

B2C+ ePLUS

Regenerative DC Converter

B2C+ is CINERGIA's solution for Regenerative and Bidirectional DC Test Platforms. Thanks to its unique flexibility, it can be used in multiple applications: Renewable Energy Sources, Energy Storage Systems, Battery Testing and Characterization, Electrical Vehicles, EV Charging Infrastructure, Traction Converters and Avionics

Key features



Bidirectional and Regenerative
Clean grid current: THDi < 3% and PF > 0.98
Same Power in DC and AC

13 models from 7.5kW to 160kW
Parallelization of units to increase the power

Emulation of grid-connected devices:
Loads absorbing energy from grid.
Generators injecting energy to the grid.
Programmable Active/Reactive consumption
Non-linear currents up to CF of 3

Independent phase configuration of:
rms current, phase angle, harmonics, interharmonics,
generation of fast transients ("Current Dips")

Intuitive User Interface
Modbus/Ethernet Open protocol, Labview drivers

What's new

MASTER/SLAVE CONNECTION

up to 8 units using a fiber optics link to increase power/voltage capabilities:

B2C: can be connected in parallel, or serial or serial/parallel

IMPROVED CONTROL

30kHz closed control loop frequency with 300kHz oversampling technique

MORE HARMONICS

50 per phase with 20 free-harmonics, in AC models

DELTA LOAD

added to the star connection, for the EL mode in AC

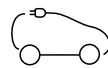
SELECTABLE SLEW RATE FOR DC

for the fastest transients and highest stability

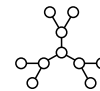
OPTIMIZED RLC MODE

RMS or instantaneous RLC model for anti-islanding test

Main Applications



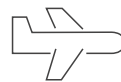
ELECTROMOBILITY



SMARTGRIDS



IEC TESTING



AERONAUTICS



PHOTOVOLTAIC

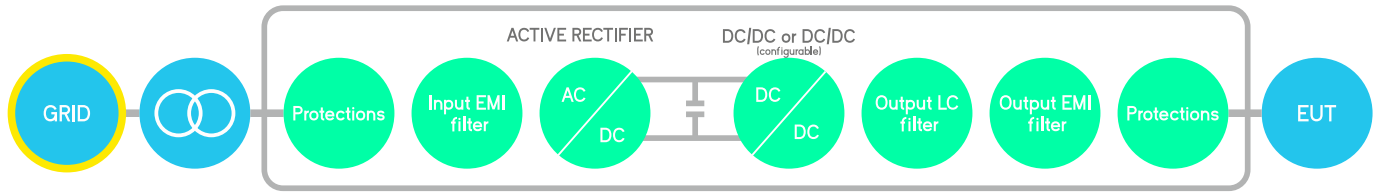


POWER HIL



ePLUS keeps the robustness, ratings and all the functionalities of the PLUS platform and adds the new features described in this datasheet

