3 Product description

3.1 General

The servo positioning controller ARS 2100 (ARS servo 2nd generation) series devices are intelligent AC servo inverter with substantial parameterisation possibilities and extension options. They are flexible and can be easily adapted to a number of different applications.

The series includes types with single-phase and three-phase supply.

Type key:

Example using the ARS 2102

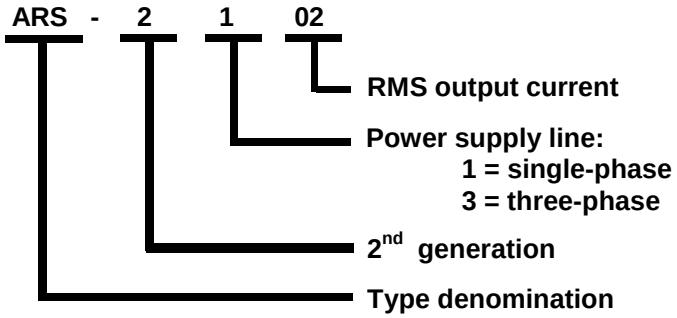


Figure 1: Type key

The single-phase supply types are designed for connection to the 230VAC mains and comprise an active PFC stage (**P**ower **F**actor **C**ontrol). The PFC stage is an active mains current converter required to fulfill the corresponding standards on the limitation of the mains harmonics. The PFC stage also serves the active control of the DC bus voltage. The PFC stage works according to the boost operation principle and provides a nominal DC bus voltage of 360VDC. This voltage is available regardless of the quality of the mains voltage and therefore also in the case of fluctuating main voltages or undervoltage. This is an important advantage regarding the selection of the servo motor, because, as compared to devices with a passive mains supply, higher rotational speeds can be achieved and/or higher torque constants can be selected. Furthermore, due the active PFC stage, the device is also suitable for varying voltage operation down to 100VAC mains supply; however, the limitation of the active power input due to the allowed maximum current of the PFC stage must be taken into consideration in this case.

4 Technical data

Table 3: Technical data: Ambient conditions and qualification

Range	Value
Admissible temperature ranges	Storage temperature: -25°C to +70°C
	Operating temperature: 0°C to +40°C +40°C to +50°C at reduced power 2,5% /K
Admissible installation height	Mounting height maximum 2000 m above msl, above 1000 m above msl with power reduction 1% per 100 m
Humidity	Relative humidity up to 90%, not bedewing
Protection degree	IP20
Protection class	I
Pollution degree	2
CE conformity Low-voltage directive: EMC directive:	 2006/95/EC verified by application of the harmonised standard EN 61800-5-1 2004/108/EC verified by application of the harmonised standard EN 61800–3
UL certification	Listed according to UL 508C, E219816

Table 4: Technical specifications: Dimensions and weight

Type	ARS 2102	ARS 2105
Dimensions H*W*D	200*54,5*200 mm	225*54,5*200 mm
Dimensions of the mounting plate	240*48,5 mm	240*48,5 mm
Weight	2,0 kg	2,1 kg

Table 5: Technical specifications: Cable specifications

Range	ARS 2102	ARS 2105
Maximum motor cable length for interference emission as per EN 61800-3		
First ambient, category C2 Switch cabinet assembly (see *chapter 8.13 Notes on safe and EMC-compliant installation*)	l ≤ 25m	
Second ambient, category C3 (industrial area)	l ≤ 25m	
Cable capacity of a phase against shield or between two lines	C‘ ≤ 200pF/m	

Table 6: Technical specifications: Motor temperature monitoring

Motor temperature monitoring	Range
Digitaler sensor	Normally closed contact: R_{cold} < 500 Ω, R_{hot} > 100 kΩ
Analoger sensor	Silicon temperature sensor, e.g. KTY81, 82 or similar R_{25} ≈ 1000 Ω...2000 Ω R_{100} ≈ 1700 Ω...3400 Ω

4.1 Operating and display elements

On the front the servo positioning controller ARS 2100 has two LEDs and one seven-segment display to indicate the operating status.

