



HSE

**Health & Safety
Executive**

**OFFSHORE TECHNOLOGY
REPORT - OTO 98 105**

**A Study of the Repeatability of
Explosion Tests
Preliminary Data Report for Test 9**

Explosions in Full Scale Offshore Module Geometries

Health & Safety Executive Contract MaTSU 8847/3522

Preliminary Data Report for Test 9

Summary of Experimental Conditions	
Date	22nd July 1997
Time	14:02
Test Series	C
Confinement Configuration	C2
Obstacle Configuration	O1
Ignition Position	(X:9.0, Y:11.6, Z:0.4)
Mean Equivalence Ratio	1.07
Water Sprays	None
Polythene Cut	Yes

All data contained in this preliminary report is subject to final confirmation.

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Table 1: Flame Arrival Times

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-1	0.5	0.5	2.0	626.1
IP-2	6.0	0.5	2.0	663.7
IP-3	10.0	0.5	2.0	662.0
IP-4	14.0	0.5	2.0	664.2
IP-5	18.0	0.5	2.0	652.4
IP-6	22.0	0.5	2.0	653.3
IP-7	27.5	0.5	2.0	661.4
IP-8	0.5	4.0	2.0	618.6
IP-9	6.0	4.0	2.0	658.7
IP-10	14.0	4.0	2.0	652.8
IP-11	22.0	4.0	2.0	660.8
IP-12	27.5	4.0	2.0	658.3
IP-13	0.5	8.0	2.0	602.0
IP-14	6.0	8.0	2.0	553.3
IP-15	10.0	8.0	2.0	523.5
IP-16	14.0	8.0	2.0	573.5
IP-17	18.0	8.0	2.0	620.5
IP-18	22.0	8.0	2.0	633.0
IP-19	27.5	8.0	2.0	652.5
IP-20	0.5	11.5	2.0	591.6
IP-21	2.0	11.5	2.0	569.5
IP-22	6.0	11.5	2.0	476.9
IP-23	10.0	11.5	2.0	354.9
IP-24	14.0	11.5	2.0	514.8
IP-25	18.0	11.5	2.0	592.9
IP-26	22.0	11.5	2.0	619.7
IP-27	26.0	11.5	2.0	642.7
IP-28	27.5	11.5	2.0	650.3
IP-29	0.5	0.5	4.0	626.6
IP-30	6.0	0.5	4.0	640.3
IP-31	10.0	0.5	4.0	635.8
IP-32	14.0	0.5	4.0	653.9
IP-33	18.0	0.5	4.0	651.0

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-34	22.0	0.5	4.0	653.0
IP-35	26.0	0.5	4.0	657.6
IP-36	27.5	0.5	4.0	660.3
IP-37	0.5	4.0	4.0	610.9
IP-38	6.0	4.0	4.0	597.1
IP-39	14.0	4.0	4.0	613.9
IP-40	22.0	4.0	4.0	642.8
IP-41	26.0	4.0	4.0	651.8
IP-42	27.5	4.0	4.0	656.6
IP-43	0.5	8.0	4.0	591.8
IP-44	2.0	8.0	4.0	575.3
IP-45	6.0	8.0	4.0	520.1
IP-46	10.0	8.0	4.0	533.9
IP-47	14.0	8.0	4.0	550.9
IP-48	18.0	8.0	4.0	590.8
IP-49	22.0	8.0	4.0	629.3
IP-50	26.0	8.0	4.0	646.3
IP-51	27.5	8.0	4.0	650.7
IP-52	26.0	10.0	4.0	645.3
IP-53	27.5	10.0	4.0	648.3
IP-54	0.5	11.5	4.0	584.3
IP-55	2.0	11.5	4.0	569.6
IP-56	6.0	11.5	4.0	507.4
IP-57	10.0	11.5	4.0	471.6
IP-58	14.0	11.5	4.0	520.4
IP-59	18.0	11.5	4.0	580.3
IP-60	22.0	11.5	4.0	623.6
IP-61	26.0	11.5	4.0	643.5
IP-62	27.5	11.5	4.0	648.0
IP-63	0.5	0.5	6.0	625.9
IP-64	6.0	0.5	6.0	678.3
IP-65	10.0	0.5	6.0	690.6
IP-66	14.0	0.5	6.0	662.6
IP-67	18.0	0.5	6.0	652.9

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-68	22.0	0.5	6.0	653.8
IP-69	27.5	0.5	6.0	663.3
IP-70	0.5	4.0	6.0	621.7
IP-71	6.0	4.0	6.0	614.1
IP-72	14.0	4.0	6.3	649.0
IP-73	22.0	4.0	6.0	644.3
IP-74	27.5	4.0	6.0	660.5
IP-75	0.5	8.0	6.0	602.3
IP-76	6.0	8.0	6.0	577.9
IP-77	10.0	8.0	6.0	587.3
IP-78	14.0	8.0	6.0	600.2
IP-79	18.0	8.0	6.0	610.5
IP-80	22.0	8.0	6.0	629.9
IP-81	27.5	8.0	6.0	660.2
IP-82	0.5	11.5	6.0	601.1
IP-83	2.0	11.5	6.0	584.3
IP-84	6.0	11.5	6.0	538.8
IP-85	10.0	11.5	6.0	544.9
IP-86	14.0	11.5	6.0	542.2
IP-87	18.0	11.5	6.0	604.3
IP-88	22.0	11.5	6.0	627.8
IP-89	26.0	11.5	6.0	645.9
IP-90	27.5	11.5	6.0	654.5

Table 2: Internal Overpressures

Pressure Transducer	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Maximum Overpressure (mbar)	1.5ms Running Average			
					Maximum Overpressure (mbar)	Time of Arrival (ms)	Idealised Profile Representation	
							Rise Time (ms)	Duration (ms)
PI-1	0.8	0.0	1.5	723	693	634	36	53
PI-2	5.8	0.0	1.5	1560	1097	690	39	54
PI-3	13.9	0.0	1.5	2603	1272	676	69	94
PI-4	21.9	0.0	1.5	4536	3606	664	15	34
PI-5	26.9	0.0	1.5	6280	3870	666	10	19
PI-6	0.5	6.0	0.0	283	275	619	74	167
PI-7	9.0	6.0	0.0	712	635	682	110	132
PI-8	14.0	6.0	0.0	6186	1390	688	76	85
PI-9	21.0	6.0	0.0	1243	953	663	61	90
PI-10	27.5	6.0	0.0	2330	1312	668	39	57
PI-11	0.5	11.5	0.0	265	241	686	163	191
PI-12	12.3	11.5	0.0	516	479	677	96	119
PI-13	27.5	11.5	0.0	1414	1089	654	28	56
PI-14	0.8	0.5	4.0	562	487	629	32	125
PI-15	4.5	0.6	4.0	755	597	692	127	146
PI-16	11.2	0.0	5.5	2469	1491	677	74	103
PI-17	12.0	0.5	4.0	1880	1463	676	74	101
PI-18	22.0	0.5	4.0	3181	2076	660	25	50
PI-19	27.5	0.5	4.0	4483	2902	664	9	24
PI-20	10.2	4.0	4.0	952	640	681	114	140
PI-21	0.5	7.0	4.0	418	198	615	125	226
PI-22	18.0	8.0	4.0	993	750	672	86	104
PI-23	27.5	6.0	4.0	1348	979	658	24	46
PI-24	0.5	11.5	4.0	219	209	686	155	176
PI-25	10.0	11.5	4.0	612	233	678	158	175
PI-26	18.0	11.5	4.0	484	378	673	123	140
PI-27	27.5	11.5	4.0	1080	953	652	19	54
PI-28	0.8	0.8	8.0	922	665	699	33	46
PI-29	13.9	1.7	8.0	-	-	-	-	-
PI-30	26.1	1.7	8.0	7974	3549	669	16	22
PI-31	5.9	5.0	8.0	-	-	-	-	-
PI-32	18.9	5.0	8.0	1170	996	667	65	98
PI-33	1.1	11.1	8.0	246	205	632	93	173
PI-34	12.8	11.2	8.0	-	-	-	-	-
PI-35	26.1	11.3	8.0	970	670	655	36	69

Table 3 : External Overpressures

Pressure Transducer	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Maximum Overpressure (mbar)	Maximum Overpressure 1.5ms Running Average (mbar)
PE-1	34.0	6.0	1.0	1,857.6	1,423.1
PE-2	40.0	6.0	1.0	2,864.5	2,864.5
PE-3	52.0	6.0	1.0	1,035.5	884.3
PE-4	76.0	6.0	1.0	459.1	260.6
PE-5	47.2	25.2	1.0	379.4	329.5
PE-6	61.3	39.3	1.0	234.0	202.0
PE-7	14.0	18.0	1.0	247.1	217.9
PE-8	14.0	24.0	1.0	-	-
PE-9	14.0	36.0	1.0	437.5	420.8
PE-10	14.0	60.0	1.0	174.7	156.3
PE-11	-21.2	25.2	1.0	161.9	151.8

Table 4: Gas Concentrations

Measuring Position	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Natural Gas Concentration (%)
1	25.7	4.0	0.7	9.5
2	12.0	8.0	0.8	9.5
3	1.2	3.1	1.5	9.5
4	7.7	10.9	3.8	9.4
5	13.5	5.5	4.5	9.4
6	25.9	6.0	5.2	9.4
7	4.0	8.5	4.9	9.4
8	19.8	8.0	7.6	9.6

Table 5: Weather Conditions

Air Temperature (°C)	Atmospheric Pressure (mbar)	Wind Speed (ms ⁻¹)	Wind Direction (° from Magnetic North)
18.9	985	3.1	333

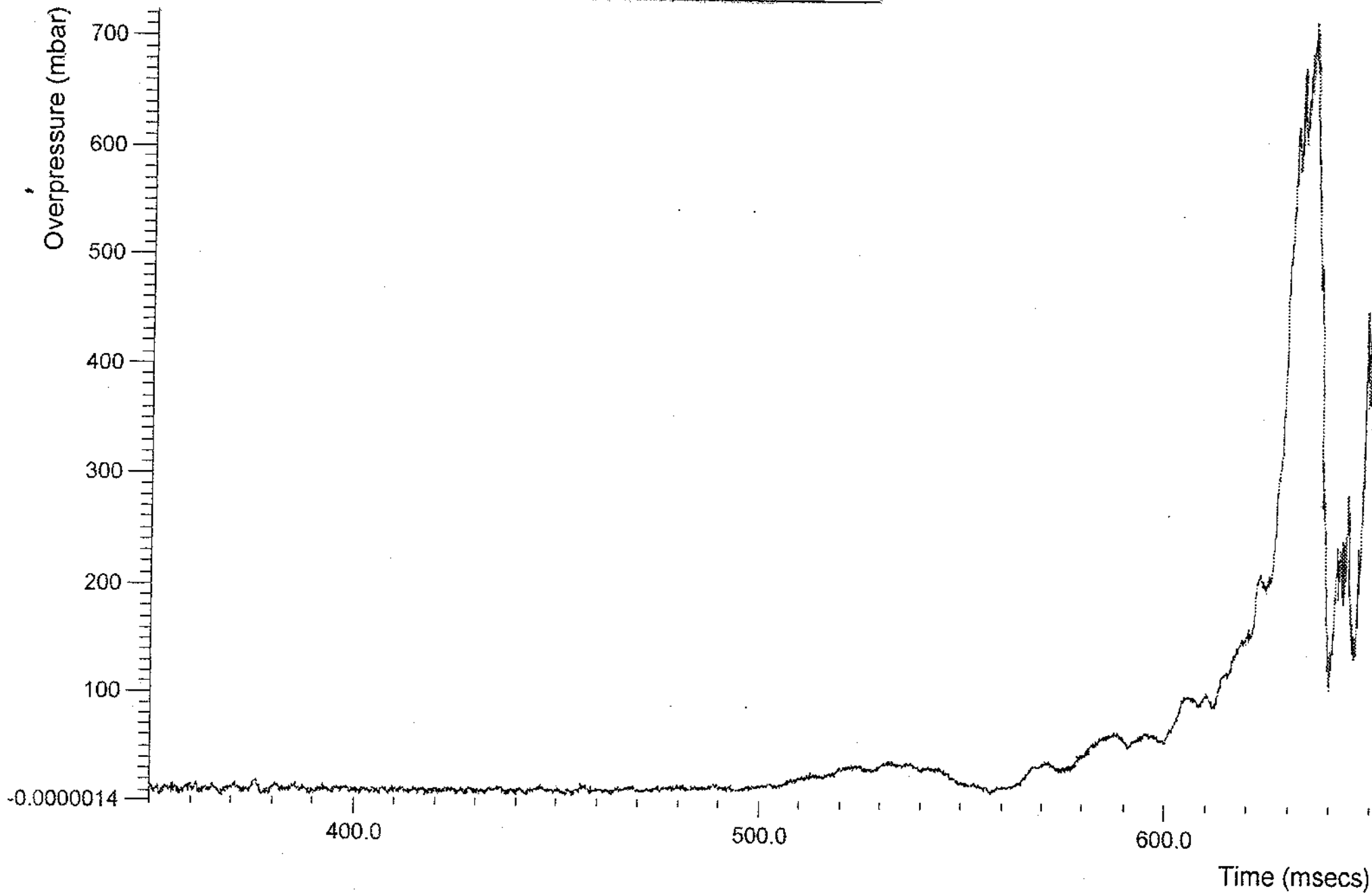
Table 6: Confinement Configuration

Confinement Configuration	Rig Face*	Confinement
C2	North	Open
	East	Open
	South	Confined
	West	Open

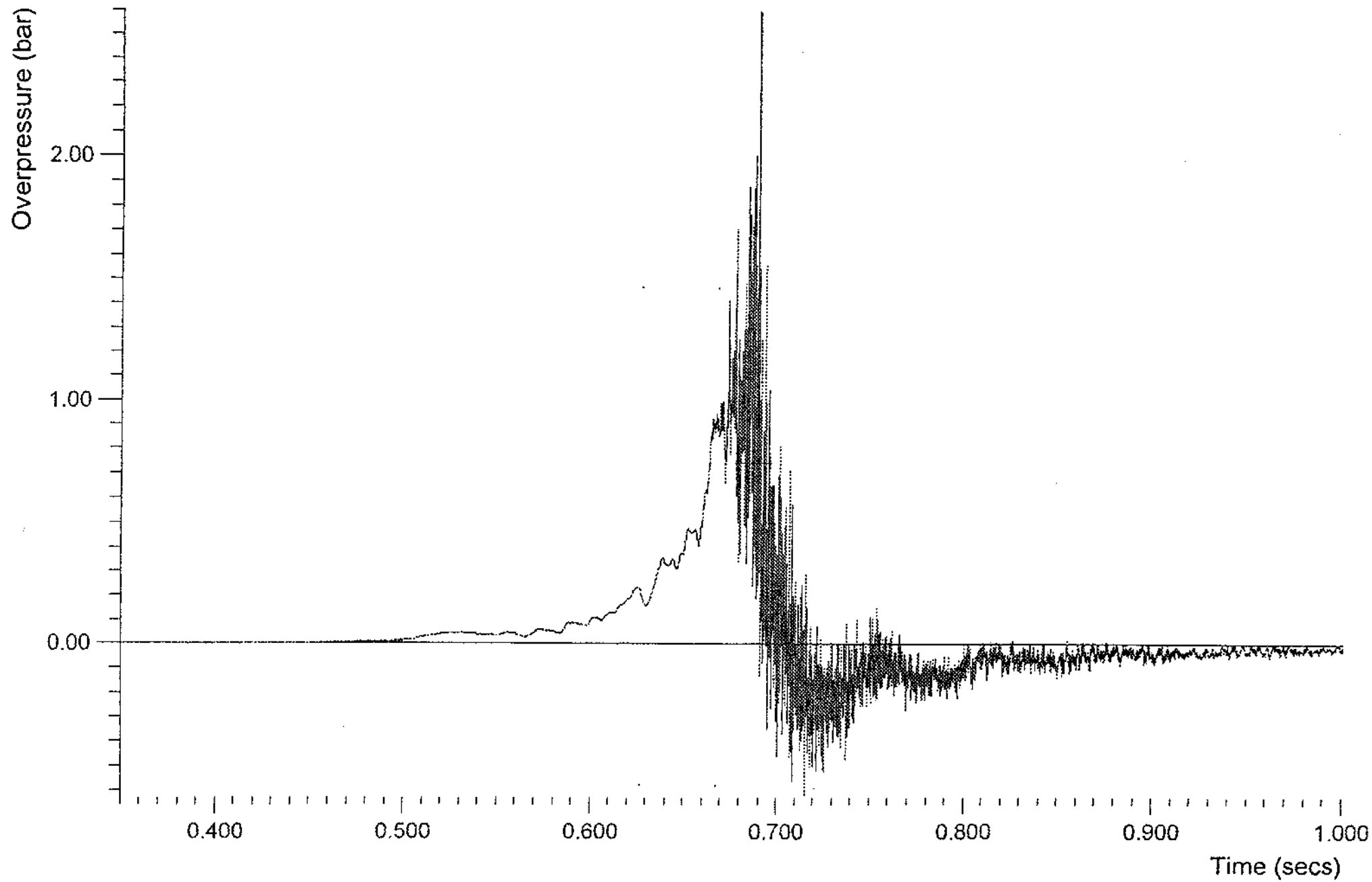
* - Origin is at the junction of the West and South faces at ground level. Roof and floor also confined.

