

maxon motor control		
maxon motor ag Brünigstrasse 220 CH – 6072 Sachseln www.maxonmotor.com	ESCON: Digital output wiring	Version: 1.01 (Eng.) Author: WJ Date: 2019-08-28

ESCON: External wiring of digital outputs and configuration features

Topic:

- How to wire the digital outputs of an ESCON servo controller?
- What configuration features are available?

Solution:

The ESCON controllers provide two digital outputs. Different predefined functions can be assigned to these digital outputs by ESCON Studio's "Startup Wizard".

Digital outputs: DigOUT3, DigOUT4

The technical specification of the digital outputs can be found in the "Hardware Reference" (-> chapter "Setup / Digital Inputs/Outputs 3 and 4") corresponding to the concrete ESCON product type in use.

Example: "ESCON 50/5" (part.no. 409510):

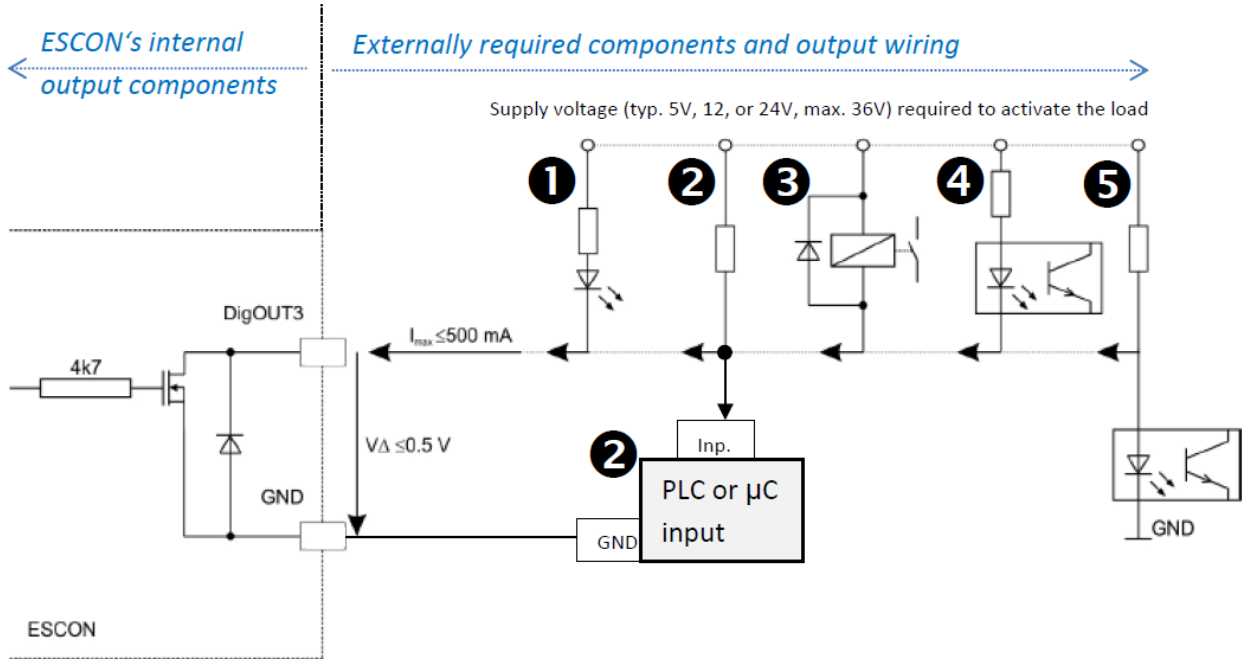
DigOUT	
Max. input voltage	+36 VDC
Max. load current	500 mA
Max. voltage drop	0.5 V @ 500 mA
Max. load inductance	100 mH @ 24 VDC; 500 mA

The internal hardware design of the ESCON's outputs is a so-called **"Open Drain"** resp. **"Open Collector" circuit**, i.e. that the **output switches to GND** but does not(!) supply a voltage by its own.

Typically there is an **external pull-up resistor required** which supplies the output and the load with the required supply voltage or the load has to be connected in between the ESCON's output (switching to GND) and a supply voltage.

The advantage by this design is that the output resp. load can be supplied to any required voltage level (e.g. 5V, 12V, 24V, within the "Max. input voltage" range specified for the ESCON's digital outputs).

Wiring examples:



- ❶ Switching a LED or signal lamp (max. 36V DC) by an ESCON's digital output.
- ❷ Commanding a top-level controller's input (e.g. of a PLC or microcontroller) by an ESCON's digital output.
- ❸ Switching a relay by an ESCON's digital output.
- ❹ ❺ Commanding an optocoupler by an ESCON's digital output.

Supply voltage of digital outputs and load

The supply voltage applied to the pull-up resistor resp. the load ...

- ... has to be chosen depending on the load's requirements and max. supply voltage specification. (e.g. PLC: typ. 24V / lamp: typ. 12-24V / LED or microcontroller: typ. 3.3V or 5V)
- ... has to be within the specified "Max. input voltage" of the ESCON's output (-> ESCON's "Hardware Reference").

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Pull-up resistor

The pull-up resistor has to be chosen in a way ($R = U / I$) so that the resulting current ...

- ... can fulfill the load's worst case requirements.
- ... does not exceed the specified ESCON's digital output "Max. load current" value (typ. 500 mA, check ESCON's "Hardware Reference").

