ÄSPÖLABORATORIET

INTERNATIONAL COOPERATION REPORT 93-01

Flowmeter measurement in borehole KAS 16

P Rouhiainen

June 1993
Supported by TVO, Finland

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102.8

9505040275 950424
PDR WASTE
WM-11 PDR

ISSN 1104-3210
ISRN SKB-ICR--93/1--SE

Ard and lette dtd.
4/25/95

FLOWMETER MEASUREMENT IN BOREHOLE KAS 16

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This document concerns a study which was conducted within an Äspö HRL joint project. The conclusions and viewpoints expressed are those of the author(s) and do not necessarily coincide with those of the client(s). The supporting organization has reviewed the document according to their documentation procedure.

ABSTRACT

Groundwater flow was measured at Äspö in borehole KAS16 with the TVO-flow meter. Flow rates and directions across the hole were recorded at nine depths. The depths were chosen on the basis of previous measurements.

The flow rates were small, less than 1 ml/h. The flow directions were mostly westwards.

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SUMMARY

TVO and SKB signed in 1992 an agreement on Joint Project regarding HRL of Äspö. One of the study subjects in this project is the direct measurement of groundwater flow in boreholes. TVO has developed a novel instrument for this purpose. The work has been conducted for TVO by PRG-Tec Ltd. The instrument has been tested previously in Finland.

A set of measurement, was carried out in borehole KAS 16 of Äspö by PRG-Tec Ltd. The purpose of the work was to study the flow rate and direction in that recently drilled borehole. The measurement depth was selected based on preceding hydraulical and geophysical measurements. The recorded flow rates were all small (< 1 ml/h) and direction pointed to west, towards the tunnel.

This report describes the instruments used and the work conducted.

1 INTRODUCTION

Äspö Hard Rock Laboratory is under construction in Sweden, about 20 km north from the city of Oskarshamn. One of the main objectives of the Äspö HRL project is to test the quality and appropriateness of different methods for characterizing the bedrock with respect to conditions of importance for final repository (P. Wikberg, G. Gustavson, I. Rhen, R. Stanfors, 1991. Äspö Hard Rock Laboratory. Evaluation and conceptual modelling based on the pre-investigations 1986-1990. SKB Technical Report 91-22).

An agreement with Teollisuuden Voima Oy (TVO), Finland, was signed in May 1992. TVO participates in the project with groundwater modelling, hydrogeochemistry, 3D geometrical modelling and flow meter measurements. The flow meter was initially developed for TVO's site investigations.

The flow meter can measure flow rates and directions across the hole. The flow along the hole can normally be measured as well. The measurements were performed in the island of Äspö. The measured sections in borehole KAS16 were chosen on the basis of the earlier tests.

2 PRINCIPLES OF OPERATION

The instrument can measure the groundwater flow across and along a borehole. A special packer system guides the flow to the flow sensors. Four inflatable sealings between conventional packers divide the selected section into four sectors, Figure 2-1. The length of the measuring section between the packers is 2 meters. The present flow guide is for 56 mm boreholes. Other flow guides can be made for larger diameters of boreholes.

Groundwater flows from the fractures to the sectors of the flow guide. The pipes from the sectors lead water to the sensor above the packer system. The sensor for the flow across the hole connects the sectors with each other, Figure 2-1. Water can freely move from one sector to any other sector.

A pipe through the packer system connects water in the borehole above and below the packers. The pipe shortcuts the possible pressure gradient along the packers. Another flow sensor is in the upper end of the pipe. This makes it possible to measure the flow along the hole.

The sensors operate with a modified thermal pulse principle. It provides minimum friction for the flow and high sensitivity. Weak heath pulse is generated into the water in the middle of the sensors, Figure 2-1. The monitoring thermistors are symmetrically placed around the heating point. If water does not flow, there will be a symmetrical temperature response. If water moves, there will be a faster and higher response in those thermistors to which water is flowing.

The flow sensors must be calibrated to obtain quantitative information of flow. A special calibration pump was used to generate the known, small and steady flows. The time and value of the maximum points of the temperature curves can be used when the results are converted to flow values.

Sensitivity is better than 1 ml/h (milliliter per hour) for the flow across the hole. This corresponds the flux value of about $2 \cdot 10^{-9}$ m/s. The flux value means the average flow speed of a water molecule in the two meters open hole section. For the flow along the hole, sensitivity is better than 3 ml/h.

The system makes it possible also to determine roughly flow direction across the hole. The orientation of the instrument itself can be solved by three flux gate magnetometers. In addition of the magnetometers, the electronics tube contains a microcontroller. The micro controller takes care of measurements and communication with a microcomputer on the ground surface.

A computer controlled hose pump on the ground surface is used to fill and empty the packer system. There are three magnetic valves in the probe. They are used to take water for the packers from the borehole

and release the pressure between the packers after inflation of the flow guide. Water for the packers is taken trough a filter from the borehole.

A winch with 1000 m cable is used to lift and lower the flowmeter. Groundwater level in the borehole and air pressure are monitored during the flow measurements.

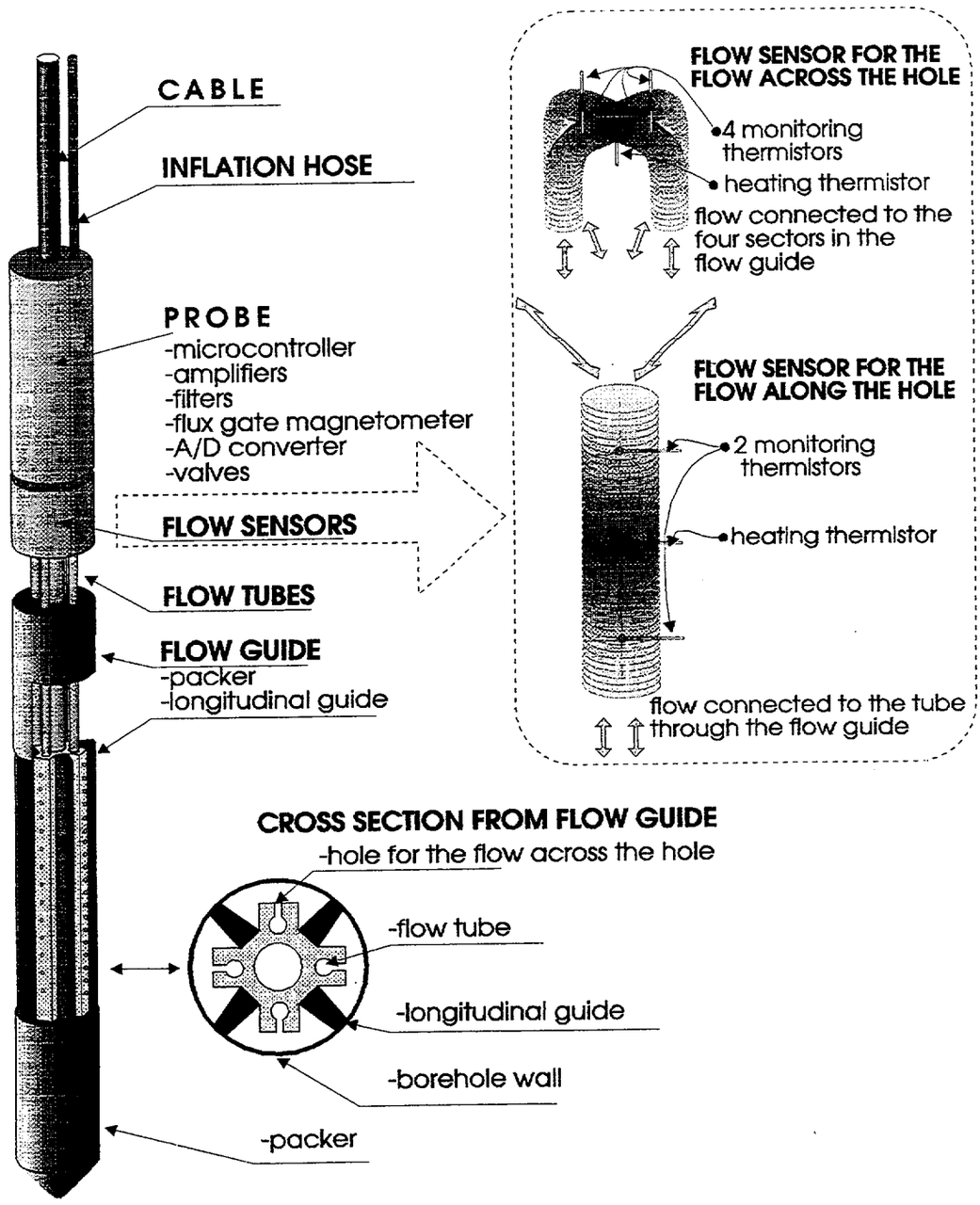


Figure 2-1. TVO-Flowmeter, principles of operation.

3 BOREHOLE EFFECTS

A borehole in the bedrock changes the conditions of groundwater flow from its original state. A long borehole acts as a shortcut for the flow in the direction of the borehole. A borehole may change flow conditions in a large volume, since the borehole may connect fractured zones which originally had different hydraulic potential level.

The purpose of the flow measurement is often to gain information of flow speed that exists in the bedrock in its natural state, i.e. in the bedrock without boreholes. Natural conditions are approximated if the boreholes are closed with several packers. Flowmeter could be connected to a multiple packer system for flow measurement in more original flow conditions. Unfortunately, this much more time consuming. There is experience of pressure build up in the holes which are closed with several packers. The pressure build up may take weeks, even months.

Open hole geometry is chosen for the TVO-Flowmeter. There is also a tube through the conventional packers in the flow guide. This prevents the possible pressure gradient along the flow guide. The strong gradient along the flow guide could create flow across the hole if the structure of the bedrock near the packer system is not symmetrical with the borehole. This flow would not exist without the packer system. The problem is visualized in Figure 3-1.

The borehole may change the flow across the hole as well but the potential changes do not extend to as large volume. An open borehole gathers water into the hole. The flux in the hole is douple of that in the bedrock far from the hole. If there is a skin zone around the hole, the ratio of the fluxes may change. There is an upper limit of the ratio of the fluxes when there are only two conductivities in the bedrock, that of the skin zone and that of the bedrock elsewhere /Bidaux P and Tsang C F, 1991/. The maximum flux ratio, or convergence factor, is 4. This is two times higher than in the "normal" case of no skin zone.

The convergence factor can be even higher if there is an exponential change of hydraulic conductivity around a borehole /Bidaux P and Tsang C F, 1991/. In extreme but still possible cases, when the hydraulic conductivity of the skin zone is very high compared with the bedrock, the convergence factor can be more than 10, that is five times higher than in the case of no skin zone.

In the fractured bedrock, water flows trough fractures and the rock matrix is generally impermeable. There are also observations that typical flow is channeled rather than plane type flow. Water leakage has been studied in tunnels in order to examine the distribution of flow rates and widths in groundwater channels. Most of the studied leaks, about 98 %, have a channel width less than 0.1 m /Palmqvist K and Lindström M, 1991/. If the channel width is small, then the convergence factor is less prominent than in the previous skin models which assumed cylinder symmetry around the hole.

Not only the borehole has an effect on the flow across the hole but the flowmeter itself may change the flow rate. The idea of the flow guide is that it gathers water from a large surface and forces the moving water to go trough the flow sensor.

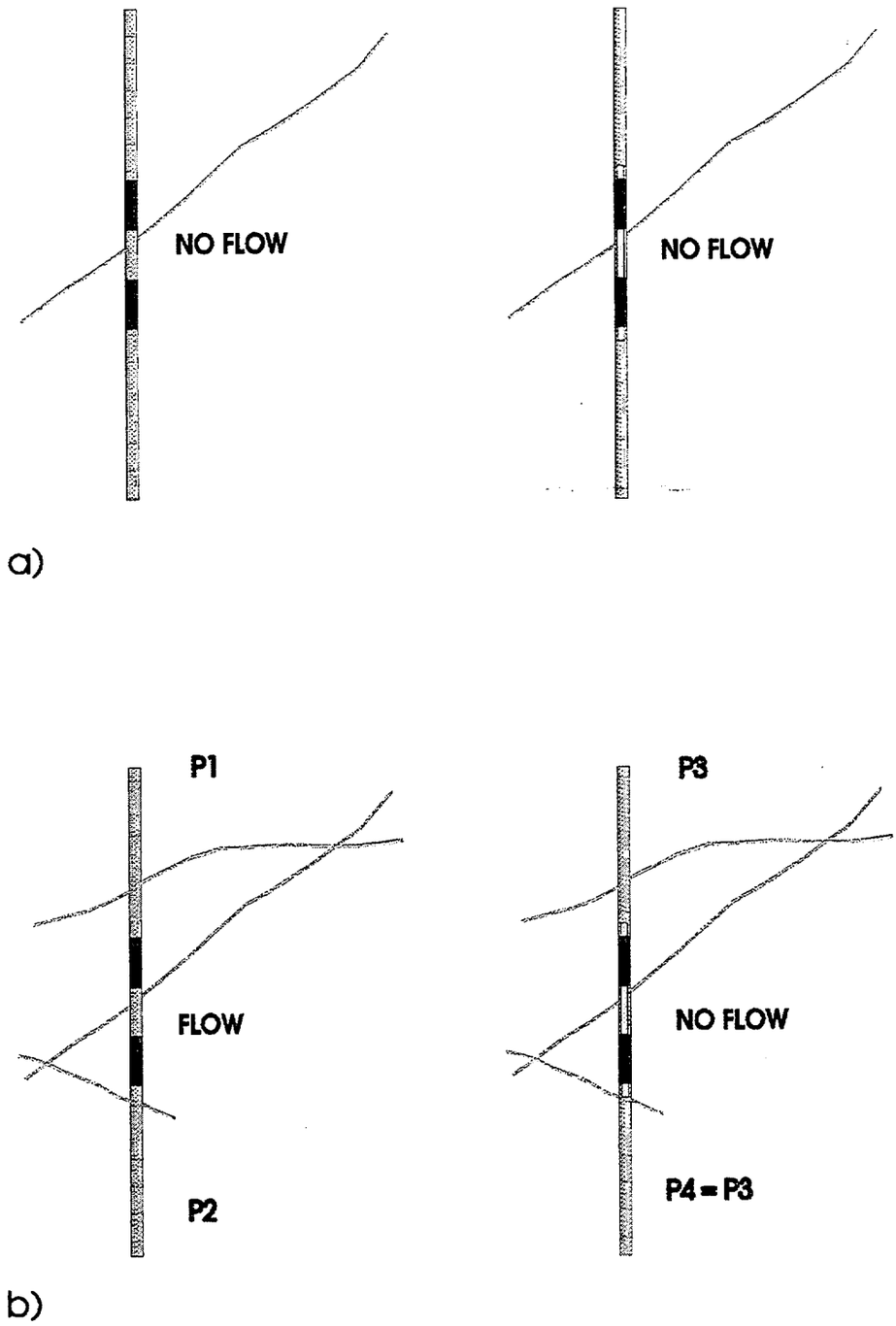


Figure 3-1. Comparison of two packer systems. Left side: conventional set of two packers, right side: two packers with an open tube through. a) confined fracture between the packers, b) previous case with contacts to the borehole above and below the packers.

The cross section area of the tubes in the flow sensor is much smaller than the area of the borehole section to be measured. This increases the flow speed in the sensor several hundred times of that in the borehole section. This, along with the high sensitivity of the flow sensor, makes it possible to measure very small fluxes of groundwater across the hole.

A drawback of this is the friction in the flow tubes and flow sensor. The friction can be changed to equivalent hydraulic conductivity. If this is very low compared with the hydraulic conductivity in the bedrock, most of the water does not go trough the sensor, and the measured value of the flow is lower than it would be in the corresponding open hole section.

The response of the flow guide to various transmissivities of the bedrock was calculated with a finite element model (Rouhiainen, 1993). The flow through the sensor was compared with the flow far from the hole trough the cross section area of the flow guide (Fig. 3-2). The cross section area is in this case 2 m (length of the section) multiplied by 0.056 m (diameter of the hole) The ratio is less than 75% of its maximum value when the transmissivity of the bedrock is larger than $2 \cdot 10^{-5}$ m^2/s.

This ratio is constant when the transmissivity of the bedrock is small. Because of the friction in the flow tubes and flow sensor, the ratio decreases when the transmissivity of the bedrock is larger than 10^{-5} m^2/s.

In some cases the diameter of the borehole is widened because the wall of the borehole is broken. This may happen in major fractured zones. The longitudinal guides may not work properly at these locations and the flowmeter can be used only for estimating the direction of the flow. The caliper measurement (the measurement of the diameter of the hole) is highly recommended to find these locations.

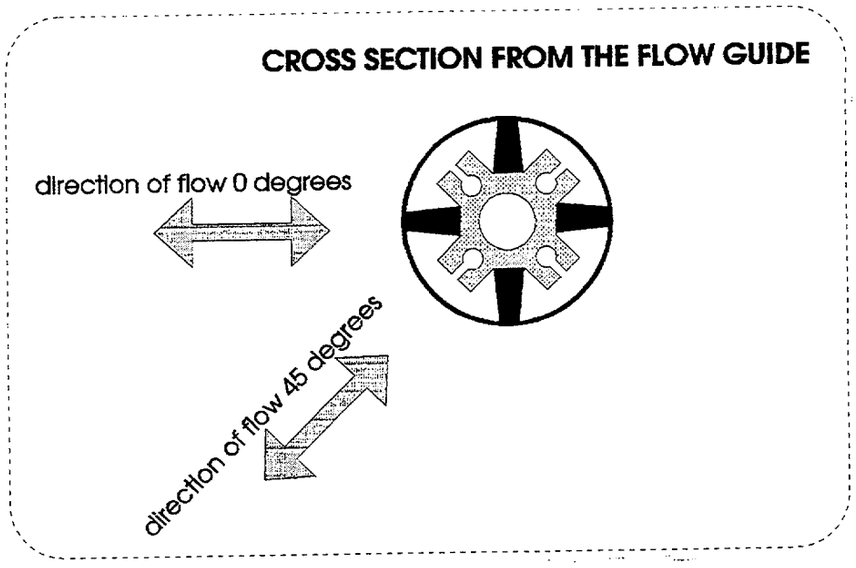
The response of the flow guide is not exactly even to all directions across it. If the flow goes to two sectors (Fig. 3-2), then the summed flow of these sectors is larger than it would be trough only one sector. The ratio of the minimum and the maximum responses is 73%.

The friction in the flowmeter should be as small as possible to improve the performance in high conductive bedrock. The friction can be decreased by increasing the diameter of the flow tubes and the tubes in the flow sensor. If the diameter of the tubes in the flow sensor is increased, then the sensitivity of the sensor gets worse.

The numbers given above hold for the prototype flowmeter. The parameters for the flowmeter were chosen for high sensitive flowmeter to be applied in a relatively intact volume of the bedrock, which could be suitable locations for the repository of nuclear wastes. The hydraulic conductivity of the bedrock in such volume is typically low.

With a new design of the flow guide, the performance of the flowmeter can be extended to three times higher transmittivities of the bedrock. If the size of the borehole is larger than 56 mm, then the flow tubes can be increased and the performance of the flowmeter can

be improved further. The dimensions of the sensor can be chosen for higher coductivities of the bedrock.



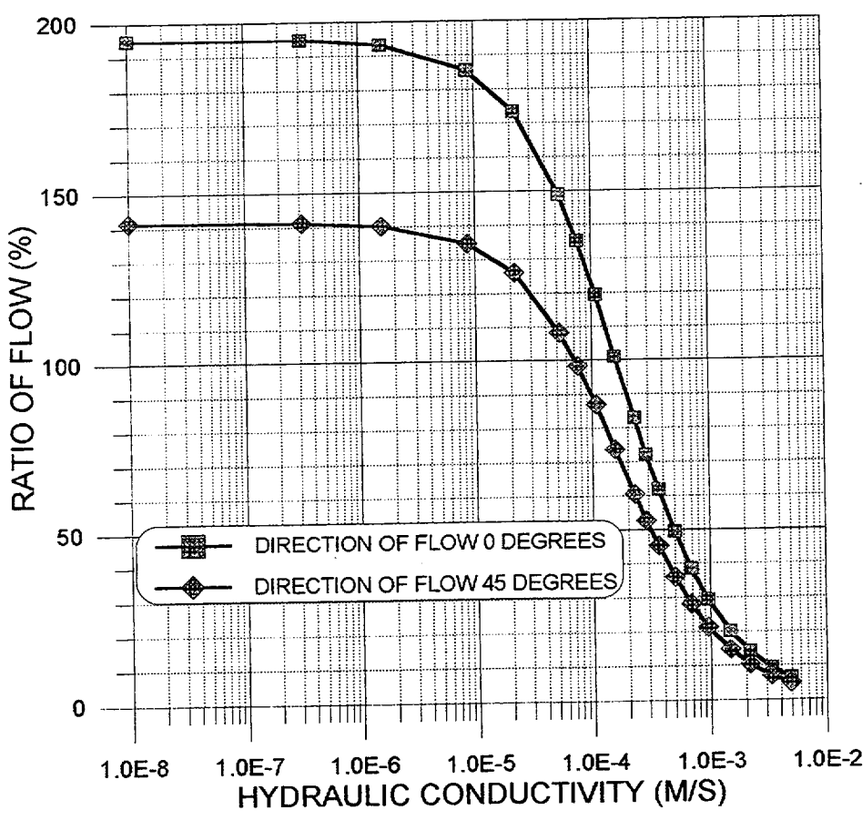


Figure 3-2. Effect of the flow guide in the hole.

4 BOREHOLE KAS16

4.1 BOREHOLE DATA

Borehole KAS16 is in the island of Äspö in Sweden. The coordinates of the borehole in Äspö coordinate system are

X	=	7171.77 m	
Y	=	2250.20 m	
Z	=	+ 3.23 m	(surface of the bedrock)

The top of the casing tube is 0.43 m above the surface of the bedrock.

Length of the hole is 548.46 m from the surface of the bedrock. Diameter of the hole is 165 mm (0.00 - 100.00 m), 66 mm (100.00 - 102.00 m) and 56 mm (102.00 - 548.46 m). The beginning direction of the hole is 138 degrees in Äspö coordinate system and 126 degrees from magnetic north. The beginning inclination angle is 84.5 degrees.

The Baltic Sea is about 10 m eastwards from hole KAS16. A tunnel is under construction about 200 m westwards from hole KAS16 at depth of 200 m. There is an open excavation 150 m northwest from the hole. A fracture zone between 393 m - 456 m is probably the main zone NE-1. NE-1 dips down 50-60 degrees northwest (P. Wikberg, G. Gustafsson, I. Rhen, R. Stanfors, 1991. Äspö Hard Rock Laboratory. Evaluation and conceptual modelling based on the pre-investigations 1986-1990. SKB Technical Report 91-22).

4.2 PREVIOUS FLOW METER LOGGING

The flow along the hole has been measured earlier with an acoustic flow meter (C Gustafsson, 1992. Mätning med UCM flödessond i KAS16. Rapport Id-nr: MT 92/R CG/361). Temperature and electric conductivity of the borehole water have also been measured. These measurements have been repeated when water was pumped from the borehole. The measurements indicated possible flow locations in the hole.

The measured flow was about 2.5 l/min down the hole to the depths of 425.0 m and 433.7 m, where the flow decreased. There were several anomalies in natural temperature measurement. The maximum points of these anomalies are listed in Table 4-1. Conductivity of water in the hole changed at the depths under heading Natural conductivity in Table 4-1. Pumping caused clear changes to the measured properties. The depths where changes appeared, are listed in Table 4-1.

Some depths of changes are listed on the same row in Table 4-1. They are probably caused by the same fractures or fracture zone.

The depths of anomalies are not exactly the same. There may be several reasons to this. There is no full certainty that the changes were caused by the same fractures to all measurements. The measurement itself has some inaccuracy, though it is not expected to be as large as the variation in some rows in Table 4-1. There is also inaccuracy in reading the locations of anomalies from the reported logs.

Table 4-1. Depths of anomalies from the top of the casing.

Natural flow	Natural temp.	Natural cond.	Pumped flow	Pumped temp.	Pumped cond.	Drilled core
				150.0		150.1
	197.2		196.7	196.0	196.5	198.4
	260.1	260.1		260.0		259.6, 260.2
	396.7	399.7	400.0			
	422.5		421.2	421.2	421.2	
425.0	425.2		425.1		424.5	
433.7	433.2	433.7	432.1	432.0	432.5	432.4
			457.0	455.8	456.0	454.0 - 456.2

The drilled core samples were also studied. Depths of fractures or fracture zones which might cause the anomalies are in the last column in Table 4-1. It is often difficult to judge which fractures could cause the anomalies.

4.3 GROUNDWATER FLOW MEASUREMENTS

The target depths for the flow meter were chosen on the basis of the locations of the anomalies in Table 4-1. The measured depths are in Table 4-2. The drilled core samples indicated bad conditions in the borehole near the depth of 420 m. This depth was not measured because there was a considerable chance to loose the packers.

In Table 4-2, there are consecutive measurements in rows 2 and 3 as well as in rows 5, 6 and 7. This is because the actual depths of anomalies are uncertain and because there is uncertainty in depth determination in positioning of the flow meter itself. On the basis of experiments the accuracy of depth in flow meter is estimated to be < +/- 0.2 m to depth of 450 m.

Table 4-2. Flow meter test sections in meters from the top of the casing.

1	149.1 - 151.1
2	195.4 - 197.4
3	197.4 - 199.4
4	259.0 - 261.0
5	429.4 - 431.4
6	431.4 - 433.4
7	433.4 - 435.4
8	454.0 - 456.0
9	458.0 - 460.0

5 RESULTS

Air pressure and groundwater level in hole were monitored during the flow meter measurements, appendix 1. The measurements were performed between 3rd and 11th of October 1992. Groundwater level is given as z-coordinate in Äspö coordinate system. Groundwater level was measured before and after each flow measurement. Time of measurement is marked with a small star on the curve of groundwater level. The beginning of flow measurement at each depth is also marked with a star on x-axis.

Groundwater level is about 4.5 m below the sea level, although distance to the sea is about 10 m. This, as well as the high flow speed down the hole, indicate that the tunnel westwards from hole KAS16 takes up water.

The tide causes fluctuation in the groundwater level. There are two maximums during 24 hours, one at about 2 a.m. and the other at 4 p.m. There is a jump downwards in the groundwater level 7th October at 6 a.m. when the flow meter was lowered from 259.0 m to 431.4 m. A jump upwards happens 9th October at 8 a.m. when the flowmeter was lifted from 454.0 m to 149.1 m. These changes show that the downwards flowing water causes about 0.2 m pressure over the flow meter along the hole at the depths between 149.1 m - 429.4 m.

When the packers were released 10th of October at 6.15 a.m. groundwater level went down about 0.14 m. Groundwater level went down additional 0.09 m when the flow meter was lifted to 30 m, where the diameter of the hole is 165 mm.

A list of the measurements of flow across the hole is given in appendix 2. Some of the measurements are also given in temperature curves, appendix 3. Flow rate and direction is also printed in appendices 2 and 3. The last readings at each depth are collected to Table 5-1.

Flow direction is calculated from the components of magnetic field. In appendix 3, direction is given for each flow channel or sector of the packer system. Each of the four sectors are about 90 degrees wide. Direction of a sector means the middle direction of the sector in perpendicular angle to the borehole.

Table 5-1. The last readings at each measurement depth.

Depth (m)	Date (day-month)	Flow rate (ml/h)	Declination (degrees)
149.1	04-10	0.3	283
195.4	05-10	< 0.1	87
197.4	06-10	< 0.1	75
259.0	07-10	< 0.1	293
431.4	07-10	< 0.1	302
433.4	07-10	< 0.1	261
429.4	08-10	0.5	221
458.0	08-10	0.1	237
454.0	09-10	0.1	315
149.1	10-10	< 0.1	267

The flow rates were very small at all measured depths. Flow directions were to west except at depths 195.4 m and 197.4 m where flow directions were to east. At 195.4 the flow rate is nearly zero.

