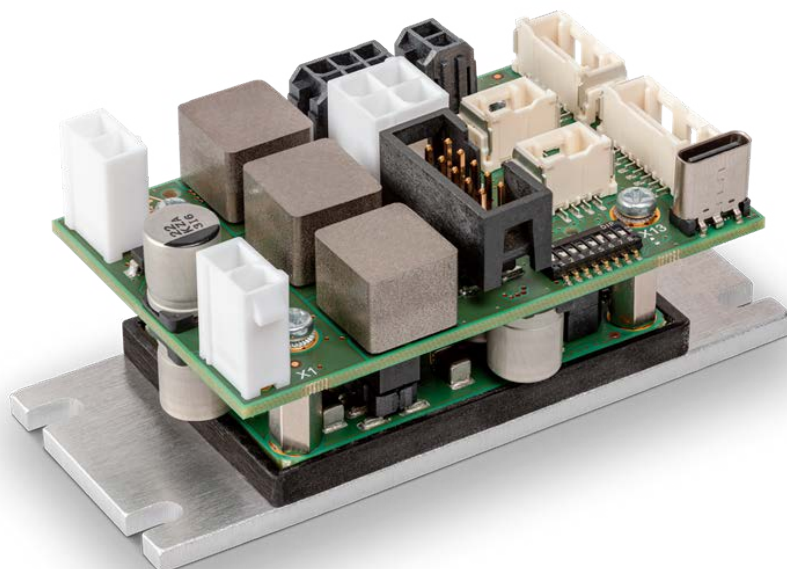


Servo Controller

# ESCON<sup>2</sup> Compact 60/12

Hardware Reference



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## READ THIS FIRST

**These instructions are for qualified technical personnel only. Before you start any work:**

- Read this manual carefully.
- Make sure that you understand this manual.
- Follow all instructions in this manual.

The product is partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g). You must incorporate it into or assemble it with other machinery or other partly completed machinery or equipment.

**You must not put the device into service unless all these conditions are met:**

- The complete machinery complies with all applicable requirements of EU Directive 2006/42/EC.
- The complete machinery fulfills all applicable health and safety requirements.
- All interfaces are implemented and comply with the requirements given in this manual.

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# 1 ABOUT

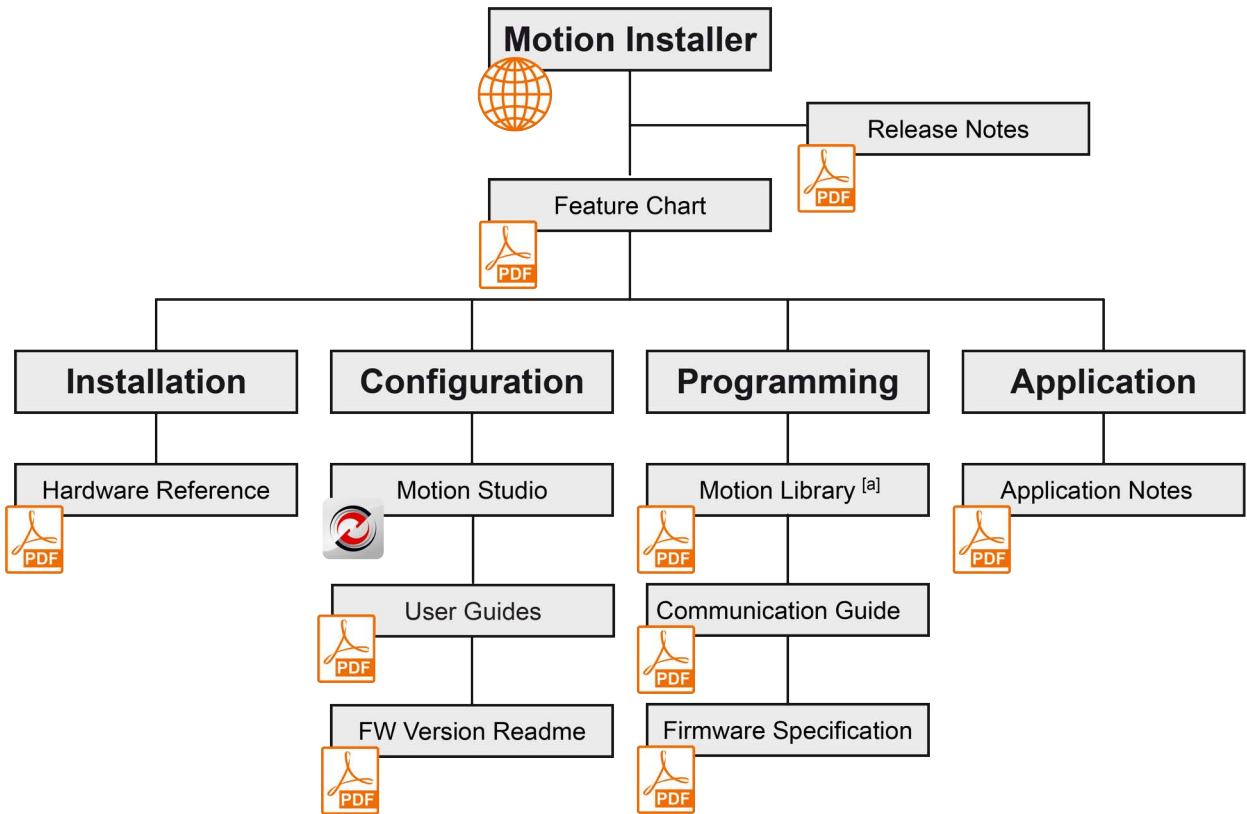
## 1.1 About this document

### 1.1.1 Intended purpose

This document familiarizes you with the ESCON2 Compact 60/12 Servo Controller. It describes the tasks for safe and proper installation and commissioning. Follow the instructions:

- to avoid dangerous situations,
- to keep installation and/or commissioning time at a minimum,
- to increase reliability and service life of the described equipment.

This document is part of a documentation set. It includes performance data, specifications, standards information, connection details, pin assignments, and wiring examples. The overview below shows the documentation hierarchy and how its parts are related:



[a] including software programming examples

Figure 1-1 Documentation structure

Find the latest edition of this document, along with additional documentation and software for ESCON2 Servo Controller, at: <http://escon.maxongroup.com>

### 1.1.2 Target audience

This document is intended for trained and skilled personnel. It provides information on how to understand and perform the respective tasks and duties.

1.1.3 How to use

Follow these notations and codes throughout the document.

| Notation | Meaning                                                                 |
|----------|-------------------------------------------------------------------------|
| ESCON2   | stands for «ESCON2 Servo Controller»                                    |
| «Abcd»   | indicating a title or a name (such as of document, product, mode, etc.) |
| (n)      | refers to an item (such as a part number, list items, etc.)             |
| *        | refers to an internal value                                             |
| ➔        | denotes “check”, “see”, “see also”, “take note of” or “go to”           |

Table 1-1 Notations used in this document

1.1.4 Symbols & signs

This document uses the following symbols and signs:

| Type                      | Symbol                                                                                           | Meaning                                                                                                                                      |
|---------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Safety alert<br>DANGER    |                | Indicates an <b>imminent hazardous situation</b> . If not avoided, it <b>will result in death or serious injury</b> .                        |
| WARNING                   |               | Indicates a <b>potential hazardous situation</b> . If not avoided, it <b>can result in death or serious injury</b> .                         |
| CAUTION                   |               | Indicates a <b>probable hazardous situation</b> or calls the attention to unsafe practices. If not avoided, it <b>may result in injury</b> . |
| Prohibited action         | <br>(typical) | Indicates a dangerous action. Hence, <b>you must not!</b>                                                                                    |
| Mandatory action          | <br>(typical) | Indicates a mandatory action. Hence, <b>you must!</b>                                                                                        |
| Requirement, Note, Remark |               | Indicates an activity you must perform prior to continuing, or gives information on a particular point that must be observed.                |
| Best practice             |               | Indicates an advice or recommendation on the easiest and best way to further proceed.                                                        |
| Material Damage           |               | Indicates information particular to possible damage of the equipment.                                                                        |

Table 1-2 Symbols and signs

### 1.1.5 Trademarks and brand names

All trademarks, brand names or other signs mentioned in this manual remain the property of their respective owners. They are protected by trademark, copyright, and/or other applicable laws. For easier reading, no symbols such as ® or ™ are being used with respect to the trademarks or brand names mentioned herein.

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CCMC | ESCON2 Compact 60/12 Hardware Reference | Edition 2026-01 | DocID rel13250

### 1.1.7 Sources for additional information

For further details and additional information, please refer to the resources listed below:

| Ref. no. | Reference                                                                                                     |
|----------|---------------------------------------------------------------------------------------------------------------|
| [1]      | maxon: ESCON2 Communication Guide<br><a href="http://escon.maxongroup.com">http://escon.maxongroup.com</a>    |
| [2]      | maxon: ESCON2 Firmware Specification<br><a href="http://escon.maxongroup.com">http://escon.maxongroup.com</a> |

Table 1-3 Sources for additional information

## 1.2 About the device

The ESCON2 Compact 60/12 is a small, powerful 4-quadrant PWM Servo Controller. Its high power density allows flexible use for brushed DC motors and brushless EC (BLDC) motors up to 720 Watts. It supports various feedback options, such as Hall sensors, incremental encoders, and absolute sensors for many drive applications.

The device is designed to be controlled by analog and digital set values, or as a slave node in a CANopen network. You can also operate it via any USB communication port of a Windows workstation. It has extensive analog and digital I/O functions.

Latest technology, such as field-oriented control (FOC), acceleration and velocity feed forward, in combination with highest control cycle rates allow sophisticated, ease-of-use motion control.

The compact servo controller is a fully integrated and ready-to-connect device for easy and quick installation.

You can find the latest edition of this document on the Internet: ➔ <http://escon.maxongroup.com>. This website also gives you access to related documents and software for ESCON2 servo controllers.

 vimeo



In addition, you can watch video tutorials in the ESCON video library. These tutorials show how to start with «Motion Studio». They also show how to set up communication interfaces, configure the controller, and give helpful tips, etc.

Explore the video library on Vimeo: ➔ <https://vimeo.com/album/4646396>

### 1.3 About the safety precautions

- Read and understand the note → «READ THIS FIRST»!
- Do not start any work unless you have the required skills → Chapter “1.1.2 Target audience” on page 1-5
- Refer to → Chapter “1.1.4 Symbols & signs” on page 1-6 to understand the symbols used.
- Follow all applicable health, safety, accident prevention, and environmental protection regulations for your country and work site.



#### DANGER

##### **High voltage and/or electrical shock**

***Touching live wires can cause death or serious injuries.***

- *Treat all power cables as live unless proven otherwise.*
- *Ensure neither end of the cable is connected to live power.*
- *Ensure the power source cannot be turned on while you work.*
- *Follow lock-out/tag-out procedures.*



#### Requirements

- *Install all devices and components according to local regulations.*
- *Electronic devices are not fail-safe. Install separate monitoring and safety equipment for each machine. If the machine has a failure, the drive system must go into a safe state and stay in this state. Possible failures include incorrect operation, failure of the control unit, failure of the cables, or other faults.*
- *Do not repair any components that maxon supplies.*



#### Electrostatic sensitive device (ESD)

- *Observe precautions for handling Electrostatic sensitive devices.*
- *Handle the device with care.*

## 2 SPECIFICATIONS

### 2.1 Technical data

| ESCON2 Compact 60/12 (P/N 854801) |                                                                                                                                                         |                                                                                                                                      |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Electrical data                   | Nominal power supply voltage $V_{CC}$                                                                                                                   | 10...60 VDC                                                                                                                          |
|                                   | Nominal logic supply voltage $V_C$                                                                                                                      | 10...60 VDC                                                                                                                          |
|                                   | Absolute supply voltage $V_{min} / V_{max}$                                                                                                             | 8 VDC / 62 VDC                                                                                                                       |
|                                   | Output voltage (max.)                                                                                                                                   | $0.90 \times V_{CC}$                                                                                                                 |
|                                   | Output current $I_{cont} / I_{max} (< 10 \text{ s}) [\text{A}]$                                                                                         | 12 A / 24 A (current measurement resolution: 26.86 mA)                                                                               |
|                                   | Pulse Width Modulation (PWM) frequency                                                                                                                  | 100 kHz                                                                                                                              |
|                                   | Sampling rate PI current controller                                                                                                                     | 50 kHz                                                                                                                               |
|                                   | Sampling rate PI speed controller                                                                                                                       | 10 kHz                                                                                                                               |
|                                   | Sampling rate analog input                                                                                                                              | 50 kHz                                                                                                                               |
|                                   | Max. efficiency                                                                                                                                         | 97.7 % → Figure 2-4                                                                                                                  |
|                                   | Max. speed DC motor                                                                                                                                     | Is limited by the max. permissible motor speed and the max. output voltage of the controller.                                        |
|                                   | Max. speed EC motor                                                                                                                                     | 120,000 rpm (FOC, 1 pole pair).<br>Can be limited by the max. permissible motor speed and the max. output voltage of the controller. |
|                                   | Built-in motor choke per phase                                                                                                                          | 4.7 $\mu\text{H}$ / 12 A                                                                                                             |
| Inputs & outputs                  | Sensor 1<br>Digital Hall sensor H1, H2, H3                                                                                                              | 0...24 VDC (internal pull-up)                                                                                                        |
|                                   | Sensor 2<br>(choice between multiple functions):<br>• Digital incremental encoder<br>• SSI absolute encoder<br>• BiSS C unidirectional absolute encoder | 2-channel, EIA/RS422, max. 6.67 MHz<br>0.4...2 MHz (single-ended, configurable)<br>0.4...4 MHz (single-ended, configurable)          |
|                                   | • High-speed digital inputs 1...2<br>• High-speed digital inputs 3...4<br>• High-speed digital output 1                                                 | EIA/RS422, max. 6.67 MHz<br>Logic: 0...12 VDC, max. 6.25 MHz<br>3.3 VDC / $I_L \leq 24 \text{ mA}$ / $R_i = 75 \Omega$               |
|                                   | Digital Inputs 1...4                                                                                                                                    | Logic: 0...30 VDC, inputs 1...2 PWM capable                                                                                          |
|                                   | Digital Outputs 1...2                                                                                                                                   | max. 36 VDC / $I_L \leq 500 \text{ mA}$ (open drain with internal pull-up)                                                           |
|                                   | Analog Inputs 1...2                                                                                                                                     | Resolution 12-bit, $\pm 10 \text{ VDC}$ (differential), 10 kHz                                                                       |
|                                   | Analog Outputs 1...2                                                                                                                                    | Resolution 12-bit, $\pm 4 \text{ VDC}$ (referenced to GND), 25 kHz                                                                   |
|                                   | Motor temperature sensor [b]                                                                                                                            | Resolution 12-bit, 0...3.3 VDC (internal pull-up)                                                                                    |
| Voltage outputs                   | Sensor supply voltage $V_{Sensor}$                                                                                                                      | 5 VDC / $I_L \leq 145 \text{ mA}$                                                                                                    |
|                                   | Peripheral supply voltage $V_{Peripheral}$                                                                                                              | -                                                                                                                                    |

Continued on next page.

| ESCON2 Compact 60/12 (P/N 854801) |                        |                    |                                                                                                   |
|-----------------------------------|------------------------|--------------------|---------------------------------------------------------------------------------------------------|
| Motor connections                 | DC motor               |                    | + Motor, – Motor                                                                                  |
|                                   | EC motor               |                    | Motor winding 1, Motor winding 2, Motor winding 3                                                 |
| Communication interfaces          | CAN                    |                    | Max. 1 Mbit/s                                                                                     |
|                                   | RS232                  |                    | -                                                                                                 |
|                                   | USB                    |                    | 12 Mbit/s (Full Speed)                                                                            |
| Status indicators                 | Device status          |                    | Operation (green)<br>Warning/Error (red)                                                          |
| Mechanical data                   | Dimensions (L x W x H) |                    | 81 x 41 x 33.5 mm                                                                                 |
|                                   | Weight (approx.)       |                    | 90 g                                                                                              |
|                                   | Mounting               |                    | M3 screws                                                                                         |
| Environmental conditions          | Temperature            | Operation          | –40...+50 °C                                                                                      |
|                                   |                        | Extended range [c] | +50...+80 °C<br>Derating: approx. -0.40 A/°C ➔Figure 2-2<br>with additional heatsink: ➔Figure 2-3 |
|                                   |                        | Storage            | –40...+85 °C                                                                                      |
|                                   | Altitude [d]           | Operation          | 0...500 m MSL                                                                                     |
|                                   |                        | Extended range [c] | 500...10'000 m MSL<br>Derating ➔Figure 2-2                                                        |
|                                   | Humidity               |                    | 5...90 % (condensation not permitted)                                                             |

- [a] The duration of the maximum output current depends on the electronics temperature and is limited automatically.
- [b] The functionality will be available with a future firmware release.
- [c] Operation within the extended range is permitted. However, a respective derating (declination of output current  $I_{cont}$ ) as to the stated values will apply.
- [d] Operating altitude in meters above Mean Sea Level, MSL.

Table 2-4      Technical data

## 2.2 Thermal data



### **Mandatory operation within the specified limits**

- Operation within the specified thermal limits is mandatory.
- If the ambient temperature exceeds the specified limits, thermal overload can occur even at low output currents.

