

HIGH VOLTAGE INTEGRATED SOLUTIONS

Type **MODBOX®**

RAIL VEHICLES



GENERAL INFORMATION

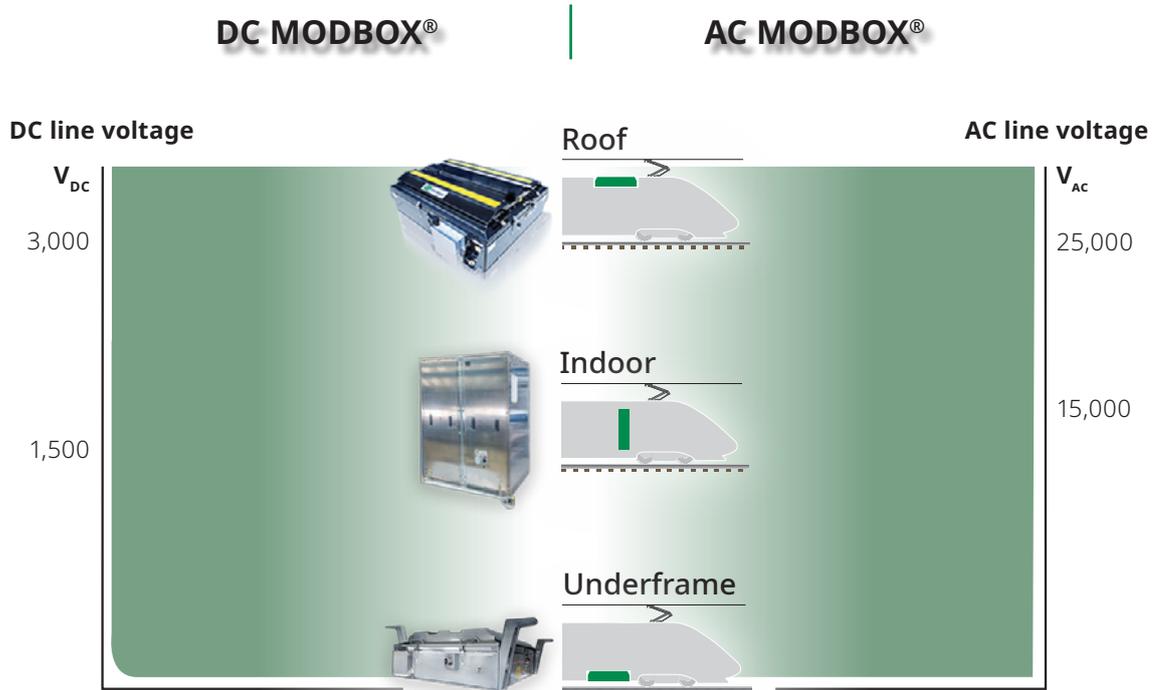
Sécheron brings decades of experience designing and manufacturing electrical safety components and systems for the traction circuits powering trains, high-speed trains, locomotives, and EMUs on AC or DC rail networks. Car builders seeking high performance, reduced engineering work and easier vehicle manufacturing combined with lower maintenance have

placed their trust in our **MODBOX®** enclosure for thousands of rail vehicles running on 1.5 kV_{DC}, 3 kV_{DC}, and 15 kVAC, 25 kV_{AC} networks worldwide.

The Sécheron **MODBOX®** enclosure includes our AC or DC circuit breakers and various high- and low-voltage components. The compact, smart enclosure ensures safe and efficient integration of high-voltage components in

vehicle roof, vehicle under-frame or vehicle indoor installations.

Each **MODBOX®** is engineered and configured to meet the needs of your project, taking into account integrated functions and interfaces with the vehicle. We primarily use Sécheron components and can include other devices from best-in-class suppliers to provide you with a turnkey solution.



MAIN BENEFITS

Car builders

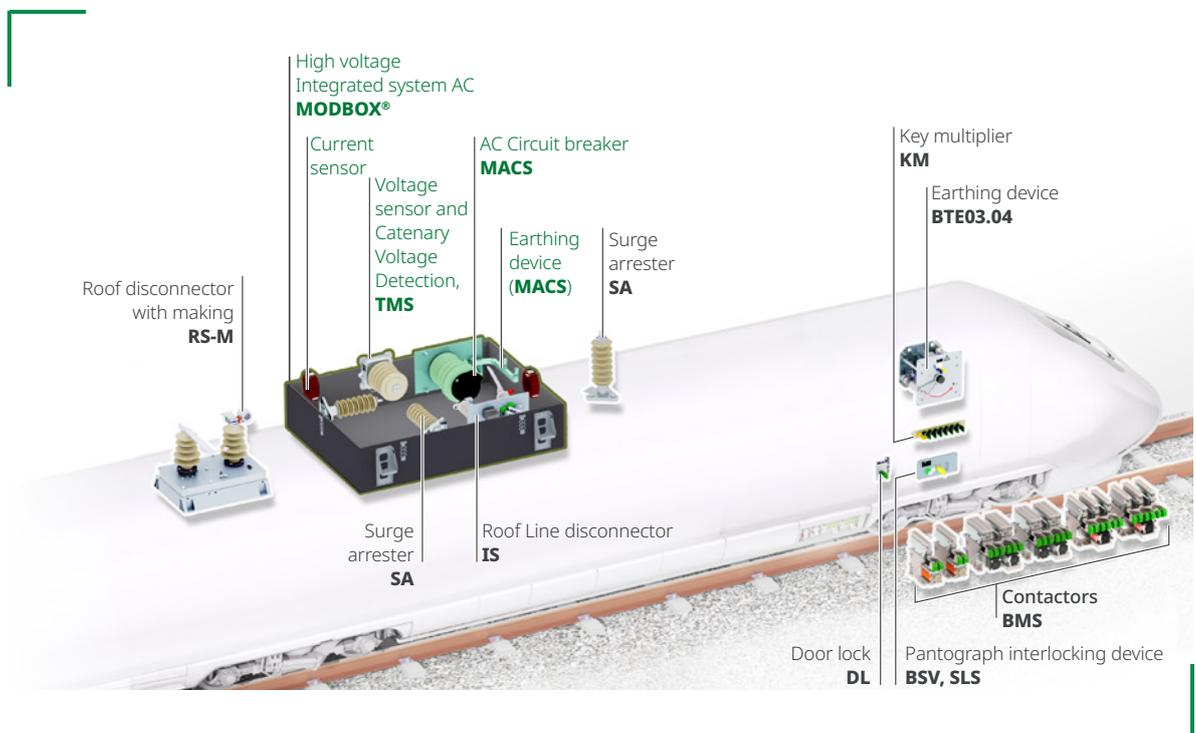
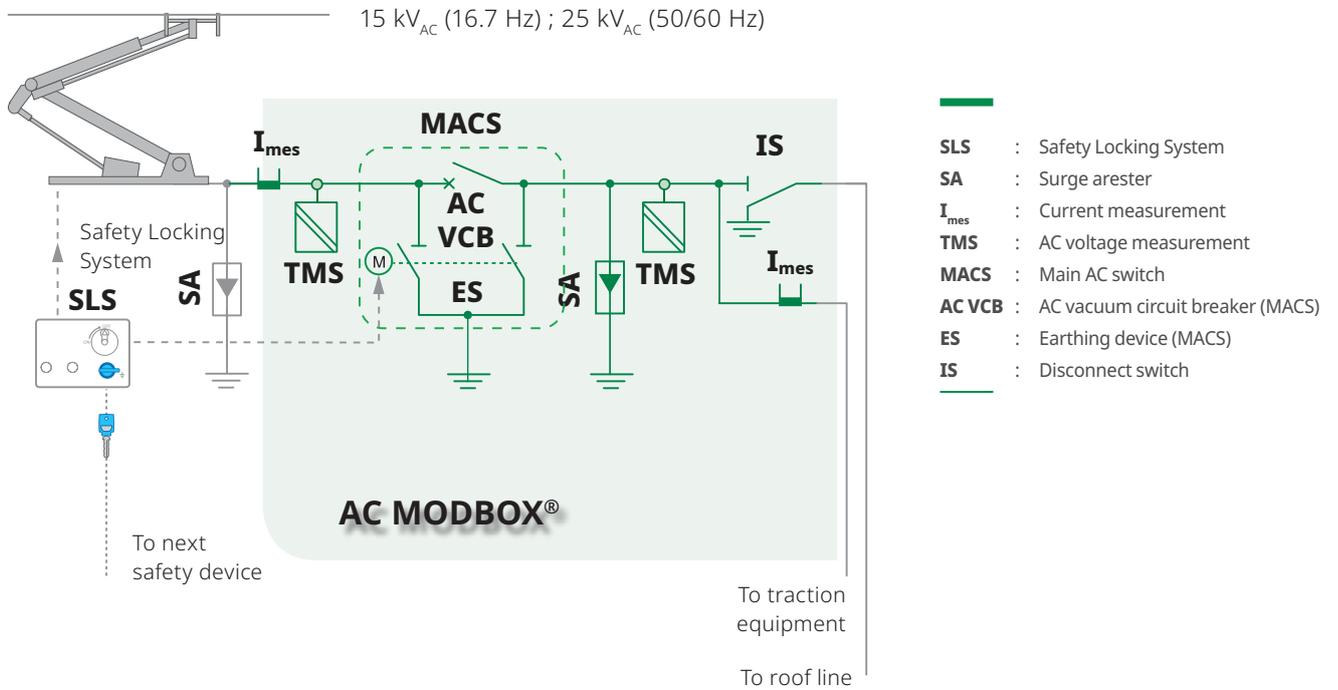
- ✓ Reduced engineering work and risks
- ✓ More efficient logistics and installation
- ✓ Eliminates the need for roof cut-outs
- ✓ Reduced footprint and height
- ✓ One-stop shop for all components
- ✓ Reduced project overall costs