The measurements were repeated at depth 149.1 m. The flow directions were about the same in both cases. Tests nr 1435 and nr 1439 at depth 195.4 m are also repeated measurements with different directions of the packer system.

6 DISCUSSION

The hydrogeological system near hole KAS16 is complicated. It is not the aim of this report to conclude if the results were in accordance of the flow system known by other means. However, some comments of measurements and results are given in the following.

Flow rate is calculated from the temperature curves. The time of the maximum point is used in this conversion. When flow rate is less than 1 ml/h, the temperature curve is flat and the maximum time is inaccurate. With the present interpretation method, flow rate is similarly inaccurate. However, symmetry or asymmetry of the temperature curves shows the direction of the flow even for the flow less than 0.1 ml/h.

Flow direction is calculated with the accuracy of one degree. This is not the real accuracy. Distribution of the flow within a sector is not known. The flow is not always coming from the opposite sector where it is going to. The actual inclination of the flow depends on orientation of fractures and it is not known on the basis of flow measurements alone. Thus, the orientation of the flow should be taken as a main trend at each depth.

There is a major regional fracture zone between 393 m - 456 m in KAS16. There was no information of the diameter of the borehole (the caliper measurement). There is a risk that the borehole was widened in the fracture zone and the packer system did not seal the sectors completely. In this case part of the flow may pass the packer system. The flow across the hole would be then larger than the measured one.

The flow rate along the borehole exceeded 50 times the measurement range of the flow sensor for vertical flows. It also created hydraulic pressure gradient along the packer system. The gradient along the packer system may be two orders of magnitude larger than the gradient across the packer system. Depending on fracture geometry, the high gradient along the packer system may generate flows across the hole in the measured section.

The flow directions were mostly westwards. It is possible that the tunnel west from borehole KAS16 takes up the water.

The exceptions of the flows to west are the two measurements at 195.4 m and 197.4 m, where the flow was to east. As mentioned before, high hydraulic gradient along the packer system can generate flows across the hole, if the fractures do not cut the hole at right angle. If the gradient along the hole is the reason for the flows at depths 195.4 m and 197.4 m, then the water conducting fractures should dip down eastward compared with the direction of the hole.

The measured flow rates were small. The flow rates depend on the gradient and hydraulic conductivity. Hydraulic conductivity was not exactly known at the measured sections but it cannot be negligible

because the earlier measurements showed clear water flows from the measured depths when water was pumped out from the hole.

The hydraulic potential must be low in the fracture zone at 396 m - 456 m. The gradient is probably high towards the zone but not necessarily along the zone. Borehole KAS16 was drilled towards the zone. The gradient is not necessarily high across borehole KAS16.

7 REFERENCES

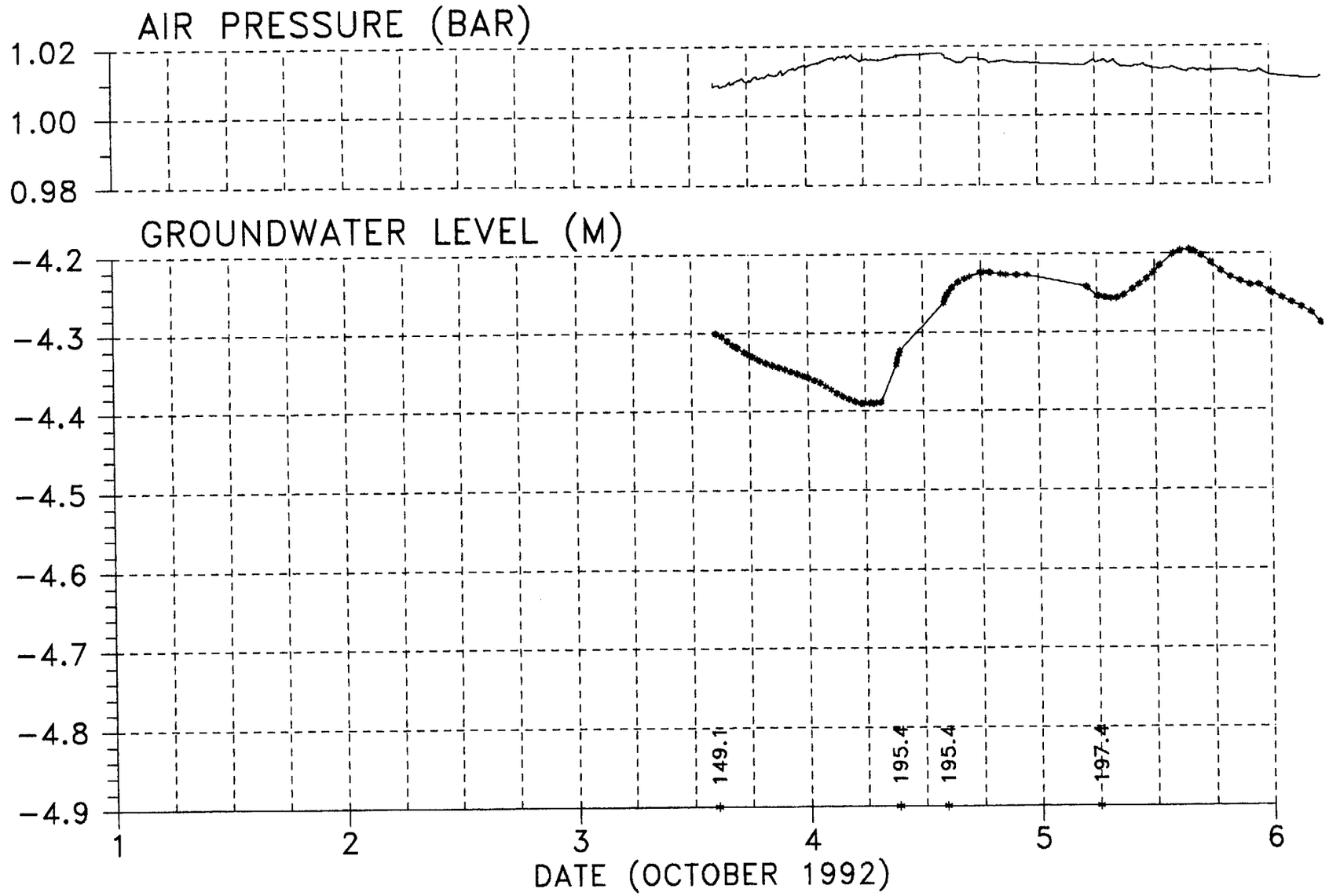
Bidaux P and Tsang C F, 1991. Fluid Flow Patterns Around a Well Bore or an Underground Drift With Complex Skin Effects, Water Resources Research, vol 27, no 11, pp 2993-3008.

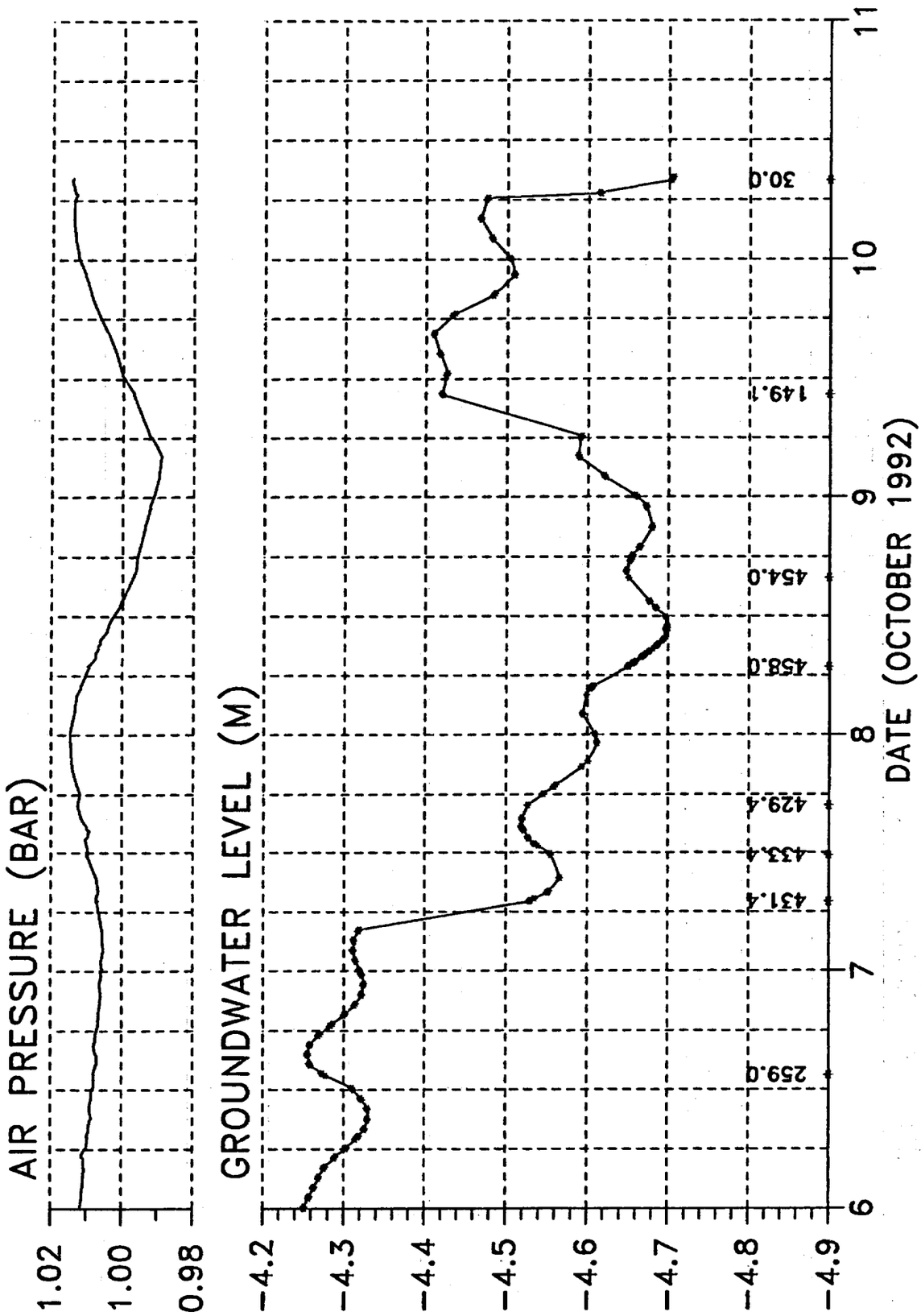
Palmqvist K and Lindström M, 1991. Channel widths, SKB Technical Report 91-14.

Rouhiainen P, 1993. TVO-Flowmeter, Report YJT-93-01, Nuclear Waste Commission of Finnish Power Companies.

NR 1401,	DEPTH:	149.1 m,	03-10-1992	14:31:23	
	FLOW RATE:	2.4 mL/H,	DIRECTION:	283 (DECL),	8 (INCL)
NR 1403,	DEPTH:	149.1 m,	03-10-1992	15:40:53	
	FLOW RATE:	1.4 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1408,	DEPTH:	149.1 m,	03-10-1992	17:49:50	
	FLOW RATE:	0.8 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1410,	DEPTH:	149.1 m,	03-10-1992	18:47:28	
	FLOW RATE:	0.8 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1412,	DEPTH:	149.1 m,	03-10-1992	19:38:55	
	FLOW RATE:	0.5 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1414,	DEPTH:	149.1 m,	03-10-1992	20:55:35	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1416,	DEPTH:	149.1 m,	03-10-1992	22:12:13	
	FLOW RATE:	0.7 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1418,	DEPTH:	149.1 m,	03-10-1992	23:28:51	
	FLOW RATE:	0.3 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1420,	DEPTH:	149.1 m,	04-10-1992	00:37:01	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1424,	DEPTH:	149.1 m,	04-10-1992	03:34:42	
	FLOW RATE:	0.7 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1426,	DEPTH:	149.1 m,	04-10-1992	04:51:21	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1428,	DEPTH:	149.1 m,	04-10-1992	05:41:52	
	FLOW RATE:	0.5 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1429,	DEPTH:	149.1 m,	04-10-1992	06:25:16	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1431,	DEPTH:	149.1 m,	04-10-1992	07:08:37	
	FLOW RATE:	0.5 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1433,	DEPTH:	149.1 m,	04-10-1992	07:39:06	
	FLOW RATE:	0.3 mL/H,	DIRECTION:	283 (DECL),	7 (INCL)
NR 1435,	DEPTH:	195.4 m,	04-10-1992	09:20:49	
	FLOW RATE:	0.7 mL/H,	DIRECTION:	183 (DECL),	0 (INCL)
NR 1439,	DEPTH:	195.4 m,	04-10-1992	14:32:10	
	FLOW RATE:	4.0 mL/H,	DIRECTION:	178 (DECL),	2 (INCL)
NR 1441,	DEPTH:	195.4 m,	04-10-1992	15:36:02	
	FLOW RATE:	2.4 mL/H,	DIRECTION:	178 (DECL),	2 (INCL)
NR 1444,	DEPTH:	195.4 m,	04-10-1992	17:54:24	
	FLOW RATE:	1.0 mL/H,	DIRECTION:	133 (DECL),	-3 (INCL)
NR 1447,	DEPTH:	195.4 m,	04-10-1992	18:51:38	
	FLOW RATE:	0.8 mL/H,	DIRECTION:	87 (DECL),	-6 (INCL)
NR 1449,	DEPTH:	195.4 m,	04-10-1992	21:36:57	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	87 (DECL),	-6 (INCL)
NR 1451,	DEPTH:	195.4 m,	05-10-1992	04:57:19	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1453,	DEPTH:	197.4 m,	05-10-1992	06:06:00	
	FLOW RATE:	9.1 mL/H,	DIRECTION:	83 (DECL),	-2 (INCL)
NR 1455,	DEPTH:	197.4 m,	05-10-1992	07:21:26	
	FLOW RATE:	6.6 mL/H,	DIRECTION:	82 (DECL),	0 (INCL)
NR 1457,	DEPTH	197.4 m,	05-10-1992	08:42:25	
	FLOW RATE:	4.3 mL/H,	DIRECTION:	85 (DECL),	3 (INCL)
NR 1458,	DEPTH:	197.4 m,	05-10-1992	09:37:37	
	FLOW RATE:	4.6 mL/H,	DIRECTION:	92 (DECL),	1 (INCL)
NR 1461,	DEPTH:	197.4 m,	05-10-1992	11:46:00	
	FLOW RATE:	2.2 mL/H,	DIRECTION:	81 (DECL),	0 (INCL)
NR 1463,	DEPTH:	197.4 m,	05-10-1992	13:45:40	
	FLOW RATE:	1.6 mL/H,	DIRECTION:	75 (DECL),	0 (INCL)
NR 1465,	DEPTH:	197.4 m,	05-10-1992	15:31:49	
	FLOW RATE:	1.2 mL/H,	DIRECTION:	75 (DECL),	0 (INCL)

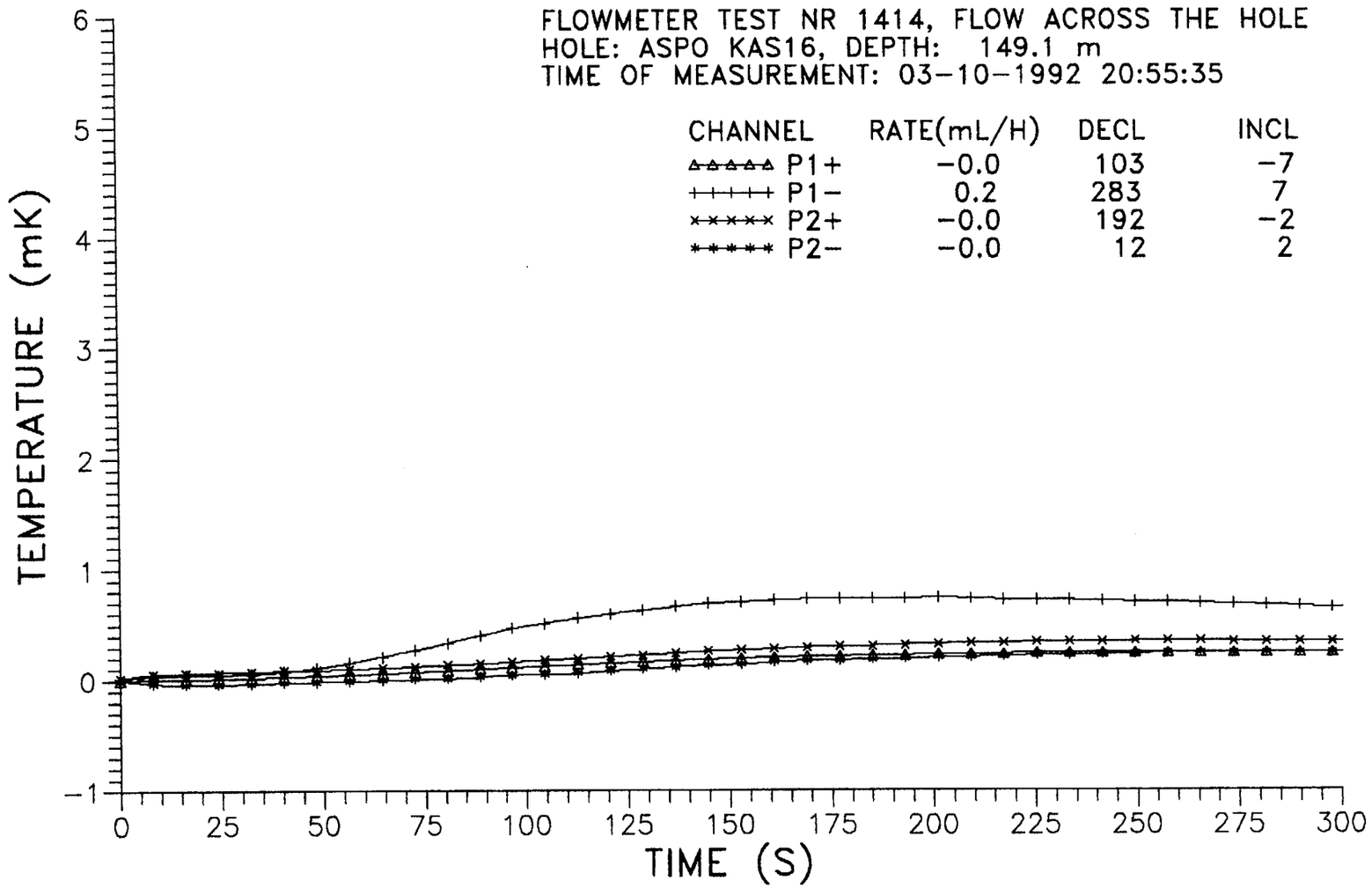
NR 1468,	DEPTH:	197.4 m,	05-10-1992	17:39:20	
	FLOW RATE:	1.8 mL/H,	DIRECTION:	77 (DECL),	-2 (INCL)
NR 1470,	DEPTH:	197.4 m,	05-10-1992	19:41:40	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	75 (DECL),	0 (INCL)
NR 1472,	DEPTH:	197.4 m,	05-10-1992	21:42:35	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	75 (DECL),	0 (INCL)
NR 1475,	DEPTH:	197.4 m,	06-10-1992	00:00:51	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1477,	DEPTH:	197.4 m,	06-10-1992	02:01:48	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1479,	DEPTH:	197.4 m,	06-10-1992	04:02:43	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1480,	DEPTH:	197.4 m,	06-10-1992	05:03:10	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1481,	DEPTH:	197.4 m,	06-10-1992	06:01:16	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1484,	DEPTH:	197.4 m,	06-10-1992	07:56:33	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1486,	DEPTH:	197.4 m,	06-10-1992	10:00:41	
	FLOW RATE:	0.1 mL/H,	DIRECTION:	75 (DECL),	0 (INCL)
NR 1488,	DEPTH:	197.4 m,	06-10-1992	12:01:37	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1489,	DEPTH:	259 m,	06-10-1992	13:29:01	
	FLOW RATE:	5.1 mL/H,	DIRECTION:	293 (DECL),	6 (INCL)
NR 1490,	DEPTH:	259 m,	06-10-1992	14:29:28	
	FLOW RATE:	6.0 mL/H,	DIRECTION:	316 (DECL),	7 (INCL)
NR 1493,	DEPTH:	259 m,	06-10-1992	15:30:19	
	FLOW RATE:	2.9 mL/H,	DIRECTION:	298 (DECL),	6 (INCL)
NR 1494,	DEPTH:	259 m,	06-10-1992	16:27:49	
	FLOW RATE:	2.2 mL/H,	DIRECTION:	299 (DECL),	6 (INCL)
NR 1495,	DEPTH:	259 m,	06-10-1992	17:30:50	
	FLOW RATE:	1.0 mL/H,	DIRECTION:	293 (DECL),	6 (INCL)
NR 1497,	DEPTH:	259 m,	06-10-1992	18:31:13	
	FLOW RATE:	0.7 mL/H,	DIRECTION:	291 (DECL),	6 (INCL)
NR 1498,	DEPTH:	259 m,	06-10-1992	19:31:44	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	291 (DECL),	6 (INCL)
NR 1499,	DEPTH:	259 m,	06-10-1992	20:32:11	
	FLOW RATE:	0.3 mL/H,	DIRECTION:	291 (DECL),	6 (INCL)
NR 1500,	DEPTH:	259 m,	06-10-1992	21:32:38	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1501,	DEPTH:	259 m,	06-10-1992	22:33:05	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	293 (DECL),	6 (INCL)
NR 1502,	DEPTH:	259 m,	06-10-1992	23:33:32	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1503,	DEPTH:	259 m,	07-10-1992	00:00:50	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1504,	DEPTH:	259 m,	07-10-1992	01:01:17	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1505,	DEPTH:	259 m,	07-10-1992	02:01:44	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1506,	DEPTH:	259 m,	07-10-1992	03:02:11	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1507,	DEPTH:	259 m,	07-10-1992	04:02:39	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1512,	DEPTH:	431.4 m,	07-10-1992	07:57:15	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1515,	DEPTH:	433.4 m,	07-10-1992	11:45:07	
	FLOW RATE:	8.6 mL/H,	DIRECTION:	243 (DECL),	1 (INCL)

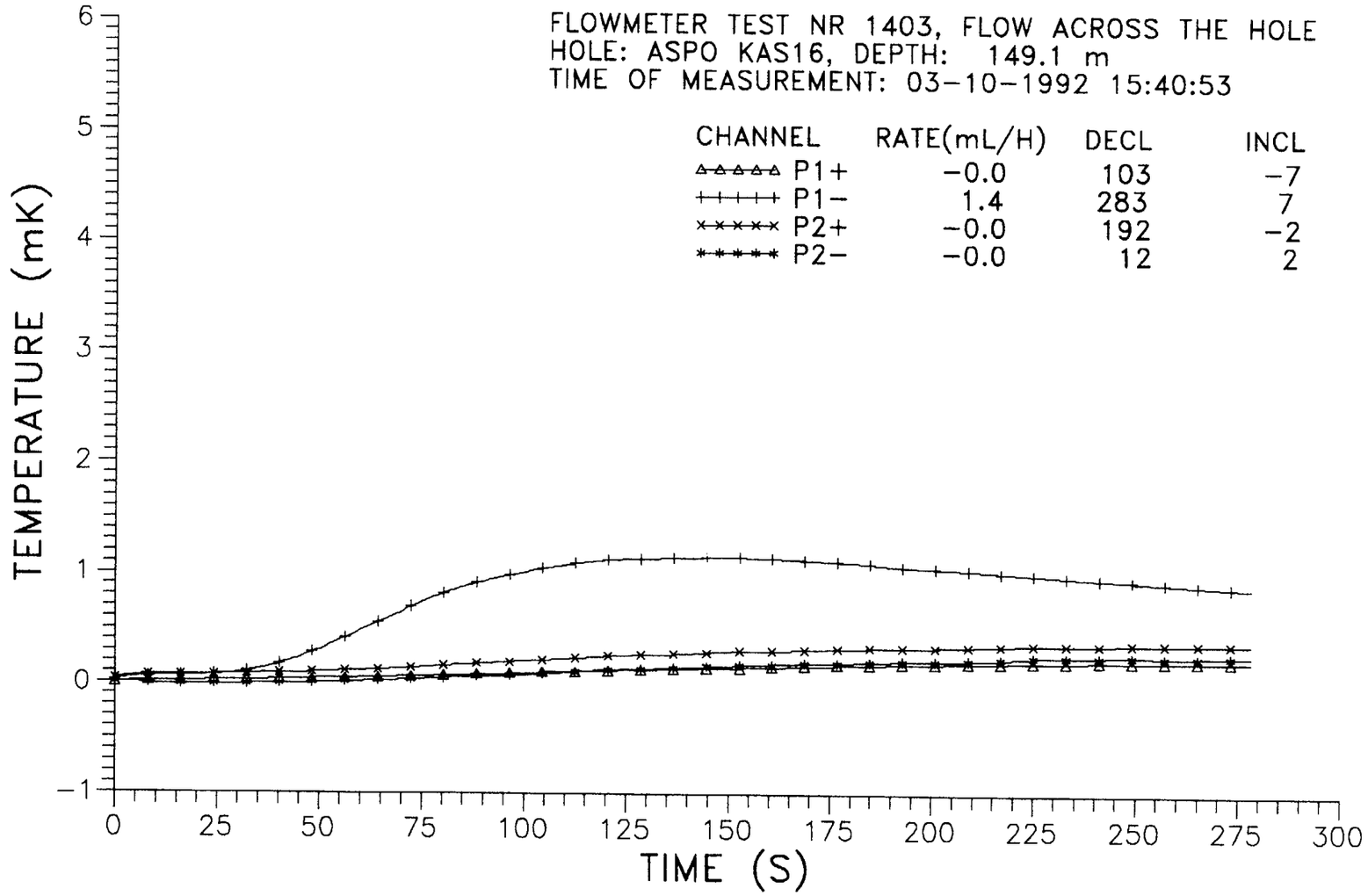

AIR PRESSURE (BAR)
1.02
1.00
0.98
GROUNDWATER LEVEL (M)
-4.2
-4.3
-4.4
-4.5
-4.6
-4.7
-4.8
-4.9
149.1
195.4
195.4
197.4
1
2
3
4
5
6
DATE (OCTOBER 1992)

