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industrieelektronik

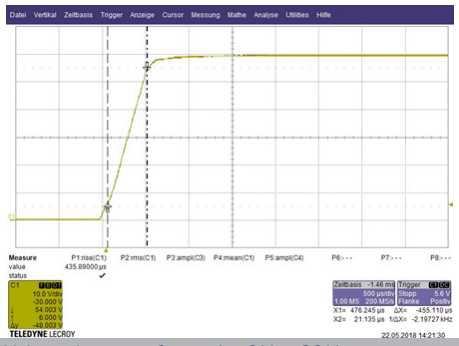
All about e-mobility

Battery Simulator BSR48HP

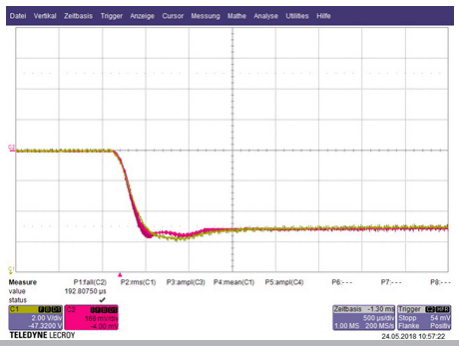
DC voltage source /-sink for 12 VDC up to 48 VDC
with optional 12 VDC module extension

Battery Simulator BSR48HP

The battery simulator is a DC voltage source/sink which simulates the static and dynamic behaviour of battery systems and to replace the original battery on stationary test stands. The specification of defined operation points and parameters allows meaningful and repeatable tests of components of 48 V onboard power systems.



Voltage in case of setpoint 0 V -> 60 V



Ri simulation in case of load jump 0 A -> 800 A; Ri = 6 mΩ

Main features

- Output power: 40 kW at 48 V, 50 kW at 60 V without current derating
- Energy recovery
- Operation modes: voltage/current/power
- Ri simulation
- Sense input
- Potential free DC output
- DC output can be switched off by DC relay
- Internal water cooling system with heat exchanger water/air or water/water
- Manual operation via touch screen
- Mobile electronic cabinet (800 mm x 800 mm x 1800 mm)

- **Options:**
- Boost module for increased control dynamics
- Crowbar module for limitation of overvoltages
- Insulation monitor for output voltage
- Short circuit protection via safety fuse
- All common field bus interfaces available (EtherCat, Profinet, CAN, ...)
- Connection to MATLAB® Simulink®

Benefits and advantages

- U_{nom}: 48 V
- $U_{output:}$ ... 10 ... 60 V
- $P_{perm.}$: 40 kW (48 V) resp. 50 kW (60 V)
- P_{30s}: 75 kW (60 V)
- $I_{perm.}$: ±833 A
- I_{30s}: ±1250 A

Data sheet for the Battery Simulator BSR48HP

Technical data:

Output voltage:	(0) [1] 10 ... 60 VDC
Output power:	40 kW (48 V), or 50 kW (60 V)
Overload (30 s):	75 kW (60 V) [2]
Output current:	± 833 A, ± 1250 A (30 s) [2]
Mains connection:	3 PE 400 ... 480 V ± 10%, 50/60Hz
External fuse:	100 A
Static control accuracy voltage:	< 15 mV
Static control accuracy current:	< ± 1 A

Battery Simulator BSR48HP

Basic device:

Voltage stability in case of load jump 0 ... 100% in 1 ms:	< ± 3,5 V, adjusted in 3 ms [3]
Current dynamics 0 ... 800A (bei U = 40 V):	< 0,8 ms
Voltage dynamics 0 V ... 60 V:	< 0,5 ms
Voltage dynamics 40 V ... 53 V:	< 0,32 ms
Voltage ripple (up to 1 MHz):	< 30 mVeff

With optional boost module:

Voltage stability in case of load jump 0 ... 100% in 1ms:	< 0,5 V, adjusted in 1,5 ms [3]
Voltage stability in case of 0 ... 100% in 0,3 ms:	< 1,4 V, adjusted in 1 ms [3]
Current dynamics 0 ... 800 A (at U = 48 V) :	< 0,3 ms
Voltage dynamics 0 V ... 60 V:	< 0,3 ms
Voltage dynamics 40 V ... 53 V:	< 0,14 ms
Voltage ripple (up to 1 MHz):	< 30 mVeff
Current ripple:	< 0,6 Aeff
Dimensions with heat exchanger water/air:	800 x 800 x 1800 mm³ incl. rollers

Integrated battery models:

– Ri simulation
– Ri plus one RC parallel circuit
– Ri plus two RC parallel circuit

Individual battery models on basis of Matlab/Simulink® [3]:

Requires additional real time capable hardware which is supported by Matlab/Simulink®, e. g. – Raspberry Pi® (cycle time = 10 ms) – speedgoat® (cycle time = 100 µs) – ...

