
**SEAT CONTROL
MODULE
CONNECTORS**

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The seat control module (SCM), also called the seat control unit (SCU), is critical in the pursuit of ultimate driver/passenger comfort. In addition to conventional horizontal/vertical and backrest adjustments, an intelligent seat can offer rotation, leg and shoulder support, and other fine-tuning features. Meanwhile, an intelligent seat can also afford capabilities such as heating, ventilating, massage, memory, greeting and so on.



As autonomous driving capabilities continue to evolve, a traditional seat control system no longer meets driver/passenger requirements. The intelligent seat will support a safer, more responsive and more comfortable experience in the future.

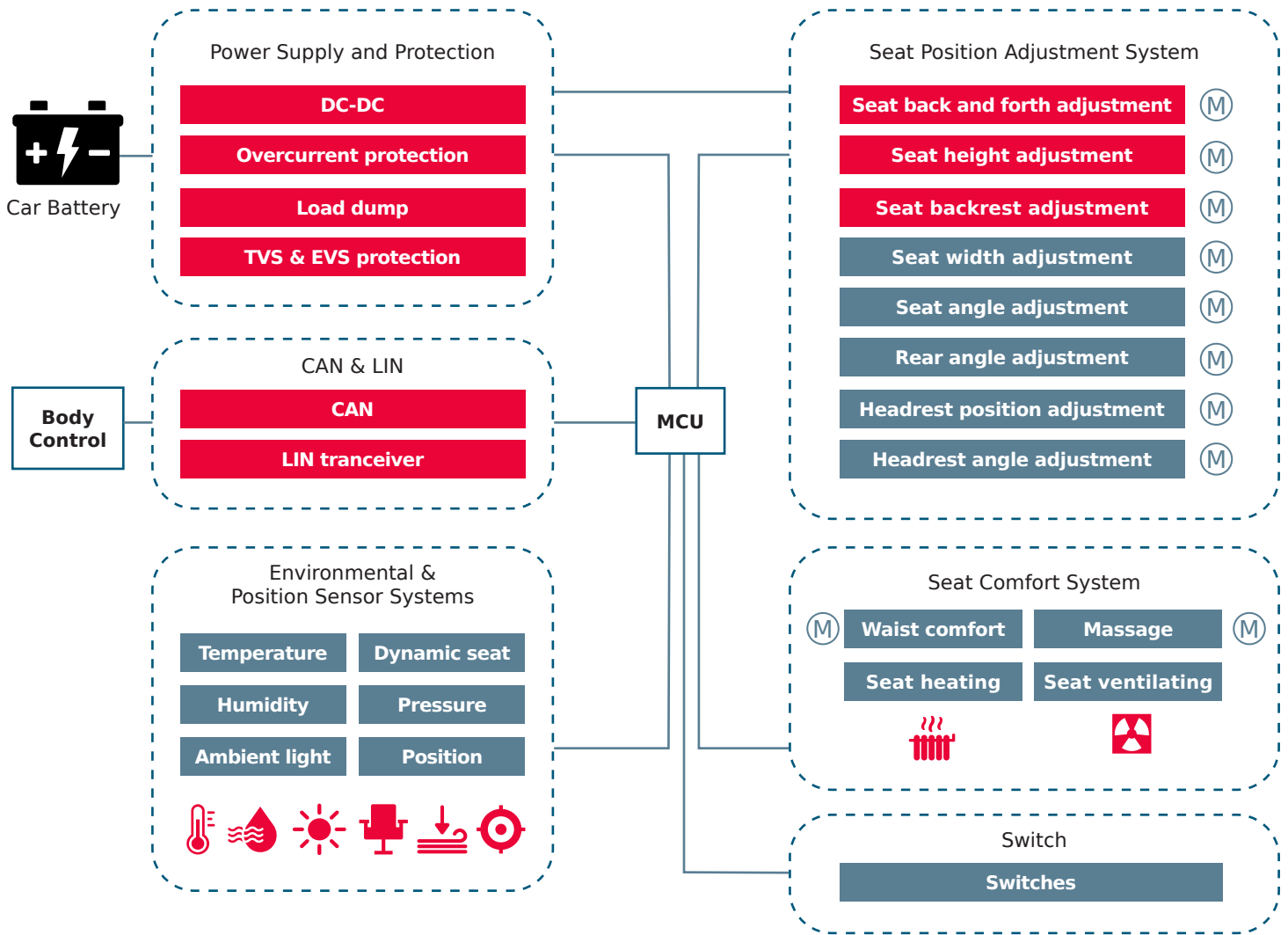
Evolving SCM functions demand many more circuits on connectors. In fact, SCM connectors in some deluxe vehicle models can have more than 80 circuits. Generally, an SCM is found beneath the seating, with limited mounting space. Due to the SCM's constrained external dimensions, their connectors require a compact footprint. As more comfort features, such as heating, ventilating and massage, are added to seating functionality, SCMs must drive an increasing number of actuators. As a result, connectors must provide more large-size terminals while ensuring they fit within a narrow space. Additionally, the connector must comply with ergonomic requirements for assembly. For example, both the inserting force and the withdrawal force should be 75N or less.

