

RENTAL LAB-GSS

BIDIRECTIONAL DC SYSTEMS UP TO 192kW



POSITIVE PROBLEM SOLVING **+ =**

The LAB-GSS is able to operate as either a DC source or an electronic DC load. This integrated approach features high dynamics enabling the user to switch quickly between quadrants.

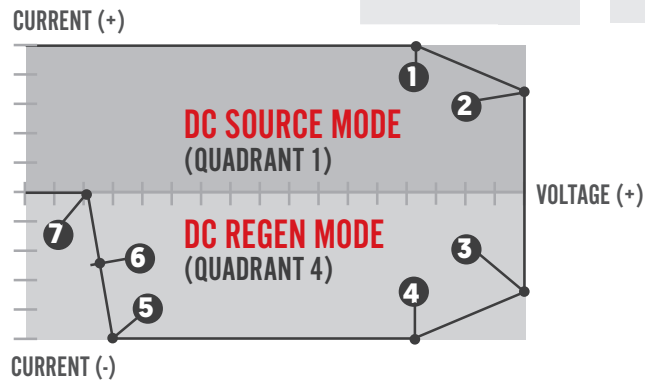
When sinking energy from the unit under test the LAB-GSS automatically inverts the DC to AC and synchronises this output to the grid. A variety of control methods are available. As standard each 32kW module is built with isolated analogue and RS-232 interfaces. Front panel control and display along other interfaces such as CAN are installed on selected modules.

- + Mains Regeneration of the DC Sink Energy**
- + Excellent GUI with Built-in Scope Function**
- + Function Generator with V/I Capability**
- + Battery Cycling and Emulation Software**
- + Stackable up to 1500V/192kW**
- + Adjustable Internal Resistance**

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SELECTION TABLE



MODELS

Part Number	Maximum Power	Q1 Source Voltage	Q4 Sink Voltage*	Current Range	Internal Resistance Range
LAB-GSS 32-65-r	32kW	0 - 65Vdc	6 - 65Vdc	0 to ± 600A	0 to 110mΩ
LAB-GSS 32-500-r	32kW	0 - 500Vdc	40 - 500Vdc	0 to ± 80A	0 to 6250mΩ
LAB-GSS+TC 64-65-r**	+64kW / -32kW	0 - 65Vdc	6 - 65Vdc	0 to +1200A / 0 to -600A	0 to 110mΩ
LAB-GSS 64-500-r	64kW	0 - 500Vdc	40 - 500Vdc	0 to ± 160A	0 to 6250mΩ
LAB-GSS 64-1000-r	64kW	0 - 1000Vdc	80 - 1000Vdc	0 to ± 80A	0 to 6250mΩ
LAB-GSS 96-500-r	96kW	0 - 500Vdc	40 - 500Vdc	0 to ± 240A	0 to 6250mΩ
LAB-GSS 96-1500-r	96kW	0 - 1500Vdc	120 - 1500Vdc	0 to ± 80A	0 to 6250mΩ
LAB-GSS 128-500-r	128kW	0 - 500Vdc	40 - 500Vdc	0 to ± 320A	0 to 6250mΩ
LAB-GSS 128-1000-r	128kW	0 - 1000Vdc	80 - 1000Vdc	0 to ± 160A	0 to 6250mΩ
LAB-GSS 160-500-r	160kW	0 - 500Vdc	40 - 500Vdc	0 to ± 400A	0 to 6250mΩ
LAB-GSS 192-500-r	192kW	0 - 500Vdc	40 - 500Vdc	0 to ± 480A	0 to 6250mΩ
LAB-GSS 192-1000-r	192kW	0 - 1000Vdc	80 - 1000Vdc	0 to ± 240A	0 to 6250mΩ
LAB-GSS 192-1500-r	192kW	0 - 1500Vdc	120 - 1500Vdc	0 to ± 160A	0 to 6250mΩ

* The maximum current that can be taken derates as the voltage reduces beneath the lower level. Please see the operating range table below.

