AMAP99S

Compact control systém

Operation instructions

Version 1.0

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Contents

History of revisions

Document name: amap99s_g_en_100.pdf

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Revision	Date	Changes
100	15. 9. 2009	New document

Related documentation

1. DetStudio Development Tool Help
2. Application Note AP0004 “Transfer of technology data within GSM/GPRS network”
   file: ap0004_cz_xx.pdf
3. Application Note AP0016 “Using RS485 interface principles”
   file: ap0016_cz_xx.pdf
4. Application Note AP0022 “Counter inputs implemented in control systems”
   file: ap0022_cz_xx.pdf

1. Introduction

AMAP99S is a compact control system built in metal case with possible connecting of **APT130** terminal with 4 × 20 character LCD display and membrane keyboard.

The Ethernet interface is complemented always.

Basic properties

- 24 digital inputs with galvanic separation
- 19 relay outputs
- 4 digital outputs with galvanic separation
- 15 analogue inputs U / I / Ni1000 / Pt1000
- Optionally up to 6 analogue outputs (by plug-in modules)
- Ethernet 10/100 Mbps
- RS232 serial interface
- Optional serial interface (by the plug-in module): RS485, CAN, M-Bus, RS232
- Assembly on the switchboard base plate

2. Technical parameters

CPU

CPU	ST10F269
FLASH memory	256 + 1024 KB
RAM AMAP99S	1024 KB
EEPROM	2 KB
RAM back-up	Panasonic BR2477/CHCE Lithium battery
Battery lifetime	5 years

RTC

Type	RTC72423A
Precision at 25 °C	±20 ppm
Precision at 0 to 50 °C	-40 to +20 ppm

Digital inputs

Number	24
Configuration	3 × 8
Common lead	Minus
Type of input	24 V DC / 24 V AC
Logical 0	Min. -30 V, max. 5 V DC
Logical 1	Min. 16 V, max. 30 V DC
Input current	6 mA at 24 V DC
Input peak current	Max. 10 mA at 30 V DC
Maximum frequency	1 kHz at 10 % distortion ratio 5 kHz at 30 % distortion ratio
Galvanic separation	Yes, three separate groups
Isolation strength	500 V AC / 1 minute *)
Wire connection	3 × WAGO 231-310 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2

Notice *) Isolation must not be used for dangerous voltage separation.

Relay outputs

Number of outputs	19
Configuration	3 × 5 + 1 × 4
Relay types	17 switching 2 switching-over
Contact protection	Varistor
Galvanic separation isolation strength	4200 V AC
Galvanic separation maximum operation voltage	300 V AC/DC
Nominal switched voltage	230 V AC / 24 V DC.
Maximum switched current	6 A (resistance load)
Switched power (resistance load)	1500 VA AC / 144 W DC
Switch-on time	10 ms
Switch-off time	5 ms
Contact lifetime Without load Nominal load	 30×10^6 switching 10^5 switching
Maximum switching frequency Without load Nominal load	 72 000/hour 600/hour
Output wire connection	4 × WAGO231-710 (7.5 mm) connector
Wire cross section	0.08 to 2.5 mm^2

Digital outputs

Number of outputs	4
Configuration	1 × 4
Common lead	Minus
Switching element	MOS
Galvanic separation	Yes
Isolation strength	500 V AC / 1 minute *)
Switched voltage	24 V DC ±20 %
Switched current	500 mA
Protection current maximum	0.7 to 2.5 A
Common lead maximum current	4.5 A
Residual current at Log. 0	0 mA
Switch-on time	40 µs
Switch-off time	100 µs
Shortcut protection	Electronic
Inductive load protection	Transil 600 W
Output wire connection	1 × WAGO 231-306 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2

Notice *) Isolation must not be used for dangerous voltage separation.

Analogue inputs

Number of inputs	15
Configuration	3 × 5
Type of inputs	0 to 5 V / 0 to 10 V / 0 to 20 mA / / Ni1000 / Pt1000 / / 24 V DC digital input
Resolution	10 bit
Input overvoltage protection	Diode
Galvanic separation	No
Wire connection	3 × WAGO 231-310 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2
Cable type	Shielded

Caution AGND terminal is internally connected with GDN terminal of control system.

Input range 0 to 5 V DC

AD converter resolution (LSB)	5 mV
Accuracy	0.1 %
Thermal dependability	25 ppm / °C
Input DC resistance	Minimum 1 MΩ
Input circuit time constant	1 ms
Maximum input voltage	50 V DC permanently

Input range 0 to 10 V DC

AD converter resolution (LSB)	10 mV
Accuracy	0.2 %
Thermal dependability	35 ppm / °C
Input resistance	20 kΩ
Input circuit time constant	0.5 ms
Maximum input voltage	50 V DC permanently

Input range 0 to 20 mA

AD converter resolution (LSB)	20 µA
Accuracy	0.1 %
Thermal dependability	75 ppm / °C

Input resistance	249 Ω / 0.1 %
Input circuit time constant	1 ms
Maximum input current	30 mA DC *)

Notice *) Sensing resistor overload occurs at input voltage higher than 7.5 V (i.e. input current higher than 30 mA).

Ni1000 input

Measuring range (Ni1000/5000)	-50 to +174 °C
Measuring range (Ni1000/6180)	-50 to +146 °C
AD converter resolution (LSB)	0.3 °C *)
Measuring precision depends on value being measured. Needs to be interpolated.	T = -50 °C 0.8 °C T = 0 °C 0.9 °C T = 150 °C 1.2 °C

Pt1000 input

Measured temperature range	-50 to +250 °C
AD converter resolution (LSB)	1 °C *)
Measuring precision depends on value being measured. Needs to be interpolated.	T = -50 °C 1.0 °C T = 0 °C 1.3 °C T = 250 °C 2.6 °C

Notice *) While NOS operating system is used (DetStudio).

Only a resistive sensor can be connected. Considering the technical solution a 12 V DC voltage appears at AIx input if the sensor is not attached. This voltage is present always for 10 ms from 110 ms interval, the current voltmeter shows an average value only.

Digital input 24 V DC

Logical 0	Min. -30 V, max. 5 V DC
Logical 1	Min. 8 V, max. 30 V
Input current	2 mA at 24 V DC
Input peak current	Max. 3 mA at 30 V DC
Input overvoltage protection	Diode
Maximum frequency	100 Hz at 10 % distortion ratio 500 Hz at 30 % distortion ratio
Galvanic separation	No
Maximum input voltage	50 V DC permanently

Notice Valid for actuating logical „0“ as well as logical „1“.

Analogue outputs

Analogue outputs (On plug-in module complementing)	0 / 2 × / 4 × / 6 ×
Output type	0 to 10V DC / 0 to 20 mA
Galvanic separation	No
Analogue outputs protection	Transil 600 W
Wire connection	2 × WAGO 231-306 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2
Cable type	Shielded

Voltage output 0 to 10 V DC	
Module type	**AM-AO2U**
Number of outputs	0 / 2 / 4 / 6
Galvanic separation	No

Output range	0 to 10V DC
Minimum load	1 kΩ
Maximum capacitive load	10 nF
Maximum output current	10 mA
Absolute setting error	0.2 %
Resolution	10 bit
Resolution per 1 bit	10 mV
Transition time 0 to 10 V DC, 1 % precision	Maximum 25 ms
Residual ripple	20 mV
Thermal dependability	35 ppm / °C
Maximum wire length	100 m
Output circuitry protection	Transil 600 W

Current output 0 to 20 mA	
Module type	**AM-AO2I**
Number of outputs	0 / 2 / 4 / 6
Galvanic separation	No
Output range	0 to 20 mA DC
Maximum load	600 Ω
Maximum output voltage	12 V DC
Absolute setting error	0.2 %
Resolution	10 bit
Resolution per 1 bit	20 µA
Transition time 0 to 20 mA, 1 % precision	Maximum 25 ms
Residual ripple	40 µA
Thermal dependability	35 ppm / °C
Maximum wire length	100 m
Output circuitry protection	Transil 600 W, Zener diode

Caution AGND terminal is internally connected with GDN terminal of system power supply connector.
Presented parameters are valid while NOS operating system is used (DetStudio).

RS232

Galvanic separation	No
Logical level 0 (input)	Min. +3 V, max. + 30 V DC
Logical level 1 (input)	Min. -30 V, max. -3 V DC
Logical level 0 (output)	Min. +5 V, max. +10 V DC
Logical level 1 (output)	Min. -10 V, max. -5 V DC
Maximum wire length	10 m
Function indicator	LED – system bar graph
Inputs protection	Transil 600 W
Outputs protection	Transil 600 W
Connector	CANON 9, female

Optional interface

Serial interface (only with plug-in module)	0 / 1 ×
Wire connection	1 × WAGO 231-303 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2

RS485	
Module type	**AM-RS485**
Overvoltage protection	Transil 600 W
Galvanic separation	Yes
Galvanic separation isolation strength	500 V AC / 1 minute *)
Terminating resistor	120 Ω on **AM-RS485**
Idle state definition to +5 V DC to 0 V DC	 1 kΩ on **AM-RS485** 1 kΩ on **AM-RS485**
Maximum wire length	1200 m / 19200 Bd
Maximum stations count	32
Function indicator	LED – system bar graph

Notice *) Isolation must not be used for dangerous voltage separation.

CAN	
Module type	**AM-CAN**
Overvoltage protection	Transil 600 W
Galvanic separation	Yes
Galvanic separation isolation strength	500 V AC / 1 minute *)
Terminating resistor	120 Ω on **AM-CAN**
Maximum wire length	1000 m / 50 kbit/s 75 m / 500 kbit/s
Signal loop delay	290 ns
Input differential impedance	20 kΩ
Function indicator	-

Notice *) Isolation must not be used for dangerous voltage separation.

M-BUS	
Module type	**AM-MBUS**
Overvoltage protection	Transil 600 W
Galvanic separation	Yes
Galvanic separation isolation strength	500 V AC / 1 minute *)
Transmission rate	150 to 9600 Bd
Maximum number of attached compo-nents	3
Maximum wire length	1000 m / 2400 Bd 350 m / 9600 Bd
Function indicator	LED – system bar graph

Notice *) Isolation must not be used for dangerous voltage separation.

RS232	
Module type	**AM-RS232**
Overvoltage protection	Transil 600 W
Galvanic separation	No
Maximum wire length	10 m
Function indicator	LED – system bar graph

Ethernet

Connecting point	RJ45 connector, according to IEEE802.3
Transmission rate	10/100 Mbps
Interface controller used	LAN91C111
Function indicator	Connector built-in LED

Galvanic separation	Yes
Isolation strength	300 V AC / 1 minute *)

Notice *) Isolation may not be used for dangerous voltage separation.

