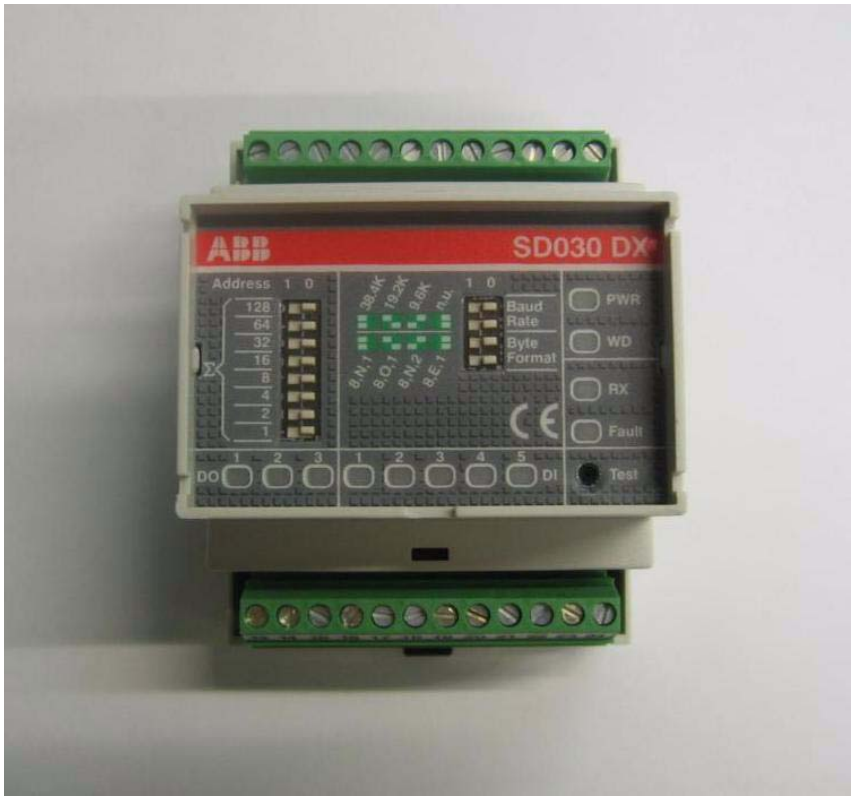
SIGNALLING UNIT
SD030 DX



INDEX

1 SAFETY NOTES

WARNING: This symbol identifies information on practices, actions and circumstances which may result on injuries or harms to personnel, damage to the unit or economic loss.

Read this manual carefully and completely before installing, setting up and operating the SD030 DX unit.

This device should only be used by qualified competent personnel.

If there are any doubts about safe use, the unit should be placed out of service to protect it against unintentional use.

Safe use must be assumed to be impossible if:

1. **there is visible damage to the unit**
2. **the unit is not operating (for example in the test)**
3. **the unit has suffered damage during the transport**

1.1. Notes for dielectric strength tests

WARNING: Dielectric strength tests on inputs and outputs of devices considered in this document are not permitted.

2 OVERVIEW

2.1. System description

Flex Interfaces are microprocessor-based devices on DIN-rail, providing input/output digital and analog signals for carrying circuit breaker's trip unit information. In addition, they can be used for driving additional input signals coming from the field to the trip unit.

The Flex Interfaces family consists of accessory and system devices, according to the RS-485 bus they are connected to: the formers are linked to an internal (accessory) bus and communicate with a trip unit by means of MM030; the latters are connected to an external (system) bus, exchanging information with a generic master unit.

While accessory Flex Interfaces have fixed communication parameters, that is baud rate and byte format, system devices can be programmed with different settings, by means of dip-switches on the front.

Moreover, signallings on accessory units are pre-programmed through a rotary selector; in case of system units, these are fully programmable via Modbus Interface in order to fit user's specific requirements.

The present manual deals with the system unit SD030 DX only, whose main features are listed in Table 1. References about different Flex Interfaces are given in 2.2.

Device type	Features	Description
SD030 DX	Mixed input/output: 3 digital output 5 digital input	• Actuates its outputs / replays the status of its inputs upon master request • Manages circuit breakers

Table 1. Features of SD030 DX unit

SD030 DX is a slave module; therefore it must be connected to a master, for example a PC, a PLC or a SCADA (Supervisory Control And Data Acquisition).

The total number of slaves connected on the System bus depends on the avalaibility of (logical) slave addresses.

Theorically, up to 247 different slave addresses are ready for use, but the number is limited by the physical layer chosen as communication channel, such as RS485 (see par. 7.4.).

The following figure shows a typical architecture involving:

- a generic Master on System Bus
- a Trip Unit (Tmax, Emax or T7/X1 series)
- SD030 DX units
- different Flex Interfaces units
- generic slaves

Connections between different units are indicatory only; wirings must be carried out according to official ABB SACE documentation and to circuit diagrams in section 10 .

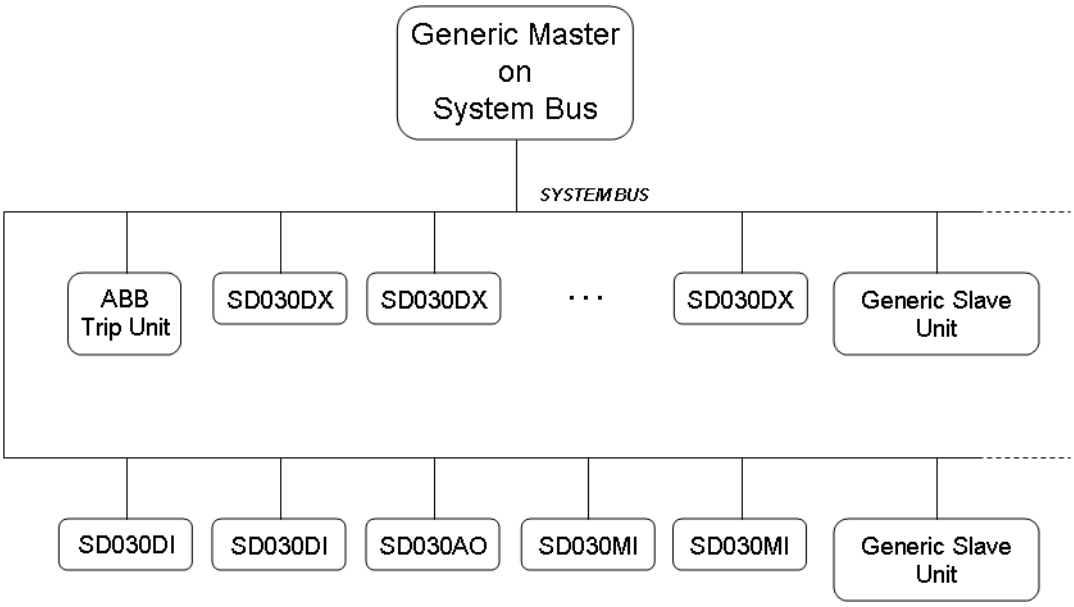


Figure 1. A typical architecture

2.2. References

The following document describes how to install, set-up and operate SD030 units.

For information about the trip units that can be interfaced with SD030 units, the following documents must be consulted:

- Instruction manual of trip unit PR121/P, PR122/P and PR123/P (doc. no. 1SDH000460R0002 for IEC version or doc. no. 1SDH000532R0002 for UL version)
- Instruction manual of trip unit PR222DS/PD (doc. no. 1SDH000436R0502 for IEC version or doc. no. 1SDH000549R0001 for UL version)
- Instruction manual of trip unit PR223DS (doc. no. 1SDH000479R0503)
- Instruction manual of trip unit PR223EF (doc. no. 1SDH000538R0002)
- Instruction manual of trip unit PR331/P, PR332/P and PR333/P (doc. no. 1SDH000587R0002)
- ABB SACE Tmax technical catalogue (doc. no. ISDC210015D0202)
- ABB SACE Emax technical catalogue (doc. no. 1SDC200006D0204)
- ABB SACE X1 technical catalogue (doc. no. 1SDC20009D0202)

For information about other Flex Interfaces units, the following documents must be consulted:

- Instruction manual of Flex interfaces fo Accessory Bus (doc. no. 1SDH000622R0001)
- Instruction manual of Flex interfaces fo System Bus (doc. no. 1SDH000649R0001)
- Instruction manual of HMI030 (doc. no. 1SDH000573R0001)

3 USER INTERFACE

3.1. Front view

The front panel of the SD030 DX consists of:

- a Test push-button
- 2 service LEDs
- 2 system bus LEDs
- 8 channel LEDs (3 for digital outputs, 5 for digital inputs)
- an eight positions dip-switch for slave address
- 2 dip-switches for communication parameters
- 2 terminal boxes for external connections

as shown in the picture below.

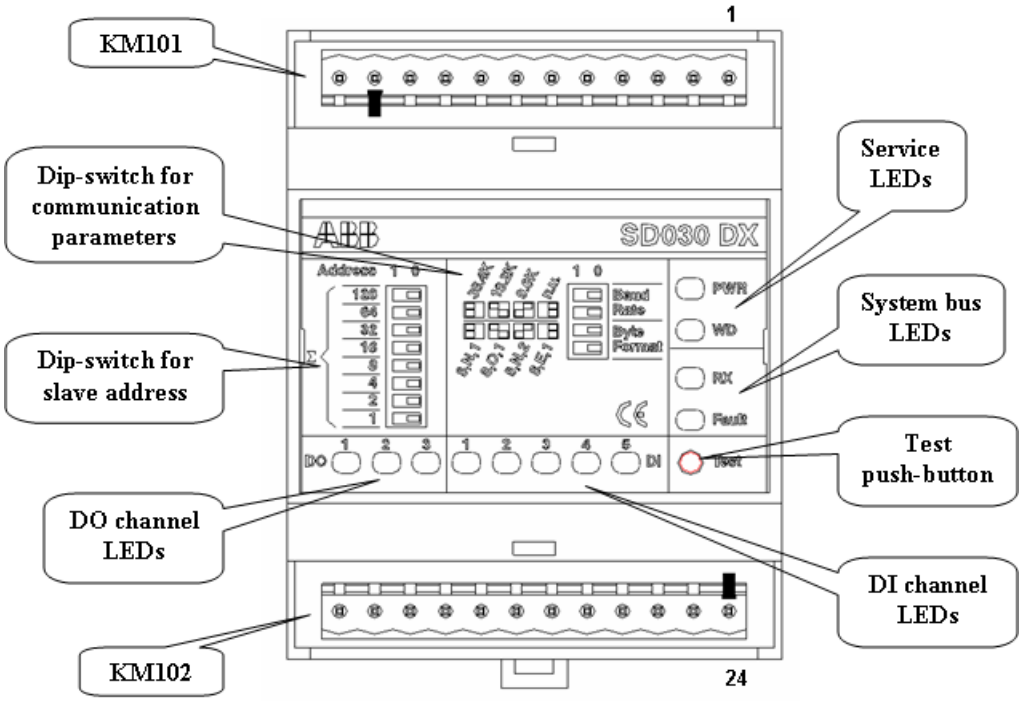


Figure 2. SD030 DX front view

3.2. Test push-button

Test push-button	Description
Pressed for 1 sec	Reset inputs/outputs and relevant LEDs Acquire the dip-switches position to take the new settings (baud rate, slave address, byte format)
Pressed for 5 sec	Execute self-test procedure (see 6.1.2.)

Table 2. Test push-button

3.3. LEDs meaning

After performing a test at start-up (see section 6.1. for additional informations), LEDs assume the following meaning:

Function	LED	Status	Meaning
Service	PWR	ON (Green)	Power supply voltage on
		OFF	Power supply voltage off
	WD	ON (Red)	Watchdog alarm: internal malfunction, the device is restarting
		OFF	Watchdog OK: device is working correctly
System bus	TX	ON (Yellow)	Data transmission on System bus
		OFF	No data transmission on System bus
	Fault	ON/Blink (Red)	Special condition / malfunction on System bus
		OFF	No special condition / malfunction on System bus
I/O channel	Depends on the unit, see relevant section	ON (Green)	See 3.3.2.
		OFF	See 3.3.2.

Table 3. SD030 DX LEDs meaning

3.3.1. Fault LED

Fault LED is used to signal many special conditions and malfunctions, as explained in the next table. In case of concurrent conditions / malfunctions, the one with the highest priority (i.e. the lowest priority number) will be signalled first.

Status	Signalling	Priority Number	Description
Fixed ON	Bus fault	7	Bus not connected or faulty
Pattern 2	Dip-switch position changed	9	Actual dip-switches position different from old one
Pattern 3	Dip-switch invalid	8	Dip-switches position not permitted: • slave address greater than 247 • baud rate dip-switch set on n.u. position See 3.4. for detailed information about dip-switched management.
Pattern 7	Malfunction	4	Device is detecting a malfunction: • Power supply votage too low or too high • Internal malfunction
Pattern 8	Maintenance mode	1	Reserved to purpose
Pattern 9	Maintenance mode	2	Maintenance mode terminated correctly
Pattern 10	Maintenance mode	3	Maintenance mode terminated incorrectly

Table 4. SD030 DX Fault LEDs meaning

Pattern x indicates that the LED periodically:

- Switches on and off x times.
- Stays off for a while.