### 2.2.1 Test setup for data collection

Unless otherwise stated, the thermal data has been generated with the unit in an upright position (connections facing to the top). It was placed on thermally poorly conductive supports, effectively floating in air.

2.2.2 Derating of output current (operation without additional heat sink)

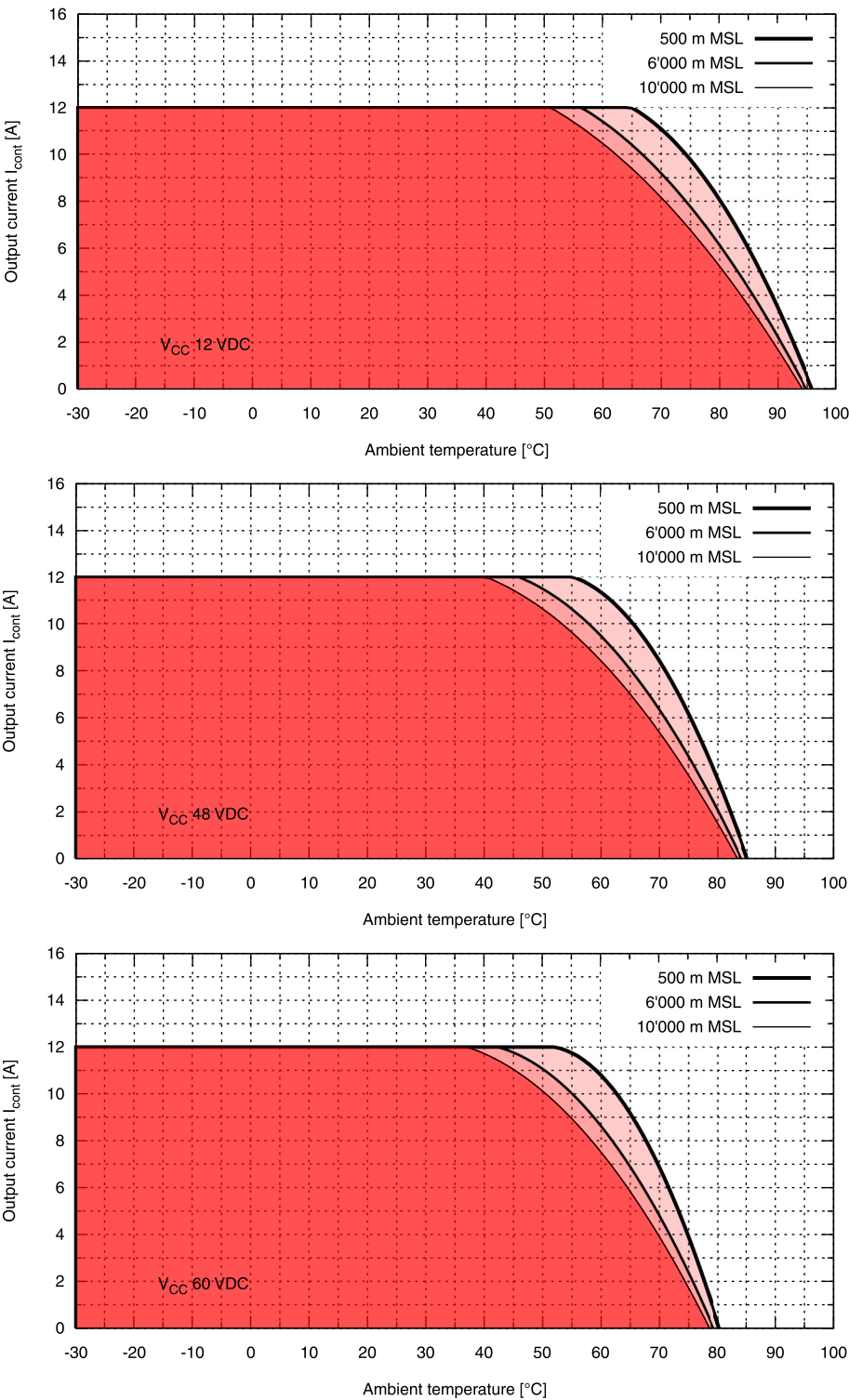


Figure 2-2 Derating of output current (operation without additional heatsink)

2.2.3 Operation with additional heatsink

During data collection in this chapter, the thermal data was measured with the unit upside down. This position allows heat to flow upward promoting effective passive cooling at the top.

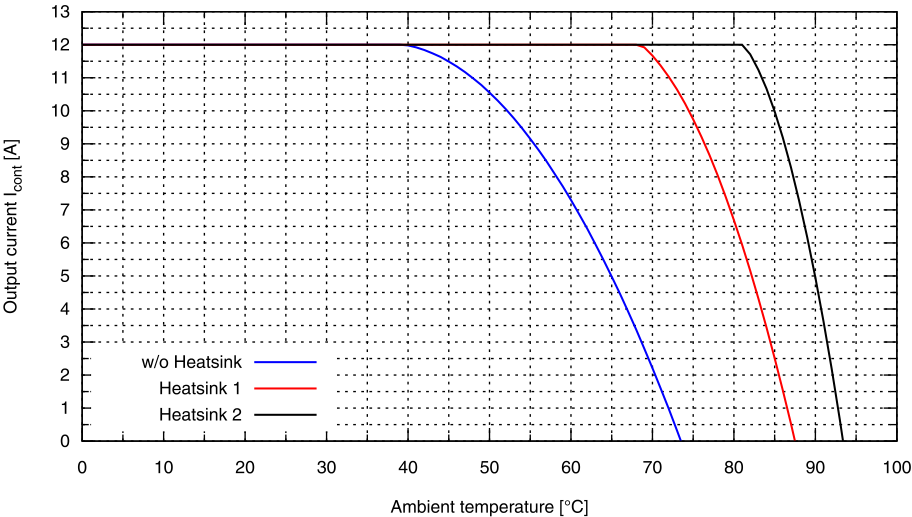


Figure 2-3 Extended operation @  $V_{CC}$  60 VDC with additional heatsink

| Heatsink | Manufacturer            | Type           | Dimensions [mm] | Thermal resistance $R_{th}$ [K/W] |
|----------|-------------------------|----------------|-----------------|-----------------------------------|
| 1        | Fischer Elektronik GmbH | SK 407 37.5 SA | 83 × 37.5 × 25  | 3.2                               |
| 2        | Fischer Elektronik GmbH | SK 655 37.5 SA | 80 × 37.5 × 80  | 2.3                               |

Table 2-5 Heatsink – tested components

2.2.4 Power dissipation and efficiency

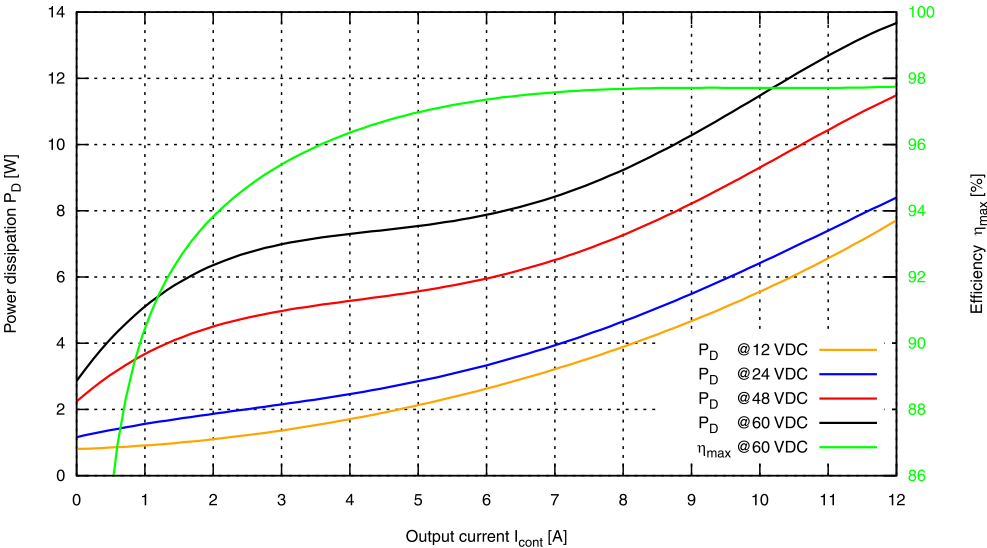


Figure 2-4 Power dissipation and efficiency

2.3 Limitations

| Functionality    |             | Switch-off threshold [a] | Recovery threshold [b] |
|------------------|-------------|--------------------------|------------------------|
| Undervoltage     |             | 7.5 VDC                  | 7.75 VDC               |
| Overvoltage      |             | 65 VDC                   | 64 VDC                 |
| Overcurrent      |             | 48 A                     | —                      |
| Thermal overload | logic       | 117 °C                   | 107 °C                 |
|                  | power stage | 105 °C                   | —                      |

- [a] The controller triggers the corresponding fault reaction. The controller changes to the disabled state. Refer to ➔ESCON2 Firmware Specification [2].
- [b] The system allows you to reset the fault.

Table 2-6 Limitations

The device has a configurable output current limit and an overcurrent protection function. This protects the controller in case of a short circuit in a motor winding or a damaged power stage. The undervoltage, overvoltage, and thermal overload power stage protection limits are also configurable. For the thermal overload power stage protection, a linear derating of the maximum output current is implemented, which starts 10 °C below the switch-off threshold. For more information, see the ➔ESCON2 Firmware Specification [2].

2.4 Dimensional drawing

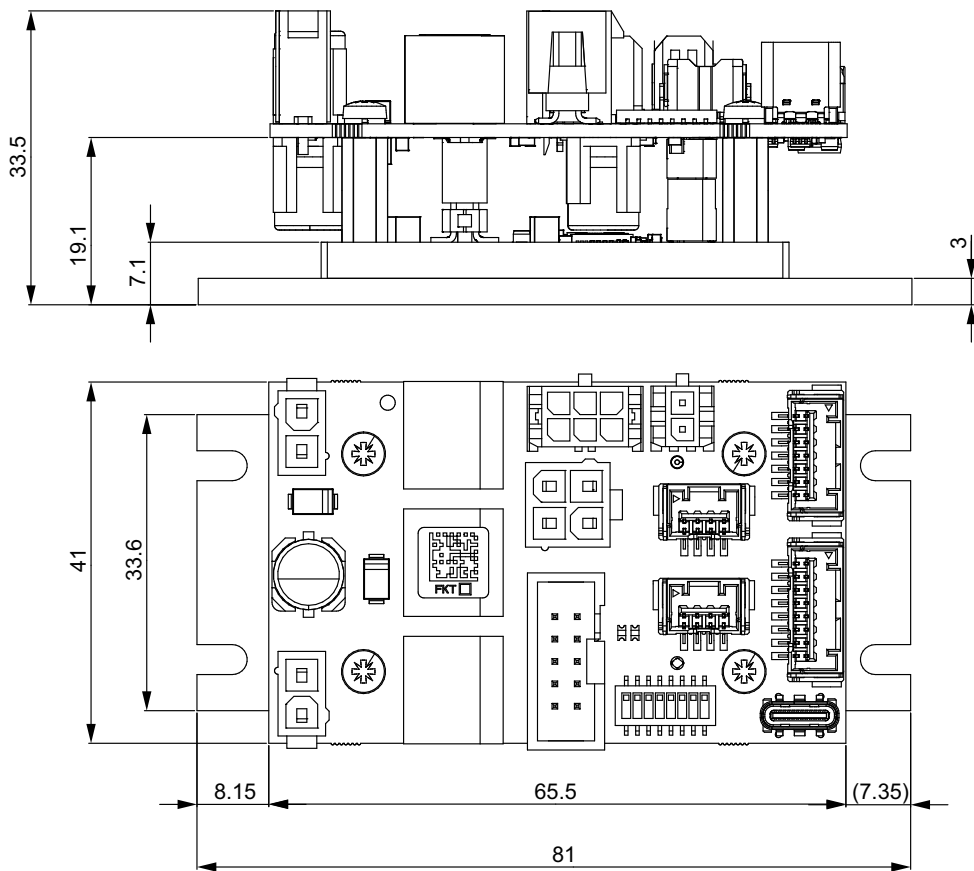


Figure 2-5 Dimensional drawing [mm]

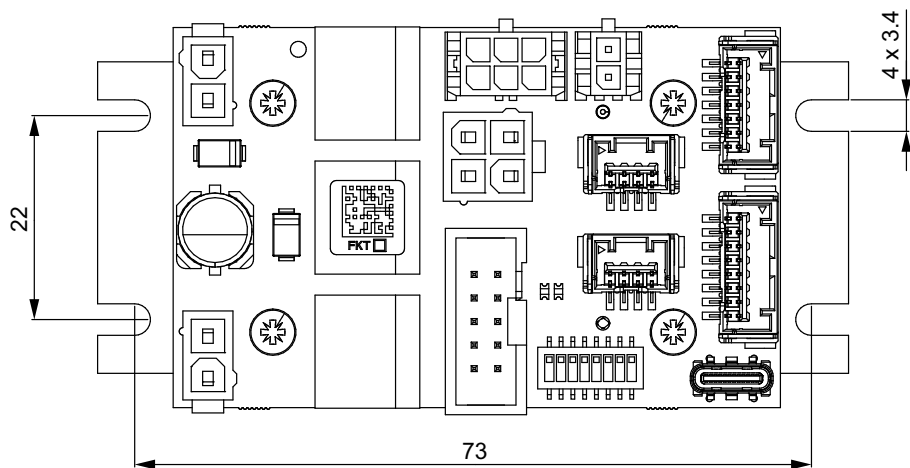


Figure 2-6 Dimensional drawing – Attachment points [mm]

## 2.5 Standards

The described device has been successfully tested for compliance with the standards listed below. Only the complete system (fully operational equipment with all components, such as the motor, servo controller, power supply unit, EMC filter, and cabling) can undergo an EMC test to ensure interference-free operation.



### Important notice

*Compliance of the device with the mentioned standards does not guarantee compliance in the final, ready-to-operate setup. To achieve compliance for your operational system, you must perform EMC testing on the complete equipment as a whole.*

| Electromagnetic compatibility |                        |                                                                                                                                                                                                                                                        |
|-------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Generic                       | IEC/EN 61000-6-2       | Immunity for industrial environments                                                                                                                                                                                                                   |
|                               | IEC/EN 61000-6-3       | Emission standard for residential, commercial and light-industrial environments                                                                                                                                                                        |
| Applied                       | IEC/EN 55022 (CISPR32) | Radio disturbance characteristics / radio interference                                                                                                                                                                                                 |
|                               | IEC/EN 61000-4-3       | Radiated, radio-frequency, electromagnetic field immunity test >10 V/m                                                                                                                                                                                 |
|                               | IEC/EN 61000-4-4       | Electrical fast transient/burst immunity test ±2 kV                                                                                                                                                                                                    |
|                               | IEC/EN 61000-4-6       | Immunity to conducted disturbances, induced by radio-frequency fields 10 Vrms                                                                                                                                                                          |
|                               | IEC/EN 61000-4-5       | Surge                                                                                                                                                                                                                                                  |
| Others                        |                        |                                                                                                                                                                                                                                                        |
| Environment                   | IEC/EN 60068-2-6       | Environmental testing – Test Fc: Vibration (sinusoidal, 10...500 Hz, 20 m/s <sup>2</sup> )                                                                                                                                                             |
|                               | MIL-STD-810F           | Random transport (10...500 Hz up to 2.53 g <sub>rms</sub> )                                                                                                                                                                                            |
| Safety                        | UL File Number         | Unassembled printed circuit boards: E207844                                                                                                                                                                                                            |
| Reliability                   | MIL-HDBK-217F [a]      | Reliability prediction of electronic equipment<br>Environment: Ground, benign (GB)<br>Ambient temperature: 298 K (25 °C)<br>Component stress: In accordance with circuit diagram and nominal power<br>Mean Time Between Failures (MTBF): 160'475 hours |

[a] The reliability calculation is based on MIL-HDBK-217F. Since component manufacturer data is more accurate, it has been used whenever possible.

Table 2-7 Standards

••page intentionally left blank••

## 3 SETUP

### IMPORTANT NOTICE: PREREQUISITES FOR INSTALLATION PERMISSION

The **ESCON2 Compact 60/12** is considered partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g). **It is intended to be incorporated into or assembled with other machinery or partly completed machinery or equipment.**



#### WARNING

##### **Risk of injury**

**Operating the device without full compliance of the surrounding system with EU Directive 2006/42/EC may cause serious injuries!**

- Do not operate the device unless you are certain that the other machinery fully complies with the EU directive's requirements.
- Do not operate the device, unless the other machinery fulfills all relevant health and safety aspects!
- Do not operate the device unless all respective interfaces have been established and fulfill the requirements stated in this document!



#### CAUTION

##### **Burn hazard**

**Hot surfaces can cause burns.**

- During operation, some parts of the device become very hot. Contact with these parts can burn your skin.
- Disconnect the power supply and secure it. Wait for the surface to cool before you do maintenance.

### 3.1 Generally applicable rules



#### **Maximum permitted supply voltage**

- Make sure that the power supply voltage is between 10...60 VDC.
- Supply voltages above 65 VDC or incorrect polarity will destroy the unit.
- The necessary output current depends on the load torque. The output current limits are:
  - continuous max. 12 A
  - short-time (acceleration) max. 24 A (< 10 s)



#### **Hot plugging the USB interface may cause hardware damage**

Do not hot-plug the USB interface (connecting while the power supply is on), the possibly high potential differences of the two power supplies of controller and PC/Notebook can lead to damaged hardware.

