

# SM Structures



## DESIGN

SM Structures are designed to maximize accessibility, ease of integration, flexibility and **compatibility with off the shelf components**.

Modular integration concept allows to customize the configuration on the basis of different payloads and subsystems chosen. In particular full compatibility covers important aspects such as side panels hole configuration and stack options configuration.

- **SIDE Panels and TOP/BOTTOM Panels** SM structures has a standard side panels holes layout to allow the integration of commercial side panels from different vendors. In case of custom made solutions the customer can require specific layout and receive engineering support from Spacemind engineers.
- **Stack option configuration** SM structures are based on a modular assembly concept that provides multiple stack height configurations allowing thus to easily integrate even large payloads. Each SM structure according to the form factor offers multiple interchangeable stack options and stack configurations, as well as stack mounting orientation. The availability of six deployment switches as a default option permits the inhibition of multiple subsystems within the deployer ensuring high degree of redundancy allowing the compliance with requirements of different launch authorities.

## QUALITY ASSURANCE

NPC is a company certified ISO9001 for Quality management system. Qualification process has been pursued for each SM structures (QT). Product Assurance protocols are applied to each delivered SM Product (AT).

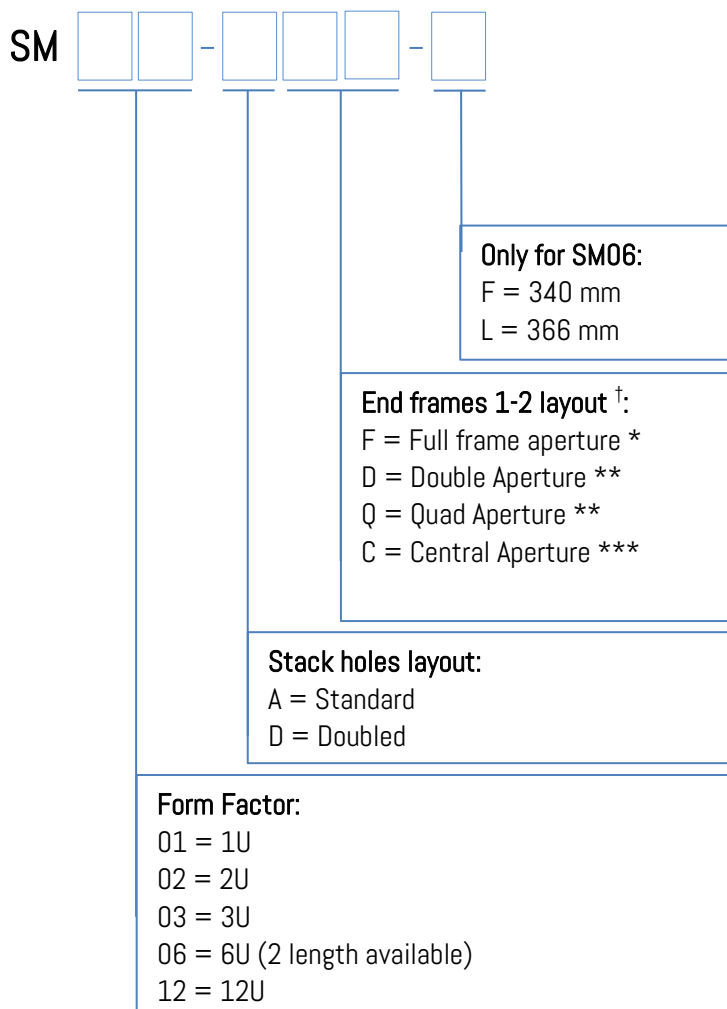
Qualification Test	QT	AT
Pre-production control	✓	✓
In-take quality control	✓	✓
Acceptance quality control	✓	✓
Vibration test	✓	-
Mechanical Shock	✓	-
TVAC Test	✓	-
Surface Treatment Test	✓	-
Functional and assembly test	✓	✓

## OPTIONS AND CUSTOMIZATION

SM structures standard version is compatible with PC104 standard: alternative configurations can be agreed with Spacemind to meet specific design requirements.

PCB stacks can be assembled separately and then integrated with the structure elements. The height of the stack can be tailored in direction (horizontal, vertical and transversal) and length according to specific requirements. Different optional customization are available on SM Structures.

Code configurator is outlined below:



### CUSTOMIZATION OPTIONS:

#### STACK HOLES LAYOUT:

Indicates the number equally spaced holes to anchor the payloads and the support frames of the stacks. Exploiting different holes it is possible to obtain different stack heights and obtain the required layout.

#### END FRAME LAYOUT:

Indicates the geometrical shape of the two end apertures of the cubesat. This option applies specifically for SM06 and SM012 permitting multiple available layout.

<sup>†</sup> End frame-1 (1<sup>st</sup> letter) and End frame-2 (2<sup>nd</sup> letter) – for SM01/02/03 only FF applies

\* For standard frame layout see item description: 1U-2U-3U Full frame aperture / 6U-Double Aperture / 12U-Quad Aperture

\*\* Options available only for 6U-12U \*\*\* Options available only for 12U (standard for 6U)

Code	Intermediate Anchor Point*		End-Frames Layout			
SM01	A: x00	D: x03	F			
SM02	A: x06	D: x12	F			
SM03	A: x11	D: x22	F			
SM06	A		F	D	C	
SM12	A		F	D	Q	C

\* In double configuration the limit of 80% of continuous rail surface in contact with deployer as per CDS exceeds. Deviation may be accepted according to service integrator policy. The customer is responsible for compliance according with proper mission requirements and constraints



