

Test Report

Document No.	B7019592	Copy No.	1	Number of pages	28
Apparatus	MO resistors type B34/30				
Designation	---				
Serial Number	---				
Manufacturer	Joint-Stock Company " Polymer-Apparat"				
Client	Joint-Stock Company " Polymer-Apparat Ak. Kostantinova Strasse, 1 195427 – Saint-Petersburg - Russian Federation				
Tested for	---				
Date(s) of tests	September 27-28, 2017				
Tested by	CESI S.p.A. Via Rubattino, 54 20134 Milano - Italy				
Test performed	Residual voltage tests				

PAD B7019592 (2437407) - CONFIDENTIAL USE

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this document has been subjected to the series of proving tests in accordance with: IEC 60099-4 – Edition 3.0 (2014-06)

The results are shown in the record of proving tests and the oscillograms attached hereto. The ratings assigned by the Manufacturer are listed on the ratings page.
The document applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

November 9, 2017

Date
Gregori Marco
B7019592 3059 AUT
Test Engineer in charge
The Manager - Arcidiaco Lorenzo
B7019592 821814 ASP
Approved By Document Digitally Signed

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LAB N° 0030

The laboratory meets the requirements of the Standard EN ISO/IEC 17025: 2005 "General Requirements for the Competence of Testing and Calibration Laboratories". The in force status of the accreditation and the list of accredited tests may be checked in the WEB site: www.accredia.it



CESI

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Notes

STL-Member

CESI Group members are founder members of the SHORT-CIRCUIT TESTING LIAISON (STL) which has been established in 1969. STL is a forum for voluntary international cooperation of testing organizations.

CESI Group Test Documents description

Type Test Certificate of

Issued for type tests of high voltage products ($> 1 \text{ kV}_{ac}$; $> 1,5 \text{ kV}_{dc}$), which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. The Type Test Certificate consists of documents unequivocally identifying the test object and describes all conditions under which the tests were conducted. It gives evidence of the unobjectionable behavior of the test object during the tests in line with the normative documents applied as well as of the results of successful testing.

Test Certificate of (complete / selected) Type Tests

Issued if type tests of low voltage products ($< 1 \text{ kV}_{ac}$; $< 1,5 \text{ kV}_{dc}$) requested by the relevant product standard were passed. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Certificate of Design Verification

Issued for passed design verification tests according to IEC 61439. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Type Test Report

Issued for high and low voltage products if parts of selected type tests have been passed; those shall be carried out in full compliance with the relevant standards but (for high voltage products) do not fulfill all STL requirements for issuing a Type Test Certificate. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Test Report

Issued for all other tests on high and low voltage products which have been carried out according to specifications, standards and/or client instructions

On-Site Test Record

Issued as a record of results acquired during the on-site tests / measurements

Test Award

Can be additionally issued for all named types of test documents above if the tests to be referenced were passed

Tests witnessed by:

Identification of the object: Requested

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings. CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.

These drawing, identified by CESI and numbered B7020387 No. 1 , is annexed to this document.

The reported expanded uncertainties are determined in accordance with the Publication JCGM 100 "Evaluation of measurement data – Guide to the expression of uncertainty in measurement" and are based on a standard uncertainty multiplied by a coverage factor $K=2$, which for a normal distribution provides a level of confidence of approximately 95%

- Voltage a.c.	: $\pm 3,0\%$
- Residual peak voltage (impulse tests)	: $\pm 3,0\%$
- Current a.c.	: $\pm 3,0\%$
- Peak current (impulse tests)	: $\pm 3,0\%$
- Time (impulse tests)	: $\pm 10,0\%$
- Time (a.c. tests)	: $\pm 1,5\%$

Laboratory information

Receipt date of the sample	September 2017
Test location	CESI – Via Rubattino 54 – Milan
CESI testing team	Mr. L. Podavitte, Mr. I Guacci
Test laboratory	P177 (Surge Arrester laboratory)
ODV SAP	70006781





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Lightning impulse residual voltage test	9 to 10	September 27, 2017
Steep current impulse residual voltage test (measurement of inductive error)	11	September 28, 2017
Steep current impulse residual voltage test	12	September 28, 2017
Technical data	from page 13 to 14	
PAGES ANNEXED:		
Oscillograms no. 13 pages		
Client's drawing - CESI no.B7020387 no. 1 page		

Test object characteristics (assigned by the client)

Manufacturer's name	Joint-Stock Company "Polymer-Apparat"
Arrester class	Distribution
Designation	DH
MO resistor type	B34/30
Drawing code	PA.VAR.0400.30
Nominal discharge current - [kA]	10,0
Maximum residual voltage at 10 kA - [kV]	14,36
Reference current - I_{ref} [mA]	1,0
Repetitive charge transfer rating - Q_{rs} [C]	0,4
Flat surface area [cm ²]	10,52
Rated frequency - [Hz]	48÷62
Year of manufacture	February 2017

geometrical characteristics measured on MO resistor

Total height [mm]	31,1 mm
Diameter [mm]	36,6 mm

Photograph of the test objects



Photo no. 1

MO resistors type B34/30

Reference Standard

The test was carried out according to the IEC 60099-4 – Edition 3.0 (2014-06) - Clause 8.3
 “Metal-oxide surge arresters without gaps for a.c. system”

Test carried out	Number of sample tested
Lightning impulse residual voltage test	3
Steep current impulse residual voltage test	

Test object identification

Test object name	Identification of test sample (given by CESI)	Lot number and /s/n of the test sample (given by JSC “Polymer Apparat”)
MO resistors type B34/30	RV1	702.378b – 36
	RV2	702.378b – 86
	RV3	702.378b – 43

Test procedure

The following tests have been carried out on the same three samples:

a) Lightning impulse residual voltage test

- wave-shape 8/20 μ s
- peak current $0,5xI_n = 5,0$ kA - $I_n = 10,0$ kA & $2xI_n = 20,0$ kA

b) Steep current impulse residual voltage test

- wave-shape front time equal to 1 μ s, tail time less than 20 μ s
- peak current $I_n = 10$ kA

- note

Correction of the inductive error

The inductive error was determined replacing the surge arrester section with a metal part having the same dimensions and measuring the voltage across the metal part in this condition.

Being the inductive error (peak value) in the range 2% to 20% of the measured residual voltage (peak value) the correction was applied by subtracting the impulse voltage shape measured on the surge arrester section and the impulse voltage shape on the metal part.

Test result

See relevant pages.

Residual voltage tests

Lightning impulse residual voltage test.

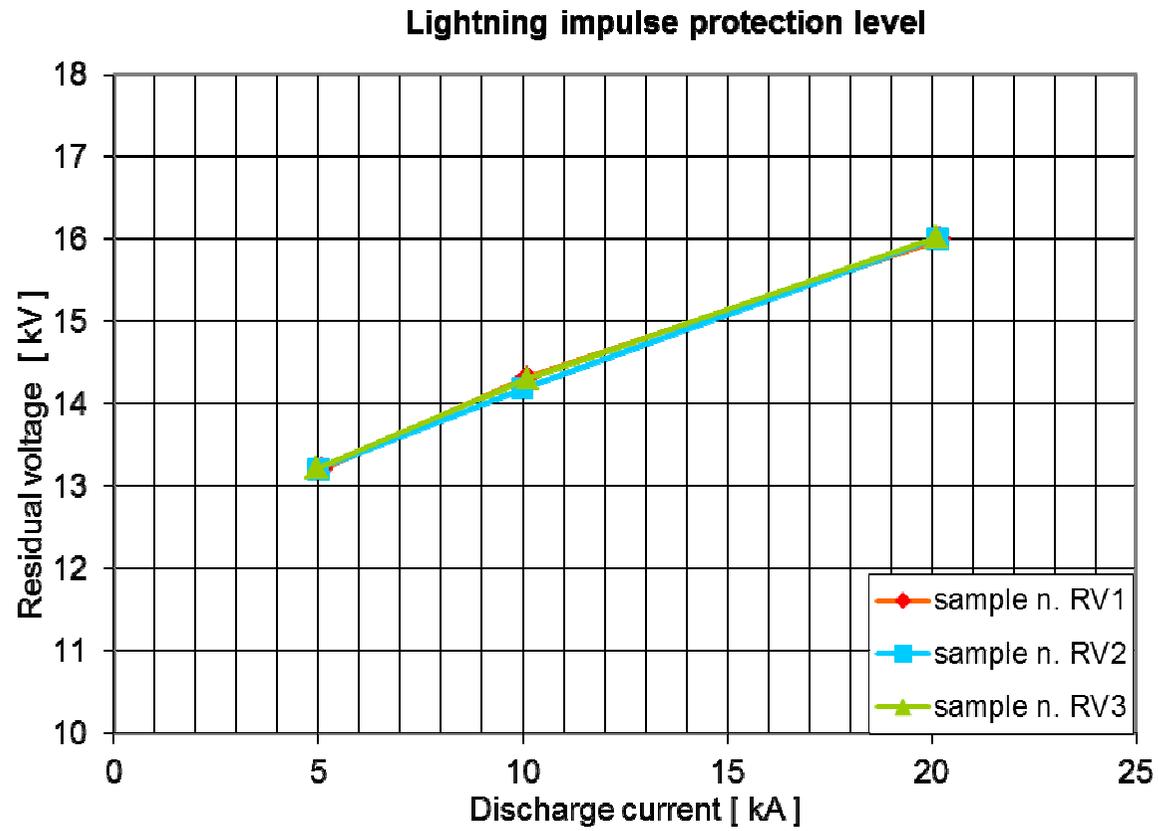
Test circuit: A0120

Ambient temperature 22°C

Date: September 27, 2017

Sample	Requested current	Charging voltage	Oscillogram	Current waveshape	Discharge current	Residual voltage	Lightning impulse protection level
No.		kV	No.	μs	kA	kV	kV
RV1	$0,5 \times I_n$	18,4	7	8,4/18,4	5,09	13,21	14,32
	I_n	24,2	1	8,5/18,2	10,12	14,32	
	$2,0 \times I_n$	36,0	4	8,5/18,1	20,20	16,00	
RV2	$0,5 \times I_n$	18,4	8	8,4/18,4	5,00	13,21	
	I_n	24,2	2	8,5/18,2	9,99	14,19	
	$2,0 \times I_n$	36,0	5	8,5/18,1	20,14	16,01	
RV3	$0,5 \times I_n$	18,4	9	8,4/18,4	4,97	13,22	
	I_n	24,4	3	8,5/18,2	10,11	14,31	
	$2,0 \times I_n$	36,0	6	8,5/18,1	20,10	16,02	

