FLXMOD

smitec

DIO 16

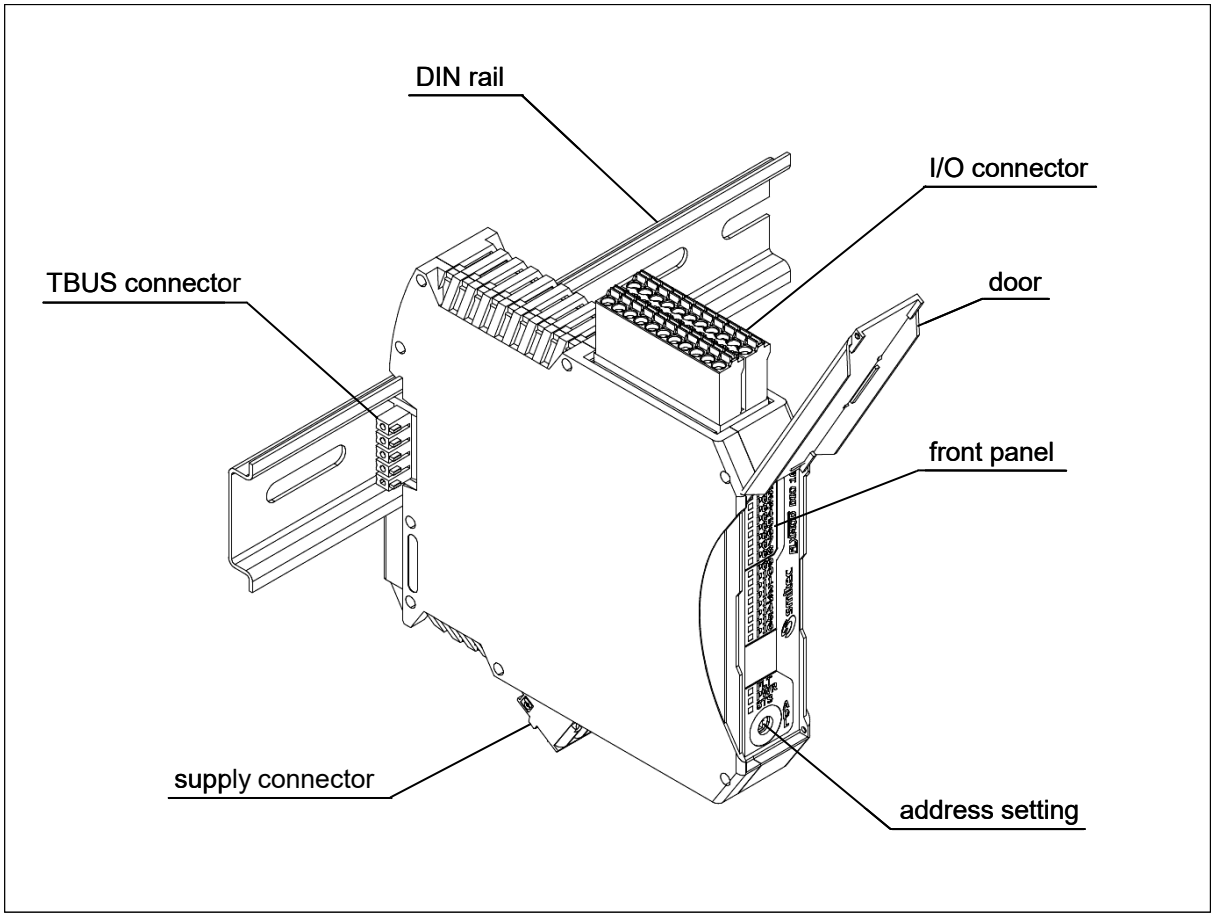
Module with 16 digital inputs/outputs

Datasheet

Description

Module with 16 digital inputs/outputs; any I/O pin of the connector could be used as input (current sinking) or output (current sourcing).
Main characteristics:

- 16 digital inputs/outputs
- Type 1 and Type 3 inputs
- Maximum output current: 500 mA for each output, 7 A total
- Overcurrent and overtemperature protection
- Status and diagnostic LEDs



Ordering informations

Products	SMITEC part number
Module with 16 digital inputs/outputs, complete with accessories (power connector, I/O connector and TBUS connector)	KZ010195

Accessories	SMITEC part number
Power supply connector (Phoenix Contact p/n 1910377)	KF100009
I/O connector (Phoenix Contact p/n 1738898)	KF101048
TBUS connector (Phoenix Contact p/n 2713722)	KF101034
Power supply fuse (Littelfuse p/n 0451 010)	KD201038

Documentation	SMITEC part number
Installing instructions	DK400042
Datasheet for DIO 16	DK400065
FLXIO and FLXMOD system integration manual	DK400076

Technical data

General data	
Housing dimensions (width x height x depth)	22.5 mm x 99.0 mm x 114.5 mm
Weight	103 g (without connectors), 125 g (with connectors)
Connection method for connectors	Spring cage terminals
Conductor cross-section (power connector)	0.2 to 2.5 mm^2 (24 – 12 AWG)
Conductor cross-section (I/O connector)	0.2 to 1.5 mm^2 (24 – 16 AWG)
Functional earth connection	To the DIN rail with spring contact
Mode state visual indicators	Fault (FLT), status (STS) and power (PWR) LED lamps on front panel

Environment data	
Permissible operating temperature	+5° to +45°C full load +5° to +55°C with output derating
Permissible storage and transport temperature	-25° to +85°C
Permissible humidity	10% to 95%, not condensing
Permissible air pressure (operation)	80 to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage and transport)	70 to 106 kPa (up to 3000 m above sea level)
Degree of protection (CE)	IP20 according to IEC 60529
Degree of protection (UL)	Open Type
Overvoltage category	II
Vibration resistance	f=10-150-10 Hz, sweep 1 octave/min, amplitude 0.15mm (10÷58.1 Hz), acceleration 2g (58.1÷150 Hz), duration 2.5h each X-Y-Z axis, according to IEC 60068-2-6
Pollution degree	2
Means of protection (UL)	Class III SELV power supply

Power supply	
Main power supply V_M	24 V DC ⎓ (-15% ÷ + 20% according to IEC 61131-2)
Maximum allowed ripple	5% of supply voltage (according to IEC 61131-2)
Current consumption from main supply	7 A max. (total of digital outputs and Vs current)
Supply overvoltage protection on V_M	Unidirectional Zener clamp (V_z > 30 V)
Supply reverse polarity protection on V_M	Input shunt diode, reverse connected
Supply fuse	10 A, not replaceable by the user
Local bus power supply	5 V DC (from local bus)
Local bus supply protections	None
Power presence visual indicators	Green LED lamp, lighted if main supply is present (PWR)
Power load from local bus at 5V DC	Approx. 0,7W
Power load from local bus at 24V DC	None
Total power dissipation	Approx. 0,7W + 0,25W for each output at full load (resistive with f=500Hz) or 0,15W for each output at full load (resistive with f=0Hz) + 0,1W for each input at high-level
Max. current on V_S pin	7 A max.

Digital inputs	
Number of inputs	16
Nominal input voltage	24 V DC
Nominal input current	2.5 mA
Common potentials	GND, common to all inputs
Input design	According to IEC 61131-2 Type 1 and Type 3 (also Type 2 with external resistor)
Maximum low-level threshold	$V_{L,max} < 5$ V
Minimum high-level threshold	$V_{H,min} > 11$ V
Permissible input voltage	-5 V ÷ +30 V (-24 V min. for 1 minute)
Input protections	Protection over voltage transients and voltage reversing (see also digital outputs)
Input reading delay	Depending on local bus cycle time
Permissible cable length to the sensor	30 m (to ensure conformance with EMC directive 2014/30/UE)
Input state visual indicators	One orange LED lamp for every input, switched on if input level is high