** Comprised of 1 × bidirectional LAB-GSS 32-65 module and 1 × unidirectional LAB-TC 32-65 module in parallel connection.

OPERATING RANGES

Part Number	Point 1 [Q1]	Point 2 [Q1]	Point 3 [Q4]	Point 4 [Q4]	Point 5 [Q4]	Point 6 [Q4]	Point 7 [Q4]
LAB-GSS 32-65	53V / 600A	65V / 492A	65V / -492A	53V / -600A	6V / -600A	4V / -300A	2V / 0A
LAB-GSS 32-500	400V / 80A	500V / 64A	500V / -64A	400V / -80A	40V / -80A	25V / -32A	15V / 0A
LAB-GSS+TC 64-65	53V / 1200A	65V / 984A	65V / -492A	53V / -600A	6V / -600A	4V / -300A	2V / 0A
LAB-GSS 64-500	400V / 160A	500V / 128A	500V / -128A	400V / -160A	40V / -160A	25V / -64A	15V / 0A
LAB-GSS 64-1000	800V / 80A	1000V / 64A	1000V / -64A	800V / -80A	80V / -80A	50V / -32A	30V / 0A
LAB-GSS 96-500	400V / 240A	500V / 192A	500V / -192A	400V / -240A	40V / -240A	25V / -96A	15V / 0A
LAB-GSS 96-1500	1200V / 80A	1500V / 64A	1500V / -64A	1200V / -80A	120V / -80A	75V / -32A	45V / 0A
LAB-GSS 128-500	400V / 320A	500V / 256A	500V / -256A	400V / -320A	40V / -320A	25V / -128A	15V / 0A
LAB-GSS 128-1000	800V / 160A	1000V / 128A	1000V / -128A	800V / -160A	80V / -160A	50V / -64A	30V / 0A
LAB-GSS 160-500	400V / 400A	500V / 320A	500V / -320A	400V / -400A	40V / -400A	25V / -160A	15V / 0A
LAB-GSS 192-500	400V / 480A	500V / 384A	500V / -384A	400V / -480A	40V / -480A	25V / -192A	15V / 0A
LAB-GSS 192-1000	800V / 240A	1000V / 192A	1000V / -192A	800V / -240A	80V / -240A	50V / -96A	30V / 0A
LAB-GSS 192-1500	1200V / 160A	1500V / 128A	1500V / -128A	1200V / -160A	120V / -160A	75V / -64A	45V / 0A

MODULARITY (MASTER/SLAVE)

Up to six LAB-GSS 500V modules are available in our rental range. These can be arranged in series, parallel or matrix array configurations. Each module is able to operate independently, with inbuilt system comms allowing users to switch between various set-ups. Additionally, 65V bidirectional LAB-GSS modules can be used in parallel with unidirectional LAB-TC modules for high current source applications [such as emulating cold starts]. This particular configuration is not in a master/slave connection.

The modular approach is useful for test houses and research labs who regularly test different sized power devices. Individual modules can be used for the day to day testing of multiple small devices, then grouped together for larger projects.

Our rental systems can be combined in series, parallel or matrix configurations with any LAB-GSS modules you have previously purchased, providing they have the same nominal outputs. Up to 64 modules can be connected in this way. This allows any short term requirements outside of usual operating ranges to be met.

65V MODULE CONFIGURATIONS

PARALLEL CONNECTION

0 to ±600A 0 to +1200A
0 to -600A

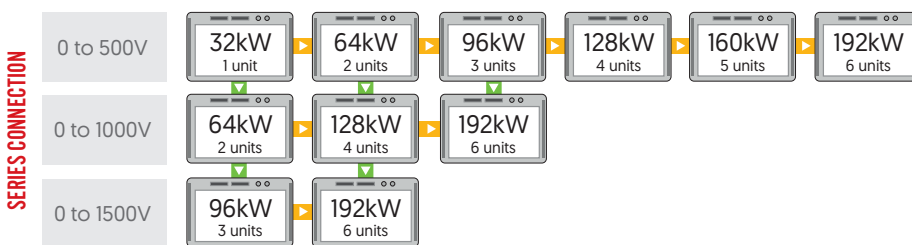
0 to 65V



500V MODULE CONFIGURATIONS

PARALLEL CONNECTION

0 to ±80A 0 to ±160A 0 to ±240A 0 to ±320A 0 to ±400A 0 to ±480A



FORM FACTOR AND ENCLOSURES

A series of cabinets are used to make deployment of our high power LAB-GSS and LAB-TC rental modules simpler, quicker and safer.

