

Ergänzung zum Beitrag in FA 4/15, S. 368 ff.

Transceiver-Probleme im Sendebetrieb

Wie bereits im Beitrag erwähnt, folgen hier die vom Autor bereitgestellten Oszilloskopbilder. Diese sind zunächst wie folgt nach Geräten sortiert:

Elecraft K3, S. 2 – 6
 Icom IC-703, S. 7 – 11
 Icom IC-7410, S. 12 – 17
 Icom IC-7800, S. 18 – 22
 Kenwood TS-590S, S. 23 – 27
 Kenwood TS-850S, S. 28 – 32
 Yaesu FT-840, S. 33 – 36
 Yaesu FT-897, S. 37 – 41
 Yaesu FT-1000 Mk V, S. 42 – 46
 Yaesu FTDX9000, S. 47 – 51

Unter den Oszilloskopbildern steht jeweils der Dateiname des Originalbildes nach dem Schlüssel:

<Gerätetyp>_<Leistung>_<Messung>

Mit *Leistung* ist die Nominal-Sendeleistung gemeint. Für die *Messungen* wurden folgende Bezeichnungen gewählt:

_1 = Einschwingen der Spitze
 _2 = Verzerrung des 1. Zeichens
 _3 = 3er-Impulsgruppe dreimal *i*
 _4 = Vorderflanke
 _5 = Rückflanke
 _6 = Zeitverzögerung bis zum HF-Signal
 _7 = Verzerrung des 2. Zeichens
 _8 = Einschwingvorgang.

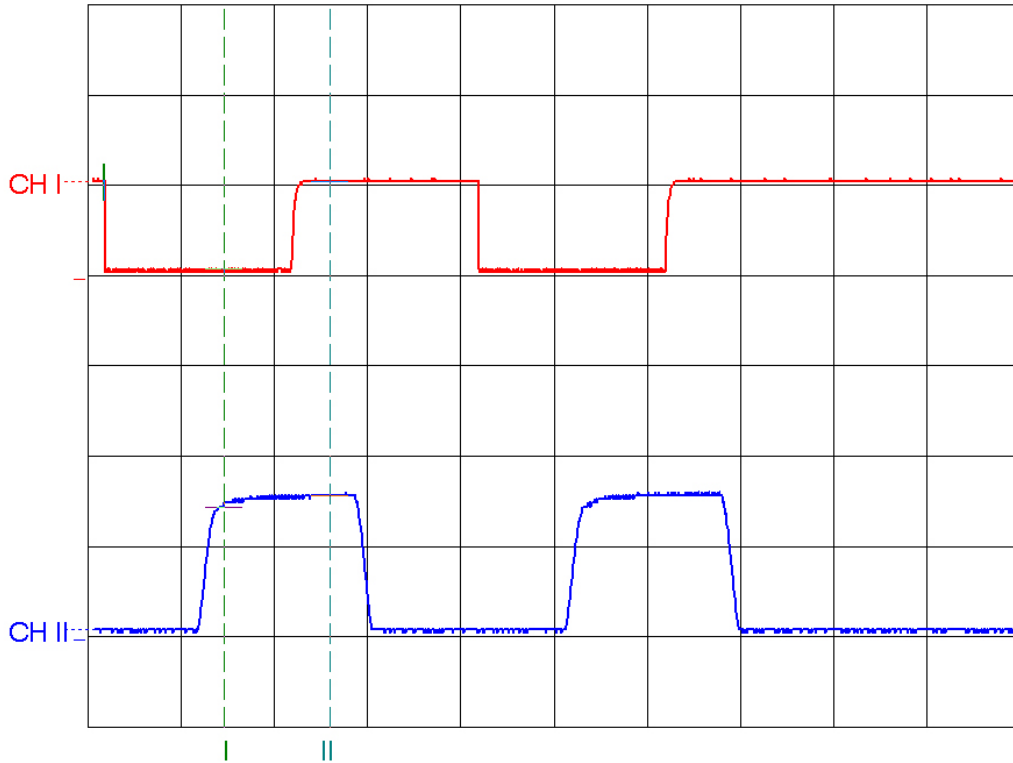
Beispiel 1: 7410_50_6 bedeutet Icom IC-7410, 50 W Nominal-Sendeleistung, Zeit bis zum HF-Signal.

Beispiel 2: K3_50_1 bedeutet Elecraft K3, 50 W Nominal-Sendeleistung, Einschwingen der Spitze.

Hinweis: Die Messungen erfolgten jeweils an einem und nur einem Einzel Exemplar des betreffenden Typs. Die Messergebnisse müssen daher nicht repräsentativ für andere Geräte desselben Typs sein.

Measure time: 16:56:53
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

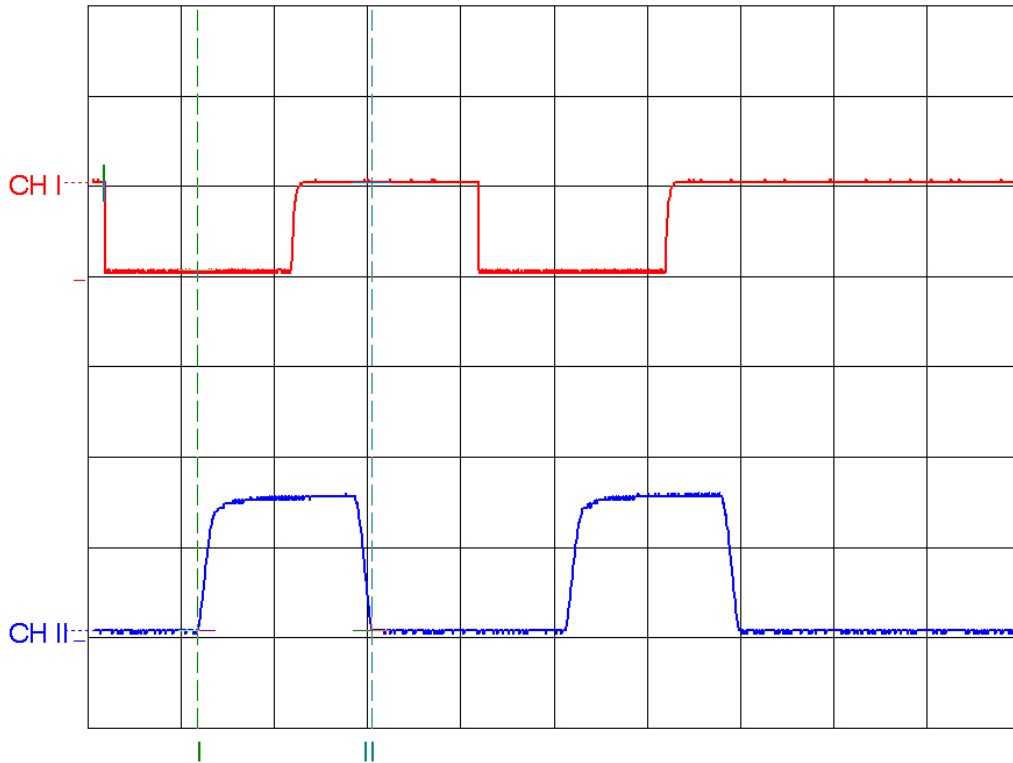


CH I : Cursor I: 600V Cursor II: 5,400V Diff. I-II: -4,8000V
CH II: Cursor I: 1,480V Cursor II: 1,600V Diff. I-II: -,1200V
dt: 22,700 ms 1/dt: 44,053 Hz

k3_50_1.wmf

Measure time: 16:56:53
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

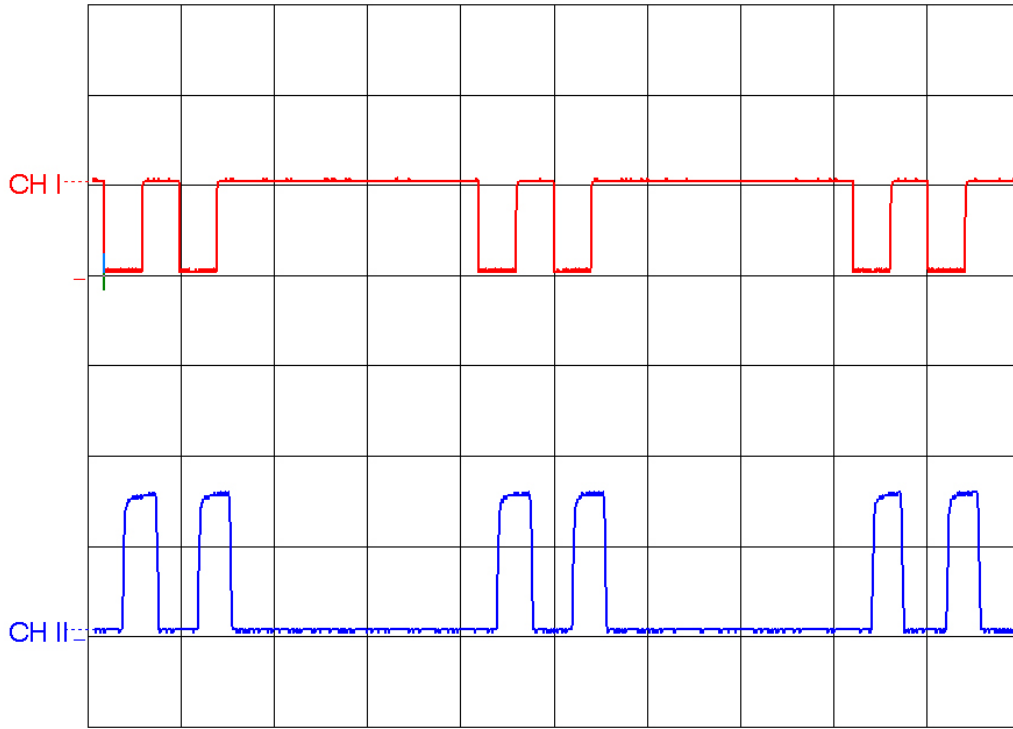


CH I : Cursor I: 600V Cursor II: 5,400V Diff. I-II: -4,8000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,600 ms 1/dt: 26,596 Hz

k3_50_2.wmf

Measure time: 17:04:16
Measure date: 16.12.2009

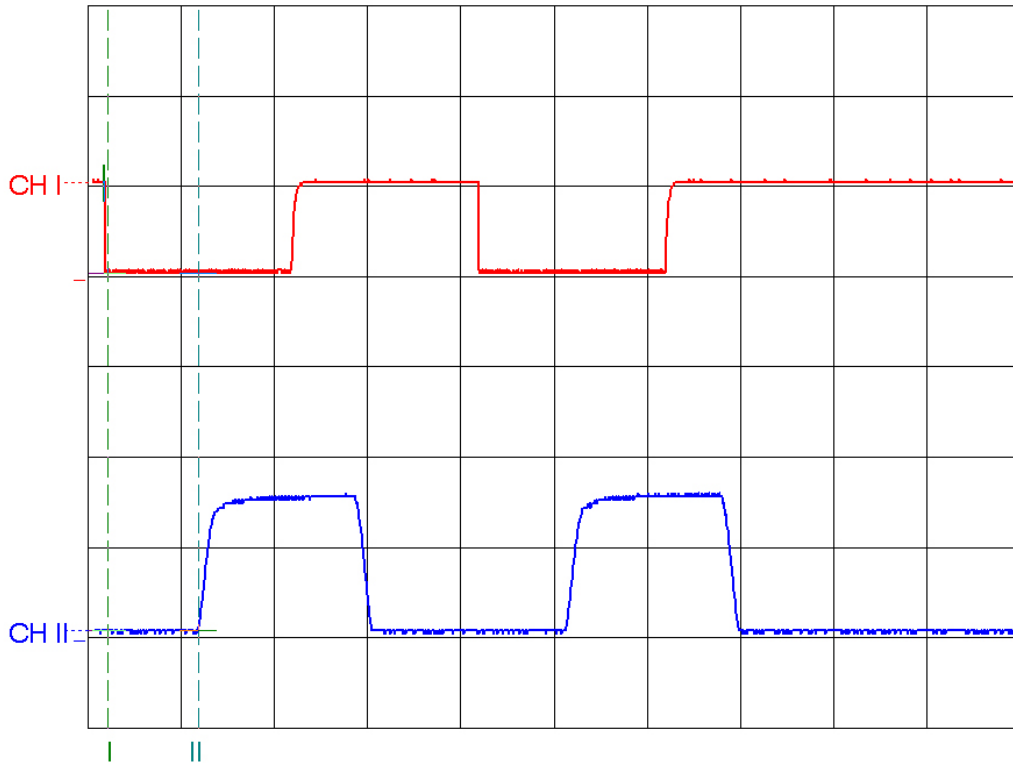
CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



k3_50_3.wmf

Measure time: 16:56:53
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

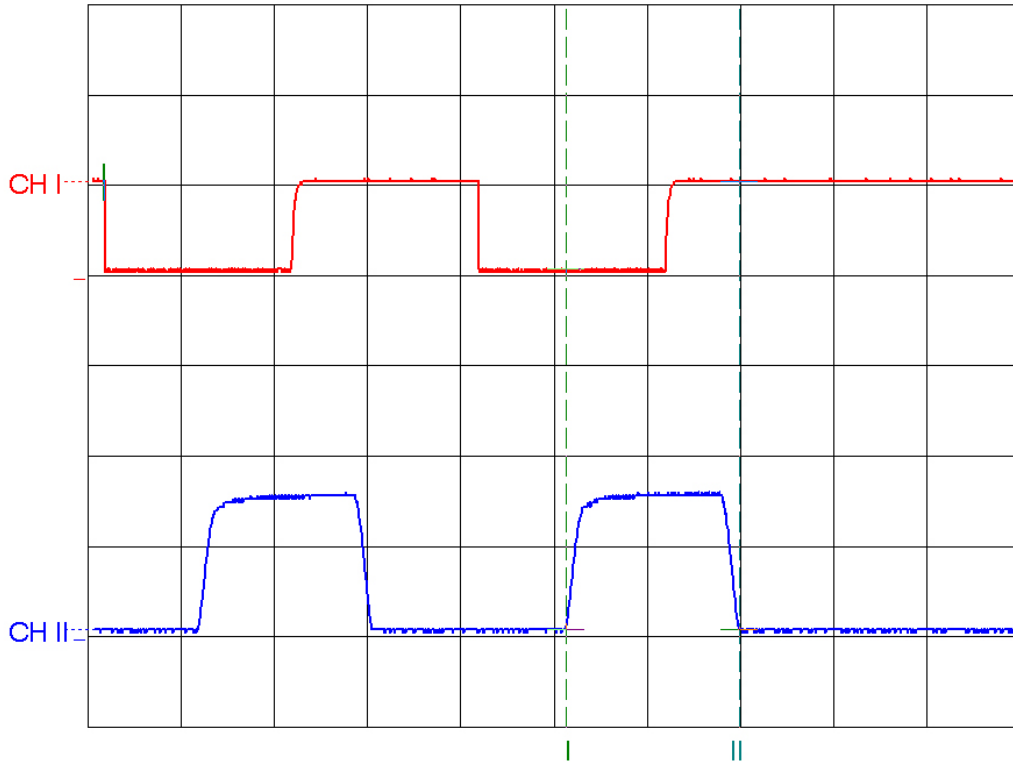


CH I: Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 19,500 ms 1/dt: 51,282 Hz

k3_50_6.wmf

Measure time: 16:56:53
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

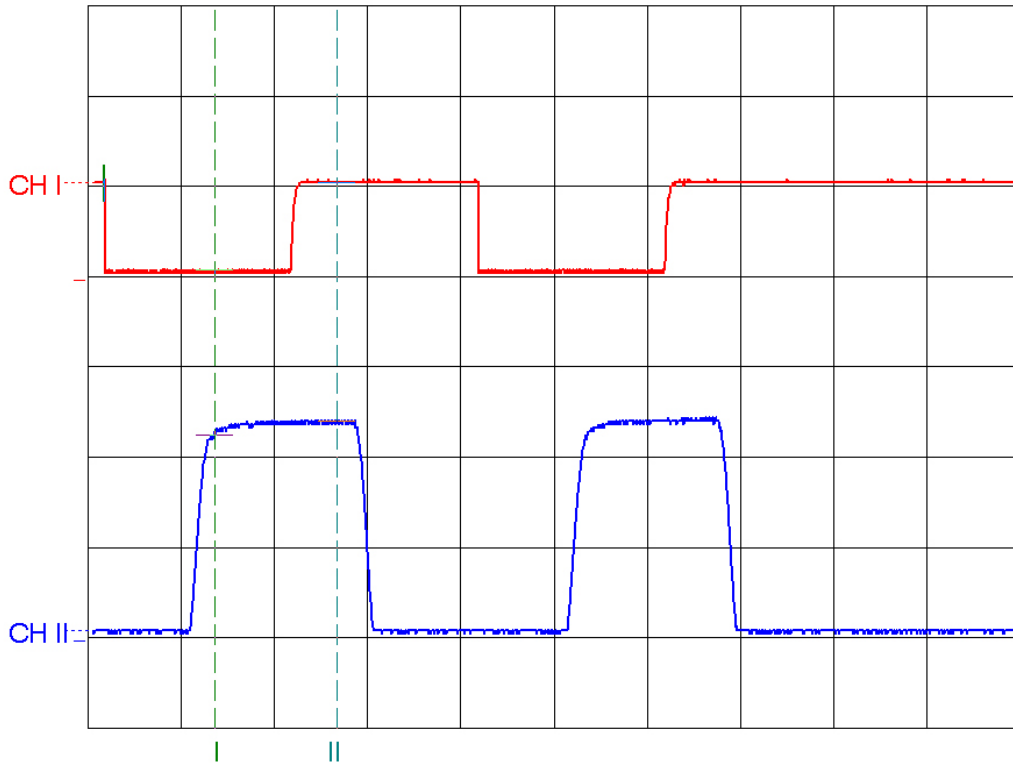


CH I : Cursor I: ,600V Cursor II: 5,400V Diff. I-II: -4,8000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,300 ms 1/dt: 26,810 Hz

k3_50_7.wmf

Measure time: 16:59:59
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

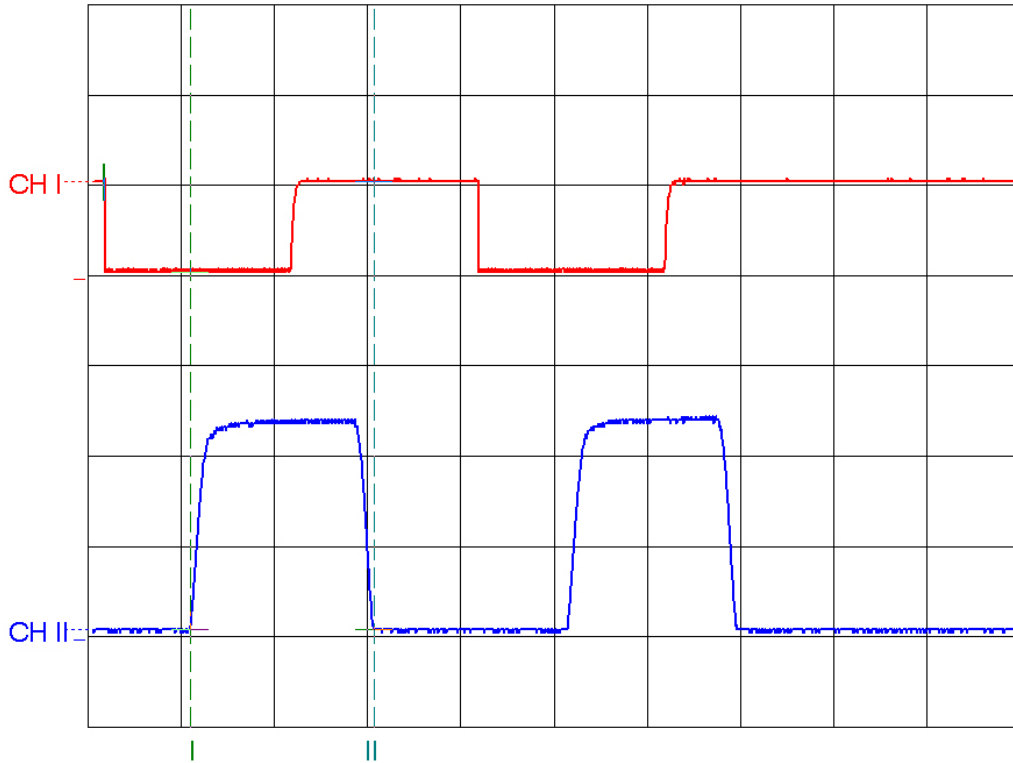


CH I : Cursor I: ,600V Cursor II: 5,400V Diff. I-II: -4,8000V
CH II: Cursor I: 2,280V Cursor II: 2,440V Diff. I-II: -,1600V
dt: 26,200 ms 1/dt: 38,168 Hz

k3_110_1.wmf

Measure time: 16:59:59
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

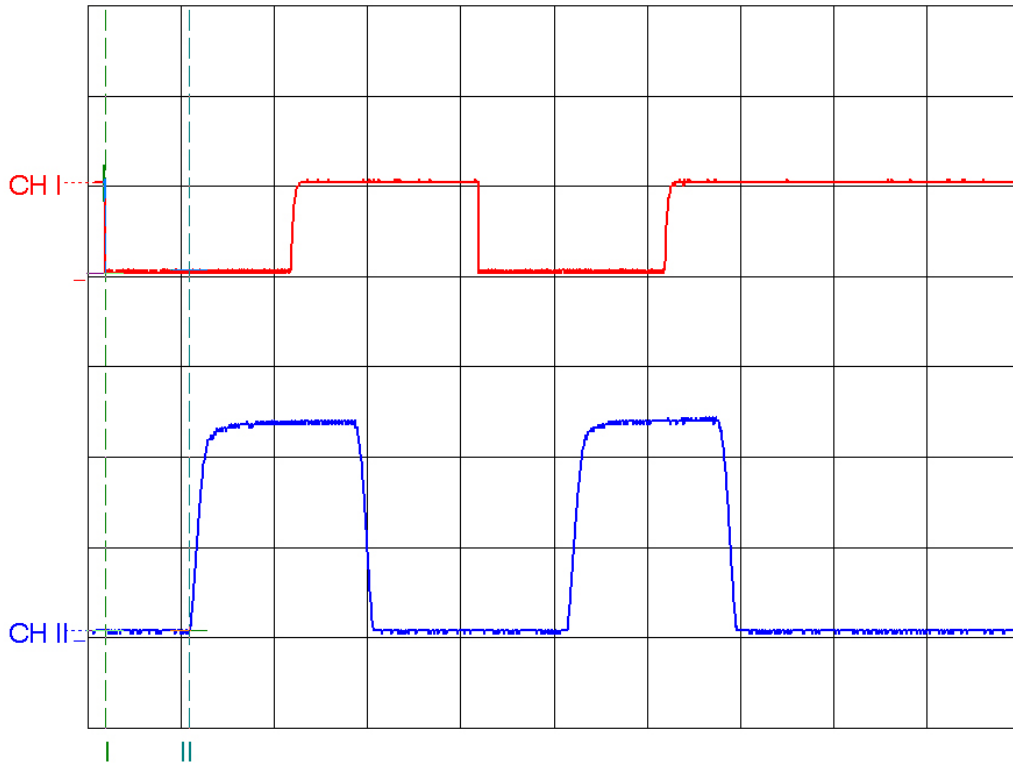


CH I: Cursor I: ,400V Cursor II: 5,400V Diff. I-II: -5,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 39,600 ms 1/dt: 25,253 Hz

k3_110_2.wmf

Measure time: 16:59:59
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

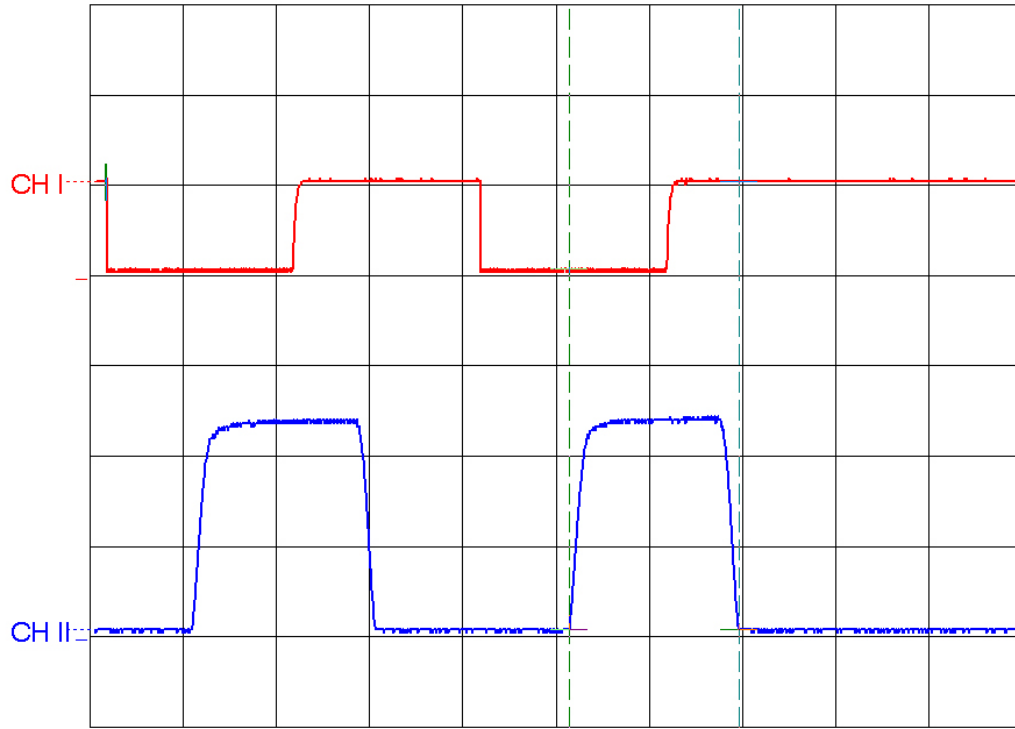


CH I: Cursor I: ,400V Cursor II: ,600V Diff. I-II: -,2000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 17,900 ms 1/dt: 55,866 Hz

k3_110_6.wmf

Measure time: 16:59:59
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

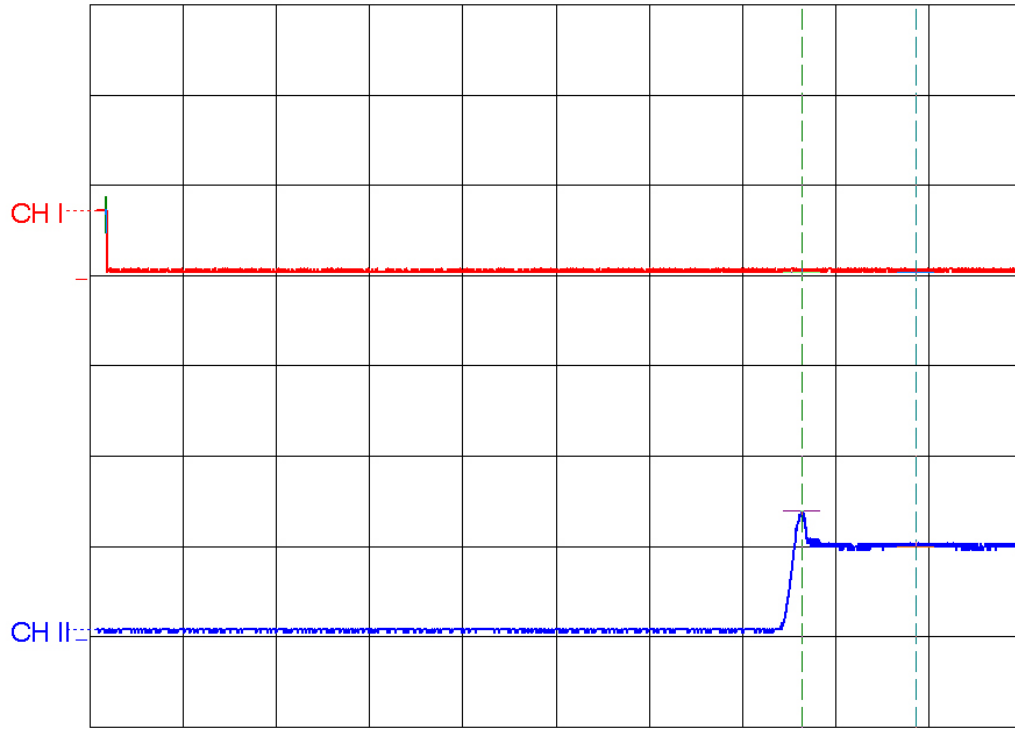


CH I: Cursor I: ,600V Cursor II: 5,400V Diff. I-II: -4,8000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 36,500 ms 1/dt: 27,397 Hz

k3_110_7.wmf

Measure time: 10:58:44
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 2 ms TR: CH1-DC

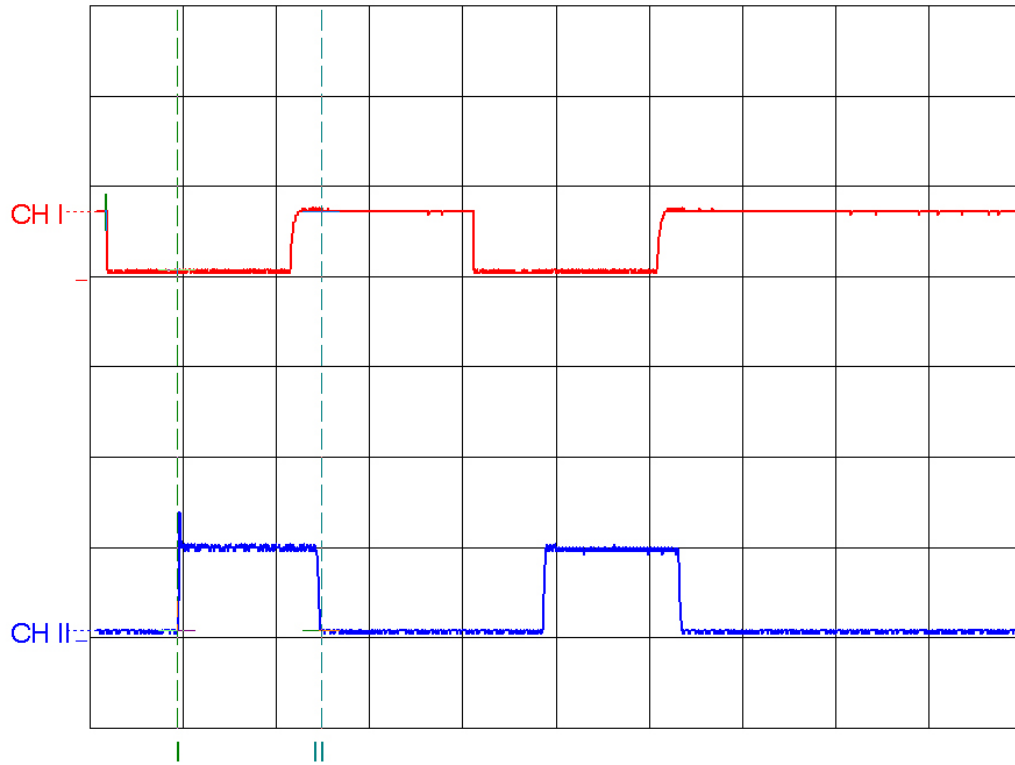


CH I : Cursor I: 400V Cursor II: 400V Diff. I-II: ,0000V
CH II: Cursor I: ,288V Cursor II: ,208V Diff. I-II: ,0800V
dt: 2,450 ms 1/dt: 408,163 Hz

