

MAXPOS 50/5

Hardware Reference



maxpos.maxongroup.com

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READ THIS FIRST

These instructions are intended for qualified technical personnel. Prior commencing with any activities...

- you must carefully read and understand this manual and
- you must follow the instructions given therein.

The MAXPOS 50/5 is considered as partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g) and is intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment.

Therefore, you must not put the device into service,...

- unless you have made completely sure that the other machinery fully complies with the EU directive's requirements!
- unless the other machinery fulfills all relevant health and safety aspects!
- unless all respective interfaces have been established and fulfill the herein stated requirements!

1 ABOUT

1.1 About this Document

1.1.1 Intended Purpose

Use the document to...
–stay safe,
–be fast,
–end up with set up and ready-to-go equipment.

The purpose of the present document is to familiarize you with the MAXPOS 50/5 Positioning Controller. It will highlight the tasks for safe and adequate installation and/or commissioning. Follow the described 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.

The present document is part of a documentation set and contains performance data and specifications, information on fulfilled standards, details on connections and pin assignment, and wiring examples. The below overview shows the documentation hierarchy and the interrelationship of its individual parts:

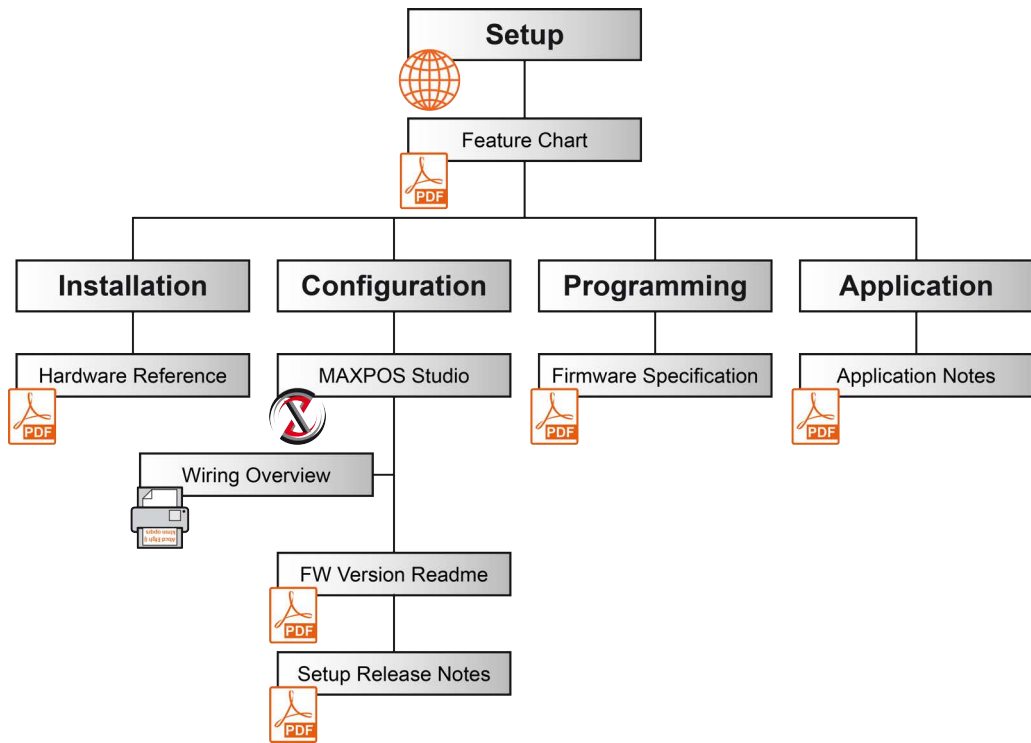


Figure 1-1 Documentation structure

1.1.2 Target Audience

The present document is intended for trained and skilled personnel. It conveys information on how to understand and fulfill the respective work and duties.

1.1.3 How to use

Take note of the following notations and codes which will be used throughout the document.

Notation	Meaning
(n)	refers to an item (such as part numbers, list items, etc.)
→	denotes “see”, “see also”, “take note of” or “go to”

Table 1-1 Notation used

1.1.4 Symbols & Signs

In the course of the present document, the following symbols and signs will be used.







Type	Symbol	Meaning	
Safety Alert	 (typical)	DANGER	Indicates an imminent hazardous situation . If not avoided, it will result in death or serious injury .
		WARNING	Indicates a potential hazardous situation . If not avoided, it can result in death or serious injury .
		CAUTION	Indicates a probable hazardous situation or calls the attention to unsafe practices. If not avoided, it may result in injury .
Prohibited Action	 (typical)	Indicates a dangerous action. Hence, you must not!	
Mandatory Action	 (typical)	Indicates a mandatory action. Hence, you must!	
Information		Requirement / Note / Remark	Indicates an activity you must perform prior continuing, or gives information on a particular item you need to observe.
		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

For easier legibility, registered brand names are listed below and will not be further tagged with their respective trademark. It must be understood that the brands (the list below is not necessarily concluding) are protected by copyright and/or other intellectual property rights even if their legal trademarks are omitted in the later course of this document.

Brand Name	Trademark Owner
Adobe® Reader®	© Adobe Systems Incorporated, USA-San Jose, CA
BISS	© iC-Haus GmbH, DE-Bodenheim
EtherCAT®	© EtherCAT Technology Group, DE-Nuremberg, licensed by Beckhoff Automation GmbH, DE-Verl
Micro-Fit™ Mini-Fit Jr.™	© Molex, USA-Lisle, IL
Pentium®	© Intel Corporation, USA-Santa Clara, CA
Windows®	© Microsoft Corporation, USA-Redmond, WA

Table 1-3 Brand names and trademark owners

1.1.6 Copyright

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1.2 About the Device

Capabilities of the device, included features, and supported motors.

maxon's MAXPOS 50/5 is a fast and highly dynamic motion controller capable to efficiently control permanent magnet-activated brushed DC motors or brushless EC motors (BLDC) up to approximately 250 Watts. It is designed to support a multitude of feedbacks.

Field-oriented control offers the possibility to drive brushless EC motors with minimal torque ripple and low noise. A wide range of operating modes meet the highest requirements and allows flexible use in a variety of fields in industrial automation applications. The MAXPOS 50/5 is especially designed being commanded and controlled as a slave node in an EtherCAT network. In addition, the unit can be configured via USB interface.

Find the latest edition of the present document, as well as additional documentation and software to the MAXPOS Positioning Controller also on the Internet: → <http://maxpos.maxongroup.com>.

1.3 About the Safety Precautions

*Keep in mind:
Safety first!
Always!*

- Make sure that you have read and understood the note “READ THIS FIRST” on page A-2!
- Do not engage with any work unless you possess the stated skills (→chapter “1.1.2 Target Audience” on page 1-3)!
- Refer to →chapter “1.1.4 Symbols & Signs” on page 1-4 to understand the subsequently used indicators!
- You must observe any regulation applicable in the country and/or at the site of implementation with regard to health and safety/accident prevention and/or environmental protection!



DANGER

High Voltage and/or Electrical Shock

Touching live wires causes death or serious injuries!

- *Consider any power cable as connected to live power, unless having proven the opposite!*
- *Make sure that neither end of cable is connected to live power!*
- *Make sure that power source cannot be engaged while work is in process!*
- *Obey lock-out/tag-out procedures!*
- *Make sure to securely lock any power engaging equipment against unintentional engagement and tag it with your name!*



Requirements

- *Make sure that all associated devices and components are installed according to local regulations.*
- *Be aware that, by principle, an electronic apparatus can not be considered fail-safe. Therefore, you must make sure that any machine/apparatus has been fitted with independent monitoring and safety equipment. If the machine/apparatus should break down, if it is operated incorrectly, if the control unit breaks down or if the cables break or get disconnected, etc., the complete drive system must return – and be kept – in a safe operating mode.*
- *Be aware that you are not entitled to perform any repair on components supplied by maxon.*



Electrostatic Sensitive Device (ESD)

- *Wear working cloth and use equipment in compliance with ESD protective measures.*
- *Handle device with extra care.*

2 SPECIFICATIONS

2.1 Technical Data

MAXPOS 50/5 (447293)		
Electrical Rating	Nominal power supply voltage +V _{CC}	10...50 VDC
	Nominal logic supply voltage +V _C	10...50 VDC
	Absolute supply voltage +V _{min} / +V _{max}	8 VDC / 56 VDC
	Output voltage (max.)	0.95 x +V _{CC}
	Output current I _{cont} / I _{max} (<1.5 s)	5 A / 15 A
	Pulse width modulation frequency	100 kHz
	Sampling rate PI – current controller	100 kHz (10 μs)
	Sampling rate PID – speed controller	10 kHz (100 μs)
	Sampling rate PID – positioning controller	10 kHz (100 μs)
	Max. efficiency	96%
	Max. speed DC motor	limited by max. permissible speed (motor) and max. output voltage (controller)
	Max. speed EC motor (sinusoidal)	200'000 rpm (1 pole pair)
	Built-in motor choke	3 x 10 μH; 5 A
Inputs & Outputs	Digital Input 1 *1) Digital Input 2 *1) Digital Input 3 *1) Digital Input 4 *1) Digital Input 5 / STO-IN1 *1) Digital Input 6 / STO-IN2 *1) Logic/PLC +V _{DigIN} +V _{DigOUT}	+2.4...+24 VDC (PLC/Logic) +2.4...+24 VDC (PLC/Logic) +2.4...+24 VDC (PLC/Logic) +2.4...+24 VDC (PLC/Logic) +9...+24 VDC (PLC) +9...+24 VDC (PLC) Configuration of Logic or PLC level at DigIN1...4 +5...+24 VDC +5...+24 VDC
	Digital Output 1 *1) Digital Output 2 *1) Digital Output 3 *1) Digital Output 4 / STO-OUT *1)	+5...+24 VDC (I _L ≤500 mA) +5...+24 VDC (I _L ≤500 mA) +5...+24 VDC (I _L ≤500 mA) +5...+24 VDC (I _L ≤500 mA)
	Hall sensor signals	H1, H2, H3 for Hall effect sensor ICs (Schmitt trigger with open collector output)
	Digital incremental encoder signals	A, A _l , B, B _l , I, I _l (max. 5 MHz)
	Sensor signals • Analog incremental encoder • Digital incremental encoder • Serial encoder (SSI / BiSS C ²)	A, A _l , B, B _l , I, I _l , Clock+, Clock-, Data+, Data-

Continued on next page.

MAXPOS 50/5 (447293)				
Voltage Outputs	Hall sensor supply voltage	+5 VDC ($I_L \leq 30$ mA)		
	Encoder supply voltage	+5 VDC ($I_L \leq 70$ mA)		
	Sensor supply voltage	+5 VDC ($I_L \leq 145$ mA)		
	Auxiliary output voltage $+V_{OUT}$	$+V_{CC} > 30$ VDC: $+V_{OUT} = +24$ VDC ($I_L \leq 300$ mA) $+V_{CC} < 30$ VDC: $+V_{OUT} = +V_{CC} - 5$ V ($I_L \leq 300$ mA)		
Motor Connections	DC motor	+ Motor, - Motor		
	EC motor	Motor winding 1, Motor winding 2, Motor winding 3		
Interfaces	EtherCAT Input EtherCAT Output	Full duplex (100 Mbit/s) as to IEEE 802.3 100 Base T		
	USB 2.0 / USB 3.0	Full speed		
Status Indicators	Axis Status	Bicolor LED (red/green)		
	EtherCAT Status	Bicolor LED (red/green)		
	EtherCAT Port Activity/Link State	LED (green)		
Physical	Weight	approx. 302 g		
	Dimensions (L x W x H)	140 x 103.5 x 27 mm		
	Mounting holes	for M4 screws		
Environment	Temperature	Operation	-30...+45 °C	
		Extended range ^{*3)}	+45...+56 °C Derating → Figure 2-2	
		Storage	-40...+85 °C	
	Altitude ^{*4)}	Operation	0...6'000 m MSL	
		Extended range ^{*3)}	6'000...10'000 m MSL Derating → Figure 2-2	
	Humidity	5...90% (condensation not permitted)		

*1) Galvanic isolation.