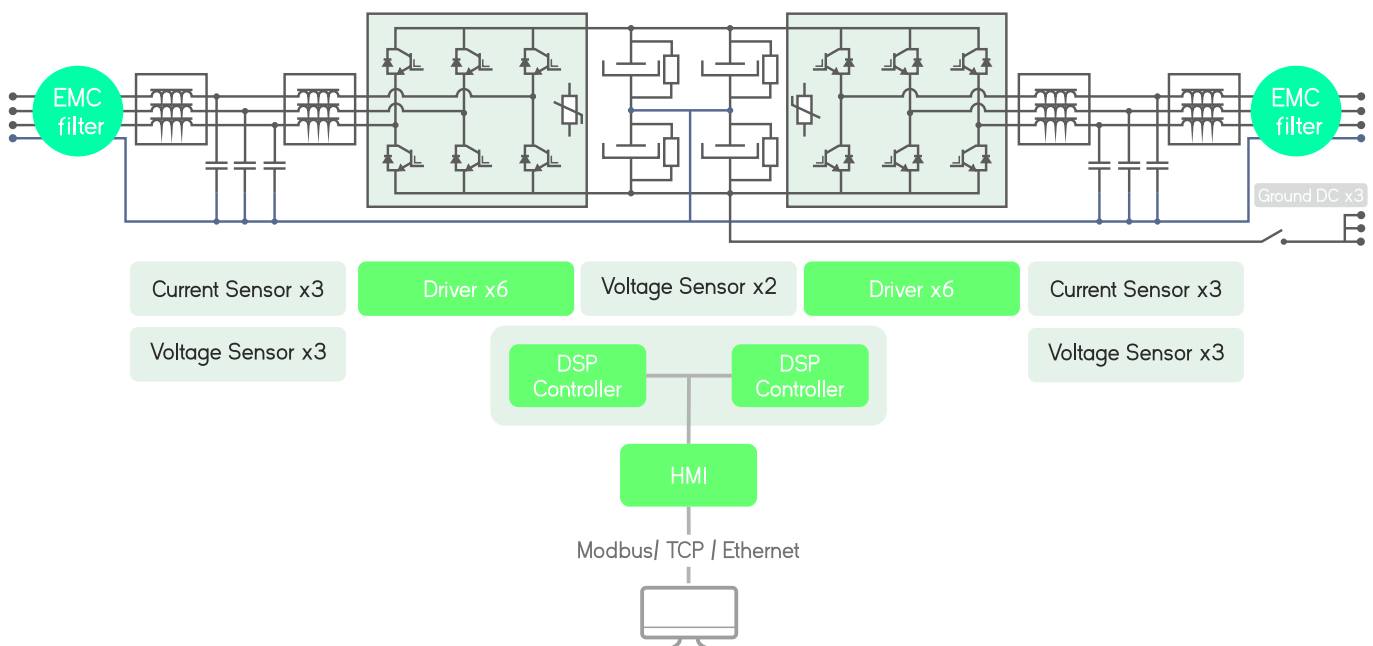
Bidirectional and Regenerative Hardware



The hardware platform is based on a Back-to-Back power conversion topology, formed by two IGBT-based power stages. The grid side stage is an Active Rectifier which produces clean sinusoidal currents with very low harmonic distortion and power factor close to one.

The EUT side stage is in DC, the three independent buck-boost bidirectional legs enable the separated control of three different DC voltages or currents.

Block diagram



Local Interface

Analogue and Digital IO ports

The isolated digital and analogue inputs/outputs permit the connection of the unit to External Controllers and Power Hardware in the Loop systems (option).

4.3" Touchscreen

Allows the local parameterization and command of the device, configuration of the communications link, plots the main signals and enables the local datalogging.

Safety First

The units integrate a local Emergency Stop pushbutton and two signals (input + output) to be connected to the laboratory interlock system. Additionally, the digital outputs can be interfaced to safety tower lights.

Master/Slave

ePLUS is a modular platform enabling the master/slave connection of units with equal power.



Software Interface in DC

DC Operation

This panel allows the user to access all DC setpoints and limits. Thanks to the unique Multichannel feature, each phase can have a different Operation Mode: voltage, current, power, resistance and advanced DC applications. Transition ramps, voltage and current limits can be modified. The limits for sink and source operation are different for safer testing, specially in battery applications.

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DC Sequence

The User Interface Software integrates a Sequence Editor to create automatic test sequences, save them for future use and import them in .csv files. A smart datalogger can be activated from the LCD of the unit to record automatically the resulting voltage and current measurements with a time resolution of 400 ms.

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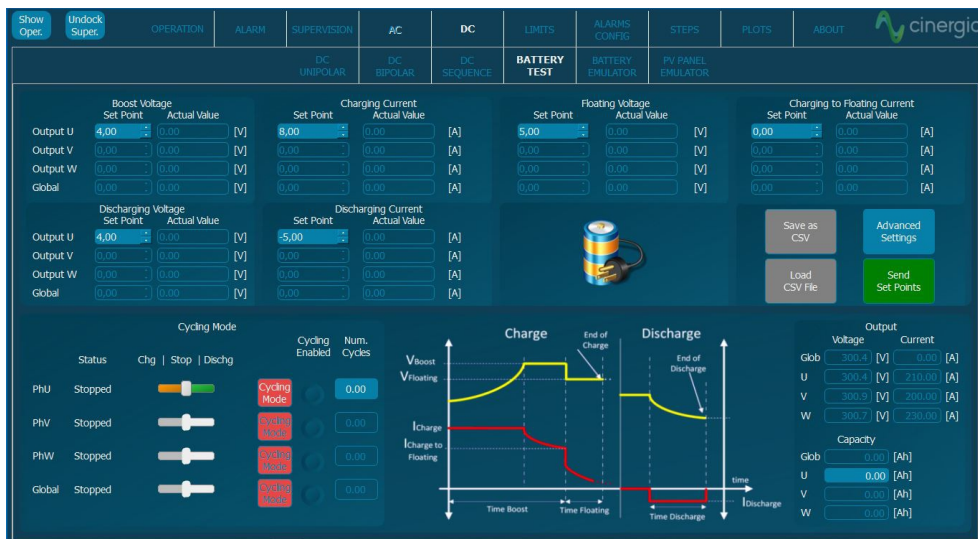
Multichannel

