

ACOS200

Compact control system

Operation manual

Version 1.02



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Revision history

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Revision	Date	Changes by	Changes
100	14. 02. 2017	Podolák S.	New document.
101	13. 09. 2017	Mlejnek J.	Chapter 2 Technical parameters – Power supply modified.
102	16. 10. 2017	Říha Z.	Pictures updated, changes in chapter 13.1.

Related documentation

1. Help tab in the EsiDet section of the DetStudio development environment
file: Esidet_en.chm
2. Application note AP0016 – Principles of RS485 interface usage
file: ap0016_en_xx.pdf
3. Application note AP0029 – Principles of CAN network usage
file: ap0029_cz_xx.pdf
4. Application note AP0037 – Principles of Ethernet network usage
file: ap0037_en_xx.pdf
5. Application note AP0050 – Design Documents for Products by AMIT
file: ap0050_en_xx.pdf
6. Application note AP0056 – AMREG communication in MODBUS RTU network
file: ap0056_cz_xx.pdf
7. Application note AP0057 – AMREG communication in MODBUS TCP network
file: ap0057_cz_xx.pdf

1 Introduction

ACOS200 is a compact control system in metal casing.

- Basic features**
- 32 galvanically isolated digital inputs
 - 32 galvanically isolated digital outputs
 - 16 analogue inputs
 - 8 analogue outputs
 - RS232 serial interface with galvanic isolation
 - RS485 serial interface with galvanic isolation
 - 2× optional RS232 / RS485 / CAN
 - Ethernet interface 10/100 Mbps
 - Integrated web server
 - Micro SD card slot – accessible after casing removal
 - Power supply 24 V DC
 - Assembly on the switchboard base plate
 - Programming in DetStudio / EsiDet environment

2 Technical parameters

CPU	CPU	STM32F427
	FLASH	2 MB + 4 MB
	SRAM	1 MB
	SRAM + RTC backup	Lithium battery BR2477, Panasonic
	Battery lifetime	5 years
	SDRAM	32 MB
	EEPROM	32 KB

RTC	Type	Processor component
	Precision at 25 °C	±20 ppm (max. ±1.73 s/day)

SD card	Type	Micro SD (HC)
	Capacity	128 MB to 32 GB ¹⁾

Note ¹⁾ Micro SD card is not included.

Digital inputs	Quantity	32
	Configuration	2× 16
	Common pole	Minus
	Input type	24 V DC, IEC61131-2 Type 1
	Logical 0	Min. -0.3 V, max. 5 V
	Logical 1	Min. 16 V, max. 28.8 V
	Input current	2.7 mA at 24 V DC
	Peak input current	Max. 3 mA at 28.8 V DC
	Input filter time constant	0 ms
	Operation period	1 ms ²⁾
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute ³⁾
	Connection points	WAGO 231-310/102-000
	Wire cross-section	0.08 mm ² to 2.5 mm ²

Note ²⁾ When using DetStudio environment.

³⁾ Isolation must not be used for separation of dangerous voltages.

Digital outputs	Number of outputs	32
	Configuration	2× 16
	Common conductor	Minus
	Switch element	MOS
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute ⁴⁾
	Voltage switched	19.2 V DC to 28.8 V DC
	Current switched	300 mA
	Max current of current protection	(0.7 to 2.5) A
	Residual current at Log. 0	0 mA
	Switch time	40 µs
	Unswitch time	100 µs
	Operation period	1 ms ⁵⁾
	Short-circuit protection	Electronic
	Inductive load treatment	Electronic

Connection points	WAGO 231-310/102-000
Wire cross-section	0.08 mm ² to 2.5 mm ²

- Note ⁴⁾ Isolation must not be used for separation of dangerous voltages.
⁵⁾ When using DetStudio environment.

Analogue inputs	Number of inputs	16
	Configuration	2× 8
	Input type	0 V to 10 V / 0 mA to 20 mA / /Ni1000 /Pt1000
	Resolution	12 bits
	Input overvoltage protection	Diodes
	Galvanic isolation	No
	Connection points	WAGO 231-310/102-000
	Wire cross-section	0.08 mm ² to 2.5 mm ²
	Cable type	Shielded

Attention AGND terminals (1, 10, 11, 20, 21, 30) are internally connected with GND terminal (31) of control system power supply.

Input range 0 V to 10 V

AD converter resolution (LSB)	2.5 mV
Accuracy	1 % ⁶⁾
Temperature dependence	25 ppm/°C
Input resistance	30 kΩ
Input circuit time constant	70 μs
Input overvoltage protection	Diodes
Maximum input voltage	50 V DC permanently

Input range 0 mA to 20 mA

AD converter resolution (LSB)	5 μA
Accuracy	1 % ⁶⁾
Temperature dependence	75 ppm/°C
Input resistance	150 Ω / 0.1 %
Input circuit time constant	0.2 ms
Input overvoltage protection	Diodes
Maximum input current	40 mA DC ⁷⁾

- Note ⁶⁾ Electromagnetic disturbance on analogue inputs may result in temporary deviation of measured value for more than 1 % from the full range.
⁷⁾ With input voltage higher than 6 V (input current higher than 40 mA), thermal overload of the sensor resistance occurs.

Input Ni1000

Measuring range (Ni1000/5000)	-50 °C to +174 °C
Measuring range (Ni1000/6180)	-50 °C to +146 °C
AD converter resolution (LSB)	0.1 °C ⁸⁾
Measuring precision depends on the value being measured, needs to be interpolated	T = -50 °C 1.5 °C ⁹⁾ T = 0 °C 1.7 °C ⁹⁾ T = 150 °C 2.7 °C ⁹⁾
Input temperature dependence	50 ppm/°C
Input circuit time constant	1 ms
Input overvoltage protection	Diodes ¹⁰⁾

Input Pt1000

Range of temperatures measured	-50 °C to +250 °C
AD converter resolution (LSB)	0.13 °C ⁸⁾
Measuring precision depends on the value being measured, needs to be interpolated	T = -50 °C 2.0 °C ⁹⁾ T = 0 °C 2.5 °C ⁹⁾ T = 250 °C 5.6 °C ⁹⁾
Input temperature dependence	50 ppm/°C
Input circuit time constant	1 ms
Input overvoltage protection	Diodes ¹⁰⁾

Note⁸⁾ When using DetStudio environment.

⁹⁾ Electromagnetic disturbance on analogue inputs may result in temporary deviation of measured value for more than 1 % from the full range.

¹⁰⁾ Only a resistance sensor can be connected to this input. According to technical design, when sensor is not connected, voltage of 10 V occurs on Alx input – voltage is switched on for 2 ms in 10 ms periods, a common voltmeter will show average value.

Analogue outputs

Number of outputs	8
Configuration	1× 8
Common conductor	Minus
Output range	0 V to 10 V
Galvanic isolation	No
Minimum load	1 kΩ
Maximum capacitive load	10 nF
Maximum current	10 mA
Setting error	1 %
Resolution	12 bits
Resolution 1 bit	2.5 mV
The overtime 0 V to 10 V DC, accuracy 1 %	Maximum 25 ms
Residual ripple	20 mV
Temperature dependence	35 ppm/°C
Maximum wire length	100 m
Output circuitry protection	Transil 600 W
Connection points	WAGO 231-310/102-000
Wire cross-section	0.08 mm ² to 2.5 mm ²
Cable type	Shielded

Attention AGND terminals (1, 10, 11, 20, 21, 30) are internally connected with GND terminal (31) of control system power supply.

RS232

Galvanic isolation	Yes
Isolation strength	300 V AC / 1 minute ¹¹⁾
Logical level 0 (input)	Min. +3 V, max. +30 V
Logical level 1 (input)	Min. -30 V, max. -3 V
Logical level 0 (output)	Min. +5 V, max. +10 V
Logical level 1 (output)	Min. -10 V, max. -5 V
Maximum cable length	10 m
Operation indication	LED
Inputs protection	Transil 600 W
Outputs protection	Transil 600 W
Connection point	Connector D-sub DE-9, socket

Note¹¹⁾ Isolation must not be used for separation of dangerous voltages.

RS485	Overvoltage protection	Transil 150 W
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute ¹²⁾
	Terminating resistor ¹³⁾	100 Ω on the motherboard
	Idle status definition ¹³⁾ up to +5 V up to 0 V	1 kΩ on the motherboard 1 kΩ on the motherboard
	Maximum wire length	1,200 m / 19,200 bps
	Maximum number of stations	32
	Connection point	WAGO 231-303/102-000
	Wire cross-section	0.08 mm ² to 2.5 mm ²
	Operation indication	LED

Note ¹²⁾ Isolation must not be used for separation of dangerous voltages.

¹³⁾ Termination resistance and idle status definition are connected simultaneously.

Optional interface	Serial communication channel (only with a module)	2×
	Interface type	RS232 / RS485 / CAN
	Connection points	WAGO 231-303/102-000
	Wire cross-section	0.08 mm ² to 2.5 mm ²

RS485

Module type	CM-RS485
Overvoltage protection	Transil 600 W
Galvanic isolation	Yes
Isolation strength	300 V AC / 1 minute ¹⁴⁾
Terminating resistor ¹⁵⁾	100 Ω on the module
Idle status definition ¹⁵⁾ up to +5 V up to 0 V	1 kΩ on the module 1 kΩ on the module
Maximum wire length	1,200 m / 19,200 bps
Maximum number of stations	32
Operation indication	LED

Note ¹⁴⁾ Isolation must not be used for separation of dangerous voltages.

¹⁵⁾ Termination resistance and idle status definition are connected simultaneously.

CAN

Module type	CM-CAN
Galvanic isolation	Yes
Isolation strength	300 V AC / 1 minute ¹⁶⁾
Terminating resistor	100 Ω on the module
Maximum wire length	1,000 m / 50 kbps 75 m / 500 kbps
Signal loop delay	290 ns
Input differential impedance	20 kΩ
Operation indication	LED

Note ¹⁶⁾ Isolation must not be used for separation of dangerous voltages.

RS232

Module type	CM-RS232
Overvoltage protection	Transil 600 W
Galvanic isolation	No
Maximum wire length	10 m
Operation indication	LED on the panel

Ethernet	Quantity	1×
	Transmission speed	10 / 100 Mbps
	Operation indication	LED
	Galvanic isolation	Yes
	Isolation strength	300 V AC / 1 minute ¹⁷⁾
	Connection point	Connector RJ45, according to IEEE802.3

Note ¹⁷⁾ Isolation must not be used for separation of dangerous voltages.

Power supply	Rated supply voltages	24 V DC
	Supply voltage range	14.4 V DC to 28.8 V DC
	Maximum power consumption	220 mA at 24 V DC
	Power dissipation (typ.)	4 W
	Connection point	WAGO 231-302/102-000
	Wire cross-section	0.08 mm ² to 2.5 mm ²
	Power supply	The device must not be powered from the DC distribution network of the building ¹⁸⁾

Note ¹⁸⁾ For more details, see chapter 9.3 “Installation rules”, paragraph “Power supply”.