Digital outputs	
Number of outputs	16
Nominal output voltage	24 V DC
Outputs rated current	500 mA each, 7.0A max @ 45°C total 500 mA each, 5.3A max @ 55°C total
Common potentials	GND, common to all outputs
Output design	High-side MOSFET with inductive load Zener clamp
Output voltage drop	< 1 V at rated current
Nominal load (ohmic)	48 Ω / 12 W
Nominal load (lamp)	12 W
Nominal load (inductive)	12 VA (load inductance < 1 H)
Short circuit current	1.7 A max.
Output protection	Overload, short circuit, overtemperature
Overload response	Restartable by bus master command
Overload and short-circuit recovery time	Depending on board temperature
Overtemperature recovery time	Depending on board temperature
Inductive kickback behaviour	Zener clamp, integrated in output chip
Output negative voltage	52 V below V_m typical
Output off to on switching delay	150 µs max. (ohmic load)
Output on to off switching delay	200 µs max. (ohmic load)
Output leakage current	10 µA max.
Permissive cable length to the load	30 m (to ensure conformance with EMC directive 2014/30/UE).
Output state visual indicator	One orange LED lamp for every output, switched on if output level is high

Interface	
Local bus	Proprietary FLXIO™
Module address setting	By rotary switch on front panel
Bus connections	By TBUS connector on DIN rail
Interface circuitry protections	ESD protections
Level of ESD protection	±8 kV (IEC 61000-4-2, contact discharge)

Connections

The module has two connectors: a power connector and an I/O connector. They allow easy “plug and play” of the module, and also a fast replacement of a faulty unit.

Warning: Use a cable with cross-section suited to the current involved. A wire smaller than necessary could cause risk of fire and unwanted voltage drops.

Warning: To ensure conformance with EMC directive 2014/30/UE, the length of the cables must not exceed 30 m!

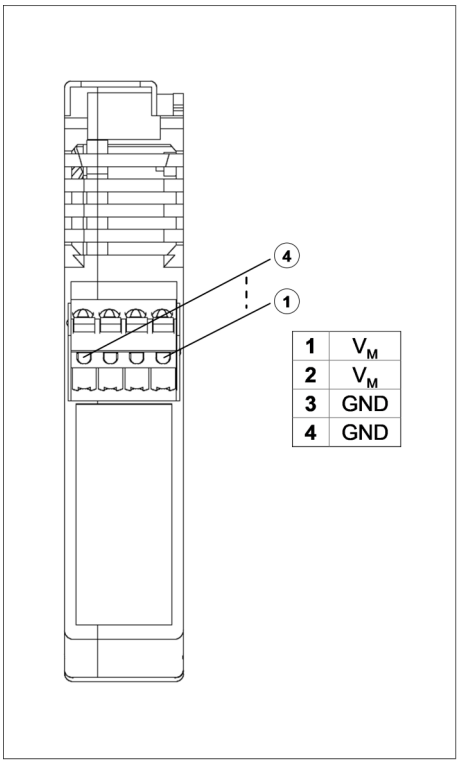
Warning: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired

Power connector

The power connector is located on the bottom wall of the module. For the pinout, refer to the illustration.

Its function is to provide the supply for the I/O circuitry, whilst the CPU of the module is fed by the TBUS connector on the back of the unit.

Refer to the FLXIO and FLXMOD System Integration Manual for power connections topology.