Appendix A: Internal Overpressure Profiles

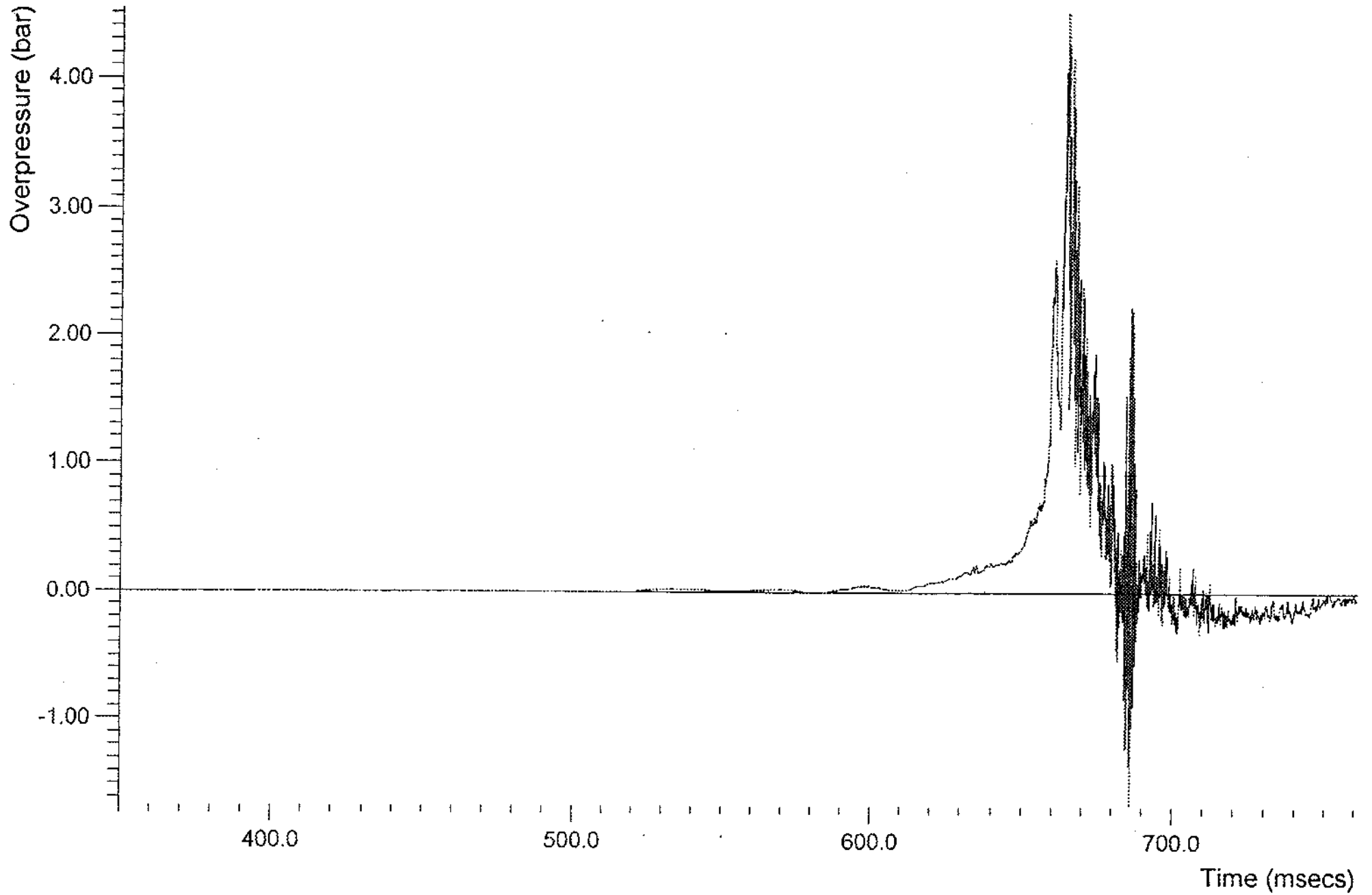
Test: HSE 9 (O1 C2 I4)
Transducer no: PI-1



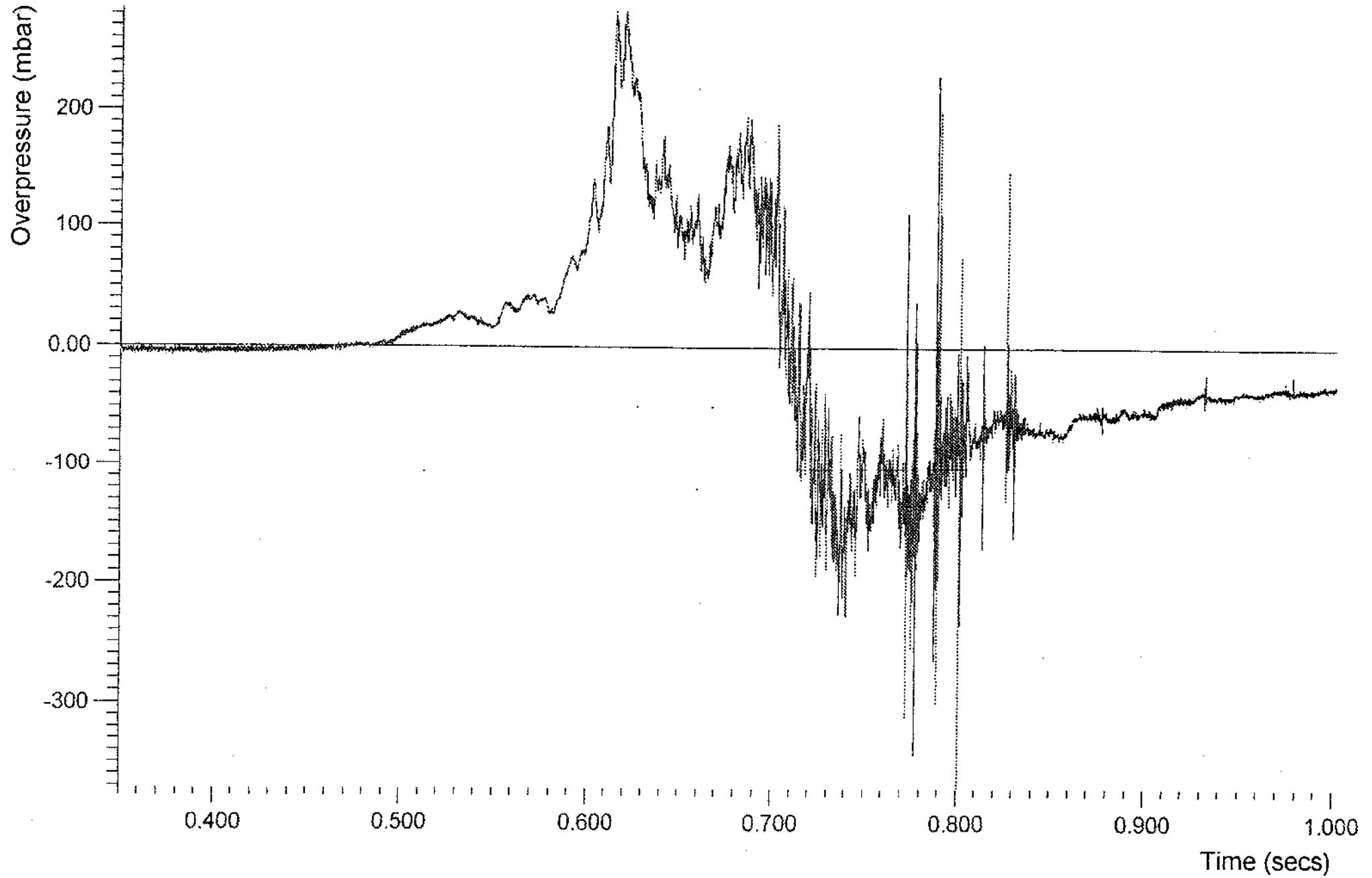
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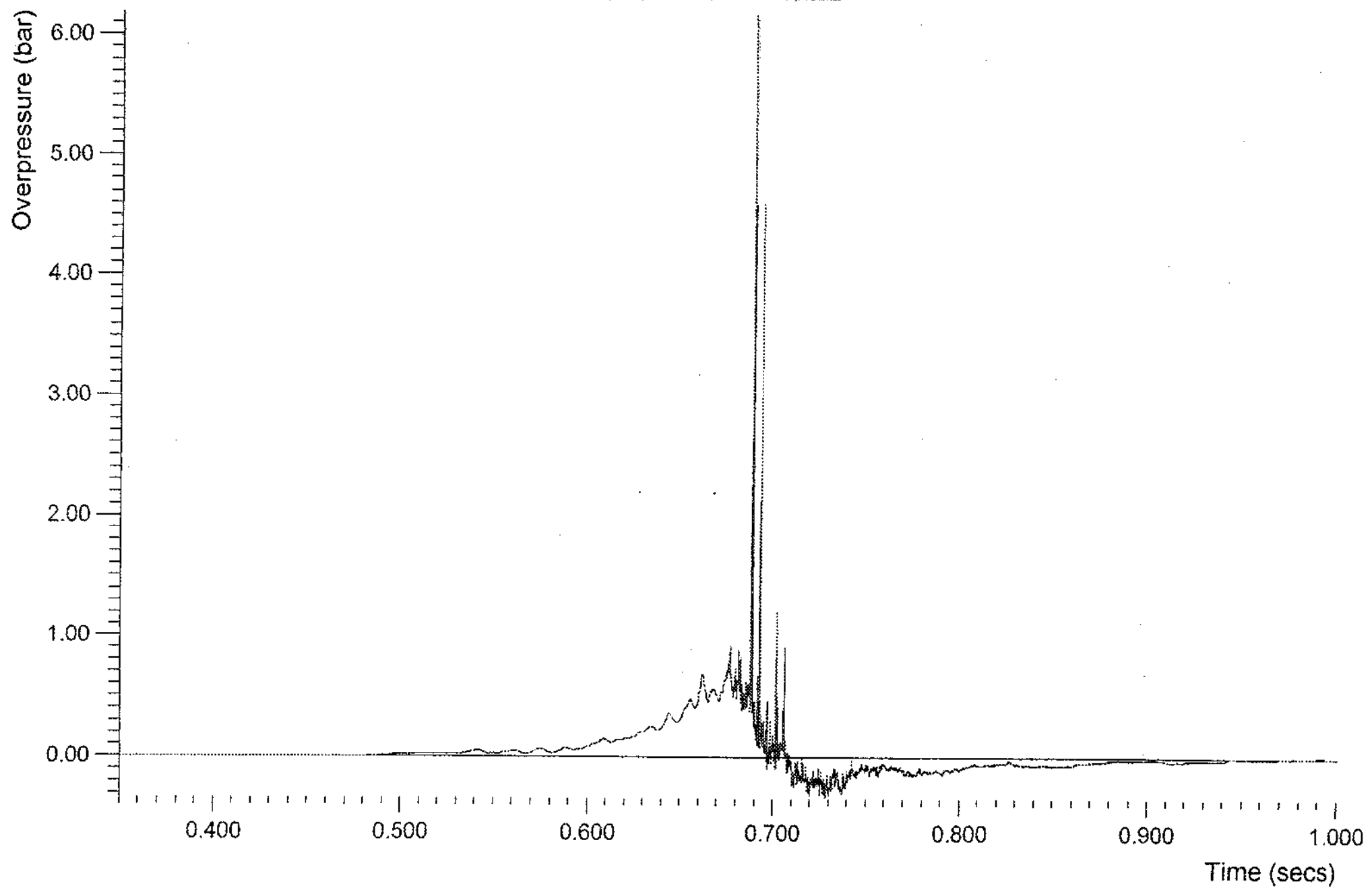
Test: HSE 9 (O1 C2 I4)
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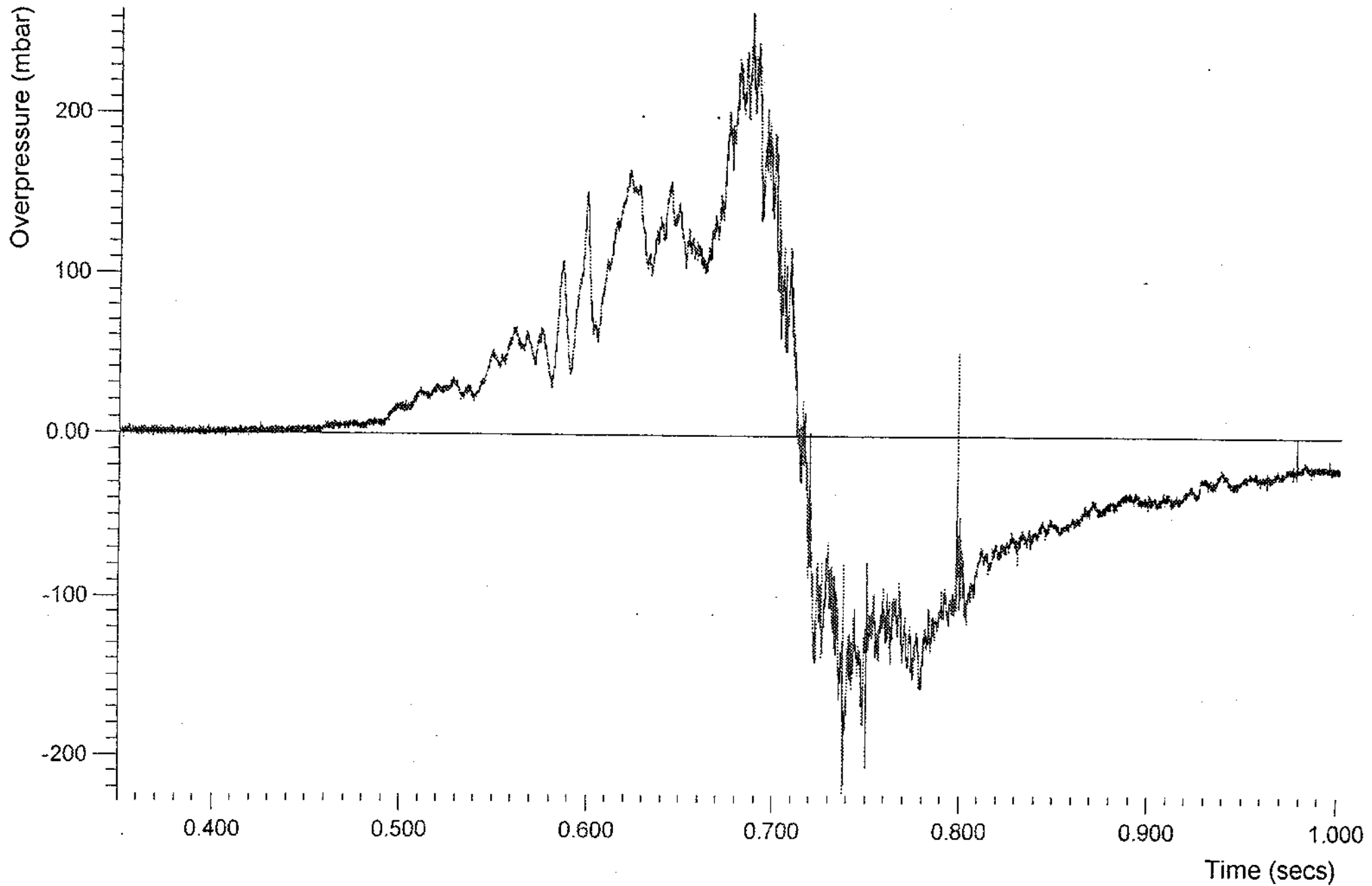
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Transducer no: PI-6



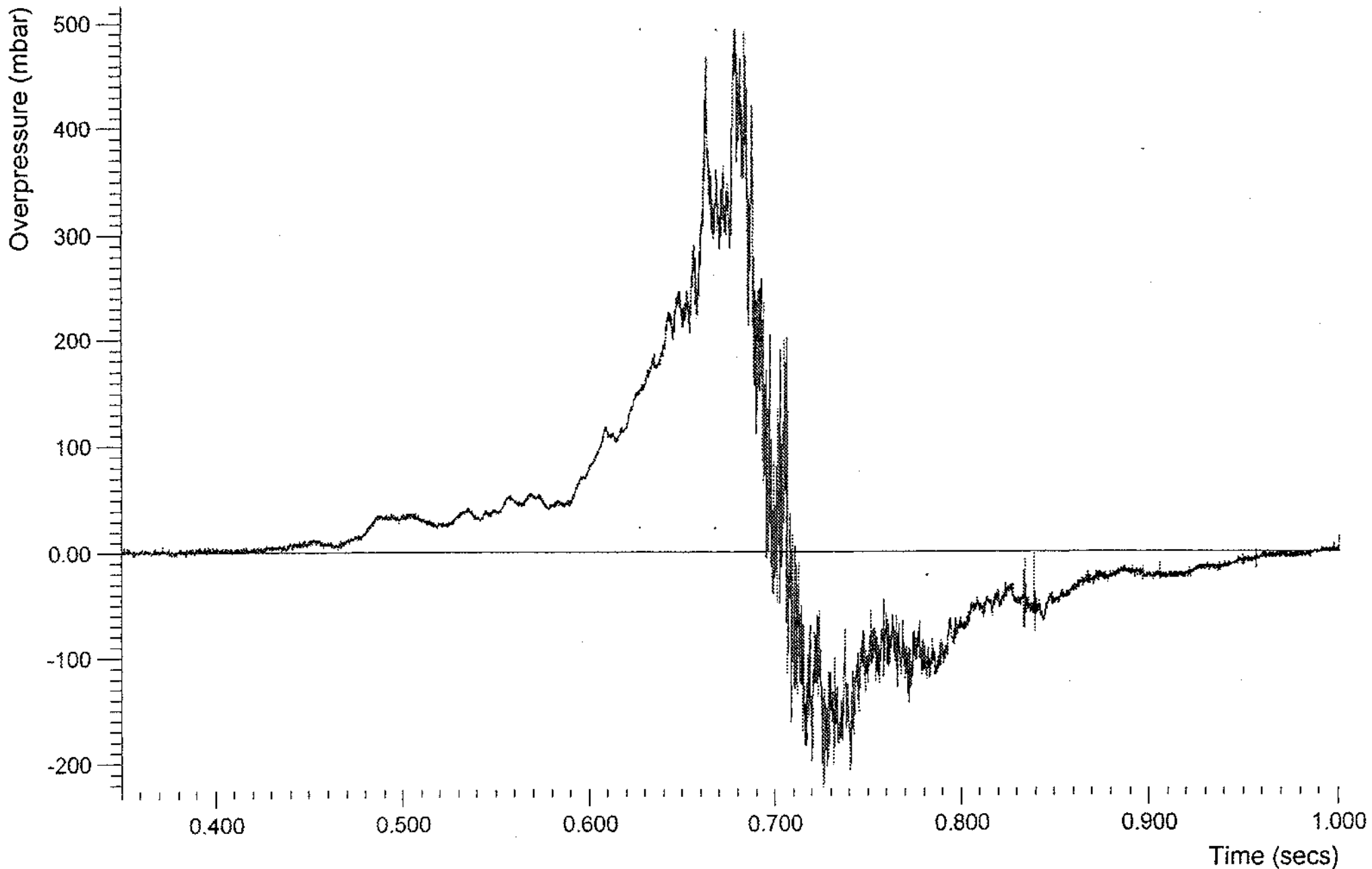
Test: HSE 9 (O1 C2 I4)
Transducer no: Pt-8



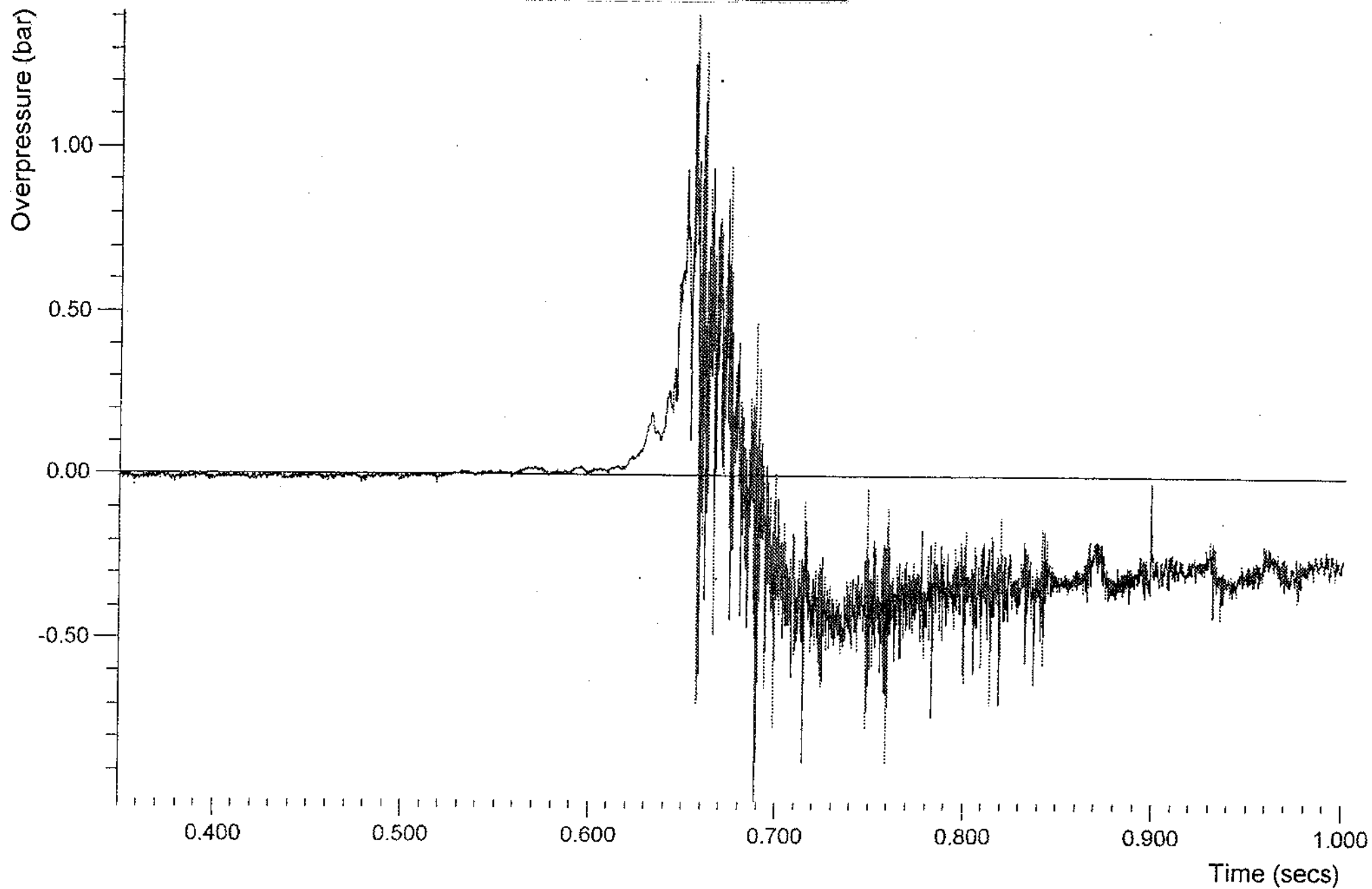
Test: HSE 9 (O1 C2 I4)
Transducer no: PI-11