Mechanics	Mechanical design	Metal case
	Surface finish	
	– case	Powder colour with print
	– base	Powder colour
	Colour – case	Green, soft, glossy, RAL 6029
	– rear cover	Light grey, soft, glossy, RAL 7035
	Assembly	Onto switchboard base plate
	Ingress protection rate	IP20
	Dimensions (w × h × d)	(395 × 187 × 44) mm
Package dimensions (w × h × d)	(442 × 253 × 58) mm	
Weight – netto	2.04 kg ± 5 %	
– brutto	2.26 kg ± 5 %	

Temperatures	Range of working temperatures	-40 °C to 70 °C
	Storage temperature range	-40 °C to 70 °C

Other	Maximum ambient humidity	< 95 % non-condensing
	Programming	DetStudio (EsiDet)

2.1 Dimensions

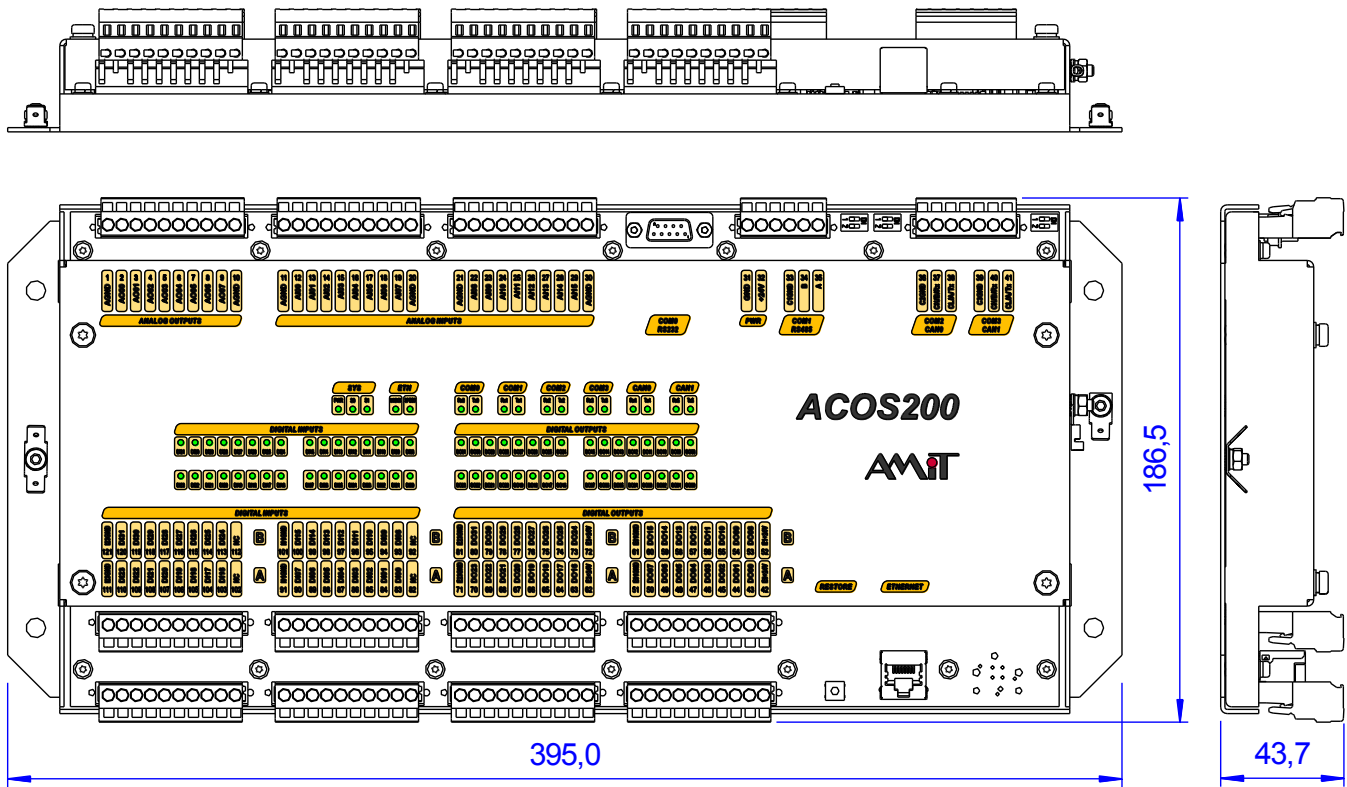


Fig. 1 – ACOS200 dimensions

2.2 Recommended drawing symbol

The following drawing symbol is recommended for the control system **ACOS200**. Only part of it will be visible in following examples.

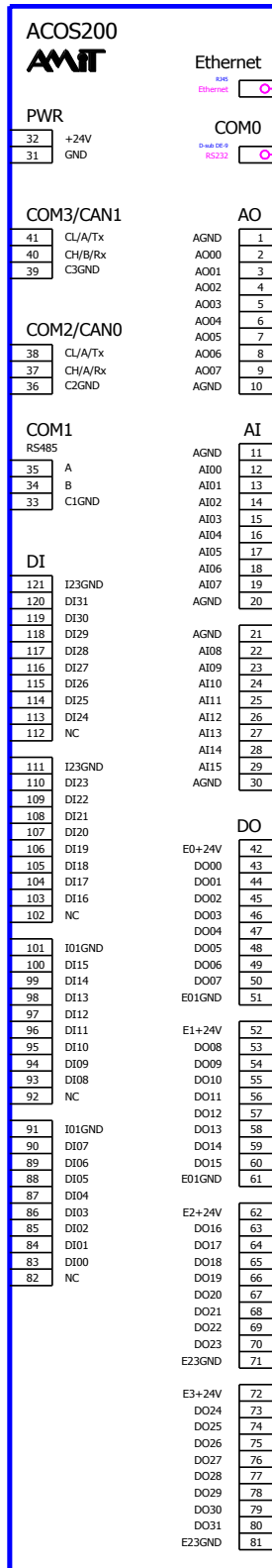


Fig. 2 – Recommended drawing symbol for **ACOS200**

3 Product label

The control system **ACOS200** is equipped with a producer label on the cover.

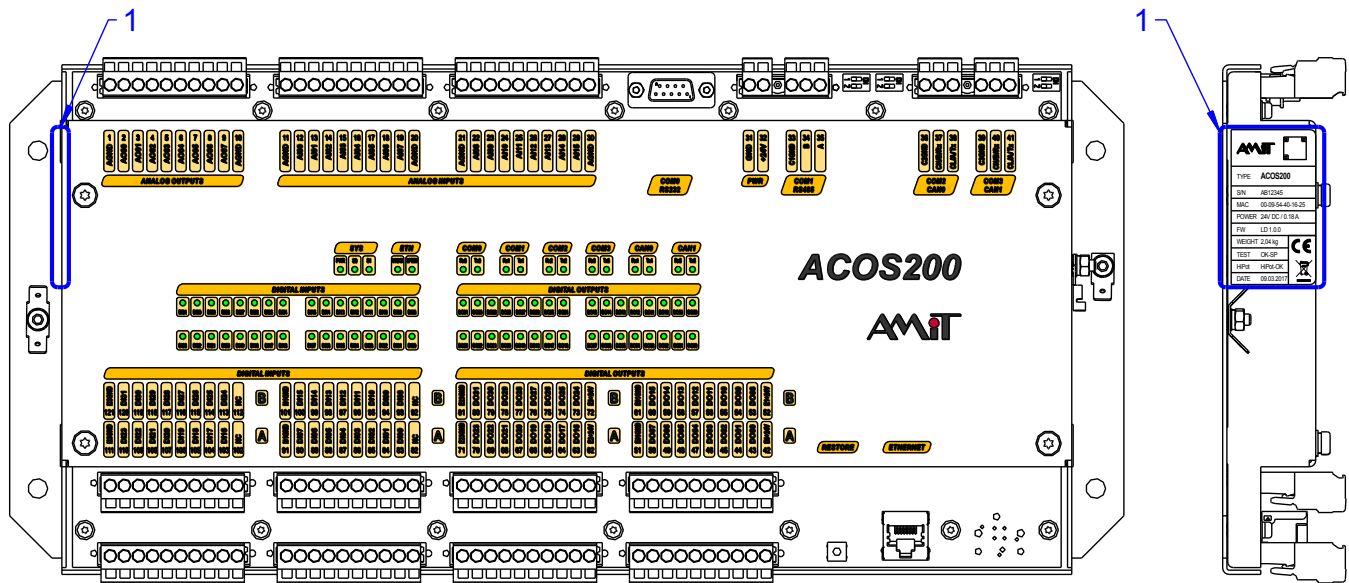


Fig. 3 – Product label location on the unit's cover

Legend	Number	Description
	1	Type label

3.1 Producer type label

The control system has a unit's producer label sticker on its side. The information is summarized in a table. For a label sample, see “Fig. 4 – Example of an AMiT type label”.

Description	Data	Note
–	AMiT logo	Producer logo
–	QR code	Producer QR code
TYPE	ACOS200	Product type designation
S/N	xxxxxxx	Serial number
MAC	00-09-54-xx-xx-xx	Ethernet interface MAC address
POWER	24 V DC / 0.18 A	Power supply voltage / Consumption
FW	LDR x.xx	Operating system loader version
WEIGHT	2.04 kg	Weight
TEST	OK-xx	Routine testing result
HiPot	HiPot-OK	HiPot test result
DATE	dd.mm.yyyy	Production date
–	Logo CE	The product is in compliance with EU legislation and directives
–	Crossed out dustbin logo	Disposal of the product is subject to regulations on the disposal of electronic waste





 	
TYPE	ACOS200
S/N	AB12345
MAC	00-09-54-40-16-25
POWER	24V DC / 0.18 A
FW	LD 1.0.0
WEIGHT	2,04 kg
TEST	OK-SP
HiPot	HiPot-OK
DATE	09.03.2017
 	

Fig. 4 – Example of an AMiT type label

4 Compliance assessment

The equipment meets the requirements of NV616/2016 Czech Government Decree. The conformity assessment has been performed in accordance with harmonized standard EN 61326-1:2013.

Tested in accordance with standards	Type of test	Classification
EN 55011:2009	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	A ¹⁹⁾
EN 61000-4-2:2006	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test	Complies
EN 61000-4-3:2006	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test	Complies
EN 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, power supply, communication, inputs and outputs	Complies
EN 61000-4-5:2014	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, power supply	Complies
EN 61000-4-5:2014	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test	Complies ²⁰⁾
EN 61000-4-6:2014	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measuring technology – Resistance to interference induced by high-frequency fields	Complies

¹⁹⁾ This is a class A device. This device can cause some radio disturbances in the internal environment. In such case the user can be requested to take the appropriate measures.

²⁰⁾ Circuitry cabling, which is different than power supply cabling and longer than 30 m, must be performed by shielded cables.

4.1 Other tests

Tested in accordance with standards	Certificate type	Class
EN 61000-4-29:2000	Electromagnetic Compatibility (EMC) – Part 4-29: Testing and measuring technology – Short-term voltage drops, short interruptions and slow voltage changes on DC power supply inputs – Resistance tests	Complies
EN 60068-2-1:2007	Environmental testing – Part 2-1: Tests – Test A: Cold	Complies
EN 60068-2-2:2007	Environmental testing – Part 2-2: Tests – Test B: Dry heat	Complies

5 Power supply

The control system **ACOS200** can be powered only from a DC power supply source. The power source must comply to all requirements specified in chapter 2 “Technical parameters”. Connection of power supply voltage is indicated by LED PWR.

