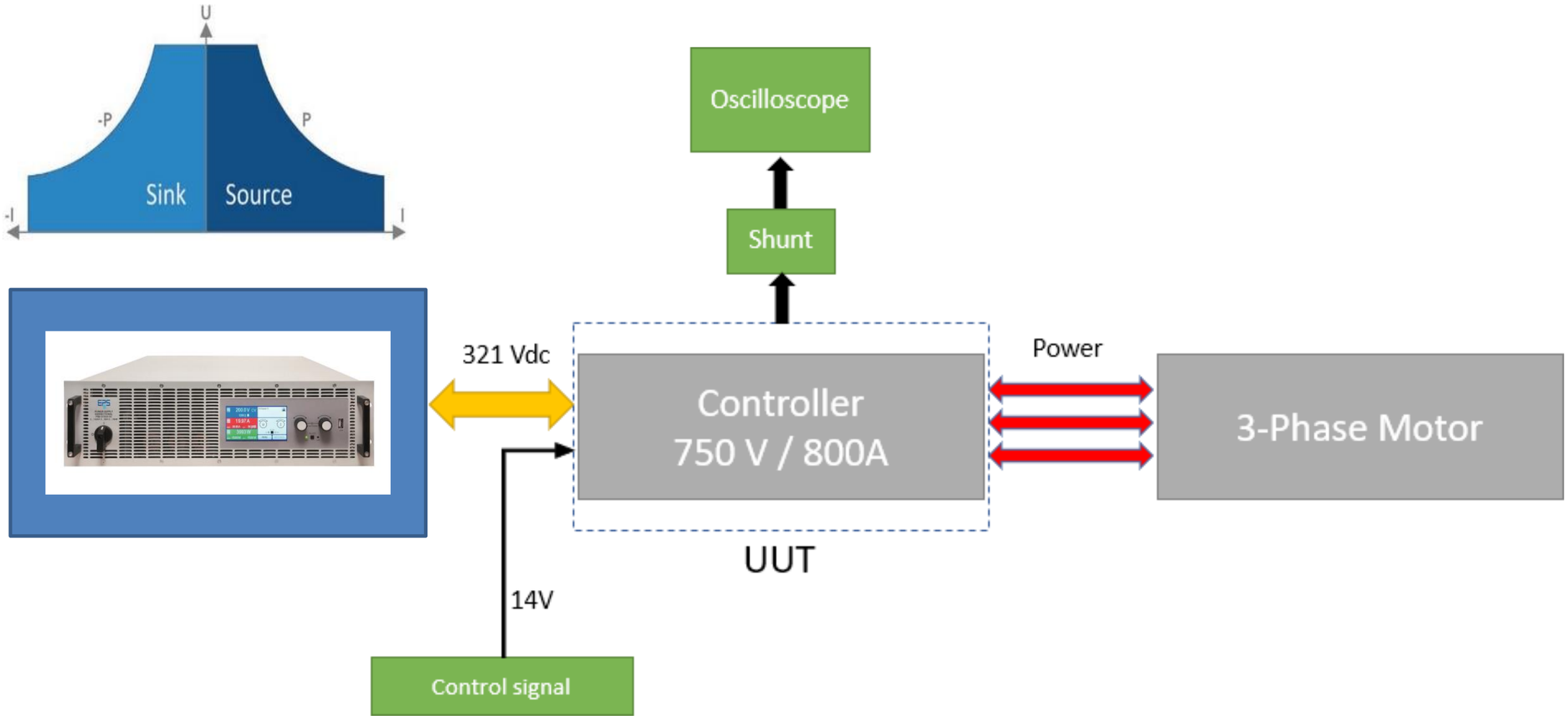
ELECTRIC VEHICLE MOTOR AND CONTROLLER TEST

This application note provides an example of testing an E-Motor and Controller for electric vehicles.