Vehicle operators

- ✓ Protection against harsh environmental conditions
- ✓ Airborne & structural noise reduction
- ✓ Lower Total Cost of Ownership (TCO)
- ✓ Proven design with long service record
- ✓ Reduced maintenance costs with **MODBOX®**
- ✓ Expert customer support
- ✓ Worldwide after-sales service

AC MODBOX®

TYPICAL APPLICATIONS



Sécheron supplies all equipment named on the above view.

AC MODBOX® - TYPICAL CONFIGURATIONS

FUNCTIONS	VOLTAGE [kV _{AC}]	PRODUCTS		QUANTITY	AC MODBOX®					
					ROOF			UNDERFRAME	INDOOR	
					MINI	COMPACT	LARGE	LARGE	LARGE	
AC circuit breaker	15 or 25 or 15 & 25 (Dual Voltage)		MACS (U _N : 125 or 170 kV)	1 unit	●	●	●	●	●	
Earthing device			2-pole electric earthing device ^{(1), (2)}	1 unit		●	●	●	●	●
			2-pole manual earthing device	1 unit	●			●	●	●
Measurement			Current sensor	1 unit	●	●	●	●	●	
				2 units		●	●	●	●	
			Voltage sensor TMS	1 unit	●	●	●	●	●	
				2 units ⁽³⁾		●	●	●	●	
Roof Line disconnector			IS 25.10	1 unit			●	●	●	
Surge arrester			Selected by Sécheron or car builder	1 unit		●	●	●	●	
				2 units ⁽⁴⁾		●	●		●	

⁽¹⁾ Safety Locking Switch type SLS to be considered with electric earthing device . ⁽²⁾ Electric earthing version is equipped with manual emergency device (MED-E) . ⁽³⁾ Not compatible with 2 Surge Arresters . ⁽⁴⁾ Not compatible with 2 TMS

The quality and the reliability of **MODBOX®** rely on several key factors, among which the deep know-how needed to integrate together high voltage components in a compact metal

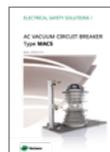
enclosure, as well as the quality and performances of the integrated components. In both areas and for decades, Sécheron has been developing a unique expertise, highly valued by our customers

worldwide, in the fields of 15/25 kV_{AC}. Naturally, Sécheron standard proven components are firstly used in **AC MODBOX®**, completed with equipment from first class suppliers.

/// SÉCHERON COMPONENTS

AC vacuum circuit breaker MACS Type

Brochure reference
SG325101Bxx



Roof Disconnector RS Type

Brochure reference
SP1870125Bxx



AC voltage sensor TMS Type

Brochure reference
SA004770Bxx



Pantograph Interlocking Switch BSV, SLS Type

Brochure reference
SP1880129Bxx



/// THIRD PARTY COMPONENTS

Surge arrester



Continuous voltage:
up to 35 kV

AC current measurement



Rated current up to
630 A
(15 kV, 16.7 Hz)
or 400 A
(25 kV, 50/60 Hz)

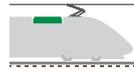
AC MODBOX® - TYPICAL DATASHEET

	Symbol	Unit	Single voltage		Dual voltage	
MAIN HIGH VOLTAGE CIRCUIT						
Nominal voltage	U_n	[kV]	15	25	15	25
Rated operational voltage	U_r	[kV]	17.25	27.5	17.25	27.5
Rated insulation voltage	U_{Nm}	[kV]	17.25	27.5	17.25	27.5
Rated operational frequency	f_r	[Hz]	16.7	50 or 60	16.7	50
Overvoltage category ⁽¹⁾	OV		4 (3 ⁽²⁾)	3	4	3
Rated impulse withstand voltage (1.2/50 μ s) ⁽¹⁾	U_{Ni}	[kV]	125 (75 ⁽²⁾)	125	125	
Rated power-frequency withstand voltage (50 Hz, 1 mn) ⁽¹⁾	U_a	[kV]	75 (34.5 ⁽²⁾)	75	75	
Conventional free air thermal current ⁽³⁾	I_{th}	[A]	630 (200 ⁽²⁾)	up to 400	up to 630	
rated short-time withstand current (1 s)	I_{cw}	[kA]	25	20	25	
Short-time withstand current (0.1 s)	I_{cw}	[kA]	40 (25 ⁽²⁾)	N.A.	40	
⁽¹⁾ Components inside the MODBOX® may have different and higher insulation performances. ⁽²⁾ for AC MODBOX-Mini version. ⁽³⁾ at Tamb=+40°C.						
HIGH VOLTAGE INTERFACE						
Cable glands (in customer's scope) / Bushings ⁽⁴⁾			1 (Input) 1 or 2 (Outputs)			
⁽⁴⁾ for AC MODBOX®-Mini						
LOW VOLTAGE AUXILIARY CIRCUIT						
Nominal voltage	U_n	[Vbc]	24 to 110			
Voltage range			[0.7 - 1.25] U_n			
LOW VOLTAGE INTERFACE						
Connector type			1 to 3 (Harting Han HPR 24B)			
OPERATING CONDITIONS						
Installation			Indoor or outdoor			
Protection index		IP	40 (indoor) / 56 (outdoor)			
Altitude		[m]	$\leq 2,000$			
Working ambient temperature (outside MODBOX®)			-40 to +45			
Pollution degree (inside MODBOX®)		PD	3			
APPLICABLE STANDARDS						
Insulation coordination			EN 50124-1 / IEC 62497-2			
Internal arc			IEC 62271-200			
Vibrations & shocks			IEC 61373: 2010 (Category 1 - Class A)			
EMC			EN 50121-3-2 / IEC 62236-3-2			
Environmental conditions			EN 50125 / IEC 62498			
Fire safety			EN 45545-2			
EXECUTION						
MODBOX® Colour			RAL 7016 (outdoor) / Natural colour (indoor)			