1) Max. effective value of the output current: 833 A. Examples for possible load cycles:
1250 A (30 s) + 0 A (38 s)
1250 A (30 s) + 630 A (90 s)
2) Recovery time to within ± 1% FS of full scale value.
3) Corresponding licenses for Matlab/Simulink® are necessary.

12 VDC extension module

Main features

- Sense input for the output voltage
- Control types:
  - Voltage control with subordinate current limitation,
  - Current control with subordinate voltage limitation,
  - Power control with subordinate current and voltage limitation
- DC output potential-free, short-circuit-proof and can be switched off via DC relay
- Protection against active voltage sources connected to the DC output with reversed polarity
- Internal water cooling via heat exchanger of the BSR48HP
- Operation via the respective fieldbus protocol or the control panel of the BSR48HP

Technical data

Extension module:

Output voltage:	(0)[5] 6 ... 15 VDC (FSU)
Output power:	3,75 kW (bei 15 VDC)
Output current:	± 250 A (FSI)
Power supply:	internally from the basic device BSR48HP
Static control accuracy voltage:	< 2 mV (≙ 0,015% FSU)
Static control accuracy current:	< ± 2 A (≙ 0,08% FSI)
Voltage stability in case of load jump 0 ... 100% in 1 ms:	< ± 0,2 V, adjusted in 1,5 ms
Current dynamics 0 ... 240 A (bei U = 12 V):	< 0,4 ms
Current dynamics (R-Last, 0 ... 180 A, 12 V):	< 0,22 ms
Voltage dynamics 0 V ... 15 V (10 ... 90%):	< 1,7 ms
Voltage dynamics 8 V ... 14 V (10 ... 90%):	< 0,8 ms
Voltage ripple:	< 20 mVeff
Current ripple:	< 0,5 Aeff

Basic device:

With heat exchanger water/air (integrated in basic device)	590 x 360 x 120 mm³ (B x T x H)
additional weight:	17 kg

Integrated battery models:

– Ri simulation
– Ri plus one RC parallel circuit
– Ri plus two RC parallel circuit

Individual battery models on basis of Matlab/Simulink® [6]:

Requires additional real time capable hardware which is supported by Matlab/Simulink®, e. g.
– Raspberry Pi® (cycle time = 10 ms)
– speedgoat® (cycle time = 100 µs)

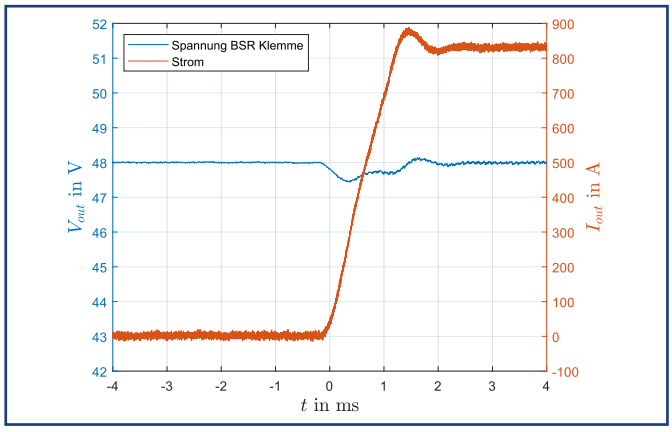
5) below 6 V with limitations regarding voltage ripple

6) Corresponding licenses for Matlab/Simulink® are necessary.

