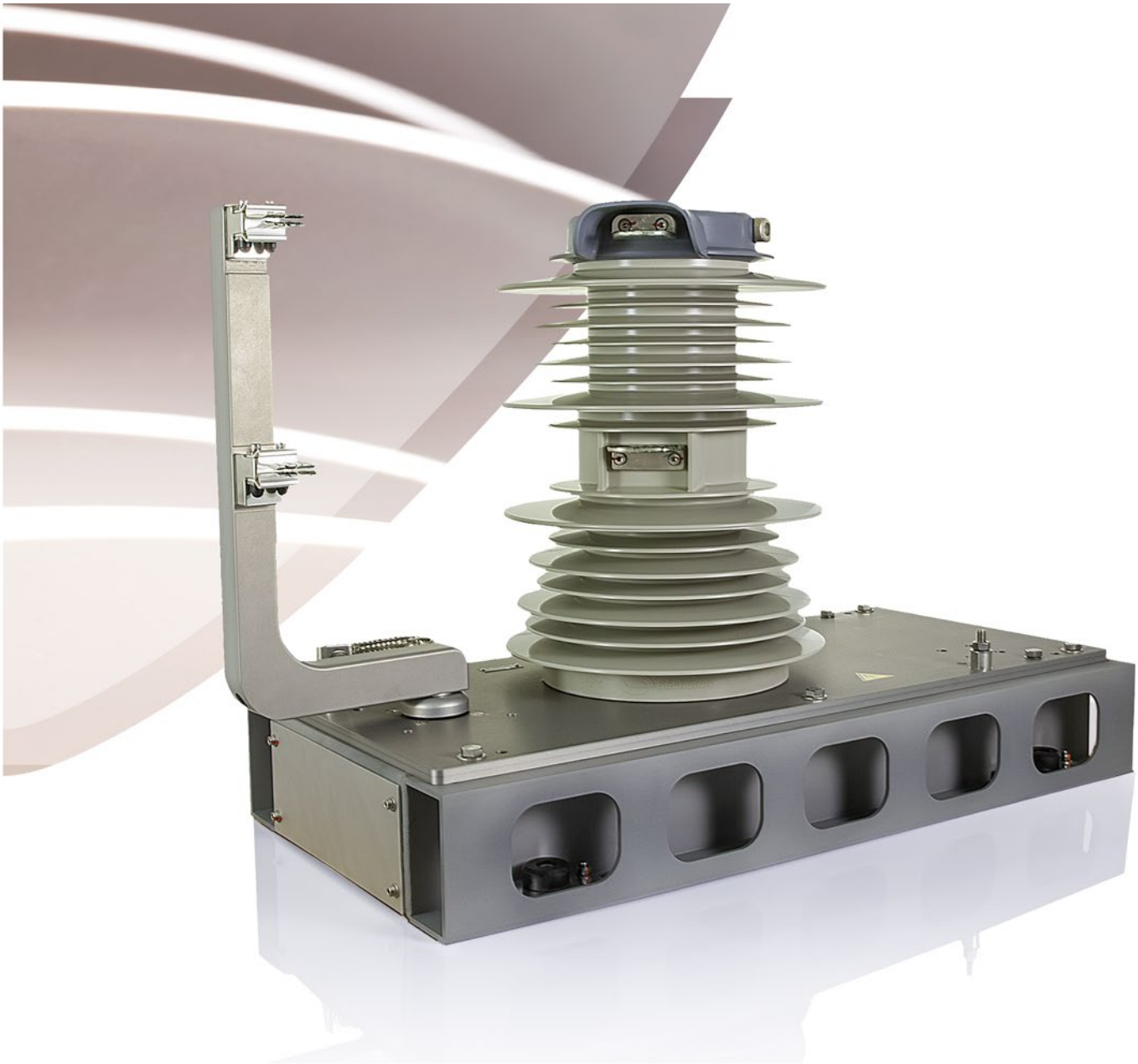
ELECTRICAL
SAFETY
SOLUTIONS

Sécheron

AC VACUUM CIRCUIT BREAKER

Type **MACS**

RAIL VEHICLES



GENERAL INFORMATION

MACS is Sécheron's main circuit breaker platform for installation on AC and AC/DC rail vehicles. It offers car builders a highly modular platform which is ideally suited to their various applications and requirements.

MACS is a fully electrically operated circuit breaker, designed to automatically open through spring release if the low voltage supply is interrupted.

Among the large range of options offered by MACS, two are unique features in the market for rail vehicle vacuum circuit breakers. The **overcurrent detection and tripping function**, ensures the autonomy of the circuit breaker in detecting, tripping and interrupting overcurrents and short circuits. The **Point-on-Wave (PoW)/Synchronous switching**, enables the MACS breaker to be closed or/and open synchronously with any phase angle of the line voltage, enabling a smart mitigation of Electromagnetic Interferences (EMI) or/and transformer's inrush currents.

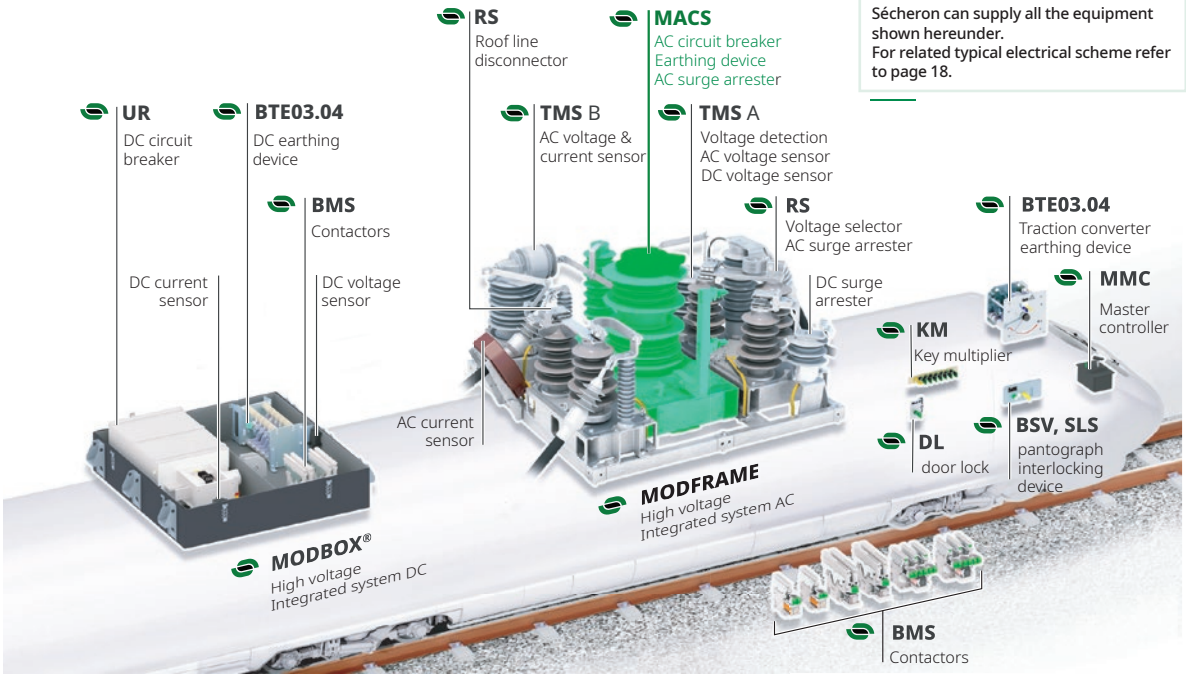
Sécheron offers many options to facilitate the integration of the circuit breaker on the vehicle. Delivered as a standalone component, the MACS can be supplied with a roof box to limit roof cut-outs, as well as noise transmission. It can also be delivered with other high voltage functions, such as current and voltage measurements, disconnectors and surge arresters, as part of Sécheron's high voltage integrated systems type **AC MODFRAME** or **AC MODBOX®**.

The MACS lightweight platform with its modularity and compact dimensions is the perfect solution for your rolling stock running on 15 kV_{AC} and/or 25 kV_{AC} networks.

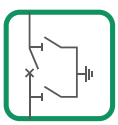
AC/DC TYPICAL APPLICATIONS

Switching and protection of main and auxiliary electric circuits for locomotives, trains and EMUs running on 15 kV_{AC} and/or 25 kV_{AC} networks.

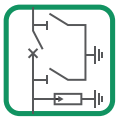
Sécheron can supply all the equipment shown hereunder.
For related typical electrical scheme refer to page 18.



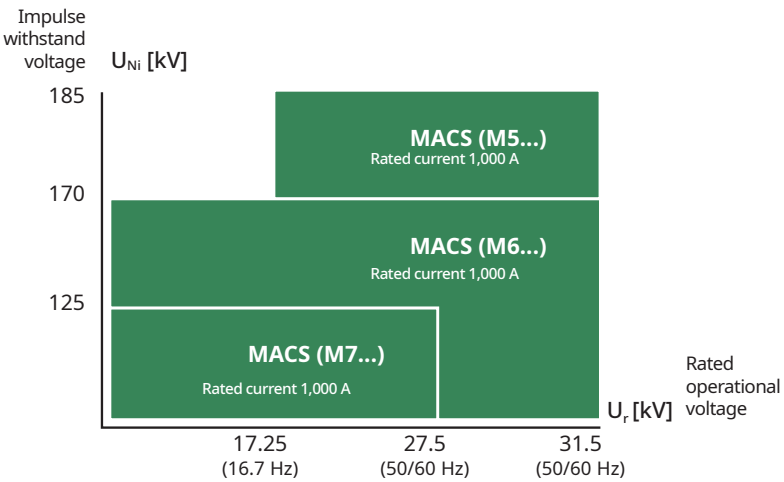
PRODUCT RANGE



AC circuit breakers with earthing device



& with surge arrester



MAIN FEATURES

- Compact multi-functional switch incorporating: AC circuit breaker, earthing device and optional surge arrester on a single 940 mm x 430 mm footprint.