	SM01	SM02	SM03	SM06	SM12
<b>Form Factor</b>	1U	2U	3U	6U	12U
<b>Measures</b>	113.5x100.0x100.0 mm	227x100.0x100.0 mm	340.5x100.0x100.0 mm	F: 340.5x226.3x100.0 L: 366.0x226.3x100.00	340.5x226.3x226.3 mm
<b>Primary structure mass</b>	84.9 g	156 g	225.7 g	550.0 g	1430 g
<b>Full structure mass</b>	125.9 g	216 g	314.5 g	754.0 g	1750 g
<b>Kill Switches</b>	6	6	6	6	6
<b>Stack layout</b>	PCI04	PCI04	PCI04	PCI04	PCI04
<b>Stack height/length</b>	Custom	Custom	Custom	Custom	Custom
<b>Stack mounting</b>	Vertical	Vertical	Vertical	Vertical/Horizontal/Transversal	Vertical/Horizontal/Transversal
<b>Configuration option</b>					
<b>Stack anchor point layout *</b>	<ul style="list-style-type: none"> <li>○ A-Standard x0</li> <li>○ D-Doubled x3 *</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ A-Standard x6</li> <li>○ D-Doubled x12 *</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ A-Standard x11</li> <li>○ D-Doubled x22 *</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ A-Standard</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ A-Standard</li> <li>○ Custom *</li> </ul>
<b>End Frames configuration options</b>	<ul style="list-style-type: none"> <li>○ F-Standard</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ F-Standard</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>○ F-Standard</li> <li>○ Custom *</li> </ul>	<ul style="list-style-type: none"> <li>D – Double Aperture **</li> <li>C – Central Aperture</li> <li>F – Full frame Aperture</li> </ul>	<ul style="list-style-type: none"> <li>Q – Quad Aperture **</li> <li>C – Central Aperture</li> <li>F – Full frame Aperture</li> <li>D – Double Aperture</li> </ul>
<b>Additional Stack Accessories</b>	<ul style="list-style-type: none"> <li>○ Additional inner frame</li> <li>○ Horizontal stack mounting adapter</li> </ul>	<ul style="list-style-type: none"> <li>○ Additional inner frame</li> <li>○ Horizontal stack mounting adapter</li> </ul>	<ul style="list-style-type: none"> <li>○ Additional inner frame</li> <li>○ Horizontal stack mounting adapter</li> </ul>	<ul style="list-style-type: none"> <li>○ Additional inner frame</li> <li>○ Horizontal stack mounting adapter</li> </ul>	<ul style="list-style-type: none"> <li>○ Additional inner frame</li> <li>○ Multipurpose CFRP inner frame</li> </ul>
<b>Shear panels options</b>	✓	✓	✓	✓	✓
<b>Side panels holes layout</b>	<ul style="list-style-type: none"> <li>○ Standard</li> <li>○ Custom</li> </ul>	<ul style="list-style-type: none"> <li>○ Standard</li> <li>○ Custom</li> </ul>	<ul style="list-style-type: none"> <li>○ Standard</li> <li>○ Custom</li> </ul>	<ul style="list-style-type: none"> <li>○ Standard</li> <li>○ Custom</li> </ul>	<ul style="list-style-type: none"> <li>○ Standard</li> <li>○ Custom</li> </ul>
<b>Additional Kill switch set</b>	✓	✓	✓	✓	✓
	*CDS deviation	*CDS deviation	*CDS deviation	**Standard version / *CDS deviation	**Standard version / *CDS deviation

# SM01

## Product Code: ZNSP-SM01

- 1U Cubesat Structure
- 6 Deployment switch (Standard) – Additional available on request
- Configurable board stacks
- Available with doubled anchor points for stack integration
- Horizontal and vertical stack assembly
- Wide access windows
- Optional shear panels available
- Qualified JX-ESPC-101133-B / ECSS-E-ST-10-03
- Primary structure mass: 89 g
- Measures: 113.5 x 100.0 x 100.0 mm
- Stainless steel threaded inserts;
- Compatible with commercial solar panels and COTS
- PCB stack assembly independent from the structure;
- Wide access windows

## Product items included in standard version

- Standard structure
- Assembly screws
- 2 Stand-off kill switches
- 4 Column switches
- (1x) Stack assembly set (bars, spacers)

## Options and customization

- Double intermediate anchor points layout
- Additional side switches
- Shear panel set
- Custom side panels holes layout



## SMO1 CONFIGURATION OPTIONS



### OPTIONS AND CUSTOMIZATION

SMO1 includes a wide range of available options to be tailored for specific platform requirements

### INTERMEDIATE ANCHOR POINTS

D version includes x3 intermediate anchor points layout allows the integration of middle frames (purchasable on demand) for specific payload integration and stack layout

### SHEAR PANEL SET

Include shear panels option for demanding applications. Custom design available for special fitting components layouts

### CUSTOM SIDE PANEL FIXING HOLES

Compatible with Spacemind solar panels and other COTS - Customizable side panel fixing holes for specific COTS integration



# SM02

## Product Code: ZNSP-SM02

- 2U Cubesat Structure
- 6 Deployment switch (Standard) – Additional available on request
- Configurable board stacks
- Available with doubled anchor points for stack integration
- Horizontal and vertical stack assembly
- Wide access windows
- Optional shear panels available
- Qualified JX-ESPC-101133-B / ECSS-E-ST-10-03
- Primary structure mass: 130 g
- Measures: 227 x 100.0 x 100.0 mm
- Stainless steel threaded inserts;
- PC 104 compatibility;
- Compatible with commercial solar panels and COTS
- PCB stack assembly independent from the structure;

## Product items included in standard version

- Standard structure
- Assembly screws
- 2 Stand-off kill switches
- 4 Column switches
- (2x) Stack assembly set (bars, spacers)

## Options and customization

- Double intermediate anchor points layout
- Additional side switches
- Shear panel set
- Custom side panels holes layout



## SM02 CONFIGURATION OPTIONS



### OPTIONS AND CUSTOMIZATION

SM02 includes a wide range of available option to be tailored for specific platform requirements

### INTERMEDIATE ANCHOR POINTS

SM02 allows to move middle frames or integrate additional ones (purchasable) to customize stacks. With D options, the stack anchor point along the structure is doubled (x12) in order to increase the flexibility for specific mission requirements.

### SHEAR PANEL SET

Include shear panel option for demanding applications. Custom design available for special fitting components layouts

### CUSTOM SIDE PANEL FIXING HOLES

Compatible with Spacemind solar panels and other COTS - Customizable side panel fixing holes for specific COTS integration



# SM03

## Product Code: ZNSP-SM03

- 3U Cubesat Structure
- 6 Deployment switch (Standard) - Additional available on request
- Configurable board stacks
- Available with doubled anchor points for stack integration
- Horizontal and vertical stack assembly
- Wide access windows
- Optional shear panels available
- Qualified JX-ESPC-101133-B / ECSS-E-ST-10-03
- Primary structure mass: 226 g
- Measures: 340.5 x 100.0 x 100.0 mm
- Stainless steel threaded inserts;
- PC 104 compatibility;
- Compatible with commercial solar panels and COTS
- PCB stack assembly independent from the structure;

## Product items included in standard version

- Standard structure
- Assembly screws
- 2 Stand-off kill switches
- 4 Column switches
- (3x) Stack assembly set (bars, spacers)

## Options and customization

- Double intermediate anchor points layout
- Additional side switches
- Shear panel set
- Custom side panels holes layout



## SM03 CONFIGURATION OPTIONS



### OPTIONS AND CUSTOMIZATION

SM03 includes a wide range of available options to be tailored for specific platform requirements

### INTERMEDIATE ANCHOR POINTS

SM03 allows to move middle frames or integrate additional ones (purchasable) to customize stacks. With D options, the stack anchor point along the structure is doubled (x22) in order to increase the flexibility for specific mission requirements.