Enabling the Separated Channel Control converts the device in three functionally independent DC Bidirectional Power Supplies, sharing the common negative rail. Each channel can have a different status (ON, OFF, Warning, Alarm), Operation Mode (see Range and Specifications table), Setpoint, Ramp and Limits.

Multichannel

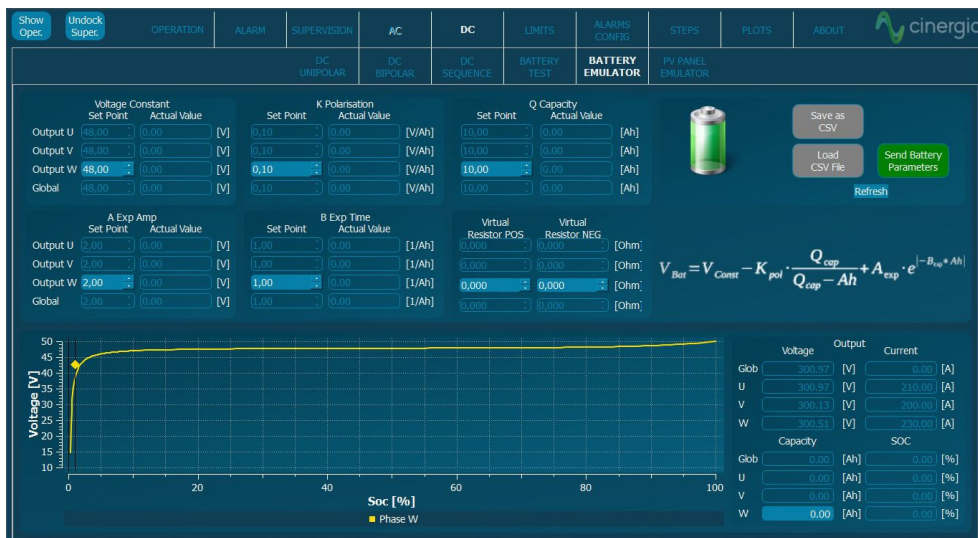
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Advanced DC Applications