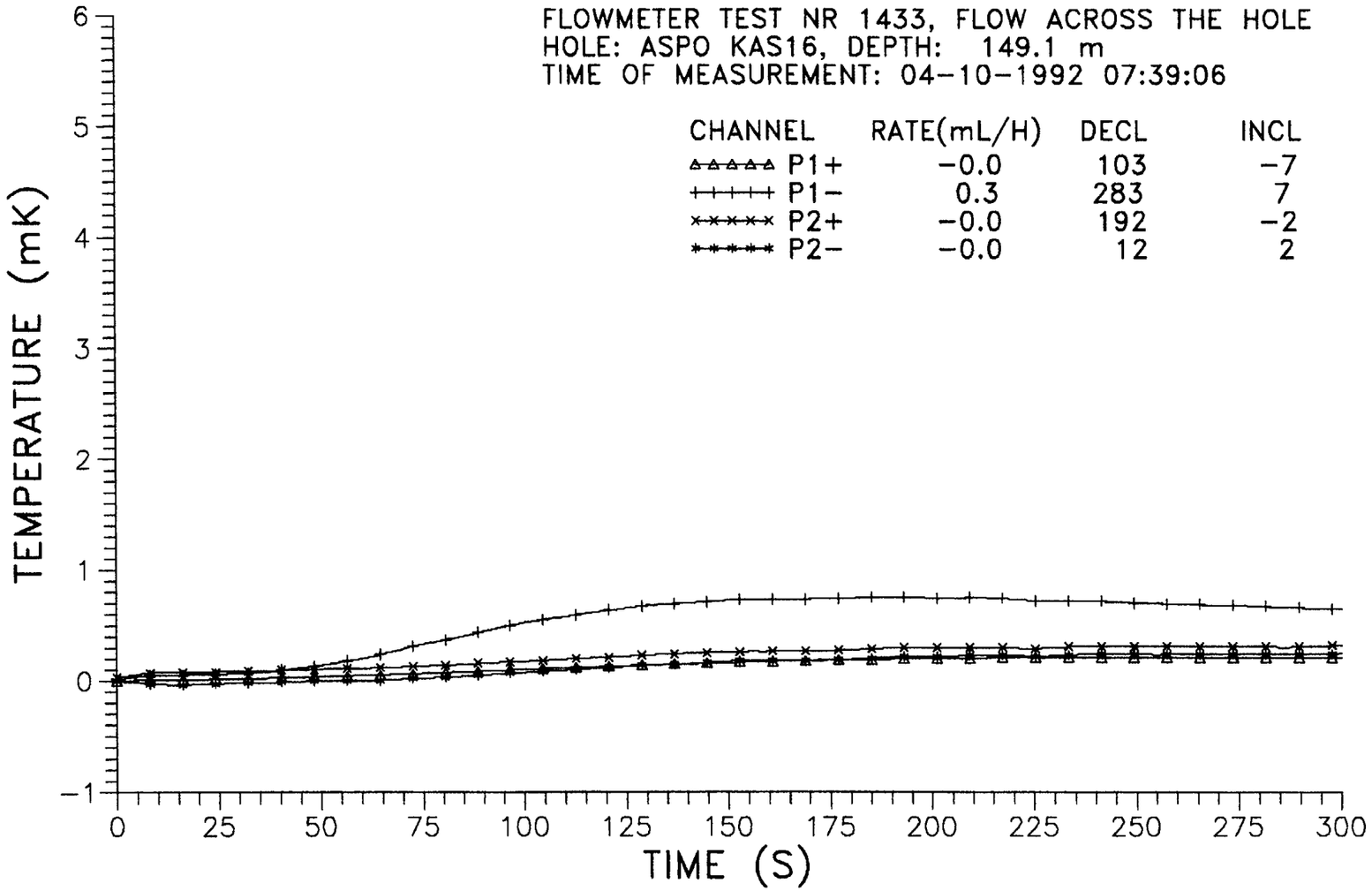

AIR PRESSURE (BAR)
1.02
1.00
0.98
GROUNDWATER LEVEL (M)
-4.2
-4.3
-4.4
-4.5
-4.6
-4.7
-4.8
-4.9
6
7
8
9
10
11
DATE (OCTOBER 1992)
259.0
431.4
433.4
429.4
458.0
454.0
149.1
30.0

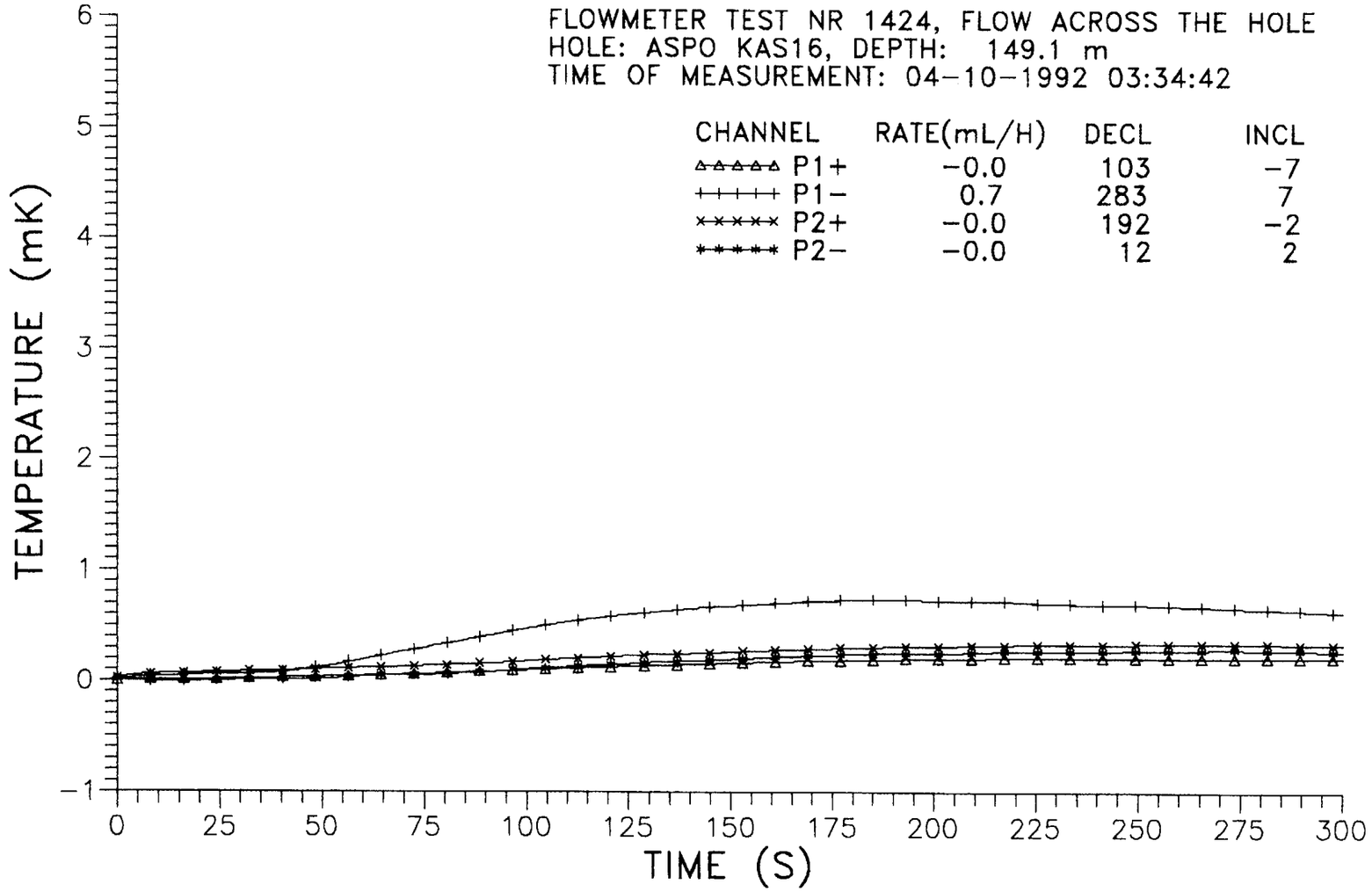
NR 1516,	DEPTH:	433.4 m,	07-10-1992	12:45:33	
	FLOW RATE:	1.5 mL/H,	DIRECTION:	226 (DECL),	-1 (INCL)
NR 1518,	DEPTH:	433.4 m,	07-10-1992	13:32:01	
	FLOW RATE:	1.7 mL/H,	DIRECTION:	261 (DECL),	2 (INCL)
NR 1520,	DEPTH:	433.1 m,	07-10-1992	14:21:44	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1521,	DEPTH:	433.1 m,	07-10-1992	14:37:29	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	259 (DECL),	3 (INCL)
NR 1522,	DEPTH:	433.1 m,	07-10-1992	15:27:45	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1525,	DEPTH:	429.4 m,	07-10-1992	18:45:57	
	FLOW RATE:	0.5 mL/H,	DIRECTION:	221 (DECL),	0 (INCL)
NR 1527,	DEPTH:	429.4 m,	07-10-1992	23:11:22	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1528,	DEPTH:	429.4 m,	08-10-1992	00:00:51	
	FLOW RATE:	0.2 mL/H,	DIRECTION:	221 (DECL),	-2 (INCL)
NR 1529,	DEPTH:	429.4 m,	08-10-1992	02:01:18	
	FLOW RATE:	0.7 mL/H,	DIRECTION:	223 (DECL),	-1 (INCL)
NR 1531,	DEPTH:	429.4 m,	08-10-1992	04:34:16	
	FLOW RATE:	0.5 mL/H,	DIRECTION:	221 (DECL),	-2 (INCL)
NR 1535,	DEPTH:	458 m,	08-10-1992	06:57:42	
	FLOW RATE:	0.8 mL/H,	DIRECTION:	237 (DECL),	-1 (INCL)
NR 1542,	DEPTH:	458 m,	08-10-1992	08:08:58	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	237 (DECL),	-1 (INCL)
NR 1558,	DEPTH:	458 m,	08-10-1992	10:32:53	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	237 (DECL),	-1 (INCL)
NR 1564,	DEPTH:	458 m,	08-10-1992	12:48:52	
	FLOW RATE:	0.1 mL/H,	DIRECTION:	237 (DECL),	-1 (INCL)
NR 1569,	DEPTH:	454 m,	08-10-1992	16:29:53	
	FLOW RATE:	1.9 mL/H,	DIRECTION:	315 (DECL),	5 (INCL)
NR 1571,	DEPTH:	454 m,	08-10-1992	18:01:00	
	FLOW RATE:	1.2 mL/H,	DIRECTION:	315 (DECL),	5 (INCL)
NR 1572,	DEPTH:	454 m,	08-10-1992	18:55:34	
	FLOW RATE:	0.9 mL/H,	DIRECTION:	313 (DECL),	6 (INCL)
NR 1573,	DEPTH:	454 m,	08-10-1992	20:56:05	
	FLOW RATE:	1.3 mL/H,	DIRECTION:	315 (DECL),	6 (INCL)
NR 1574,	DEPTH:	454 m,	08-10-1992	22:56:37	
	FLOW RATE:	1.1 mL/H,	DIRECTION:	315 (DECL),	5 (INCL)
NR 1575,	DEPTH:	454 m,	09-10-1992	00:00:52	
	FLOW RATE:	0.3 mL/H,	DIRECTION:	315 (DECL),	5 (INCL)
NR 1576,	DEPTH:	454 m,	09-10-1992	02:01:23	
	FLOW RATE:	0.3 mL/H,	DIRECTION:	315 (DECL),	6 (INCL)
NR 1577,	DEPTH:	454 m,	09-10-1992	04:01:54	
	FLOW RATE:	0.4 mL/H,	DIRECTION:	315 (DECL),	6 (INCL)
NR 1578,	DEPTH:	454 m,	09-10-1992	06:02:25	
	FLOW RATE:	0.1 mL/H,	DIRECTION:	315 (DECL),	6 (INCL)
NR 1579,	DEPTH:	149.1 m,	09-10-1992	10:21:52	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1580,	DEPTH:	149.1 m,	09-10-1992	12:22:21	
	FLOW RATE:	1.5 mL/H,	DIRECTION:	267 (DECL),	4 (INCL)
NR 1581,	DEPTH:	149.1 m,	09-10-1992	14:22:49	
	FLOW RATE:	0.1 mL/H,	DIRECTION:	176 (DECL),	-4 (INCL)
NR 1582,	DEPTH:	149.1 m,	09-10-1992	16:25:24	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1584,	DEPTH:	149.1 m,	09-10-1992	18:21:27	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1585,	DEPTH:	149.1 m,	09-10-1992	20:21:55	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)

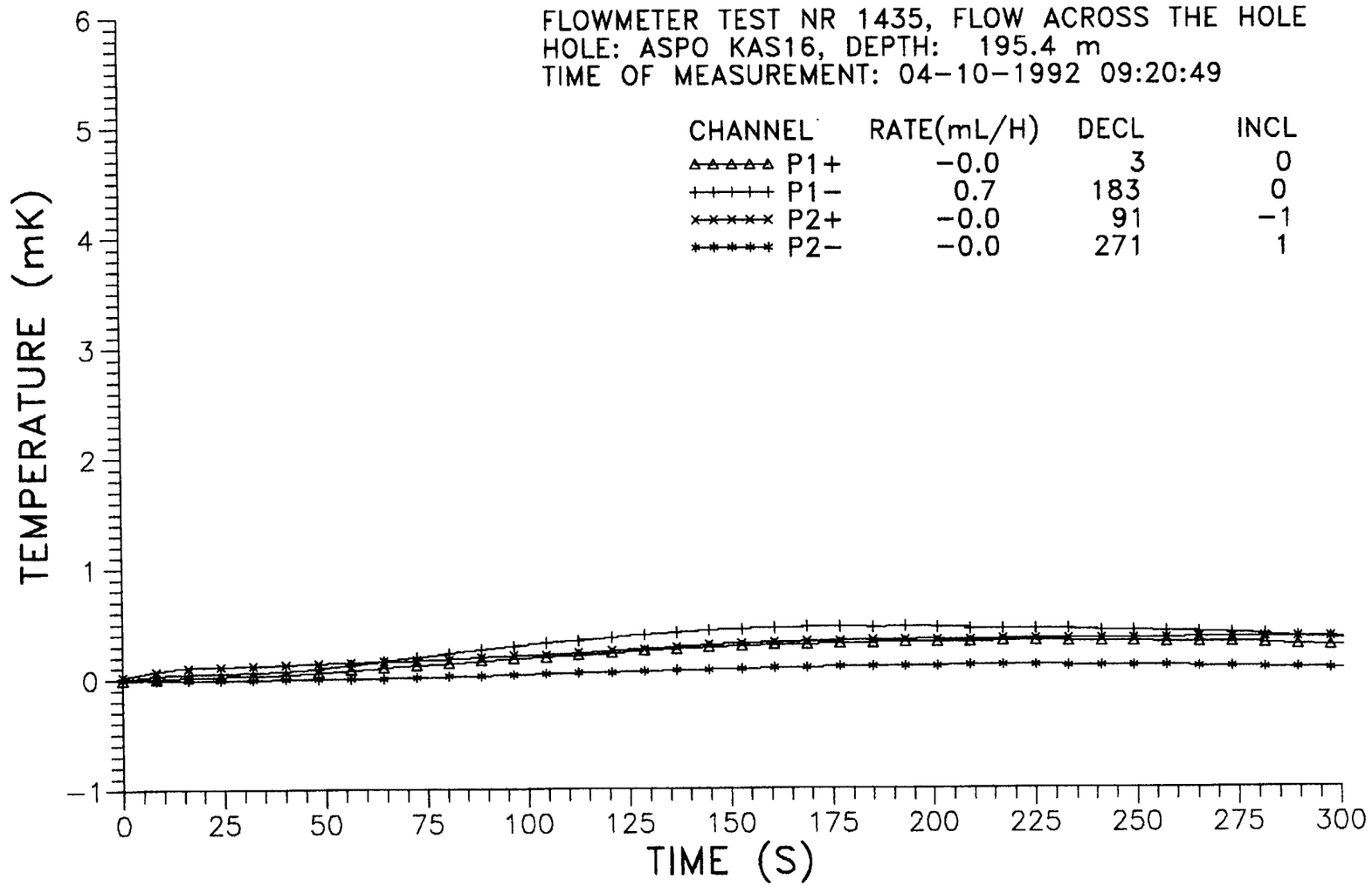
NR 1586,	DEPTH:	149.1 m,	09-10-1992	22:22:23	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1587,	DEPTH:	149.1 m,	10-10-1992	00:00:52	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1588,	DEPTH:	149.1 m,	10-10-1992	02:01:20	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1589,	DEPTH:	149.1 m,	10-10-1992	04:01:48	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)
NR 1590,	DEPTH:	149.1 m,	10-10-1992	06:02:03	
	FLOW RATE:	0.0 mL/H,	DIRECTION:	0 (DECL),	0 (INCL)

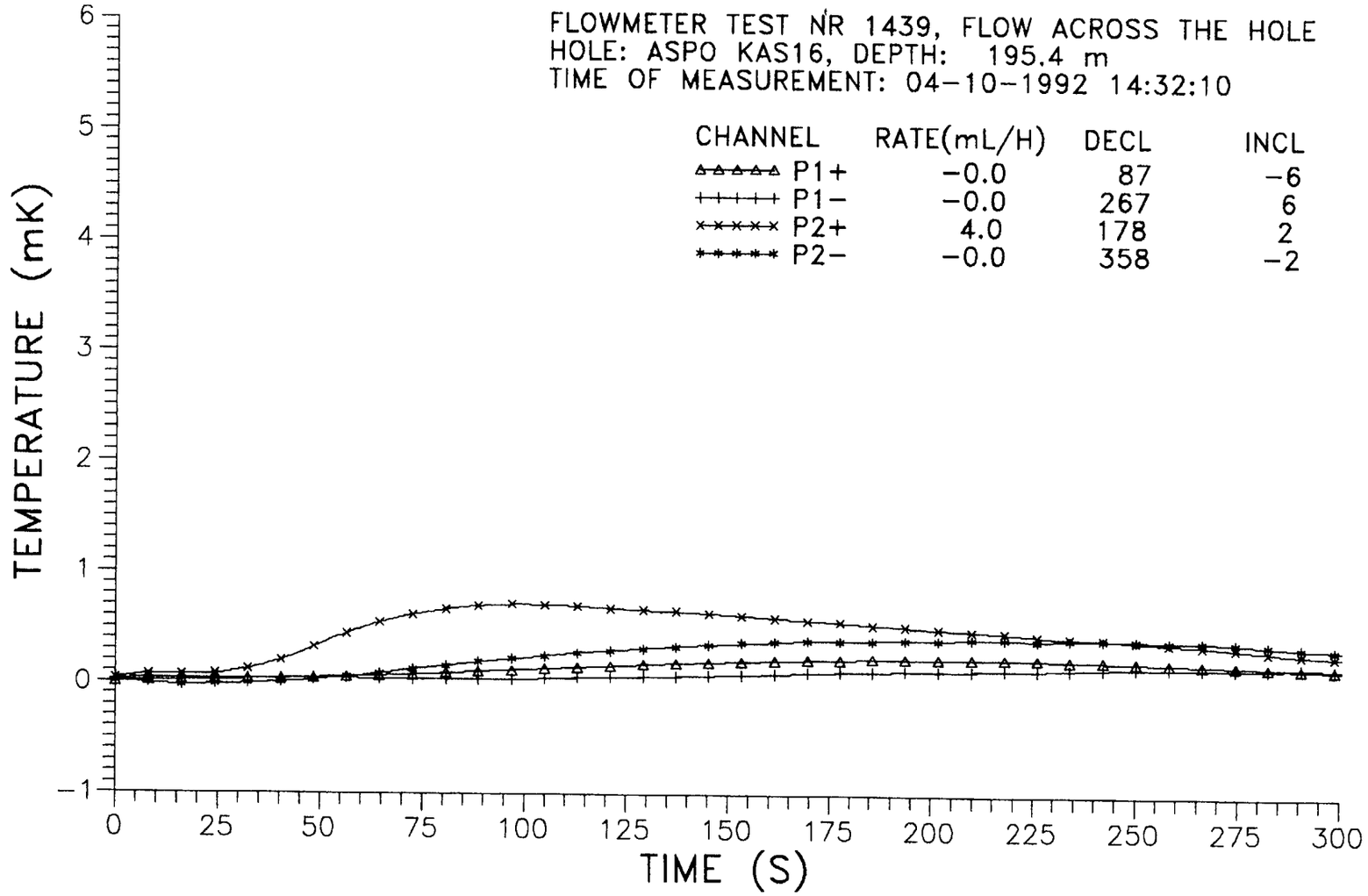

FLOWMETER TEST NR 1414, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 03-10-1992 20:55:35
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 103 -7
P1- 0.2 283 7
P2+ -0.0 192 -2
P2- -0.0 12 2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300
TIME (S)

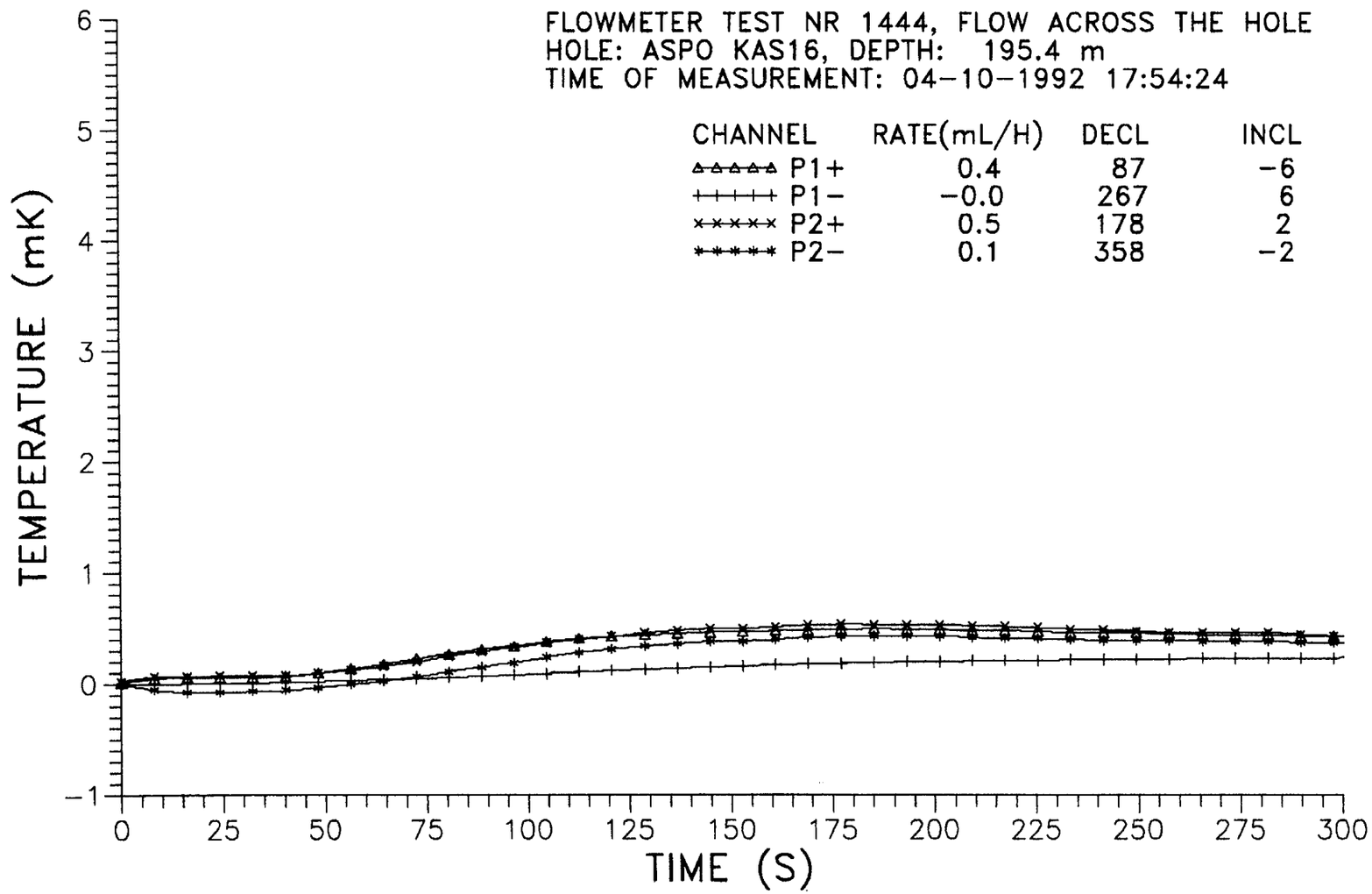

FLOWMETER TEST NR 1403, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 03-10-1992 15:40:53
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 103 -7
P1- 1.4 283 7
P2+ -0.0 192 -2
P2- -0.0 12 2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

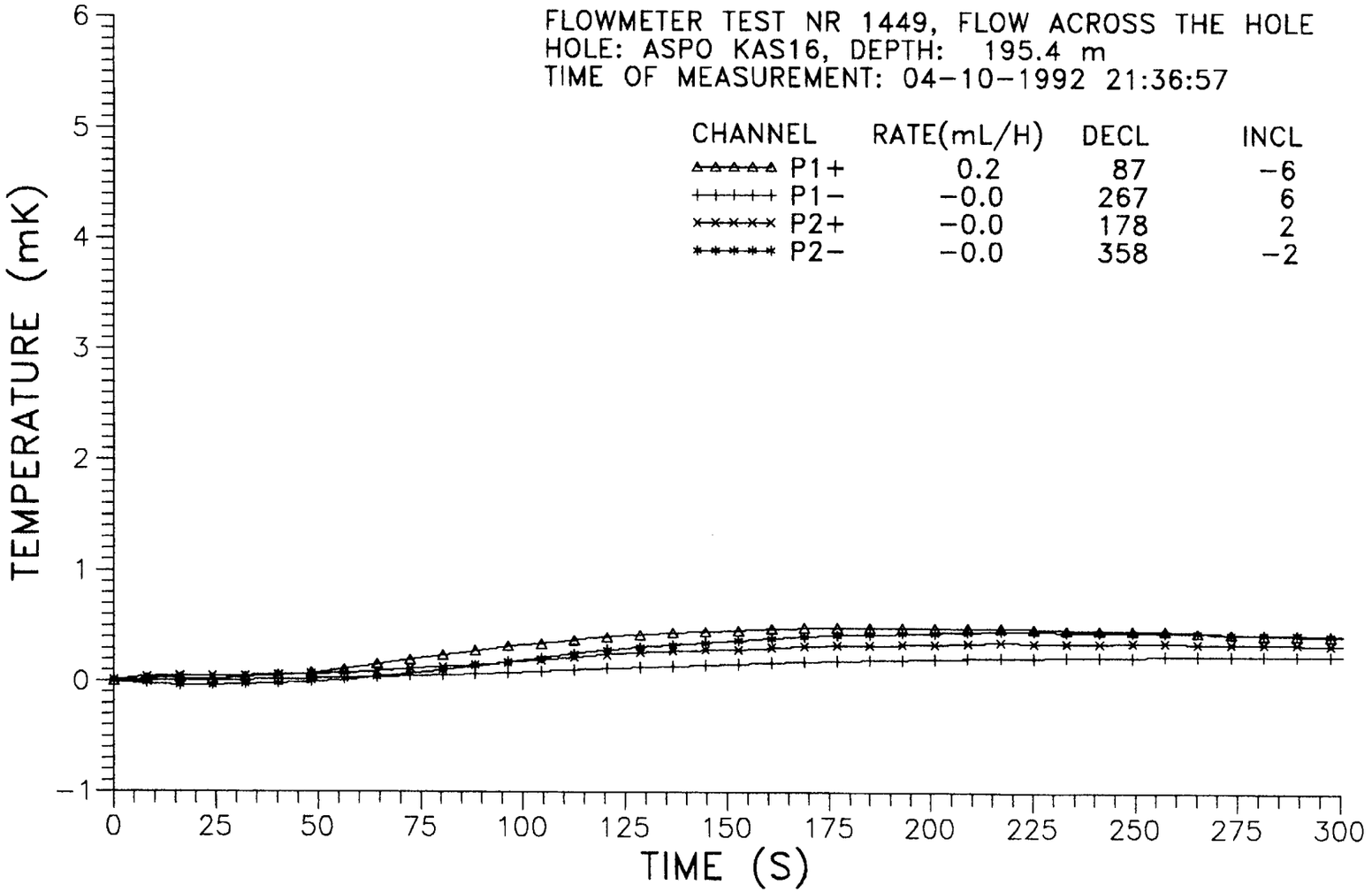

FLOWMETER TEST NR 1433, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 04-10-1992 07:39:06
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 103 -7
P1- 0.3 283 7
P2+ -0.0 192 -2
P2- -0.0 12 2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