### SHEAR PANEL SET

Include shear panel option for demanding applications. Custom design available for special fitting components layouts

### CUSTOM SIDE PANEL FIXING HOLES

Compatible with Spacemind solar panels and other COTS ; Customizable side panel fixing holes for specific COTS integration

# SM06

## Product Code: ZNSP-SM06

- 6U Cubesat Structure
- 6 Deployment switch (Standard) - Additional available on request
- Modular user configurable board stacks
- Horizontal; vertical; transversal stack assembly
- Available with different Z frames:
  - D: 2-aperture pattern (83x90mm) - Standard
  - C: Centered body aperture (83x60mm)
  - F: Full Frame aperture (83x207mm)
- Optional shear panels available
- Qualified JX-ESPC-101133-B / ECSS-E-ST-10-03
- Primary structure mass: 550 g
- Secondary structure mass: 204 g
- Measures:
  - SM06 F - 340,5 x 226.3 x 100.0 mm
  - SM06 L - 366 x 226.3 x 100.0 mm
- Stainless steel threaded inserts;
- PC 104 compatibility
- Compatible with commercial solar panels and COTS
- PCB stack assembly independent from the structure

## Product items included in standard version

- Standard structure (including 12 inner frames)
- Assembly screws
- 2 Stand-off kill switches
- 4 Column switches

## Options and customization

- Double available version (L – F)
- End frames layout (F - D - C)
- Additional side switches
- Shear panel set
- Custom side panels holes layout



## SM06 CONFIGURATION OPTIONS



### FULLY CUSTOMIZABLE STACK MOUNTING LAYOUT

Wide combination of stack mounting solutions are possible exploiting SM modularity: horizontal, vertical e transversal with customizable length

### TRANSVERSAL MOUNTING

Transversal stack mounting allows to integrate separated stack of 1U size

### HORIZONTAL MOUNTING

Horizontal stack mounting allows to integrate separated stack of 1U size as well full stack of 2U

### VERTICAL MOUNTING

Vertical stack mounting allows to integrate separated stack of 1U size as well as custom length stack exploiting more than 20 fixing hole available at different height

### CUSTOM SIDE PANEL FIXING HOLES

Compatible with Spacemind solar panels and other COTS; Customizable side panel fixing holes for specific COTS integration

## SM06 CONFIGURATION OPTIONS



### END-FRAMES LAYOUT

Different end frames layouts allow to customize the structure for specific platform requirements. Users can select specific and different end frame for both end of the Cubesat. Customizable on request.

#### D – DOUBLE APERTURE LAYOUT

Double aperture layout is the standard layout of SM06 end-frame presenting 2x 85x100 mm aperture. See the list of proven compatible COTS for details

#### C – CENTRAL APERTURE LAYOUT

Central aperture layout is the SM06 end-frame is the suitable solution for payload requiring centered axial alignment such optics and propulsion system. The frame presents 1x 76x76 mm aperture and 2x 8x60 mm aperture.

#### F – FULL FRAME APERTURE LAYOUT

Full frame aperture layout is the SM06 end-frame allowing the maximum flexibility for demanding payload thanks to a total clearance of 85x210 mm



# SM12

## Product Code: ZNSP-SM12

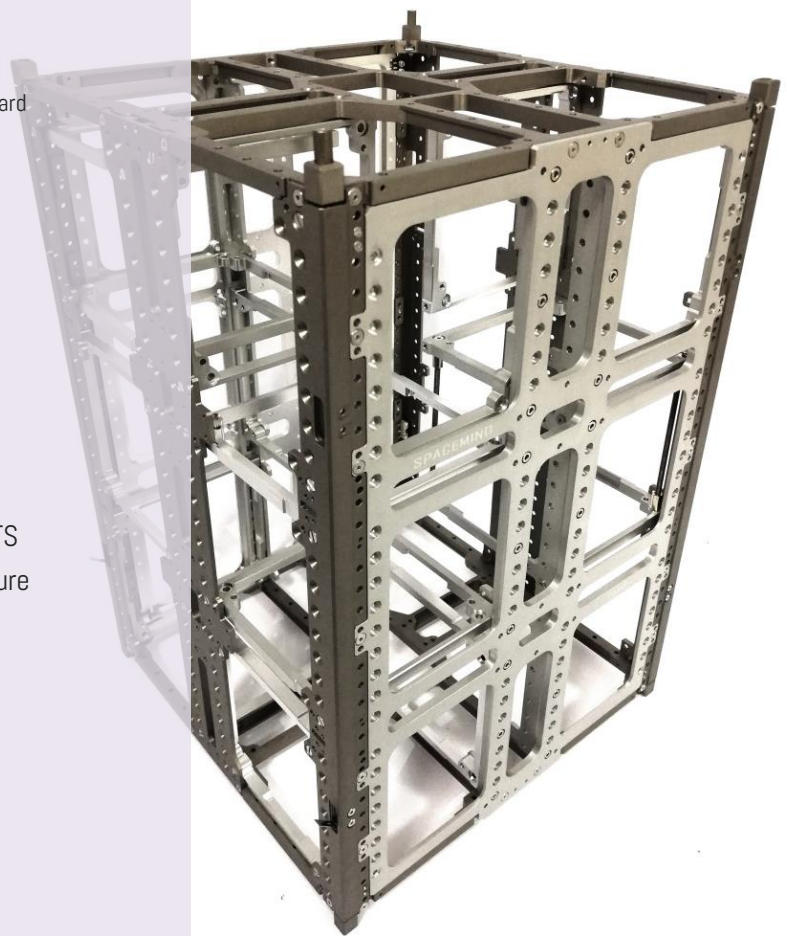
- 12U Cubesat Structure
- 6 Deployment switch (Standard) - Additional available on request
- Modular user configurable board stacks
- Horizontal; vertical; transversal stack assembly
- Qualified JX-ESPC-101133-B / ECSS-E-ST-10-03
- Available with different Z frames:
  - Q: 4-aperture pattern (4x 83x90mm) - Standard
  - D: 2-aperture pattern (2x 83x210mm)
  - C: Centered body aperture (1 100x100mm)
  - F: Full Frame aperture (1x 200x200mm)
- Optional shear panels available
- Primary structure mass: 1430 g
- Secondary structure mass: 320 g
- Measures 340,5 x 226.3 x 226.3 mm
- Stainless steel threaded inserts;
- PC 104 compatibility
- Compatible with commercial solar panels and COTS
- PCB stack assembly independent from the structure
- CFRP stacks supporting frame available

## Product items included in standard version

- Standard structure (including 12 inner frames)
- Assembly screws
- 2 Stand-off kill switches
- 4 Column switches

## Options and customization

- End frames layout (Q - F - D - C)
- Additional side switches
- Shear panel set
- Custom side panels holes layout





## SM12 CONFIGURATION OPTIONS



### FULLY CUSTOMIZABLE STACKS LAYOUT

Wide combination of stack mounting solutions are possible exploiting SM modularity: horizontal, vertical and transversal with customizable length