Web: www.onsystech.com email: info@onsystech.com, sales@onsystech.com

- Electric Motor and Drive-train (Electric Mobility) Testing is a critical part of bringing any electric drive-train into production.
- Here the requirements for an electric drive-train test cell are discussed.
- The implementations of such test cells are described, and examples of test results are provided.
- The energy and power requirements for three- phase motor and controller, Unit Under Test (UUT) connected through a common dc bus are described.
- The data used represents various steady state load conditions during durability test cycles.
- This “Smart Green Technology” concept not only reduces the energy requirement from the grid but also eliminates the inefficiencies by putting energy back on the grid.
- Traditional test setups require a dedicated DC source and Load in parallel to deal with bi-directional energy flow. This can require a complex test setup to coordinate energy flow and to avoid damaging expensive test equipment.
- The PSB 9000 is a bi-directional DC source and electronic load which simplifies the test setup, avoids catastrophic damage and decreases test times. This electronic load has the unique option of back-feeding converted energy into the grid.

Test Setup


U
-P
P
Sink
Source
-I
I
Oscilloscope
Shunt
321 Vdc
Controller
750 V / 800A
Power
3-Phase Motor
UUT
14V
Control signal

* **Bi-Directional DC Source and regenerative Electronic Load:** EPS Electronic Power Supply is a bidirectional power supply that meets multiple requirements and solves multiple tasks. First and foremost, the system is a power supply. It also meets the function of an electronic load by absorbing energy and feeding it back into the grid. The parameters for the power supply as well as for those for the electronic load can be adjusted flexibly. The integrated functions include a battery test mode, an arbitrary generator and a vehicle start-up curve. As the internal resistance is adjustable, the functioning of batteries, fuel cells can also be reproduced. Ideal to be used to return the energy in test processes, for example on a drive test rig, to the supply source.

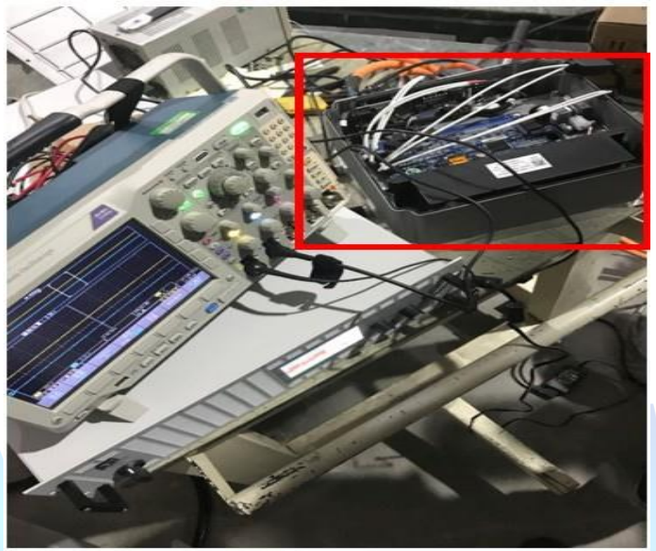
This example provides a block diagram of the simplified test setup using the EPS /PSB 9000 Series Power Supply.

- DSO-scope and shunt used for measurements. Digital signal for controller adjustments.

Siglent Make DSO 

TEST Condition Example:

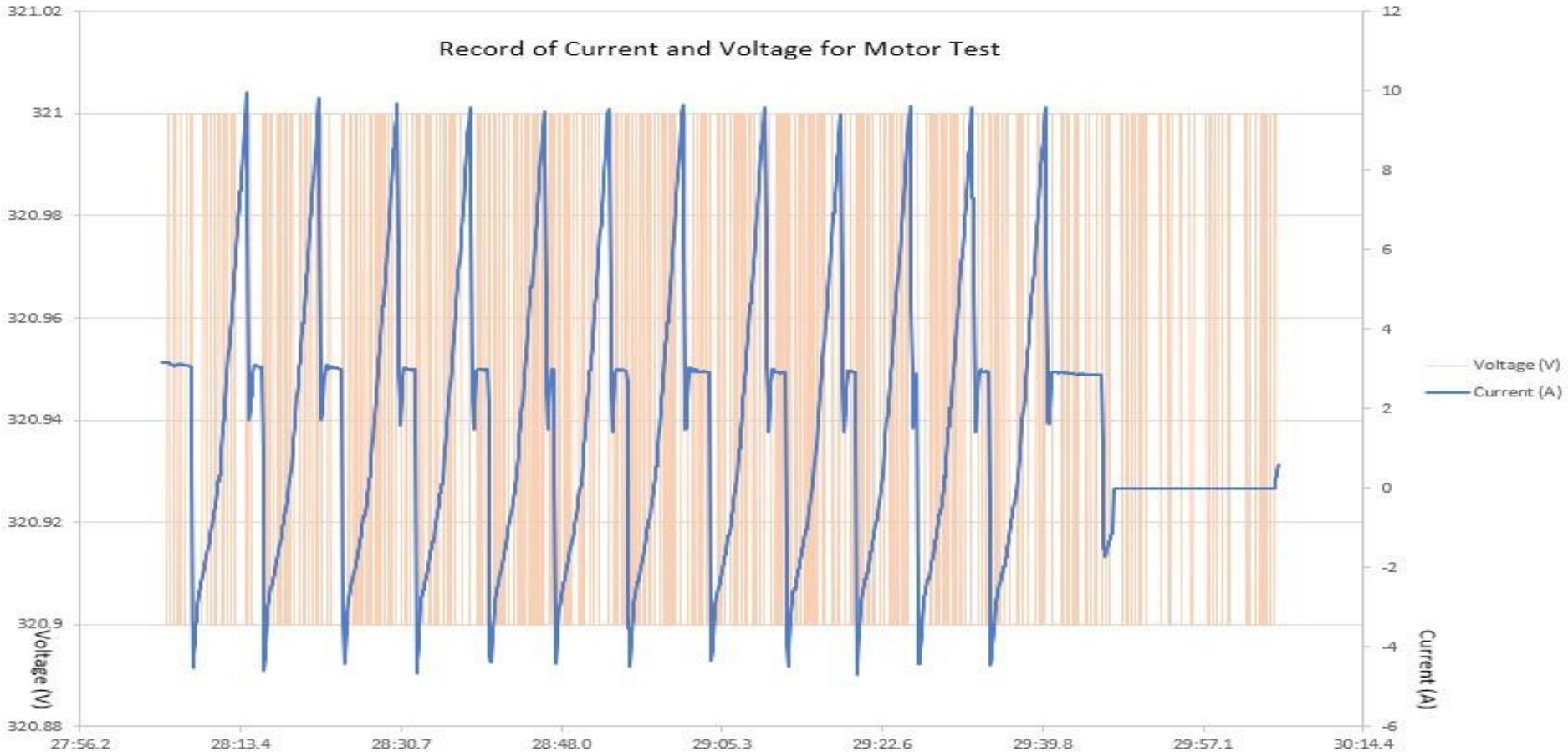
UUT: Controller maximum power: 750 Vdc / 800 Adc (the test below provides 320 Vdc and programmed to 10 Adc.