- Avoid potential differences between the power supply of controller and PC/Notebook or, if possible, balance them.
- Insert the USB connector first, then switch on the power supply of the controller.



#### **Best practice**

Keep the motor mechanically disconnected during the setup and adjustment phase.

3.2 Connections

For in-depth details on connections →Chapter “3.3 Connection specifications” on page 3-19.

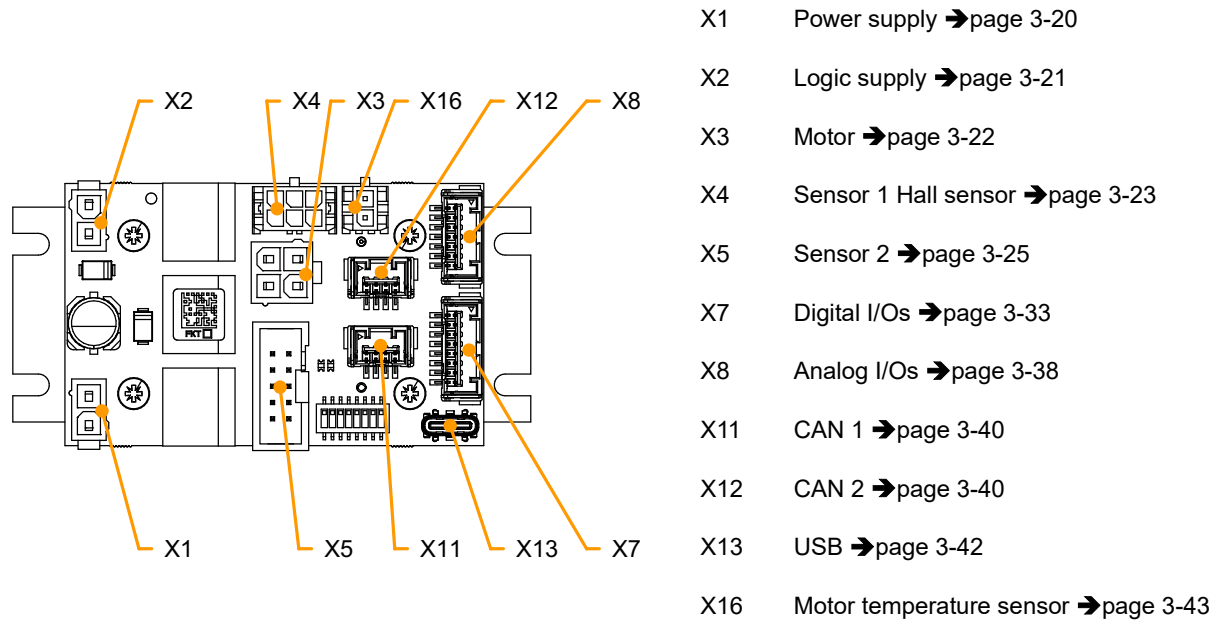


Figure 3-7      Connections

3.2.1 Cabling

PLUG&PLAY

Take advantage of maxon’s prefab cable assemblies. They come as ready-to-use parts and will help to reduce commissioning time to a minimum.

- a) Check the following table and find the part number of the cable assembly that matches the setup you will be using.
- b) Follow the cross-reference to get the cable’s pin assignment.

| Prefab cable assembly |                                                                                       |                     |       |
|-----------------------|---------------------------------------------------------------------------------------|---------------------|-------|
| Connector             | Designation                                                                           | Part Number         | →Page |
| X1                    | Power cable high current<br><b>Mandatory for supply of power stage!</b>               | 710929              | 3-20  |
| X2                    | Power cable high current or Power cable<br><b>Optional for separate logic supply!</b> | 710929 or<br>275829 | 3-22  |
| X3                    | Motor cable high current                                                              | 710930              | 3-23  |
| X4                    | Hall sensor cable                                                                     | 275878              | 3-24  |
| X5                    | Encoder cable                                                                         | 275934              | 3-26  |
| X7                    | Signal cable 8core                                                                    | 520853              | 3-34  |
| X8                    | Signal cable 7core                                                                    | 520854              | 3-38  |
| X11                   | CAN-CAN cable<br>CAN-COM cable                                                        | 520858              | 3-40  |
|                       |                                                                                       | 520857              | 3-41  |
| X12                   | CAN-CAN cable<br>CAN-COM cable                                                        | 520858              | 3-40  |
|                       |                                                                                       | 520857              | 3-41  |
| X13                   | USB Type C – Type C cable                                                             | 845854              | 3-42  |
|                       | USB Type A – Type C cable                                                             | 838461              | 3-42  |
| X16                   | NTC cable                                                                             | 847301              | 3-43  |

Table 3-8      Prefab maxon cables

### MAKE&BAKE YOUR OWN

If you decide not to employ maxon's prefab cable assemblies, you might wish to use the prepackaged kit that contains all connectors required to make up your own cabling.

| Motion connector set (P/N 846644) |                                                      |          |
|-----------------------------------|------------------------------------------------------|----------|
| Connector                         | Specification                                        | Quantity |
| Connectors                        |                                                      |          |
| X1, X2                            | Molex Mini-Fit Jr., 2 poles (39012020)               | 2        |
| X3                                | Molex Mini-Fit Jr., 4 poles (39012040)               | 1        |
| X4                                | Molex Micro-Fit 3.0, 6 poles (430250600)             | 1        |
| X7                                | Molex CLIK-Mate, 8 poles (5025780800)                | 1        |
| X8                                | Molex CLIK-Mate, 7 poles (5025780700)                | 1        |
| X10                               | Molex CLIK-Mate, 5 poles (5025780500)                | 1        |
| X11, X12                          | Molex CLIK-Mate, 4 poles (5025780400)                | 2        |
| X16                               | Molex Micro-Fit 3.0, 2 poles (430250200)             | 1        |
| Crimp Terminals                   |                                                      |          |
| X1, X2, X3                        | Molex Mini-Fit Plus, AWG16 (457503112, 457503111)    | 8        |
| X4, X16                           | Molex Micro-Fit 3.0, AWG26-30 (430300010, 430300004) | 8        |
| X7, X8, X10, X11, X12             | Molex CLIK-Mate, AWG24-28 (5025790100, 5025790000)   | 30       |

Table 3-9 Motion connector set – Content

### TOOLS

| Tool                                           | Manufacturer | Part Number |
|------------------------------------------------|--------------|-------------|
| Hand crimper for Mini-Fit Jr., crimp terminals | Molex        | 2002182200  |
| Hand crimper for Micro-Fit 3.0 crimp terminals | Molex        | 0638190000  |
| Hand crimper for CLIK-Mate crimp terminals     | Molex        | 2002187400  |

Table 3-10 Recommended tools

## 3.3 Connection specifications

The actual connection depends on your drive system configuration and the type of motor you are using. Follow the description in the given order and choose the wiring diagram (→see page 4-49) that best suits your components.



#### How to read pin assignment tables

In the subsequent sections of the document, you will come across tables outlining the pin assignments. These tables provide information about the hardware connectors, their corresponding wired signals, the assigned pins, and details regarding the prefab cables that are available.

- The initial column provides the pin numbers for the connectors.
- The second column specifies the pin numbers for the corresponding end (Head A) of the prefab cable.
- The third column describes the core color of the prefab cable.
- The fourth column indicates the pin numbers for the other end (Head B) of the prefab cable.

### 3.3.1 Power supply (X1)

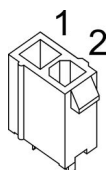


Figure 3-8 Power supply connector X1

| X1<br>Pin | Prefab cable  |                |               | Signal          | Description                              |
|-----------|---------------|----------------|---------------|-----------------|------------------------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                 |                                          |
| 1         | 1             | black          | –             | GND             | Ground                                   |
| 2         | 2             | black          | +             | V <sub>CC</sub> | Power supply voltage input (10...60 VDC) |

Table 3-11 Power supply connector X1 – Pin assignment

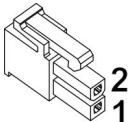
| Power cable high current (710929)                                                                          |                                              |                                                                |  |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------|--|
| <div>A</div> <div></div> |                                              | <div>B</div>                                                   |  |
| Cross-section                                                                                              | 2 × 1.5 mm <sup>2</sup> , non-shielded, grey |                                                                |  |
| Length                                                                                                     | 3 m                                          |                                                                |  |
| Head A                                                                                                     | Plug                                         | Molex Mini-Fit Plus, 2 poles (0039012025)                      |  |
|                                                                                                            | Contacts                                     | Molex Mini-Fit Plus HCS, AWG16, female crimp terminals (45750) |  |
| Head B                                                                                                     | Wire end sleeves 1.5 mm <sup>2</sup>         |                                                                |  |

Table 3-12 Power cable high current

| Power supply requirements               |                                                                                                                                                       |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nominal output voltage V <sub>CC</sub>  | 10...60 VDC                                                                                                                                           |
| Absolute output voltage V <sub>CC</sub> | min. 8 VDC / max. 62 VDC                                                                                                                              |
| Output current                          | Depending on load <ul style="list-style-type: none"> <li>• continuous max. 12 A</li> <li>• short-time (acceleration) max. 24 A (&lt; 10 s)</li> </ul> |

Table 3-13 Power supply requirements

- 1) Use the formula below to calculate the required voltage under load.
- 2) Choose a power supply according to the calculated voltage. Consider the following:
  - a) During braking of the load, the power supply must buffer the recovered kinetic energy (e.g., in a capacitor).
  - b) If using an electronically stabilized power supply, ensure the overcurrent protection circuit is inoperative within the operating range.



**The formula already takes the following into account:**

- Maximum PWM duty cycle of 90 %
- Controller's max. voltage drop of 1 V @ 24 A

**KNOWN VALUES:**

- Operating torque M [mNm]
- Operating speed n [rpm]
- Nominal motor voltage U<sub>N</sub> [Volt]
- Motor no-load speed at U<sub>N</sub>; n<sub>O</sub> [rpm]
- Speed/torque gradient of the motor Δn/ΔM [rpm/mNm]

**SOUGHT VALUE:**

- Supply voltage V<sub>CC</sub> [Volt]

**SOLUTION:**

$$V_{CC} \geq \left[ \frac{U_N}{n_O} \cdot \left( n + \frac{\Delta n}{\Delta M} \cdot M \right) \cdot \frac{1}{0.9} \right] + 1[V]$$

**3.3.2 Logic supply (X2)**

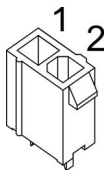


Figure 3-9      Logic supply connector X2

| X2<br>Pin | Prefab cable  |                |               | Signal         | Description                              |
|-----------|---------------|----------------|---------------|----------------|------------------------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                |                                          |
| 1         | 1             | black          | –             | GND            | Ground                                   |
| 2         | 2             | black          | +             | V <sub>C</sub> | Logic supply voltage input (10...60 VDC) |

Table 3-14      Logic supply connector X2 – Pin assignment

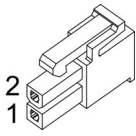
| Power cable (P/N 275829)                                                                                                                                                                                                                                                            |                                       |                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------|
| <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <b>A</b><br/>  </div> <div style="text-align: center;"> <b>B</b> </div> </div> |                                       |                                                       |
| Cross-section                                                                                                                                                                                                                                                                       | 2 × 0.75 mm <sup>2</sup> , grey       |                                                       |
| Length                                                                                                                                                                                                                                                                              | 3 m                                   |                                                       |
| Head A                                                                                                                                                                                                                                                                              | Plug                                  | Molex Mini-Fit Jr., 2 poles (39012020)                |
|                                                                                                                                                                                                                                                                                     | Contacts                              | Molex Mini-Fit Jr. female crimp terminals (457501112) |
| Head B                                                                                                                                                                                                                                                                              | Wire end sleeves 0.75 mm <sup>2</sup> |                                                       |

Table 3-15 Power cable

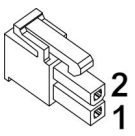
| Power cable high current (P/N 710929)                                                                                                                                                                                                                                               |                                              |                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------|
| <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <b>A</b><br/>  </div> <div style="text-align: center;"> <b>B</b> </div> </div> |                                              |                                                                |
| Cross-section                                                                                                                                                                                                                                                                       | 2 × 1.5 mm <sup>2</sup> , non-shielded, grey |                                                                |
| Length                                                                                                                                                                                                                                                                              | 3 m                                          |                                                                |
| Head A                                                                                                                                                                                                                                                                              | Plug                                         | Molex Mini-Fit Plus, 2 poles (0039012025)                      |
|                                                                                                                                                                                                                                                                                     | Contacts                                     | Molex Mini-Fit Plus HCS, AWG16, female crimp terminals (45750) |
| Head B                                                                                                                                                                                                                                                                              | Wire end sleeves 1.5 mm <sup>2</sup>         |                                                                |

Table 3-16 Power cable high current

| Logic supply requirements     |                          |
|-------------------------------|--------------------------|
| Nominal output voltage $V_C$  | 10...60 VDC              |
| Absolute output voltage $V_C$ | min. 8 VDC / max. 62 VDC |
| Min. output power             | $P_C$ min. 3 W           |

Table 3-17 Logic supply requirements

### 3.3.3 Motor (X3)

The controller is set to drive either maxon EC motor (BLDC, brushless DC motor) or maxon DC motor (brushed DC motor) with separated motor/encoder cable.

#### 3.3.3.1 Motor (X3)

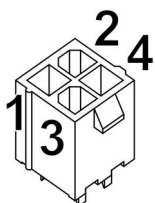


Figure 3-10 Motor connector X3



#### **Best practice**

*Keep the motor mechanically disconnected during the setup and adjustment phase.*

| X3<br>Pin | Prefab cable  |                |               | Signal          | Description              |
|-----------|---------------|----------------|---------------|-----------------|--------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                 |                          |
| 1         | 1             | black          |               | Motor winding 1 | EC motor: Winding 1      |
|           |               |                |               | Motor (+M)      | DC motor: Motor +        |
| 2         | 2             | black          |               | Motor winding 2 | EC motor: Winding 2      |
|           |               |                |               | Motor (-M)      | DC motor: Motor -        |
| 3         | 3             | black          |               | Motor winding 3 | EC motor: Winding 3      |
|           |               |                |               | -               | DC motor: DO NOT CONNECT |
| 4         | 4             | black          |               | Motor shield    | Cable shield             |

Table 3-18 Motor connector X3 – Pin assignment for maxon EC &amp; DC motor

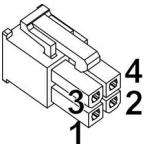
| Motor cable high current (710930)                                                                                               |                                          |                                                                |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------|
| <div><div>A</div><div></div><div>B</div></div> |                                          |                                                                |
| Cross-section                                                                                                                   | 3 × 1.5 mm <sup>2</sup> , shielded, grey |                                                                |
| Lenght                                                                                                                          | 3 m                                      |                                                                |
| Head A                                                                                                                          | Plug                                     | Molex Mini-Fit Plus, 4 poles (0039012045)                      |
|                                                                                                                                 | Contacts                                 | Molex Mini-Fit Plus HCS, AWG16, female crimp terminals (45750) |
| Head B                                                                                                                          | Wire end sleeves 1.5 mm <sup>2</sup>     |                                                                |

Table 3-19 Motor cable high current

### 3.3.4 Sensor 1 Hall sensor (X4)

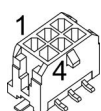


Figure 3-11 Sensor 1 Hall sensor connector X4

| X4<br>Pin | Prefab cable  |                |               | Signal              | Description                                                    |
|-----------|---------------|----------------|---------------|---------------------|----------------------------------------------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                     |                                                                |
| 1         | 1             | green          |               | Hall sensor 1       | Hall sensor 1 input                                            |
| 2         | 2             | brown          |               | Hall sensor 2       | Hall sensor 2 input                                            |
| 3         | 3             | white          |               | Hall sensor 3       | Hall sensor 3 input                                            |
| 4         | 4             | yellow         |               | GND                 | Ground                                                         |
| 5         | 5             | grey           |               | V <sub>Sensor</sub> | Sensor supply voltage output (5 VDC / I <sub>L</sub> ≤ 145 mA) |
| 6         | 6             | black          |               | Hall shield         | Cable shield                                                   |

Table 3-20 Sensor 1 Hall sensor connector X4 – Pin assignment

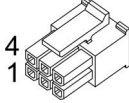
| Hall sensor cable (P/N 275878)                                                                                                  |                                           |                                                        |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------|
| <div><div>A</div><div></div><div>B</div></div> |                                           |                                                        |
| Cross-section                                                                                                                   | 5 × 0.14 mm <sup>2</sup> , shielded, grey |                                                        |
| Length                                                                                                                          | 3 m                                       |                                                        |
| Head A                                                                                                                          | Plug                                      | Molex Micro-Fit 3.0, 6 poles (430250600)               |
|                                                                                                                                 | Contacts                                  | Molex Micro-Fit 3.0 female crimp terminals (430300010) |
| Head B                                                                                                                          | Wire end sleeves 0.14 mm <sup>2</sup>     |                                                        |

Table 3-21 Hall sensor cable



**Important notice**

The maximum supply current of the sensor supply voltage output  $V_{\text{Sensor}}$  is in total 145 mA. It can be used for:

- Hall sensors →Chapter “3.3.4 Sensor 1 Hall sensor (X4)” on page 3-23
- Incremental encoders →Chapter “3.3.5.1 Incremental encoder” on page 3-26
- SSI / BiSS C encoders →Chapter “3.3.5.2 SSI / BiSS C unidirectional absolute encoder” on page 3-28
- Other peripherals which need a 5 VDC supply.