### VERTICAL MOUNTING

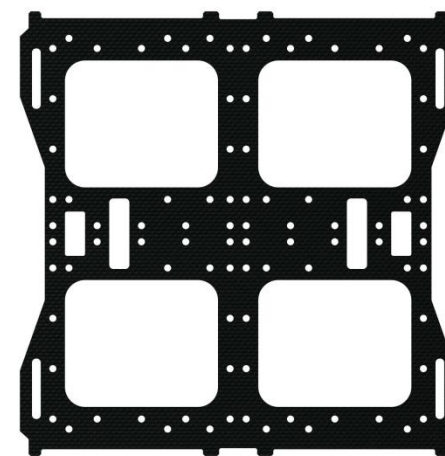
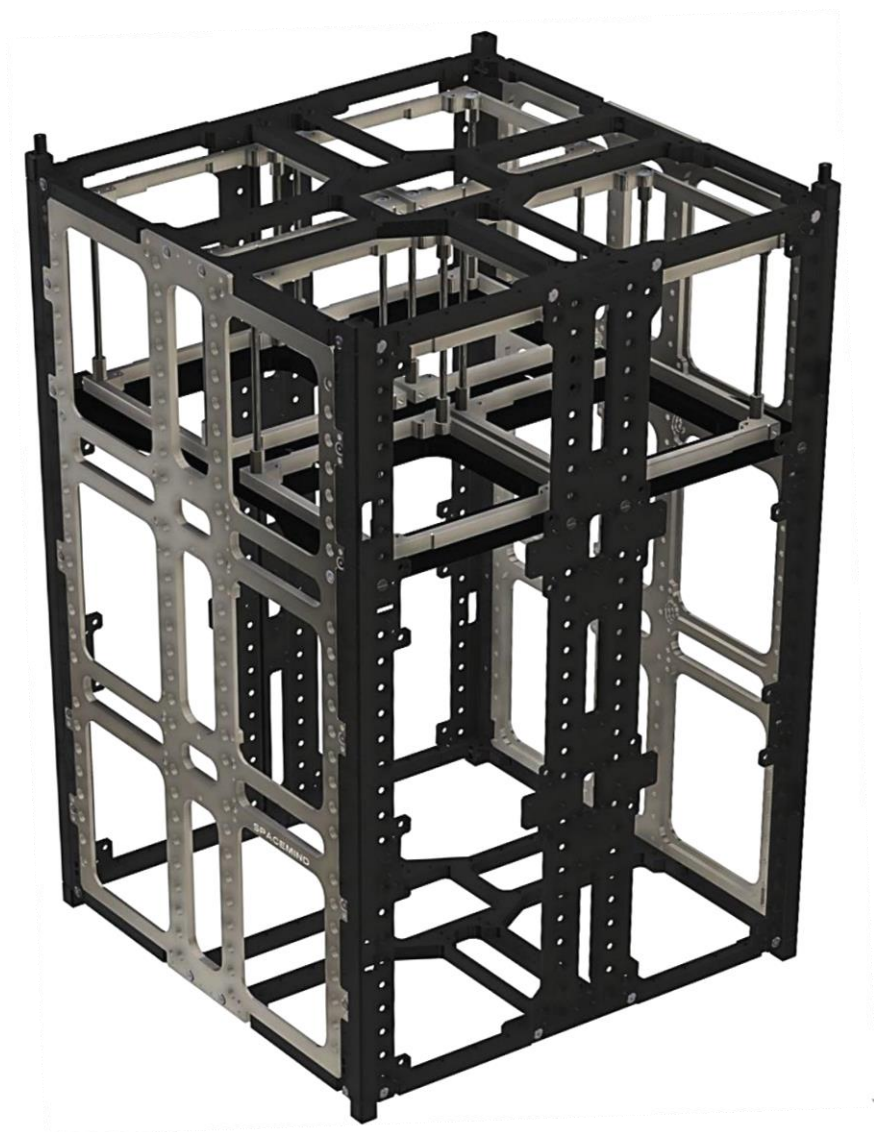
Vertical stack mounting allows to integrate separated stack of 1U size as well as custom length stack exploiting more than 20 fixing hole available at different height

### TRANSVERSAL MOUNTING

Transversal stack mounting allows to integrate separated stack of 1U size as well full stack of 2U

### HORIZONTAL MOUNTING

Horizontal stack mounting allows to integrate separated stack of 1U size as well full stack of 2U



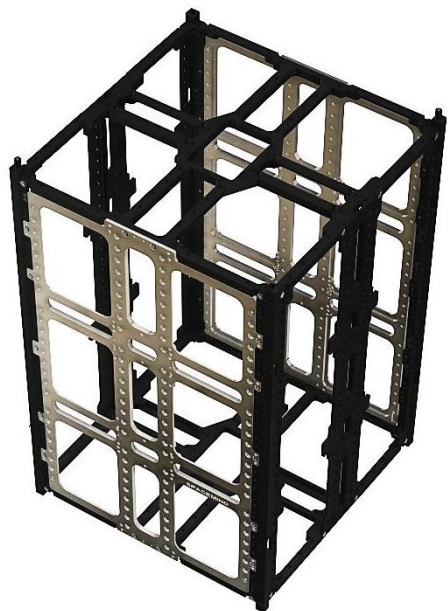
### SM-STR042

#### MULTIPURPOSE CFRP INNER FRAME

SM-STR042 is a multipurpose inner frame SM12 compatible that can be exploited as stack and payload support structure, facilitating the integration of the satellite. Made in CFRP qualified for outgassing standards, the solution ensures high mechanical performances with a reduced impact on the overall satellite mass.

SM-STR042 presents as standard a wide pattern of holes in order to be fully compatible with SM12 standard frames and allowing integration of horizontal, transversal and vertical stacks, as well as any other payload that can be safely anchored. The product is available also in aluminum alloys.

## SM12 END-FRAMES OPTIONAL LAYOUTS



### Q – QUAD APERTURE

Quad aperture layout is the standard layout of SM12 end-frames presenting 4x 83x90 mm aperture.



### D – DOUBLE APERTURE

Double aperture layout presenting 2 aperture to allow integration of 6U form factor components.



### C – CENTRAL APERTURE

The suitable solution for centered axial aligned payload such optics and propulsion system.



### F – FULL FRAME APERTURE

The solution allowing the maximum flexibility for demanding payload such as large optics thanks to a total clearance of 200x200 mm.

## SPARE PARTS



### SM-STR042

Multipurpose integration plane

- Compatible with **SM12** Customizable on request
- Made in CFRP (outgassing standards compatible) or Aluminum alloy
- Customizable on request



### SM-STR007

Inner frame for SM01/02/03

- Additional inner frame – Customizable on request
- Compatible with **SM01/SM02/SM03**
- Made in aluminum alloy - Weight 20g



### SM-STR607

Inner frame for SM12/06

- Additional inner frame – Customizable on request
- Compatible with **SM06/SM12**
- Made in aluminum alloy - Weight 20g



### SM-STR608

Horizontal Stack Adapter for SM01/02/03

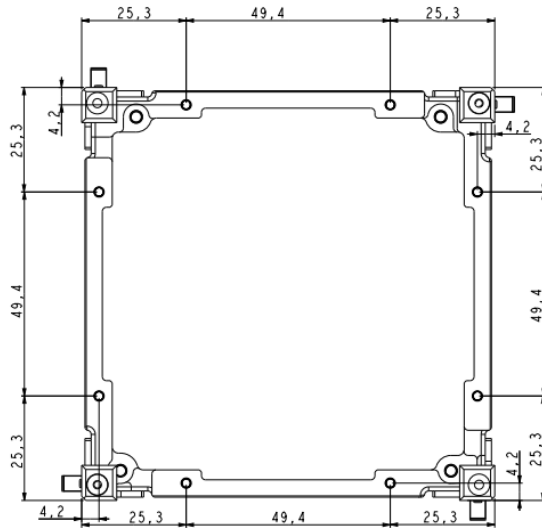
- Stack adapter for horizontal mounting
- Compatible with **SM01/SM02/SM03**
- Made in aluminum alloy - Weight 7g



