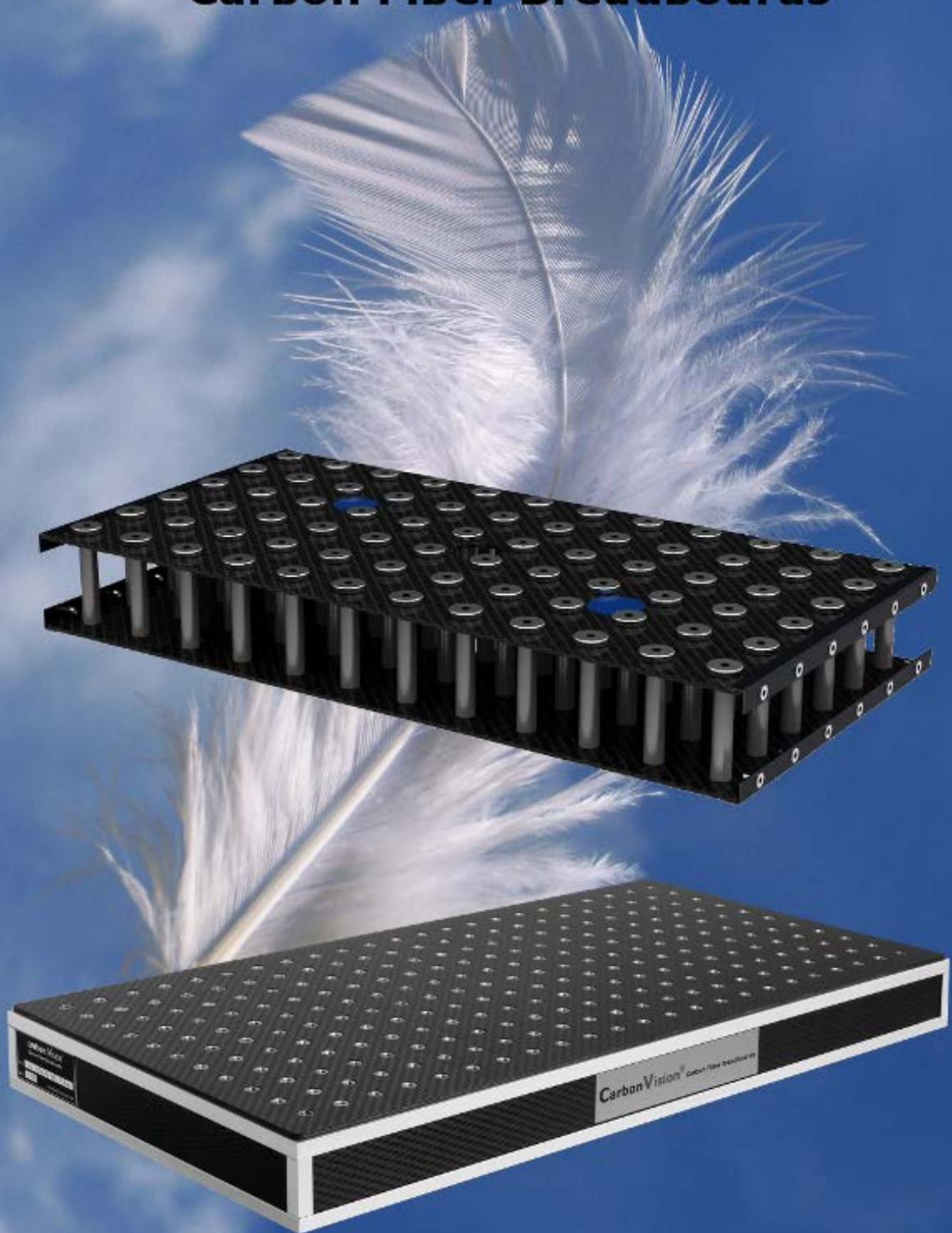


# Carbon Vision

Carbon Fiber Breadboards



# Carbon Fiber Breadboard – EC Version

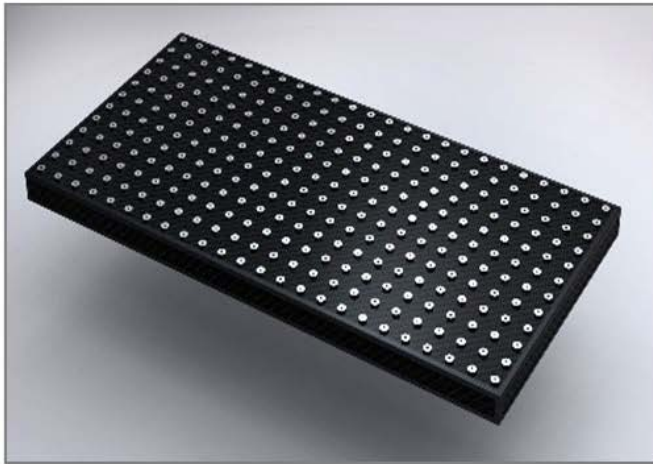


Cost effective series of breadboards based on honeycomb or sandwich panels with thick CFRP (Carbon Fiber Reinforced Polymer) cover plate.