Among the available safety features is a status indicator that alerts users of any residual energy on the DC link that is greater than 15V. This operates even if the mains power is turned off. Another indicator assesses the quality and correct rotation of the AC input voltage and illuminates if correct. Panel mounted DC sockets are both mechanically keyed and colour coded to eliminate any possible user errors.

A rack mounted switch panel is provided with selected cabinets, allowing users to switch between parallel and series configurations. Specific features vary per cabinet, please contact ETPS to discuss an exact cabinet.

Common features include:

- + All 4 Heavy Duty Castors with Locking Function
- + Passive Indication of Connected Line Voltage
- + Passive Indication of DC Output Voltage
- + 5m DC Cable Sets with Ring Terminals
- + Panel Mounted Emergency Stop



OPERATING RANGES AND FEATURES

TECHNICAL DATA (PER MODULE)

GENERAL	
AC Line Voltage / Current Relationship	3 × 380VAC ± 10% / 54Arms (per 32kW module) 3 × 400VAC ± 10% / 51Arms (per 32kW module) 3 × 415VAC ± 10% / 49Arms (per 32kW module) 3 × 440VAC ± 10% / 47Arms (per 32kW module) 3 × 460VAC ± 10% / 45Arms (per 32kW module) 3 × 480VAC ± 10% / 43Arms (per 32kW module)
Line Frequency	50Hz ± 0.5Hz for UK (48 - 62Hz possible)
Mains Connection Type	3L + PE (no neutral)
Powerfactor (Q1 Active / Q4 Mode)	≥0.99
Protective Conductor Current at 50Hz	<20mA
Touch Current Unweighted	<20mA
Touch Current Weighted	<2mA
Isolation (Line to Case / Logic)	1670VDC 1s
Isolation (Output to Case / Logic)	65V module: 2060VDC 1s 500V modules: 2540VDC 1s
Isolation (Transformer)	4800VAC
Isolation Output to Case	65V module: >10.8MΩ (35nF per DC bar) 500V modules: >10.8MΩ (13.6nF per DC bar)
Isolation Output to Case (-bar and +bar)	65V module: +680VDC / -680VDC 500V modules: +1000VDC / -1000VDC
EMC Emissions and Immunity	EN61000-6-4 & EN61000-6-2
Islanding for Generation to Public Grid	EN50438 & VDE0126
LVD for Power Installations	EN50178
Voltage Range	0 to 100% of V _{max}
Current Range	0 to ± 100% of I _{max}
Power Range	0 to ± 100% of P _{max}
Internal Resistance Range	See selection table
Switchable Output Capacitance	65V module: 6mF / 17.2mF 500V modules: 0.09mF / 0.9mF
Standard Interfaces	Analogue and RS-232
Available Interfaces on Request	HMI, USB, Ethernet and CANmp
Voltage Sense Compensation	0 - V _{MAX}
Efficiency	Up to 92%
Load Regulation (CV, CC)	<± 0.1% of full scale value
Line Regulation (CV, CC)	<± 0.1% of full scale value
Temperature Coefficient (CV)	<0.02% of full scale value per°C
Temperature Coefficient (CC)	<0.03% of full scale value per°C
Response Time [Typical 10-90% Load Step Change]	1.1ms (with an ohmic load, at constant line and temperature)
Over Voltage Protection	0 - 110% of V _{MAX}
Over Current Protection	0 - 110% of I _{MAX}
DC Ripple (≤300Hz)	65V module: <0.2%Vpp (<0.05%Vrms) of full scale value 500V modules: <0.5%Vpp (<0.1%Vrms) of full scale value
DC Noise (40kHz-1MHz)	65V module: <0.2Vpp (<0.05Vrms) 500V modules: <1Vpp (<0.2Vrms)
Stability (CV, CC)	<± 0.05% of full scale value
Recommended Operating Temperature	5 - 40°C
Weight (per Module)	97kg, flight case weight is available on request
Connection to UK Grid	ER G59-3 tested
Dimensions (per Module)	19" × 9U × 634mm (W × H × D), flight case dimensions are available on request