Commanding an input of a top level controller

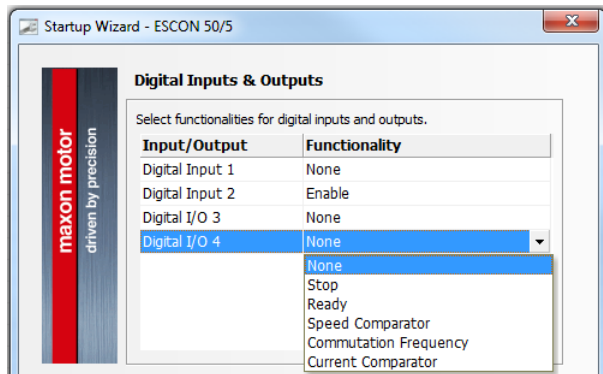
If an ESCON output has to command the input of a top level controller (e.g. microcontroller or PLC) like by wiring example ②, ...

- ... the pull-up resistor (typ. 1 ... 10 kOhm) has be connected in between the ESCON's digital output pin and a supply voltage (which has to be chosen depending on the required logic '1' voltage level to command the top level controller's input).
 - In case of a PLC input the required voltage level is typically 24V.
 - In case of a microcontroller or processor the required voltage level might be typically 3.3 V or 5 V. Please check the microcontroller's hardware specification to apply a proper voltage level to the pull-up resistor. (Caution: A too high voltage level can damage the top-level microcontroller easily!)
- ... the ESCON's output pin has to be connected to the top-level controller's input in addition.
- ... the GND of the ESCON, the top-level controller, and the power supply has to be connected.

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Configurable output functionality

There are different predefined functions available which can be assigned to each digital output by ESCON Studio's "Startup Wizard":

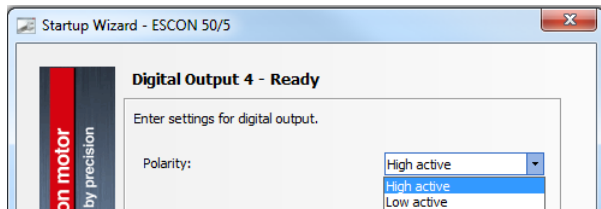


- **Stop:**
"Stop" is a function which is just be available in case of the ESCON's I/O pin is configured as a digital input (and not output). In this case the motor will be stopped (= decelerated) depending on an input signal.
- **Ready:**
The function "Ready" signals the operational state ("Ready" resp. "Error") of the ESCON.
- **Speed resp. Current Comparator:**
The digital output is activated or deactivated depending on the actual value (i.e. speed resp. motor current) and a configured limit, range, or deviation.
 - **Limit:**
The signal gets active and stays active as long as the actual value (speed resp. motor current) reaches or exceeds the configured limit value.
 - **Range:**
The signal gets active and stays active as long as the actual value (speed resp. motor current) is within the configured value range.
 - **Deviation:**
The signal gets active and stays active as long as the actual value is within the specified deviation range around the external or internal set value. It is possible to observe by this function if a drive can actually follow the resulting profile based on an externally commanded set value and internally configured settings like acceleration or deceleration.
- **Commutation Frequency:**
This function is just available in case of an EC (= brushless) motor.
The digital output provides a frequency which corresponds to the electrical frequency of the motor (= 1 pulse per electrical turn of the motor).
Hint:
In case of a multi-pole pair motor this frequency has to be divided by the pole pair number to get the mechanical speed of the motor shaft.

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Configurable digital output polarity

The polarity of the digital outputs can be configured by ESCON Studio's "Startup Wizard":



- **High active:**
Actuation with positive logic '1'
=> The "Open Drain" output is non-conducting (= High impedance) in "Active" state and the supply voltage (passing by the of the pull-up resistor) is present at the ESCON's output pin.
 - Wiring example ❶:
The LED will be turned off because the current flow through the internal output transistor of the ESCON is blocked.
 - Wiring example ❷:
The PLC (resp. microcontroller) will detect the voltage level (logic '1') at its input.
 - Wiring example ❸:
The relay will be switched off because the current flow through the internal output transistor of the ESCON is blocked.
 - Wiring example ❹:
The optocoupler will be switched off because the current flow through the internal output transistor of the ESCON is blocked.
 - Wiring example ❺:
The optocoupler will be activated because the current flow goes through the LED of the optocoupler.

- **Low active:**
Actuation with negative logic '0'
=> The "Open Drain" output is conducting to GND in "Active" state and the voltage level at the ESCON's output's pin is close to 0V due to this.
 - Wiring example ❶:
The LED will be turned on because the current flow goes through the LED and ESCON's internal output transistor which is switched to GND.
 - Wiring example ❷:
The PLC (resp. microcontroller) will detect a voltage level of 0V (= logic '0') because the ESCON's internal output transistor is switched to GND.
 - Wiring example ❸:
The relay will be switched on because the current flow goes through the relay and ESCON's internal output transistor which is switched to GND.

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- Wiring example ④:
The optocoupler will be switched on because the current flow goes through the optocoupler's LED and ESCON's internal output transistor which is switched to GND.
- Wiring example ⑤:
The optocoupler will be deactivated because the current flow does not go through the optocoupler but through ESCON's internal output transistor which is switched to GND. The voltage at the optocoupler's input is close to 0V due to this.