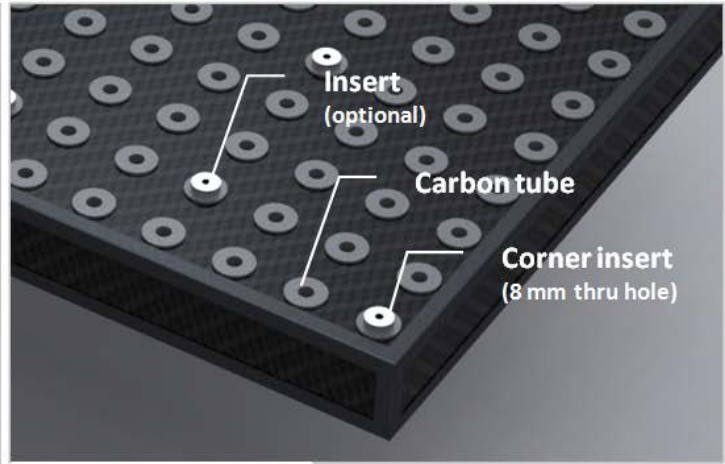
Stiffness and thermal stability can be adjusted by bonding additional CFRP plates on top/bottom side of the board.

Dimension	Typical breadboard sizes are available, maximum size 2000 x 2500 mm
Thickness	Typical thickness ranges from 25, 50, 75 to 100 mm or according to structural requirements or customer needs
Flatness	Flatness of entire mounting surface EC- Version $\leq 0.05$ mm , ECI- Version $\leq 0.2$ mm
Mounting Grid	Typical mounting grid: 25x25 mm, 50x50 mm or customized
Mounting Holes	Metric and imperial threads, inserts are made from stainless steel, Aluminium, Titanium or INVAR
Damping	Nominal damping
Thermal Expansion	Lateral directions $CTE_{x,y} = 2.5 \cdot 10^{-6}$ [mm/mm·K] @ 273 K for plane plate
Stiffness	Nominal stiffness
Weight	Area weight approximately 14 kg/m <sup>2</sup> (50 mm grid)
Design	<ul style="list-style-type: none"> <li>- Honeycomb structure with skins made from multi-layered Carbon fiber fabrics cured with Epoxy Resin</li> <li>- Skins are designed typically to meet quasi-isotropic behaviour or according to structural/thermal requirements</li> <li>- High rigidity Aluminium or closed cell foam</li> </ul>
Top Side	Single inserts according to mounting grid, with first inserts 25 mm from edges or customized
Bottom Side	Single inserts with through holes at corners, 25 mm from edges or customized
Sidewalls	Carbon fiber plates with edge protection profiles
Ventilation	For vacuum applications core materials are ventilated