703_5_1.wmf

Measure time: 10:53:31
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

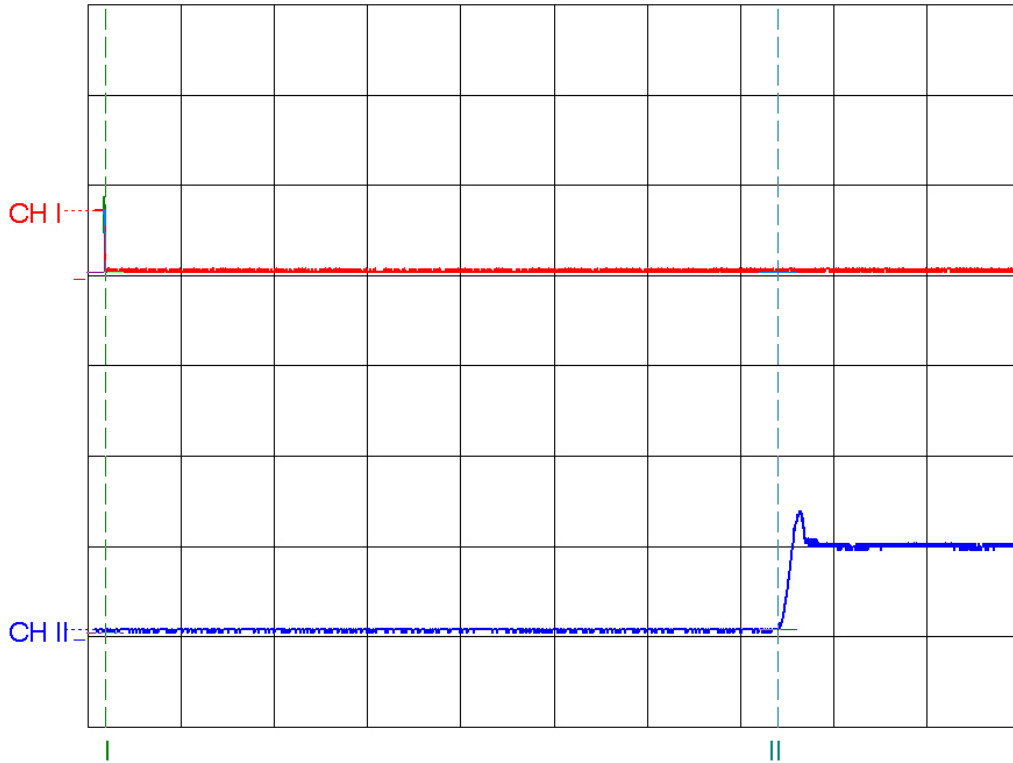


CH I : Cursor I: ,600V Cursor II: 3,800V Diff. I-II: -3,2000V
CH II: Cursor I: ,024V Cursor II: ,024V Diff. I-II: ,0000V
dt: 31,000 ms 1/dt: 32,258 Hz

703_5_2.wmf

Measure time: 10:58:44
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 2 ms TR: CH1-DC

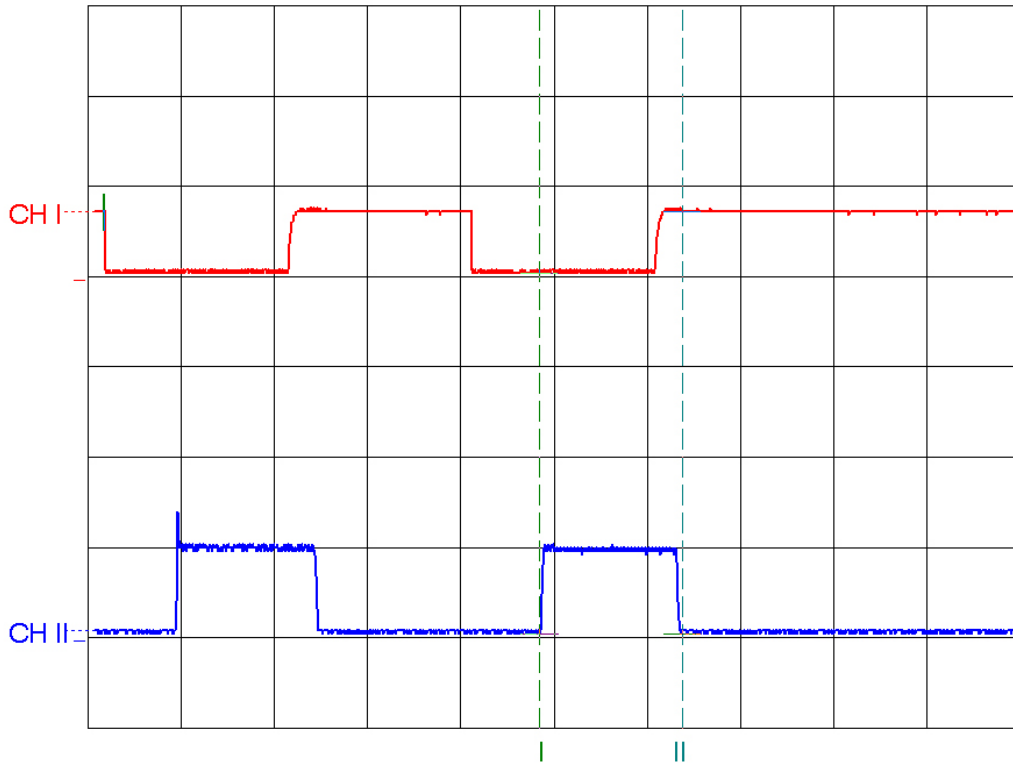


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,016V Cursor II: ,024V Diff. I-II: -,0080V
dt: 14,450 ms 1/dt: 69,204 Hz

703_5_6.wmf

Measure time: 10:53:31
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

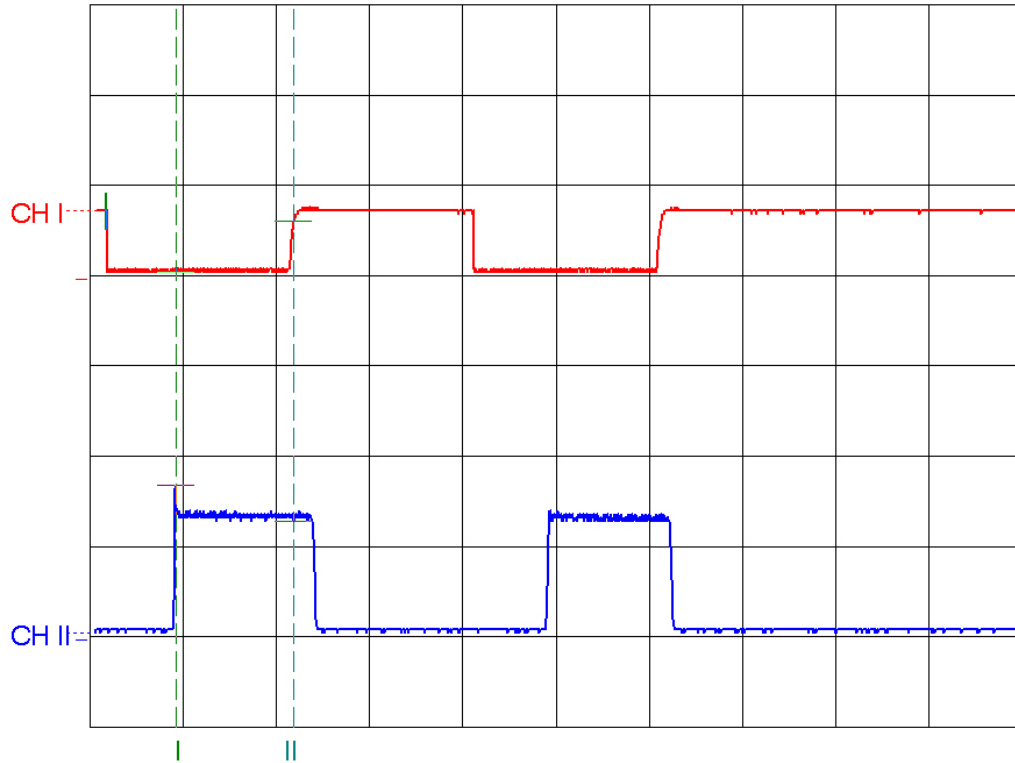


CH I : Cursor I: ,400V Cursor II: 3,800V Diff. I-II: -3,4000V
CH II: Cursor I: ,016V Cursor II: ,016V Diff. I-II: ,0000V
dt: 30,600 ms 1/dt: 32,680 Hz

703_5_7.wmf

Measure time: 11:11:38
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

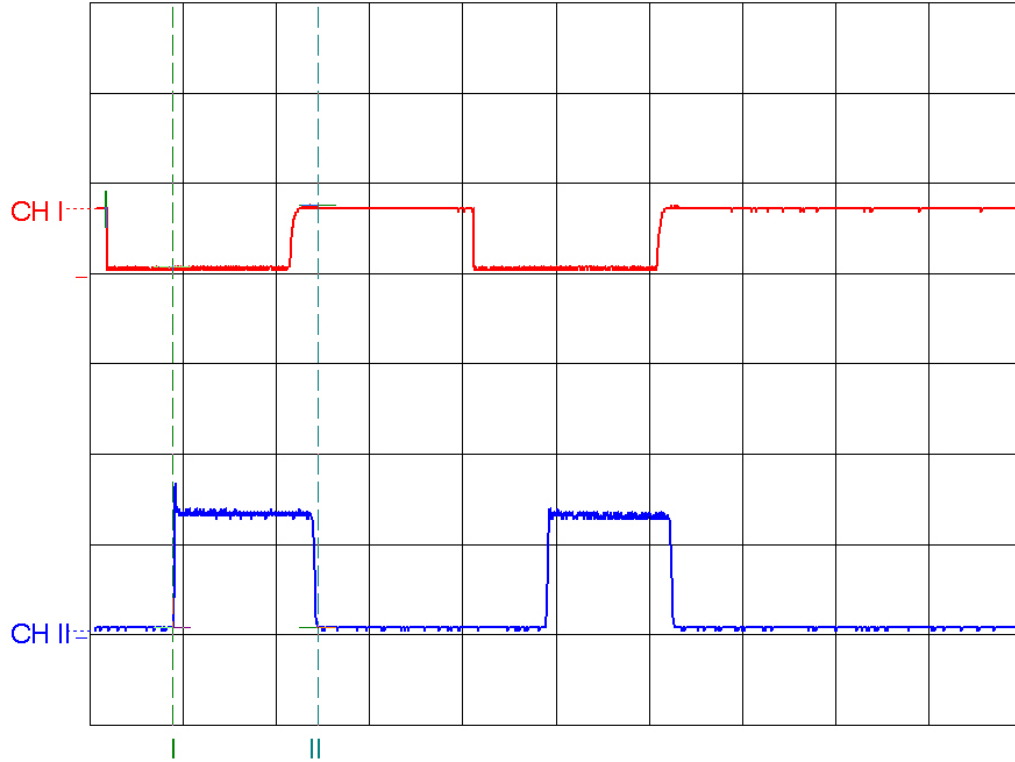


CH I : Cursor I: 400V Cursor II: 3,200V Diff. I-II: -2,8000V
CH II: Cursor I: ,344V Cursor II: ,264V Diff. I-II: ,0800V
dt: 25,400 ms 1/dt: 39,370 Hz

703_10_1.wmf

Measure time: 11:11:38
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

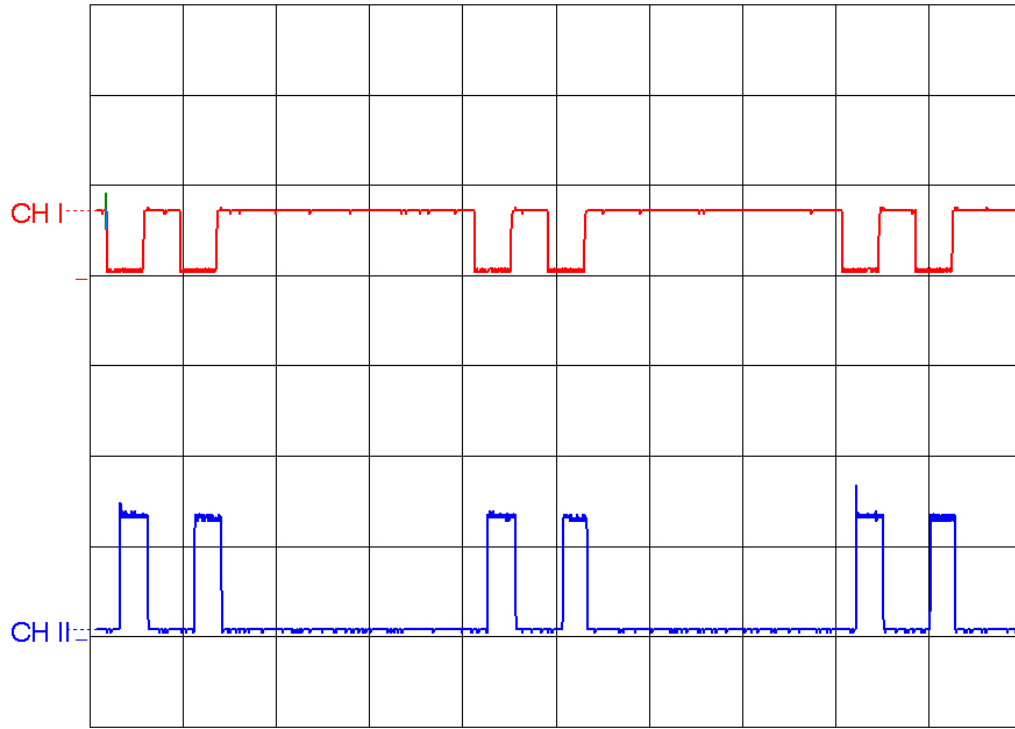


CH I : Cursor I: ,600V Cursor II: 4,000V Diff. I-II: -3,4000V
CH II: Cursor I: ,024V Cursor II: ,024V Diff. I-II: ,0000V
dt: 31,300 ms 1/dt: 31,949 Hz

703_10_2.wmf

Measure time: 11:07:36
Measure date: 23.11.2009

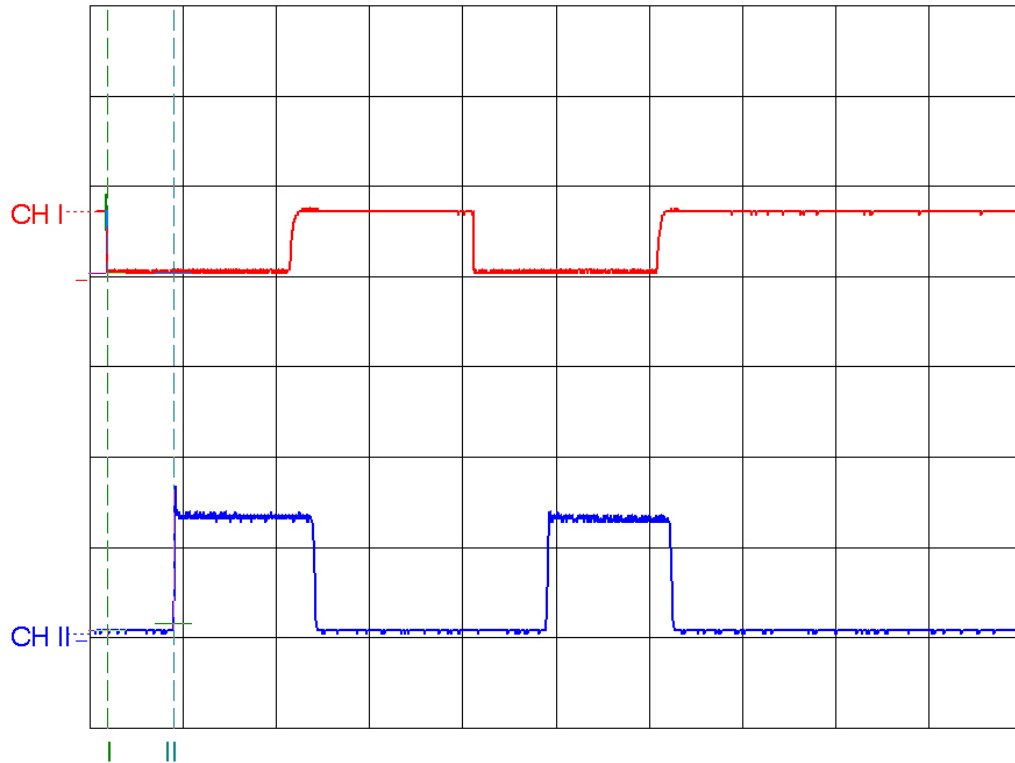
CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 100 ms TR: CH1-DC



703_10_3.wmf

Measure time: 11:11:38
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

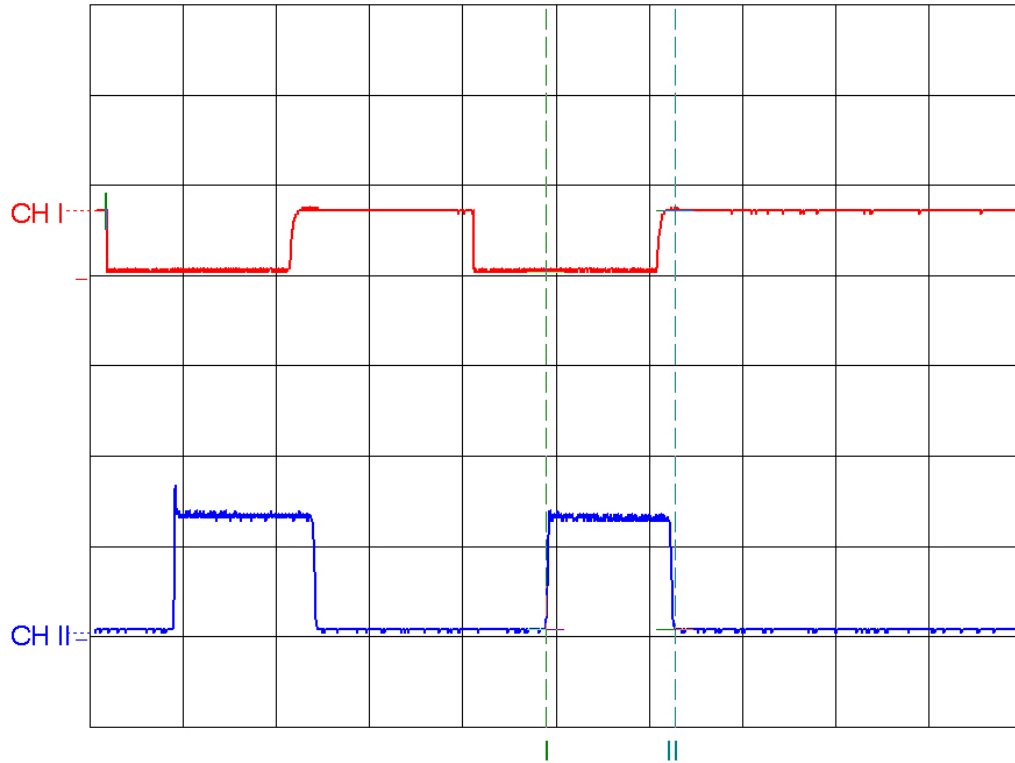


CH I: Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,024V Cursor II: ,040V Diff. I-II: -,0160V
dt: 14,200 ms 1/dt: 70,423 Hz

703_10_6.wmf

Measure time: 11:11:38
Measure date: 23.11.2009

CH1: 5,000V/DIV DC CH2: ,200V/DIV DC TB A: 20 ms TR: CH1-DC

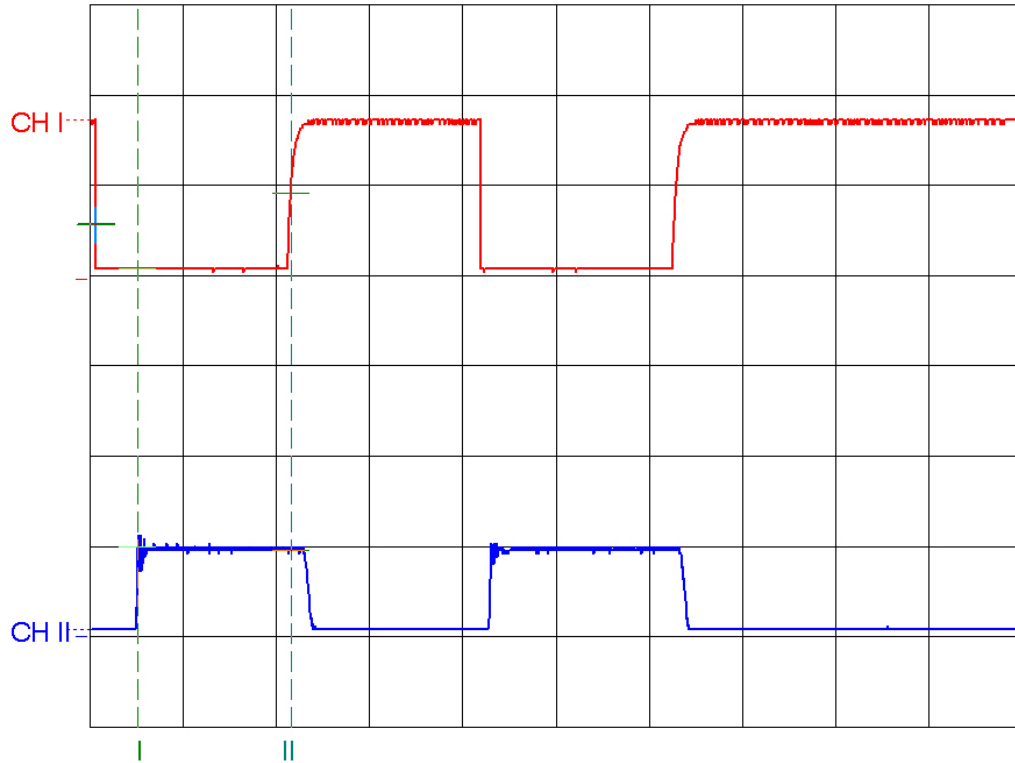


CH I: Cursor I: 400V Cursor II: 3,800V Diff. I-II: -3,4000V
CH II: Cursor I: ,024V Cursor II: ,024V Diff. I-II: ,0000V
dt: 27,700 ms 1/dt: 36,101 Hz

703_10_7.wmf

Measure time: 10:52:59
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

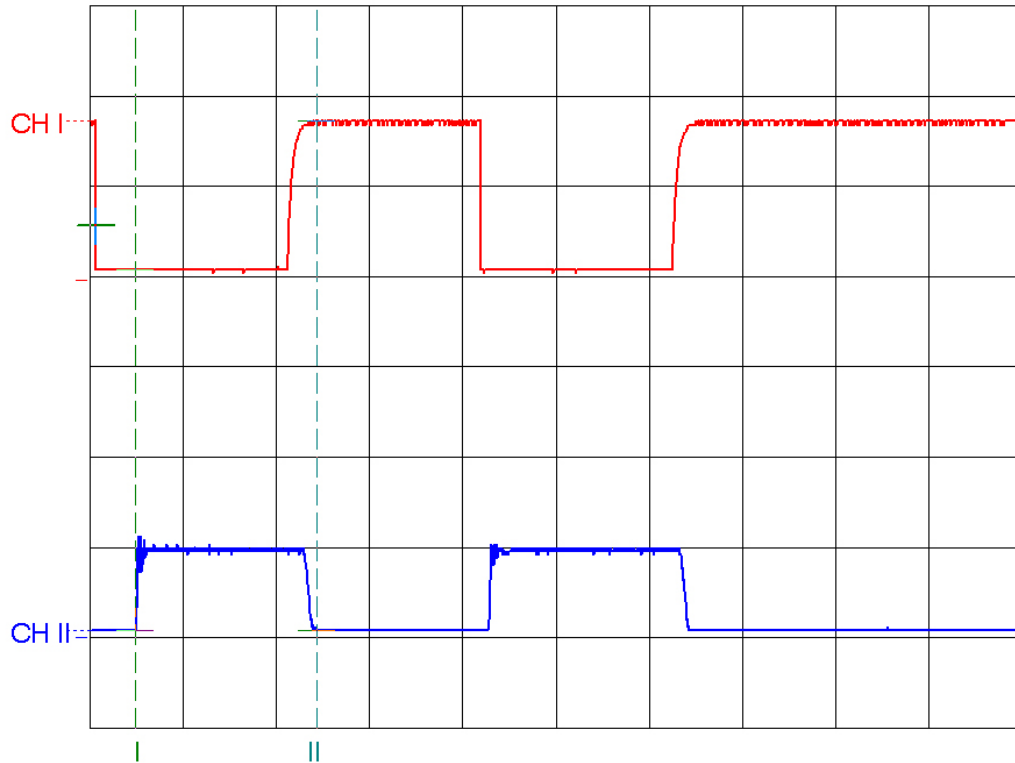


CH I : Cursor I: ,240V Cursor II: 1,920V Diff. I-II: -1,6800V
CH II: Cursor I: 1,000V Cursor II: ,960V Diff. I-II: ,0400V
dt: 32,800 ms 1/dt: 30,488 Hz

7410_25_1.wmf

Measure time: 10:52:59
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

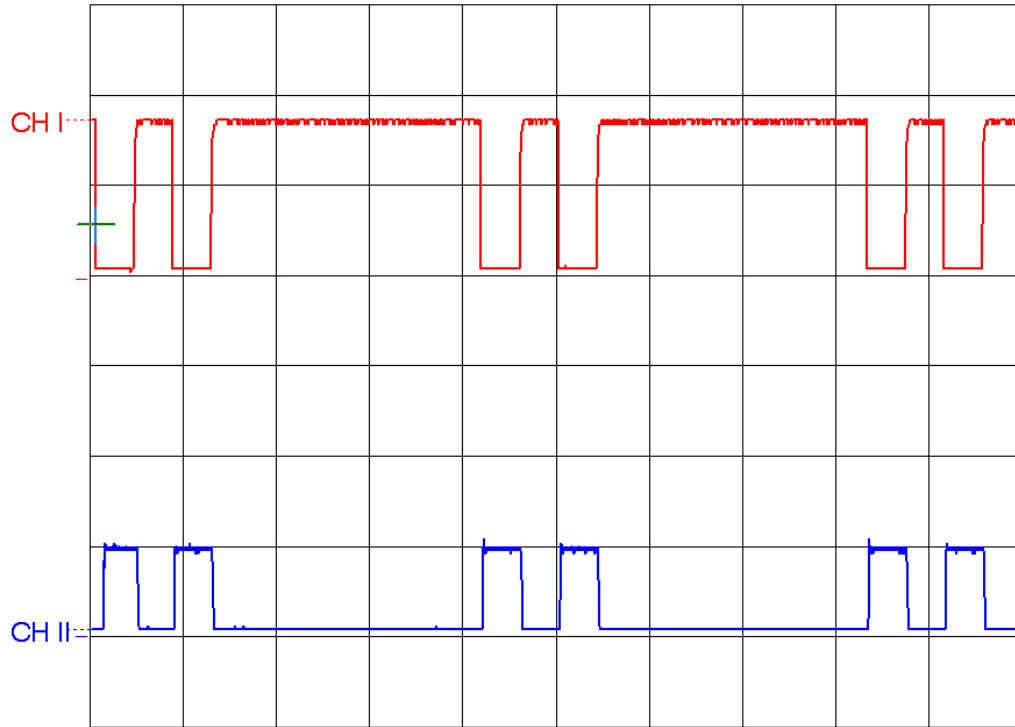


CH I : Cursor I: ,240V Cursor II: 3,520V Diff. I-II: -3,2800V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 38,800 ms 1/dt: 25,773 Hz

7410_25_2.wmf

Measure time: 10:55:36
Measure date: 25.11.2014

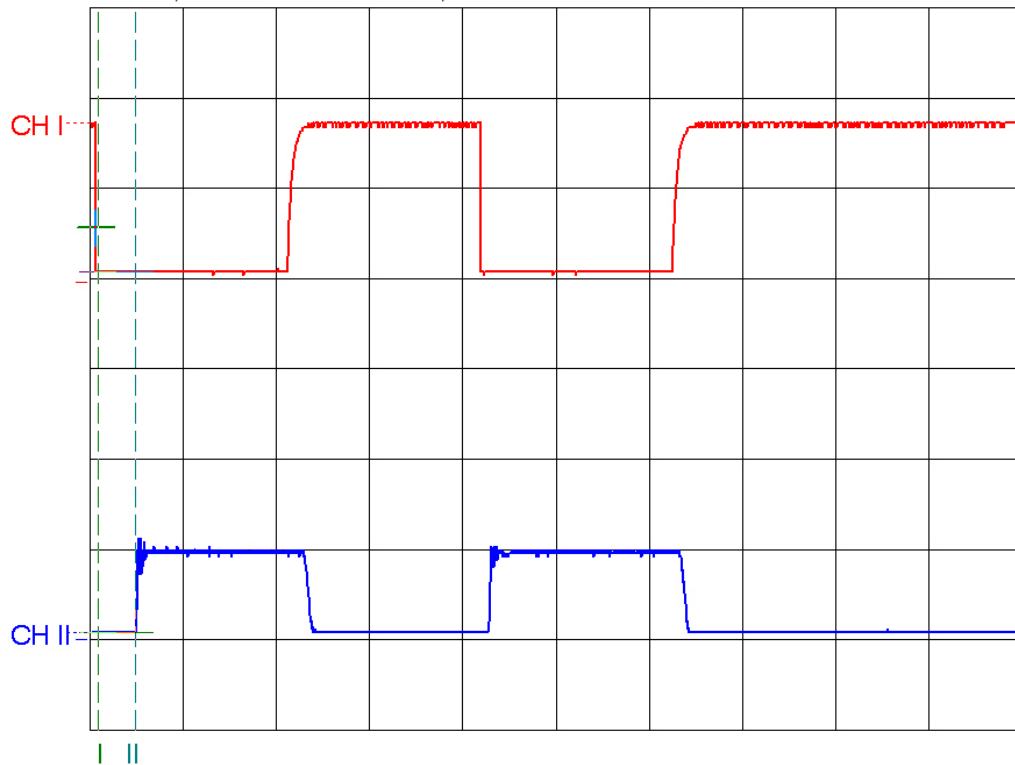
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



7410_25_3.wmf

Measure time: 10:52:59
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

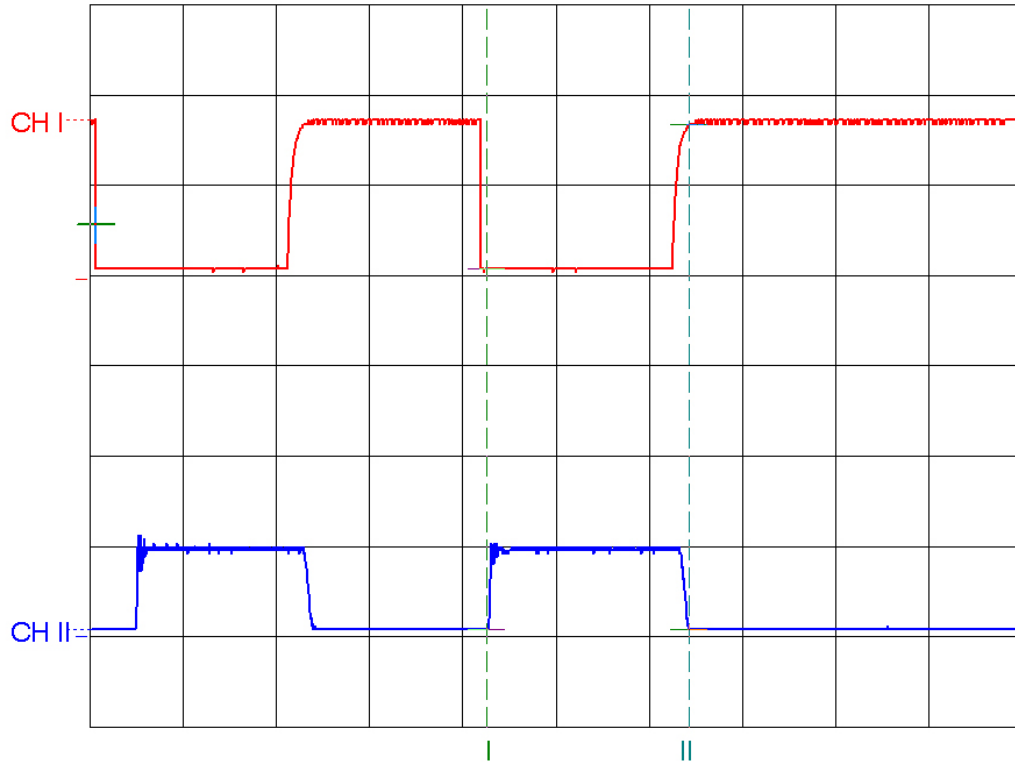


CH I : Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 8,100 ms 1/dt: 123,457 Hz