For integration of roof disconnect switch, contact Sécheron.

AC CIRCUIT BREAKER

- Suitable for 15 kV_{AC} and/or 25 kV_{AC} networks.
- Conventional free air thermal current 1,000 A.
- Rated impulse withstand voltage (1.2 / 50 µs): U_{Ni} = 125 kV, 170 kV and 185 kV.
- External creepage distances
  > 1,000 mm (U_{Ni} = 125 kV and 170 kV)
  > 1,250 mm (U_{Ni} = 185 kV).
- Electric operation (closing and holding).
- Operation in ambient temperature from -40 °C to +70 °C (-50 °C to +70 °C in option).
- Reference standards: IEC/EN 60077-4, IEC/EN 61373, EN 50121-3-2, EN 45545.

EARTHING DEVICE

- Integrated earthing device with manual or electric operation.
- Safe manual operation guaranteed through interlocking keys.
- Ice breaking capability (20 mm ice).

SURGE ARRESTER

- Optional integrated surge arrester (to be defined by Sécheron upon customer's specifications).

MAIN BENEFITS

- Indoor or outdoor installation.
- Vertical or horizontal mounting.
- Specific version (U_{Ni} = 185 kV) with increased insulation level for outdoor operation in harsh environmental conditions (pollution, humidity, etc.).
- High level of safety thanks to automatic opening via spring release (no need for stored auxiliary electrical energy).
- Wide range of configurations and options to suit all operating conditions and requirements.
- Optional overcurrent detection and tripping function
- Optional Point-on-Wave/Synchronous switching at closing or/and opening, to mitigate against electromagnetic interferences or/and inrush currents.
- Optional roof box to limit roof cut-outs and structural noise transmission.
- Can be delivered integrated with other high voltage components in the AC MODFRAME for roof open air installation.
- Can be supplied with other high- and low- voltage components inside MODBOX® to mitigate operational risks from harsh environmental conditions (ice, sand, etc.).
- Compliant with LOC & PAS TSI, 1302/2014/EU.
- Specific configurations can also be developed for particular environments.
- Experts with a comprehensive understanding of working environments and coordination of protective devices.

DATA FOR PRODUCT SELECTION

	Symbol	Unit					
MAIN HIGH VOLTAGE CIRCUIT							
AC circuit breaker							
Application			Single & dual voltage				Harsh environment
MACS designation code			M7		M6		M5
Nominal voltage	U_n	[kV]	15	25	15	25	25
Rated operational voltage	U_r	[kV]	17.25 (1)	27.25 (1)	17.25 (1)	31.5 (1)	31.5 (1)
Rated insulation voltage	U_{Nm}	[kV]	30		31.5		33
Rated operational frequency	f_r	[Hz]	16.7	50 & 60	16.7	50 & 60	50 & 60
Rated impulse withstand voltage (1.2/50 µs)	U_{Ni}	[kV]	125		170		185
Rated power-frequency withstand voltage (50 Hz, 1 mn)							
- Pole-pole	U_a	[kV]	75		80		85
- Pole-earth	U_a	[kV]	75		80		100
Conventional free air thermal current (2)	I_{th}	[A]	1,000		1,000		1,000
Rated operational current	I_r	[A]	1,000		1,000		1,000
Operational category			C3		C3		C3
Peak short-circuit making current	I_{MC}	[kA]	62.5	50	62.5	50	50
Rated short-circuit breaking current	I_{BC}	[kA]	25	20	25	20	20
DC component for asymetrical breaking current		%	≤ 50		≤ 50		≤ 50
Peak and rated short-time withstand current (1 s)	$\hat{I}_{cw}/I_{cw}$	[kA]/[kA]	62.5/25		62.5/25		62.5/25
Short-time withstand current (0.1 s)	I_{cw}	[kA]	40	-	40	-	-
Minimum creepage distances		[mm]	> 1,000		> 1,000		> 1,250

(1) For other values, please contact Sécheron. • (2) At T_{amb} = +40 °C and tested with high voltage connections according to standard IEC/EN 60943.

Earthing device

Peak and rated short-time withstand current (1 s)	$\hat{I}_{cw}/I_{cw}$	[kA]/[kA]	62.5/25	62.5/25	62.5/25

LOW VOLTAGE AUXILIARY CIRCUIT

Control circuit

AC circuit breaker

Nominal voltage (power supply and control order)	U_n	[V_{DC}]	24 to 110
Range of voltage (power supply and control order)			[0.7 - 1.25] Un
Maximum power (loading and holding) (3)(4)	P_{max}	[W]	≤ 180 (depends on battery voltage)
Nominal holding power (4)	P_h	[W]	≤ 35
Opening power		[W]	0
Mechanical opening time (4)	T_o	[ms]	≤ 50
Mechanical closing time (4)	T_c	[ms]	≤ 65

Earthing device (electrically operated version)

Nominal voltage	U_n	[V_{DC}]	24, 32, 36, 48/50, 72, 110
Operating power (4)		[W]	125
Commutation time (4)		[s]	≤ 3

(3) Loading time < 12 seconds. • (4) At U_n and T_{amb} = + 23 °C.

Auxiliary contacts

Type of contacts			Potential free
Rated voltage		[V_{DC}]	24 to 110
Conventional thermal current	I_{th}	[A]	10
Switching categories according to EN60947 (silver contacts)			AC - 15 230 V_{AC} 1.0 A DC - 13 110 V_{DC} 0.5 A
Minimum let-through current at 24 V_{DC} (5)		[mA]	≥ 10 (silver contacts) or 4 ≤ I < 10 (gold contacts)

AC circut breaker

Quantity			4a+4b (standard) / 4a+4b (additional in option) (6)

Earthing switch

Quantity			0 (standard) / 2a+2b (option) - For manual earthing switch 2a+2b (option) - For electric earthing switch

(5) For a dry and clean environment. (6) For MACS version with Point-on-Wave/Synchronous switching, only 2a+2b additional in option. •

Low voltage interface

Type of connection (7)			
- AC VCB with manual earthing device			1 Connector: Harting 51 P
- AC VCB with electric earthing device			2 Connectors: Harting 51 P + Harting 24 DD
- Voltage analog input for synchronous switching			1 connector Harting Han 3A
- Current analog input for overcurrent detection and tripping			1 connector Harting Han 3A

(7) Refer to page 12 for mobile connector information.

Insulation

Rated power-frequency withstand voltage (50 Hz, 1 mn)	U_a	[kV]	1.5

OPERATING CONDITIONS

Installation			Indoor or outdoor
Altitude		[m]	≤ 2,000
Working ambient temperature	T_{amb}	[°C]	-40 to +70 / -50 to +70 (option)
Humidity			Class 5K2
Pollution degree		[IP]	PD4
Minimum mechanical durability	N	[Cycles]	250,000

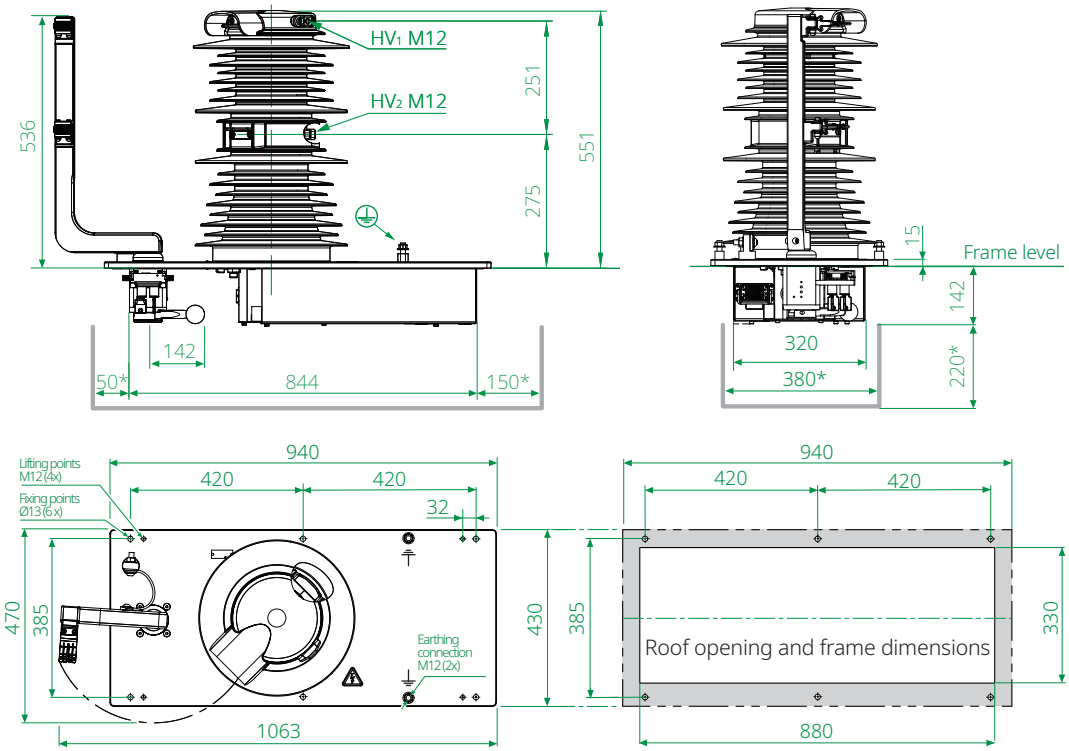
PRODUCT INTEGRATION

MAIN DIMENSIONS

Dimensions without tolerances are approximate only. All dimensions given in mm. The maximum permissible flatness deviation of the support frame is 0.5 mm. HV and earth connections: M12 screws.