# Measures

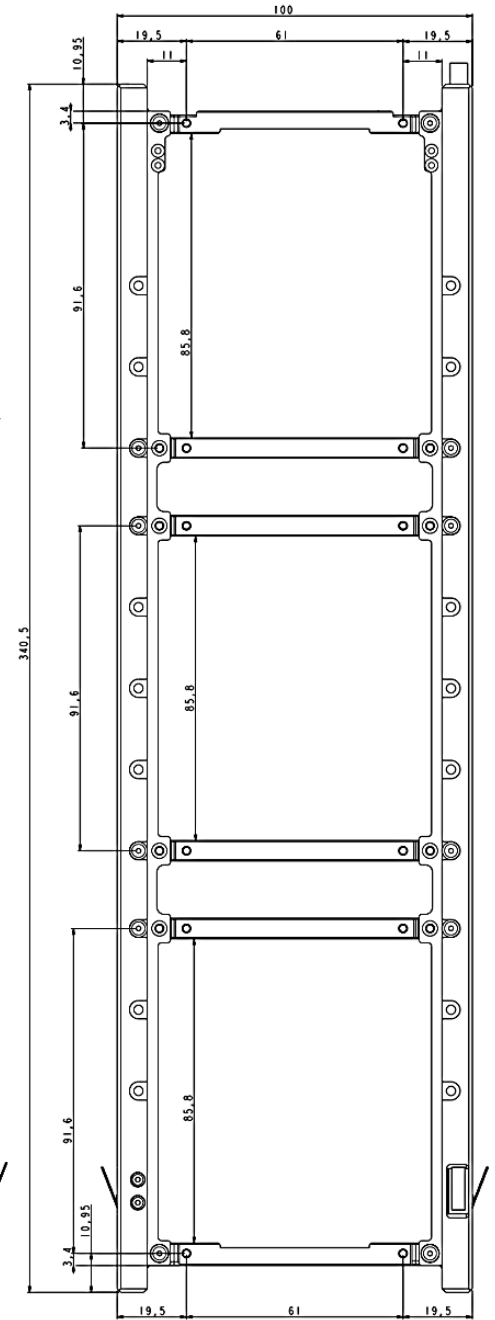
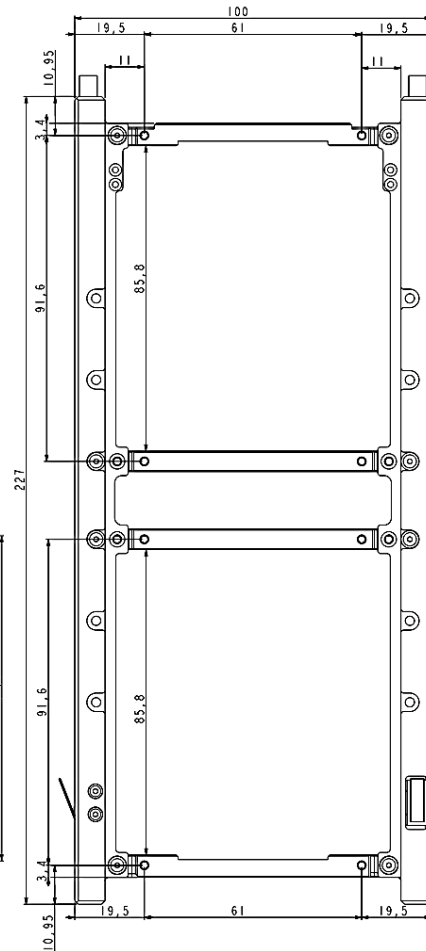
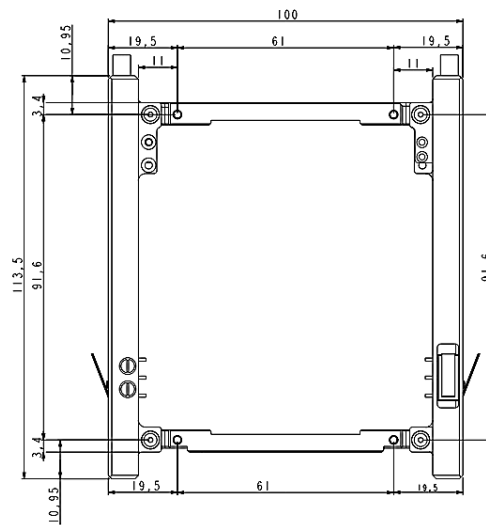
## SM01/SM02/SM03- Top view

- Side panels fixing holes is equal for +Z and -Z sides
- The reported view is the same for SM01 / SM02 / SM03
- All measures are in *mm*



## SM01/SM02/SM03 - Side view

- Side panels fixing holes is equal for  $\pm X$  and  $\pm Y$  sides
- All measures are in *mm*

