ELECTRONIC TEST & POWER SYSTEMS

LAB-SCUBI

SINGLE CHANNEL BIDIRECTIONAL PSU

POSITIVE PROBLEM SOLVING

The LAB-SCUBI is a series of high power single channel Bidirectional PSUs. Each system is able to operate as either a DC source or a DC electronic load.

This integrated approach features high dynamics enabling the user to switch seamlessly between quadrants. When sinking energy from the unit under test the LAB-SCUBI automatically inverts the DC to AC and synchronises this output to the grid. An extended feature set includes voltage and current ripple below 0.1%, sense terminals for voltage drop compensation as well as a range of protection features. Soft tools for LabVIEW integration are optionally available.

- Dedicated Battery Testing/Emulation Modes
- Seamless Transition Between Source/Sink
- Nominal Outputs up to 1200V/±1200A
- Lowest Life Component 60,000h
- High Dynamics and Stability

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GENERAL SPECIFICATIONS

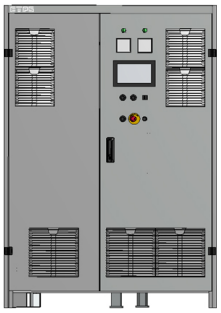
STANDARD FEATURES

TECHNICAL DATA	
Permissible Ambient Temperature	0 - 40°C
Climate Class	3K3 EN60721 (85% relative humidity non condensing, with cabinet heating up to 95% relative humidity without condensing)
Cooling	Forced air cooling / air-water heat exchanger
Minimum Distance from Wall	0mm (standard) for rear and side
Minimum Distance from Ceiling	300mm (standard), 0mm possible (optional)
Installation	Operating area with restricted access
Protection Class	IP20 (as standard) IEC 60529
Maximum Altitude	1000m above sea level with nominal load

HIGHLIGHTED FEATURES

IP20 CABINETS

As standard, each LAB-SCUBI cabinet is rated to IP20. The base of each cabinet has slots in it so it can be easily moved around via pump trucks or forklifts. Cable entry is also provided via the bottom of the cabinet. The standard front to top airflow cooling system means that no distance between the wall and rear of the cabinet is required.



POWER RECYCLING

When functioning as a load, the LAB-SCUBI has an inbuilt monitoring system that synchronises with grid conditions. This recycles DC sink energy back to the grid, with typical losses of only 5-10%.

LONG LIFE COMPONENTS

Each LAB-SCUBI system is built for longevity. The lowest life components being the fans rated at 60,000h and electrolytic capacitors rated at 130,000h/15 years. This ensures that the systems are suitable for constant operation in long term projects.

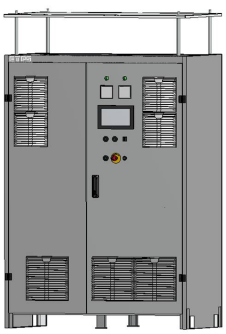
OPTIONS

CODE	DESCRIPTION
/IP21	Additional roof structure providing protection to IP21. Height increases by 300mm. Rear of cabinets can be positioned against walls.
/IP23	Top mounted fans providing protection to IP23 cabinet. Height increases by 300mm. Rear of cabinets can be positioned against walls.
/IP54-TOP	Top Mounted air to liquid heat exchangers. Cabinet heights increase to 2750mm, depths increase to 900mm. Rear of cabinets can be positioned against walls.
/IP54-REAR	Top Mounted air to liquid heat exchangers. Cabinet depths increase to 1160mm. Additional clearance of 800mm recommended at the rear for service/maintenance.
/CAB-HALOGEN-FREE	Each cabinet is fitted with halogen free cables.
/CAB-HEATING-SEP	100W heating element at the bottom of the cabinet to help guard against condensation.
/CAB-BAS-200	Additional 200mm base plinth, providing a larger possible bend radius for ease of cable access. 200mm is added to the standard cabinet height.
/CUSTOM-RAL	All cabinets are painted in a user chosen RAL colour (e.g. Signal White - RAL 9003).

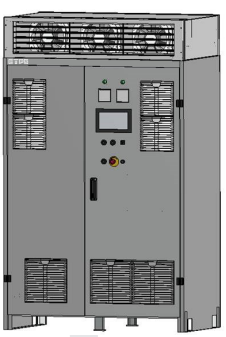
ILLUSTRATED OPTIONS

Other cabinet IP ratings are available on request. Please contact ETPS with your specific requirement.