Notes:



Residual voltage tests

Steep current impulse residual voltage test.

Measurement of the inductive error

Test circuit: A0121B

Ambient temperature : 23°C

Date: September 28, 2017

Sample	Charging voltage	Oscillogram	Current waveshape	Discharge current	Peak voltage	Inductive error
No.	kV	No.	µs	kA	V	%
aluminium block	33,3	10	1,0/2,2	10,18	270,0	< 2 (1)

Notes: (1) correction is not required

Residual voltage tests

Steep current impulse residual voltage test.

Test circuit: A0121B

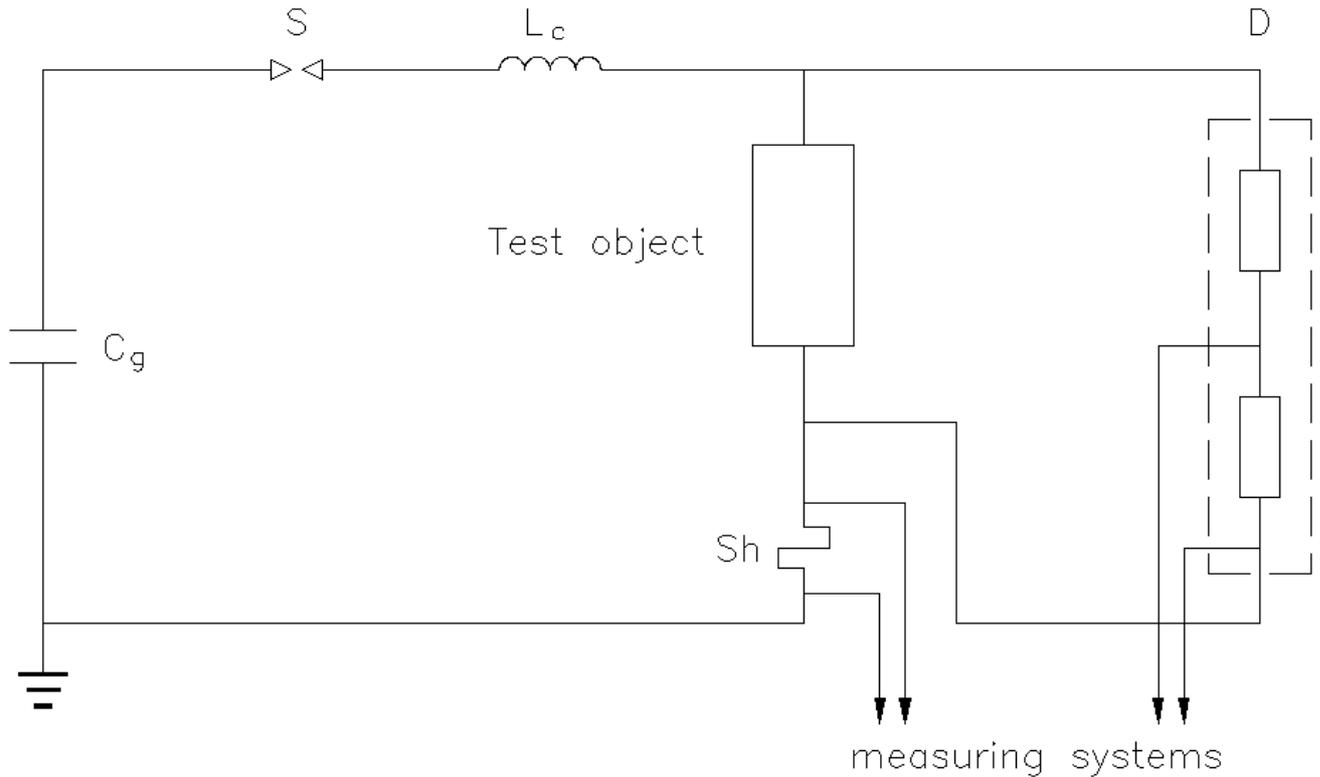
Ambient temperature : 23°C

Date: September 28, 2017

Sample	Charging voltage	Oscillogram	Current waveshape	Discharge current	Residual voltage	Steep current impulse protection level
No.	kV	No.	µs	kA	kV	kV
RV1	33,3	11	1,0/2,2	9,95	15,33	15,47
RV2	33,3	12		9,95	15,40	
RV3	33,4	13		9,95	15,47	

Notes:

Circuit A0120



Impulse generator

- No. of stages 1
- Cg 6,64 μ F
- Lc 6 μ H

S - Spark-gap
 For 2xIn a resistor block has been added

Voltage measuring system.

- D - Voltage divider SAGI; CESI No.11120
 - Electro optical system type HBM CESI No. 57986(Rx) – 57991 (Tx)
- OSC - Oscilloscope type NATIONAL INSTRUMENT NI PXI-1031/NI-PXI 8108/NI-PXI 5122;
 - CESI No 056227- 0562226 (on channel No.2)

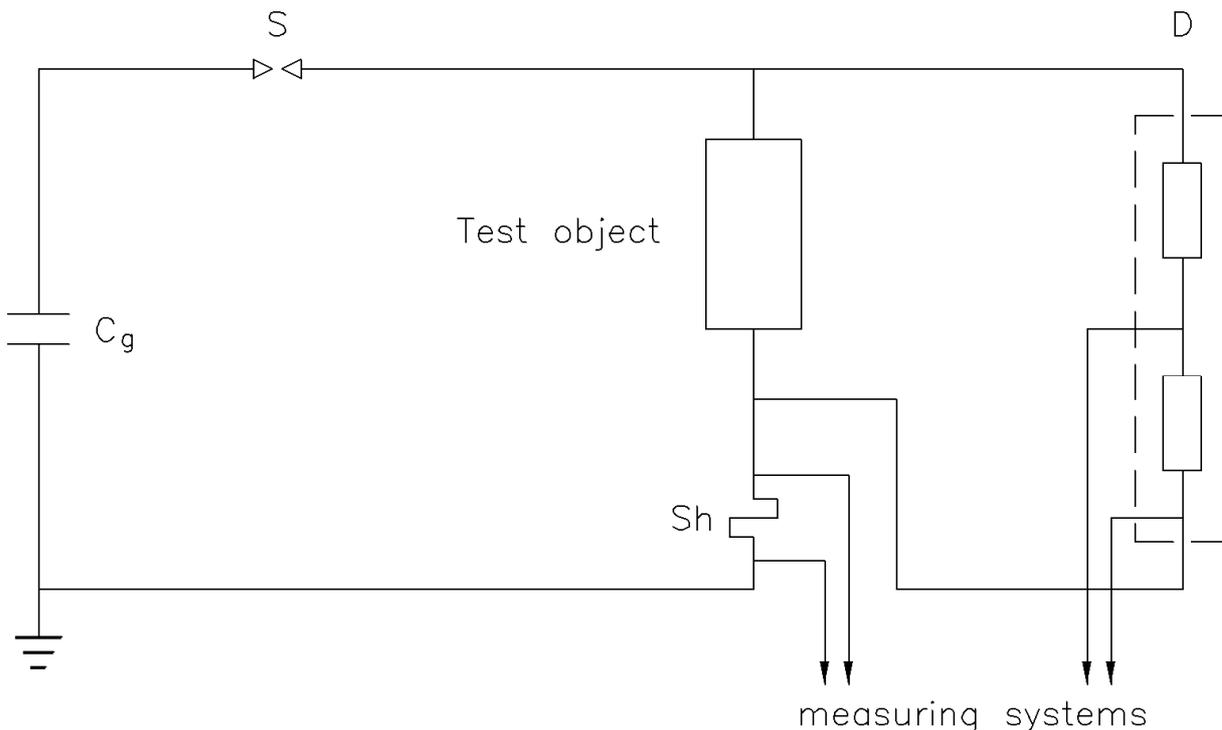
Current measuring system

- Sh - Current shunt CESI No.6042; R= 1,98 m Ω ; peak current= 250 kA
 - Electro optical system HBM CESI No. 57986(Rx) – 57987 (Tx)
- OSC - Oscilloscope type NATIONAL INSTRUMENT NI PXI-1031/NI-PXI 8108/NI-PXI 5122;
 - CESI No 056227- 0562226 (on channel No.1)

SOFTWARE SYSTEM:

- SW - S.A.D. Surge arrester version 2.0

Circuit A0121B



Impulse generator

No. of stages 1
 Cg 0,500 μ F

S - Spark-gap

Voltage measuring system.