All currents resulting from parts connected to the sensor supply voltage output  $V_{\text{Sensor}}$  must not exceed 145 mA in total.

| Hall sensor                                      |                                                   |
|--------------------------------------------------|---------------------------------------------------|
| Sensor supply voltage output $V_{\text{Sensor}}$ | 5 VDC                                             |
| Max. Hall sensor supply current                  | 145 mA (→refer to Important notice)               |
| Input voltage                                    | 0...24 VDC                                        |
| Max. input voltage                               | 24 VDC                                            |
| Low-level input voltage                          | < 0.8 VDC                                         |
| High-level input voltage                         | > 2.0 VDC                                         |
| Internal pull-up resistor                        | 2.7 k $\Omega$ (referenced to 5.45 VDC - 0.6 VDC) |

Table 3-22 Hall sensor specification

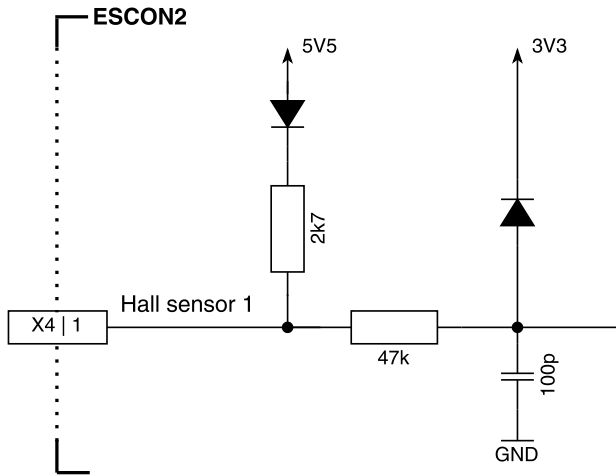


Figure 3-12 Hall sensor input circuit (analogously valid for Hall sensors 2 & 3)

### 3.3.5 Sensor 2 Encoder / I/Os (X5)

Additional sensors, both incremental and serial encoders, or digital inputs and outputs can be connected. Only one sensor/function can be used at a time, i.e. either an incremental encoder, or an absolute encoder, or high-speed digital I/Os.



#### Best practice

For best performance and good resistance against electrical interference, **we recommend using encoders with a line driver (differential scheme)**. Otherwise, limitations may apply due to slow switching edges. Nevertheless, the controller supports both schemes – differential and single-ended (unsymmetrical).

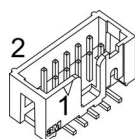


Figure 3-13 Sensor 2 connector X5

| X5<br>Pin | Prefab cable  |                |               | Signal              | Description                                                    |
|-----------|---------------|----------------|---------------|---------------------|----------------------------------------------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                     |                                                                |
| 1         | 1             | brown          | 1             | Data                | Data (SSI, BiSS C)                                             |
|           |               |                |               | HsDigIN4            | High-speed digital input 4                                     |
| 2         | 2             | white          | 2             | V <sub>Sensor</sub> | Sensor supply voltage output (5 VDC / I <sub>L</sub> ≤ 145 mA) |
| 3         | 3             | red            | 3             | GND                 | Ground                                                         |
| 4         | 4             | white          | 4             | Clock               | Clock (SSI, BiSS C)                                            |
|           |               |                |               | HsDigOUT1           | High-speed digital output 1                                    |
| 5         | 5             | orange         | 5             | Channel A\          | Digital incremental encoder channel A complement               |
|           |               |                |               | HsDigIN1\           | High-speed digital input 1 complement                          |
| 6         | 6             | white          | 6             | Channel A           | Digital incremental encoder channel A                          |
|           |               |                |               | HsDigIN1            | High-speed digital input 1                                     |
| 7         | 7             | yellow         | 7             | Channel B\          | Digital incremental encoder channel B complement               |
|           |               |                |               | HsDigIN2\           | High-speed digital input 2 complement                          |
| 8         | 8             | white          | 8             | Channel B           | Digital incremental encoder channel B                          |
|           |               |                |               | HsDigIN2            | High-speed digital input 2                                     |
| 9         | 9             | green          | 9             | –                   | not connected                                                  |
| 10        | 10            | white          | 10            | HsDigIN3            | High-speed digital input 3                                     |

Table 3-23 Sensor 2 connector X5 – Pin assignment

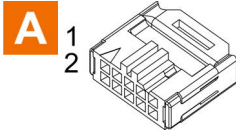
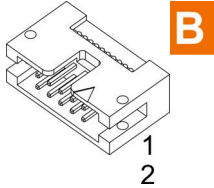
| Encoder cable (275934)                                                            |                                                                                     |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |
| Cross-section                                                                     | 10 × AWG28, round-jacket, flat cable, pitch 1.27 mm                                 |
| Length                                                                            | 3 m                                                                                 |
| Head A                                                                            | DIN 41651 female, pitch 2.54 mm, 10 poles, with strain relief                       |
| Head B                                                                            | DIN 41651 plug, pitch 2.54 mm, 10 poles, with strain relief                         |

Table 3-24 Encoder cable



**Important notice**

The maximum supply current of the sensor supply voltage output  $V_{\text{Sensor}}$  is in total 145 mA. It can be used for:

- Hall sensors →Chapter “3.3.4 Sensor 1 Hall sensor (X4)” on page 3-23
- Incremental encoders →Chapter “3.3.5.1 Incremental encoder” on page 3-26
- SSI / BiSS C encoders →Chapter “3.3.5.2 SSI / BiSS C unidirectional absolute encoder” on page 3-28
- Other peripherals which need a 5 VDC supply.

All currents resulting from parts connected to the sensor supply voltage output  $V_{\text{Sensor}}$  must not exceed 145 mA in total.

**3.3.5.1 Incremental encoder**

| Digital incremental encoder (differential)       |                                       |
|--------------------------------------------------|---------------------------------------|
| Sensor supply voltage output $V_{\text{Sensor}}$ | 5 VDC                                 |
| Max. sensor supply current                       | ≤ 145 mA (→refer to Important notice) |
| Min. differential input voltage                  | ± 200 mV                              |
| Max. input voltage                               | ± 12 VDC                              |
| Line receiver (internal)                         | EIA/RS422 standard                    |
| Max. input frequency                             | 6.67 MHz                              |

Table 3-25 Differential digital incremental encoder specification

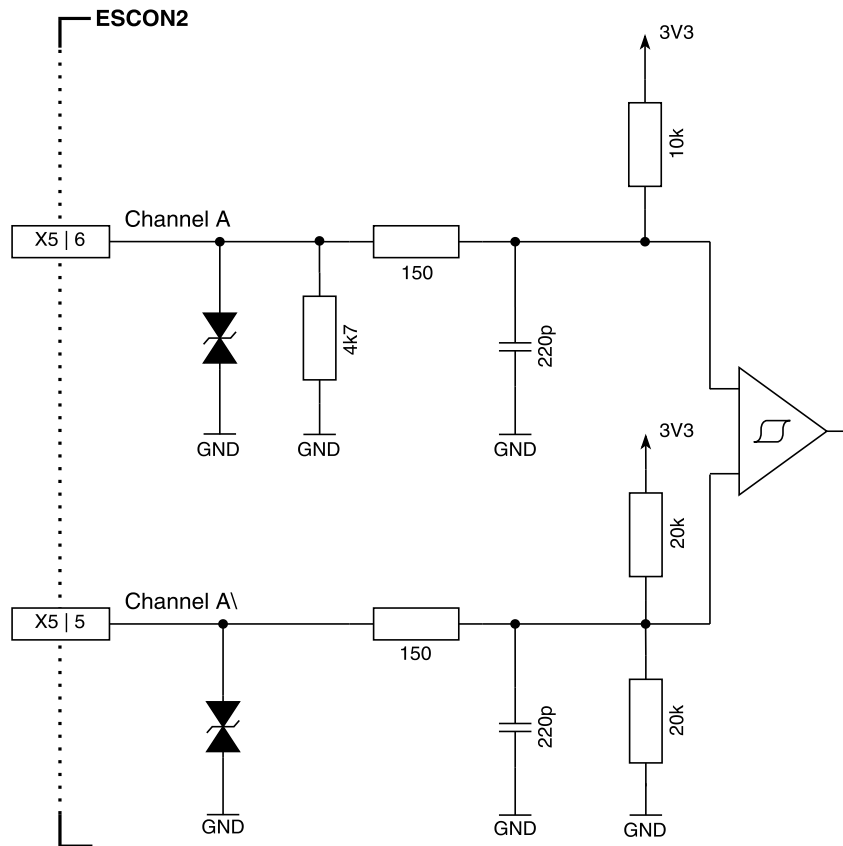
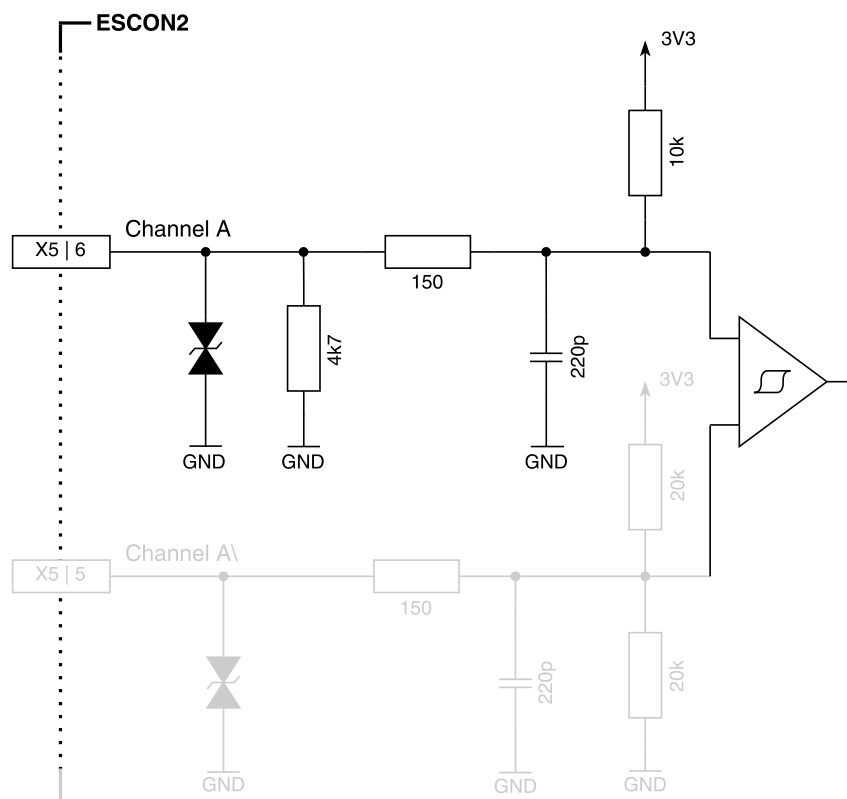


Figure 3-14 Digital incremental encoder input circuit Ch A “differential” (analogously valid for Ch B)

| Digital incremental encoder (single-ended)       |                |                                                    |
|--------------------------------------------------|----------------|----------------------------------------------------|
| Sensor supply voltage output $V_{\text{Sensor}}$ |                | 5 VDC                                              |
| Max. sensor supply current                       |                | $\leq 145 \text{ mA}$ (→refer to Important notice) |
| Input voltage                                    |                | 0...5 VDC                                          |
| Max. input voltage                               |                | $\pm 12 \text{ VDC}$                               |
| Low-level input voltage                          |                | $< 1 \text{ VDC}$                                  |
| High-level input voltage                         |                | $> 2.4 \text{ VDC}$                                |
| Input high current                               |                | $I_{\text{IH}}$ = typically 1.3 mA @ 5 VDC         |
| Input low current                                |                | $I_{\text{IL}}$ = typically -0.36 mA @ 0 VDC       |
| Max. input frequency                             | Push-pull      | 6.25 MHz                                           |
|                                                  | Open collector | 100 kHz (required external 3k3 pull-up)            |

Table 3-26 Single-ended digital incremental encoder specification



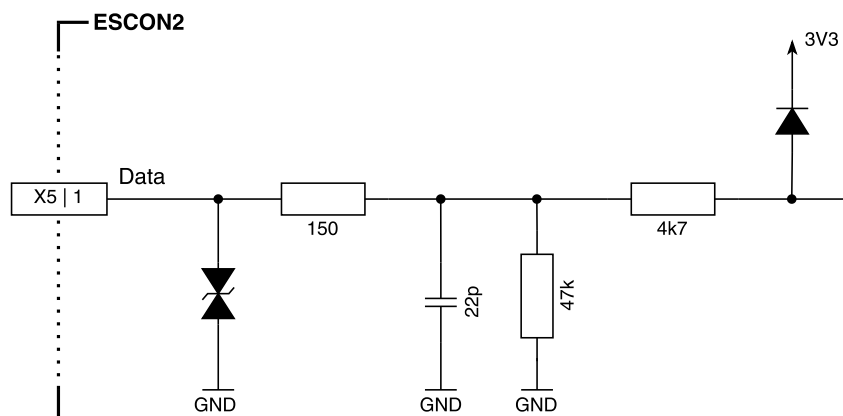


Figure 3-16 SSI absolute encoder data input (analogously valid for BiSS C)

| SSI / BiSS C unidirectional absolute encoder clock channel |        |             |
|------------------------------------------------------------|--------|-------------|
| Output voltage                                             |        | 3.3 VDC     |
| Output resistance                                          |        | 47 $\Omega$ |
| Max. output current                                        |        | 24 mA       |
| Clock frequency                                            | SSI    | 0.4...2 MHz |
|                                                            | BiSS C | 0.4...4 MHz |

Table 3-29 Single-ended SSI / BiSS C unidirectional absolute encoder clock channel specification

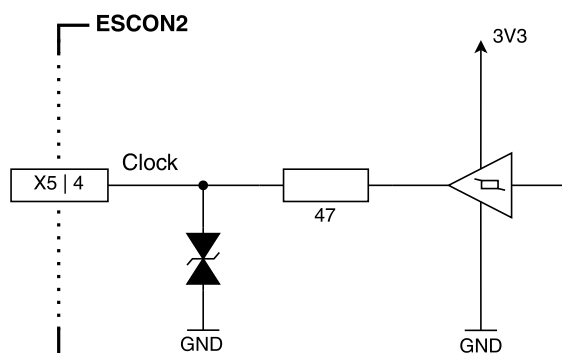


Figure 3-17 SSI absolute encoder clock output (analogously valid for BiSS C)

### 3.3.5.3 High-speed digital I/Os

Alternatively, the sensor 2 interface can be used for high-speed digital I/O operation.

For easier plug-and-play, use maxon's ribbon cable (P/N 354046) and adapter (P/N 262359) to connect the high-speed digital I/Os to a 10-pole screw terminal.

| High-speed digital inputs 1...2 (differential) |                    |
|------------------------------------------------|--------------------|
| Max. input voltage                             | $\pm 12$ VDC       |
| Min. differential input voltage                | $\pm 200$ mV       |
| Line receiver (internal)                       | EIA/RS422 standard |
| Max. input frequency                           | 6.67 MHz           |
| Total reaction time                            | < 1.5 ms           |

Table 3-30 Differential high-speed digital inputs specification

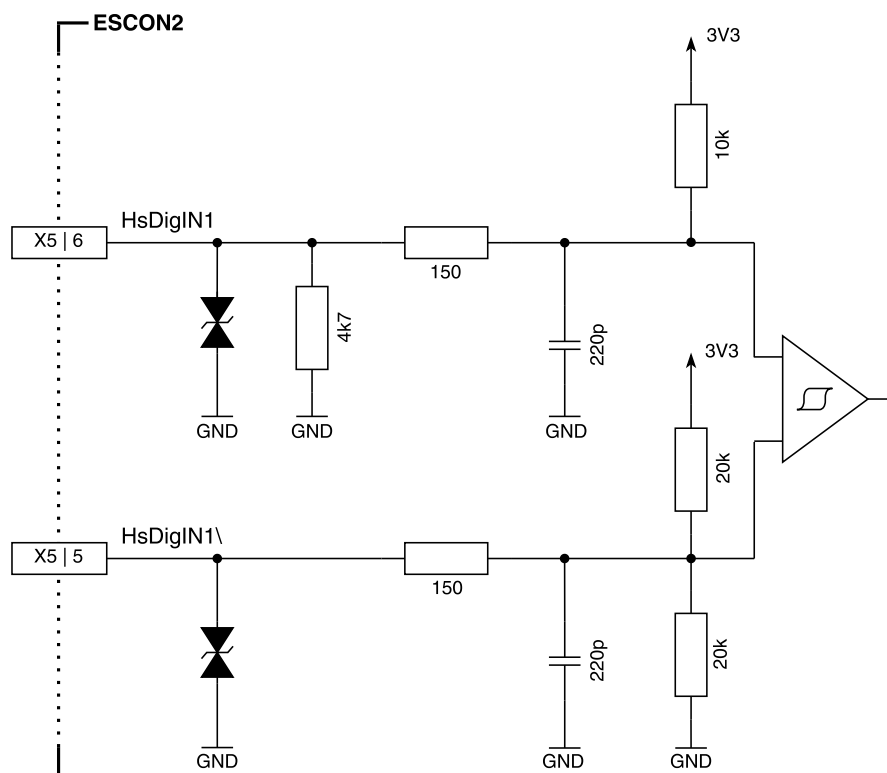


Figure 3-18 HsDigIN1 circuit “differential” (analogously valid for HsDigIN2)

| High-speed digital inputs 1...4 (single-ended) |              |                                       |
|------------------------------------------------|--------------|---------------------------------------|
| Input voltage                                  |              | 0...5 VDC                             |
| Max. input voltage                             |              | ± 12 VDC                              |
| Low-level input voltage                        |              | < 1.0 VDC                             |
| High-level input voltage                       |              | > 2.4 VDC                             |
| Input high current                             | HsDigIN1...3 | $I_{IH}$ = typically 1.3 mA @ 5 VDC   |
|                                                | HsDigIN4     | $I_{IH}$ = typically 0.34 mA @ 5 VDC  |
| Input low current                              | HsDigIN1...3 | $I_{IL}$ = typically -0.36 mA @ 0 VDC |
|                                                | HsDigIN4     | $I_{IL}$ = typically 0 mA @ 0 VDC     |
| Max. input frequency                           |              | 6.25 MHz                              |
| Total reaction time                            |              | < 1.5 ms                              |