Molex pays close attention to trends in the industry by listening to our customers. For example, based on previous collaboration with numerous OEMs and tier-one suppliers, Molex has launched the stAK50h Connector System, the Stac64 Connector System and others that help resolve various challenges engineers face with SCM designs.



COMMON FEATURES OF SEAT CONTROL MODULE (SCM) APPLICATIONS

Seat Control Module (SCM)



- Basic functional configuration for SCM
- Commonly found in middle and high-end car models



KEY FACTORS INFLUENCING THE SELECTION OF SCM CONNECTOR OPTIONS

Connector choices for an SCM cannot be defined at the beginning of design work; instead, they should be made in sync with the SCM hardware circuit design and software programming. There are nine factors that primarily affect the number of circuits required in an SCM connector:

- 1 Number of regulating motors**

The number of SCM motors depends on the type of power seat. A seat may be equipped with 2, 3, 4 or 6 electric motors based on specific vehicle requirements.
- 2 Level of comfort and intelligent functions**

SCMs can provide comfort and intelligent functions such as seat-adjustment memory, heating, ventilating and massage, in addition to seat adjustment.
- 3 Integration of other functions**

SCMs can provide functions other than seat control (e.g., rearview mirror control with integrated memory storage in which either of the two rearview mirrors have four signals and five control signals). The rearview mirror control system is also commonly found in an integrated body control module or door control module. The distribution of functions differs according to the design principles adopted by various OEMs.
- 4 Number and types of automotive sensors in SCM design**

The number and types of sensors for position, temperature, speed, humidity and pressure monitoring selected during the SCM design phase will have a direct bearing on the required number of connector circuits.
- 5 SCM switching signal**

The SCM needs to receive switching signals to identify the driver's intention. For example, a 12-direction memory seat's control contains 16 ways of switching the signals, including 12 ways of seat adjustment, set, M1, M2 and M3.
- 6 Number of CAN/LIN communication lines**

The SCM normally requires 3 circuits, namely 1 way for the controller area network (CAN) and 2 ways for the local interconnect network (LIN).
- 7 Operating temperature**

The SCM is mounted within the cabin. Therefore, its operating temperature should be within -40 to +85°C.
- 8 Installation location**

The SCM is often mounted beneath the driver's seat, and its switch is normally mounted on the left door or left side of the driver seat.
- 9 Cost**

Because the ultimate goal of the module's design is to support commercialization of the vehicle, SCM cost is a fundamental consideration for its product selection, as long as basic technical indicators are guaranteed. Generally, more functions and circuits would translate into a greater number of interfaces, and, as a result, greater cost.

Basic design requirements for seat control SCMs

- Working voltage: 9 to 16V
- Operating temperatures: -40 to +85°C
- LIN/CAN communication: LIN: 19.2 kbps/CAN: 500 kbps
- Vibration level: V1



CUSTOMERS' GENERAL NEEDS

Flexibility of functional configurations, diversity of drive strategy

The SCM may drive different levels of power load and data rates based on its configuration design. An SCM design will typically require:

- 8 to 16 2.80mm terminals for the control over power supply, grounding and large loads with $I \leq 30.0A$ for applications such as the seat position adjustment motor.
- 2 to 16 1.20/1.50mm terminals for the control over small loads with $I \leq 10.0A$ for applications such as seat heating, steering wheel heating, seat ventilation, seat massage and driver seat alarm motor.
- 30 to 80 0.50/0.64mm terminals for the control over small loads with $I \leq 3.0A$ for sensors and lighting, CAN&LIN, motor control signal transmission, and switch control.