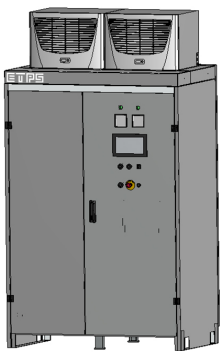
IP21



IP23



IP54-TOP



SELECTION TABLE

Part Number	Maximum Power	Voltage Range*	Current Range	Internal Resistance Range
100kW MODELS				
LAB-SCUBI 600-100-200	100kW	0 to 600V	0 to ± 200A	-30mΩ to 3000mΩ
LAB-SCUBI 600-100-600	100kW	0 to 600V	0 to ±600A	-10mΩ to 1000mΩ
LAB-SCUBI 600-100-1000	100kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-100-200	100kW	0 to 800V	0 to ±200A	-40mΩ to 4000mΩ
LAB-SCUBI 800-100-600	100kW	0 to 800V	0 to ±600A	-13mΩ to 1333mΩ
LAB-SCUBI 800-100-1000	100kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-100-200	100kW	0 to 1000V	0 to ±200A	-50mΩ to 5000mΩ
LAB-SCUBI 1000-100-600	100kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-100-1000	100kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
120kW MODELS				
LAB-SCUBI 300-120-600	120kW	0 to 300V	0 to ±600A	-5mΩ to 500mΩ
LAB-SCUBI 300-120-1000	120kW	0 to 300V	0 to ±1000A	-3mΩ to 300mΩ
160kW MODELS				
LAB-SCUBI 300-160-1000	160kW	0 to 300V	0 to ±1000A	-3mΩ to 300mΩ
LAB-SCUBI 600-160-600	160kW	0 to 600V	0 to ±600A	-10mΩ to 1000mΩ
LAB-SCUBI 600-160-1000	160kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-160-200	160kW	0 to 800V	0 to ±200A	-40mΩ to 4000mΩ
LAB-SCUBI 800-160-600	160kW	0 to 800V	0 to ±600A	-13mΩ to 1333mΩ
LAB-SCUBI 800-160-1000	160kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-160-200	160kW	0 to 1000V	0 to ±200A	-50mΩ to 5000mΩ
LAB-SCUBI 1000-160-600	160kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-160-1000	160kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
250kW MODELS				
LAB-SCUBI 600-250-600	250kW	0 to 600V	0 to ±600A	-10mΩ to 1000mΩ
LAB-SCUBI 600-250-1000	250kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-250-600	250kW	0 to 800V	0 to ±600A	-13mΩ to 1333mΩ
LAB-SCUBI 800-250-1000	250kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-250-600	250kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-250-1000	250kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
320kW MODELS				
LAB-SCUBI 600-320-600	320kW	0 to 600V	0 to ±600A	-10mΩ to 1000mΩ
LAB-SCUBI 600-320-1000	320kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-320-600	320kW	0 to 800V	0 to ±600A	-13mΩ to 1333mΩ
LAB-SCUBI 800-320-1000	320kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-320-600	320kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-320-1000	320kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
LAB-SCUBI 1200-320-600	320kW	0 to 1200V	0 to ±600A	-20mΩ to 2000mΩ
LAB-SCUBI 1200-320-1200	320kW	0 to 1200V	0 to ±1200A	-10mΩ to 1000mΩ
400kW MODELS				
LAB-SCUBI 600-400-1000	400kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-400-1000	400kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-400-600	400kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-400-1000	400kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
500kW MODELS				
LAB-SCUBI 600-500-1000	500kW	0 to 600V	0 to ±1000A	-6mΩ to 600mΩ
LAB-SCUBI 800-500-1000	500kW	0 to 800V	0 to ±1000A	-8mΩ to 800mΩ
LAB-SCUBI 1000-500-600	500kW	0 to 1000V	0 to ±600A	-17mΩ to 1667mΩ
LAB-SCUBI 1000-500-1000	500kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
650kW MODELS				
LAB-SCUBI 1000-650-1000	650kW	0 to 1000V	0 to ±1000A	-10mΩ to 1000mΩ
LAB-SCUBI 1200-650-1200	650kW	0 to 1200V	0 to ±1200A	-10mΩ to 1000mΩ

* The max. current that can be sunk derates as the voltage reduces below 5V (10V for 1200V models).

INPUT

STANDARD FEATURES

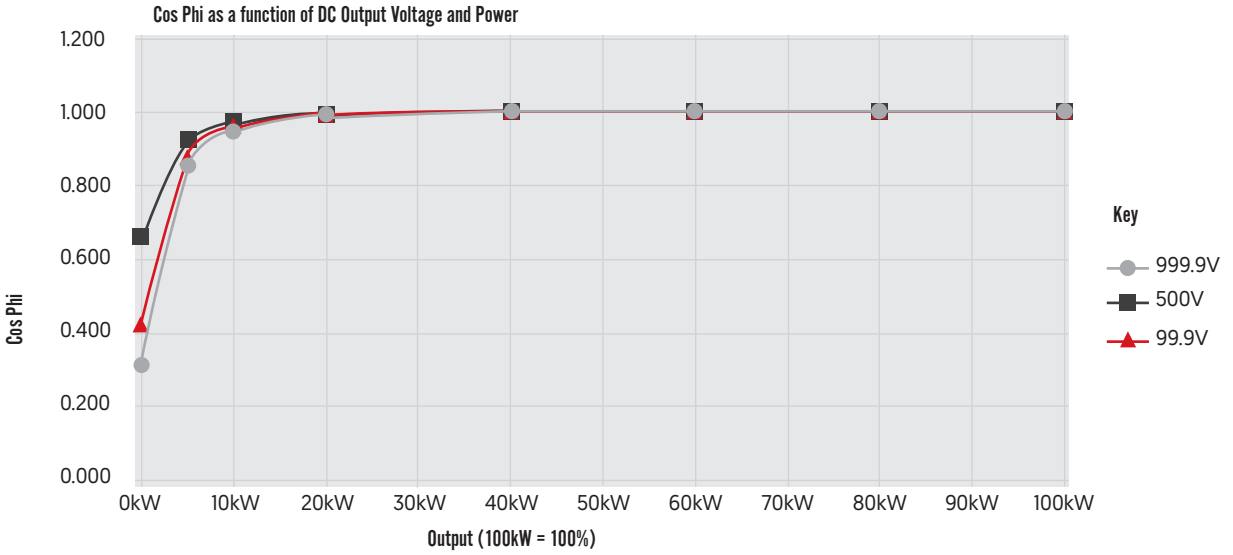
TECHNICAL DATA	
Rectifier Type	Isolation transformer, galvanically isolated
Power Factor	>0.99 (at >55% load), >0.83 (at 10% load)
AC Input Voltage/Frequency	400V[1] ± 10%, 3-phase, (N), PE, 50 / 60Hz ± 5%