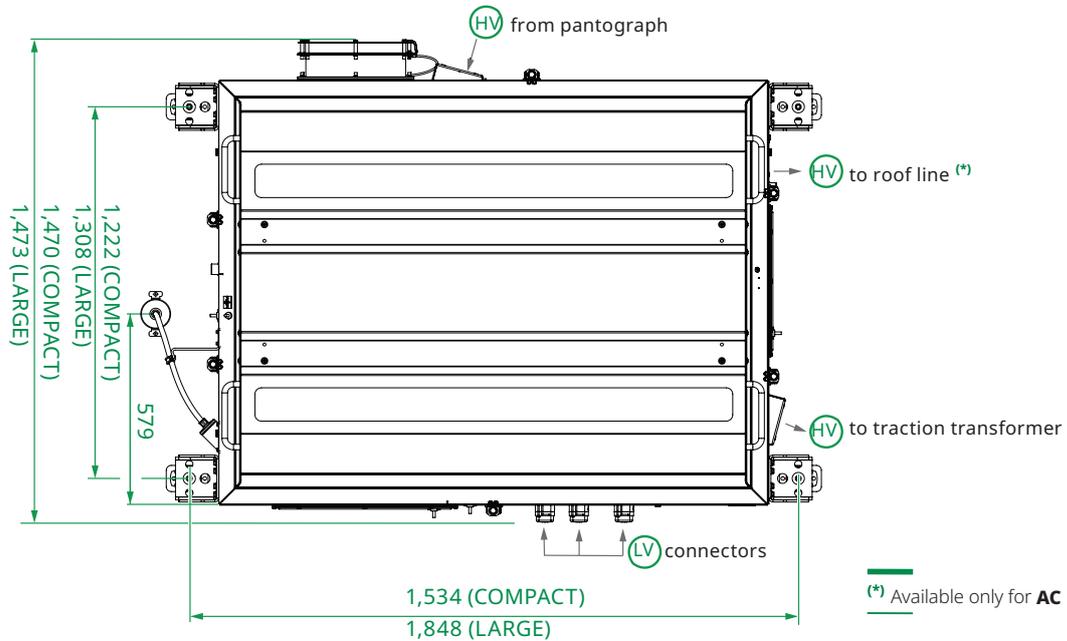
AC MODBOX® - MAIN DIMENSIONS

Tolerances are according to ISO 2768-cl

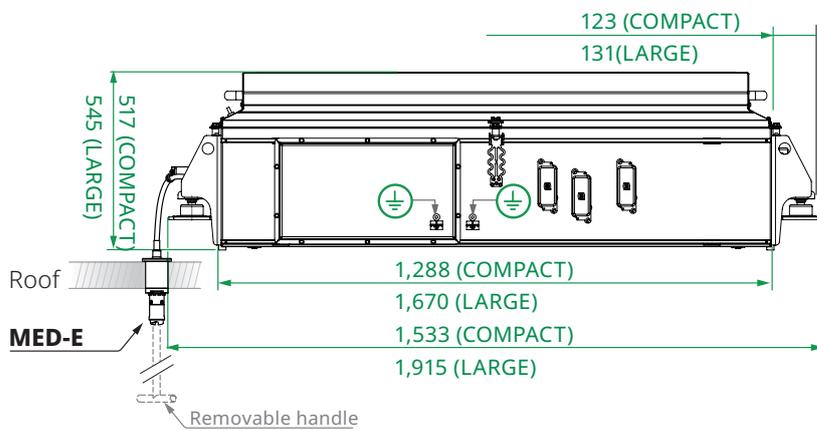
ROOF INSTALLATION



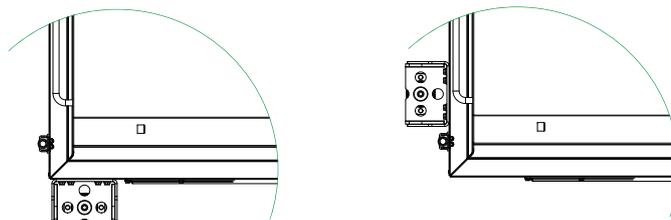
AC MODBOX® - COMPACT & - LARGE



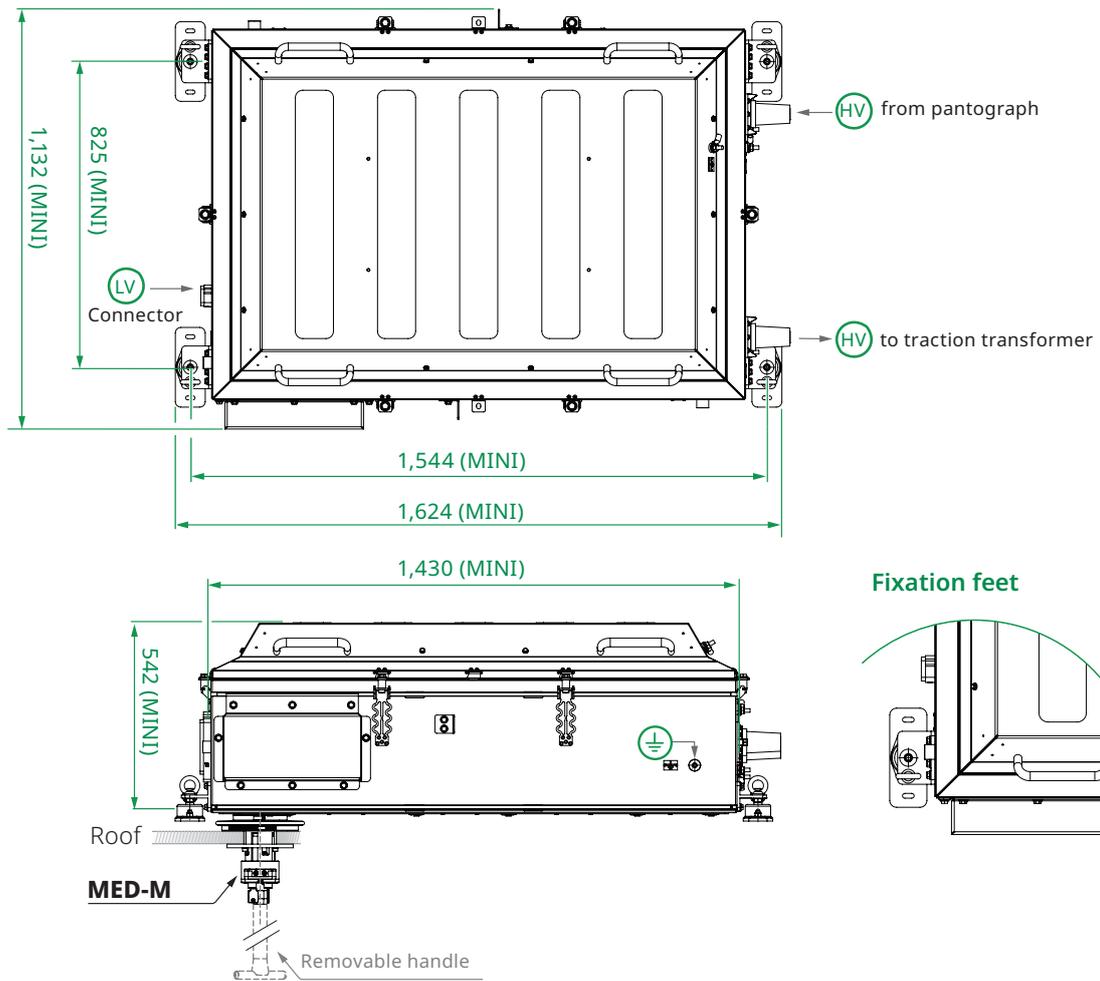
(*) Available only for **AC MODBOX®** Large



