 60.24096,
    93.3735, 93.3735, 68.27309, 80.32128, 117.4699, 76.30522, 90.36144,
    60.24096, 111.4458, 86.34538, 180.7229, 99.39759, 216.8675, 277.1084,
    280.1205, 331.3253, 457.8313, 409.6385, 105.4217, 3.459382, 6.024096 ;

 EVP = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 ;

 EVR = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 ;

 TP = 0, 62.35, 36.71, 73.34, 19.62, 66.01, 23.29, 70.89, 35.49, 9.86, 55.03,
    79.44, 4.98, 14.74, 62.35, 78.22, 80.66, 46.48, 79.44, 79.44, 81.88,
    81.88, 81.88, 81.88, 81.88, 79.44, 81.88, 81.88, 81.88, 81.88, 79.44,
    81.88, 78.22, 78.22, 80.66, 80.66, 80.66, 80.66, 80.66, 70.89, 61.13, 0 ;

 IP = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
    0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 ;

 TQ = 0, 78.22, 81.88, 81.88, 80.66, 80.66, 85.54, 80.66, 90.43, 90.43,
    85.54, 89.21, 103.85, 95.31, 90.43, 97.75, 109.96, 111.18, 119.72,
    124.61, 119.72, 113.62, 111.18, 105.07, 105.07, 109.96, 111.18, 111.18,
    113.62, 113.62, 113.62, 125.83, 135.59, 138.03, 138.03, 130.71, 130.71,
    128.27, 124.61, 150.24, 101.41, 0 ;

 SP = 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72,
    661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72,
    661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72,
    661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72, 661.72,
    661.72, 661.72, 661.72, 661.72, 661.72, 661.72 ;
}
```

Parameters Log names

Table 15. Drilling Parameters log names

Log name	Description	Type	Required	Remark
time	Measured time	float	required	dimension
DEPTH	Measured penetration length	float	required	variable
AS	Advance Speed (penetration rate)	float	required	

Log name	Description	Type	Required	Remark
EVP	Event Particular	integer	optional	
EVR	Event new Rod	integer	optional	
EVS	Event start relay	float	optional	
TP	Tool pressure	float	optional	
TPAF	Tool Pressure As a Force	float	optional	
TQ	Rotation pressure (Torque)	float	optional	
TQC	Casing Rotation pressure	float	optional	
TQAT	Tool Torque As a Torque	float	optional	
TQCCW	Torque pressure CounterClockWise	float	optional	
TQCW	Torque pressure ClockWise	float	optional	
GEAR	Gear engaged in the gearbox	float	optional	
RSP	Rotation Speed	float	optional	
RSPC	Casing Rotation Speed	float	optional	
RPI	Rotation per Inch index	float	optional	
HP	Holding Pressure	float	optional	
SP	Striking Pressure	float	optional	
RV	Reflected Vibration	float	optional	
WOB	Weight on bit	float	optional	
SPECE	Specific Energy	float	optional	
TOTE	Total Energy	float	optional	
IP	Injection pressure	float	optional	
IF	Injection Flow (inlet flow)	float	optional	
OF	Drilling fluid outflow (Outlet Flow)	float	optional	
IV	Injection Volume	float	optional	
OV	Outlet Volume	float	optional	
AP	Air Pressure	float	optional	
AF	Air Flow	float	optional	
AV	Air Volume	float	optional	
WF	Water Flow	float	optional	
WP	Water Pressure	float	optional	
WV	Water Volume	float	optional	
ECM	Electrical Conductivity of Mud	float	optional	
PHM	pH of Mud	float	optional	

Log name	Description	Type	Required	Remark
DO2M	Dissolved O2 in Mud	float	optional	
TEMPM	Temperature of Mud	float	optional	
PP	Pile Profile (PILEUP)	float	optional	

Ménard Pressuremeter Test convention

Definition

Ménard Pressuremeter Test is performed by the radial expansion of a tricell probe placed in the ground. This test is specified by the standard *ISO 22476-4*.

The convention is simply named *pressuremeter*.

Three different pressuremeter *test types* are supported by this format.

Table 16. Ménard Pressuremeter Test types

Test type	Description
ground	Ménard pressuremeter test in natural soils
volume_loss	Equipment volume loss calibration test
pressure_loss	Probe pressure loss calibration test

Example of Ménard Pressuremeter Test convention

Example of Ménard Pressuremeter Test convention (ground test type)