Mechanics

Mechanical construction	Metal case
Assembly	Onto switchboard base plate
Cover protection rate	IP20
Signal connection	WAGO Cage Clamp connectors
Maximum wire cross section	2.5 mm^2
Dimensions (w × h × d)	423 × 230 × 50 mm
Weight	3.0 kg

Power supply

Power supply	24 V DC ±20 %
Maximum power consumption	400 mA at 24 V DC
Wire connection	1 × WAGO 231-302 (5.08 mm) connector
Wire cross section	0.08 to 2.5 mm^2

Temperatures

AMAP99S operating temperature	0 to 65 °C
AMAP99S/I2 operating temperature	-20 to 65 °C
Storage temperature	-20 to 70 °C

Others

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

2.1. Dimensions

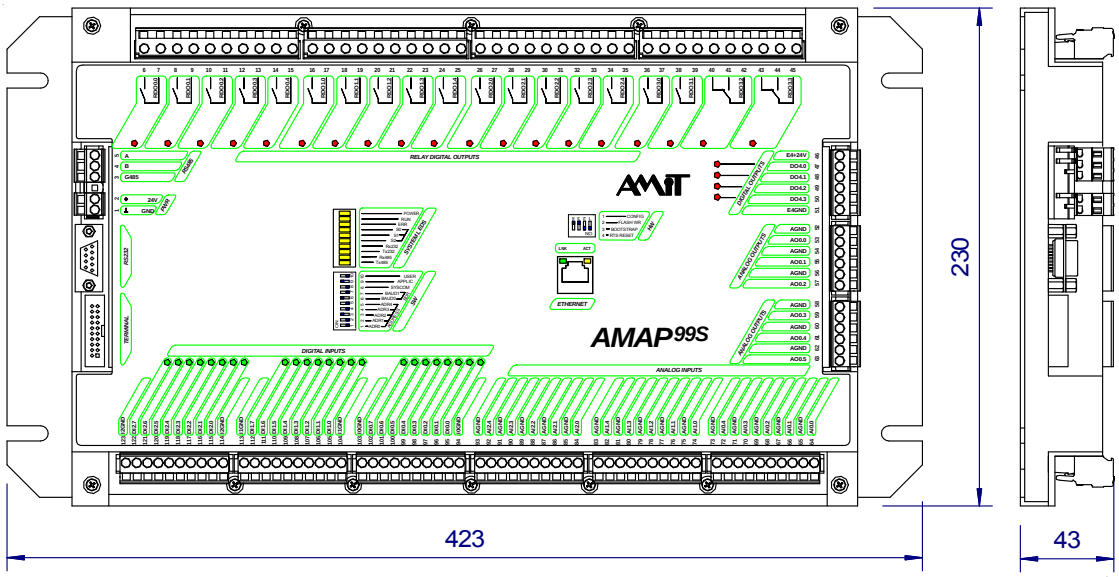

Fig. 1 - **AMAP99S** dimensions

2.2. Compliance assessment

Provided fair use, this product comply with requirements of Czech Government Decree NV616/2006 and NV17/2003. The compliance assessment with NV616/2006 has been performed in accordance with harmonized standard

EN 61326, compliance assessment with NV17/2003 has been performed in accordance with harmonized standard EN 61010-1.

Tested in accordance with standard	Type of test	Classification
EN 55022	Radio disturbance	A *)
EN 61000-3-2	EMC – Limits for harmonic current emissions	Complies
EN 61000-3-3	EMC – Limits for voltage fluctuations and flicker	Complies **)
EN 61000-4-3	EMC – Radiated, radio-frequency, electromagnetic field immunity test, 80 MHz – 2 GHz	10 V/m
EN 61000-4-3	EMC – Radiated, radio-frequency, electromagnetic field immunity test, 2 GHz – 2.7 GHz	3 V/m
EN 61000-4-4	Electrical fast transient/burst immunity test, voltage supply	4 kV
EN 61000-4-4	Electrical fast transient/burst immunity test, I/O	2 kV
EN 61000-4-5	Surge immunity test, supply voltage, RDO	2 kV
EN 61000-4-5	Surge immunity test, RS485, Ethernet	4 kV#)
EN 61000-4-5	Surge immunity test, others	1 kV#)
EN 61000-4-6	Immunity to conducted disturbances inducted by radio frequency fields	10 V
EN 61010-1	Safety requirements for electrical equipment	complies

*) This is a product of class A. In the internal environment this product can cause some radio disturbances. In such case the user may be asked to take the appropriate measures.

**) This is true, when any appliance being attached to the control system outputs has not the peak current drain greater than 0.9 A AC. When it happens, it is necessary to review again the compliance assessment with EN 61000-3-3 in terms of used application software.

#) Circuitry cabling other than power supply, which is longer than 30 m must be carried out by using the shielded cables.

2.2.1 Other tests

EN 60068-2-1	Environmental testing – Cold.
EN 60068-2-2	Environmental testing – Dry heat.
EN 61000-4-29	EMC – Voltage dips, short interruptions and voltage variations on D.C. input power port immunity tests.

2.2.2 Recommended drawing symbol

This drawing symbol is recommended for control system **AMAP99S**. Only part of it will be visible in following examples.

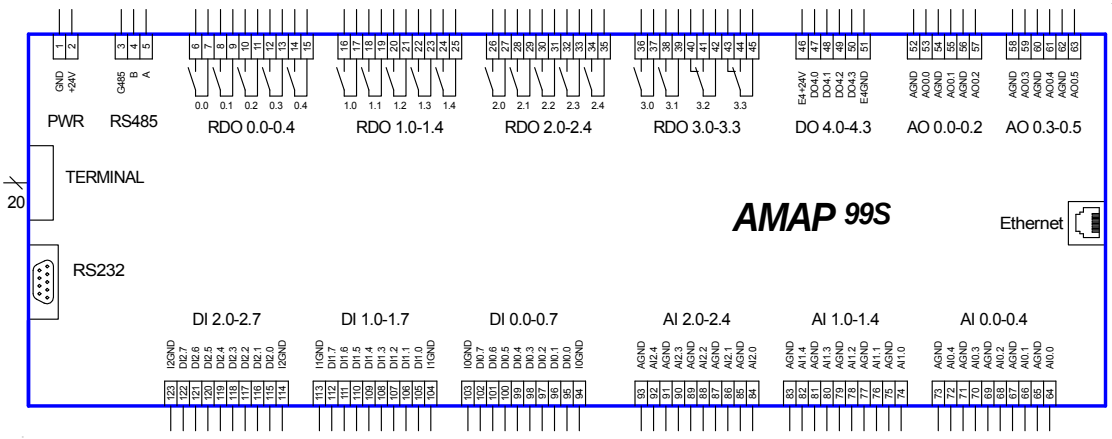

Fig. 2 - Recommended drawing symbol for **AMAP99S**

3. Power supply

Control system AMAP99S can be supplied only by DC power supply.

Power supply 24 V DC

Control system AMAP99S can be supplied by current DC power supplies made by AMiT.

Wiring example

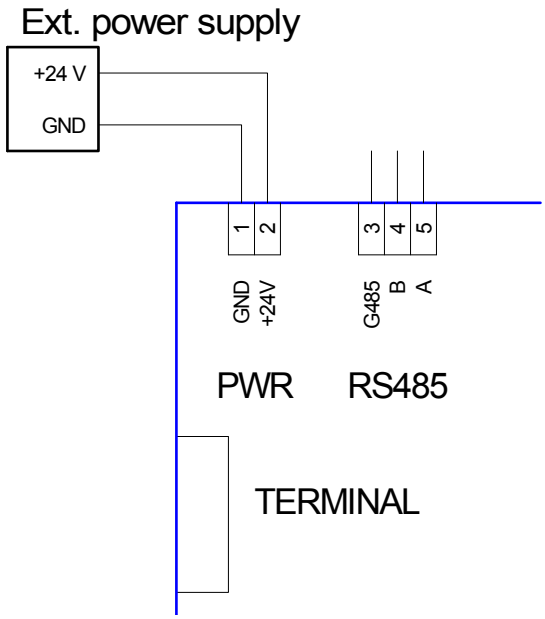

Fig. 3 - Example of single control system supplying

Notice It is recommended to bind together the GND, IGND (inputs ground) and EGND (outputs ground) terminals with the switchboard PE terminal at installation.

4. Inputs/outputs

4.1. Digital inputs

Digital inputs of **AMAP99S** control system can be used for AC as well as for DC signal. The way of evaluating is determined by software.

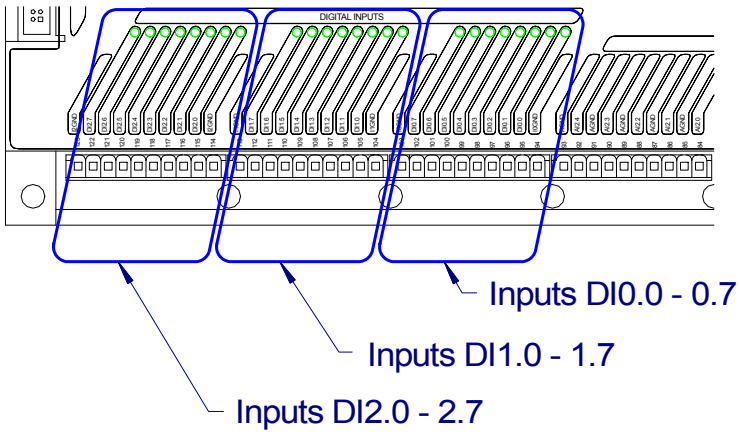

Fig. 4 - Location of DI0.0 to DI2.7 terminals

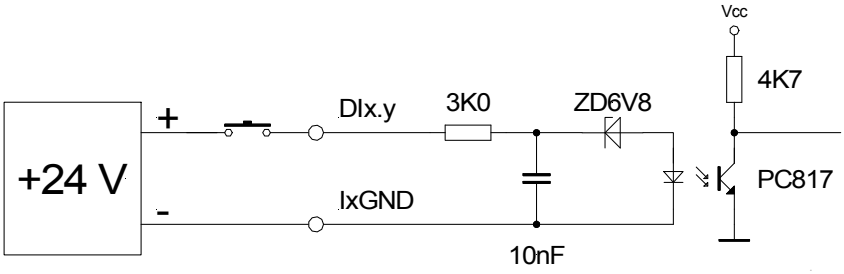

Fig. 5 - Wiring scheme of single digital input channel

LED indicators Digital input status is indicated by green LED, located close to relevant input on panel – see the terminals location.

LED indicators

Terminal	Label	Meaning
94	I0GND	Ground terminal, group 0
95	DI0.0	Digital input 0, group 0
96	DI0.1	Digital input 1, group 0
97	DI0.2	Digital input 2, group 0
98	DI0.3	Digital input 3, group 0
99	DI0.4	Digital input 4, group 0
100	DI0.5	Digital input 5, group 0
101	DI0.6	Digital input 6, group 0
102	DI0.7	Digital input 7, group 0
103	I0GND	Ground terminal, group 0

Terminal	Label	Meaning
104	I1GND	Ground terminal, group 1
105	DI1.0	Digital input 0, group 1
106	DI1.1	Digital input 1, group 1
107	DI1.2	Digital input 2, group 1
108	DI1.3	Digital input 3, group 1
109	DI1.4	Digital input 4, group 1
110	DI1.5	Digital input 5, group 1
111	DI1.6	Digital input 6, group 1
112	DI1.7	Digital input 7, group 1
113	I1GND	Ground terminal, group 1
114	I2GND	Ground terminal, group 2
115	DI2.0	Digital input 0, group 2
116	DI2.1	Digital input 1, group 2
117	DI2.2	Digital input 2, group 2
118	DI2.3	Digital input 3, group 2
119	DI2.4	Digital input 4, group 2
120	DI2.5	Digital input 5, group 2
121	DI2.6	Digital input 6, group 2
122	DI2.7	Digital input 7, group 2
123	I2GND	Ground terminal, group 2