[1] 380V, 415V,420V,440 and 480V inputs are available on request.

HIGHLIGHTED FEATURE

ACTIVE POWER FACTOR CORRECTION

LAB-SCUBI systems have Active Power Factor Correction (PFC) circuit integrated into the input stage as standard. This enhances the overall efficiency of the systems across the output power range when compared to a unit that does not have active PFC. In practice, this means a significant lower peak current value, a decrease of RMS value of the phase current and less perturbations of other equipment running on the same grid.



OPTIONS

CODE	DESCRIPTION
/NSV	Non standard AC input voltage (eg. 690Vac).

OUTPUT

STANDARD FEATURES

TECHNICAL DATA	
Maximum Output Voltage	See selection table
Minimum Output Voltage	5V (typical) to sink full current within the maximum power capability
Measuring Accuracy and Resolution	Voltage: 0.1% F.S. / 16 bit ADC, current: 0.1% F.S. / 16 bit ADC
Control Accuracy[2,3]	Voltage: 0.1% F.S. , current: 0.1% F.S.
Voltage Tolerance Dynamic	Battery simulator mode: <1% F.S. (0 - 100% I_{NOM} in 3ms), Battery tester mode: <3% F.S. (0 - 100% I_{NOM} in 3ms)
Voltage Ripple[4]	≤0.1% rms F.S. (V > 10)
Current Ripple[5]	≤0.1% rms F.S. (V > 10)
Current Rise Time[6]	Typical time for a 10% to 90% load step: <1ms (800V models), <1.3ms (1000V models)
Overall Efficiency	Typically 92% to 95% (depending on system power)

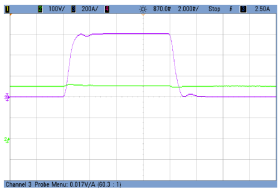
[2] Via 16 bit digital controller. [3] Digital controller (± 600A = 15 bit + sign). [4] Resistance as load, operation mode simulator (in constant voltage mode).

[5] 48/96V battery (constant voltage mode). [6] Measured at half nominal voltage with max. 5% overshoot (in constant current mode).

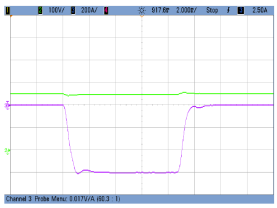
HIGHLIGHTED FEATURES

FAST DYNAMICS AND HIGH STABILITY

The LAB-SCUBI provides a highly stable output of ≤0.1% rms F.S. for both current and voltage, ideal for powering sensitive DUTs. The high dynamics of the system allows users to switch quickly between quadrants. This is particularly useful when performing tests on bidirectional devices with fast current step changes such as super capacitors and electric motors. A typical time for a 10% to 90% load step in CC mode is less than 1ms assuming an ohmic load. Example scope shots of a previous test are provided below:



Measurement in Source Mode
Current step: 10 to 90% (60 to 540A)
Output filter: 1200µF
Measured value: 0.8ms



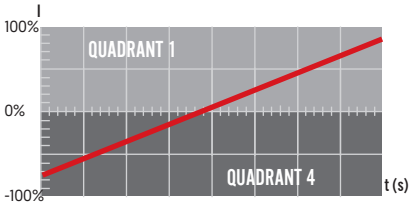
Measurement in Sink Mode
Current step: -10 to -90% (-540 to -60A)
Output filter: 1200µF
Measured value: 0.8ms

SENSE COMPENSATION

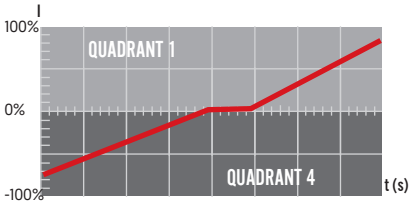
Sense terminals are built into the LAB-SCUBI for the connection of sense wire which compensates for voltage drops in the load lines. Up to 5% of the system's nominal voltage value can be compensated for. This is particularly useful for applications with long cables which have unwanted voltage drops.

SEAMLESS SOURCE/SINK TRANSITION

When switching between sinking and sourcing current, the LAB-SCUBI provides a seamless transition. This means that during the quadrant change there is zero deadband time and no unwanted/disruptive behaviour is introduced to the power system's output characteristics. This feature is particularly useful for when users need to switch between charging and discharging a battery at a constant current rate, or simulate fast dynamics.