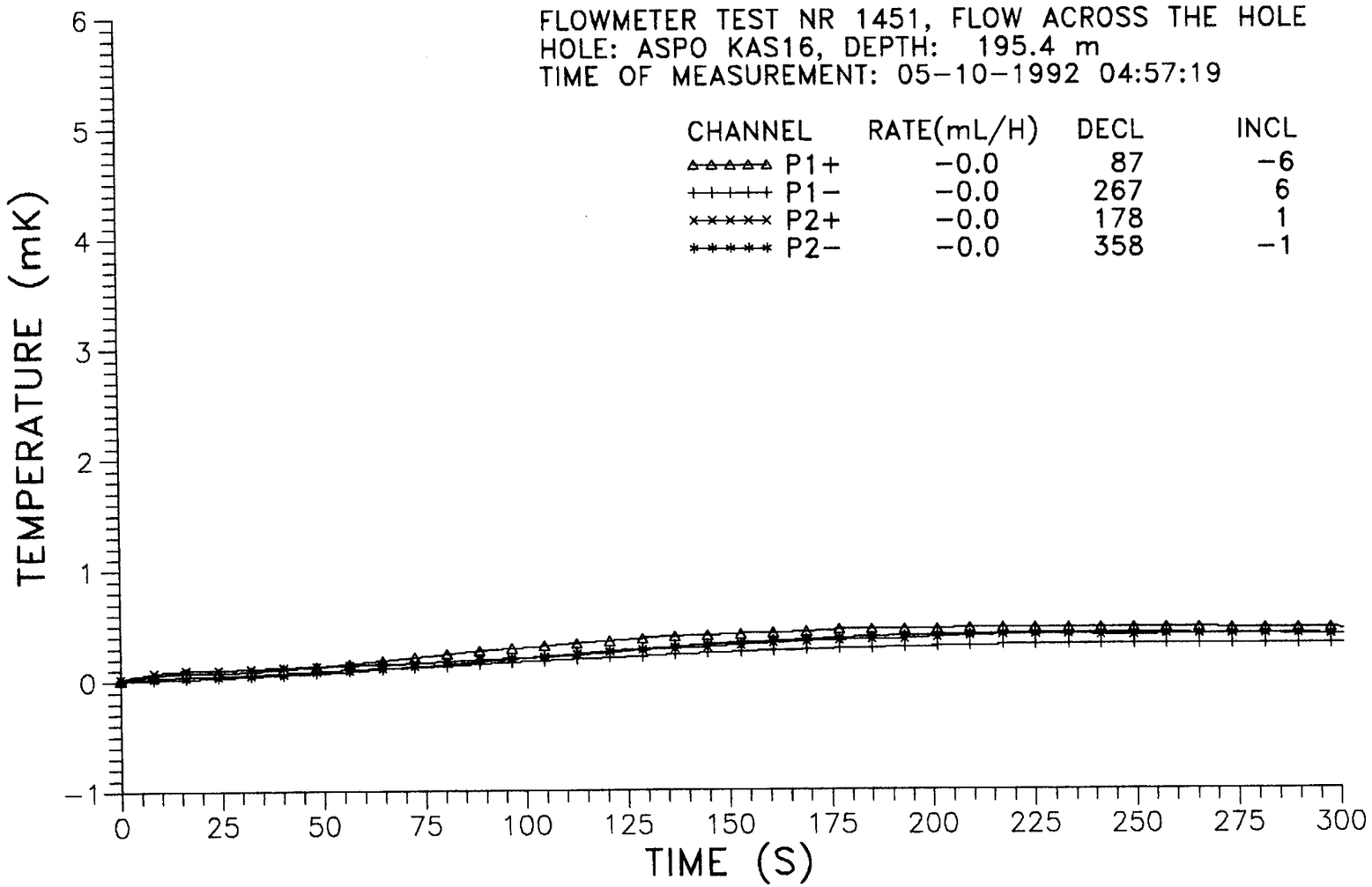

FLOWMETER TEST NR 1424, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 04-10-1992 03:34:42
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 103 -7
P1- 0.7 283 7
P2+ -0.0 192 -2
P2- -0.0 12 2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

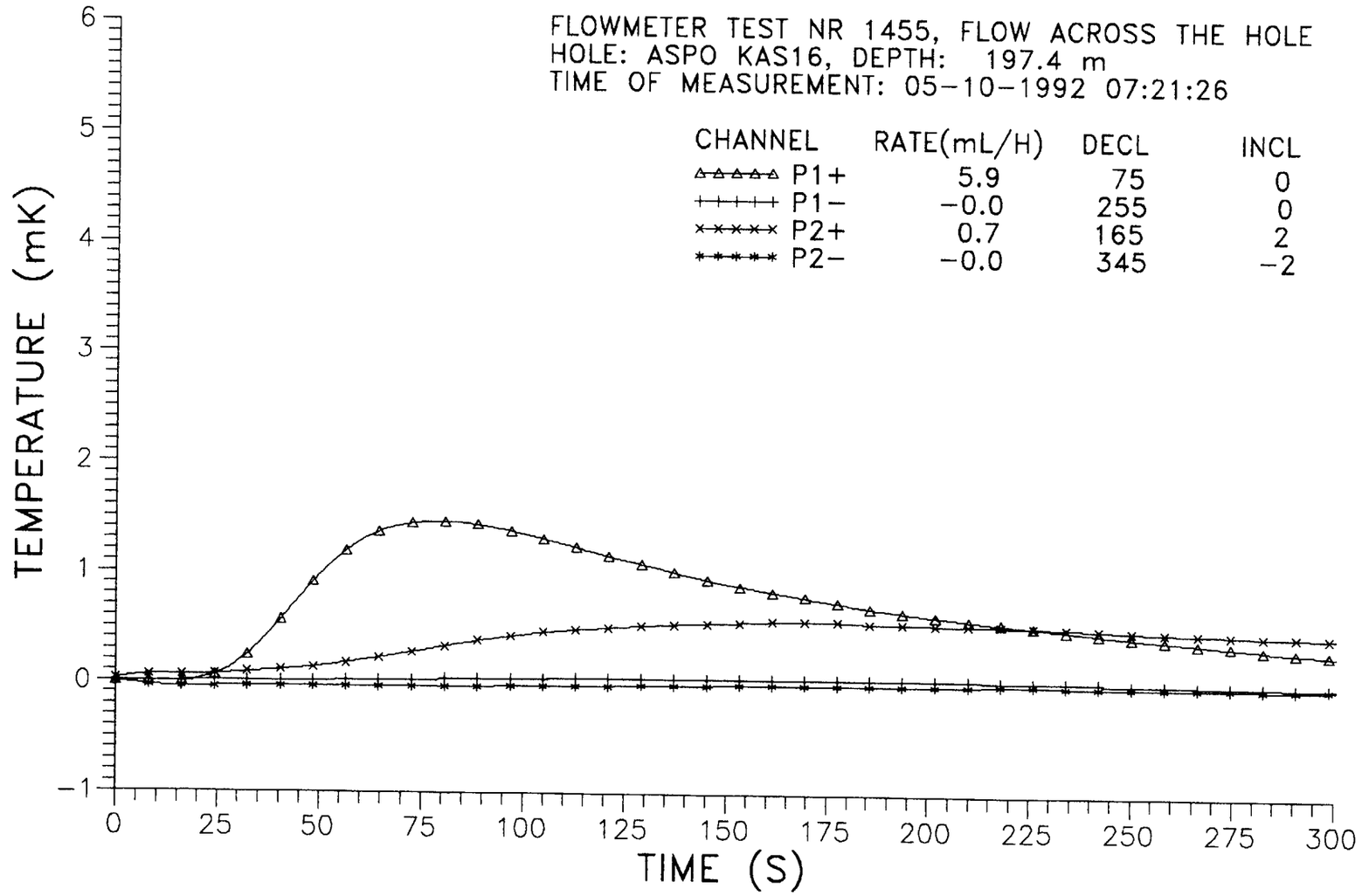

FLOWMETER TEST NR 1435, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 195.4 m
TIME OF MEASUREMENT: 04-10-1992 09:20:49
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 3 0
P1- 0.7 183 0
P2+ -0.0 91 -1
P2- -0.0 271 1
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

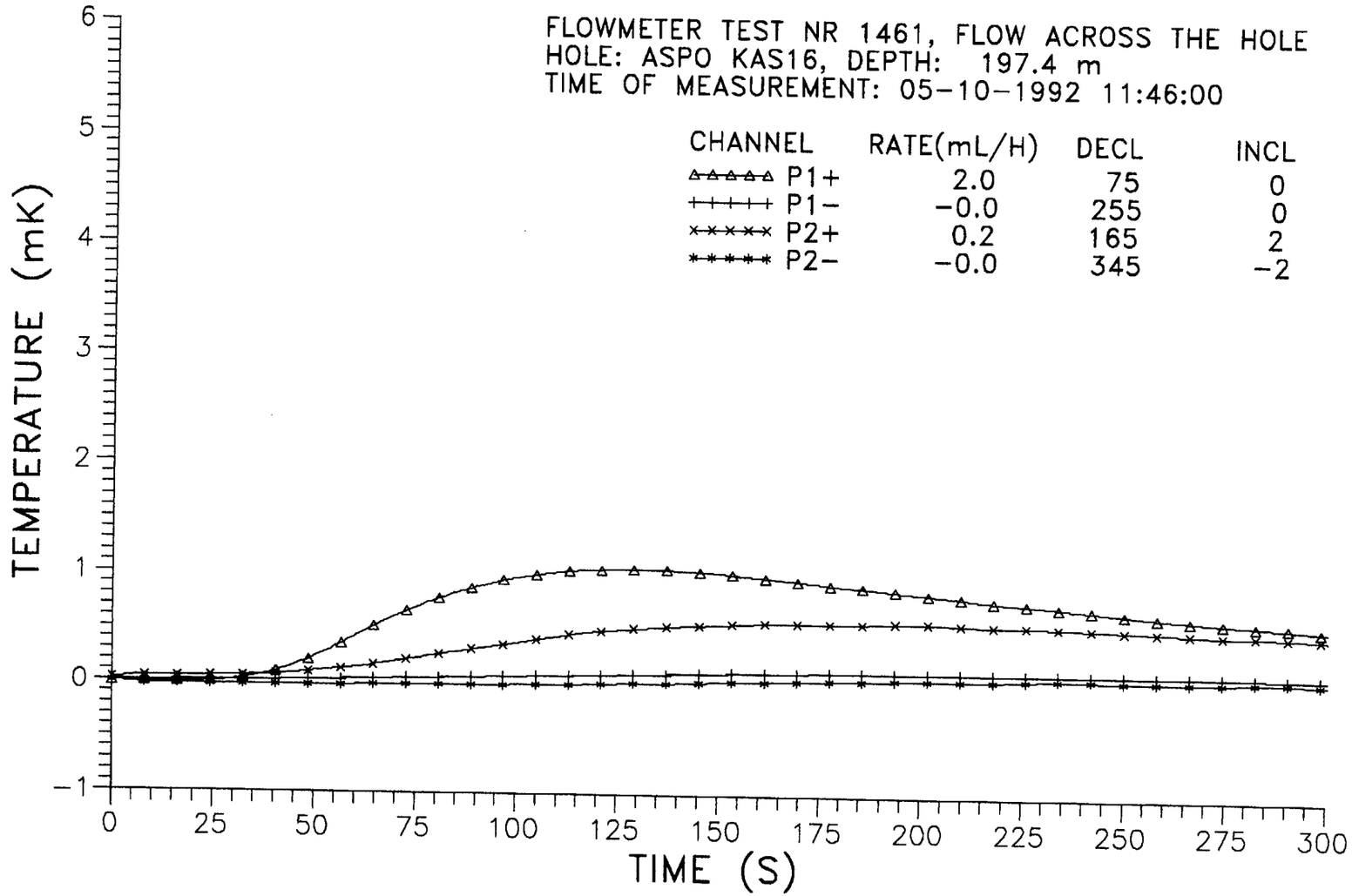

FLOWMETER TEST NR 1439, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 195.4 m
TIME OF MEASUREMENT: 04-10-1992 14:32:10
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 87 -6
P1- -0.0 267 6
P2+ 4.0 178 2
P2- -0.0 358 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

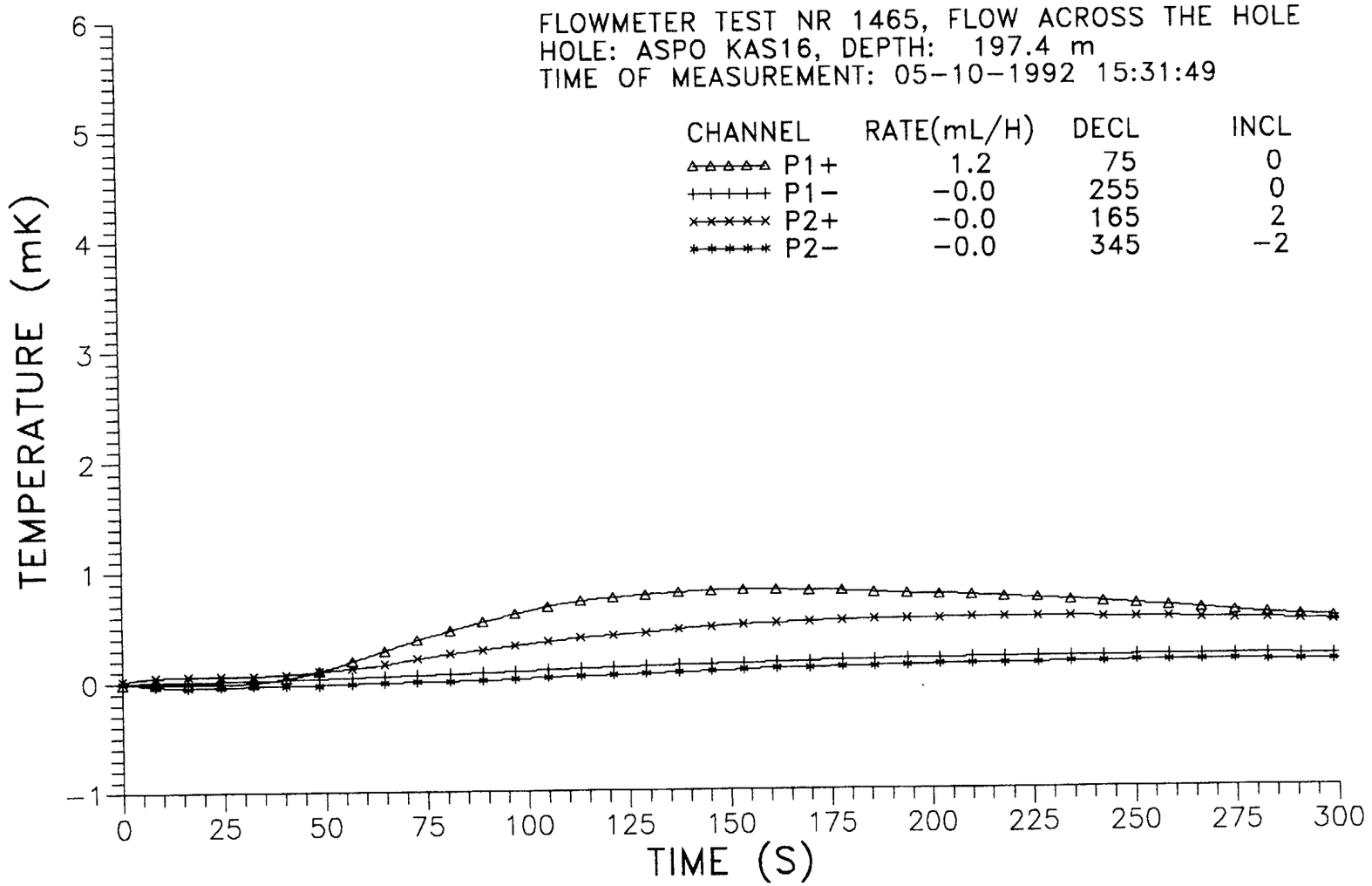

FLOWMETER TEST NR 1444, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 195.4 m
TIME OF MEASUREMENT: 04-10-1992 17:54:24
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.4 87 -6
P1- -0.0 267 6
P2+ 0.5 178 2
P2- 0.1 358 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

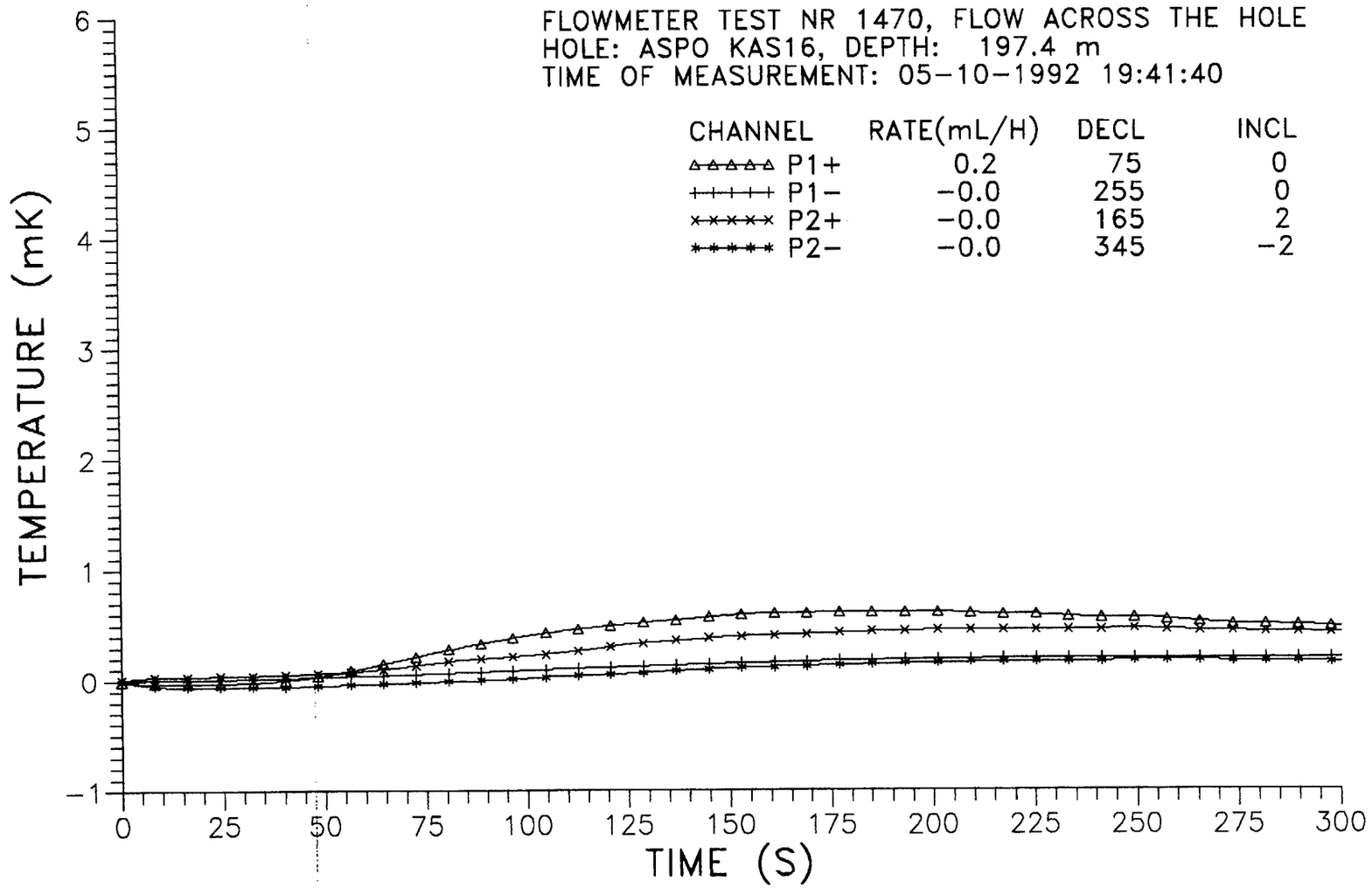

FLOWMETER TEST NR 1449, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 195.4 m
TIME OF MEASUREMENT: 04-10-1992 21:36:57
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.2 87 -6
P1- -0.0 267 6
P2+ -0.0 178 2
P2- -0.0 358 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

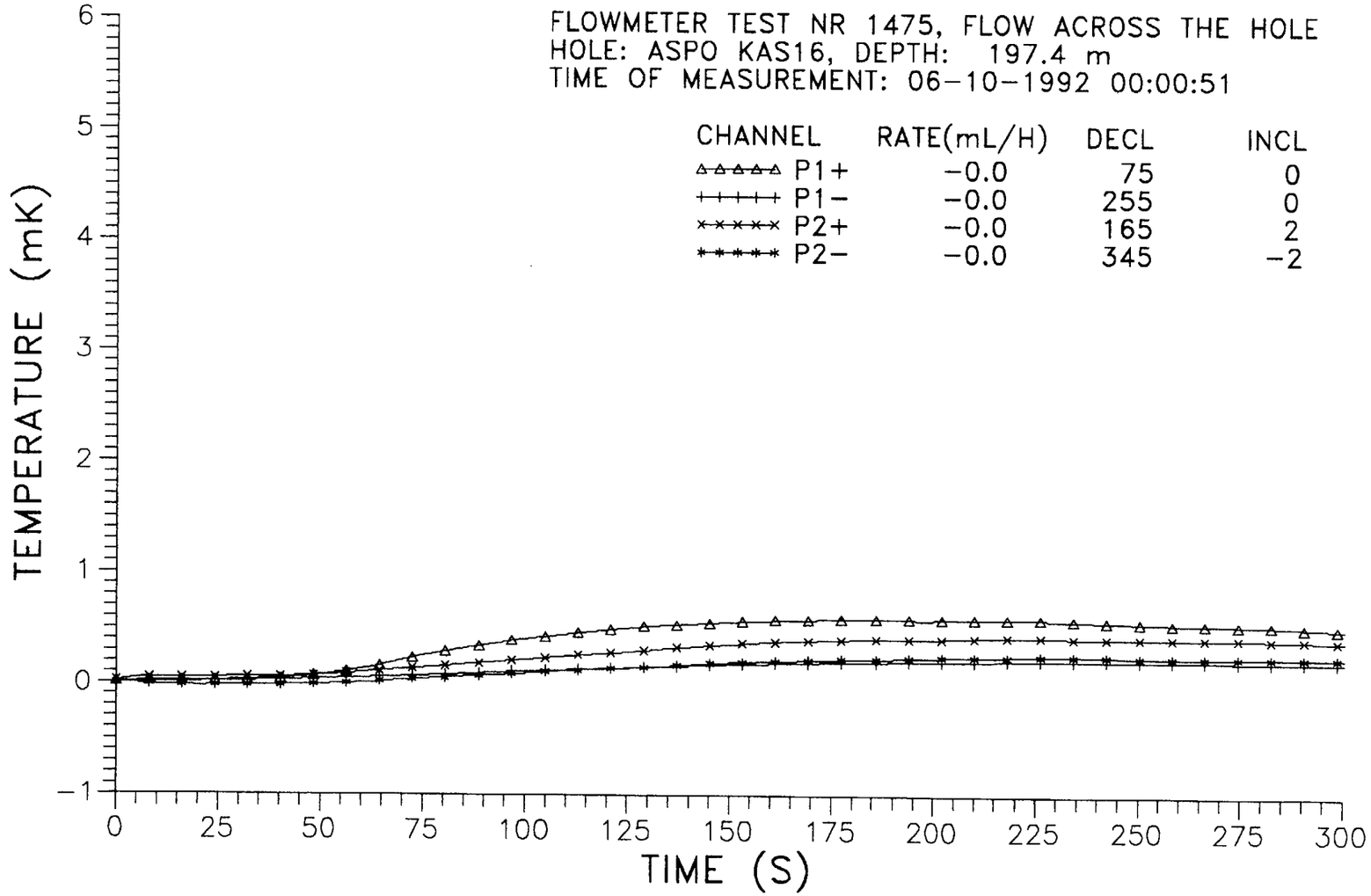

FLOWMETER TEST NR 1451, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 195.4 m
TIME OF MEASUREMENT: 05-10-1992 04:57:19
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 87 -6
P1- -0.0 267 6
P2+ -0.0 178 1
P2- -0.0 358 -1
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300
TIME (S)

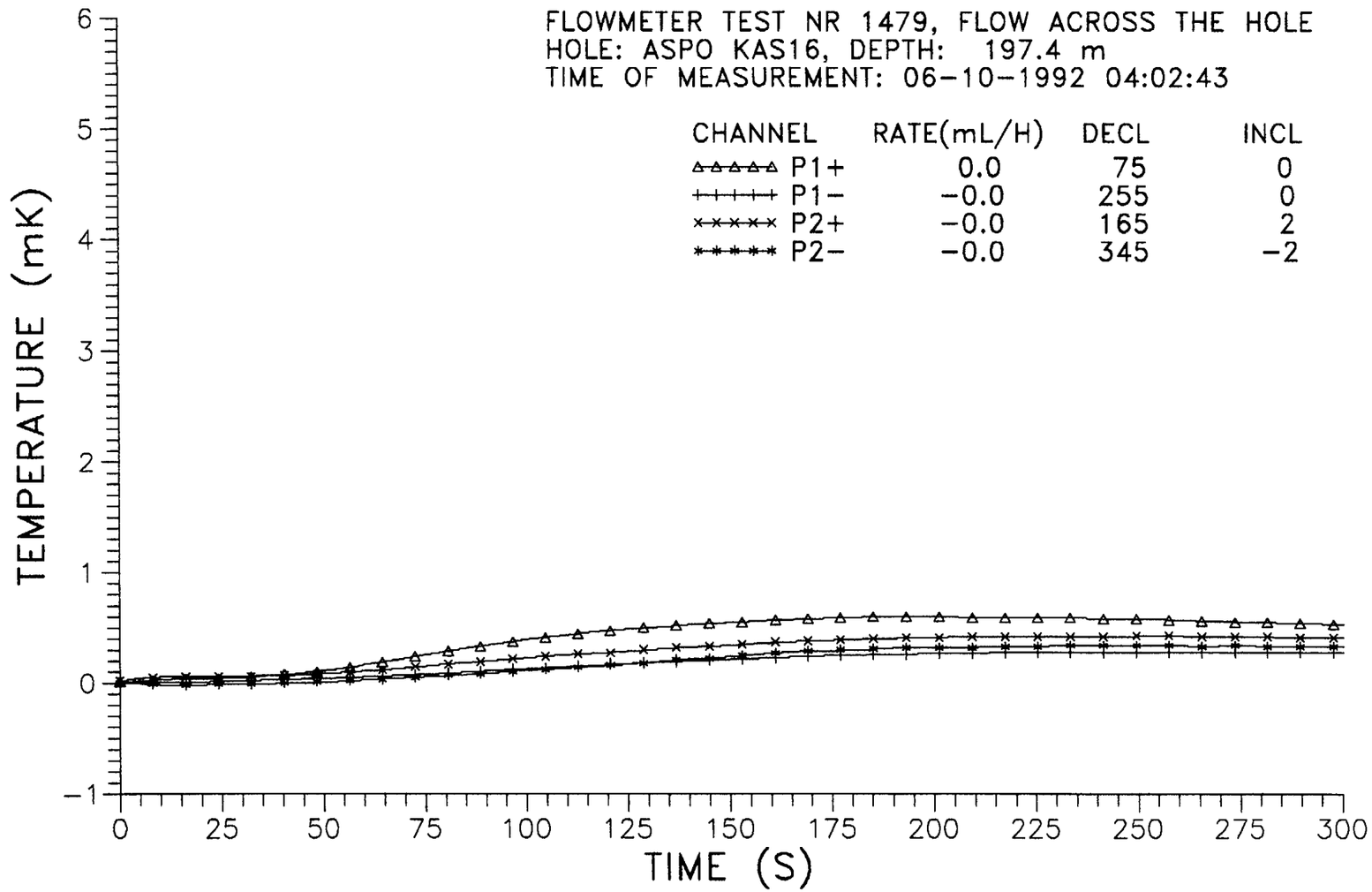

FLOWMETER TEST NR 1455, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 05-10-1992 07:21:26
CHANNEL RATE(mL/H) DECL INCL
P1+ 5.9 75 0
P1- -0.0 255 0
P2+ 0.7 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