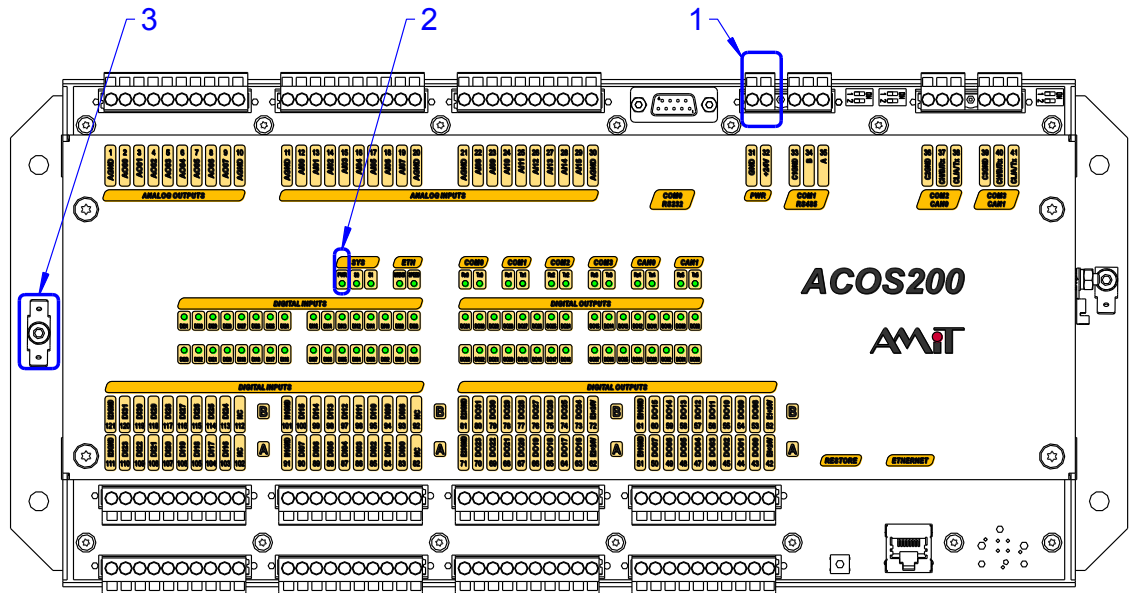


Fig. 5 – Power supply connector location

Legend

Number	Description
1	Power supply connector
2	LED PWR
3	Terminals for connection between metal parts and protective conductor

Connector wiring

Terminal	Signal	Description
31	GND	Power supply Ground
32	+24V	Power supply +24 V DC

LED description

LED	Description
Light on	Power supply is connected
Light off	Power supply is not connected

Connection example

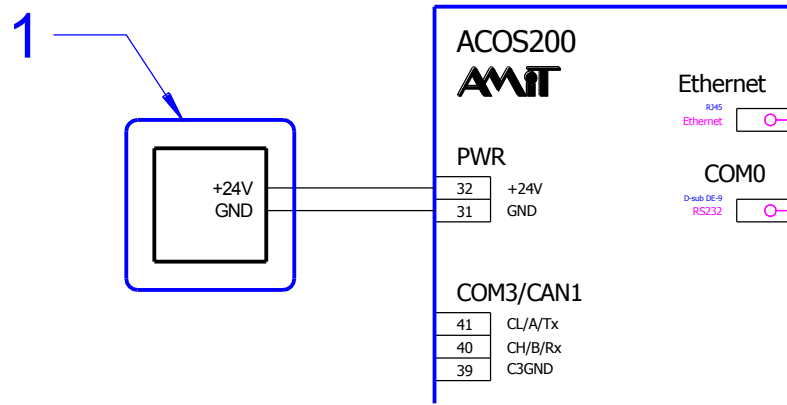


Fig. 6 – Example of power supplying the control system itself

Legend

Number	Description
1	External power supply 24 V DC

Note It is recommendable to link together the GND, IxxGND (inputs ground) and ExxGND (outputs ground) terminals with the switchboard PE terminal.

6 Inputs / outputs

Digital inputs and outputs of the control system **ACOS200** are galvanically isolated from other electronics; analogue inputs and outputs are galvanically connected.

6.1 Digital inputs

Digital inputs are implemented by means of integrated circuits that guarantee the current characteristics. At input voltage higher than 7.5 V, the input current is 2.5 mA. At input voltage 30 V, the input current increases to 2.75 mA.

The operating system reads the status of inputs with a period of 1 ms.

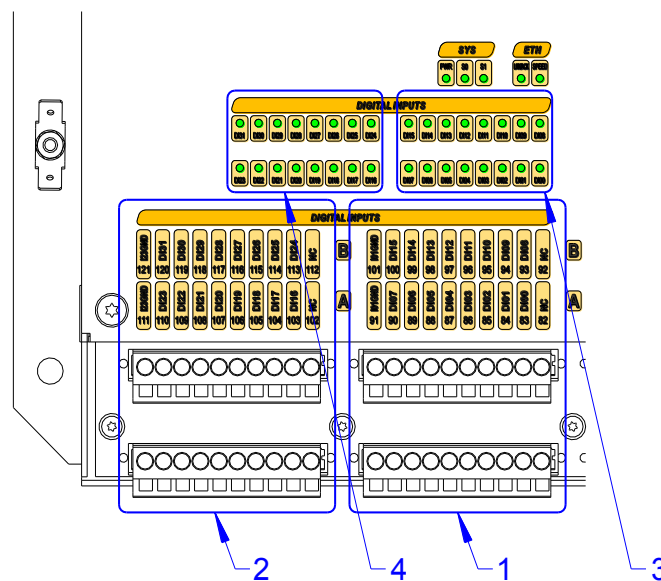


Fig. 7 – Locations of connectors with digital inputs indicated

Legend	Number	Description
	1	Connectors of inputs DI00 to DI15
	2	Connectors of inputs DI16 to DI31
	3	Indication of inputs DI00 to DI15
	4	Indication of inputs DI16 to DI31

Connector wiring	Terminal	Signal	Description
	82	NC	Not connected
	83	DI00	Digital input 0
	84	DI01	Digital input 1
	85	DI02	Digital input 2
	86	DI03	Digital input 3
	87	DI04	Digital input 4
	88	DI05	Digital input 5
	89	DI06	Digital input 6
	90	DI07	Digital input 7
	91	I01GND	Common ground for inputs DI00 to DI15

Terminal	Signal	Description
92	NC	Not connected
93	DI08	Digital input 8
94	DI09	Digital input 9
95	DI10	Digital input 10
96	DI11	Digital input 11
97	DI12	Digital input 12
98	DI13	Digital input 13
99	DI14	Digital input 14
100	DI15	Digital input 15
101	I01GND	Common ground for inputs DI00 to DI15
102	NC	Not connected
103	DI16	Digital input 16
104	DI17	Digital input 17
105	DI18	Digital input 18
106	DI19	Digital input 19
107	DI20	Digital input 20
108	DI21	Digital input 21
109	DI22	Digital input 22
110	DI23	Digital input 23
111	I23GND	Common ground for DI16 to DI31
112	NC	Not connected
113	DI24	Digital input 24
114	DI25	Digital input 25
115	DI26	Digital input 26
116	DI27	Digital input 27
117	DI28	Digital input 28
118	DI29	Digital input 29
119	DI30	Digital input 30
120	DI31	Digital input 31
121	I23GND	Common ground for DI16 to DI31

LED indicators Digital input status is indicated by green LEDs located near the relevant input on panel – see “Fig. 7 – Locations of connectors with digital inputs indicated”.

Wiring examples

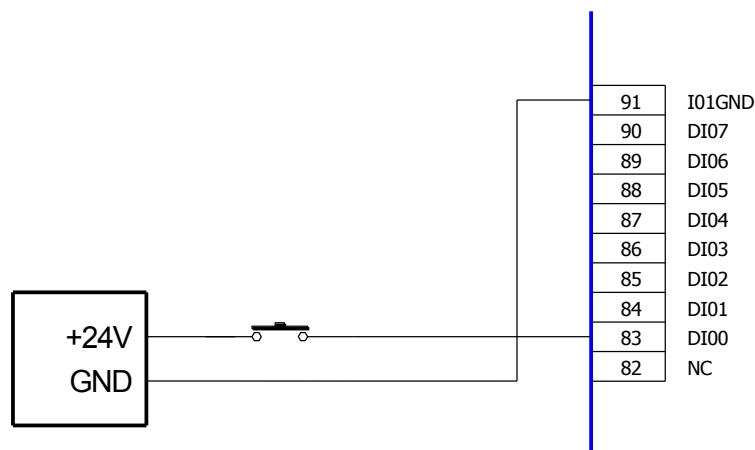


Fig. 8 – Passive contact supplied from self-reliant power supply

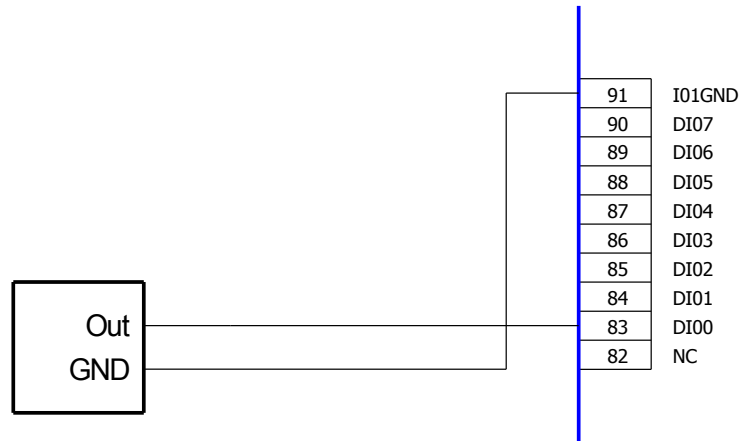


Fig. 9 – Connection of self-supplied active output

6.2 Digital outputs

Digital outputs are implemented by means of galvanically isolated switches 24 V/300 mA DC. Status of each output is indicated by green LEDs on the panel. Output is protected against short-circuits, overheating-proof and protected against overvoltage upon switching an inductive load.

The operating system writes into outputs with the period of 1 ms.

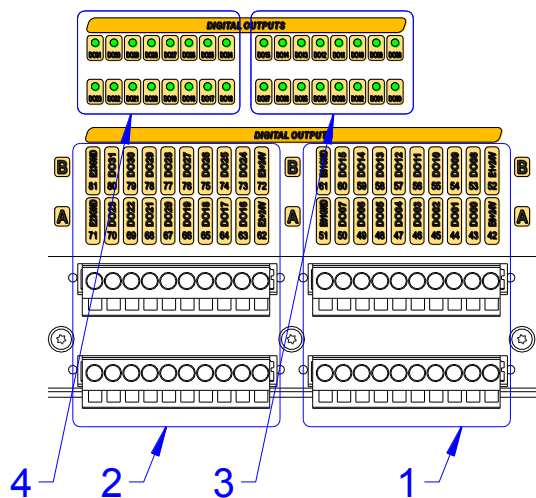


Fig. 10 – Locations of connectors with digital input indication

Legend

Number	Description
1	Connectors of outputs DO00 to DO15
2	Connectors of outputs DO16 to DO31
3	Indication of outputs DO00 to DO15
4	Indication of outputs DO16 to DO31

Connector wiring	Terminal	Signal	Description
	42	E0+24V	Output power supply, group 0
	43	DO00	Digital output 0
	44	DO01	Digital output 1
	45	DO02	Digital output 2
	46	DO03	Digital output 3
	47	DO04	Digital output 4
	48	DO05	Digital output 5
	49	DO06	Digital output 6
	50	DO07	Digital output 7
	51	E01GND	Common ground, outputs DO00 to DO15
	52	E1+24V	Output power supply, group 1
	53	DO08	Digital output 8
	54	DO09	Digital output 9
	55	DO10	Digital output 10
	56	DO11	Digital output 11
	57	DO12	Digital output 12
	58	DO13	Digital output 13
	59	DO14	Digital output 14
	60	DO15	Digital output 15
	61	E01GND	Common ground, outputs DO00 to DO15
	62	E2+24V	Output power supply, group 2
	63	DO16	Digital output 16
	64	DO17	Digital output 17
	65	DO18	Digital output 18
	66	DO19	Digital output 19
	67	DO20	Digital output 20
	68	DO21	Digital output 21
	69	DO22	Digital output 22
	70	DO23	Digital output 23
	71	E23GND	Common ground, outputs DO16 to DO31
	72	E3+24V	Output power supply, group 3
	73	DO24	Digital output 24
	74	DO25	Digital output 25
	75	DO26	Digital output 26
	76	DO27	Digital output 27
	77	DO28	Digital output 28
	78	DO29	Digital output 29
	79	DO30	Digital output 30
	80	DO31	Digital output 31
	81	E23GND	Common ground, outputs DO16 to DO31

LED indicators Digital input status is indicated by green LEDs located near the relevant outputs on the panel – see “Fig. 10 – Locations of connectors with digital input indication”.