LAB-SCUBI seamless transition between sink and source



Typical bidirectional power system without seamless transition

INTERNAL RESISTANCE RANGE

Each LAB-SCUBI is built with a user programmable internal resistance range as standard. This makes the power systems ideal for simulating the output of energy storage devices such as an ageing battery pack, fuel cell stacks and super capacitors. The exact range varies by model, for model specific details please contact ETPS.

OUTPUT

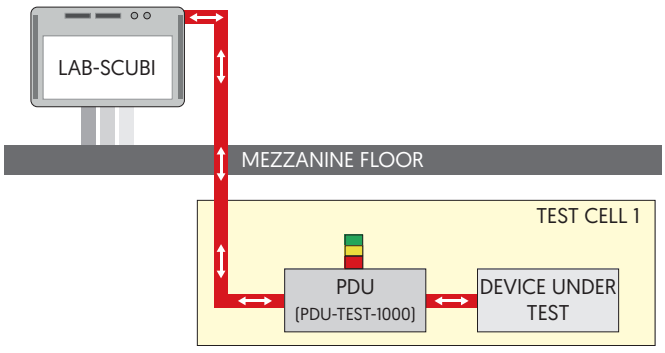
OPTIONS

CODE	DESCRIPTION
/OL	Overload up to 50% of nominal system power for up to 60 seconds, with cooling time minimum of 3 minutes at nominal load afterwards (selected models only).
/SCR	Second current range for improved resolution and accuracy in low current applications.
/B-CAP-M	External IP65 metal control cabinet with switchable output capacitors. 20360µF of additional capacitance is provided for models up to 800V, with 9660µF available for 1000V systems. Special 1100V metal capacitor boxes with discharge resistors are available on request.
/B-CAP-P	External IP65 plastic control cabinet with switchable output capacitors. 19800µF of additional capacitance is provided for models up to 800V, with 8100µF available for 1000V systems.
/PARALLEL	Master/slave interface for current balancing of up to 2 LAB-SCUBI systems in parallel connection.
/MASTER	External cabinet providing safety master control required to achieve Performance Level d in parallel operation.
/PDSB-1IN-2OUT	External cabinet for switching a single LAB-SCUBI output between 2 separate test cells/DUTs. Cabinet is rated IP20 as standard with IP53 available on request. Dimensions are available on request. Up to 4 discharge units (/DCU-X-XX) can be built into the cabinet.
/PDSB-1IN-4OUT	External cabinet for switching a single LAB-SCUBI output between 4 separate test cells/DUTs. Cabinet is rated IP20 as standard with IP53 available on request. Dimensions are available on request. Up to 4 discharge units (/DCU-X-XX) can be built into the cabinet.
/PDSB-2IN-1OUT	External cabinet for combining 2 x LAB-SCUBI outputs into a single output. Cabinet is rated IP20 as standard with IP53 available on request. Dimensions are available on request. Up to 4 discharge units (/DCU-X-XX) can be built into the cabinet.
/PDSB-2IN-2OUT	External cabinet for operating 2 × LAB-SCUBI systems in parallel, switching the combined output to 1 of 2 test cells. The 2 × LAB-SCUBI systems can also be operated individually into the 2 test cells. Cabinet is rated IP20 as standard with IP53 available on request. Dimensions are available on request. Up to 4 discharge units (/DCU-X-XX) can be built into the cabinet.
/PDSB-2IN-4OUT	External cabinet for operating 2 × LAB-SCUBI systems in parallel, switching the combined output to 1 of 4 test cells. The 2 × LAB-SCUBI systems can also be operated individually into 2 of 4 test cells. Cabinet is rated IP20 as standard with IP53 available on request. Dimensions are available on request. Up to 4 discharge units (/DCU-X-XX) can be built into the cabinet.
/PDU	Control cabinet rated to IP54 for local installation close to DUT. Cabinets are available with 1, 2 or 4 inputs at up to 1000V/4000A. Dimensions are available on request. A 1000V voltmeter is included, as is a 4 position light post to signal operational status of the system. Options can be specified for the cabinet such as door interlocks, inbuilt diodes and 2 × MXP capacitors 280µF/1120Vdc.
/SENSE-M	Sense cable connecting the LAB-SCUBI and the device under test or /PDU-XXX.
/CONTROL-M	Control cable connecting the LAB-SCUBI and the /PDU-XXX.

HIGHLIGHTED OPTION

POWER DISTRIBUTION UNITS (PDU)

A PDU is used to connect a LAB-SCUBI to a DUT, when the power system is located in a different place. Both wall mounted and free standing cabinets are available. A voltmeter is included, as is an indicator light which shows the status of the insolation monitoring (turned off or active). A short-circuit switch for safe connection of a DUT when operating in quadrant 4 is available for certain models (battery simulator mode only).



OUTPUT

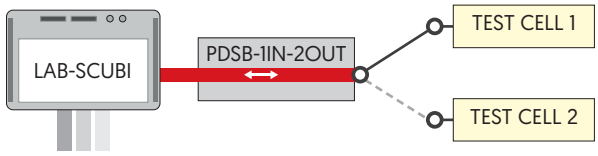
HIGHLIGHTED OPTIONS

POWER DISTRIBUTION SWITCH BOARDS (PDSU)

PDSB control cabinets can be provided for remotely switching the output of a single LAB-SCUBI system between separate test cells, or for connecting the output of two separate LAB-SCUBIs in parallel to a nominated test cell. Up to four discharge units can also be installed in the cabinet on request.