Extended Technical Data is Available on Request

LAB-TC TECHNICAL DATA

GENERAL	
Operating Modes	Constant Voltage (0 - 100% of V_{MAX}) Constant Current (0 - 100% of I_{MAX}) Constant Power (5 - 100% of P_{MAX})
Input Voltage	3 × 360 - 440 VAC
Line Frequency	48 - 62Hz
Mains Connection Type	3L + PE (no neutral)
Internal Resistance Range	Adjustable $\Omega_{MAX} = [V_{NOM} / I_{NOM}]$
Interfaces	Analogue & RS-232
Remote Sense	0 - $V_{MAX} + 2\%$
Efficiency	Up to 95%
Load Regulation (CV, CC)	<± 0.1%
Line Regulation (CV, CC)	<± 0.1%
Response time (10-90%)	<2ms
Over Voltage Protection	0 - 110% of V_{MAX}
Over Current Protection	0 - 110% of I_{MAX}
Output Ripple (300Hz Vrms)	<0.4%
Output Noise (40kHz-1MHz)	<0.1 Vrms
Stability (CV, CC)	<± 0.05%
Operating Temperature	5 - 40°C
Temperature Coefficient (CV)	0.02% per °C
Temperature Coefficient (CC)	0.03% per °C
Temperature Coefficient (CV)	<0.02% of full scale value per°C
Temperature Coefficient (CC)	<0.03% of full scale value per°C
Dimensions (Module Only)	19" × 9U × 570mm (W × H × D), specific flight case dimensions are available on request
Weight (Module Only)	64kg, specific flight case weight is available on request

A more detailed technical summary is available on request

HIGHLIGHTED LAB-GSS AND LAB-TC FEATURES

SENSE COMPENSATION

Sense plus terminals are built into modules for the connection of sense wire which compensates for voltage drops in the load lines. This has a number of advantages over traditional sense. It is permitted to interrupt the load line during operation (voltage on). The maximum voltage drop compensation is adjustable. The voltage difference between the module output and sensing point is monitored. If a set limit is exceeded, the module shuts off. This is particularly useful for applications with long cables often prone to unwanted voltage drops.

INTERNAL RESISTANCE RANGE

Each module is built with a user programmable internal resistance range as standard. This makes the power supplies ideal for simulating the output of energy storage devices such as battery packs, fuel cell stacks and super capacitors. The exact range varies by module and can be viewed in the selection table.

INTERFACES AND CONTROL

STANDARD RS-232 INTERFACE

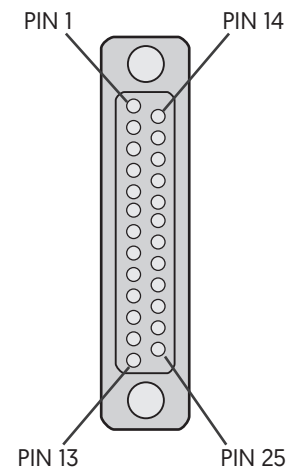
The RS-232 interface is configured as a Sub-D 9 pin connector (female) and is located on the front panel. The TopControl GUI is operated via RS-232. The software runs on Windows and allows the user to control, measure and configure the power system.

TECHINCAL DATA	
Isolation to Electronics and Earth Configuration	125 Vrms
Baud Rate	38,400 baud
Resolution (programming & readback)	0.025% FS [for V & I], 0.1% FS [for P & Ri]

STANDARD ANALOGUE INTERFACE

The control port is configured as a Sub-D 25 female connector and is located on the rear panel. It allows output values to be set and read proportionally using a 0-10VDC analogue signal. Digital inputs and outputs enable various functions such as the interlock and output ON/OFF. A 10VDC reference is provided for analogue control. Digital functions are switched via a high/low signal. A 24VDC supply voltage is provided for these functions. The control port is labelled X105.