AC CIRCUIT BREAKER 15/25 kV$_{AC}$ - U$_{Ni}$ = 125 kV (MACS M7.. DESIGNATION CODE)

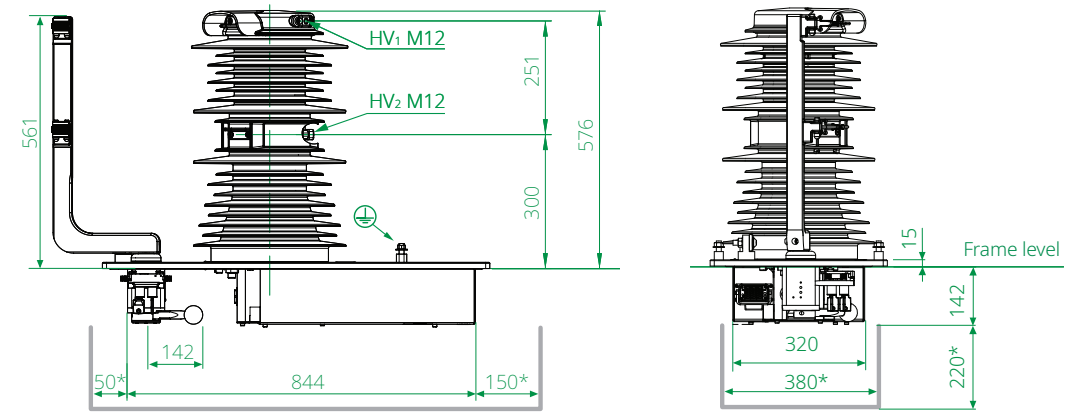
Weight : 103 kg



(*) Space needed for operation and maintenance.

AC CIRCUIT BREAKER 15/25 kV$_{AC}$ - U$_{Ni}$ = 170 kV (MACS M6.. DESIGNATION CODE)

Weight : 104 kg

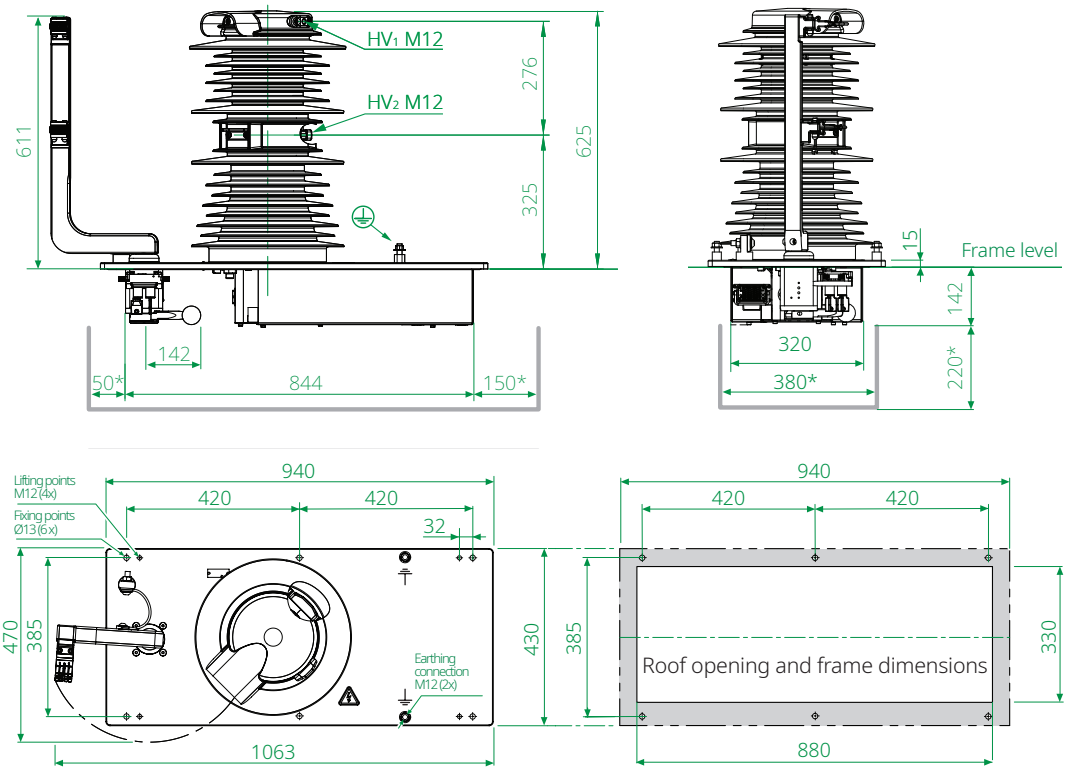


(*) Space needed for operation and maintenance.

For top view, roof opening and frame dimensions, please refer to above model for U$_{Ni}$ = 125 kV.

AC CIRCUIT BREAKER 25 kV$_{AC}$ - U$_{Ni}$ = 185 kV (MACS M5.. DESIGNATION CODE)

Weight : 105 kg



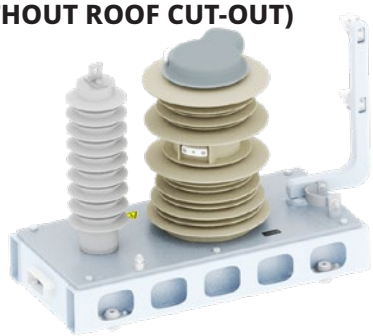
(*) Space needed for operation and maintenance.

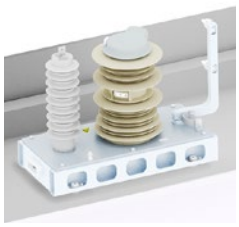
INSTALLATION POSSIBILITIES

VERTICAL INSTALLATION ON THE ROOF (WITH ROOF CUT-OUT)

With this solution a roof cut-out is required for the MACS low voltage compartment as well as for the manual operating mechanism of the earthing device.

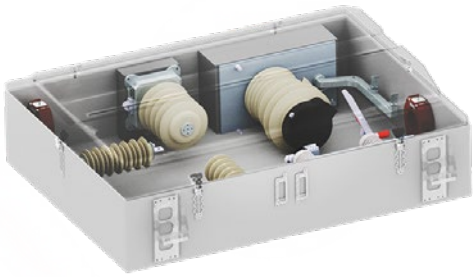
VERTICAL INSTALLATION ON THE ROOF (WITHOUT ROOF CUT-OUT)





To avoid roof cut-out while reducing structural noise transmission, MACS can also be delivered together with Sécheron's optional roof box.

HORIZONTAL INSTALLATION ON THE ROOF OR UNDERFRAME



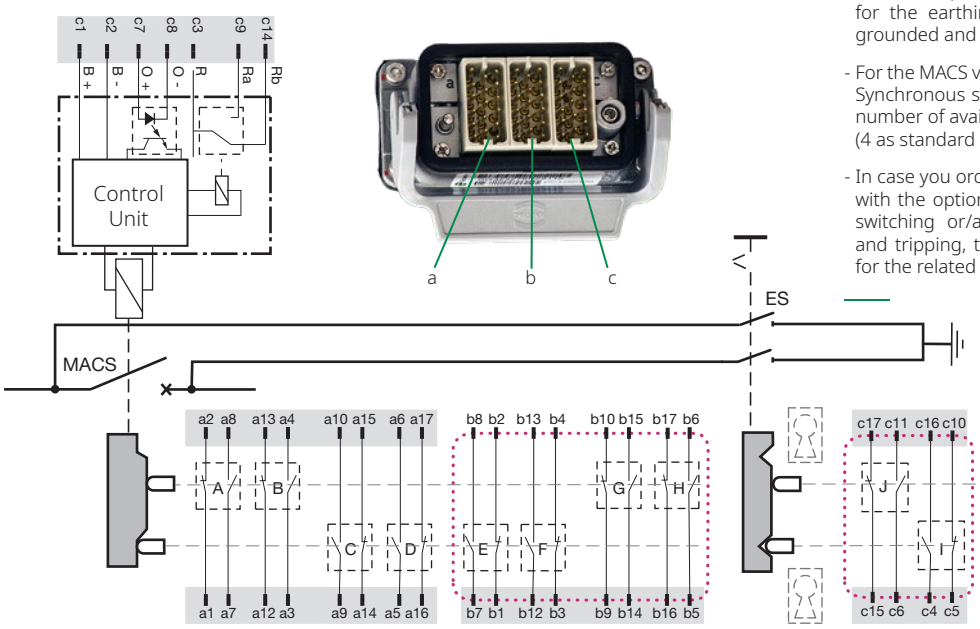
Underframe mounting or roof mounting in special high voltage box (Sécheron **AC MODBOX®**).

LOW VOLTAGE WIRING DIAGRAM
(HARTING HAN® MODULAR 51-PINS CONNECTOR)

Legend of the schemes:

	Circuit breaker main contacts		Low voltage connector interface (male pin)
	Earthing device main contacts	a b	1a + 1b - switch PF
	Closing coils		Earthing device manual operation
	Harting connector		Optional auxiliary contact
B	Battery power supply	O	Control order
R	Ready switch (MACS ready to close)	ES	Earthing device

The representation below depicts **MACS**
in standard configuration (4a+4b – switch PF),
with optional additional auxiliary switches (4a+4b – switch PF)
and manual earthing device (2a+2b – switch PF).