Table 3-31 Single-ended high-speed digital input specification

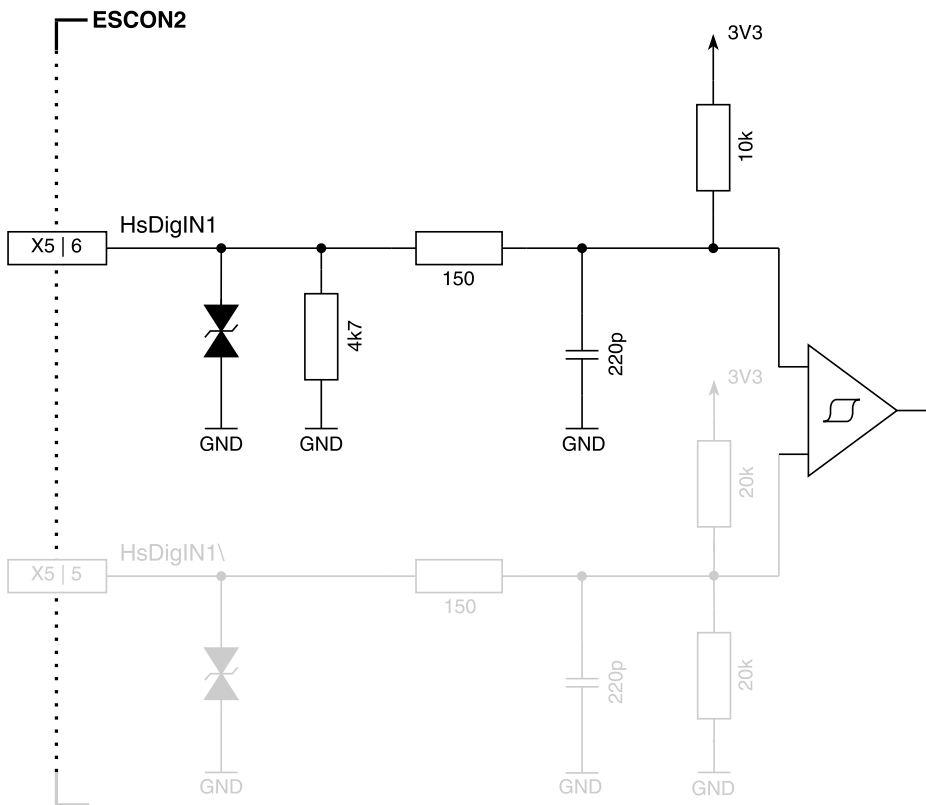


Figure 3-19 HsDigIN1 circuit “single-ended” (analogously valid for HsDigIN2...3)

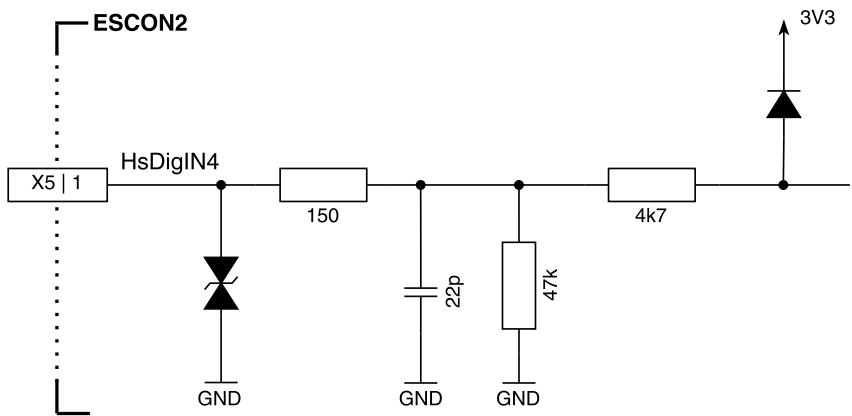


Figure 3-20 HsDigIN4 circuit “single-ended”

WIRING EXAMPLES

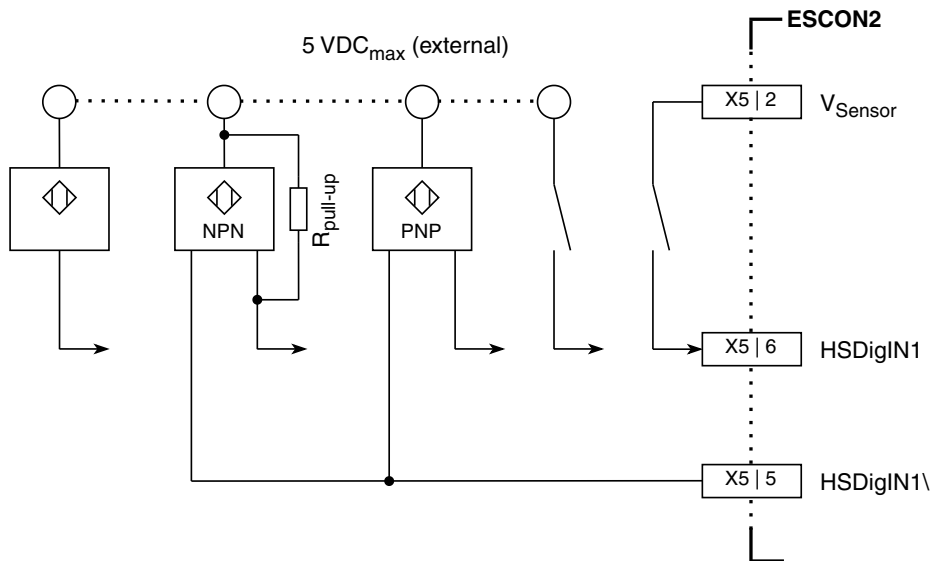


Figure 3-21     Wiring examples for proximity sensors and switches on HsDigIN1 (analogously valid for HsDigIN2)

| High-speed digital output 1 |               |                    |
|-----------------------------|---------------|--------------------|
| Output voltage              |               | 3.3 VDC            |
| Output resistance           | Total         | 75 Ω (47 Ω + 28 Ω) |
|                             | Gate internal | 28 Ω               |
| Max. output current         |               | 24 mA              |
| Max. output frequency       |               | 25 kHz             |

Table 3-32     High-speed digital output specification

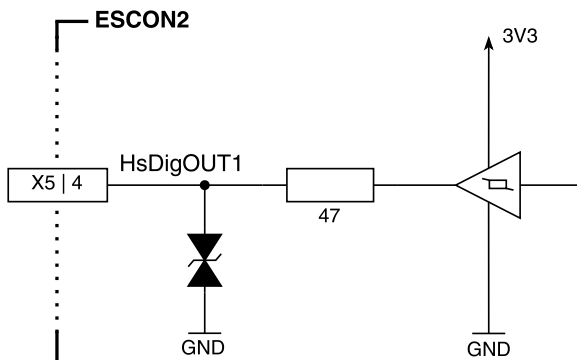


Figure 3-22     HsDigOUT1 circuit

WIRING EXAMPLES

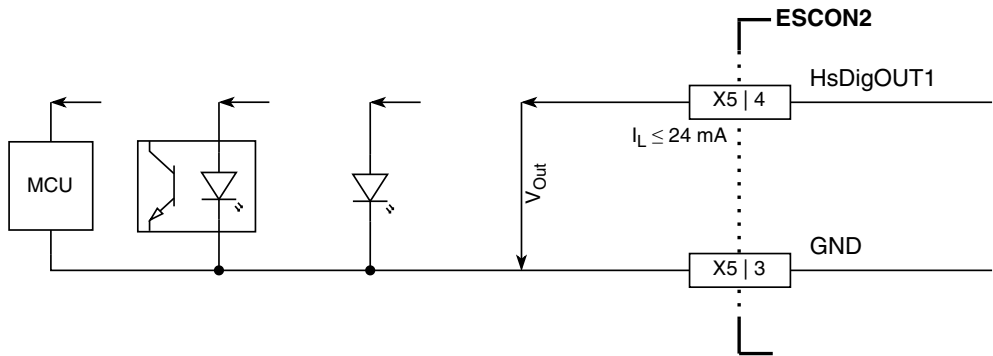


Figure 3-23     Wiring examples for "sourcing" on HsDigOUT1

3.3.6     Digital I/Os (X7)

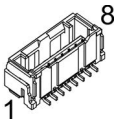


Figure 3-24     Digital I/Os connector X7

| X7<br>Pin | Prefab cable  |                |               | Signal           | Description                                                                                                                                                                                                                                                                                                                                                        |
|-----------|---------------|----------------|---------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | Head A<br>Pin | Cable<br>color | Head B<br>Pin |                  |                                                                                                                                                                                                                                                                                                                                                                    |
| 1         | 1             | white          |               | DigIN1           | Digital input 1                                                                                                                                                                                                                                                                                                                                                    |
| 2         | 2             | brown          |               | DigIN2           | Digital input 2                                                                                                                                                                                                                                                                                                                                                    |
| 3         | 3             | green          |               | DigIN3           | Digital input 3                                                                                                                                                                                                                                                                                                                                                    |
| 4         | 4             | yellow         |               | DigIN4           | Digital input 4                                                                                                                                                                                                                                                                                                                                                    |
| 5         | 5             | grey           |               | DigOUT1          | Digital output 1                                                                                                                                                                                                                                                                                                                                                   |
| 6         | 6             | pink           |               | DigOUT2          | Digital output 2                                                                                                                                                                                                                                                                                                                                                   |
| 7         | 7             | blue           |               | GND              | Ground                                                                                                                                                                                                                                                                                                                                                             |
| 8         | 8             | red            |               | V <sub>I/O</sub> | Dual-use <ul style="list-style-type: none"><li>• Use V<sub>I/O</sub> as the supply voltage for I/O operation (for example, switches).<br/>V<sub>I/O</sub> = V<sub>Sensor</sub> (5 VDC) - 0.75 VDC = 4.25 VDC.</li><li>• Use V<sub>I/O</sub>, internally connected to a freewheeling diode, when switching inductive loads powered by an external supply.</li></ul> |

Table 3-33     Digital I/Os connector X7 – Pin assignment

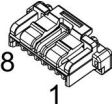
| Signal cable 8core (P/N 520853)                                                                                                            |                                       |                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------|
| <div><div><div>A</div></div><div><div>B</div></div></div> |                                       |                                                   |
| Cross-section                                                                                                                              | 8 × 0.14 mm <sup>2</sup> , grey       |                                                   |
| Length                                                                                                                                     | 3 m                                   |                                                   |
| Head A                                                                                                                                     | Plug                                  | Molex CLIK-Mate, single row, 8 poles (5025780800) |
|                                                                                                                                            | Contacts                              | Molex CLIK-Mate crimp terminals (5025790000)      |
| Head B                                                                                                                                     | Wire end sleeves 0.14 mm <sup>2</sup> |                                                   |

Table 3-34      Signal cable 8core

| Digital inputs 1...2        |                                                                                         |
|-----------------------------|-----------------------------------------------------------------------------------------|
| Input voltage               | 0...30 VDC                                                                              |
| Max. input voltage          | ±30 VDC                                                                                 |
| Low-level input voltage     | < 0.8 VDC                                                                               |
| High-level input voltage    | > 2.1 VDC                                                                               |
| Input resistance            | typically 47 kΩ < 3.3 VDC<br>typically 37 kΩ @ 5 VDC<br>typically 25 kΩ @ 24 VDC        |
| Input current at logic 1    | typically 135 µA @ 5 VDC                                                                |
| Hardware switching delay    | < 6 µs                                                                                  |
| Total reaction time         | < 2.3 ms                                                                                |
| PWM duty cycle (resolution) | 10...90 % (0.1 %)                                                                       |
| PWM frequency               | 50 Hz...10 kHz                                                                          |
| PWM accuracy                | typically +0.1 % absolute @ 50 Hz / 5 VDC<br>typically +1.5 % absolute @ 10 kHz / 5 VDC |

Table 3-35      Digital inputs 1...2 specification

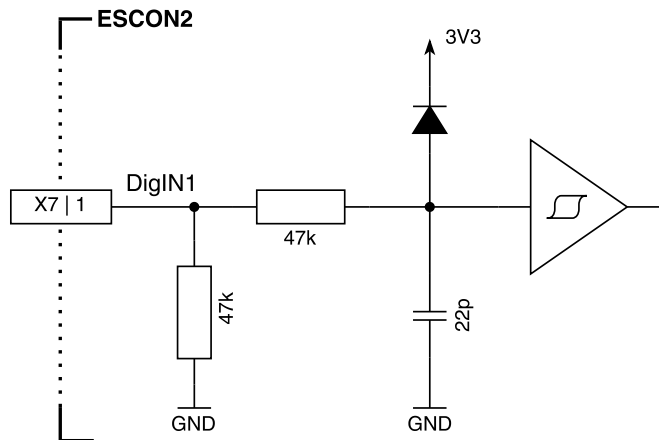


Figure 3-25      DigIN1 circuit (analogously valid for DigIN2)

| Digital inputs 3...4     |                                                                                  |
|--------------------------|----------------------------------------------------------------------------------|
| Input voltage            | 0...30 VDC                                                                       |
| Max. input voltage       | ±30 VDC                                                                          |
| Low-level input voltage  | < 0.8 VDC                                                                        |
| High-level input voltage | > 2.1 VDC                                                                        |
| Input resistance         | typically 47 kΩ < 3.3 VDC<br>typically 37 kΩ @ 5 VDC<br>typically 25 kΩ @ 24 VDC |
| Input current at logic 1 | typically 135 μA @ 5 VDC                                                         |
| Hardware switching delay | < 300 μs                                                                         |
| Total reaction time      | < 2.3 ms                                                                         |

Table 3-36 Digital inputs 3...4 specification

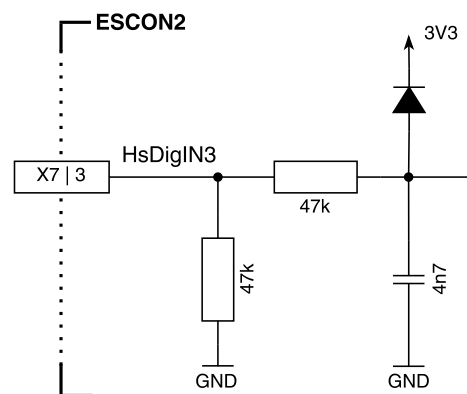


Figure 3-26 DigIN3 circuit (analogously valid for DigIN4)

### WIRING EXAMPLES

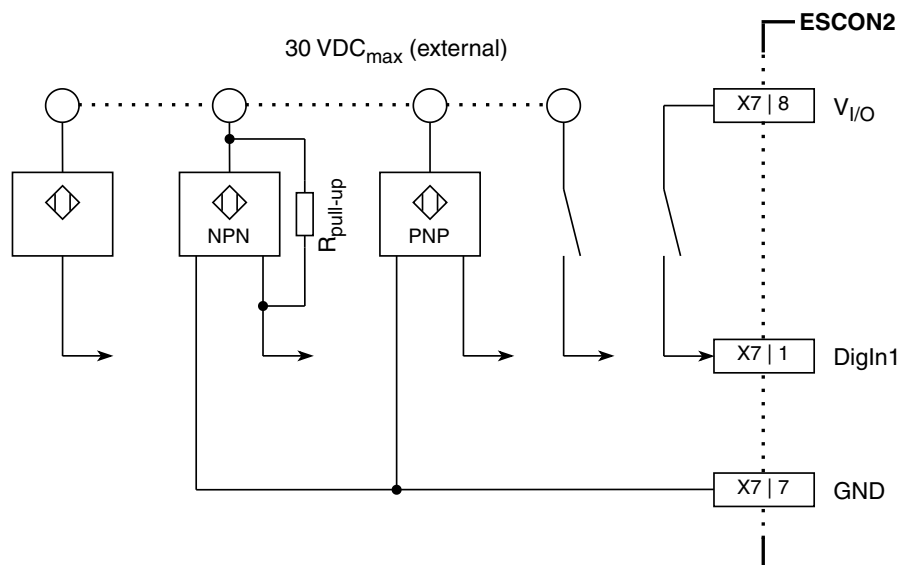


Figure 3-27 Wiring examples for proximity sensors and switches on DigIN1 (analogously valid for DigIN2..4)

| Digital outputs 1...2 “sinking” |                                                                 |
|---------------------------------|-----------------------------------------------------------------|
| Max. input voltage              | 36 VDC                                                          |
| Max. load current               | 500 mA                                                          |
| Max. voltage drop               | 0.25 VDC @ 500 mA                                               |
| Max. load inductance            | 100 mH @ 24 VDC; 500 mA with internal clamping typically 45 VDC |
| Max. output frequency           | 25 kHz                                                          |

Table 3-37 Digital outputs specification – Sinking

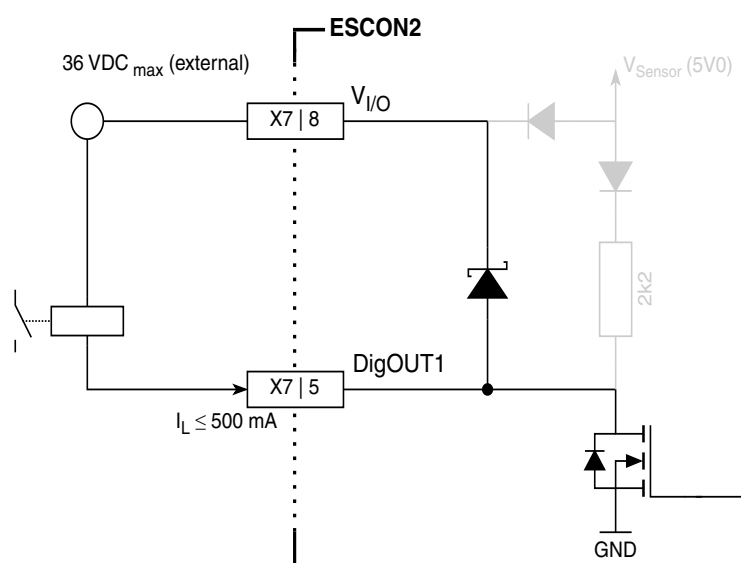


Figure 3-28 DigOUT1 circuit with wiring example for “sinking” inductive loads (analogously valid for DigOUT2)



#### Freewheeling diode for inductive loads

When utilizing the digital output load switch for the operation of inductive loads, such as relays, and  $V_{I/O}$  is not used, it is essential to confirm the presence of a freewheeling diode to prevent potential harm to the hardware. If possible, install the freewheeling diode at the load.