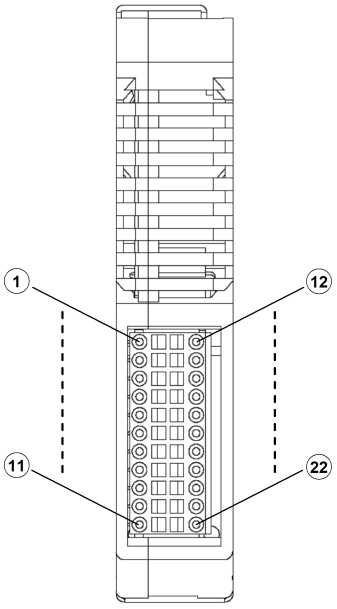
For connector ratings and the applicable wiring refer to the following table

Connector type: Phoenix Contact FKC 2,5/ 4-ST (1910377) **Order code: KF100009**			
Technical data		**Conductor cross section**	
Nominal voltage (CE)	250V	Solid (CE)	0,2÷2,5mm²
Nominal voltage (UL)	300V	Solid (UL)	26÷12AWG - 75°C
Nominal current (CE)	12A	Flexible (CE)	0,2÷2,5mm²
Nominal current (UL)	10A	Flexible (UL)	26÷12AWG - 75°C
		Flexible, with ferrule without plastic sleeve	0,25÷2,5mm²
Stripping length	10mm	Flexible, with ferrule with plastic sleeve	0,25÷2,5mm²
Screwdriver to open contacts	0,6 x 3,5mm	2 flexible conductors with same cross section, stranded, TWIN ferrules with plastic sleeve	0,5÷1,5mm²

Warning: Pay attention to NOT supply the module with reverse polarity. This is to not blow internal fuse and/or damage the connected devices and/or burn the module itself.

I/O connector

Located on the upper side of the module, this connector (see illustration) permits the wiring of sensors and actuators.
As you can see from the illustration, each row of the connector has the same pinout, to ease the wiring and prevent mistakes.



1	FE	**12**	FE
2	V_s	**13**	V_s
3	GND	**14**	GND
4	IO.01	**15**	IO.09
5	IO.02	**16**	IO.10
6	IO.03	**17**	IO.11
7	IO.04	**18**	IO.12
8	IO.05	**19**	IO.13
9	IO.06	**20**	IO.14
10	IO.07	**21**	IO.15
11	IO.08	**22**	IO.16