Wiring examples

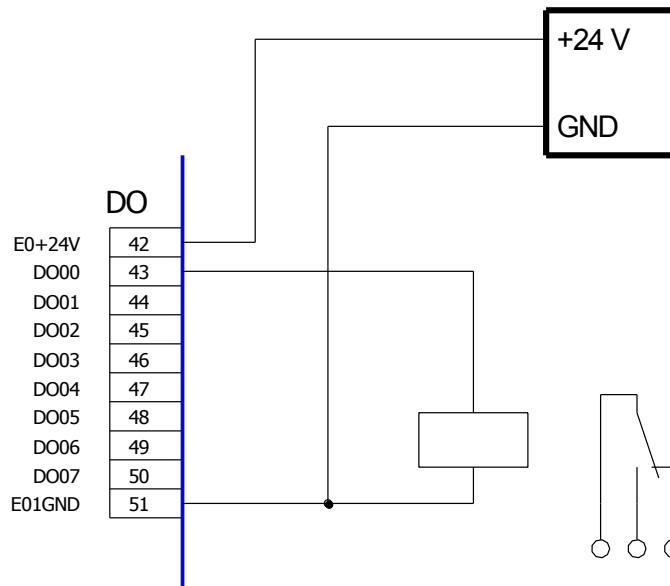


Fig. 11 – Operation of the power contactor by transistor output

6.3 Analogue inputs

The control system **ACOS200** has sixteen analogue inputs which are independently configurable for ranges 0 V to 10 V, 0 mA to 20 mA and for direct connection of sensors Ni1000 or Pt1000.

Each analogue input is read twice, with interval of 10 ms to provide maximum suppression of possible 50 Hz interference. Each of the analogue inputs is read with the period of 160 ms.

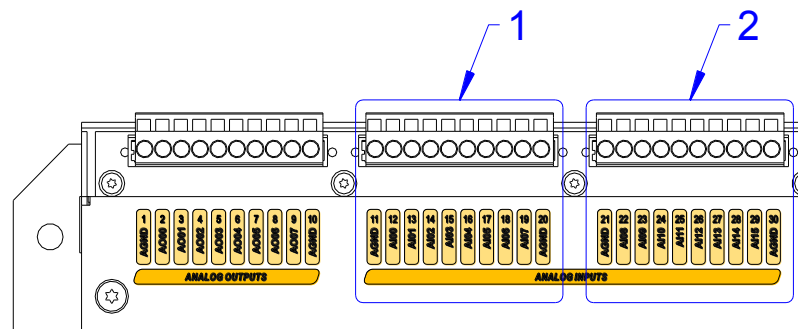


Fig. 12 – Location of analogue input connectors

Legend	Number	Description
	1	Connectors of inputs AI00 to AI07
	2	Connectors of inputs AI08 to AI15

Connector wiring	Terminal	Signal	Description
	11	AGND	Analogue ground
	12	AI00	Analogue input 0
	13	AI01	Analogue input 1
	14	AI02	Analogue input 2

Terminal	Signal	Description
15	AI03	Analogue input 3
16	AI04	Analogue input 4
17	AI05	Analogue input 5
18	AI06	Analogue input 6
19	AI07	Analogue input 7
20	AGND	Analogue ground
21	AGND	Analogue ground
22	AI08	Analogue input 8
23	AI09	Analogue input 9
24	AI10	Analogue input 10
25	AI11	Analogue input 11
26	AI12	Analogue input 12
27	AI13	Analogue input 13
28	AI14	Analogue input 14
29	AI15	Analogue input 15
30	AGND	Analogue ground

Configuration jumpers

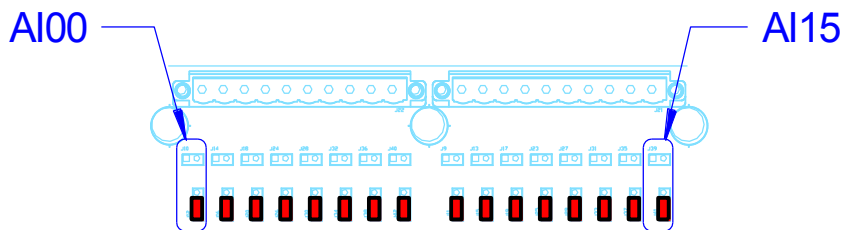


Fig. 13 – Setting of configuration jumpers for range 0 V to 10 V

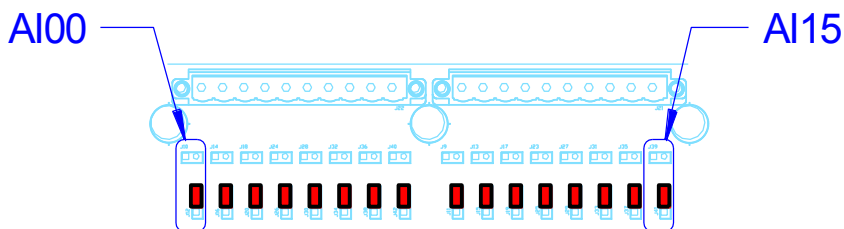


Fig. 14 – Setting of configuration jumpers for range 0 mA to 20 mA

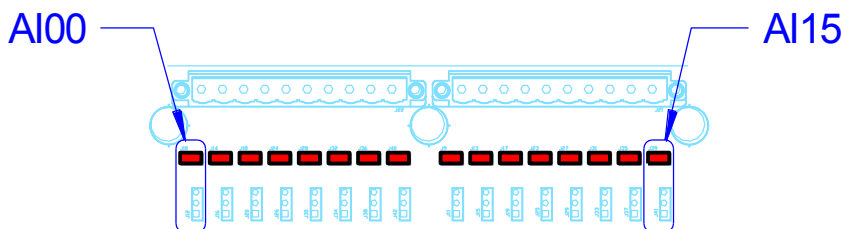


Fig. 15 – Setting of configuration jumpers for Ni1000/Pt1000

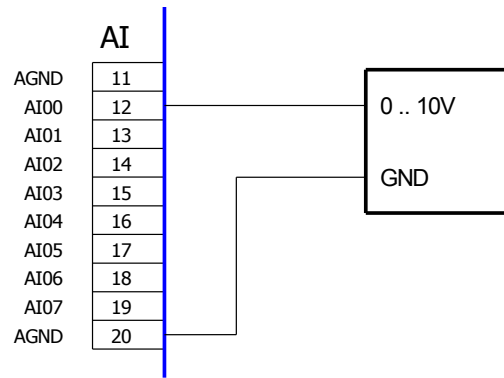


Fig. 16 – Connection of voltage sensor 0 V to 10 V

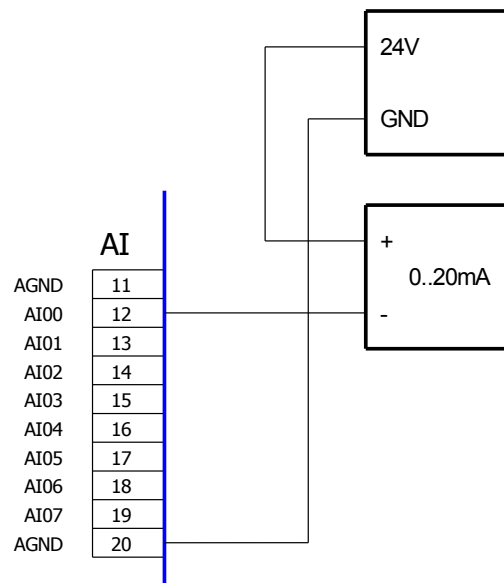


Fig. 17 – Connection of sensor with current output 0 mA to 20 mA (4 mA to 20 mA)

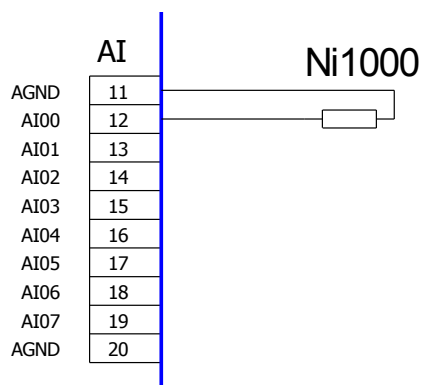


Fig. 18 – Sensors Ni1000/Pt1000 wiring example

6.4 Analogue outputs

The control system **ACOS200** has eight analogue outputs. The output voltage range is from 0 V to 10 V. Outputs are implemented on the principle of Pulse Width Modulation – PWM.

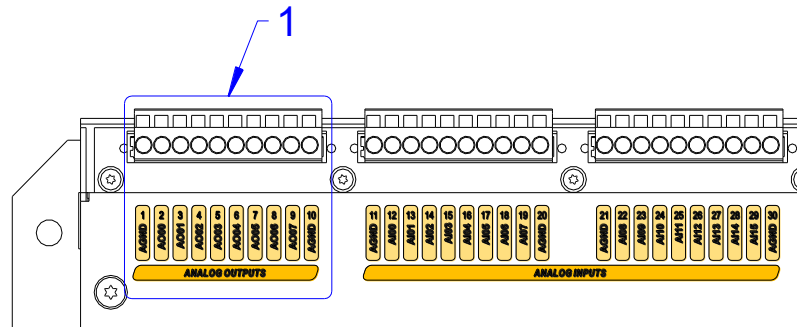


Fig. 19 – Location of analogue output connectors

Legend	Number	Description
	1	Type of output AO00 to AO07

Connector wiring	Terminal	Signal	Description
	1	AGND	Analogue ground
	2	AO00	Analogue output 0
	3	AO01	Analogue output 1
	4	AO02	Analogue output 2
	5	AO03	Analogue output 3
	6	AO04	Analogue output 4
	7	AO05	Analogue output 5
	8	AO06	Analogue output 6
	9	AO07	Analogue output 7
	10	AGND	Analogue ground

Wiring example

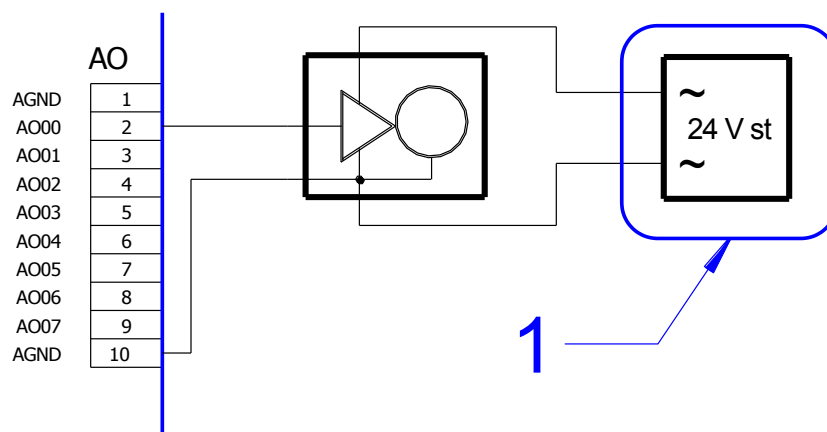


Fig. 20 – Connection of AC supplied servo

Legend	Number	Description
	1	External AC 24 V power supply

7 Communication interfaces

The control system **ACOS200** has five communication interfaces.

The standard RS232 interface conducts to the D-sub DE-9 connector. The interface comes with galvanic isolation.

The RS485 interface is always implemented. The RS485 interface comes with galvanic isolation.