Wiring examples

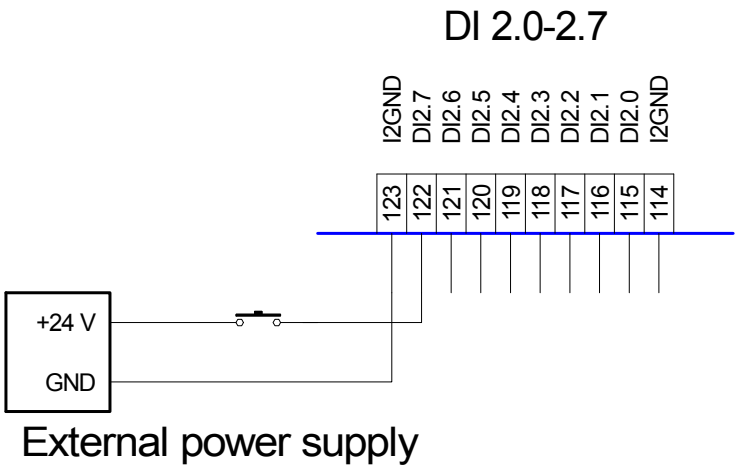

Fig. 6 - Passive contact supplied from individual power supply

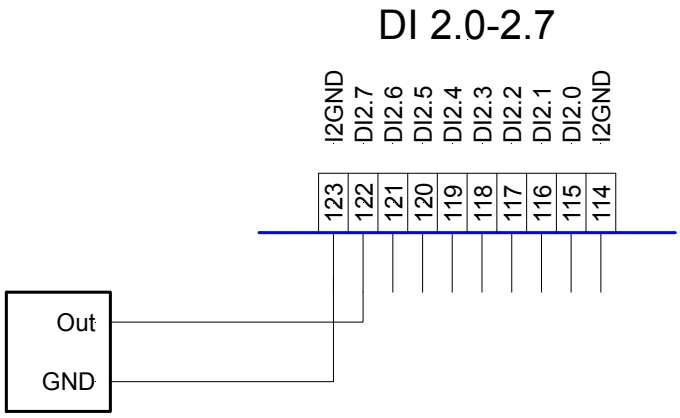

Fig. 7 - Attaching of self-supplied active output

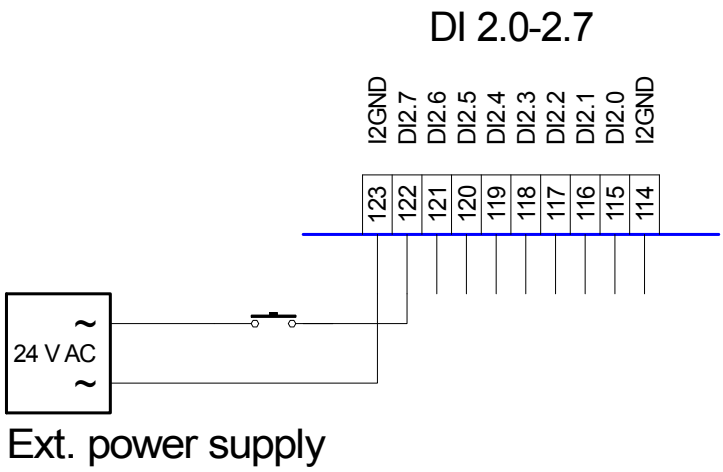

Fig. 8 - Passive contact supplied from AC power supply

4.2. Digital outputs

4.2.1 Relay outputs

Outputs 0 to 16 keeps only switching contact at their disposal, outputs 17 and 18 keeps switch-over contact.

Relay outputs are particularized into four groups. The first three groups have five switching contact each, the last group includes two switching and two switch-over contacts.

Relay contacts are led onto 231 type WAGO connectors with 7.5 mm span.

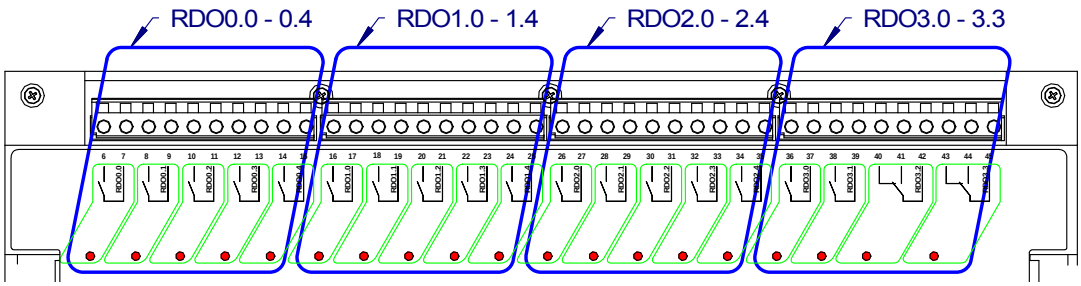

Fig. 9 - Location of RDO0.0 to RDO3.3 terminals

LED indicators

Relay output status is indicated by red lighting LED located on panel – see location of connectors.

Connectors numbering

Terminals	Label	Meaning
6, 7	RDO0.0	Switching contacts, output 0.0
8, 9	RDO0.1	Switching contacts, output 0.1
10, 11	RDO0.2	Switching contacts, output 0.2
12, 13	RDO0.3	Switching contacts, output 0.3
14, 15	RDO0.4	Switching contacts, output 0.4
16, 17	RDO1.0	Switching contacts, output 1.0
18, 19	RDO1.1	Switching contacts, output 1.1
20, 21	RDO1.2	Switching contacts, output 1.2

Terminals	Label	Meaning
22, 23	RDO1.3	Switching contacts, output 1.3
24, 25	RDO1.4	Switching contacts, output 1.4
26, 27	RDO2.0	Switching contacts, output 2.0
28, 29	RDO2.1	Switching contacts, output 2.1
30, 31	RDO2.2	Switching contacts, output 2.2
32, 33	RDO2.3	Switching contacts, output 2.3
34, 35	RDO2.4	Switching contacts, output 2.4
36, 37	RDO3.0	Switching contacts, output 3.0
38, 39	RDO3.1	Switching contacts, output 3.1
40	RDO3.2	Normally closed contact, output 3.2
41	RDO3.2	Switching contact, output 3.2
42	RDO3.2	Switch-over contact, output 3.2
43	RDO3.3	Normally closed contact, output 3.3
44	RDO3.3	Switching contact, output 3.3
45	RDO3.3	Switch-over contact, output 3.3

Wiring example

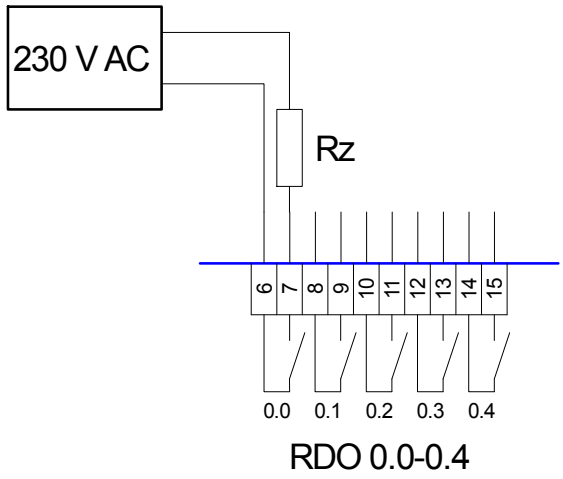

Fig. 10 - Switching of heating resistor, fed by mains 230 V AC

4.2.2 Semiconductor outputs

Semiconductor outputs are implemented as galvanically separated MOS switches 24 V/500 mA DC. Status of each output is indicated by red lighting LED on panel. Output is shortcut-protected, overheating-proof and protected against overvoltage upon switching an inductive load.

Relay contacts are led onto 231 type WAGO connectors with 5 mm span.

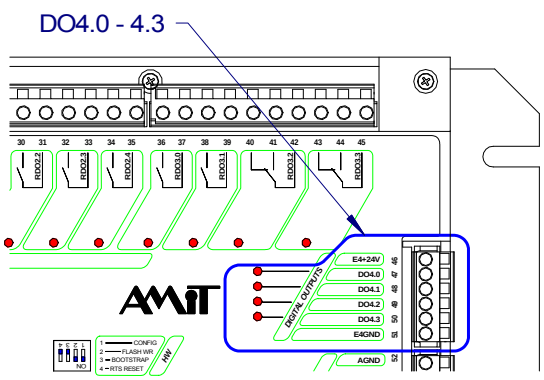

Fig. 11 - Location of DO4.0 to DO4.3 terminals

LED indicators Semiconductor output status is indicated by red lighting LED located on panel – see location of connectors.

Connectors numbering

Terminal	Label	Meaning
46	E4+24V	Outputs feeding, group 4
47	DO4.0	Digital output 0, group 4
48	DO4.1	Digital output 1, group 4
49	DO4.2	Digital output 2, group 4
50	DO4.3	Digital output 3, group 4
51	E4GND	Ground terminal, group 4

Wiring example

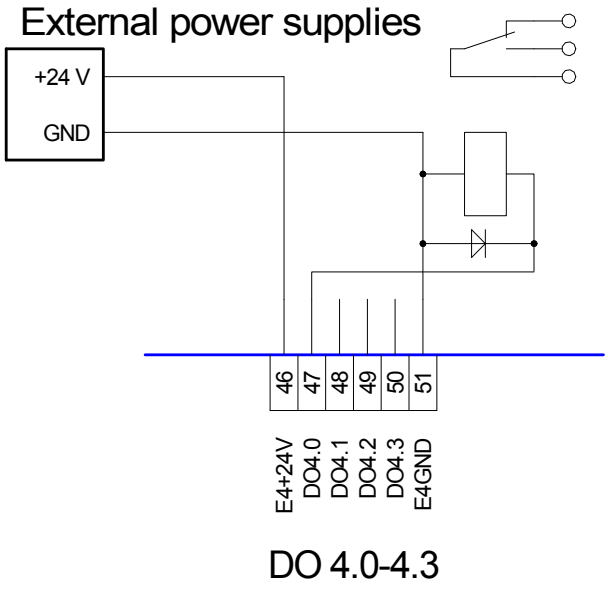

Fig. 12 - Operating the power contactor by semiconductor output.

Notice It is necessary to wire terminals E4+24V as well as E4GND, otherwise the outputs will not work properly.

4.3. Analogue inputs

The control system **AMAP99S** includes 15 analogue inputs. All inputs are independently configurable for range 0 to 5 V, 0 to 10 V, 0 to 20 mA and for direct attaching of Ni1000/Pt1000 sensors.

The analogue inputs can be also utilized as DC digital inputs. The way of signal evaluating is determined by software.

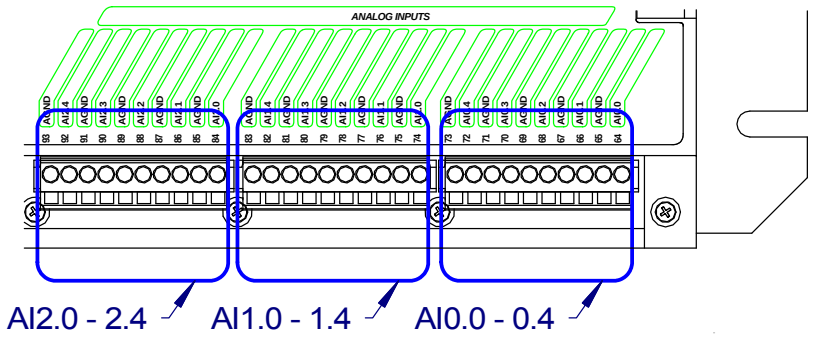

Fig. 13 - Location of AI0.0 to AI2.4 terminals

Connectors numbering

Terminal	Label	Meaning
64	AI0.0	Analogue input 0, group 0
65	AGND	Analogue ground
66	AI0.1	Analogue input 1, group 0
67	AGND	Analogue ground
68	AI0.2	Analogue input 2, group 0
69	AGND	Analogue ground
70	AI0.3	Analogue input 3, group 0
71	AGND	Analogue ground
72	AI0.4	Analogue input 4, group 0
73	AGND	Analogue ground
74	AI1.0	Analogue input 0, group 1
75	AGND	Analogue ground
76	AI1.1	Analogue input 1, group 1
77	AGND	Analogue ground
78	AI1.2	Analogue input 2, group 1
79	AGND	Analogue ground
80	AI1.3	Analogue input 3, group 1
81	AGND	Analogue ground
82	AI1.4	Analogue input 4, group 1
83	AGND	Analogue ground
84	AI2.0	Analogue input 0, group 2
85	AGND	Analogue ground
86	AI2.1	Analogue input 1, group 2
87	AGND	Analogue ground
88	AI2.2	Analogue input 2, group 2
89	AGND	Analogue ground
90	AI2.3	Analogue input 3, group 2
91	AGND	Analogue ground
92	AI2.4	Analogue input 4, group 2
93	AGND	Analogue ground