For connector ratings and the applicable wiring refer to the following table

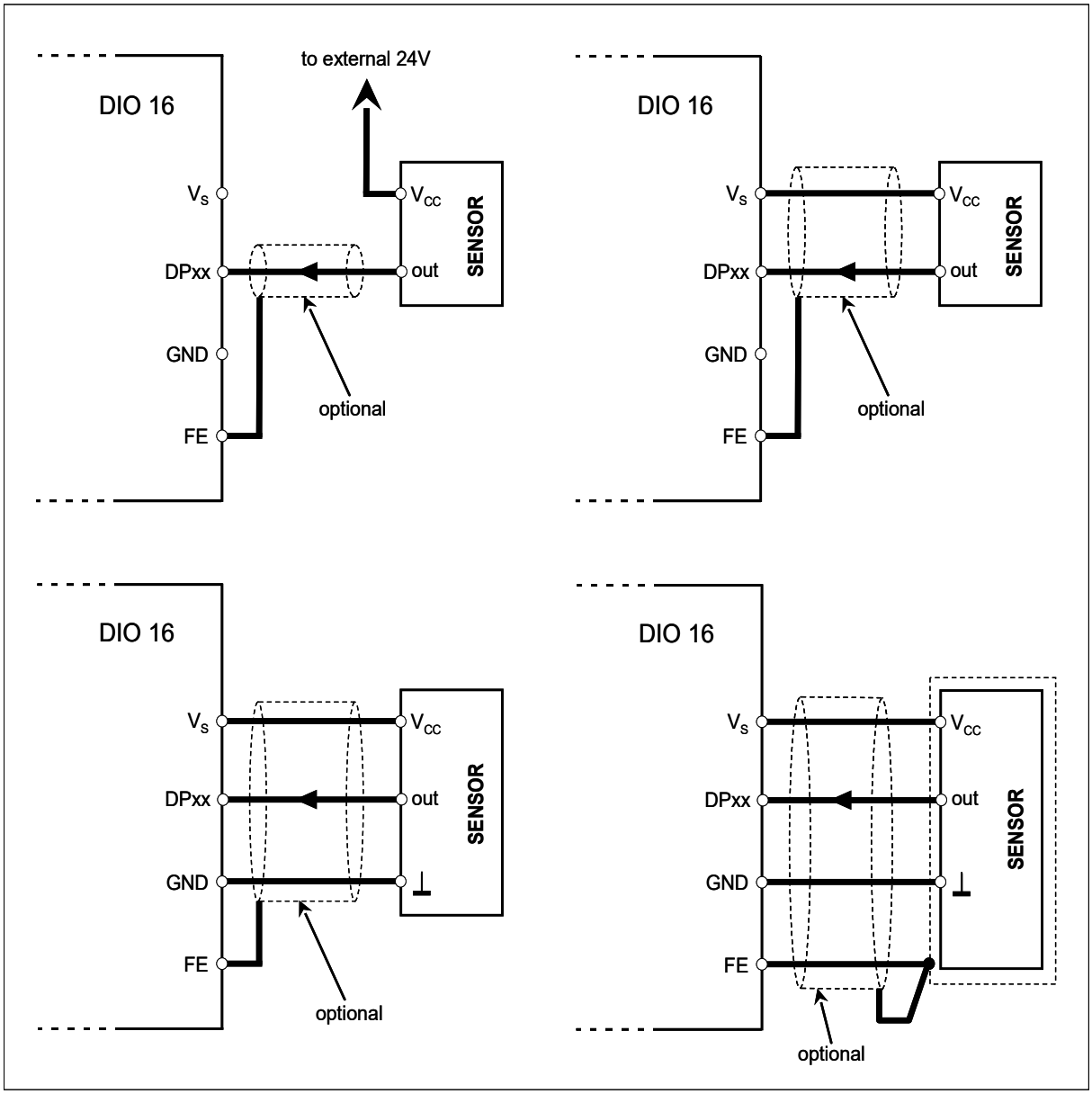
Connector type: Phoenix Contact FMCD 1,5/11-ST-3,5 (1738898) **Order code: KF101048**			
Technical data		**Conductor cross section**	
Nominal voltage (CE)	160V	Solid (CE)	0,2÷1,5mm²
Nominal voltage (UL)	150V	Solid (UL)	24÷16AWG - 75°C
Nominal current (CE)	8A	Flexible (CE)	0,2÷1,5mm²
Nominal current (UL)	8A	Flexible (UL)	24÷16AWG - 75°C
Stripping length	10mm	Flexible, with ferrule without plastic sleeve	0,25÷1,5mm²
Screwdriver to open contacts	0,4 x 2,5mm	Flexible, with ferrule with plastic sleeve	0,25÷0,75mm²