Optionally, there are up to two communication interface RS485, RS232 or CAN available. Signals conduct to the WAGO connector. All interfaces except RS232 are galvanically isolated from the control system circuitry.

The Ethernet interface is led to RJ45 connector.

7.1 RS232

This interface is intended for connection of two devices according to standard RS232. For bi-directional communication, the three wires are sufficient; however, modem control requires a fully implemented D-Sub DE-9 connector.

Connector wiring D-Sub DE-9 on the control system **ACOS200**.

Pin	Signal	Type
1	DCD	Input
2	TxD	Output
3	RxD	Input
4	DSR	Input
5	GND	–
6	DTR	Output
7	CTS	Input
8	RTS	Output
9	RI	Input

Note Items **Signal** and **Type** correspond to signals on the system **ACOS200**, and are cross-connected to PC. The **KABEL 232P** cable is used to connect the control system to PC.

Programme Operation The RS232 interface is designated as COM0 during programming.

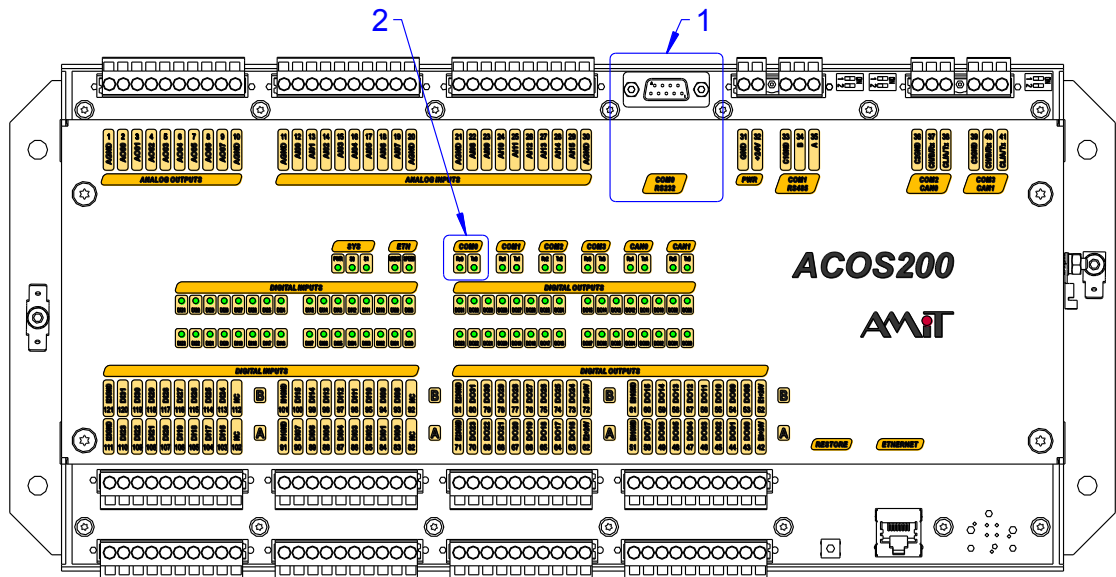


Fig. 21 – Location of RS232 line connector and indication LEDs

Legend	Number	Description
	1	D-sub DE-9 connector, RS232
	2	Status LED

RS232 interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx0	The control system is receiving data
	Tx0	The control system is transmitting data

7.2 RS485

RS485 is a half-duplex serial interface. It serves to connect multiple stations (up to 32 within a single segment). All stations communicate through single signal pair.

In order for RS485 to work properly, it is necessary to follow the rules mentioned in application note *AP0016 – Principles of RS485 interface usage*.

Connector wiring	Terminal	Signal	Description
	33	C1GND	Galvanically isolated RS485 interface, ground
	34	B	Galvanically isolated RS485 interface, signal B
	35	A	Galvanically isolated RS485 interface, signal A

Programme Operation RS485 is labelled as COM1 in programming.

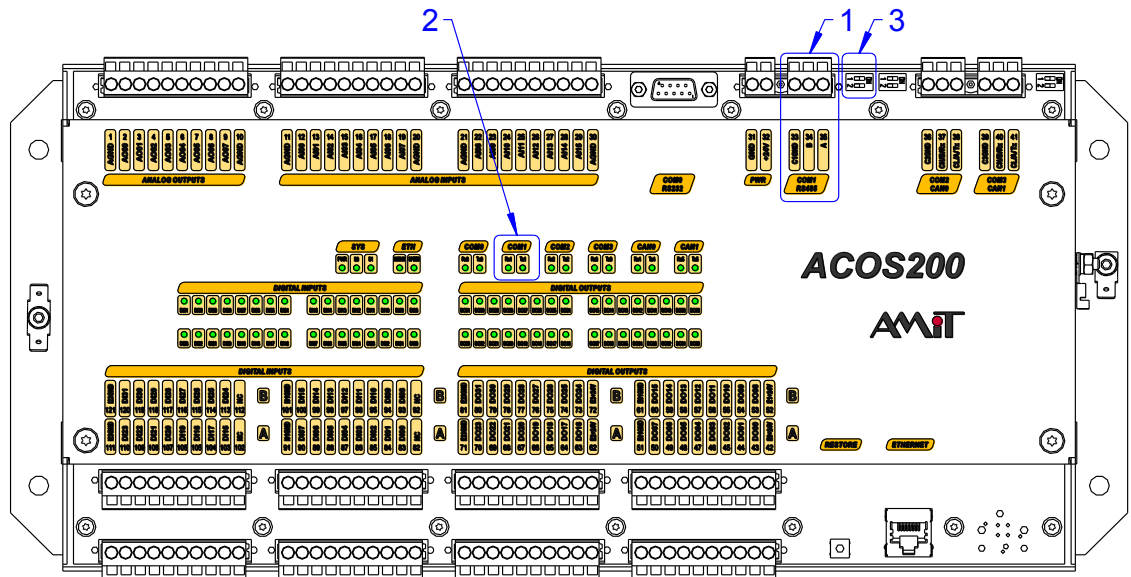


Fig. 22 – Location of connector RS485 and indication LEDs

Legend	Number	Description
	1	Connector WAGO RS485
	2	Status LED
	3	RS485 wires termination

RS485 interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx1	The control system is receiving data
	Tx1	The control system is transmitting data

Each station in RS485 network must have a terminating resistor and idle status definition set properly. Configuration jumpers located near the RS485 connector are used for termination setting.

Switches	Position		Description
	DIP1	DIP2	
	ON	ON	Terminal station – idle statuses and termination are active.
	OFF	OFF	Intermediate station – idle statuses and termination are inactive.

7.3 Optional interface, channel COM2/CAN0

The control system **ACOS200** may host the following optional interfaces:

- RS485 (module **CM-RS485**),
- RS232 (module **CM-RS232**),
- CAN (module **CM-CAN**).

All interfaces except RS232 are galvanically isolated. At the same time, only a single module can be implemented.

Signals are led out to the WAGO231 connector.

Programme Operation The serial interface is designated as COM2 or CAN0 during programming.

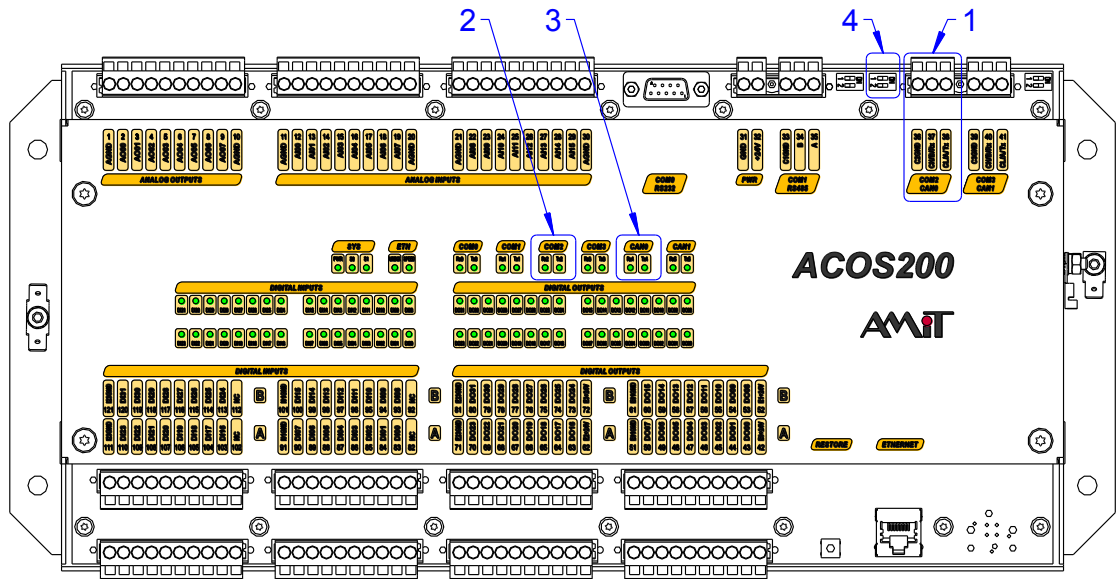


Fig. 23 – Location of the connector and signalling for COM2 / CAN0

Legend

Number	Description
1	Connector WAGO, RS485 / RS232 / CAN
2	RS232 / RS485 indication LEDs
3	CAN indication LED
4	RS485 line termination / CAN

RS485

When using the RS485 interface, the **CM-RS485** module needs to be plugged in.

RS485 is a half-duplex serial interface. It serves to connect multiple stations (up to 32 within a single segment). All stations communicate through single signal pair.

RS485 circuitry is galvanically isolated from other electronics of the control system **ACOS200**.

In order for RS485 to work properly, it is necessary to follow the rules mentioned in application note *AP0016 – Principles of RS485 interface usage*.

Connector wiring

Terminal	Signal	Description
36	C2GND	Galvanically isolated RS485 interface, ground
37	CH/B/Rx	Galvanically isolated RS485 interface, signal B
38	CL/A/Tx	Galvanically isolated RS485 interface, signal A

RS485 interface activity is indicated by LEDs located on the front panel.

LEDs description

LED	Description
Rx2	The control system is receiving data
Tx2	The control system is transmitting data

Each station in RS485 network must have a terminating resistor and idle status definition set properly. Configuration jumpers located near the RS485 connector are used for termination setting.

Switches	Position		Description
	DIP1	DIP2	
	ON	ON	Terminal station – idle statuses and termination are active
	OFF	OFF	Intermediate station – idle statuses and termination are inactive

RS232

When using the RS232 interface, the **CM-RS232** module needs to be plugged in.

RS232 circuitry is NOT galvanically isolated from other electronics of the control system **ACOS200**.

This RS232 interface has only RxD and TxD signals available, therefore it is not possible to use it for modem connection.

Connector wiring	Terminal	Signal	Description
	36	C2GND	RS232 interface, ground
	37	CH/B/Rx	RS232 interface, signal Rx
	38	CL/A/Tx	RS232 interface, signal Tx

RS232 interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx2	The control system is receiving data
	Tx2	The control system is transmitting data

CAN

When using the CAN interface, the **CM-CAN** module needs to be plugged in.

RS485 circuitry is galvanically isolated from other electronics of the control system **ACOS200**.

In order for CAN to work properly, it is necessary to follow the rules mentioned in application note *AP0029 – Principles of CAN network usage*.

Connector wiring	Terminal	Signal	Description
	36	C2GND	Galvanically isolated CAN interface, ground
	37	CH/B/Rx	Galvanically isolated CAN interface, signal CH
	38	CL/A/Tx	Galvanically isolated CAN interface, signal CL

CAN interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx4	The control system is receiving data
	Tx4	The control system is transmitting data

Each station in the CAN network must have wires termination resistors set properly. Configuration jumpers located near the CAN connector are used for termination setting.