Wiring scheme

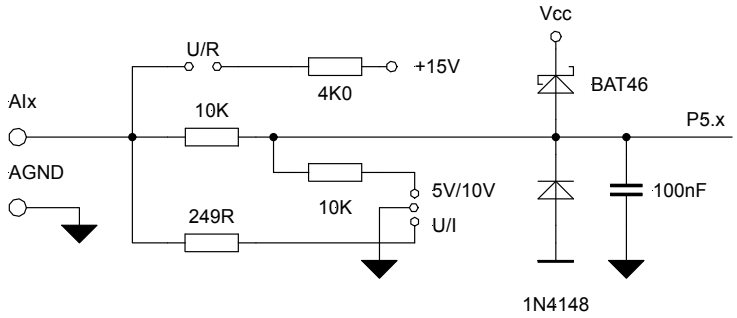

Fig. 14 - Wiring scheme of analogue input single channel

Configuration jumpers

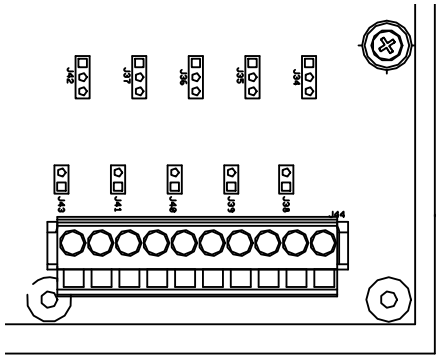

Fig. 15 - Setting of configuration jumpers for 0 to 5 V range

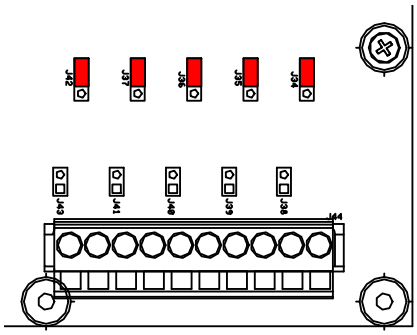

Fig. 16 - Setting of configuration jumpers for 0 to 10 V range, digital input 24 V DC

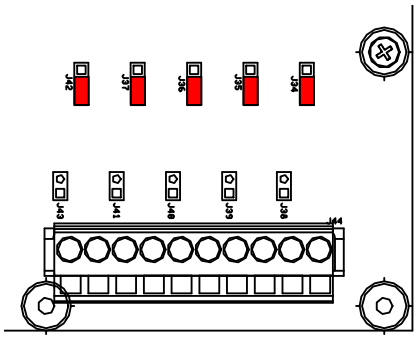

Fig. 17 - Setting of configuration jumpers for 0 to 20 mA range

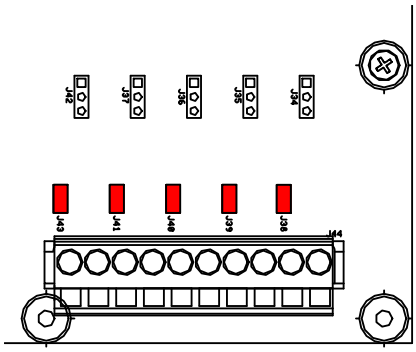

Fig. 18 - Setting of configuration jumpers for Ni1000 / Pt1000 range

Jumpers location

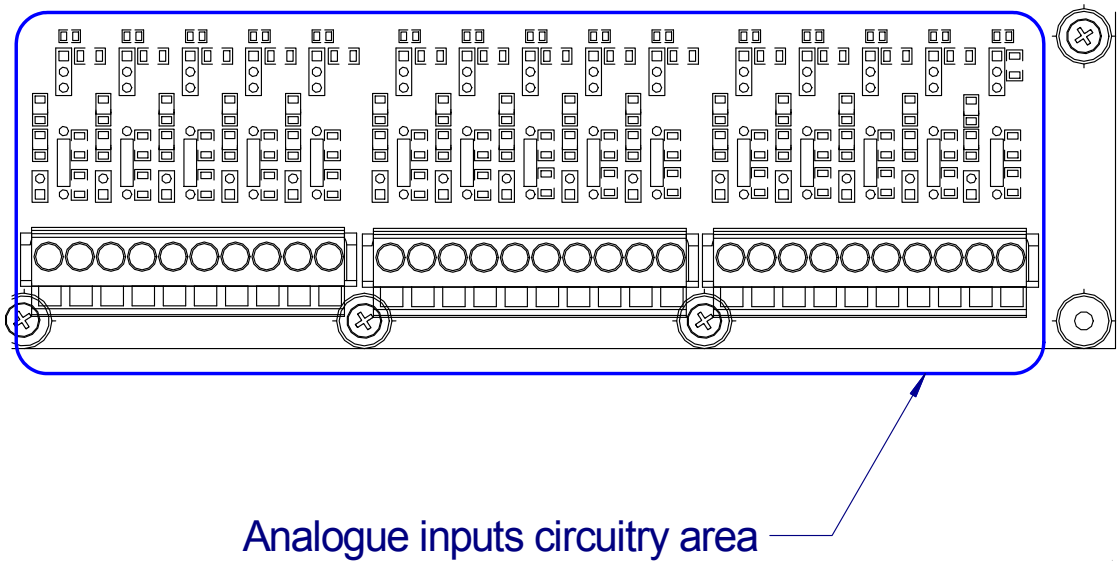

Fig. 19 - Configuration jumpers are accessible after dismounting of metal case (see the chapter **8. Assembly**).

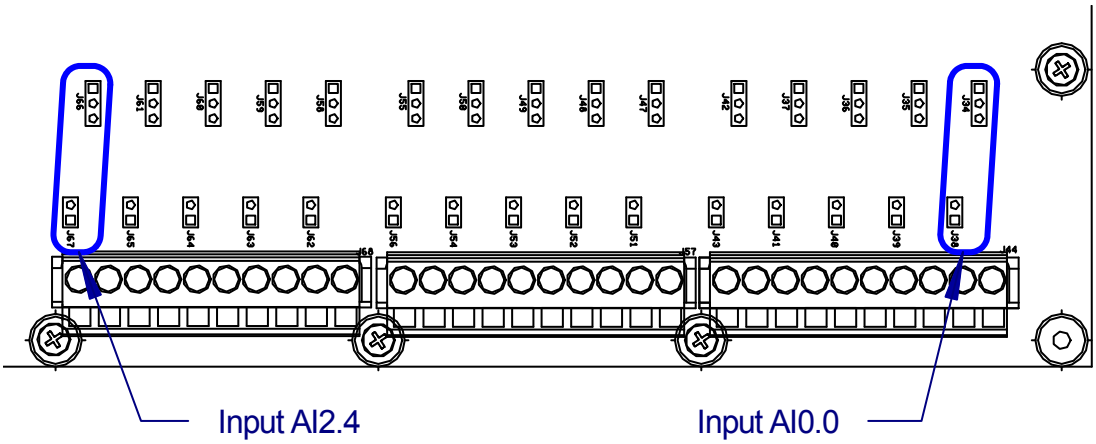

Fig. 20 - Locating of individual inputs

Wiring examples

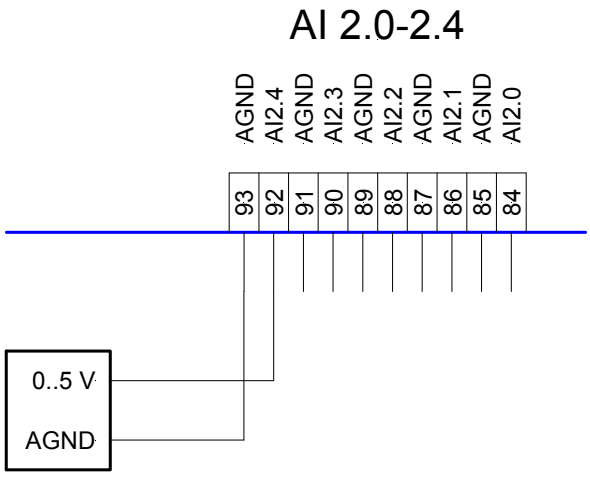

Fig. 21 - Coupling of voltage sensor 0 to 5 V

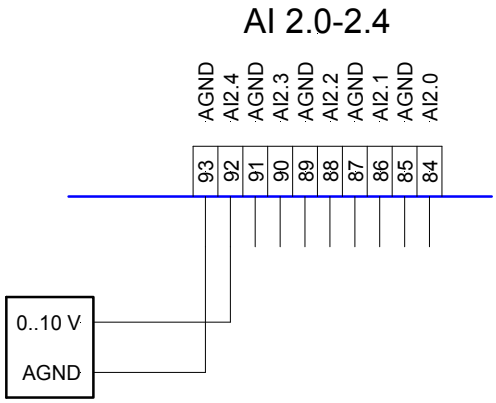

Fig. 22 - Coupling of voltage sensor 0 to 5 V

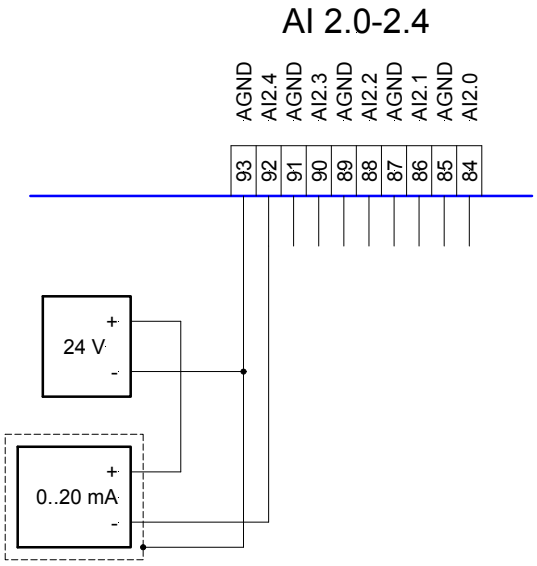

Fig. 23 - Coupling of sensor with current output 0 to 20 mA (4 to 20 mA)

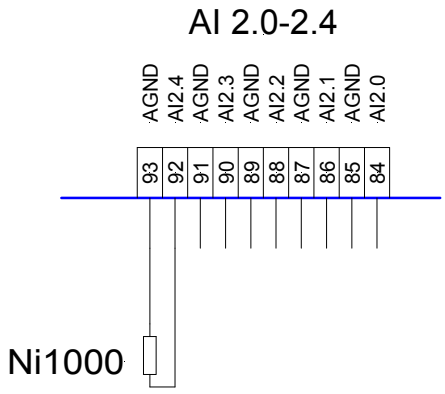

Fig. 24 - Coupling of Ni1000 / Pt1000 sensor

Reference voltage supply

The +5.0 V DC reference voltage can be found on control system board. By manufacturer is set the reference voltage with ±1 mV precision. The setting trimmer is secured by colour drop. On control system board there are available measuring points for reference voltage inspection. These elements are accessible after dismounting the metal cover.

See the **Maintenance** chapter for details.

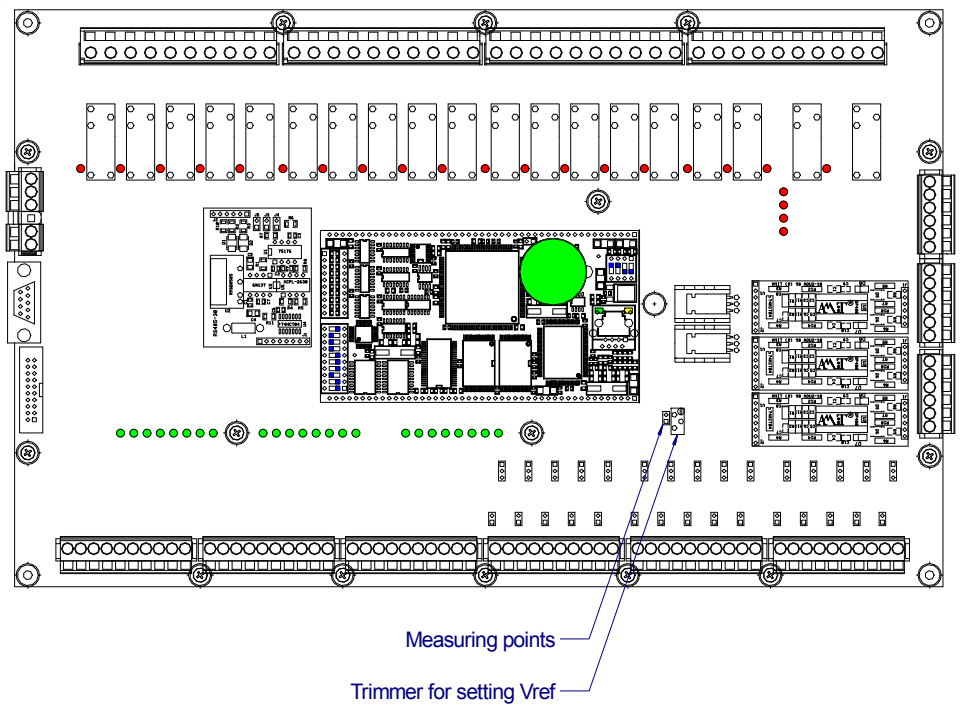

Fig. 25 - Measuring points and trimmer for reference voltage setting

4.4. Analogue outputs

The AMAP99S control system can have up to six analogue outputs. This is determined by number of used plug-in modules **AM-AO2U** or **AM-AO2I**. There are two outputs on single module. Output voltage range is 0 to 10 V DC, while output current range is 0 to 20 mA. Outputs are realized on the PWM basis.