Connection notes

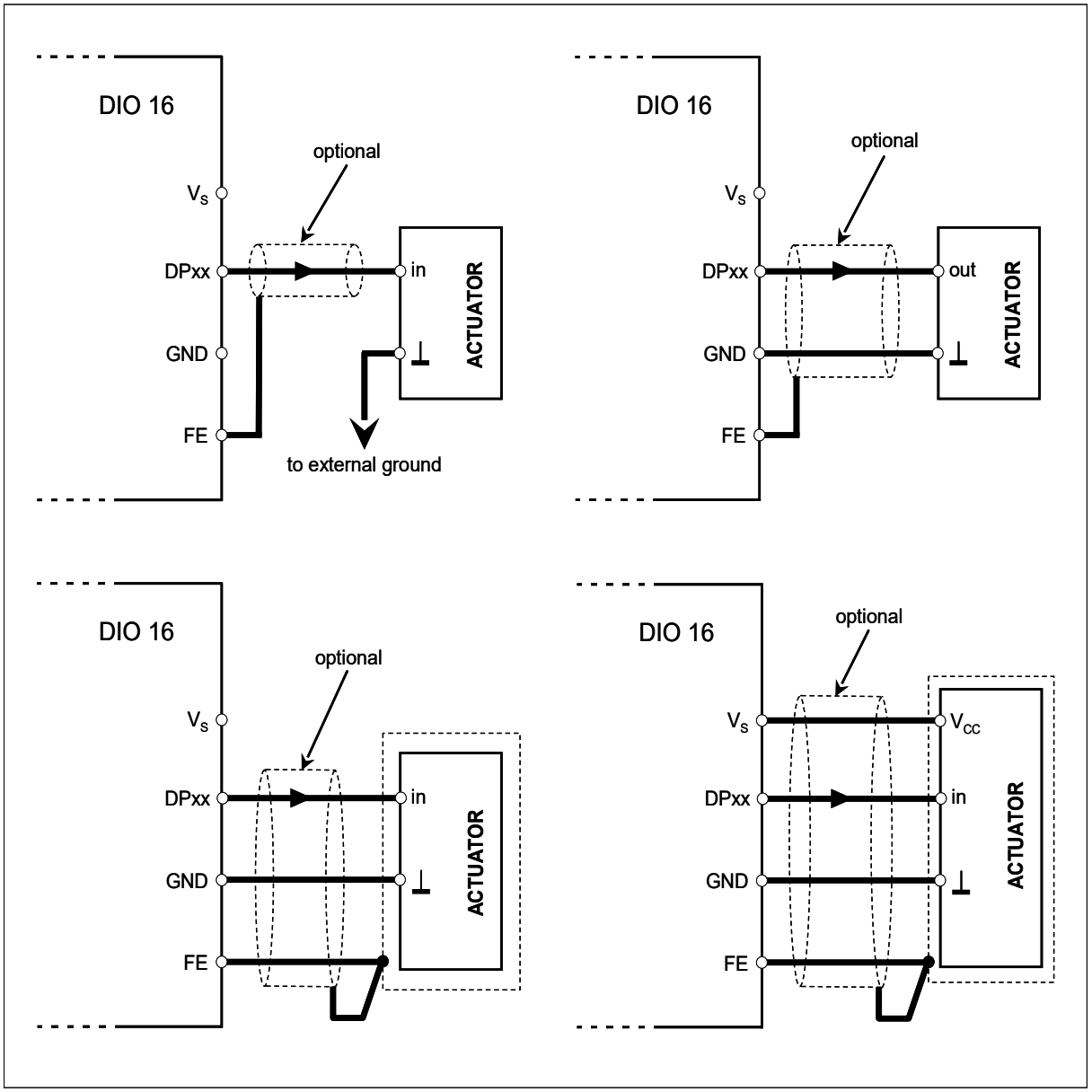
The connection scheme differs slightly depending on the sensor/actuator itself.
In more detail, the wiring is different using 1-wire, 2-wire, 3-wire and 4-wire devices (see illustrations in the following pages).
If the digital outputs are used, the sum of the current provided by the outputs and the supply current for sensors and actuators (if provided by the I/O connector) must not exceed 7 A, or the module internal fuse will blow.

Warning: If the system has to work in noisy environment (typical in some industrial plants), you can improve electromagnetic immunity by using a shielded cable; in usual conditions, these precautions are unnecessary.

Warning: Wiring sensors in 1-wire mode in NOT recommended but possible; if it is unavoidable, pay attention to use exactly the same power source connected to the V_M input connector. This is to avoid potential burns in the devices connected to the module and/or burn the module itself.



Wiring for 1-wire (above, on the left) sensors in NOT recommended but possible: see warning above.
Recommended wiring for 2-wire (above, on the right), 3-wire (below, on the left) and 4-wire (below, on the right) sensors.