TECHINCAL DATA	
Isolation to Electronics and Earth	125 Vrms
Unit Ready/Error	Relay Contact
Ouput Voltage ON / Warnings	Relay Contact
Actual Voltage Readback 0 - 100%	0 to 10V
Actual Current Readback -100% to 100%	-10V to 10V
Resolution (programming & readback) for V, I, P, Ri	0.2% FS
Output Voltage Off/On	0/24VAC/DC
2 Digital Application Inputs	0/24VAC/DC
Interlock Circuit	0/24VDC
Voltage Setting 0 to 100%	0 to 10V
Current Setting -100% to 100%	-10V to 10V
Power Setting 0% to 100%	+10V to 0V
Internal Resistance Setting 0% to 100%	0V to 10V



PIN	SIGNAL	I/O	DESCRIPTION
1	AGND	I	Analogue ground for pins 2–4, 14–16
2	VREF	I	Voltage setpoint input 0–10 V
3	IREF	I	Current setpoint input 0–10 V
4	IACT	O	Current feedback output 0–10 V
5	0VDC	O	0 VDC I/O ground for pin 25 ¹
6	+10VDC	O	Analogue reference voltage
7	COM	I	[Connected to pin 17] 0VDC DigIn; common ground for pins 8–9, 18–20, 24
8	APP_DIGITALIN_4; CLEAR_ERROR	I	Digital input 0-2V /10-24V DC
9	VOLTAGE_ON	I	Digital input 0-2/10-24V DC
10	OK/ALARM_b ²	O	Relay output 1 normally open
11	OK/ALARM_a ²	O	Relay output 1 common
12	RUN_b ²	O	Relay output 2 normally open
13	RUN_a ²	O	Relay output 2 common
14	PREF	I	Power limit analogue input 0–10 V
15	RREF	I	Ri-simulation analogue input 0–10 V

PIN	SIGNAL	I/O	DESCRIPTION
16	VACT	O	Voltage feedback output 0–10 V
17	COM	I	{Connected to pin 7} Common ground to pins 8–9, 18–20, 24
18	APP_DIGITALIN_1	I	Digital input [low] 0-2 VDC/[high] 10–28 VDC
19	APP_DIGITALIN_2	I	Digital input [low] 0-2 VDC/[high] 10–28 VDC
20	APP_DIGITALIN_3; ANAOG_REFERENCE_SELECT	I	Digital input [(low) 0-2 VDC/[(high) 10–28 VDC Analogue reference select
21	WARN_a ²	O	Relay output 3 normally open
22	WARN_b ²	O	Relay output 3 normally closed
23	WARN_c ²	O	Relay output 3 common
24	INTERLOCK_IN_+	I	Input Interlock +
25	+24VDC	O	24VDC I/O Aux power output 24 VDC, max. 0.2 A

¹ Pin 5 [0 VDC] is used as the reference earth for pin 25 [24 VDC] and is connected internally to the equipotential bonding via a 1 kΩ resistor to earth.

² Maximum switching current: 1 A; maximum switching voltage: 24 V.

Other interfaces are available with rental modules on request, please contact ETPS to discuss a specific control method.

SOFTWARE/SOFT TOOLS

STANDARD TOP CONTROL GUI

All rental LAB-GSS modules come with a simple and intuitive TopControl operating GUI. Live values of the power system are displayed graphically along with any warning and error messages. The software provides a variety of second level parameters, ideal for users who like to optimise their test processes. In standard user mode the operator can remotely program set values, enable voltage output as well as the ability to analyse different variables including set and actual values via the integrated scope.

The scope function can simultaneously record up to 8 system variables. Recording can be started manually or by a defined trigger event from any variable of the system. All actual and set values (currents/voltages/power/internal resistance) can be recorded. Other recordable items include system temperatures, intermediate DC circuit, low voltage auxiliary power supplies, error related values and variables from the controller section.