7410_25_6.wmf

Measure time: 10:52:59
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

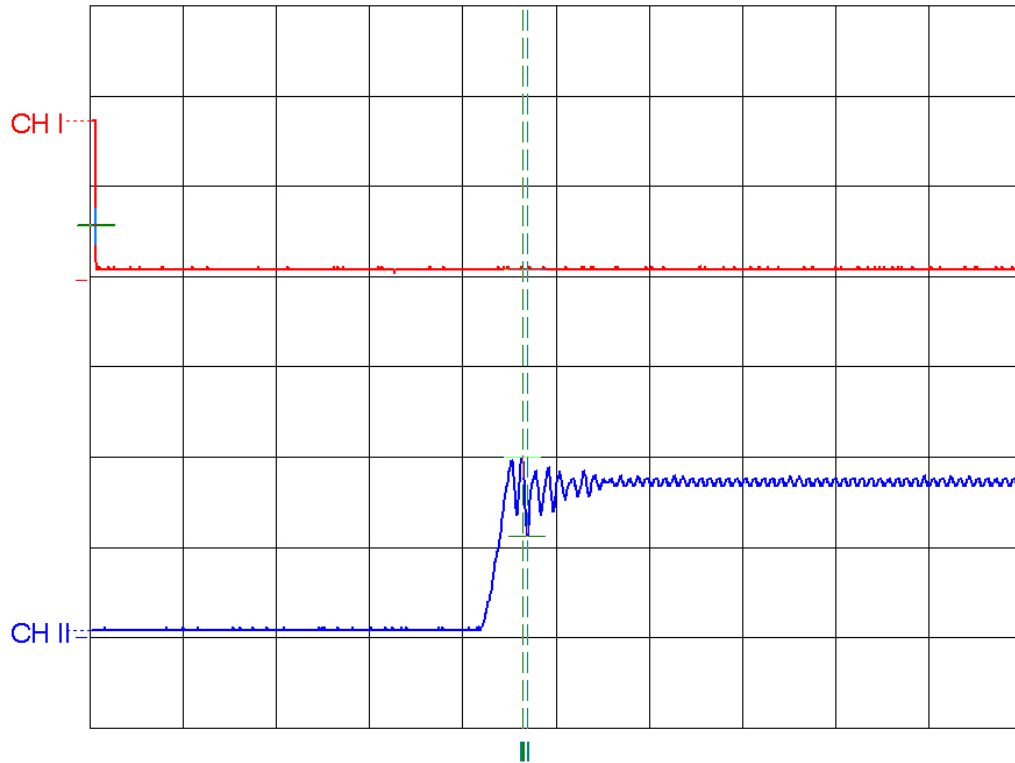


CH I: Cursor I: ,240V Cursor II: 3,440V Diff. I-II: -3,2000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 43,400 ms 1/dt: 23,041 Hz

7410_25_7.wmf

Measure time: 11:20:36
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

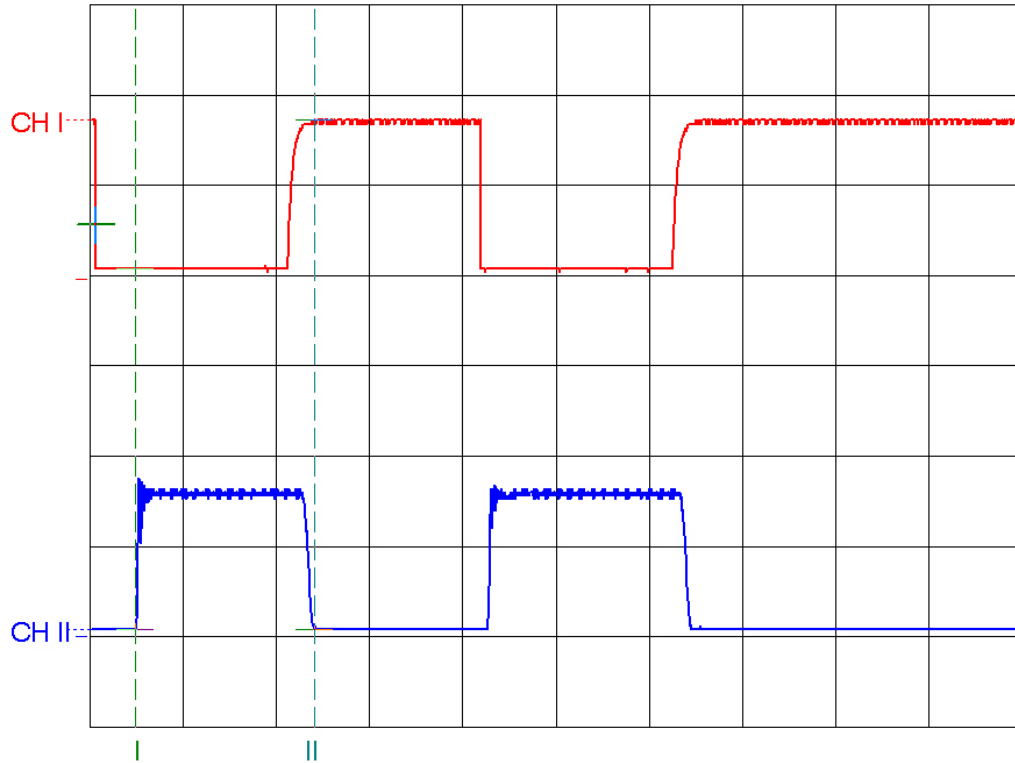


CH I: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: 2,000V Cursor II: 1,120V Diff. I-II: ,8800V
dt: 120,000 μ s 1/dt: 8,333 kHz

7410_50_1.wmf

Measure time: 10:50:49
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

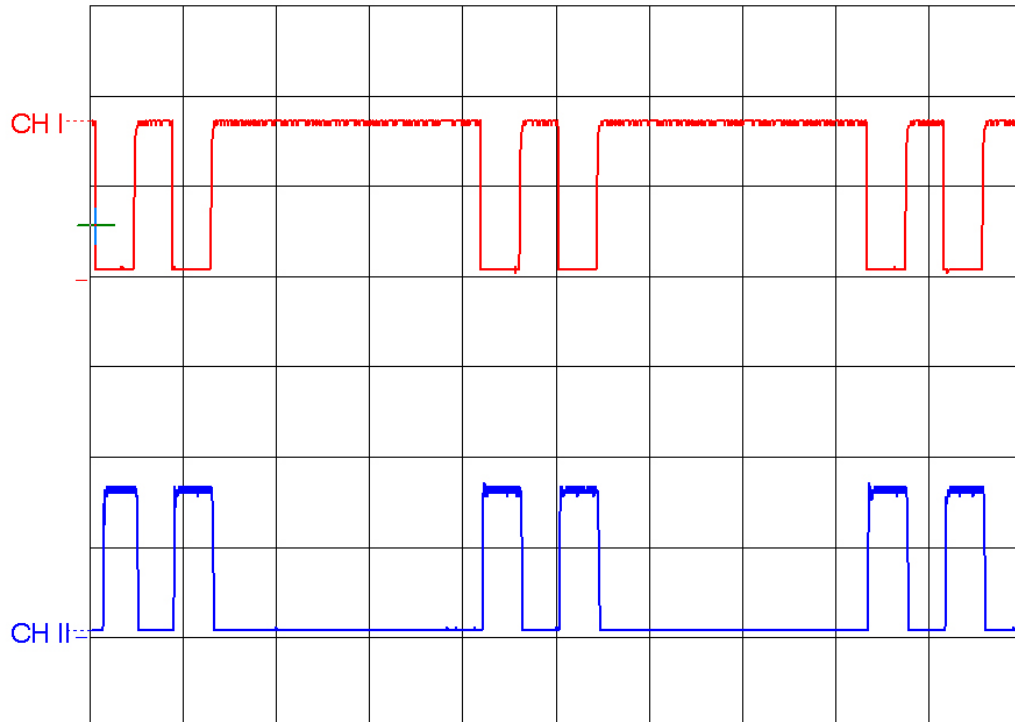


CH I: Cursor I: ,240V Cursor II: 3,520V Diff. I-II: -3,2800V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 38,300 ms 1/dt: 26,110 Hz

7410_50_2.wmf

Measure time: 10:57:43
Measure date: 25.11.2014

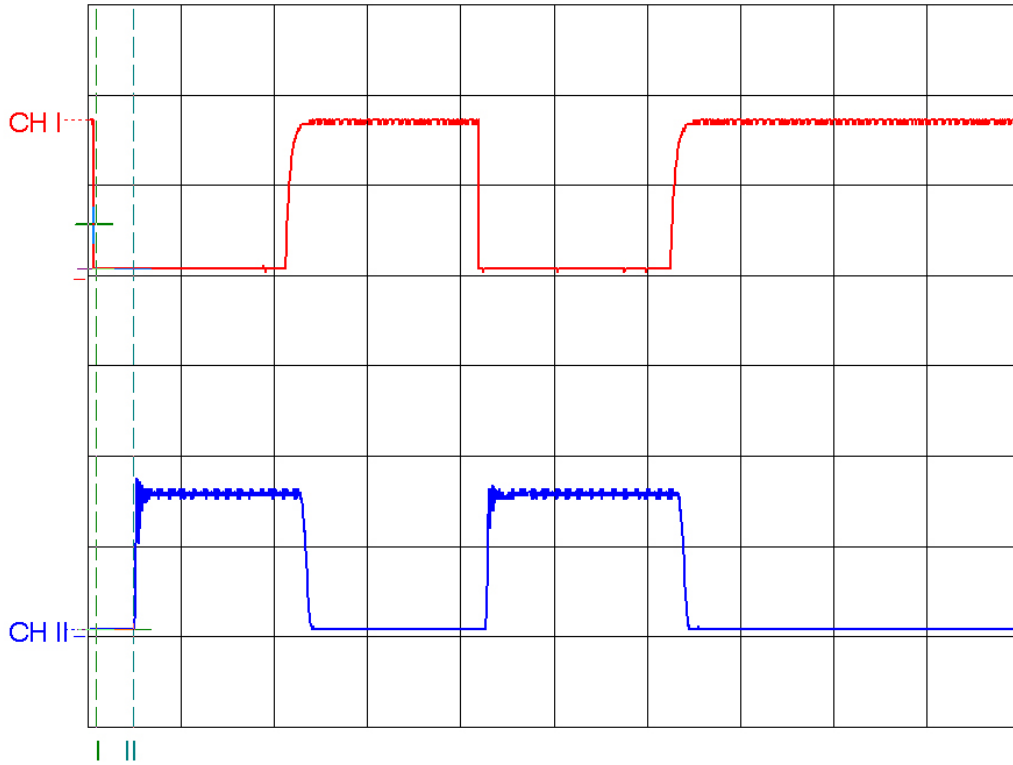
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



7410_50_3.wmf

Measure time: 10:50:49
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

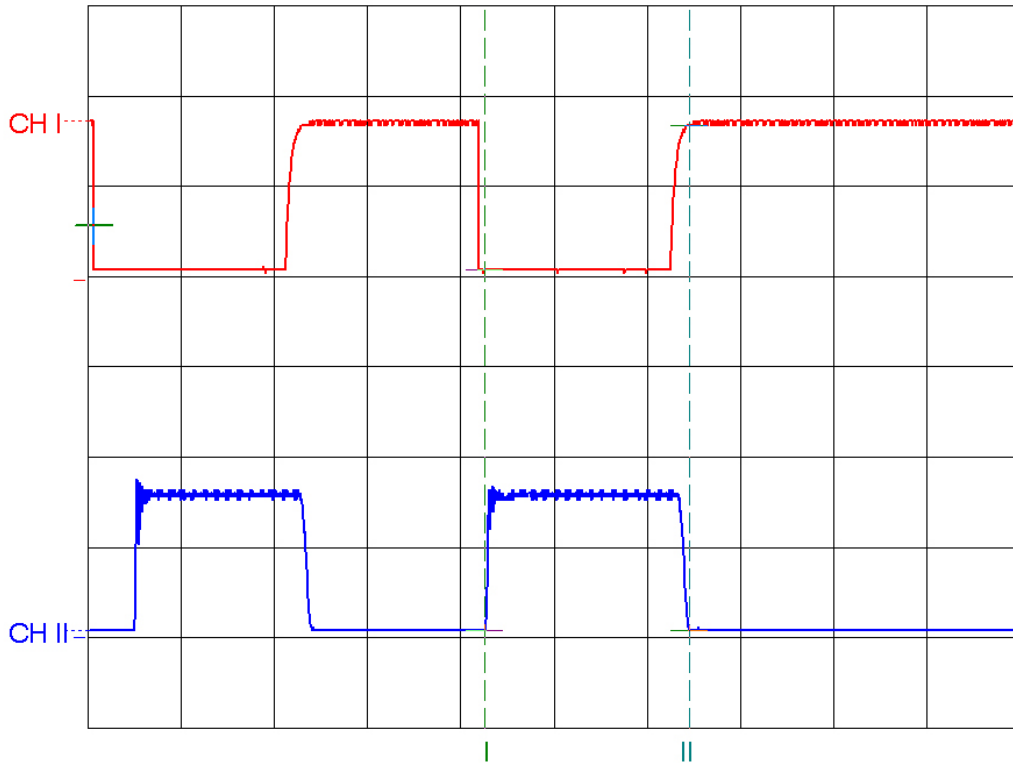


CH I : Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 8,100 ms 1/dt: 123,457 Hz

7410_50_6.wmf

Measure time: 10:50:49
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

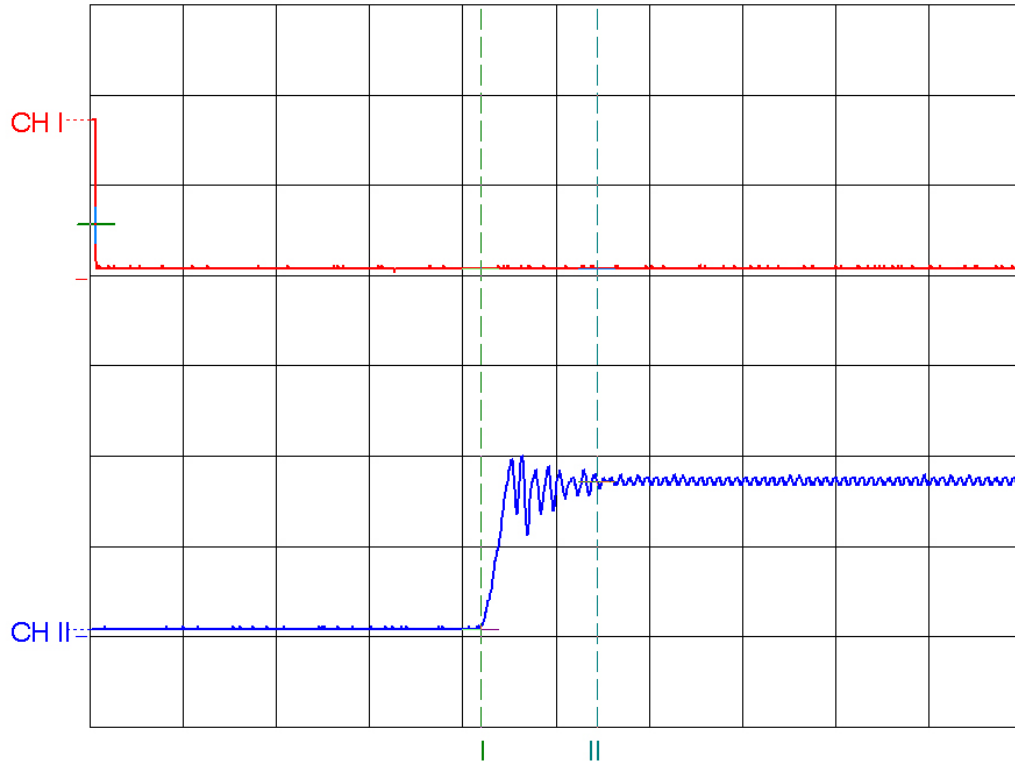


CH I : Cursor I: ,240V Cursor II: 3,440V Diff. I-II: -3,2000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 43,900 ms 1/dt: 22,779 Hz

7410_50_7.wmf

Measure time: 11:20:36
Measure date: 25.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

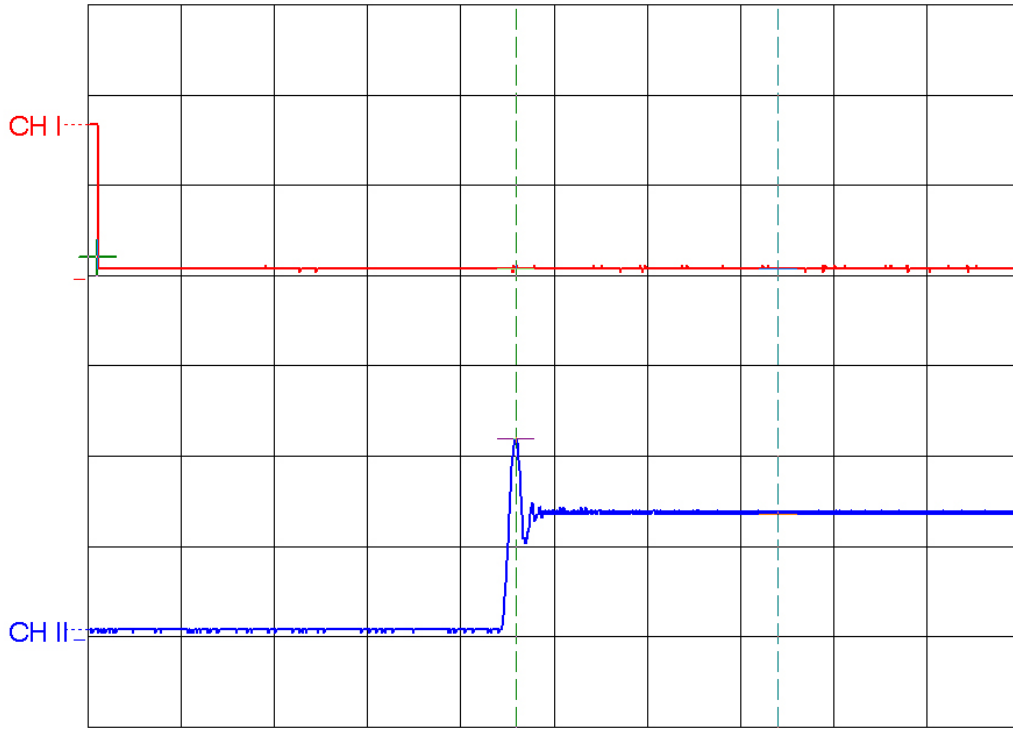


CH I : Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: ,080V Cursor II: 1,720V Diff. I-II: -1,6400V
dt: 2,500 ms 1/dt: 400,000 Hz

7410_50_8.wmf

Measure time: 15:44:07
Measure date: 02.06.2012

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

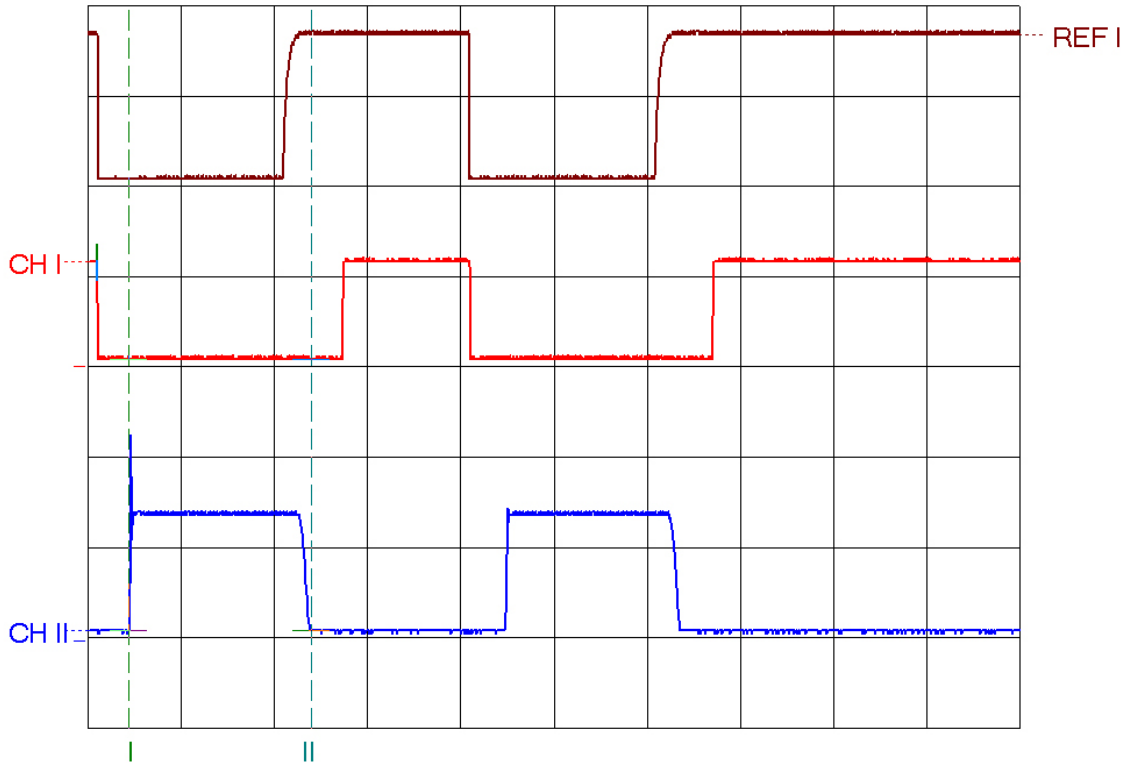


CH I : Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: 2,240V Cursor II: 1,400V Diff. I-II: ,8400V
dt: 5,640 ms 1/dt: 177,305 Hz

7800_50_1.wmf

Measure time: 15:23:46
Measure date: 02.06.2012

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

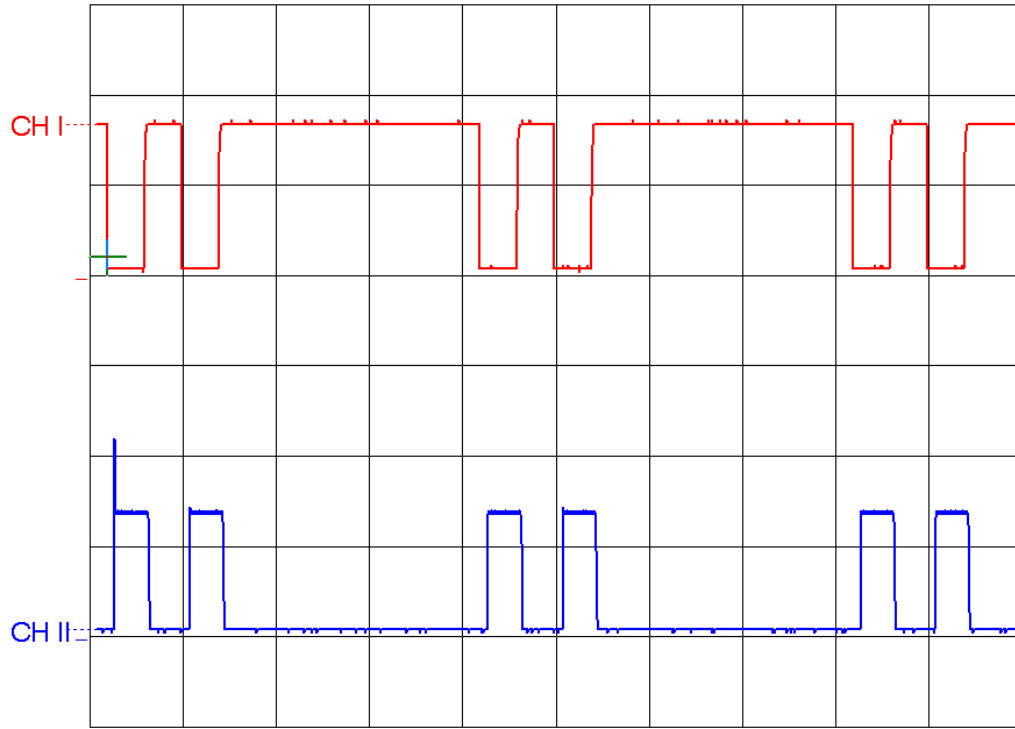


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 39,100 ms 1/dt: 25,575 Hz

7800_50_2.wmf

Measure time: 15:58:17
Measure date: 02.06.2012

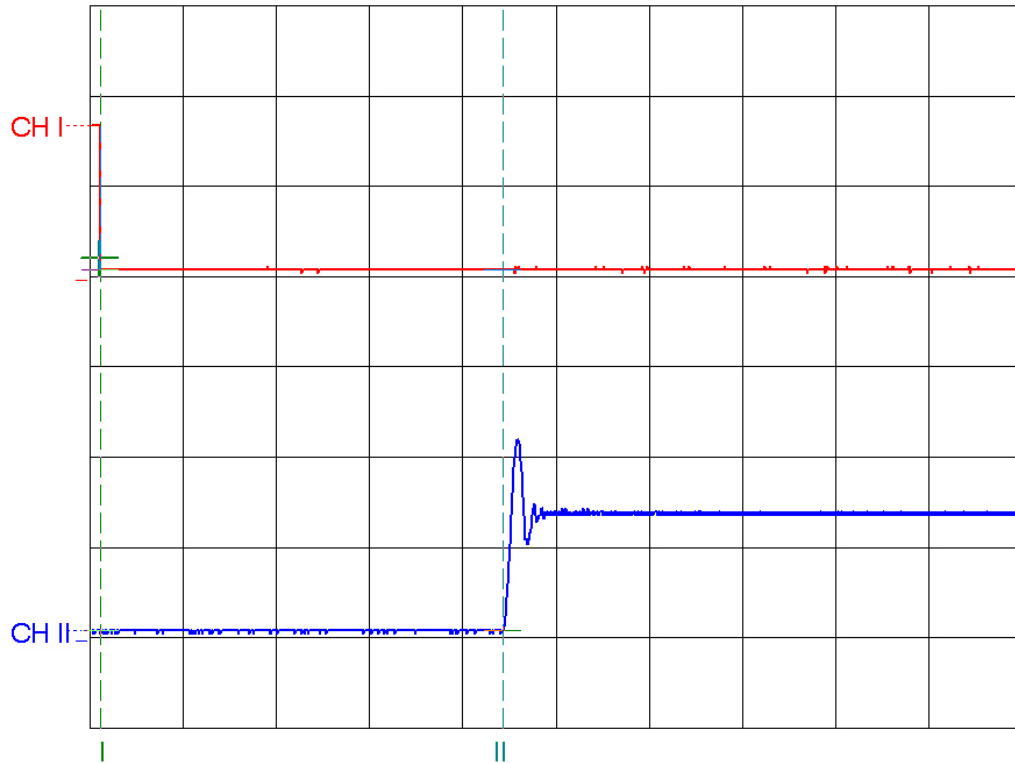
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



7800_50_3.wmf

Measure time: 15:44:07
Measure date: 02.06.2012

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

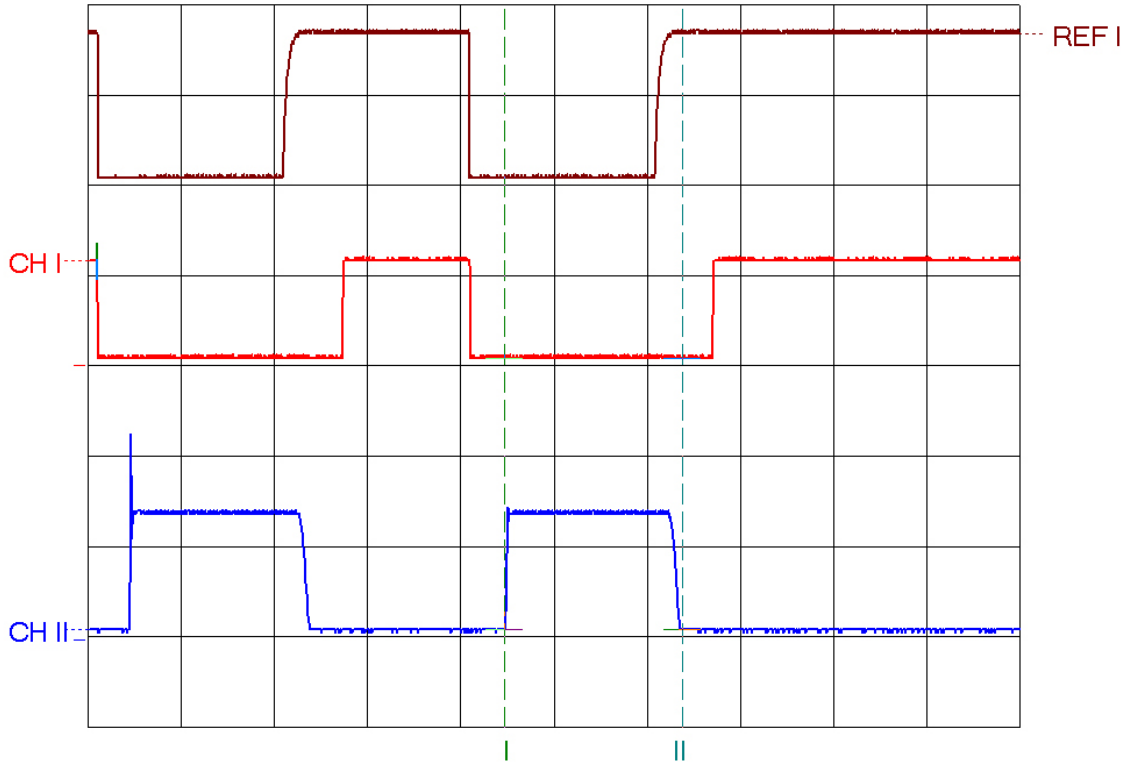


CH I: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 8,650 ms 1/dt: 115,607 Hz