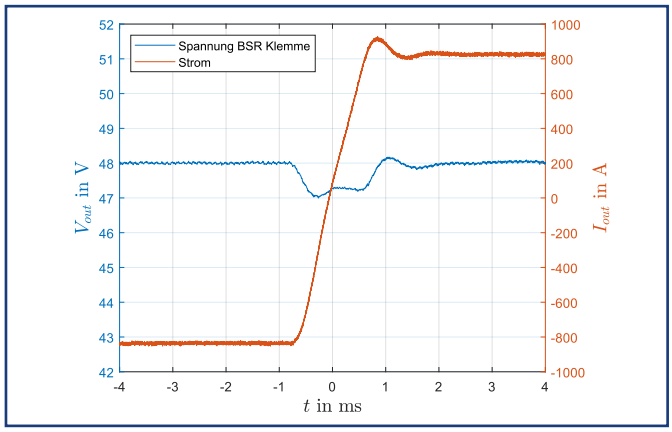
Typical time courses of the BSR48HP

Cable length to DUT 3 m and usage of universale control

48 VDC and load jump from 0 A to 833 A

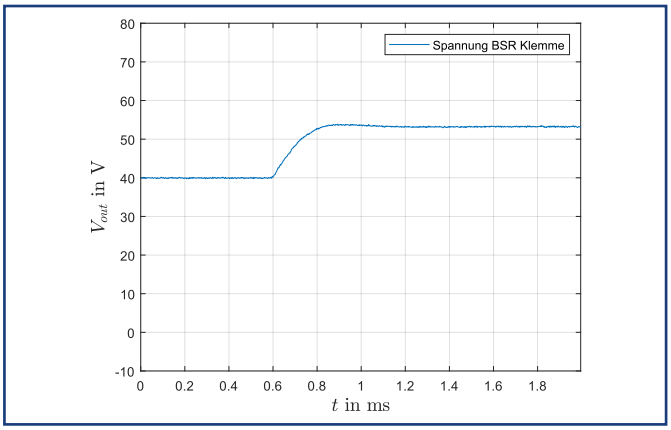


48 VDC and load jump from – 833 A to 833 A

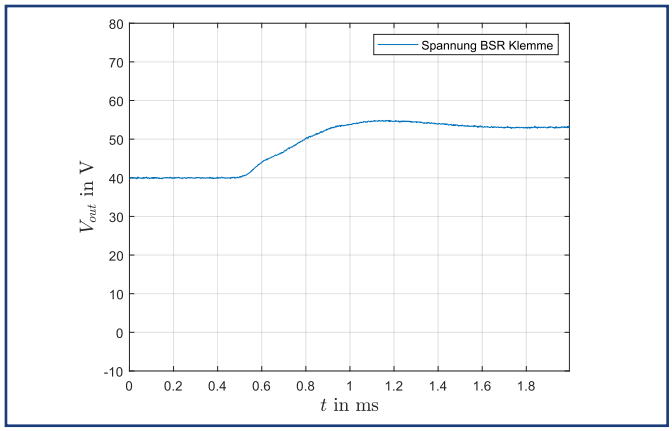


Set value jump from 40 V to 53 V

with Booster

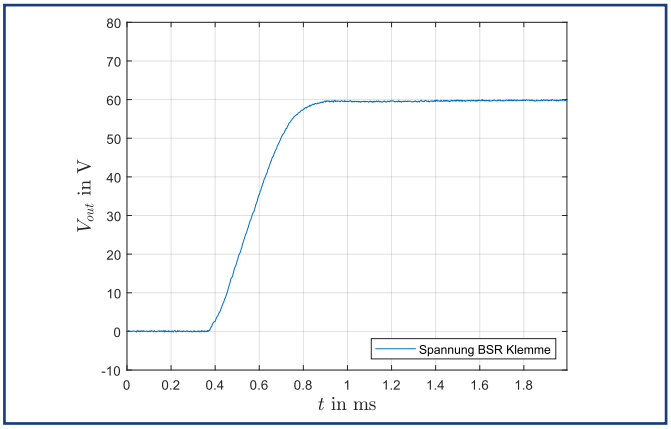


without Booster

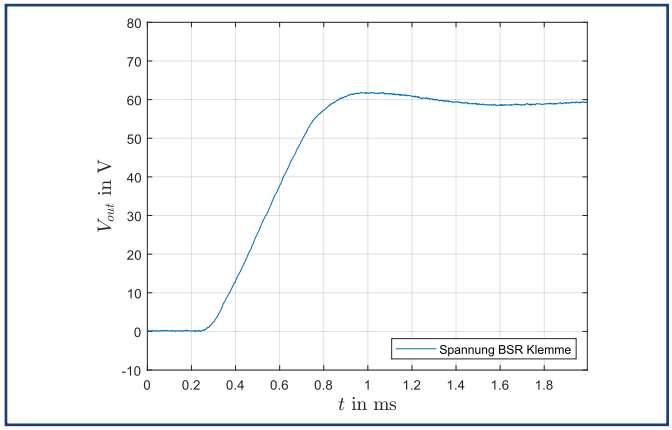