D - Voltage divider SAGI; CESI No.11120
 - Electro optical system type HBM CESI No. 57986(Rx) – 57991 (Tx)

OSC - Oscilloscope type NATIONAL INSTRUMENT NI PXI-1031/NI-PXI 8108/NI-PXI 5122;
 - CESI No 056227- 0562226 (on channel No.2)

Current measuring system

Sh - Current Pearson CESI No.8252; 0,01 V x A
 - Electro optical system HBM CESI No. 57986(Rx) – 57987 (Tx)

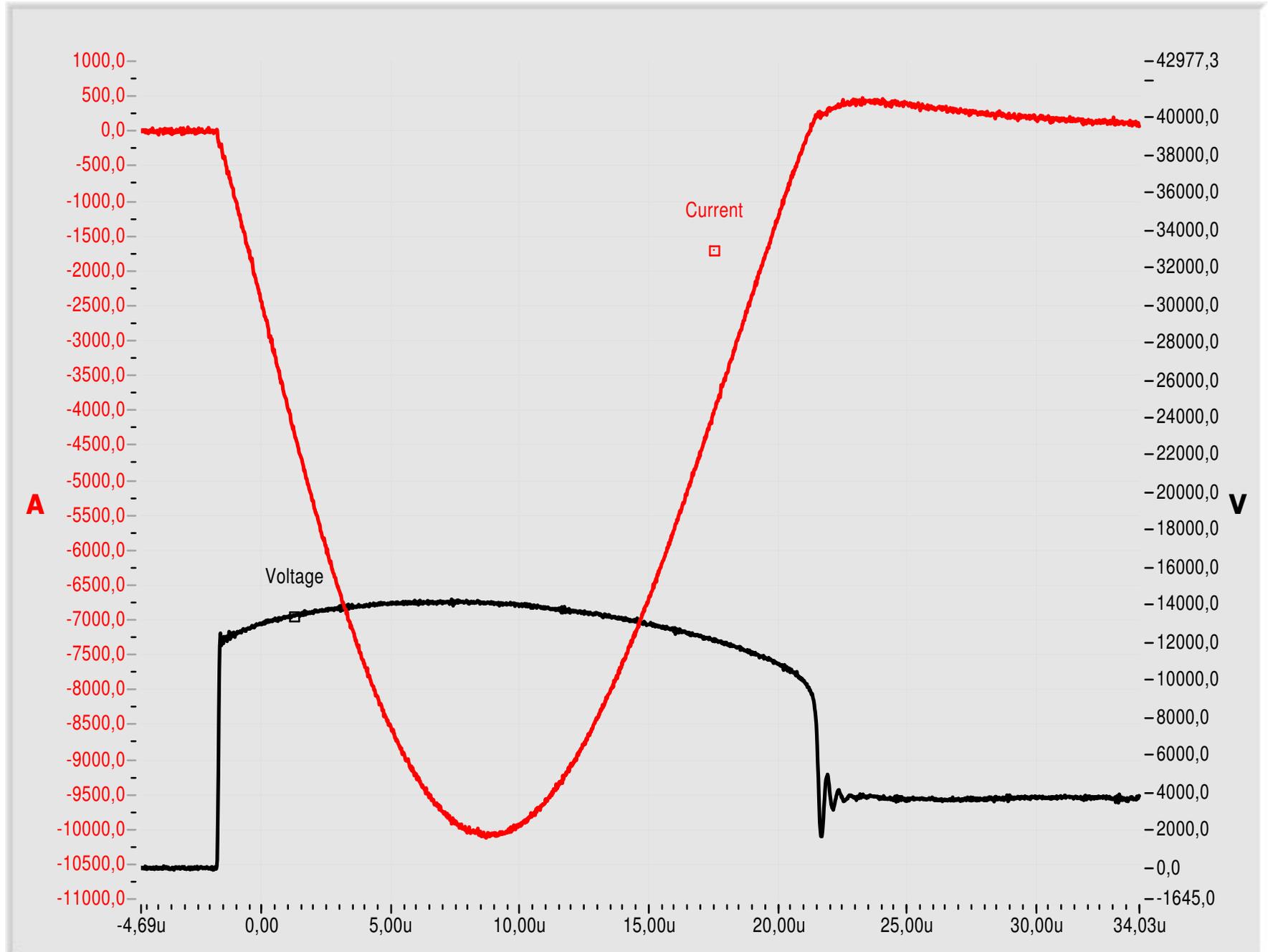
OSC - Oscilloscope type NATIONAL INSTRUMENT NI PXI-1031/NI-PXI 8108/NI-PXI 5122;
 - CESI No 056227- 0562226 (on channel No.1)

SOFTWARE SYSTEM:

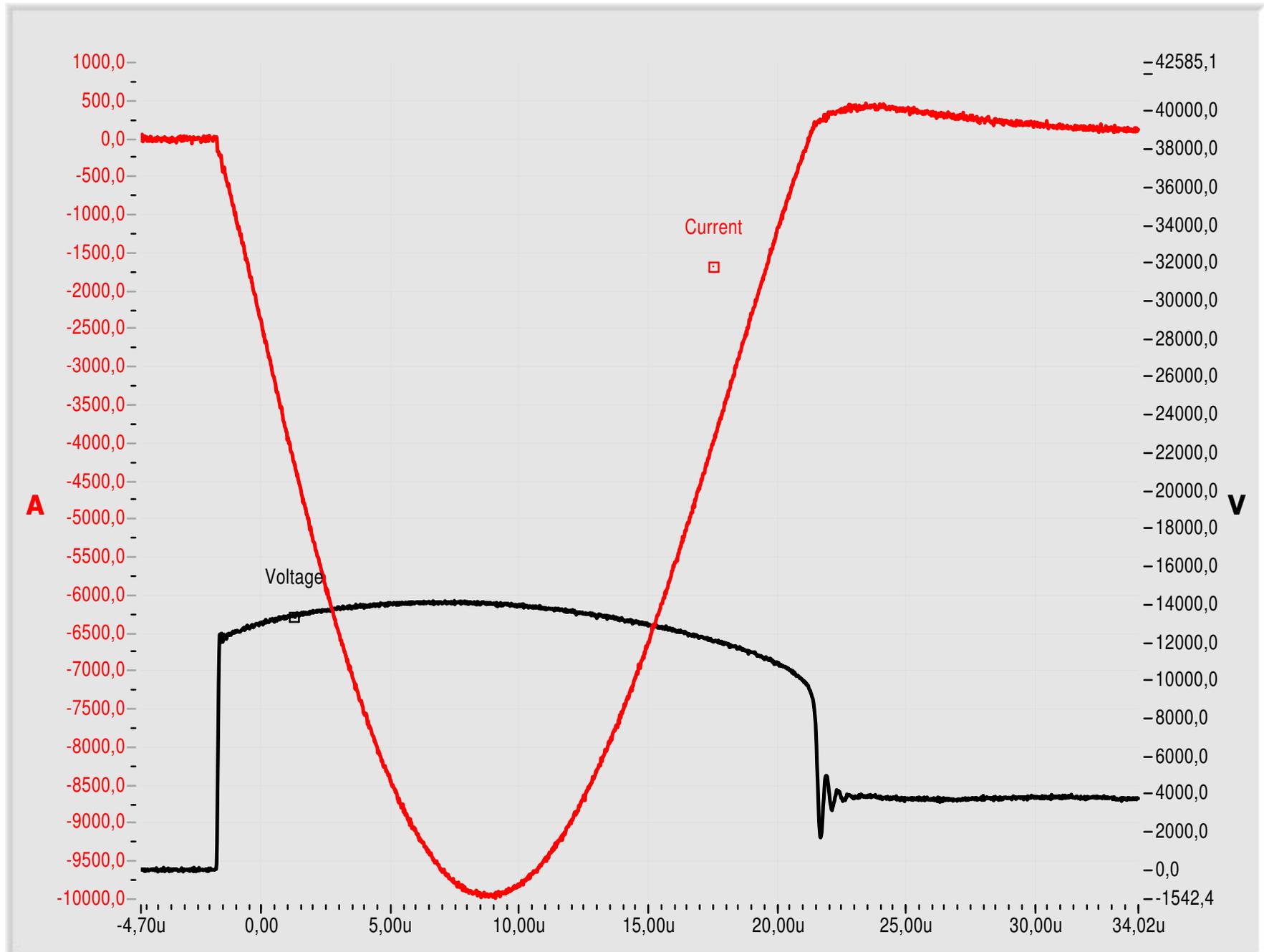
SW - S.A.D. Surge arrester version 2.0



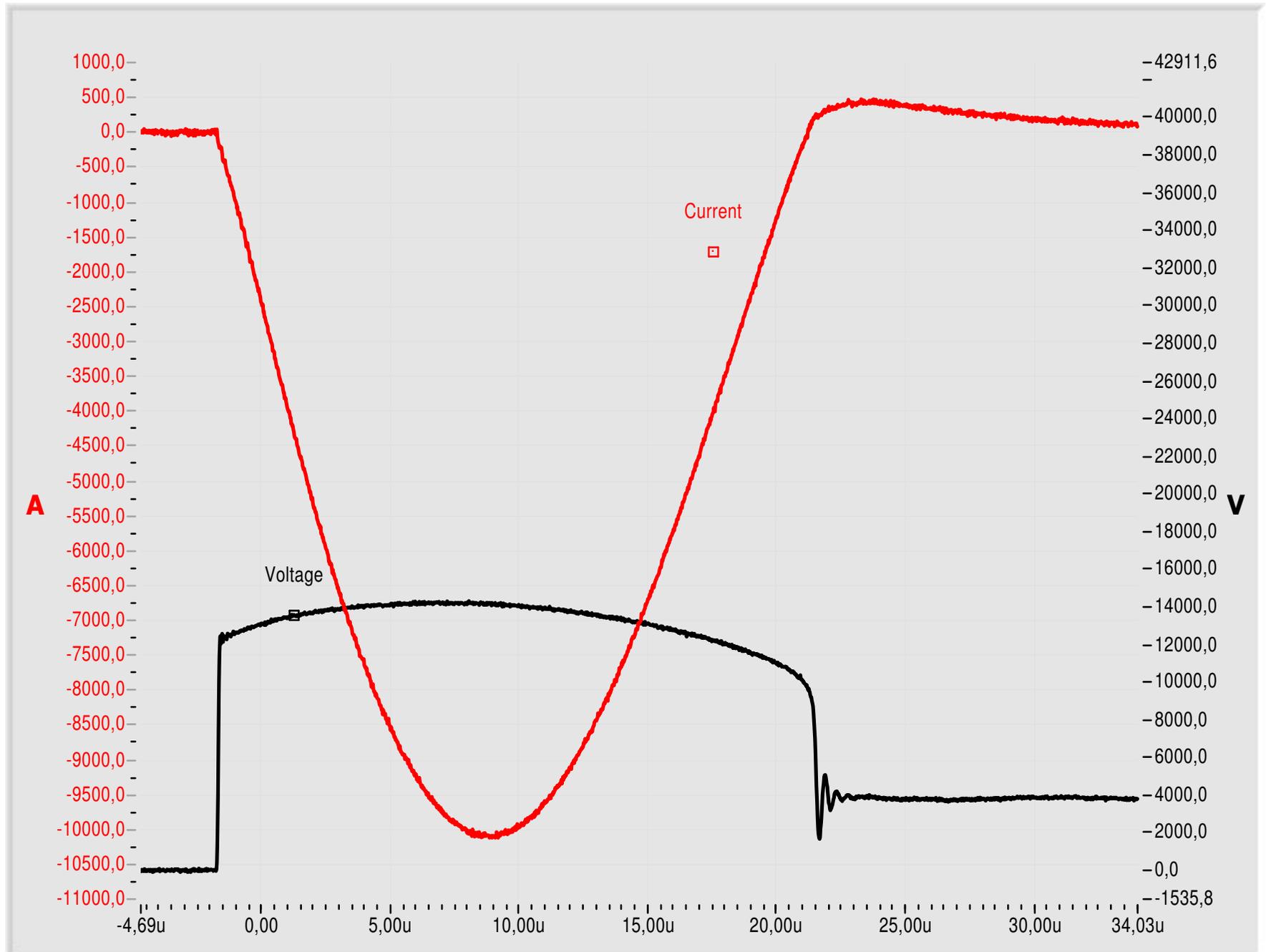
CESI B7019592 Oscillogram n. 1



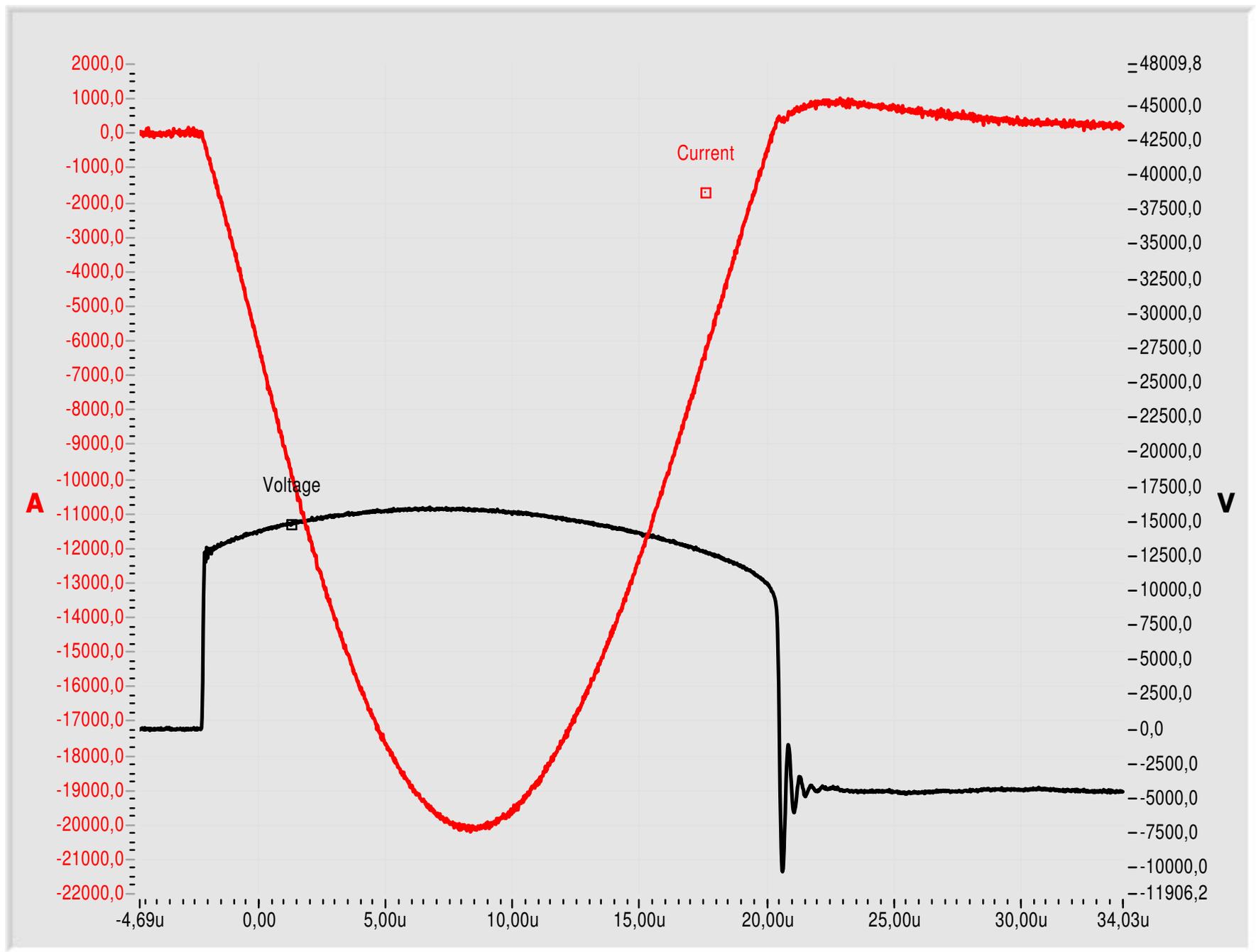
CESI B7019592 Oscillogram n. 2



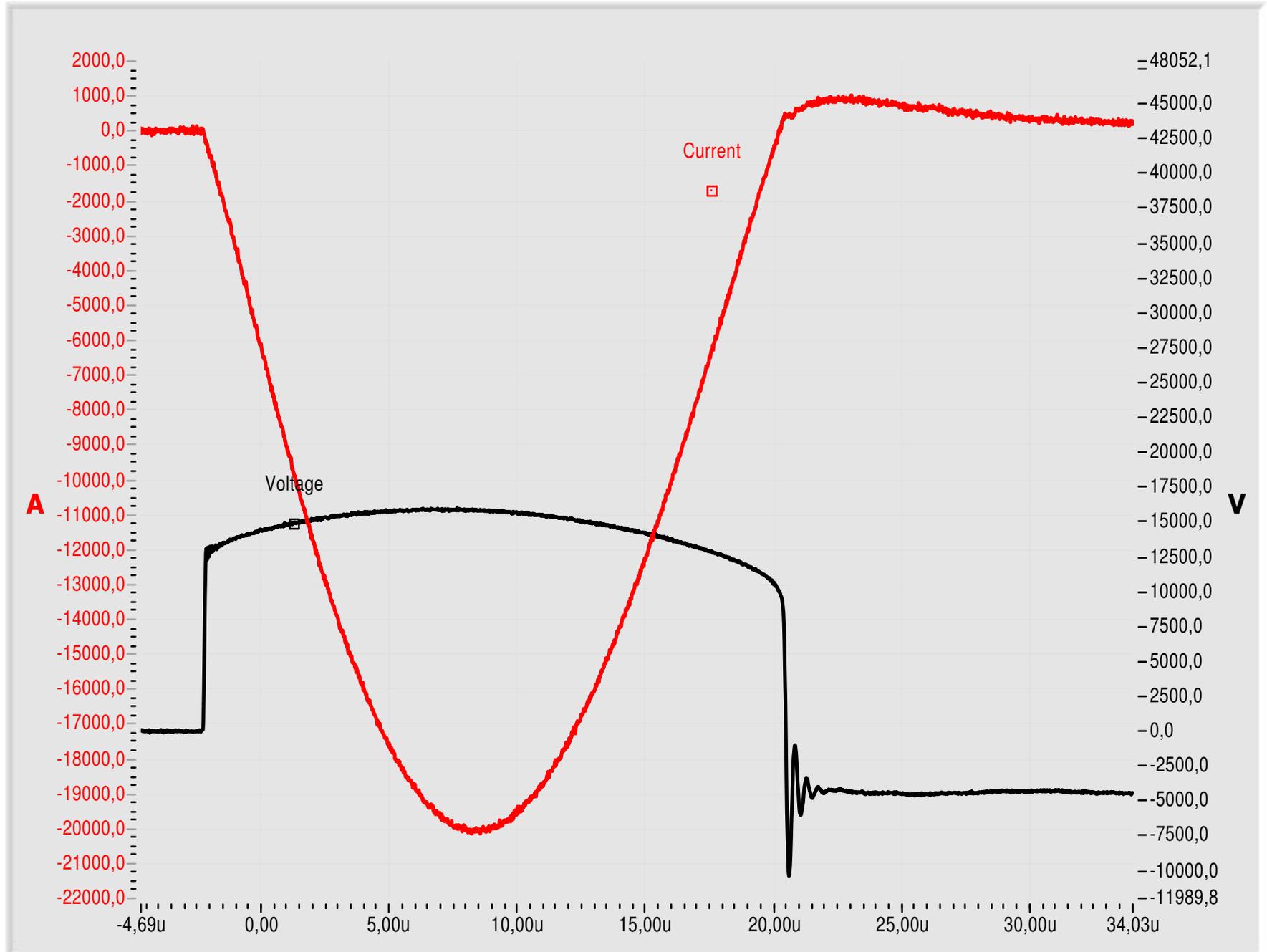
CESI B7019592 Oscillogram n. 3



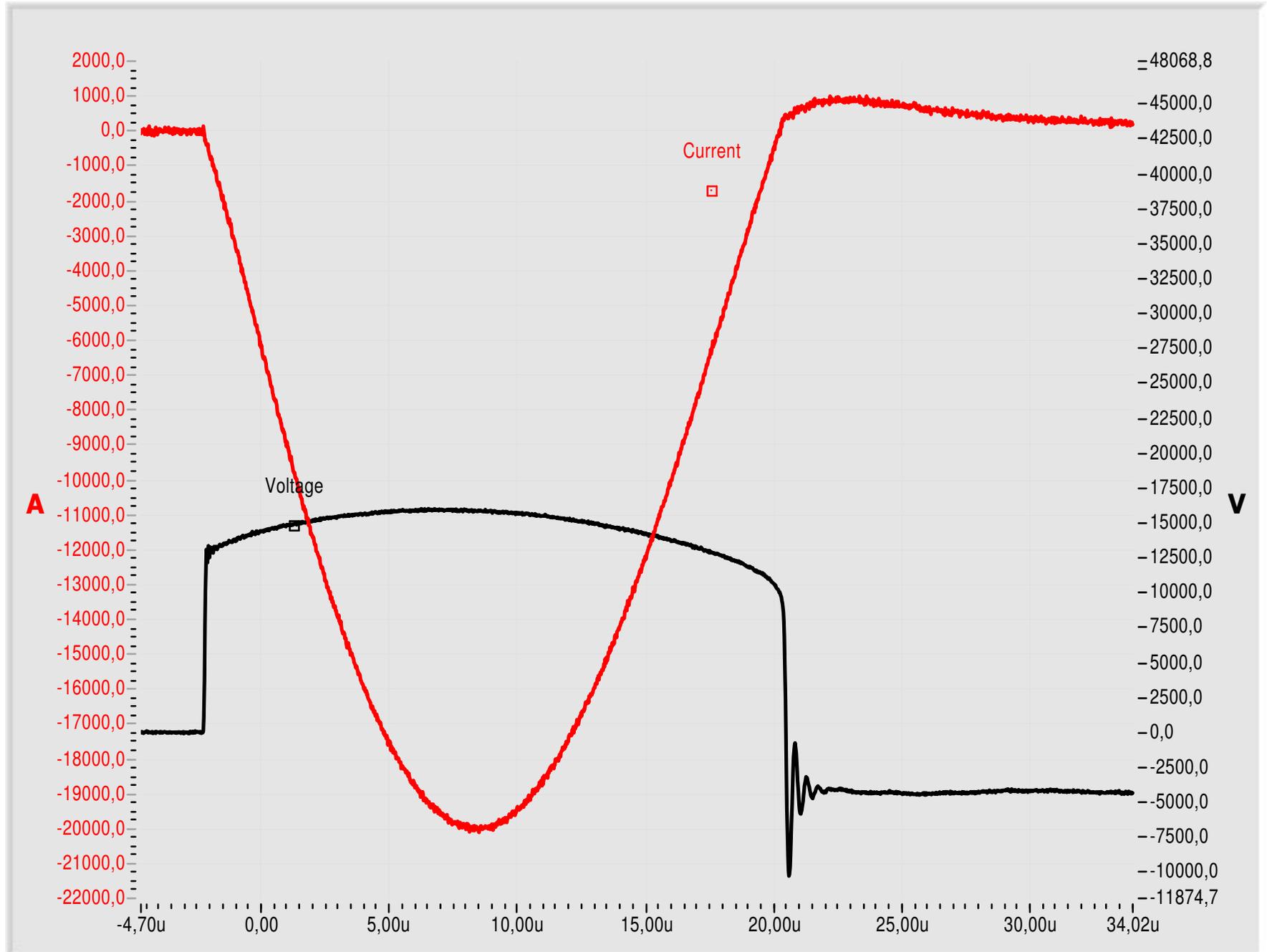