7800_50_6.wmf

Measure time: 15:23:46
Measure date: 02.06.2012

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

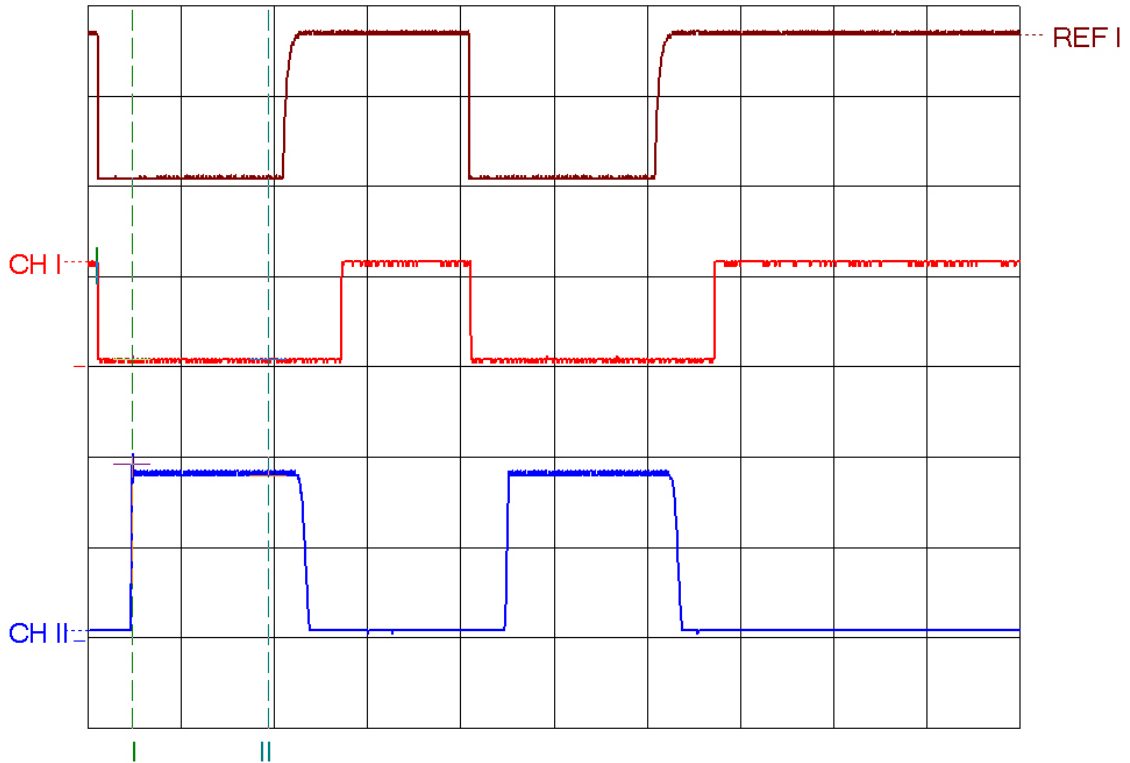


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 38,100 ms 1/dt: 26,247 Hz

7800_50_7.wmf

Measure time: 14:53:08
Measure date: 02.06.2012

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

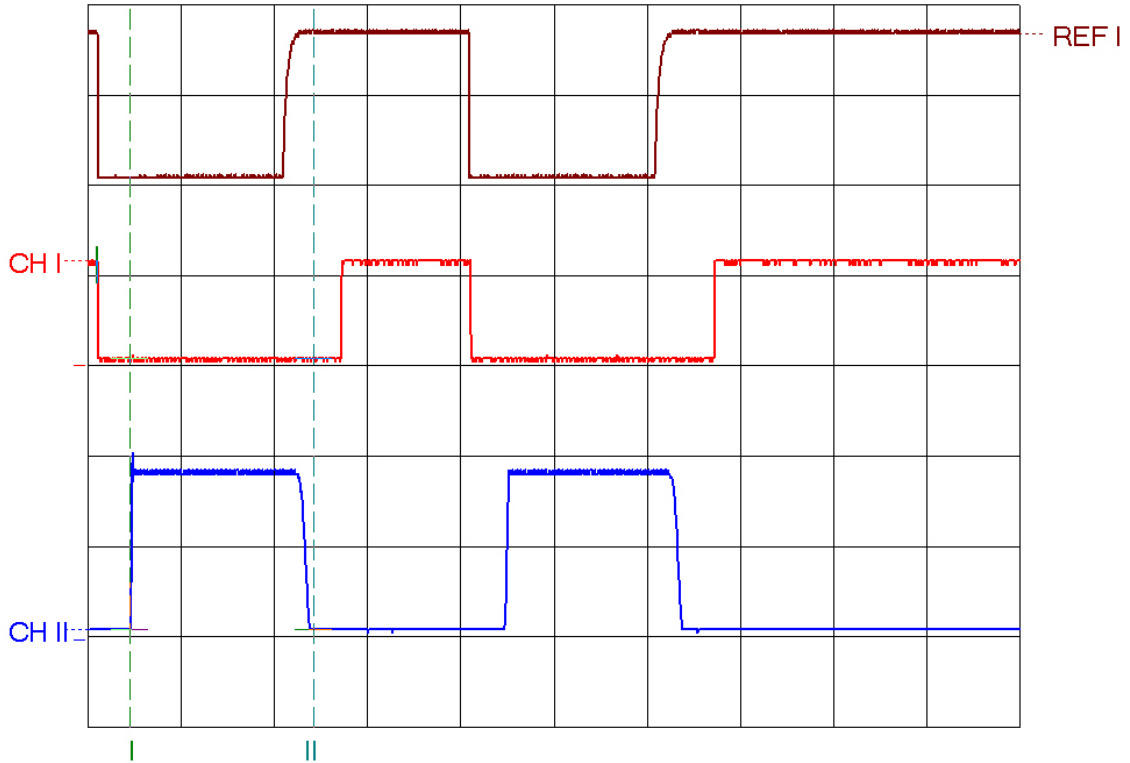


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: 3,920V Cursor II: 3,680V Diff. I-II: ,2400V
dt: 29,300 ms 1/dt: 34,130 Hz

7800_200_1.wmf

Measure time: 14:53:08
Measure date: 02.06.2012

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

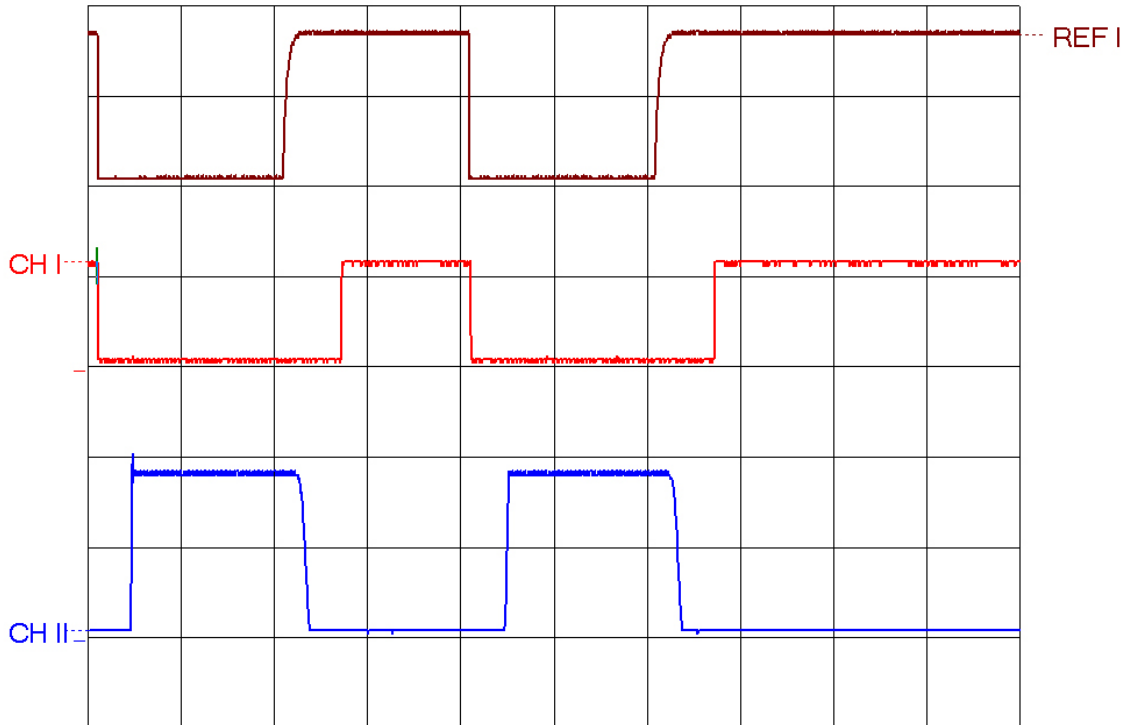


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 39,400 ms 1/dt: 25,381 Hz

7800_200_2.wmf

Measure time: 15:04:27
Measure date: 02.06.2012

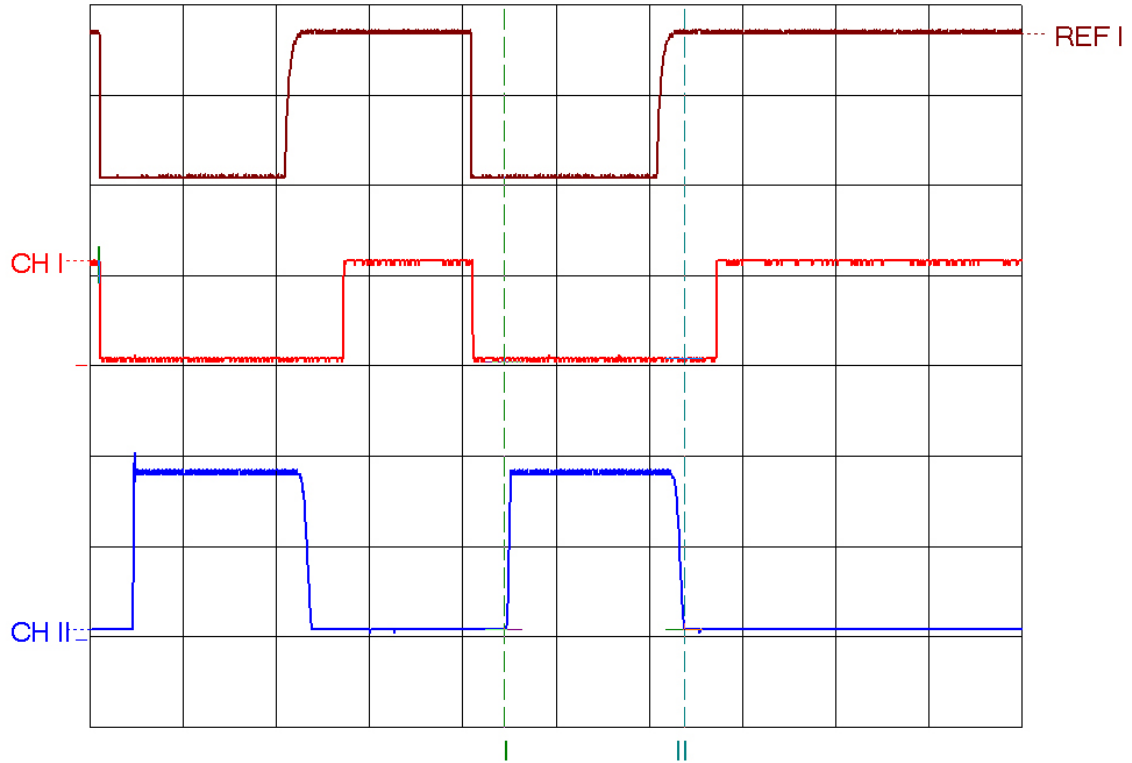
CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC



7800_200_6.wmf

Measure time: 14:53:08
Measure date: 02.06.2012

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

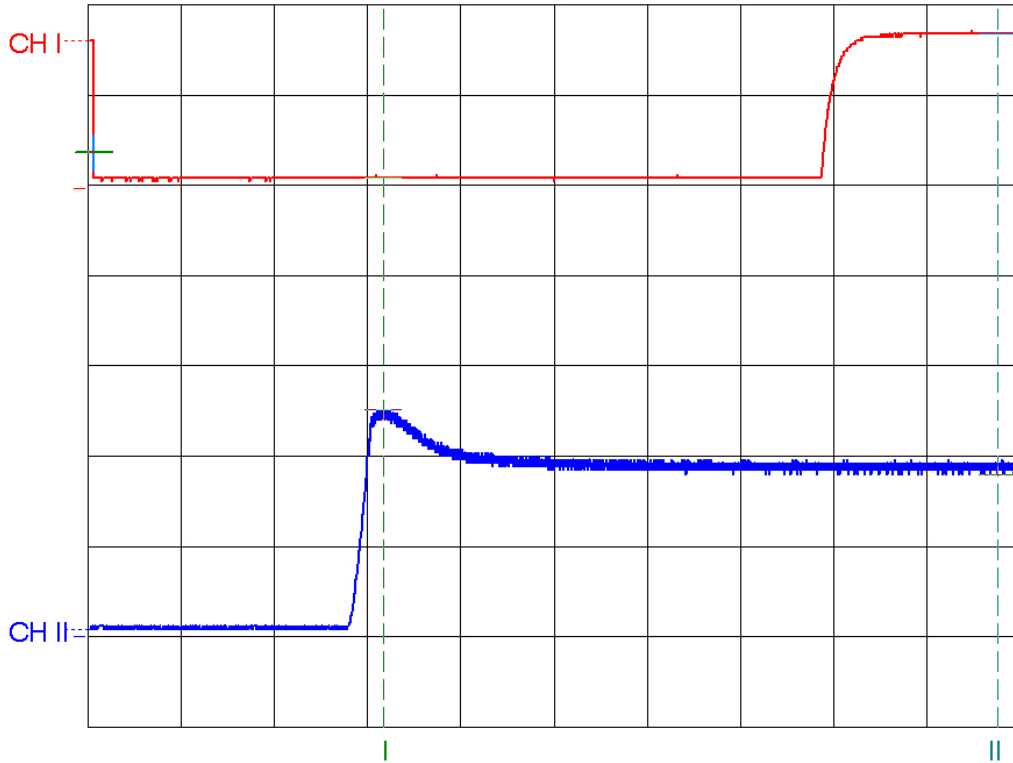


CH I: Cursor I: ,200V Cursor II: ,400V Diff. I-II: -,2000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 38,600 ms 1/dt: 25,907 Hz

7800_200_7.wmf

Measure time: 09:29:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 5 ms TR: CH1-DC

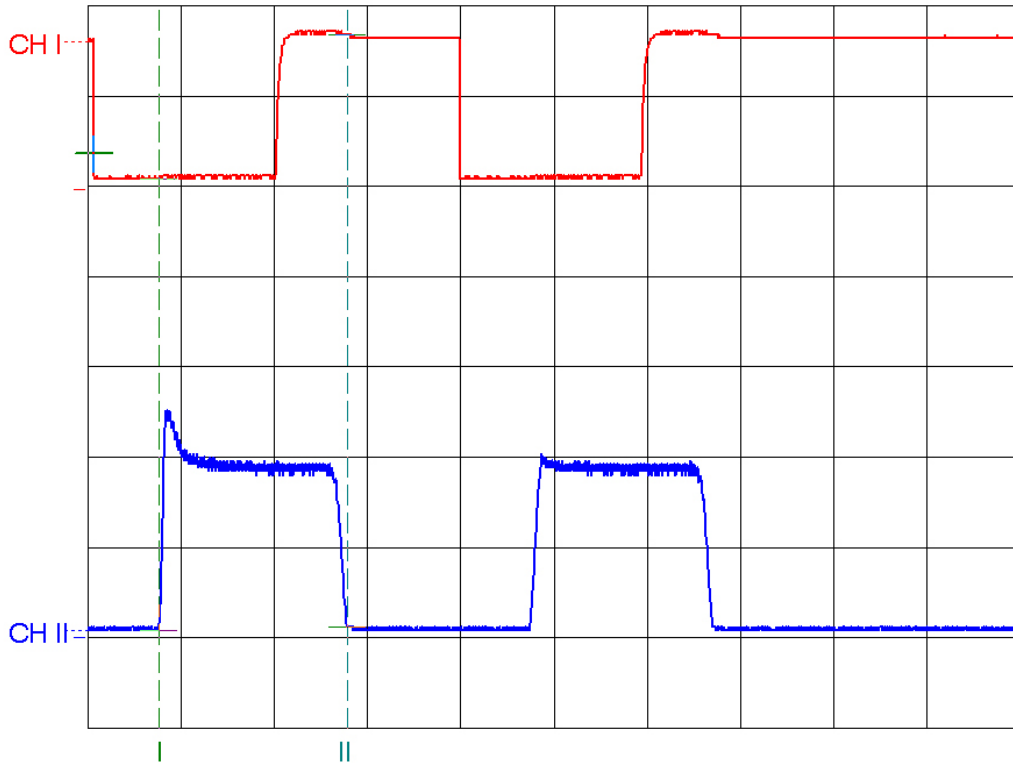


CH I : Cursor I: ,240V Cursor II: 3,440V Diff. I-II: -3,2000V
CH II: Cursor I: 1,260V Cursor II: ,900V Diff. I-II: ,3600V
dt: 32,925 ms 1/dt: 30,372 Hz

590_25_1.wmf

Measure time: 09:26:01
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 20 ms TR: CH1-DC

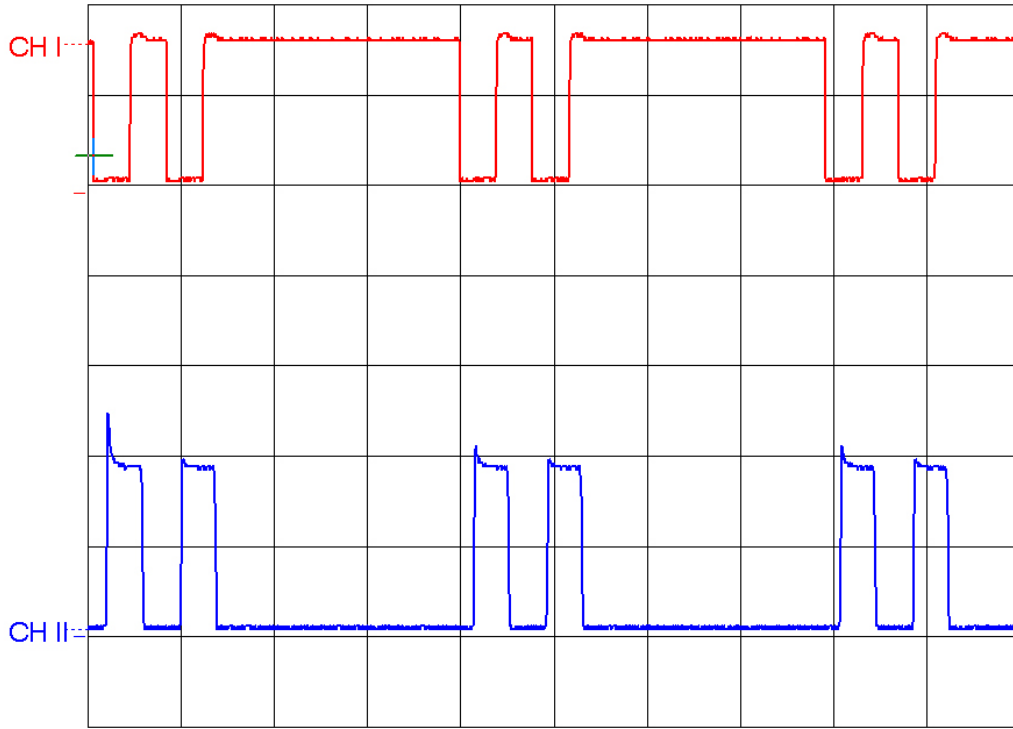


CH I : Cursor I: ,240V Cursor II: 3,440V Diff. I-II: -3,2000V
CH II: Cursor I: ,040V Cursor II: ,060V Diff. I-II: -,0200V
dt: 40,600 ms 1/dt: 24,631 Hz

590_25_2.wmf

Measure time: 09:52:02
Measure date: 14.06.2014

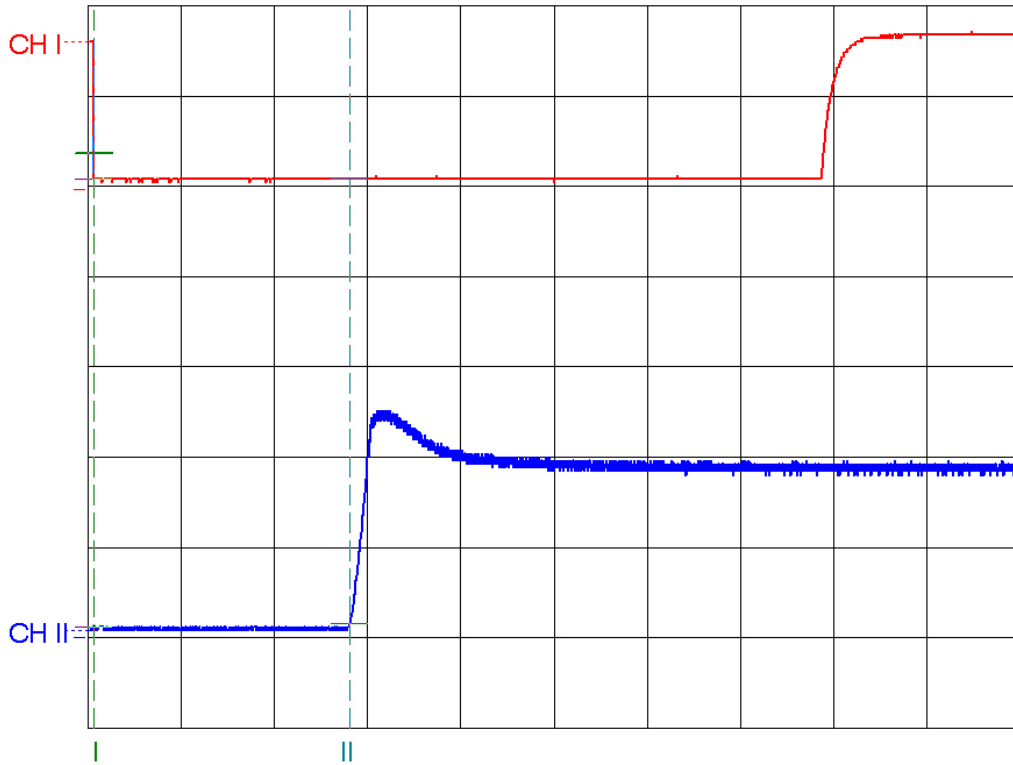
CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 100 ms TR: CH1-DC



590_25_3.wmf

Measure time: 09:29:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 5 ms TR: CH1-DC

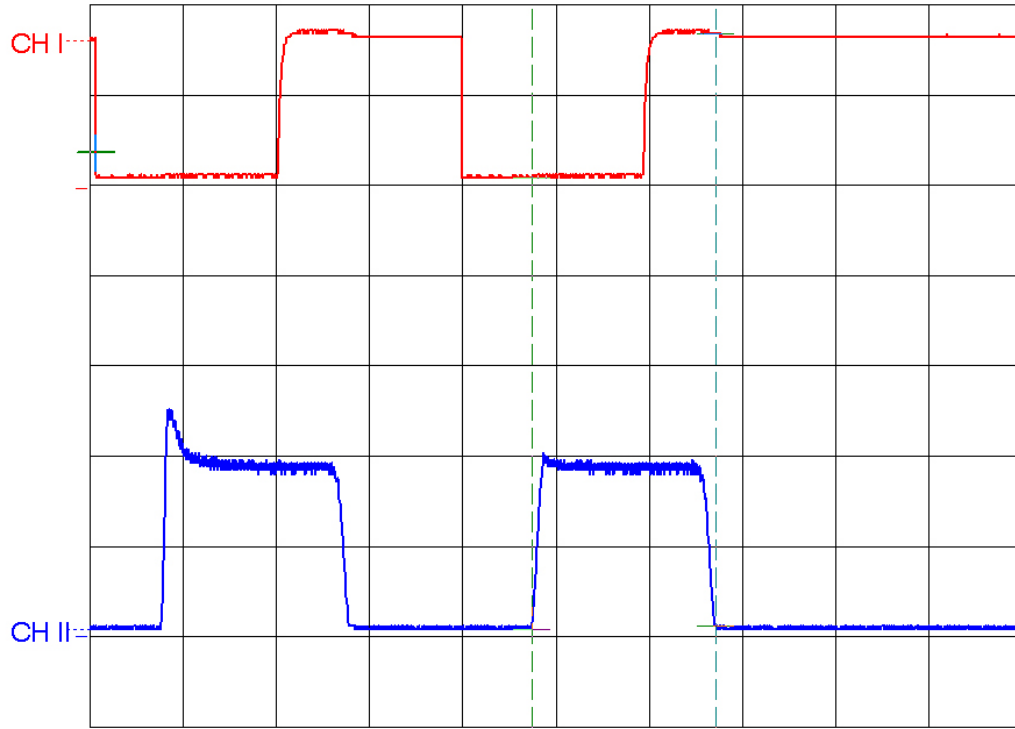


CH I: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
CH II: Cursor I: ,060V Cursor II: ,080V Diff. I-II: -,0200V
dt: 13,725 ms 1/dt: 72,860 Hz

590_25_6.wmf

Measure time: 09:26:01
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 20 ms TR: CH1-DC

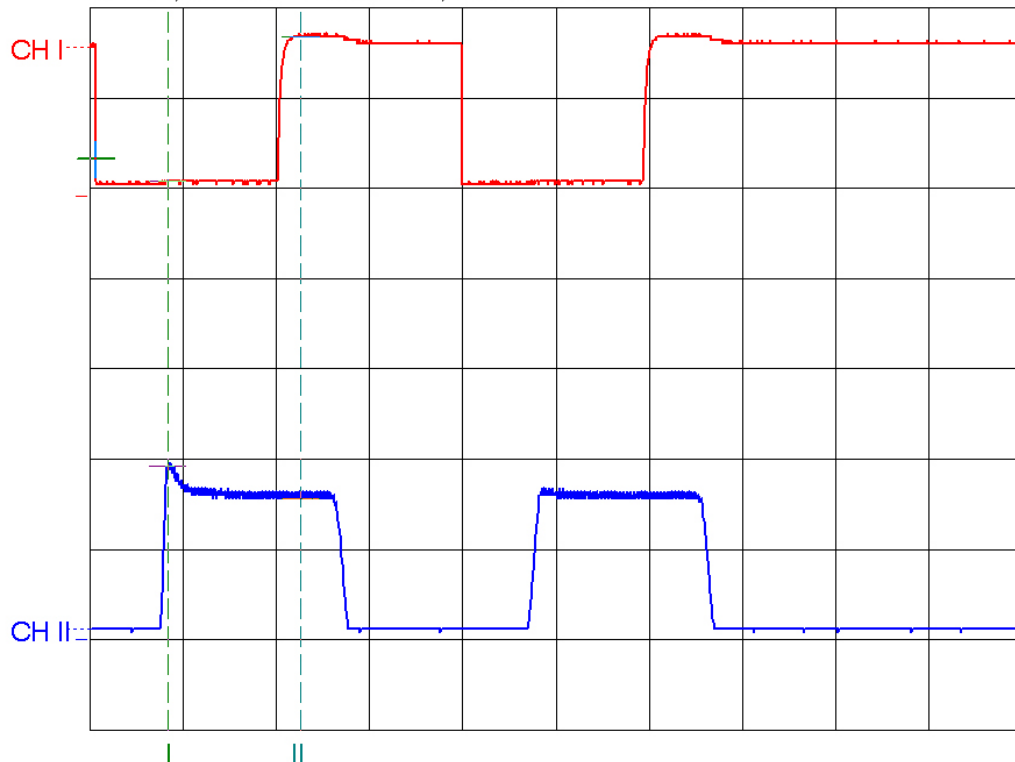


CH I : Cursor I: ,240V Cursor II: 3,440V Diff. I-II: -3,2000V
CH II: Cursor I: ,040V Cursor II: ,060V Diff. I-II: -,0200V
dt: 39,600 ms 1/dt: 25,253 Hz

590_25_7.wmf

Measure time: 09:39:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

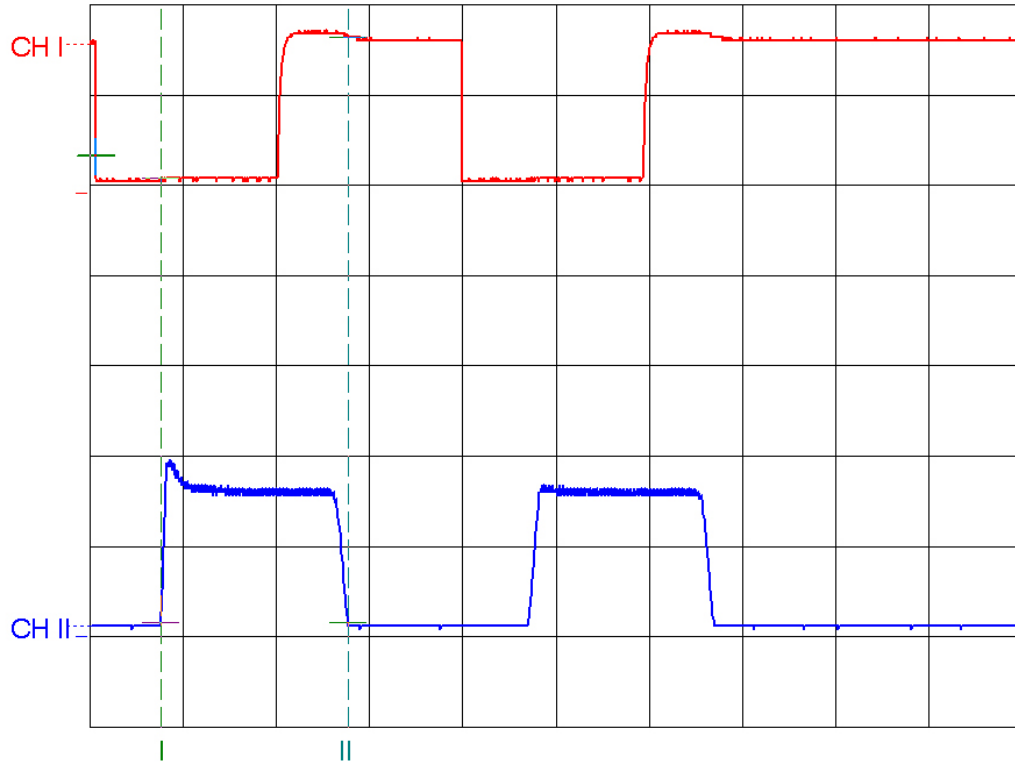


CH I : Cursor I: ,320V Cursor II: 3,520V Diff. I-II: -3,2000V
CH II: Cursor I: 1,920V Cursor II: 1,560V Diff. I-II: ,3600V
dt: 28,700 ms 1/dt: 34,843 Hz

590_50_1.wmf

Measure time: 09:39:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

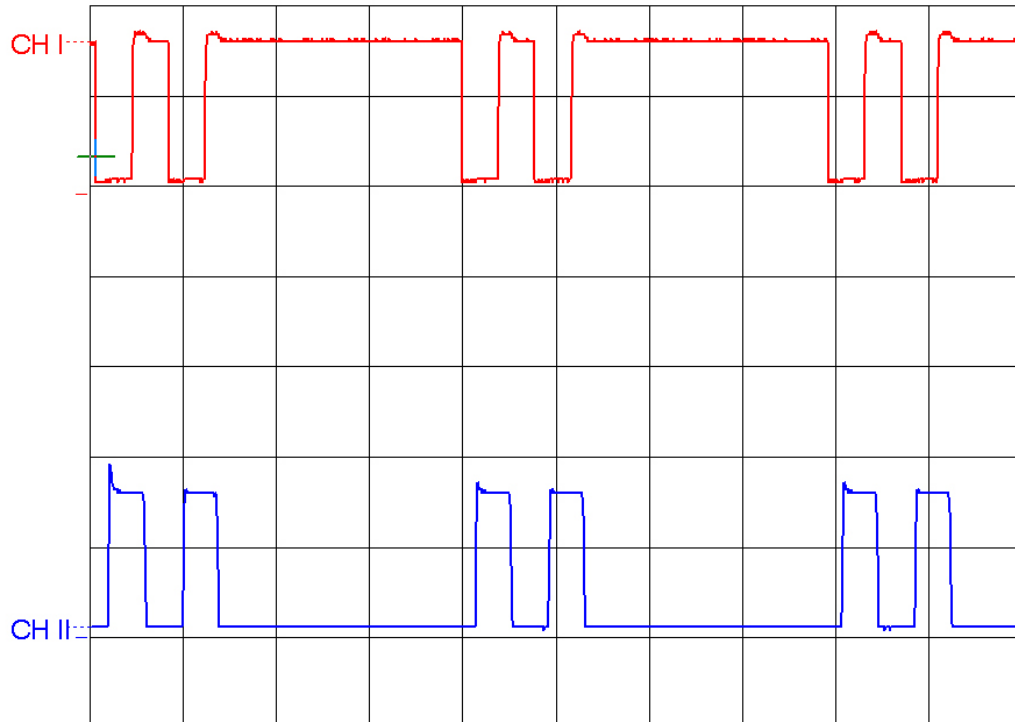


CH I: Cursor I: ,320V Cursor II: 3,440V Diff. I-II: -3,1200V
CH II: Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
dt: 40,300 ms 1/dt: 24,814 Hz

590_50_2.wmf

Measure time: 09:49:58
Measure date: 14.06.2014

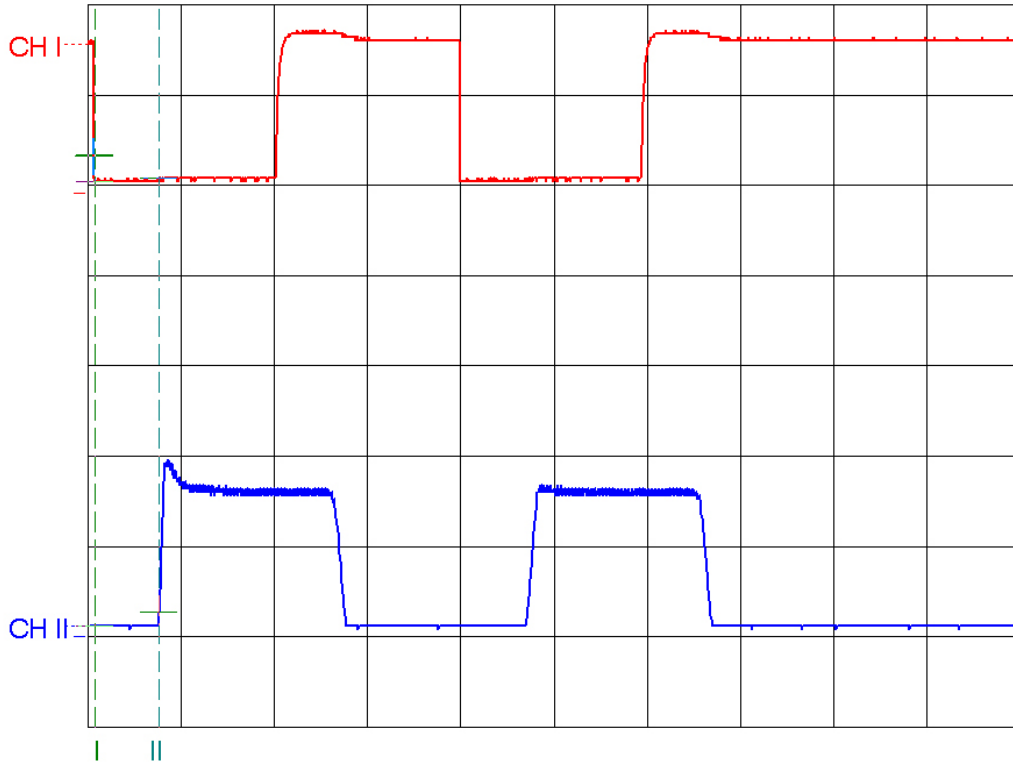
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