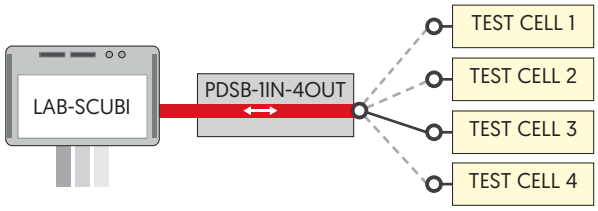
PDSB-1IN-2OUT

PDSB-1IN-2OUT CONFIGURATIONS		
Operation Mode	Test Cell 1	Test Cell 2
1	Contactors Open	Contactors Open
2	LAB-SCUBI 1	Contactors Open
3	Contactors Open	LAB-SCUBI 1



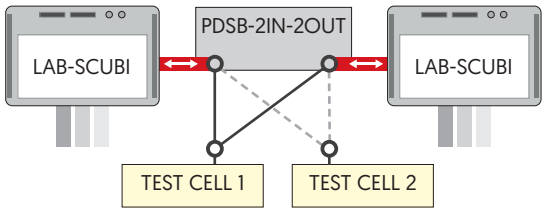
PDSB-1IN-4OUT

PDSB-1IN-4OUT CONFIGURATIONS				
Operation Mode	Test Cell 1	Test Cell 2	Test Cell 3	Test Cell 4
1	Contactors Open	Contactors Open	Contactors Open	Contactors Open
2	LAB-SCUBI 1	Contactors Open	Contactors Open	Contactors Open
3	Contactors Open	LAB-SCUBI 1	Contactors Open	Contactors Open
4	Contactors Open	Contactors Open	LAB-SCUBI 1	Contactors Open
5	Contactors Open	Contactors Open	Contactors Open	LAB-SCUBI 1



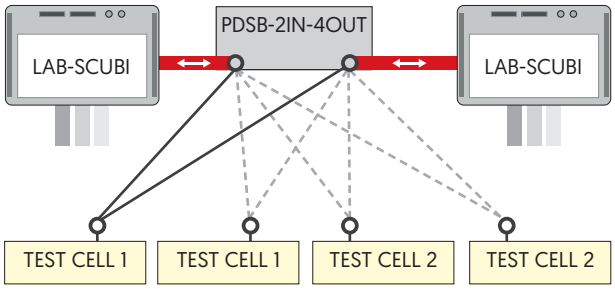
PDSB-2IN-2OUT

PDSB-2IN-2OUT CONFIGURATIONS		
Operation Mode	Test Cell 1	Test Cell 2
1	Contactors Open	Contactors Open
2	LAB-SCUBI 1	LAB-SCUBI 2
3	LAB-SCUBI 1 & 2 in Parallel	Contactors Open
4	Contactors Open	LAB-SCUBI 1 & 2 in Parallel



PDSB-2IN-4OUT

PDSB-2IN-4OUT CONFIGURATIONS				
Operation Mode	Test Cell 1	Test Cell 2	Test Cell 3	Test Cell 4
1	Contactors Open	Contactors Open	Contactors Open	Contactors Open
2	LAB-SCUBI 1	LAB-SCUBI 2	Contactors Open	Contactors Open
3	Contactors Open	Contactors Open	LAB-SCUBI 1	LAB-SCUBI 2
4	LAB-SCUBI 1 & 2 in Parallel	Contactors Open	Contactors Open	Contactors Open
5	Contactors Open	LAB-SCUBI 1 & 2 in Parallel	Contactors Open	Contactors Open
6	Contactors Open	Contactors Open	LAB-SCUBI 1 & 2 in Parallel	Contactors Open
7	Contactors Open	Contactors Open	Contactors Open	LAB-SCUBI 1 & 2 in Parallel



OUTPUT

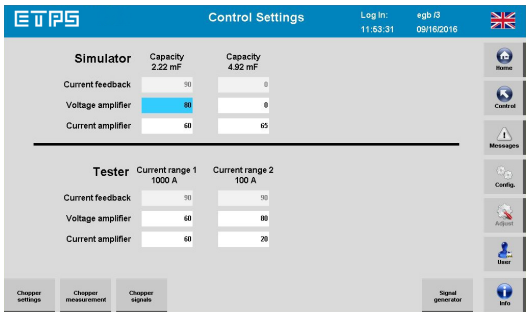
HIGHLIGHTED OPTIONS

SECOND CURRENT RANGE

A second current range can be built into systems to give better accuracy and resolution for low current applications. This is particularly useful when testing high voltage equipment, such as electric vehicle battery packs, which typically produce low currents. The lower current range is not operable when 2 × LAB-SCUBI systems are operating in parallel.

CAPACITANCE VALUES

Output capacitance is provided to improve stability when operating in constant voltage mode. This is particularly useful to assist the fast current demands when testing drives. Some electric drives require a very stable voltage during a step change. If the voltage drop is too low it could damage the drive.