# Carbon Fiber Breadboard – AD Version



Top Side of Board



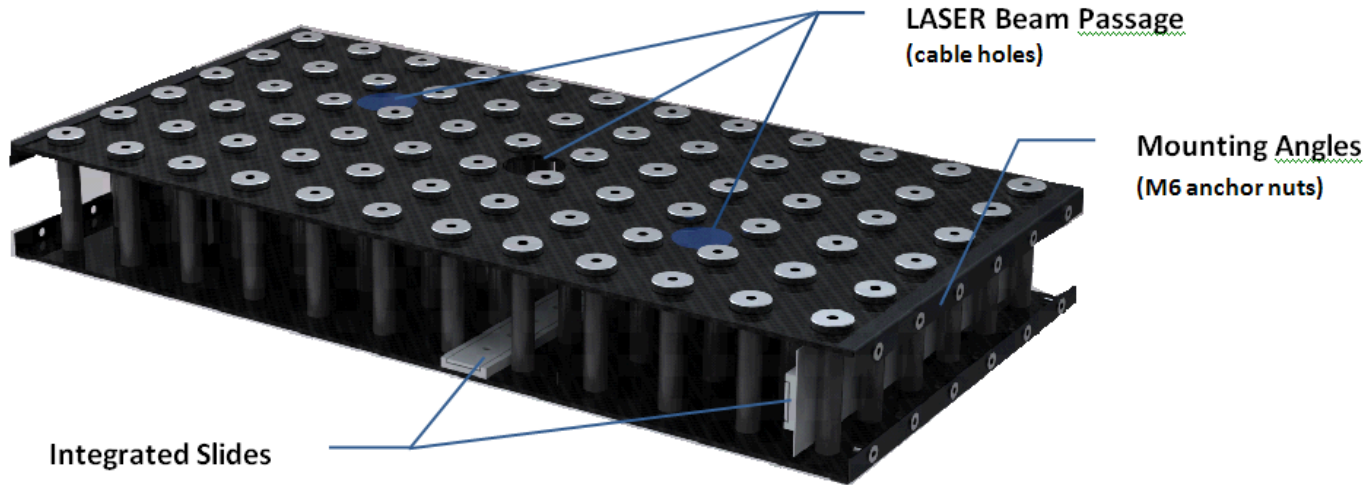
Bottom Side of Board

Advanced version of EC-series. At each mount location, a tube made from Carbon Fiber Reinforced Polymer (CFRP) links the top and bottom plate. The tubes allow easy cleaning of the board, installation of removeable additional mounts on the bottom side, tuning of natural frequencies and vibrational damping by inserting adaptive elements.

Dimension	Typical breadboard sizes are available, maximum size 2000 x 2500 mm
Thickness	Typical thickness ranges from 25, 50, 75 to 100 mm or according to structural requirements or customer needs
Flatness	Flatness of entire mounting surface AD- Version $\leq 0.05$ mm , ADI- Version $\leq 0.2$ mm
Mounting Grid	Typical mounting grid: 25x25 mm, 50x50 mm or customized
Mounting Holes	Metric and imperial threads, inserts are made from stainless steel, Aluminium, Titanium or INVAR
Damping	Nominal damping
Thermal Expansion	Lateral directions $CT_{Ex,y} = 2.5 \cdot 10^{-6}$ [mm/mm·K] @ 273 K for plane plate
Stiffness	Nominal stiffness
Weight	Area weight approximately 15 kg/m <sup>2</sup> (50 mm grid)
Design	<ul style="list-style-type: none"> <li>- Honeycomb structure with skins made from multi-layered Carbon fiber fabrics cured with Epoxy Resin</li> <li>- Skins are designed typically to meet quasi-isotropic behaviour or according to structural/thermal requirements</li> <li>- High rigidity Aluminium or closed cell foam</li> </ul>

Top Side	Single inserts according mounting grid, with first inserts 25 mm from edges
Bottom Side	Single inserts with through hole at corners, 25 mm from edges or customized
Sidewalls	Carbon fiber plates with edge protection profiles
Ventilation	For vacuum applications core materials are ventilated
Cleanroom	Suitable