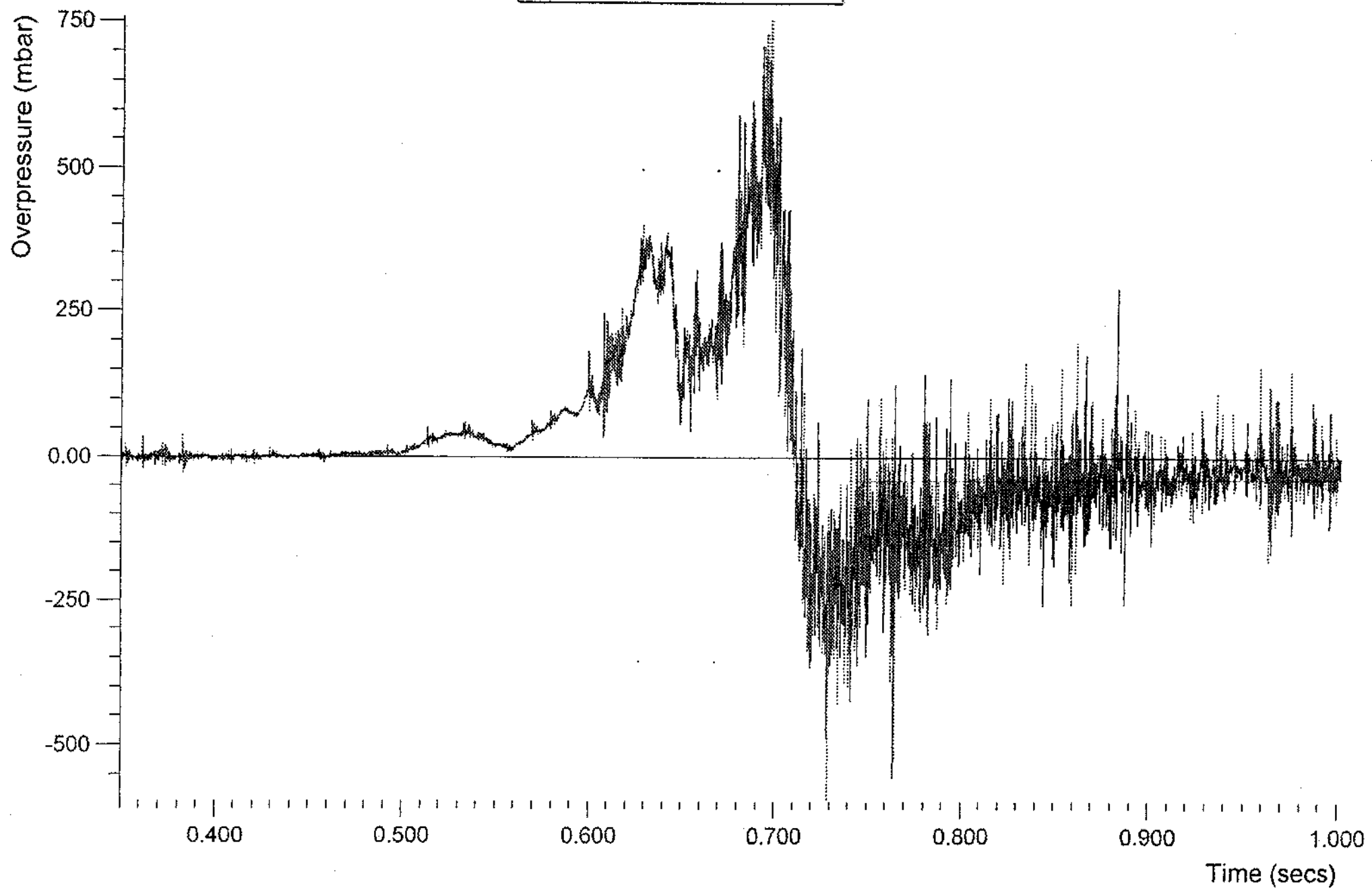
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Transducer no: PI-12



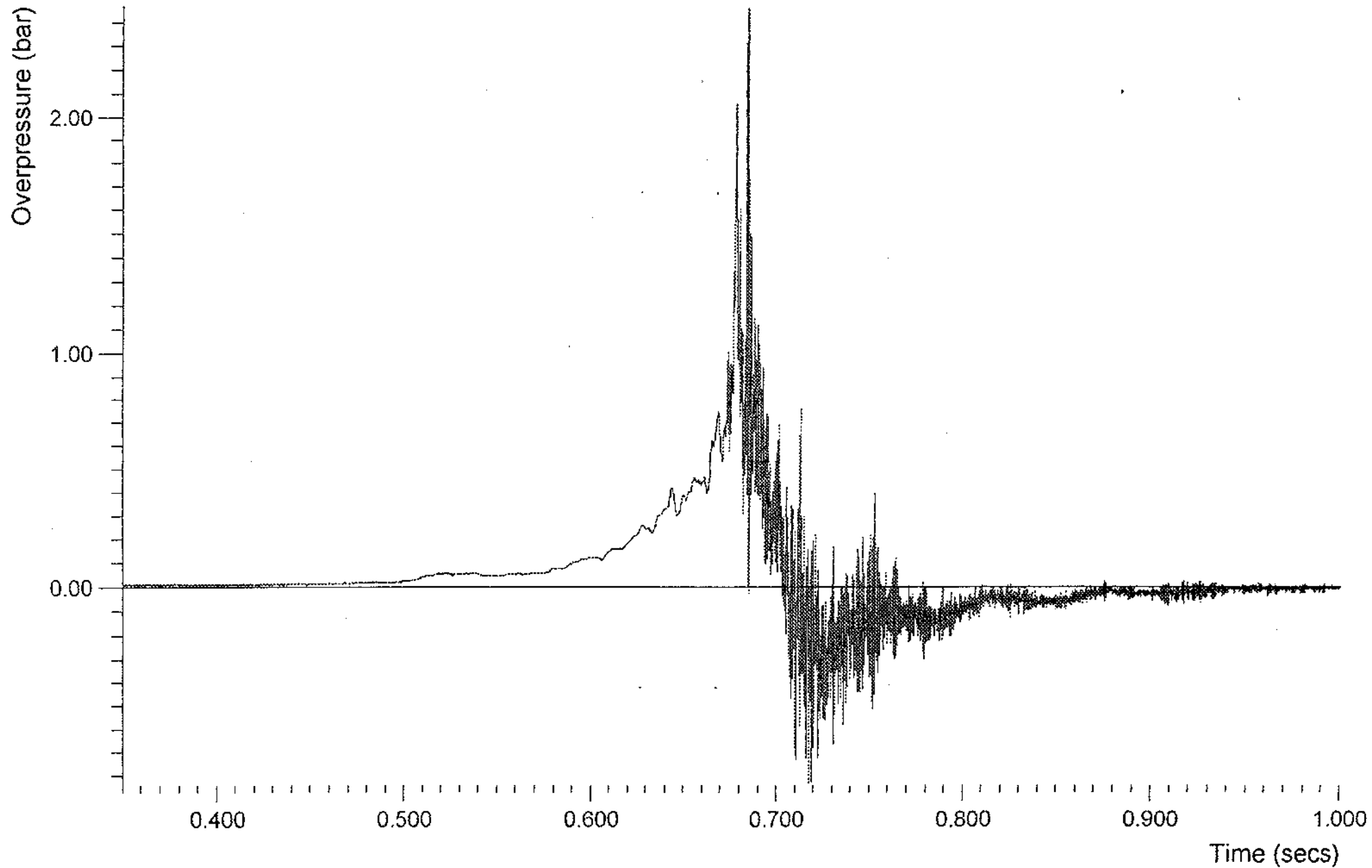
Test: HSE 9 (O1 C2 I4)
Transducer no: PI-13



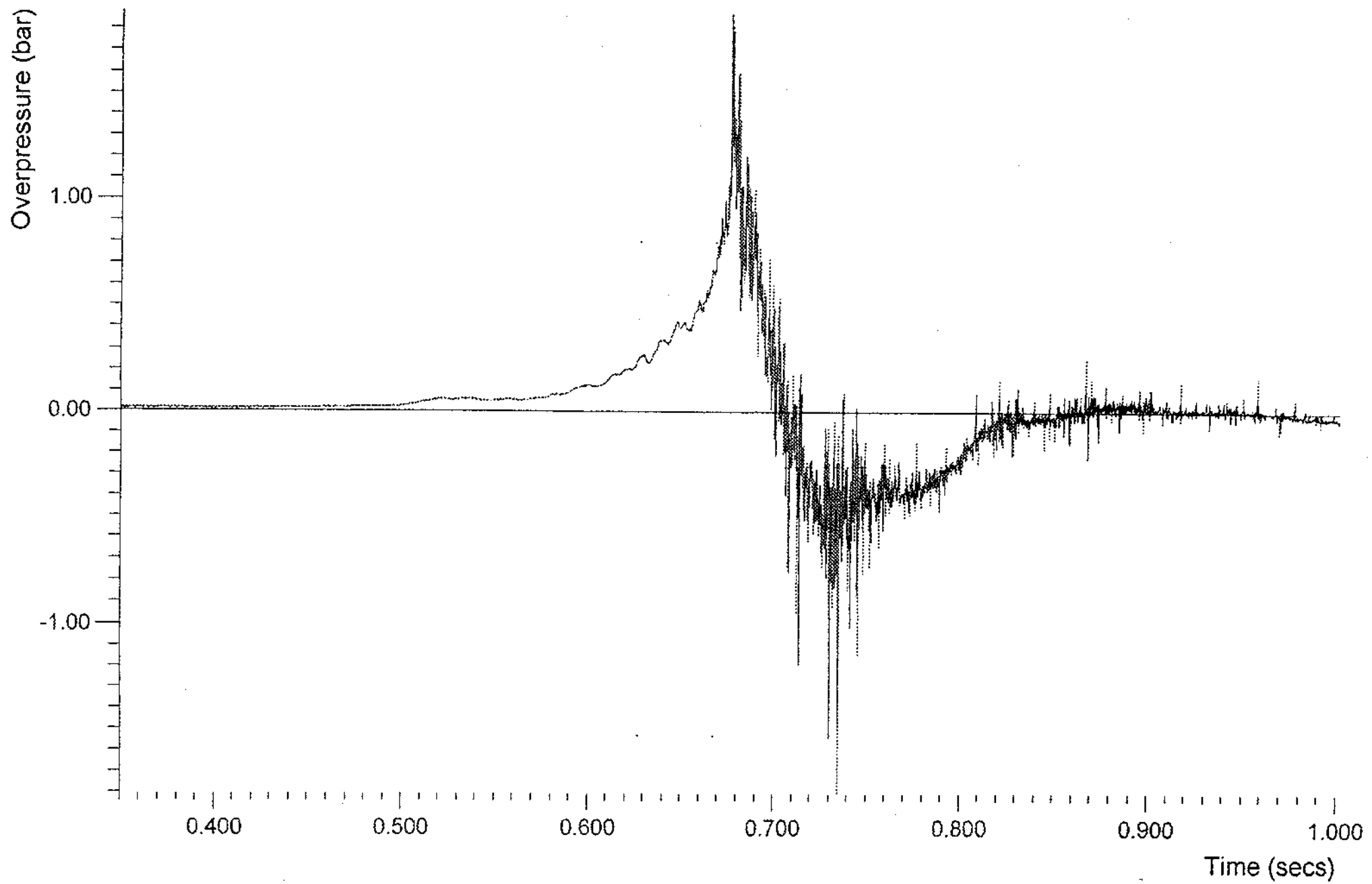
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Transducer no: PI-15



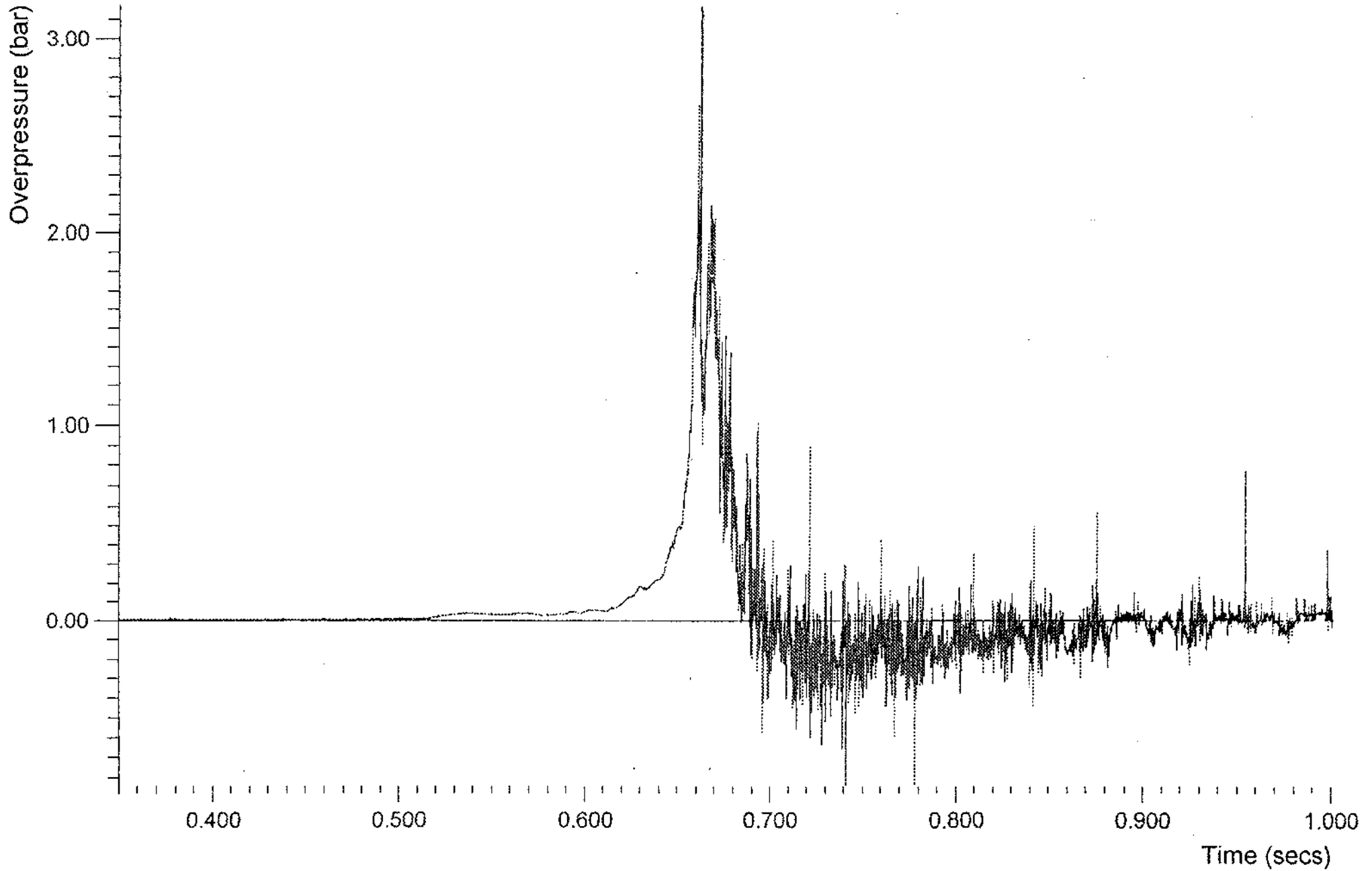
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Transducer no: PI-16



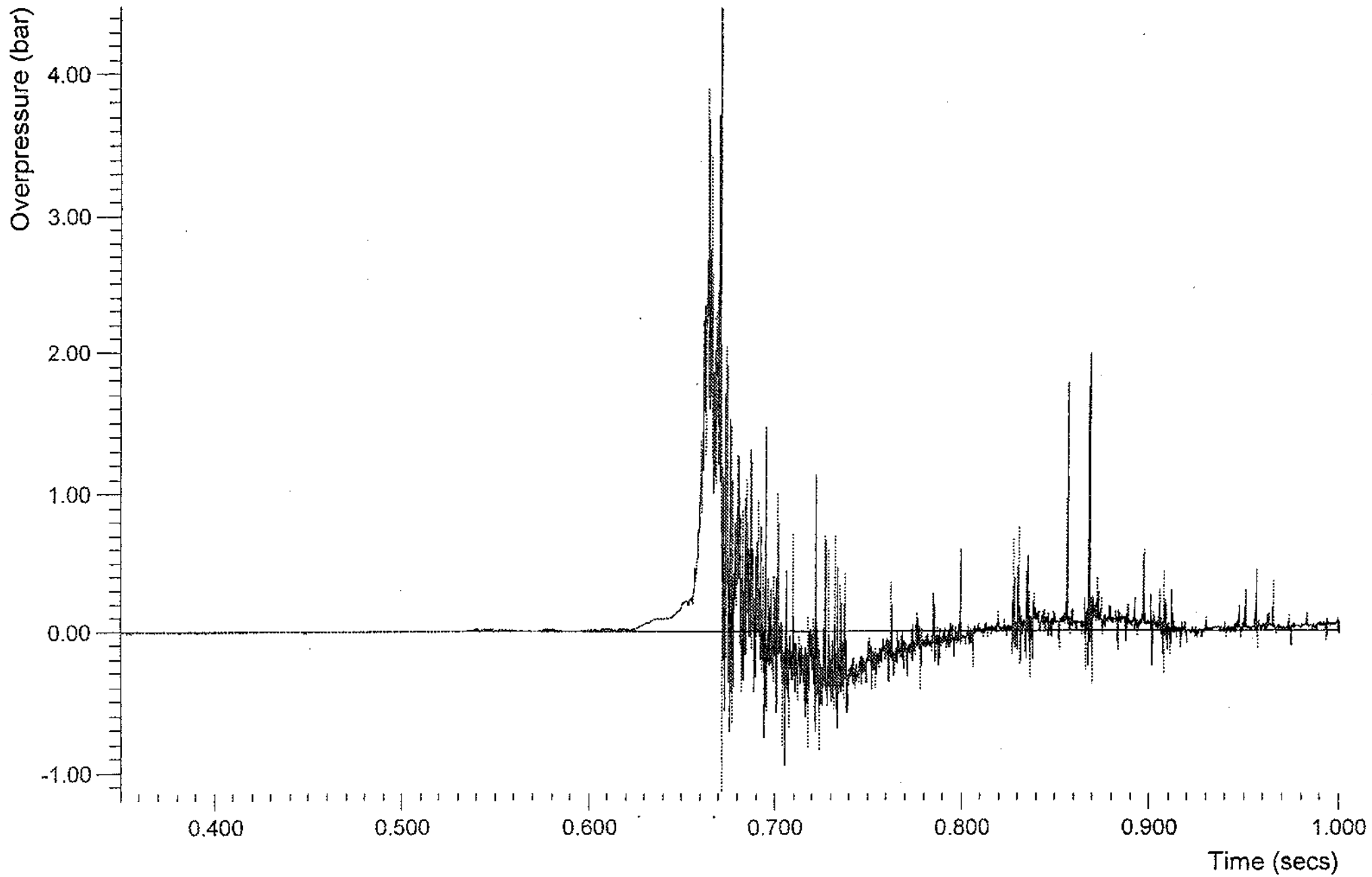
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Transducer no: PI-17