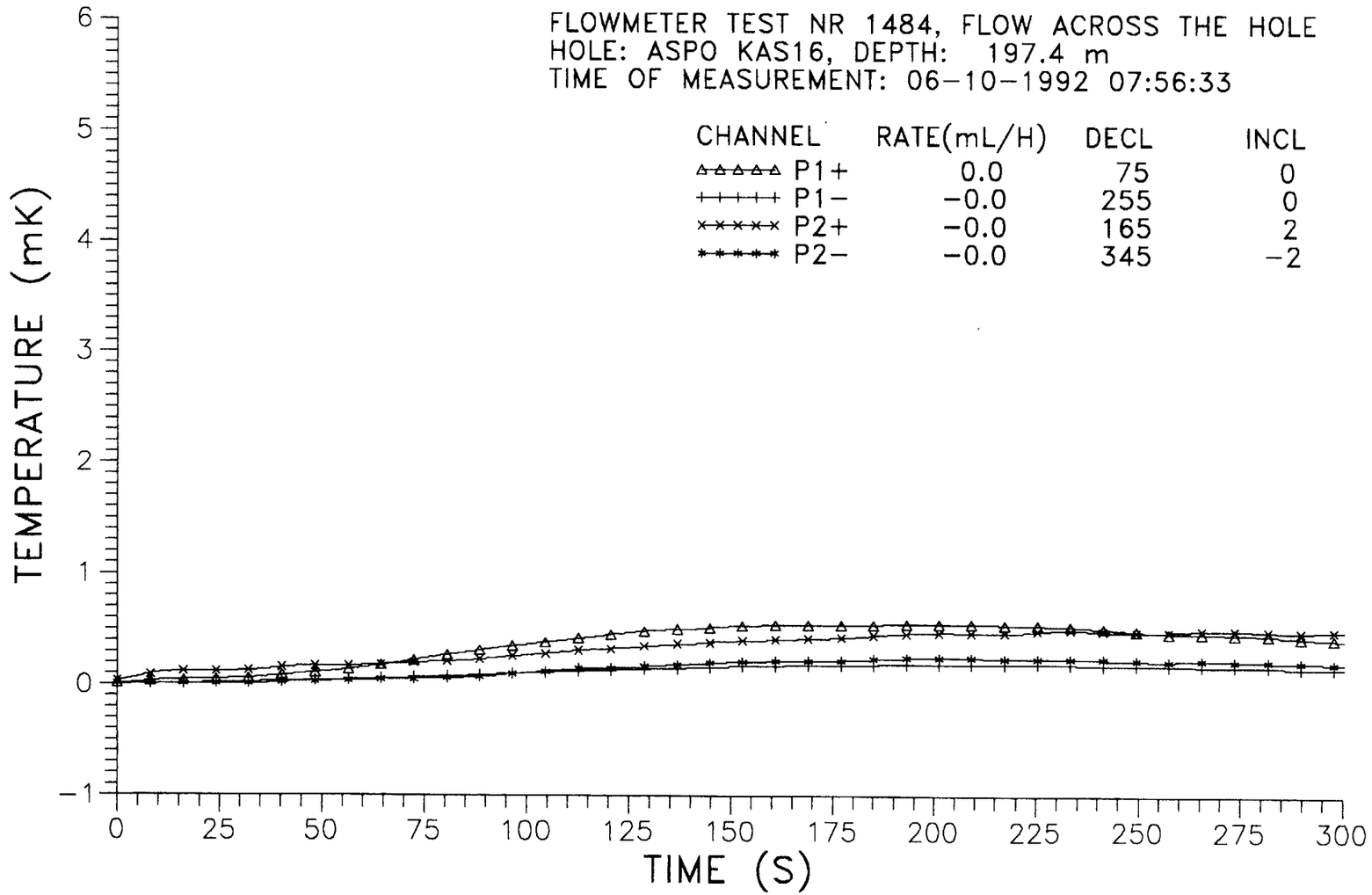

FLOWMETER TEST NR 1461, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 05-10-1992 11:46:00
CHANNEL RATE(mL/H) DECL INCL
P1+ 2.0 75 0
P1- -0.0 255 0
P2+ 0.2 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

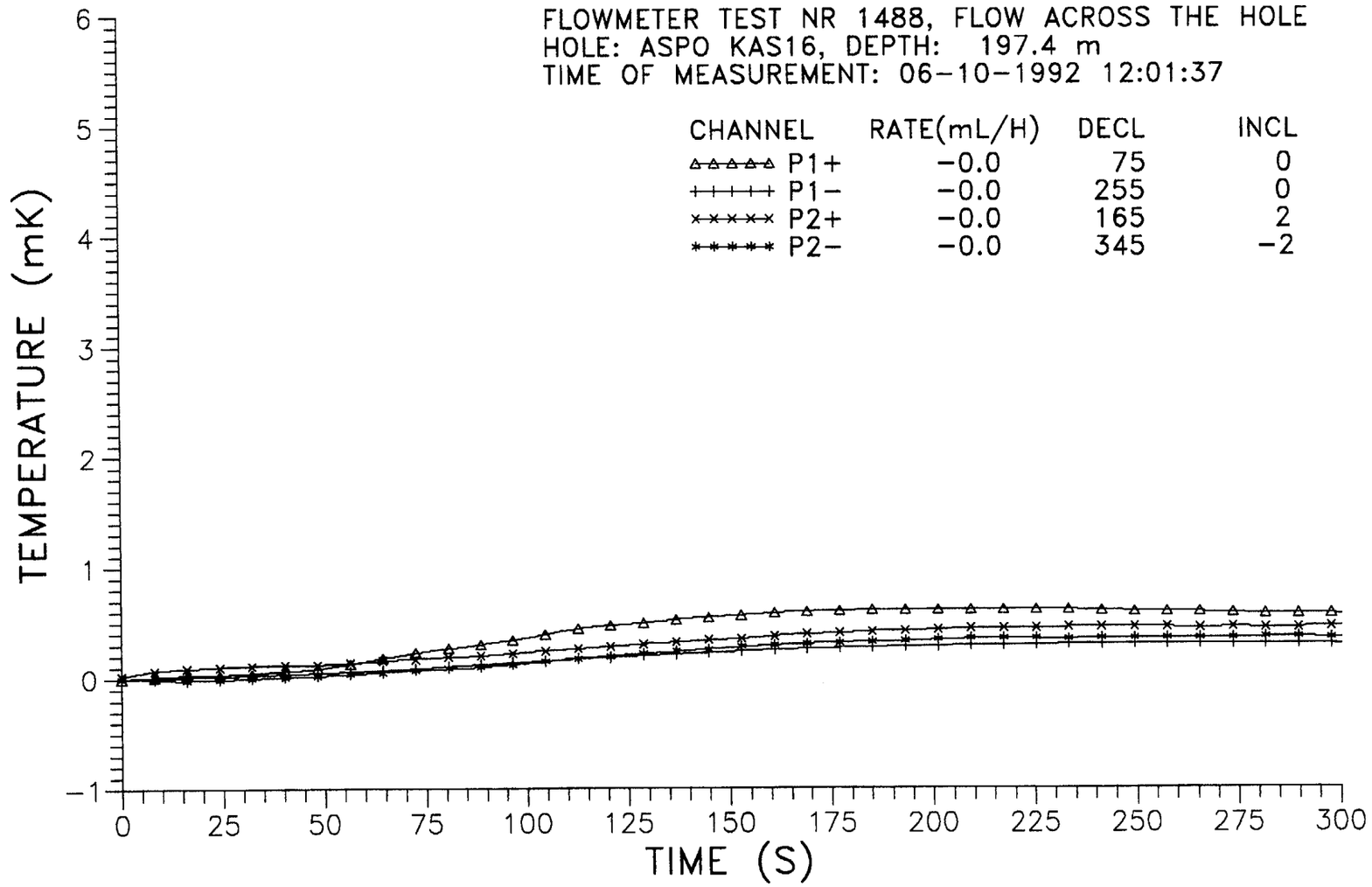

FLOWMETER TEST NR 1465, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 05-10-1992 15:31:49
CHANNEL RATE(mL/H) DECL INCL
P1+ 1.2 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

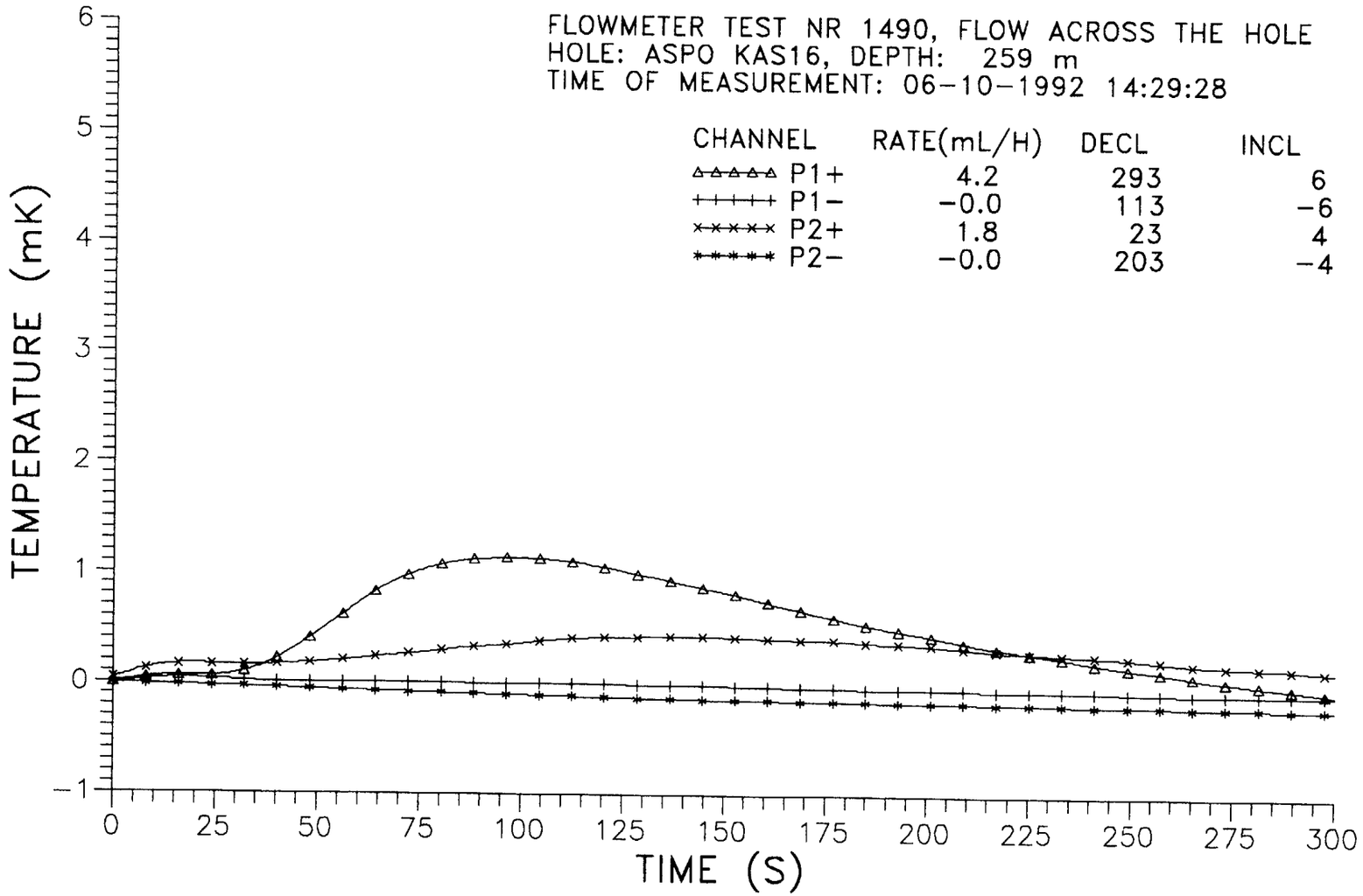

FLOWMETER TEST NR 1470, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 05-10-1992 19:41:40
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.2 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

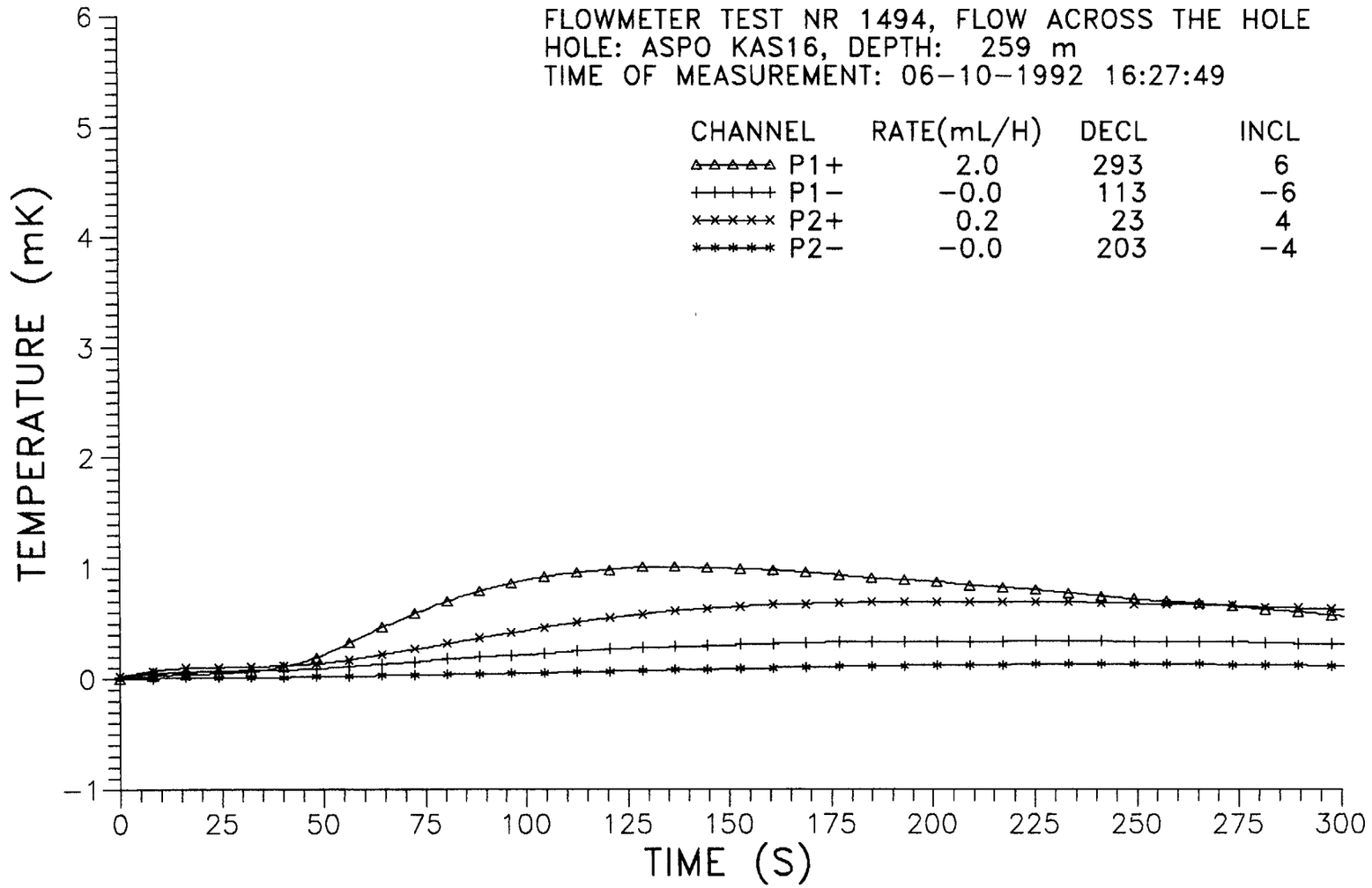

FLOWMETER TEST NR 1475, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 06-10-1992 00:00:51
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

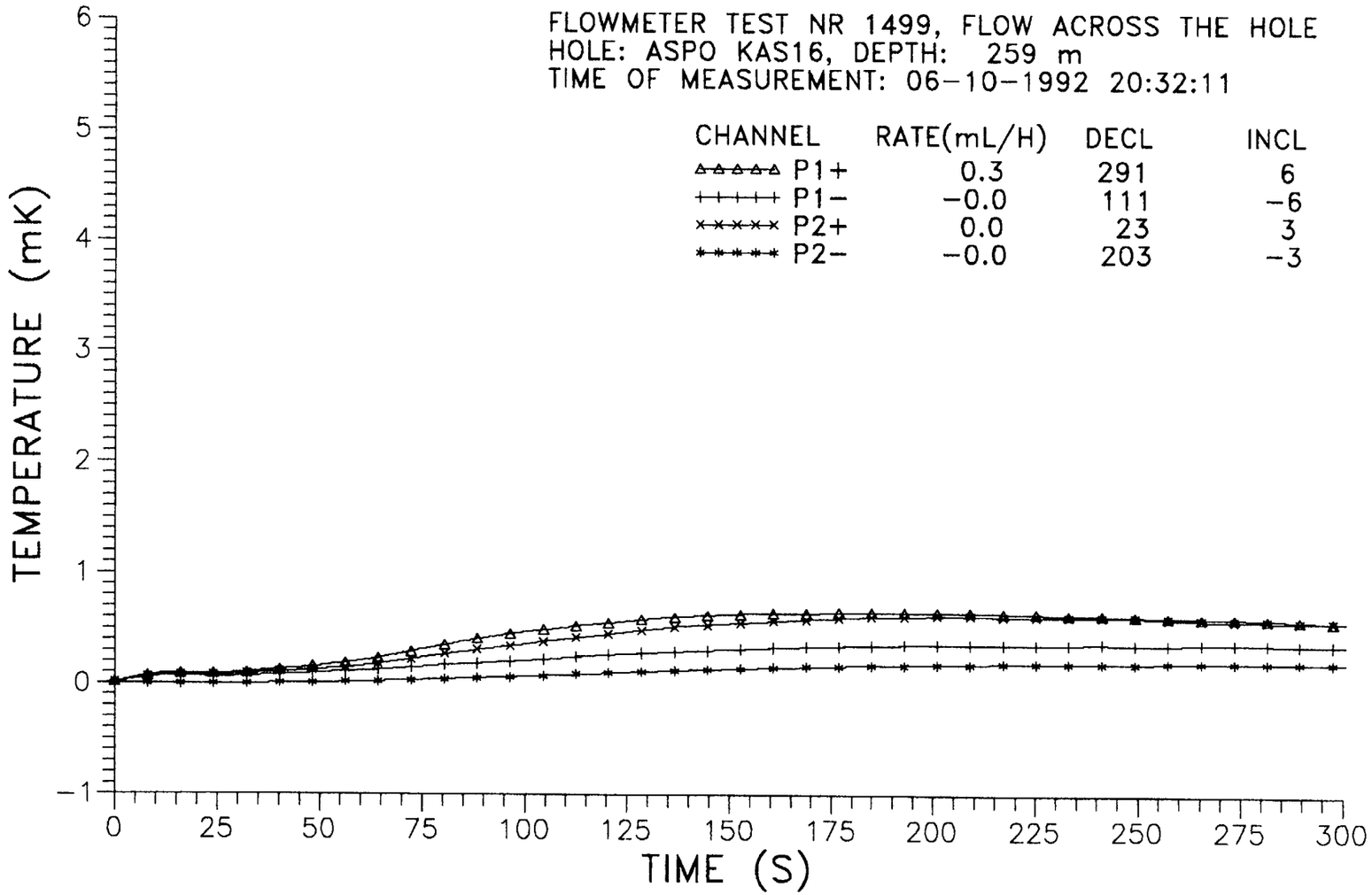

FLOWMETER TEST NR 1479, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 06-10-1992 04:02:43
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.0 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

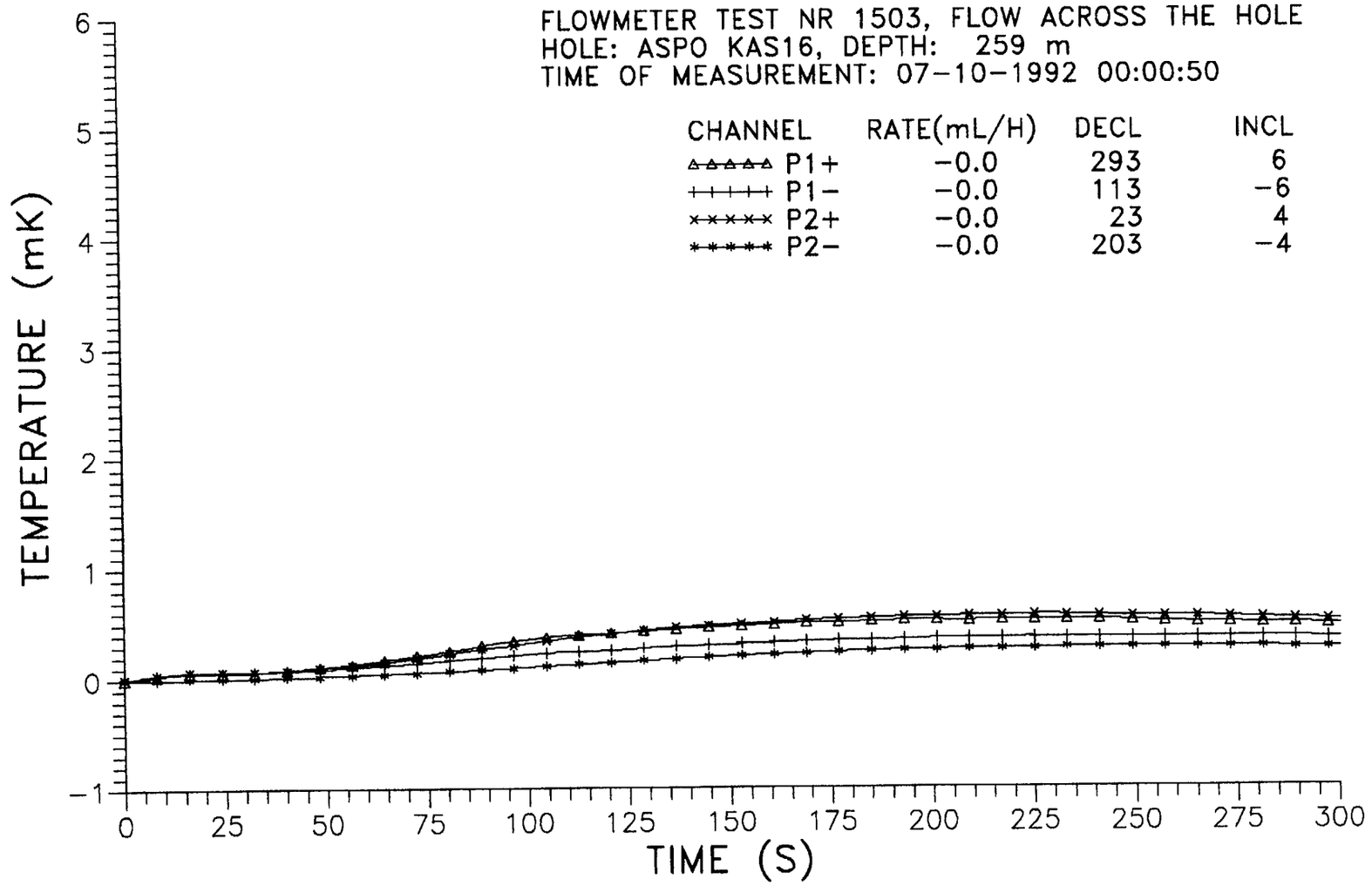

FLOWMETER TEST NR 1484, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 06-10-1992 07:56:33
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.0 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

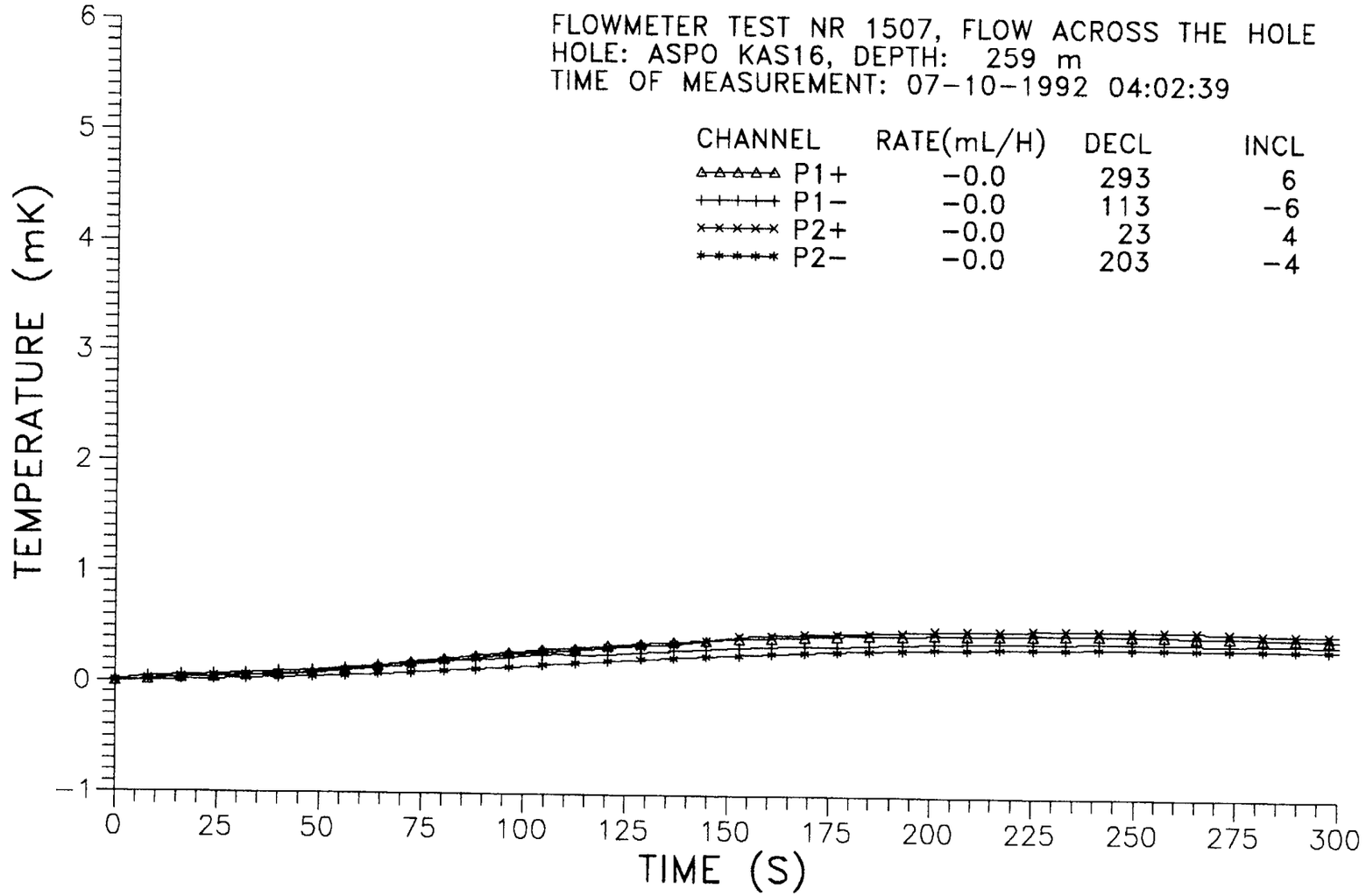

FLOWMETER TEST NR 1488, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 197.4 m
TIME OF MEASUREMENT: 06-10-1992 12:01:37
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 75 0
P1- -0.0 255 0
P2+ -0.0 165 2
P2- -0.0 345 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