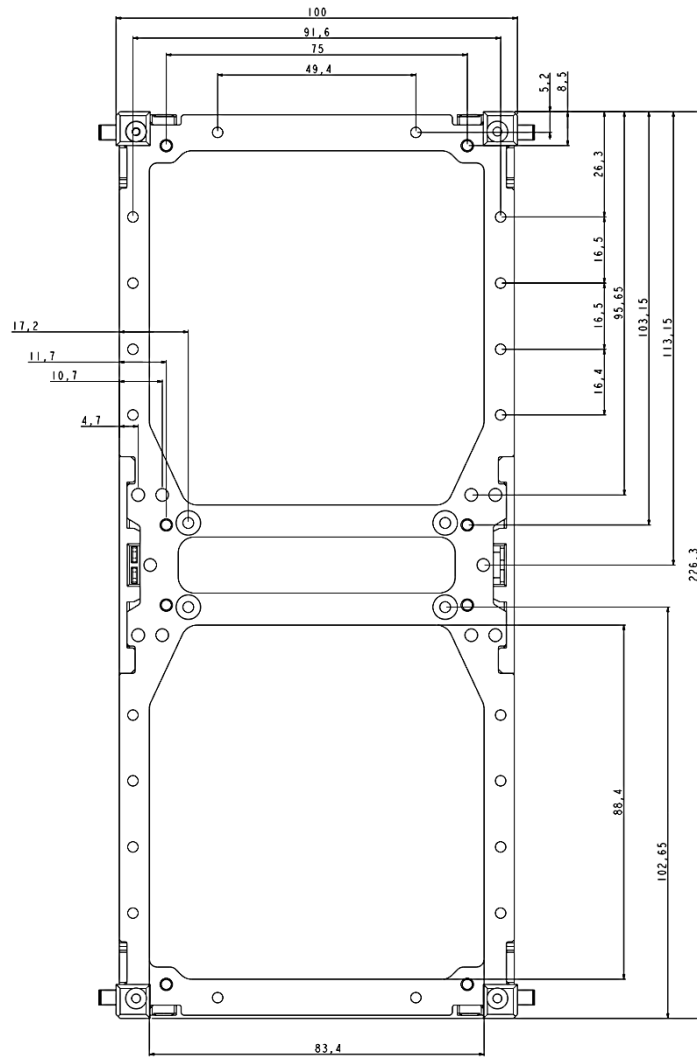




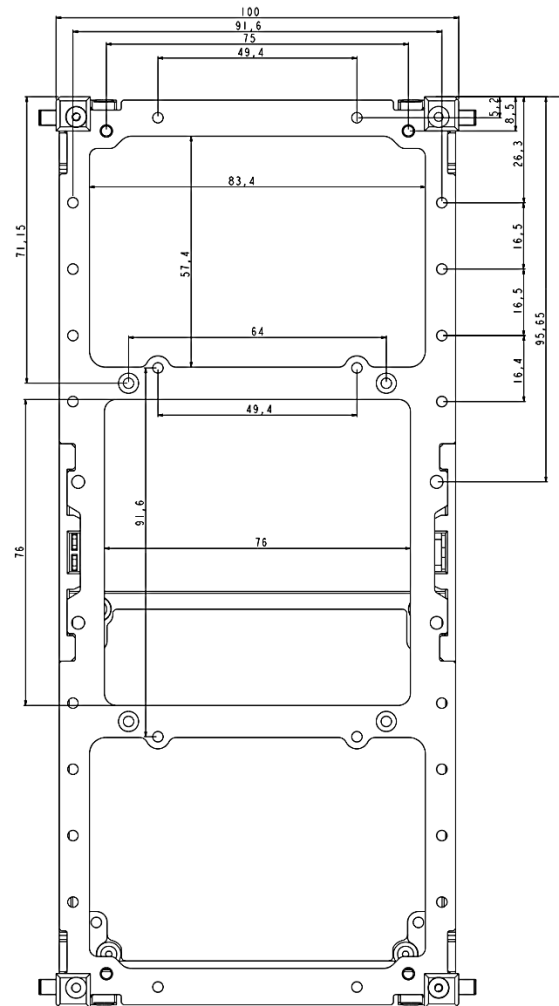


## SM06 - Top views

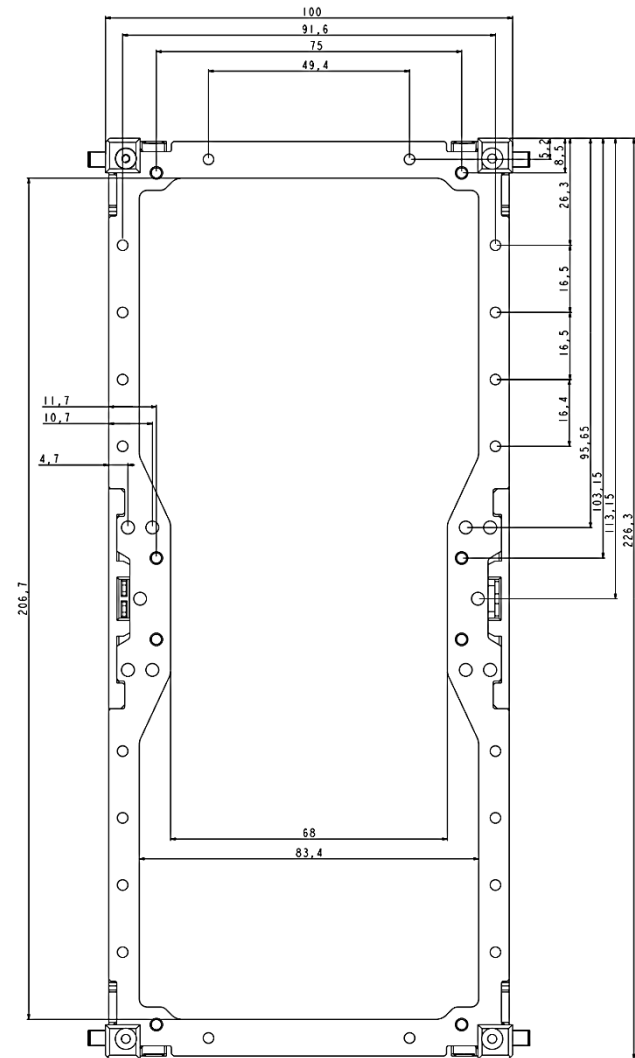