*2) BiSS encoders must support bidirectional communication.

*3) Operation within the extended range (temperature and altitude) is permitted. However, a respective derating (declination of output current I_{cont}) as to the stated values will apply.

*4) Operating altitude in meters above Mean Sea Level, MSL.

Table 2-4 Technical data

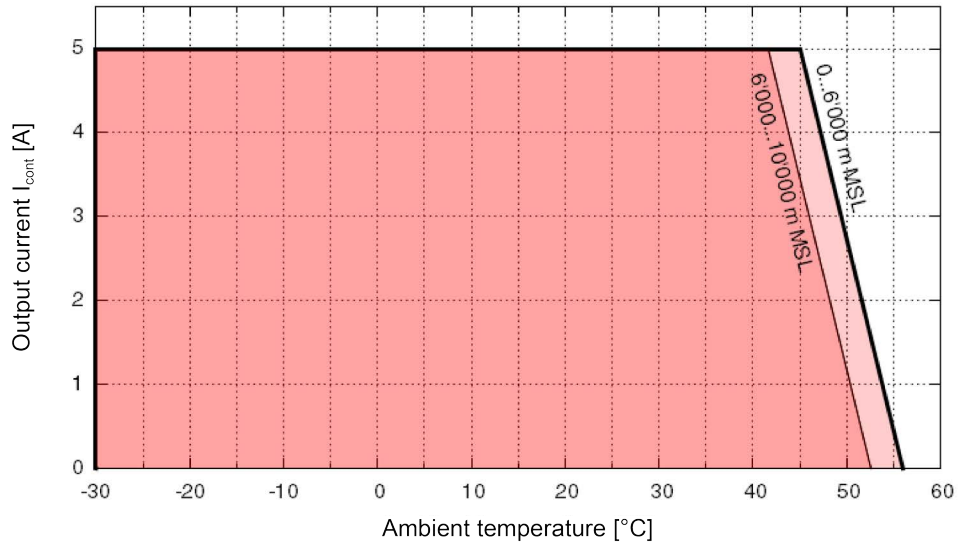


Figure 2-2 Derating output current

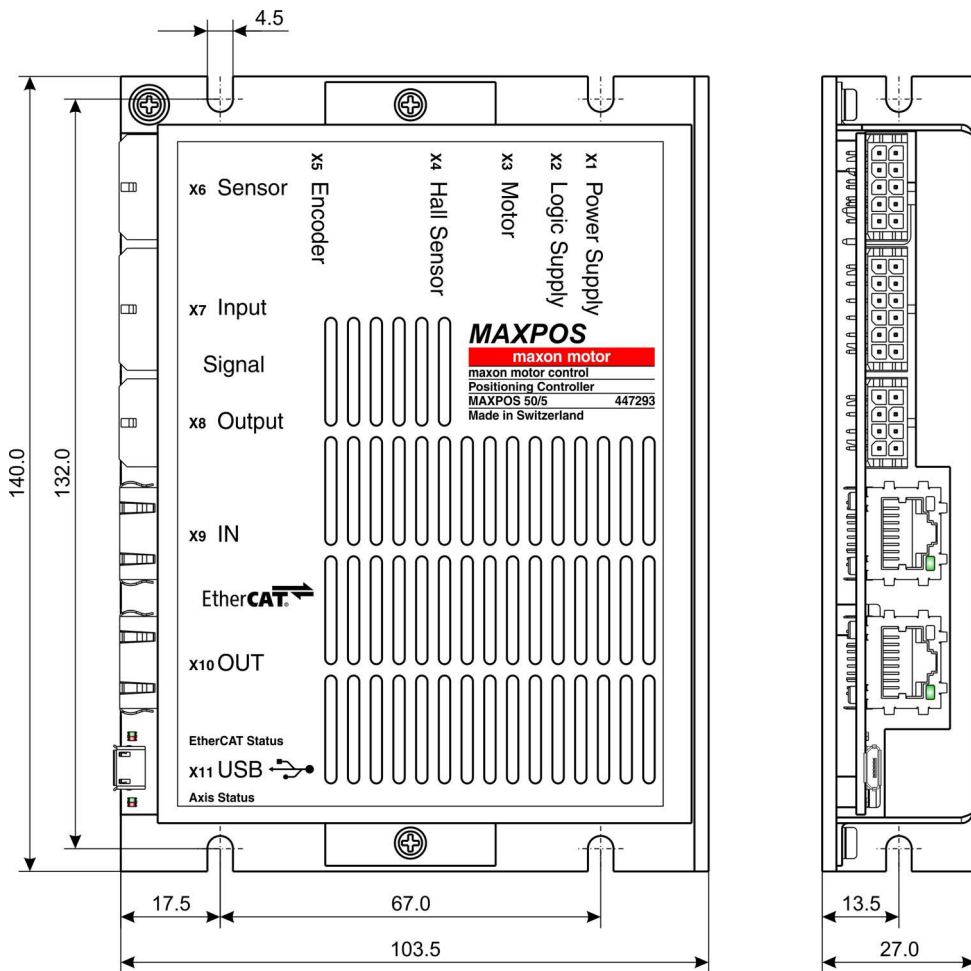


Figure 2-3 Dimensional drawing [mm]

2.2 Standards

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



Important Notice

The device's compliance with the mentioned standards does not imply its compliance within the final, ready to operate setup. In order to achieve compliance of your operational system, you must perform EMC testing of the involved 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 (CISPR22)	Radio disturbance characteristics / radio interference
	IEC/EN 61000-4-2	Electrostatic discharge immunity test 8 kV/6 kV
	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 61000-4-8	Power frequency magnetic field 30 A/m
Others		
Environment	IEC/EN 60068-2-6	Environmental testing – Test Fc: Vibration (sinusoidal, 10...500 Hz, 20 m/s ²)
	MIL-STD-810F	Random transport (10...500 Hz up to 2.53 g _{rms})
Safety	UL File Number E76251, E207844, E229342, and E243951; unassembled printed circuit board	
Reliability	MIL-HDBK-217F	Reliability prediction of electronic equipment Environment: Ground, benign (GB) Ambient temperature: 298 K (25 °C) Component stress: In accordance with circuit diagram and nominal power Mean Time Between Failures (MTBF): 149'081 hours

Table 2-5 Standards

3 SETUP

Important Notice: Prerequisites for Permission to commence Installation

The **MAXPOS 50/5** is considered as partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g) and **is intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment.**



WARNING

Risk of Injury

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

- Do not operate the device, unless you have made completely sure 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!

3.1 Generally applicable Rules



Maximal permitted Supply Voltage

- Make sure that supply power is between 10...50 VDC.
- Supply voltages above 56 VDC, or wrong polarity will destroy the unit.
- Note that the necessary output current is depending on the load torque. Yet, the output current limits of the MAXPOS 50/5 are as follows; continuous max. 5 A / short-time (acceleration) max. 15 A.



Hot plugging the USB interface may cause hardware damage

If the USB interface is being hot-plugged (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.



How to read the Wiring Details

The subsequent description follows this scheme:

- Column "**X... & Head A**": Pin number...
 - of the socket,
 - of the corresponding plug, and
 - of Head A of the matching prefab maxon cable.
- Column "**Prefab Cable**": Wire color of the prefab maxon cable.
- Column "**Head B**": Pin number of Head B of the matching prefab maxon cable.

3.2 Tools

Tool	Manufacturer	Part Number
Hand crimper (63819-0000) for female crimp terminals	Molex	430-30-xxxx
Hand crimper (63819-0900) for female crimp terminals	Molex	444-76-xxxx

Table 3-6 Recommended tools

3.3 Cabling

Get an overview on interfaces, connections, and available accessories.

Here you can get the connection information required to commission your MAXPOS 50/5. You will find all details for both approaches, Plug&Play and making your own cables.

PLUG&PLAY

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

- a) Check the «Cable Selector» (→Table 3-7) to find the cable assemblies' part number matching the setup you will be using.
- b) Follow the cross-reference to get the cable assemblies' pin assignment.

MAKE&BAKE YOUR OWN

- a) Check the «Cable Selector» (→Table 3-7) to find the required cables for the setup you will be using.
- b) Follow the cross-reference to get the cable's specification and pin assignment.
- c) Use the installation kit (→page 3-42) containing plugs and terminals that will fit the controller's sockets. Thereby, make sure to use tools as recommended (→page 3-11).

Socket	Cable		
	Part number	Designation	→Page
X1	275829	Power Cable	3-14
X2	275829	Power Cable	3-16
X3	275851	Motor Cable	3-17
X4	275878	Hall Sensor Cable	3-20
X5	275934	Encoder Cable	3-22
X6	451290	Sensor Cable 5x2core	3-25
X7	451291	Signal Cable 12core	3-29
X8	451292	Signal Cable 8core	3-35
X9	422827	Ethernet Cable	3-39
X10	422827	Ethernet Cable	3-39
X11	403968	USB Type A - micro B Cable	3-41