A password protected section is available to the advanced user and service technician. In addition to the standard functions the authorised user is able to:

- + Program linear ramp functions at start up and set value steps during operation
- + Configure multi-unit operation
- + Program the PID controller parameters
- + Program the unit's limit values
- + Calibrate and adjust values as necessary
- + Update the firmware



FUNCTION GENERATOR

Complex DC waveforms can be implemented through an embedded function generator, available with most modules. The highly programmable nature of the function generator allows users to plot out exact waveforms. This is often advantageous when emulating a power device with a very specific behaviour profile. For example, when quality testing fuel cell powered equipment, the specific behaviour of a discharging fuel cell can be programmed and replicated.

As well as custom shapes, standard square, sawtooth and sine waveforms can be plotted against time. Voltage/current and voltage/power relationships can also be programmed where necessary. Parametric programming is possible, where instead of the time axis, an input variable (V_{IN} , I_{IN} or P_{IN}) can be selected.



APPLICATION SPECIFIC GUIs

An application GUI can be used to program hardware to replicate real world behaviour of a power component. This allows specific sections of a circuit to be isolated and researched. Hard to replicate conditions, such as as cranking curve from a cold start, can also be programmed and repeated.

A selection of GUIs below are available with rental LAB-GSS modules. Please enquire to ETPS if you require a specific program for your testing.

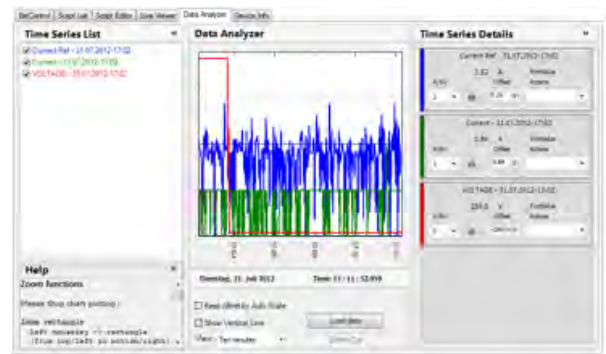
BATTERY EMULATION (/BATSIM)

BatSim provides a convenient method for the LAB-GSS to emulate different sized battery stacks. Nearly all relevant electrical characteristics are programmable, including the number of cells, energy capacity, cut off limits, chemistry type and nominal voltage.



ELECTRIC DRIVE CYCLING (/BATCONTROL)

Drive cycle tests can be implemented using BatControl. Previous data obtained from a test track can be imported and recreated, allowing the LAB-GSS to simulate a real world driving test inside a lab environment. Battery and capacitor charge/discharge profiles can also be implemented through the GUI.



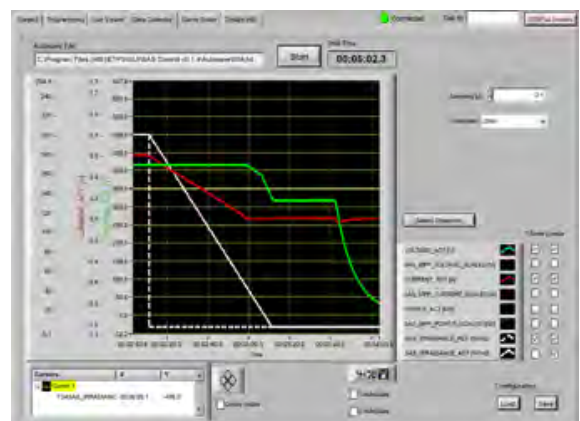
CAPACITOR SIMULATION (/CAPSIM)

The bidirectional characteristics of a real capacitor stack can be emulated when CapSim is installed with LAB-GSS modules. Number of cells in series/parallel, state of charge, cell cut off limits, dynamic capacitance and resistance are programmable.



SOLAR ARRAY SIMULATION (/SAS)

SASControl software has all EN 50530 tests pre-installed. The GUI allows users to edit irradiance, temperature and amplitude values. Previous tests have been conducted using over 400,000 individual data points, with more possible.