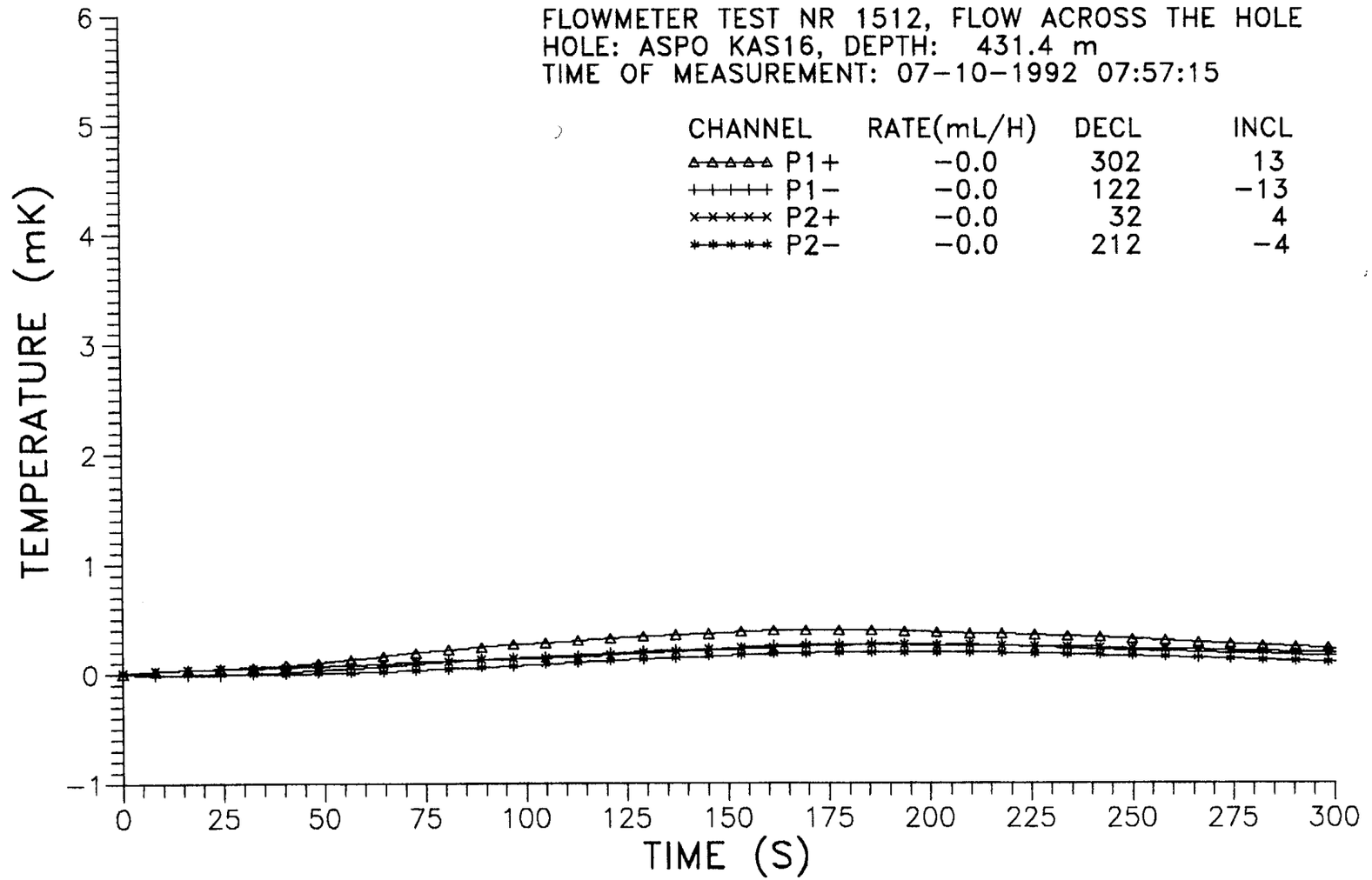

FLOWMETER TEST NR 1490, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 259 m
TIME OF MEASUREMENT: 06-10-1992 14:29:28
CHANNEL RATE(mL/H) DECL INCL
P1+ 4.2 293 6
P1- -0.0 113 -6
P2+ 1.8 23 4
P2- -0.0 203 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

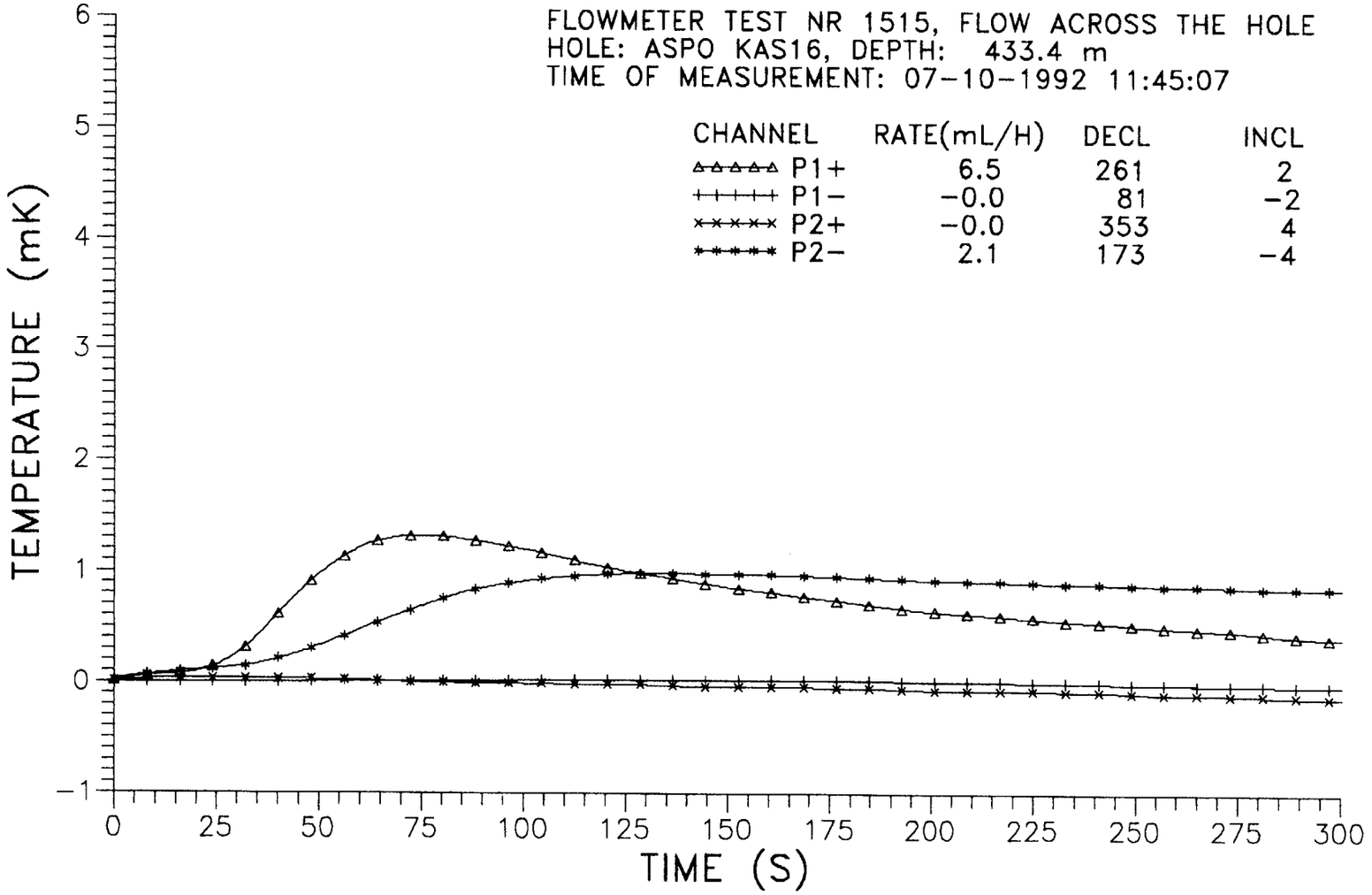

FLOWMETER TEST NR 1494, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 259 m
TIME OF MEASUREMENT: 06-10-1992 16:27:49
CHANNEL RATE(mL/H) DECL INCL
P1+ 2.0 293 6
P1- -0.0 113 -6
P2+ 0.2 23 4
P2- -0.0 203 -4
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

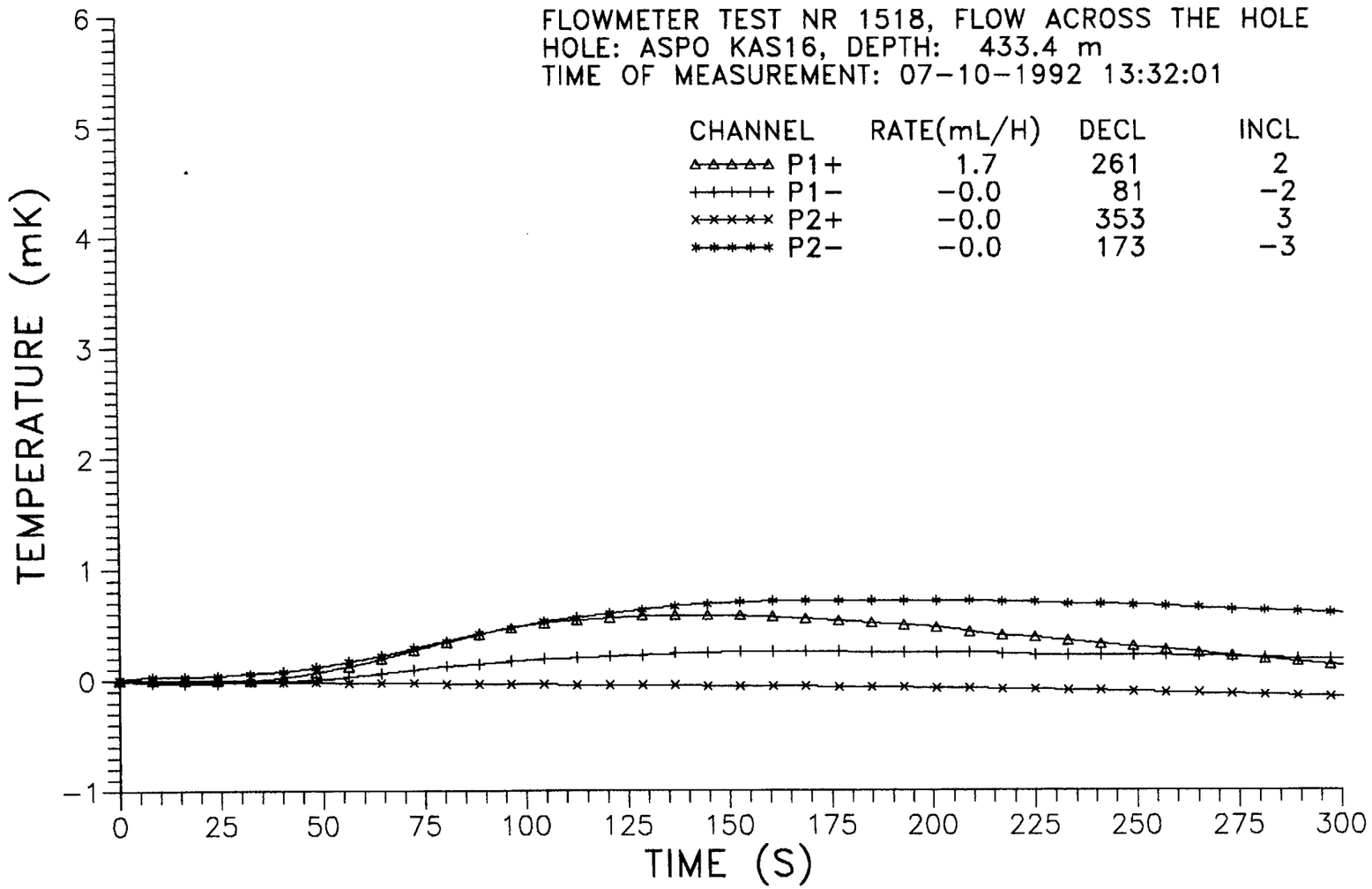

FLOWMETER TEST NR 1499, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 259 m
TIME OF MEASUREMENT: 06-10-1992 20:32:11
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.3 291 6
P1- -0.0 111 -6
P2+ 0.0 23 3
P2- -0.0 203 -3
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

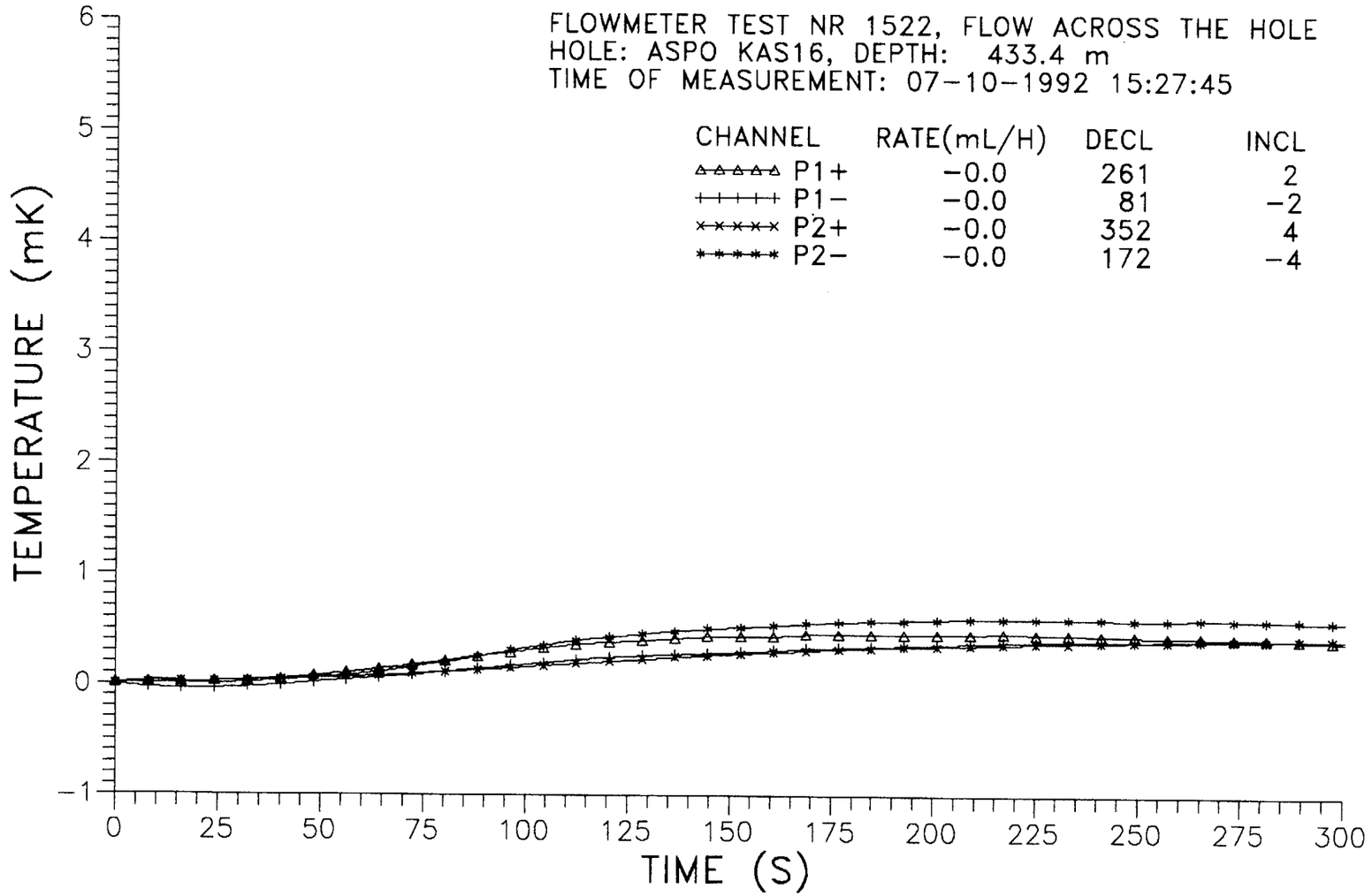

FLOWMETER TEST NR 1503, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 259 m
TIME OF MEASUREMENT: 07-10-1992 00:00:50
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 293 6
P1- -0.0 113 -6
P2+ -0.0 23 4
P2- -0.0 203 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

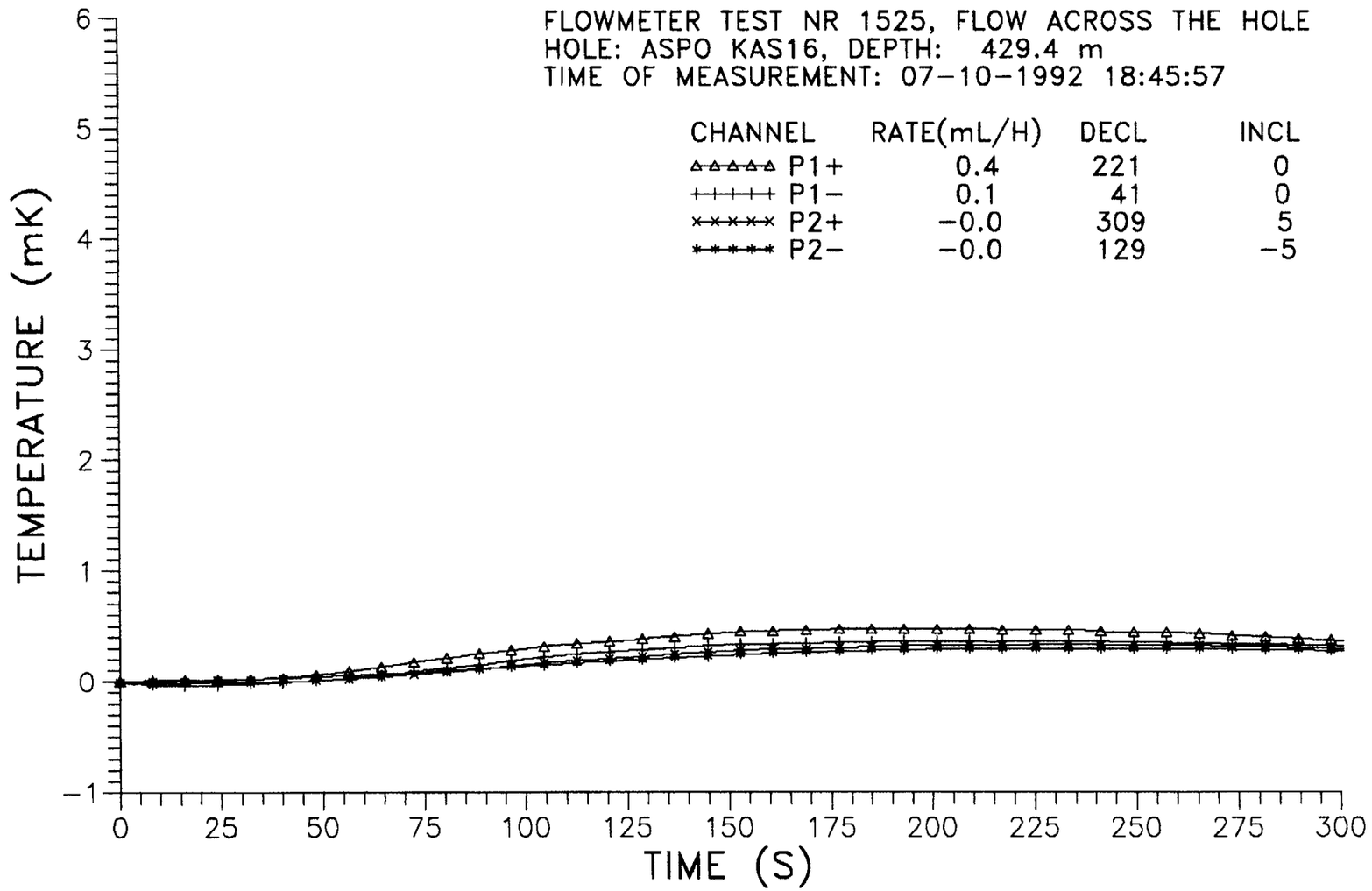

FLOWMETER TEST NR 1507, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 259 m
TIME OF MEASUREMENT: 07-10-1992 04:02:39
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 293 6
P1- -0.0 113 -6
P2+ -0.0 23 4
P2- -0.0 203 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

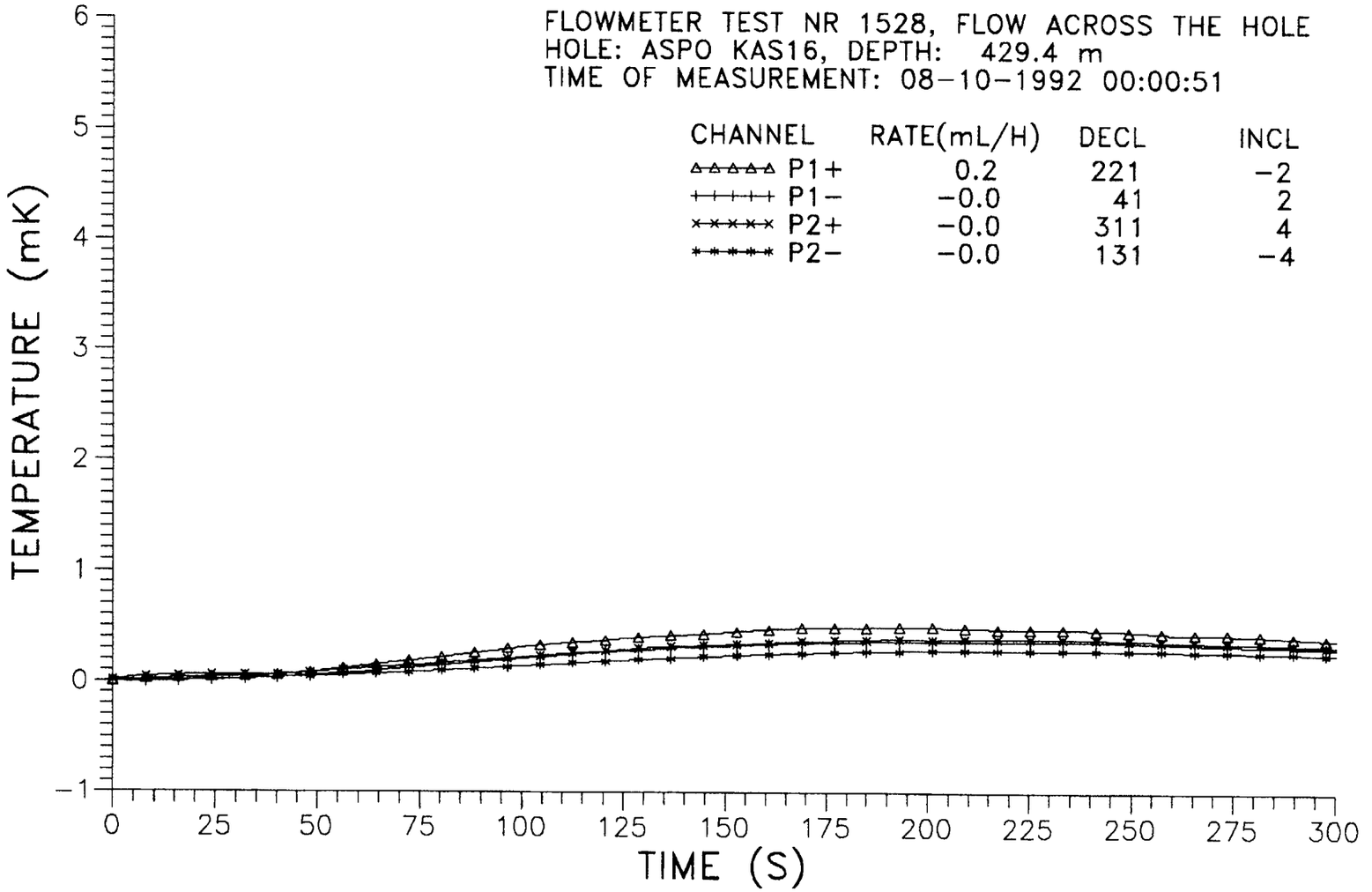

FLOWMETER TEST NR 1512, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 431.4 m
TIME OF MEASUREMENT: 07-10-1992 07:57:15
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 302 13
P1- -0.0 122 -13
P2+ -0.0 32 4
P2- -0.0 212 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300
TIME (S)

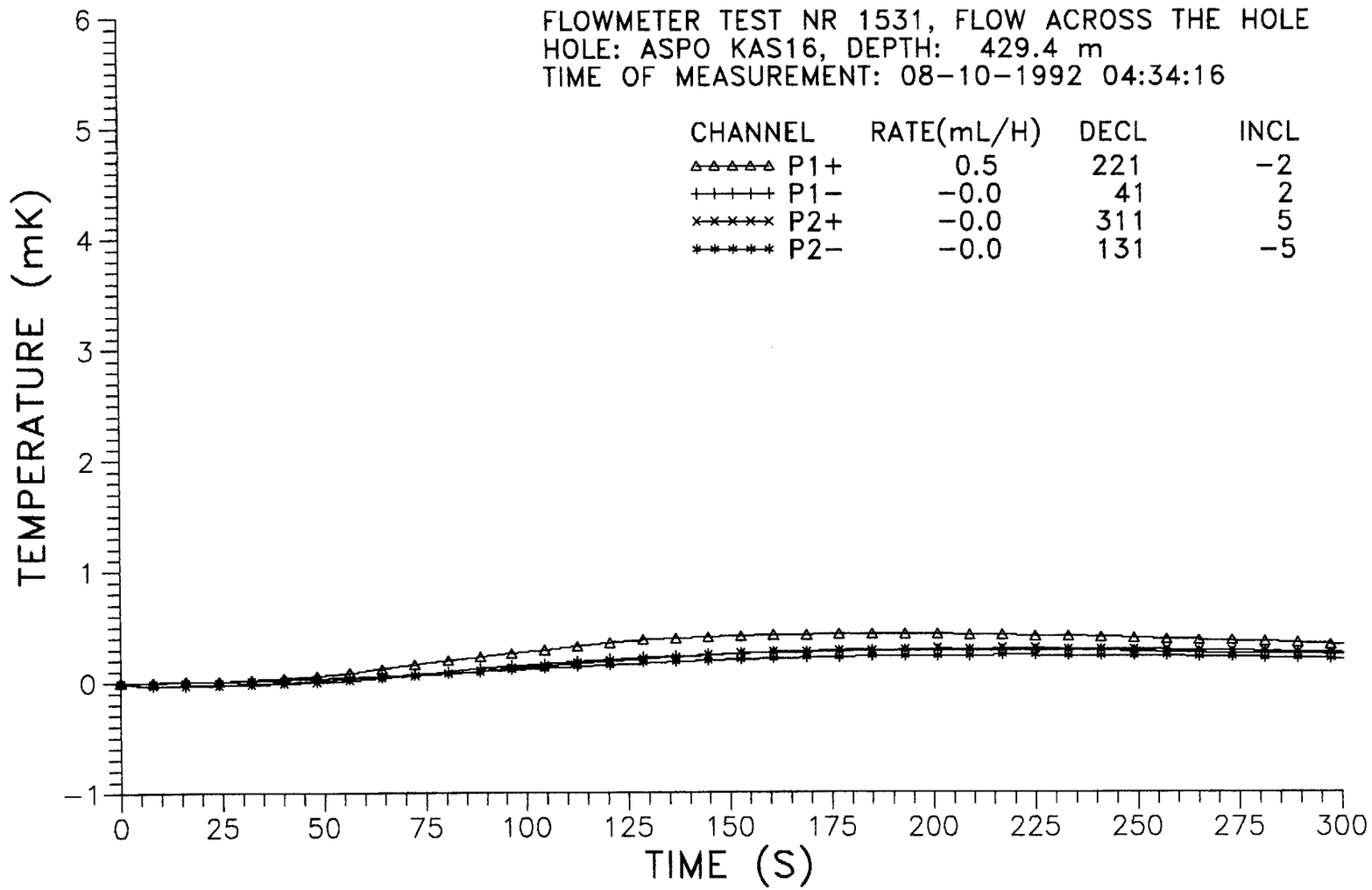

FLOWMETER TEST NR 1515, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 433.4 m
TIME OF MEASUREMENT: 07-10-1992 11:45:07
CHANNEL RATE(mL/H) DECL INCL
P1+ 6.5 261 2
P1- -0.0 81 -2
P2+ -0.0 353 4
P2- 2.1 173 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