Table 3-7 Cable selector

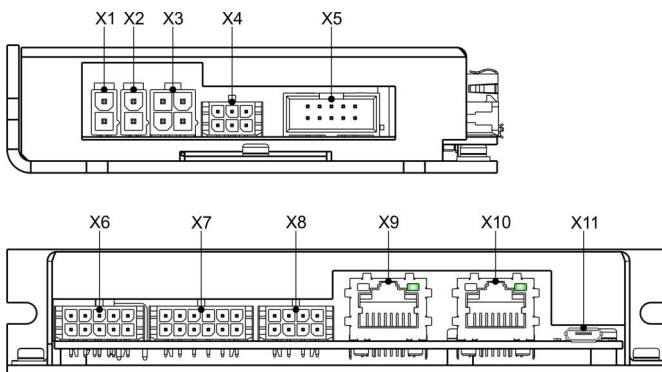


Figure 3-4 Interfaces – Designations and location

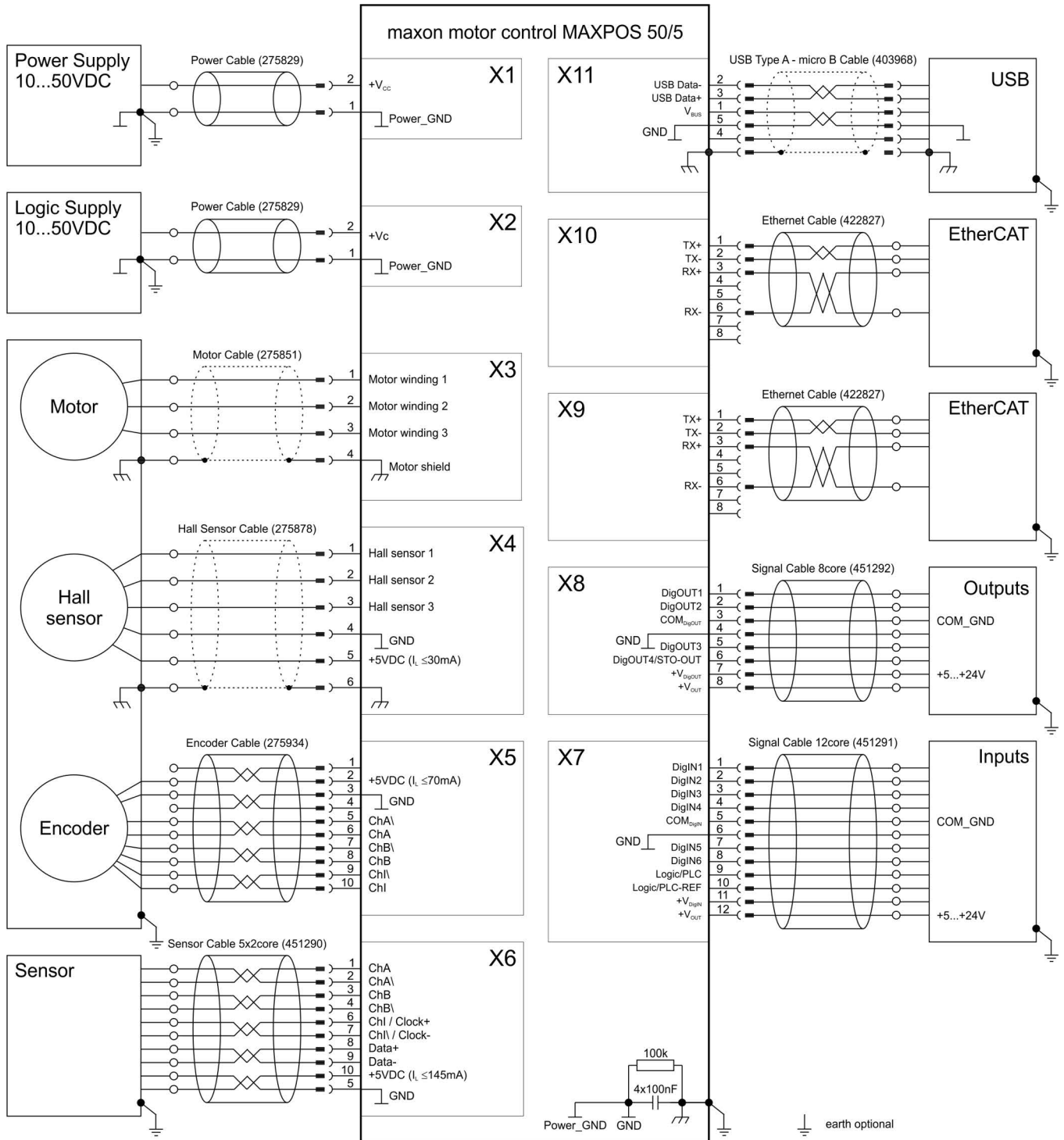


Figure 3-5 Wiring diagram

3.4 Connections

Follow in given order to cover all subjects. The actual connection will depend on the overall configuration of your drive system and the type of motor you will be using.

Follow the description in given order and choose the connection scheme that suits the respective components you are using. For corresponding wiring diagrams → chapter “4 Wiring” on page 4-45.

3.4.1 Power Supply (X1)

Basically, any power supply may be used, provided it meets the below stated minimal requirements.

Power Supply Requirements	
Nominal power supply voltage	+V _{CC} 10...50 VDC
Absolute supply voltage	min. 8 VDC; max. 56 VDC
Output current	Depending on load <ul style="list-style-type: none"> • continuous max. 5 A • short-time (acceleration, <1.5 s) max. 15 A

Table 3-8 Power supply requirements

Proceed as follows to determine the required voltage under load:

- 1) Use the formula below to calculate the required voltage under load.
- 2) Choose a power supply according to the calculated voltage. Thereby consider:
 - a) During braking of the load, the power supply must be capable of buffering the recovered kinetic energy (for example, in a capacitor).
 - b) If you are using an electronically stabilized power supply, make sure that the overcurrent protection circuit is configured inoperative within the operating range.



Note

The formula already takes the following into account:

- Maximum PWM duty cycle of 95%
- Controller's max. voltage drop of 1 V @ 5 A

KNOWN VALUES:

- Operating torque M [mNm]
- Operating speed n [rpm]
- Nominal motor voltage U_N [Volt]
- Motor no-load speed at U_N, n₀ [rpm]
- Speed/torque gradient of the motor Δn/ΔM [rpm/mNm]

SOUGHT VALUE:

- Power supply voltage +V_{CC} [Volt]

SOLUTION:

$$V_{CC} \geq \left[\frac{U_N}{n_0} \cdot \left(n + \frac{\Delta n}{\Delta M} \cdot M \right) \cdot \frac{1}{0.95} \right] + 1 [V]$$

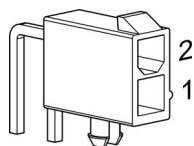


Figure 3-6 Power supply plug X1

X1 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	black	-	Power_GND	Ground of supply voltage
2	black	+	+V _{CC}	Power supply voltage (10...50 VDC)

Table 3-9 Power supply plug X1 – Pin assignment

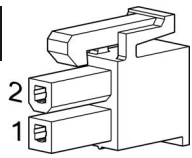
Power Cable (275829)			
A			B
Cross-section	2 x 0.75 mm ² , grey		
Length	3 m		
Head A	Plug	Molex Mini-Fit Jr., 2 poles (39-01-2020)	
	Contacts	Molex Mini-Fit Jr. female crimp terminals (444-76-xxxx)	
Head B	Cable end sleeves 0.75 mm ²		

Table 3-10 Power Cable

3.4.2 Logic Supply (X2)

By default, the logic is powered by the regular supply voltage. Optionally, you may wish to feed the logic supply voltage separately, permitting a safe and economical power backup feature. Basically, any power supply may be used, provided it meets the below stated minimal requirements.

Power Supply Requirements	
Output voltage	+V _c 10...50 VDC
Absolute supply voltage	min. 8 VDC; max. 56 VDC
Min. output power	P _c min. 6.5 W

Table 3-11 Logic supply requirements

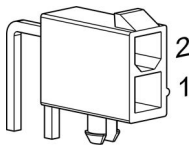


Figure 3-7 Logic supply plug X2

X2 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	black	-	Power_GND	Ground of supply voltage
2	black	+	+V _c	Logic supply voltage (10...50 VDC)

Table 3-12 Logic supply plug X2 – Pin assignment

For details on the matching Power Cable → Table 3-10.

3.4.3 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.



Note

If you are using a **maxon DC motor with integrated motor/encoder ribbon cable**, you will need to **change the jumpers JP1 and JP2** (→“Hardware Settings” on page 3-18)!

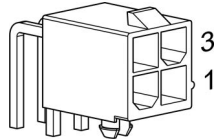


Figure 3-8 Motor plug X3

X3 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	white		Motor (+M) Motor winding 1	DC motor: Motor + EC motor: Winding 1
2	brown		Motor (-M) Motor winding 2	DC motor: Motor - EC motor: Winding 2
3	green		Motor winding 3	EC motor: Winding 3
4	black		Motor shield	Cable shield

Table 3-13 Motor plug X3 – Pin assignment

Motor Cable (275851)			
A	 3 1		B
Cross-section	3 x 0.75 mm ² shielded, grey		
Length	3 m		
Head A	Plug	Molex Mini-Fit Jr., 4 poles (39-01-2040)	
	Contacts	Molex Mini-Fit Jr. female crimp terminals (444-76-xxxx)	
Head B	Cable end sleeves 0.75 mm ²		

Table 3-14 Motor Cable

3.4.3.1 Hardware Settings

JUMPERS

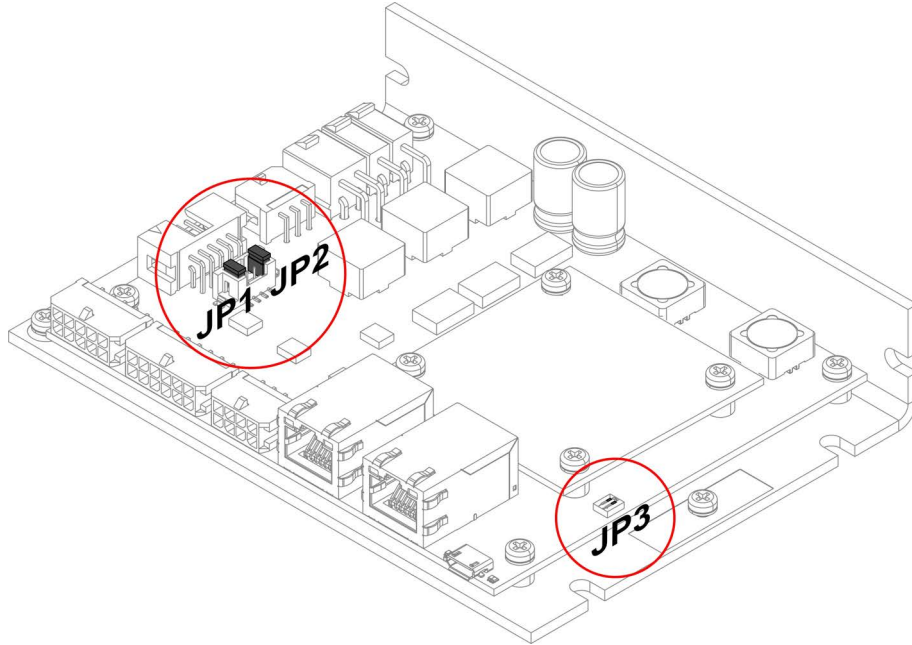


Figure 3-9 Jumpers – Location and factory setting

JUMPERS JP1 & JP2

If you are using a maxon DC motor with integrated motor/encoder ribbon cable, you will need to change the jumpers JP1 and JP2. Proceed as follows:



STOP!

Check on safety precautions before continuing (→page 1-6).

- 1) Open housing and find jumpers JP1 and JP2.
- 2) Set jumpers JP1 and JP2 to “closed” position (→Figure 3-10, right).

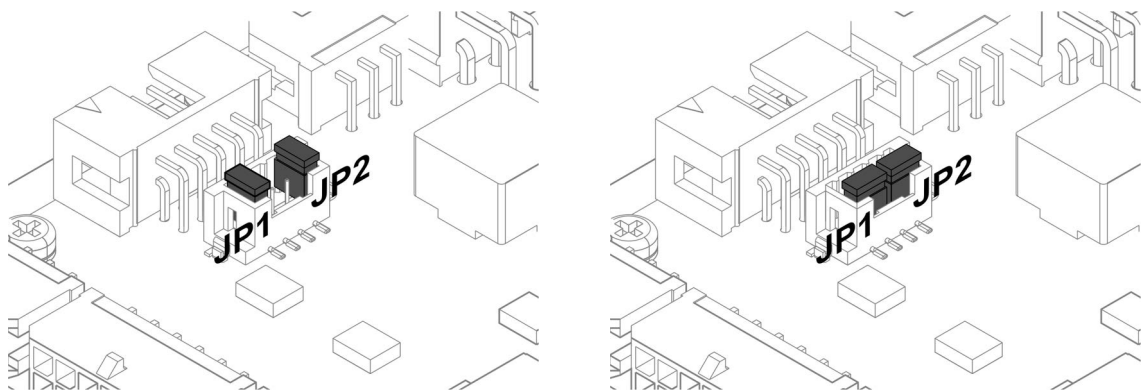


Figure 3-10 Jumpers JP1/JP2 – OPEN; factory setting (left) / CLOSED (right)

- 3) For encoder connections →chapter “3.4.5 Encoder (X5)” on page 3-22.

JUMPER JP3

To assign digital inputs 5 and 6 as «Safe Torque OFF (STO)» signal inputs, you will need to set jumper JP3 accordingly (for location → Figure 3-9).

- 1) Set both jumper switches 1 and 2 “OFF”.
- 2) For corresponding input/output connections → chapter “3.4.7.2 Digital Inputs (PLC Level)” on page 3-30 and → chapter “3.4.8.2 Digital Outputs” on page 3-36.



Figure 3-11 Jumper JP3 – ON; factory setting (left) / OFF; STO activated (right)

3.4.4 Hall Sensor (X4)

Suitable Hall effect sensors IC use «Schmitt trigger» with open collector output.