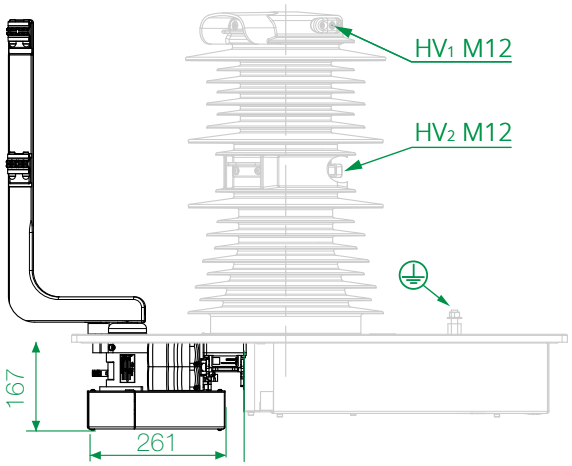


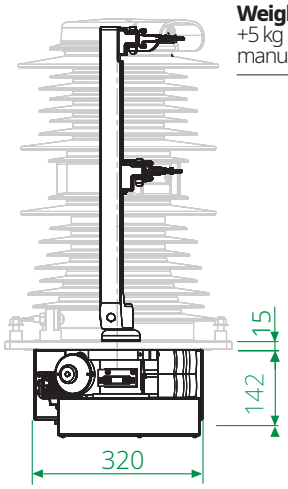
For electric earthing device, please contact Sécheron.

- The auxiliary switches' state is represented for the MACS in open position.
- The auxiliary switches' state is represented for the earthing device in position not grounded and locked in this position.
- For the MACS version with Point-on-Wave/ Synchronous switching option, maximum number of available auxiliary switches is 6 (4 as standard + 2 as option).
- In case you order the MACS configuration with the optional functions, synchronous switching or/and overcurrent detection and tripping, thank you to ask Sécheron for the related spécific control scheme.

OPTIONS (SUBJECT TO ADDITIONAL COSTS)

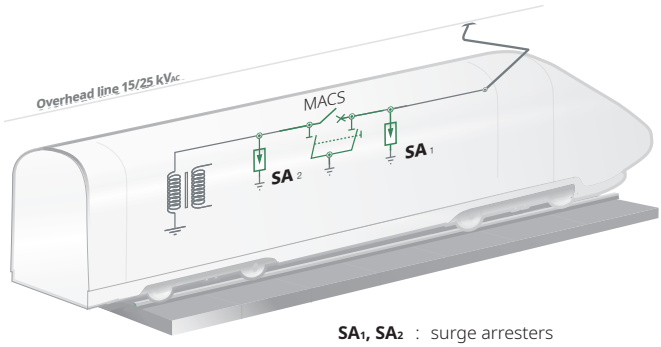
EARTHING DEVICE - ELECTRIC OPERATION





Weight :
+5 kg versus
manual operation

INTEGRATION OF SURGE ARRESTER

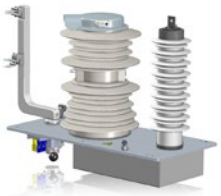


SA1, SA2 : surge arresters
MACS : AC vacuum circuit breaker
+ earthing device

For safe and efficient protection against lightning and switching overvoltages, Sécheron strongly recommends the use of two surge arresters SA_1 and SA_2 in the vehicle's high voltage circuit.

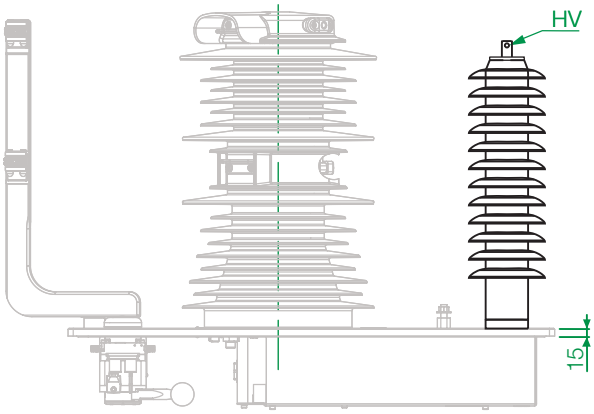
In order to effectively protect the AC circuit breaker, the distance between each surge arrester and the AC circuit breaker must not be too long.

Customers wishing to add a surge arrester to the MACS can rely on Sécheron's specialists to specify the most appropriate type.

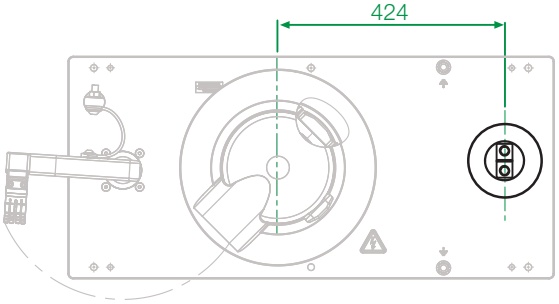


The connection between the AC circuit breaker and the surge arrester is not shown on the drawing but can also be delivered by Sécheron.

Weight and height of surge arresters depend on selected type.



Surge arrester connections: M12 screws.



OVERCURRENT DETECTION AND TRIPPING FUNCTION

The **short-circuit and overcurrent detection and slef-tripping function** ensures the autonomy of the **MACS** in detecting, tripping and interrupting overcurrents and short circuits.

This function requires an input from the current transformer that measures the vehicle input current. This signal can be provided either by Sécheron TMS current & voltage sensor, or by an individual current transformer.

Two types of overcurrent detection are achieved through different thresholds and reaction times:
- Instantaneous maximum current / short-circuit detection
- RMS current overcurrent detection

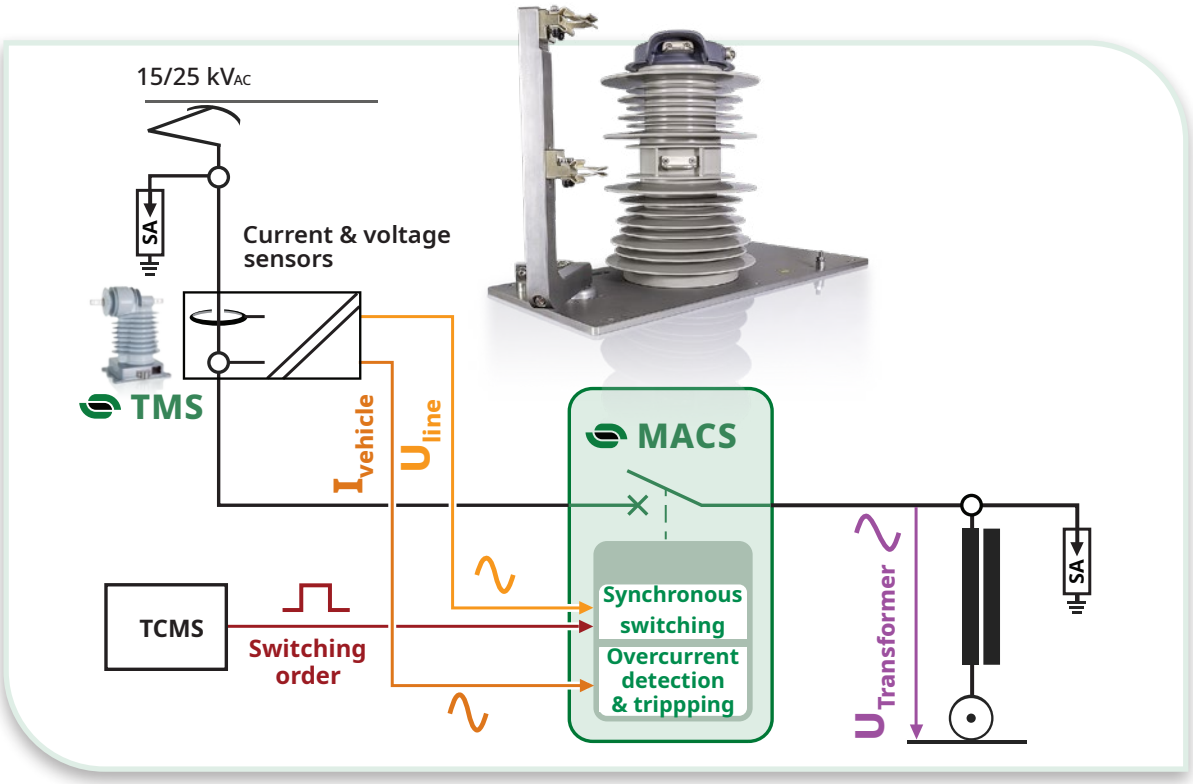
When the detection of one of these events is proven, MACS main contacts automatically open with its usual mechanical opening time.

Whenever short-circuits or overcurrents are detected, a relay integrated in the MACS control unit provides the information to the vehicle.

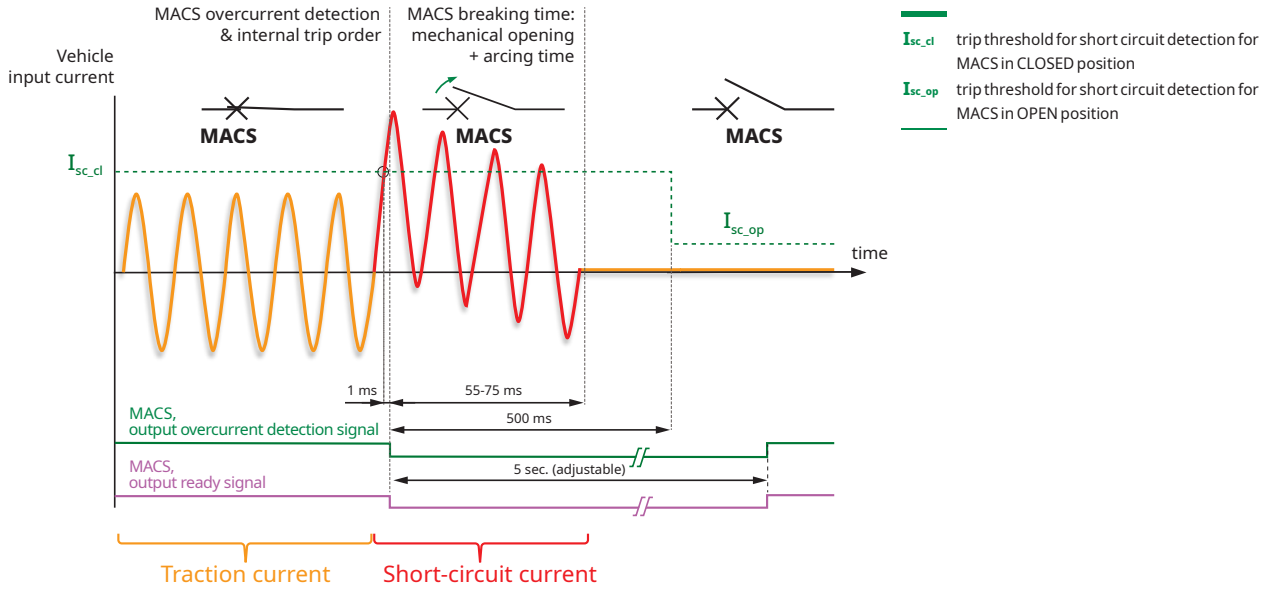
A series of protocols and security measures are implemented for this highly critical function to ensure safe operations and monitoring of the MACS as well as hazards mitigation.