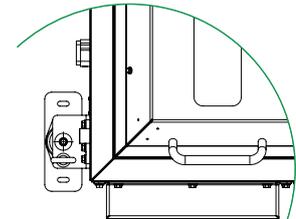
Fixation feet



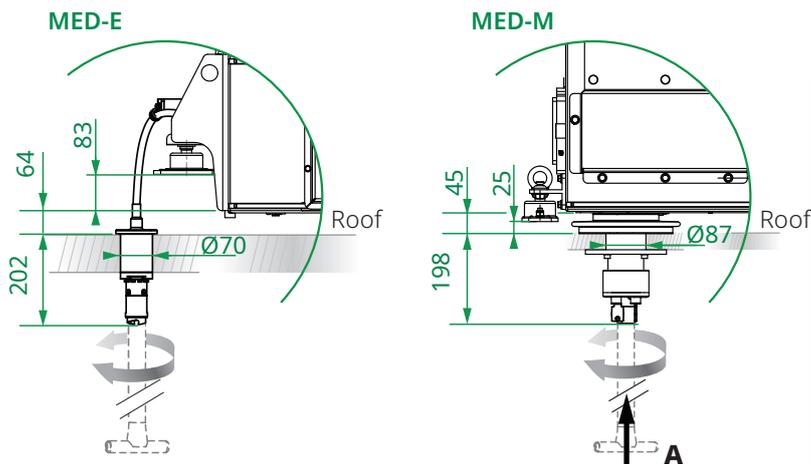
AC MODBOX® - MINI



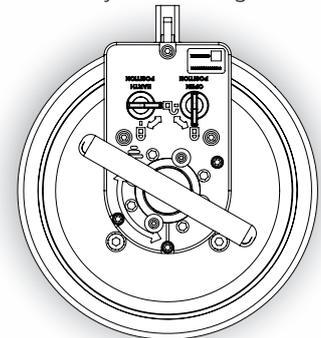
Fixation feet



MED-E & MED-M



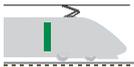
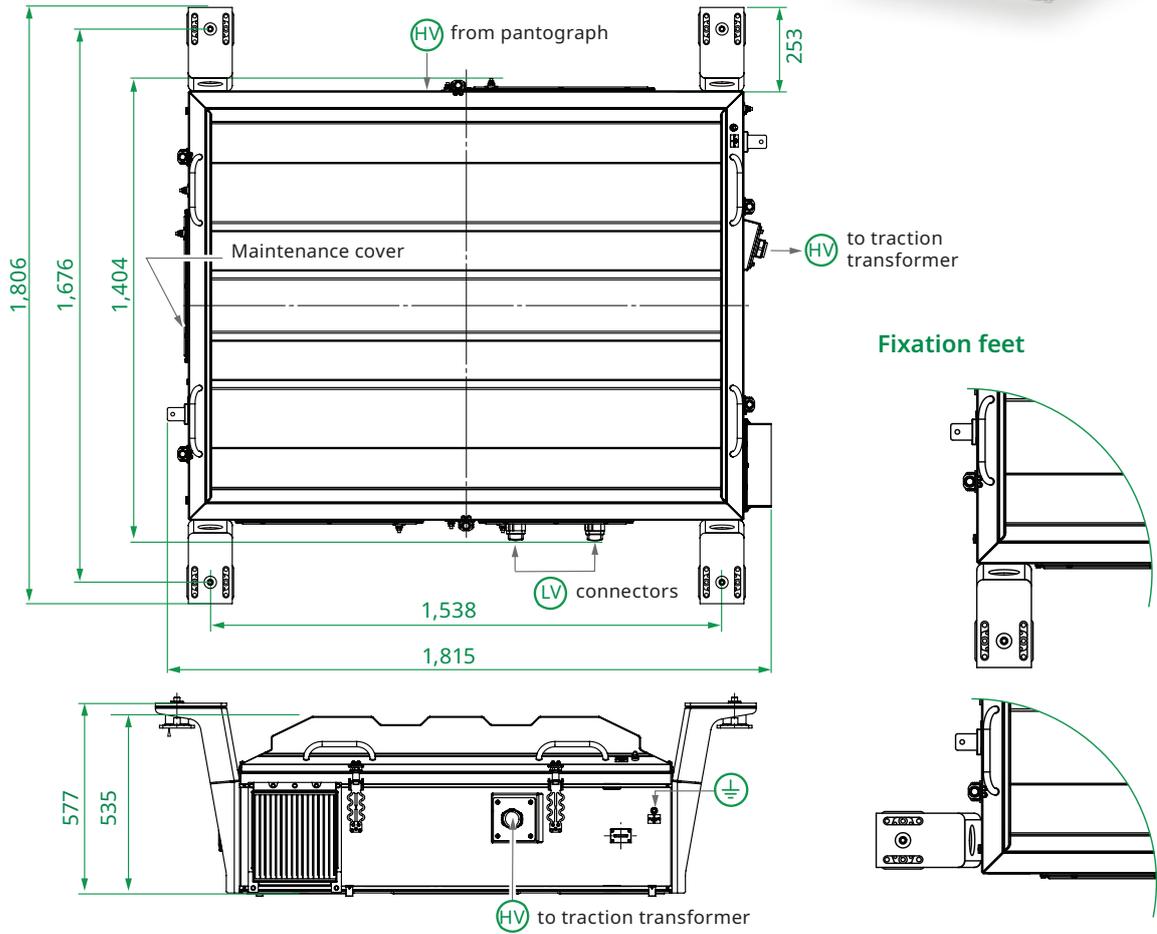
A view (non defined scale) Key interlocking



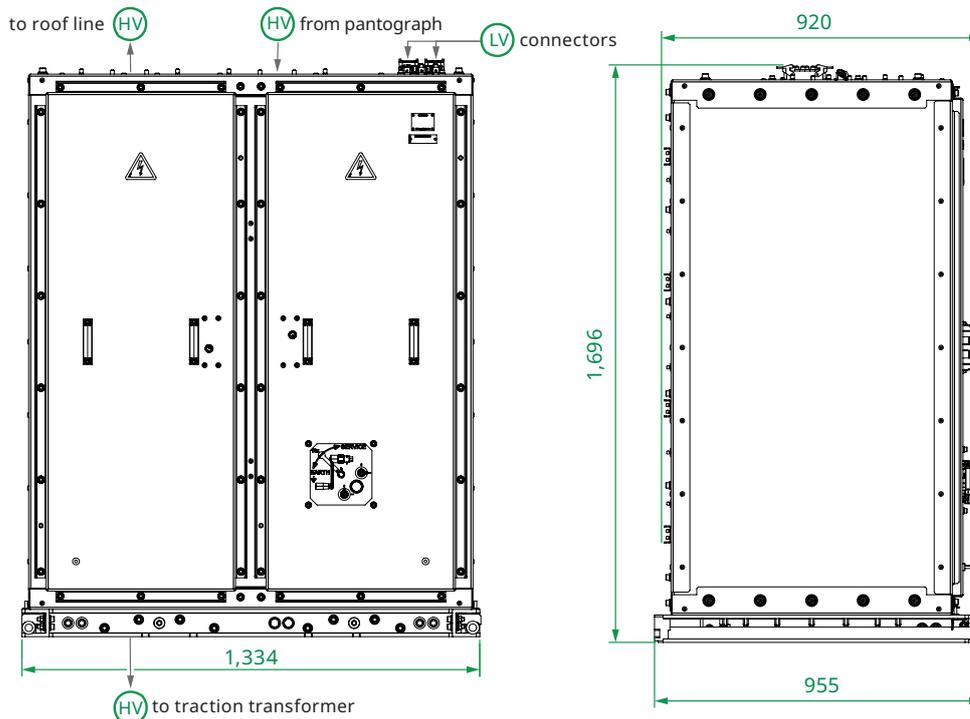
MED-E is an optional equipment used with the electrically operated earthing device of the MACS when installed in a roof mounted AC MODBOX. Accessible from under the vehicle's roof, it is ONLY used to connect manually the MACS circuit breaker to its earthing device in case the low voltage supply is not available. MED-E cannot be used to disconnect manually the earthing device.