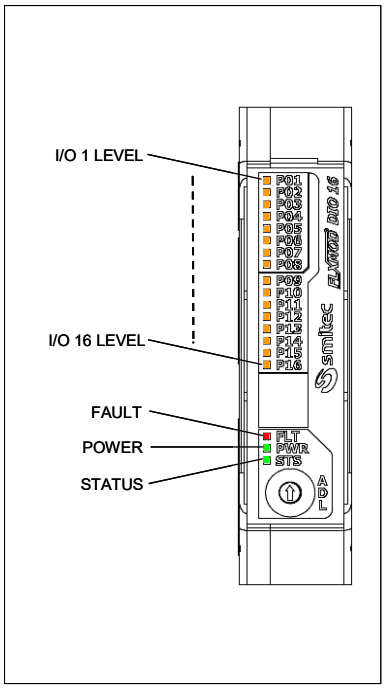
Recommended wiring for 1-wire (above, on the left), 2-wire (above, on the right), 3-wire (below, on the left) and 4-wire (below, on the right) actuators.

Module addressing

Before operation you must set the address of the module by the rotary switch reachable from the front panel; the operation is easily done opening the transparent plastic cover and turning the rotor with a small bladed screwdriver.
The address determination is described in the FLXIO and FLXMOD System Integration Manual.

Diagnostic and status indicators

Each module is provided with a series of LED lamps on the front panel (see illustration), that indicates the status of the unit, the logic state of every input/output and a possible diagnostic warning. For the sake of clarity, different lamp colours are employed.



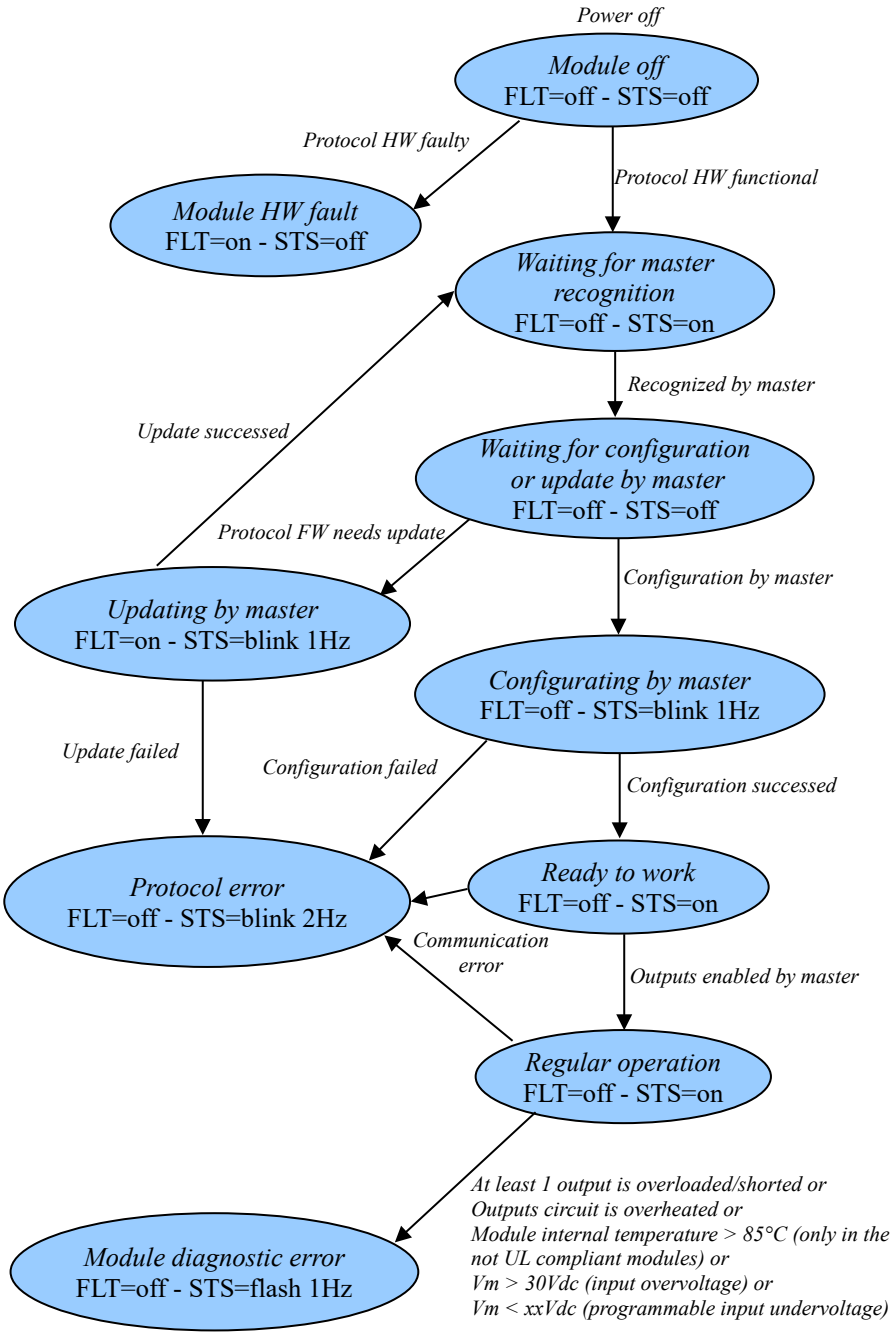
The green power (**PWR**) LED is lighted if the 24 V supply (V_M) is present and the internal fuse is not blown.
Self monitoring of supply voltage is also implemented to deliver a best self-diagnosis. The module switches in diagnostic error when V_M > 30Vdc and when V_M < of the value set up by the master module (low voltage check is disabled by default); this status is displayed by STS LED.