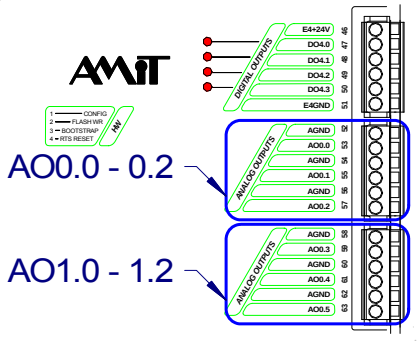

Fig. 26 - Location of AO0.0 to AO1.2 terminals

Connectors numbering

Terminal	Label	Meaning
52	AGND	Analogue ground
53	AO0.0	Analogue output 0
54	AGND	Analogue ground
55	AO0.1	Analogue output 1
56	AGND	Analogue ground
57	AO0.2	Analogue output 2
58	AGND	Analogue ground
59	AO0.3	Analogue output 3
60	AGND	Analogue ground
61	AO0.4	Analogue output 4
62	AGND	Analogue ground
63	AO0.5	Analogue output 5

Wiring scheme

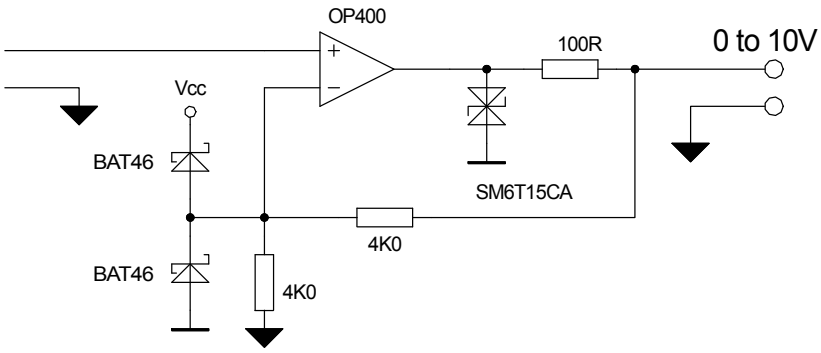

Fig. 27 - Wiring scheme of single channel analogue voltage output final stage

Wiring examples

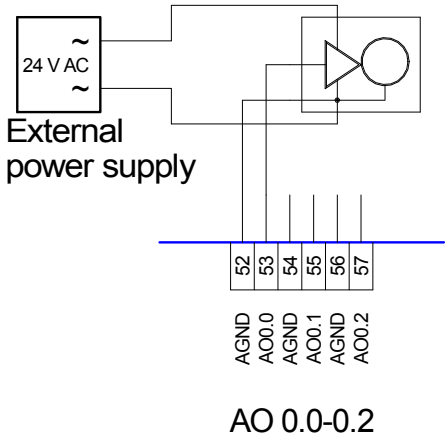

Fig. 28 - Coupling of AC supplied servo

Assembly of AM-AO2x module These elements are accessible after dismounting the metal cover. Module locating and orientation are described in the chapter **8. Assembly**, part **Configuration**. Be careful at assembly for orientation and module proper plug in!

5. Communication lines

The **AMAP99S** control system holds two communication lines.

UART0 of C167CR processor is utilized for standard RS232 interface, which is led to CANON 9 connector.

Optionally, the RS485, RS232, CAN or M-BUS interface can be utilized. Each time only one interface module can be installed. Signals are led to WAGO connector. All interfaces except RS232 are galvanically separated from control system circuitry.

5.1. RS232, channel S0

According to RS232 standard, this interface is assigned for connection of two equipments. By default, personal computers are equipped with RS232. Relatively low radius and low immunity to disturbances are disadvantageous. For bi-directional communication the three wires are sufficient, for modem commanding a full complementing of CANON 9 connector is necessary.

Line reset By setting ON the DIP switch RTS-RESET, the control system can be reset also through serial line by CTS (pin 7) input control.

CTS signal	Function
Log. 0	Reset
Log. 1	System run

This signal is used for control from PC by RTS signal.

Caution It is recommended to use the Line Reset only under application software uploading or debugging. Don□t use it under application run!

Connector wiring CANON 9 connector on **AMAP99S** control system.

PIN	MEANING	TYPE
1	Not used	-
2	TxD	Output
3	RxD	Input
4	DSR	Input
5	GND	-
6	DTR	Output
7	CTS	Input
8	RTS	Output
9	Not used	-

Notice The **MEANING** item corresponds to **AMAP99S** control system signals. When connected to PC, it must be cable-crossed. The **TYPE** item represents the signal type on **AMAP99S** control system. Use the **KABEL 232P** for connection of control system to PC.

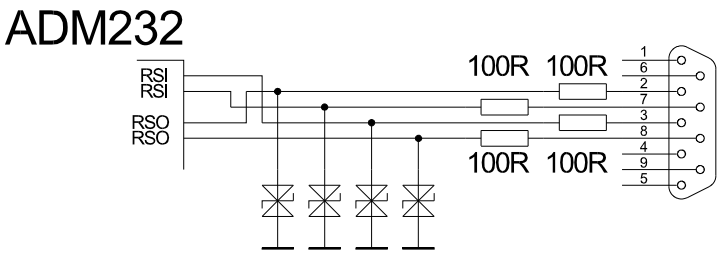

Fig. 29 - Wiring scheme of protective circuits

Connector location

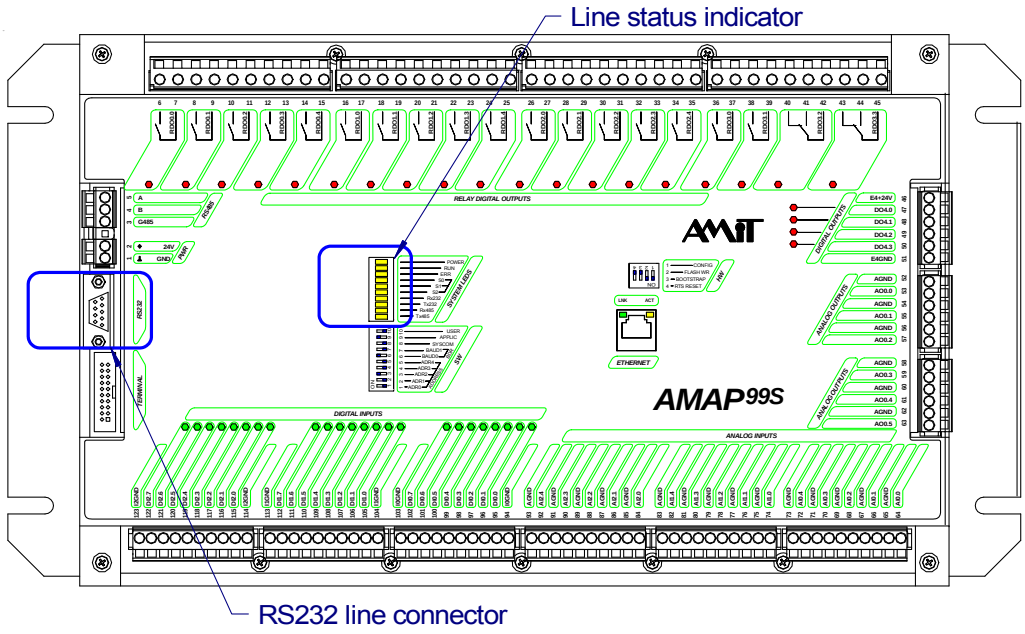

Fig. 30 - Location of RS232 line connector and indication LEDs

Modem connection

To the **AMAP99S** control system can be directly connected the AMiT **DM-GSM** or **DM-GPRS** modems. Use the **KABEL232RMS** cable to do that. Operating of both modems is implemented in NOS operating system. Details can be found at DetStudio manual and in AP0004 application note as well.

5.2. Optional interface, channel S1

Following optional interfaces can be used at the AMAP99S control system:

- RS485 (module AM-RS485)
- RS232 (module AM-RS232)
- CAN (module AM-CAN)
- M-BUS (module AM-MBUS)

All interfaces except RS232 are galvanically separated. At the same time only single module can be used.

Signals are led out to the WAGO231 connector.

RS485

While using the RS485 interface the **AM-RS485** module needs to be plugged in.

RS485 is a half-duplex serial interface. It can be utilized for interconnecting of more units (up to 32 within single segment). All units can communicate through single signal pair.

RS485 circuitry is galvanically separated from other electronics of **AMAP99S** control system.

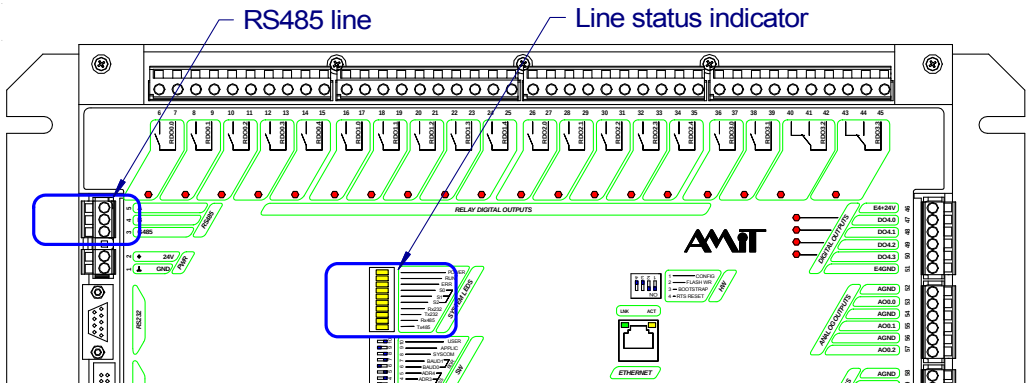

Fig. 31 - Location of RS485 line terminals and indication LEDs

Connector numbering

Terminal	Label	Meaning
3	G485	RS485 line ground
4	B	RS485 line, signal B
5	A	RS485 line, signal A

Jumpers

Jumper	Meaning
J3	Signal A idle state
J4	RS485 line termination
J5	Signal B idle state

Configuration jumpers

Jumpers for idle state definition as well as the terminating resistor jumper are accessible on **AM-RS485** module after dismounting the upper metal case.

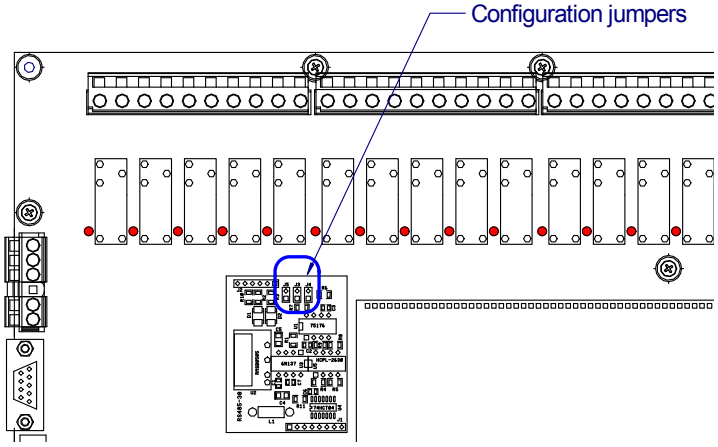

Fig. 32 - Configuration jumpers location

Wiring scheme

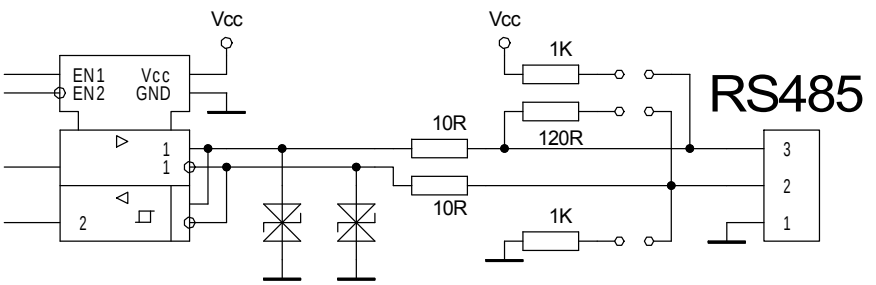

Fig. 33 - Wiring scheme of protective circuits and connecting the terminating and idle state resistors

Terminal stations All jumpers are installed.