MED-M is an additional equipment used with the manually operated earthing device of the MACS when installed in a roof mounted AC MODBOX. Accessible from under the vehicle's roof, it is used to connect and disconnect manually the MACS circuit breaker to its earthing device during maintenance operations, as well as to secure its safety position through key interlocks.

UNDERFRAME INSTALLATION

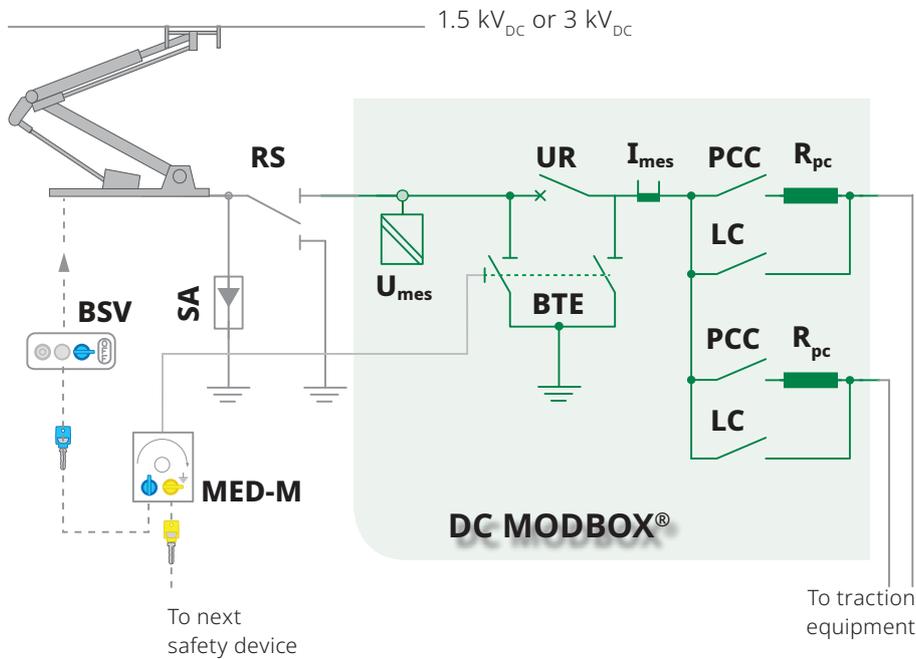


INDOOR INSTALLATION



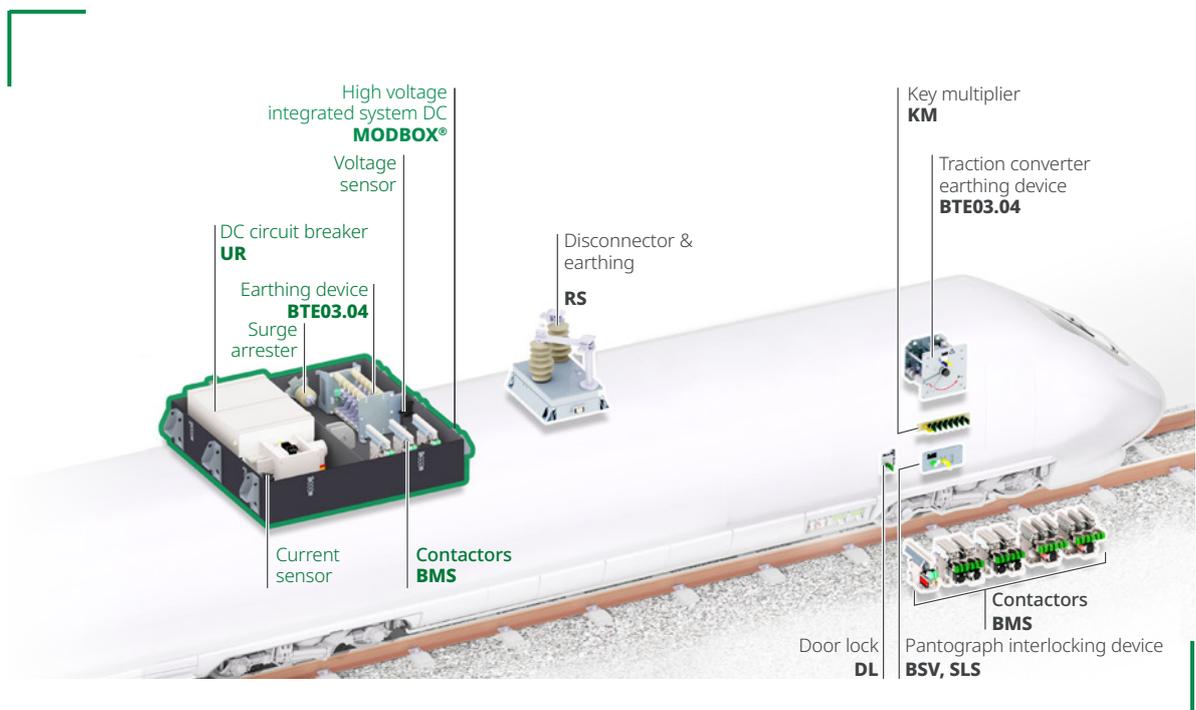
DC MODBOX®

TYPICAL APPLICATIONS



- BSV** : Pantograph interlocking box
- MED-M** : Manual earthing device
- SA** : Surge arrester
- RS** : Disconnecter & Earthing
- U_{mes}** : Voltage measurement
- UR** : High speed DC circuit breaker
- BTE** : Earthing device
- I_{mes}** : Current measurement
- PCC** : Precharging contactor
- LC** : Line contactor BMS
- R_{pc}** : Precharging resistor

Let us analyse your traction scheme and prepare a proposal for a **MODBOX®** adapted to your application and to a safe operation of the integrated components.



Sécheron supplies all equipment named on the above view.

DC MODBOX® - TYPICAL CONFIGURATIONS

FUNCTIONS	VOLTAGE [V _{dc}]	PRODUCTS	QUANTITY	DC MODBOX®			
				ROOF		UNDERFRAME	INDOOR
				COMPACT	MEDIUM	COMPACT	MEDIUM
DC circuit breaker	1,500	 UR26	1 unit	●	●	●	●
Earthing device		 BTE03.04A 2 & 4-Poles manual operation	1 unit		●	●	●
Measurement		 Current sensor	1 unit	●	●	●	●
			1 unit	●	●	●	●
Line switching & precharging		 BMS line contactor	1 unit		●		●
			 PCC precharging contactor	2 units		●	
			Charging resistor (ceramic type)				

FUNCTIONS	VOLTAGE [V _{dc}]	PRODUCTS	QUANTITY	DC MODBOX®					
				ROOF			UNDERFRAME	INDOOR	
				COMPACT	MEDIUM	LARGE	COMPACT	MEDIUM	
DC circuit breaker	3,000 or 1,500 & 3,000 (Dual voltage)	 UR26 (3,000 VDC) (with or without indirect trip control CID 3)	1 unit	●	●	●	●	●	
			1 unit	●	●	●	●	●	
Earthing device		 BTE03.04A 2- & 4-Poles manual operation	1 unit		●				●
			1 unit			●			
			1 unit						
Measurement		 Current sensor	1 unit	●	●	●	●	●	
			1 unit	●	●	●	●	●	
Line switching & precharging	 SEC line contactor	1 unit		●	●			●	
		 HS precharging contactor	2 units			●			
		Charging resistor (ceramic type)							

The quality and the reliability of **MODBOX®** rely on several key factors, among which the deep know-how needed to integrate together high voltage components in a compact metal enclosure, as well as the

quality and performances of the integrated components. In both areas and for decades, Sécheron has been developing a unique expertise, highly valued by our customers worldwide, in the fields of 1.5/3 kV_{DC}.