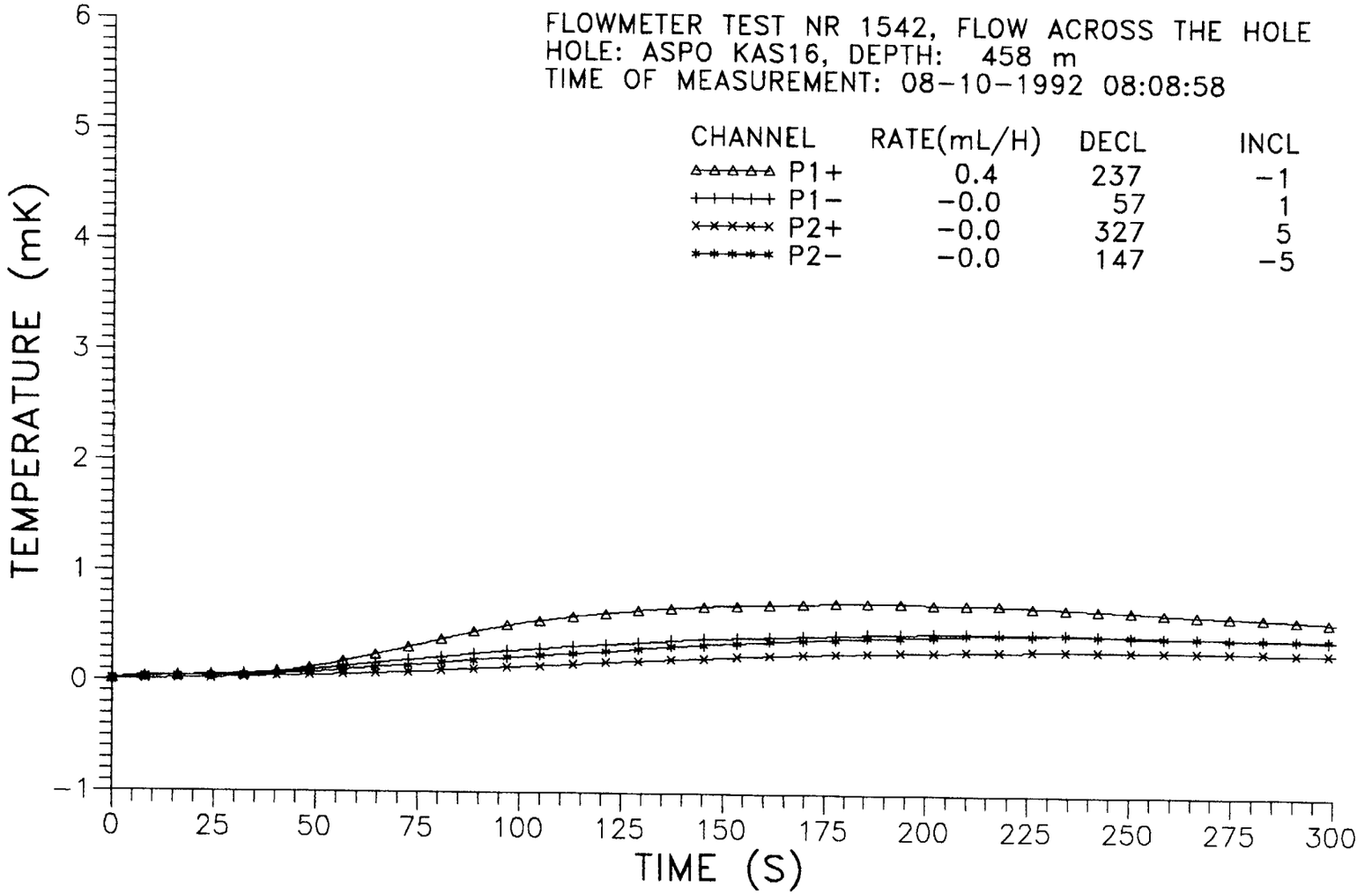

FLOWMETER TEST NR 1518, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 433.4 m
TIME OF MEASUREMENT: 07-10-1992 13:32:01
CHANNEL RATE(mL/H) DECL INCL
P1+ 1.7 261 2
P1- -0.0 81 -2
P2+ -0.0 353 3
P2- -0.0 173 -3
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

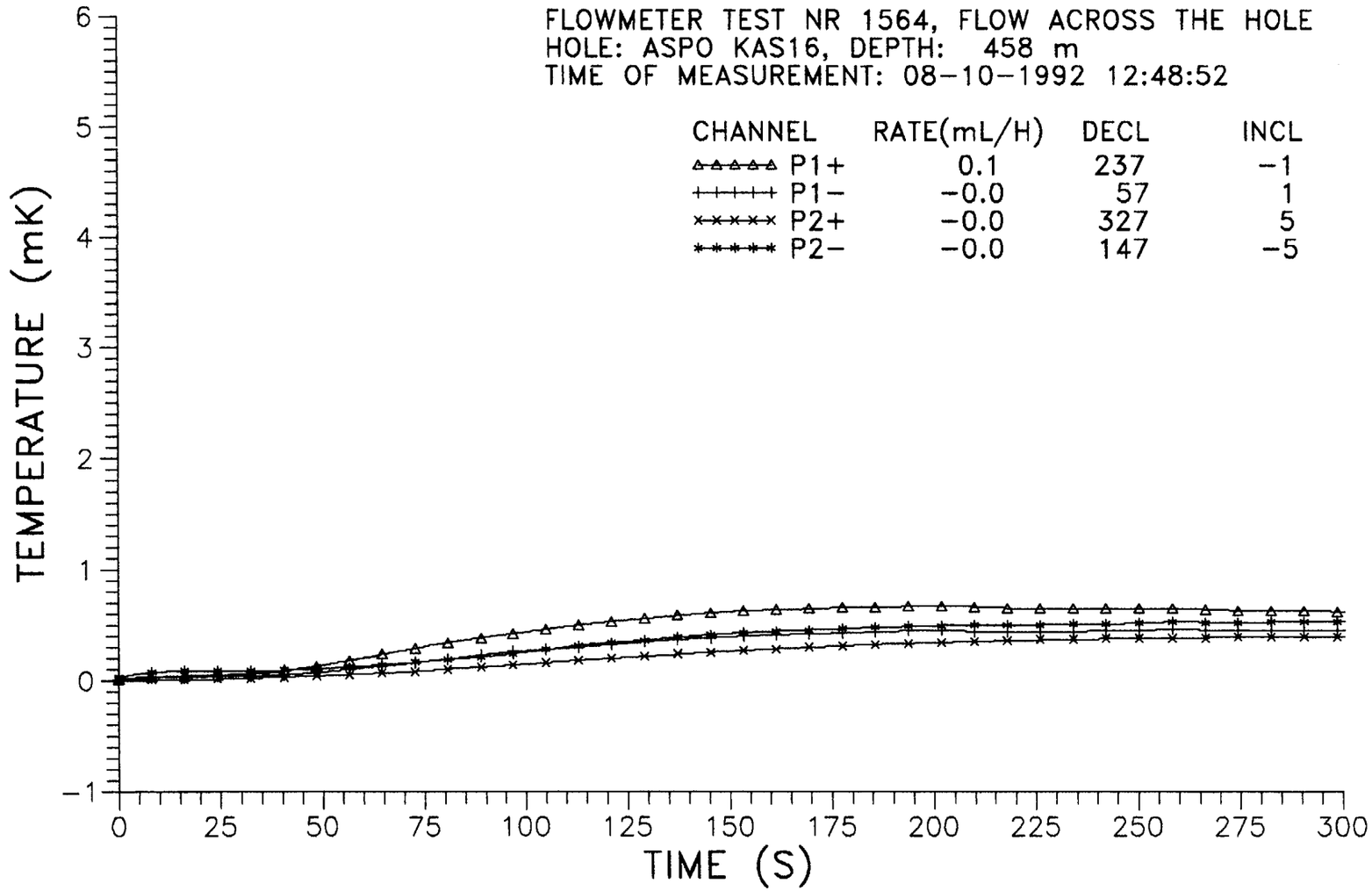

FLOWMETER TEST NR 1522, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 433.4 m
TIME OF MEASUREMENT: 07-10-1992 15:27:45
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 261 2
P1- -0.0 81 -2
P2+ -0.0 352 4
P2- -0.0 172 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

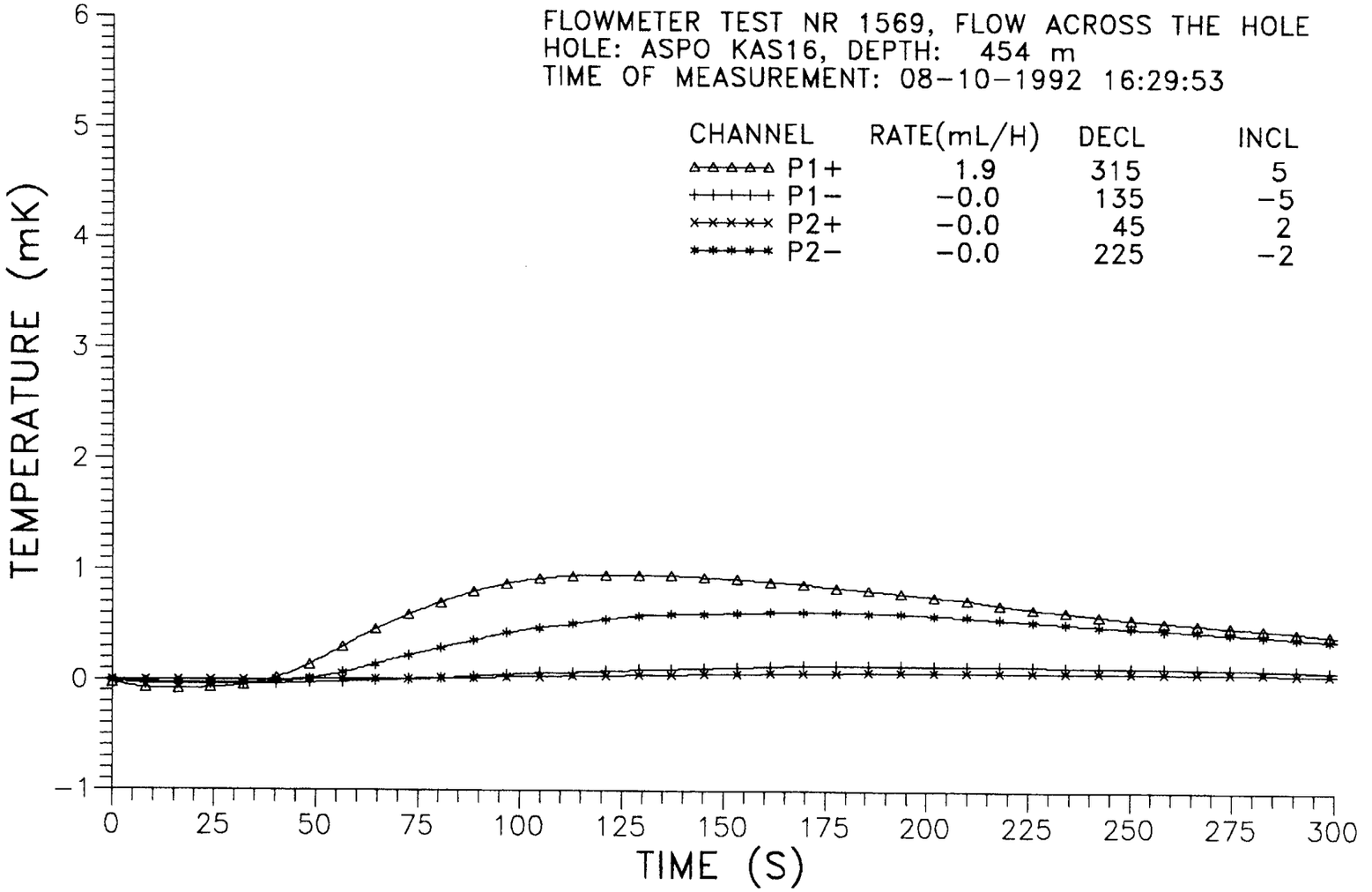

FLOWMETER TEST NR 1525, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 429.4 m
TIME OF MEASUREMENT: 07-10-1992 18:45:57
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.4 221 0
P1- 0.1 41 0
P2+ -0.0 309 5
P2- -0.0 129 -5
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

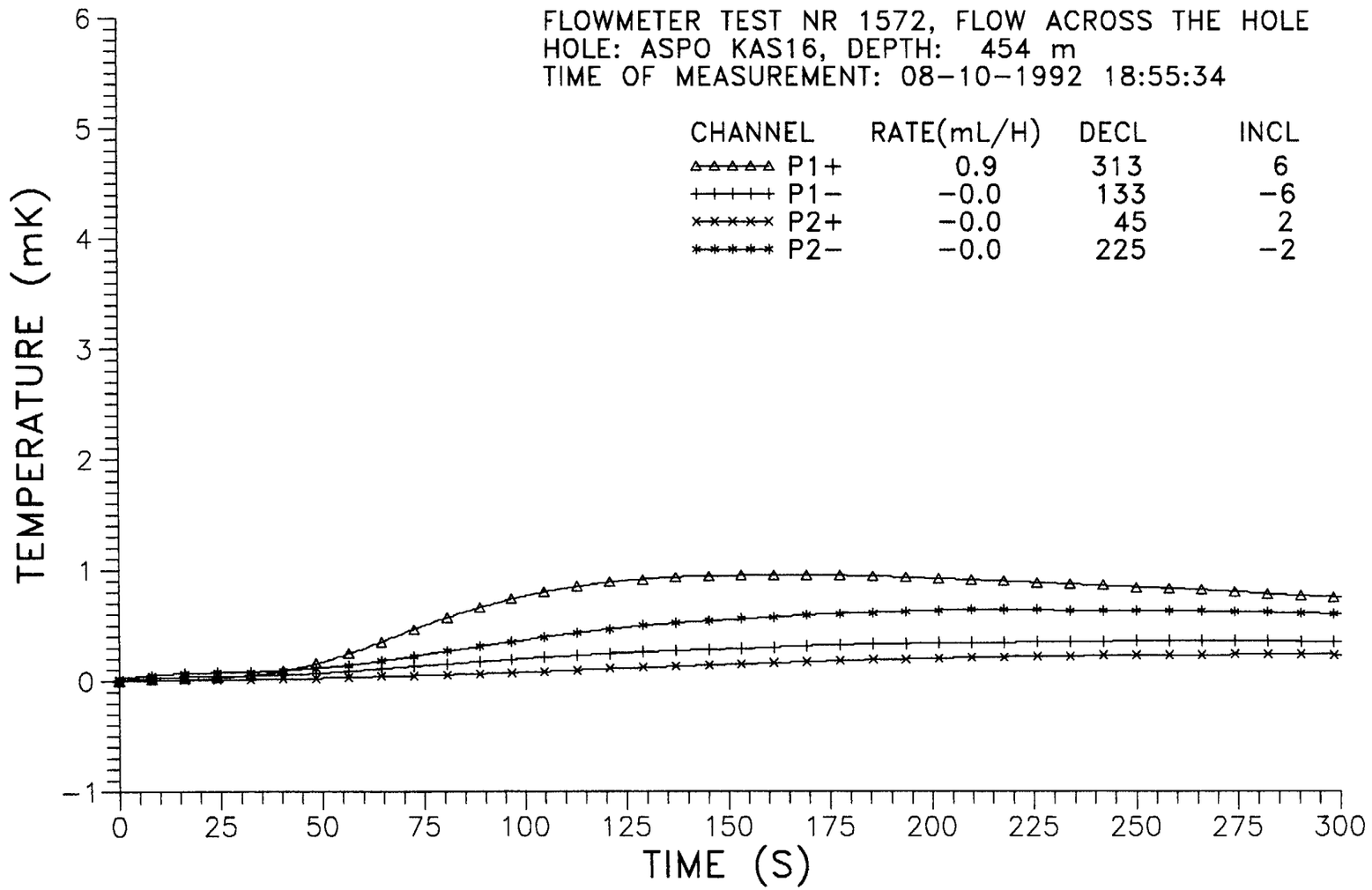

FLOWMETER TEST NR 1528, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 429.4 m
TIME OF MEASUREMENT: 08-10-1992 00:00:51
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.2 221 -2
P1- -0.0 41 2
P2+ -0.0 311 4
P2- -0.0 131 -4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

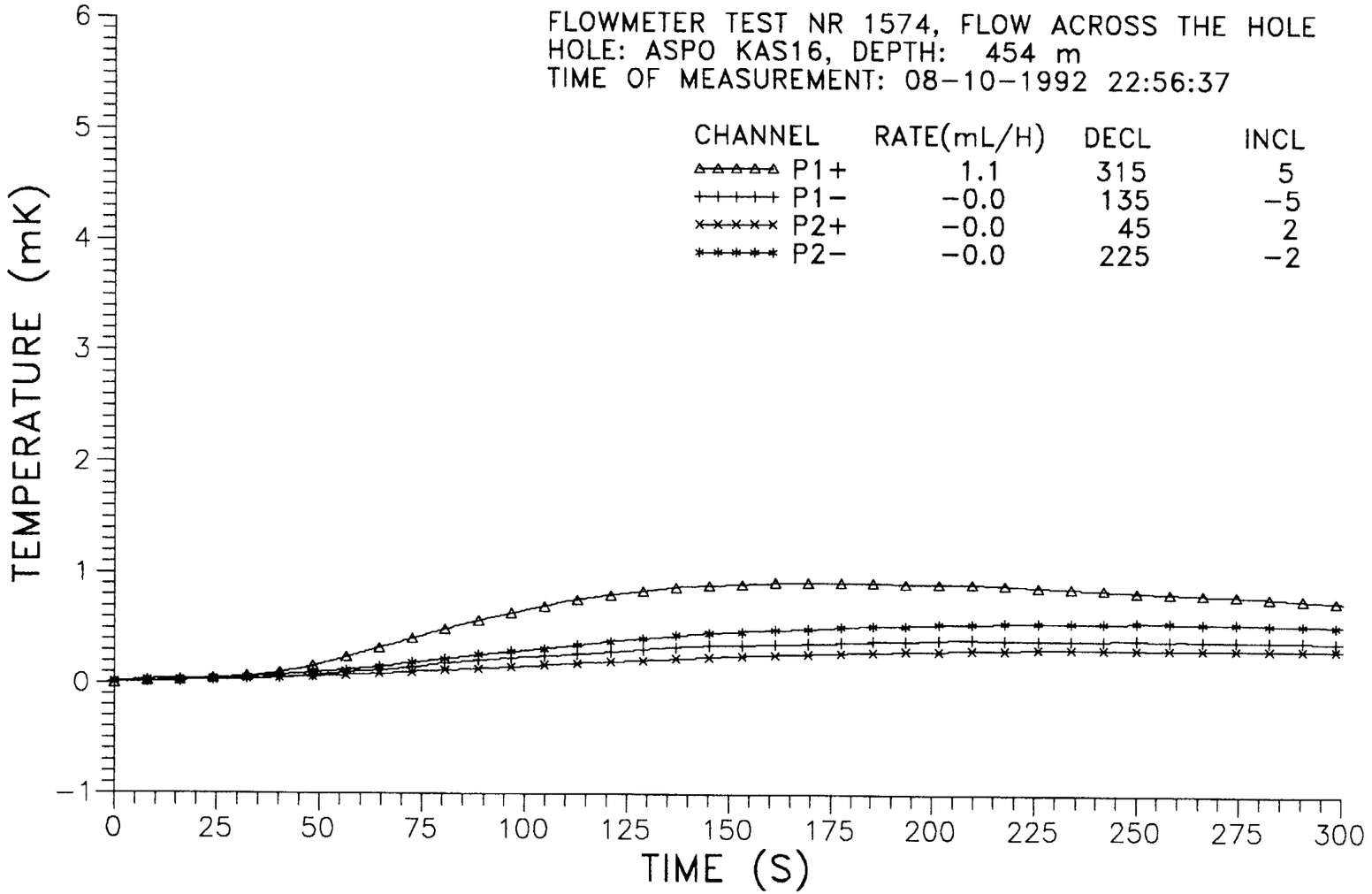

FLOWMETER TEST NR 1531, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 429.4 m
TIME OF MEASUREMENT: 08-10-1992 04:34:16
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.5 221 -2
P1- -0.0 41 2
P2+ -0.0 311 5
P2- -0.0 131 -5
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

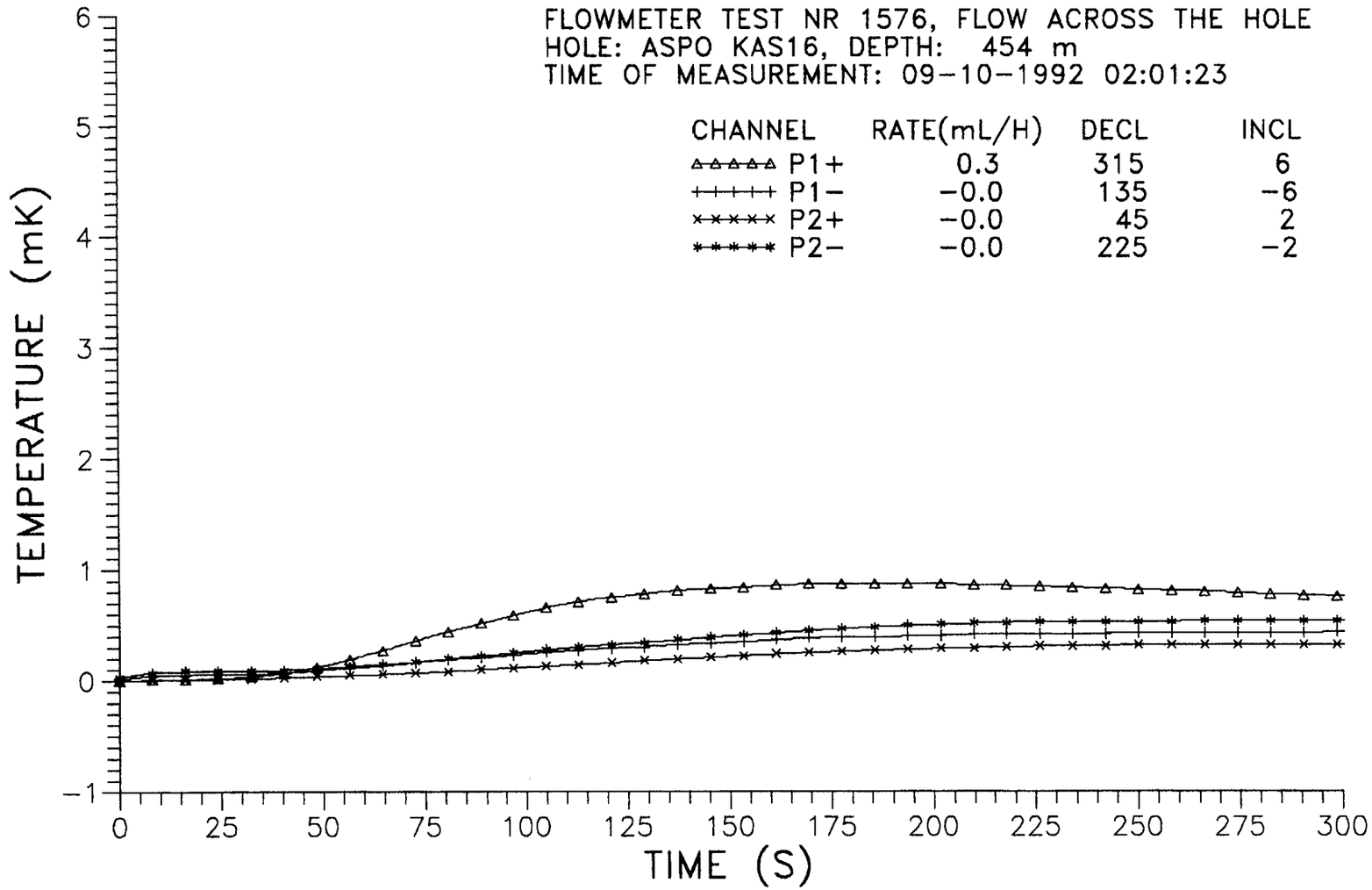

FLOWMETER TEST NR 1542, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 458 m
TIME OF MEASUREMENT: 08-10-1992 08:08:58
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.4 237 -1
P1- -0.0 57 1
P2+ -0.0 327 5
P2- -0.0 147 -5
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

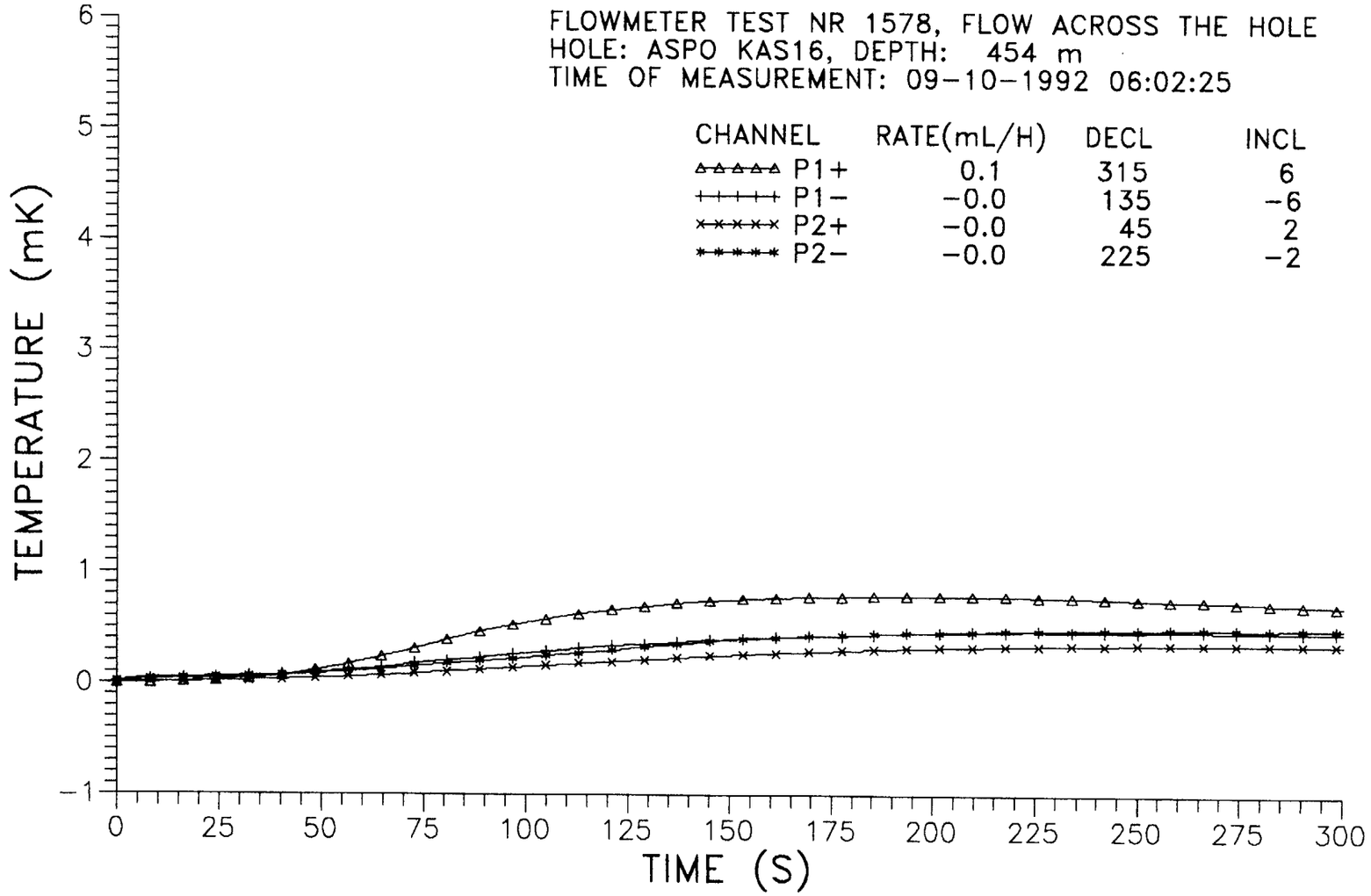

FLOWMETER TEST NR 1564, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 458 m
TIME OF MEASUREMENT: 08-10-1992 12:48:52
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.1 237 -1
P1- -0.0 57 1
P2+ -0.0 327 5
P2- -0.0 147 -5
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