The following example shows Pattern 3:

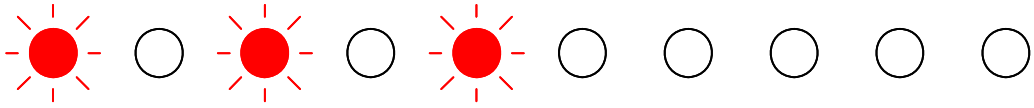


Figure 3. Pattern 3

3.3.2. Channel LEDs

3.3.2.1 DO channel LEDs

Each DO channel has its own LED to signal the status of the internal electro-mechanical relay. When the LED is on the relevant relay is closed, while the LED is off when the relevant relay is open.

Relay open	Relay closed
LED OFF	LED ON (Green)

Table 5. DO channel LEDs meaning

3.3.2.2 DI channel LEDs

Each DI channel has its own LED. whose status depends on the value the channel is currently driving.

Each LED points out if a low input value (DI not active) or high input value (DI active) is detected, as explained in the following table.

NOT ACTIVE 0V < DI value < 4V	ACTIVE 15V < DI value < 24V
LED OFF	LED ON (Green)

Table 6. DI channel LEDs meaning

See also par. 7.1.3. for information about DI behavior.

3.4. Dip-switches

The dip-switches placed on the front panel of SD030 DX are used to set the slave address and the communication parameters.

Any changes of the dip-switches become effective only if the Test push-button is kept pressed for 1 second in order to reset the unit.

3.4.1. Slave address dip-switch

An eight positions dip-switch allows to set the slave address from 1 up to 247[1].

Note 1: Slave address 0 is not permitted; if all the address dip-switches are set to 0, slave address and communication parameters will be remotely adjusted by the master unit.

The last available settings are loaded in case no remote adjustement is performed.

If the user select an address outside the specified range, the unit will keep on using the last valid address and it will signal the anomaly by means of the proper Fault LED pattern (see Table 4.).

3.4.2. Communication parameters dip-switches

There are two dip-switches to adjust the baud rate and two for the byte format. All available arrangements are displayed in Figure 4.

1. Though there are up to 247 different logical addresses, only a few can be used, according to the physical layer that carries out communication. If a slave address greater than 247 is set, the unit will signal the invalid configuration by blinking the FAULD led, as explained in 3.3.1.

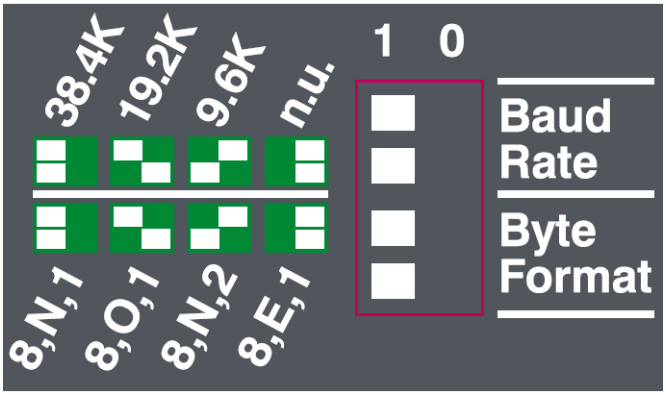


Figure 4. Available arrangements for communication parameters dip-switches

Note 2: The “not used” configuration considers a 19,2kbps baud rate by default. However, when the n.u. position is set, the unit will signal the invalid configuration by means of the FAULT led (see 3.3.1.).

3.5. Terminal boxes

The SD030 DX unit has two terminal boxes, KM101 and KM102 in Figure 2. , for external connections (auxiliary supply, communication bus, ...).

KM101 pin no.	Signal	Description
1	0V (Vaux)	Auxiliary power supply
2	24V (Vaux)	Auxiliary power supply
3	Earth	Protection earth
4	-	-
5 - 6	DI 1	Digital input channel 1
7 - 8	DO 1	Digital output channel 1
9 - 10	DO 2	Digital output channel 2
11 - 12	DO 3	Digital output channel 3

Table 7. KM101 terminal box for SD030 DX

KM102 pin no.	Signal	Description
13 - 14	DI 2	Digital input channel 2
15 - 16	DI 3	Digital input channel 3
17 - 18	DI 4	Digital input channel 4
19 - 20	DI 5	Digital input channel 5
21	-	-
22	Earth	Protection earth
23	BUSI-A	RS-485 Accessory bus
24	BUSI-B	RS-485 Accessory bus

Table 8. KM102 terminal box for SD030 DX

Connections must be performed according to section 4.1. and section 10 .

4 INSTALLATION

4.1. Installation instructions

Flex Interfaces units are mounted on standard 35 mm guide (DIN EN50022 type TS 35 x 15 mm), see Figure 6.

Make connections as indicated in section 4.2. and section 10.

If Flex Interfaces are installed in enclosures near other devices generating electromagnetic fields (relays, transformers, motor controllers, ...), a proper shielding, grounding and other tricks should be considered to reduce unwanted effects, such as induced electrical noise on signal and power line.

An earth terminal is provided to connect the electronic circuit to the installation earth.

For the removable front connectors use shielded cables with conductors having a cross-section between 0.5 and 1.5 mm^2 (AWG 22 ... 14).

4.2. Connections

Carefully consider the relevant electrical diagram in section 10 for the wiring of each terminal.

For the dedicated inputs and outputs, wirings different than that described in the official ABB SACE electrical diagram are not allowed.

The shield of the connecting cable for System bus must be connected to earth only in one point to avoid groung loop.

5 APPLICATION SCENARIOS

The SD030 DX unit can operate either as a standard or a programmable IO module; it can also be used as a circuit breakers supervisor.

In this way, it is possible to define up to three different applicative scenarios, each of them characterized by a specific use of the device IOs. This is schematically explained in the following table.

COMMAND TYPE	AVAILABLE SCENARIOS					
	STANDARD IO		PROGRAMMABLE IO		CB SUPERVISOR	
	Actuation Feasibility	Actuation Time (see Note 3)	Actuation Feasibility	Actuation Time (see Note 3)	Actuation Feasibility	Actuation Time (see Note 3)
CB Open	No	n.a.	No	Set by user	Yes	Depending on scenario
CB Close	No	n.a.	No	Set by user	Yes	Depending on scenario
CB Reset	No	n.a.	No	Set by user	Yes	Depending on scenario
Open DOs	Yes	Istantaneous	Yes	n.a.	No	n.a.
Close DOs	Yes	Istantaneous	Yes	n.a.	No	n.a.

Table 9. Available scenarios for SD030 DX

Note 3: The actuation time is the time for which the command remains active.

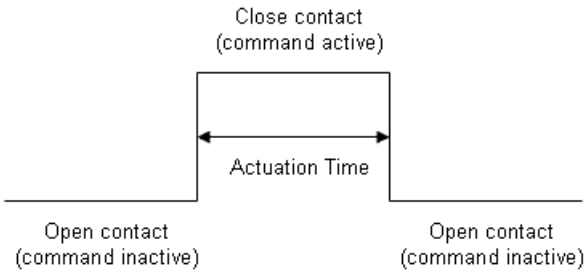


Figure 5. Command actuation time

5.1. Scenario A: standard IO

In this case, the SD030 DX operates as the SD030 DO concerning the outputs and as the SD030 DI for the inputs.

The IO behavior can be summarized as follow:

- outputs are normally open
- each output can be closed/opened by means of appropriate Modbus commands (see Table 19.)
- once closed, the output stays in this state untill an open/reset command is received
- inputs are activated and deactivated according to the value of the applied voltage (see 3.3.2.2 and 7.1.3.)

To perform this scenario, the value of the CB actuator type (see Modbus Register 1270) must be 0.

5.2. Scenario B: programmable IO

In this case, the behavior of the SD030 DX is the same of Scenario A but the length of the output command can be programmed by the user:

- outputs are normally open
- once closed, an output stays in this state according to the length set by the user (see Modbus registers 1260 t0 1262)
- for the opening command it is not possible to define a length because it is the normal state
- the opening command will open the output either the length has been terminated or not
- inputs are activated and deactivated according to the value of the applied voltage (see 3.3.2.2 and 7.1.3.)

To perform this scenario, the value of the CB actuator type (see Modbus Register 1270) must be 1.

5.3. Scenario C: Circuit Breaker supervisor

In this case, the device DOs are used to control the circuit breaker while DIs serve to acquire information about circuit breaker or protection unit informations.

The possible scenarios depend on the CB types managed by SD030 DX and are described in the following table.

CB type	Register no. 1270 Value	DO Actuation type	Springs	Protection	Circuit Breakers			Mode
			Discharged=0 Charged=1	Normal=0 Tripped=1	Isolated=0 Inserted=1	Open=0 Close=1	Normal=0 Tripped=1	Remote=0 Local=1
n.u.	0	see 5.1.						
n.u.	1	see 5.2.						
Isomax S1-S2	2	Solenoid operating mechanism for Isomax	NC	NC	DI3	DI4	DI1	NC
Isomax S3	3	Direct action motor operator for Isomax	NC	NC	DI3	DI4	DI1	NC
Isomax S4-S5	4		NC	DI2	DI3	DI4	DI1	NC
Isomax S6-S7*	5	Stored energy motor operation for Isomax	NC	DI2	DI3	DI4	DI1	NC
Tmax T1-T2-T3 3 wire solenoid*	6	Solenoid operating mechanism for Tmax	NC	DI2	DI3	DI4	DI1	NC
Tmax T1-T2-T3 5 wire solenoid	7							
Tmax T4-T5-T6*	8	Stored energy motor operation for Tmax	NC	DI2	DI3	DI4	DI1	DI5
Tmax T7* Emax X1*	9	SOR, SCR and trip reset for Tmax/ Emax	DI1	DI2	DI3	DI4	NC	DI5
New Emax E1 to E6* Old Emax E1 to E6*	10	YO, YC and trip reset for Emax	DI1	DI2	DI3	DI4	NC	DI5

Table 10. Circuit Breakers actuation

Legenda:

DI = Digital Input

NC = Not Connected

n.u. = connection to CB non expected in this scenario

* = with both AC and DC supply

Circuit diagrams related to these scenarios can be found in chapter 10 .

Note 4: A rearm time is necessary to charge the springs. A closing command can be propagated to the circuit breaker only if the springs are charged.

The informations about CB and protection unit status are collected in a single Modbus register (address 125 in Table 19.); the byte format is made as follow:

Mode	Protection	Circuit Breaker			
Remote=0 Local=1	Normal=0 Tripped=1	Normal=0 Tripped=1	Discharged=0 Charged=1	Isolated=0 Inserted=1	Open=0 Close=1
Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Table 11. Modbus register for CB status

6 OTHER OPERATIONS

6.1. General

At the start-up of the SD030 DX units, a procedure is immediately performed to verify that all LEDs work correctly:

- WD LED turns on
- all remanent LEDs turn on
- all LEDs but PWR switch off

Different procedure can be initiate by means of the Test push-button of SD030 DX, as explained in Table 2.

6.1.1. Reset

The reset procedure is executed when the Test push-button is pressed for about 1 sec:

all I/O channels become inactive and relevant LEDs are switched off.

After reset, the position of the dip-switches is updated, if different settings have been applied.

6.1.2. Self-test

The self-test procedure is executed by SD030 DX if the Test push-button on the front panel is kept pressed for about 5 sec:

- all LEDs light in succession and are kept on for about 1 second; then they are turned off simultaneously
- all I/O channels are activated and deactivated, while relevant LEDs are switched on and off

The procedure ends when the PWR LED is permanently ON.

This test helps to check if:

- the device operates correctly during initialization
- LEDs switch on and off correctly
- I/O channels work properly

Note 5: Unit reset is automatically carried out before self-test took place.

7 TECHNICAL CHARACTERISTICS

7.1. Electrical characteristics

Effective operation	Max 10 s after the power on
Electromagnetic compatibility	IEC 61947-2 IEC 60533

Table 12. Electrical characteristcs of system Flex Interfaces

Contact ABB SACE for informations about the ESD compliance standards.

7.1.1. Auxiliary power supply

The SD030 DX unit must be powered by an auxiliary supply.

Characteristics	SD030 DX
Supply voltage	24 Vdc ± 20%
Maximum ripple	± 5%
Nominal power @ 24 Vdc	2 W

Table 13. Auxiliary supply for SD030 DX

Since the auxiliary voltage must be isolated from the ground, it is necessary to use 'galvanically separeted converters', conforming to IEC standard 60950 (UL 1950) or equivalent IEC 60364-41, in order to guarantee a common mode current or a leakage current (as defined in IEC 478/1), not greater than 3.5mA.

7.1.2. DO internal relays characteristics

The digital output channels have a normally open contact connected to the terminal box and are independent by each other. The following table sums up the main characteristics of the relay used for each channel.