Scalable SCM functional configurations for diverse customer demands

Various vehicle classes — economy, comfort and deluxe — have different SCM configurations according to their functional requirements: SCM interconnects normally have 40 to 110 circuits, and the customer may choose to use 1 or 2-3 controllers for seat control for the entire vehicle, based on the demands of the functional layout.

- SCMs in economy and comfort models often offer 40 to 70 circuits, controlling 6- to 8-directional seat adjustment and seat memory, while other comfort and intelligent features would be added or removed by the specific vehicle model.
- In deluxe models, SCMs often have 70 to 110 circuits controlling 10- to 12-directional driver-seat adjustment as well as rearview mirror memory, while the design will also be updated based on demands for other comfort and intelligent features such as seat heating, ventilation, massage and waist support.
- Keeping a reasonable redundancy during the SCM design phase, say around 10% as recommended, will facilitate future functional expansion.

Other general needs due to restricted SCM mounting location

In most cases the mounting location of the SCM is beneath the seat, where the space is extremely limited:

- The size of the SCM is around 30.00mm in some deluxe models, so connector height must be around 25.00mm
- Mating/unmating force $\leq 75N$
- IP5X-rated protection
- Design features to protect against assembly errors
- Separate frame connector facilitating operations since the SCM connects to gateway/door/instrumentation, etc., according to functional configuration

SCM Connector Solutions

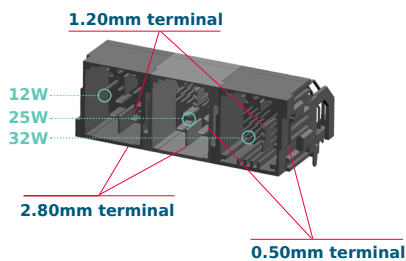
Molex stAK50h, Stac64 and Mini50 Connector Systems utilize terminals that have been widely accepted in the automotive industry to fulfill the functional requirements for CAN, LIN and power within 1 component, and offer the assurance of standardization.

STAK50H CONNECTORS

Current-carrying capability on single terminal:

- 2.80mm – maximum current: 23.0A
- 1.20mm – maximum current: 13.0A
- 0.50mm – maximum current: 3.0A

StAK50h Connectors with non-waterproof, hybrid circuits; 12-, 25-, 27-/28- and 32-circuit versions available; splicing supported between interfaces.

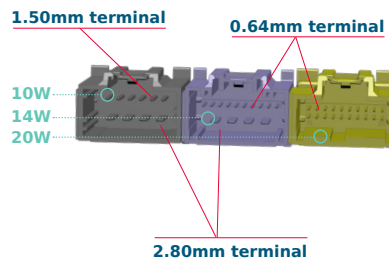


STAC64 CONNECTORS

Current-carrying capability on single terminal:

- 2.80mm – maximum current: 30.0A
- 1.50mm – maximum current: 20.0A
- 0.64mm – maximum current: 6.0A

Stac64 Connectors with non-waterproof, hybrid circuits; 10- and 14-circuit versions available; 0.64mm terminal available on 8-, 12-, 16- and 20-circuit versions; splicing supported between interfaces.

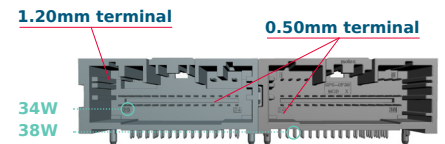


MINI50 CONNECTORS

Current-carrying capability on single terminal:

- 1.20mm – maximum current: 16.0A
- 0.50mm – maximum current: 4.0A

Mini50 Connectors, 34- and 38-circuit versions, non-waterproof, hybrid versions available with 43 circuits; splicing supported on 34- and 38-circuit versions.



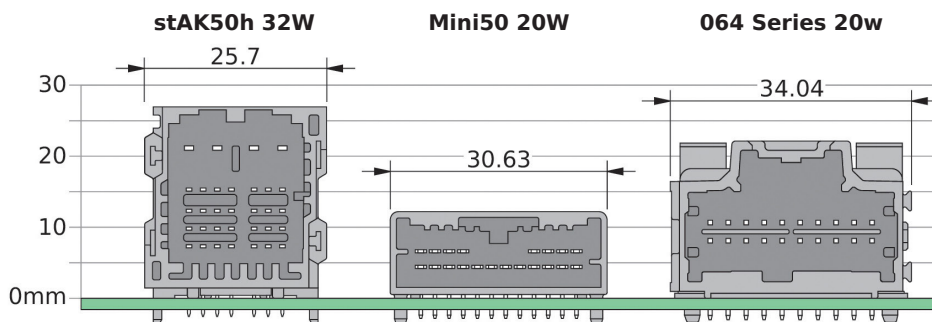
Miniaturized StAK50h and Mini50 Connectors have some of the smallest terminals in today's automotive industry