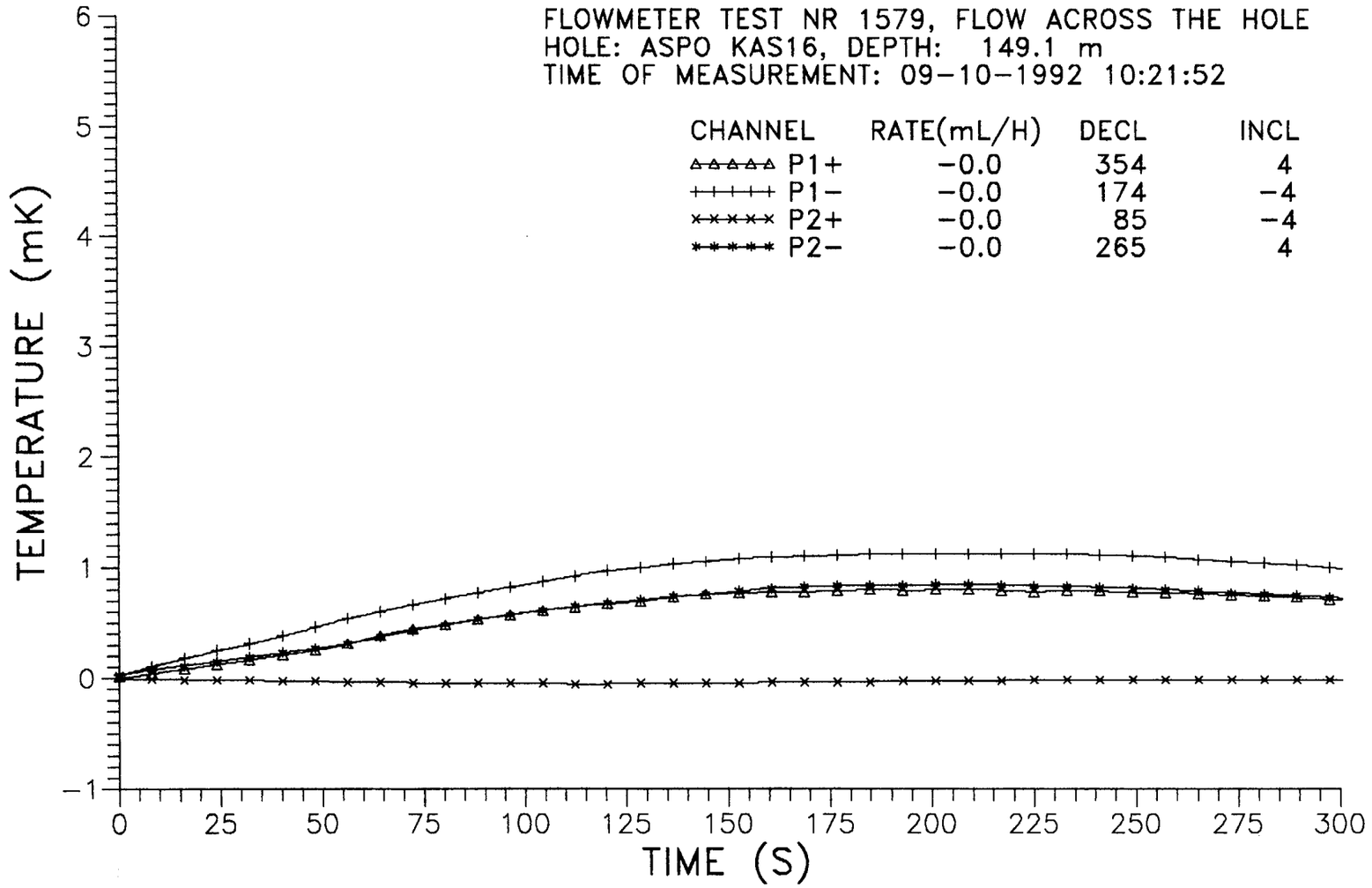

FLOWMETER TEST NR 1569, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 454 m
TIME OF MEASUREMENT: 08-10-1992 16:29:53
CHANNEL RATE(mL/H) DECL INCL
P1+ 1.9 315 5
P1- -0.0 135 -5
P2+ -0.0 45 2
P2- -0.0 225 -2
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

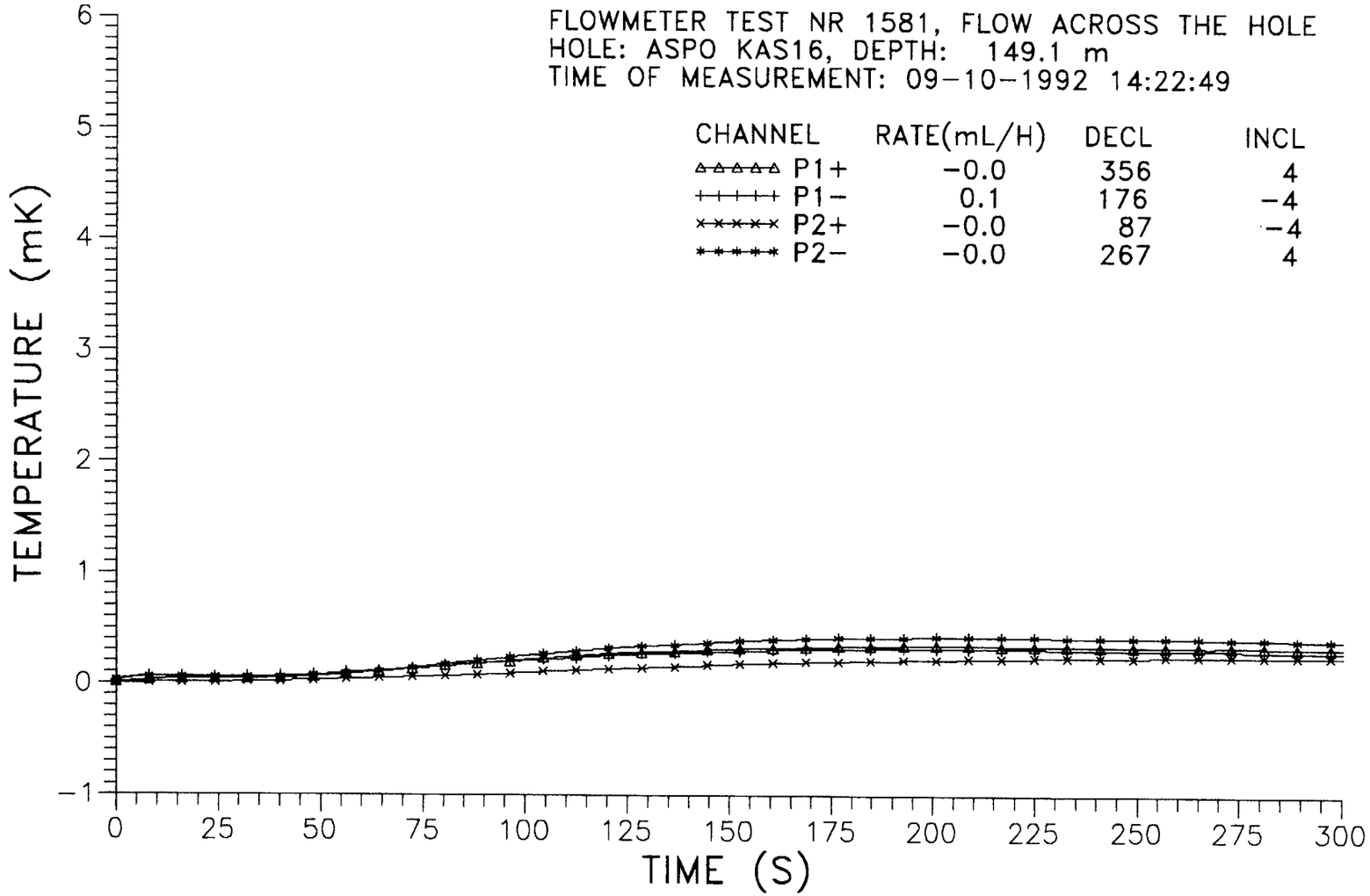

FLOWMETER TEST NR 1572, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 454 m
TIME OF MEASUREMENT: 08-10-1992 18:55:34
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.9 313 6
P1- -0.0 133 -6
P2+ -0.0 45 2
P2- -0.0 225 -2
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

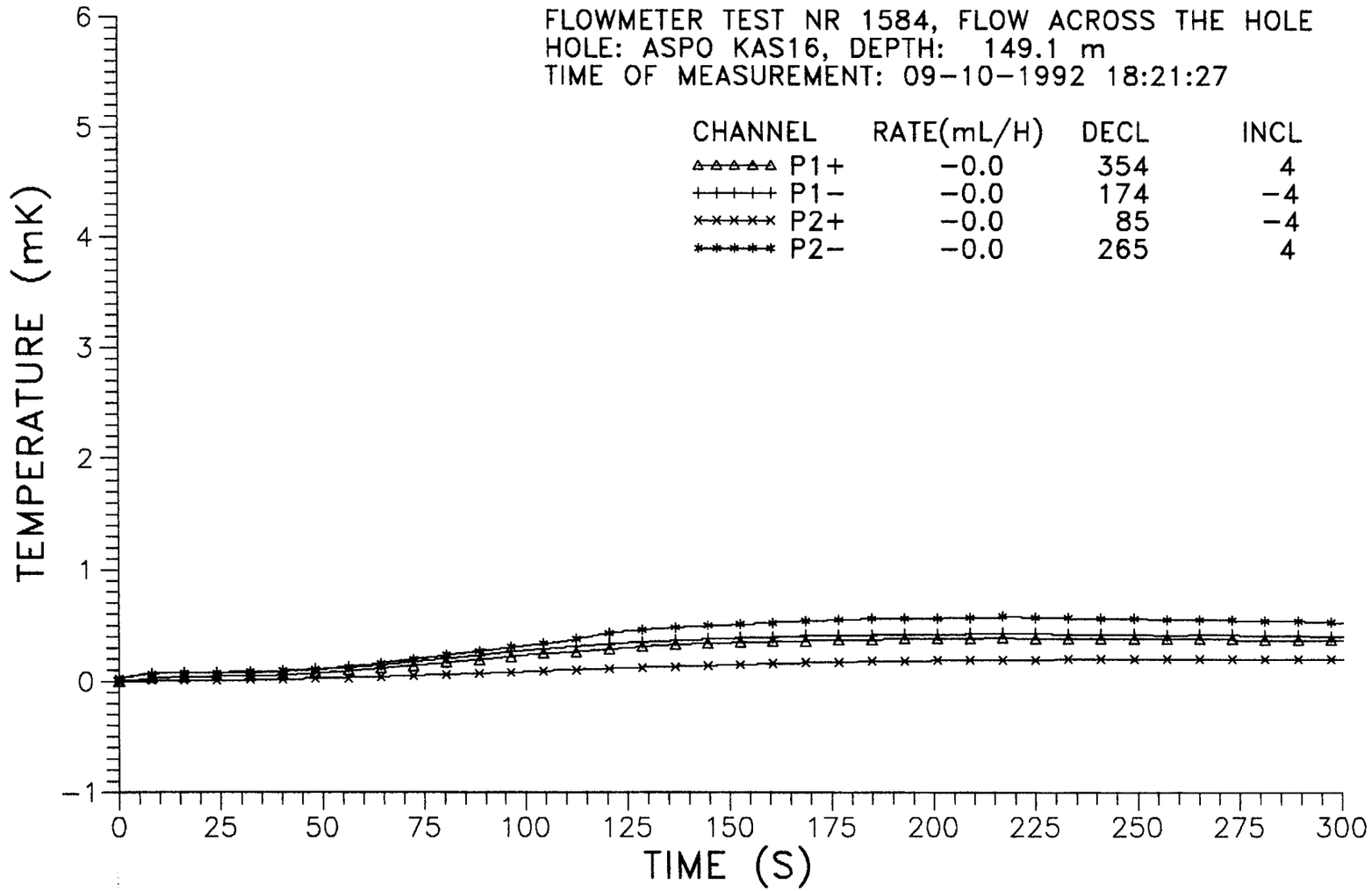

FLOWMETER TEST NR 1574, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 454 m
TIME OF MEASUREMENT: 08-10-1992 22:56:37
CHANNEL RATE(mL/H) DECL INCL
P1+ 1.1 315 5
P1- -0.0 135 -5
P2+ -0.0 45 2
P2- -0.0 225 -2
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

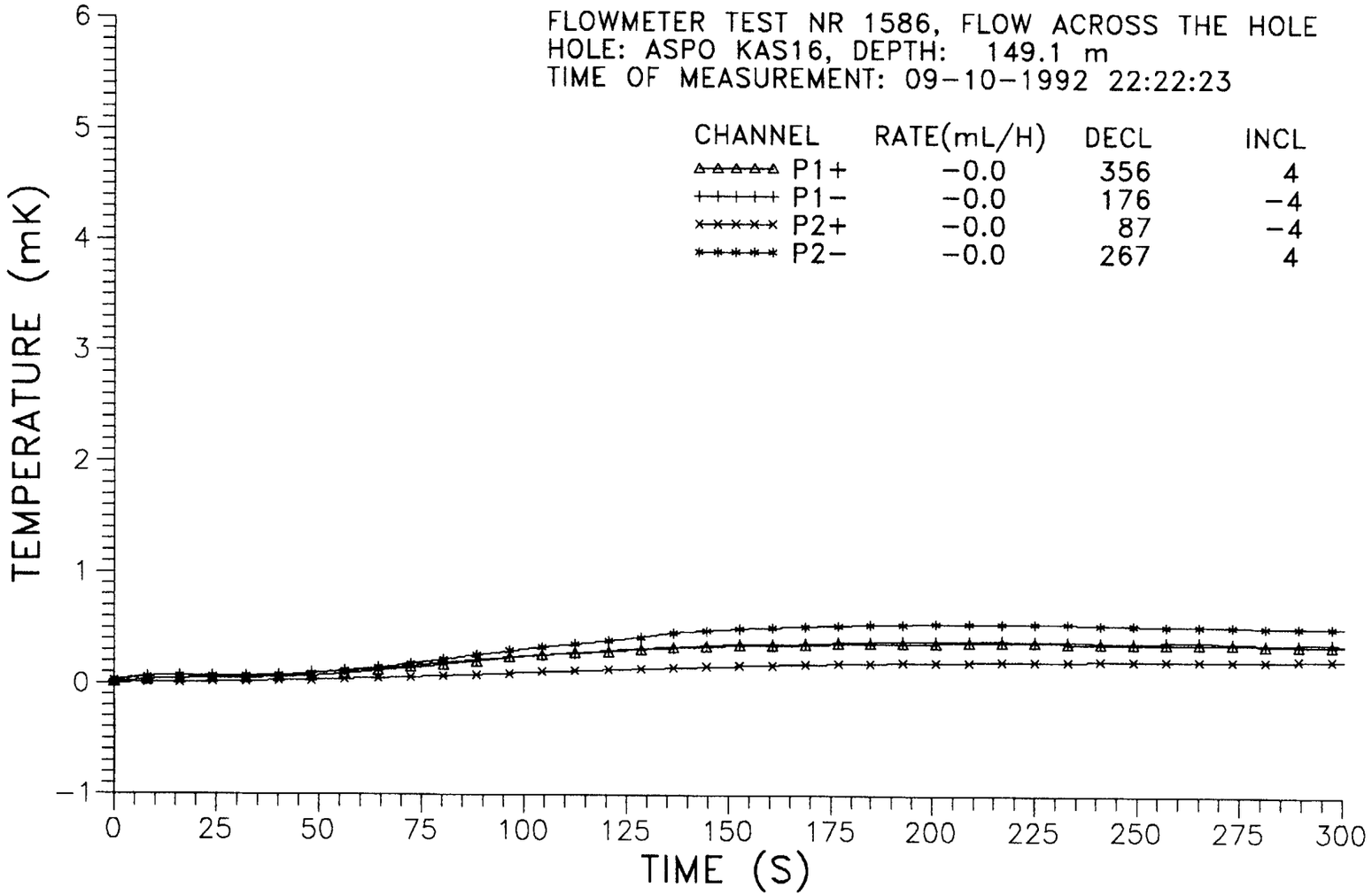

FLOWMETER TEST NR 1576, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 454 m
TIME OF MEASUREMENT: 09-10-1992 02:01:23
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.3 315 6
P1- -0.0 135 -6
P2+ -0.0 45 2
P2- -0.0 225 -2
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

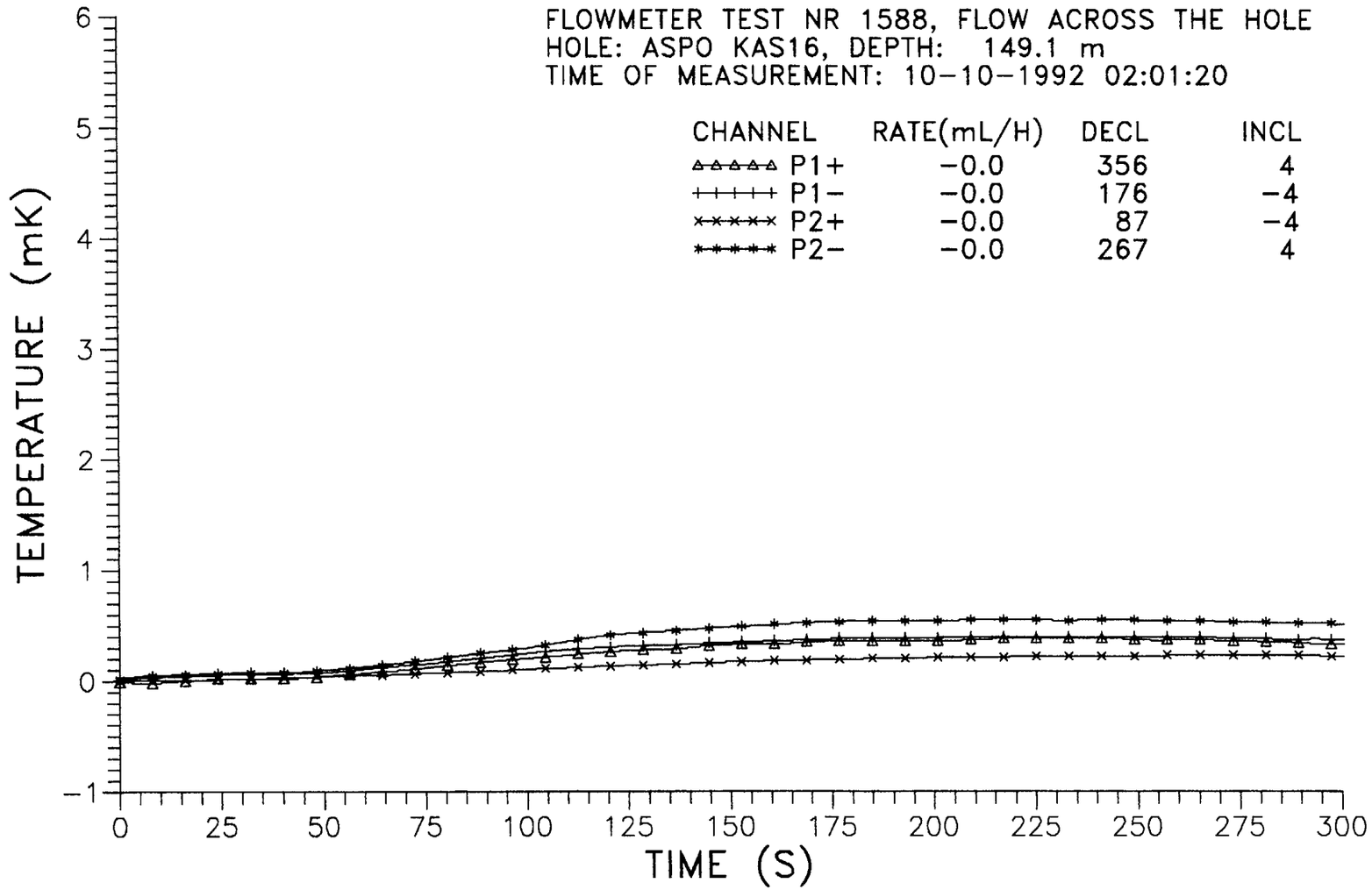

FLOWMETER TEST NR 1578, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 454 m
TIME OF MEASUREMENT: 09-10-1992 06:02:25
CHANNEL RATE(mL/H) DECL INCL
P1+ 0.1 315 6
P1- -0.0 135 -6
P2+ -0.0 45 2
P2- -0.0 225 -2
TEMPERATURE (mK)
TIME (S)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300

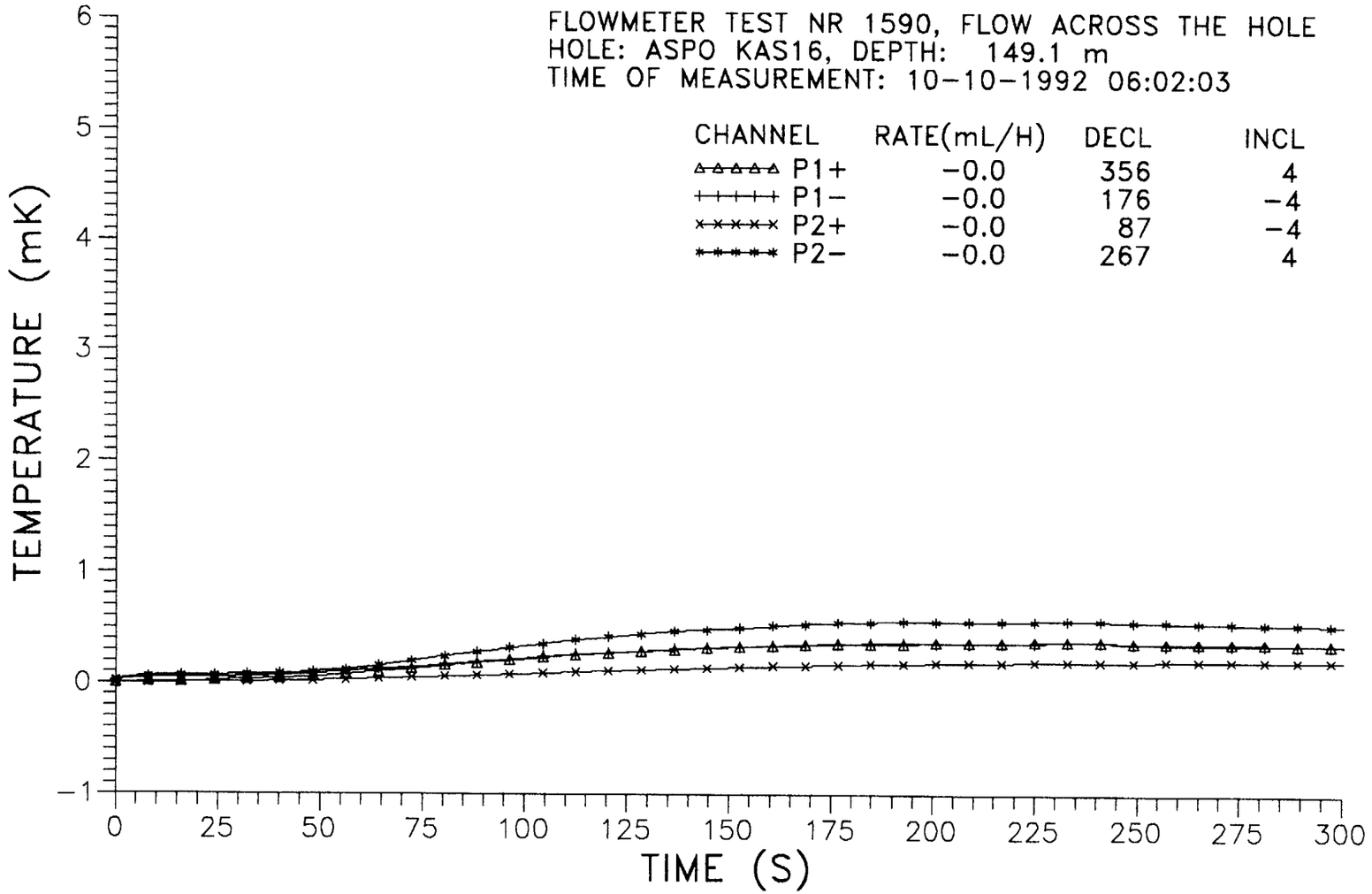

FLOWMETER TEST NR 1579, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 09-10-1992 10:21:52
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 354 4
P1- -0.0 174 -4
P2+ -0.0 85 -4
P2- -0.0 265 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)


FLOWMETER TEST NR 1581, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 09-10-1992 14:22:49
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 356 4
P1- 0.1 176 -4
P2+ -0.0 87 -4
P2- -0.0 267 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)


FLOWMETER TEST NR 1584, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 09-10-1992 18:21:27
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 354 4
P1- -0.0 174 -4
P2+ -0.0 85 -4
P2- -0.0 265 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)


FLOWMETER TEST NR 1586, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 09-10-1992 22:22:23
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 356 4
P1- -0.0 176 -4
P2+ -0.0 87 -4
P2- -0.0 267 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)


FLOWMETER TEST NR 1588, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 10-10-1992 02:01:20
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 356 4
P1- -0.0 176 -4
P2+ -0.0 87 -4
P2- -0.0 267 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0
25
50
75
100
125
150
175
200
225
250
275
300
TIME (S)


FLOWMETER TEST NR 1590, FLOW ACROSS THE HOLE
HOLE: ASPO KAS16, DEPTH: 149.1 m
TIME OF MEASUREMENT: 10-10-1992 06:02:03
CHANNEL RATE(mL/H) DECL INCL
P1+ -0.0 356 4
P1- -0.0 176 -4
P2+ -0.0 87 -4
P2- -0.0 267 4
TEMPERATURE (mK)
6
5
4
3
2
1
0
-1
0 25 50 75 100 125 150 175 200 225 250 275 300
TIME (S)

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ICR 93-01
Flowmeter measurement in borehole KAS 16
P Rouhiainen
June 1993
Supported by TVO, Finland

ISSN 1104-3210
ISRN SKB-ICR--93/1--SE

CM GRUPPEN, Bromma 1994