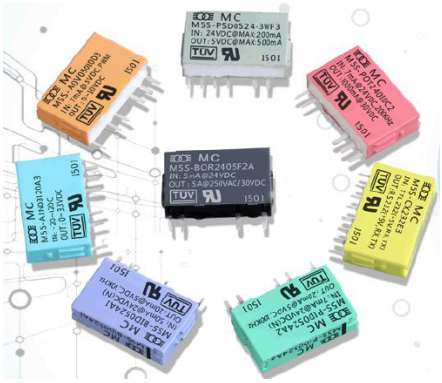
M5S modular I/O components

Modular components with integrated circuits aiming at versatile operation in industrial systems like regulators or programmable logic controllers.



Connection of electronics and industrial control

The modules are a connecting element between electronics on one side as well as the world of industrial control on the other side. The modules are completely sealed, water proof, fire proof and dust proof.

Universal wiring diagram for full flexibility

A universal wiring diagram allows all M5S I/O modules to be interchangeable without the need to change the internal or external wiring. By plugging different modules, customer specific input/output configurations can be achieved as well as the addition of functions to already rolled-out devices.

Overview (Standard modules are underlined)

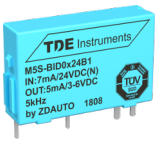
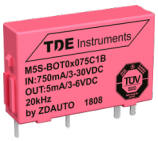
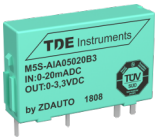
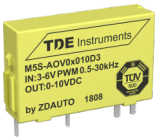
Digital input - „BI“/“PI“ 	Switches, voltage detection	BID0324A1, BID0524A1, BID0324B1, BID0524B1, BIA0324B5, BIA0524B5, BIA03110B5, BIA05110B5, BIA03220B5, BIA05220B5
	Pulses up to 200 kHz	PID0324A2, PID0524A2, PID0324B2, PID0524B2
Digital output - „BO“/“PO“ 	DC switch output	BOT03750C1b, BOT05750C1b, BOT03750D1b, BOT05750D1b, BOT0315E1b, BOT0515E1b, BOT0315F1b, BOT0515F1b
	AC switch output	BOS03800E2Zb, BOS05800E2Zb
	Pulses up to 200 kHz	POT0315C2b, POT0515C2b, POT0315D2b, POT0515D2b
Analogue input - „AI“ 	20 mA analogue signal	AIA03020A3, AIA05020A3, AIA03020B3, AIA05020B3, AIA03020C4, AIA05020C4
	10 Volt analogue signal	AIV03010A3, AIV05010A3, AIV03010B3, AIV05010B3, AIV03010C4, AIV05010C4
	Temperature sensors type N, type J, type K, Pt100	AIN03120A3, AIN05120A3, AIJ03600A3, AIJ05600A3, AIK031200A3, AIK051200A3, AIP03600A3, AIP05600A3, AIP03600B3, AIP05600A3
Analogue output - „AO“ 	20 mA analogue signal	AOA03020C3, AOA05020C3, AOA03020D3Ab, AOA05020D3Ab
	10 Volt analogue signal	AOV03010C3, AOV05010C3, AOV03010D3Ab, AOV05010D3Ab

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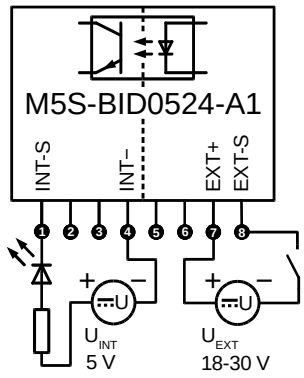
M5S digital input - „BI“/“PI“ 3
M5S digital output - „BO“/“PO“ 4
M5S analogue input - „AI“ 6
M5S analogue output - „AO“ 9
Signal description 10
Dimensions [mm] 10
Evaluation boards for Arduino and Raspberry Pi 11
M5S mechanical relays – „BOR“ 16
M5S communication modules - „CX“ 17
Contact (Exclusive Sales Europe) 20

M5S digital input - „BI“/“PI“

- For detection of switch states, pulses or encoder signals
- Galvanic isolation via optocouplers
- Open collector output

M5S-BID0324A1, M5S-BID0524A1

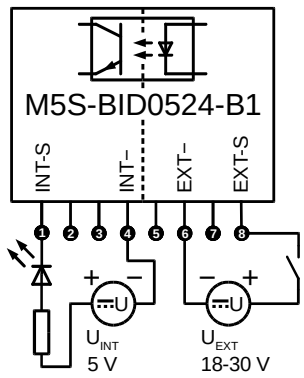
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Voltage/current		Signal	Voltage/current
DC optocouple binary input	BID03	0-5 kHz	3.3 V/8 mA DC	Yes	0-5 kHz, source	18-30 V DC, 7 mA @ 24 V DC
	BID05	0-5 kHz	5 V/8 mA DC			



Signal ←	
Pin 1 (Output)	**Pin 8 (Input)**
Active low	Active low
Passive	Passive

M5S-BID0324B1, M5S-BID0524B1

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Voltage/current		Signal	Voltage/current
DC optocouple binary input	BID03	0-5 kHz	3.3 V/8 mA DC	Yes	0-5 kHz, sink	18-30 V DC, 7 mA @ 24 V DC
	BID05	0-5 kHz	3.3 V/8 mA DC			



