RENTAL
LAB-GSS

ETPS
ELECTRONIC TEST & POWER SYSTEMS

HIGH CURRENT BIDIRECTIONAL DC SYSTEMS

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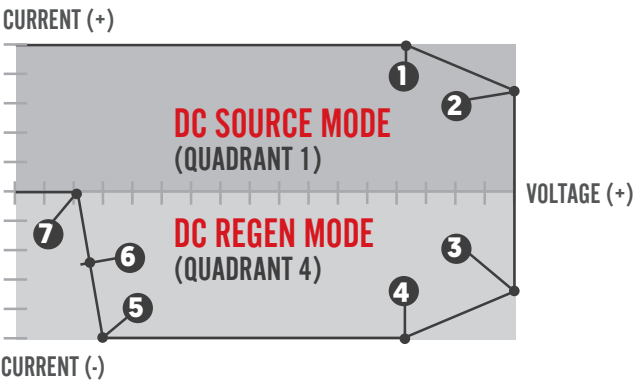
When sinking energy from the unit under test the LAB-GSS automatically inverts the DC to AC and synchronises this output to the grid. A variety of control methods are available. As standard each 32kW module is built with isolated analogue and RS-232 interfaces. Front panel control and display along other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

CONTENTS

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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+TC 64-65-r**	+64kW / -32kW	0 - 65Vdc	6 - 65Vdc	0 to +1200A / 0 to -600A	0 to 110mΩ

* 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+TC 64-65	53V / 1200A	65V / 984A	65V / -492A	53V / -600A	6V / -600A	4V / -300A	2V / 0A

MODULARITY (MASTER/SLAVE)

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.

Our rental systems can be combined in series, parallel or matrix master/slave 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	32kW 1 unit	64kW 2 units

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.

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

LAB-GSS TECHNICAL DATA

GENERAL	
AC Line Voltage / Current Relationship	3 × 380VAC ± 10% / 54Arms 3 × 400VAC ± 10% / 51Arms 3 × 415VAC ± 10% / 49Arms 3 × 440VAC ± 10% / 47Arms 3 × 460VAC ± 10% / 45Arms 3 × 480VAC ± 10% / 43Arms
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)	2060VDC 1s
Isolation (Transformer)	4800VAC
Isolation Output to Case	>10.8MΩ (35nF per DC bar)
Isolation Output to Case (-bar and +bar)	+680VDC / -680VDC
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 Vmax
Current Range	0 to ± 100% of Imax
Power Range	0 to ± 100% of Pmax
Internal Resistance Range	See selection table
Switchable Output Capacitance	6mF/ 17.2mF
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)	<0.2%Vpp (<0.05%Vrms) of full scale value
DC Noise (40kHz-1MHz)	<0.2Vpp (<0.05Vrms)
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

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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.

1mΩ   3200mΩ

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 ouput 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 1   PIN 14

PIN 13   PIN 25
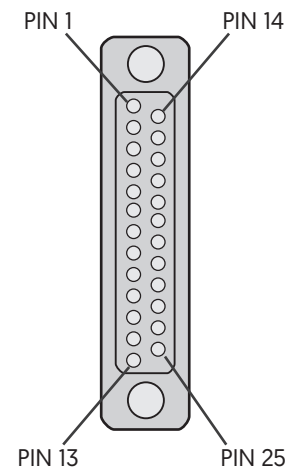
PIN	SIGNAL	I/O	DESCRIPTION
1	AGND	I	Analogue ground for pins 2–4, 14–16
2	VREF	I	Voltage setpoint input 0–10 V
3	IREF	I	Current setpoint input 0–10 V
4	IACT	O	Current feedback output 0–10 V
5	0VDC	O	0 VDC I/O ground for pin 25[1]
6	+10VDC	O	Analogue reference voltage
7	COM	I	(Connected to pin 17) 0VDC 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.

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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 anlyse 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
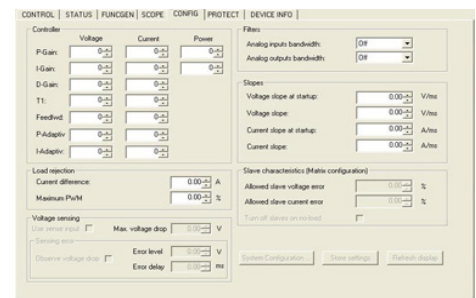
FUNCTION GENERATOR

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.
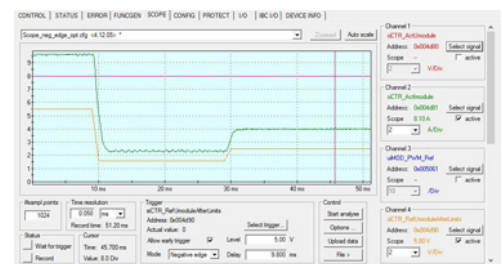
APPLICATION SPECIFIC GUIs