Switches	Position		Description
	DIP1	DIP2	
	ON	ON	Terminal station – termination active
	OFF	OFF	Intermediate station – termination inactive

7.4 Optional interface, channel COM3/CAN1

The control system **ACOS200** may host the following optional interfaces:

- RS485 (module **CM-RS485**),
- RS232 (module **CM-RS232**),
- CAN (module **CM-CAN**).

All interfaces except RS232 are galvanically isolated. At the same time, only a single module can be implemented.

Signals are led out to the WAGO231 connector.

Programme Operation The serial interface is designated as COM3 or CAN1 during programming.

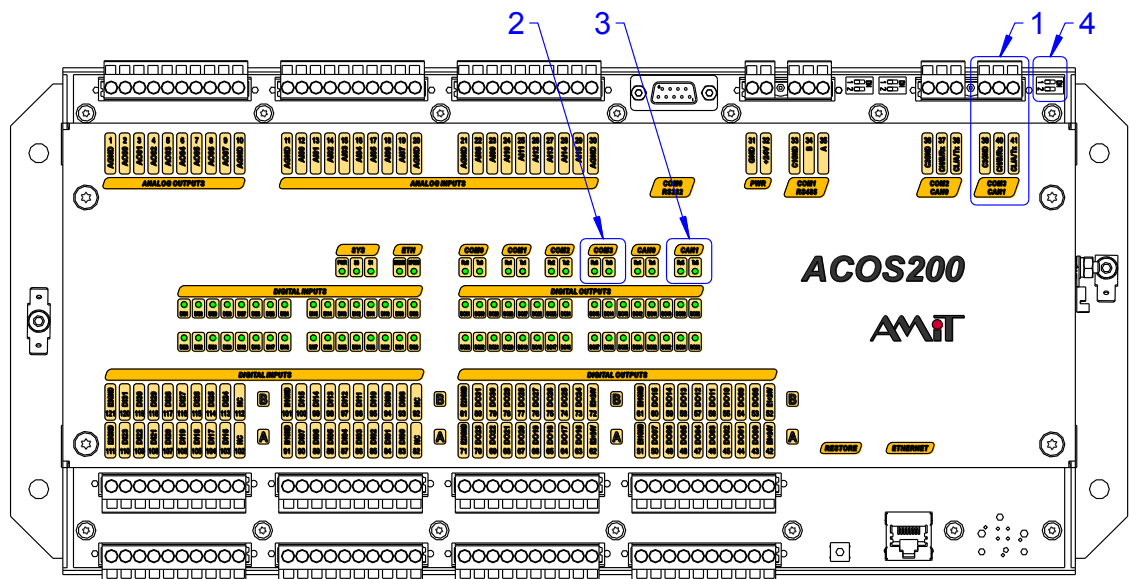


Fig. 24 – Location of the connector and signalling for COM3 / CAN1

Legend	Number	Description
	1	Connector WAGO, RS485 / RS232 / CAN
	2	RS232 / RS485 indication LEDs
	3	CAN indication LED
	4	RS485 line termination / CAN

RS485

When using the RS485 interface, the **CM-RS485** module needs to be plugged in.

RS485 is a half-duplex serial interface. It serves to connect multiple stations (up to 32 within a single segment). All stations communicate through single signal pair.

RS485 circuitry is galvanically isolated from other electronics of the control system **ACOS200**.

In order for RS485 to work properly, it is necessary to follow the rules mentioned in application note *AP0016 – Principles of RS485 interface usage*.

Connector wiring	Terminal	Signal	Description
	39	C3GND	Galvanically isolated RS485 interface, ground
	40	CH/B/Rx	Galvanically isolated RS485 interface, signal B
	41	CL/A/Tx	Galvanically isolated RS485 interface, signal A

RS485 interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx3	The control system is receiving data
	Tx3	The control system is transmitting data

Each station in RS485 network must have a terminating resistor and idle status definition set properly. Configuration jumpers located near the RS485 connector are used for termination setting.

Switches	Position		Description
	DIP1	DIP2	
	ON	ON	Terminal station – idle statuses and termination are active
OFF	OFF	Intermediate station – idle statuses and termination are inactive	

RS232

When using the RS232 interface, the **CM-RS232** module needs to be plugged in.

RS232 circuitry is NOT galvanically isolated from other electronics of the control system **ACOS200**.

This RS232 interface has only RxD and TxD signals available, therefore it is not possible to use it for modem connection.

Connector wiring	Terminal	Signal	Description
	39	C3GND	RS232 interface, ground
	40	CH/B/Rx	RS232 interface, signal Rx
	41	CL/A/Tx	RS232 interface, signal Tx

RS232 interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx3	The control system is receiving data
	Tx3	The control system is transmitting data

CAN

When using the CAN interface, the **CM-CAN** module needs to be plugged in.

RS485 circuitry is galvanically isolated from other electronics of the control system **ACOS200**.

It is necessary to follow the rules mentioned in application note *AP0029 – Principles of CAN network usage*.

Connector wiring	Terminal	Signal	Description
	39	C3GND	Galvanically isolated CAN interface, ground
	40	CH/B/Rx	Galvanically isolated CAN interface, signal CH
	41	CL/A/Tx	Galvanically isolated CAN interface, signal CL

CAN interface activity is indicated by LEDs located on the front panel.

LEDs description	LED	Description
	Rx5	The control system is receiving data
	Tx5	The control system is transmitting data

Each station in the CAN network must have wires termination resistors set properly. Configuration jumpers located near the CAN connector are used for termination setting.

Switches	Position		Description
	DIP1	DIP2	
	ON	ON	Terminal station – termination active
OFF	OFF	Intermediate station – termination inactive	

7.5 Ethernet

The control system can be directly connected to LAN network by means of Ethernet interface. Standard structured cabling components can be used to make the connection.

The Ethernet interface can be used both for visualization and remote loading of application software into the control system via Internet. Ethernet interface is supported by DetStudio Environment. TCP/IP protocols are used for communication; therefore the communication network can be shared both by control systems and personal computers. The control system **ACOS200** can also be used as a gateway from Ethernet to DB-Net network.

The control system **ACOS200** also allows activation of an internal WEB server.

Signals conduct out to the RJ45 connector.

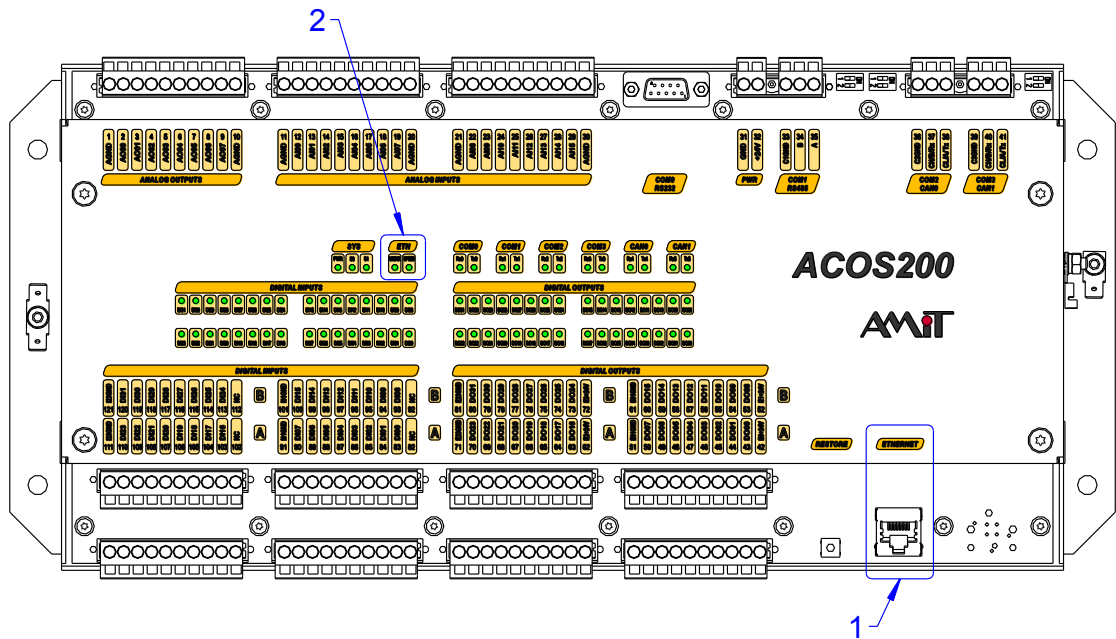


Fig. 25 – Location of the RJ45 connector and indication

Legend	Number	Description
	1	Connector RJ45
	2	Status LED

Interface state indication Activity of Ethernet line is indicated by LEDs (LNK/ACT and SPEED) on the front panel.

LEDs description	LED	Colour	Description
	LNK/ACT	Green	Ethernet connection, data reception or transmission. Lit when the line is connected, flashing when transmitting data.
	SPEED	Green	Lit when connected at speed 100 Mbps.

More information is available in application note *AP0037 – Principles of Ethernet network usage*.

Note Ethernet galvanic isolation must not be used for separation of dangerous voltage.

8 Internal measurement, SD card

8.1 Temperature sensor

The control system electronics includes a temperature sensor. The measured temperature value is several degrees higher than ambient temperature. This is caused by heat from the control system components. The temperature value can be measured in applications written in DetStudio development environment by using the following method:

Operation example `Ram.fTemp = IO.Temperature;`

The value measured is temperature in °C.

8.2 Backup battery voltage

Voltage of backup battery can be measured in applications written in DetStudio development environment using the following method:

Operation example `Ram.fUbat = IO.VBatt;`

The measured value is battery voltage [V].

The operator can be alerted to replace the battery according to this value.

More information regarding the backup battery can be found in chapter 13 “Maintenance”.

8.3 SD card

The micro SD card holder is available after we remove the cover on the processor module.

The way card is used is given by current possibilities of DetStudio / EsiDet development environment. Details about card usage are described in application software documentation.

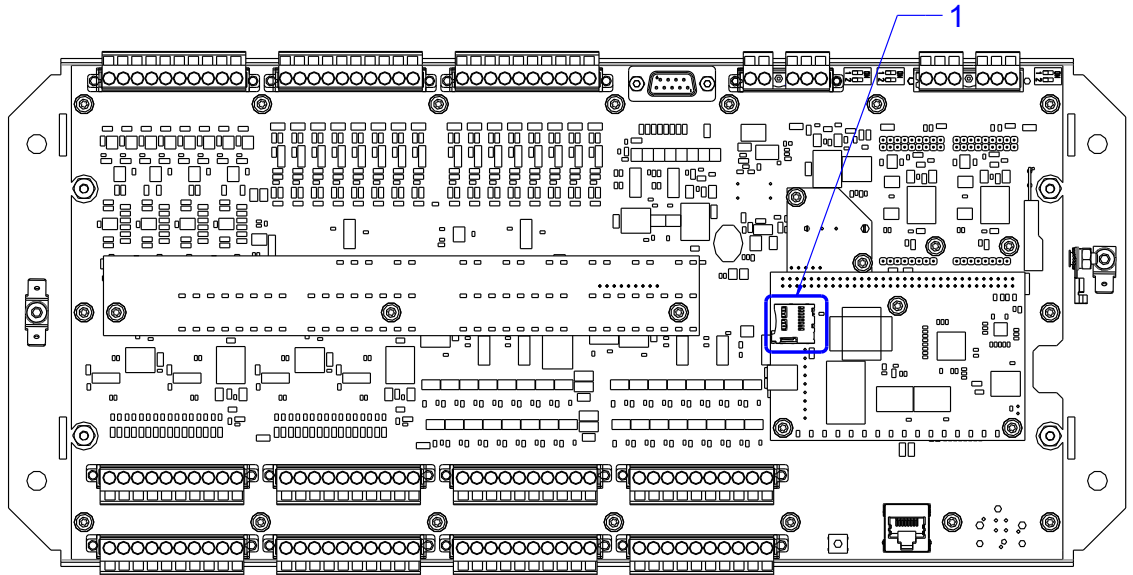


Fig. 26 – Location of the Micro SD card slot

Legend

Number	Description
1	Location of the Micro SD card slot

9 Mounting

9.1 Mounting procedure

The control system **ACOS200** must be installed in the switchboard. It is designed for assembly onto switchboard base plate. On the left side of the metal case, there is an M4 screw with earthing cable terminal end, which must be connected by the green-yellow wire to the PE terminal in the switchboard. The wire cross-section must be at least 2.5 mm².