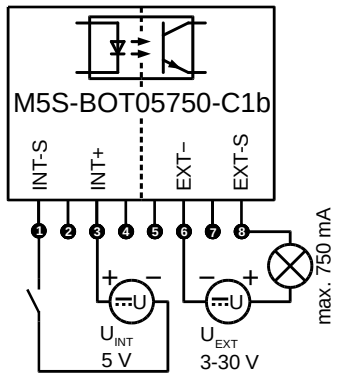
Signal ←	
Pin 1 (Output)	**Pin 8 (Input)**
Active low	Active high
Passive	Passive

M5S digital output - „BO“/“PO“

- For control of relays, lamps, buzzers or other signaling devices
- Galvanic isolation via optocouplers
- Solid state relay or transistor output

M5S-BOT03750C1b, M5S-BOT05750C1b

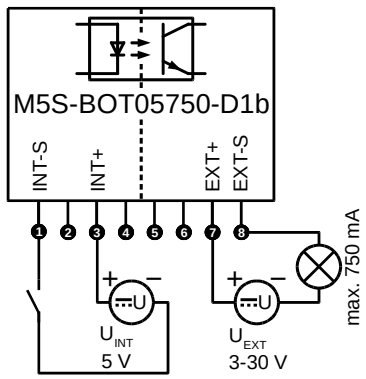
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Voltage/current		Signal	Voltage/current
Optocouple with transistor output	BOT03	0-5 kHz	3.3 V/5 mA DC	Yes	0-5 kHz, sink	3-30 V/750 mA DC
	BOT05	0-5 kHz	5 V/5 mA DC			



Signal →	
Pin 1 (Input)	**Pin 8 (Output)**
Active low	Active low
Passive	Passive

M5S-BOT03750D1b, M5S-BOT05750D1b

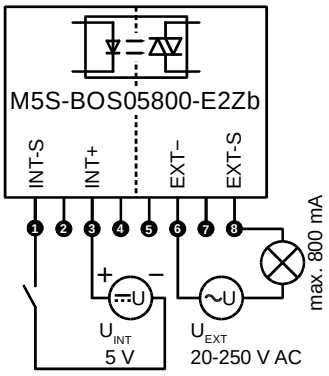
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Voltage/current		Signal	Voltage/current
Optocouple with transistor output	BOT03	0-5 kHz	3.3 V/5 mA DC	Yes	0-5 kHz, source	3-30 V/750 mA DC
	BOT05	0-5 kHz	5 V/5 mA DC			



Signal →	
Pin 1 (Input)	**Pin 8 (Output)**
Active low	Active high
Passive	Passive

M5S-BOS03800E2Zb, M5S-BOS05800E2Zb

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Voltage/current		Signal	Voltage/current
SSR binary output, zero-cross switching	BOS03	0-100 Hz	3.3 V/5 mA DC	Yes	50-60 Hz, AC	20-250 V, 1-800 mA AC
	BOS05	0-100 Hz	5 V/5 mA DC			



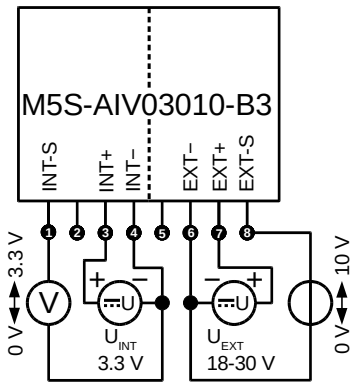
Signal →	
Pin 1 (Input)	**Pin 8 (Output)**
Active low	Active low
Passive	Passive

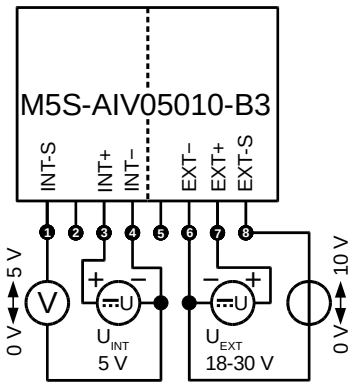
M5S analogue input - „AI“

- For measurement of analogue signals, potentiometers, temperature sensors as well as other current or voltage sources
- Optional: isolated or non-isolated signal
- Multi function: DC voltage/current as well as different types of temperature sensors

M5S-AIV03010B3, M5S-AIV05010B3

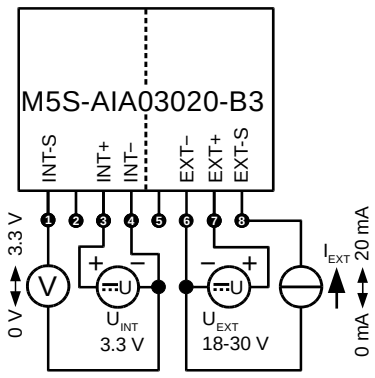
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue input voltage isolated	AIV03	0-3.3 V DC	3.3 V/10 mA DC	Yes	0-10 V DC	18-30 V 30 mA DC
	AIV05	0-5 V DC	5 V/10 mA DC			