```
<convention version="1.2">
  <pressuremeter>
    <cu_ref>CPVA001</cu_ref>
    <ground>
      <pressure_loss_filename>50001180101062101P.bor</pressure_loss_filename>
      <cu_height unit="m">1</cu_height>
      <test_depth unit="m">2</test_depth>
      <logfile>data.nc</logfile>
    </ground>
  </pressuremeter>
</convention>
```

Common properties

Table 17. Pressuremeter common properties

Property	Description	Type	Required	Example
cu_ref	Control Unit ID	text	optional	CPVA001

Property	Description	Type	Required	Example
thresholds	Stop and start thresholds	structure (see below)	optional	
stop_cause	Stop cause	code (see below)	optional	MANUAL

Table 18. Thresholds (optional)

Property	Description	Type
limit_volume	Maximum volume to protect the probe	Quantity
final_volume	Volume at end of test	Quantity
limit_pressure	Maximum pressure to protect the probe	Quantity
final_pressure	Pressuree at end of test	Quantity

Table 19. Stop cause (optional)

Property	Description	Type
MANUAL	Manual stop	text
LIMIT_PRESSURE	Limit pressure stop	text
LIMIT_VOLUME	Limit volume stop	text
FINAL_PRESSURE	Final pressure stop	text
FINAL_VOLUME	Final volume stop	text
EMERGENCY_STOP	Emergency stop	text

Volume loss test

Volume loss example

```
<convention version="1.2">
  <pressuremeter>
    <cu_ref>CPVA500</cu_ref>
    <thresholds>
      <limit_volume unit="cm3">630</limit_volume>
      <final_volume unit="cm3">550</final_volume>
      <limit_pressure unit="bar">55.00</limit_pressure>
      <final_pressure unit="bar">10.00</final_pressure>
    </thresholds>
    <stop_cause>MANUAL</stop_cause>
    <volume_loss>
      <cover_type>CVR_REINFORCED_MESH</cover_type>
      <probe_type>PRB_G</probe_type>
      <central_cell_diameter unit="mm">63</central_cell_diameter>
      <central_cell_length unit="mm">370</central_cell_length>
      <tubing_type>TUB_COAXIAL</tubing_type>
      <tubing_length unit="m">25</tubing_length>
```

```
        <calibration_cylinder_diameter unit="mm">66</calibration_cylinder_diameter>
        <membrane_pressure_loss unit="bar">0.54</membrane_pressure_loss>
        <slotted_tube>true</slotted_tube>
        <central_cell_diameter_inside_slotted_tube
 unit="mm">44</central_cell_diameter_inside_slotted_tube>
        <logfile>data.nc</logfile>
      </volume_loss>
    </pressuremeter>
  </convention>
```

Table 20. Volume loss properties

Property	Description	Type	Required	Example
calibration_cylinder_diameter	Calibration cylinder diameter	length	required	66 (mm)
central_cell_diameter	Central cell diameter	length	required	63 (mm)
central_cell_diameter_inside_slotted_tube	outer diameter of the inner part of the probe in the split tube	length	required	44 (mm)
central_cell_length	Central cell length	length	required	370 (mm)
cover_type	Cover type	code (see below)	required	CVR_REINFORCED_MESH
membrane_pressure_loss	Membrane pressure loss	pressure	required	0.54 (bar)
probe_type	Type of pressuremeter probe	code (see below)	required	PRB_G
slotted_tube	Slotted tube placed around the probe to protect it	boolean	required	true
tubing_length	Tubing length	length	required	25 (m)
tubing_type	Tubing type	code (see below)	required	TUB_COAXIAL
logfile	Name of data file	text	required	data.nc

Table 21. Cover type codes

Cover type	Description
CVR_RUBBER	Rubber
CVR_REINFORCED_MESH	Reinforced mesh
CVR_METALIC_MESH	Metallic mesh

Cover type	Description
CVR_METALIC_STRIPS	Metallic strips

Table 22. Probe type codes

Probe type	Description
PRB_G	Type of pressuremeter probe where the central measuring cell is formed by a dedicated membrane over which an external membrane is fitted to form the guard cells
PRB_E	Type of pressuremeter probe where the three cells are formed by three separate membranes in line

Table 23. Tubing type codes

Tubing type	Description
TUB_TWIN	Parallel lines
TUB_COAXIAL	Coaxial line

Pressure loss test

Pressure loss example