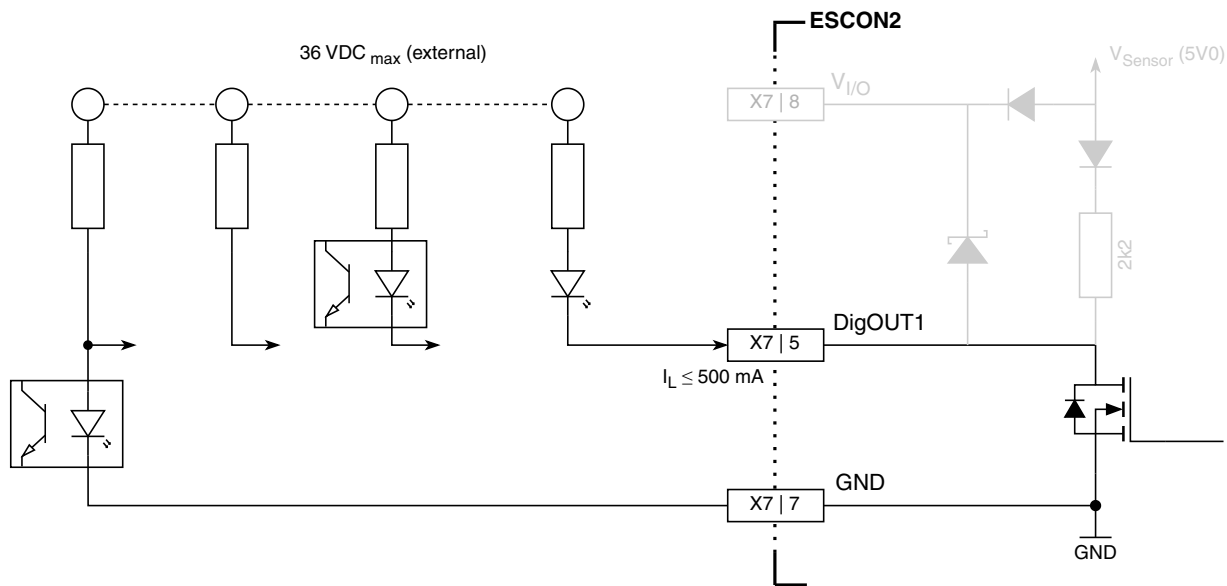


Figure 3-29 DigOUT1 circuit with wiring examples for “sinking” general-purpose loads (also valid for DigOUT2)

| Digital outputs 1...2 “sourcing” |                                                                                 |
|----------------------------------|---------------------------------------------------------------------------------|
| Output voltage                   | $V_{\text{Out}} = 5 \text{ VDC} - 0.75 \text{ VDC} - (I_L \times 2'200 \Omega)$ |
| Max. load current                | $I_L \leq 2 \text{ mA}$                                                         |

Table 3-38 Digital outputs specification – Sourcing

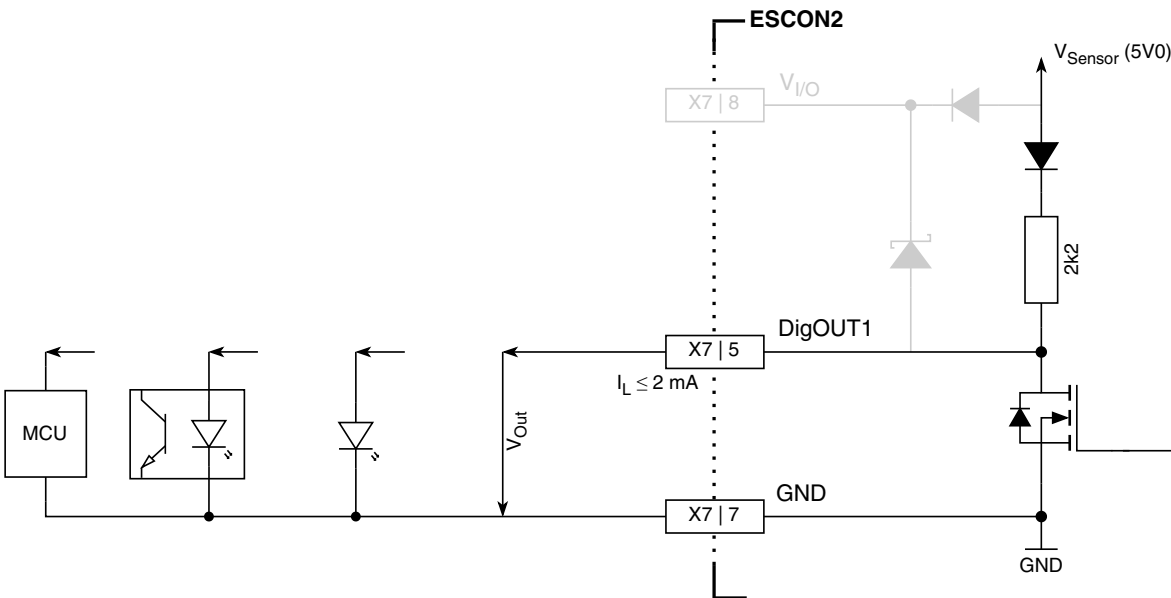


Figure 3-30 DigOUT1 circuit with wiring examples for “sourcing” (analogously valid for DigOUT2)

3.3.7 Analog I/Os (X8)

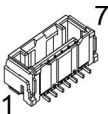


Figure 3-31 Analog I/Os connector X8

| X8 Pin | Prefab cable |             |            | Signal | Description                    |
|--------|--------------|-------------|------------|--------|--------------------------------|
|        | Head A Pin   | Cable color | Head B Pin |        |                                |
| 1      | 1            | white       |            | AnIN1+ | Analog input 1 positive signal |
| 2      | 2            | brown       |            | AnIN1– | Analog input 1 negative signal |
| 3      | 3            | green       |            | AnIN2+ | Analog input 2 positive signal |
| 4      | 4            | yellow      |            | AnIN2– | Analog input 2 negative signal |
| 5      | 5            | grey        |            | AnOUT1 | Analog output 1                |
| 6      | 6            | pink        |            | AnOUT2 | Analog output 2                |
| 7      | 7            | blue        |            | GND    | Ground                         |

Table 3-39 Analog I/Os connector X8 – Pin assignment

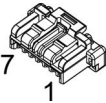
| Signal cable 7core (P/N 520854)                                                                                                   |                                       |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------|
| <div><div>A</div><div></div><div>B</div></div> |                                       |                                                   |
| Cross-section                                                                                                                     | 7 × 0.14 mm <sup>2</sup> , grey       |                                                   |
| Length                                                                                                                            | 3 m                                   |                                                   |
| Head A                                                                                                                            | Plug                                  | Molex CLIK-Mate, single row, 7 poles (5025780700) |
|                                                                                                                                   | Contacts                              | Molex CLIK-Mate crimp terminals (5025790000)      |
| Head B                                                                                                                            | Wire end sleeves 0.14 mm <sup>2</sup> |                                                   |

Table 3-40 Signal cable 7core

| Analog inputs 1...2 |                   |                                  |
|---------------------|-------------------|----------------------------------|
| Input voltage       |                   | ±10 VDC (differential)           |
| Max. input voltage  |                   | ±24 VDC                          |
| Common mode voltage |                   | –5...+10 VDC (referenced to GND) |
| Input resistance    | differential      | 80 kΩ                            |
|                     | referenced to GND | 65 kΩ                            |
| A/D converter       |                   | 12-bit                           |
| Resolution          |                   | 5.64 mV                          |
| Bandwidth           |                   | 10 kHz                           |

Table 3-41 Analog input specification

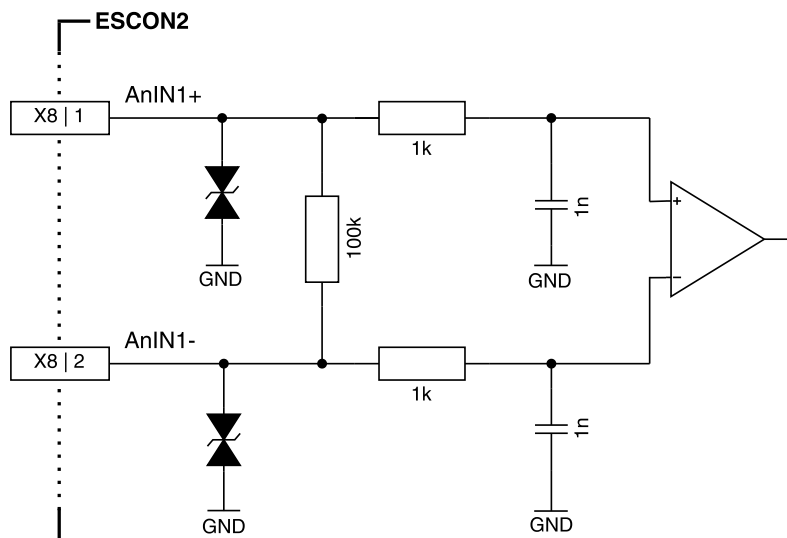


Figure 3-32 AnIN1 circuit (analogously valid for AnIN2)

### WIRING EXAMPLES

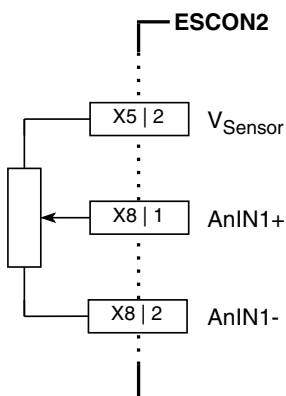


Figure 3-33 Wiring examples for a potentiometer on AnIN1 (analogously valid for AnIN2)

The figure above shows how to connect an external potentiometer to the analog input. It is recommended to use a potentiometer that has a resistance of 10 k $\Omega$  or more to reduce the load on the voltage output.

| Analog outputs 1...2                 |                                                                                                                 |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Output voltage                       | $\pm 4$ VDC                                                                                                     |
| D/A converter                        | 12-bit                                                                                                          |
| Resolution                           | 2.42 mV                                                                                                         |
| Refresh rate                         | 50 kHz                                                                                                          |
| Analog bandwidth of output amplifier | 25 kHz                                                                                                          |
| Max. capacitive load                 | 300 nF<br><b>Note:</b> The increase rate is limited in proportion to the capacitive load (e.g. 5 V/ms @ 300 nF) |
| Max. output current limit            | 1 mA                                                                                                            |

Table 3-42 Analog output specification

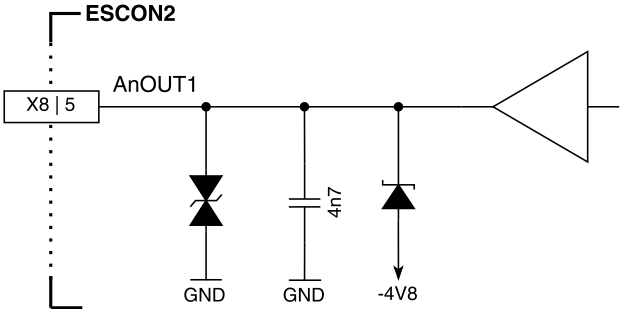


Figure 3-34 AnOUT1 circuit (analogously valid for AnOUT2)

3.3.8 CAN 1 (X11) & CAN 2 (X12)

The ESCON2 is specially designed to be commanded and controlled via a Controller Area Network (CAN), a highly efficient data bus common in all fields of automation and motion control. It is preferably used as a slave node in the CANopen network.

For the CAN configuration check →Chapter “3.4 DIP switch configuration (SW1)” on page 3-45.



Figure 3-35 CAN 1 connector X11/CAN 2 connector X12

| X11/12<br>Pin | Prefab cable  |                |                                |                                | Signal     | Description       |
|---------------|---------------|----------------|--------------------------------|--------------------------------|------------|-------------------|
|               | Head A<br>Pin | Cable<br>color | P/N<br>520858<br>Head B<br>Pin | P/N<br>520857<br>Head B<br>Pin |            |                   |
| 1             | 1             | white          | 1                              | 7                              | CAN high   | CAN bus high line |
| 2             | 2             | brown          | 2                              | 2                              | CAN low    | CAN bus low line  |
| 3             | 3             | green          | 3                              | 3                              | GND        | Ground            |
| 4             | 4             | yellow         | 4                              | 5                              | CAN shield | Cable shield      |

Table 3-43 CAN 1 connector X11/CAN 2 connector X12 – Pin assignment

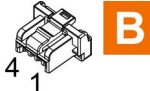
| CAN-CAN cable (P/N 520858)                                                          |                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |                                                       |  |
| Cross-section                                                                       | 2 × 2 × 0.22 mm <sup>2</sup> , twisted pair, shielded |                                                                                       |
| Length                                                                              | 3 m                                                   |                                                                                       |
| Head A                                                                              | Plug                                                  | Molex CLIK-Mate, single row, 4 poles (5025780400)                                     |
|                                                                                     | Contacts                                              | Molex CLIK-Mate crimp terminals (5025790000)                                          |
| Head B                                                                              | Plug                                                  | Molex CLIK-Mate, single row, 4 poles (5025780400)                                     |
|                                                                                     | Contacts                                              | Molex CLIK-Mate crimp terminals (5025790000)                                          |

Table 3-44 CAN-CAN cable

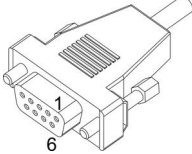
| CAN-COM cable (P/N 520857)                                                                                                                                                                                                                                                                          |                                                                |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------|
| <div><div></div><div></div><div></div></div> |                                                                |                                                   |
| Cross-section                                                                                                                                                                                                                                                                                       | 2 × 2 × 0.22 mm <sup>2</sup> , twisted pair, shielded          |                                                   |
| Length                                                                                                                                                                                                                                                                                              | 3 m                                                            |                                                   |
| Head A                                                                                                                                                                                                                                                                                              | Plug                                                           | Molex CLIK-Mate, single row, 4 poles (5025780400) |
|                                                                                                                                                                                                                                                                                                     | Contacts                                                       | Molex CLIK-Mate crimp terminals (5025790000)      |
| Head B                                                                                                                                                                                                                                                                                              | Female D-Sub connector DIN 41652 9 poles, with mounting screws |                                                   |

Table 3-45 CAN-COM cable

| CAN interface            |                                        |
|--------------------------|----------------------------------------|
| Standard                 | ISO 11898-2:2003                       |
| Max. bit rate            | 1 Mbit/s                               |
| Max. number of CAN nodes | 31/127 (via hardware/software setting) |
| Protocol                 | CiA 301 version 4.2.0                  |
| Node-ID setting          | By DIP switch or software              |

Table 3-46 CAN interface specification



**Note**

- Consider the CAN master's maximal bit rate.
- The standard bit rate setting (factory setting) is 1 Mbit/s.
- Use 120 Ω termination resistor at both ends of the CAN bus.
- For detailed CAN information see separate document →ESCON2 Communication Guide [1].

3.3.9 USB (X13)



**Hot plugging the USB interface may cause hardware damage**

Do not hot-plug the USB interface (connecting while the power supply is on), the possibly high potential differences of the two power supplies of controller and PC/Notebook can lead to damaged hardware.