590_50_3.wmf

Measure time: 09:39:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

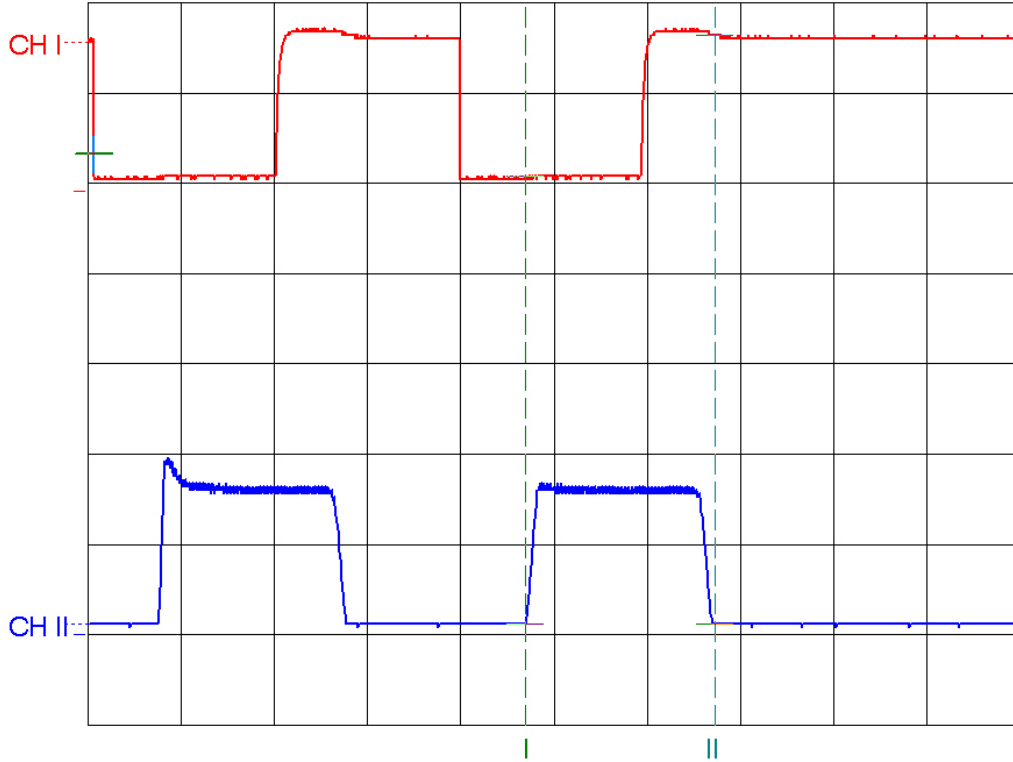


CH I : Cursor I: ,240V Cursor II: ,320V Diff. I-II: -,0800V
CH II: Cursor I: ,120V Cursor II: ,280V Diff. I-II: -,1600V
dt: 13,800 ms 1/dt: 72,464 Hz

590_50_6.wmf

Measure time: 09:39:15
Measure date: 14.06.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

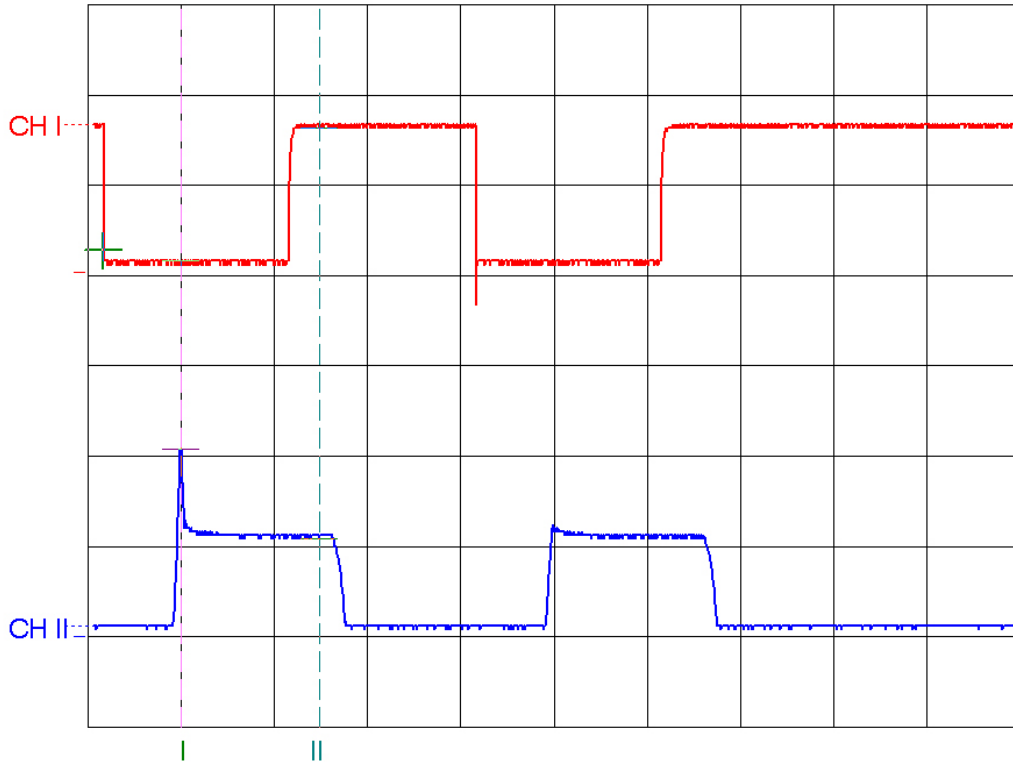


CH I : Cursor I: ,320V Cursor II: 3,440V Diff. I-II: -3,1200V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 40,800 ms 1/dt: 24,510 Hz

590_50_7.wmf

Measure time: 16:11:25
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

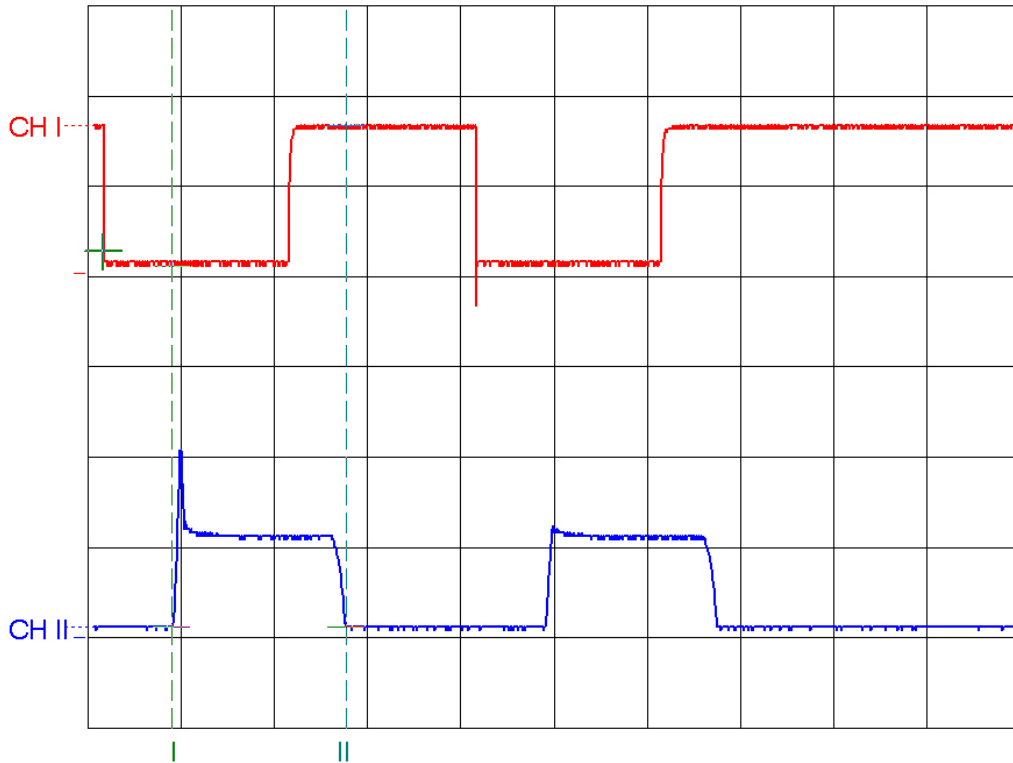


CH I : Cursor I: 600V Cursor II: 8,000V Diff. I-II: -7,4000V
CH II: Cursor I: 2,080V Cursor II: 1,080V Diff. I-II: 1,0000V
dt: 29,700 ms 1/dt: 33,670 Hz

850_30_1.wmf

Measure time: 16:11:25
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

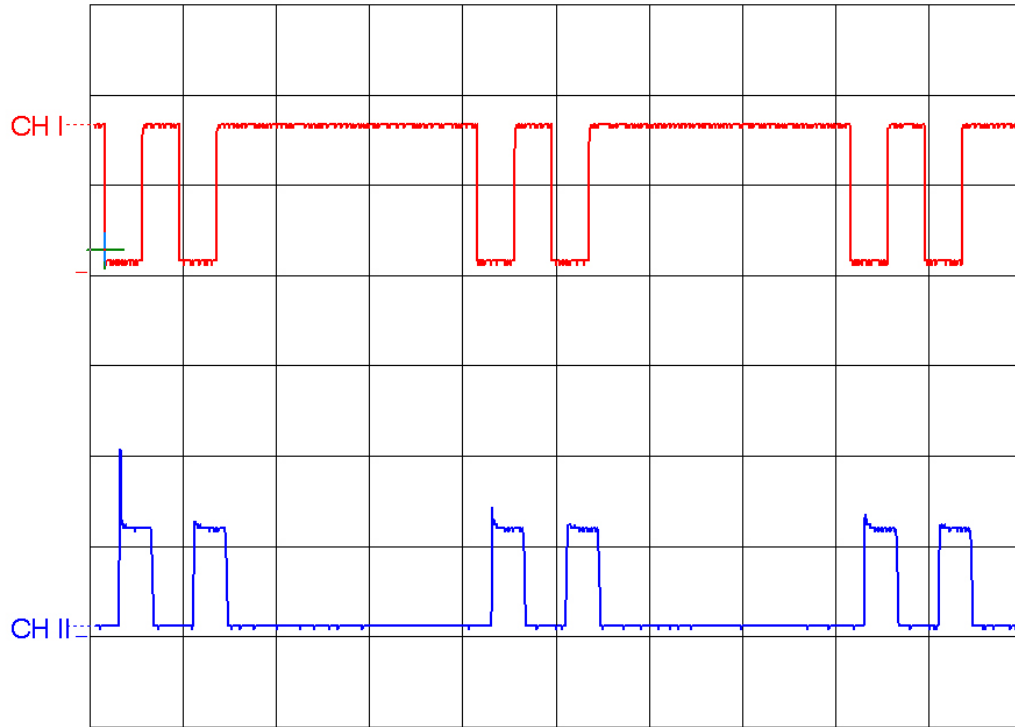


CH I : Cursor I: ,400V Cursor II: 8,200V Diff. I-II: -7,8000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,500 ms 1/dt: 26,667 Hz

850_30_2.wmf

Measure time: 16:23:56
Measure date: 16.12.2009

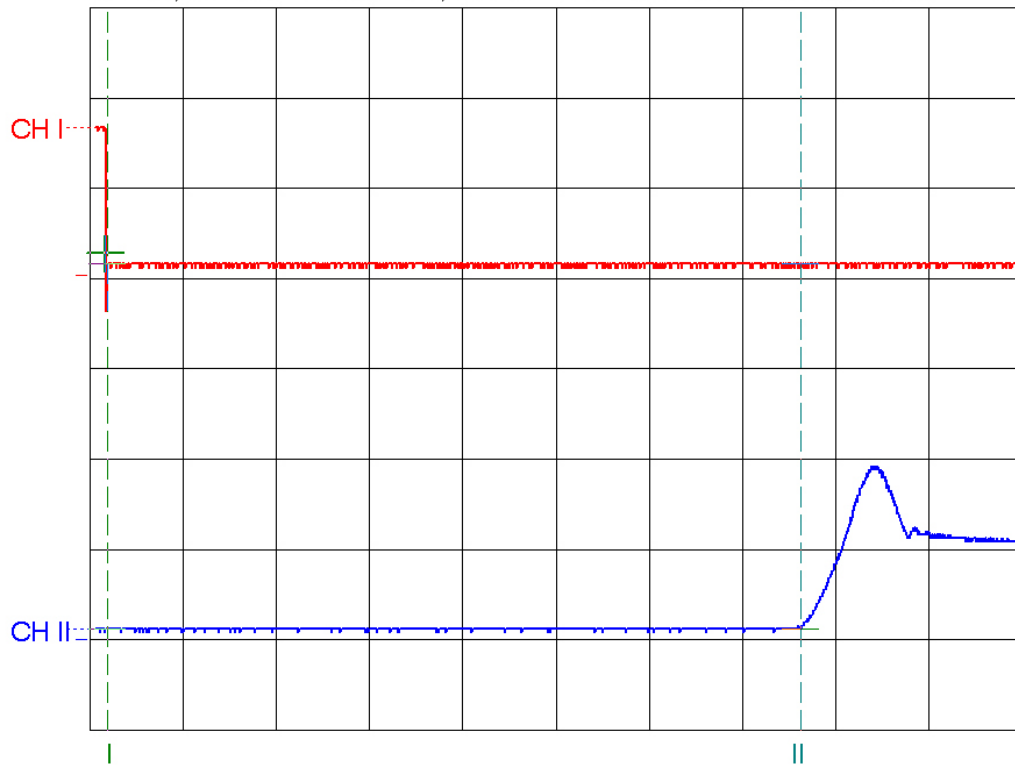
CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



850_30_3.wmf

Measure time: 16:17:34
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

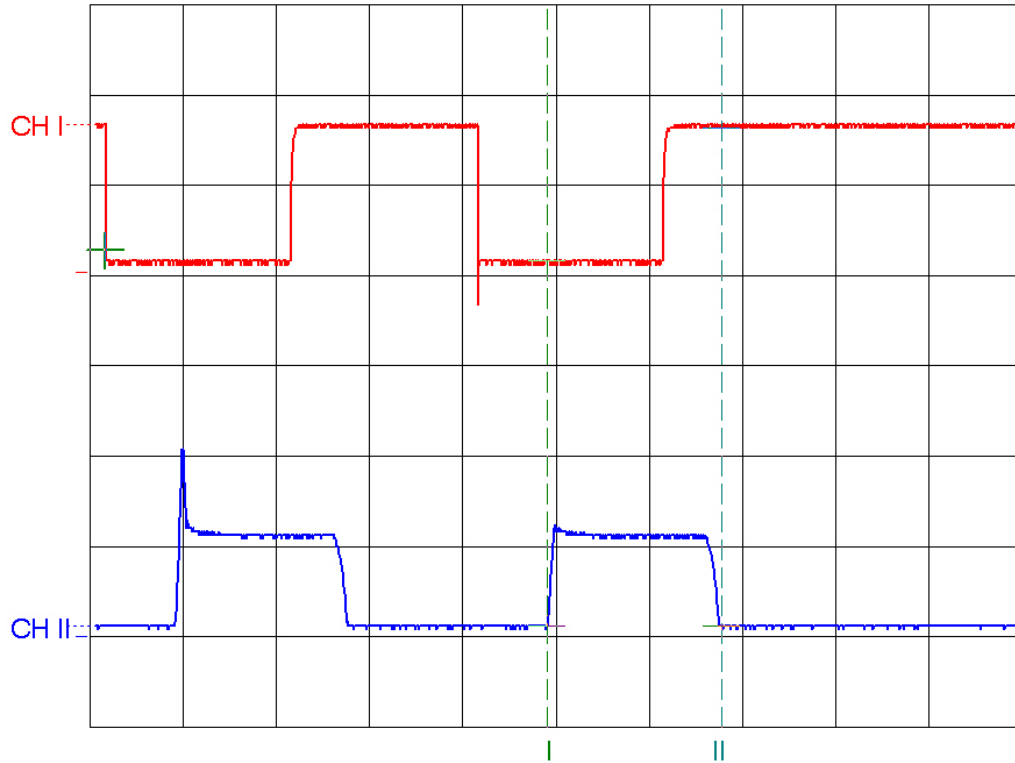


CH I: Cursor I: ,600V Cursor II: ,600V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 14,880 ms 1/dt: 67,204 Hz

850_30_6.wmf

Measure time: 16:11:25
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

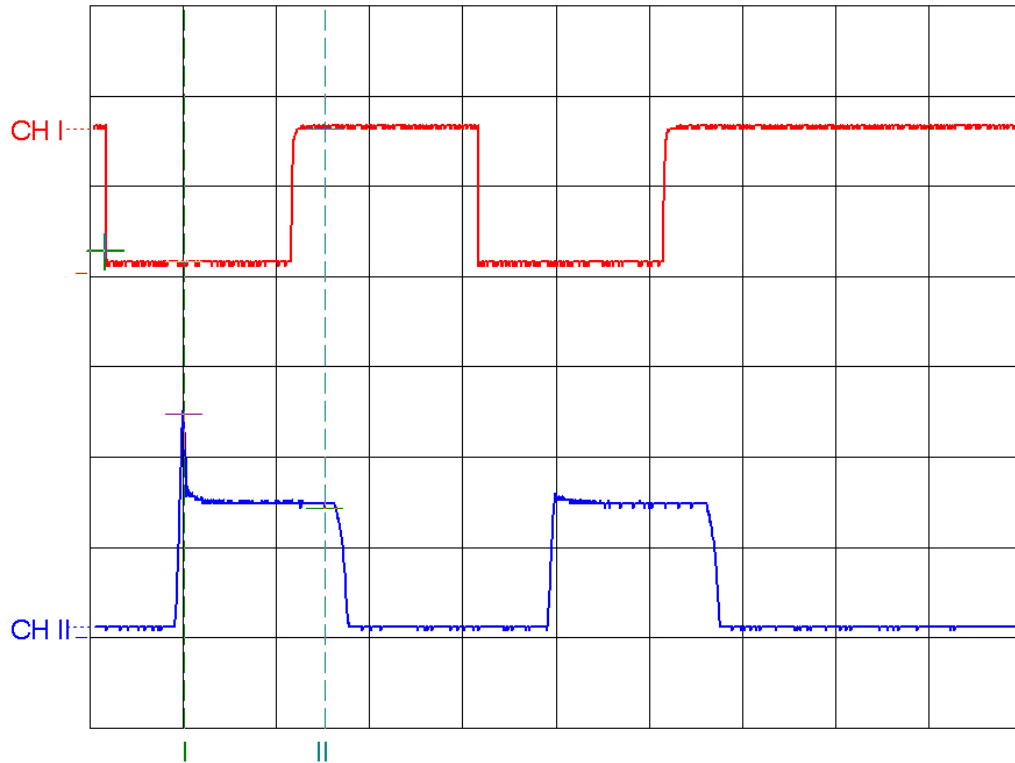


CH I: Cursor I: 600V Cursor II: 8,000V Diff. I-II: -7,4000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,500 ms 1/dt: 26,667 Hz

850_30_7.wmf

Measure time: 16:06:44
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

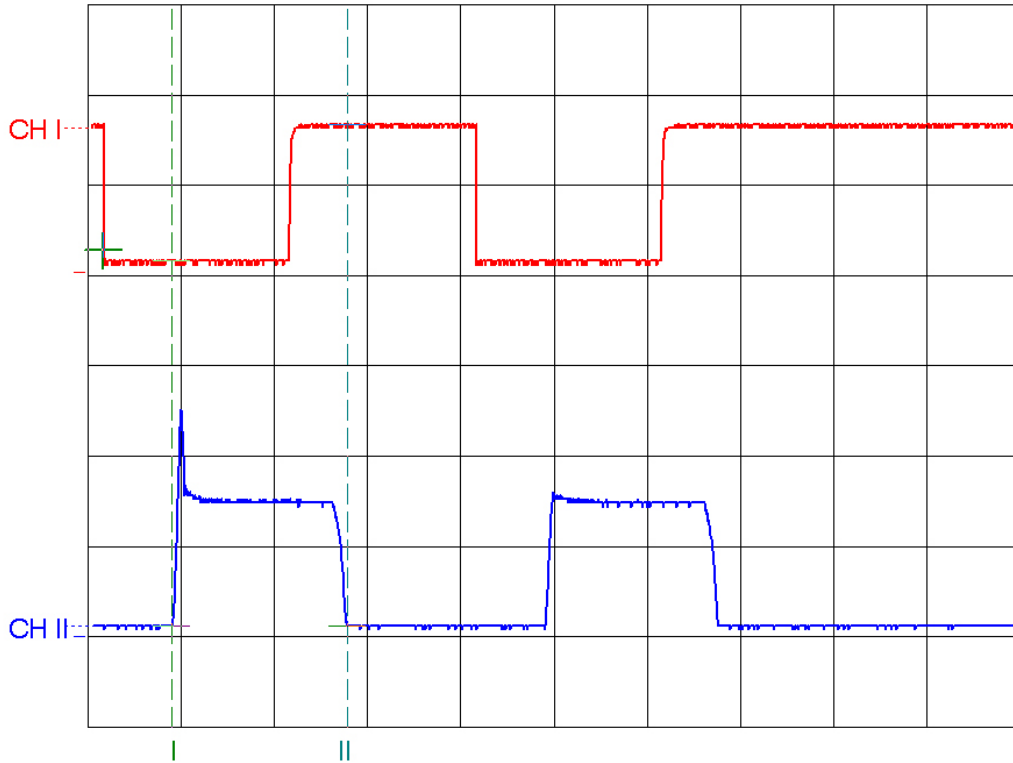


CH I: Cursor I: 600V Cursor II: 8,000V Diff. I-II: -7,4000V
CH II: Cursor I: 2,480V Cursor II: 1,440V Diff. I-II: 1,0400V
dt: 30,300 ms 1/dt: 33,003 Hz

850_50_1.wmf

Measure time: 16:06:44
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

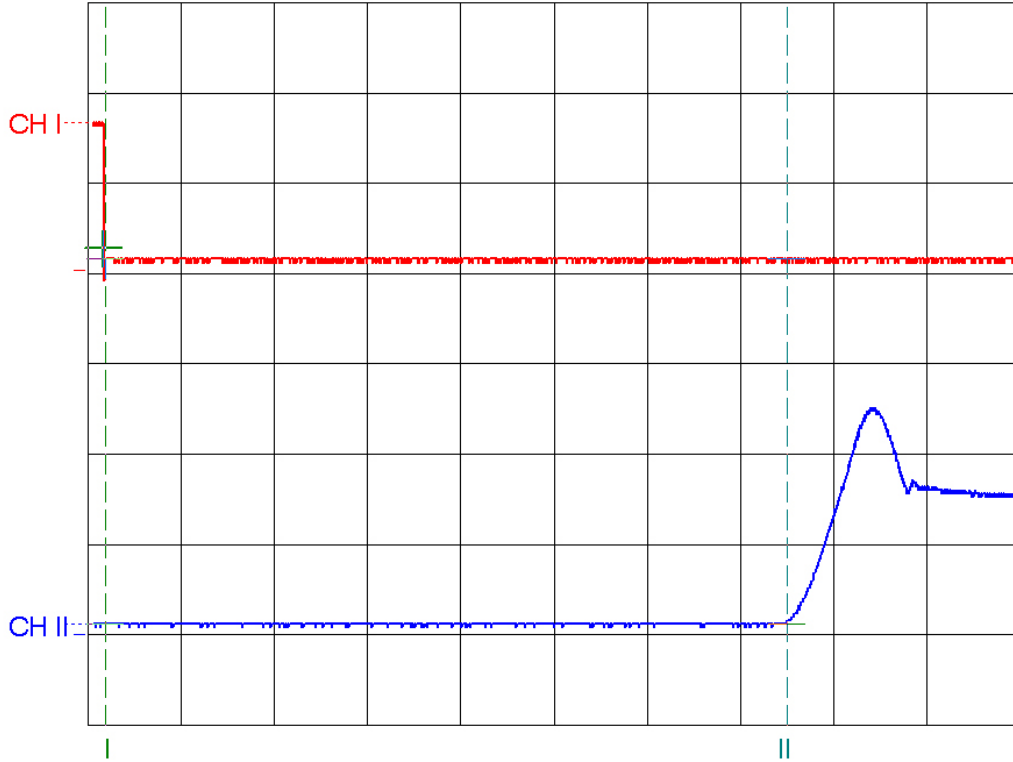


CH I: Cursor I: ,600V Cursor II: 8,200V Diff. I-II: -7,6000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,800 ms 1/dt: 26,455 Hz

850_50_2.wmf

Measure time: 16:09:38
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 2 ms TR: CH1-DC

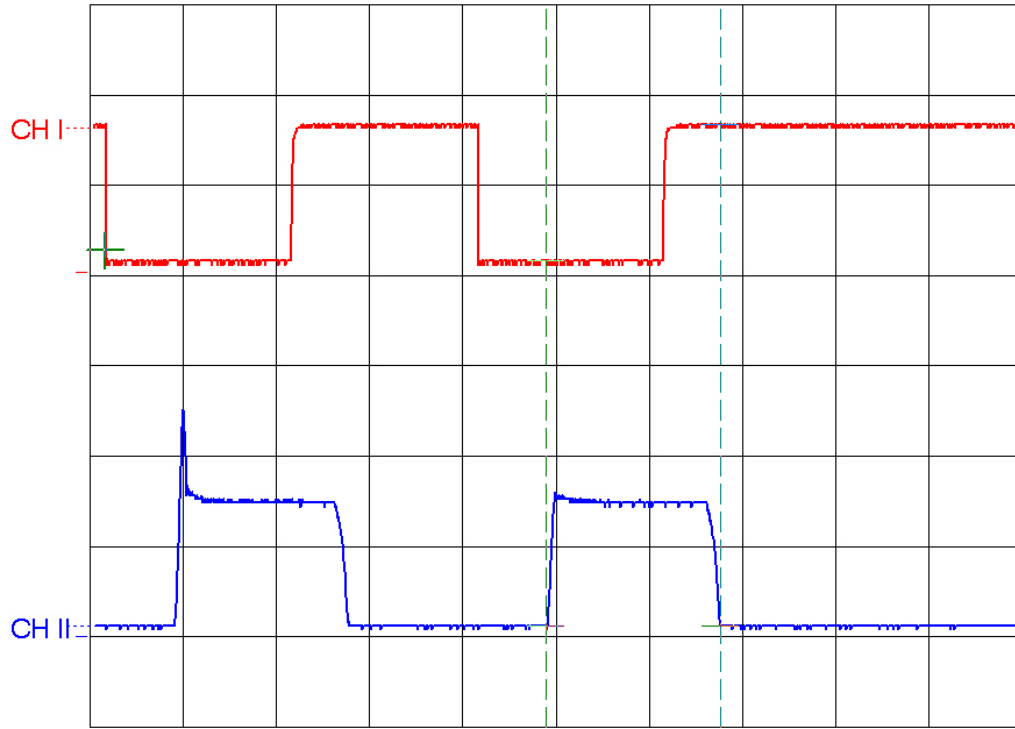


CH I: Cursor I: ,600V Cursor II: ,600V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 14,630 ms 1/dt: 68,353 Hz

850_50_6.wmf

Measure time: 16:06:44
Measure date: 16.12.2009

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

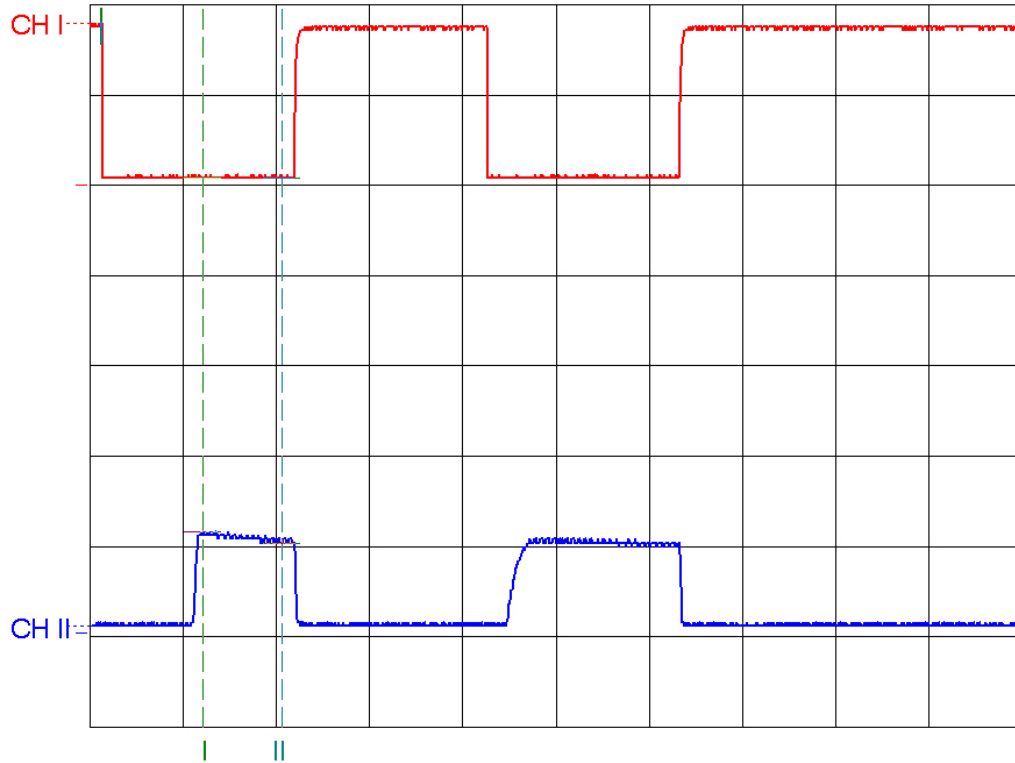


CH I: Cursor I: ,600V Cursor II: 8,200V Diff. I-II: -7,6000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 37,600 ms 1/dt: 26,596 Hz

850_50_7.wmf

Measure time: 16:50:23
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

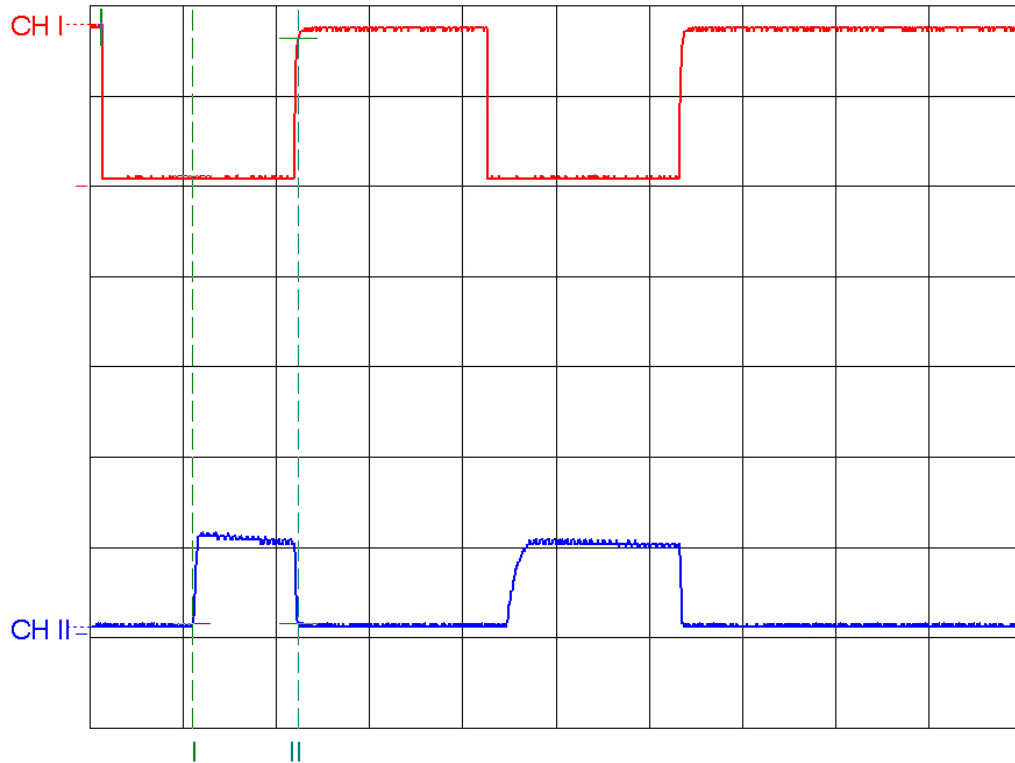


CH I : Cursor I: 400V Cursor II: 400V Diff. I-II: ,0000V
CH II: Cursor I: 1,120V Cursor II: 1,000V Diff. I-II: ,1200V
dt: 16,900 ms 1/dt: 59,172 Hz