When choosing the /SIM and /SIM-TEST options an extra level of capacitance is provided. If a test routine requires the fastest possible dynamics in constant current mode, then the standard capacitance of the LAB-SCUBI can used in the basic or battery tester operation modes. For people who frequently need to switch between battery tester and simulation modes the /SIM-TEST option is ideal. This provides the ability to change between the lower and higher level of capacitance.

CAPACITANCE BUILT INTO LAB-SCUBI SYSTEMS		
	Standard in Basic and Battery Tester Modes	/SIM-TEST and/SIM Options
300V/600A Models	Installed: 2490µF, Total: 2490µF	Additional: 4400µF, Total: 6890µF
600V/200A Models	Installed: 1660µF, Total: 1660µF	Additional: 6600µF, Total: 8260µF
600V/600A Models	Installed: 1660µF, Total: 1660µF	Additional: 6600µF, Total: 8260µF
600V/1000A Models	Installed: 2490µF, Total: 2490µF	Additional: 6600µF, Total: 9090µF
800V/200A Models	Installed: 1660µF, Total: 1660µF	Additional: 6600µF, Total: 8260µF
800V/600A Models	Installed: 1660µF, Total: 1660µF	Additional: 6600µF, Total: 8260µF
800V/1000A Models	Installed: 1660µF, Total: 1660µF	Additional: 6600µF, Total: 8260µF
1000V/200A Models	Installed: 1660µF, Total: 1660µF	Additional: 2700µF, Total: 4360µF
1000V/600A Models	Installed: 1660µF, Total: 1660µF	Additional: 2700µF, Total: 4360µF
1000V/1000A Models	Installed: 2490µF, Total: 2490µF	Additional: 2700µF, Total: 5190µF
1200V/600A Models	Installed: 2400µF, Total: 2400µF	Additional: 2400µF, Total: 4800µF
1200V/1200A Models	Installed: 3600µF, Total: 3600µF	Additional: 2400µF, Total: 6000µF

ILLUSTRATED CAPACITANCE OPTION

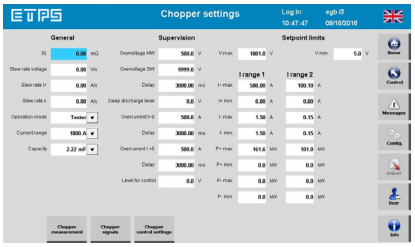
The /B-CAP-X options provide you with additional capacitance from an external box, which can be switched between 3 different levels depending on the requirements of the test application. As a result, users with long load lines can situate the box next to the device under test.

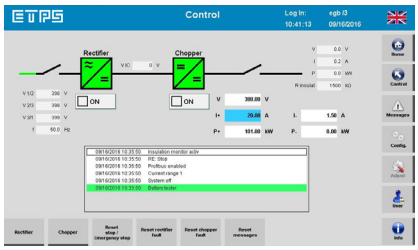
/B-CAP-M

INTERFACES & CONTROL

STANDARD TOUCHSCREEN CONTROL

The LAB-SCUBI comes with a simple and intuitive TFT touchscreen with a menu driven interface which allows measuring and setting of V, I, P and Ri values among others. The interface provides users with the convenience of remote access when setting test values. The touchscreen is also accessible via a PC through the VNC over Ethernet interface, as mentioned overleaf.





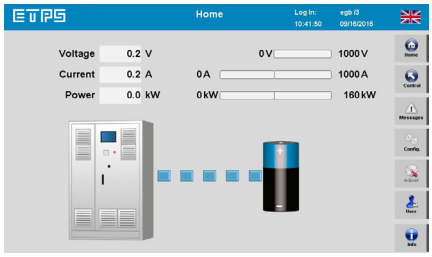
Current and voltage ramps are programmable should you need to replicate a defined output for a specific research application. An under voltage limit can be user set to prevent a deep discharge which could potentially damage a battery pack. An event log is also provided which provides details of user actions, warnings and faults.

Up to 10 named users can be specified to operate the interface, each with their own password. Varying levels of permission access can be assigned to each user, from simple access where it is only possible to view measured values and switch the system on/off, to configurator level where users can control more complex features such as enabling DC contactors to be open/closed or setting ramps and shutdown limits.

STANDARD OPERATING MODES

Each LAB-SCUBI features constant power, constant current, constant power and internal resistance operation. As standard the power system operates in battery testing mode. This is ideal for testing battery power components and provides users with the benefits of:

- High dynamics during current changes
- Output filter with lower capacitance
- Control mode: current (CC)
- Fast current rise time
- Current ripple <0.1% f.s. rms at Vdc>10Vdc



CAN 2.0 STANDARD INTERFACES

A CAN 2.0 interface with dbc file is provided as standard. This operates at 100Hz. The fast sampling frequency allows users to record quickly changing data, so that they can identify what's happening at a particular point in time. A MODBUS is also provided along with VNC over Ethernet.

HIGHLIGHTED FEATURE

VNC OVER ETHERNET

The VNC over Ethernet interfaces allows the touchscreen to be controlled via a PC. This feature is particulary useful for remote operation where the system may be operating in a potentially hazardous environment, or isolated from the device under test.