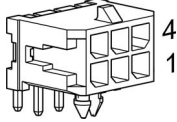


Figure 3-12 Hall sensor plug X4

X4 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	green		Hall sensor 1	Hall sensor 1 input
2	brown		Hall sensor 2	Hall sensor 2 input
3	white		Hall sensor 3	Hall sensor 3 input
4	yellow		GND	Ground
5	grey		+5 VDC	Hall sensor supply voltage (+5 VDC; $I_L \leq 30$ mA)
6	black		Hall shield	Cable shield

Table 3-15 Hall sensor plug X4 – Pin assignment

Hall Sensor Cable (275878)		
Cross-section	5 x 0.14 mm ² shielded, grey	
Length	3 m	
Head A	Plug	Molex Micro-Fit 3.0, 6 poles (430-25-0600)
	Contacts	Molex Micro-Fit 3.0 female crimp terminals (430-30-xxxx)
Head B	Cable end sleeves 0.14 mm ²	

Table 3-16 Hall Sensor Cable

Continued on next page.

Hall Sensor	
Hall sensor supply voltage	+5 VDC
Max. Hall sensor supply current	30 mA
Input voltage	0...24 VDC
Max. input voltage	+24 VDC
Logic 0	typically <0.8 V
Logic 1	typically >2.4 V
Internal pull-up resistor	2.7 k Ω (against +5.65 V - 0.6 V)

Table 3-17 Hall sensor specification

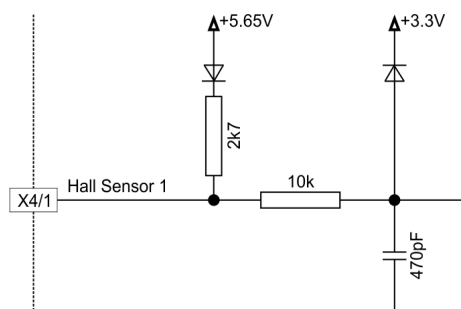


Figure 3-13 Hall sensor 1 input circuit (analogously valid for Hall sensors 2 & 3)

3.4.5 Encoder (X5)

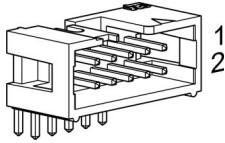


Figure 3-14 Encoder socket X5

X5 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	brown	1	DC motor: Motor + EC motor: none	DC motor: + Motor (→Remark below) EC motor: not connected
2	white	2	+5 VDC	Encoder supply voltage (+5 VDC; ≤70 mA)
3	red	3	GND	Ground
4	white	4	DC motor: Motor – EC motor: none	DC motor: – Motor (→Remark below) EC motor: not connected
5	orange	5	Channel A\	Channel A complement
6	white	6	Channel A	Channel A
7	yellow	7	Channel B\	Channel B complement
8	white	8	Channel B	Channel B
9	green	9	Channel I\	Channel I complement
10	white	10	Channel I	Channel I

Table 3-18 Encoder socket X5 – Pin assignment



Remark

May require change of jumper (JP1/JP2) settings (→“Hardware Settings” on page 3-18).



Best Practice

- The use of encoder with built-in Line Driver is mandatory.
- Even though 2-channel will do, we strongly recommend to use only 3-channel versions!
- Implemented are three high-speed RS422 receivers featuring fault detection circuitry and fault status outputs. The receivers' inputs feature fault thresholds that detect the device's “not in valid state”.
- The receivers indicate whether a receiver input is in open circuit condition (except index channel), short-circuit condition, or beyond the common mode range (smaller –10 V or higher +13.2 V). They also generate a fault indication if the differential input voltage drops below the 475 mV threshold.
- By default, the controller is set for a 500 counts per turn encoder. For other encoders, you will need to adjust respective settings via software.

Continued on next page.

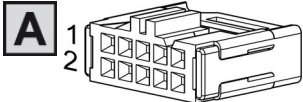
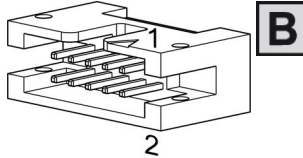
Encoder Cable (275934)			
A			B
Cross-section	10 x AWG28, round-jacket, twisted pair flat cable, pitch 1.27 mm, grey		
Length	3.20 m		
Head A	DIN 41651 female, pitch 2.54 mm, 10 poles, with strain relief		
Head B	DIN 41651 Plug, pitch 2.54 mm, 10 poles, with strain relief		

Table 3-19 Encoder Cable

Accessories		
Suitable strain relief	Retainer	For sockets with strain relief: 1 retainer clip, height 13.5 mm, 3M (3505-8110)
		For sockets without strain relief: 1 retainer clip, height 7.9 mm, 3M (3505-8010)
	Latch	For sockets with strain relief: 2 pieces, 3M (3505-33B)

Table 3-20 Encoder socket X5 – Accessories

Encoder	
Encoder supply voltage	+5 VDC
Max. encoder supply current	70 mA
Min. differential input voltage	±475 mV
Line receiver (internal)	EIA RS422 Standard
Max. encoder input frequency	5 MHz

Table 3-21 Encoder specification

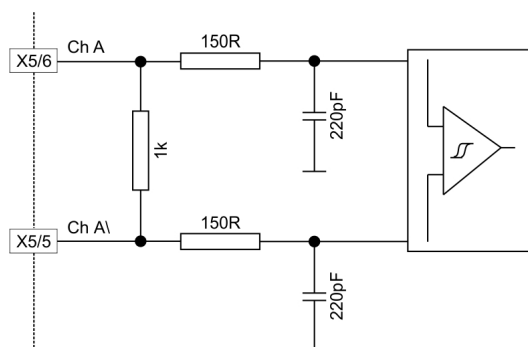


Figure 3-15 Encoder input circuit Ch A (analogously valid for Ch B)

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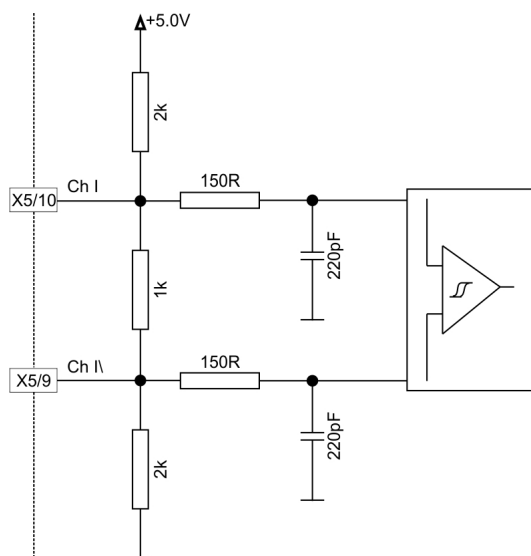


Figure 3-16 Encoder input circuit Ch I

3.4.6 Sensor (X6)

Additional sensors, both, incremental and serial encoders can be connected.

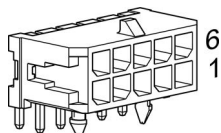


Figure 3-17 Sensor plug X6

X6 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	white		Channel A	Channel A
2	brown		Channel A\	Channel A complement
3	green		Channel B	Channel B
4	yellow		Channel B\	Channel B complement
5	grey		GND	Signal ground
6	blue		Channel I	Channel I / Clock+
7	red		Channel I\	Channel I complement / Clock-
8	black		Data+	Data+
9	violet		Data-	Data-
10	pink		+5 VDC	Sensor supply voltage (+5 VDC; ≤145 mA) (→Remark below)

Table 3-22 Sensor plug X6 – Pin assignment



Remark

Check on the applied sensor's data sheet. If the specified inrush current or the maximum continuous current of the sensor should exceed 145 mA, you can connect the encoder supply voltage (X5) or the Hall sensor supply voltage (X4) in parallel to the sensor supply voltage.

Sensor Cable 5x2core (451290)		
Cross-section	5 x 2 x 0.14 mm ² , grey	
Length	3 m	
Head A	Plug	Molex Micro-Fit 3.0, 10 poles (430-25-1000)
	Contacts	Molex Micro-Fit 3.0 female crimp terminals (430-30-xxxx)
Head B	Cable end sleeves 0.14 mm ²	

Table 3-23 Sensor Cable 5x2core

3.4.6.1 Incremental Encoders

Digital Incremental Encoder	
Sensor voltage	+5 VDC
Max. sensor supply current	145 mA
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA RS422 Standard
Max. encoder input frequency	5 MHz

Table 3-24 Digital incremental encoder specification

Analog Incremental Encoder	
Sensor voltage	+5 VDC
Max. sensor supply current	145 mA
Input voltage	±1.8 V (differential)
Max. input voltage	±12 VDC
Common mode voltage	-1...+4 VDC (referenced to GND)
Input resistance	120 Ω
A/D converter	12-bit
Resolution	0.88 mV
Bandwidth	50 kHz

Table 3-25 Analog incremental encoder specification

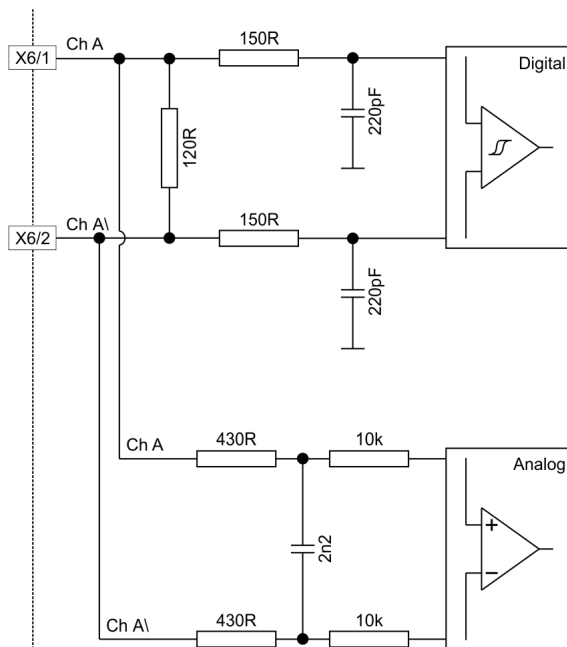


Figure 3-18 Incremental encoder – Sensor input circuit Ch A (analogously valid for Ch B)

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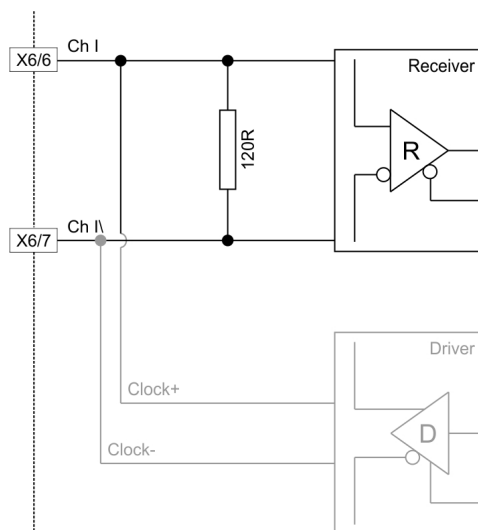


Figure 3-19 Incremental encoder – Sensor input circuit Ch I and clock output

3.4.6.2 Serial Encoders

Serial Encoder	
Sensor voltage	+5 VDC
Max. sensor supply current	145 mA
Min. differential input voltage	±200 mV
Min. differential output voltage	±1.5 V @ external load R=120 Ω
Max. output current	60 mA
Line receiver (internal)	EIA RS485 Standard
Max. encoder input/output frequency	16 MHz

Table 3-26 Serial encoder specification

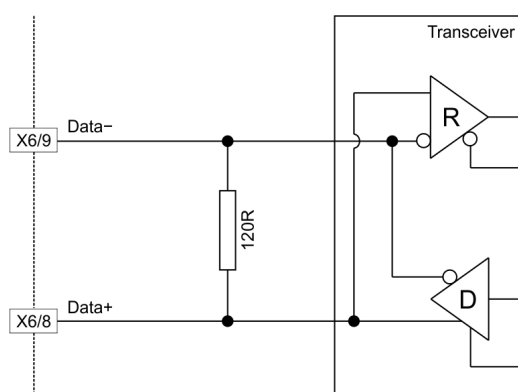


Figure 3-20 Serial encoder – Data circuit

Continued on next page.