Naturally, Sécheron standard proven components are firstly used in **DC MODBOX®**, completed with equipment from first class suppliers.

/// SÉCHERON COMPONENTS

DC high speed circuit breaker UR 26/40 Type

Brochure reference
SG105306Bxx



Line contactors SEC Type

Brochure reference
SG201096Bxx



Line contactors BMS Type

Brochure reference
SG202168Bxx



Line contactors BMS Type

Brochure reference
SG202454Bxx



Roof disconnecter RS Type

Brochure reference
SG1870125Bxx



Earthing device BTE03.04 Type

Brochure reference
SP1880136Bxx



Contactor for pre-charging, heating HS Type

Brochure reference
DW6047Bxx



Pantograph Interlocking Device BSV, SLS Type

Brochure reference
SP1880129Bxx



/// THIRD PARTY COMPONENTS

Surge arrester

Rated voltage :
4.7 kV



DC voltage measurement

Rated voltage :
up to 3.6 kV



DC current measurement

Rated current :
500; 1,000
or 2,000 A



Differential relay

Rated voltage
up to 3.6 kV



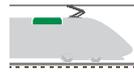
DC MODBOX® - TYPICAL CONFIGURATIONS

	Symbol	Unit	Single voltage		Dual voltage	
MAIN HIGH VOLTAGE CIRCUIT						
Nominal voltage	U_n	[V]	1,500	3,000	1,500	3,000
Rated operational voltage	U_r	[V]	1,800	3,600	1,800	3,600
Rated insulation voltage	U_{Nm}	[kV]	2,300	3,600	2,300	3,600
Overtoltage category ⁽¹⁾	OV		3	3	3	
Rated impulse withstand voltage (1.2/50 μ s) ⁽¹⁾	U_{Ni}	[kV]	12	20	12	20
Rated power-frequency withstand voltage (50 Hz, 1 mn) ⁽¹⁾	U_a	[kV]	5.5	9.2	5.5	9.2
Conventional free air thermal current ⁽²⁾	I_{th}	[A]	up to 3,200	up to 1,600	up to 2,000	up to 1,600
Maximum breaking capacity	A_2 / T_1	[kA/ms]	100 / 0	50 / 0	100 / 0	50 / 0
⁽¹⁾ Components inside the MODBOX® may have different and higher insulation performances. ⁽²⁾ at Tamb=+40°C.						
HIGH VOLTAGE INTERFACE						
Cable glands (M32x1.5 or M40x1.5) (cable glands for not shielded cables as a standard)					1 or 2 (Input) 1 to 4 (Outputs)	
LOW VOLTAGE AUXILIARY CIRCUIT						
Nominal voltage	U_n	[Vbc]	24 to 110			
Voltage range			[0.7 - 1.25] U_n			
LOW VOLTAGE INTERFACE						
Connector type			1 to 3 (Harting Han HPR 24B)			
OPERATING CONDITIONS						
Installation			Indoor or outdoor			
Protection index	IP		40 (indoor) / 56 (outdoor)			
Altitude		[m]	$\leq 2,000$			
Working ambient temperature (outside MODBOX®)		[°C]	-40 to +45			
Pollution degree (inside MODBOX®)	PD		3			
APPLICABLE STANDARDS						
Insulation coordination			EN 50124-1 / IEC 62497-2			
Short-circuit tests			EN/IEC 60077-3			
Vibrations & shocks			IEC 61373: 2010 (Category 1 - Class A)			
EMC			EN 50121-3-2 / IEC 62236-3-2			
Environmental conditions			EN 50125 / IEC 62498			
Fire safety			EN 45545-2			
EXECUTION						
MODBOX® Colour			RAL 7016 (outdoor) / Natural colour (indoor)			

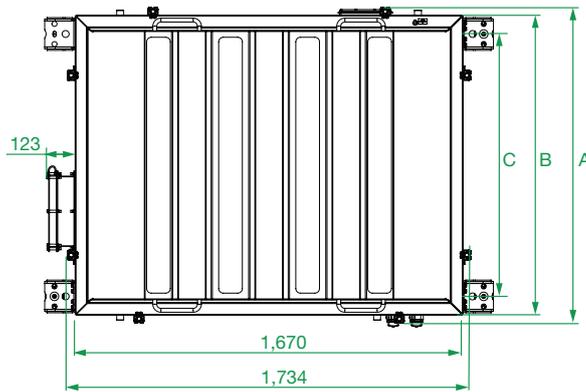
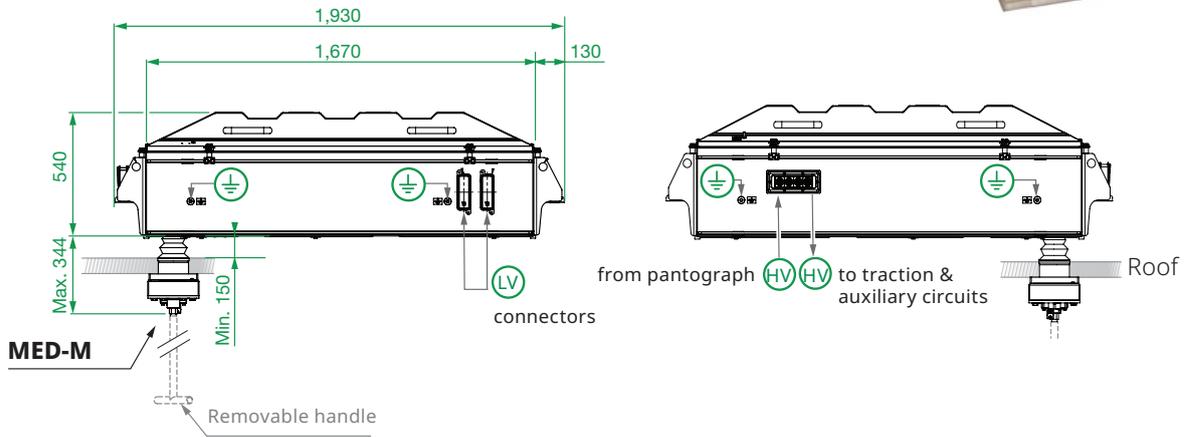
DC MODBOX® - MAIN DIMENSIONS