840_25_1.wmf

Measure time: 16:50:23
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

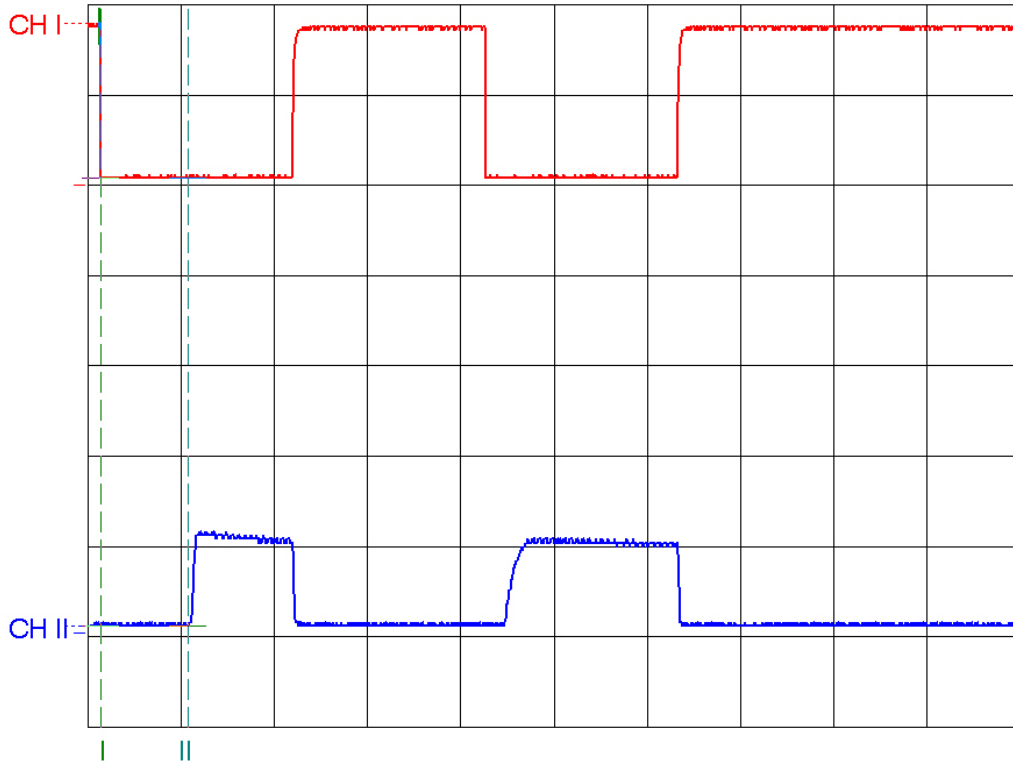


CH I : Cursor I: ,600V Cursor II: 8,200V Diff. I-II: -7,6000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 22,900 ms 1/dt: 43,668 Hz

840_25_2.bmp

Measure time: 16:50:23
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

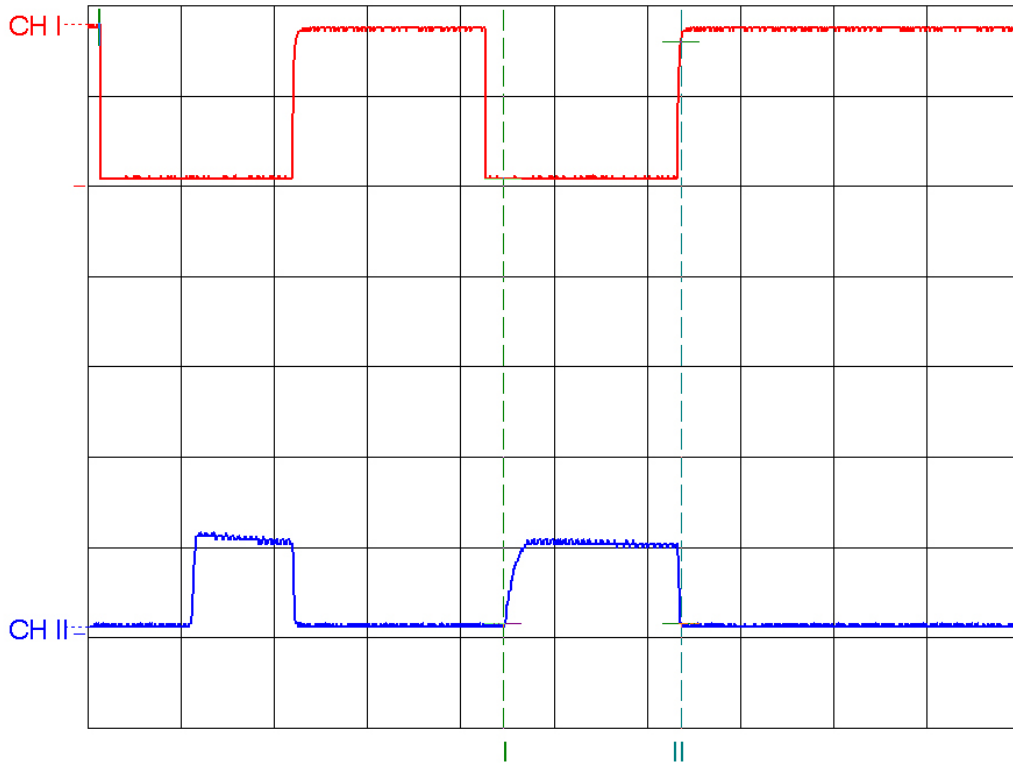


CH I : Cursor I: ,400V Cursor II: ,400V Diff. I-II: ,0000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 18,700 ms 1/dt: 53,476 Hz

840_25_6.wmf

Measure time: 16:50:23
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

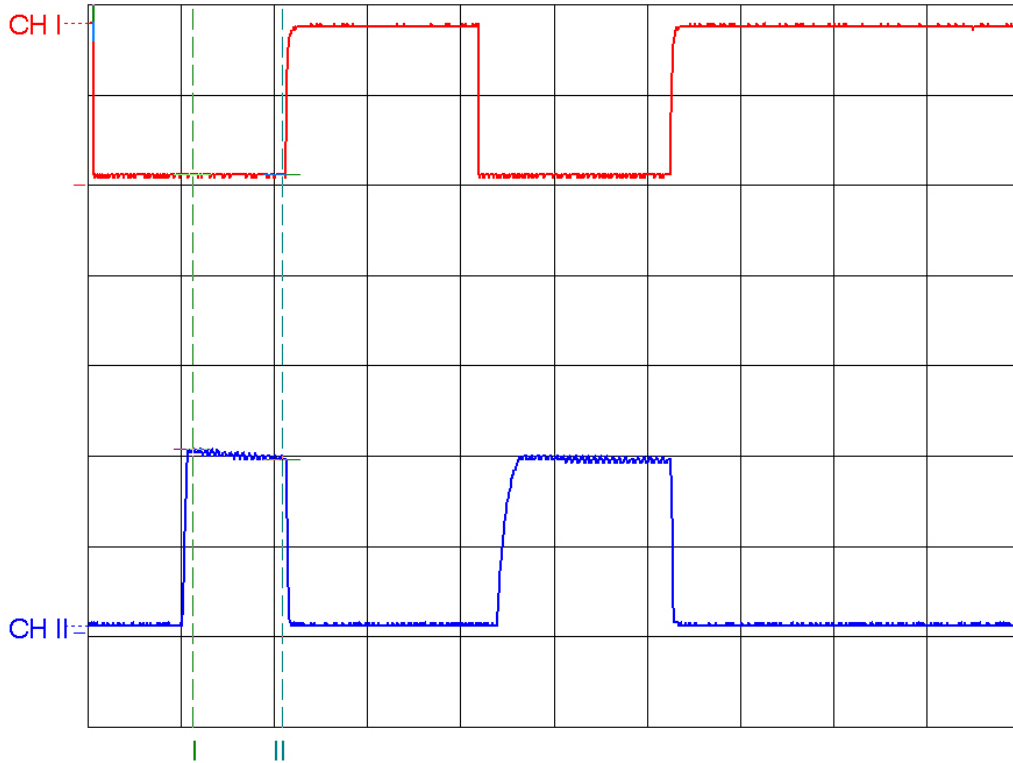


CH I : Cursor I: ,400V Cursor II: 8,000V Diff. I-II: -7,6000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 38,100 ms 1/dt: 26,247 Hz

840_25_7.wmf

Measure time: 16:48:11
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

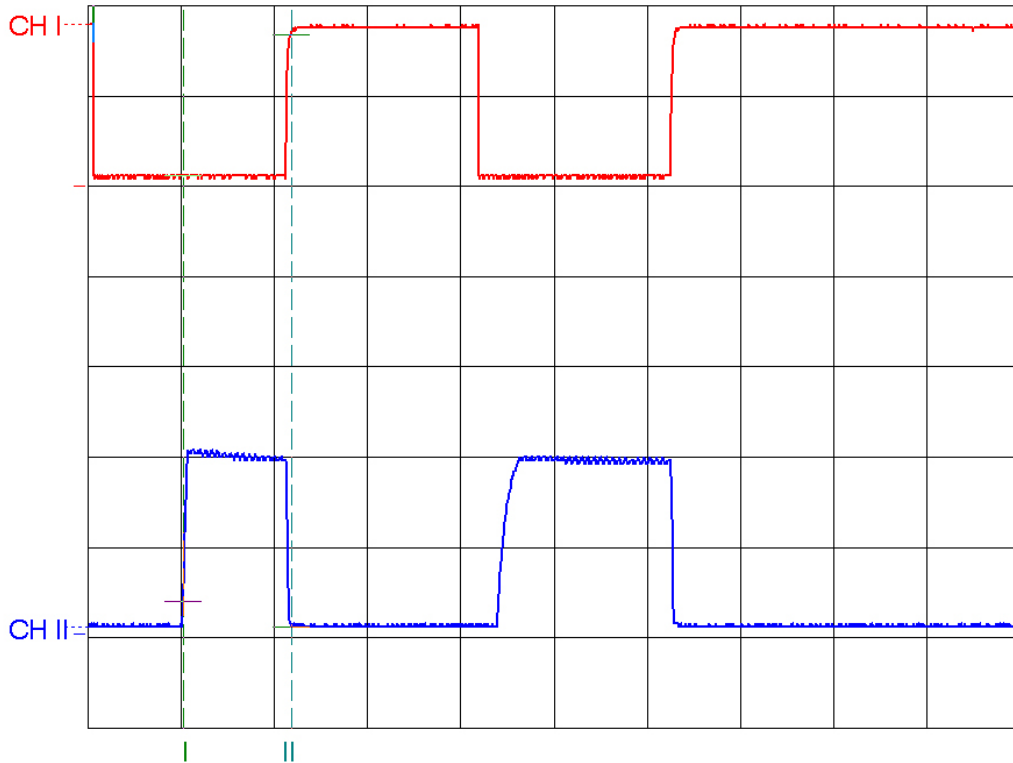


CH I : Cursor I: 600V Cursor II: 600V Diff. I-II: ,0000V
CH II: Cursor I: 2,040V Cursor II: 1,920V Diff. I-II: ,1200V
dt: 19,400 ms 1/dt: 51,546 Hz

840_75_1.wmf

Measure time: 16:48:11
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

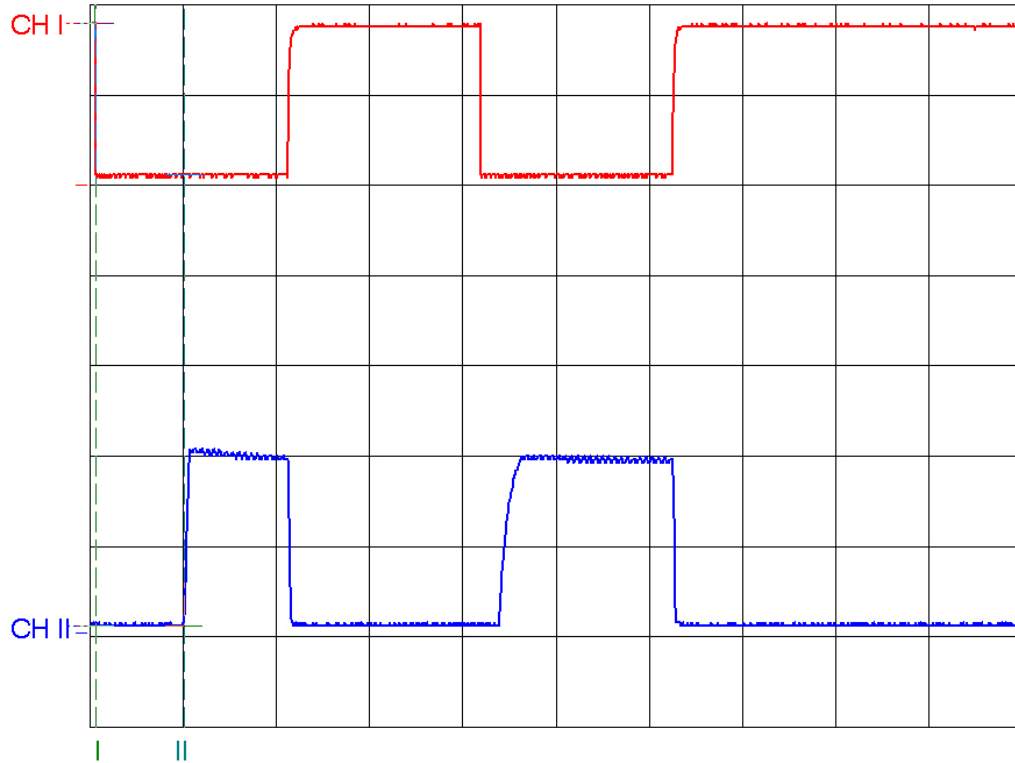


CH I : Cursor I: 600V Cursor II: 8,400V Diff. I-II: -7,8000V
CH II: Cursor I: ,360V Cursor II: ,080V Diff. I-II: ,2800V
dt: 23,200 ms 1/dt: 43,103 Hz

840_75_2.wmf

Measure time: 16:48:11
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

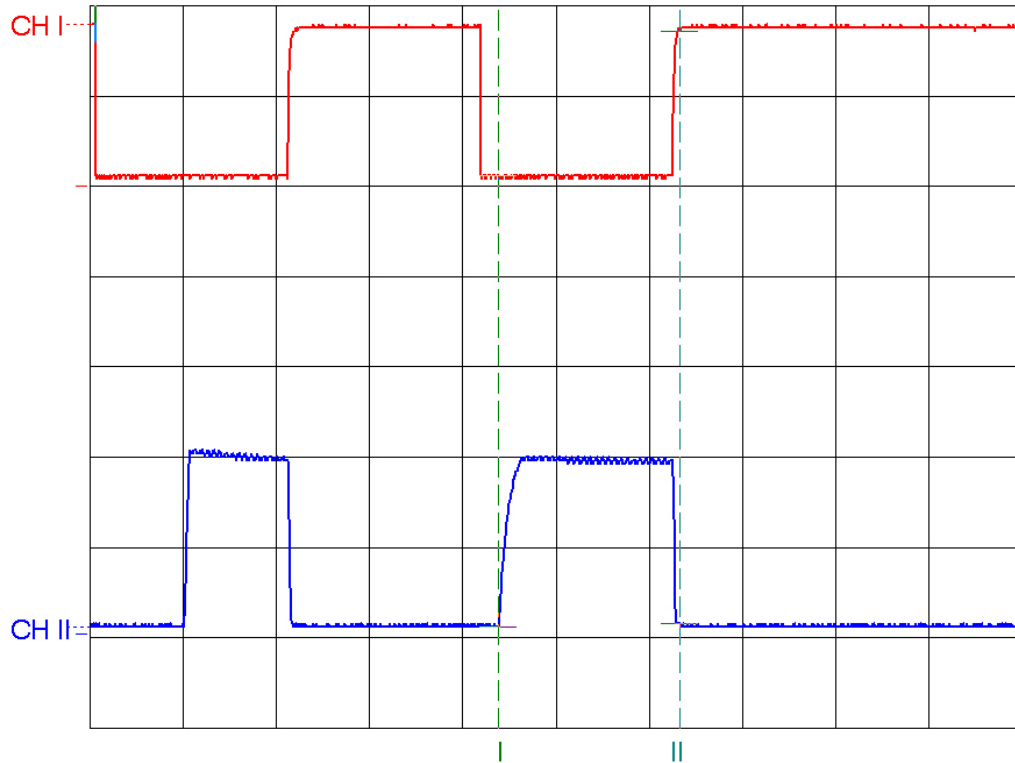


CH I : Cursor I: 9,000V Cursor II: ,600V Diff. I-II: 8,4000V
CH II: Cursor I: ,080V Cursor II: ,080V Diff. I-II: ,0000V
dt: 18,900 ms 1/dt: 52,910 Hz

840_75_6.wmf

Measure time: 16:48:11
Measure date: 23.09.2014

CH1: 5,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

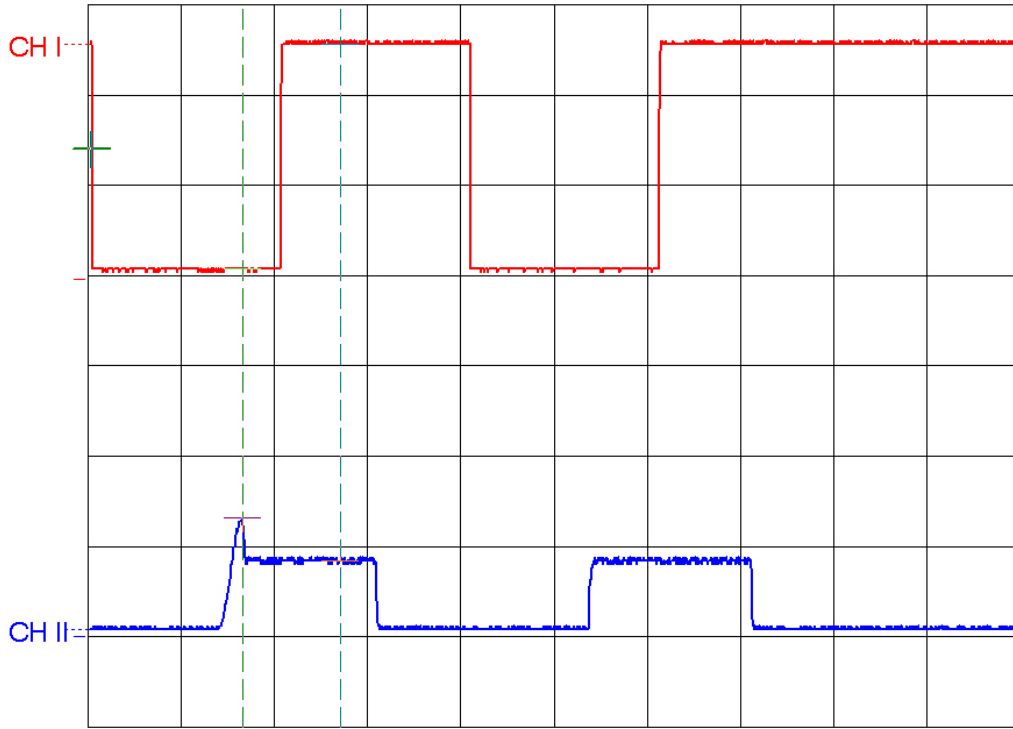


CH I : Cursor I: ,600V Cursor II: 8,600V Diff. I-II: -8,0000V
CH II: Cursor I: ,080V Cursor II: ,120V Diff. I-II: -,0400V
dt: 38,900 ms 1/dt: 25,707 Hz

840_75_7.wmf

Measure time: 15:57:46
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

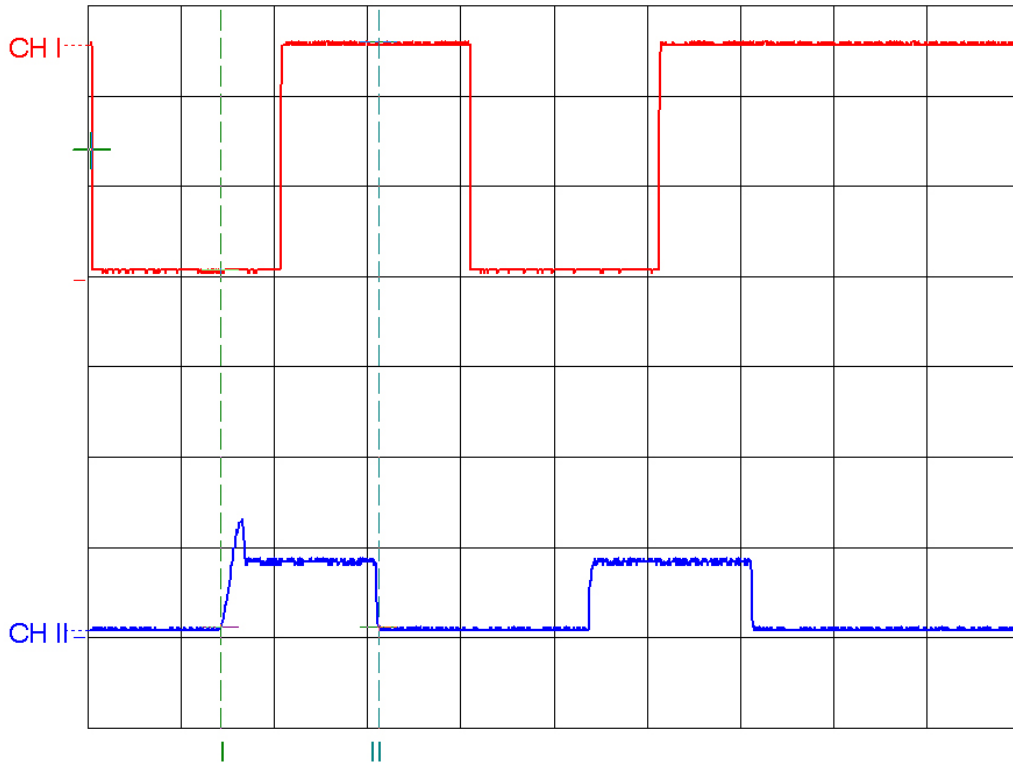


CH I : Cursor I: ,240V Cursor II: 5,200V Diff. I-II: -4,9600V
CH II: Cursor I: 1,320V Cursor II: ,840V Diff. I-II: ,4800V
dt: 21,000 ms 1/dt: 47,619 Hz

897_25_1.wmf

Measure time: 15:57:46
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

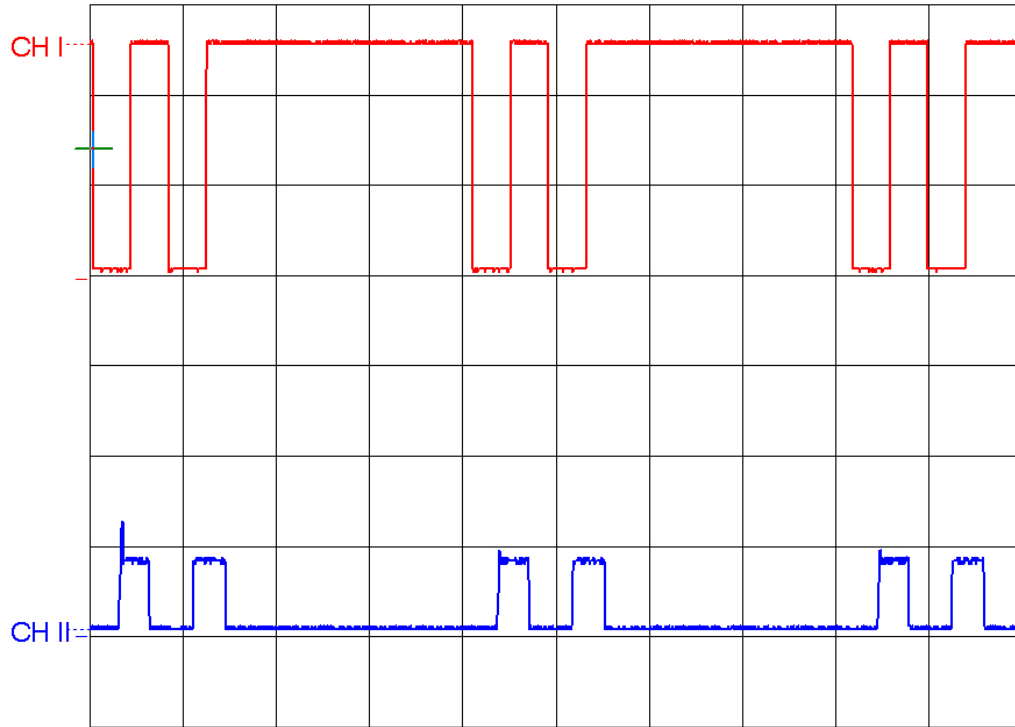


CH I : Cursor I: ,240V Cursor II: 5,280V Diff. I-II: -5,0400V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 34,000 ms 1/dt: 29,412 Hz

897_25_2.wmf

Measure time: 16:02:16
Measure date: 30.11.2014

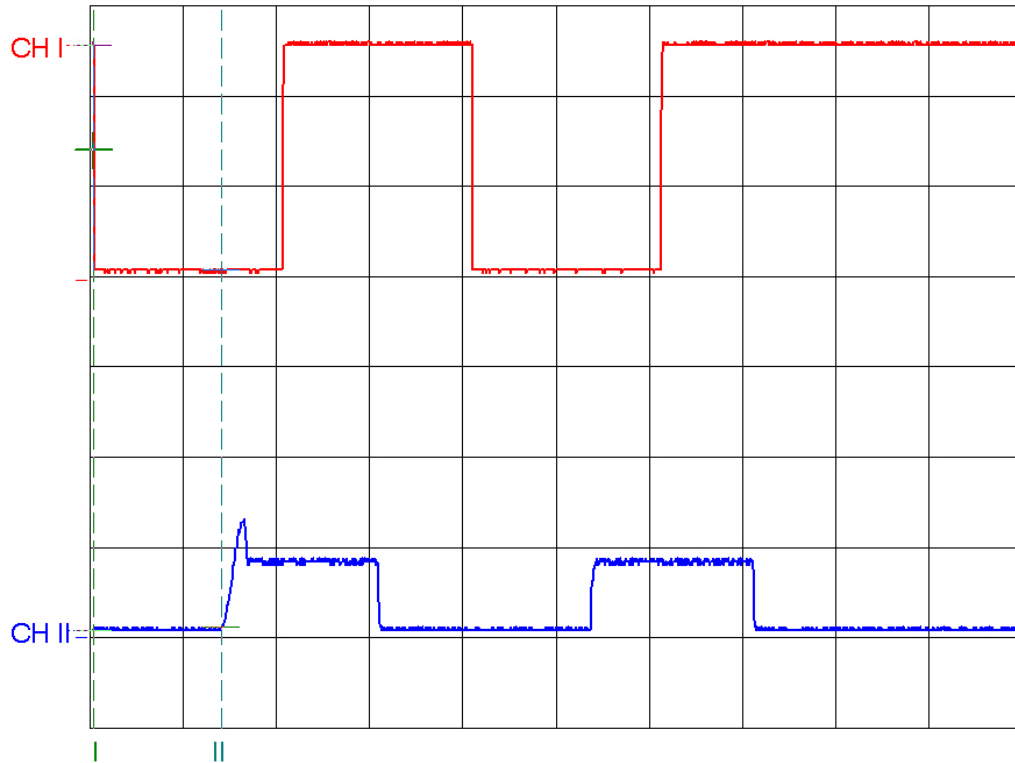
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



897_25_3.wmf

Measure time: 15:57:46
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

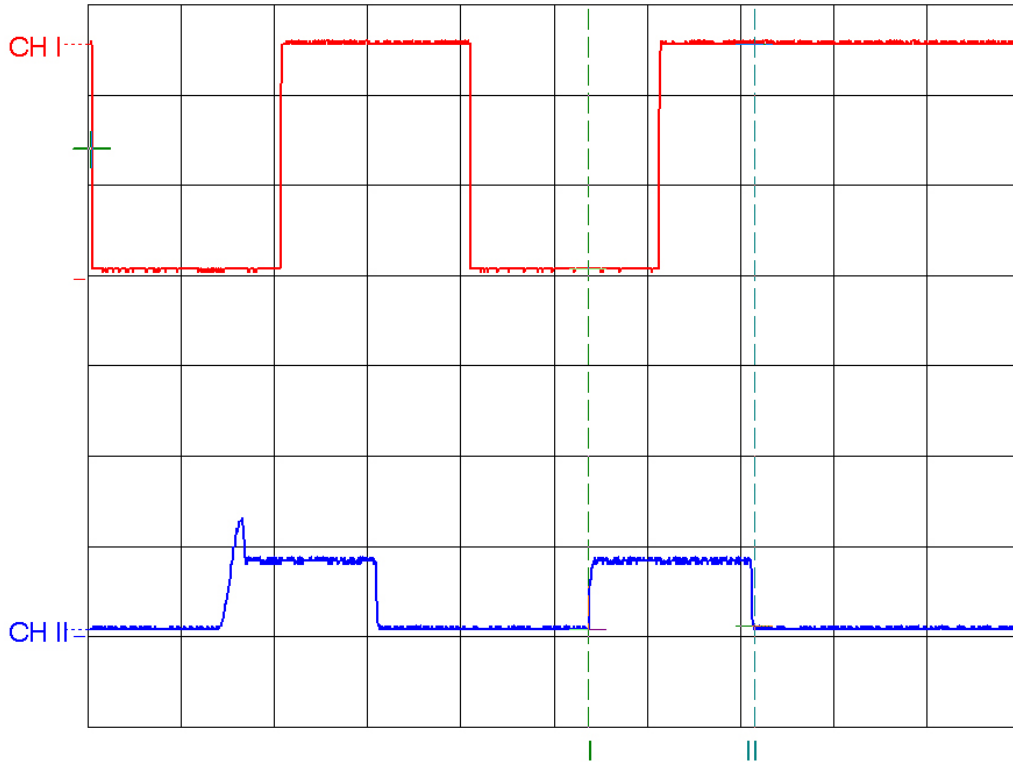


CH I: Cursor I: 5,200V Cursor II: ,240V Diff. I-II: 4,9600V
CH II: Cursor I: ,080V Cursor II: ,120V Diff. I-II: -,0400V
dt: 27,300 ms 1/dt: 36,630 Hz