Load	Resistance Load (cos ϕ = 1)
Type	Monostable SPDT
Max breaking capacity	150 W, 2000 VA
Max breaking voltage	30 Vdc, 250 Vac
Max breaking current	5 A @ 30 Vdc 8 A @ 250 Vac

Table 14. Characteristics of DO relays

7.1.3. DI channel characteristics

The digital input channels support a voltage signal in the range 0V ... 24V where:

- the range 0V ... 4V will be seen as a not active digital singal (binary 0)
- the range 15V ... 24 V will be seen as an active digital signal (binary 1)
- the range 5V ... 15V will be seen as an undetermined digital signal

7.2. Mechanical characteristic

The mechanical characteristics of the SD030 DX case are the following:

Characteristic	Description
Case	Self-extinguish Noryl resin
Protection degree	IP20
Dimensions	see Figure 6.
Weight	100 g
Connectors	2 x 12 ways removables connectors (with screw terminals)

Table 15. Mechanical characteristics

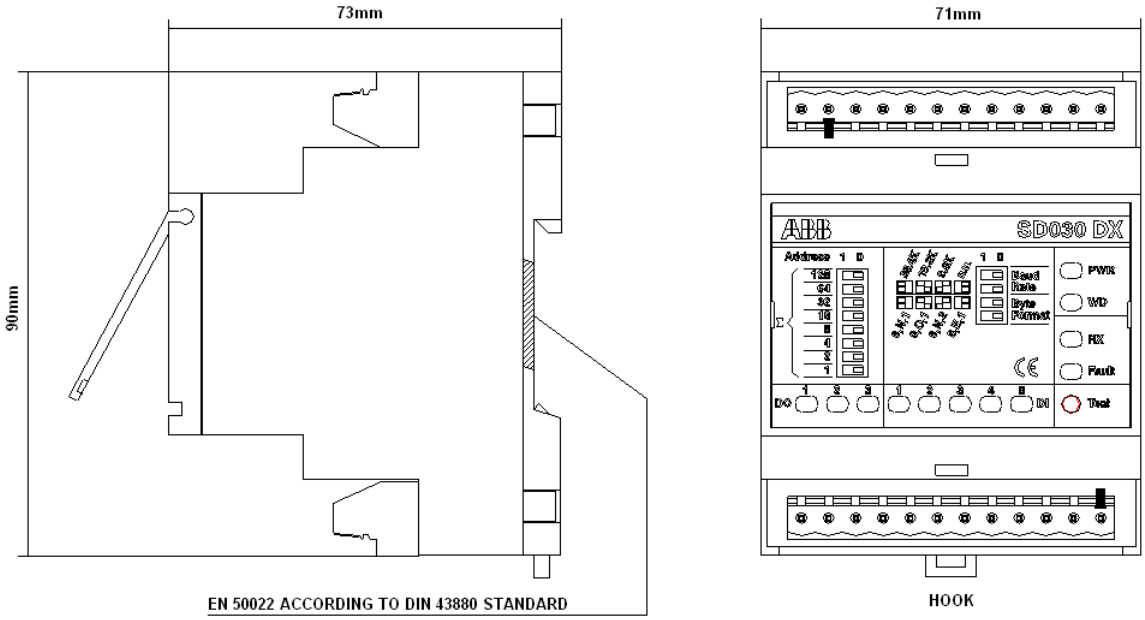


Figure 6. SD030 DX case dimensions

7.3. Environmental conditions

Characteristic	System Flex Interfaces
Operating environmental temperature	-25 °C ... +70 °C
Storage temperature	-40 °C ... +90 °C
Relative humidity	5% ... 98% with condensation (with coating)
Atmospheric pressure	1 bar, 0 m ... 2000 m

Table 16. Environmental conditions

7.4. RS-485 bus

The SD030 DX has got one serial bus used to communicate with other devices of the system.

It uses RS-485 as physical layer.

Each RS-485 channel is optically isolated and it is possible to connect at most 32 devices (using 32 different addresses from 1 to 247).

The connecting cable must be Belden 3105 with 120 Ohm characteristic impedence, or similar. Therefore, a 120 Ohm terminal resistor must be used.

The maximum length of the System bus is 300 m. In case of lot of stub connections, the bus length decreases accordingly.

8 TROUBLESHOOTING

The following table sums up a number of typical operational situations useful to understand and solve possible faults and malfunctions.

Note: Before consulting the following table, check the LEDs status on the front panel of the connected devices (wait for the start up phase to end if the system has just been powered up); see section 3.3.

Situation	Possible causes	Suggestions
SD030 DX does not turn on	Auxiliary voltage not present	• Check auxiliary supply connection • Check if the value of auxiliary supply is in the range specified in 7.1.1.
SD030 DX does not communicate	System malfunctioning (RX LED is blinking)	• Check the system
	Device malfunctioning (RX LED is OFF): • System bus disconnected or not properly connected • Wrong communication parameters • Wrong dip switch position • Slave address collision	• Check connections • Check communication parameters on system bus (see Modbus register 1028-1031) • Check the dip switch position (see Modbus register 504) • Check if there are not two or more devices on the system bus with the same address
WD LED is ON or blinking	Device malfunctioning	Contact ABB technical support
DO unexpected behavior or actuation failure	• Wrong CB actuator type • Wrong Modbus command • DO disconnected or not properly connected • Internal malfunction or fault condition • Different output mode • Bus fault • Different SW version	• Check the value in the Modbus register 1270 • Check the Modbus query • Check connections • Check the LED behavior according to 3.3. • Check the DO output mode in Modbus register 406 • Check the DOs behavior on bus fault (see Modbus registers 402 and 404) • Check the SW version on Modbus register 701
DI unexpected behavior	• DI disconnected or not properly connected • Internal malfunction or fault condition • Input level out of acceptable range • Wrong CB actuator type • Different SW version	• Check connections • Check the LED behavior according to 3.3. • Check the input level according to 7.1.3. • Check the value in the Modbus register 1270 • Check the SW version on Modbus register 701

Table 17. Troubleshooting for SD030 DX

If the previous list does not solve the problem and/or if you suspect that any device is faulty, malfunctioning or has generated unexpected behavior, we recommend you to follow the instructions below:

- Prepare a brief description of the problem ecountered
- Note down the serial number of the unit
- Send all the information gathered with your application circuit diagram to the nearest ABB technical support

9 SD030 DX MODBUS INTERFACE

9.1. Modbus function formats

9.1.1. Available Modbus Function

Function Code	Description
03 (03h)	Read Holding Registers
04 (04h)	Read Input Registers
06 (06h)	Write Single Register
16 (10h)	Write Multiple Registers

9.1.2. Function 03 (03h): Read Holding Registers

Query:

Addr	Function	Starting address		Number of Registers		Crc	
AA	03h	High	Low	High	Low	ch	cl

Response:

Addr	Function	Byte count	Register Value		Register Value		...	Crc	
AA	03h	nn	High	Low	High	Low	...	ch	cl

9.1.3. Function 04 (04h): Read Input Registers

Query:

Addr	Function	Starting address		No. of Inputs Registers		Crc	
AA	04h	High	Low	High	Low	ch	cl

Response:

Addr	Function	Byte count	Input Register		Input Register		...	Crc	
AA	04h	nn	High	Low	High	Low	...	ch	cl

9.1.4. Function 06 (06h): Write Single Register

Query:

Addr	Function	Register Address		Register Value		Crc	
AA	06h	High	Low	High	Low	ch	cl

Response (query echo):

Addr	Function	Register Address		Register Value		Crc	
AA	06h	High	Low	High	Low	ch	cl

9.1.5. Function 16 (10h): Write Multiple Registers

Query:

Addr	Function	Starting Address		Number of Registers		Byte Count	Register value		Register value		...	Crc	
AA	10h	High	Low	High	Low	nn	High	Low	High	Low	...	ch	cl

Response:

Addr	Function	Starting Address		Number of Registers		Crc	
AA	10h	High	Low	High	Low	ch	cl

Note: The lenght of all queries must be compliant with the maximum value allowable for Modbus messages (256 byte).

Legenda:

AA= slave address (1...247)

cl = CRC low byte

ch = CRC high byte

9.2. Exception responses

9.2.1. Illegal function

Addr	Function	Exception code	Crc		When...
AA	Function +80h	01	ch	cl	Device does not support the received fucntion code

9.2.2. Illegal data address

Addr	Function	Exception code	Crc		When...
AA	Function +80h	02	ch	cl	• Starting address is 9999 (standard addressing type) • Starting address is outside a map section (ABB Sace addressing type) • Starting address not defined • Strating address not supported by function

9.2.3. Illegal data value

Addr	Function	Exception code	Crc		When...
AA	Function +80h	03	ch	cl	• The message is too long • The number of items is not in range (=0 or >max number of items) • Byte counts is different form the expected value • The whole query requested buffer (starting address + number of items) does not belong to a device map buffer • Command value different from “1”

9.2.4. Slave device failure

Addr	Function	Exception code	Crc		When...
AA	Function +80h	04	ch	cl	• Data with congruency byte not valid

9.2.5. Slave device busy

Addr	Function	Exception code	Crc		When...
AA	Function +80h	06	ch	cl	• EEPROM busy • Commands inhibition

9.3. Modbus Map

Relative Address-1	Modbus Type: Analog Input	Modbus Type: Analog Output
	Function: 4	Function: 3, 6, 16
0÷1	Communication statistics	Commands (see Table 20.)
2÷4		
6÷8	DO number of operations counters	
20÷22		DO Open Command
30÷32		DO Close Command
100	Wink status	
102	DO status	
104	DI status	
120÷126	CB Operations Statistic	
400	Bus Inactivity Time	Bus Inactivity Time
404	DOs behavior on Bus Fault	DOs behavior on Bus Fault
406	DO Output Mode	DO Output Mode
504	Dip Switches	
506	Power Supply Value	
700	Slave ID	
701	SW version	
704÷711	Device Serial Number	
1028÷1031	Communication parameters	
1084÷1088	Tag Name	Tag Name
1089÷1093	User Data	User Data
1095	Date of Installation	Date of Installation
1096	Date of Test	
1260÷1262	DO actuation command time	DO actuation command time
1270	CB actuator type	CB actuator type

Table 18. SD030 DX Modbus Map

Rel addr-1	No. of item	Reg Name	Range	Default	Note
0	1	Number of received messages	0÷65535	-	
1	1	Number of received messages with CRC error	0÷65535	-	
2	1	Number of responses	0÷65535	-	
3	1	Number of slave busy responses	0÷65535	-	
4	1	Number of exception responses	0÷65535	-	
6	1	DO1 no. of operations	0÷65535	-	DO1 no. of close to open operations
7	1	DO2 no. of operations	0÷65535	-	DO2 no. of close to open operations
8	1	DO3 no. of operations	0÷65535	-	DO3 no. of close to open operations
20	1	DO1 Open Command	0÷1	-	1=open DO1
21	1	DO2 Open Command	0÷1	-	1=open DO2
22	1	DO3 Open Command	0÷1	-	1=open DO3
30	1	DO1 Close Command	0÷1	-	1=close DO1
31	1	DO2 Close Command	0÷1	-	1=close DO2
32	1	DO3 Close Command	0÷1	-	1=close DO3

Rel addr-1	No. of item	Reg Name	Range	Default	Note		
100	1	Wink status	0÷1	0	0=Wink Off 1=Wink On		
102	1	DO status	0÷255	-	Bit No.	Bit=0	Bit=1
					0	DO1 open	DO1 close
					1	DO2 open	DO2 close
					2	DO3 open	DO3 close
					3÷15	n.u.	n.u.
104	1	DI status	0÷255	-	Bit No.	Bit=0	Bit=1
					0	DI1 open	DI1 close
					1	DI2 open	DI2 close
					2	DI3 open	DI3 close
					3	DI4 open	DI4 close
					4	DI5 open	DI5 close
					5÷15	n.u.	n.u.
120	1	Number of CB trips	0÷65535	-	Number of CB normal to CB tripped transitions		
121	1	Number of Protection trips	0÷65535	-	Number of Protection normal to Protection trip transitions		
122	1	Number of CB manual operations	0÷65535	-	Number of CB close to CB open transitions not due to CB open command		
123	1	number of CB remote operations	0÷65535	-	Number of CB close to CB open transitions due to CB open command		
124	1	Number of CB operations	0÷65535	-	Number of CB manual operations + remote operations		
125	1	CB status informations	0÷65535	-	Bit No.	Bit=0	Bit=1
					0	CB open	CB close
					1	CB isolated	CB inserted
					2	Springs discharged	Springs charged
					3	CB normal	CB tripped
					4	Protection normal	Protection tripped
					5	Remote	Local
					6÷15	n.u.	n.u.
126	1	Last CB command result	0÷65535	-	0=OK 1=Processing 2=Open failure 3=Close failure 4=Reset failure 5=Springs failure		
400	1	Bus Inactivity Time	0÷60	5	Seconds to detect inactivity on bus		
404	1	Outputs behavior on Bus Fault	0÷1	0	0=Reset Output state 1=Keep Output state		
406	1	DO Output Mode	0÷255	-	Bit No.	Bit=0	Bit=1
					0	DO1 normal	DO1 latched
					1	DO2 normal	DO2 latched
					2	DO3 normal	DO3 latched
					3÷15	n.u.	n.u.
504	1	Dip Switches	0÷65535	-			
506	1	Power Supply value	0÷65535	-	Value of supply voltage in mV		
700	1	Slave ID	97÷105	-	103=SD030 DX		
701	1	SW version	0÷65535	-	MSB=Mayor version LSB=Minor version		