Clock Output	
Min. differential output voltage	$\pm 1.5 \text{ V @ external load } R=120 \Omega$
Max. output current	60 mA
Line transceiver (internal)	EIA RS485 Standard
Max. output frequency	16 MHz

Table 3-27 Clock output specification

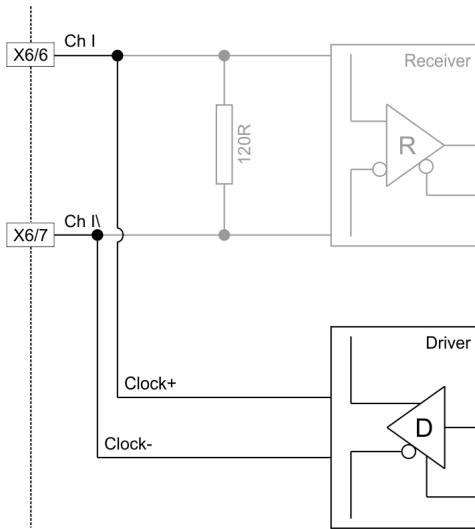


Figure 3-21 Serial encoder – Clock output

3.4.7 Signal Input (X7)

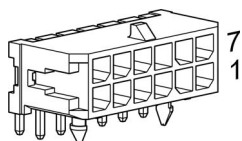


Figure 3-22 Signal input plug X7

X7 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	white		DigIN1	Digital input 1
2	brown		DigIN2	Digital input 2
3	green		DigIN3	Digital input 3
4	yellow		DigIN4	Digital input 4
5	grey		COM _{DigIN}	Common signal to DigIN1...6
6	pink		GND	Signal ground
7	blue		DigIN5/ STO-IN1	Digital input 5 Safe Torque OFF input signal 1
8	red		DigIN6/ STO-IN2	Digital input 6 Safe Torque OFF input signal 2
9	black		Logic/PLC	Configuration of Logic or PLC level at DigIN1...4
10	violet		Logic/PLC-REF	→ Table 3-26 and Table 3-28
11	grey/ pink		+V _{DigIN}	External supply input voltage for DigIN1...6 (+5...+24 VDC)
12	red/blue		+V _{OUT}	Auxiliary output voltage

Table 3-28 Signal input plug X7 – Pin assignment

Signal Cable 12core (451291)		
Cross-section	12 x 0.14 mm ² , grey	
Length	3 m	
Head A	Plug	Molex Micro-Fit 3.0, 12 poles (430-25-1200)
	Contacts	Molex Micro-Fit 3.0 female crimp terminals (430-30-xxxx)
Head B	Cable end sleeves 0.14 mm ²	

Table 3-29 Signal Cable 12core

3.4.7.1 Supply Voltage for DigINs

For galvanic isolated digital inputs, an external supply voltage must be applied. Basically, any power supply may be used, provided it meets the below stated minimal requirements.

Supply Voltage for DigINs	
Supply voltage for DigINs $+V_{\text{DigIN}}$	External supply input voltage for DigIN1...6 (+5...+24 VDC)
Min. current	25 mA

Table 3-30 Supply voltage for DigINs

3.4.7.2 Digital Inputs (PLC Level)

DigIN1...4	
Type of input	Galvanic isolated, single-ended
Input voltage	+24 VDC
Max. input voltage	± 30 VDC
Logic 0	$U_{\text{in}} < 5$ VDC
Logic 1	$U_{\text{in}} > 9$ VDC
Input current at logic 1	>1.5 mA @ 5 VDC >2.0 mA @ 9 VDC typically 2.6 mA @ 24 VDC
Switching delay	<2 μs @ 24 VDC

Table 3-31 DigIN1...4 specification (PLC level)

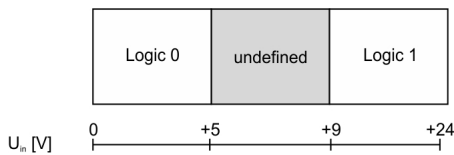


Figure 3-23 DigIN1...6 PLC Level

DigIN5...6	
Type of input	Galvanic isolated, single-ended
Input voltage	+24 VDC
Max. input voltage	± 30 VDC
Logic 0	$U_{\text{in}} < 5$ VDC
Logic 1	$U_{\text{in}} > 9$ VDC
Input current at logic 1	>1.5 mA @ 5 VDC >2.0 mA @ 9 VDC typically 2.6 mA @ 24 VDC
Switching delay	<2 μs @ 24 VDC

Table 3-32 DigIN5...6 specification (PLC level)

Continued on next page.

By default, the galvanic isolated digital inputs 5 and 6 are defined as “general purpose inputs” and may be configured for «Safe Torque OFF» by internal DIP switch. For location →chapter “3.4.3.1 Hardware Settings” on page 3-18, for corresponding output configuration →chapter “3.4.8.2 Digital Outputs” on page 3-36, “DigOUT4”.

- DIP switch JP3, switches 1 and 2 “ON” (factory setting): Safe Torque OFF deactivated
- DIP switch JP3, switches 1 and 2 “OFF”: Safe Torque OFF activated

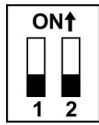


Figure 3-24 DIP Switch JP3 – Activation of DigIN5...6

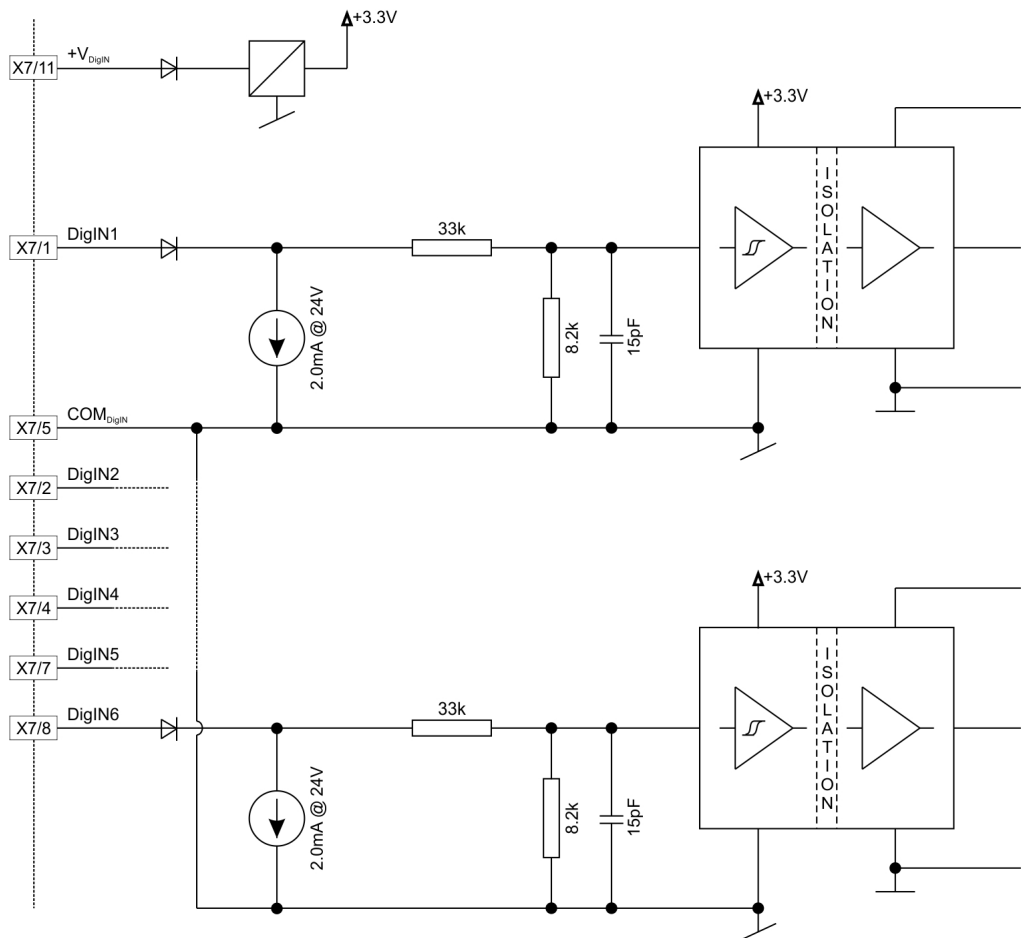


Figure 3-25 DigIN1...6 input circuit – PLC level

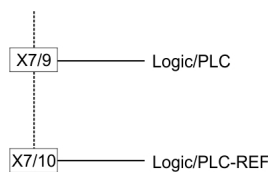


Figure 3-26 PLC Level (not connected)

3.4.7.3 Digital Inputs (Logic Level)

For external wire bridge details of DigIN1...4 in Logic level → Figure 3-28.

DigIN1...4	
Type of input	Galvanic isolated, single-ended
Input voltage	+2.4...+24 VDC
Max. input voltage	±30 VDC
Logic 0	<0.8 VDC
Logic 1	>2.4 VDC
Input current at logic 1	typically 2 mA @ 5 VDC
Switching delay	<2 μs @ 5 VDC

Table 3-33 DigIN1...4 specification (logic level)

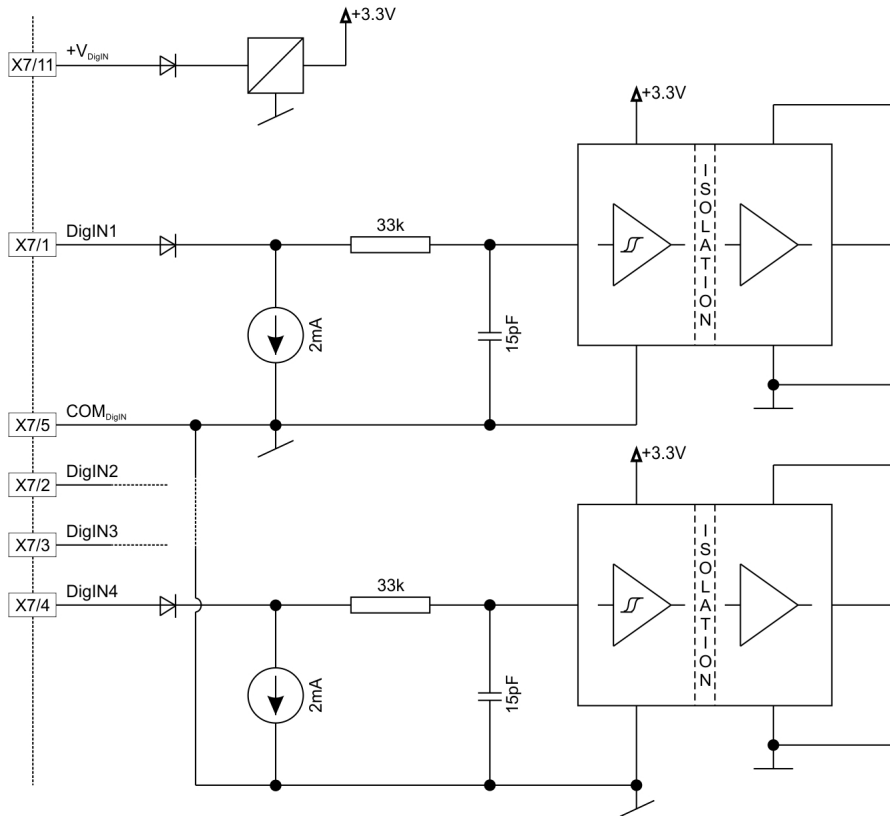


Figure 3-27 DigIN1...4 input circuit – Logic level

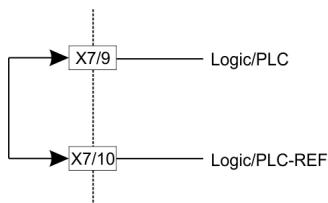


Figure 3-28 Logic level (connected)