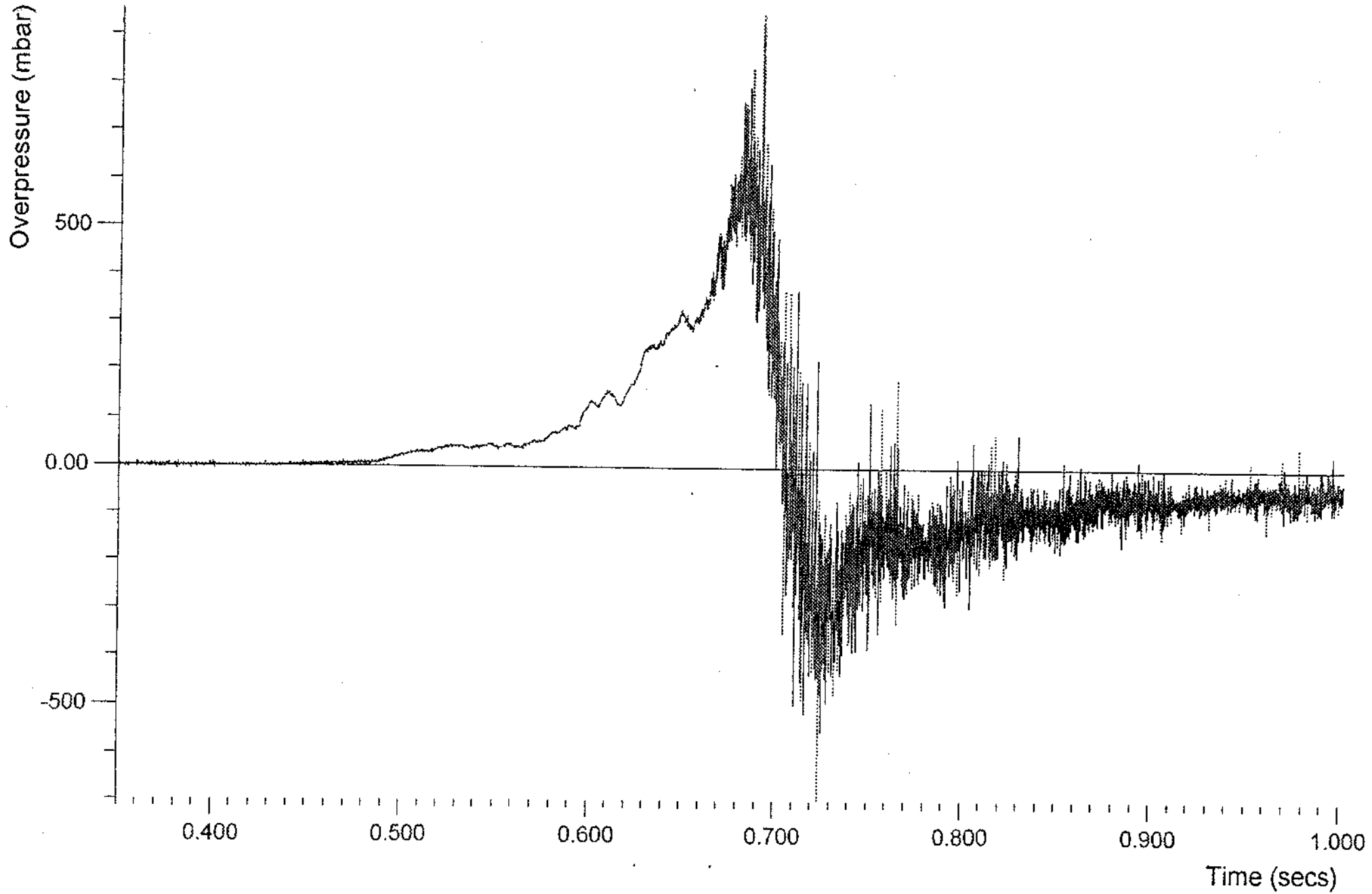
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Transducer no: PI-18



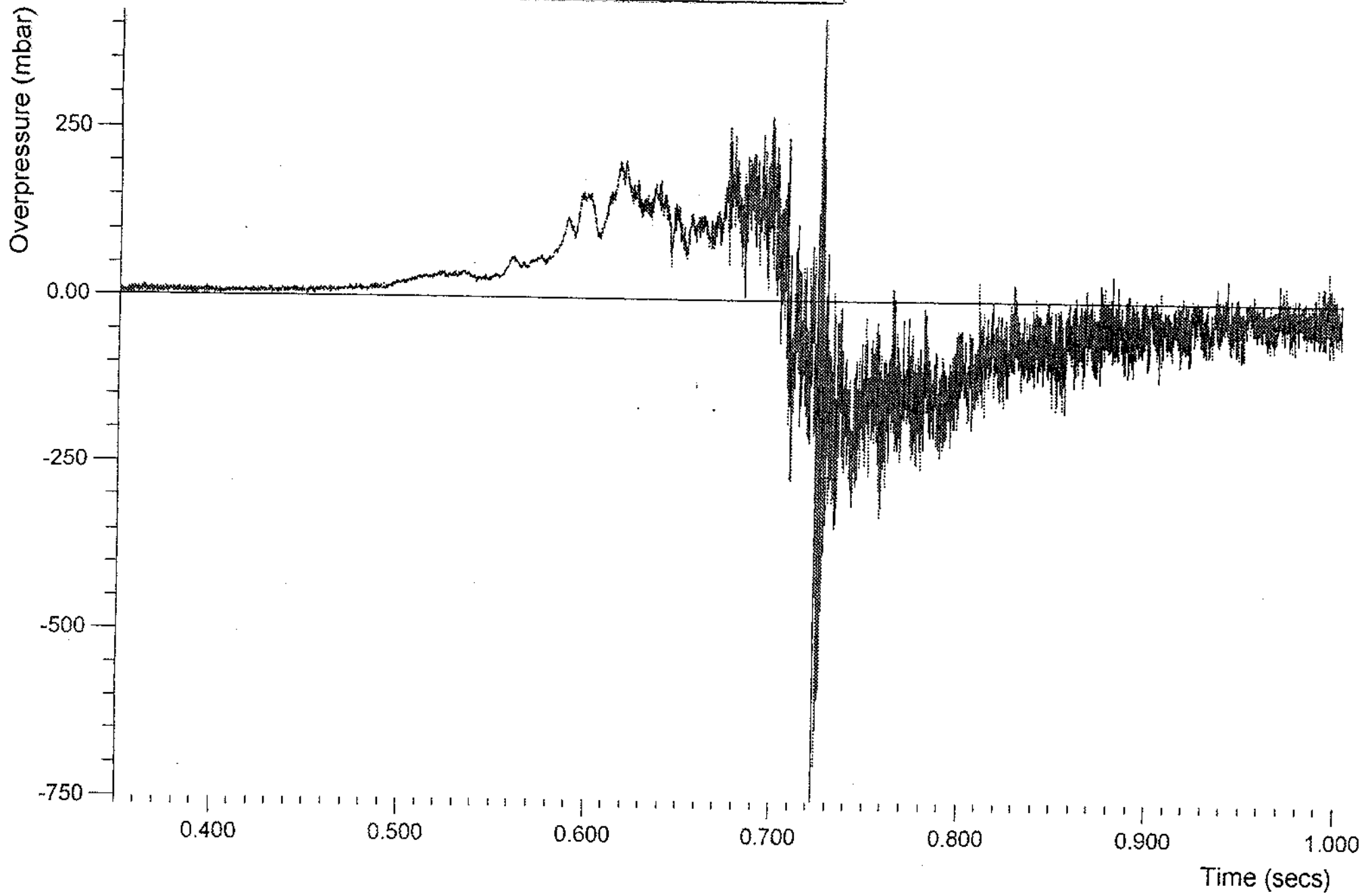
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Transducer no: PI-19



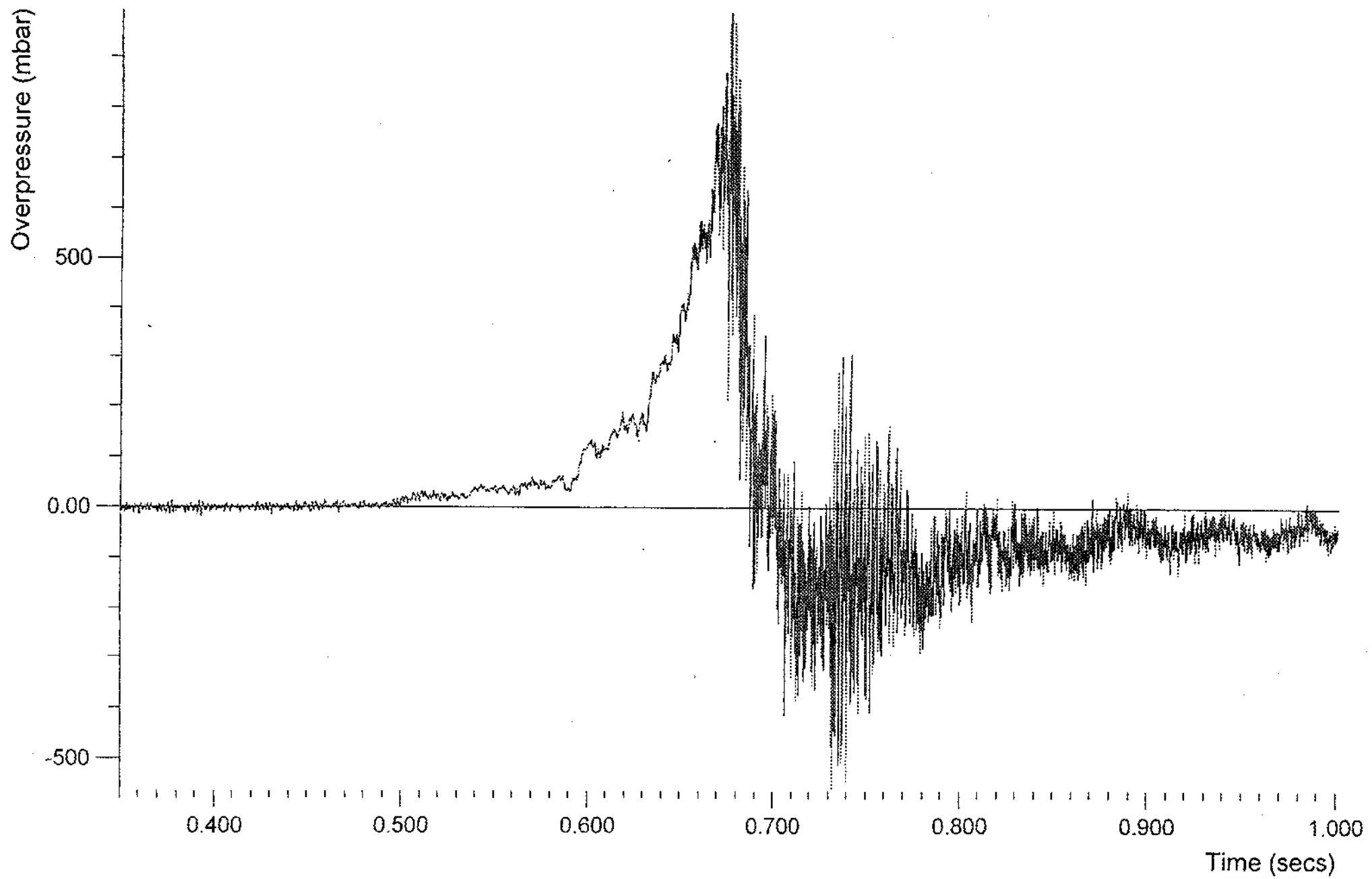
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Transducer no: PI-20



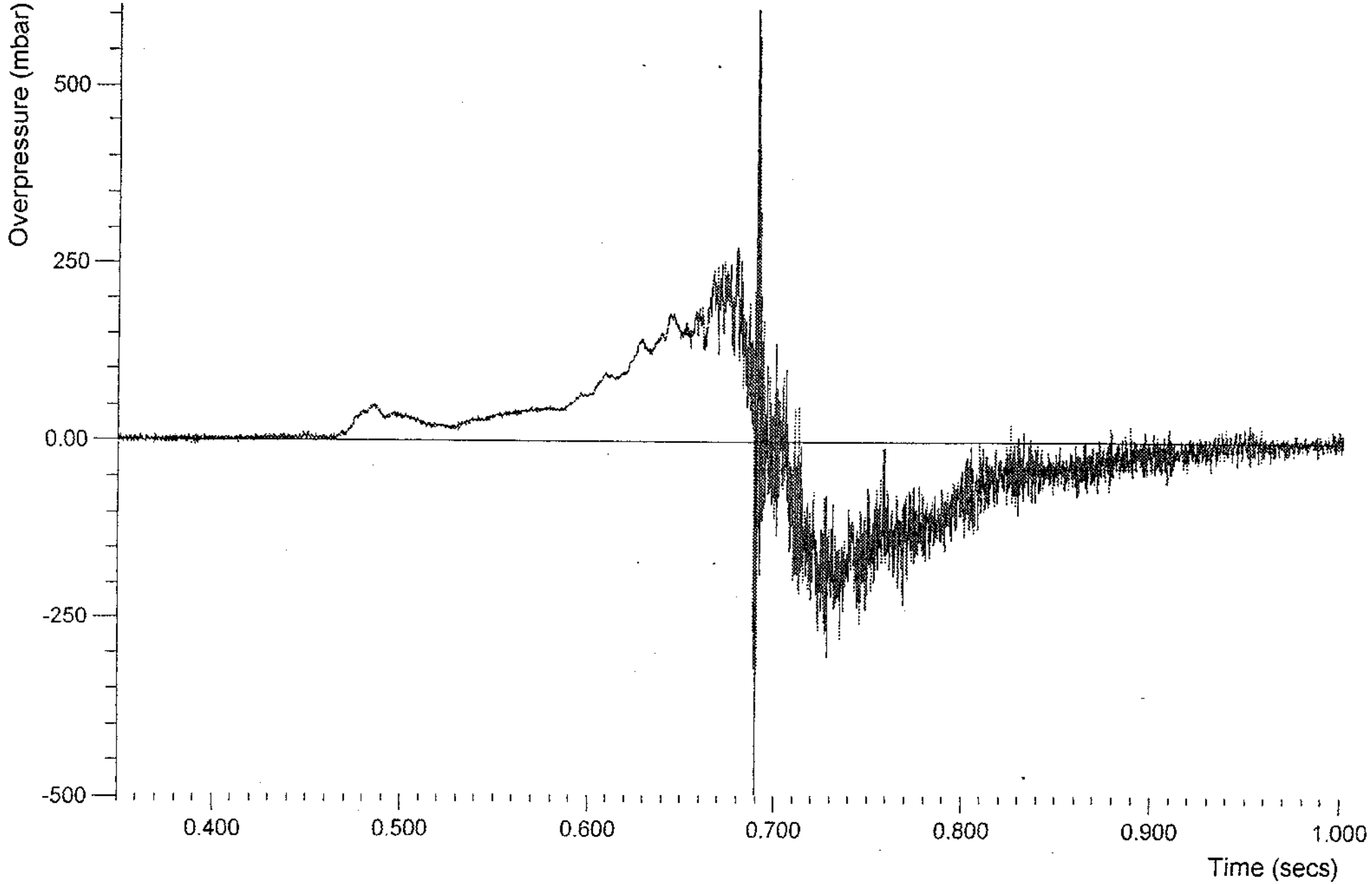
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Transducer no: PI-21