Rel addr-1	No. of item	Reg Name	Range	Default	Note
704	8	Device Serial Number	16 char	“00000000 ABB SACE”	1 byte for each character
1028	1	Slave Address	1÷247	-	
1029	1	Addressing type	0	0	0=Standard
1030	1	Baud rate	0÷2	Dip depending	0=9600 1=19200 2=38400
1031	1	Byte Format	0÷3	Dip depending	0=”E,8,1” 1=O,8,1” 2=”N,8,2” 3=”N,8,1”
1084	5	Tag Name	10 char	“CB.Name”	1 byte for each character
1089	5	User Data	10 char	“User.Data”	1 byte for each character
1095	1	Date of Installation	0÷65535	0	Number of days passed since 31 December 1999
1096	1	Date of Test	0÷65535	0	Number of days passed since 31 December 1999
1260	1	DO1 actuation command time	0÷65535	100	Actuation time (ms) Valid if CB actuator type=1 only
1261	1	DO2 actuation command time	0÷65535	100	Actuation time (ms) Valid if CB actuator type=1 only
1262	1	DO3 actuation command time	0÷65535	100	Actuation time (ms) Valid if CB actuator type=1 only
1270	1	CB actuator type	0÷10	0	0=SD030 DX used as standard IO 1=SD030 DX used as programmable IO 2=Isomax S1-S2 3=Isomax S3 4=Isomax S4-S5 5=Isomax S6-S7 (AC+DC) 6=Tmax T1-T2-T3 3-wire solenoid 7=Tmax T1-T2-T3 5-wire solenoid 8=Tmax T4-T5-T6 (AC+DC) 9=Tmax T7, Emax X1 (AC+DC) 10=Emax E1...E6, new Emax E1-E6 (AC+DC)

Table 19. Modbus registers for SD030 DX

9.3.1. Commands registers

Value	Command type (address=0)	Parameter (address=1)
0	Dummy	Don’t care
1	Electronic self-test	Don’t care
2	Reset Signals	Don’t care
3	Reset Communication statistics	Don’t care
4÷10	n.u.	-
11	Wink	0=Wink Off 1=Wink On