This module is provided by outputs short circuit and overload protection.
In case of short-circuit of at least one digital output, it immediately shuts down the involved output; then, for safety reasons, the internal logic shuts down all outputs and a diagnostic error is issued by STS LED.
In output/s overload condition the self-diagnostic may take some time before the diagnostic error is issued, depending on the severity of the overload (thermal protection). The actions taken in this case are the same of above.

Only in the not UL compliant modules (see label on the side of the case), an overall internal module temperature diagnostic issues a diagnostic error when the internal temperature exceeds 85°C. It may be caused by the combination of environment temperature and digital outputs total current. The status is displayed again by the STS LED.
The UL compliant modules have no temperature alarm.

The **P01-P16** orange LEDs indicate, if lighted, that the corresponding input/output logical level is “1”.

The status of the unit is indicated by both status (**STS**) and fault (**FLT**) LEDs; their behaviour is described in the following logic state chart. The exact cause of a diagnostic error can be read out by master module and the application software.


Power off
Module off
FLT=off - STS=off
Protocol HW faulty
Protocol HW functional
Module HW fault
FLT=on - STS=off
Waiting for master recognition
FLT=off - STS=on
Recognized by master
Update successed
Waiting for configuration or update by master
FLT=off - STS=off
Protocol FW needs update
Configuration by master
Updating by master
FLT=on - STS=blink 1Hz
Configurating by master
FLT=off - STS=blink 1Hz
Update failed
Configuration failed
Configuration successed
Protocol error
FLT=off - STS=blink 2Hz
Ready to work
FLT=off - STS=on
Communication error
Outputs enabled by master
Regular operation
FLT=off - STS=on
At least 1 output is overloaded/shorted or
Outputs circuit is overheated or
Module internal temperature > 85°C (only in the not UL compliant modules) or
Vm > 30Vdc (input overvoltage) or
Vm < xxVdc (programmable input undervoltage)
Module diagnostic error
FLT=off - STS=flash 1Hz