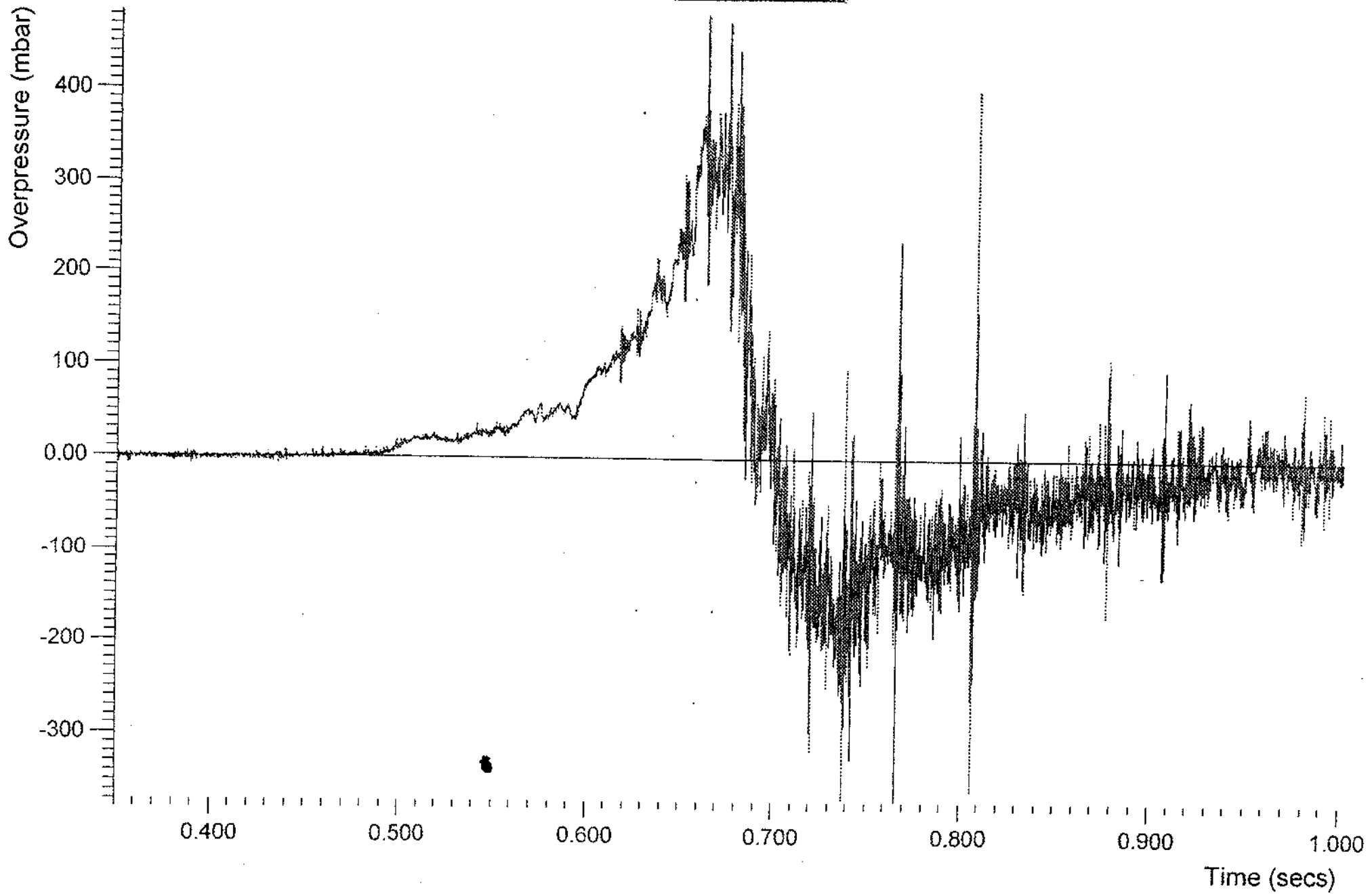
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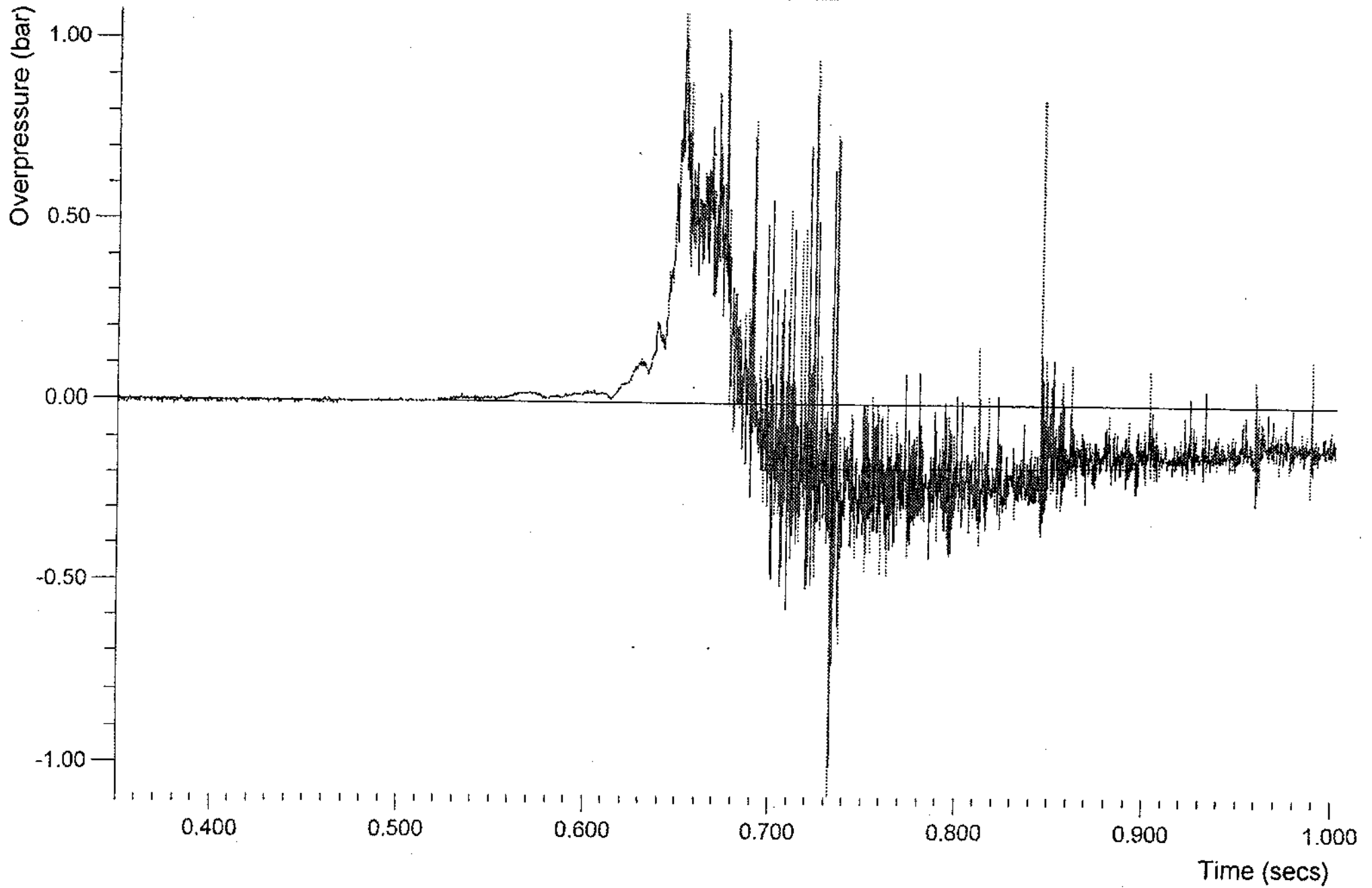
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Transducer no: PI-25



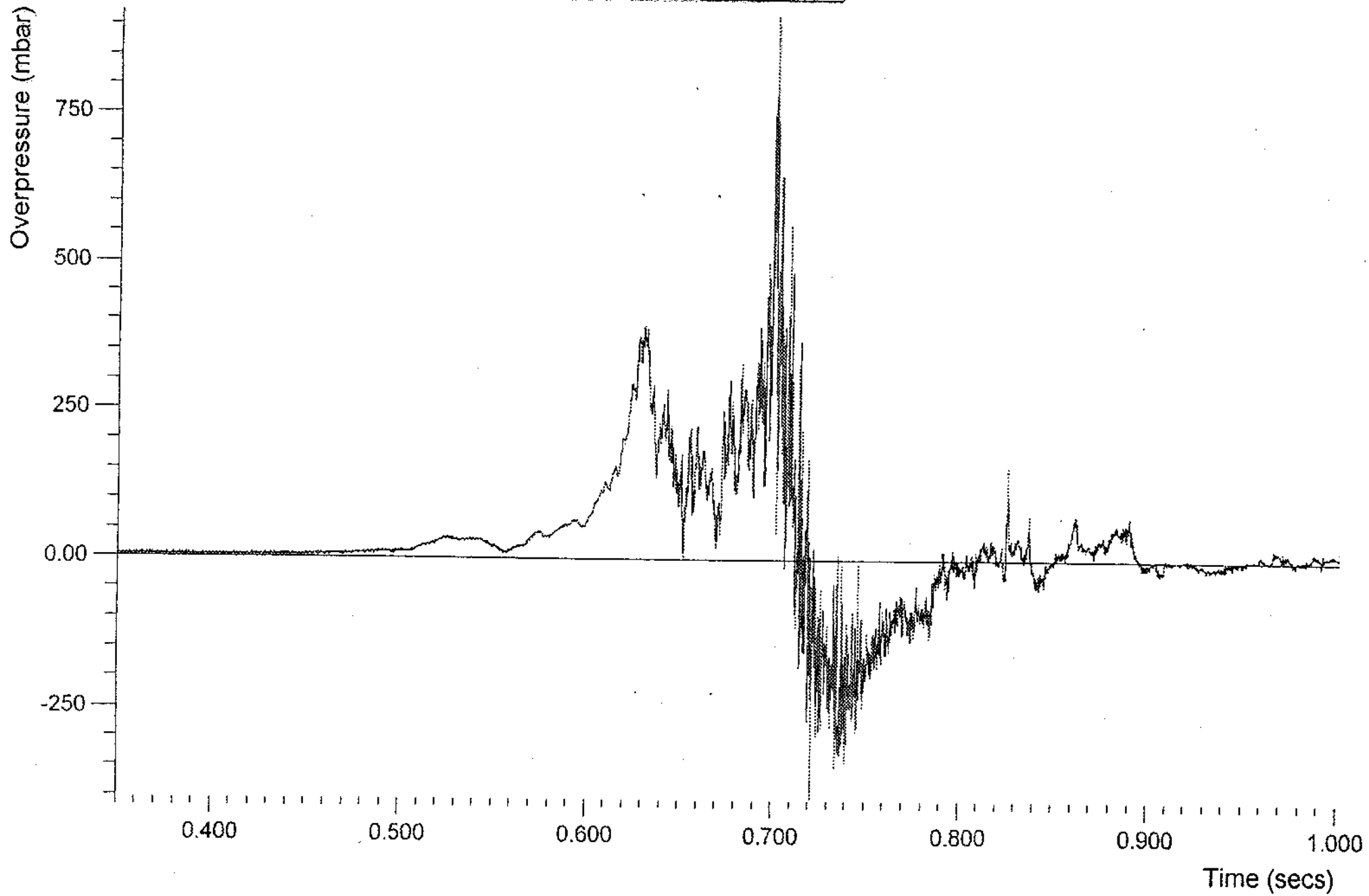
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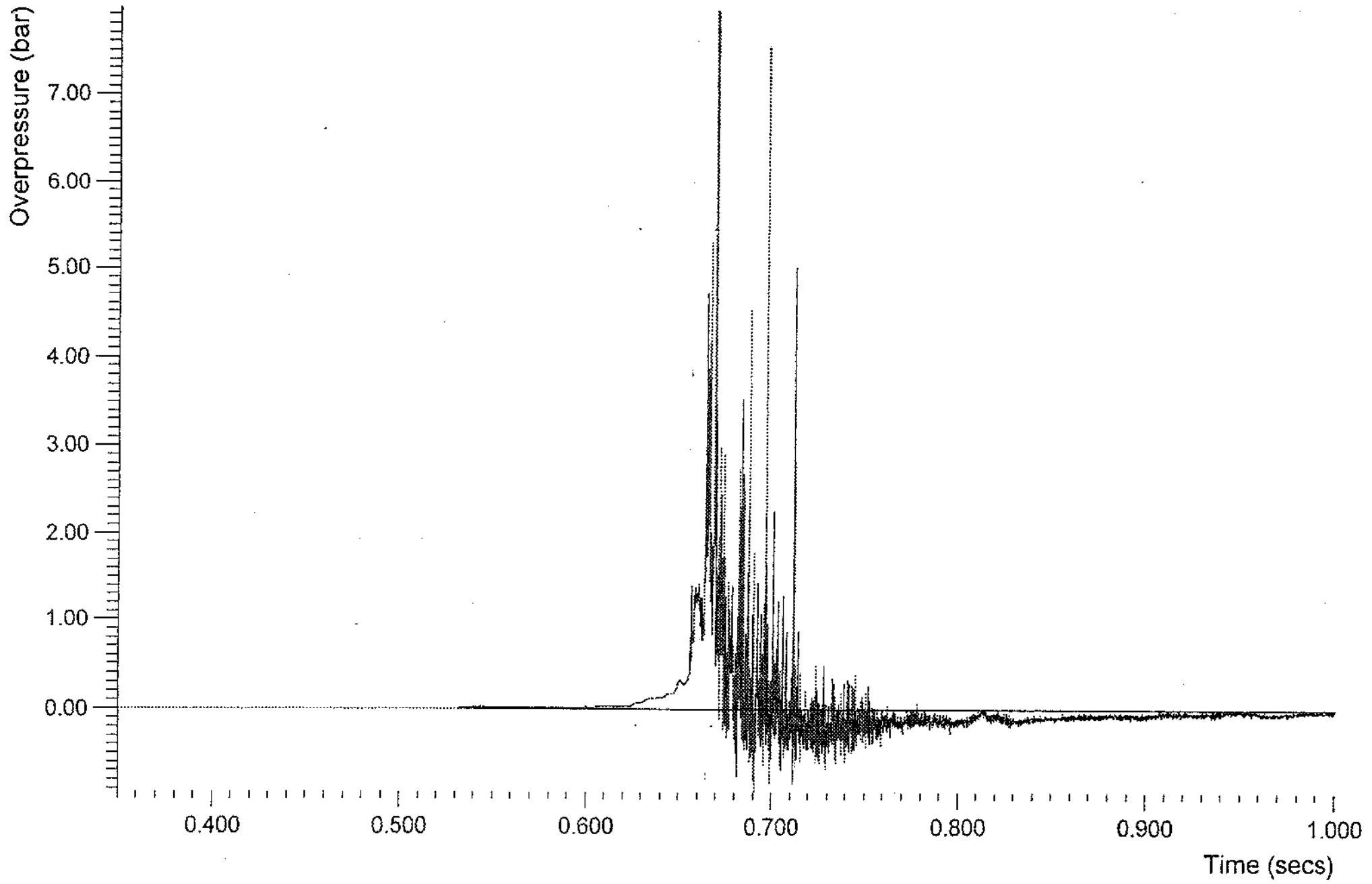
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Transducer no: PI-27



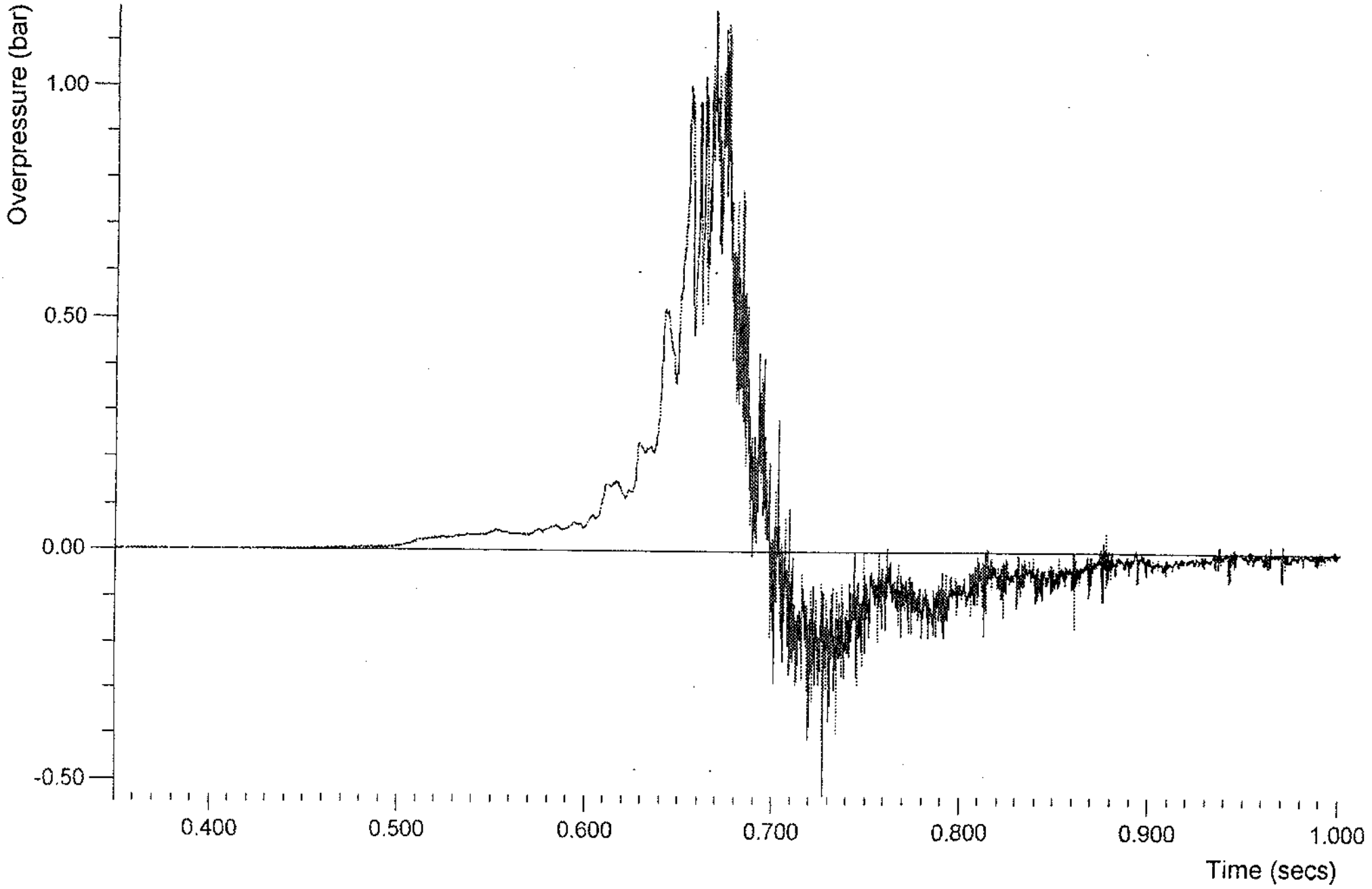
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Transducer no: PI-28



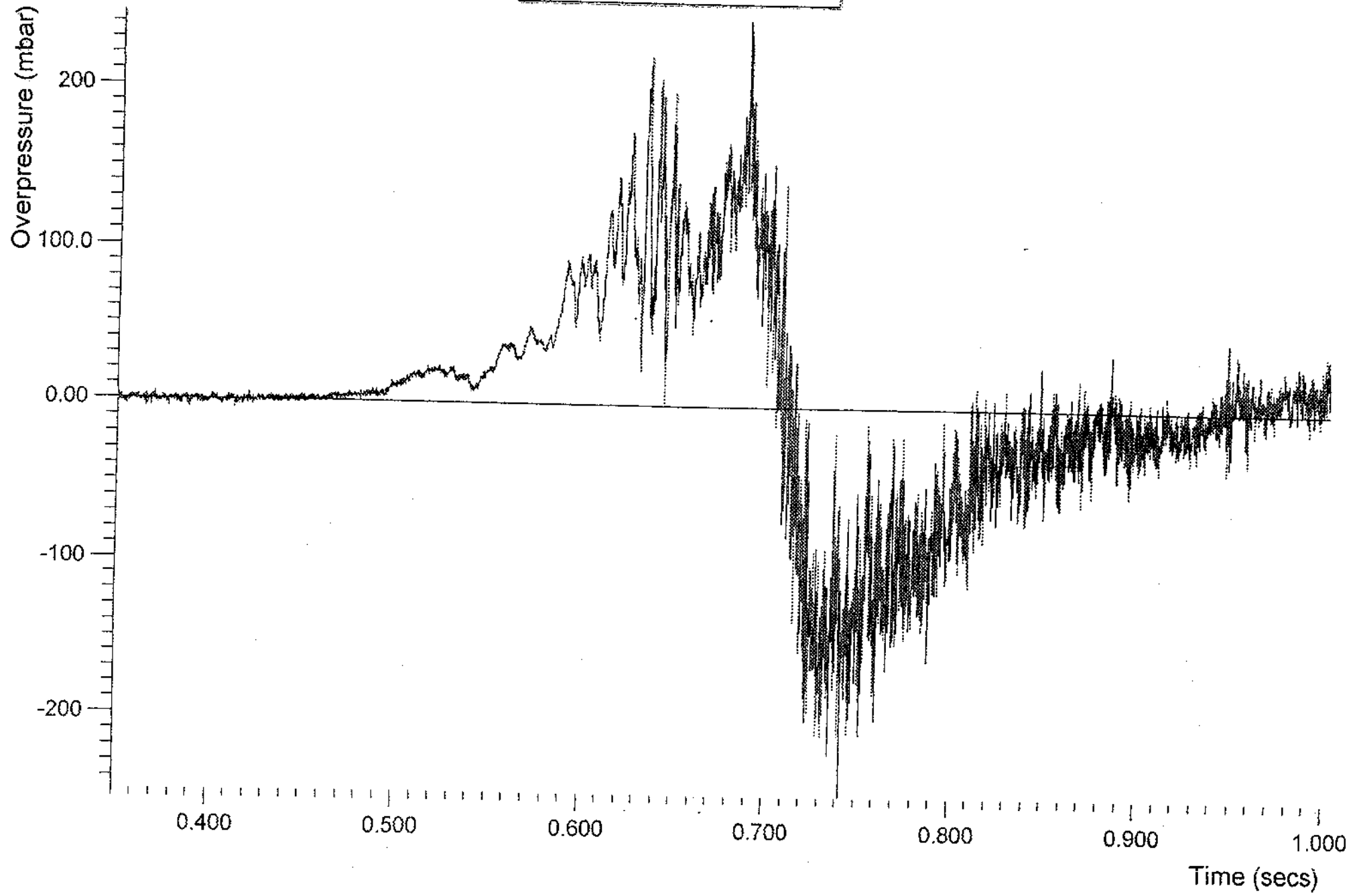
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Transducer no: PI-30