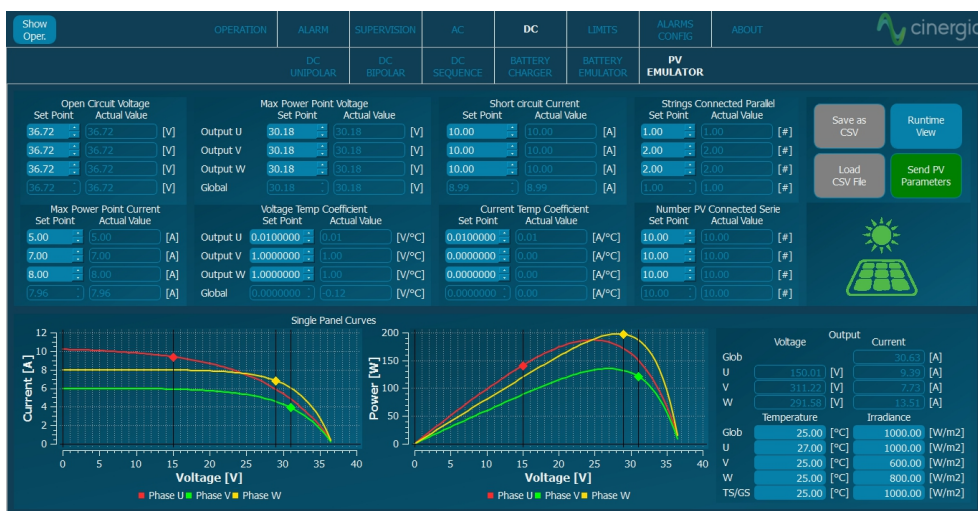
Battery Pack Testing

This functionality enables the user to precisely control the charge, discharge and cycling of a Battery. Basic parameters include the charge/discharge current, fast charge and floating voltages while Advanced parameters add Energy (Ah) and Time as transition conditions. Profiles for each Battery technology can be saved and imported in .CSV files.



Battery Emulation

The B2C+ integrates a mathematical model to emulate the voltage behaviour of a real battery pack. The output voltage will change as a function of the SOC and Current. By configuring the provided parameters, the voltage profile can be adjusted to match different technologies: Lilon, NiMH, NiCd, Pb, Flux, etc...



PV Panel Emulation

The PV Panel model is based on the single-diode equivalent circuit of a PV cell and the series-parallel connection of cells to form a panel. A Runtime functionality allows the simulation of a complete day by launching different irradiance and temperature setpoints from a .csv file, enabling the user burn-in and functional tests of PV Inverters.

B2C+ vAC Range & Specifications

Input side (GRID side)

AC Voltage

Rated: 3x400Vrms + Neutral + Earth
Range: +15% / -20%

Rated AC Current

Depends on model (see Wiring Manual)

Frequency

48-62Hz

Current Harmonic Distortion

THDi < 3% at rated power

Current Power factor

PF > 0.98 at rated power

Efficiency

≥ 89% (7.5 & 10), ≥ 91% (15 to 30), ≥ 92% (40 to 200)

Output side in DC (EUT side)

Terminals

Number: 6 (3 positive + 3 negative)

Configuration of Channels

Unipolar Independent: 2Q, independent setpoints per channel

Unipolar Parallel: 2Q, one global setpoint for all channels

Multichannel: 2Q, independent start/stop, operation mode and setpoints per channel (note: multichannel is an option for ≥ 80kVA)

Bipolar (4Q two independent setpoints)

Voltage Mode (CV)

Range: 2Q: 20⁽¹⁾ to 750V (800V with High Voltage option)

4Q: 0 to +350V / 0 to -350 (+ rail / 0 / - rail, Bipolar configuration)

Setpoint Resolution: 10mV

Effective Resolution⁽²⁾: < 0.05% of FS⁽³⁾

Setpoint Accuracy⁽⁴⁾: ± 0.1% of FS⁽³⁾

Transient Time⁽⁵⁾: < 1ms (10% to 90% at a step to Vrated)

Ripple⁽⁷⁾ (peak-peak): < 0.55% of FS⁽³⁾

Current Mode (CC)

Range: from 0 to ± 110% of Irated (see models table)

Setpoint Resolution: 10mA

Effective Resolution⁽²⁾: < 0.05% of FS⁽³⁾ (< 0.1% models 7.5 & 10)

Setpoint Accuracy⁽⁴⁾: ± 0.2% of FS⁽³⁾

Transient Time⁽⁵⁾: < 1ms (10% to 90% at a step to Irated)

Ripple⁽⁷⁾ (peak-peak): < 0.7% of FS⁽³⁾

Power Mode (CP)

Range: from 0 to ± 200%⁽⁸⁾ of Prated (see models table)

Derived current setpoint: Psetpoint / Vmeasured

Setpoint Resolution: 1W

Effective Resolution⁽²⁾: < 0.1% of FS⁽³⁾ (< 0.25% models 7.5 & 10)

Setpoint Accuracy⁽⁴⁾: ± 0.4% of FS⁽³⁾

Transient Time⁽⁵⁾: < 2.5ms (10% to 90% at a step to Prated)

Resistance Mode (CR)

Range: from 0.1 to 1000 Ohm

Derived current: Vmeasured / Rsetpoint

Setpoint Resolution: 0.01 Ohm

Setpoint Accuracy⁽⁴⁾: ± 0.2% of FS⁽³⁾

Transient Time⁽⁵⁾: < 2ms (10% to 90% at a step to Rrated))