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WIRING EXAMPLE: DIFFERENT TYPES OF PROXIMITY SWITCHES

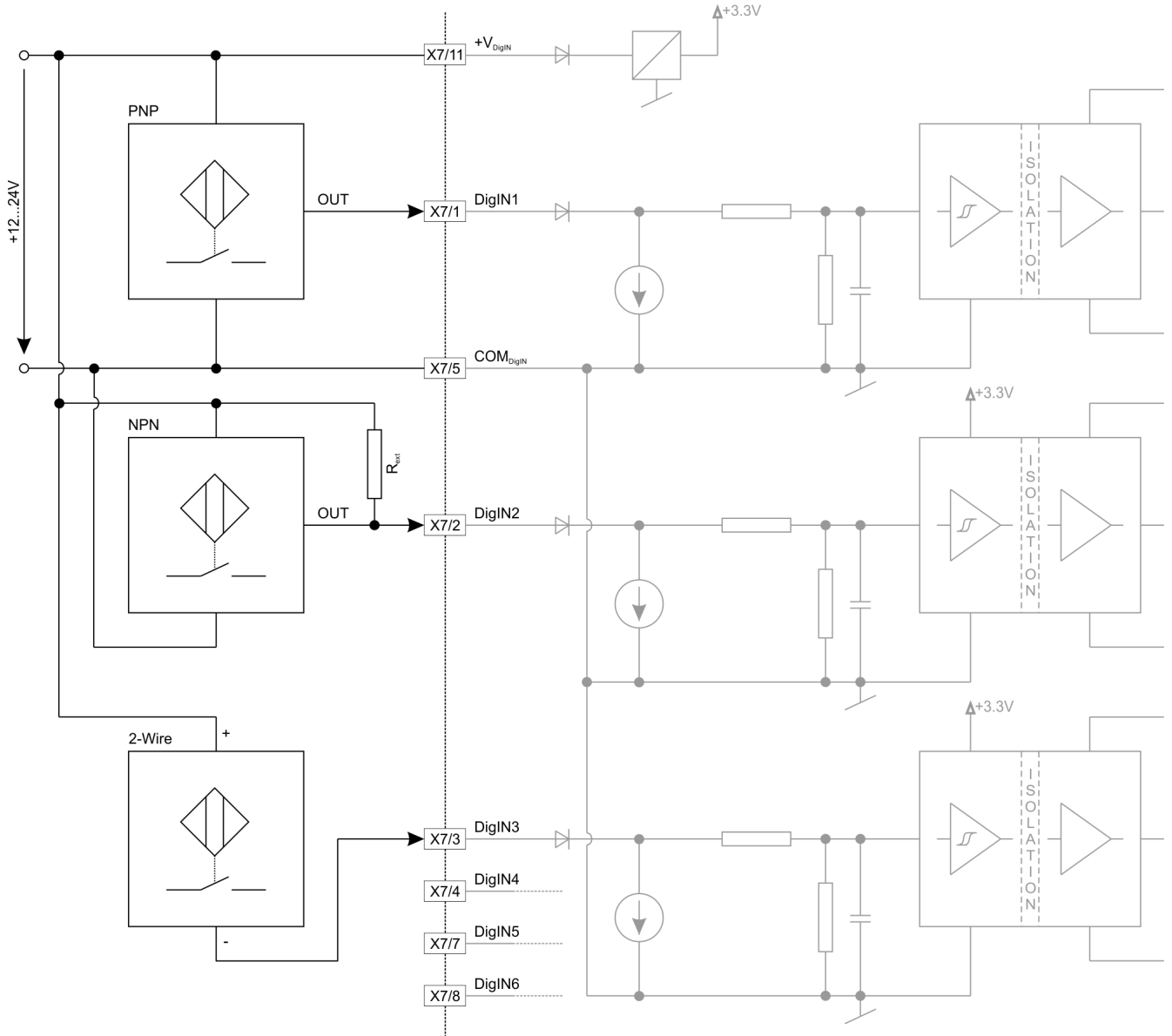


Figure 3-29 DigIN1...6 input circuit – Examples for external wiring



Best Practice

- Preferably, use 3-wire PNP proximity switches.
- Using 3-wire NPN proximity switches requires an additional pull-up resistor.
 $R_{ext} (12 V) = 1000 \Omega (200 mW)$
 $R_{ext} (24 V) = 3300 \Omega (200 mW)$
- By principle, using 2-wire proximity switches is possible.

SUPPLY OF INPUTS WITHOUT GALVANIC ISOLATION

For galvanic isolated digital inputs, an external supply voltage must be applied. If no external power supply is available, the device's auxiliary output voltage ($+V_{OUT}$) may be used. Thereby, galvanic isolation will be lost. For external wire bridge details → Figure 3-30.

Auxiliary Output Voltage	
Output voltage	$+V_{CC} > 30 \text{ VDC}: +V_{OUT} = +24 \text{ VDC}$ $+V_{CC} < 30 \text{ VDC}: +V_{OUT} = +V_{CC} - 5 \text{ V}$
Max. current	300 mA

Table 3-34 Analog output voltage specification

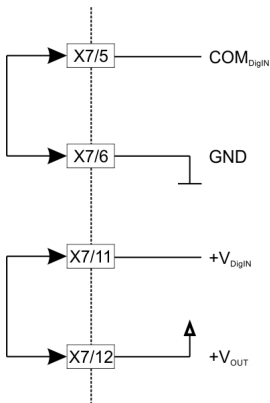


Figure 3-30 Input supply without galvanic separation

3.4.8 Signal Output (X8)

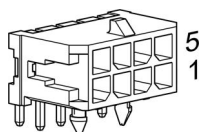


Figure 3-31 Signal output plug X8

X8 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	white		DigOUT1	Digital output 1
2	brown		DigOUT2	Digital output 2
3	green		COM _{DigOUT}	Common signal to DigOUT
4	yellow		GND	Signal ground
5	grey		DigOUT3	Digital output 3
6	pink		DigOUT4/ STO-OUT	Digital output 4 Safe Torque OFF output signal
7	blue		+V _{DigOUT}	External supply input voltage for DigOUT1...4 (+5...+24 VDC)
8	red		+V _{OUT}	Auxiliary output voltage

Table 3-35 Signal output plug X8 – Pin assignment

Signal Cable 8core (451292)		
Cross-section	8 x 0.14 mm ² , grey	
Length	3 m	
Head A	Plug	Molex Micro-Fit 3.0, 8 poles (430-25-0800)
	Contacts	Molex Micro-Fit 3.0 female crimp terminals (430-30-xxxx)
Head B	Cable end sleeves 0.14 mm ²	

Table 3-36 Signal Cable 8core

3.4.8.1 Supply Voltage for DigOUTs

For galvanic isolated digital outputs, an external supply voltage must be applied. Basically, any power supply may be used, provided it meets the below stated minimal requirements.

Supply Voltage for DigOUTs	
Supply voltage for DigOUTs $+V_{\text{DigOUT}}$	External supply input voltage for DigOUT1...4 (+5...+24 VDC)
Min. current	20...2000mA (depending on load)

Table 3-37 DigOUT supply voltage specification

3.4.8.2 Digital Outputs

DigOUT1...3	
Type of output	Galvanic isolated, open source
Output voltage	$U_{\text{out}} \geq (+V_{\text{DigOUT}} - 0.2 \text{ V})$
Max. load current	$I_{\text{load}} \leq 500 \text{ mA}$
Leakage current	$I_{\text{leak}} \leq 10 \mu\text{A}$
Switching delay (rising edge)	$< 50 \mu\text{s @ 24 VDC; } I_{\text{load}} \leq 10 \text{ mA}$
Switching delay (falling edge)	$< 200 \mu\text{s @ 24 VDC; } I_{\text{load}} \leq 10 \text{ mA}$
Max. load inductance	175 mH @ 500 mA

Table 3-38 DigOUT1...3 specifications

DigOUT4	
Type of output	Galvanic isolated, open source
Output voltage	$U_{\text{out}} \geq (+V_{\text{DigOUT}} - 0.2 \text{ V})$
Max. load current	$I_{\text{load}} \leq 500 \text{ mA}$
Leakage current	$I_{\text{leak}} \leq 10 \mu\text{A}$
Switching delay (rising edge)	$< 50 \mu\text{s @ 24 VDC; } I_{\text{load}} \leq 10 \text{ mA}$
Switching delay (falling edge)	$< 200 \mu\text{s @ 24 VDC; } I_{\text{load}} \leq 10 \text{ mA}$
Max. load inductance	175 mH @ 500 mA

Table 3-39 DigOUT4 specifications

By default, the galvanic isolated digital output 4 is defined as “general purpose output” and may be configured for «Safe Torque OFF» by internal DIP switch. For location →chapter “3.4.3.1 Hardware Settings” on page 3-18. For corresponding input configuration →chapter “3.4.7.2 Digital Inputs (PLC Level)” on page 3-30, “DigIN5...6”.

- DIP switch JP3, switches 1 and 2 “ON” (factory setting): Safe Torque OFF deactivated
- DIP switch JP3, switches 1 and 2 “OFF”: Safe Torque OFF activated



Figure 3-32 DIP switch JP3 – Activation of DigOUT4

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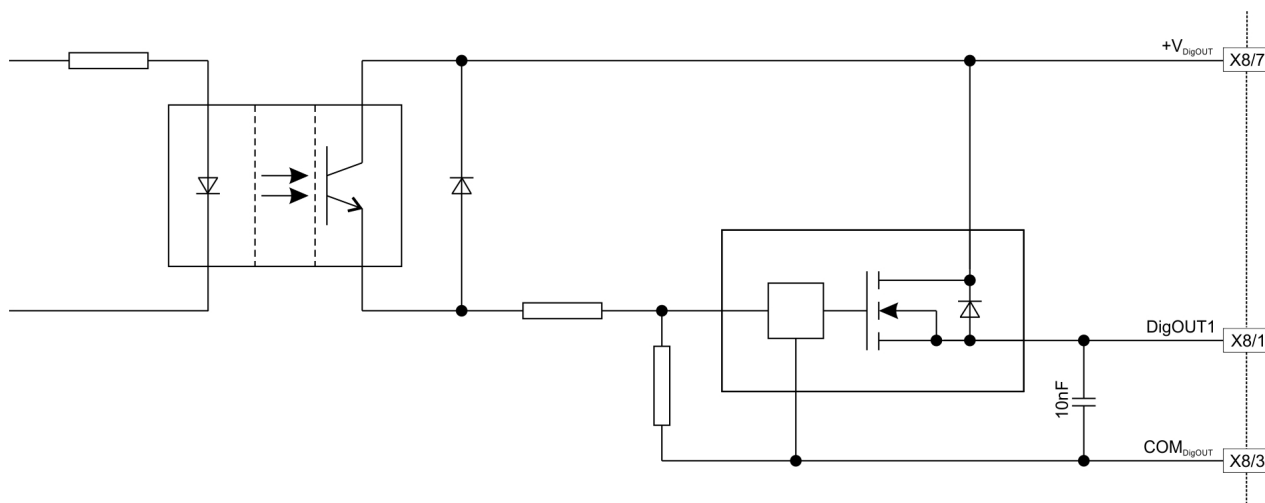


Figure 3-33 DigOUT1 output circuit (analogously valid for DigOUT2...4)