Intermediate stations All jumpers are removed.

CAN

An **AM-CAN** module needs to be plugged in while CAN interface is used.

CAN circuitry is galvanically separated from other electronics of **AMAP99S** control system.

Connectors numbering

Terminal	Label	Meaning
3	G485	CAN line, ground
4	B	CAN line, signal CANH
5	A	CAN line, signal CANH

Jumpers

Jumper	Meaning
J2	CAN line termination

Configuration jumpers Termination resistor jumper is accessible on **AM-CAN** module after removing the metal case.

RS232

An **AM-RS232** module needs to be plugged in while RS232 interface is used.

RS232 circuitry is NOT galvanically separated from other electronics of **AMAP99S** control system.

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

Connectors numbering

Terminal	Label	Meaning
3	G485	RS232 line, ground
4	B	RS232 line, signal RxD
5	A	RS232 line, signal TxD

M-Bus

An **AM-BUS** module needs to be plugged in while M-Bus interface is used.

This interface is used for connecting components being produced by various manufacturers.

Connectors numbering

Terminal	Label	Meaning
3	G485	Ground
4	B	External power supply
5	A	M-Bus line

5.3. Ethernet interface

Through Ethernet interface can be the control system direct connected into LAN network. For connecting is possible to use components of standard structured cabling.

The Ethernet interface can be used both for visualization and remote upload of application software onto control system via Internet. Ethernet interface is supported by DetStudio development tool. Because for communication is implemented the TCP/IP protocol family, the communication network can share both control systems and personal computers.

The **AMAP99S** control system can be utilized as bridge between DB-Net network and RS485 line as well.

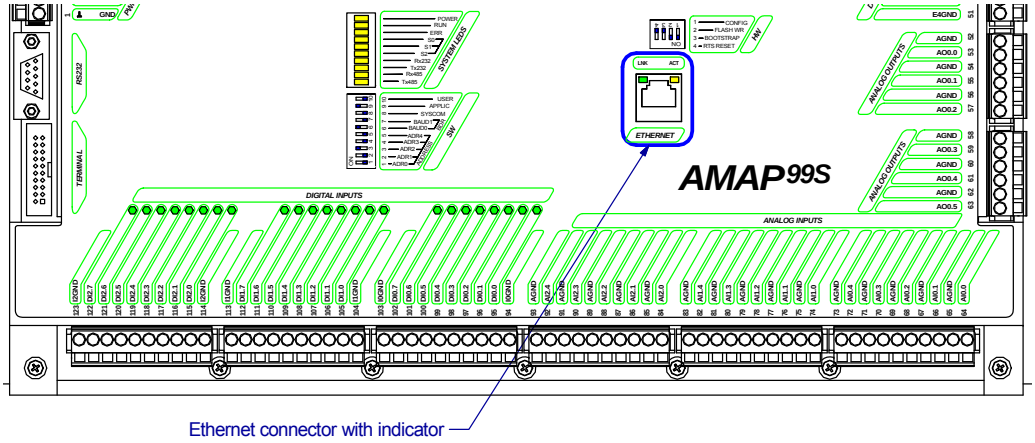

Fig. 34 - Location of Ethernet interface connector and indication LED

6. Connectors and terminals layout

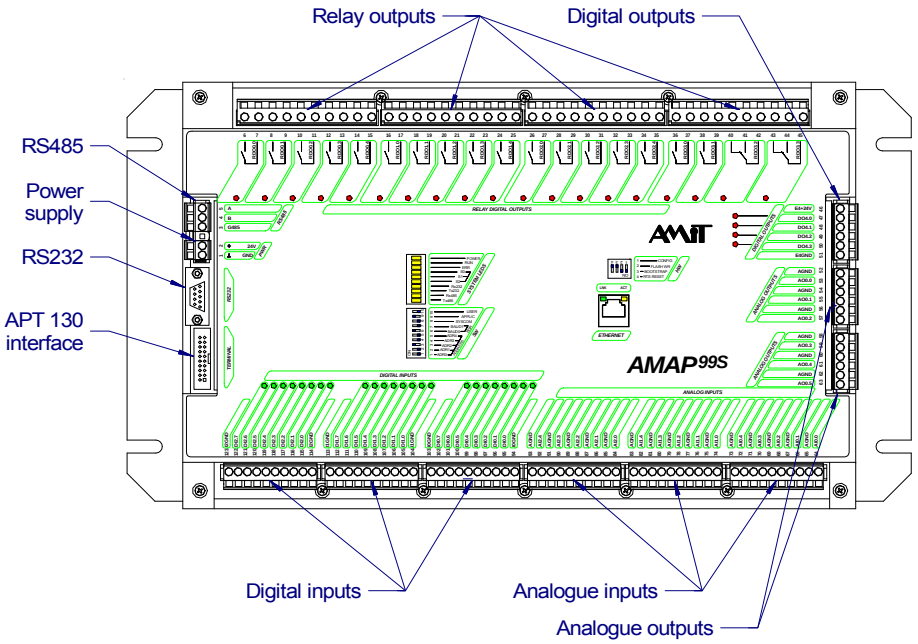

Fig. 35 - Connectors and terminals layout

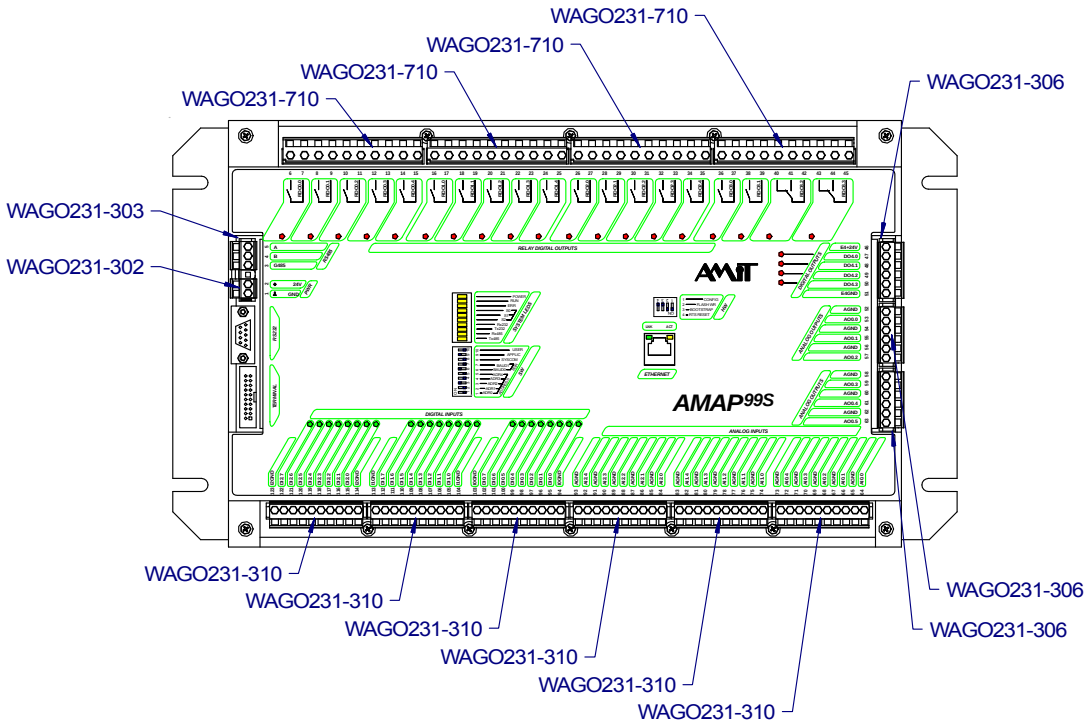

Fig. 36 - Individual connector types

Terminal	Label	Meaning
1	GND	Ground terminal, control system power supply
2	+24V	+24 V DC, control system power supply
3	G485	RS485 line ground
4	B	RS485 line, signal B
5	A	RS485 line, signal A
6	RDO0.0	Relay output 0, group 0
7	RDO0.0	Relay output 0, group 0
8	RDO0.1	Relay output 1, group 0
9	RDO0.1	Relay output 1, group 0
10	RDO0.2	Relay output 2, group 0
11	RDO0.2	Relay output 2, group 0
12	RDO0.3	Relay output 3, group 0
13	RDO0.3	Relay output 3, group 0
14	RDO0.4	Relay output 4, group 0
15	RDO0.4	Relay output 4, group 0
16	RDO1.0	Relay output 0, group 1
17	RDO1.0	Relay output 0, group 1
18	RDO1.1	Relay output 1, group 1
19	RDO1.1	Relay output 1, group 1
20	RDO1.2	Relay output 2, group 1
21	RDO1.2	Relay output 2, group 1
22	RDO1.3	Relay output 3, group 1
23	RDO1.3	Relay output 3, group 1
24	RDO1.4	Relay output 4, group 1
25	RDO1.4	Relay output 4, group 1
26	RDO2.0	Relay output 0, group 2
27	RDO2.0	Relay output 0, group 2
28	RDO2.1	Relay output 1, group 2
29	RDO2.1	Relay output 1, group 2
30	RDO2.2	Relay output 2, group 2
31	RDO2.2	Relay output 2, group 2
32	RDO2.3	Relay output 3, group 2
33	RDO2.3	Relay output 3, group 2
34	RDO2.4	Relay output 4, group 2
35	RDO2.4	Relay output 4, group 2
36	RDO3.0	Relay output 0, group 3
37	RDO3.0	Relay output 0, group 3
38	RDO3.1	Relay output 1, group 3
39	RDO3.1	Relay output 1, group 3
40	RDO3.2	Relay output 2, NC contact, group 3
41	RDO3.2	Relay output 2, NO contact, group 3
42	RDO3.2	Relay output 2, switch-over contact, group 3
43	RDO3.3	Relay output 3, NC contact, group 3
44	RDO3.3	Relay output 3, NO contact, group 3
45	RDO3.3	Relay output 3, switch-over contact, group 3
46	E4+24V	Outputs feeding, group 4
47	DO4.0	Digital output 0, group 4
48	DO4.1	Digital output 1, group 4
49	DO4.2	Digital output 2, group 4
50	DO4.3	Digital output 3, group 4
51	E4GND	Ground terminal, group 4
52	AGND	Analogue ground