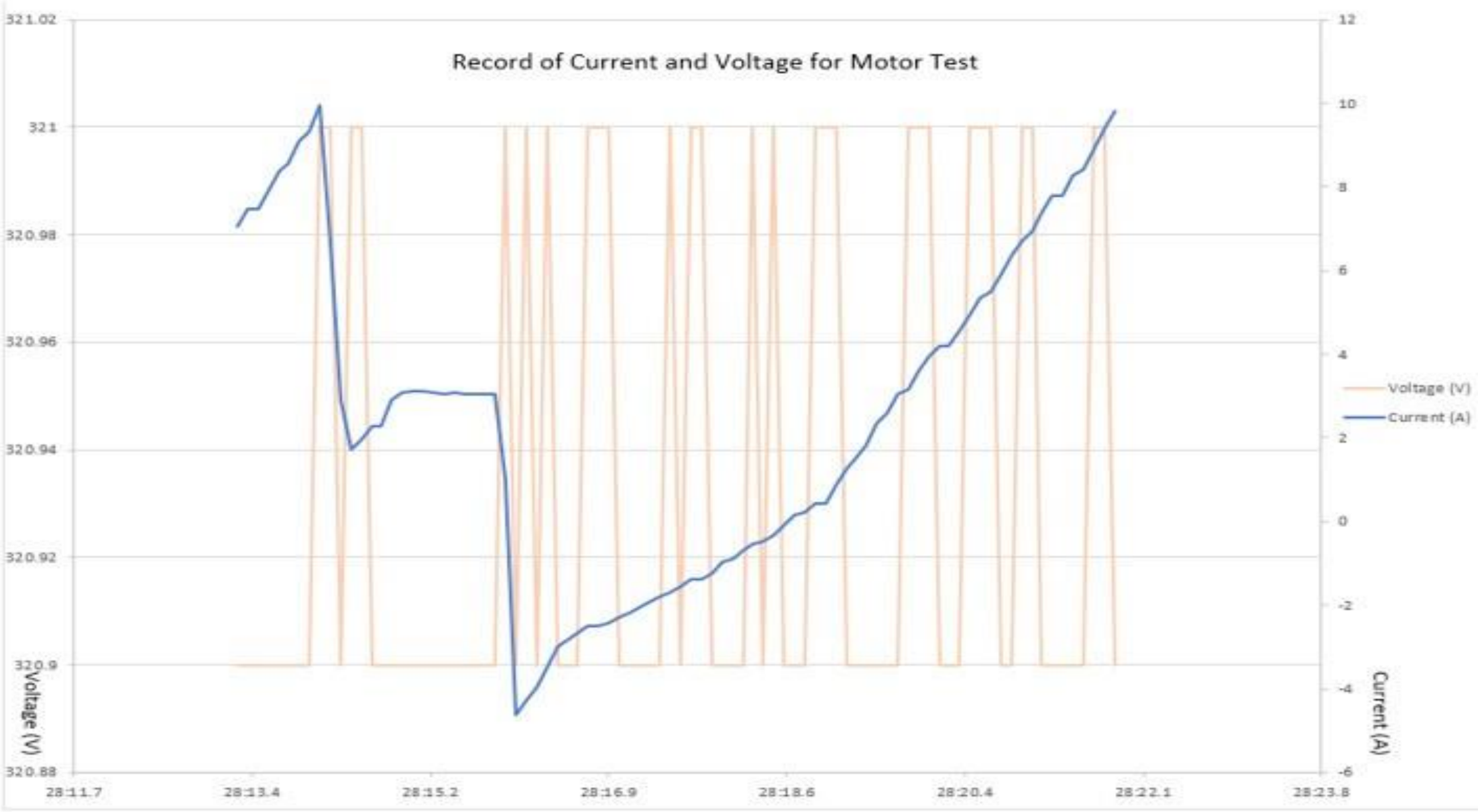
The motor RPM is approximately 6,000 RPM, Clockwise and Counter-Clockwise at no-load condition

Test Method:

The E-Motor rates at 6,000 RPM in clockwise direction, pulling positive current up to 10 Adc (Source).
After approximately 100msec, the control controller turns voltage to the motor OFF and the current quickly dissipates into the PSB 9000 at approximately -5 Adc (Sink).
Voltage is re-applied and the motor spins back up to steady state current of 10 Adc



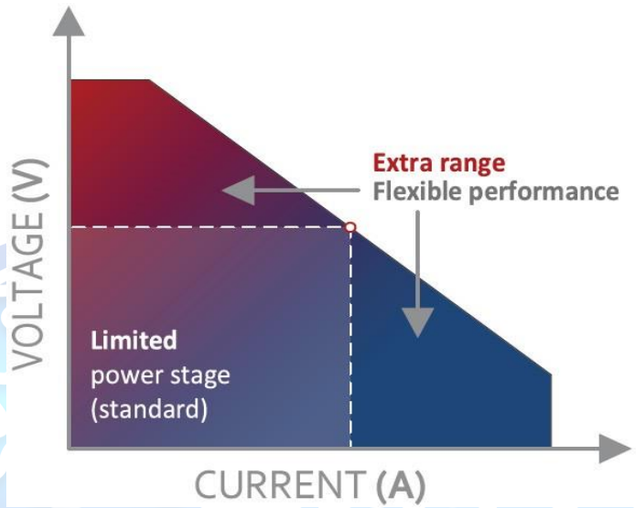
Above Fig: Voltage and current trace, 100msec sample rate