Table 7: Display elements and RESET button

Element	Function
Seven-segment display	Display of operating mode and a coded error number in the case of a malfunction
LED1	Operational state
LED2	Status display CAN bus
RESET-Button	Hardware reset for processor

4.2 Supply [X9]

Table 8: Technical specifications: Performance data [X9]

Type	ARS 2102	ARS 2105
Supply voltage	1 x 100 .. 230 VAC [± 10%], 50...60Hz	
Alternative DC supply	60 .. 380 VDC	
24V supply	24 VDC [± 20%] (0,55 A) *)	24 VDC [± 20%] (0,65 A) *)
Intermediate circuit voltage with active PFC (load-dependent)	360 .. 380 VDC	

*) plus current consumption of a possibly connected holding brake and I/Os

Table 9: Technical specifications: Internal brake resistor [X9]

Type	ARS 2102	ARS 2105
Brake resistance internal	165 Ω	110 Ω
Pulse power	1,1 kW	1,6 kW
Continuous power	10 W	20 W
Threshold limit	440 V	440 V

Table 10: Technical specifications: External brake resistor [X9]

Type	ARS 2102	ARS 2105
Brake resistance external	≥ 100 Ω	≥ 80 Ω
Continuous power	≤ 250 W	≤ 500 W
Operating voltage	≥ 460 V	≥ 460 V

Table 11: Performance data of PFC stage

Type	ARS 2102	ARS 2105
For a nominal supply voltage of 230 VAC [± 10%]:		
Continuous power output	500 W	1000 W
Peak power output	1000 W	2000 W

Below the nominal supply voltage, the power output of the PFC stage is reduced linearly. These performance curves are shown in Figure 3.