Reclosing the MACS immediately after short-circuit conditions is prevented, as well as after a series of overcurrent detections.

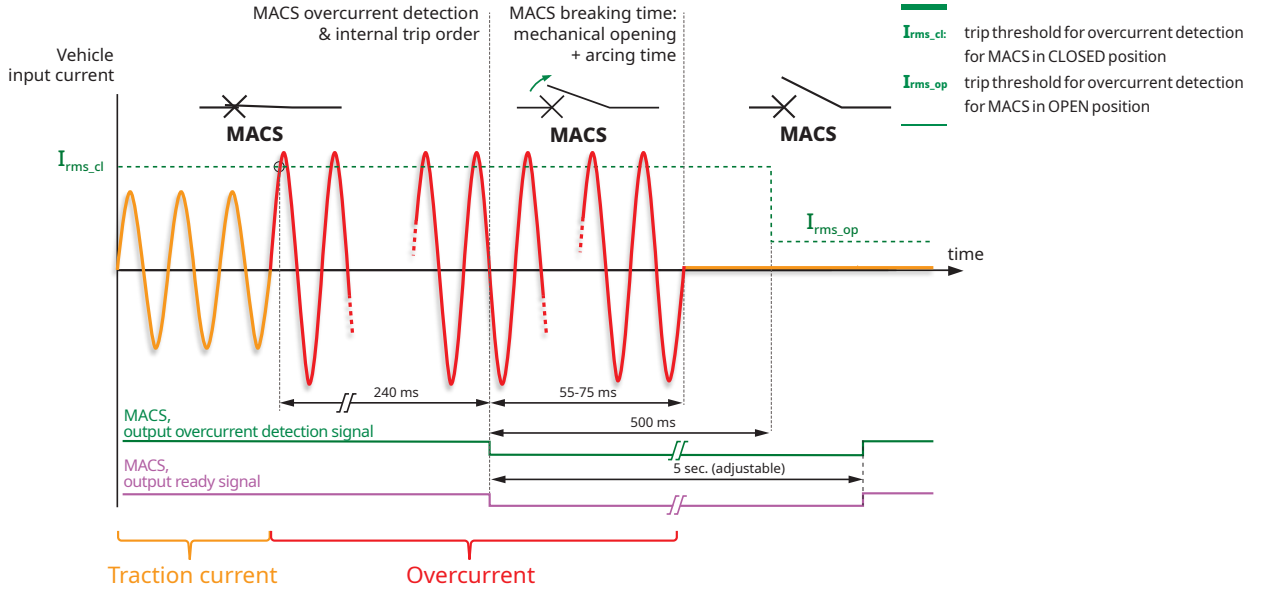
This major innovation further enhances the vehicle safety, as it avoids dividing safety functions and responsibilities among several devices and vehicle's stakeholders, which is a common practice today for AC circuit breakers available on the market



SHORT CIRCUIT DETECTION & TRIPPING



RMS DETECTION & TRIPPING



MAIN BENEFITS

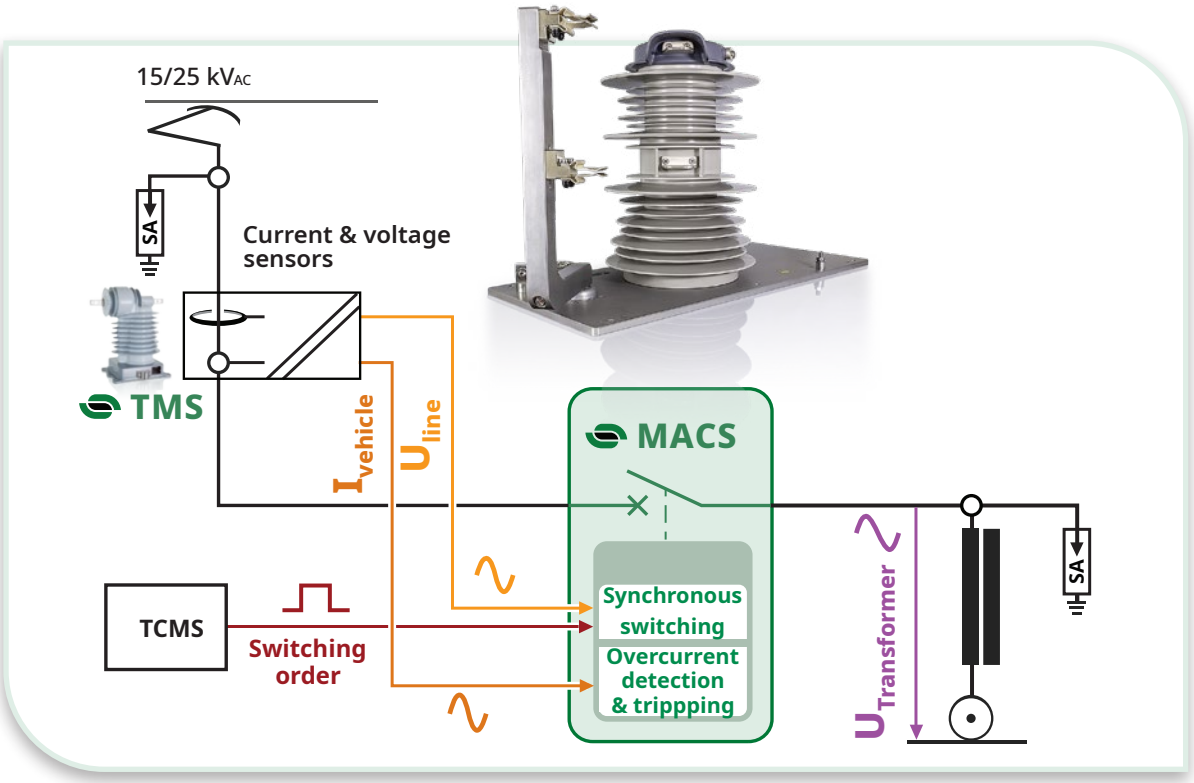
- Built-in detection and tripping function for an autonomous protection against overcurrents and short-circuits.
- Enhanced vehicle safety with an AC circuit breaker no more depending on third party detection and trip signals.
- Adjustable thresholds for detection and tripping of overcurrents and short-circuits.
- Different detection thresholds for MACS in CLOSE and OPEN positions to detect any unsafe operating condition.
- Function's failure rate complies with Safety Integrity Level 2 (SIL2).
- Can be selected together with point-on-wave/synchronous switching function.

REQUIREMENTS FOR MACS OVERCURRENT DETECTION AND TRIP FUNCTION

- Have one AC current sensor analogue output available for connection to the MACS control unit.
- The input can come from Sécheron's TMS or from a Current Transformer.
- MACS analogue input: from 0.25 to 5 A_{AC}.
- Define the detection/trip thresholds for the overcurrents and short-circuits protections.
- Define the delay time before authorizing to reclose the MACS after a detection and trip of an overcurrent/short-circuit.
- Select the appropriate code (E, N or P) for the line 21 of the ordering code (page 19).
- Order the additional low voltage connector for the current analogue input signal on MACS.

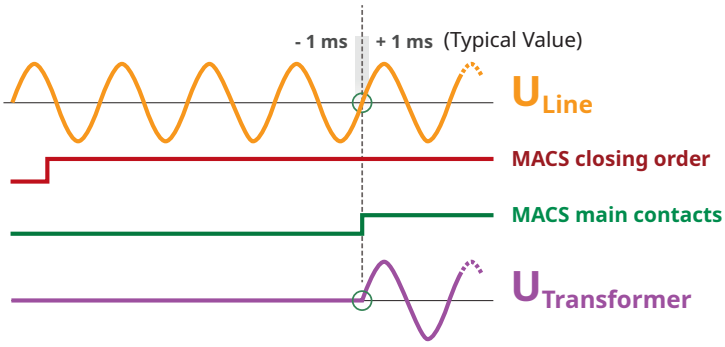
POINT-ON-WAVE/SYNCHRONOUS SWITCHING FUNCTION

Sécheron has designed a unique **Point-on-Wave/ Synchronous switching** function that can be installed on our AC circuit breakers type **MACS**. This function enables to close or/and open repetitively the MACS on a predefined phase angle of the line voltage and with a typical accuracy within ± 1 ms (± 18 degree at 50 Hz). With this function, MACS can for instance be closed on the phase 0 degree (or 180 degrees) so that the main contacts closes at the exact time when the line voltage is 0 volts, avoiding thus high dv/dt and limiting induced potential electromagnetic interferences. If closing on the phase 90 degrees (or 270 degrees) is selected, the AC circuit breaker will close when the value of the line voltage wave is at its maximum, minimizing the vehicle inrush current.