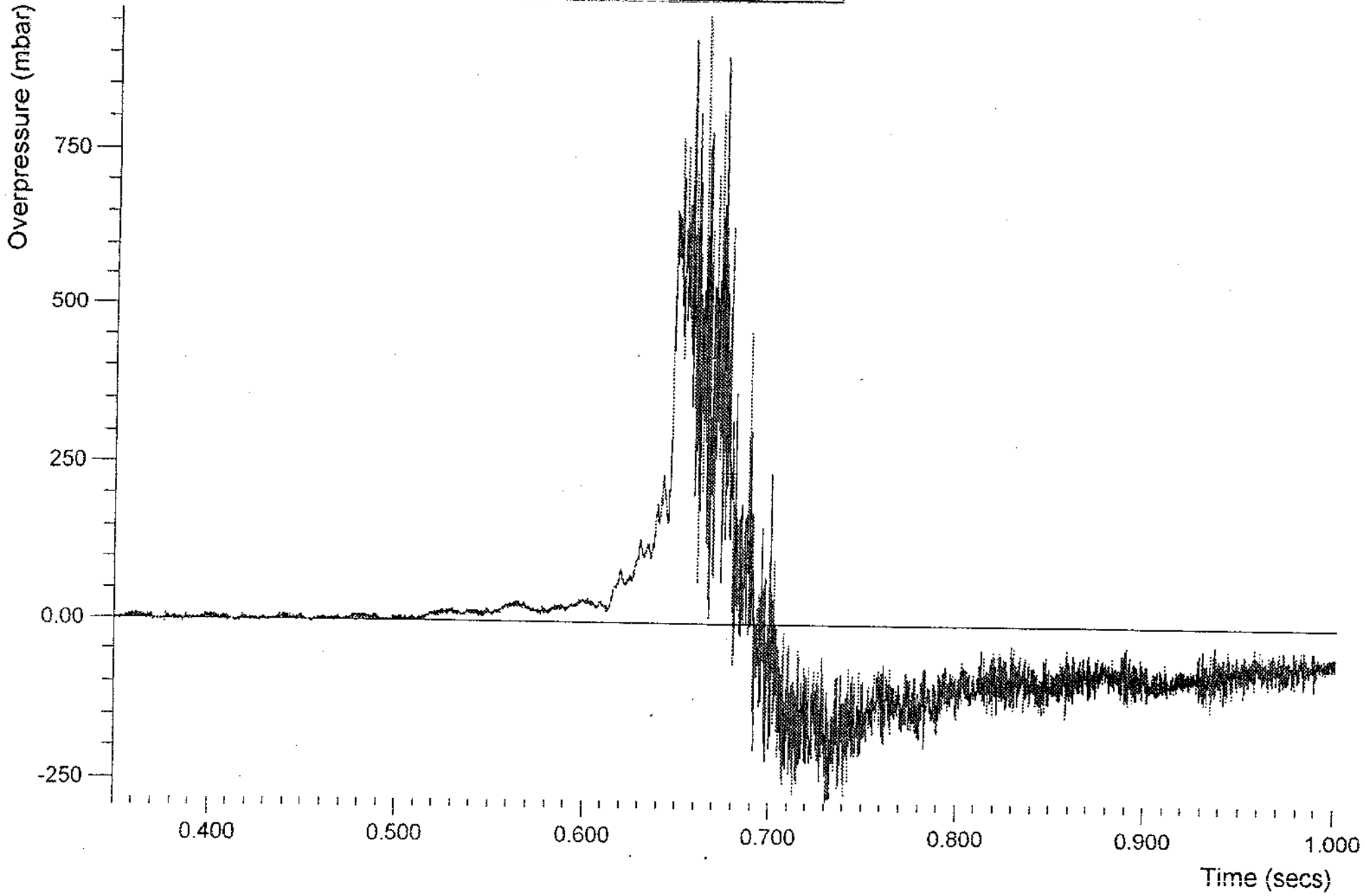
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Transducer no: PI-32



Test: HSE 9 (O1 C2 I4)
Transducer no: Pt-33

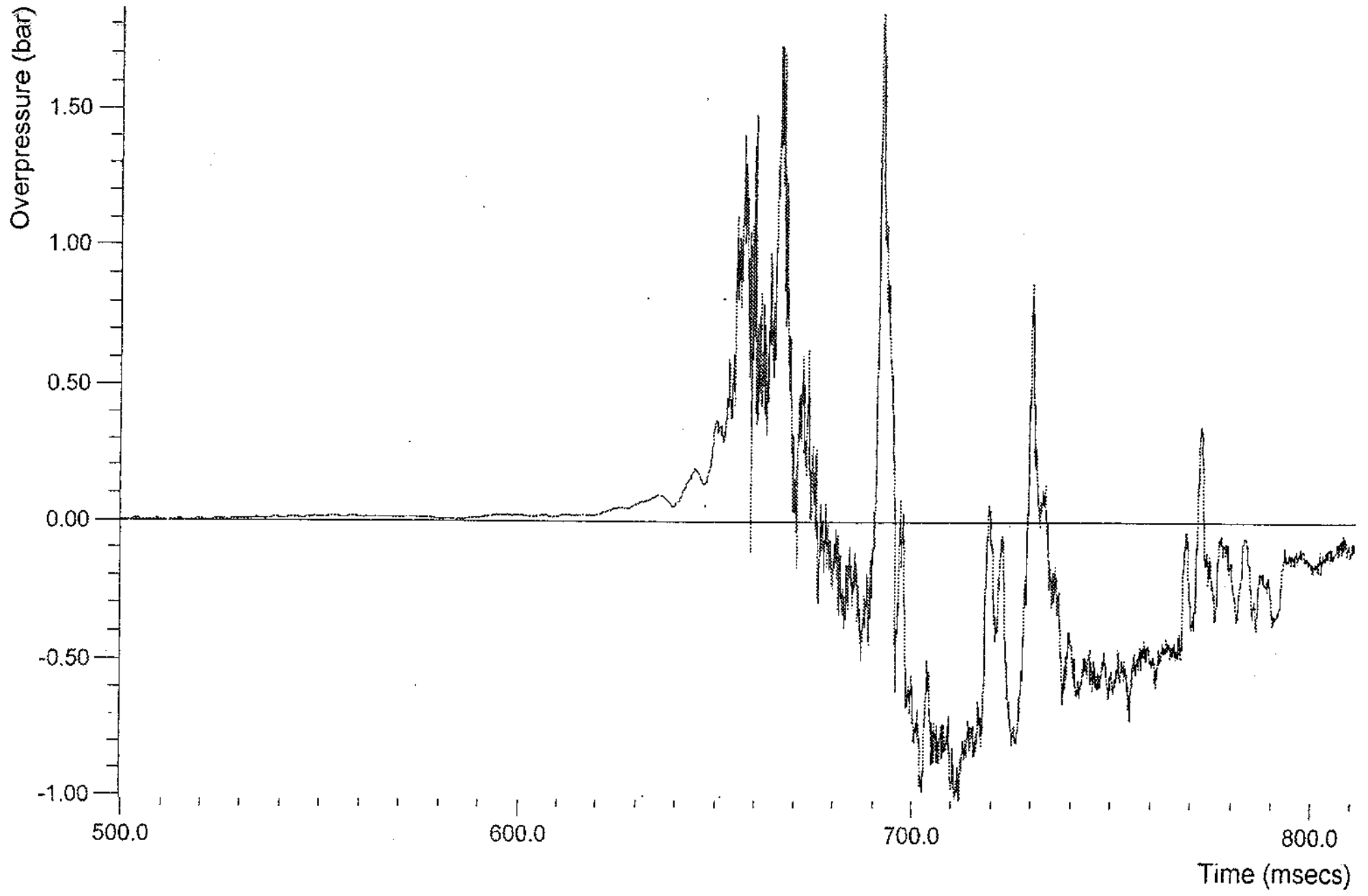


Test: HSE 9 (O1 C2 I4)
Transducer no: PI-35

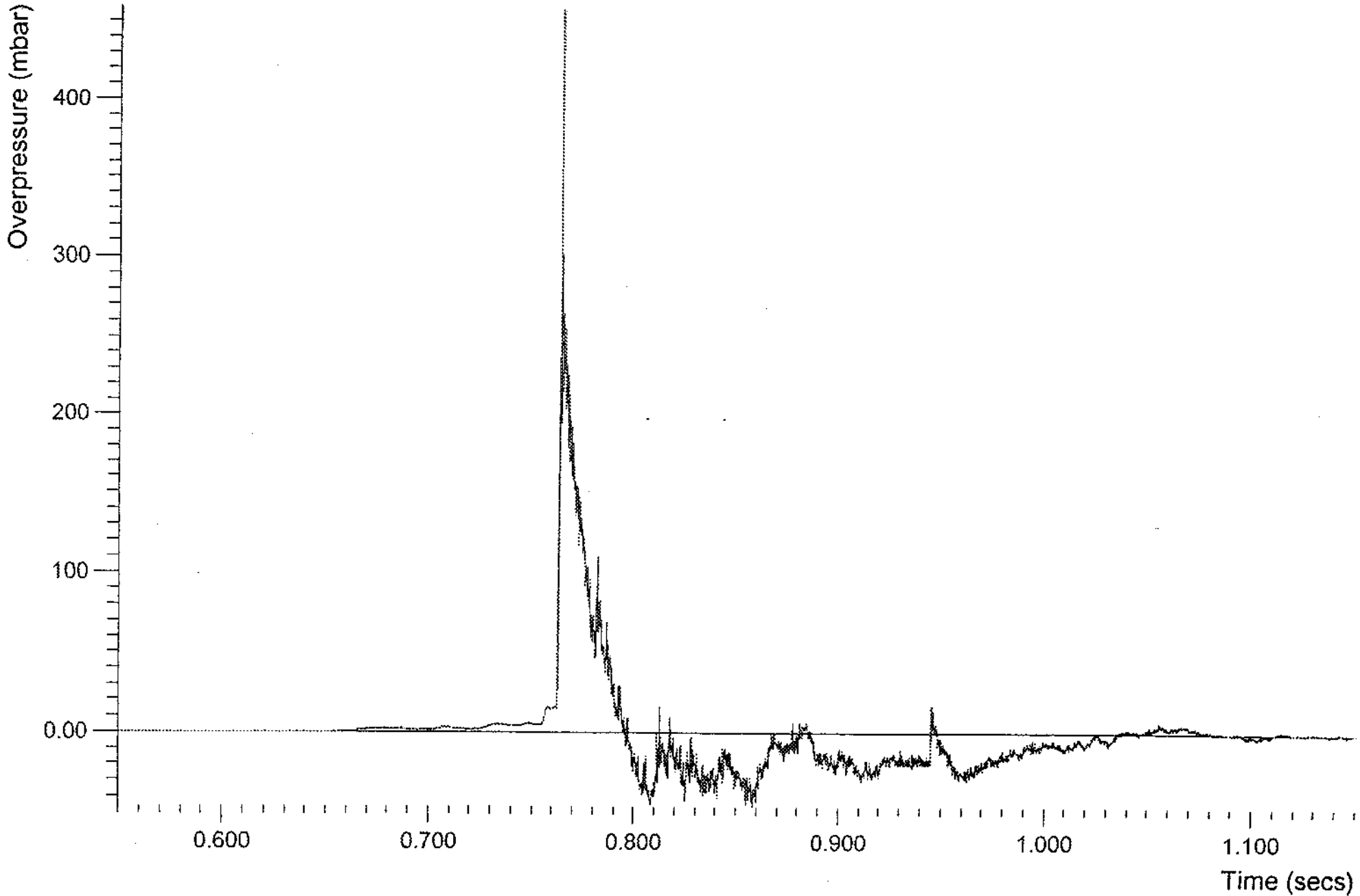


Appendix B: External Overpressure Profiles

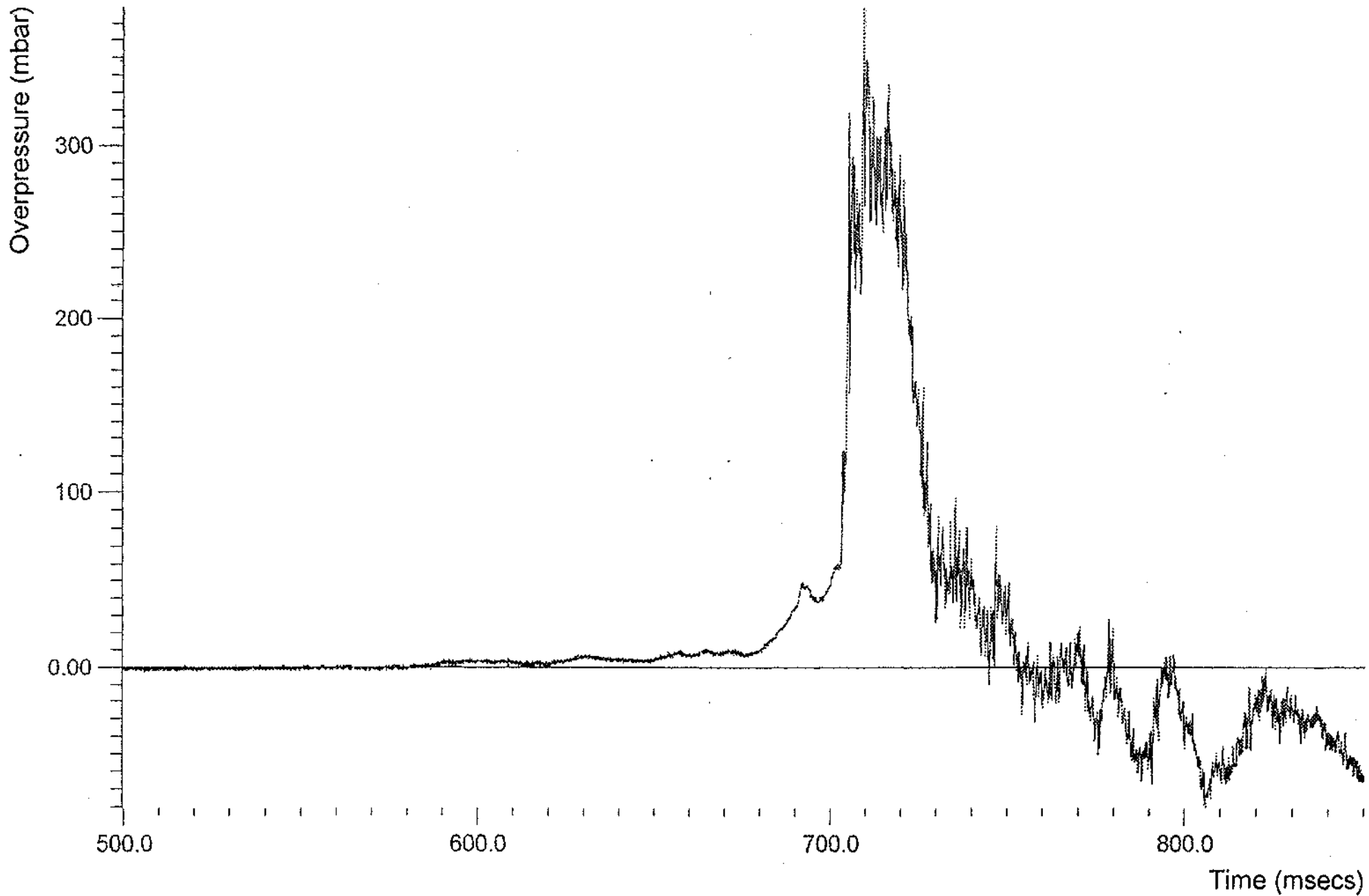
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Transducer no: PE-1



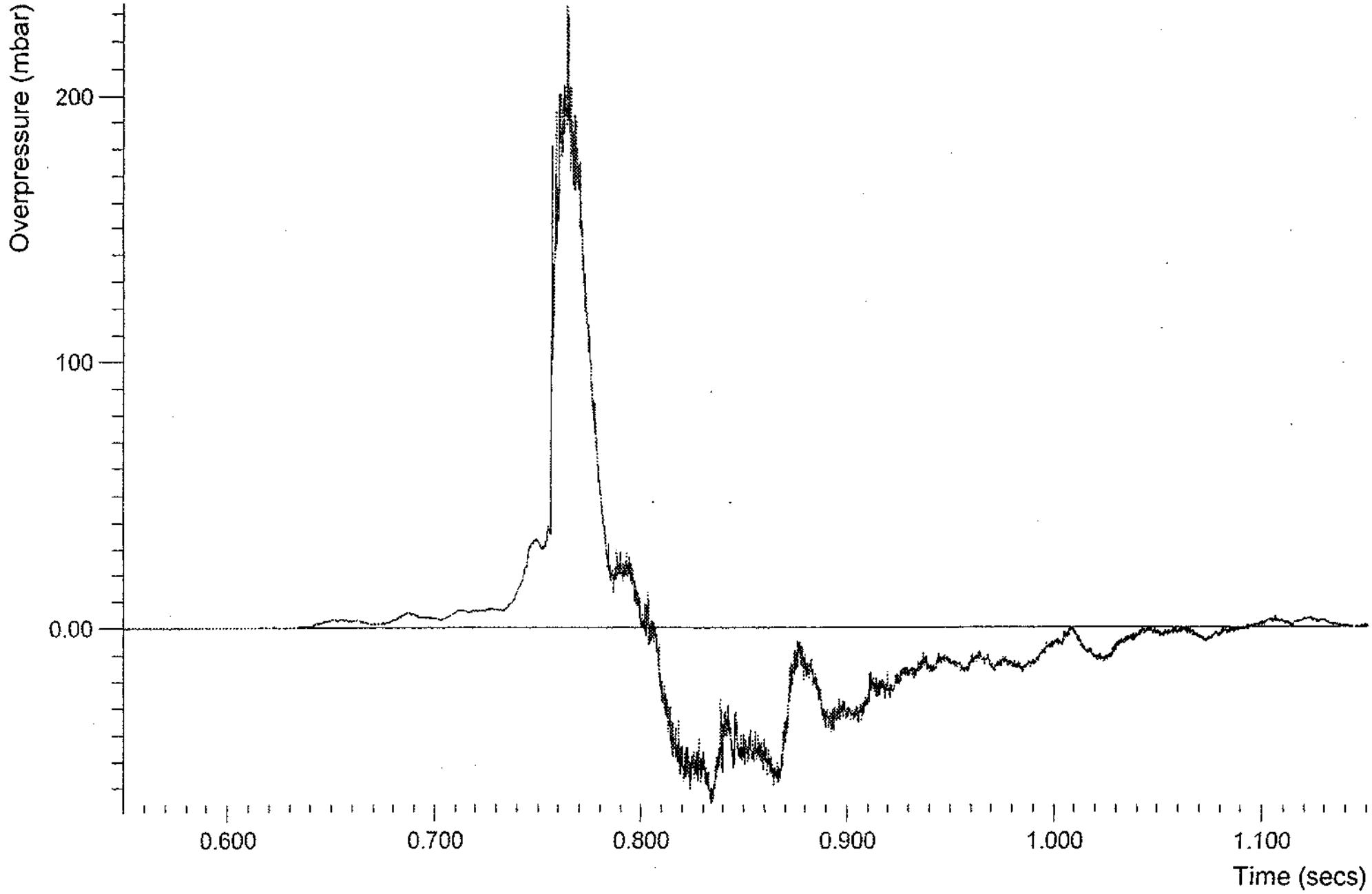
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Transducer no: PE-4