Above Fig: Zoom in

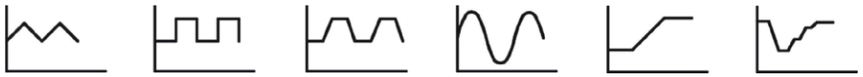
As the EPS Bidirectional Power supply do sources and sinks. Voltage stability maintains at 320.9 Vdc even during the transition of positive to negative current flow

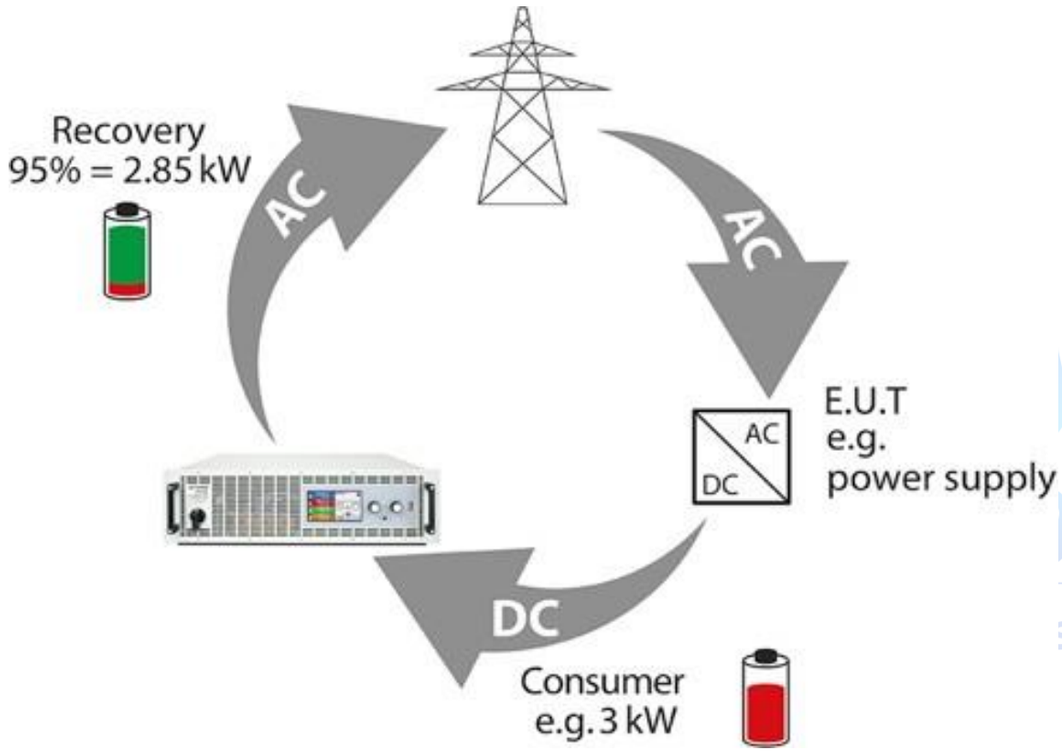
Additional Benefit of EPS Power Supply: an Auto-Ranging output stage. Typical programmable DC sources offer full output power at maximum voltage so at reduced voltages, the available power is greatly reduced. Auto-Ranging dynamically adjusts available output current at reduced voltages, maintaining full power from 33% to 100% of full-scale voltage. This is particularly useful when testing wide- ranging input products.