INTERFACES & CONTROL

OPTIONS

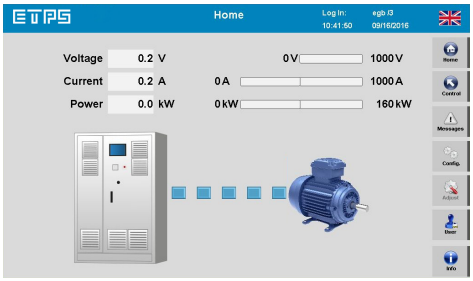
CODE	DESCRIPTION
/SCPI	SCPI interface over Ethernet operating at 100Hz for remote programming.
/LABVIEW	Interface for controlling the LAB-SCUBI via LABVIEW commands
/MATLAB-SIMULINK	Interface for controlling the LAB-SCUBI via MATLAB or Simulink, an industry PC and B&R Automation Studio software are included
/PROFIBUS	PROFIBUS DP interface operating at 100Hz for remote programming.
/PROFINET	PROFINET interface operating at 100Hz for remote programming.
/ANALOGUE	0-10V analogue interface operating at 100Hz for remote programming.
/ANALOGUE-IPLUS	High speed 0-10V analogue interface with access to I+ controller for remote programming. The interface operates at 250Hz.
/HSCAN	High speed CAN bus interface with cycle time of 1kHz for specifying setpoints (not possible when 2× systems are operating in parallel)
/ETHERCAT	EtherCAT interface operating at 100Hz for remote programming.
/SIM	Simulation mode allowing the LAB-SCUBI to emulate electrical characteristics of a battery pack.
/SIM-TEST	Allows the LAB-SCUBI to be switchable between battery testing mode and battery simulation mode.

HIGHLIGHTED OPTION

BATTERY EMULATION (/SIM)

When testing battery powered devices, the LAB-SCUBI can also be installed with a battery simulation mode (/SIM) instead of the standard battery tester mode. Where you require to both test and emulate batteries, the system can be installed with both operating modes (/SIM-TEST), which are user switchable between the two. The battery simulation mode provides users with the benefits of:

+ Low voltage dip during current transients
+ Output filter with higher capacitance
+ Control mode: voltage (CV)



ISOLATION, SAFETY & PROTECTION

STANDARD FEATURES

TECHNICAL DATA	
Isolation (Primary/Secondary)	5.3kVdc
Isolation (Primary/Case)	2.8kVdc
Isolation (Secondary/Case)	2.8kVdc (models ≤600Vdc), 3.1kVdc (models >600Vdc)
Short Circuit Behaviour	Short circuit proof I_K <3kA (models <1000A), I_K <8 kA (1000A models)
Protections	Over voltage protection, under voltage protection, over temperature protection, over current protection
Safety	EN ISO 13849-1
Basic Standard	EN 62040
EMC	EN 61000-2-4 grid distrubances, EN 61000-6-2 interference immunity, EN 61000-6-4 interference emission, EN 61800-3 cat C2 (A1) variable - speed electrical drives

ISOLATION, SAFETY & PROTECTION

HIGHLIGHTED STANDARD FEATURES

STOP BUTTON

The cabinet of the LAB-SCUBI is built with a black stop button as standard. For a complete system shutdown, an emergency stop circuit is provided which meets performance level d according to EN ISO 13849-1. A red emergency stop button is optionally available.

OVP, UVP, OCP & OTP PROTECTION

Over voltage and over current protection limits can be adjusted to help safeguard sensitive loads. An under voltage limit can be also be user set to prevent a deep discharge which could potentially damage a battery pack.

OPTIONS

CODE	DESCRIPTION
/PLe	System rated to Performance Level e.
/FLOAT	4 potential free contacts for remote signalling and monitoring of system state (not safety rated).
/FLOAT-E-STOP	Safety rated (PLd to EN 13849) relay interface for signalling E-Stop activated.
/FLOAT-STOP	Safety rated (PLd to EN 13849) relay interface for signalling stop activated.
/FLOAT-CONTACT	Safety rated (PLd to EN 13849) relay interface for signalling DC contactors are open.
/DC-1000A-1000V	2 × DC disconnectors rated at 1500V/1000A performance level D.
/DIODE-1000	Diode providing protection up to 1000A/1000V for the device under test. The diode can be built into the LAB-SCUBI cabinets or provided in a separate cabinet. Dimensions are available on request.
/DCU-2-500	Protection unit which discharges energy from a device under test into a resistor when the output of the LAB-SCUBI is turned off. Resistance of 2Ω at up to 500kW is switched via a thyristor. The discharge unit also functions when the emergency stop is pressed.
/DCU-2-670	Protection unit which discharges energy from a device under test into a resistor when the output of the LAB-SCUBI is turned off. Resistance of 1.5Ω at up to 670kW is switched via a thyristor. The discharge unit also functions when the emergency stop is pressed.
/E-STOP	Red emergency stop mushroom button on cabinet door.
/DOOR-STOP	Door fitted interlock. The LAB-SCUBI system shuts down when the cabinet door is opened.
/S-TIME	Change of safe shutdown time between 0.5s to 100s (standard is 5s) when emergency stop / stop is activated
/DOOR-LOCK	Door fitted interlock. Opening of doors is only possible when AC mains switch is in OFF position. As long as doors are opened, system cannot be started.
/ISOMETER	Isolation monitoring device linked into safety system.