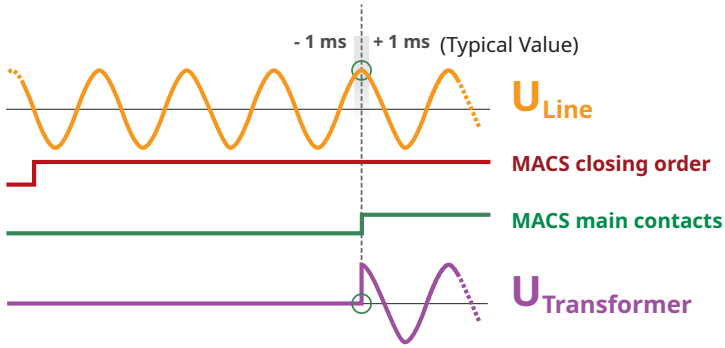
Closing synchronous switching at 0°

⇒ **Reduction of Electromagnetic interference (EMI)**



Closing synchronous switching at 90°

⇒ **Reduction of transformer's inrush current**



MAIN BENEFITS

- Synchronous switching of the MACS with the line voltage phase.
- Adjustable setting of the predefined phase angle of line voltage for synchronous closing or/and opening.
- Setting of the predefined phase angle can be different for closing and opening.
- High accuracy for Point-on-Wave/ Synchronous switching, typically within ± 1ms.
- Switching accuracy independent from the ambient temperature and control voltage.
- Suitable for 12 kV (25 Hz), 15 kV (16.7 Hz), 25 kV (50 & 60 Hz).
- Reliable closing at 0 Volts crossing to avoid dV/dt and subsequent electromagnetic interferences.
- Reliable closing at maximum voltage of the sine wave to limit vehicle inrush current.
- Point-on-Wave/Synchronous switching function can be directly integrated in the MACS control unit with no impact on the product's dimensions.
- Can be selected together with overcurrent detection and tripping function.

REQUIREMENTS TO ORDER POINT-ON-WAVE/SYNCHRONOUS SWITCHING FUNCTION

- Have one AC voltage sensor's analogue output available for connection to the MACS control unit. The input can come from Sécheron's **TMS** voltage & current sensor (current loop output) or from a Voltage Transformer (voltage output).

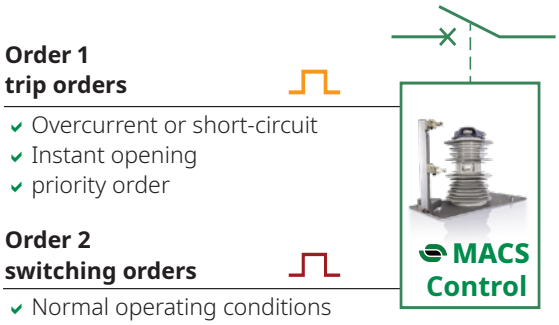
  MACS input voltage range:
  - from 37.5 to 120 V_{AC} (1)
  - 8 to 25 mA

- Define precisely the goal to be achieved using the Point-on-Wave/Synchronous switching function, so that Sécheron can recommend the best settings adapted to your application and requirements: reduce Inrush Current, reduce Electromagnetic Interferences (EMI), others, ...

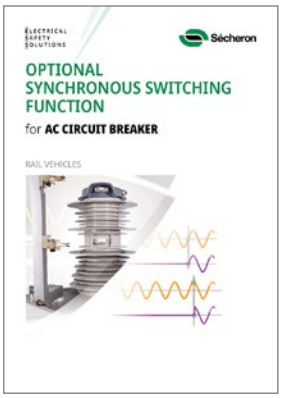
- To order the Point-on-Wave/Synchronous switching option, select the appropriate code (J, L, N or P) for the line 21 of the ordering code page 19.

- Order the additional low voltage connector for the voltage analog input signal.

- Upon the needs of the application, the synchronous switching behaviour of the orders can be set in different modes
  - Point-on-Wave/Synchronous switching at closing only (at any predefined phase)
  - Point-on-Wave/Synchronous switching at opening and closing (at any predefined phase angle, possibly different than closing phase angle).



For the Point-on-Wave/Synchronous switching function you can also refer to our below brochure.

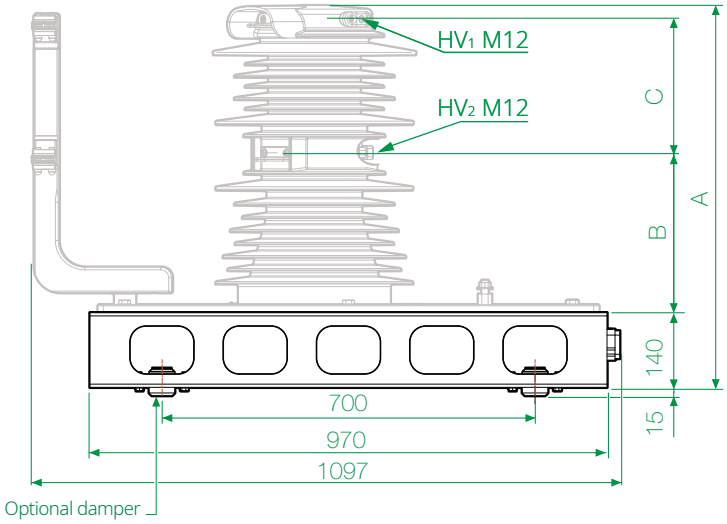


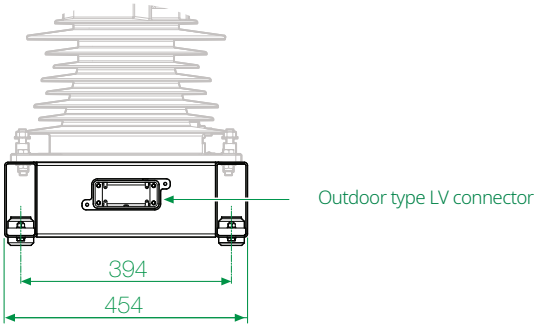
Brochure
Synchronous switching
AC circuit breakers
SA013236BEN

(1) for other voltage ranges, please contact Sécheron.

Please note that in case the Point-on-Wave/Synchronous switching option is selected, the maximum number of auxiliary switches for the MACS is limited to 6 instead of 8 (4 as standard + 2 as option).

ROOF BOX





Main dimensions: Refer to the table below

	MACS designation code		
	M7	M6	M5
U_{Ni} [kV]	125	170	185
A (mm)	691	716	766
B (mm)	275	300	325
C (mm)	251	251	276

Roof box dimensions are only indicative.

Selecting the optional electrically operated earthing device together with the roof box, will limit the roof crossing to the low voltage connections.

In case the manual earthing device is selected with the optional roof box, a roof crossing for the earthing device manual operation as well as for the low voltage connections is to be foreseen.

MAIN BENEFITS

- No roof cut-out required to install the AC circuit breaker.
- No roof cut-out if the optional electric version for earthing device is selected.
- Reduced size hole in roof for the operating mechanism of the manual earthing device.
- Substantial reduction in noise transmission through the car body structure.
- Structural validation according to EN 12663.
- Validated for vibrations & shocks according to IEC/EN 61373.

LOW VOLTAGE MOBILE CONNECTOR
(HARTING HAN® MODULAR 51-PINS CONNECTOR)

	MACS configurations				Mobile connectors						
	Auxilliary Switches			Fixed connector type	Type	Number of pin		Cable gland	Cable entry	Secheron's reference	
	Device [1]	Number	Type [2]			Size 2.5 mm²	Size 1.5 mm²				
	AC circuit breaker with manual or electric [3] earthing device										
Case 1	AC VCB + ES	4a + 4b 0a + 0b	PF	Harting HAN® Modular 51 pins	Harting HAN® Modular 51 pins	2	21	M25		SG325249R00101	
										SG325249R00201	
Case 2	AC VCB + ES	4a + 4b 2a + 2b	PF	Harting HAN® Modular 51 pins	Harting HAN® Modular 51 pins	2	29	M32		SG325249R00303	
										SG325249R00403	
Case 3	AC VCB + ES	8a + 8b 0a + 0b	PF	Harting HAN® Modular 51 pins	Harting HAN® Modular 51 pins	2	37	M32		SG325249R00302	
										SG325249R00402	
Case 4	AC VCB + ES	8a + 8b 2a + 2b	PF	Harting HAN® Modular 51 pins	Harting HAN® Modular 51 pins	2	45	M32		SG325249R00304	
										SG325249R00404	

[1] AC VCB : AC vacuum circuit breaker ES : Earthing device. [2] PF : potential free.

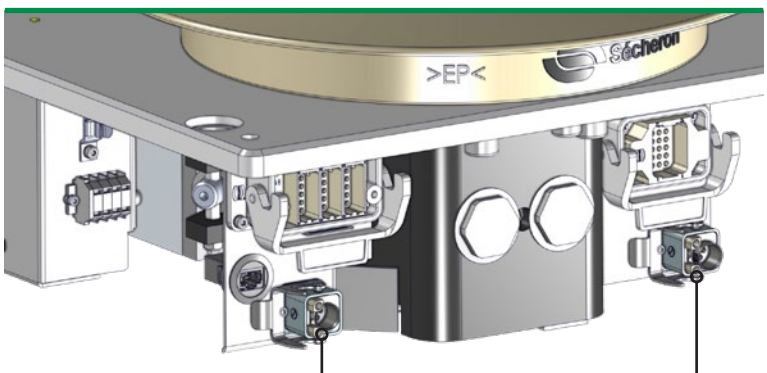
[3] For the electric earthing device the additional low voltage mobile connector indicated below must be considered.

Additional low voltage mobile connector for electric earthing device									
ES	2a + 2b	PF	Harting HAN® 24 DD	Harting HAN® 24 DD	2	12	M25		SG325249R00521
									SG325249R00520

MOBILE CONNECTOR FOR MACS ANALOGUE INPUT

MACS configurations		Mobile connectors					
Function	Analogue input source	Type	Female pins [4] Size	Female pins [4] Qty	Cable gland	Cable entry	Secheron's reference
PoW/Synchronous switching option	Sécheron TMS	Harting HAN® 3A	1.5 mm²	2	M20		SA016375R00001
	Voltage transformer						SA016375R00002
Overcurrent detection & tripping option	Sécheron TMS	Harting HAN® 3A	1.5 mm²	2	M20		SA016375R00001
	Current transformer						SA016375R00002

[4] An additional keying pin is delivered with the mobile connector's kit, which location on the connector will discriminate the connector for PoW/synchronous switching function from the one for overcurrent detection & tripping function.