Terminal	Label	Meaning
53	AO0.0	Analogue output 0
54	AGND	Analogue ground
55	AO0.1	Analogue output 1
56	AGND	Analogue ground
57	AO0.2	Analogue output 2
58	AGND	Analogue ground
59	AO0.3	Analogue output 3
60	AGND	Analogue ground
61	AO0.4	Analogue output 4
62	AGND	Analogue ground
63	AO0.5	Analogue output 5
64	AI0.0	Analogue input 0, group 0
65	AGND	Analogue ground
66	AI0.1	Analogue input 1, group 0
67	AGND	Analogue ground
68	AI0.2	Analogue input 2, group 0
69	AGND	Analogue ground
70	AI0.3	Analogue input 3, group 0
71	AGND	Analogue ground
72	AI0.4	Analogue input 4, group 0
73	AGND	Analogue ground
74	AI1.0	Analogue input 0, group 1
75	AGND	Analogue ground
76	AI1.1	Analogue input 1, group 1
77	AGND	Analogue ground
78	AI1.2	Analogue input 2, group 1
79	AGND	Analogue ground
80	AI1.3	Analogue input 3, group 1
81	AGND	Analogue ground
82	AI1.4	Analogue input 4, group 1
83	AGND	Analogue ground
84	AI2.0	Analogue input 0, group 2
85	AGND	Analogue ground
86	AI2.1	Analogue input 1, group 2
87	AGND	Analogue ground
88	AI2.2	Analogue input 2, group 2
89	AGND	Analogue ground
90	AI2.3	Analogue input 3, group 2
91	AGND	Analogue ground
92	AI2.4	Analogue input 4, group 2
93	AGND	Analogue ground
94	I0GND	Ground terminal, group 0
95	DI0.0	Digital input 0, group 0
96	DI0.1	Digital input 1, group 0
97	DI0.2	Digital input 2, group 0
98	DI0.3	Digital input 3, group 0
99	DI0.4	Digital output 5, group 1
100	DI0.5	Digital output 6, group 1
101	DI0.6	Digital output 7, group 1
102	DI0.7	Digital input 7, group 0
103	I0GND	Ground terminal, group 0
104	I1GND	Ground terminal, group 1

Terminal	Label	Meaning
105	DI1.0	Digital input 0, group 1
106	DI1.1	Digital input 1, group 1
107	DI1.2	Digital input 2, group 1
108	DI1.3	Digital input 3, group 1
109	DI1.4	Digital input 4, group 1
110	DI1.5	Digital input 5, group 1
111	DI1.6	Digital input 6, group 1
112	DI1.7	Digital input 7, group 1
113	I1GND	Ground terminal, group 1
114	I2GND	Ground terminal, group 2
115	DI2.0	Digital input 0, group 2
116	DI2.1	Digital input 1, group 2
117	DI2.2	Digital input 2, group 2
118	DI2.3	Digital input 3, group 2
119	DI2.4	Digital input 4, group 2
120	DI2.5	Digital input 5, group 2
121	DI2.6	Digital input 6, group 2
122	DI2.7	Digital input 7, group 2
123	I2GND	Ground terminal, group 2

Caution The GND terminal (1) is internally connected with AGND terminals (52, 54, 56, 58, 60, 62, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93).

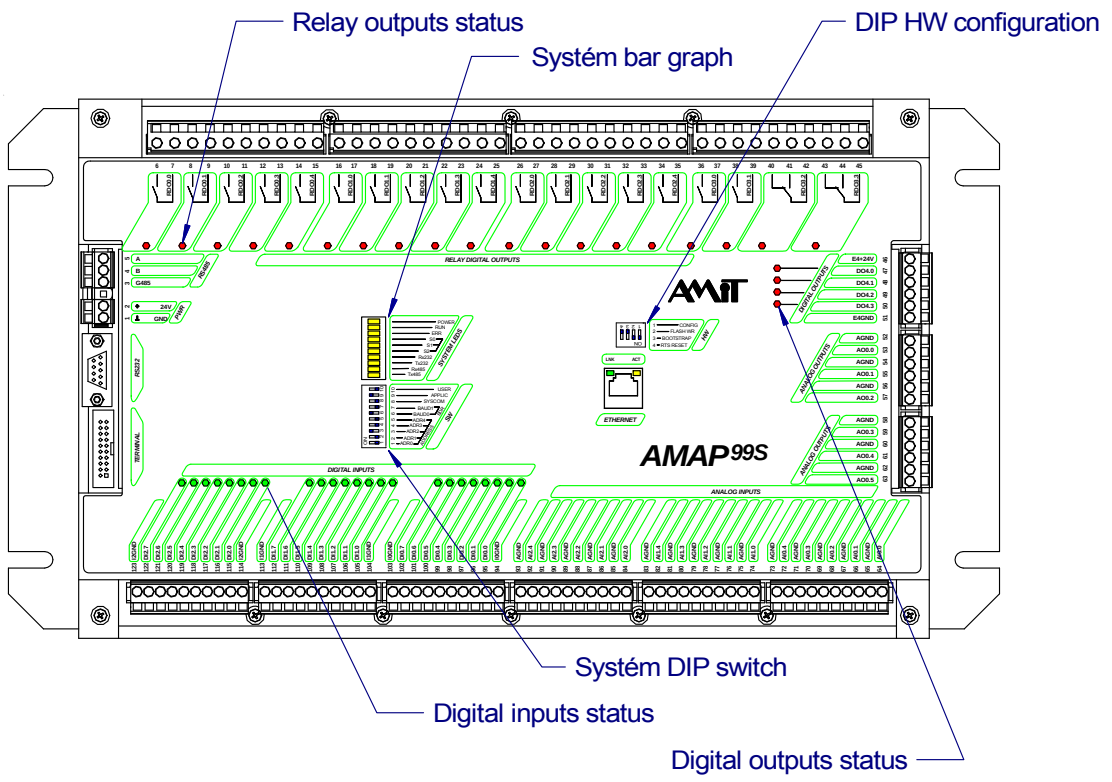

Fig. 37 - DIP switch and indicator locations

7. Configuration settings

The configuration process can be carried out after metal case removal. But first is necessary to unfasten four corner screws and take them out. Then can be the metal case removed straight up.

Following figure shows all plug-in modules of **AMAP99S** control system in proper position, analogue inputs as well as RS485 line configuration elements and measuring points for reference voltage.
(Instead of module **AM-AO2U** (voltage output) is also possible to implement modules **AM-AO2I** (current output).

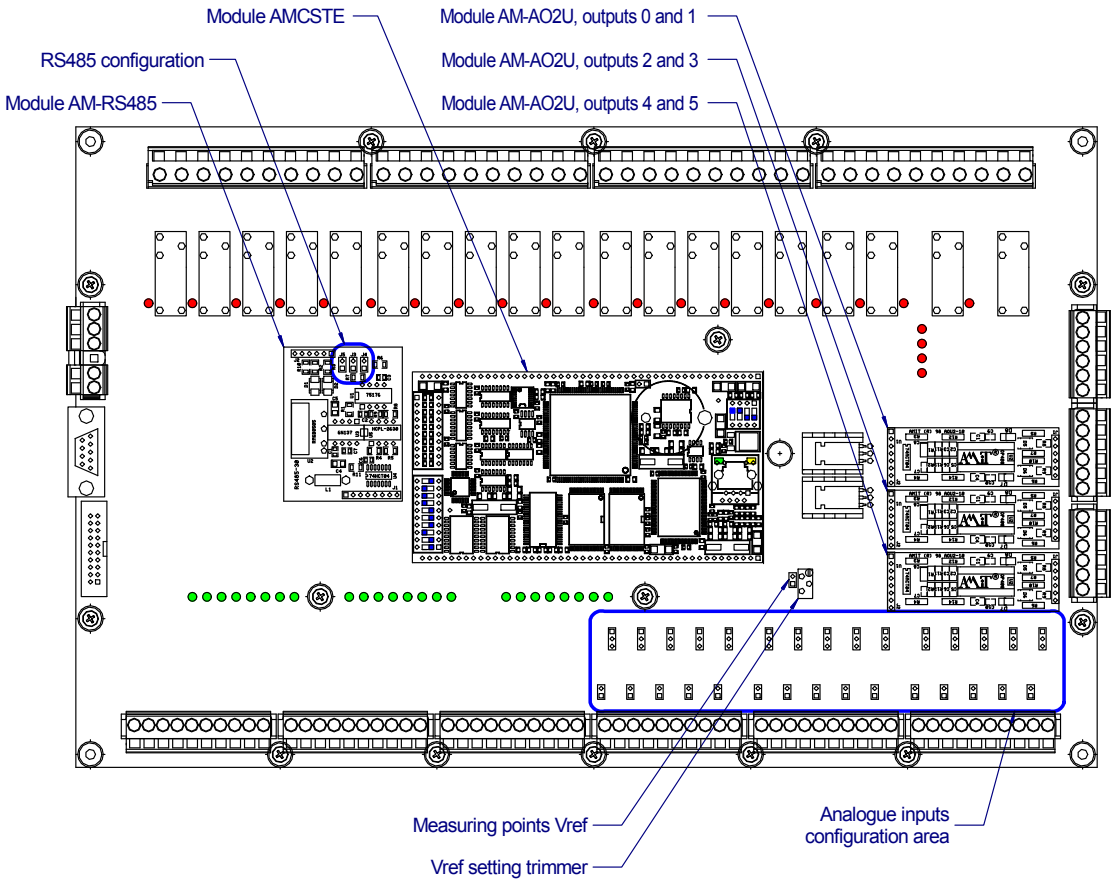

Fig. 38 - Configuration jumpers location

8. Assembly

Control system **AMAP99S** must be installed in switchboard. It is designed for assembly onto switchboard base plate. On the right side of metal case is located M4 screw with earthing cable terminal end, which must be connected by green-yellow conductor with PE terminal in the switchboard. Conductor cross-section must be as minimum as 2.5 mm^2.

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

8.1. Mounting holes

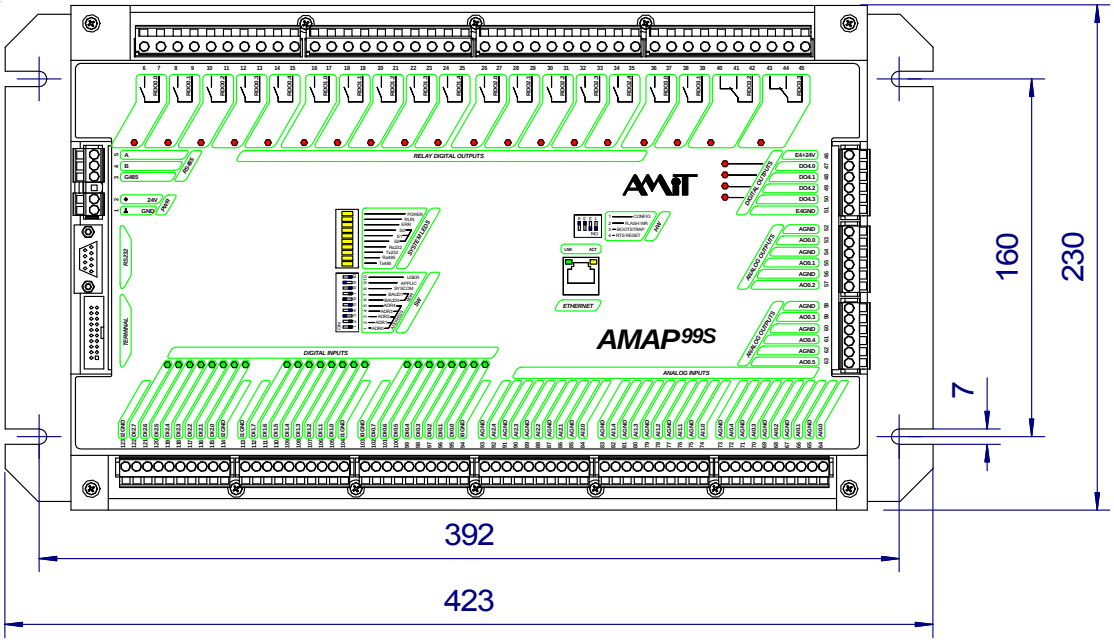

Fig. 39 - Locating of mounting holes at the control system case

Fasten the control system into switchboard using four M4 screws.