HIGHLIGHTED OPTIONS

BLOCKING DIODE

A blocking diode is available to provide protection for the device under test against any back EMF. This is particularly useful to prevent damage to unidirectional power sources such as fuel cells. The device provides protection up to 1000A and comes in its own wheeled cabinet with 2 voltmeters to measure both sides of the diode assembly.

DISCHARGE UNIT

Discharge units are available as an additional safety feature. When the DC output is turned off, energy from the device under test will be discharged into a resistor at up to 500kW per second. This ensures that there is no residual energy on the DC link when disconnecting a device under test. This feature also works when the emergency stop button is pressed.

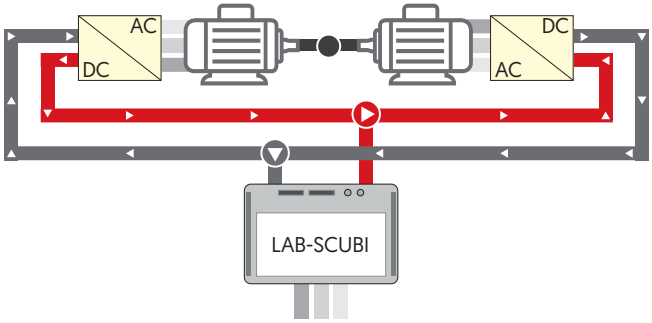
DC DISCONNECTORS

DC contactors are available that are linked to the safety system as standard. If the emergency stop is triggered the contactors open. They are designed to be operated under load and have an expected lifetime of 10,000 switch cycles under load.

COMMON LAB-SCUBI APPLICATIONS

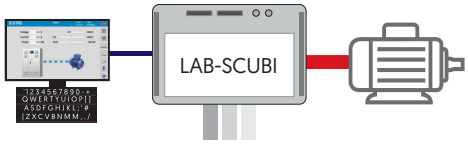
FEEDING LOSSES IN DYNAMOMETERS

The wide operating ranges of the LAB-SCUBI are ideal for operating two dynamometers back to back in a closed circuit, as they feed DC energy into the loop to compensate for losses in the circuit. Rapid response times allow the power supply to react quickly to current demand, which is especially important when testing motorsport vehicles during fast step changes from acceleration and deceleration.



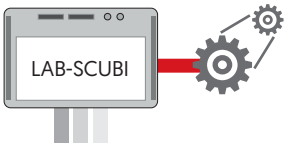
TESTING ELECTRIC DRIVES

LAB-SCUBI systems can be optionally built with a high level of output capacitance, to improve stability when operating in constant voltage mode. This is particularly useful to assist the very fast peak demand of current when testing electric drives. Some electric drives are susceptible to damage if the voltage drop is too low, so a stable voltage is often vital to prevent this condition occurring.



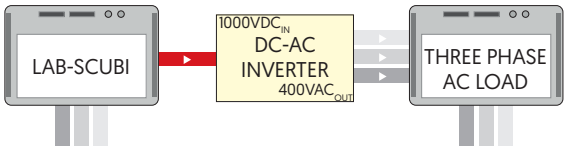
TESTING FLYWHEELS

LAB-SCUBI power systems are ideal for the production testing of flywheels. The bidirectional nature of each system allows them to actively decelerate the flywheel at the end of testing. This increases efficiency, as the flywheel doesn't have to freely spin and stop before the next one is tested.



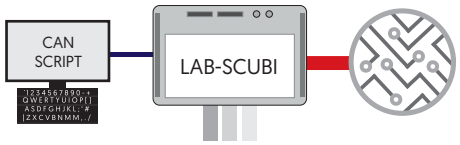
INVERTER/CONVERTER TESTING

The DC input of a power conversion device can be replicated. The influence that variables, such as line voltage variation, have on performance can be isolated and tested. This allows optimum operating conditions to be characterised to improve efficiency and performance.



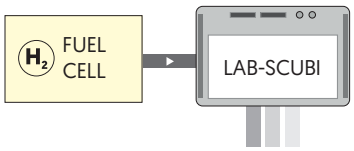
COMPONENT LIFETIME TESTING

The LAB-SCUBI can create operating conditions which electrical systems will be subjected to in real world use. By using a computer interface, an automated test routine can be written and repeated on a controlled loop. Potential degradation issues later in the products lifetime can be identified and rectified. Quality testing can also be performed, to ensure that components are working as expected before they leave the manufacturing facility.



FUEL CELL LOADING

When used as an electronic load, the LAB-SCUBI replaces fuel cell powered components, emulating user discharge behaviour. When load testing, the LAB-SCUBI recycles sink energy back to the local grid. This allows companies to use the energy produced from their own fuel cells during testing, to power other on-site equipment.



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ETPS
ELECTRONIC TEST & POWER SYSTEMS

Tel: +44 (0) 1246 452909
Sales: 0800 612 95 75
sales@etps.co.uk
www.etps.co.uk

ETPS Ltd
Unit 14, The Bridge
Beresford Way, Chesterfield
S41 9FG

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