Miniaturized terminals enable reduced connector size:

- 20% smaller than the traditional 0.64mm terminal
- Multi-row pin arrangement with smaller connector width and reduced PCB footprint
- 11.70 to 25.70mm height for low-profile version

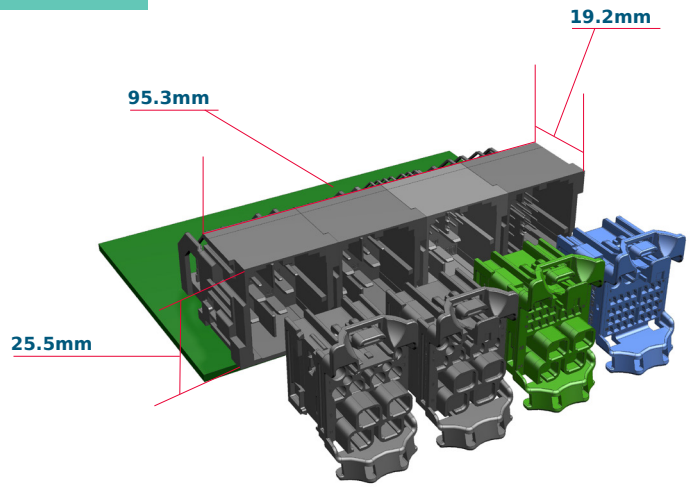
Ergonomic design with optional outgoing line directions

- Mating/unmating forces meeting GMW3191 connector test and validation specifications, and an ergonomic design facilitates operation
- Horizontal and vertical header options facilitate outgoing wire routing during installation
- An optional outlet cover is available on the harness-end connector, supporting cable management
- Zoned harness management is supported upon splicing for multiple interfaces



CASE 1: STAK50H CONNECTORS

StAK50h
12w+12w+25w+32w,
81 ways in total



SCM CONNECTOR CASE 1	2.8mm	1.2mm	0.5mm
12w	4	8	/
12w	4	8	/
25w	4	/	21
32w	/	4	28
TOTAL	12	20 <small>with redundancy</small>	49
	81 ways		

Advantages:

- Integrated hybrid design
- 0.50mm terminal system – miniaturized
- 5-row terminal design with compact construction
- Splicing supported
- Rational redundancy design

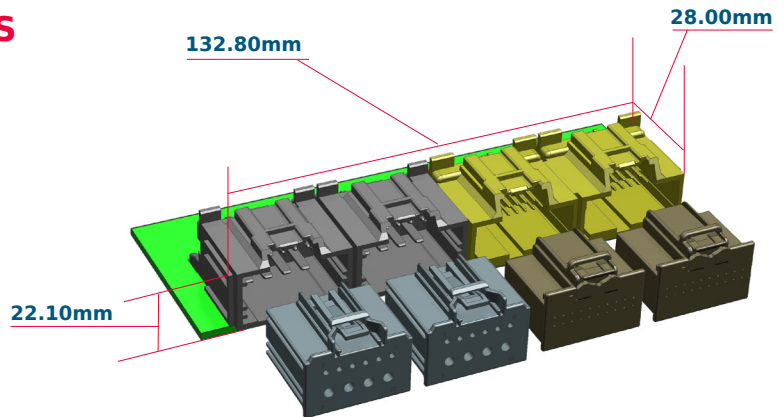


LIST OF STAK50H CONNECTOR SERIES (FREE COMBINATION UPON CUSTOMER DEMAND)

Type of StAK50h	2.8mm pin	1.2mm pin	0.5mm pin	Board connector part number		Harness end Connector Part Numbers
				Vertical	Horizontal	
12w	4	8	/	2005010121	2005020121	1600260001
25w	4	/	21	2005010251	2005020251	1600270011
27w	/	8	19	2005010271	2005020271	1600290011
28w	/	7	21	2005010281	2005020281	1600140011
32w	/	4	28	2005010321	2005020321	1600280011

CASE 2: STAC64 CONNECTORS

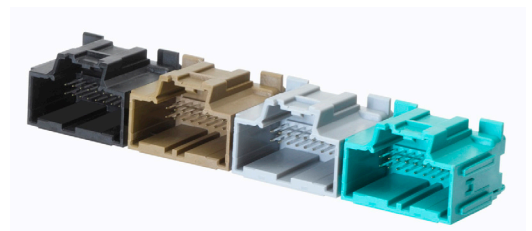
Stac64
10w+10w+20w+20w,
60 ways in total