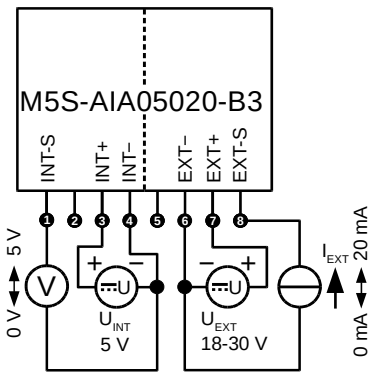




M5S-AIA03020B3, M5S-AIA05020B3

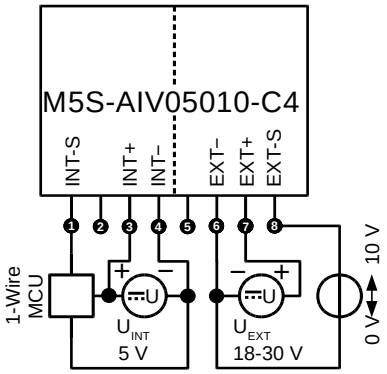
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue input current isolated	AIA03	0-3.3 V DC	3.3 V/10 mA DC	Yes	0-20 mA DC	18-30 V 30 mA DC
	AIA05	0-5 V DC	5 V/10 mA DC			





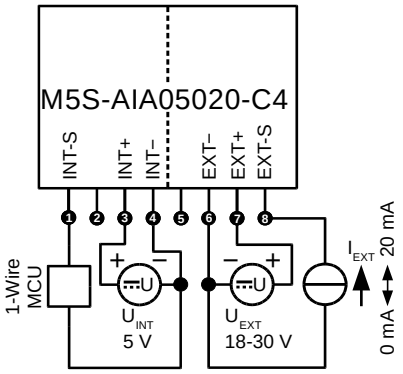
M5S-AIV03010C4, M5S-AIV05010C4

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue input voltage isolated, 1-Wire	AIV03	3.3 V 1-Wire serial interface	3.3 V/10 mA DC	Yes	0-10 V DC	18-30 V 30 mA DC
	AIV05	5 V 1-Wire serial interface	5 V/10 mA DC			



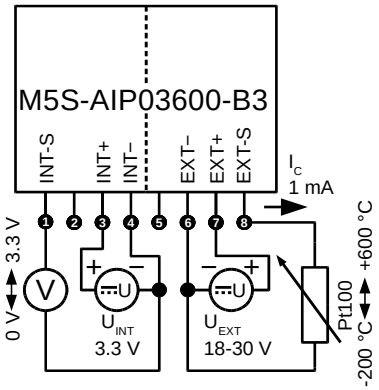
M5S-AIA03020C4, M5S-AIA05020C4

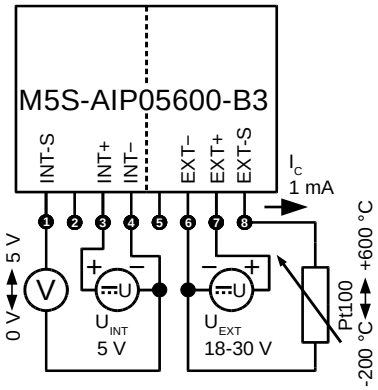
Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue input current isolated, 1-Wire	AIA03	3.3 V 1-Wire serial interface	3.3 V/10 mA DC	Yes	0-20 mA DC	18-30 V 30 mA DC
	AIA05	5 V 1-Wire serial interface	5 V/10 mA DC			



M5S-AIP03600B3, M5S-AIP05600B3

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue input temperature sensor Pt100 isolated	AIP03	0-3.3 V DC	3.3 V/10 mA DC	Yes	Pt100 2-wire −200 - 600 °C	18-30 V 30 mA DC
	AIP05	0-5 V DC	5 V/10 mA DC			



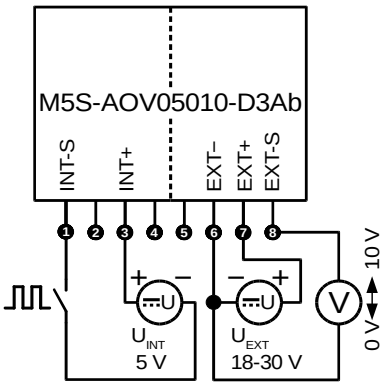


M5S analogue output - „AO“

- For the control of speed regulators, heating regulators or other voltage/current measuring devices.
- Optional: isolated or non-isolated signal
- Analogue signals: 10 V, 20 mA

M5S-AOV03010D3Ab, M5S-AOV05010D3Ab

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue output voltage isolated	AOV03	PWM 0-100% duty cycle	3.3 V/10 mA DC	Yes	0-10 V DC	18-30 V 30 mA DC
	AOV05		5 V/10 mA DC			

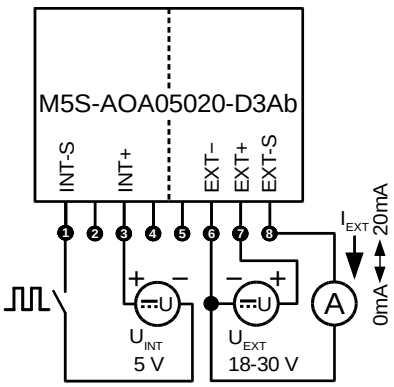


Signal →	
Pin 1 (Input)	**Pin 8 (Output)**
Active low	10 V
Passive	0 V

Valid frequency range for internal circuit signal (input signal): 1-10 kHz

M5S-AOA03020D3Ab, M5S-AOA05020D3Ab

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
Analogue output current isolated	AOA03	PWM 0-100% duty cycle	3.3 V/10 mA DC	Yes	0-20 mA DC	18-30 V 30 mA DC
	AOA05		5 V/10 mA DC			