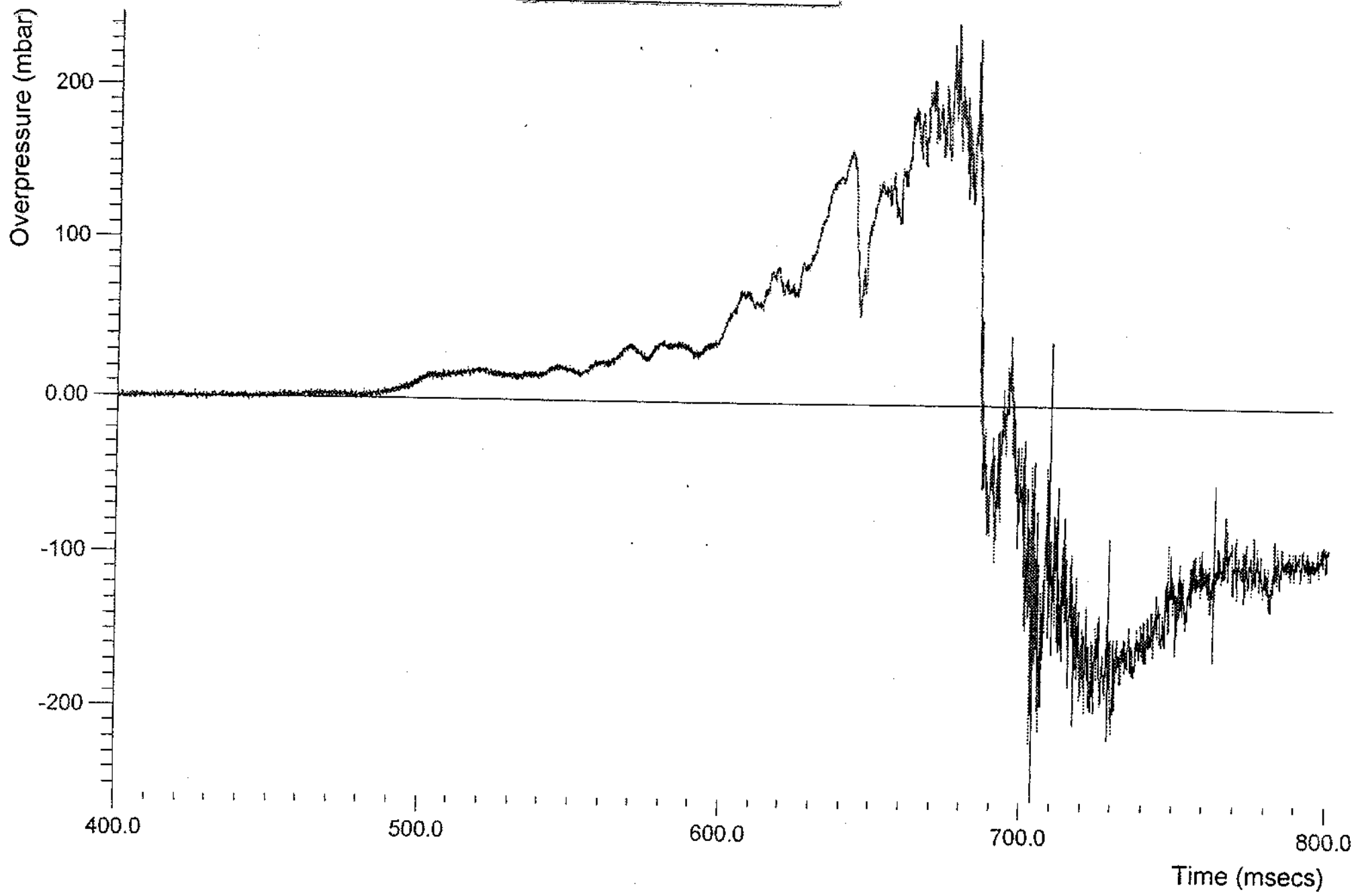
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Transducer no: PE-5



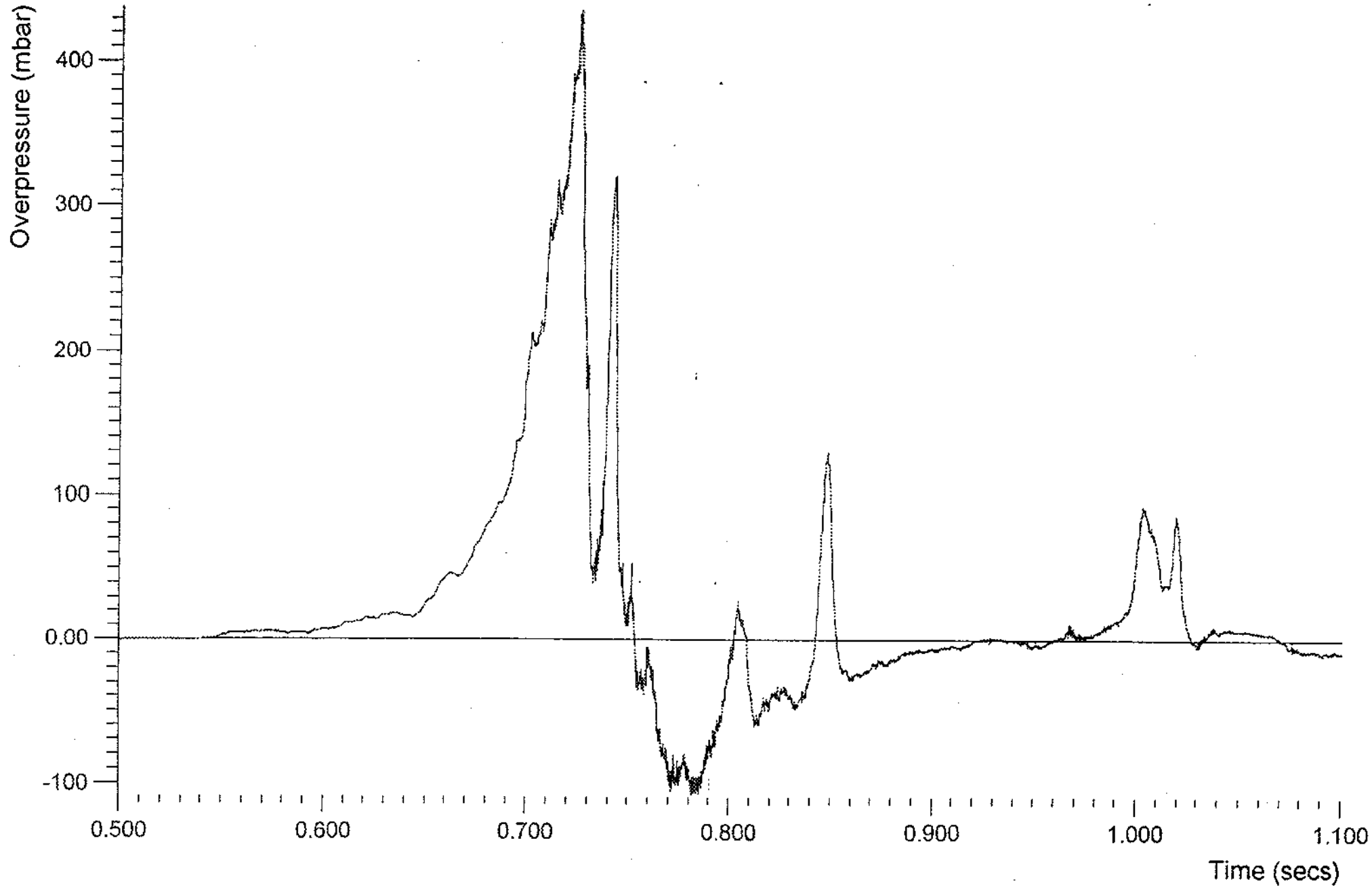
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Transducer no: PE-6



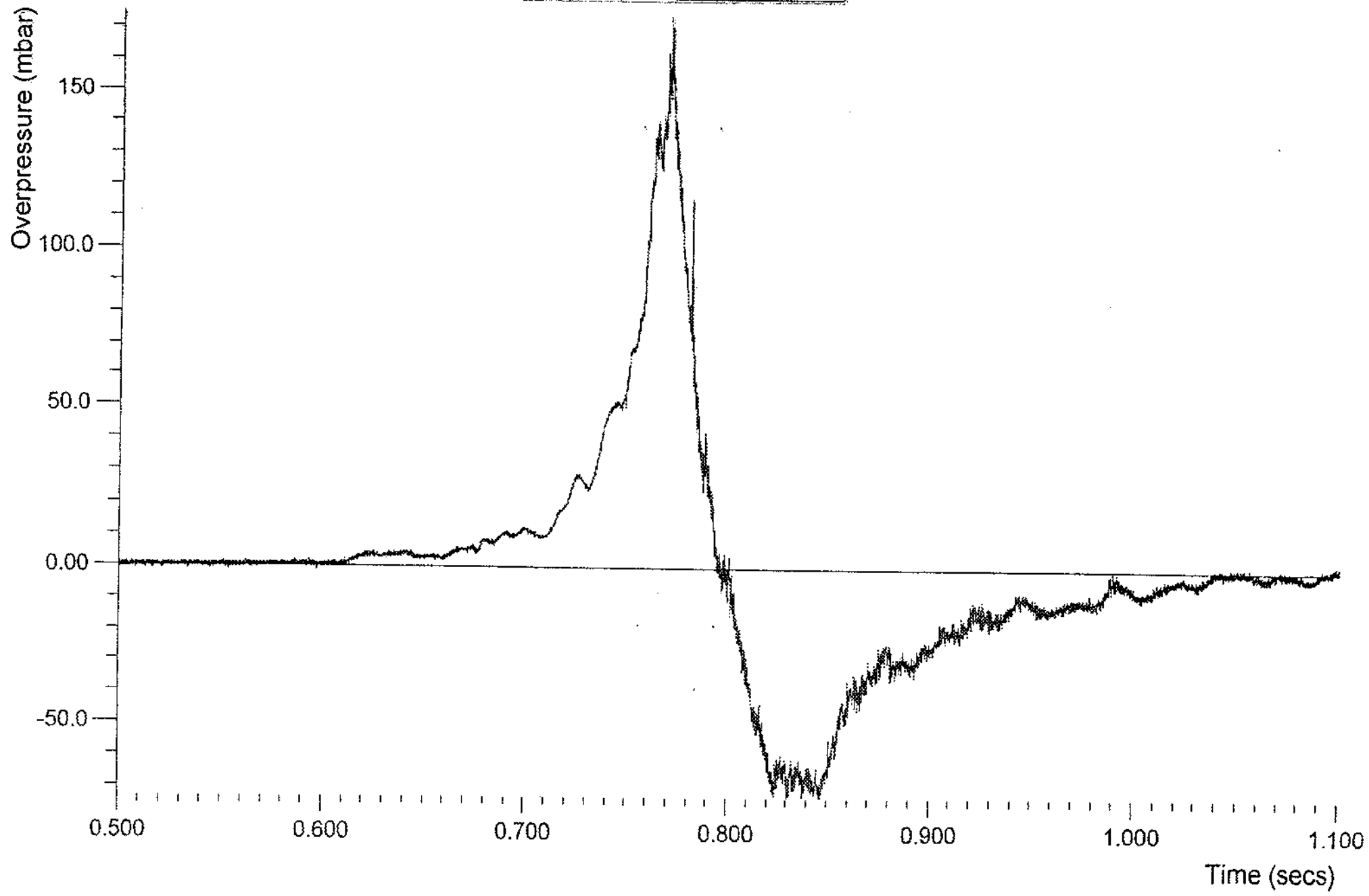
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Transducer no: PE-7



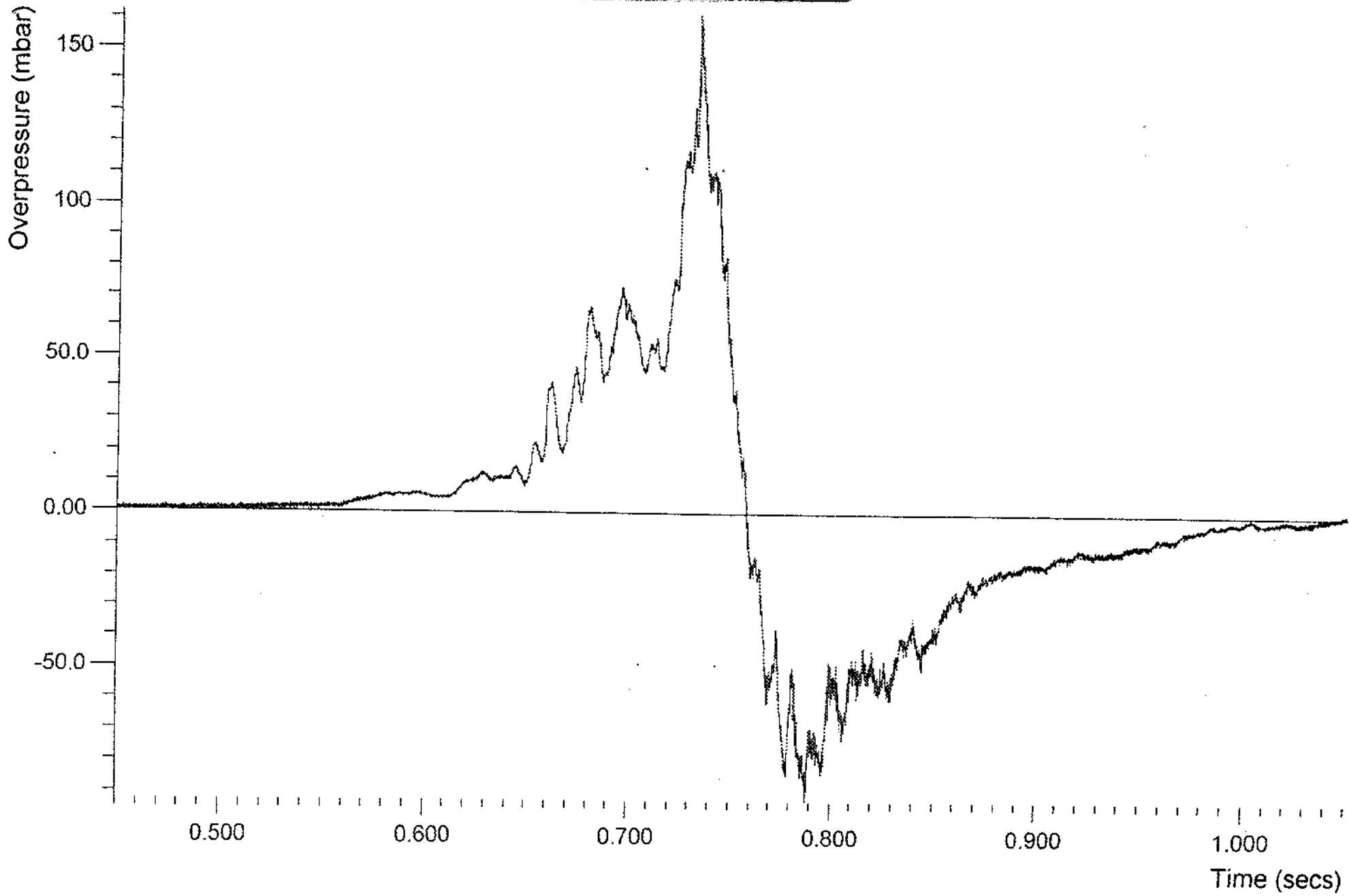
Test: HSE 9 (O1 C2 I4)
Transducer no: PE-9