SM06 – D Frame



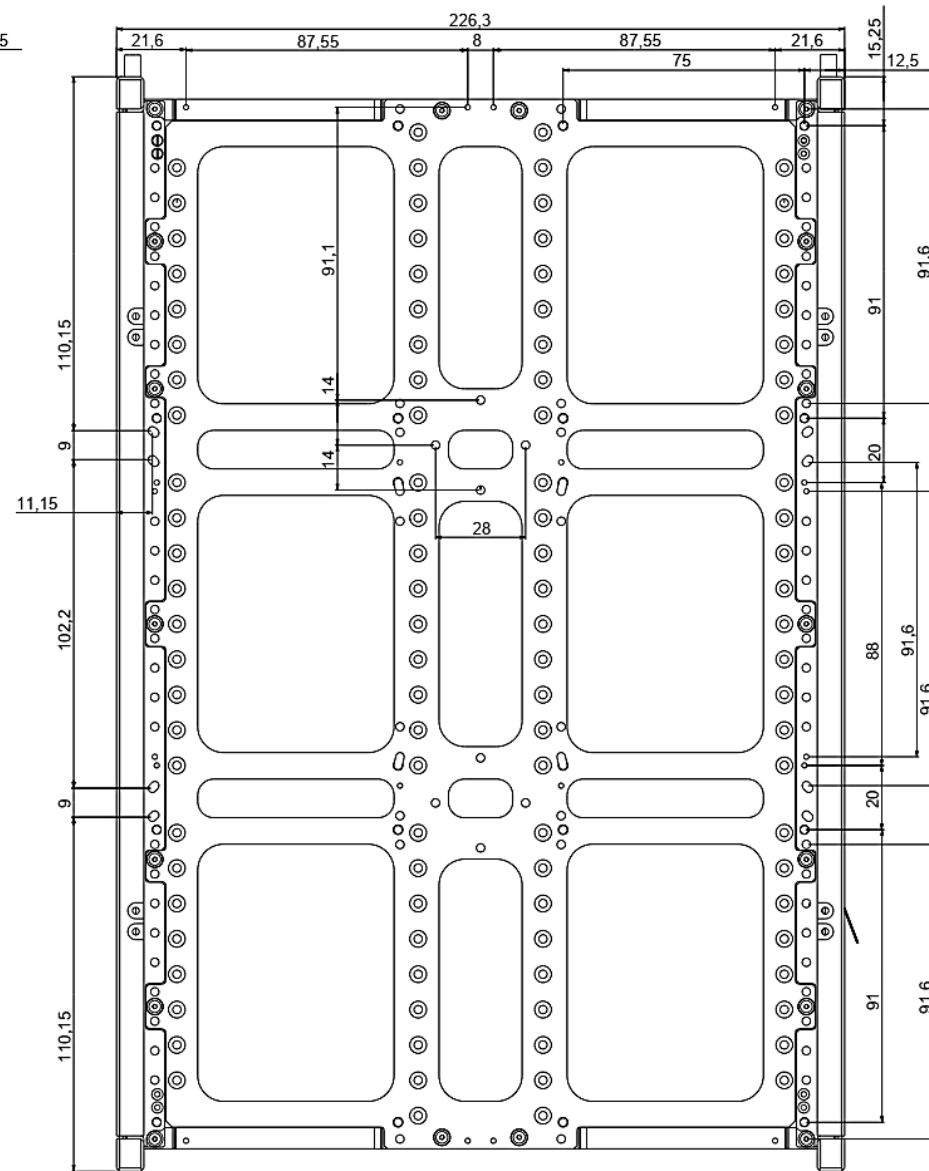
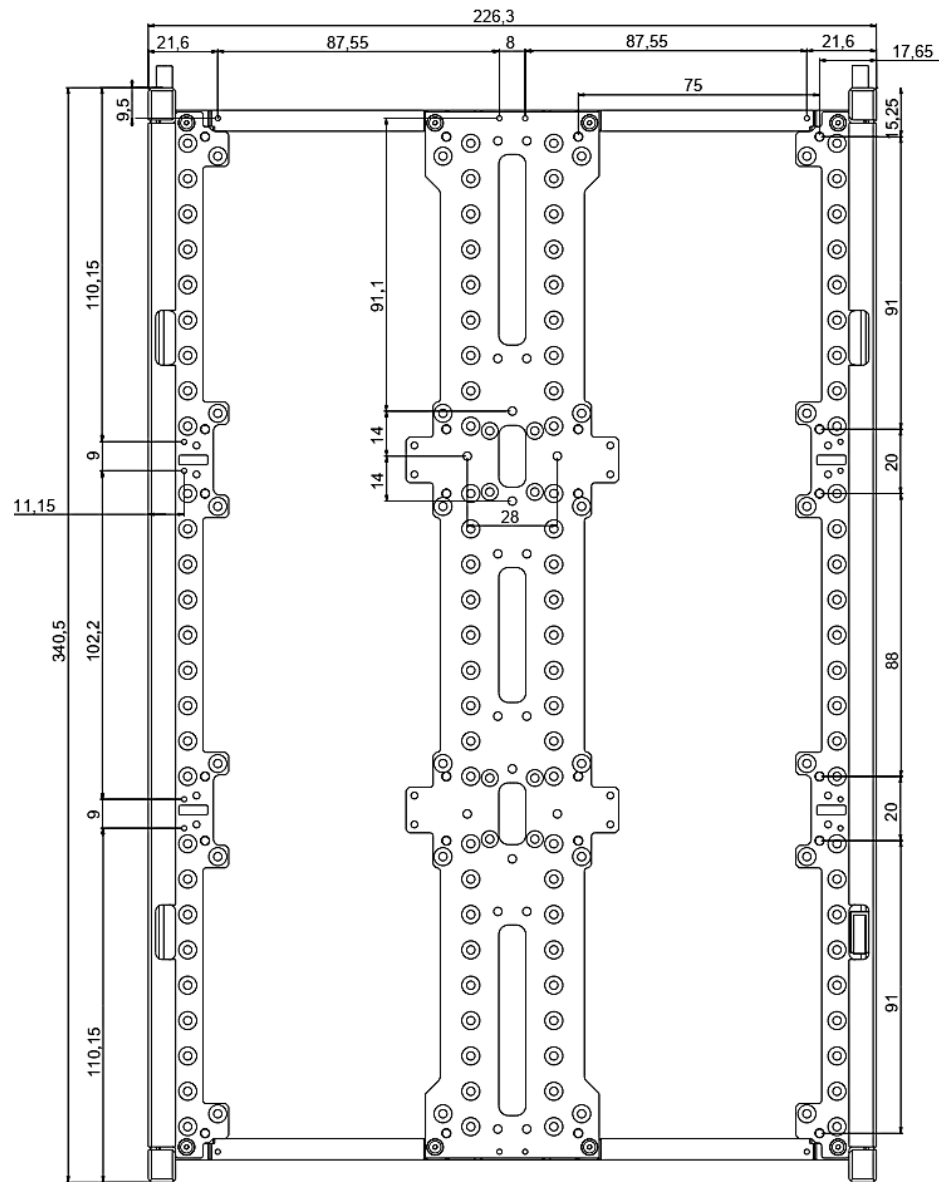
SM06 – C Frame