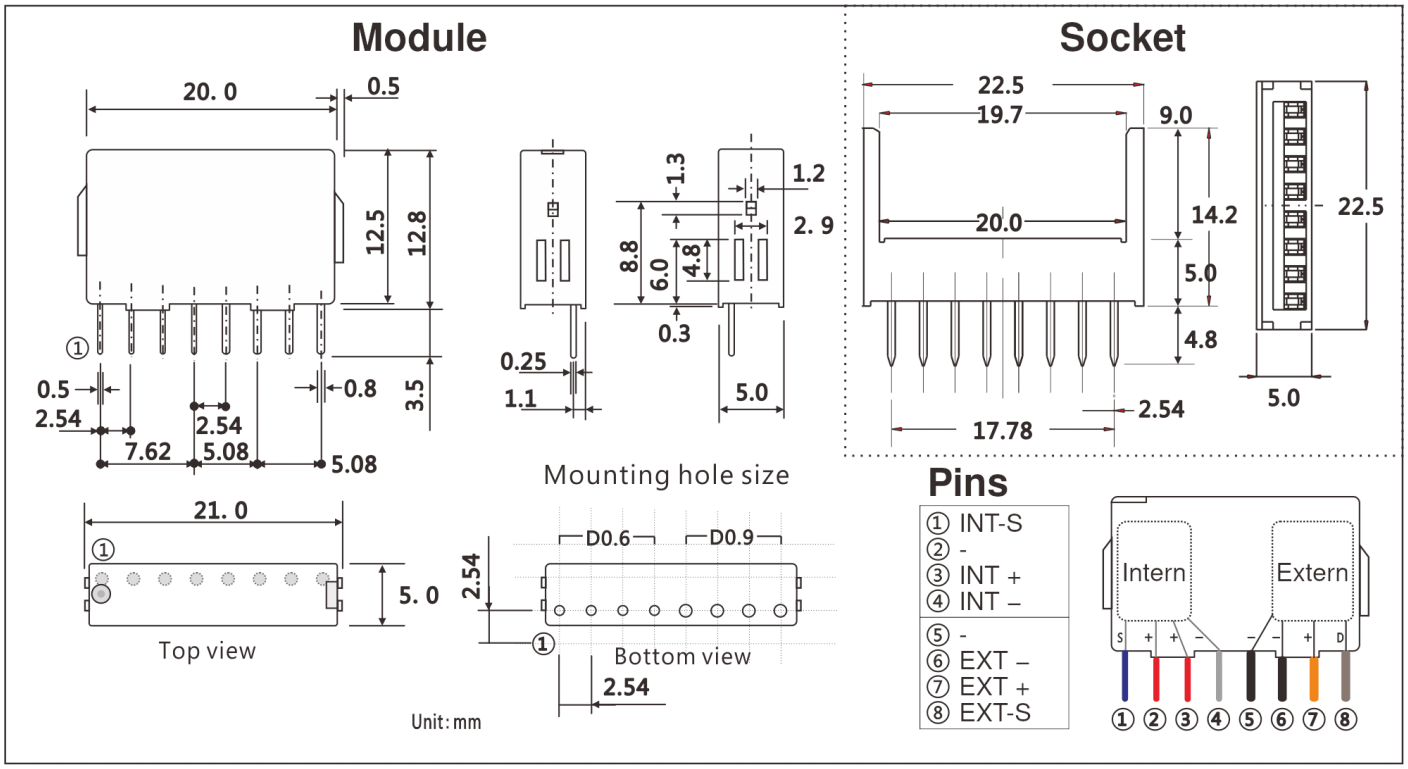
Signal →	
Pin 1 (Input)	**Pin 8 (Output)**
Active low	20 mA
Passive	0 mA

Valid frequency range for internal circuit signal (input signal): 1-10 kHz

Signal description

Signal	Name	Description
INT-S	Internal signal	Internal connection to the microcontroller, can be used as GPIO (BI, PI, BO, PO modules) or PWM (AO modules). If supported by the microcontroller, also analogue signals (ADC or DAC) (AI, AO modules) or 1-wire serial interface (AI modules), for microcontrollers that do not have ADC functions.
INT+	Internal positive supply	Internal power supply from the microcontroller, e.g. 3.3 V or 5 V
INT−	Internal negative supply	Ground of the internal supply circuit
EXT−	External negative supply	Ground of the external supply circuit
EXT+	External positive supply	External power supply, mostly 24 V DC
EXT-S	External signal	External signal. This is where the external signals like switching signals, switched loads, temperature sensors, analogue sensors or analogue control inputs are connected.

Dimensions [mm]



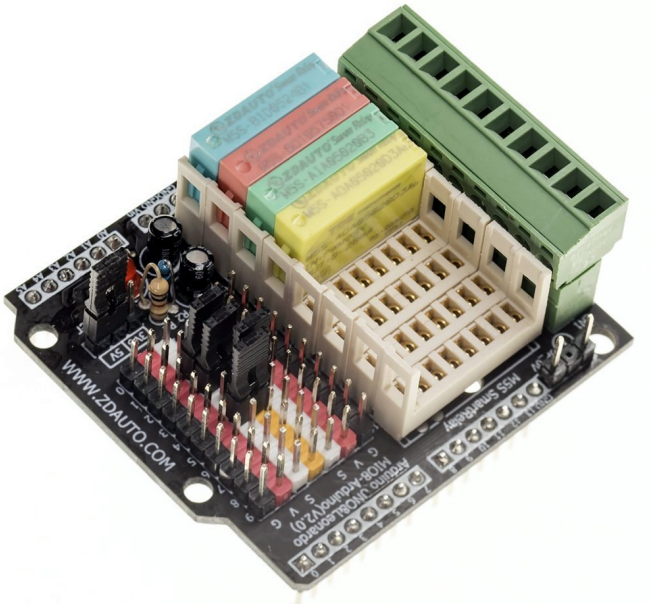
Evaluation boards for Arduino and Raspberry Pi

Using the evaluation boards, the functionality of M5S I/O modules can be explored easily. The M5S I/O modules allow switching of external circuits and input of external circuits with higher voltages than directly allowed on the Arduino/ Raspberry Pi, e.g. 24 V or 230 V (depending on the specific M5S I/O module version).