Operation Modes

DC
Programmable Current (CC)
Power Amplifier (HiL)
Programmable Voltage (CV)
Programmable Power (CP)
Programmable Resistance (CR)
Steps
Optional Battery Testing (BTest)(charge/discharge/cycling)
Optional Battery Emulation (Bemu)
Optional PV Panel Emulation (PVEmu)

Overload/Overcurrent

Admissible DC overcurrent is: 110% of rated value during 1 minute
Admissible overloads: 125% of rated value during 10 minutes,
150% during 1 minute, 200% during 2 seconds

User Interface

Local Control (4.3" Touchscreen panel)
Isolated Digital port: 6 inputs, 4 outputs
Isolated Analogue port: 6 inputs (rms setpoints or power amplifier),
6 outputs (rms readback or real-time readback)
Interlock port: 1 NC Input, 1 NO Output
Emergency Stop pushbutton

Remote Control Port

LAN Ethernet with Open Modbus-TCP protocol
RS485 (option), CAN and RS232 (using external gateway)

Software

Graphical User Interface for Windows 7/10
LabView drivers and open Labview interface example

Enhanced

Master/Slave operation

Connection: fiber optics link (x6)
Configuration: from software user interface/MODBUS
up to 8 units:
AC: parallel
DC: parallel, serial or serial-parallel



Protections

Overvoltage (peak, rms), Overcurrent (peak, rms), Overload
Shortcircuit, Emergency Stop, Watchdog, Heart Beat, Output
Contactor, Wrong Configuration
Alarms and Limits are user configurable and can be saved in a password protected
EEPROM

Measurements⁽⁶⁾ Grid Voltage (rms), Current (rms), Power (P,Q) and Frequency
Output Voltage (rms, avg), Current (rms, avg), Power (P,Q) and Frequency
Heatsink Temperatures (x2) and DC Link Voltage
Datalogging available through FTP connection

Ambient Operating temperature⁽⁸⁾ : 5-40°C
Relative Humidity: up to 95%, non-condensing
Cooling: Forced air
Acoustic noise at 1m: < 52dB(A)(7.5 to 60), < 65dB(A)(80 to 120), < 70dB(A)(160 and 200)

Standards CE Marking
Operation and Safety: EN-50178, EN-62040-1
EMC: EN-62040-2
RoHS

All specifications are subject to change without notice.

Options

Choose your options

- Galvanic Isolation
- Three channel mode: allows different operation mode, start/stop/reset per channel (included in all models from 7.5 to 60, both included)
- 30kHz Switching Frequency: only available for models 15 (derated to 7.5kW), 20 (derated to 7.5kW) and 30 (derated to 10kW)
- Isolation monitor (advised for IT systems)
- Low voltage ripple capacitance
- Anti-islanding monitor (only advised in net injection to the grid and following local regulations)
- High Voltage (HV): voltage up to 295Vrms phase-neutral in AC up to 800V in DC
- RS485
- Battery Emulation
- Battery Test
- PV Panel Emulation

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(1) Minimum voltage setpoint is 0V in DC. The recommended minimum setpoint for long-term use is 20Vrms in AC and 20V in DC.
(2) Effective resolution measured with a 400ms window
(3) FS Range of voltage is 800V (with High Voltage option)
FS Range of current is 2|3 · I-rated (see models table)
FS Range of power is 2|200% · Prated I (see models table)

(4) Accuracies are valid for settings above 10% of FS
(5) Measured with the rated resistive load and high-dynamics controllers configuration
(6) Accuracy of measurements is ±0.1% of FS for rms voltage, ±0.2% of FS for rms current, ±0.4% of FS for active power (valid only above 10% of FS)
(7) Consult us for lower voltage/current ripple requirements
(8) Rated power figures are given at 20°C
(9) The maximum output voltage depends on frequency following $V_f < 46000$