```
<convention version="1.2">
    <pressuremeter>
      <cu_ref>CPVA500</cu_ref>
      <thresholds>
        <limit_volume unit="cm3">630</limit_volume>
        <final_volume unit="cm3">550</final_volume>
        <limit_pressure unit="bar">45.00</limit_pressure>
        <final_pressure unit="bar">10.00</final_pressure>
      </thresholds>
      <stop_cause>MANUAL</stop_cause>
      <pressure_loss>
        <volume_loss_filename>50000240718101441P.bor</volume_loss_filename>
        <logfile>data.nc</logfile>
      </pressure_loss>
  </pressuremeter>
</convention>
```

Table 24. Pressure loss properties

Property	Description	Type	Required	Example
volume_loss_filename	Name of associated volume loss test	text	required	50000240718101441P.bor
logfile	Name of data file	text	required	data.nc

Ground test

Ground test example

```
<convention version="1.2">
  <pressuremeter>
    <cu_ref>CPVA500</cu_ref>
    <thresholds>
      <limit_volume unit="cm3">630</limit_volume>
      <final_volume unit="cm3">550</final_volume>
      <limit_pressure unit="bar">45.00</limit_pressure>
      <final_pressure unit="bar">39.00</final_pressure>
    </thresholds>
    <stop_cause>MANUAL</stop_cause>
    <ground>
      <pressure_loss_filename>50000240718103320P.bor</pressure_loss_filename>
      <cu_height unit="m">1.5</cu_height>
      <test_depth unit="m">3</test_depth>
      <logfile>data.nc</logfile>
    </ground>
  </pressuremeter>
</convention>
```

Table 25. Ground properties

Property	Description	Type	Required	Example
cu_height	Height of the control unit relative to ground level	length	required	1 (m)
pressure_loss_filename	Name of associated pressure loss test	text	required	50001180101060101P.bor
test_depth	Depth of the test relative to ground level	length	required	2 (m)
logfile	Name of data file	text	required	data.nc

Data file

Data file is made with the netCDF (3.6+) format. They contain data logs and log names declarations (variables).

Example of data.nc dump

Example of data file (*data.nc* dump to *data.cdl* format)

Data.cdl example

```
netcdf data {
```

```
dimensions:
    time = UNLIMITED ; // (14 currently)
variables:
    float time(time) ;
        time:unit = "s" ;
        time:label = "time" ;
    int STEP(time) ;
        STEP:label = "Palier" ;
    float PR1(time) ;
        PR1:unit = "bar" ;
        PR1:label = "PR1S" ;
    float PR15(time) ;
        PR15:unit = "bar" ;
        PR15:label = "PR15S" ;
    float PR30(time) ;
        PR30:unit = "bar" ;
        PR30:label = "PR30S" ;
    float PR60(time) ;
        PR60:unit = "bar" ;
        PR60:label = "PR60S" ;
    float PG1(time) ;
        PG1:unit = "bar" ;
        PG1:label = "PG1S" ;
    float PG15(time) ;
        PG15:unit = "bar" ;
        PG15:label = "PG15S" ;
    float PG30(time) ;
        PG30:unit = "bar" ;
        PG30:label = "PG30S" ;
    float PG60(time) ;
        PG60:unit = "bar" ;
        PG60:label = "PG60S" ;
    float V1(time) ;
        V1:unit = "cm3" ;
        V1:label = "V1S" ;
    float V15(time) ;
        V15:unit = "cm3" ;
        V15:label = "V15S" ;
    float V30(time) ;
        V30:unit = "cm3" ;
        V30:label = "V30S" ;
    float V60(time) ;
        V60:unit = "cm3" ;
        V60:label = "V60S" ;
        V60:scale_max = 500.f ;
    float CREEP(time) ;
        CREEP:unit = "cm3" ;
        CREEP:label = "fluage" ;
    float DELT60(time) ;
        DELT60:unit = "cm3" ;
        DELT60:label = "delt60" ;
```