LV connector voltage input
for PoW/Synchronous switching option

LV connector current input
for Overcurrent detection & tripping option

Notes:

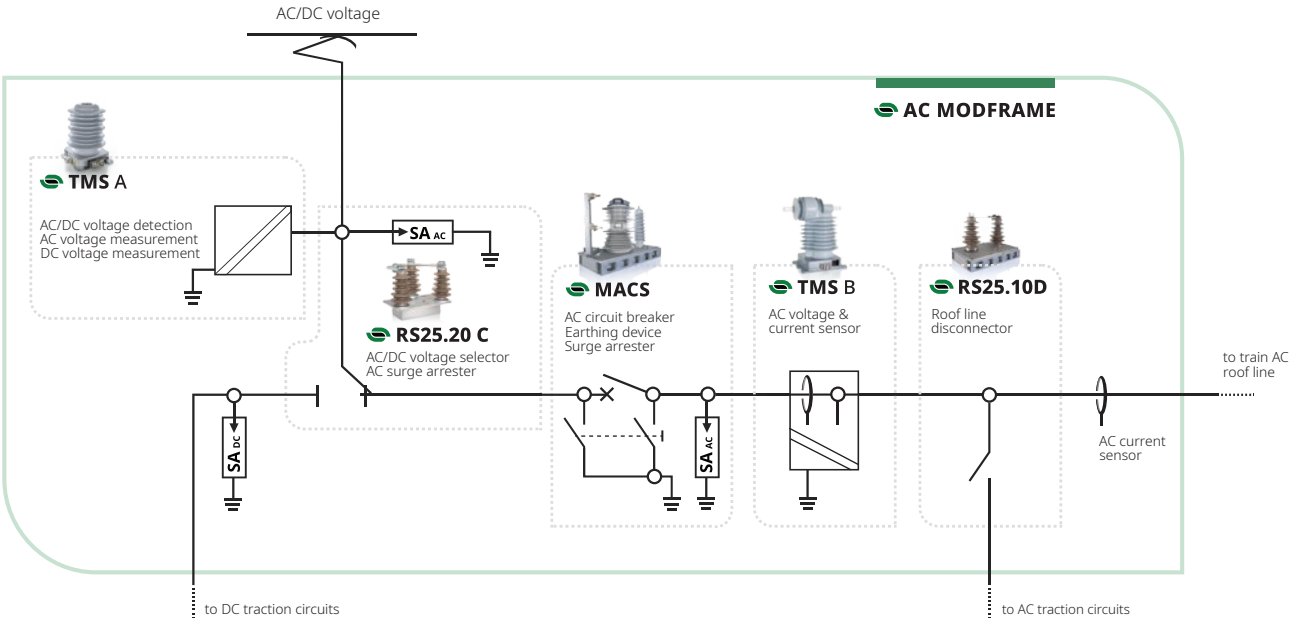
- Harting Han® Modular 51-pin connector composed of 3 Harting HAN® DDD17 modules (each module supplied with 17 pins).
- The above references are given for mobile connectors assuming that all the auxiliary contacts are wired, with an external wire diameter of 2.8 mm for a 2.5 mm² conductor size and 2.3 mm for a 1.5 mm² conductor size. If the conditions differ from these, the above references may change. In this case, please inform Sécheron accordingly.

INTEGRATION OF MACS IN SECHERON AC HIGH VOLTAGE SYSTEMS

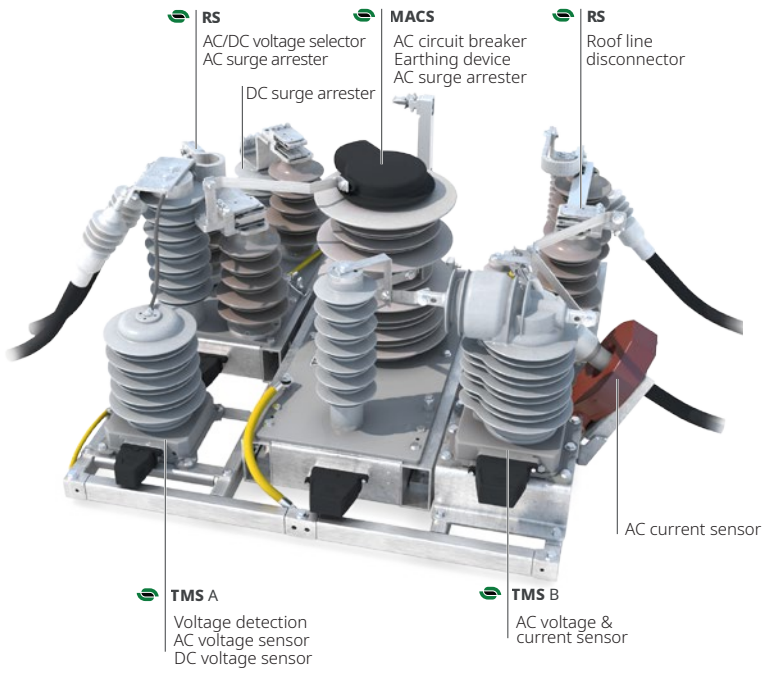
AC MODFRAME

The **AC MODFRAME** is an integrated solution developed for open-air rooftop installation on AC and AC/DC Electrical Multiple Units (EMU). It integrates most of the high voltage roof components required for the operation and protection of AC rail vehicles on a single outdoor frame. The main components installed are from Sécheron's range, supplemented by other devices from leading third party suppliers. All components installed on the MODFRAME are connected together with busbars, cables and braids, offering the car builder a simple and easy interface for high voltage connections between the MODFRAME and the vehicle. Low voltage cables are directly connected to the individual components through easily accessible outdoor type low voltage connectors. The installation of the MODFRAME on the roof does not require any roof cut-out except if the manual operation is selected for the earthing device.

Typical applications



AC MODFRAME

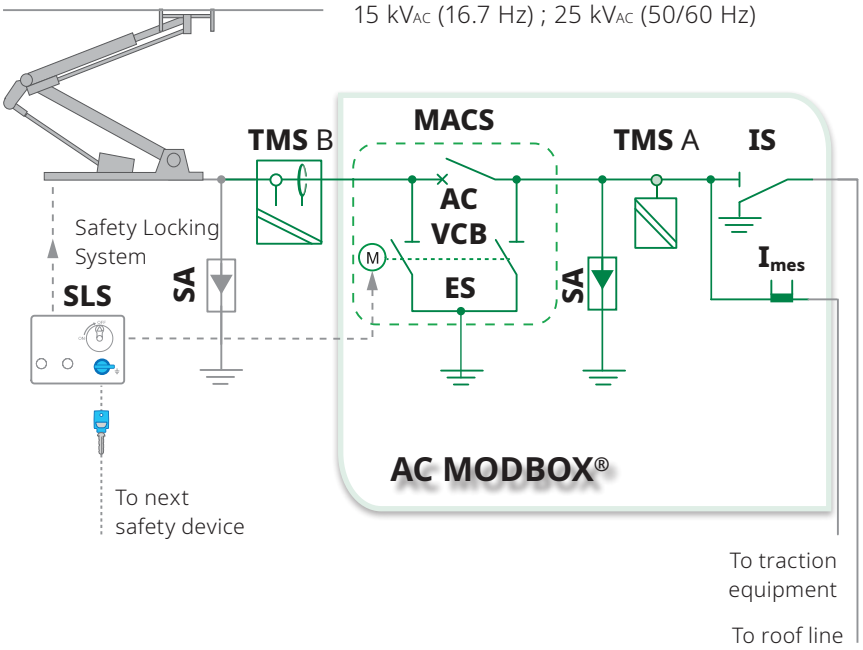


AC MODBOX®

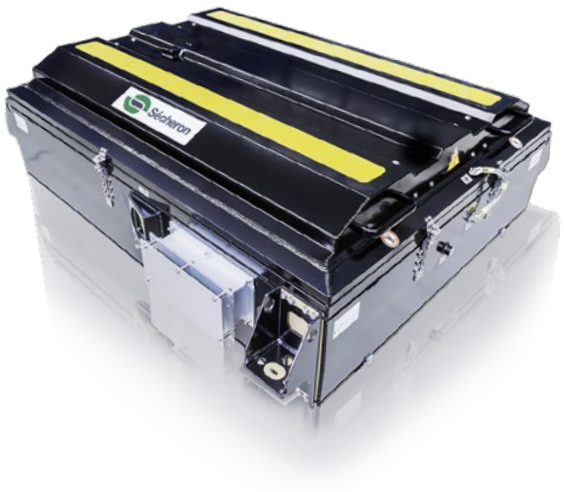
Car builders looking for solutions to protect roof-mounted high-voltage equipment from harsh environmental conditions, or wishing to reduce the aerodynamic drag of vehicles on their high-speed train platforms consider our **AC MODBOX®.**

The Sécheron AC MODBOX® compact metal enclosure ensures a safe and efficient integration of our AC circuit breakers and various high- and low-voltage components, among which the voltage sensor type TMS. AC MODBOX 's designs are also available tor installation inside the vehicle or under its chassis.