Tolerances are according to ISO 2768-cl

ROOF INSTALLATION

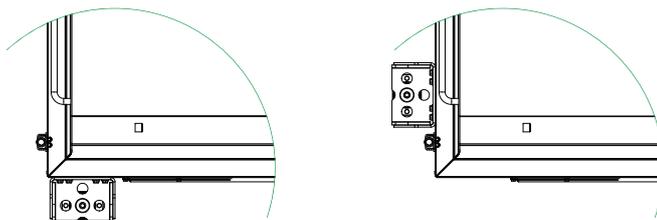


DC MODBOX® - COMPACT, - MEDIUM & - LARGE

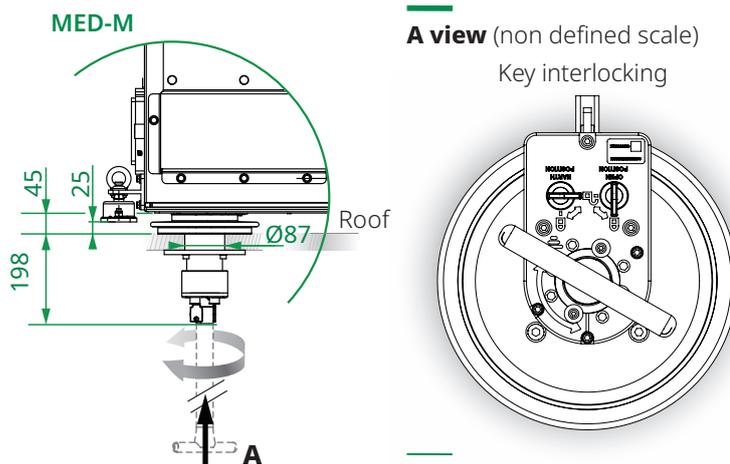


[mm]	COMPACT	MEDIUM	LARGE
A	964	1,368	1,764
B	900	1,300	1,700
C	738	1,140	1,538

Fixation feet

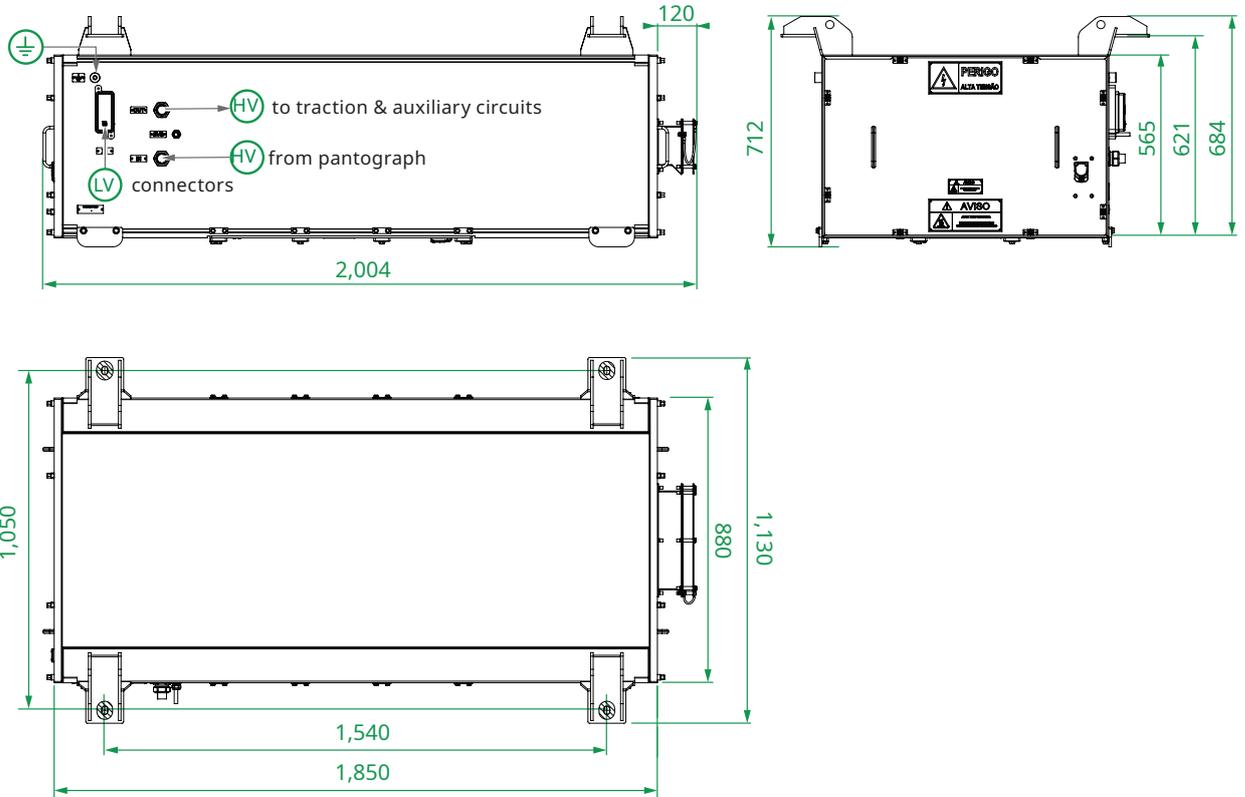


MED-M FOR MANUAL EARTHING DEVICE

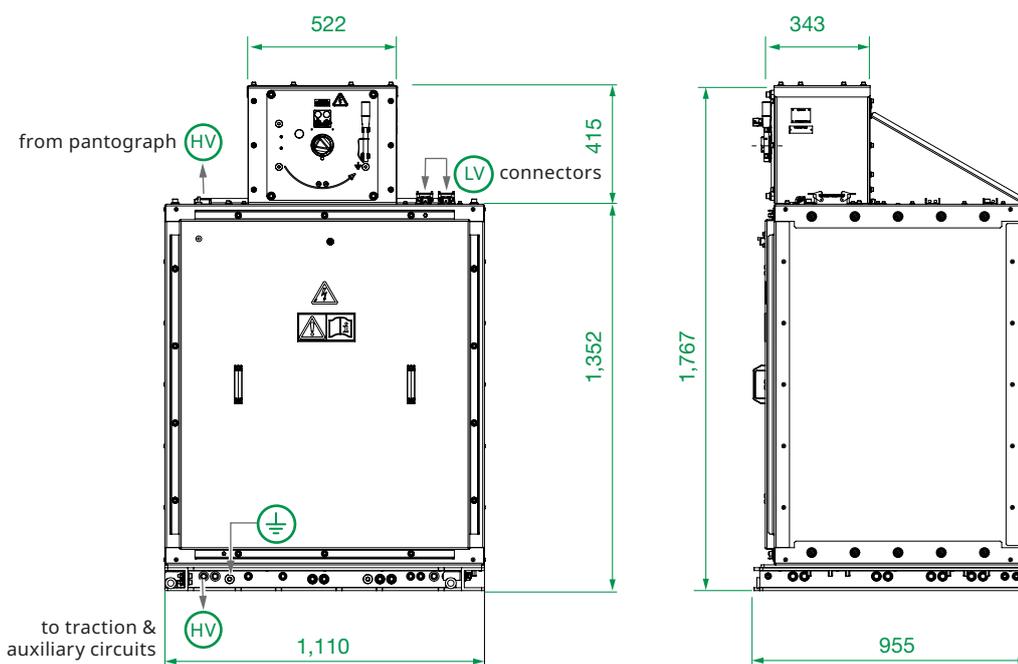
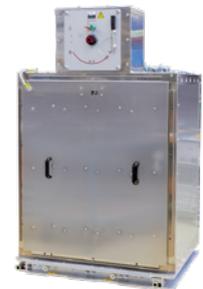
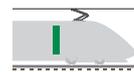


MED-M is the additional equipment used with the manually operated earthing device BTE03.04 when installed in a roof mounted DC MODBOX. Accessible from under the vehicle's roof, it is used to connect and disconnect manually the DC circuit breaker type UR to its earthing device BTE03.04 during maintenance operations, as well as to secure its safety position through key interlocks.

UNDERFRAME INSTALLATION



INDOOR INSTALLATION



SAFETY INTERLOCKING

Human safety for people operating and maintaining equipment on rail vehicles is a key topic always addressed by Sécheron when designing components and systems.

When the earthing device to ground the AC or DC circuit breaker is installed in the AC or

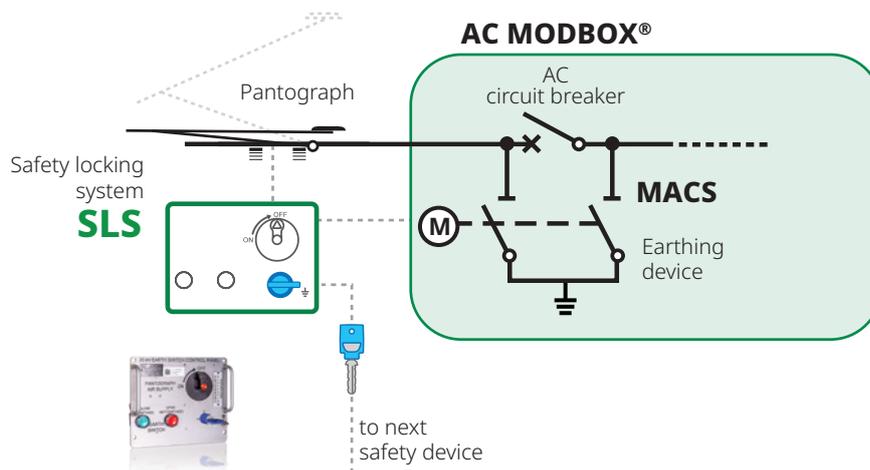
DC **MODBOX®**, it is no longer directly accessible for operation through its usual manual handle. Building on our long expertise in safety earthing device and interlocking components, efficient solutions have been designed to keep the highest safety level for the maintenance

operations, when vehicles are equipped with AC or/and DC **MODBOX®**.