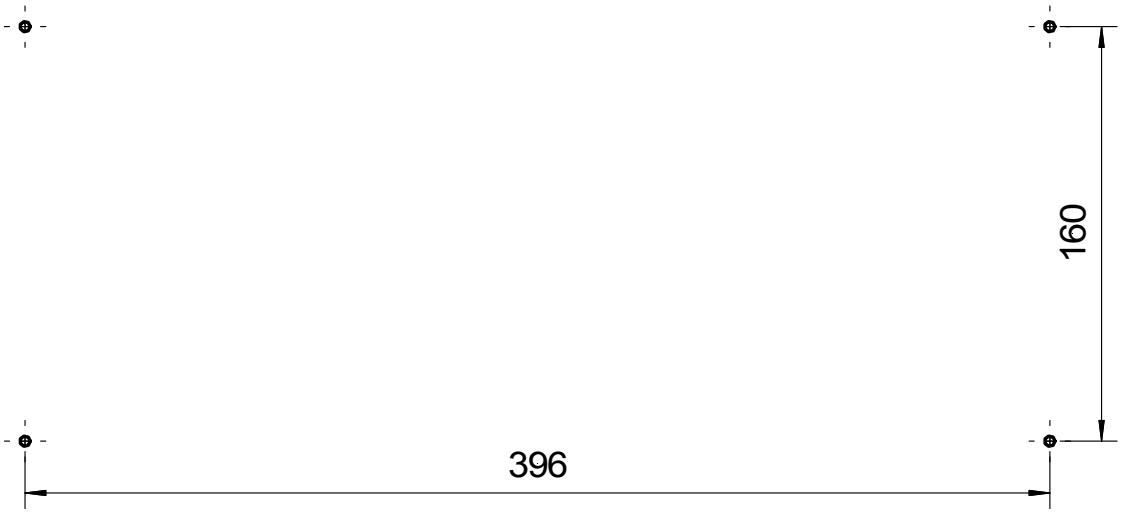

Fig. 40 - Locating of mounting holes

8.2. Installation principles

If this appliance is used by way, which is not intended by manufacturer, the provided protection facility can be violated.

This appliance is designed for assembly into switchboard, not currently accessible for operator.

EMC filter Use an EMC filter on 230 V AC supply voltage inlet. Based on environment character and wiring layout this requirement can be reassessed

Connect the negative supplying terminal of control system (24 V DC) to the switchboard PE terminal.

Protection Appliance must be protected by external circuit-breaker with rated current corresponding to maximum nominal load.

Mains switch assembly If the control system provides switching of mains voltage, then into supplying inlet must be integrated a sufficiently sized switch, easily accessible by operator.

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

The separate supplying section is recommended. Common section for digital inputs and outputs is convenient as well.

Accomplish the connection with PE on the switchboard inlet.

Use the shielded conductors at longer distance lead wires and in higher level disturbance environment. Connect the shielding to the PE terminal just on switchboard inlet.

Should the lead wires were outdoor installed, the appropriate inputs and outputs need to be overvoltage protected.

Analogue inputs Use the shielded signal cables for wiring. Connect the cable shielding to the PE terminal just on switchboard inlet.

Should the lead wires were outdoor installed, the appropriate inputs and outputs need to be overvoltage protected.

Analogue outputs When connecting the power source for analogue drives, be particular that power circuit does not close itself through control system analogue ground.

Use the shielded signal cables for wiring. Connect the cable shielding to the PE terminal just on switchboard inlet.

Should the lead wires were outdoor installed, the appropriate outputs need to be overvoltage protected.

RS485 channel Use the shielded signal cables for wiring. Cable shielding should be connected to the RS485 line connector shielding and only at single point of line segment is connected to PE terminal (direct earthing), at another points through line arrester (indirect earthing).

For mutual separating of line segments is possible to use the **DM-485TO485** repeater manufactured by AMiT.

RS232 channel 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 shielding to the PE terminal just on switchboard inlet.

Notice All PE connections must be realized with as low as possible impedance. Technical parameters of control system are guaranteed solely when the metal switchboard is used.

Ethernet interface Unshielded – patch cable can be used for service or when utilized within the switchboard frame.

Use the STP cabling for permanent use outside the switchboard frame.

Notice All PE connections must be realized with as low as possible impedance. Technical parameters of control system are guaranteed solely when the metal switchboard is used.

8.3. Installing of optional communication modules

Following figure shows all plug-in modules of **AMAP99S** control system in their respective proper position. (Instead of module **AM-AO2U** (voltage output) is also possible to implement modules **AM-AO2I** (current output).

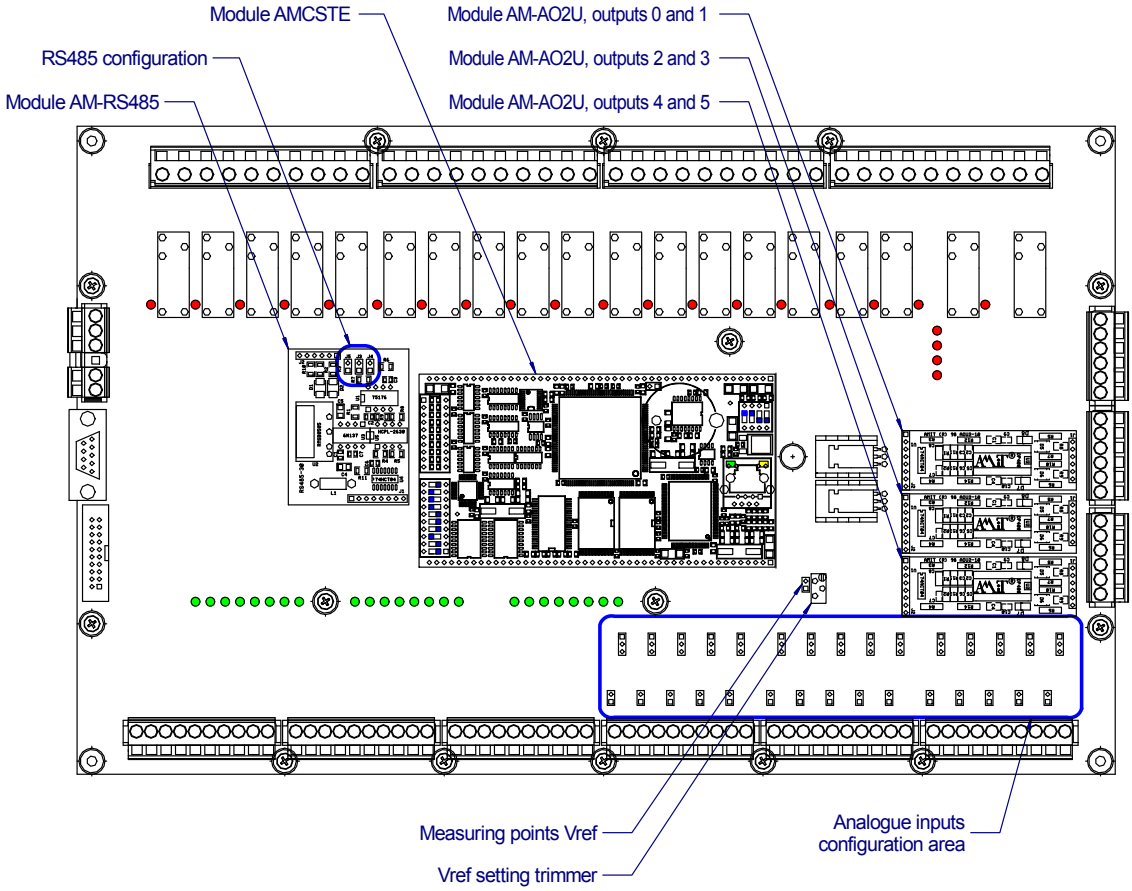

Fig. 41 - Modules location

9. Ordering information and assembling

Control system

AMAP99S	Control system, full WAGO connector set, operation manual, warranty card
AMAP99S/I2	**AMAP99S**, industrial temperature range -20 to 65 °C

Connection to PC

KABEL 232P	RS232 connecting cable PC – **AMAP99S**

This cable is made for debugging and uploading the application software into control system.

Optional interface

AM-RS485	RS485 line communication module, warranty card
AM-RS232	RS232 line communication module, warranty card
AM-MBUS/1-3	M-Bus line communication module, warranty card
AM-CAN	CAN line communication module, warranty card

Notice Only one optional module can be used at the same time. Assembling is made by orderer.

Analogue outputs

AM-AO2U	Analogue voltage outputs module, maximum 3 pcs total, warranty card
AM-AO2I	Analogue current outputs module, maximum 3 pcs total, warranty card

Notice Single output module includes two analogue outputs, while by one output connector of control system three analogue outputs can be connected. Assembling is made by orderer.

9.1. Default factory settings

Analogue inputs All analogue inputs are set for 0 to 10 V range.

RS485 If the **AM-RS485** module is implemented, then terminating of communication line is made.

CAN If the **AM-CAN** module is implemented, then terminating of communication line is made.

10. Maintenance

The control system does not require any regular inspection or service, except reference voltage setting and backup battery voltage check.

Reference voltage source

The reference voltage 5.0 V DC for A/D convertor is set by manufacturer with ±1 mV precision. For voltage inspection should be used a sufficiently precise measuring instrument!

Inspection must me carried out once every five years.

Backup battery

For program and parameters backup in the RAM memory is used a backup battery. Its nominal voltage is 3.0 V DC; nominal capacity is 1 Ah. If its voltage drops under 2.7 V DC, then it is considered to be discharged. When it happens, it is necessary to change it.

Inspection must me carried out once every five years. The assumed battery lifetime is 10 years.

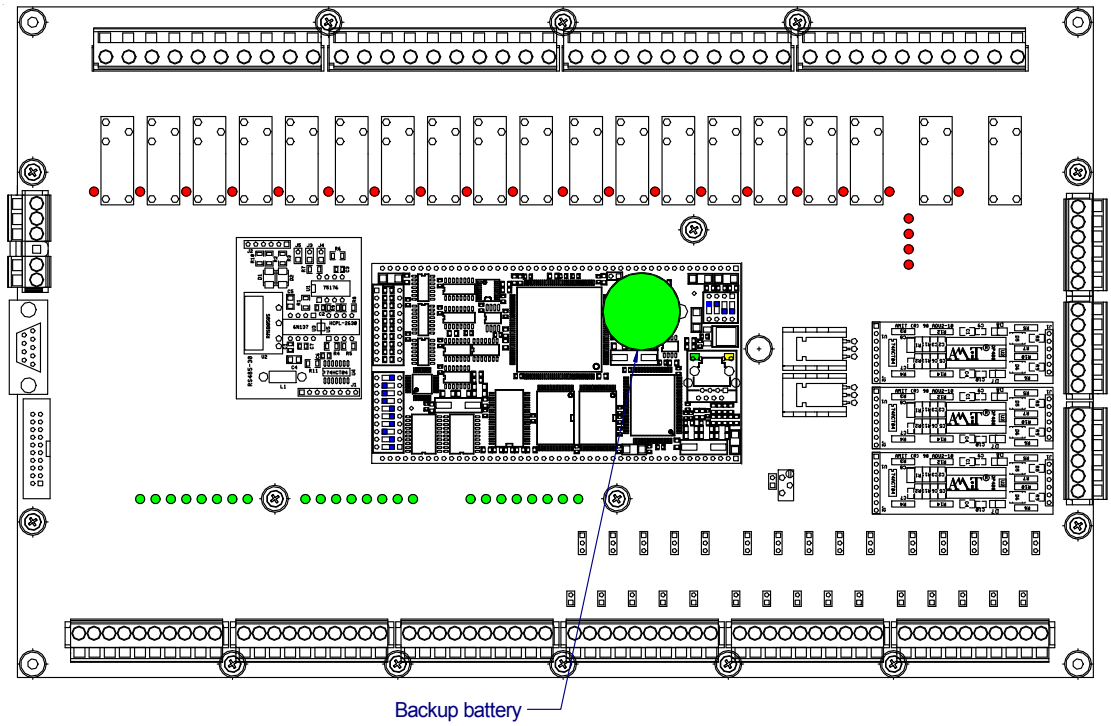

Fig. 42 - Battery is accessible after removing the metal case

Cleaning

Time after time, it is necessary with regard to way of equipment using, remove dust from control system. The equipment can be cleaned in cut-off state and disassembled, by dry paintbrush or fine brush, eventually by vacuum cleaner.

Notice

Above mentioned service can be performed by manufacturer or authorized service only!

11. Waste disposal

Electronics disposal Control system electronics disposal is governed by Waste Electrical and Electronic Equipment directives. The equipment must not be disposed together with common public waste. It must be delivered to places specified for that purpose and recycled.

Battery disposal Control system includes a lithium battery. The battery is a dangerous waste. Therefore, it must be delivered to places specified for that purpose. Disposal of worn-out batteries and accumulators must not be contrary to valid regulations.