SM06 – F Frame

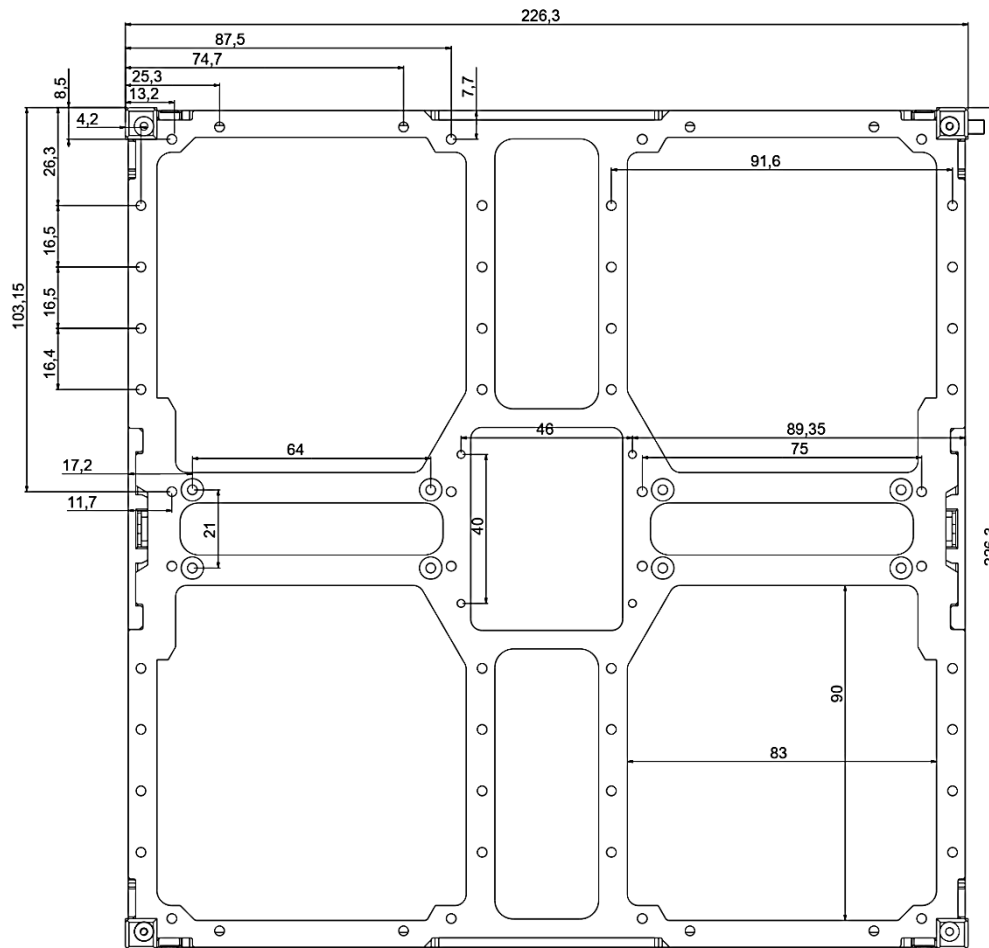


## SM12 - Side views

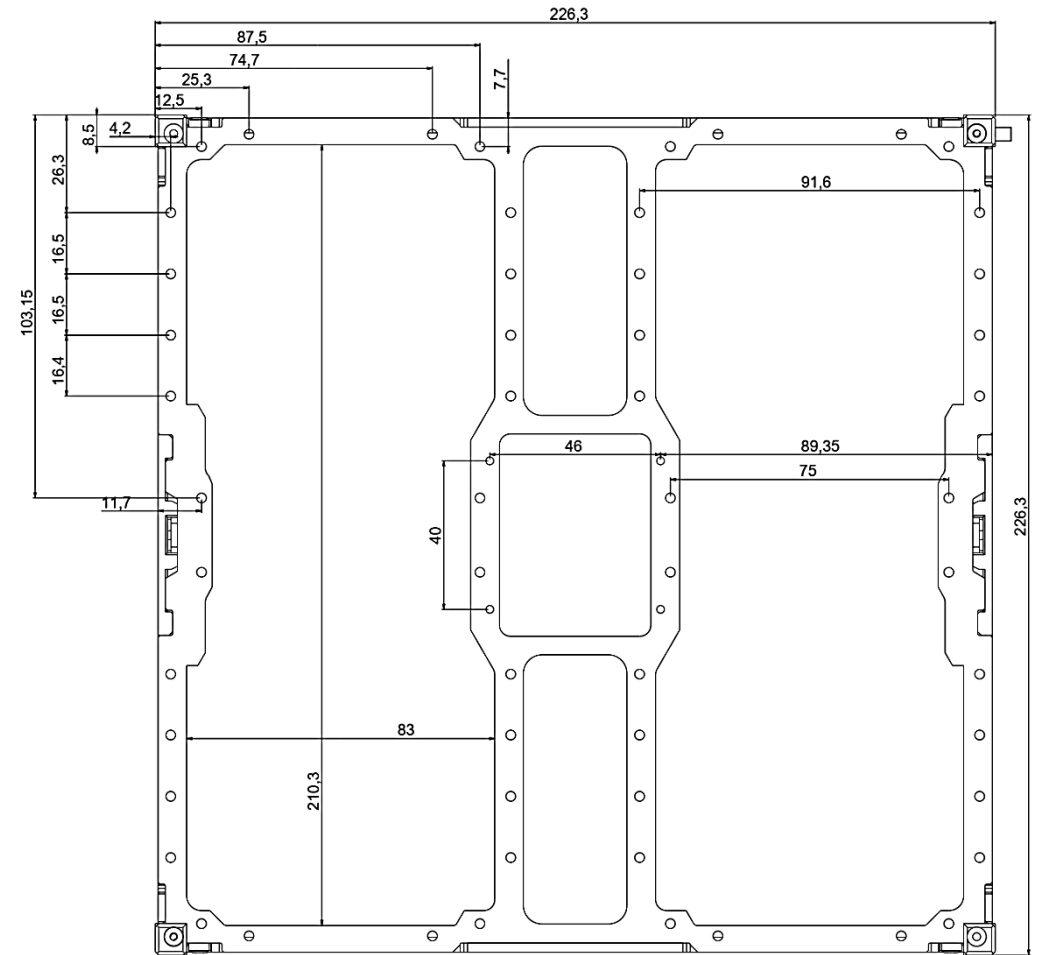


## SM12 - Top views

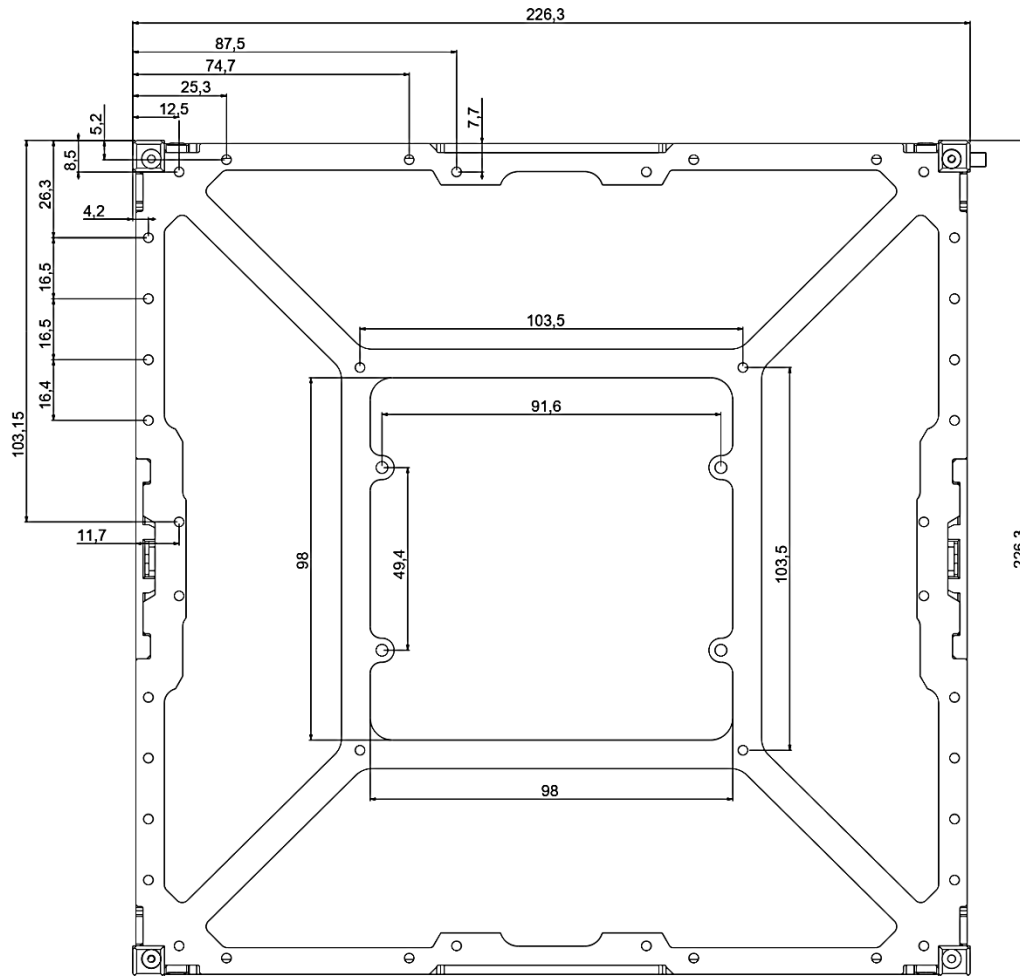
SM12 – Q Frame



SM12 – D Frame



SM12 – C Frame



SM12 – F Frame