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.
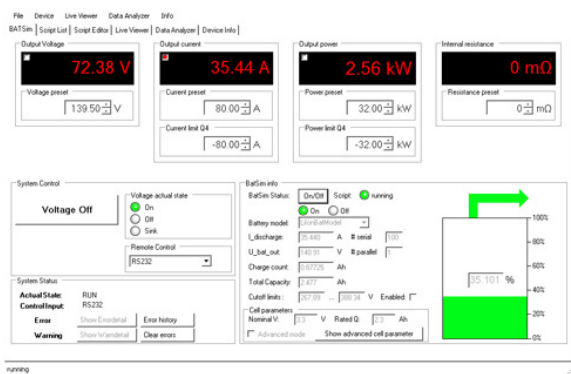
ELECTRIC DRIVE CYCLING (/BATCONTROL)

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.
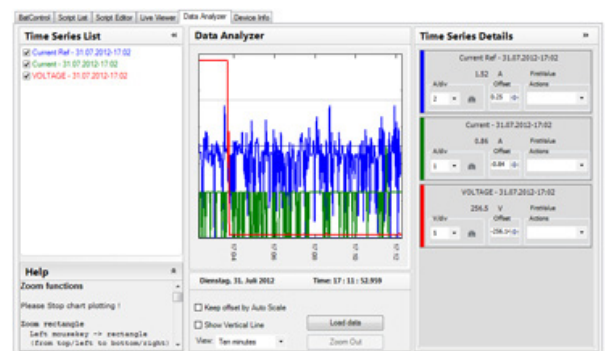

CAPACITOR SIMULATION (/CAPSIM)

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.
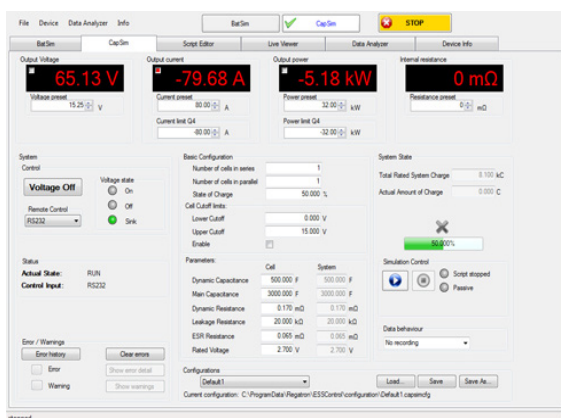
SOLAR ARRAY SIMULATION (/SAS)

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 invidual data points, with more possible.

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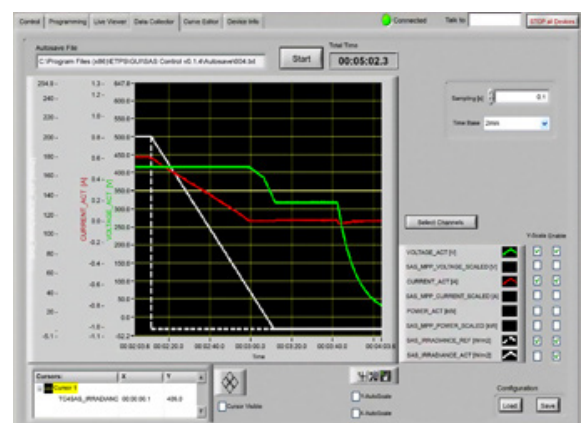
NEW LAB-GSS SYSTEMS

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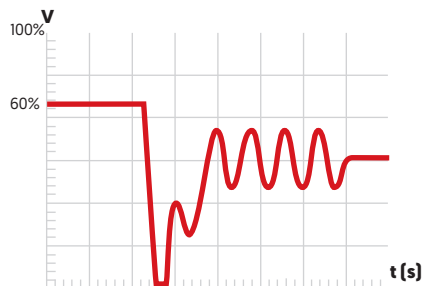
Where necessary, units can be treated to a laboratory rack or flight case integration. Common options include mains cables, passive indication of any residual DC voltage, isolation monitoring of DC cables and a panel mounted emergency stop. Switch panels with removable DC links can be fitted to simplify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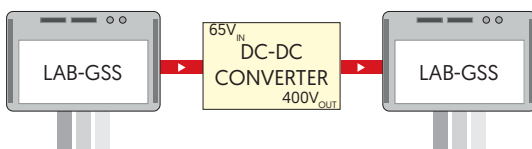
COMMON LAB-GSS APPLICATIONS

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.

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

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.

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.
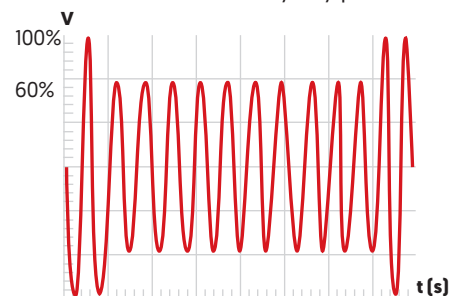
" WE ARE POSITIVE PEOPLE "

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**