897_25_6.wmf

Measure time: 15:57:46
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

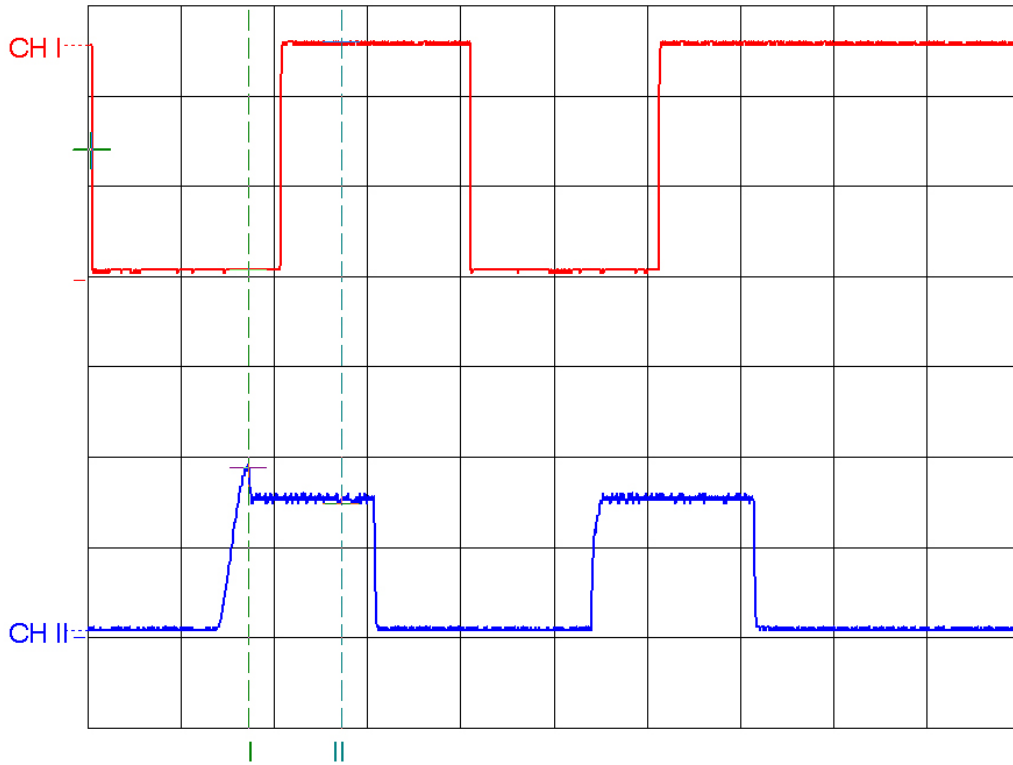


CH I: Cursor I: ,240V Cursor II: 5,200V Diff. I-II: -4,9600V
CH II: Cursor I: ,080V Cursor II: ,120V Diff. I-II: -,0400V
dt: 35,700 ms 1/dt: 28,011 Hz

897_25_7.wmf

Measure time: 16:03:49
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

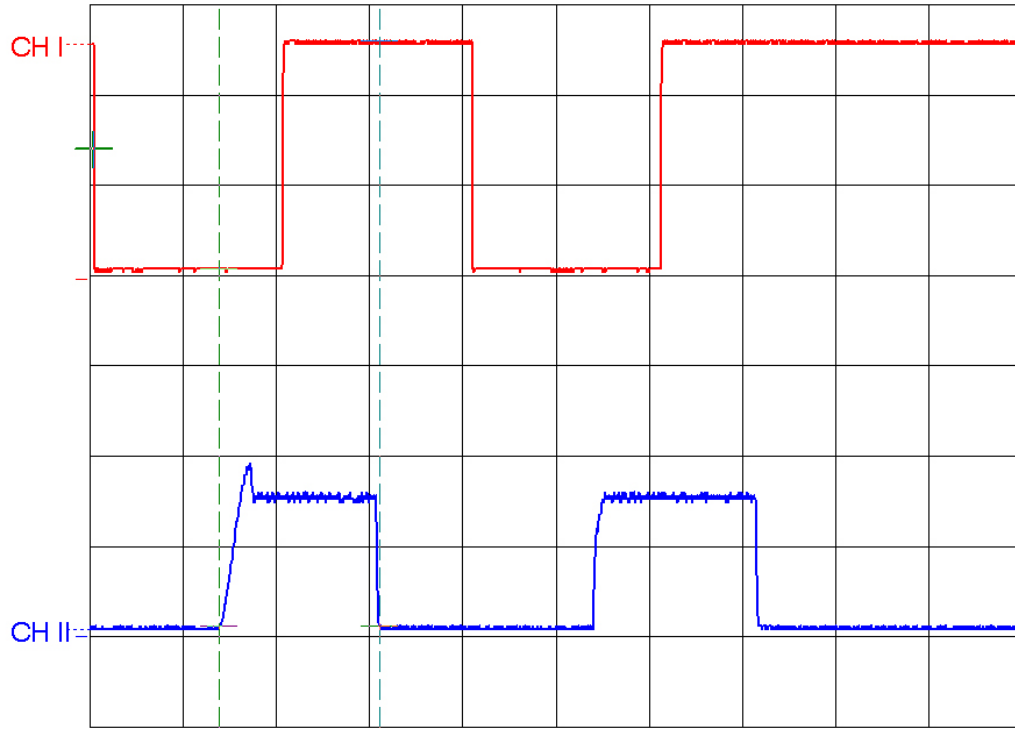


CH I: Cursor I: ,240V Cursor II: 5,280V Diff. I-II: -5,0400V
CH II: Cursor I: 1,880V Cursor II: 1,480V Diff. I-II: ,4000V
dt: 19,800 ms 1/dt: 50,505 Hz

897_50_1.wmf

Measure time: 16:03:49
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

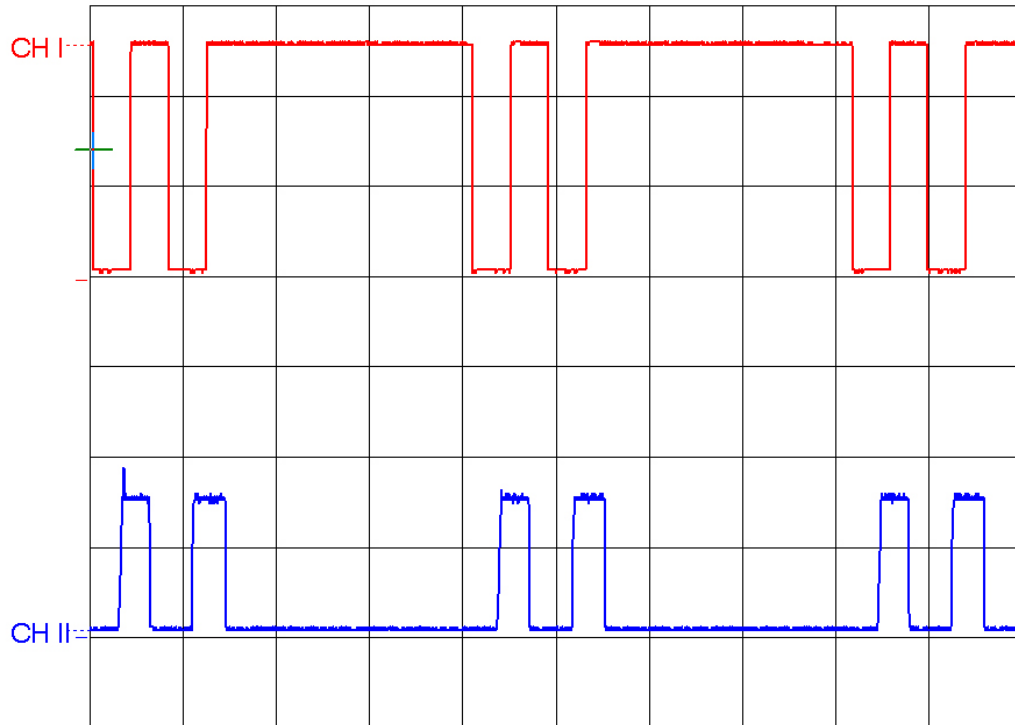


CH I : Cursor I: ,240V Cursor II: 5,280V Diff. I-II: -5,0400V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 34,400 ms 1/dt: 29,070 Hz

897_50_2.wmf

Measure time: 16:05:27
Measure date: 30.11.2014

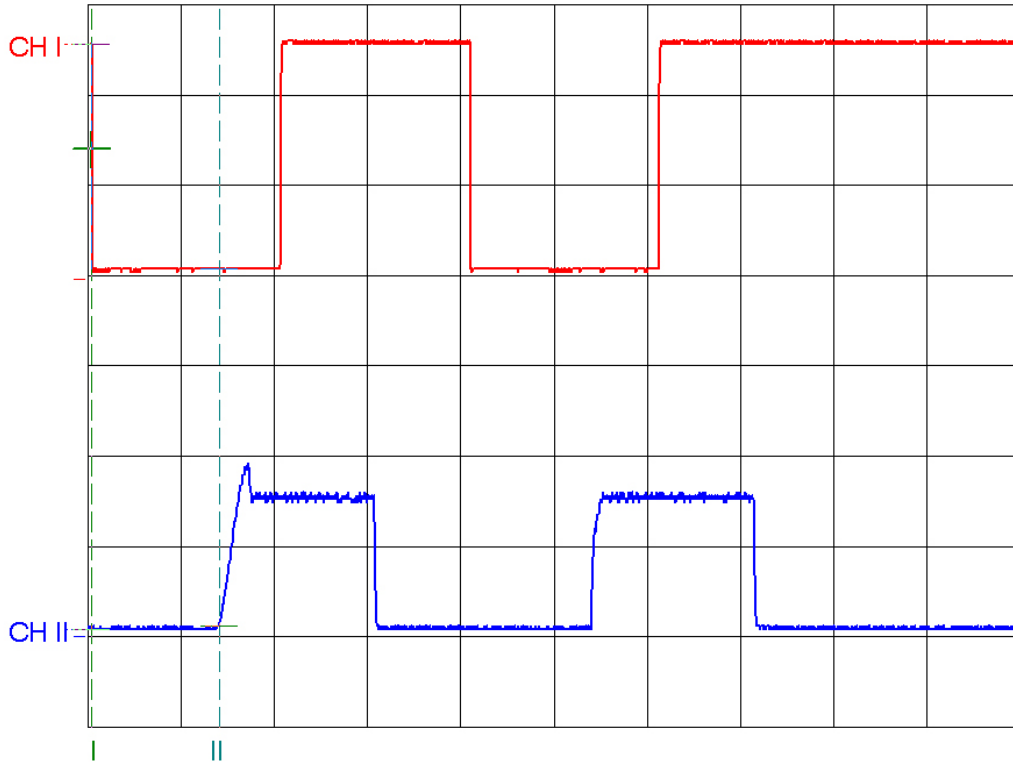
CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 100 ms TR: CH1-DC



897_50_3.wmf

Measure time: 16:03:49
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

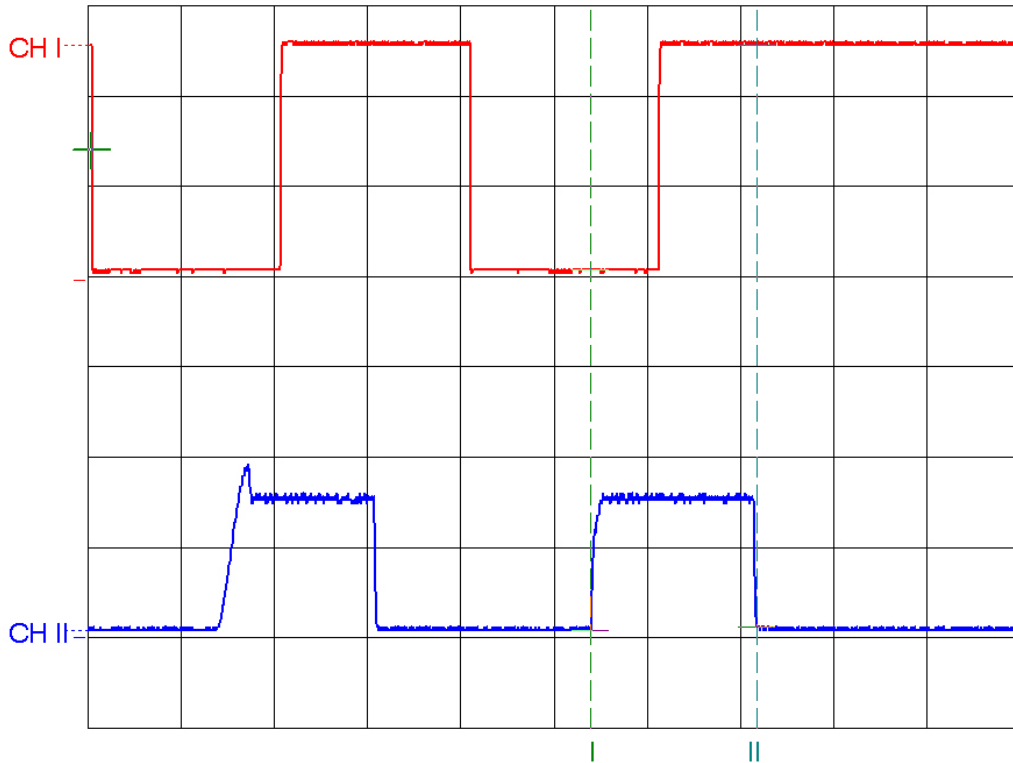


CH I : Cursor I: 5,200V Cursor II: ,240V Diff. I-II: 4,9600V
CH II: Cursor I: ,080V Cursor II: ,120V Diff. I-II: -,0400V
dt: 27,300 ms 1/dt: 36,630 Hz

897_50_6.wmf

Measure time: 16:03:49
Measure date: 30.11.2014

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

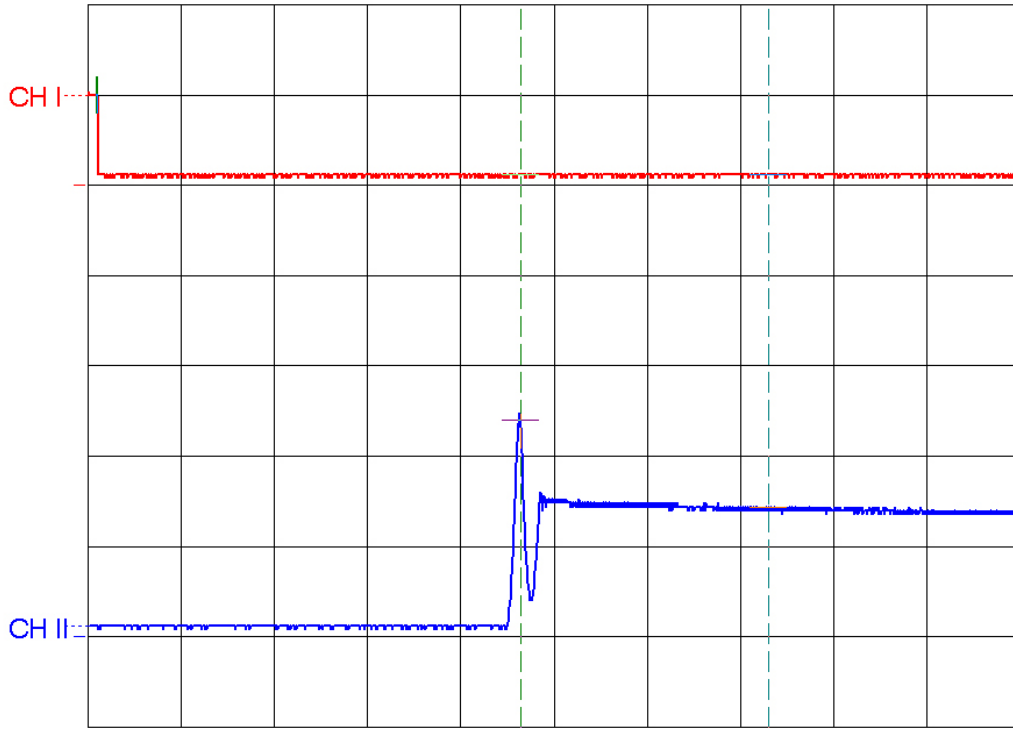


CH I : Cursor I: ,240V Cursor II: 5,200V Diff. I-II: -4,9600V
CH II: Cursor I: ,080V Cursor II: ,120V Diff. I-II: -,0400V
dt: 35,700 ms 1/dt: 28,011 Hz

897_50_7.wmf

Measure time: 11:44:10
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: ,500V/DIV DC TB A: 2 ms TR: CH1-DC

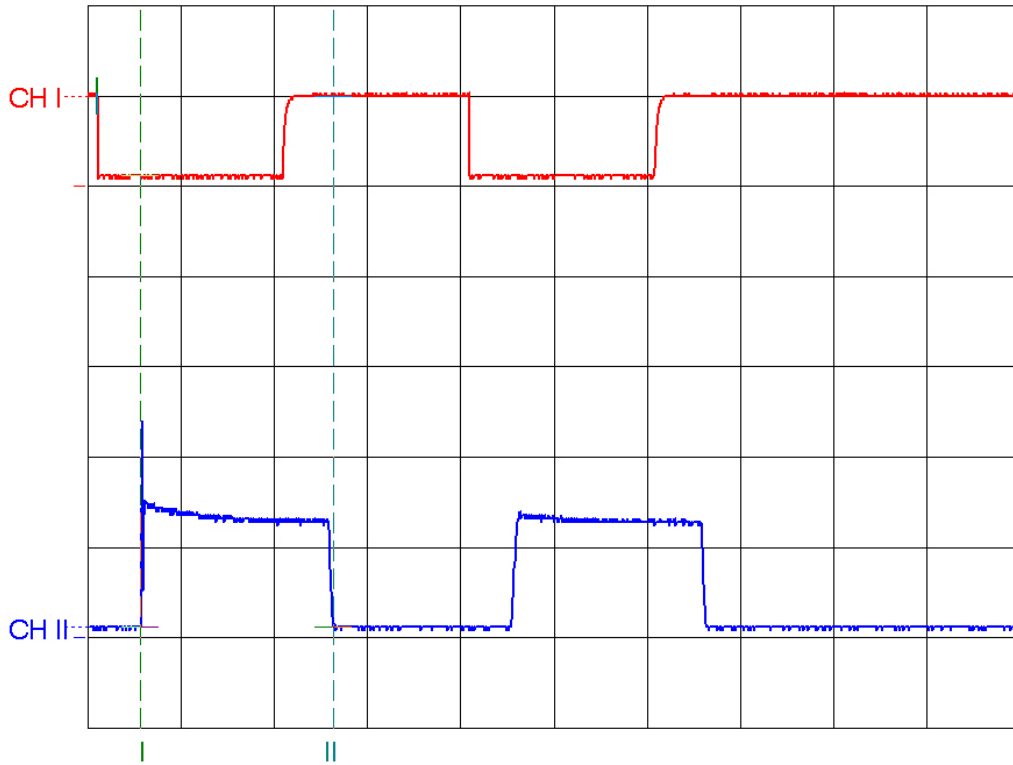


CH I : Cursor I: ,600V Cursor II: ,600V Diff. I-II: ,0000V
CH II: Cursor I: 1,200V Cursor II: ,720V Diff. I-II: ,4800V
dt: 5,320 ms 1/dt: 187,970 Hz

1000_20_1.wmf

Measure time: 11:41:22
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: ,500V/DIV DC TB A: 20 ms TR: CH1-DC

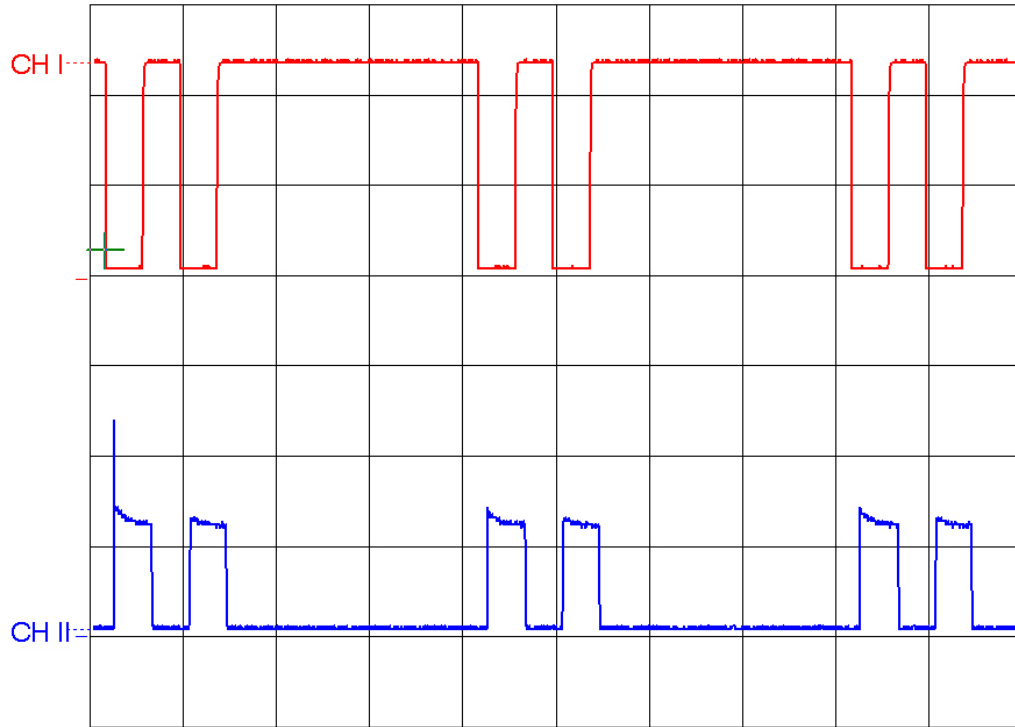


CH I : Cursor I: ,600V Cursor II: 5,000V Diff. I-II: -4,4000V
CH II: Cursor I: ,060V Cursor II: ,060V Diff. I-II: ,0000V
dt: 41,400 ms 1/dt: 24,155 Hz

1000_20_2.wmf

Measure time: 16:35:59
Measure date: 16.12.2009

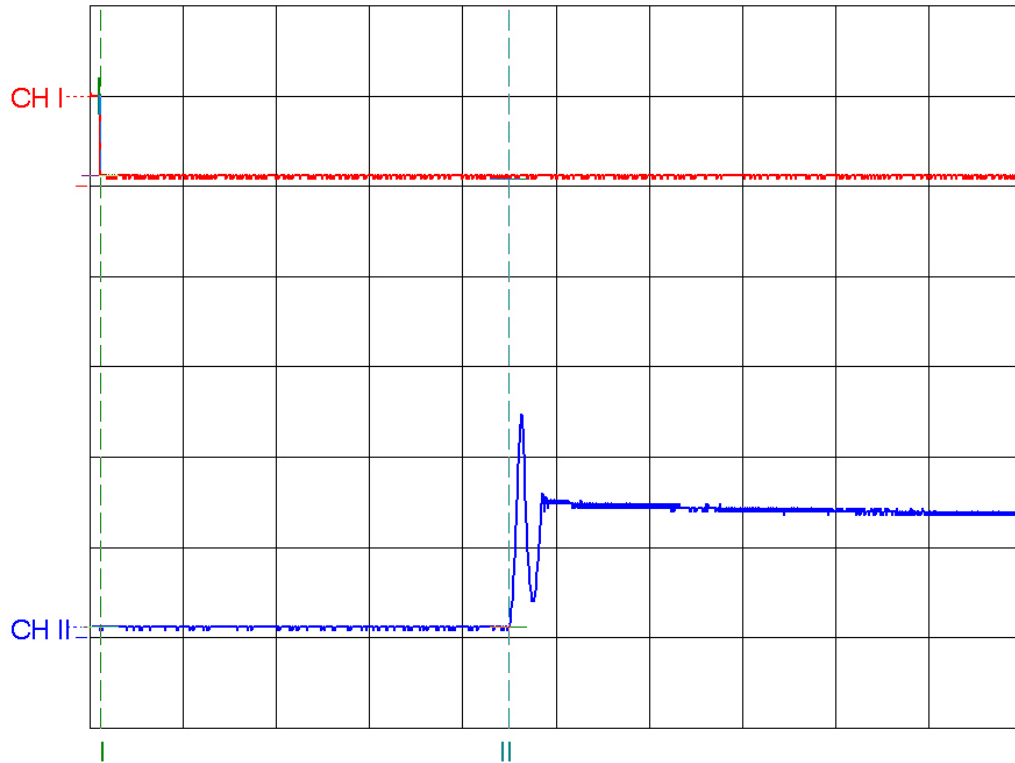
CH1: 2,000V/DIV DC CH2: ,500V/DIV DC TB A: 100 ms TR: CH1-DC



1000_20_3.wmf

Measure time: 11:44:10
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: ,500V/DIV DC TB A: 2 ms TR: CH1-DC

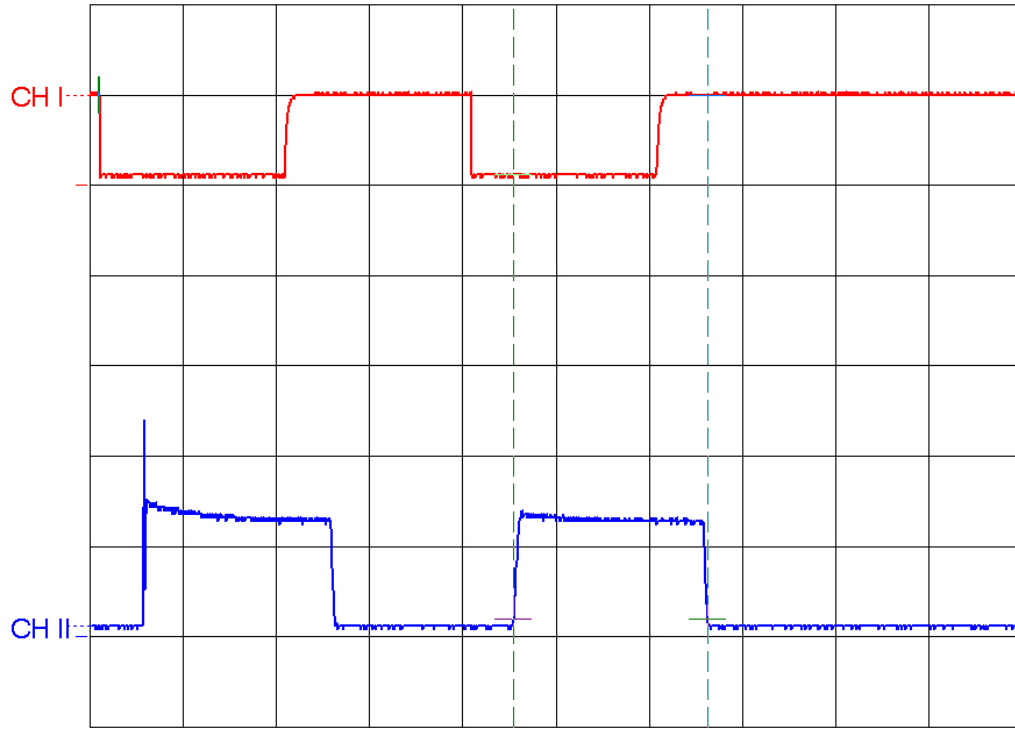


CH I: Cursor I: ,600V Cursor II: ,400V Diff. I-II: ,2000V
CH II: Cursor I: ,060V Cursor II: ,060V Diff. I-II: ,0000V
dt: 8,780 ms 1/dt: 113,895 Hz

1000_20_6.wmf

Measure time: 11:41:22
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: ,500V/DIV DC TB A: 20 ms TR: CH1-DC

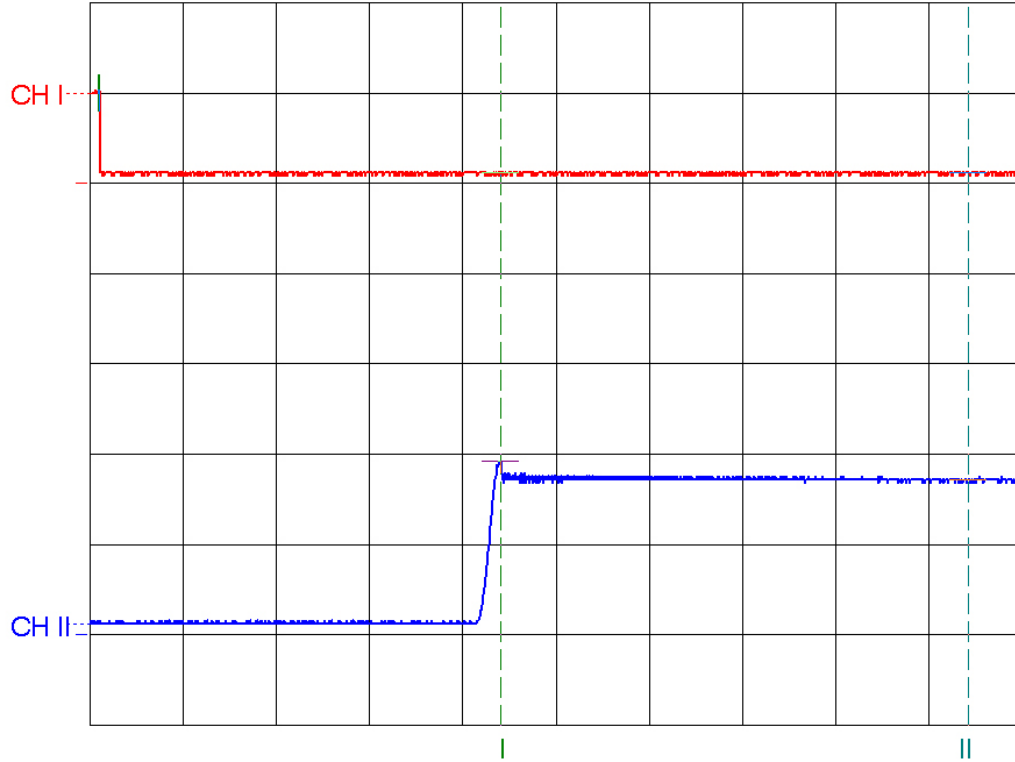


CH I: Cursor I: ,600V Cursor II: 5,000V Diff. I-II: -4,4000V
CH II: Cursor I: ,100V Cursor II: ,100V Diff. I-II: ,0000V
dt: 41,600 ms 1/dt: 24,038 Hz

1000_20_7.wmf

Measure time: 11:47:57
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 2 ms TR: CH1-DC

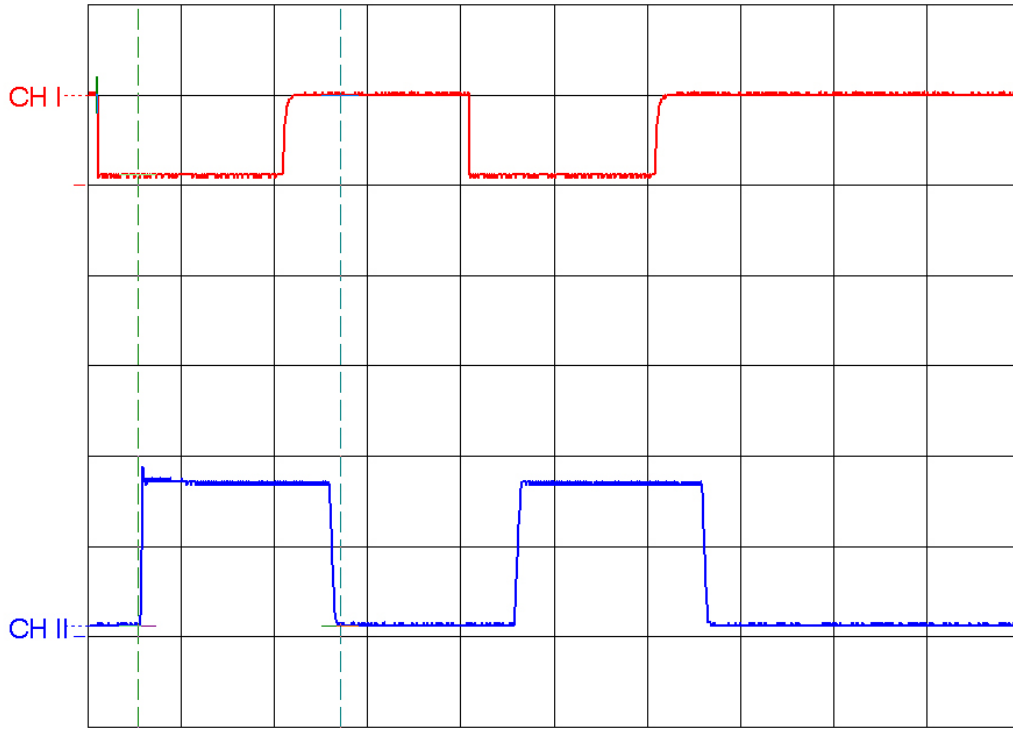


CH I: Cursor I: ,600V Cursor II: ,600V Diff. I-II: ,0000V
CH II: Cursor I: 3,840V Cursor II: 3,440V Diff. I-II: ,4000V
dt: 10,040 ms 1/dt: 99,602 Hz

