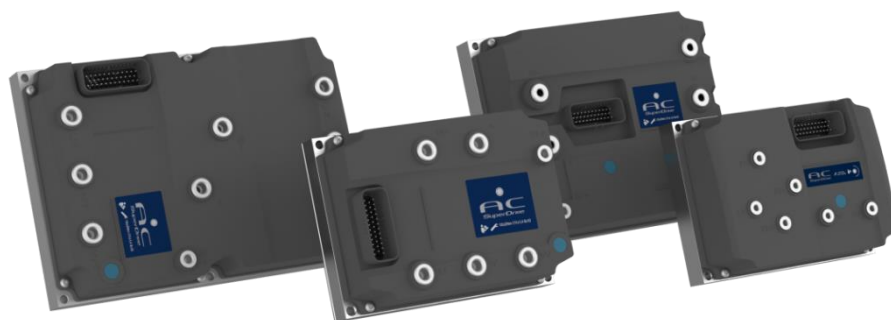


ACS GEN7

The 7th generation ACS motor controllers

The ACS GEN7 family of motor controllers with a very high power density has been designed with traction, hydraulic pump and generator applications in mind. An ACS is the ideal choice for most battery-powered electric vehicles. With Inmotion's customizable proprietary PLASMA software platform, the ACS offers compliance to demanding functional safety requirements. In addition to CAN bus communication, all ACS models are available with optional vehicle control I/O for distribution of vehicle control functionality in a larger control system, or for stand-alone operation.

Inmotion is a long-term, global supplier of electric motors, motor controllers and auxiliary equipment for commercial vehicles. Our "In-region, for-region" manufacturing strategy brings our production facilities closer to yours. This gives you higher quality at a lower cost and shorter lead time. We work in close cooperation with you to integrate and configure our flexible standard products to your specific needs. We help you to realize reliable and efficient vehicles for emission-free transport solutions.



ACS is a flexible standard platform

- **Power** levels **4-80 kVA** and nominal **voltages 24-96 V**
- Supports **AC induction, AC synchronous** and **brushless DC motors**
- Standard **firmware** with **extensive configurability** ensures optimal system functionality
- Application software **can be configured by you** or by Inmotion
- ARM **processor** capable of **parallel execution** of motor control and customized vehicle control tasks
- **Auto tuning** functionality for pairing the controller with a motor already installed in a vehicle
- Support for **traction, pump** or **generator applications** including functions such as hill-hold, programmable braking/acceleration characteristics and dual traction
- **Multi-axle options** (ACS W & M), which reduce size, share components and simplify cabling and mounting

- CAN communication, **J1939** and/or **CANopen** (slave or master) with support for **diagnostics** and **software download**

Monitoring of operation for optimal performance

- **I/O version** allows **vehicle control** to reside **in the ACS**, directly interfacing vehicle sensors and actuators
- State of the art **vector control** with **optimal efficiency** throughout the full speed range

Safe operation for personnel and equipment

- **Dual CPUs** and **dual feedback** channels for redundant cross monitoring and supervision allows **ISO13849-1, category 3** implementation of safety functions to achieve **PL=c/d**
- **Limitation of the output** as a function of **motor speed, motor and controller temperature, battery voltage, DC power, DC current** and/or **motor torque** to protect powertrain components.

Maximize operating time by minimizing service time

- **Software quality** is assured through development and review processes in compliance with **Automotive SPICE®** and **ISO 13849-1**
- Extensive and powerful **event handling** and **data logging** simplify troubleshooting and **minimize vehicle down time**
- **Best in class quality and reliability**, achieved through **superior design, world class manufacturing** processes and **field experience**
- **Rugged design** protected against ingress of dust and water according to **IP65**

GENERAL

Motor type	Induction AC, Synchronous AC, Brushless DC
Communication	CAN (CANopen, J1939)
Switching frequency	4, 8, 12, 16 kHz
Operating stator frequency	0-599 Hz
Control mode	Speed (rpm), Torque (Nm), Current (ARMS) or Voltage (VDC)
Connector	AMP SEAL 23-pin or AMP SEAL 35-pin
Operating temperature	- 40 °C to + 55 °C (- 40 °F to + 131 °F)
Storage temperature	- 40 °C to + 85 °C (- 40 °F to + 185 °F)
Protection class	IP65
Standards	UL 583 and EC declaration of incorporation of partly completed machinery according to directive 2006/42/EC and 2014/30/EU i.e. C-standard EN 1175-1 and EN 12895

I/O SUMMARY

The 23 pin interface (23P) is optimized for slave units in a CAN network, with limited I/O capacity. The 35 pin interface (35P) features a larger number of I/O to be used by the application software for standalone operation, vehicle control, or as distributed I/O in a vehicle network. The dual inverter I/O (35P-D) requires more motor interface pins and is thus slightly different.