Are shown below typical examples of safety interlocking when **AC MODBOX®** or/and **DC MODBOX®** are involved in a project.

TYPICAL PROJECT WITH AC MODBOX®

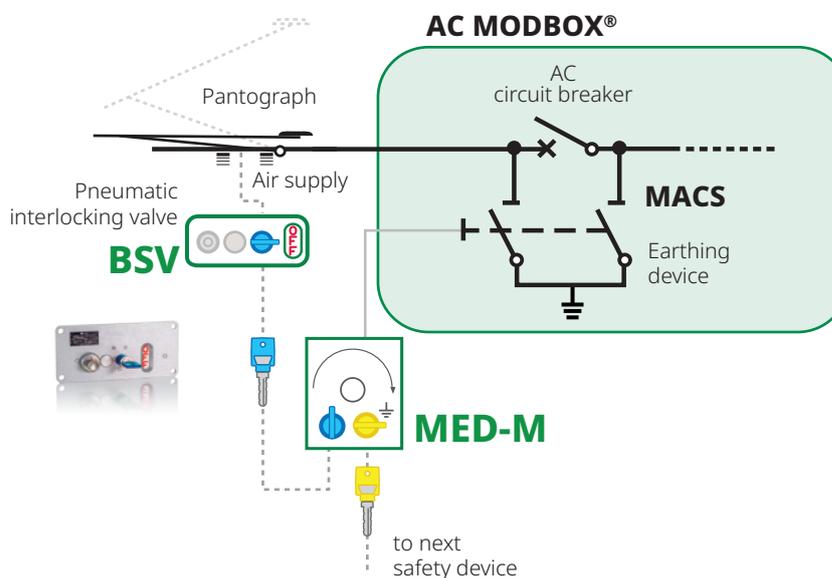
Configuration with electrical earthing device



In **AC MODBOX®**, both poles of AC circuit breaker type MACS are grounded through the electrically operated earthing device integrated to the MACS.

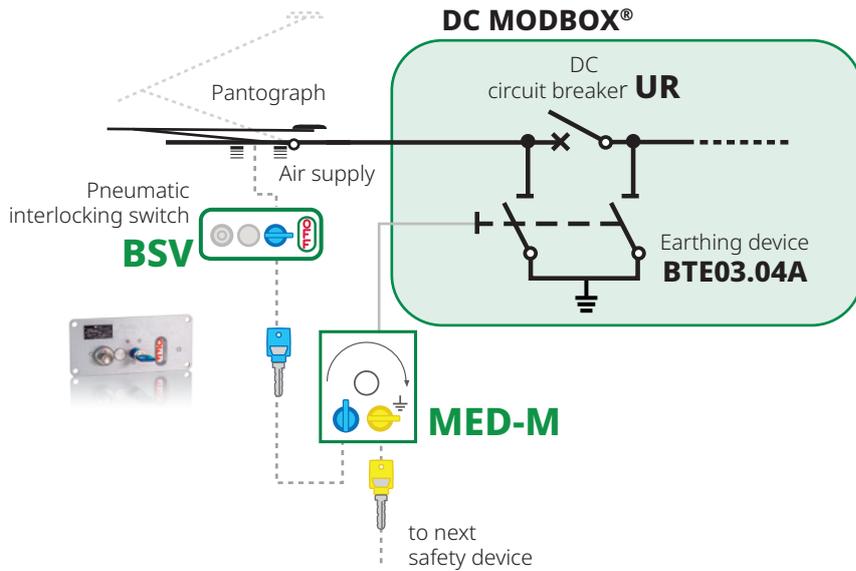
Control operations of the electric earthing device are interlocked with the pantograph air supply valve through Sécheron safety locking switch type SLS. It secures the maintenance operations, locking the pantograph in its lowered position and the electric earthing device in its safety grounded position.

Configuration with manual earthing device



For **AC MODBOX® Mini**, where the MACS is equipped with manually operated earthing device that can be operated and locked through the MED-M equipment from under the roof.

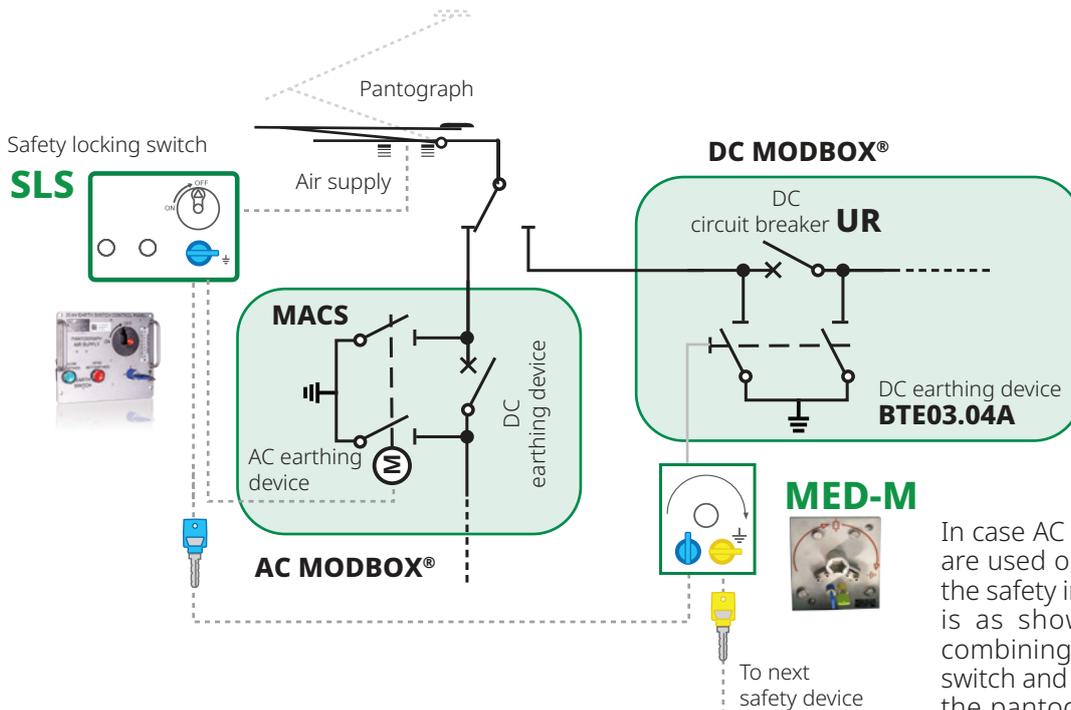
TYPICAL PROJECT WITH WITH DC MODBOX®



In **DC MODBOX®**, both poles of DC circuit breaker type UR are grounded through the manual earthing device type BTE03.04A.

BTE03.04A can only be set in its grounded position after the pantograph has been locked in its lowered position through the interlocking box type BSV. The key released from BSV gives access to the operation of BTE03.04A through its remote manual operation device type MED-M. Once the earthing device is locked in its safety position, a new key is release to operate the next safety step.

TYPICAL PROJECT WITH AC AND DC MODBOX®



In case AC and DC **MODBOX®** are used on the same vehicle, the safety interlocking scheme is as show in this section, combining SLS safety locking switch and MED-M to interlock the pantograph position and the position of both earthing devices for AC and DC circuit breakers.



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