Table 20. Modbus command operations

10 CIRCUIT DIAGRAMS

10.1. SD030 DX

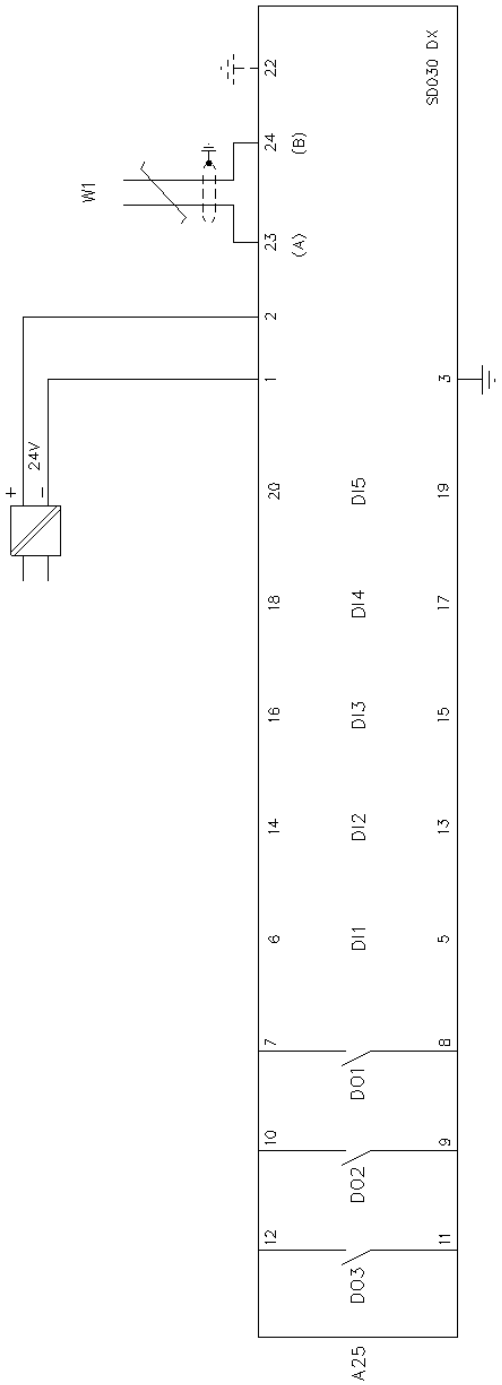


Figure 7. SD030 DX circuit diagram

10.2. New Emax E1 to E6 CB with DC supply

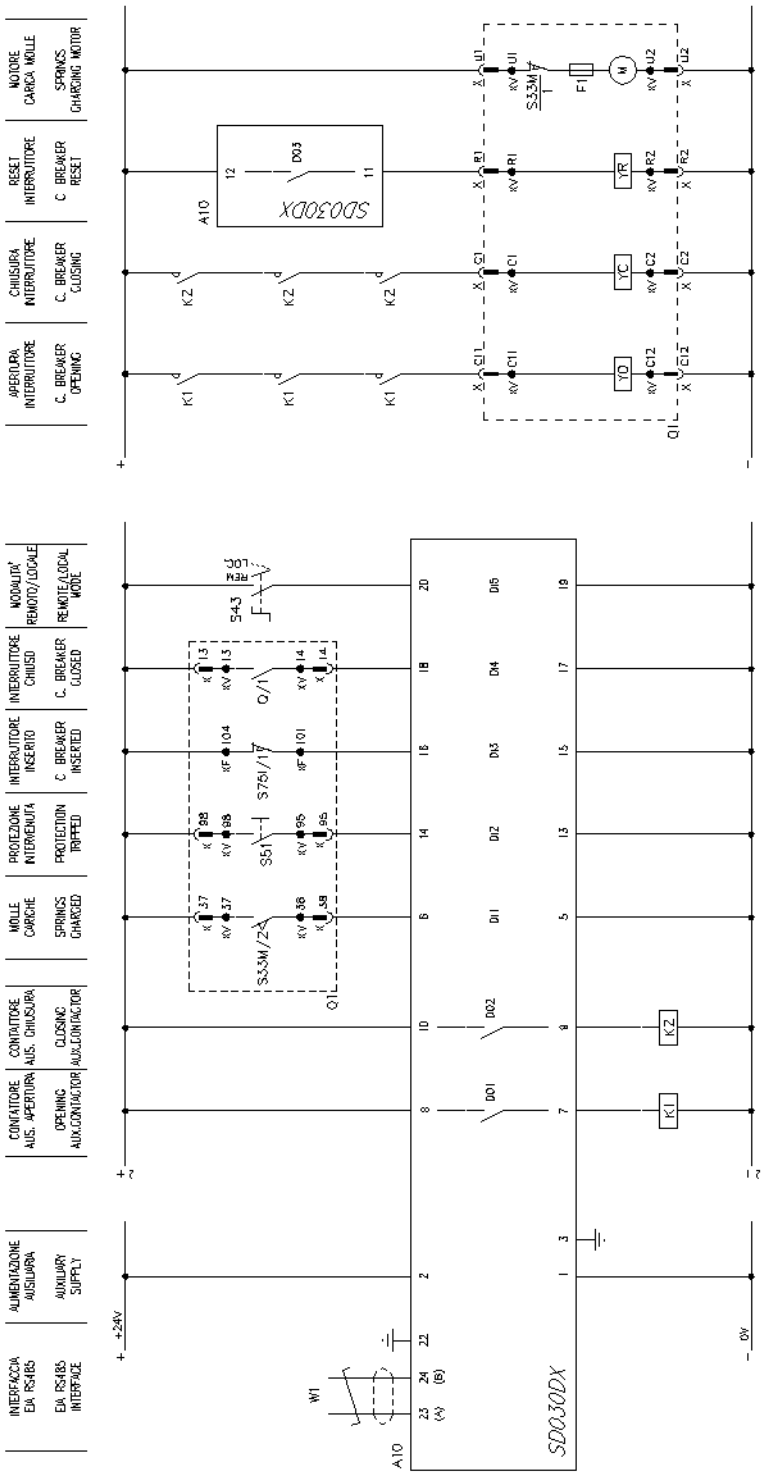


Figure 8. New Emax E1 to E6 CB with DC supply

10.3. New Emax E1 to E6 CB with AC supply

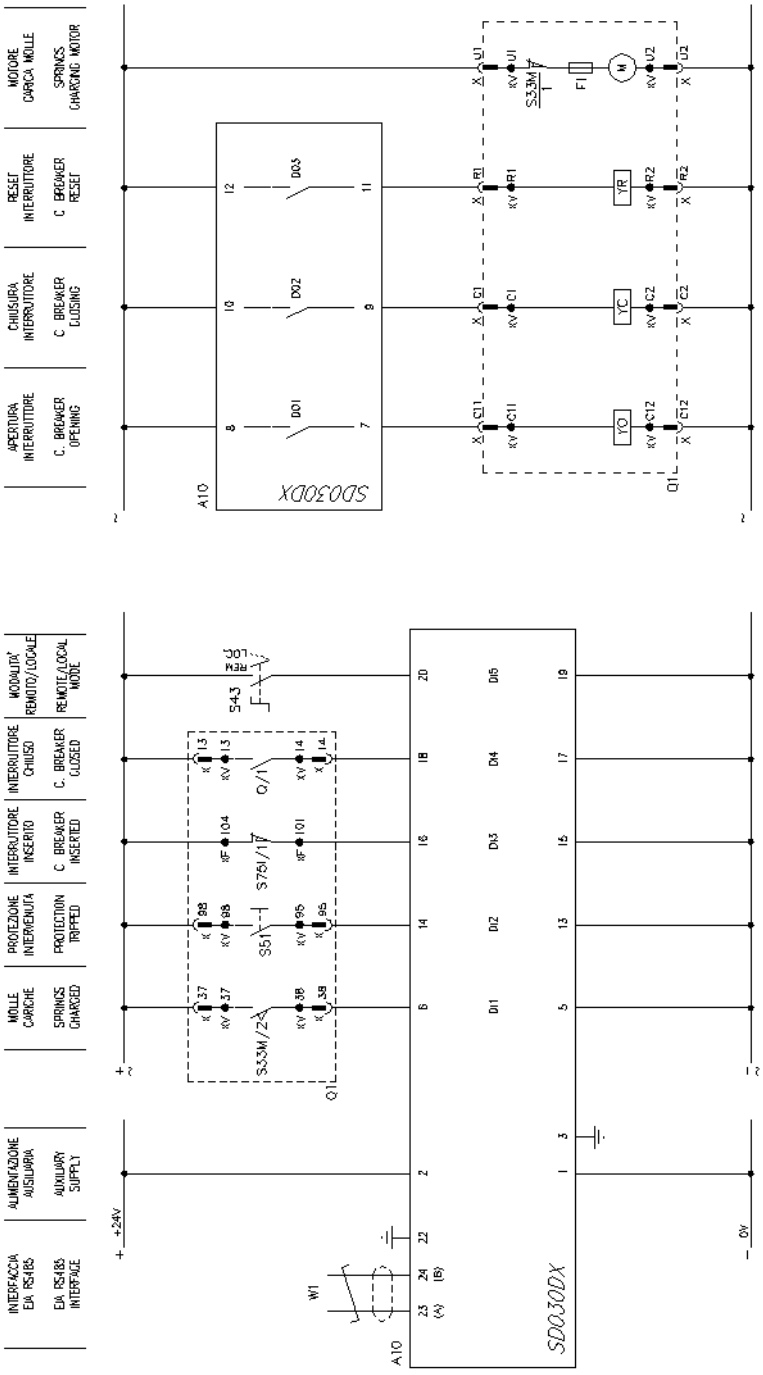


Figure 9. New Emax E1 to E6 CB with AC supply

10.4. Emax E1 to E6 CB with DC supply

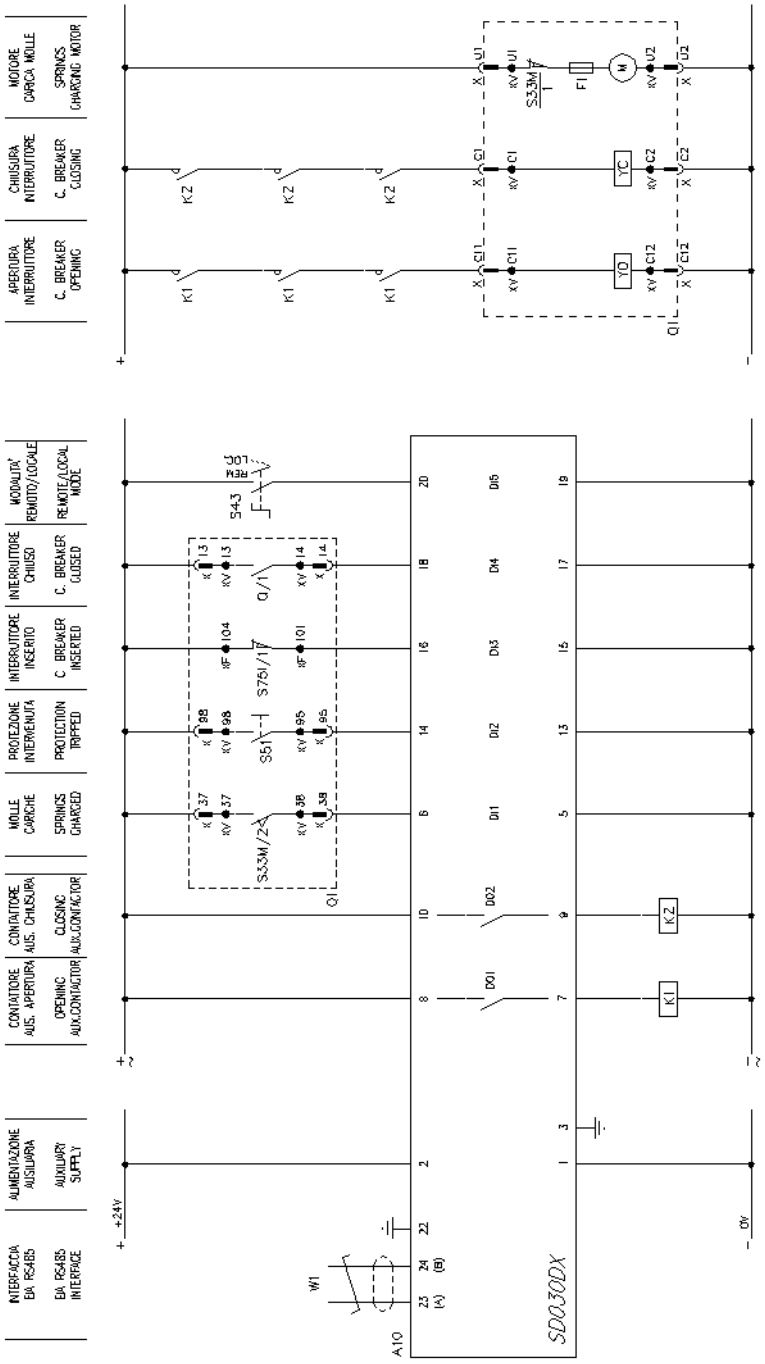


Figure 10. Emax E1 to E6 CB with DC supply

10.5. Emax E1 to E6 CB with AC supply

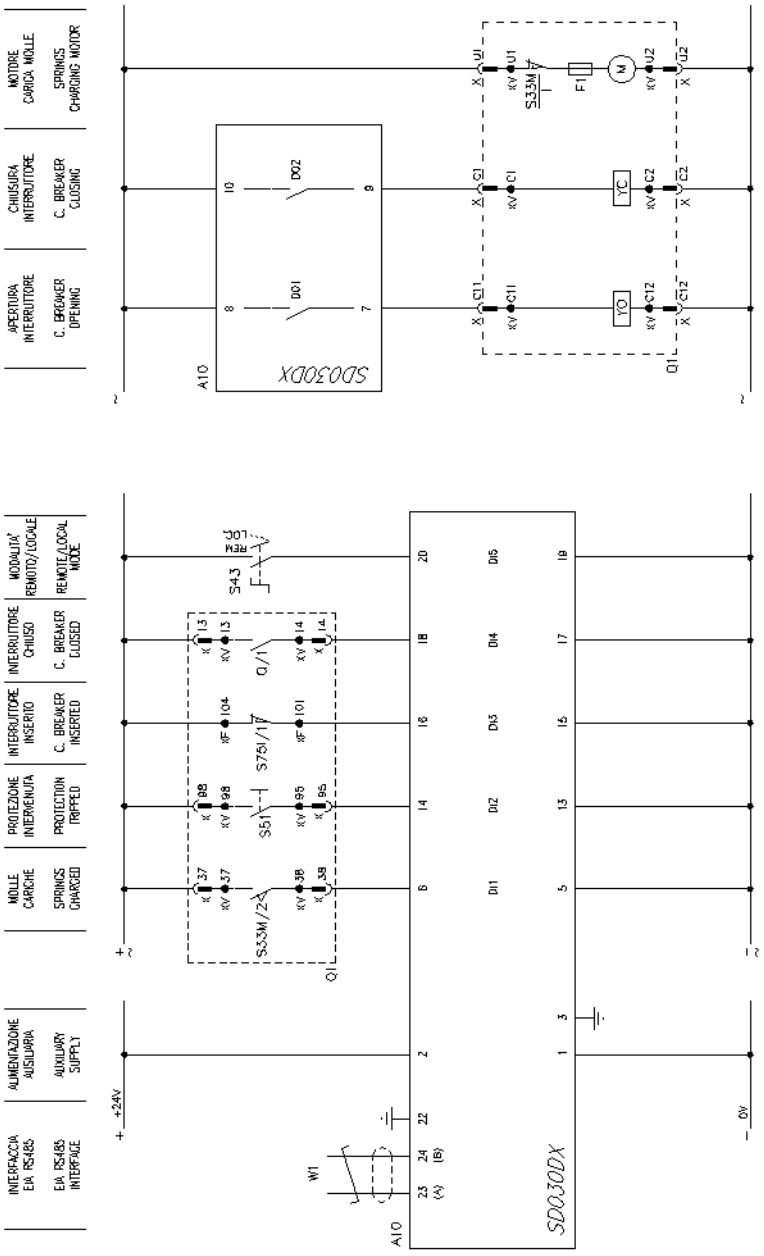


Figure 11. Emax E1 to E6 CB with AC supply

10.6. Tmax T7 and Emax X1 CBs with DC supply