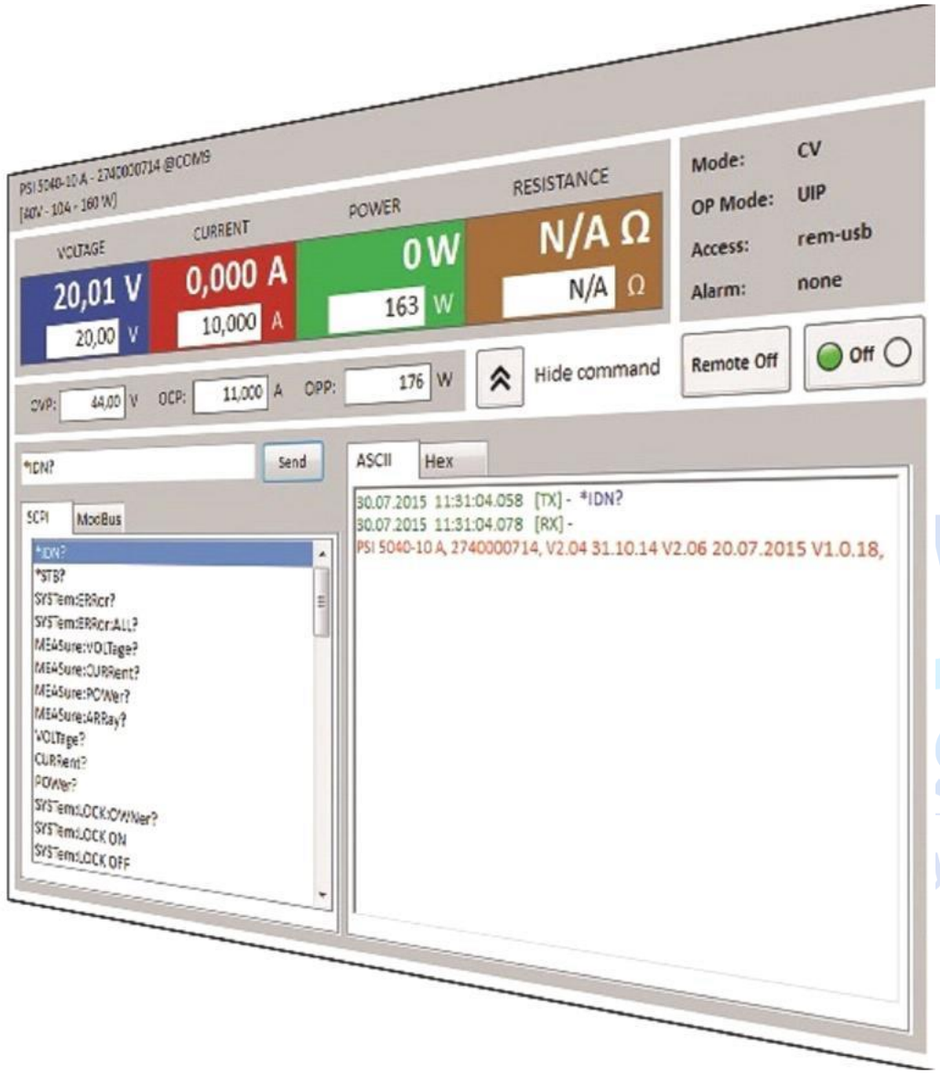


- available from 5 kW up to 480 kW in a per- configured chassis. Remote interface options include Ethernet, CAN Profibus, ProfiNet, ModBus, USB, RS232 or GPIB to make integration even easier.

- another added benefit is the PSB's ability to recycle the loaded energy back to the grid at approximately 95% efficiency. This results in operational energy cost savings and since the unit only dissipates 5% of the energy in the form of heat, the power density is industry leading at 15- kW in a single 3U rack mount chassis.






PSI 5040-10 A - 2740000714 @COM9
[40V - 10A - 160 W]
VOLTAGE
CURRENT
POWER
RESISTANCE
20,01 V
20,00 V
0,000 A
10,000 A
0 W
163 W
N/A Ω
N/A Ω
Mode: CV
OP Mode: UIP
Access: rem-usb
Alarm: none
OVP: 44,00 V
OCP: 11,000 A
OPP: 176 W
Hide command
Remote Off
Off
*IDN?
Send
SCPI
ModBus
*IDN?
*STB?
SYSTem:ERRor?
SYSTem:ERRor:ALL?
MEASure:VOLTage?
MEASure:CURRent?
MEASure:POWer?
MEASure:ARRay?
VOLTage?
CURRent?
POWer?
SYSTem:LOCK:OWNer?
SYSTem:LOCK ON
SYSTem:LOCK OFF
ASCII
Hex
30.07.2015 11:31:04.058 [TX] - *IDN?
30.07.2015 11:31:04.078 [RX] -
PSI 5040-10 A, 2740000714, V2.04 31.10.14 V2.06 20.07.2015 V1.0.18,

Please contact us for detail discussion on your requirement and our solution for EV Test Solution.

Thanks & Regards
Ajay Singh
Email: sales@onsystech.com
Web: www.onsystech.com
Ph: +91-9372898215