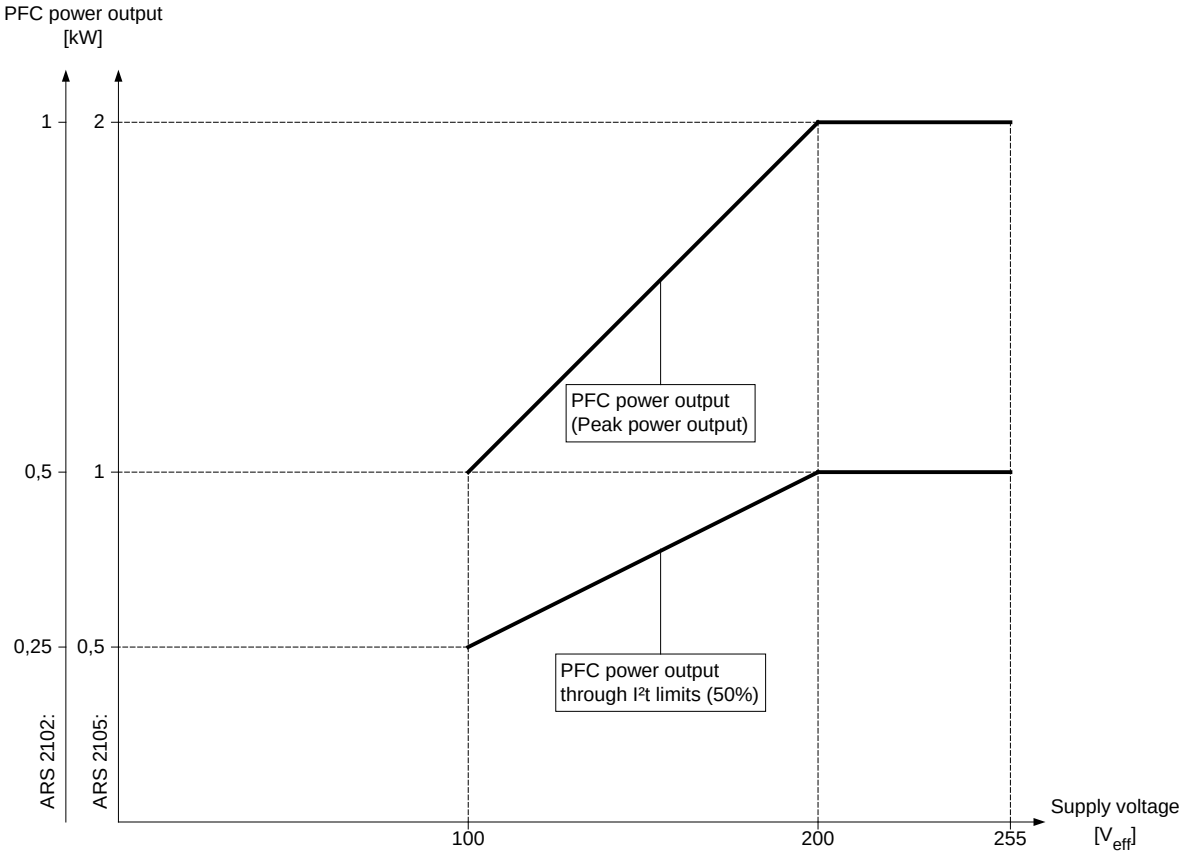


Figure 3: Performance curve of the PFC stage

4.3 Motor connection [X6]

Table 12: Technical specifications: Motor connection specifications [X6]

Type	**ARS 2102**	**ARS 2105**
Specifications for operation with 1x 230 VAC 50 Hz		
Output power	0,5 kVA	1,0 kVA
Max. output power for 5 s	1,0 kVA	2,0 kVA
Output current	2,5 A_{RMS}	5 A_{RMS}
Max. output current for 5 s	5 A_{RMS}	10 A_{RMS}
Clock frequency	max. 13 kHz	max. 13 kHz
Max. mains current for continuous operation	2,4 A_{RMS}	4,7 A_{RMS}

4.4 Motor feedback connection [X2A] and [X2B]

Different feedback systems can be connected to the servo positioning controller ARS 2100 via the universal encoder interface:

- Resolver (interface [X2A])
- Encoder (interface [X2B])
  - Incremental encoders with analog and digital track signals
  - SinCos encoder (single-turn/multi-turn) with HIPERFACE
  - SinCoder with HIPERFACE
  - Multiturn absolute encoder with EnDat

The encoder type is determined in the Metronix ServoCommander™ parameterisation software.

The feedback signal is available via the incremental encoder output [X11] for master-slave application.

It is possible to evaluate two shaft encoder systems in parallel. Typically, the resolver for the current control is connected to [X2A], and e.g. an absolute encoder is connected to [X2B] as a feedback system for the positioning control.

4.4.1 Resolver connection [X2A]

Common resolvers are evaluated at the 9-pole D-Sub connector [X2A]. Single-pole and multi-pole resolvers are supported. The user must define the resolver pole pair number in the corresponding Metronix ServoCommander menu „Motor data“, so that the ARS 2100 can properly determine the speed. The pole pair number of the motor (P_{0Motor}) is always an integer multiple of the pole pair number of the resolver ($P_{0Resolver}$). Senseless combinations will generate an error message during the identification of the motor, e.g. $P_{0Resolver} = 2$ and $P_{0Motor} = 5$.

The resolver offset angle, which is determined automatically during the identification, is readable and writeable for service purposes.

Table 13: Technical specifications: Resolver [X2A]

Parameter	Value
Transformation ratio	0,5
Carrier frequency	5 to 10 kHz
excitation voltage	7 V_{RMS}, short circuit-proof
Impedance excitation (at 10kHz)	≥ (20 + j20)Ω
Impedance stator	≤ (500 + j1000)Ω

Heidenhain encoders

Incremental and absolute encoders by Heidenhain are evaluated. The following series of encoders can be connected:

- Heidenhain ERN1085, ERN 1387, ECN1313, RCN220, RCN 723, RON786, ERO1285, etc.
- Encoders with EnDat interface.

Table 15: Technical specifications: Encoder evaluation [X2B]

Parameter	Value
Parameterisable number of encoder lines	1 - 16384 lines/revolution
Angular resolution / Interpolation	10 Bit / period
Encoder signals A, B	1 V_{PP} differential; 2.5 V offset
Encoder signal N	0.2 to 1 V_{PP} differential; 2.5 V offset
Commutation track A1, B1 (optional)	1 V_{PP} differential; 2.5 V offset
Input impedance encoder signals	Differential input 120 Ω
Limit frequency	f_{Limit} > 400 kHz (high-res. signal) f_{Limit} ca. 10 kHz (commutation track)
Additional communication interface	EnDat (Heidenhain) and HIPERFACE (Stegmann)
Output supply	5 V or 12 V; max. 300 mA; current-limited control via sensor lines Setpoint programmable via SW

4.5 Communication interfaces

4.5.1 RS232 [X5]

Table 16: Technical specifications: RS232 [X5]