WIRING EXAMPLE: PERMANENT MAGNET BRAKE

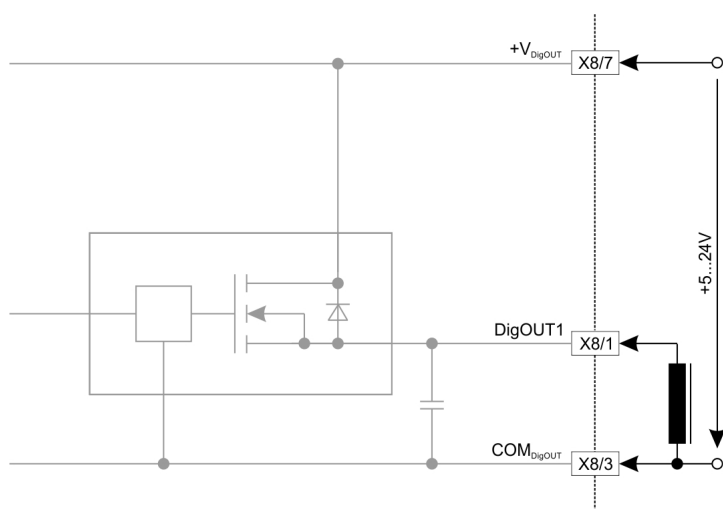


Figure 3-34 DigOUT1 output circuit – Example for permanent magnet brake

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WIRING EXAMPLE: LED / LOGIC / RELAY / PLC INPUT

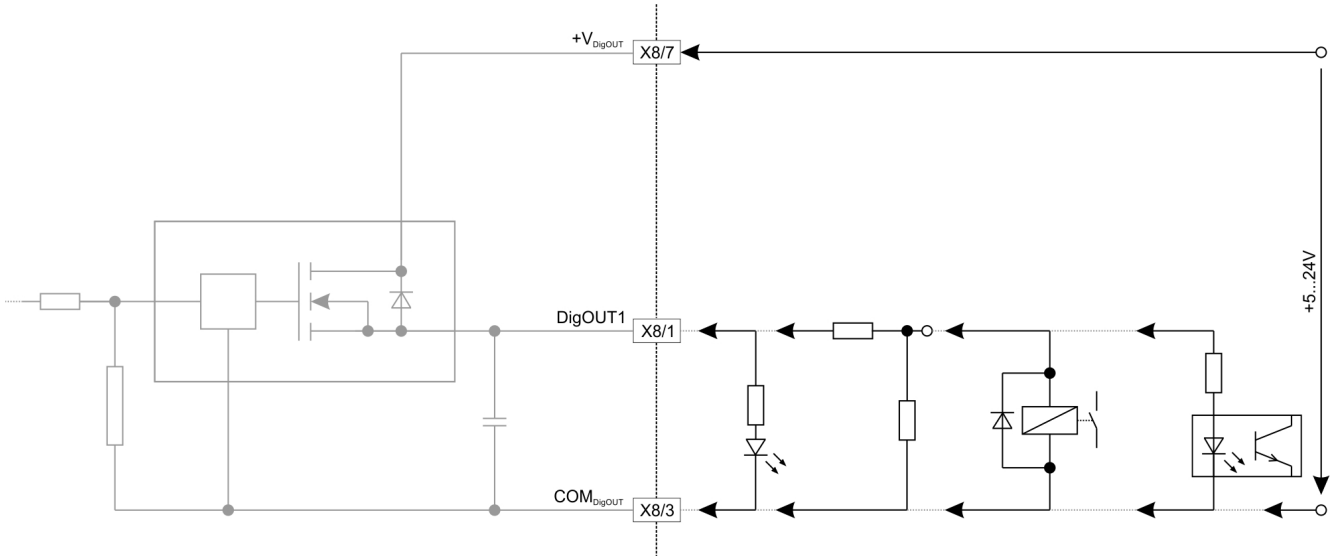


Figure 3-35 DigOUT1 output circuit – Example for LED, logic, relay, PLC input

SUPPLY OF OUTPUTS WITHOUT GALVANIC ISOLATION

For galvanic isolated digital outputs, an external supply voltage must be applied. If no external power supply is available, the device's auxiliary output voltage ($+V_{OUT}$) may be used. Thereby, optical isolation will be lost. For external wire bridge details → Figure 3-36.

Auxiliary Output Voltage	
Output voltage	$+V_{CC} > 30 \text{ VDC}: +V_{OUT} = +24 \text{ VDC}$ $+V_{CC} < 30 \text{ VDC}: +V_{OUT} = +V_{CC} - 5 \text{ V}$
Max. current	300 mA

Table 3-40 Auxiliary output voltage specification

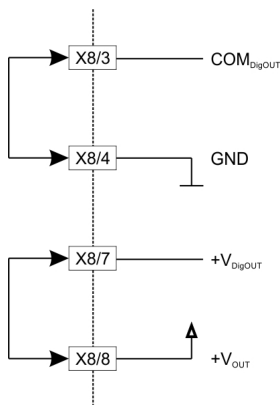


Figure 3-36 Output supply without optical separation

3.4.9 EtherCAT IN (X9) and EtherCAT OUT (X10)

The MAXPOS 50/5 features two EtherCAT sockets, one for input, the other for output. Both sockets are identical in respect to external wiring. In the subsequent description, only “EtherCAT IN (X9)” will be used which is analogously valid also for “EtherCAT OUT (X10)”.



Potential Damage

Even though both EtherCAT sockets are prepared for identical external wiring, make sure to always connect them as follows:

- Use EtherCAT IN (X9) as «Input».
- Use EtherCAT OUT (X10) as «Output».

For detailed information → separate document «MAXPOS Communication Guide».

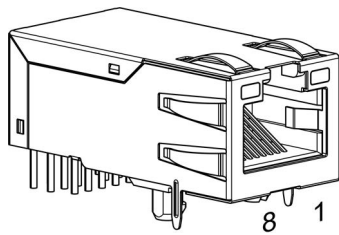


Figure 3-37 EtherCAT IN socket X9

X9 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1	white/orange	1	TX+	Transmission Data+
2	orange	2	TX-	Transmission Data-
3	white/green	3	RX+	Receive Data+
4	blue	4	n/a	not available
5	white/blue	5	n/a	not available
6	green	6	RX-	Receive Data-
7	white/brown	7	n/a	not available
8	brown	8	n/a	not available

Table 3-41 EtherCAT IN socket X9 – Pin assignment

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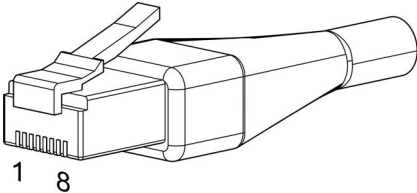
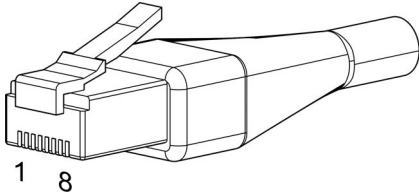
Ethernet Cable (422827)			
A	 1 8	 1 8	B
Cross-section	Cat. 5e SF/UTP (ISO/IEC 11801), 1:1 patch cable, green		
Length	2 m		
Head A	RJ45 (8P8CS) EIA/TIA-568B		
Head B	RJ45 (8P8CS) EIA/TIA-568B		

Table 3-42 Ethernet Cable

EtherCAT	
Standard	IEEE 802.3 100 Base T
Max. bit rate	100 Mbit/s (Full Duplex)

Table 3-43 EtherCAT specifications

3.4.10 USB (X11)



Hot plugging the USB interface may cause hardware damage

If the USB interface is being hot-plugged (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.

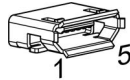


Figure 3-38 USB socket X11



Note

Column “Head B” (→Table 3-44) refers to USB terminals of your PC.

X11 & Head A Pin	Prefab Cable Color	Head B Pin	Signal	Description
1		1	V _{BUS}	USB BUS supply voltage input +5 VDC
2		2	USB D-	USB Data- (twisted pair with Data+)
3		3	USB D+	USB Data+ (twisted pair with Data-)
4		-	ID	not connected
5		4	GND	USB ground

Table 3-44 USB socket X11 – Pin assignment

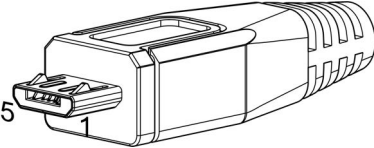
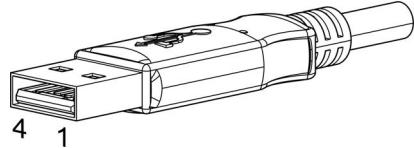
USB Type A - micro B Cable (403968)	
A	
B	
Cross-section	According to USB 2.0 / USB 3.0 specification
Length	1.5 m
Head A	USB Type “micro B”, male
Head B	USB Type “A”, male

Table 3-45 USB Type A - micro B Cable

Continued on next page.

USB	
USB Standard	USB 2.0 / USB 3.0 (full speed)
Max. bus supply voltage	+5.25 VDC
Typical input current	20 mA
Max. DC data input voltage	-0.5...+3.8 VDC

Table 3-46 USB specifications

3.4.11 MAXPOS 50/5 Connector Set

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.

Content of MAXPOS 50/5 Connector Set (451746)		
Socket	Specification	Quantity
X1, X2	Molex Mini-Fit Jr. 2 poles (39-01-2020)	2
X3	Molex Mini-Fit Jr. 4 poles (39-01-2040)	1
X4	Molex Micro-Fit 3.0 6 poles (430-25-0600)	1
X6	Molex Micro-Fit 3.0 10 poles (430-25-1000)	1
X7	Molex Micro-Fit 3.0 12 poles (430-25-1200)	1
X8	Molex Micro-Fit 3.0 8 poles (430-25-0800)	1
X1, X2, X3	Molex Mini-Fit Jr. female crimp terminals (444-76-xxxx)	10
X4, X6, X7, X8	Molex Micro-Fit 3.0 female crimp terminals (430-30-xxxx)	38
X5	3M Retainer Clip with Strain Relief, H = 13.5mm (3505-8110)	1

Table 3-47 MAXPOS 50/5 Connector Set – Content



Best Practice

If you should decide not to use the ready-made cable assemblies, we strongly suggest that you use the recommended tools (→“Tools” on page 3-11).

3.5 Status Indicators

The MAXPOS 50/5 features three sets of LED indicators to display the device condition:

- A Axis Status LEDs indicate operating status and error conditions
- B EtherCAT Status LEDs indicate errors and RUN state conditions
- C EtherCAT Port LEDs indicates port activity

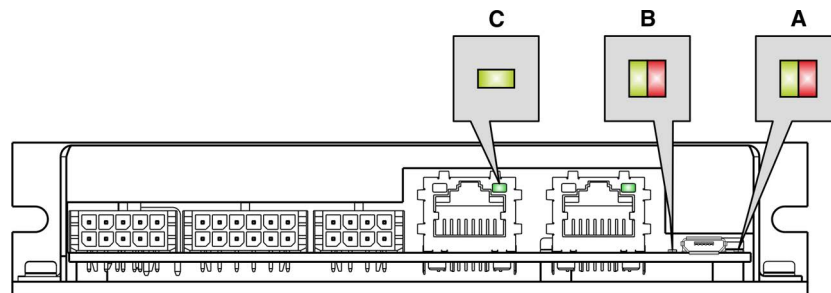


Figure 3-39 Status LEDs – Location



For detailed information → separate document «MAXPOS Firmware Specification».