Technical parameters of control system are guaranteed solely when metal switchboard is used.

9.2 Mounting apertures

All dimensions are stated in mm.

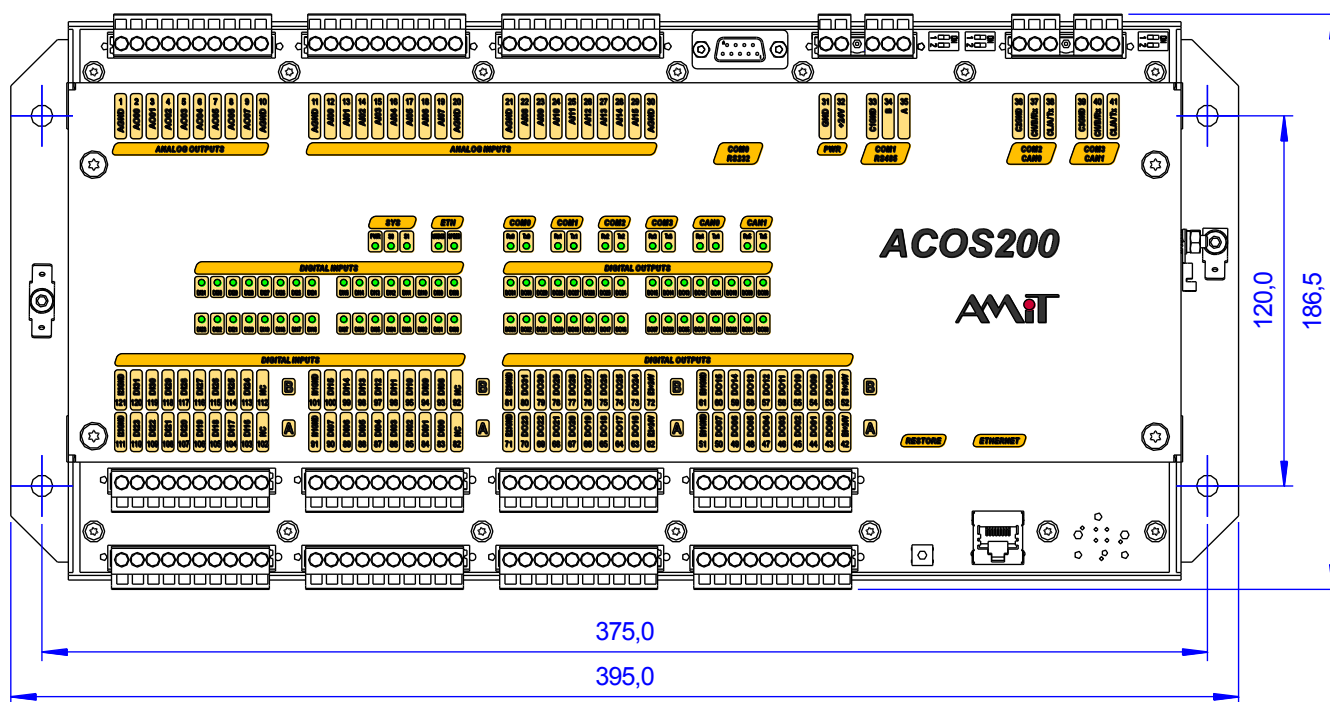


Fig. 27 – Location of mounting apertures on the control system

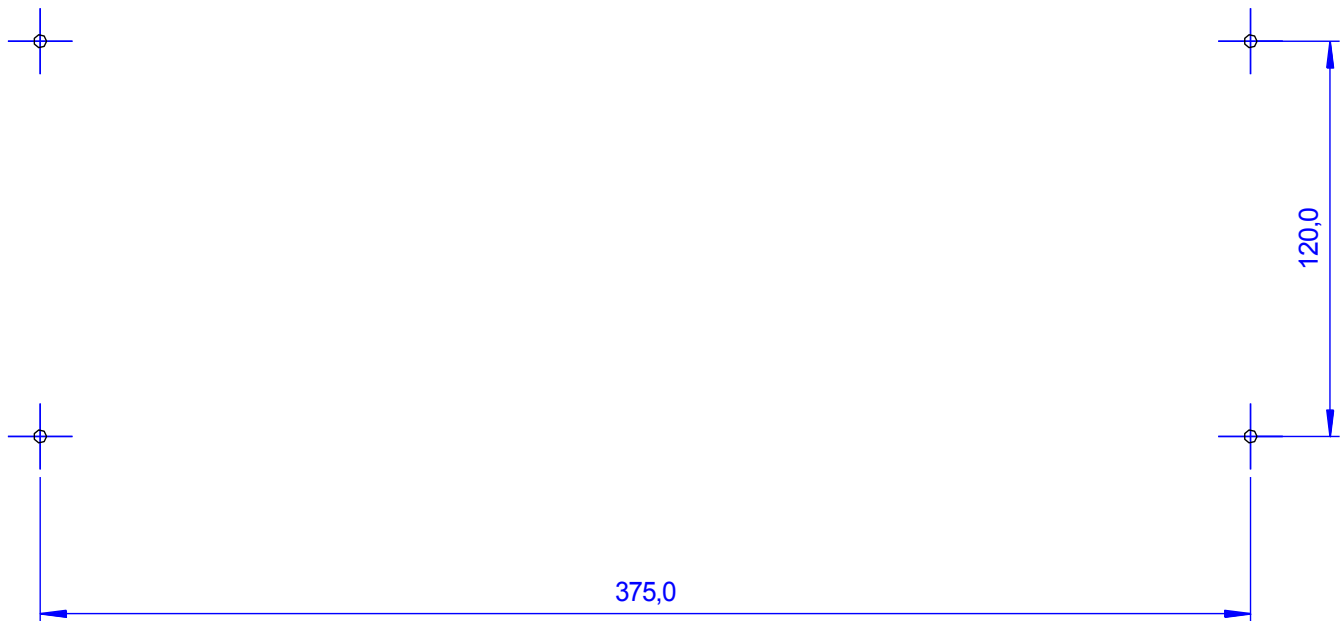


Fig. 28 – Location of mounting apertures

9.3 Installation rules

EMC filter Use an EMC filter on 230 V AC power supply voltage input. This can be reconsidered on the basis of the wiring and the environment character.

Connect the negative supplying terminal of control system (GND) to the switchboard PE terminal.

Power supply The device must not be powered from DC distribution network of the building. Multiple devices may be powered from a single power supply source on the condition that this power supply source only powers devices of a similar type, located in a single building.

Digital I/O Connect the negative terminal of all inputs and outputs to the switchboard PE terminal.

We recommend using a separate power supply section. Common section for DI and DO is convenient as well.

Implement the connection with PE on the switchboard input.

Use shielded wires for longer distance lead wires and in higher level disturbance environment. Connect the shielding right at the switchboard input to PE.

If the supply cables go outside the building, put overvoltage protection on the relevant outputs and inputs.

Analogue inputs Use shielded cables for wiring. Connect the shielding right at the switchboard input to PE.

If the supply cables go outside the building, put overvoltage protection on the relevant outputs and inputs.

RS485 It is necessary to perform RS485 interface connection according to recommendations in application note *AP0016 – Principles of RS485 interface usage*.

RS232 When used only for service or utilized within the switchboard frame, then can be used also the unshielded flat communication cable.

Use the shielded cables for permanent use outside the switchboard frame. Connect the cable shielding to the switchboard's PE terminal immediately on the input.

Ethernet It is necessary to perform Ethernet connection according to recommendations in application note *AP0037 – Principles of Ethernet network usage*.

Note All connections to PE must be performed with the least impedance possible. Technical parameters of control system are guaranteed only when these wiring rules are applied.

10 Programming and setting

The control system **ACOS200** is factory-programmed with a Loader that allows the user to upload of the user application.

The user may also create their own user application in:

- DetStudio / EsiDet development environment.

The user application can be uploaded into the control system **ACOS200** by means of the Ethernet interface. It can be done through:

- DetStudio development environment.

SW download The development environment is available for free download at amitautomation.com.

10.1 Communication parameters setting

The communication parameters can be set from the PC using DetStudio / Find station on Ethernet.

Connection to PC It is necessary to connect **ACOS200** to PC using Ethernet. The connection can be direct or by means of other active Ethernet elements (switch, router, etc.).

10.2 Button RESTORE

The button “**RESTORE**” is located next to the connector of the Ethernet interface and serves to activate the loader or to activate the restoration of factory settings.

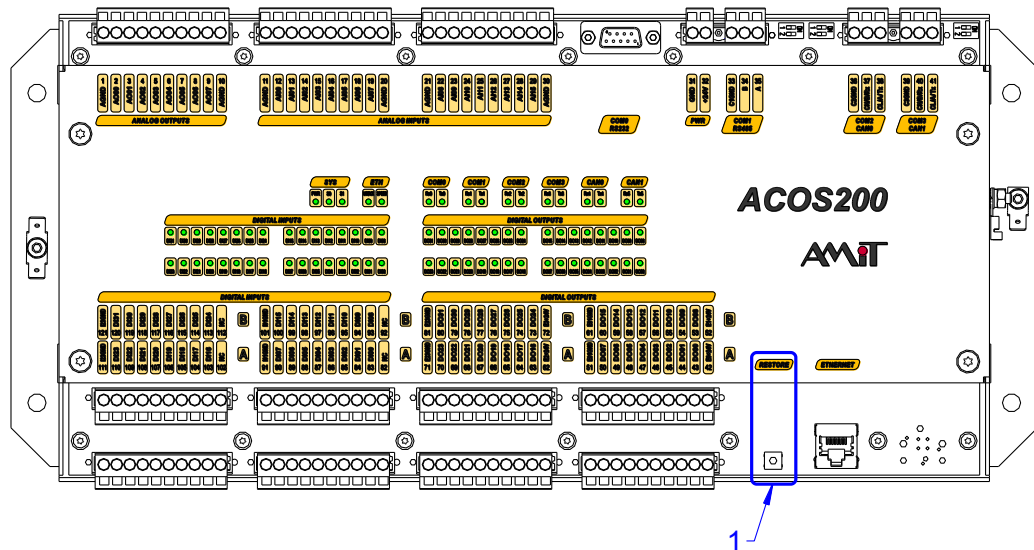


Fig. 29 – Button “**RESTORE**”

Legend	Number	Description
	1	Location of the button “ RESTORE ”

The button “**RESTORE**” can be pushed with a suitable blunt tool anytime the user application is running.

10.3 Status LED

LED S0 serves to indicate the programme status of **ACOS200**. LED S1 is reserved for future use.