- Avoid potential differences between the power supply of controller and PC/Notebook or, if possible, balance them.
- Insert the USB connector first, then switch on the power supply of the controller.
- It is recommended to use a galvanic isolator to avoid potential differences.  
With a galvanic isolator, you can also connect the USB while the system is powered (hot-plugging).  
One suitable device is the USB Isolator 33204 from Wiesemann & Theis GmbH.

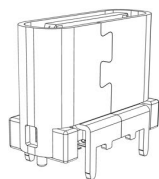


Figure 3-36 USB connector X13

| USB Type C - Type C cable (P/N 845854) |            |
|----------------------------------------|------------|
| <b>A</b>                               | <b>B</b>   |
|                                        |            |
| USB standard                           | USB 3.2    |
| Length                                 | 1.5 m      |
| Head A                                 | USB Type C |
| Head B                                 | USB Type C |

Table 3-47 USB Type C – Type C cable

| USB Type A - Type C cable (P/N 838461) |                   |
|----------------------------------------|-------------------|
| <b>A</b>                               | <b>B</b>          |
|                                        |                   |
| USB standard                           | USB 2.0 / USB 3.0 |
| Length                                 | 1.5 m             |
| Head A                                 | USB Type C        |
| Head B                                 | USB Type A        |

Table 3-48 USB Type A – Type C cable

| USB                               |                        |
|-----------------------------------|------------------------|
| Data signaling rate               | 12 Mbit/s (Full speed) |
| Max. bus supply voltage $V_{Bus}$ | 5.25 VDC               |
| Max. DC data input voltage        | -0.3...+3.8 VDC        |

Table 3-49 USB interface specification

3.3.10 Motor temperature sensor (X16) (future release)

The functionality will only be available with a future firmware release.

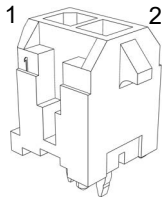


Figure 3-37 Motor temperature sensor connector X16

| X16<br>Pin | Prefab cable  |                |               | Signal    | Description                    |
|------------|---------------|----------------|---------------|-----------|--------------------------------|
|            | Head A<br>Pin | Cable<br>color | Head B<br>Pin |           |                                |
| 1          | 1             | black          |               | GND       | Ground                         |
| 2          | 2             | red            |               | MotorTemp | Motor temperature sensor input |

Table 3-50 Motor temperature sensor connector X16 – Pin assignment

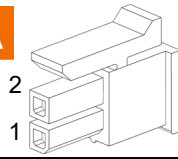
| NTC cable (P/N 847301)                                                                                     |                                      |                                                         |  |
|------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------|--|
| <div><div>A</div></div> |                                      | <div>B</div>                                            |  |
| Cross-section                                                                                              | 2 × 0.5 mm <sup>2</sup> , grey       |                                                         |  |
| Length                                                                                                     | 3 m                                  |                                                         |  |
| Head A                                                                                                     | Plug                                 | Molex Micro-Fit 3.0, 2 poles (430250200)                |  |
|                                                                                                            | Contacts                             | Molex Micro-Fit 3.0 female crimp terminals (0430300001) |  |
| Head B                                                                                                     | Wire end sleeves 0.5 mm <sup>2</sup> |                                                         |  |

Table 3-51 NTC cable

| Motor temperature sensor input |                                |
|--------------------------------|--------------------------------|
| Input voltage                  | 0...3.3 VDC                    |
| Max. input voltage             | +24 VDC                        |
| A/D converter                  | 12-bit                         |
| Internal pull-up resistor      | 3.3 kΩ (referenced to 3.3 VDC) |

Table 3-52 Motor temperature sensor – specifications

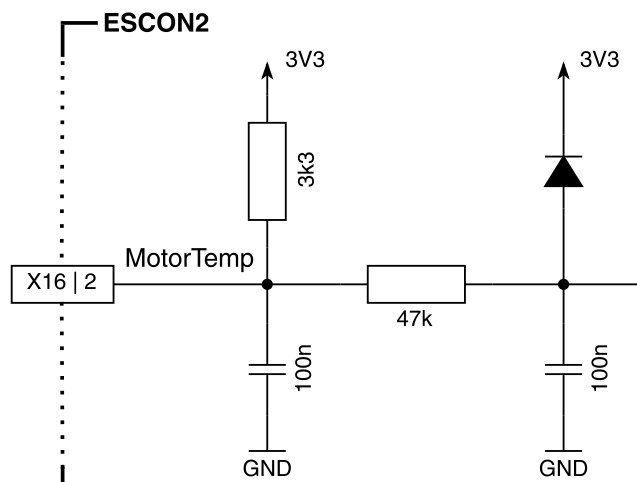


Figure 3-38 Motor temperature circuit

3.4 DIP switch configuration (SW1)

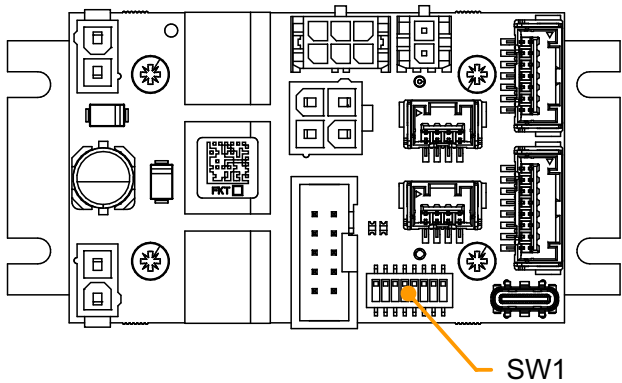


Figure 3-39 DIP switch SW1



**DIP switch 8 has no functionality assigned and is not connected.**

3.4.1 CAN ID (Node-ID)

The device’s identification (subsequently called “ID”) can be set by means of DIP switches 1...5 or software using binary code.



**Setting the ID by DIP switch SW1**  
• DIP switches 6...8 do not have any impact on the ID.

| Setting                                                                                                                                                                                                                        | Switch | Binary Code    | Valence |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|---------|
| <div><div><div>1</div><div>8</div></div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div>ON</div><div>OFF</div></div><div>(factory setting)</div></div></div> | 1      | 2 <sup>0</sup> | 1       |
|                                                                                                                                                                                                                                | 2      | 2 <sup>1</sup> | 2       |
|                                                                                                                                                                                                                                | 3      | 2 <sup>2</sup> | 4       |
|                                                                                                                                                                                                                                | 4      | 2 <sup>3</sup> | 8       |
|                                                                                                                                                                                                                                | 5      | 2 <sup>4</sup> | 16      |

Table 3-53 DIP switch SW1 – Binary code values

Continued on next page.

The set ID can be calculated by adding the valence of all activated switches. Use the following table as a (non-concluding) guide:

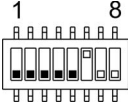
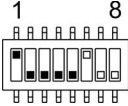
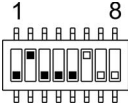
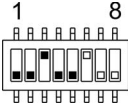
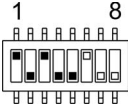
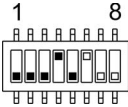
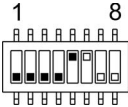
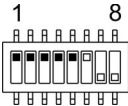
| Setting                                                                                          | Switch |   |   |   |   | ID |
|--------------------------------------------------------------------------------------------------|--------|---|---|---|---|----|
|                                                                                                  | 1      | 2 | 3 | 4 | 5 |    |
| <br>ON<br>OFF   | 0      | 0 | 0 | 0 | 0 | –  |
| <br>ON<br>OFF   | 1      | 0 | 0 | 0 | 0 | 1  |
| <br>ON<br>OFF   | 0      | 1 | 0 | 0 | 0 | 2  |
| <br>ON<br>OFF   | 0      | 0 | 1 | 0 | 0 | 4  |
| <br>ON<br>OFF  | 1      | 0 | 1 | 0 | 0 | 5  |
| <br>ON<br>OFF | 0      | 0 | 0 | 1 | 0 | 8  |
| <br>ON<br>OFF | 0      | 0 | 0 | 0 | 1 | 16 |
| <br>ON<br>OFF | 1      | 1 | 1 | 1 | 1 | 31 |
| 0 = Switch "OFF"      1 = Switch "ON"                                                            |        |   |   |   |   |    |

Table 3-54      DIP switch SW1 – Examples

#### SETTING THE ID BY MEANS OF «MOTION STUDIO»

- The ID may be set by software (changing object 0x2000 «Node-ID», range 1...127).
- The ID set by software is valid if the ID is set to "0" (DIP switches 1...5 set to OFF).

3.4.2 CAN automatic bit rate detection

With this function, the CANopen interface can be put in a “listen only” mode. For further details see separate document ➔ESCON2 Firmware Specification [2]. Automatic bit rate detection is activated with DIP switch 6.

| Switch | OFF                                                                                                                                                                                                                           | ON                                                                                                                                                                                                                                                |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6      | <div><div><div>18</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div><div><div>ON</div><div>OFF</div></div></div> <div>Automatic bit rate detection deactivated</div> | <div><div><div>18</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div><div><div>ON</div><div>OFF</div></div></div> <div>Automatic bit rate detection activated<br/>(factory setting)</div> |

Table 3-55 DIP switch SW1 – CAN automatic bit rate detection

3.4.3 CAN bus termination

A 120 Ω termination resistor can be "activated" with DIP switch 7.

| Switch | OFF                                                                                                                                                                                                                                | ON                                                                                                                                                                                                              |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7      | <div><div><div>18</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div><div><div>ON</div><div>OFF</div></div></div> <div>Without bus termination<br/>(factory setting)</div> | <div><div><div>18</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div></div><div><div>ON</div><div>OFF</div></div></div> <div>Bus termination with 120 Ω</div> |

Table 3-56 DIP switch SW1 – CAN bus termination

3.5 Status indicators

The ESCON2 features a set of LED indicators to display the device condition.

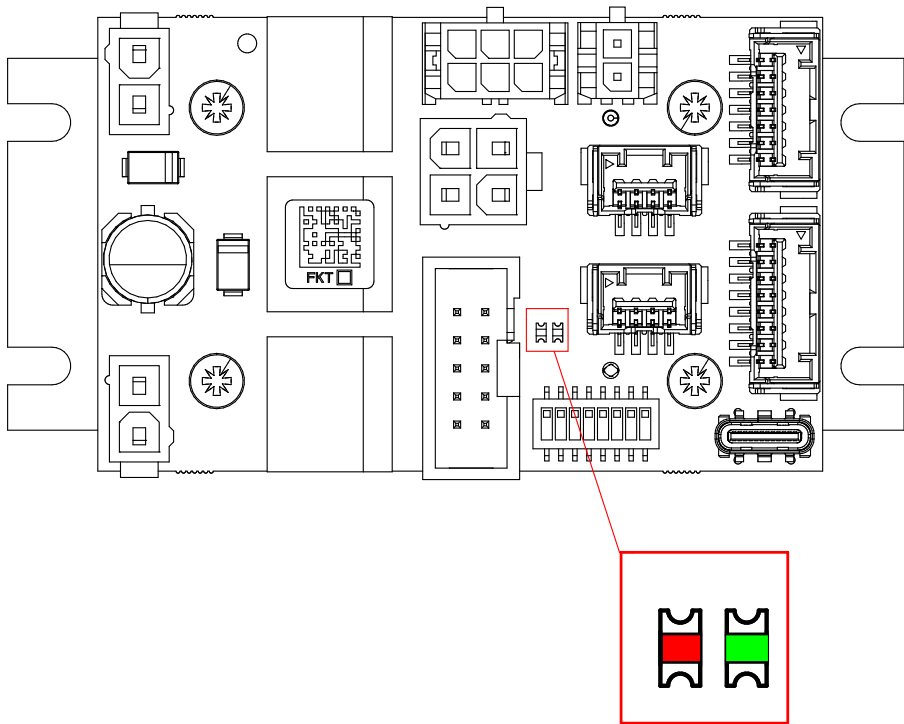


Figure 3-40 LEDs – Location

The LEDs display the actual status and possible warnings and errors of the ESCON2:

- Green LED shows the operation status
- Red LED indicates warnings and errors

| LED   |      | Warning / Error                  | Description                                                                                                                       |
|-------|------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Green | Red  |                                  |                                                                                                                                   |
| Slow  | OFF  | No warning/error active.         | Power stage is disabled. The ESCON2 is in status <ul style="list-style-type: none"><li>• Switch on disabled</li></ul>             |
| Slow  | Slow | At least one warning is active.  | <ul style="list-style-type: none"><li>• Ready to switch on</li><li>• Switched on</li></ul>                                        |
| ON    | OFF  | No warning/error active.         | Power stage is enabled. The ESCON2 is in status <ul style="list-style-type: none"><li>• Operation enabled</li></ul>               |
| ON    | Slow | At least one warning is active.  | <ul style="list-style-type: none"><li>• Quick stop active</li></ul>                                                               |
| ON    | ON   | At least one error has occurred. | Power stage is enabled. The ESCON2 is in temporary status <ul style="list-style-type: none"><li>• Fault reaction active</li></ul> |
| OFF   | ON   | At least one error has occurred. | Power stage is disabled. The ESCON2 is in status <ul style="list-style-type: none"><li>• Fault</li></ul>                          |
| Flash | ON   | n/a                              | Firmware update in progress or invalid application                                                                                |

Slow = LED is slowly blinking (0.5 s OFF, 0.5 s ON)  
Flash = LED is flashing (0.9 s OFF, 0.1 s ON)

Table 3-57 Device status LEDs

4 WIRING

This section provides wiring information for your setup. You can either use the consolidated wiring diagrams (see →Figure 4-42) featuring the full scope of interconnectivity and pin assignments, or you may use the connection over-views for either DC motor or EC (BLDC) motor to determine the wiring for your particular motor type and the appropriate feedback signals.

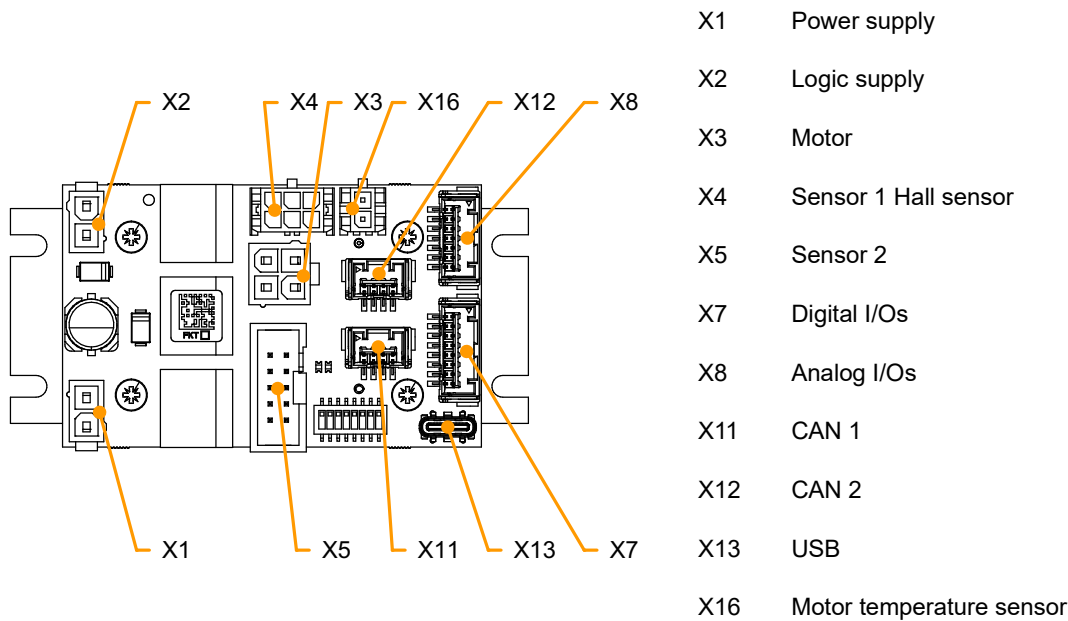


Figure 4-41 Interfaces – Designations and location



**Signs and abbreviations used**

The subsequent diagrams feature these signs and abbreviations:

- «EC motor» stands for brushless EC motor (BLDC).
-  Ground safety earth connection (optional).

4.1 Possible combinations to connect a motor

The following tables show feasible ways to connect the motor with its respective feedback signals or possible combinations thereof. To find the wiring that best suits your setup, proceed as follows:

- 1) Decide on the type of motor you are using and go to the respective subsection;  
For DC motor, see →Chapter “4.1.1 DC motor” on page 4-50 or  
For EC (BLDC) motor, see →Chapter “4.1.2 EC (BLDC) motor” on page 4-50.
- 2) Connect the power supply and the logic supply as shown in the referenced figure.
- 3) Check-out the listing for the combination that best suits your setup. Pick the wiring method number and go to the respective table;  
For DC motor see →Table 4-58,  
For EC (BLDC) motor see →Table 4-59.
- 4) Pick the row with the corresponding wiring method # and refer to the listed figure(s) to find the relevant wiring information.

#### 4.1.1 DC motor

##### Power supply

Power supply and optional logic supply ..... Figure 4-43

##### Motor & feedback signals

Without sensor ..... Method # DC1 [a]

Digital incremental encoder ..... Method # DC2

SSI / BiSS C unidirectional absolute encoder ..... Method # DC3

| Method # | Sensor 2                    |                                              | ➔Figure(s)   |
|----------|-----------------------------|----------------------------------------------|--------------|
|          | Digital incremental encoder | SSI / BiSS C unidirectional absolute encoder |              |
| DC1 [a]  |                             |                                              | 4-45         |
| DC2      | ✓                           |                                              | 4-45<br>4-48 |
| DC3      |                             | ✓                                            | 4-45<br>4-49 |

[a] For method # DC1, only the operating mode current control can be used.