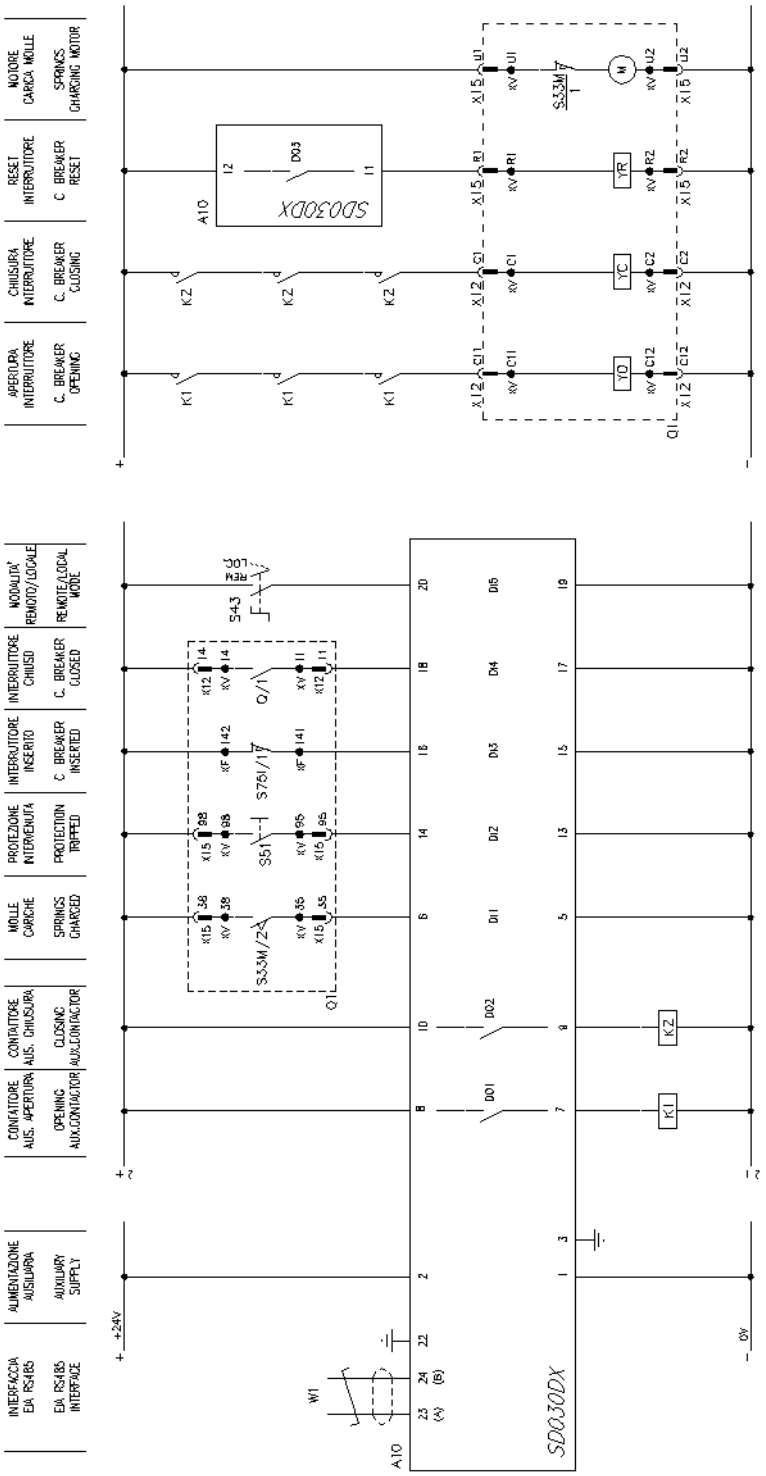


Figure 12. Tmax T7 and Emax X1 CBs with DC supply

10.7. Tmax T7 and Emax X1 CBs with AC supply

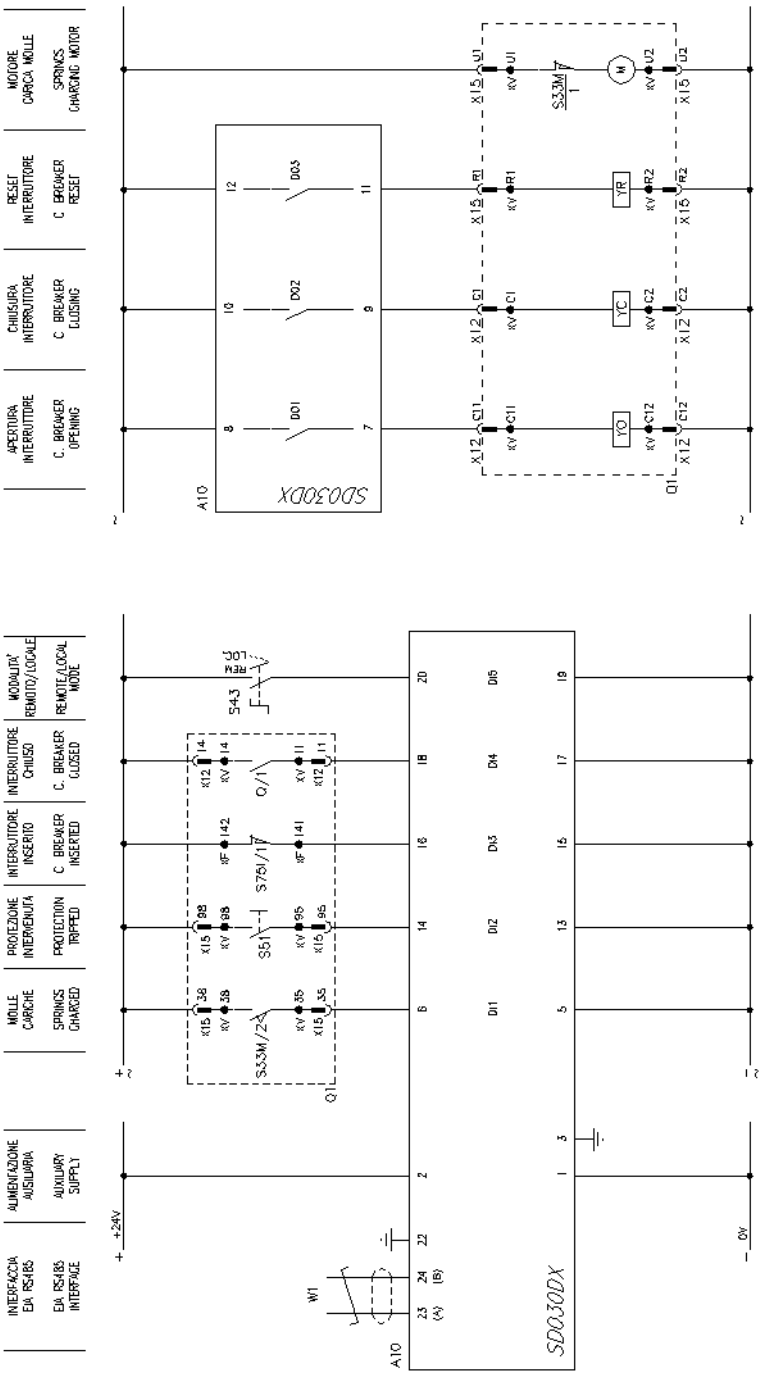


Figure 13. Tmax T7 and Emax X1 CBs with AC supply

10.8. Tmax T4-T5-T6 CBs with DC supply

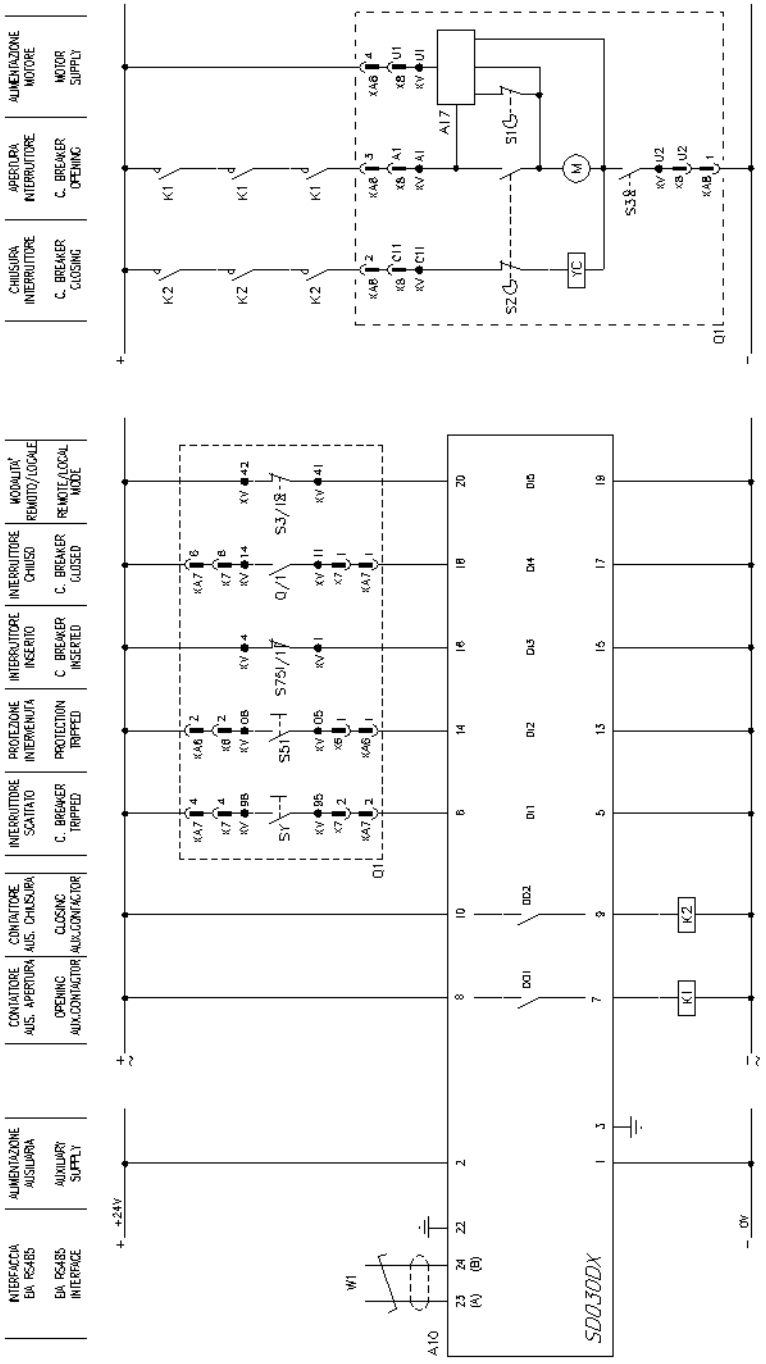


Figure 14. Tmax T4-T5-T6 CBs with DC supply

10.9. Tmax T4-T5-T6 CBs with AC supply

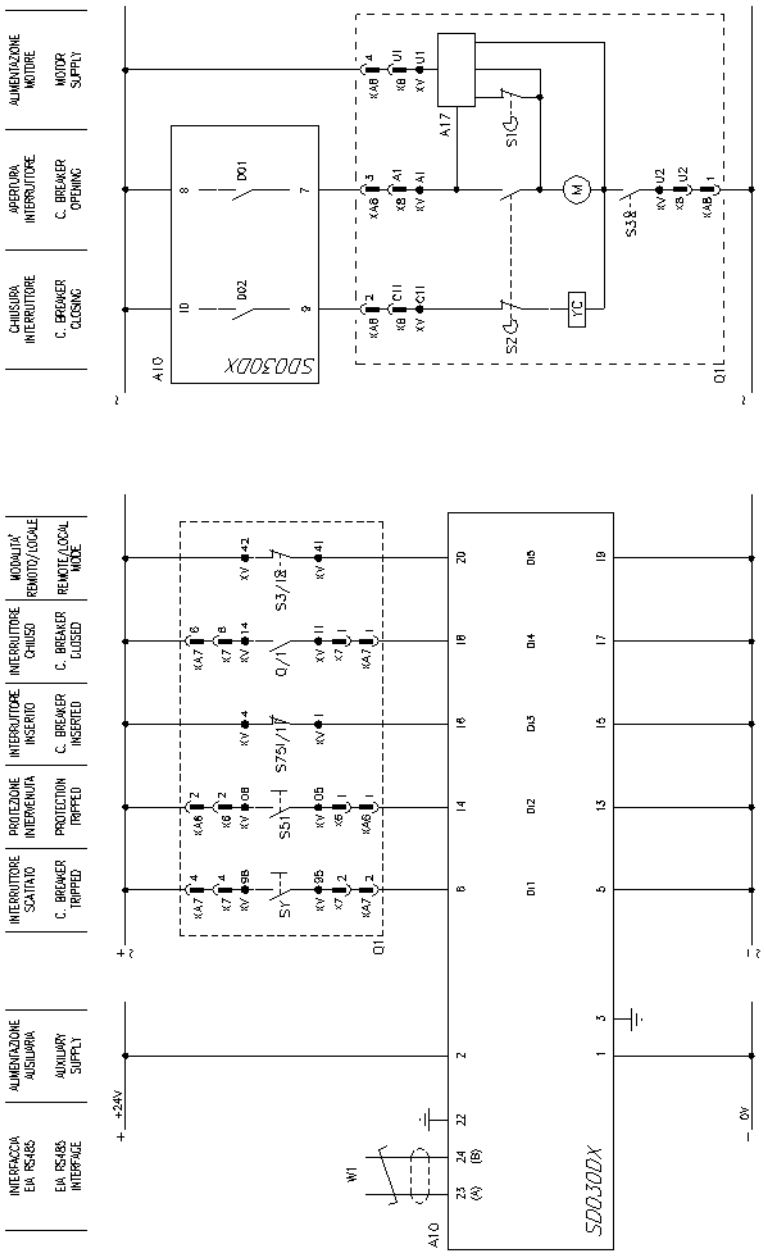


Figure 15. Tmax T4-T5-T6 CBs with AC supply

10.10.Tmax T1-T2-T3 CBs 5-wire solenoid operator

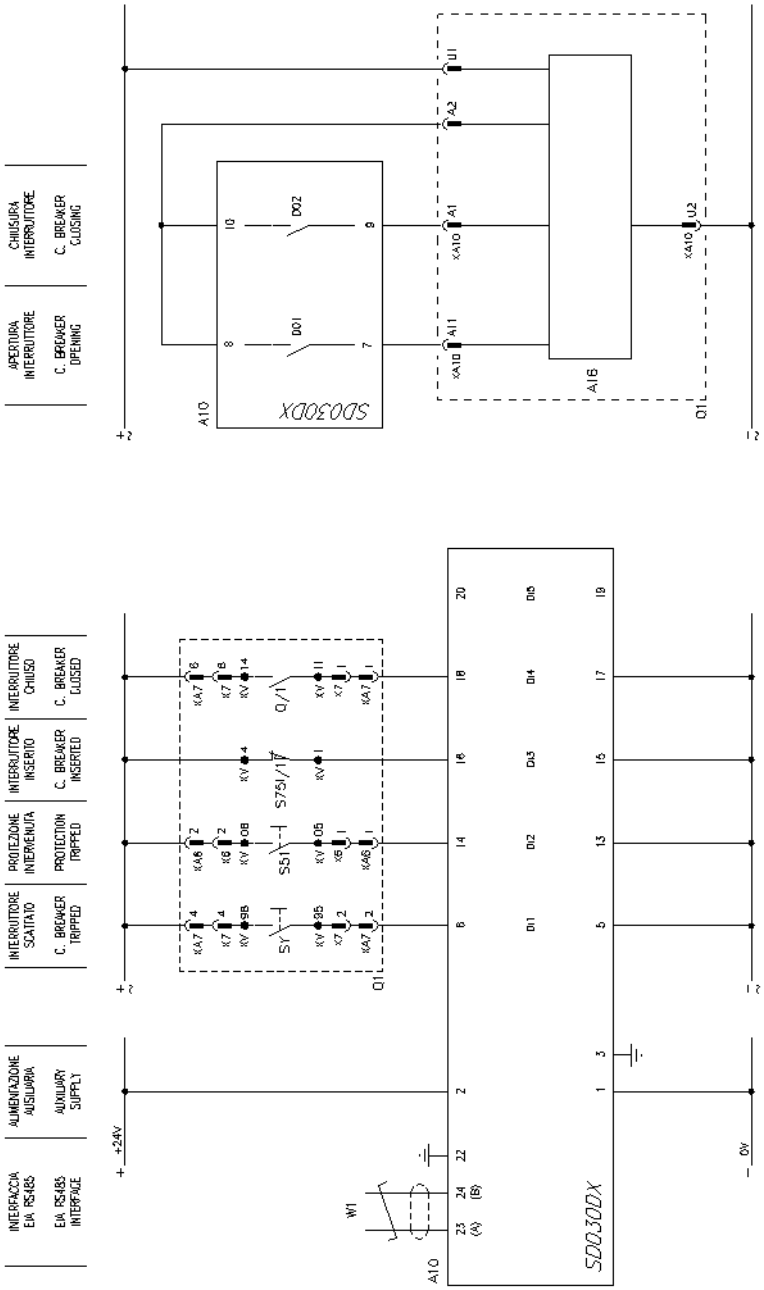


Figure 16. Tmax T1-T2-T3 CBs 5-wire solenoid operator

10.11.Tmax T1-T2-T3 CBs 3-wire solenoid operator DC supply

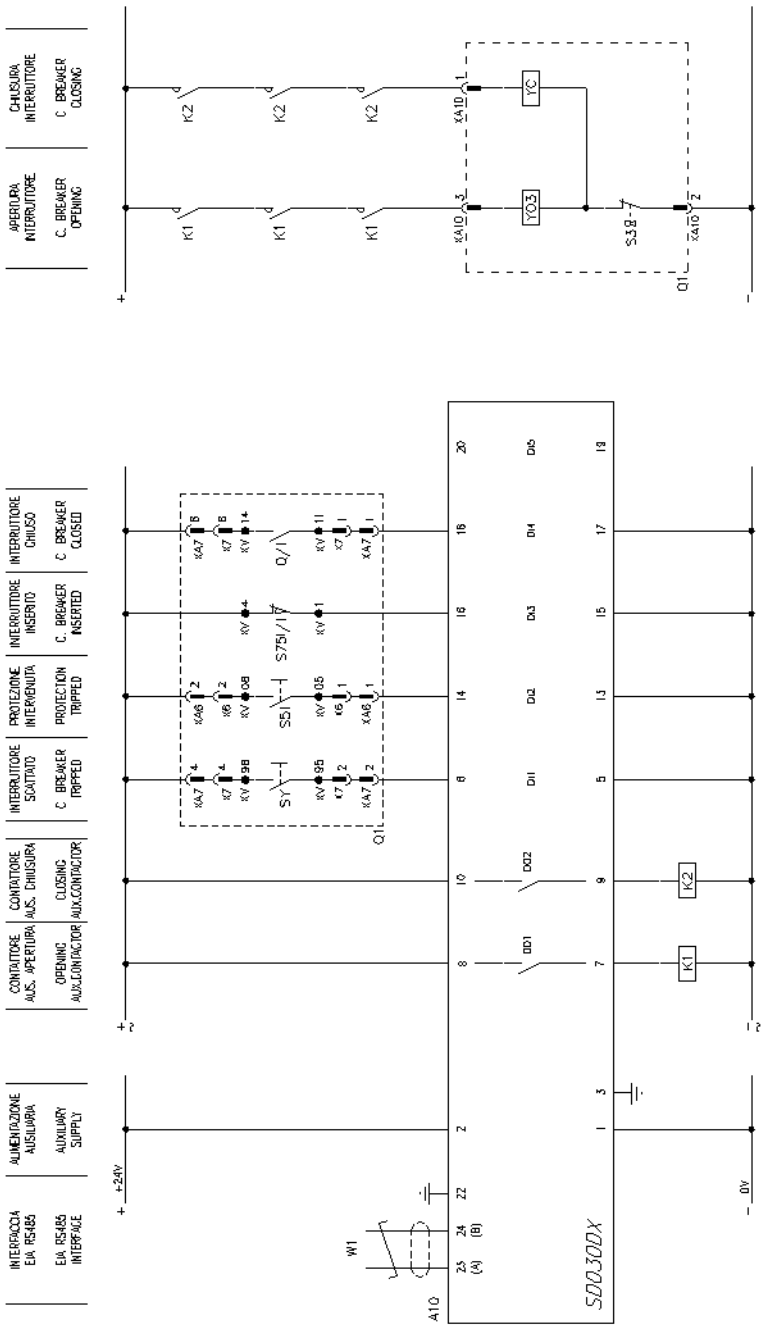