Set value jump from 0 V to 60 V

with Booster

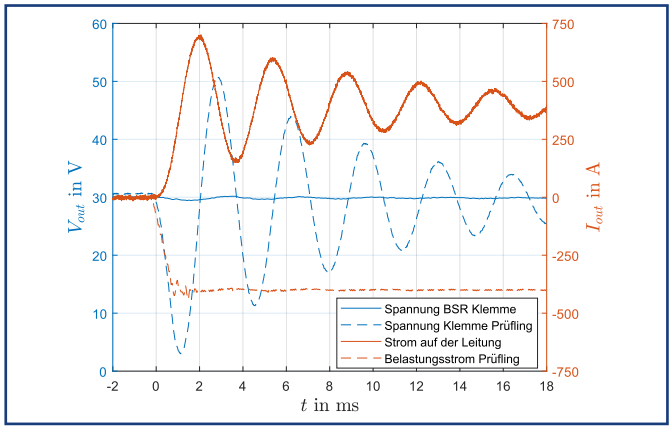


without Booster

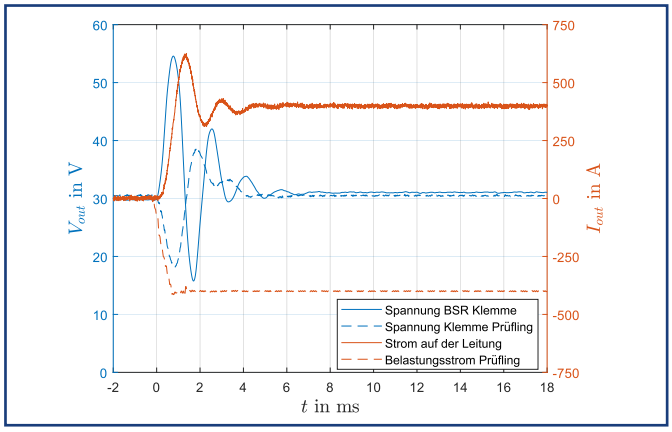


Cable length to DUT 20 m and usage of different control

With standard rcontrol on the clamps of the BSR48HP
and load jump from 0 A to 400 A in 1 ms

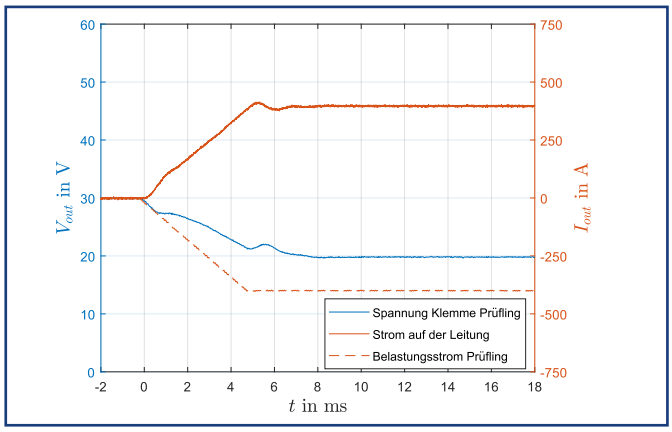


With SH controller taking into account the line and capacity
and load jump from 0 A from 400 A to 1 ms