Test: HSE 9 (O1 C2 I4)
Transducer no: PE-10



Test: HSE 9 (O1 C2 I4)
Transducer no: PE-11

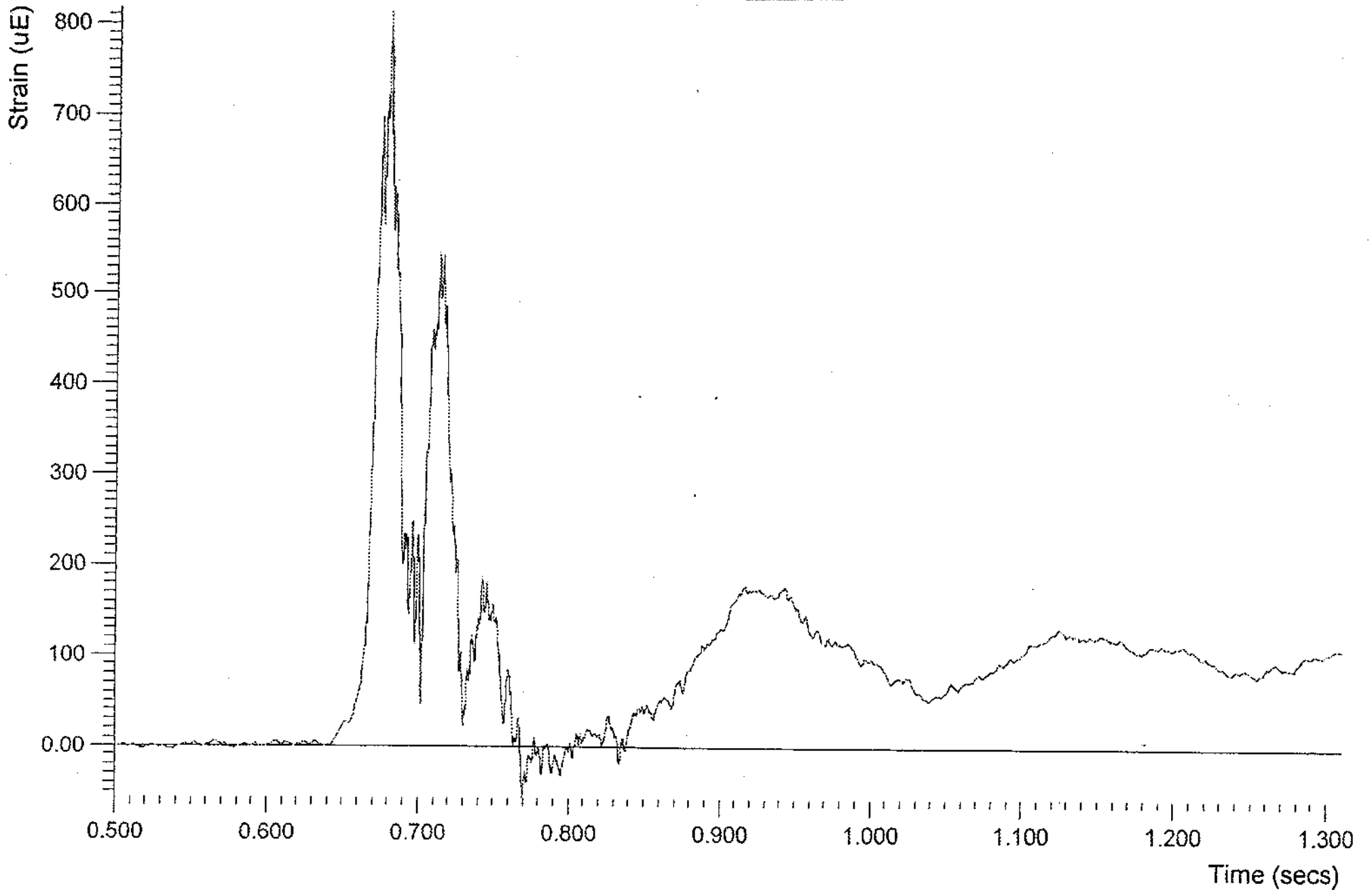


Appendix C: Strain Gauge Profiles

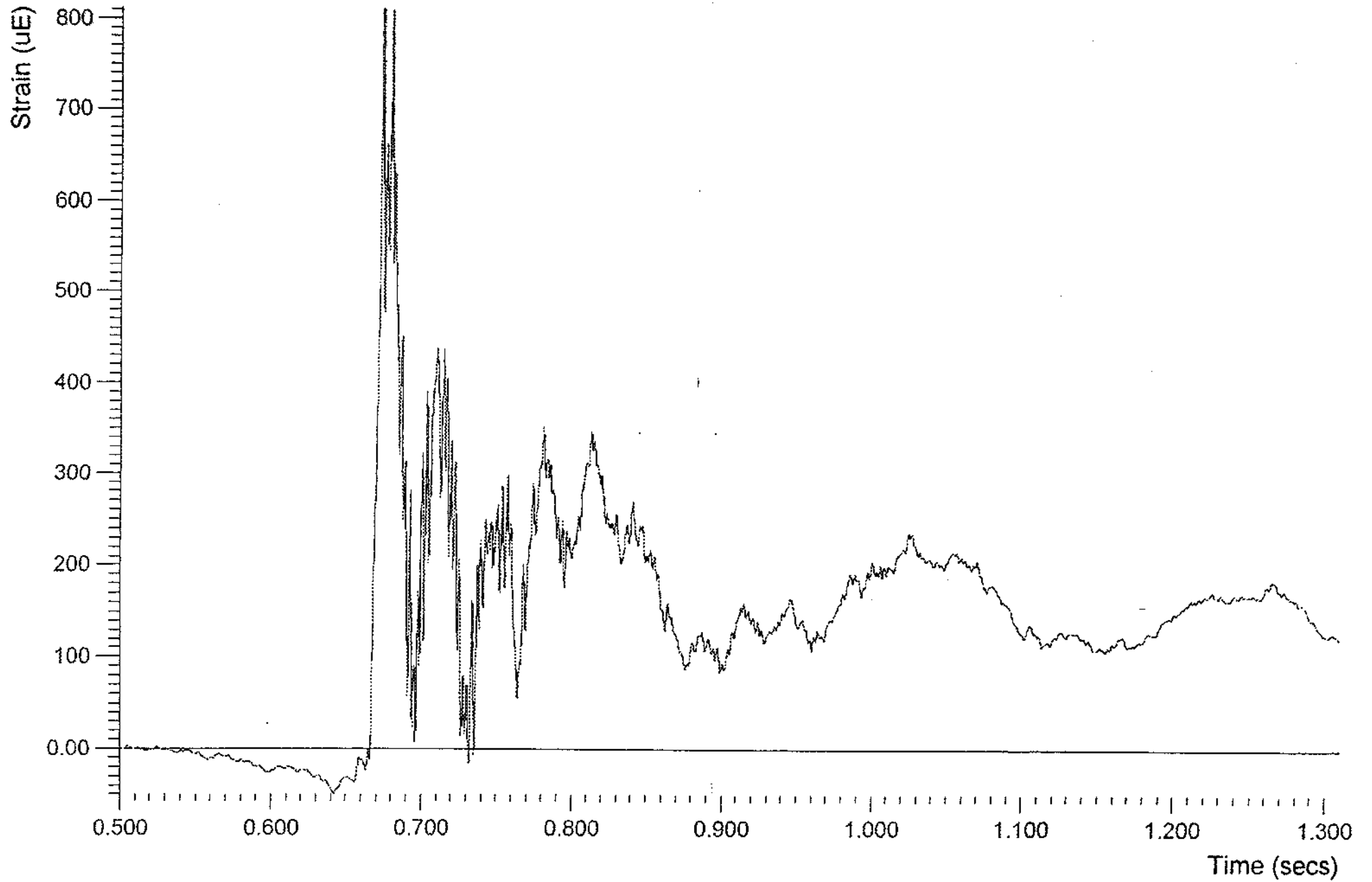
Table C1: Location of Strain Gauges

Measuring Position	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)
ST-301	28.06	-0.05	0.24
ST-302	28.01	-0.32	0.24
ST-303	28.00	-0.56	0.24
ST-304	27.90	-0.32	0.24
ST-305	20.00	-7.17	1.50
ST-306	20.00	-6.82	1.20

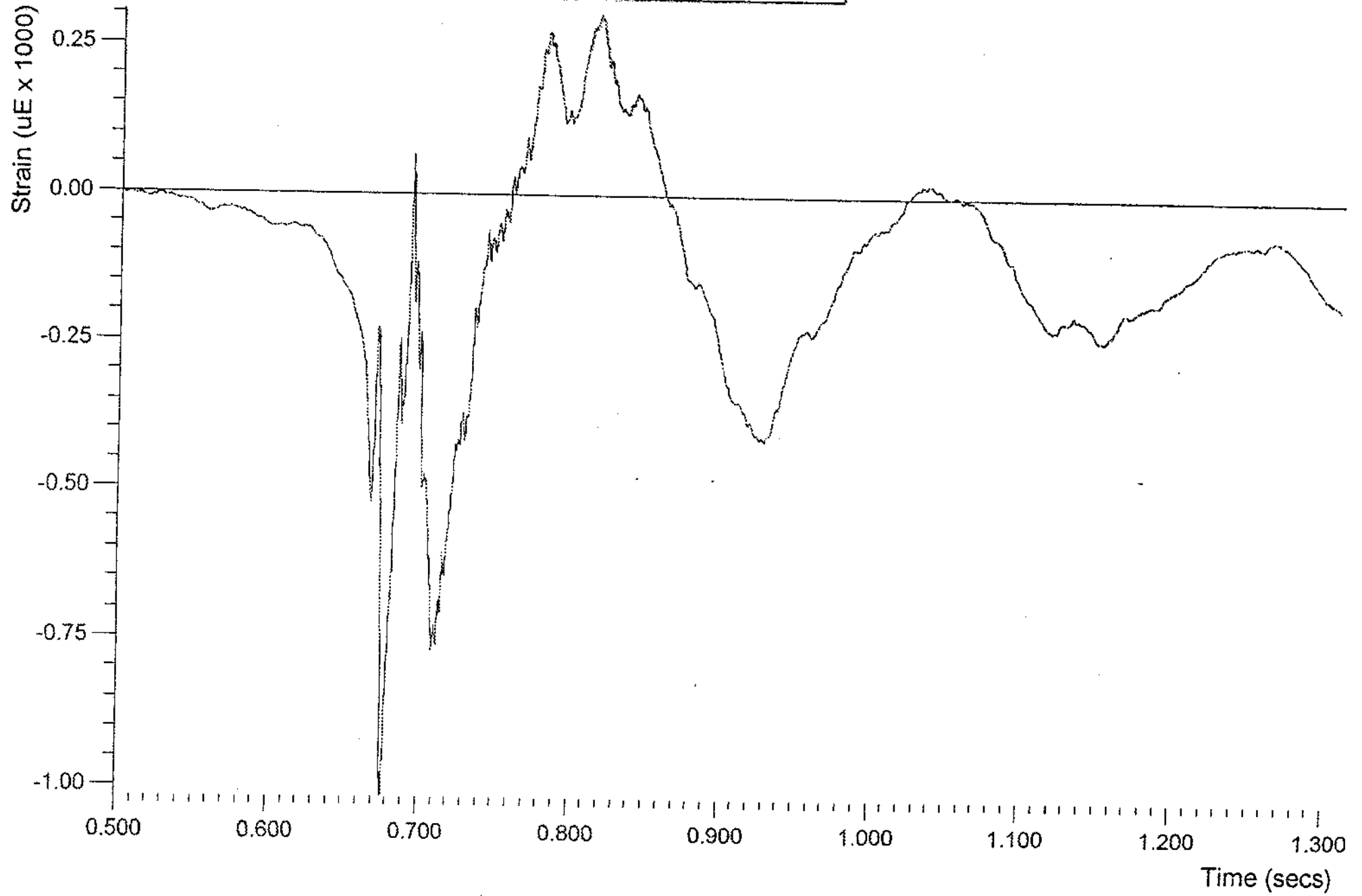
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Strain Gauge ST-301



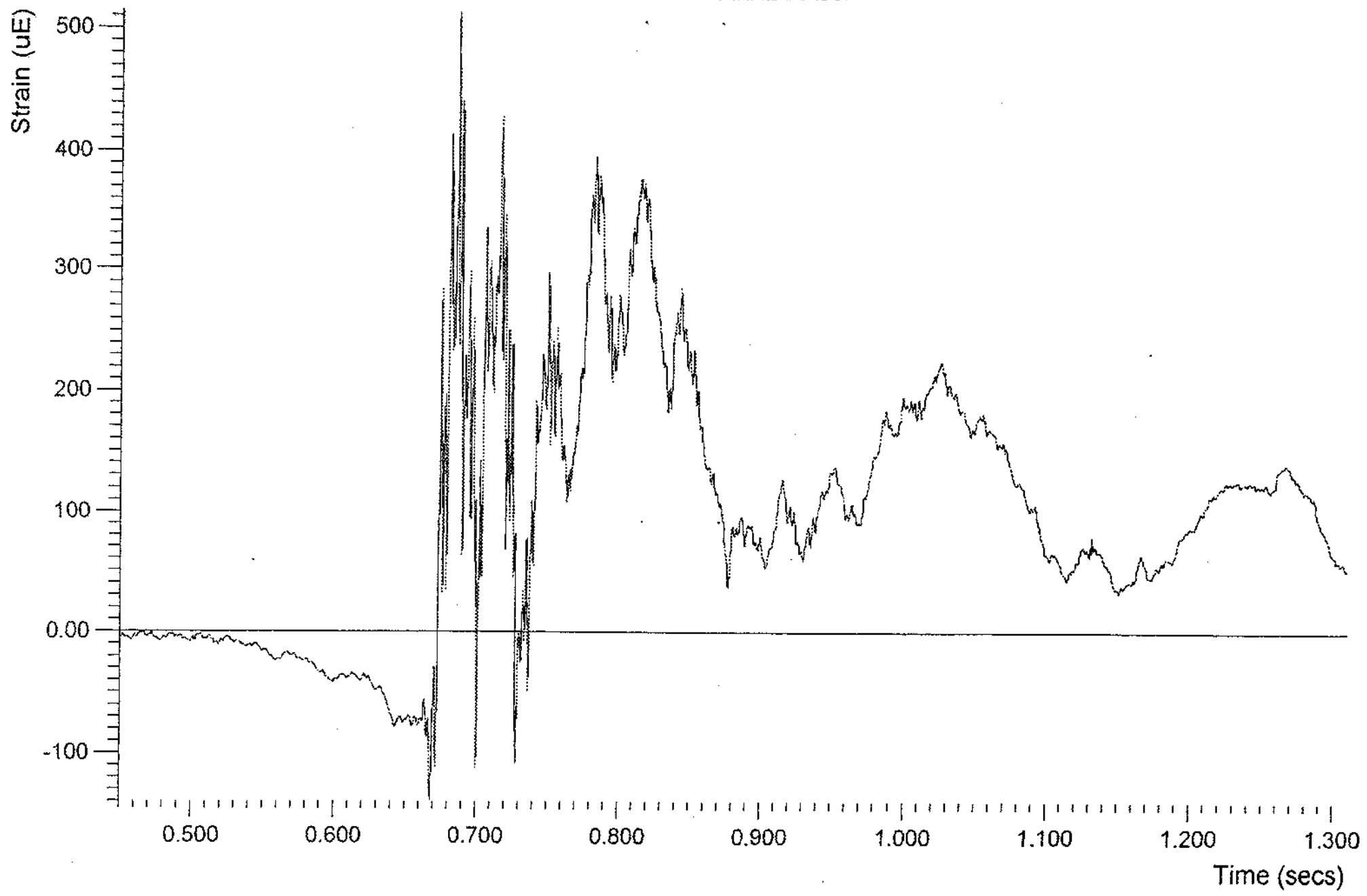
Test: HSE 9 (O1 C2 I4)
Strain Gauge ST-302



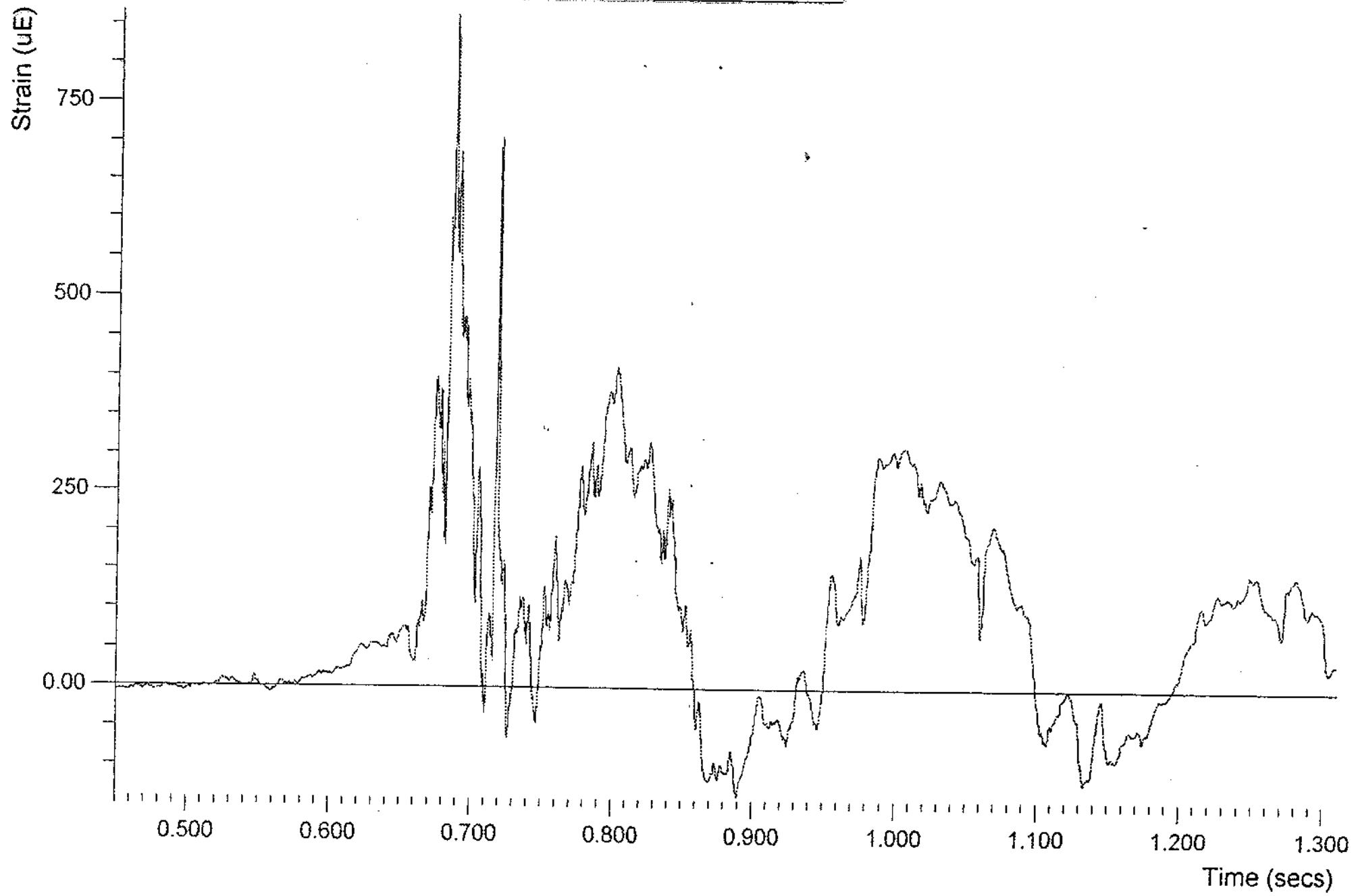
Test: HSE 9 (O1 C2 I4)
Strain Gauge ST-303



Test: HSE 9 (O1 C2 I4)
Strain Gauge ST-304



Test: HSE 9 (O1 C2 I4)
Strain Gauge ST-305

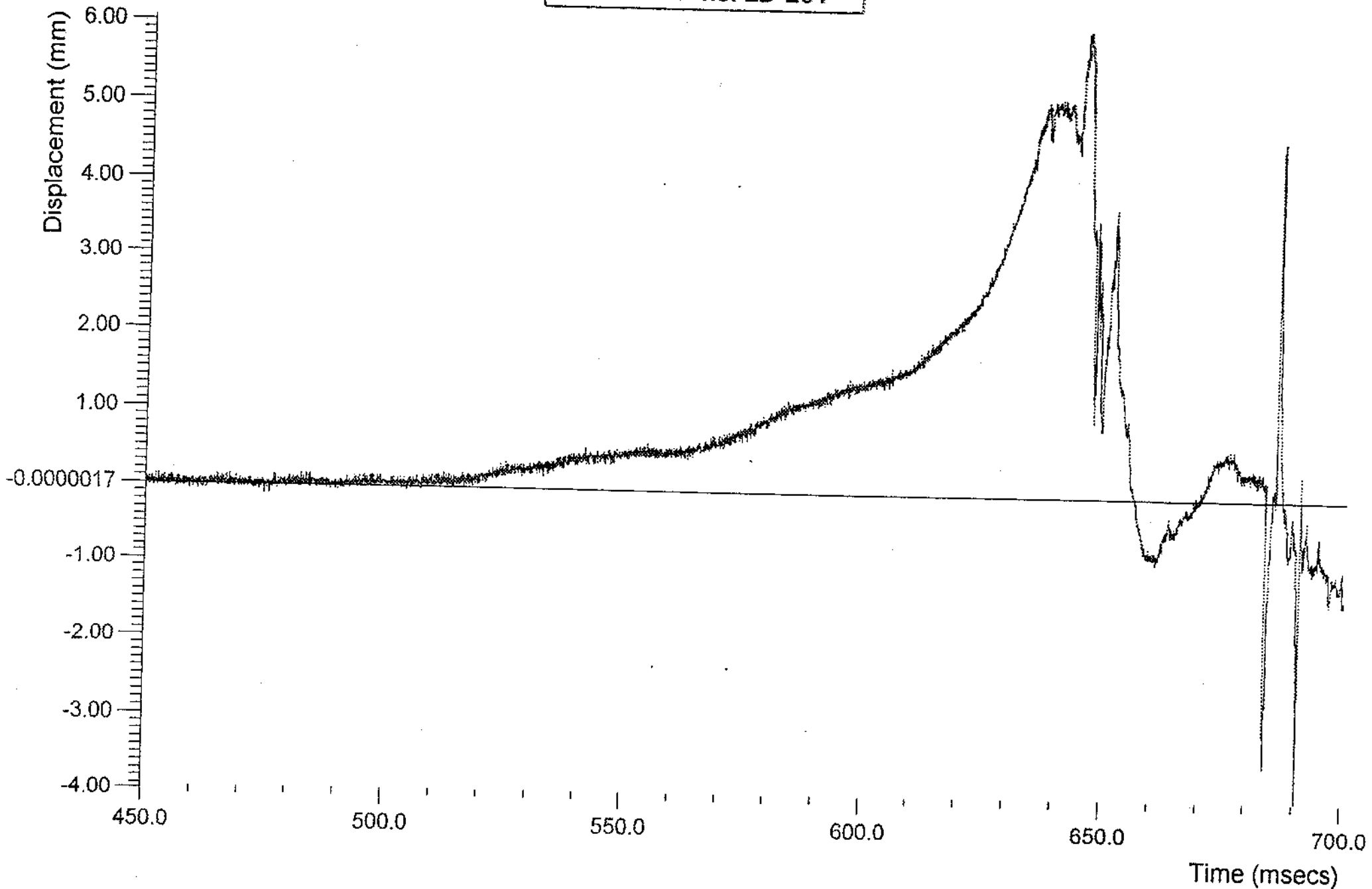


Appendix D: Linear Displacement Transducer Profiles

Table D1: Location of Linear Displacement Transducers

Measuring Position	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)
LD-201	0.00	-0.66	4.00
LD-202	11.50	-0.60	4.00
LD-203	24.00	-0.66	4.00

Test: HSE 9 (O1 C2 I4)
Transducer no: LD-201



Test: HSE 9 (O1 C2 I4)
Transducer no: LD-202