Figure 17. Tmax T1-T2-T3 CBs 3-wire solenoid operator DC supply

10.12.Tmax T1-T2-T3 CBs 3-wire solenoid operator AC supply

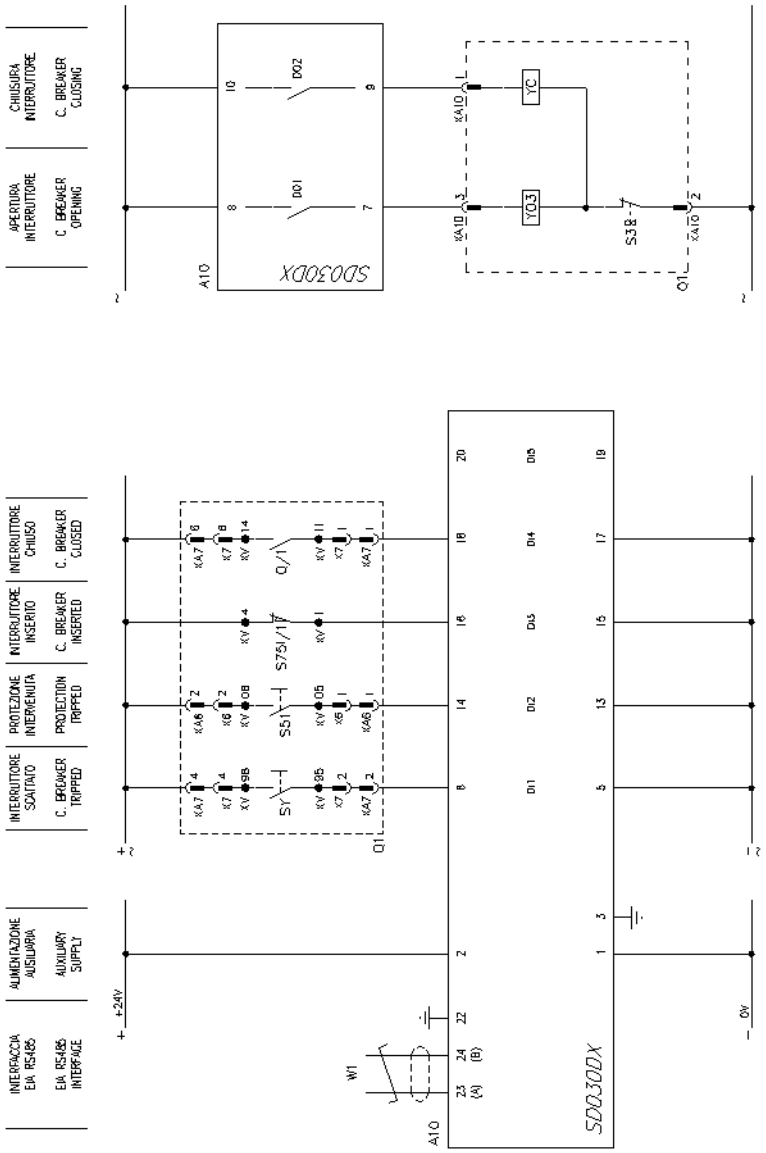


Figure 18. Tmax T1-T2-T3 CBs 3-wire solenoid operator AC supply

10.13.Isomax S6-S7 CBs DC supply

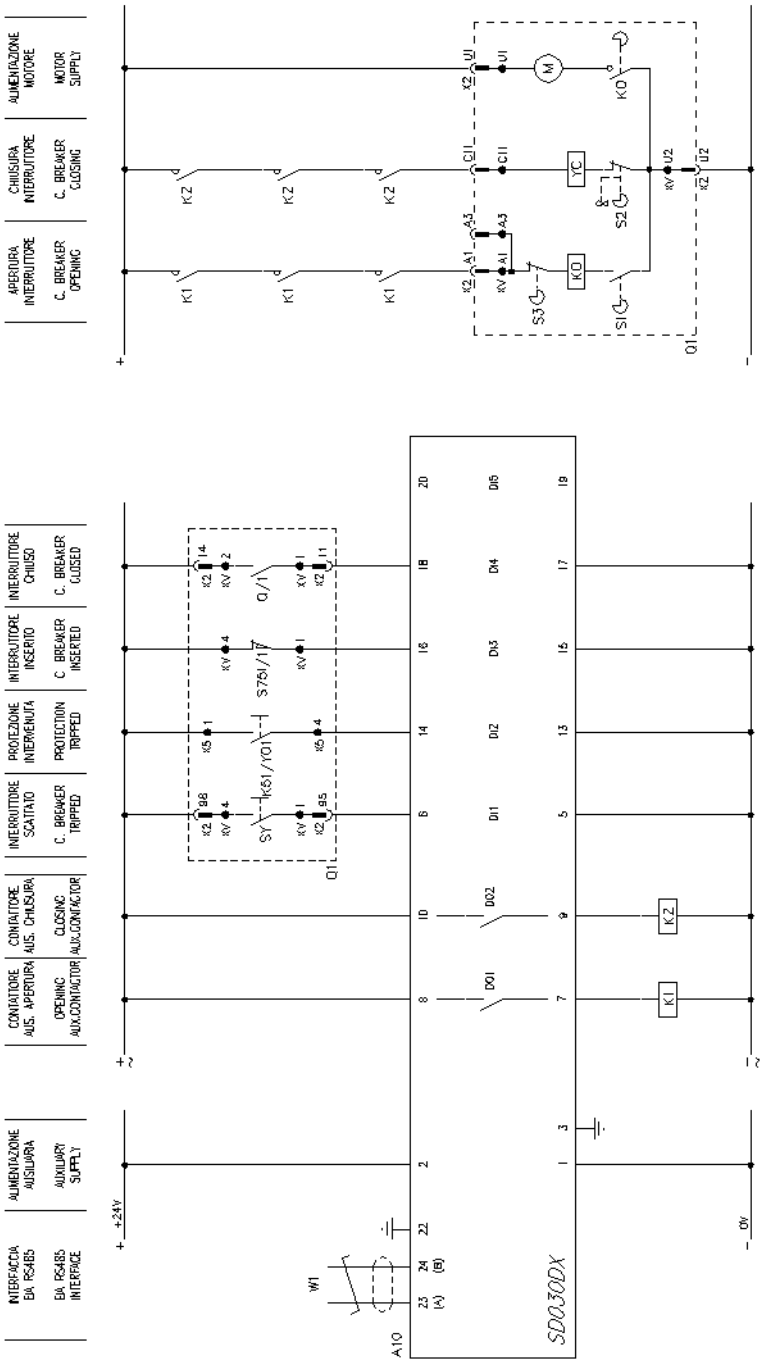


Figure 19. Isomax S6-S7 CBs DC supply

10.14.Isomax S6-S7 CBs AC supply

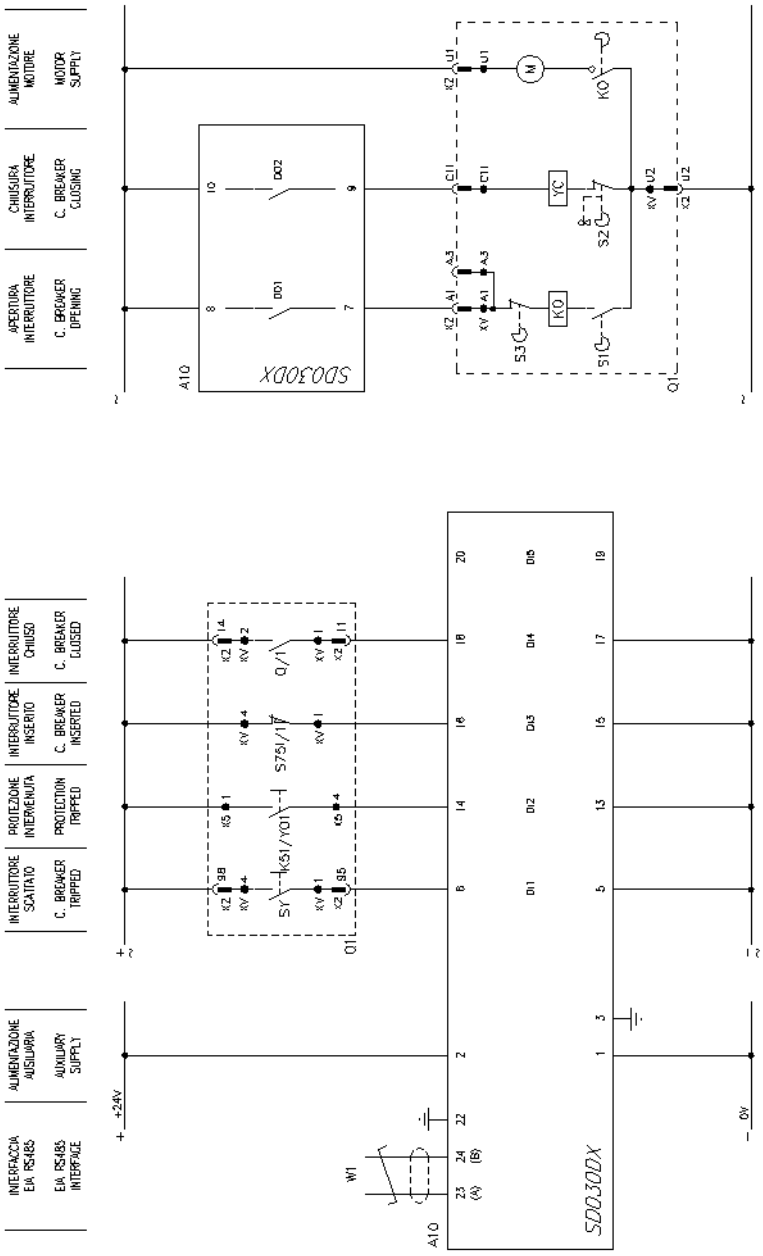


Figure 20. Isomax S6-S7 CBs AC supply

10.15.Isomax S4-S5 CBs

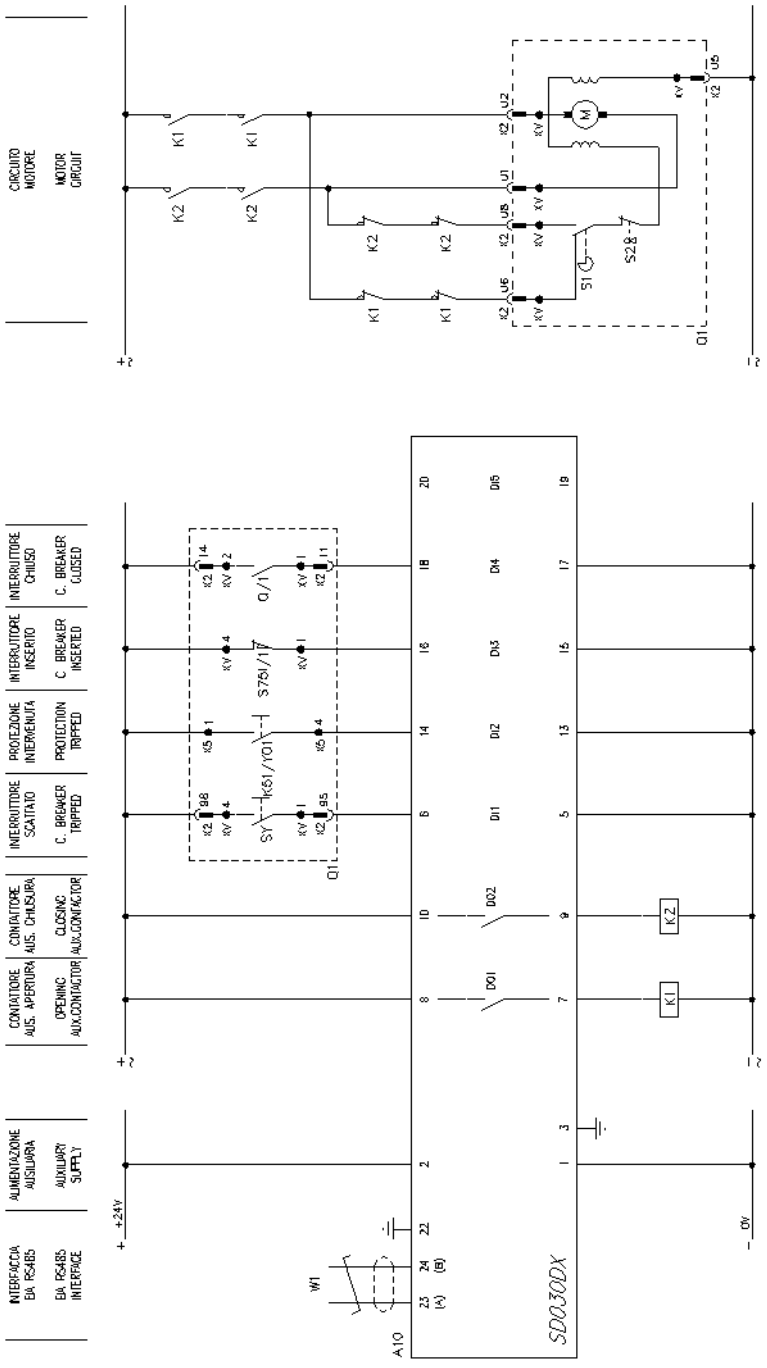


Figure 21. Isomax S4-S5 CBs

10.16.Isomax S3 CB

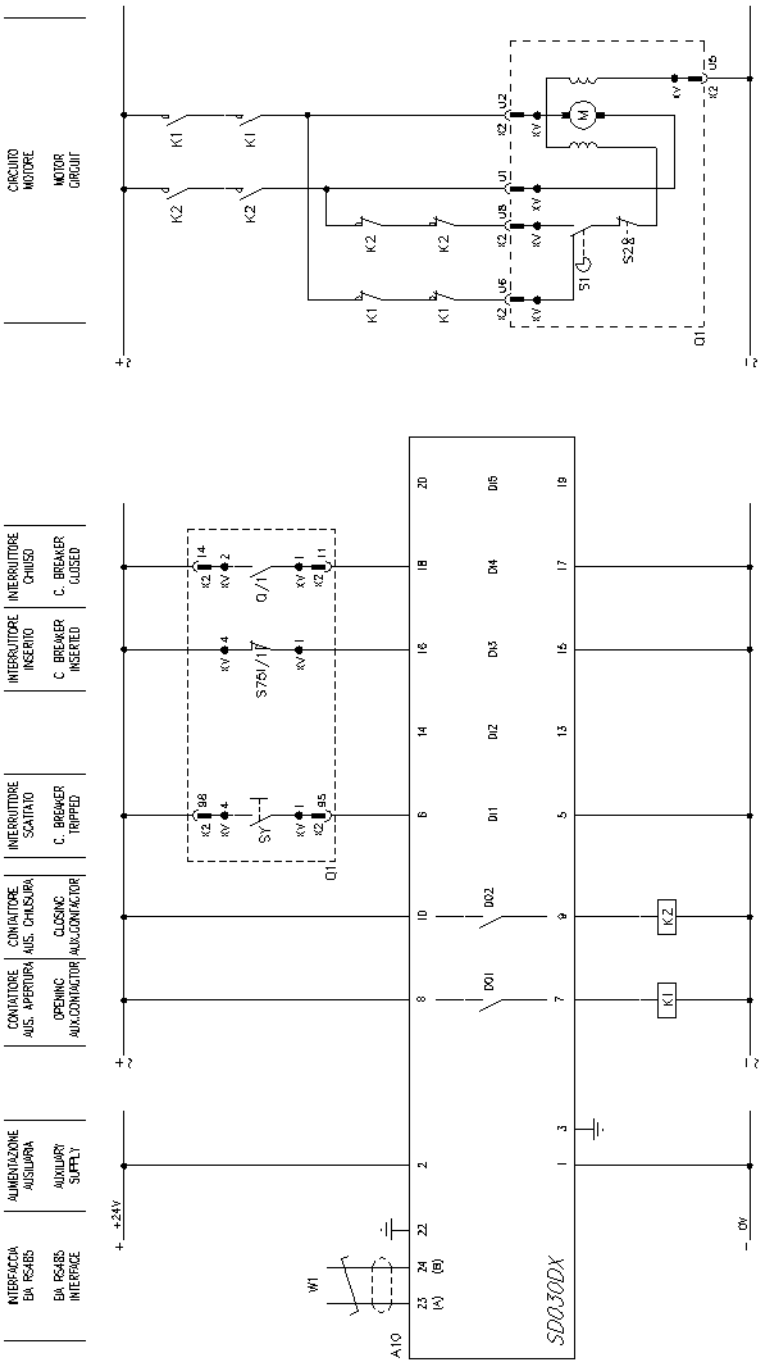


Figure 22. Isomax S3 CB

10.17.Isomax S1-S2 CBs DC supply

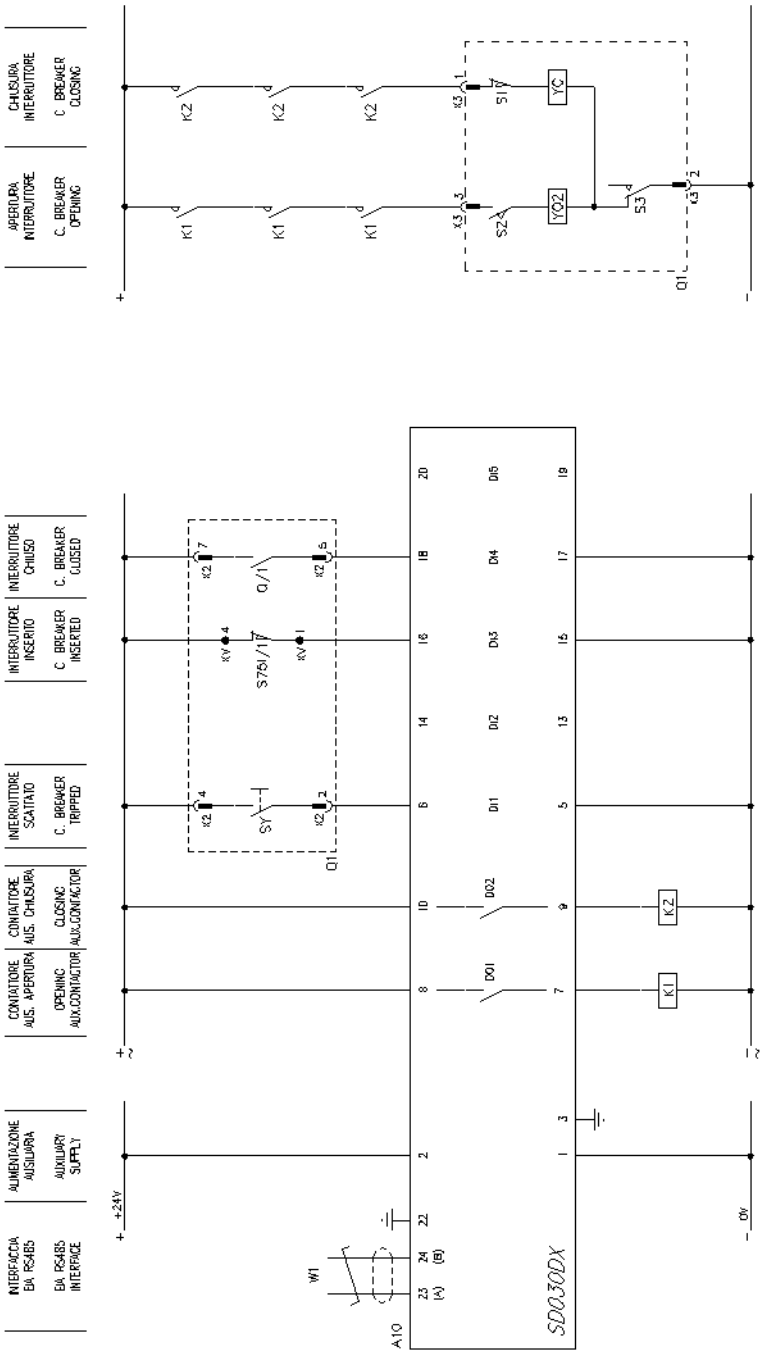


Figure 23. Isomax S1-S2 CBs DC supply