CESI B7019592 Oscillogram n. 4



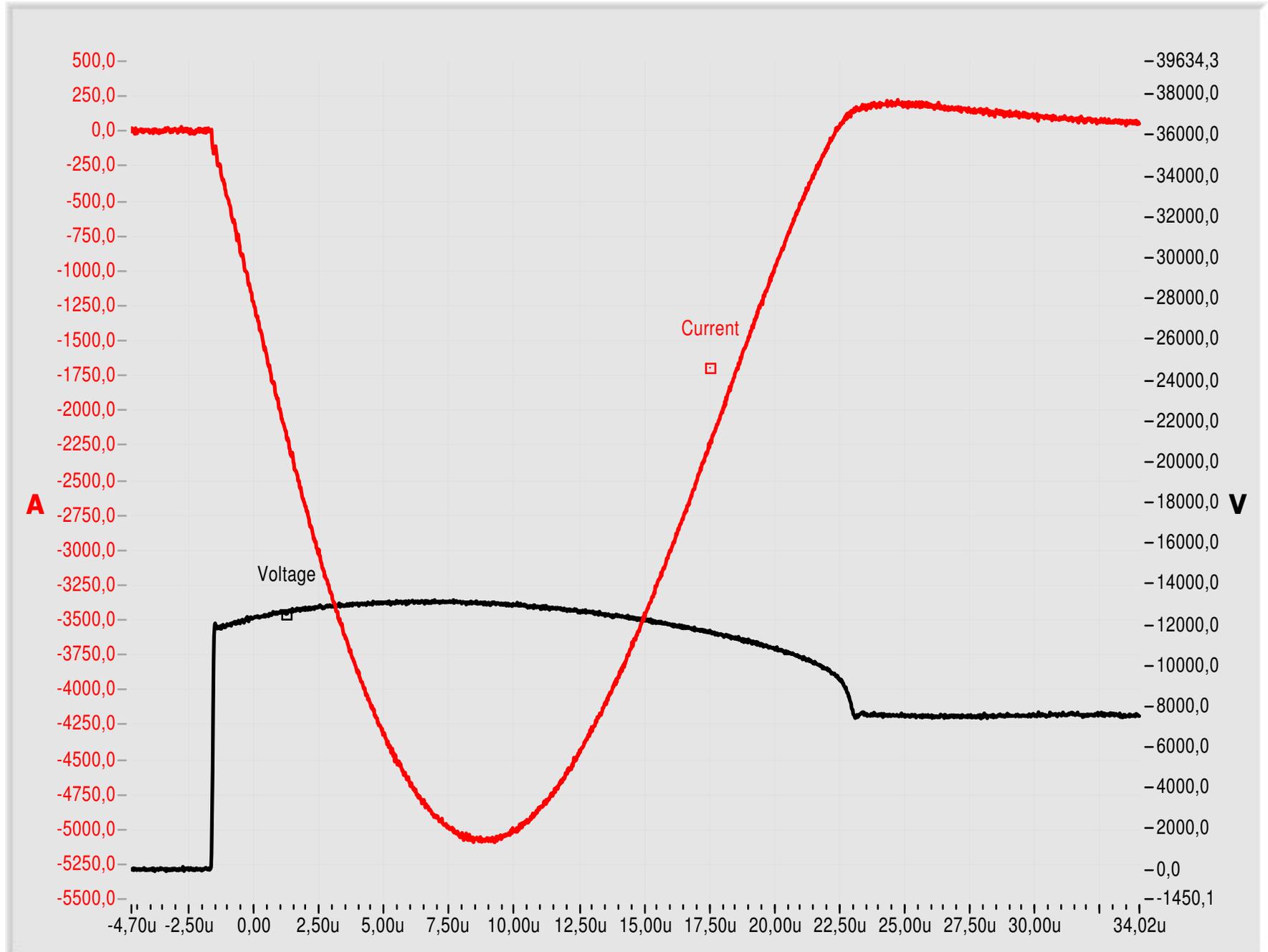
CESI B7019592 Oscillogram n. 5



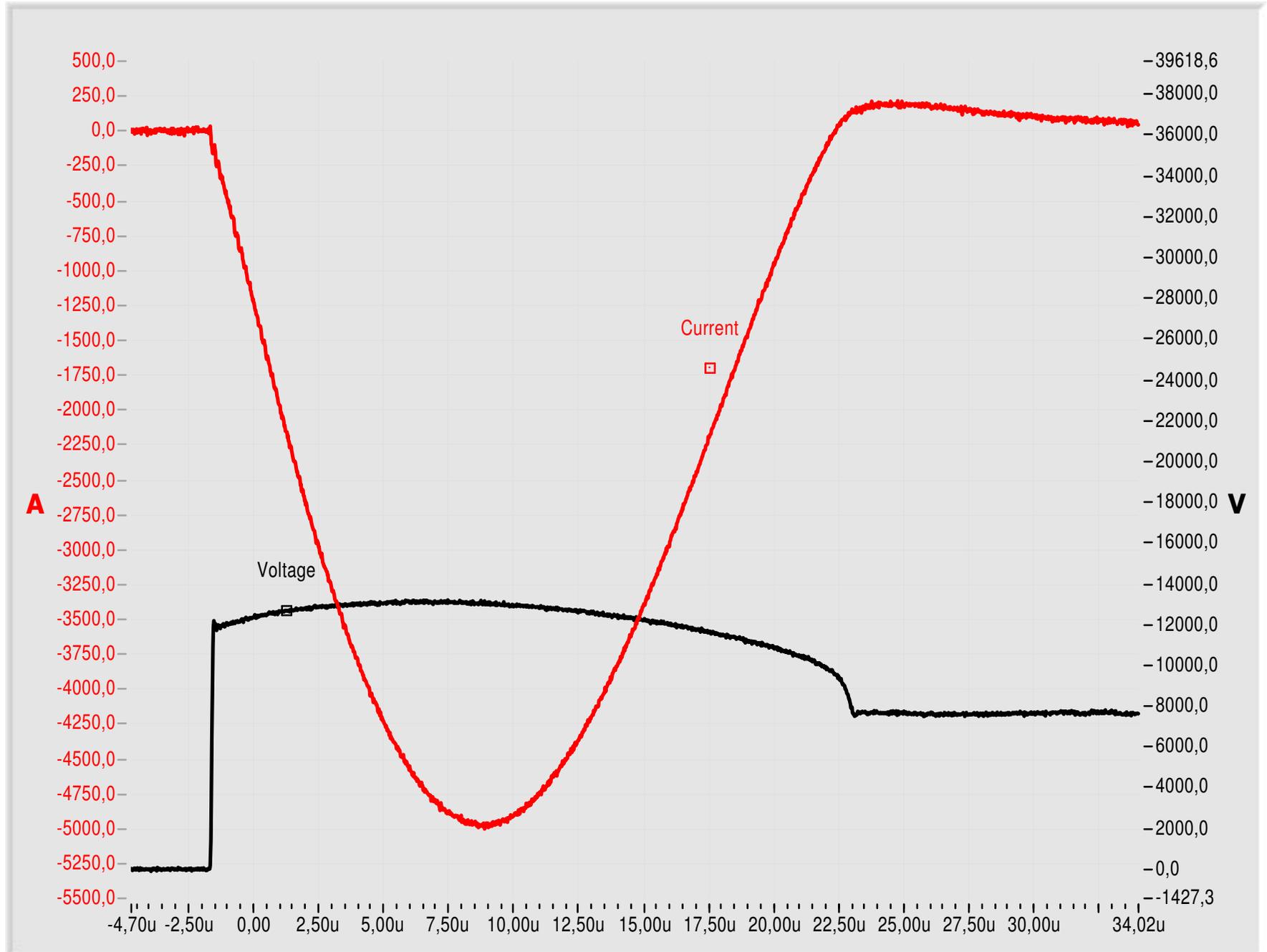
CESI B7019592 Oscillogram n. 6



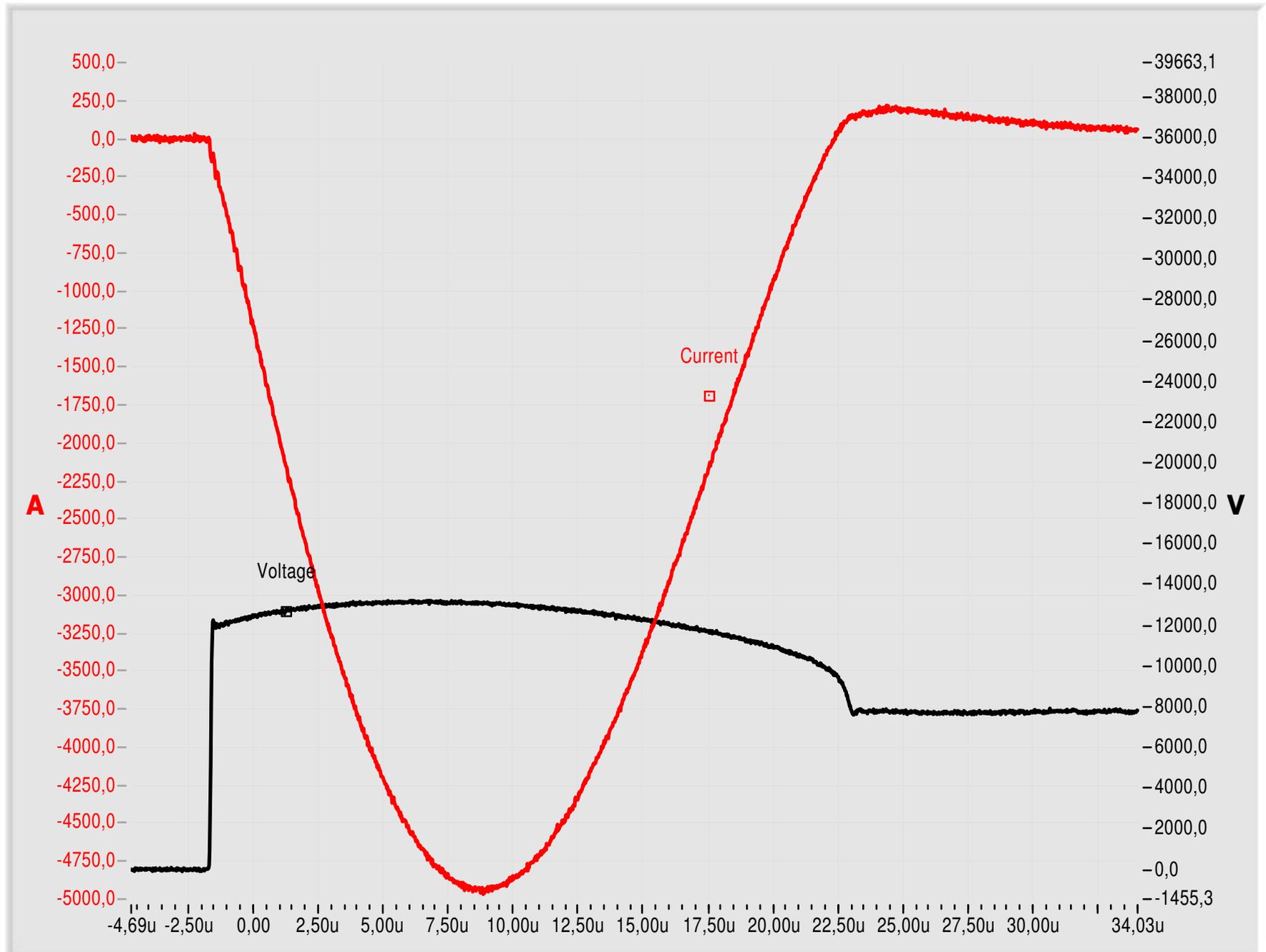
CESI B7019592 Oscillogram n. 7



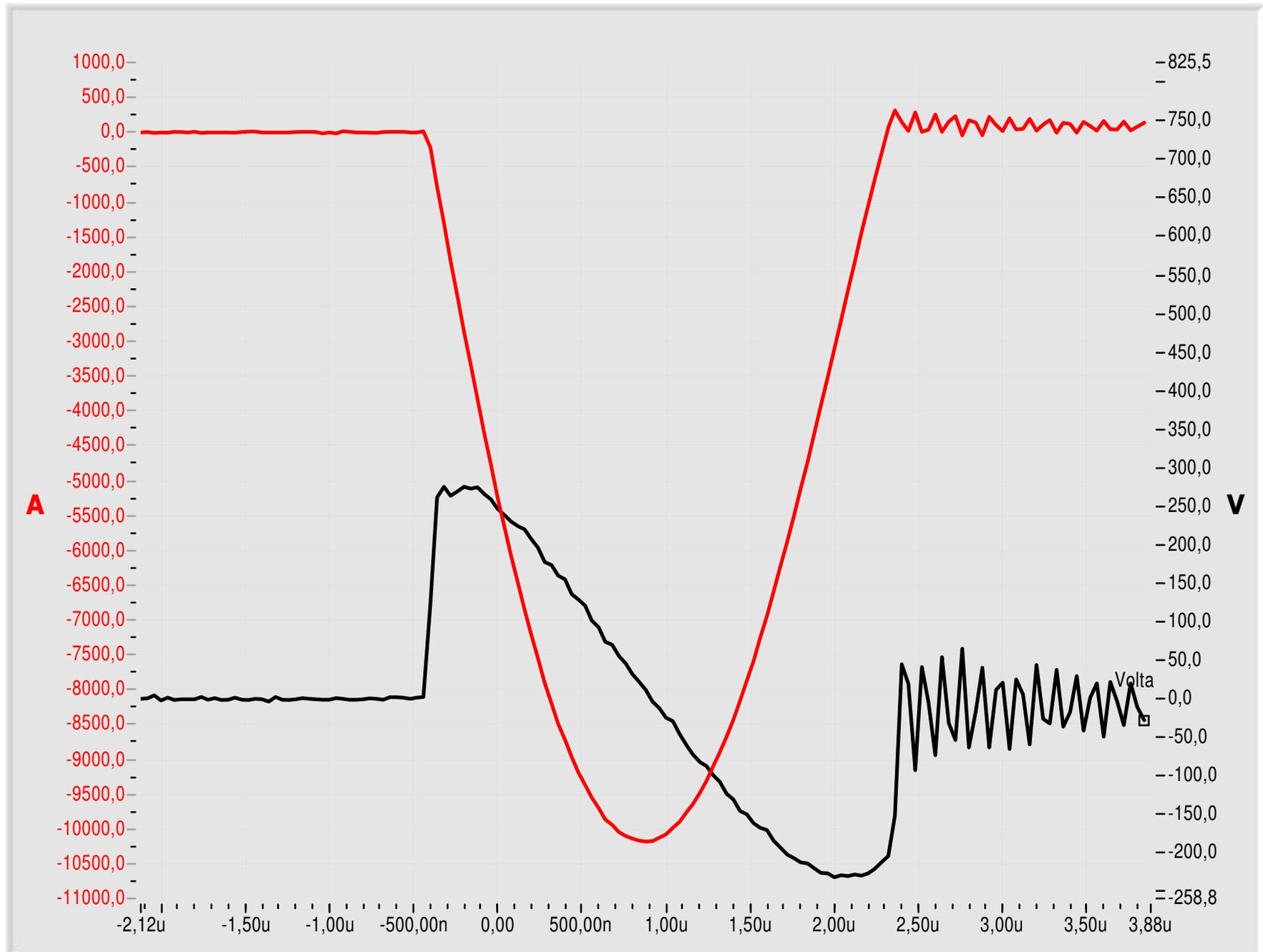
CESI B7019592 Oscillogram n. 8