Models

B2C+ ePlus

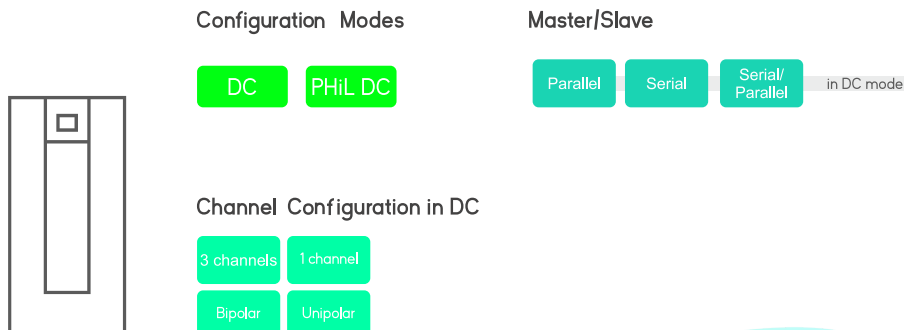
Reference	DC Power Rated ⁽⁹⁾	DC Voltage Normal Range / HV option	Rated DC Current			Weight (kg)	Dimensions DxWxH (mm)
			Independent Unipolar Mode	Parallel Unipolar Mode	+ / 0 / - Bipolar 4Q Mode		
B2C+7.5 ePlus	7.5kW	10-750 / 800V	±10A	±30A	±10A	155 kg	770x450x1100 mm
B2C+10 ePlus	10kW	10-750 / 800V	±15A	±45A	±15A	155 kg	770x450x1100 mm
B2C+15 ePlus	15kW	10-750 / 800V	±20A	±60A	±20A	155 kg	770x450x1100 mm
B2C+20 ePlus	20kW	10-750 / 800V	±25A	±75A	±25A	155 kg	770x450x1100 mm
B2C+30 ePlus	27kW	10-750 / 800V	±30A	±90A	±30A	155 kg	770x450x1100 mm
B2C+40 ePlus	40kW	10-750 / 800V	±40A	±120A	±40A	190kg	770x450x1100 mm
B2C+50 ePlus	50kW	10-750 / 800V	±50A	±150A	±50A	190kg	770x450x1100 mm
B2C+60 ePlus	54kW	10-750 / 800V	±57A	±171A	±57A	190kg	770x450x1100 mm
B2C+80 ePlus	80kW	20-750 / 800V	±105A	±315A	±105A	270kg	880x875x1320 mm
B2C+100 ePlus	100kW	20-750 / 800V	±130A	±390A	±130A	295kg	880x875x1320 mm
B2C+120 ePlus	108kW	20-750 / 800V	±130A	±390A	±130A	295kg	880x875x1320 mm
B2C+160 ePlus	145kW	20-750 / 800V	±155A	±465A	±155A	545kg	850x900x2000 mm
B2C+200 ePlus	160kW	20-750 / 800V	±185A	±555A	±185A	555kg	850x900x2000 mm

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Galvanic Isolation (optional)

		Circuit Breaker Recommended	Weight (kg)		Circuit Breaker Recommended	Weight (kg)	Dimensions DxWxH (mm)
INSIDE THE CABINET	IT 7.5i	Type C - 25A	145 kg	IN EXTERNAL CABINET IP20	IT 30e	Type D - 80A	595x415x708 mm
	IT 10i	Type C - 25A	145 kg		IT 40e	Type D - 100A	725x525x773 mm
	IT 15i	Type C - 32A	145 kg		IT 50e	Type D - 125A	725x525x773 mm
	IT 20i	Type C - 40A	145 kg		IT 60e	Type D - 160A	875x600x900 mm
	IT 30i	Type C - 50A	195 kg		IT 80e	Type D - 200A	875x600x900 mm
	* IT 40i	Type C - 63A	195 kg		IT 100e	Type D - 250A	875x600x900 mm
	* IT 50i	Type C - 83A	195 kg		IT 120e	Type D - 315A	875x600x900 mm
				IT 160e	Type D - 400A	964x684x1252 mm	
				IT 200e	Type D - 500A	1192x744x1430 mm	

*In the IT40i and IT50i models the size of the cabinet increases to a total of 770x835x1100mm. The others keep the original size.



CINERGIA, Regenerative Power Electronics Solutions

- Grid Emulators AC, DC, AC/DC
- Electronic Loads, AC, DC, AC/DC, HF (360-900Hz)
- Bidireccional DC, Battery Emulators, PV Panel Emulators

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