1000_200_1.wmf

Measure time: 11:46:17
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

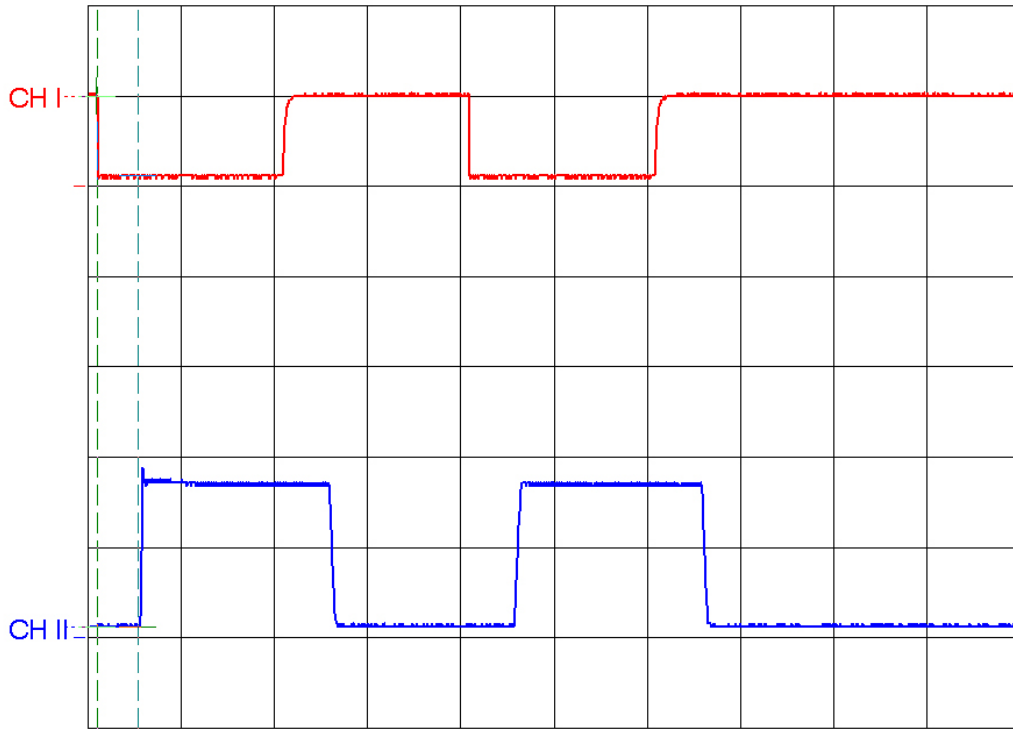


CH I : Cursor I: 600V Cursor II: 5,000V Diff. I-II: -4,4000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 43,400 ms 1/dt: 23,041 Hz

1000_200_2.wmf

Measure time: 11:46:17
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

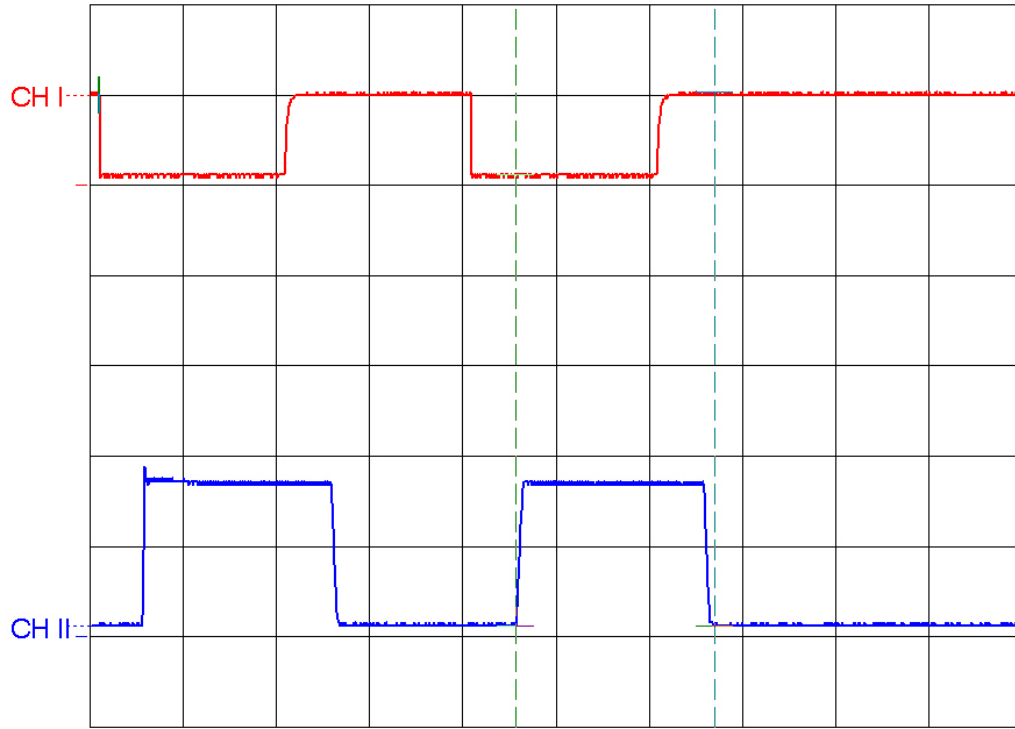


CH I : Cursor I: 5,000V Cursor II: ,600V Diff. I-II: 4,4000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 8,800 ms 1/dt: 113,636 Hz

1000_200_6.wmf

Measure time: 11:46:17
Measure date: 16.11.2009

CH1: 5,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

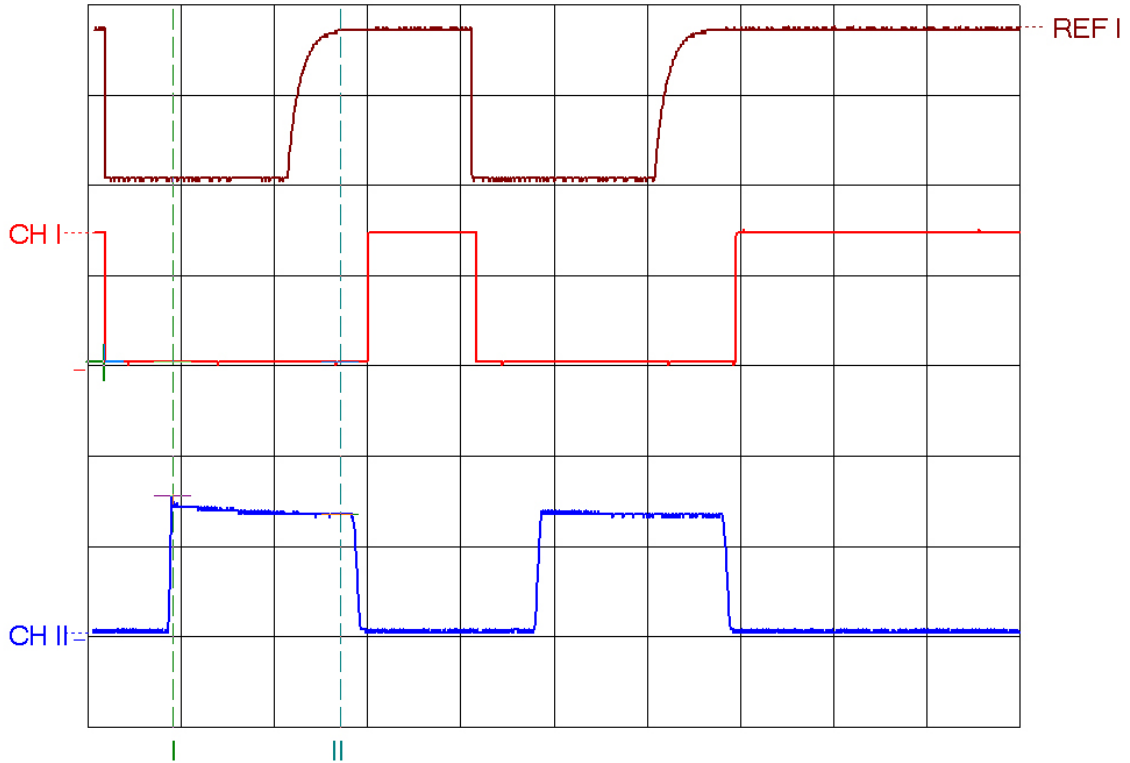


CH I: Cursor I: 600V Cursor II: 5,200V Diff. I-II: -4,6000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 42,600 ms 1/dt: 23,474 Hz

1000_200_7.wmf

Measure time: 13:39:20
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

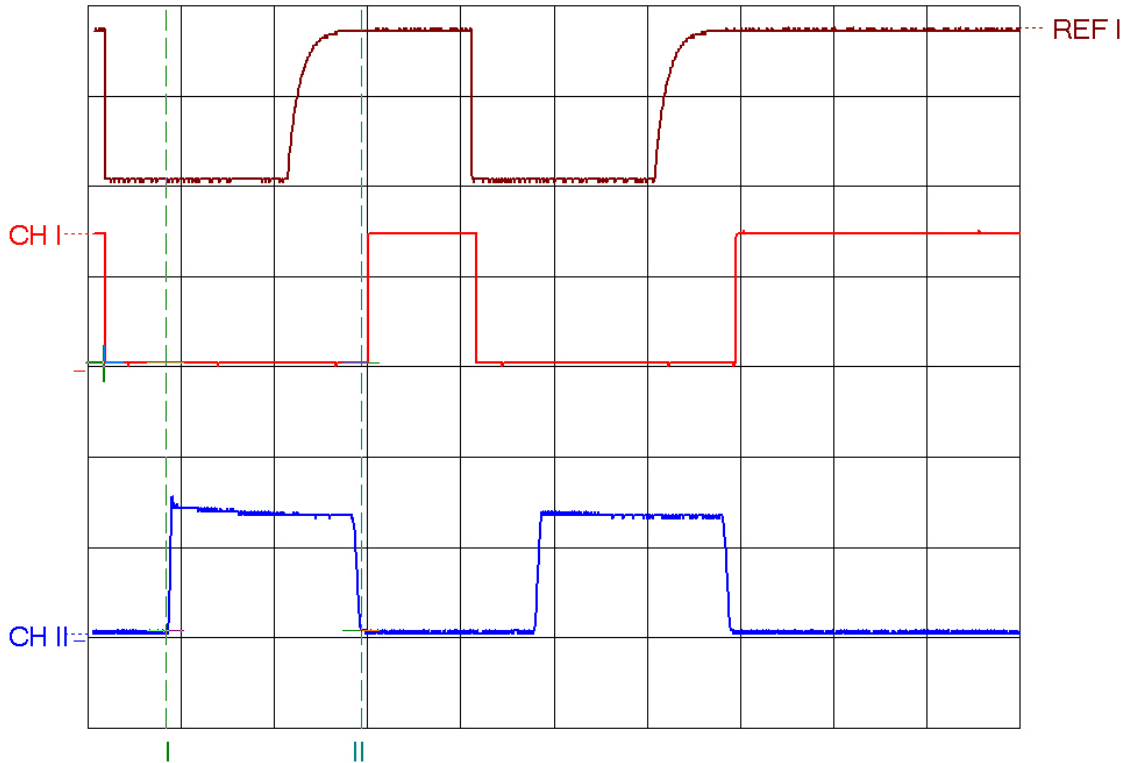


CH I : Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
CH II: Cursor I: 1,600V Cursor II: 1,400V Diff. I-II: ,2000V
dt: 36,100 ms 1/dt: 27,701 Hz

9000_50_1.wmf

Measure time: 13:39:20
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

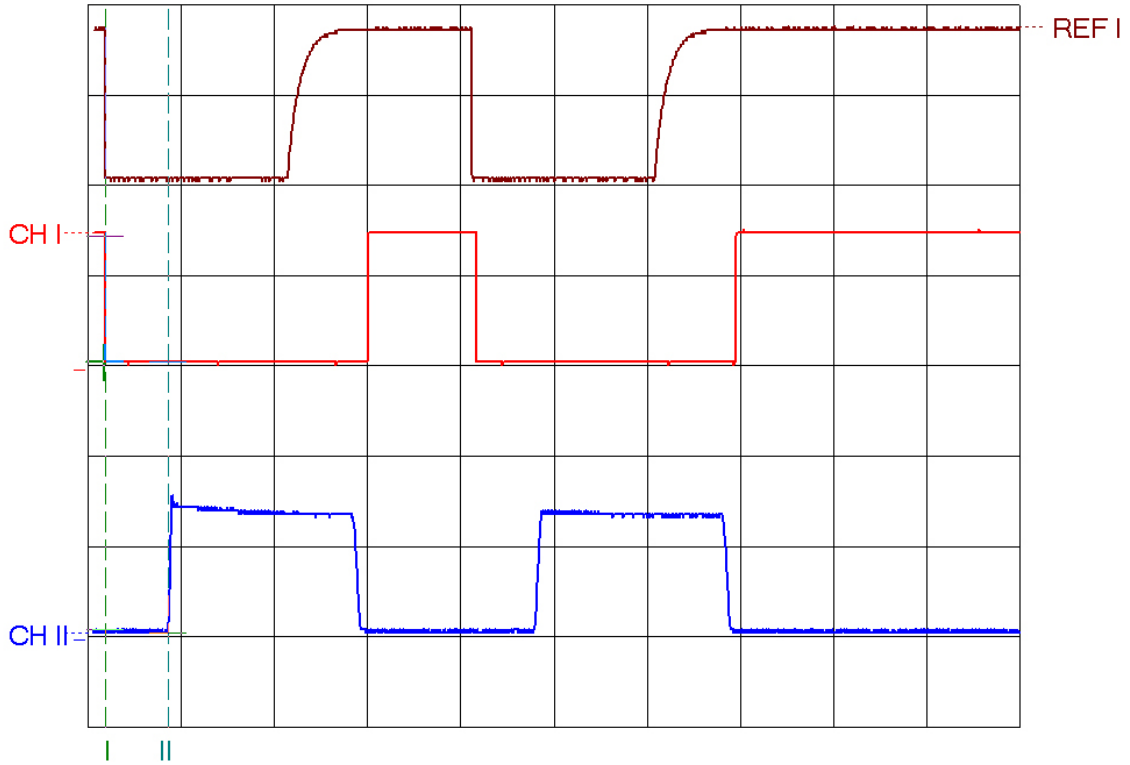


CH I : Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 41,900 ms 1/dt: 23,866 Hz

9000_50_2.wmf

Measure time: 13:39:20
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

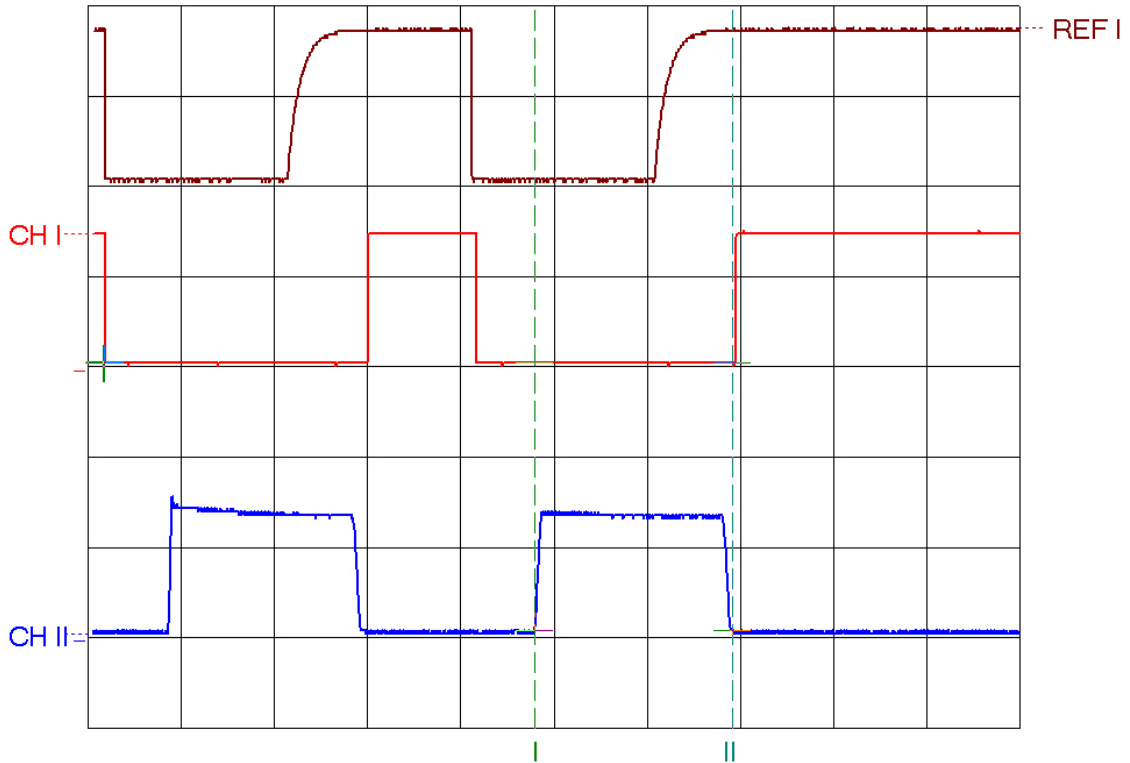


CH I : Cursor I: 2,960V Cursor II: ,160V Diff. I-II: 2,8000V
CH II: Cursor I: ,120V Cursor II: ,080V Diff. I-II: ,0400V
dt: 13,400 ms 1/dt: 74,627 Hz

9000_50_6.wmf

Measure time: 13:39:20
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 1,000V/DIV DC TB A: 20 ms TR: CH1-DC

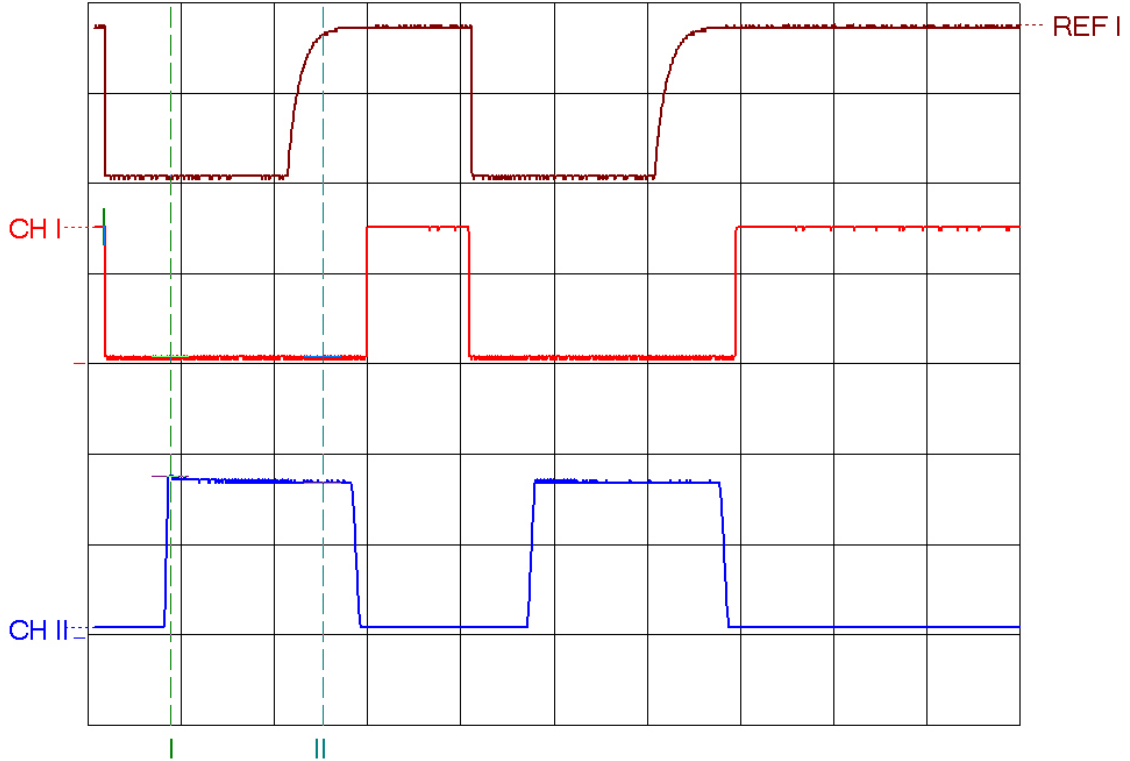


CH I : Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
CH II: Cursor I: ,120V Cursor II: ,120V Diff. I-II: ,0000V
dt: 42,600 ms 1/dt: 23,474 Hz

9000_50_7.wmf

Measure time: 13:12:21
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

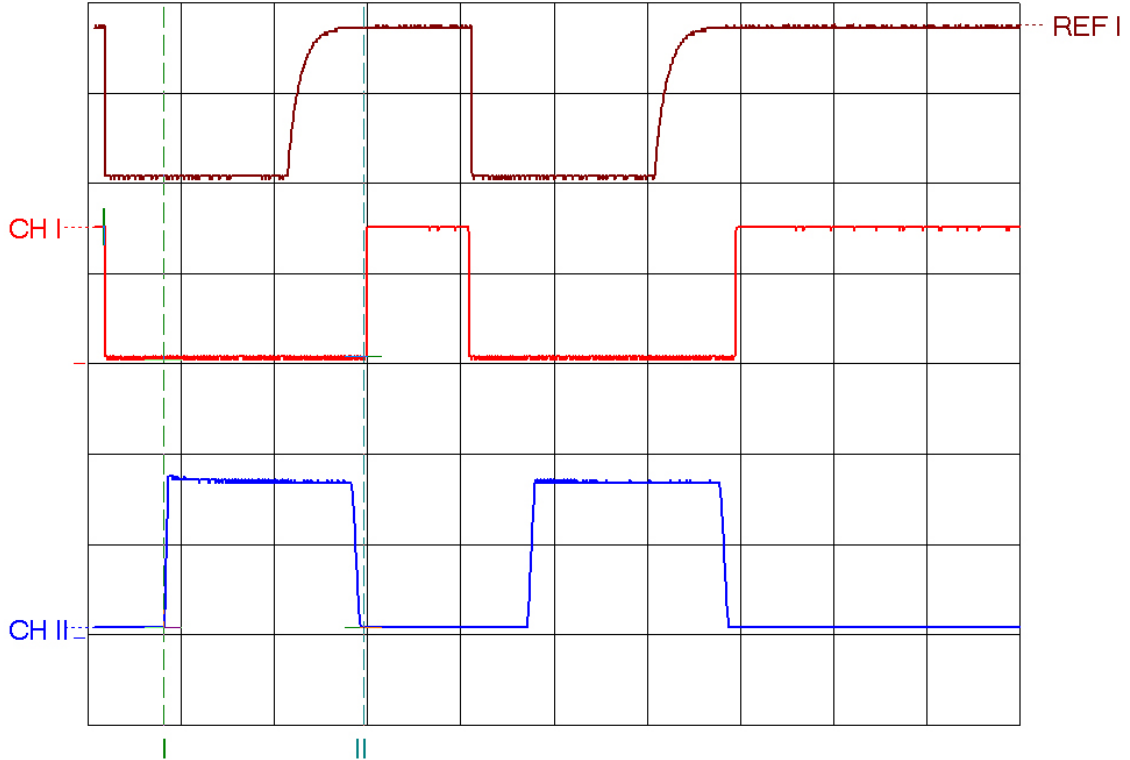


CH I : Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
CH II: Cursor I: 3,600V Cursor II: 3,440V Diff. I-II: ,1600V
dt: 32,800 ms 1/dt: 30,488 Hz

9000_200_1.wmf

Measure time: 13:12:21
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

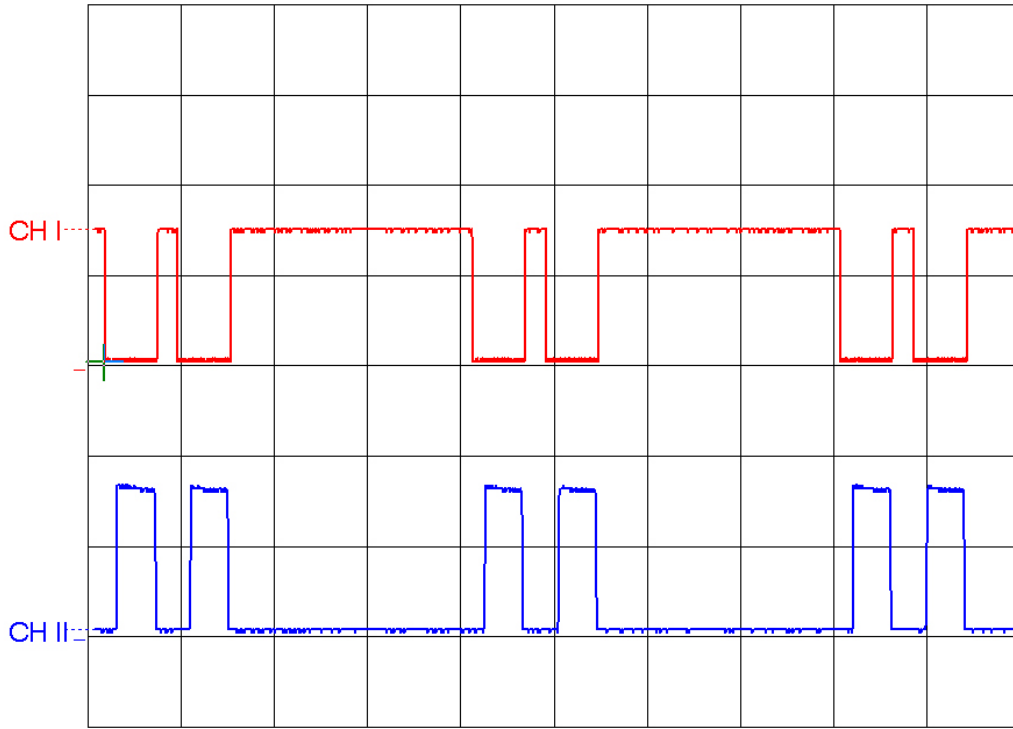


CH I : Cursor I: ,080V Cursor II: ,160V Diff. I-II: -,0800V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 43,100 ms 1/dt: 23,202 Hz

9000_200_2.wmf

Measure time: 13:55:22
Measure date: 23.12.2011

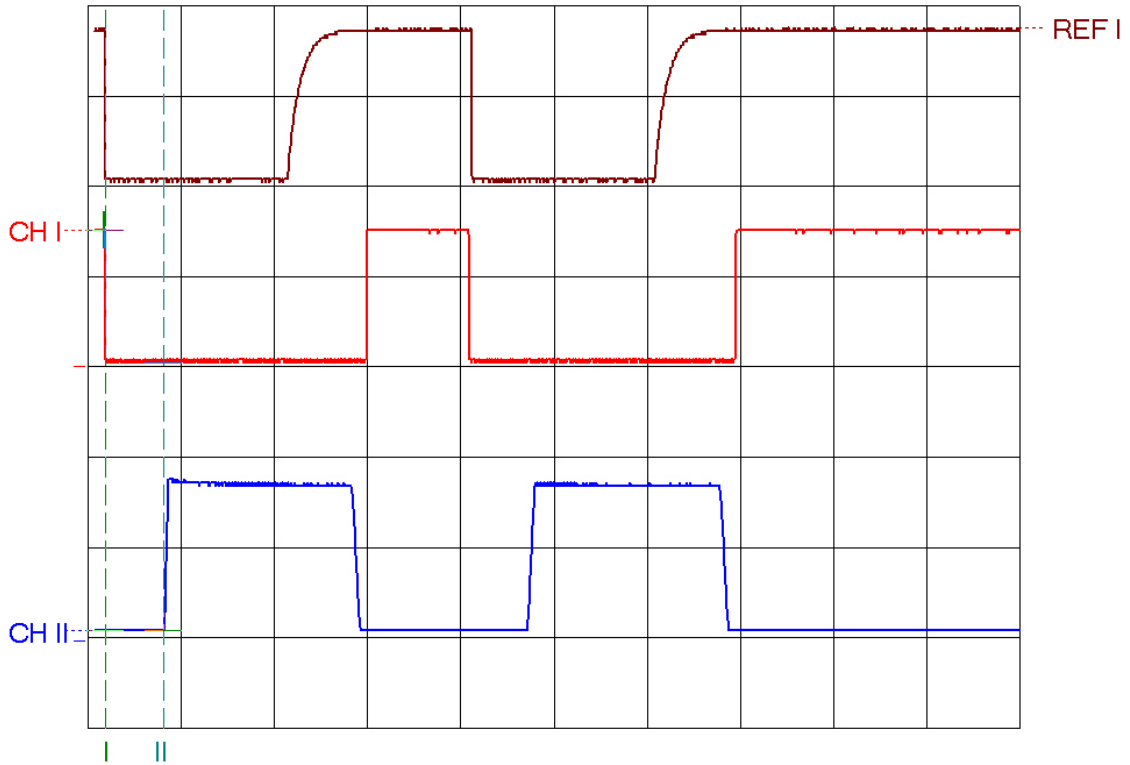
CH1: 2,000V/DIV DC CH2: 2,000V/DIV DC TB A: 100 ms TR: CH1-DC



9000_200_3.wmf

Measure time: 13:12:21
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC

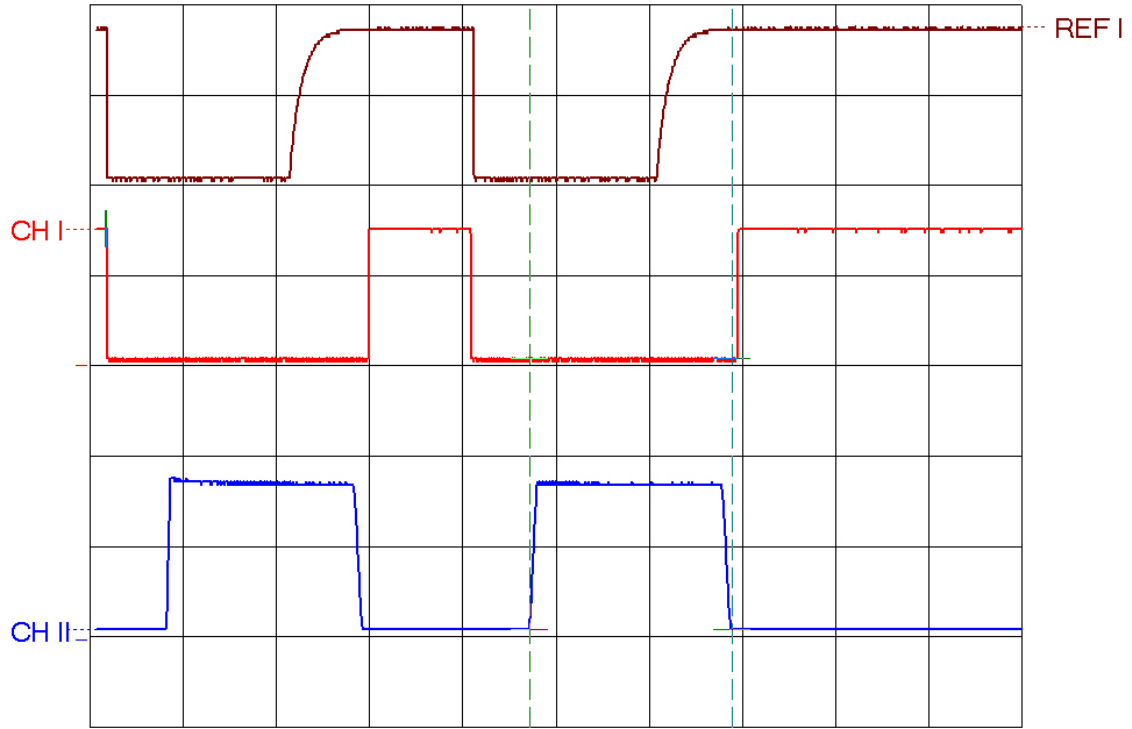


CH I : Cursor I: 3,040V Cursor II: ,080V Diff. I-II: 2,9600V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 12,700 ms 1/dt: 78,740 Hz

9000_200_6.wmf

Measure time: 13:12:21
Measure date: 23.12.2011

CH1: 2,000V/DIV DC CH2: 2,000V/DIV DC TB A: 20 ms TR: CH1-DC



CH I: Cursor I: ,160V Cursor II: ,160V Diff. I-II: ,0000V
CH II: Cursor I: ,240V Cursor II: ,240V Diff. I-II: ,0000V
dt: 43,600 ms 1/dt: 22,936 Hz

9000_200_7.wmf