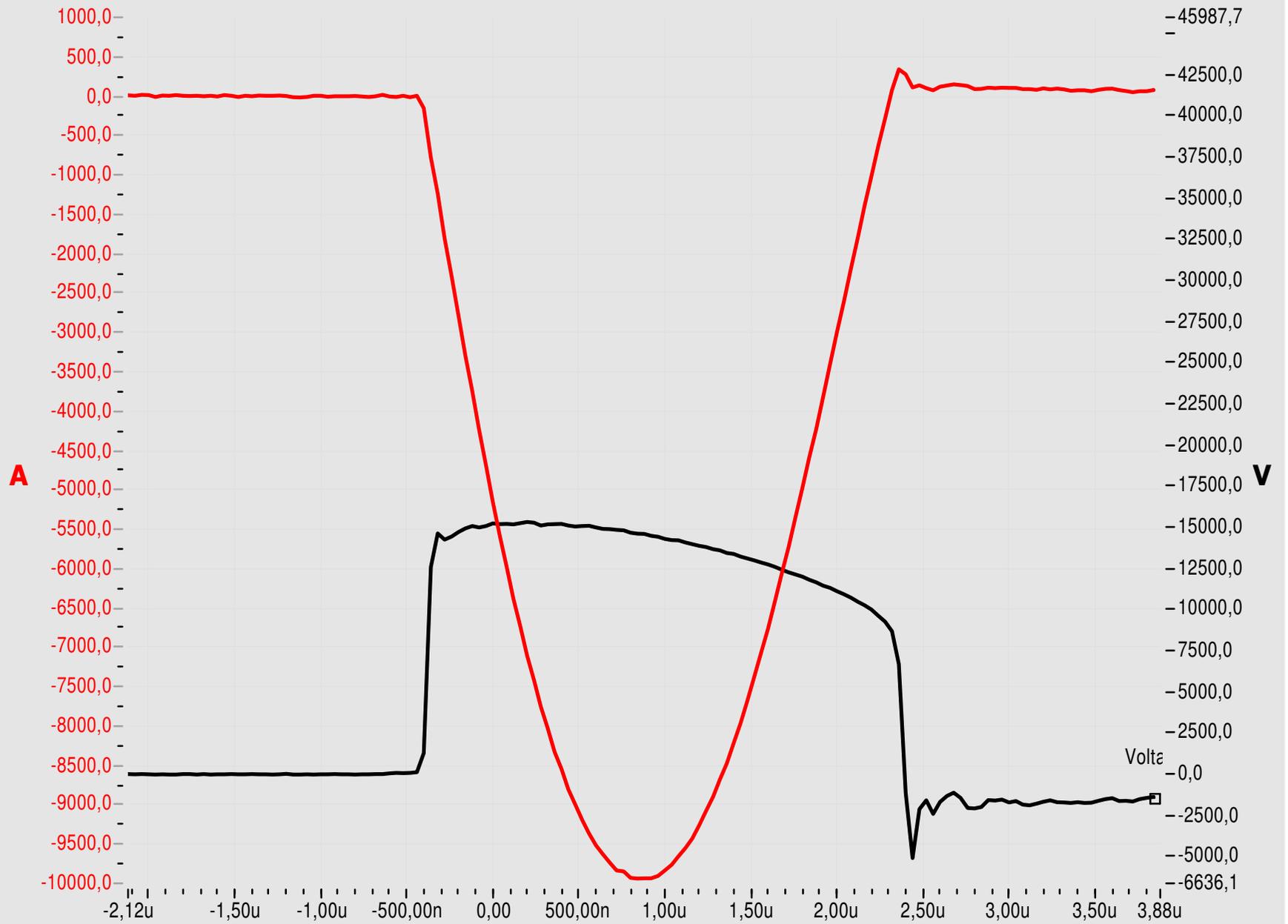
CESI B7019592 Oscillogram n. 9



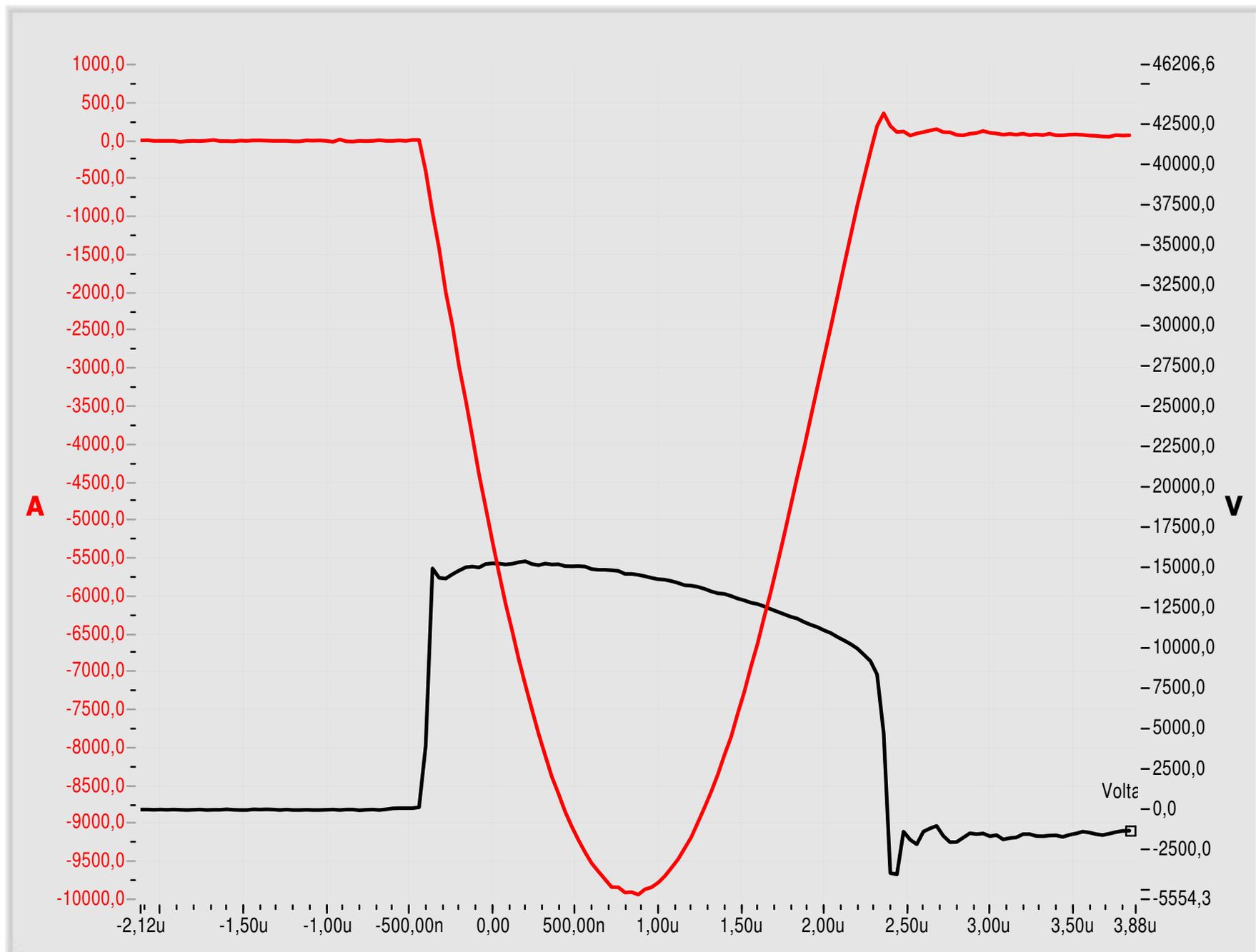
CESI B7019592 Oscillogram n. 10



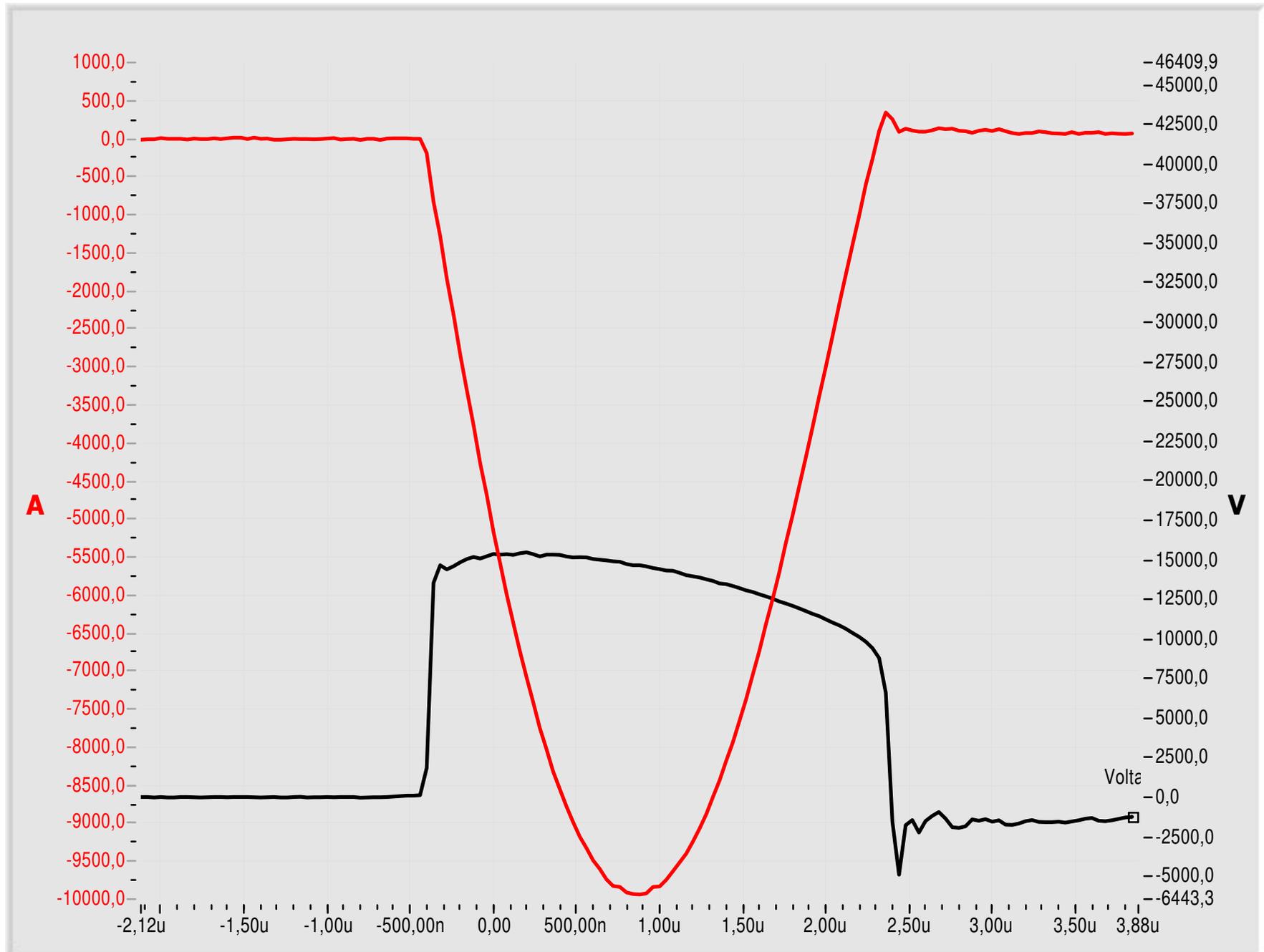
CESI B7019592 Oscillogram n. 11



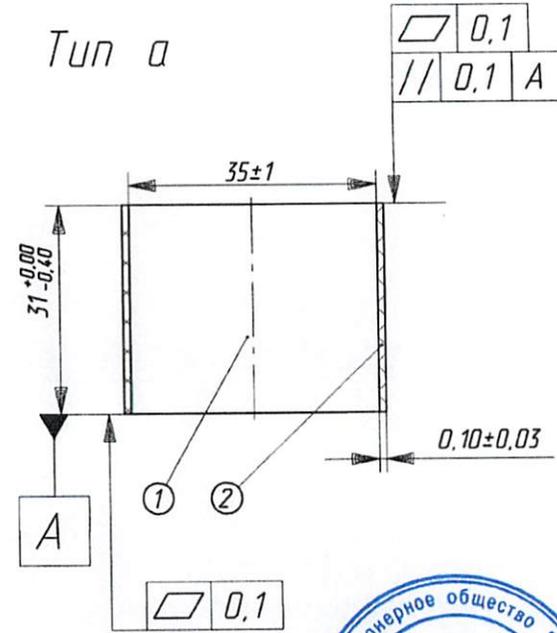
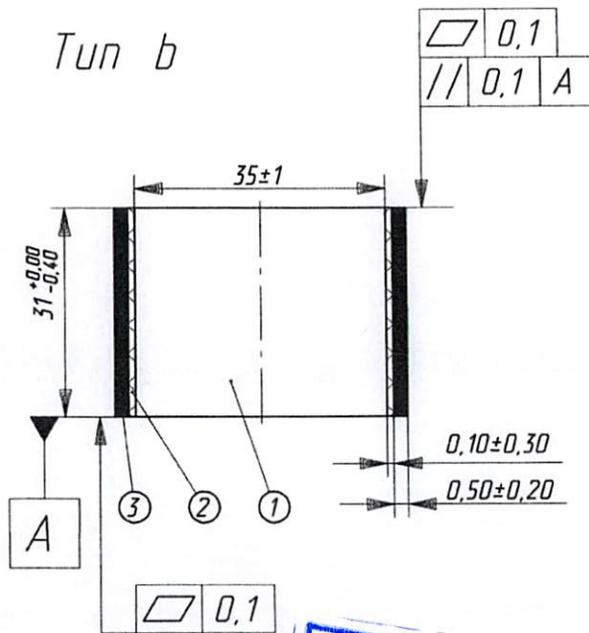