	ACS 23 pin basic	ACS 35 pin premium	ACS Dual 35 pin
Dedicated HW ID	2	-	-
Multifunction I/O ¹	3	5	5
Digital inputs	-	9	5
Analog inputs	-	2	-
High side in/out	1	1	1
Sensor supply	1	2	2
Current control output	2	2	4
PWM control output	-	2	-
On/off output	-	2	-
CAN ²	2	1	2
Motor temp	1	1	2

¹ Multifunction I/O can be used as motor feedback, analog in, or digital in. Motor feedback supported is encoder, UVW (6-step), analog sin/cos

² CAN interface consists of CAN_HIGH, CAN_LOW and CAN_GND. The 23P and 35P-D versions have two of each pin to facilitate daisy-chaining in a network. Additionally all inverters have a CAN_120 pin that serves to terminate the CAN bus if a jumper is placed in the wiring harness

OPTIONS

ACS model	Power terminals	Multi axle control
W	Threads	-
W Combi	Threads	Three-phase motor and DC motor
S	Threads	-
M	Studs or threads	-
MD	Studs or threads	Two three-phase motors
L	Studs or threads	-

CURRENT AND OUTPUT RATINGS

ACS model	Nominal DC supply voltage U _{dc}	Rated current S ₂ , 2 min ARMS ¹	Rated current S ₂ , 1 h ARMS ²	Rated power S ₂ , 2 min kVA ¹	Rated power S ₂ , 1 h kVA ²	Rated DC current S ₃ , 15 % A
ACS W³ and ACS W Combi³						
ACS24W24	24	240	120	7	4	-
ACS24W24 Combi						240
ACS48W18	36-48	180	90	11	5	-

ACS model	Nominal DC supply voltage U _{dc}	Rated current S ₂ , 2 min ARMS ¹	Rated current S ₂ , 1 h ARMS ²	Rated power S ₂ , 2 min kVA ¹	Rated power S ₂ , 1 h kVA ²
ACS S³					
ACS24S35	24	350	150	10	4
ACS48S28	36-48	280	120	17	7

ACS M and ACS MD³					
ACS24M55	24	550	275	16	8
ACS48M35		350	175	21	10
ACS48M45	36-48	450	225	27	13
ACS48M55		550	275	32	16
ACS80M23	80	230	115	23	11
ACS80M35		350	175	34	17
ACS80M40		400	200	39	20
ACS96M23	96	230	115	27	14
ACS96M35		350	175	41	21
ACS96M40		400	180	47	21

ACS L					
ACS48L70	36-48	700	350	41	21
ACS48L90		900	450	53	27
ACS80L50	80	500	250	49	25
ACS80L60		600	300	59	29
ACS80L70		700	350	69	34
ACS96L50	96	500	250	59	29
ACS96L60		600	300	71	35
ACS96L70		700 ⁴	350	82	41

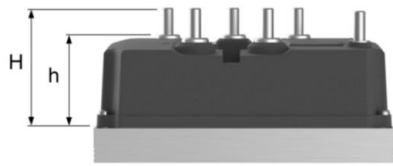
¹ 2 minute rating at 8 kHz switching frequency and 25 °C ambient temperature

² 1 hour rating at 8 kHz switching frequency, 40 °C ambient temperature, and 6 m/s air flow through finned heat sink

³ Available with 35-pins I/O connector only

⁴ Current rating limited to S₂ 90 seconds

ACS GEN7 HEIGHT WITHOUT HEAT SINK



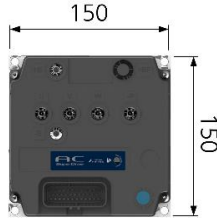
¹ With optional studs
² Without optional studs

ACS model	H ¹ [mm]	h ² [mm]
W & W Combi	-	47.0
S	-	50.4
M	72.3	52.3
MD	72.3	52.3
L	79.7	59.7

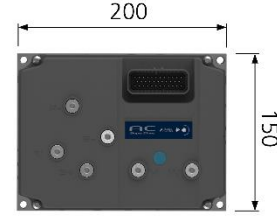
ACS FOOTPRINTS [mm]



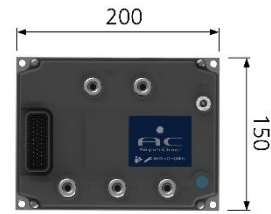
ACS W



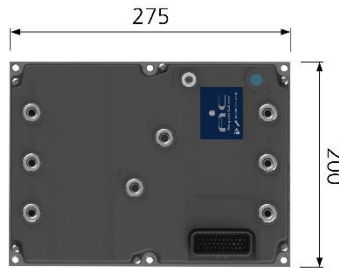
ACS W Combi



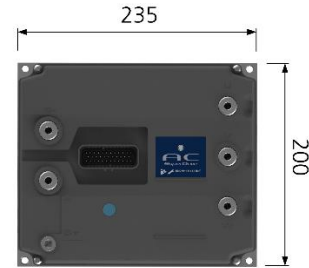
ACS S



ACS M



ACS MD



ACS L¹

¹ Footprint for ACS L with heat sink type W see below

HEAT SINKS

Heat sink type	Height [mm]	ACS compatibility
C (flat)		W (h = 11) W Combi (h = 11) S (h = 23) M (h = 23) MD (h = 23) L (h = 23)
Q (finned)		MD
T (finned)		S M
W (liquid-cooled)		L
Y (finned)		S M MD L