Features

- 8 sockets for M5S modules
- Terminal blocks for external circuit (EXT-S) and external power supply, e.g. 24 V DC
- Pin header for internal circuit (INT-S)
- Configuration and pin mapping of internal circuit to processor pins via jumper cables
- Isolated circuit possible if only isolated M5S modules are used

MIO-UNO: Arduino UNO M5S I/O Shield



Pin assignment

1: (EXT+) External circuit +, connected to all pins 7 of the M5S modules

2: (EXT-S-1..8) External signals 1 - 8
(pin 8 of each M5S)

3: (EXT−) External circuit -, connected to all pins 6 of the M5S modules

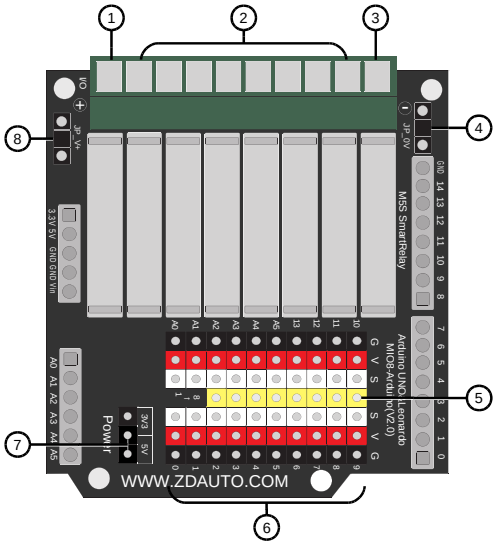
4: JP_0V connects external circuit −
to internal power supply −
(common ground)

5: (INT-S-1..8) Internal signals 1 - 8
(pin 1 of each M5S)

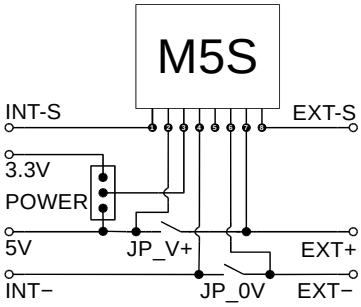
6: Connector field
G: Internal power supply -
V: Internal power supply +
S: Signal pin of Arduino

7: POWER connects the voltage rail of the Arduino with all pins 3 of the M5S modules (supply of M5S):
- Pin 1-2: 3.3 V
- Pin 2-3: 5 V

8: JP_V+ connects external circuit + with internal 5 V power supply.
(CAUTION, only for external voltage 5 V!)



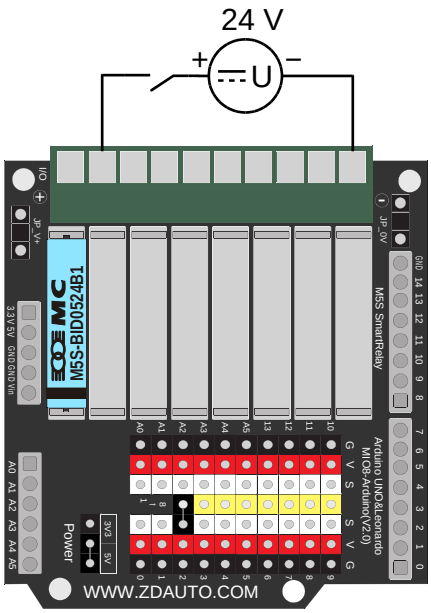
Overview



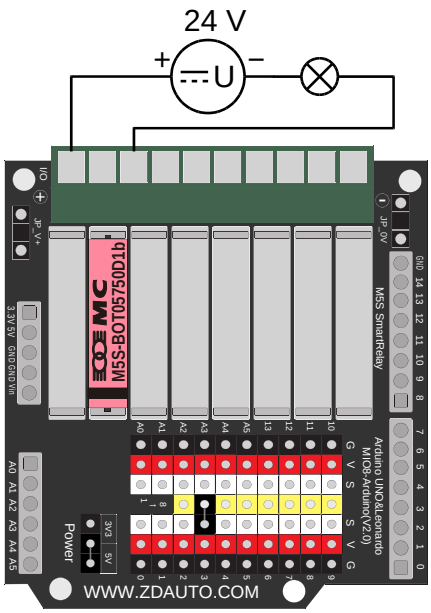
Connection diagram

Application wiring diagrams (examples)

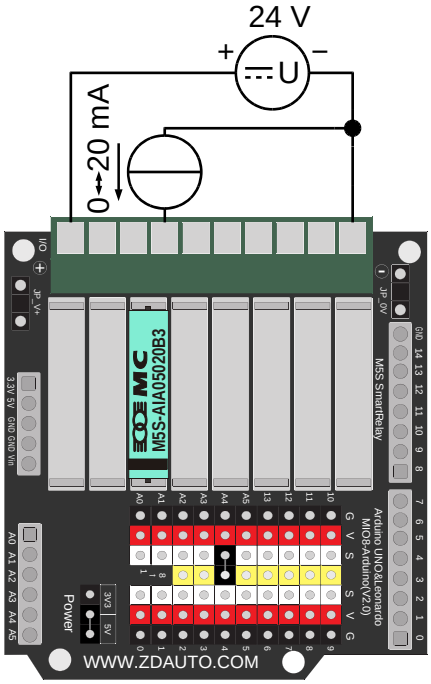
Arduino pins and M5S pins need to be connected by jumpers or jumper cables.