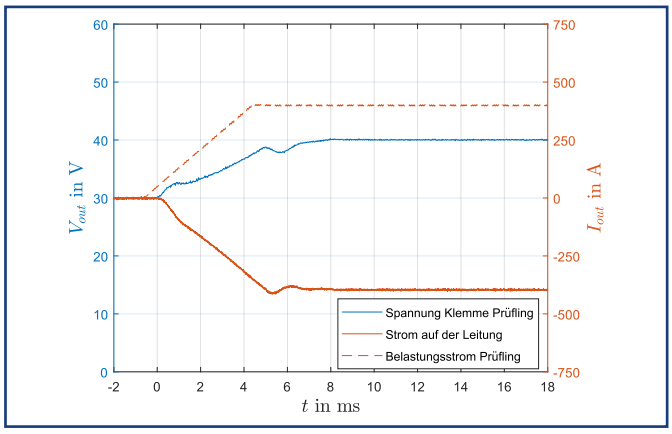


Ri-simulation with a cable length of 20 m

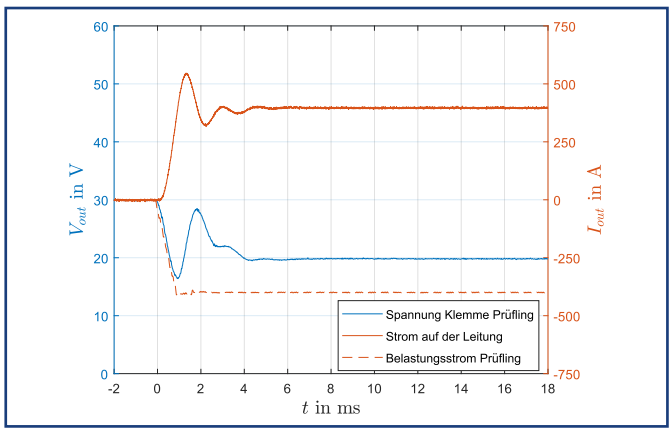
SH controller 30 VDC L_{Line} = 50 µH
load jump from 0 A to 400 A in 5 ms, Ri = 25 mΩ



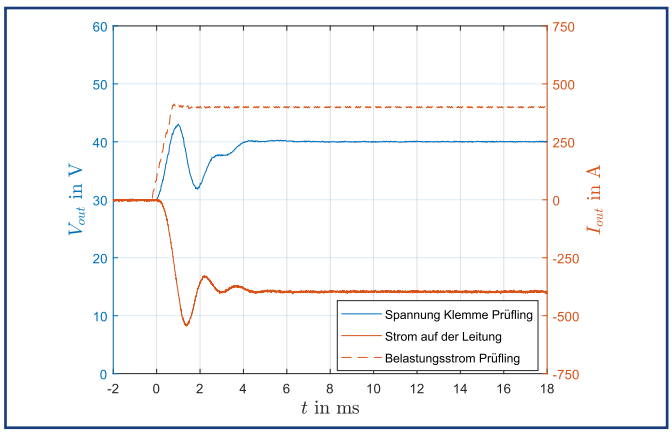
SH controller 30 VDC L_{Line} = 50 µH
load jump from 0 A to – 400 A in 5 ms, Ri = 25 mΩ



SH controller 30 VDC L_{Line} = 50 µH
load jump from 0 A to 400 A in 1 ms, Ri = 25 mΩ

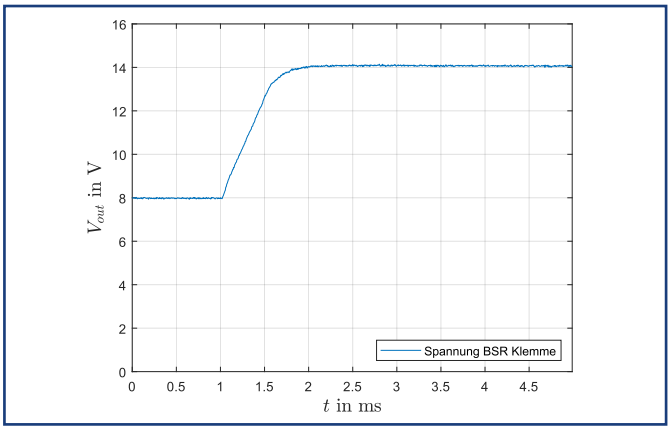


SH controller 30 VDC L_{Line} = 50 µH
load jump from 0 A to – 400 A in 1 ms, Ri = 25 mΩ