Typical applications



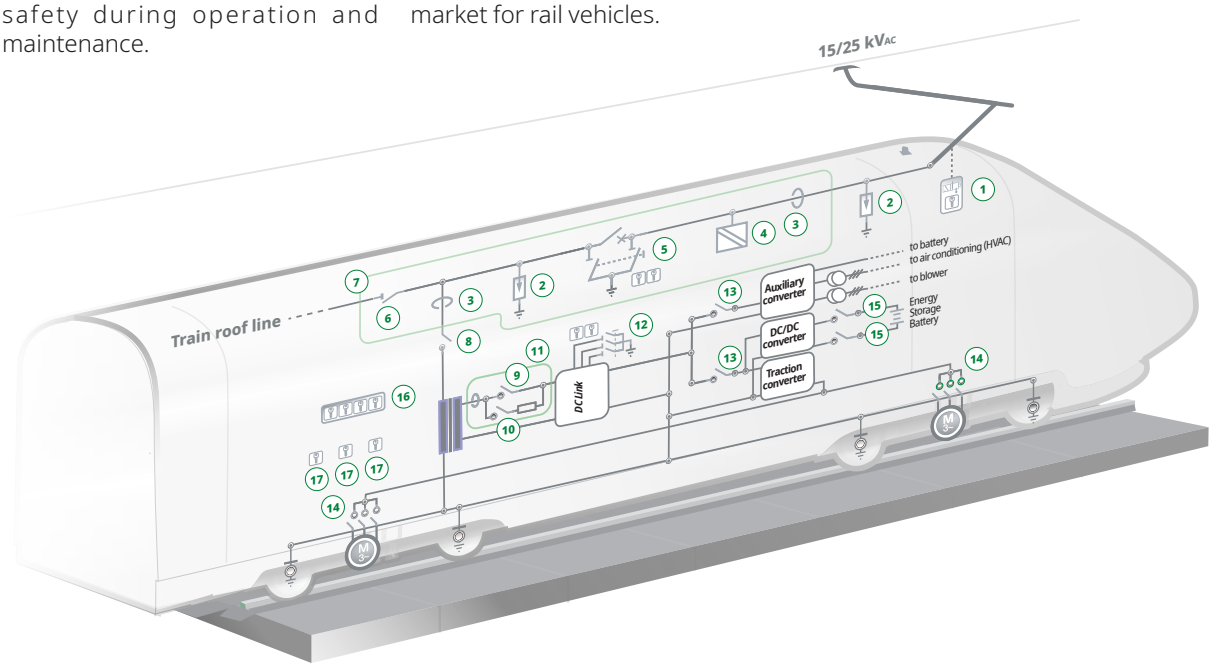
SLS	:	Safety Locking System
SA	:	Surge arester
TMS A	:	AC voltage measurement
TMS B	:	AC voltage measurement & current sensor
MACS	:	Main AC switch
AC VCB	:	AC vacuum circuit breaker (MACS)
ES	:	Earthing device (MACS)
IS	:	Disconnect switch



SÉCHERON COMPONENTS & SYSTEMS OVERVIEW FOR AC RAIL VEHICLES

Sécheron offers one of the most comprehensive range of components and systems for AC rail vehicles. All our solutions are designed to ensure vehicles' passengers and operators the highest and most coherent safety during operation and maintenance.

All Sécheron's solutions are valued by car builders and operators throughout the world for their high reliability and low maintenance requirements. They all represent the highest level of technology for such components on the world market for rail vehicles.



COMPONENTS FOR AC VEHICLES

REFERENCE BROCHURES

HIGH VOLTAGE INTEGRATED SYSTEM

AC MODFRAME
SA016148BEN

AC MODBOX®
SG580044BEN

VOLTAGE & CURRENT SENSOR

TMS
SA004770BEN

AC CIRCUIT BREAKER

MACS
SG325101BEN

OFFLOAD SWITCHES

RS
SP1870125BEN

XMS
SG200998BEN

BTE
SP1880136BEN

CONTACTORS

BMS..08-10
SG202168BEN

BMS..15-18
SG202454BEN

BSV, SLS
SP1880129BEN

KM, DL
SA004770BEN

BMS..08 FOR PMS MOTOR
SA003724BEN

DESIGNATION CODE FOR ORDERING

- Be sure to establish the designation code from the latest version of our brochure by downloading it from the website: www.secheron.com
- Be careful to write down the complete alphanumerical designation code with 12 characters when placing your order
- For technical reasons some variants and options indicated in the designation code might not be combined
- For other configurations not described in the brochure, please contact Secheron.

DESIGNATION CODE

(*) Options are subject to additional costs

Example of customer's choice:	M	7	A	1	Ø	E	A	H	Z	Z	1	J
Line:	10	11	12	13	14	15	16	17	18	19	20	21

Line	Description	Designation	standard	Options*	Customer's choice
10	Product type	**MACS**	**M**	**M**	**M**
11	Nominal Voltage & Insulation	15 kV or/and 25 kV (U_{Ni} = 125 kV)	7		
		15 kV or/and 25 kV (U_{Ni} = 170 kV)	6		
		25 kV - Harsh environment (U_{Ni} = 185 kV)	5		
12	Mechanical interface	Standard base plate / vertical mounting	A		
		Version for optional roof box (1)		F	
13	Earthing device (ES)	Yes (with manual operation)	1		
		Yes (with electric operation)		2	
14	Integrated surge arrester (SA_2)	No	0		
		Yes - For surge arrester type and code, please contact Sécheron		...	
15	Control voltage	24 V_{DC}	A		
		32 V_{DC}		F	
		36 V_{DC}	B		
		48 V_{DC} / 50 V_{DC}	C		
		72 V_{DC}	D		
		110 V_{DC}	E		
16	Auxiliary contacts on the AC circuit breaker	4a + 4b - (switch PF) - silver type	A		
		4a + 4b - (switch PF) - gold type		C	
		8a + 8b - (switch PF) - silver type (2)		B	
		8a + 8b - (switch PF) - gold type (2)		D	
17	Auxiliary contacts on the earthing device	None (3)	Z		
		2a + 2b - (switch PF) - silver type		H	
		2a + 2b - (switch PF) - gold type		C	
18	Interlocking keys/locks for earthing device	(Electric operation) Not applicable	Z		
		1 blue (master) + 1 yellow (slave)		B	
		1 blue (master) + 2 yellow (slave)		C	
		2 blue (master) + 1 yellow (slave)		F	
		1 yellow (master) + 1 green (slave)		H	
		1 yellow (master) + 2 green (slave)		I	
		2 yellow (master) + 1 green (slave)		L	
		Key / locks delivered by customer		S	
19	Key and lock codification for each unit	(Electric operation) Not applicable	Z		
		No	0		
		Yes		1	
20	Ambient temperature range	-40 °C to +70 °C	1		
		-50 °C to +70 °C (4)		2	
21	Overcurrent detection/trip | synchronous switching - voltage sensor type on vehicle				
	No | No (5) -	Not applicable	A		
	No | No (6) -	Not applicable		D	
	Yes (8) | No -	Not applicable		H	
	No | Yes (7) -	Sécheron TMS voltage sensor input		J	
	No | Yes (7) -	Voltage sensor transformer type		L	
	Yes (8) | Yes (7) -	Sécheron TMS voltage sensor input		N	
	Yes (8) | Yes (7) -	Voltage sensor transformer type		P	

(1) The roof box kit must be ordered separately. (2) If the synchronization function is selected line 21 the number of auxiliary switches is limited to 6 instead of 8 (4 as standard + 2 as option). (3) For manual switch only (4) This option cannot be combined with options line 21. (5) Single input for trip order. (6) Two inputs for trip order.

Signature:

Name:

Place and date:

(7) Synchronization parameters to be defined when ordering:

1. Voltage sensor type | Voltage input for MACS:

   TMS (with bipolar output) ☐ | **Transformer** ☐ | > 12 V & ≤ 35 V ☐ > 35 V & ≤ 100 V ☐ > 100 V & ≤ 150 V ☐

2. Catenary supply voltage : 25 kV (50 Hz) ☐ 15 kV (16.7 Hz) ☐ 25 kV (50 Hz) & 15 kV (16.7 Hz) ☐ 25 kV (60 Hz) ☐ 12 kV (25 Hz) ☐

3. Synchronization parameters:

   Neutral section : Opening phase ($\Phi_{\_open}$)_____° Closing phase ($\Phi_{\_close}$)_____°

   Other events: Closing after vehicle's power up ($\Phi_{\_PwrUp}$) _____°

   Closing after trip orders through order 1 ($\Phi_{\_EMOpen}$)_____°

(8) Parameters for overcurrent detection and trip function:

Trip thresholds for MACS in CLOSED position: for overcurrent (I_{rms_cl})_____A (rms) for short-circuit (I_{sc_cl})_____A (peak)

Trip thresholds for MACS in OPEN position: for overcurrent ___A (rms) for short-circuit (I_{sc_op})_____A (peak)

Reclosing delay after tripping: on overcurrent _____ms

Current transformer ratio: (N_{ocp})_____ : _____

MATERIAL TO BE ORDERED SEPARATELY AND ADDITIONALLY TO THE MACS

Low voltage connector(s)

The low voltage connector must be ordered separately (refer to page 12).

- LV mobile connector for the AC circuit breaker with manual earthing device:

in case Point-on-Wave/Synchronous switching option is selected :

☐ SG325249R00…__ __ __ (select the last 3 digits in the table page 12 function of your selection)

- Additional LV mobile connector for the electric earthing device:

☐ SG325249R00521 ☐ SG325249R00520

- Additional LV mobile connector for voltage analog input (only in case synchronous switching option is selected)

☐ SA016375R00001 ☐ SA016375R00002

- Additional LV mobile connector for current analog input (only in case overcurrent detection and tripping option is selected)

☐ SA016375R00001 ☐ SA016375R00002

Optional roof box kit

☐ for MACS with electrically operated earthing device

☐ for MACS with manual Earthing device

Signature:

Name:

Place and date:

Sécheron

Sécheron SA
Rue du Pré-Bouvier 25
1242 Satigny - Geneva
CH-Switzerland

www.secheron.com
Tel: +41 22 739 41 11
Fax: +41 22 739 48 11
ess@secheron.com

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