# Carbon Fiber Breadboard – CA Version

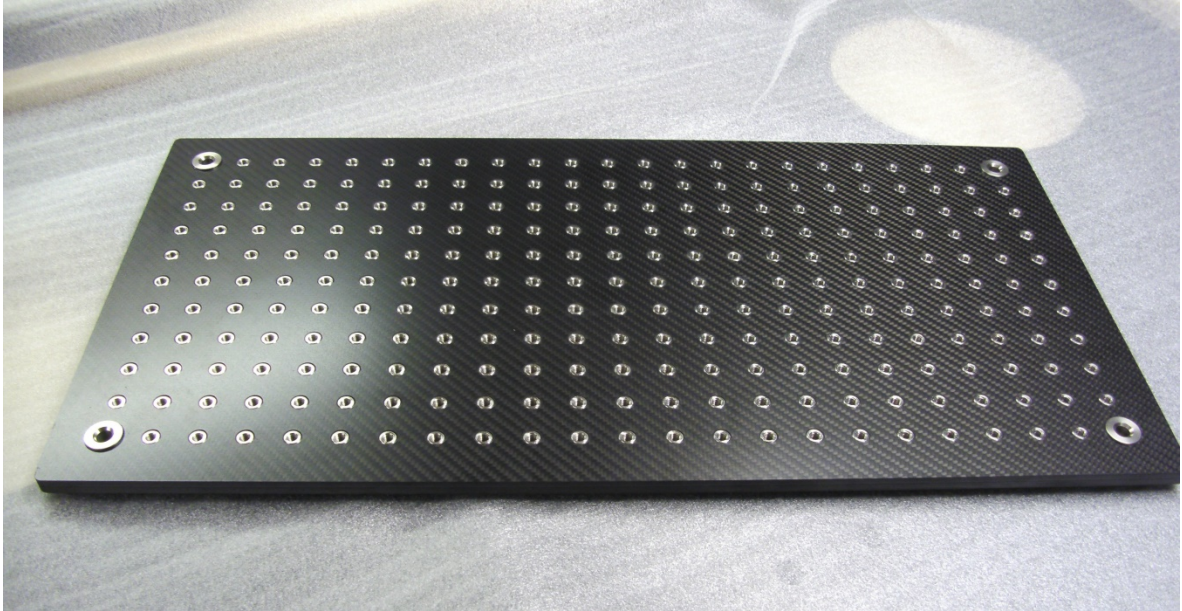


Boards of the CA-series are entirely made from Carbon Fiber Reinforced Polymer (CFRP). The top and bottom plates consist of CFRP shells structurally joined by tubes and/or ribs made from CFRP. In addition to the advantages of the AD-series, boards of the CA-series allow the integration of optical / electronic components inside the stiff carbon shell and easy routing of wires and optical fibers. Breadboards can be ordered customized and with removeable side-walls.

Dimension	Typical breadboard sizes, maximum size 2000 x 2500 mm
Thickness	Typical thickness ranges from 25, 50, 75 to 100 mm or according to structural requirements or customer needs
Flatness	Flatness of entire mounting surface CA- Version $\leq 0.05$ mm , CAI- Version $\leq 0.2$ mm
Mounting Grid	Typical mounting grid: 25x25, 50x50 mm or customized
Mounting Holes	Metric and imperial threads, inserts made from stainless steel, Aluminium, Titanium or INVAR
Damping	Nominal damping
Thermal Expansion	Lateral directions $CTE_{x,y} = 2.5 \cdot 10^{-6}$ [mm/mm·K] @ 273 K for plane plate Vertical direction $CTE_z = -0.1 \div 0.5 \cdot 10^{-6}$ [mm/mm·K] @ 273K for CFRP tube in axial direction
Stiffness	Nominal stiffness
Weight	Area weight approximately 19 kg/m <sup>2</sup> (50 mm grid)
Design	<ul style="list-style-type: none"> <li>- Plate structure with spacer tubes and/or ribs.</li> <li>- Plates are designed typically to meet quasi-isotropic behaviour or according to structural/thermal requirements</li> <li>- Tubes are designed typically for high axial stiffness</li> </ul>

Top Side	Single inserts according mounting grid, with first inserts 25 mm from edges
Bottom Side	Single inserts with through hole at corners, 25 mm from edges or customized
Sidewalls	Edge protection profiles, side walls on demand
Vacuum	Suitable
Cleanroom	Suitable

# Carbon Fiber Breadboard – SL Version



Slim Line Breadboards of SL-series offer high stiffness at minimum thickness. The breadboards are entirely made from Carbon Fiber Reinforced Polymer (CFRP), consisting of a top and bottom plate. The plates are optionally structurally decoupled by a damping foil which is laminated in-between.

Typically breadboards of SL-series are used as additional platforms mounted on top of a larger breadboard or an optical table.

Dimension	Typical breadboard sizes, maximum size 2000 x 2500 mm
Thickness	Typical thickness ranges from 5 to 25 mm
Flatness	Flatness of entire mounting surface SL- Version $\leq 0.05$ mm , SLI- Version $\leq 0.2$ mm
Mounting Grid	Typical mounting grid: 25x25, 50x50 mm or customized
Mounting Holes	Metric or imperial threads, inserts made from stainless steel, Aluminium, Titanium or INVAR
Damping	Optimized damping
Thermal Expansion	Lateral directions $CTE_{x,y} = 2.5 \cdot 10^{-6}$ [mm/mm·K] @ 273 K for plane plate
Stiffness	Nominal stiffness
Weight	Area weight approximately 22 kg/m <sup>2</sup> (25mm grid)
Design	<ul style="list-style-type: none"> <li>- Plate structure with optional damping foil in-between.</li> <li>- Plates are designed typically to meet quasi-isotropic behaviour or according to structural/thermal requirements.</li> </ul>

Top Side	Single inserts according mounting grid, with first inserts 25 mm from edges
Bottom Side	Single inserts with through hole at corners, 25 mm from edges or customized
Sidewalls	None
Vacuum	Suitable
Cleanroom	Suitable