```
data:

 time = 80, 142, 205, 268, 330, 394, 456, 519, 582, 647, 711, 776, 840, 905 ;

 STEP = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 ;

 PR1 = 0.06, 1.08, 1.81, 2.85, 4.01, 5.98, 7.96, 9.8, 13.87, 17.81, 22.05,
    25.77, 29.73, 33.8 ;

 PR15 = 0.06, 0.81, 1.81, 2.82, 3.86, 5.81, 7.82, 9.81, 13.82, 17.85, 21.75,
    25.75, 29.75, 33.76 ;

 PR30 = 0.03, 0.81, 1.82, 2.83, 3.84, 5.85, 7.82, 9.83, 13.82, 17.84, 21.78,
    25.75, 29.77, 33.75 ;

 PR60 = 0.04, 0.82, 1.82, 2.84, 3.86, 5.83, 7.83, 9.82, 13.84, 17.81, 21.76,
    25.75, 29.77, 33.75 ;

 PG1 = 0.11, 0.28, 1.31, 2.14, 3.17, 5.24, 7.14, 9.17, 13.21, 17.14, 21.14,
    25.15, 29.12, 33.09 ;

 PG15 = 0.1, 0.29, 1.18, 2.12, 3.15, 5.19, 7.18, 9.17, 13.15, 17.16, 21.06,
    25.09, 29.06, 33.08 ;

 PG30 = 0.09, 0.28, 1.19, 2.16, 3.17, 5.22, 7.17, 9.16, 13.14, 17.15, 21.1,
    25.08, 29.1, 33.06 ;

 PG60 = 0.08, 0.29, 1.17, 2.14, 3.17, 5.18, 7.18, 9.14, 13.15, 17.13, 21.09,
    25.08, 29.06, 33.08 ;

 V1 = 60, 103, 215, 257, 280, 303, 320, 335, 359, 386, 411, 441, 477, 518 ;

 V15 = 76, 149, 238, 266, 285, 307, 324, 339, 366, 392, 419, 452, 491, 532 ;

 V30 = 85, 176, 241, 268, 287, 308, 325, 340, 368, 395, 423, 457, 498, 540 ;

 V60 = 92, 198, 244, 270, 287, 309, 326, 342, 370, 397, 428, 463, 506, 550 ;

 CREEP = 7, 22, 3, 2, 0, 1, 1, 2, 2, 2, 5, 6, 8, 10 ;

 DELT60 = 92, 106, 46, 26, 17, 22, 17, 16, 28, 27, 31, 35, 43, 44 ;
}
```

Pressuremeter Log names

Table 26. Pressuremeter log names

Log name	Description	Type	Required	Remark
time	Measured time	float	required	NETCDF dimension
STEP	Step number	integer	required	
PR1	Liquid pressure at 1 s [3]	float	required	
PR15	Liquid pressure at 15 s [3]	float	required	
PR30	Liquid pressure at 30 s [3]	float	required	
PR60	Liquid pressure at 60 s [3]	float	required	
PG1	Gas pressure at 1 s [4]	float	required	
PG15	Gas pressure at 15 s [4]	float	required	
PG30	Gas pressure at 30 s [4]	float	required	
PG60	Gas pressure at 60 s [4]	float	required	
V1	Volume of injected liquid at 1 s [5]	float	required	
V15	Volume of injected liquid at 15 s [5]	float	required	
V30	Volume of injected liquid at 30 s [5]	float	required	
V60	Volume of injected liquid at 60 s [5]	float	required	
CREEP	Difference in volumes recorded at 60 s and at 30 s at each pressure hold	float	required	
DELT60	60 s injected volume change between successive pressure holds	float	required	

[1] except for Ménard Pressuremeter Calibration Test

[2] RGL,relative to ground level

[3] Liquid pressure applied by the control unit indicator to the the central cell as read x s after the beginning of the pressure hold

[4] Gas pressure applied by the control unit indicator to the guard cells as read x s after the beginning of the pressure hold

[5] Volume injected in the central measuring cell as read x s after the beginning of the pressure hold