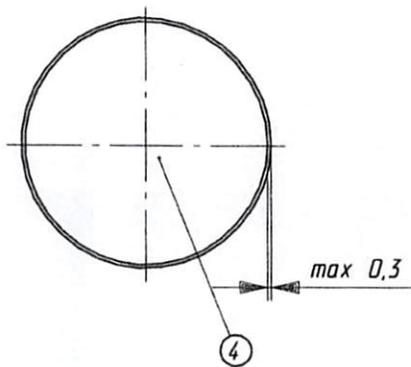
CESI B7019592 Oscillogram n. 12



CESI B7019592 Oscillogram n. 13



PA.VAR.0400.30



1. Металлооксидный варистор (MOV disk)
2. Изоляционное покрытие стекло (Glass insulating collar)
3. Изоляционное покрытие полиуретан (PU insulating collar)
4. Алюминиевый электрод (Al - electrode)



Инв. № дубл.	Подп. и дата
Взам. инв. №	Подп. и дата
Инв. № подл.	Подп. и дата

Изм.	Лист	№ докум.	Подп.	Дата
Разраб.		Потолов А.В.	Игорь	09.17
Проб.		Петухов А.П.	Александр	09.17
Т.контр.				
Н.контр.				
Утв.		Шевцов И.В.	Игорь	09.17

PA.VAR.0400.30

Varistor B34/30

Оксид цинка

Лит.	Масса	Масшт.
	0.177	1:1
Лист 1	Листов 1	
ЗАО "Полимер-Аппарат"		