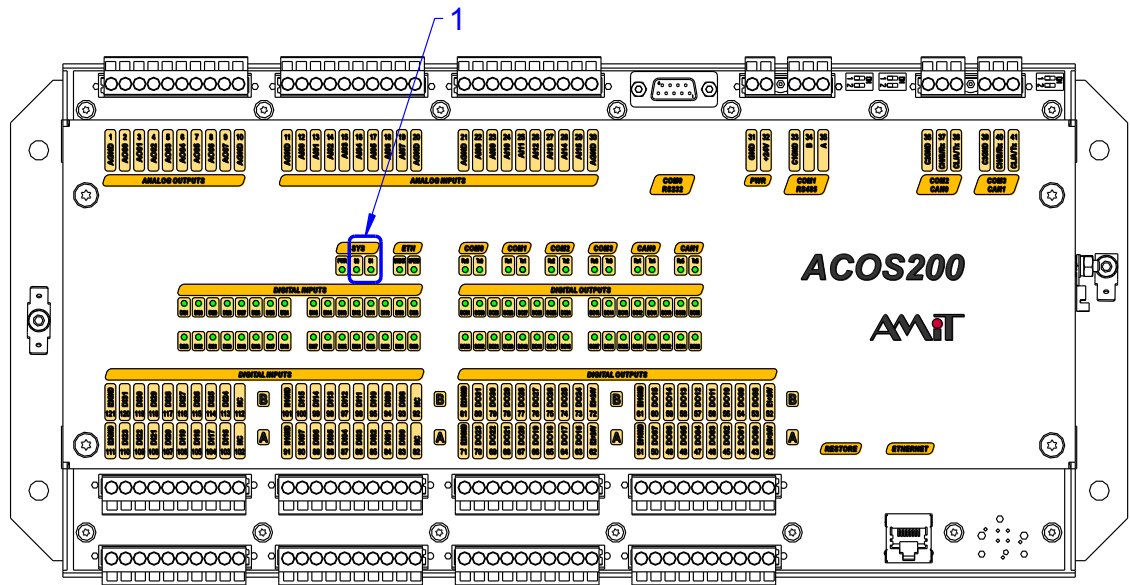


Fig. 30 – Status LEDs location

Number	Description
1	S0 and S1 LED indication

LED	Light	Description
S0	Flashing in intervals 0.1 s for a period of 1 s	Reset process indication.
	Lights on permanently	Restoring factory settings.
	Regular flashing in intervals 1 s	Application / loader is running.
	Irregular flashing in intervals 0.5 s	The running application is indicating an error. Irregular flashing means that after a certain amount of flashes, a pause of 2 s ensues. The number of flashes between two consecutive pauses signals the numeric code of the error: 1 – BackUp RAM reading error, 2 – error during reading from EEPROM, 3 – suspiciously frequent writing to EEPROM, 15 – unknown error.
S1		Reserved for future use.

10.4 Loader

The status when the Loader is launched can be used in cases the user application is causing any troubles, e.g. repeated restarting, inability to connect to **ACOS200**, etc.

Loader activation We activate the Loader by pressing the button "**RESTORE**", which is located next to the Ethernet interface connector (see chapter 10.2 "Button RESTORE").

A corresponding action is called according to the time and duration of the button press, see the following table.

RESTORE button	Press length	Action
	> 1 s, but < 10 s – after startup	Launches the Loader. The communication parameters are kept.
	> 3 s, but < 10 s – during application run	

In both cases, the Loader is launched in **ACOS200** after the button is released.

In order to activate the application loaded in **ACOS200**, it is necessary to turn the control system on and off.

11 Factory settings

RS485 configuration The RS485 line is fitted with jumpers which activate the line termination and idle status definition.

Ethernet factory settings

Parameter	Default value
Station IP address	192.168.1.1
Network mask	255.255.255.0
Default gateway	0.0.0.0

Web server factory settings

Parameter	Default value
Administrator login / password	root/amit
Service login / password	Service/amit
User login / password	user/amit

Parameter	Default value for TCP port
FTP server – data	20
FTP server – control	21
WEB server	80

Web server factory settings are only significant in case the server is included in the user application.

11.1 Restore factory settings

Factory settings can be restored by means of the “**RESTORE**” button (see chapter 10.2 “Button RESTORE”).

After the process of restoring factory settings finishes, parameters stated in the previous chapter will be set in **ACOS200**.

Web server factory settings are restored only in case the server is included in the user application.

Attention In order for the process of restoring factory settings to be completed properly, the user must not unplug the power supply from **ACOS200!**

- Restoring procedure**
- The button “**RESTORE**” can be pushed and held with a suitable blunt tool. As long as we hold the button, S0 LED lights fully (for approx. 15 s).
 - Release the button “**RESTORE**”.
After ca 6 s, LED S0 starts flashing quickly, the user application re-launches and LED S0 starts flashing in 1 s intervals.
 - Factory settings of communication parameters have been restored.

12 Ordering information and package contents

Control system	ACOS200	Complete unit, see chapter 12.1 "Package contents"
Other	CM-RS485 ²¹⁾	Communication module for RS485
	CM-RS232 ²¹⁾	Communication module for RS232
	CM-CAN ²¹⁾	Communication module for CAN
	SP_MB247720	Battery module (spare part)

²¹⁾ The control system can host maximum two arbitrary communication modules. Assembling is made by the customer.

12.1 Package contents

ACOS200	Part	Quantity
	Control system ACOS200	1
	WAGO 231-302/102-000 – power supply connector	1
	WAGO 231-303/102-000 – communication interface connector	3
	WAGO 231-310/102-000 – connectors for AI/AO/DI/DO	11

13 Maintenance

The device does not require any regular inspection or service, except checking of voltage of backup battery.

Battery module The battery module serves to backup software, hours and parameters in the RAM memory. Nominal battery voltage is 3.0 V nominal capacity is 1 Ah. If the battery voltage drops under 2.1 V, the battery is considered depleted. When it happens, it is necessary to change the battery module.

Checking is necessary at least once every year. An assumed battery lifetime is 5 years according to manufacturer. We recommend implementing the backup battery measuring directly into application.

If the following conditions are met, replacement intervals may be extended according to the chart on “Fig. 31 – Backup battery replacement interval”.

Terms of extension of service interval for battery replacement are as follows:

- The control system must not be in storage no longer than 1 year before use.
- Storage temperature must be in range of +10 °C to +35 °C.
- Relative storage humidity must not exceed 90 %, humidity condensation on the control system must be prevented.

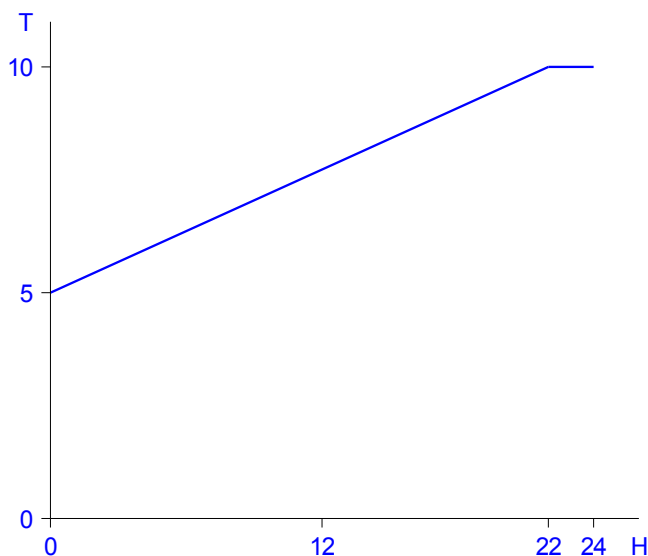


Fig. 31 – Backup battery replacement interval

Legend

Symbol	Description
T	Service interval (years)
H	Powered device operation time (hours/day)

Cleaning Time after time it is necessary to remove a dust from the inner electronics according to the way of use. The device needs to be cleaned turned off and disassembled, with a dry clean brush or a soft brush or a vacuum cleaner.

Warning The maintenance mentioned above can only be performed by the manufacturer or authorized service only.

13.1 Battery module replacement

Necessary equipment:

- screwdriver Torx T20,
- screwdriver Torx T10,
- a laptop with installed DetStudio development environment and the current project.

Replacement procedure

- Backup the data from the control system **ACOS200** using DetStudio, menu Debugging / Data manager, Read data into a new file (see DetStudio Help).
- Unplug the supply voltage.
- Remove the cover using the T20 screwdriver.
- Release the actual battery module, according to Fig. 32 using the T10 screwdriver.
- Replace the battery module.
- Fix the new battery module, order Pad / Spring pad / Screw according to Fig. 33 using the T10 screwdriver.
- Replace the cover and tighten it on using the T20 screwdriver.
- Plug in the power supply, restore the data using DetStudio (see DetStudio Help).
- Restore the time in the control system using DetStudio (see DetStudio Help).

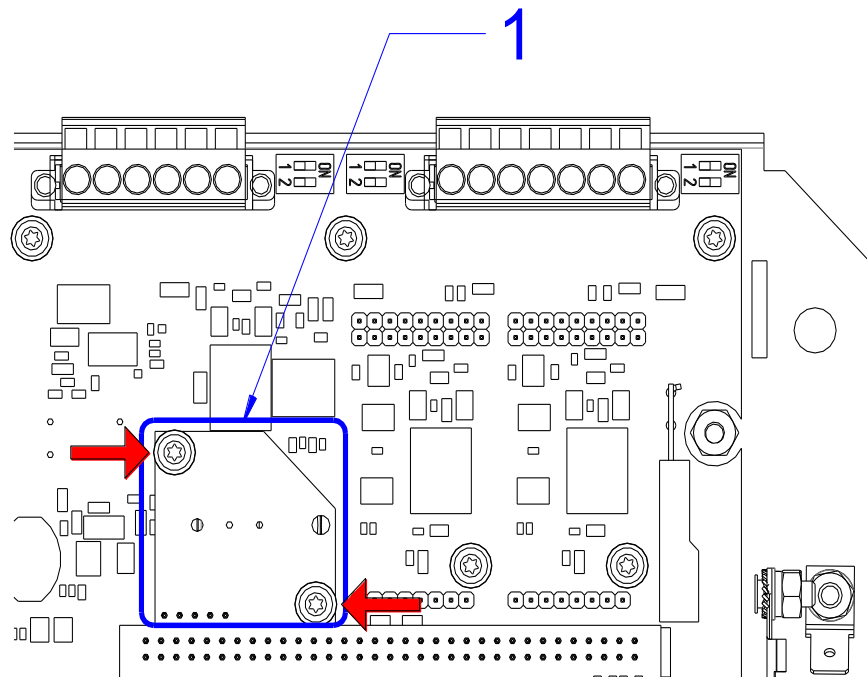


Fig. 32 – Location of the battery module and assembly screws

Legend	Number	Description
	1	Location of the replaceable battery module

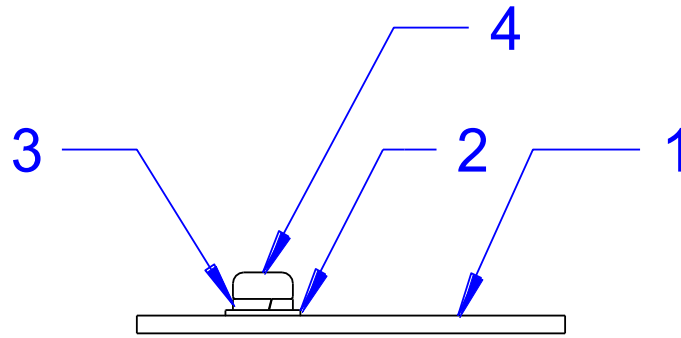


Fig. 33 – Set on the battery module

Legend

Number	Description
1	Battery module
2	Normal pad
3	Spring pad
4	Screw M3 with a cylinder head and Torx T10 groove

14 Waste disposal

Electronics disposal Disposal of the device is subject to the rules on the disposal of electrical waste and electronic equipment. The device must not be disposed of in municipal waste. It must be submitted to designated sites and recycled.

Battery disposal The device contains a lithium battery. The battery is a hazardous waste. Therefore, it must be delivered to places specified for that purpose. Disposal of depleted batteries and accumulators must not be in contrary to valid regulations.