NEW LAB-GSS SYSTEMS

If you are looking to purchase a system, new LAB-GSS modules can be found in our Bidirectional DC range. A selection of options are available including integrated safety relays, an extended internal resistance range, reverse polarity protection, as well as a variety of interfaces. Ruggedised modifications are possible to guard against shock, vibration and humidity for harsh environments.

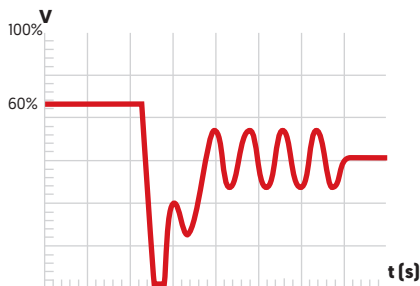
Where necessary, units can be treated to a laboratory rack or flight case integration. Common options include mains cables, passive indication of any residual DC voltage, isolation monitoring of DC cables and a panel mounted emergency stop. Switch panels with removable DC links can be fitted to simplify reconfiguration between series, parallel or independent use.



COMMON LAB-GSS APPLICATIONS

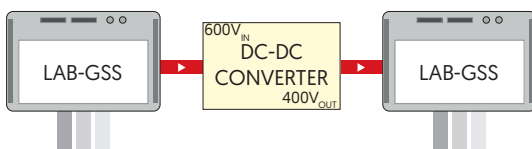
CRANKING CURVE TESTING

Electrical components within a vehicle's subsystem must be able to withstand a wide range of input voltage surges and drops during a start-up. The LAB-GSS can accurately recreate these conditions within a lab environment. This increases reproducibility and accuracy of results when compared to using real batteries. Hard to replicate conditions such as voltage cranking during a cold start can be achieved. Voltage/current and voltage/power relationships can be programmed against time where necessary.



INVERTER/CONVERTER TESTING

The DC input of virtually any 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.



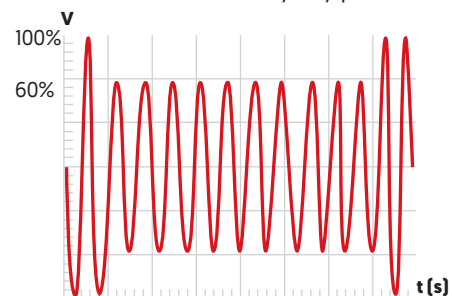
ISO 16750-2 TESTING

65V LAB-GSS modules can be programmed to perform a number of ISO 16750-2 tests. The embedded function generator allows the modules to implement the voltage/time relationships which many of the strict standards require. Specific tests include:

- + 4-5: Slow Decrease and Increase of Supply Voltage
- + 4-6-1: Discontinuities in Supply Voltage
- + 4-6-2: Reset Behaviour at Voltage Drop
- + 4-6-3: Starting Profile
- + 4-6-4: Load Dump
- + 4-9-1: Single Line Interruption
- + 4-10: Short Circuit Protection

VOLTAGE DROPS & INTERRUPTS

In electronic systems sudden voltage interruptions may cause unexpected behaviour. Supply line disturbances may have several causes, including an additional switch on of large capacitive loads parallel to the supply line or a short circuit caused by loads sharing the supply. The LAB-GSS can generate many complex DC waveforms to test devices under realistic conditions to identify any potential issues.



Every effort is made to ensure that the information provided within this technical summary is accurate. However, ETPS Ltd must reserve the right to make changes to the published specifications without prior notice. Where certain operating parameters are critical for your application we advise that they be confirmed at the time of order. ETPS Ltd specialises in modifying its proven platforms to suit your needs. Please contact our office if your requirement is non-standard. Please note that your actual unit may differ from those shown.



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WE ARE
POSITIVE
PEOPLE
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ETPS engineer electronic power supply and testing systems. Our problem solving skills provide the spark of innovation to some of the world's leading technology brands.



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POSITIVE PROBLEM SOLVING