10.18.Isomax S1-S2 CBs AC supply

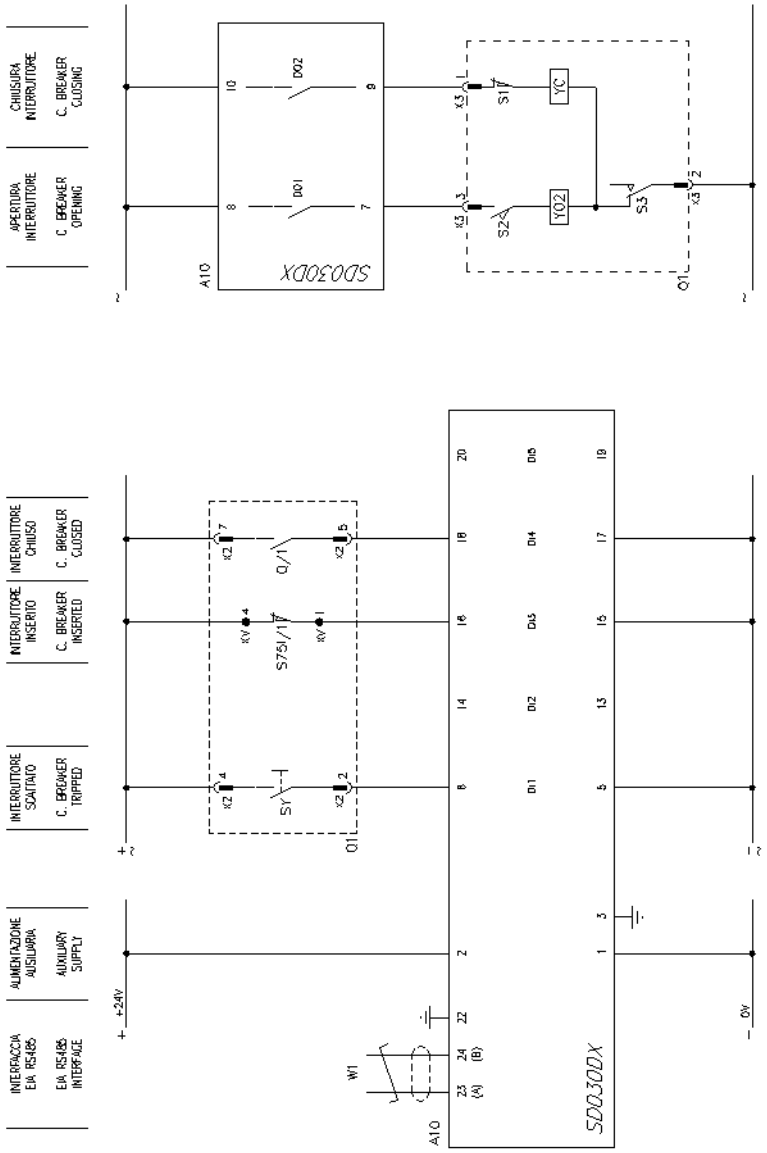


Figure 24. Isomax S1-S2 CBs AC supply

10.19.Graphical symbols for electrical diagrams (617 IEC standards)

Caption	Description
A10	Device type SD030 DX
DI	Digital Input
DO	Digital Output
K1-K2	Contactors type ABB BC6 for circuit breakers control
Q1	Circuit breaker (or switch disconnector) to connect to EIA RS485 bus
S43	Selector switch for REMOTE/LOCAL mode
W1	Connection interface to EIA RS485 bus

Table 21. Description of electrical diagrams captions

For captions, notes and symbols circuit breakers internal circuit, see relative circuit diagram.

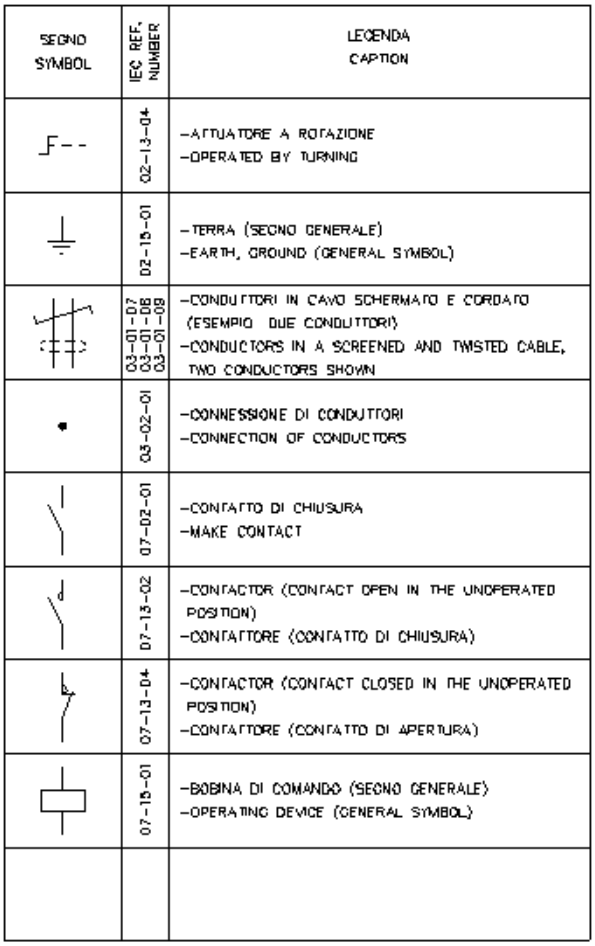


Figure 25. Graphical symbols used in circuit diagrams