Table 4-58 Possible combinations of feedback signals for DC motor

#### 4.1.2 EC (BLDC) motor

##### Power supply

Power supply and optional logic supply ..... Figure 4-43

##### Motor & feedback signals

Hall sensors ..... Method # EC1

Hall sensors & Digital incremental encoder ..... Method # EC2

Hall sensors & SSI / BiSS C unidirectional absolute encoder ..... Method # EC3

SSI / BiSS C unidirectional absolute encoder ..... Method # EC4

| Method # | Sensor 1     | Sensor 2                    |                                              | ➔Figure(s)           |
|----------|--------------|-----------------------------|----------------------------------------------|----------------------|
|          | Hall sensors | Digital incremental encoder | SSI / BiSS C unidirectional absolute encoder |                      |
| EC1      | ✓            |                             |                                              | 4-46<br>4-47         |
| EC2      | ✓            | ✓                           |                                              | 4-46<br>4-47<br>4-48 |
| EC3      | ✓            |                             | ✓                                            | 4-46<br>4-47<br>4-49 |
| EC4      |              |                             | ✓                                            | 4-46<br>4-49         |

Table 4-59 Possible combinations of feedback signals for EC (BLDC) motor

## 4.2 Main wiring diagram

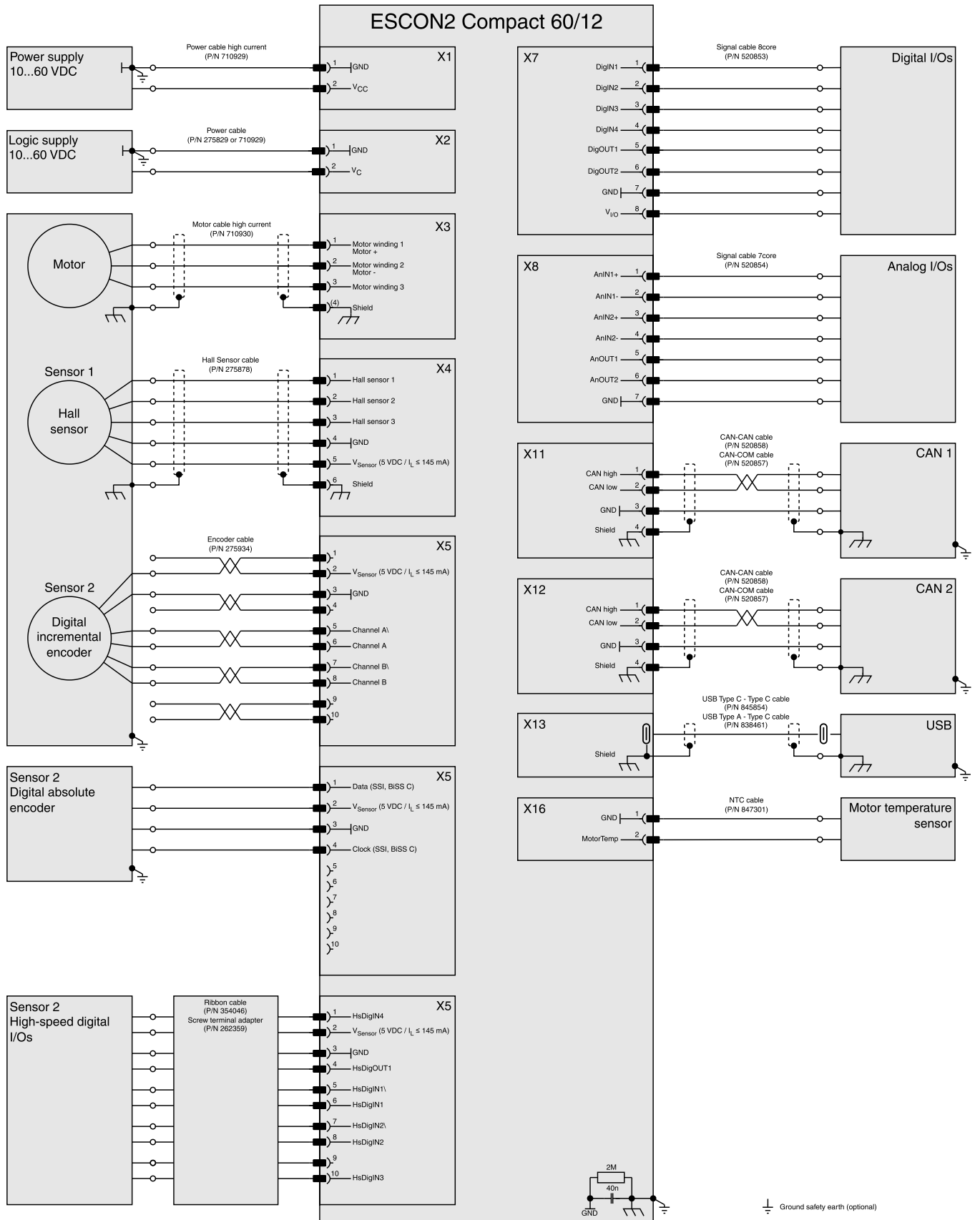


Figure 4-42 Main wiring diagram

4.3 Excerpts

4.3.1 Power supply

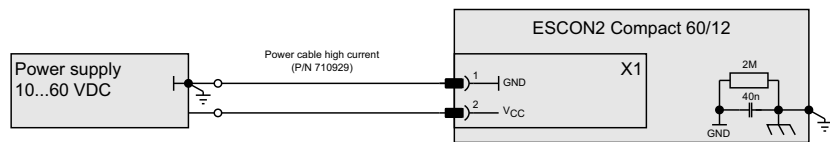


Figure 4-43 Power supply

4.3.2 Logic supply

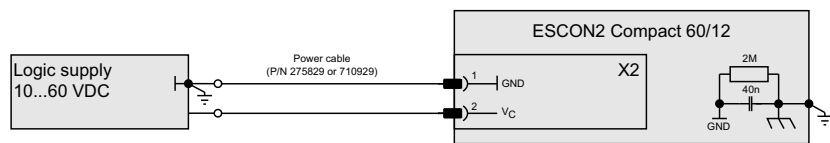


Figure 4-44 Logic supply

4.3.3 DC motor

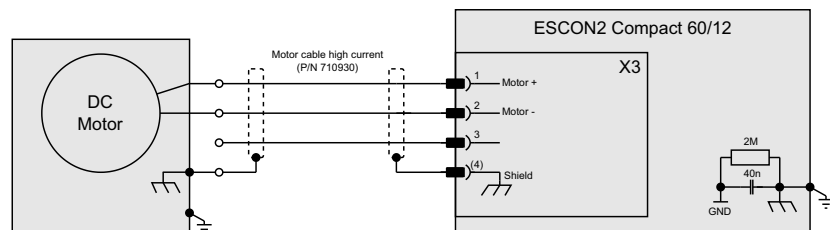


Figure 4-45 DC motor

4.3.4 EC (BLDC) motor

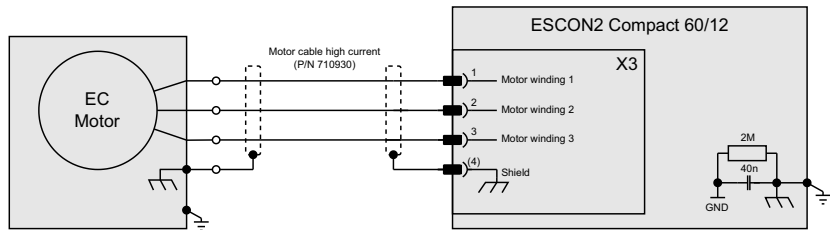


Figure 4-46 EC (BLDC) motor

4.3.5 Sensor 1 Hall sensor

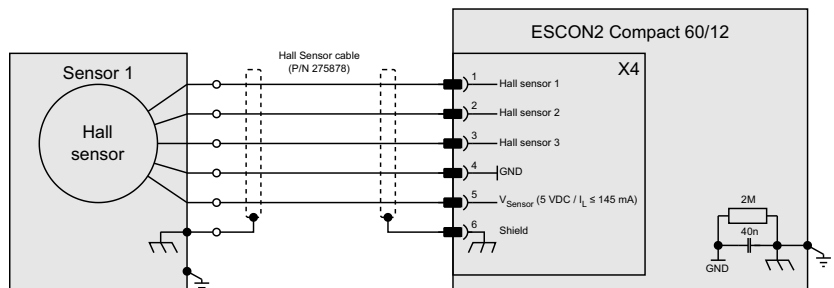


Figure 4-47 Sensor 1 Hall sensor

4.3.6 Sensor 2 Encoder / I/Os

4.3.6.1 Digital incremental encoder

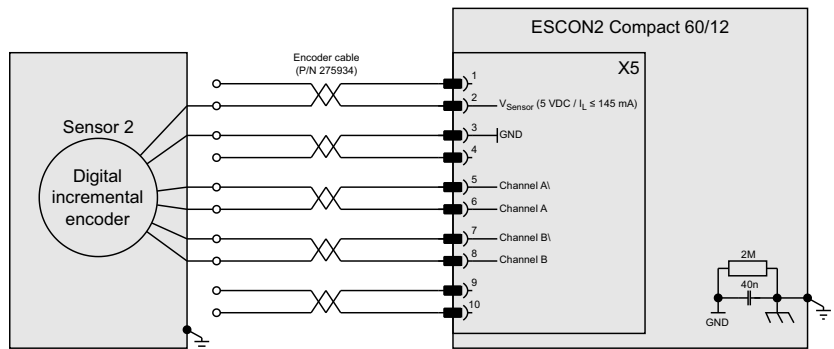


Figure 4-48 Digital incremental encoder

This interface can handle a digital incremental encoder, an SSI / BiSS C digital unidirectional absolute encoder or high-speed digital I/O's. Only one out of these three functions can be used at the same time.

4.3.6.2 SSI / BiSS C unidirectional absolute encoder

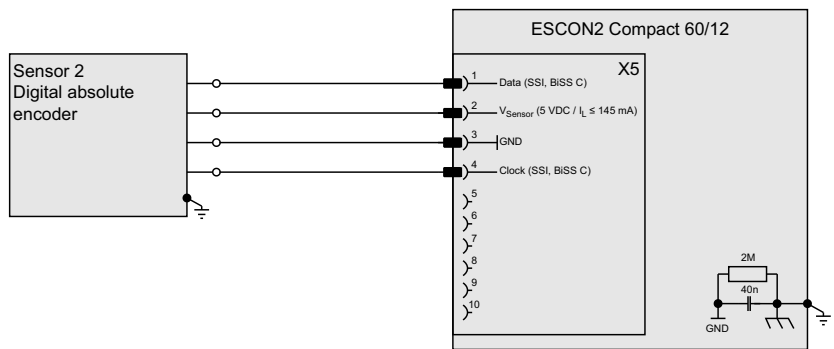


Figure 4-49 SSI / BiSS C unidirectional absolute encoder

This interface can handle a digital incremental encoder, an SSI / BiSS C digital unidirectional absolute encoder or high-speed digital I/O's. Only one out of these three functions can be used at the same time.

4.3.6.3
High-speed digital I/Os

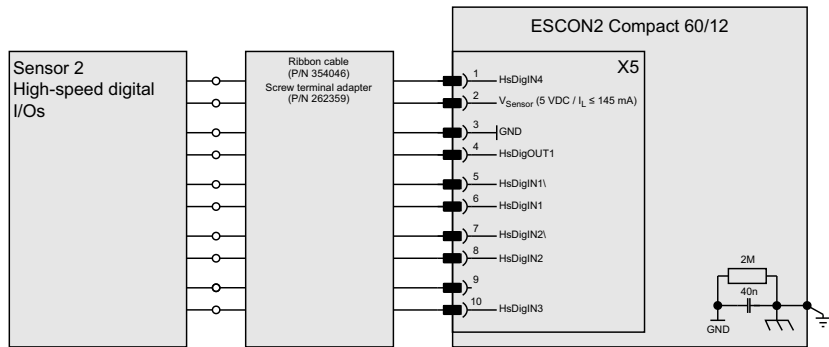


Figure 4-50
High-speed digital I/Os

This interface can handle a digital incremental encoder, an SSI / BiSS C digital unidirectional absolute encoder or high-speed digital I/O's. Only one out of these three functions can be used at the same time.

4.3.7
Digital I/Os

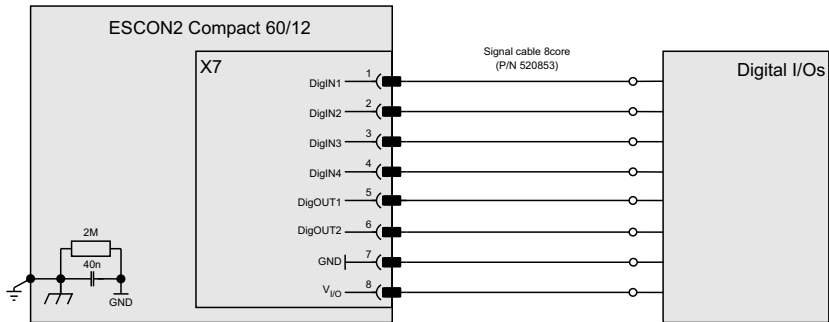


Figure 4-51
Digital I/Os

4.3.8
Analog I/Os

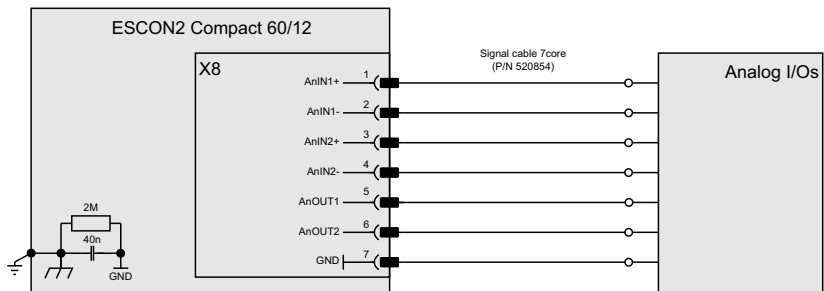


Figure 4-52
Analog I/Os

4.3.9 CAN

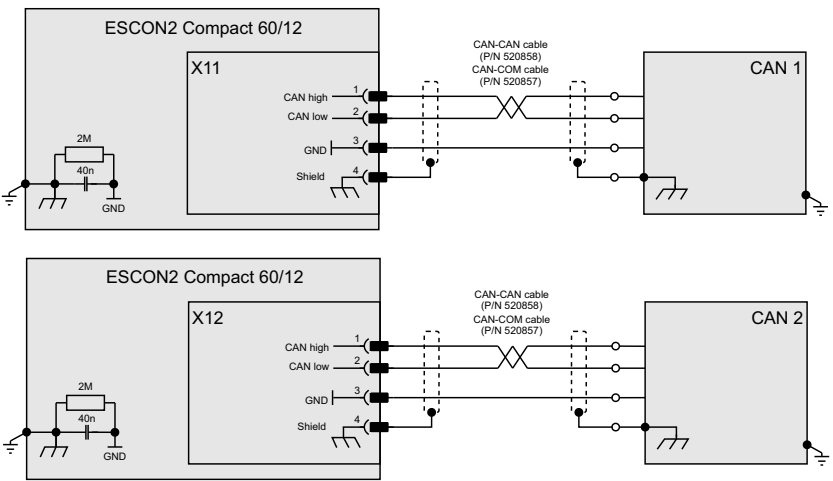


Figure 4-53 CAN

Depending on the preferred interface, one of the two prefab CAN cables can be used.

4.3.10 USB

4.3.10.1 USB-C

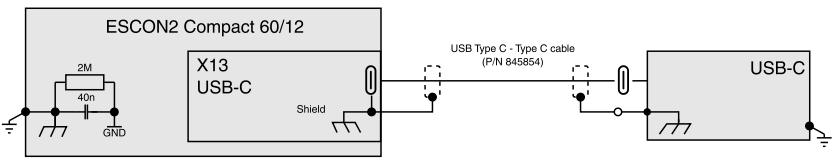


Figure 4-54 USB-C

4.3.10.2 USB-A

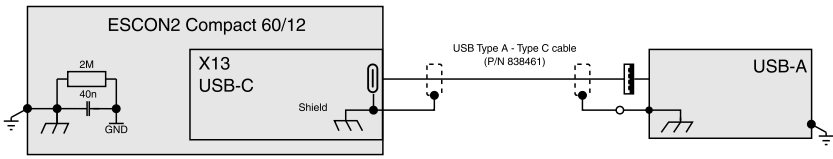


Figure 4-55 USB-A

4.3.11 Motor temperature sensor (future release)

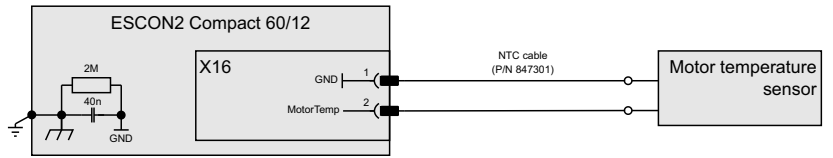


Figure 4-56 Motor temperature sensor

••page intentionally left blank••

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