SCM CONNECTOR CASE 2	2.8mm	1.5mm	0.64mm
10w	4	6	/
10w	4	6	/
20w	/	/	20
20w	/	/	20
TOTAL	8	12	40
	60 ways		

Advantages:

- Hybrid design, splicing supported
- Low-profile, dual-row terminal design
- Design flexibility via option availability
- Superior current-carrying capability

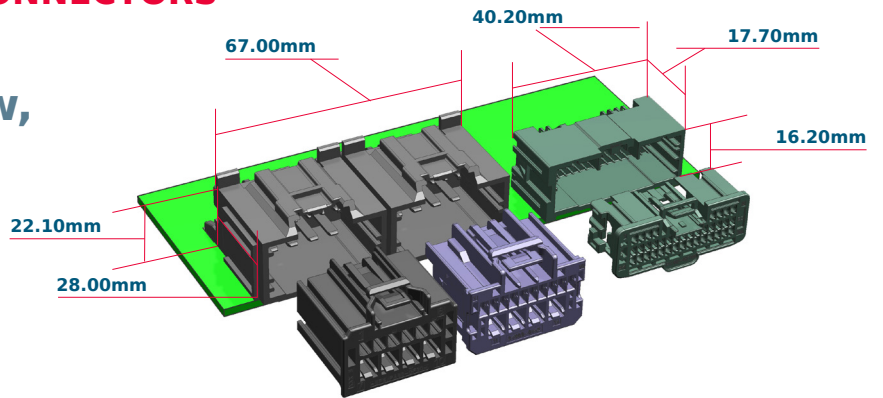


LIST OF STAC64 CONNECTOR SERIES (FREE MIX AND MATCH UPON CUSTOMER DEMAND)

Type of Stac64	2.8mm pin	1.5mm pin	0.64mm pin	Board connector part number		Harness end Connector Part Numbers
				Vertical	Horizontal	
8w	/	/	8	34690008X	34691008X	34729008X
10w	4	6	/	34695010X	34696010X	313721X00
12w	/	/	12	34690012X	34691012X	34729012X
14w	4	/	10	34772014X	34773014X	34969014X
16w	/	/	16	34690016X	34691016X	34729016X
20w	/	/	20	34690020X	34691020X	34729020X

CASE 3: STAC64 + MINI50 CONNECTORS

Stac64
10w+10w+Mini50 38w,
58 ways in total



SCM CONNECTOR CASE 3	2.8mm	1.5mm	0.50mm
Stac64 10w	4	6	/
Stac64 10w	4	6	/
Mini50 38w	/	/	38
	8	12	38
TOTAL	58 ways		

Advantages:

- Mixed terminal design, splicing supported
- Low profile
- Miniaturized 0.50mm terminal option combined
- Superior current-carrying capability
- Options provide design flexibility



LIST OF STAC64 CONNECTOR SERIES (FREE MIX AND MATCH UPON CUSTOMER DEMAND)

Type of Stac64	2.8mm pin	1.5mm pin	0.64mm pin	Board connector part number		Harness end Connector Part Numbers
				Vertical	Horizontal	
8w	/	/	8	34690008X	34691008X	34729008X
10w	4	6	/	34695010X	34696010X	313721X00
12w	/	/	12	34690012X	34691012X	34729012X
14w	4	/	10	34772014X	34773014X	34969014X
16w	/	/	16	34690016X	34691016X	34729016X
20w	/	/	20	34690020X	34691020X	34729020X

LIST OF MINI50 CONNECTOR SERIES						
Series No.	Plating	Rows	Orientation	Termination Style	Circuit Sizes	
34792	Tin	Single	Vertical	Through-Hole	4, 8	
34793			Right Angle	SMT	2, 4, 8	
34912		Dual	Vertical	Through-Hole	12, 16, 20, 24	
34825			Right Angle	SMT		
34826			Triple	Vertical	Through-Hole	34 Hybrid and 38
34897		Right Angle				
34958		Two-Bay Stacked				
34961		Gold	Single	Right Angle	SMT	2, 4, 8
34960			Dual			
34912-60xx	Gold	Single	Right Angle	SMT	2, 4, 8	
34897-6xxx		Dual				

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