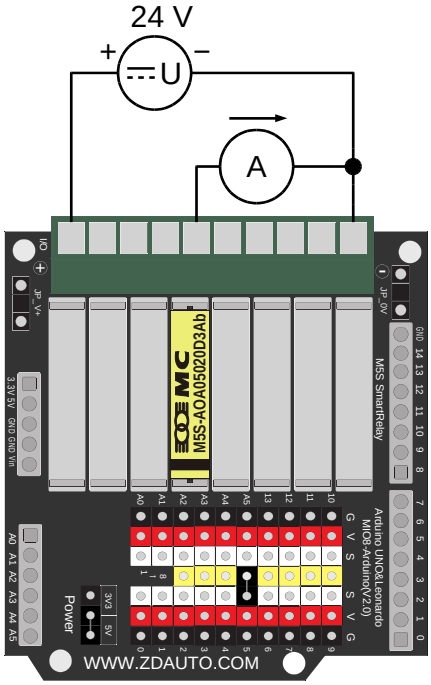
Detecting a voltage of 24 V DC.
Input wiring diagram BID0524B1.
M5S 1 connected to Arduino digital pin 2.



Switching a load with a maximum voltage of 24 V DC and a maximum current of 750 mA.
Output wiring diagram BOT05750D1b.
M5S 2 connected to Arduino digital pin 3.



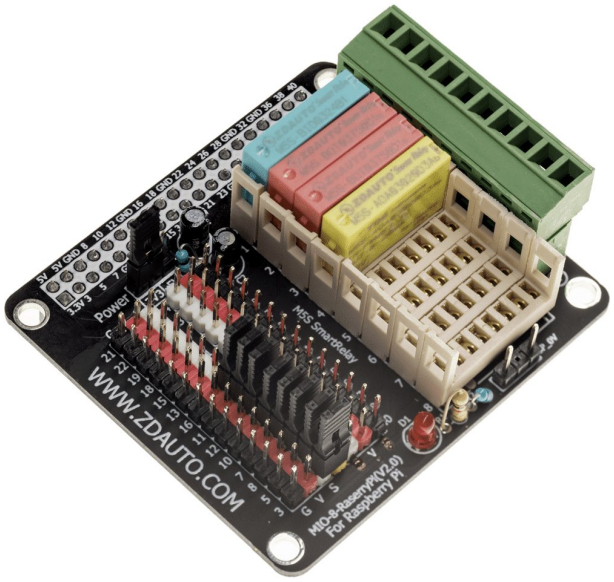
Measuring an analogue current ranging from 0 to 20 mA with voltage supply 24 V DC.
Input wiring diagram AIA05020B3.
M5S 3 connected to Arduino analogue pin A4.



Output of an analogue current ranging from 0 to 20 mA with voltage supply 24 V DC.
Output wiring diagram AOA05020D3Ab.
M5S 4 connected to Arduino digital pin 5.

MIO-RASPBERRYPI: Raspberry Pi M5S I/O HAT

Supports all Raspberry Pi models with a 40-pin GPIO interface, e.g. Pi 1 Model B+, Pi 3 Model B.



Pin assignment

1: (EXT+) External circuit +, connected to all pins 7 of the M5S modules

2: (EXT-S-1..8) External signals 1 - 8
(pin 8 of each M5S)

3: (EXT−) External circuit −, connected to all pins 6 of the M5S modules

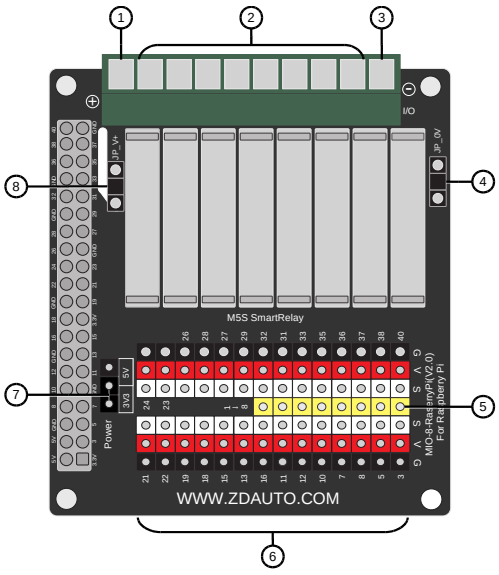
4: JP_0V connects external circuit −
to internal power supply −
(common ground)

5: (INT-S-1..8) Internal signals 1 - 8
(pin 1 of each M5S)

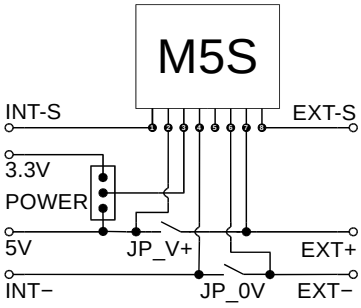
6: Connector field
G: Internal power supply -
V: Internal power supply +
S: Signal pin of Raspberry Pi

7: POWER connects the voltage rail of the Arduino with all pins 3 of the M5S modules (supply of M5S):
- Pin 1-2: 3.3 V
- Pin 2-3: 5 V (should not be used!)