Communication interfaces	Value
RS232	As per RS232 specification, 9600 Baud to 115.2kBaud

4.5.2 CAN bus [X4]

Table 17: Technical specifications: CAN bus [X4]

Communication interfaces	Value
CAN controller	ISODIS 11898, full CAN controller, max. 1Mbaud
CAN protocol	CANopen as per DS301 and DS402

4.5.3 I/O interface [X1]

Table 18: Technical specifications: Digital inputs and outputs [X1]

Inputs/outputs	Specifications	
Signal level	24V (8V...30V) active high, conforming with EN 1131-2	
Logic inputs general DIN0 DIN1 DIN2 DIN3	 Bit 0 \ Bit 1, \ Target selection for positioning Bit 2, / 16 targets selectable from target table Bit 3 /	
DIN4	Control input stage enable at High	
DIN5	Controller enable at High, clear error high-low transition at Low	
DIN6	End switch input 0	
DIN7	End switch input 1	
DIN8	Control signal Start positioning	
DIN9	Home switch for homing or saving of positions	
Logic outputs general	Galvanically separated, 24V (8V...30V) active high	
DOUT0	Operational state	24 V, max. 100 mA
DOUT1	Freely configurable	24 V, max. 100 mA
DOUT2	Freely configurable, optional use as input DIN10	24 V, max. 100 mA
DOUT3	Freely configurable, optional use as input DIN11	24 V, max. 100 mA
DOUT4 [X6]	Holding brake	24 V, max. 1 A

Table 19: Technical specifications: analog inputs and outputs [X1]

Analog in-/outputs	Values	
High-resolution analog input: AIN0	±10V input range, 16 Bit, differentially, < 250µs delay time	
Analog input: AIN1	Optionally, this input can also be parameterized as digital input DIN AIN1 with a switching threshold at 8V.	±10V, 10 Bit, single ended, < 250µs delay time
Analog input: AIN2	Optionally, this input can also be parameterized as digital input DIN AIN2 with a switching threshold at 8V.	±10V, 10 Bit, single ended, < 250µs delay time
Analog outputs: AOUT0 and AOUT1	±10V output range, 9 bit resolution, f_{Limit} > 1kHz	

4.5.4 Incremental encoder input [X10] <FW3.x>

The input supports common incremental encoders.

For example encoders corresponding to the industry standard ROD426 by Heidenhain or encoders with single-ended TTL outputs as well as open collector outputs.

Alternatively, the A and B encoder signals are interpreted by the device as pulse-direction signals, so that the controller can also be driven by stepping motor control boards.

Table 20: Technical specifications: Incremental encoder input [X10]

Parameter	Value
Parameterisable line count	$1 – 2^{28}$ lines / revolution
Trace signals: A, #A, B, #B, N, #N	In accordance with RS422 specification
Max. input frequency	1 MHz
Pulse direction interface: CLK, #CLK, DIR, #DIR, RESET, #RESET	In accordance with RS422 specification
Supply output	5 V, 100 mA max.

8.4 Connection: Motor [X6]

8.4.1 Device side [X6]

- PHOENIX Mini-Combicon MC 1,5/9-G-5,08

8.4.2 Counterplug [X6]

- PHOENIX Mini-Combicon MC 1,5/9-ST-5,08
- PHOENIX Mini-Combicon connector housing 12-pole, KGG-MC 1,5/12
- Coding to PIN1 (BR-)

8.4.3 Pin configuration [X6]

Table 26: Pin configuration [X6]

Pin No.	Denomination	Value	Specification
1	BR-	0V brake	Holding brake (motor), signal level dependent on switch status, high side / low side switch
2	BR+	24V brake	
3	PE	PE	Cable shield from motor
4	-MTdig	GND	Motor temperature sensor[1)], normally closed contact, PTC, KTY...
5	+MTdig	+5V / 5mA	
6	PE	PE	Ground conductor from motor
7	W	0...270V_{RMS} 0...2,5 A_{RMS} (ARS 2102) 0...5 A_{RMS} (ARS 2105) 0...1000Hz	Connection of three motor phases
8	V		
9	U		

[1)] Please comply with *Chapter 9 Additional requirements for the servo drives concerning the UL approval* on *page 100.*

The cable shield of the motor cable must also be connected to the controller housing (PE screw terminal).