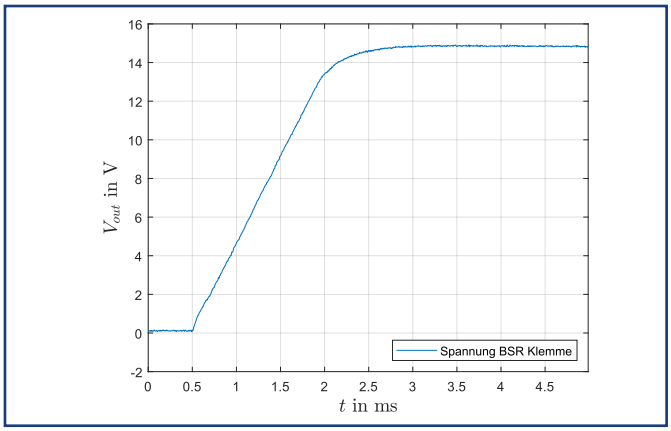


Typical time courses of the 12 VDC extension module

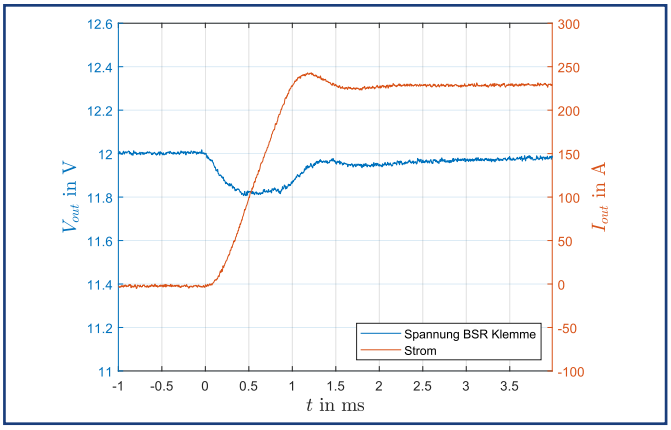
Set value jump from 8 VDC to 14 VDC



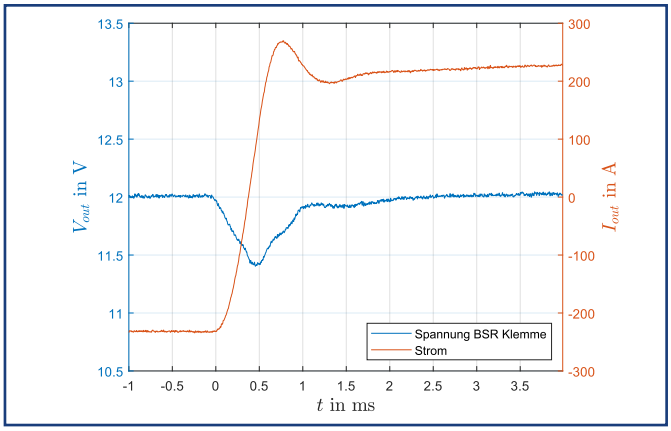
Set value jump from 0 VDC to 15 VDC



12 VDC and load jump from 0 A to 230 A

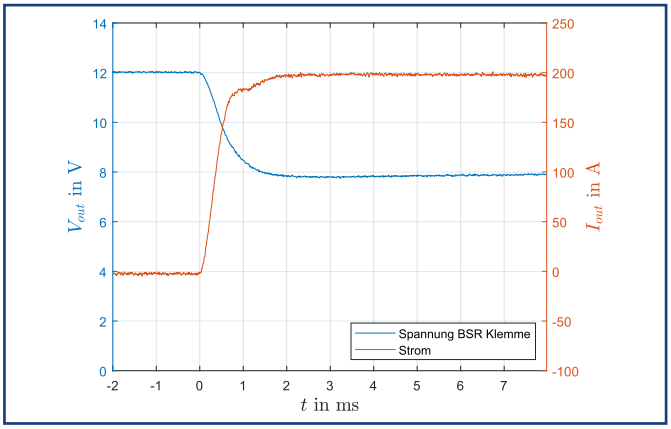


12 VDC and load jump from – 230 A to + 230 A

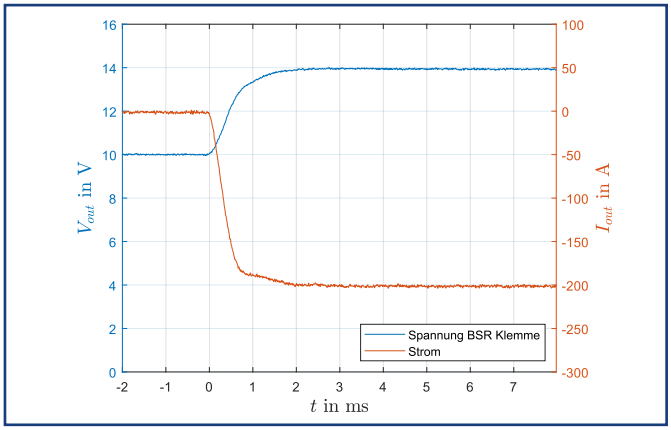


Ri-Simulation

12 VDC and load jump 200 A with Ri = 20 mOhm



12 VDC and load jump – 200 A with Ri = 20 mOhm



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