8: JP_V+ connects external circuit + with internal 5 V power supply
(CAUTION, only for external voltage 5 V!)



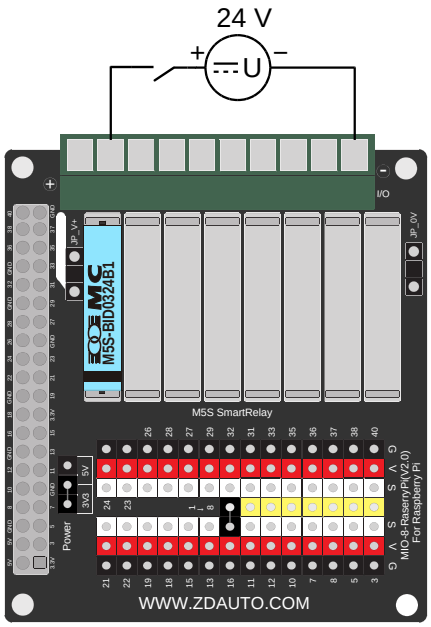
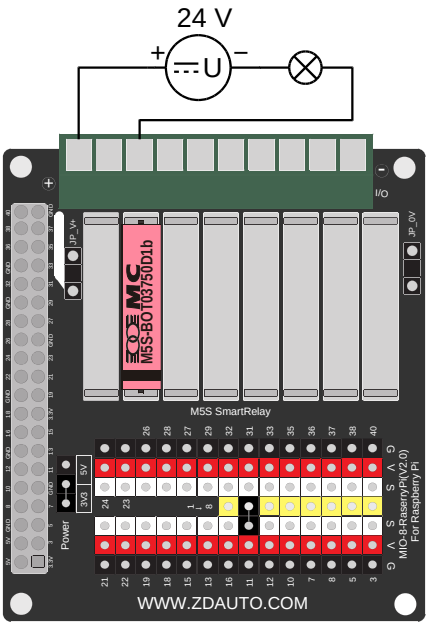
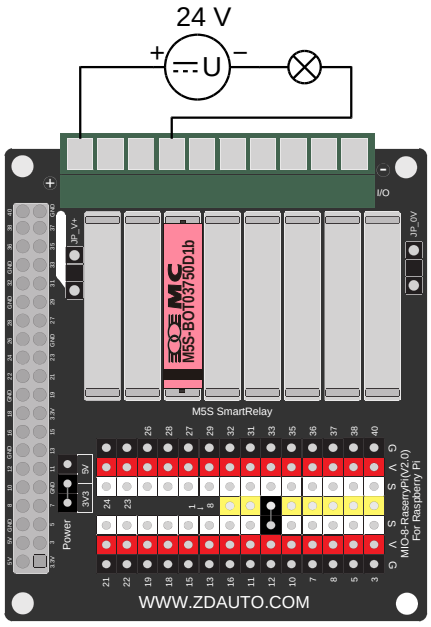
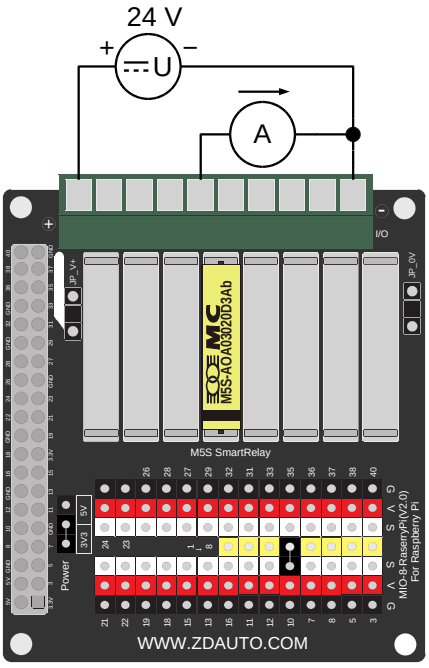
Overview



Connection diagram

Application wiring diagrams (examples)

Raspberry Pi pins and M5S pins need to be connected by jumpers or jumper cables.

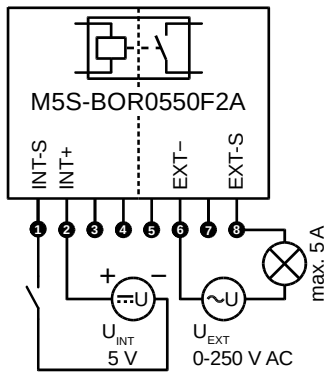
<table>
<tr>
<td>
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<tr>
<td>Detecting a voltage of 24 V DC.
Input wiring diagram BID0324B1.
M5S 1 connected to Raspberry Pi pin 16 (GPIO23).</td>
<td>Switching of a load with a maximum voltage of 24 V DC and a maximum current of 750 mA.
Output wiring diagram BOT03750D1b.
M5S 2 connected to Raspberry Pi pin 11 (GPIO17).</td>
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<tr>
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<tr>
<td>Switching of a load with a maximum voltage of 24 V DC and a maximum current of 750 mA.
Output wiring diagram BOT03750D1b.
M5S 2 connected to Raspberry Pi pin 12 (GPIO18).</td>
<td>Output of an analogue current ranging from 0 to 20 mA with voltage supply 24 V DC.
Output wiring diagram AOA03020D3Ab.
M5S 4 connected to Raspberry Pi pin 10 (GPIO15).</td>
</tr>
</table>

M5S mechanical relays – „BOR“

- For switching higher currents with a low switching frequency
- Relay driver circuit at the input (INT) required
- Dry, gold-plated silver alloy contact at the output (EXT)
- Galvanic isolation

M5S-BOR0550F2A, M5S-BOR2450F2A

Description	Internal circuit			Isolation	External circuit
	Version	Signal	Voltage/current		Voltage/current
Relay binary output	BOR05	0-20 Hz	5 V/25 mA DC	Yes	250 V, 0-5 A AC 30 V, 0-3 A DC
	BOR24	0-20 Hz	24 V/5 mA DC		



Signal
→
NO (normally open)

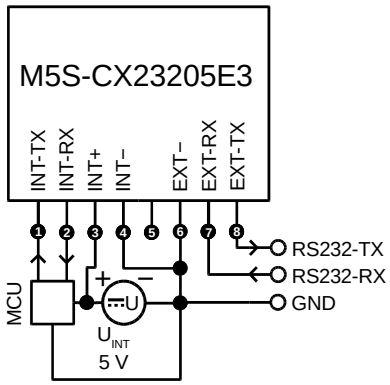
Usage with the evaluation boards is not recommended, as a current of 25 mA is required.

M5S communication modules - „CX“

- These modules can be used to address different communication interfaces.
- The communication modules use 2 signal pins on the control side as opposed to the I/O modules, each using 1 signal pin.
- TX/RX wiring on the control side
- Optional: isolated or non-isolated signal
- RS232, RS422, RS485, USB, LAN, CAN
- Not usable with the evaluation boards for Arduino and Raspberry Pi

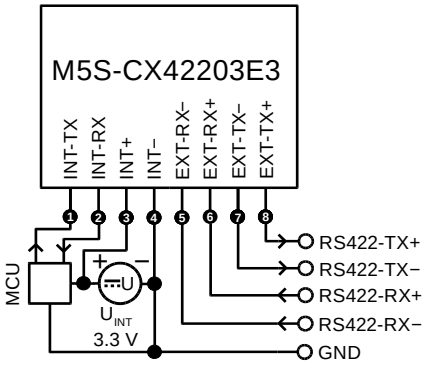
M5S-CX23203E3, M5S-CX23205E3

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
RS232 communication module non-isolated	CX23203	0-3.3 V TTL	3.3 V/5 mA DC	No	± 9 V RS232 interface	Via internal supply
	CX23205	0-5 V TTL	5 V/5 mA DC			



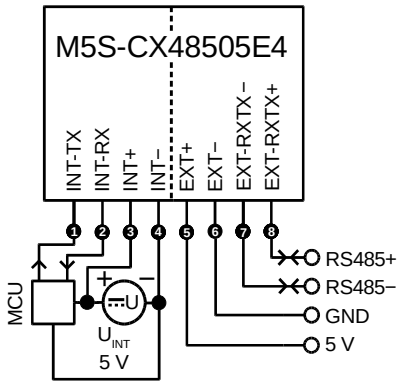
M5S-CX42203E3, M5S-CX42205E3

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
RS422 communication module non-isolated	CX42203	0-3.3 V TTL	3.3 V/5 mA DC	No	5 V differential voltage RS422 interface	Via internal supply
	CX42205	0-5 V TTL	5 V/5 mA DC			



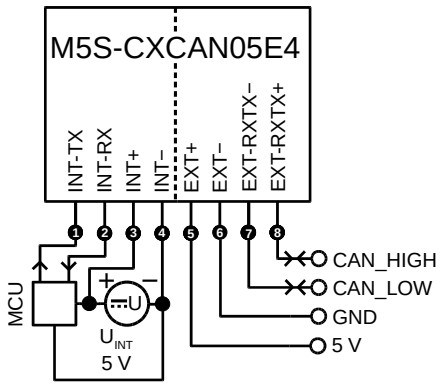
M5S-CX48503E4, M5S-CX48505E4

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
RS485 communication module isolated	CX48503	0-3.3 V TTL	3.3 V/5 mA DC	Yes	5 V differential voltage RS485 interface	5 V/ 8 mA DC
	CX48505	0-5 V TTL	5 V/5 mA DC			



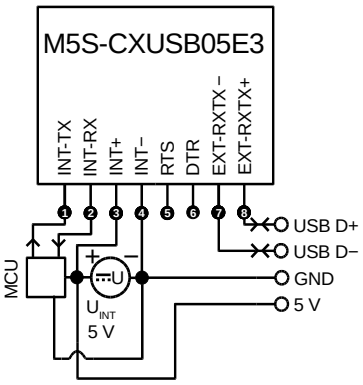
M5S-CXCAN03E4, M5S-CXCAN05E4

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
CAN communication module isolated	CXCAN03	0-3.3 V TTL	3.3 V/5 mA DC	Yes	CAN interface	5 V/ 8 mA DC
	CXCAN05	0-5 V TTL	5 V/5 mA DC			



M5S-CXUSB03E3, M5S-CXUSB05E3

Description	Internal circuit			Isolation	External circuit	
	Version	Signal	Supply		Signal	Supply
USB communication module non-isolated	CXUSB03	0-3.3 V TTL	3.3 V/5 mA DC	No	USB interface	Via internal supply
	CXUSB05	0-5 V TTL	5 V/5 mA DC			



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