3.5.1 Axis Status LEDs

The LEDs (→ Figure 3-39; **A**) display the actual status and possible errors of the MAXPOS:

- Green LED shows the status
- Red LED indicates errors

LED		Status / Error
Green	Red	
Slow	OFF	Power stage is disabled. MAXPOS is in status... <ul style="list-style-type: none"> • “Switch ON Disabled” • “Ready to Switch ON” • “Switched ON”
ON	OFF	Power stage is enabled. MAXPOS is in status... <ul style="list-style-type: none"> • “Operation Enable” • “Quick Stop Active”
OFF	ON	FAULT state. MAXPOS is in status... <ul style="list-style-type: none"> • “Fault”
ON	ON	Power stage is enabled. MAXPOS is in temporary status... <ul style="list-style-type: none"> • “Fault Reaction Active”
Flash	ON	No valid firmware or firmware download in progress

Flash = Flashing (≈0.9 s OFF/≈0.1 s ON)
Slow = Slow blinking (≈1 Hz)

Table 3-48 Axis status LEDs

3.5.2 EtherCAT Status LEDs

The LEDs (→Figure 3-39; **B**) display the actual status and possible errors of the MAXPOS in respect to the EtherCAT network:

- Red LED indicates errors
- Green LED shows the RUN states

LED		Status / Error
Green	Red	
OFF	—	MAXPOS is in state INIT
Blink	—	MAXPOS is in state PRE-OPERATIONAL
Single flash	—	MAXPOS is in state SAFE-OPERATIONAL
ON	—	MAXPOS is in state OPERATIONAL
—	OFF	MAXPOS is in operating condition
—	Double flash	An application watchdog timeout has occurred. Example: Timeout of Sync Manager Watchdog.
—	Single flash	MAXPOS has changed the EtherCAT state due to internal error. Example: Change of state "Op" to "SafeOpError" due to Sync Error.
—	Blink	General Configuration Error Example: State change commanded by master is not possible due to actual settings (register, object, hardware configuration).
Blink = continuous blinking (≈5 Hz) Flash = Flashing (≈5 Hz), followed by pause of 1 second		

Table 3-49 EtherCAT status LEDs

3.5.3 EtherCAT Port LEDs

The LED (→Figure 3-39; **C**) displays the actual status of the MAXPOS's EtherCAT ports (applies for both ports, X9 "IN" and X10 "OUT"):

- Green LED shows the link states

LED	Status
Green	
OFF	Port is closed
Flicker	Port is open / activity present
ON	Port is open
Flicker = continuous flickering (≈1 Hz)	

Table 3-50 EtherCAT port LEDs

4 WIRING

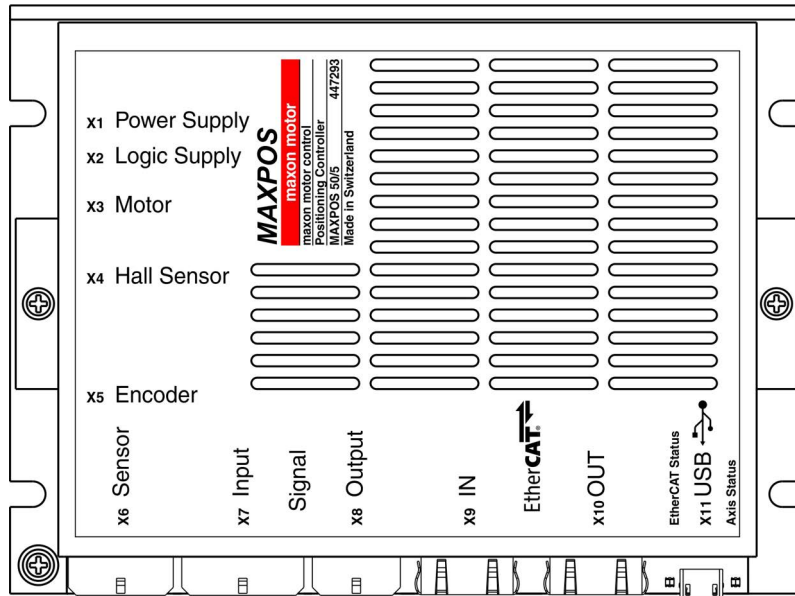


Figure 4-40 Interfaces – Designations and location



Remark

The subsequent diagrams feature this sign:



Ground safety earth connection (optional)

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4.2 DC Motors (brushed)

4.2.1 DC Motor without Sensor

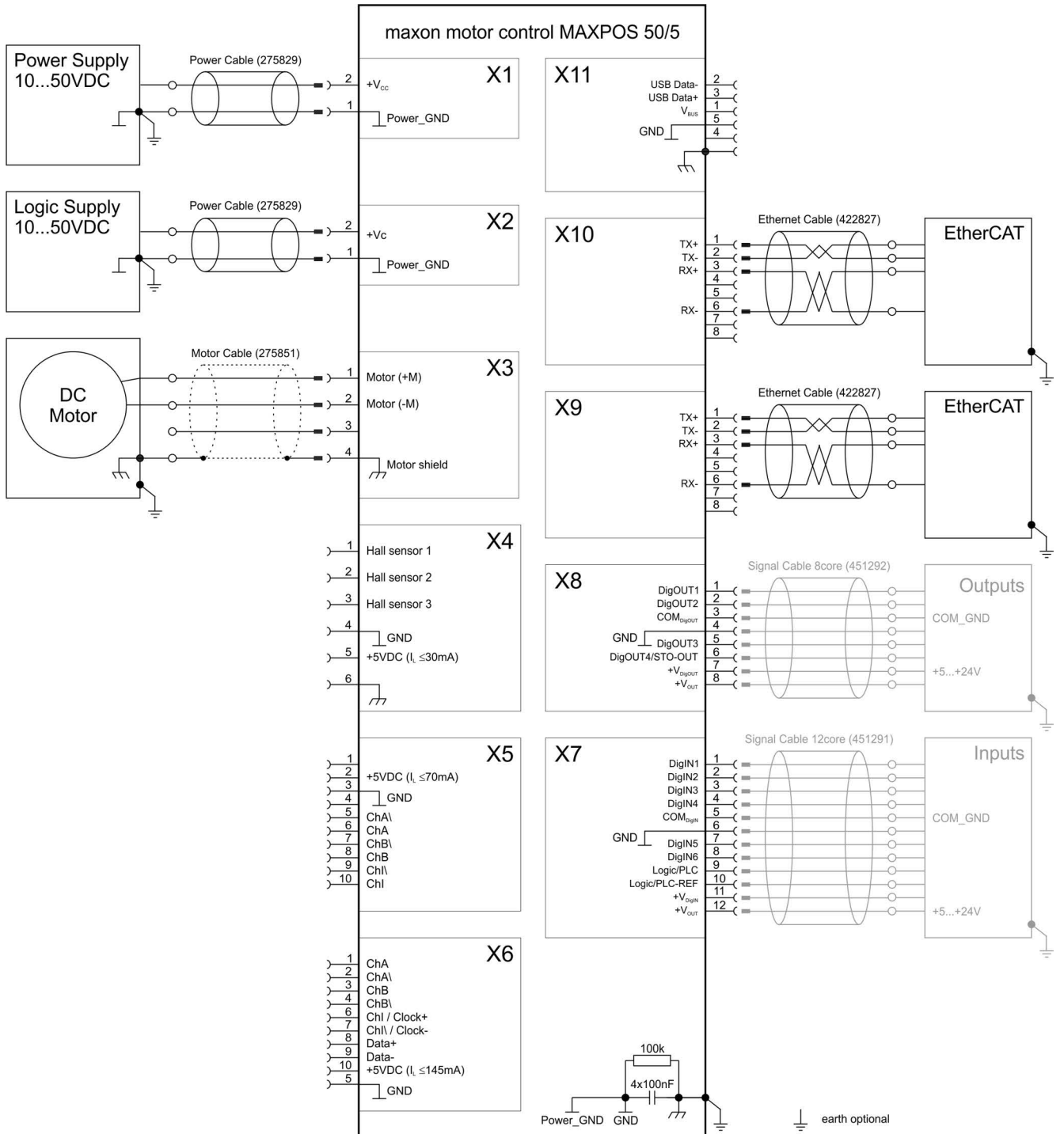


Figure 4-41 DC motor (no sensor)



When using a DC motor without any feedback sensor, operation will only be possible in Cyclic Synchronous Torque Mode (CST). All other operation modes require an encoder as feedback sensor.

4.2.2 DC Motor – Digital Incremental Encoder

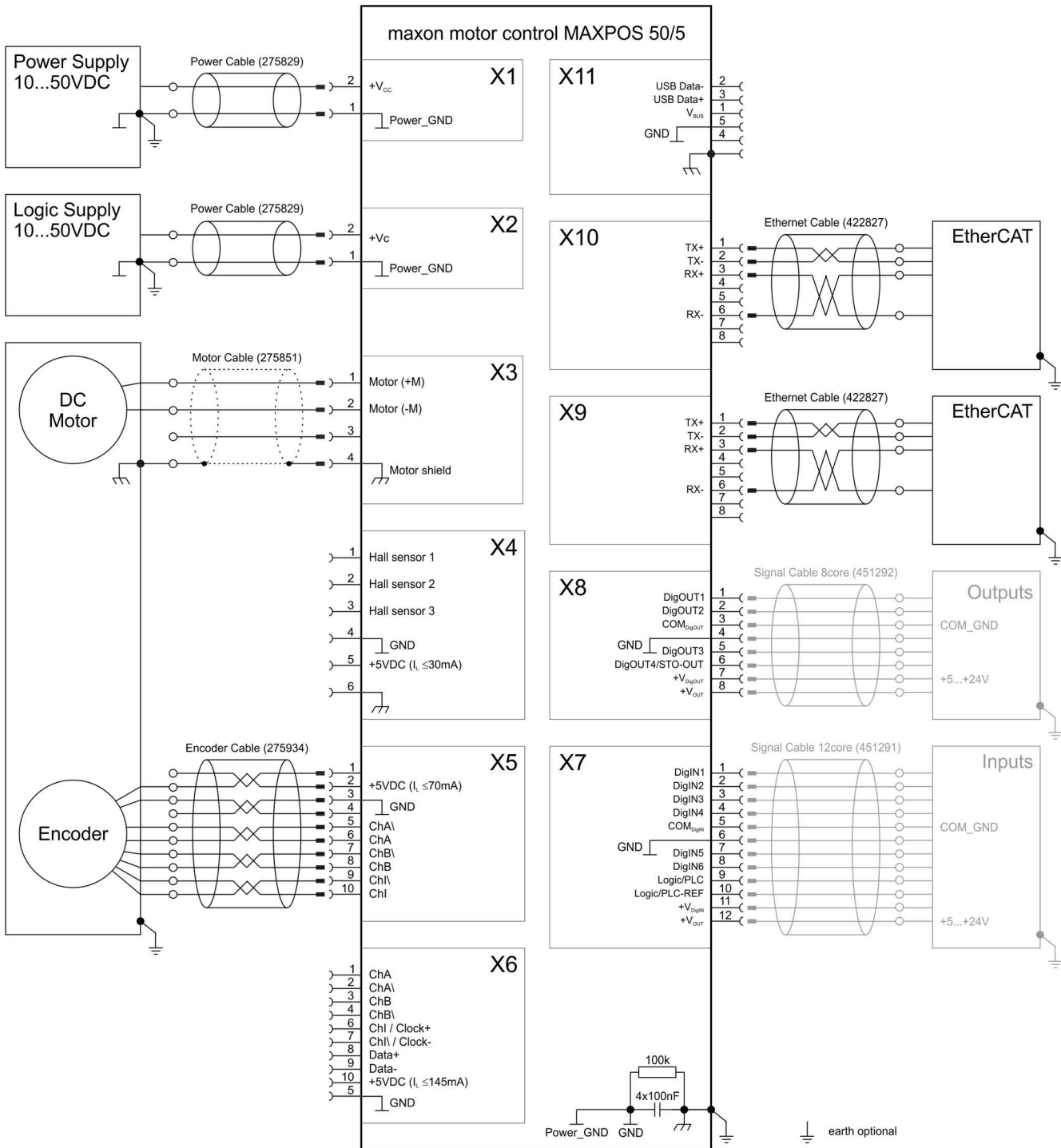


Figure 4-42 DC motor (digital incremental encoder)

4.2.3 DC Motor – Integrated Motor/Encoder Ribbon Cable

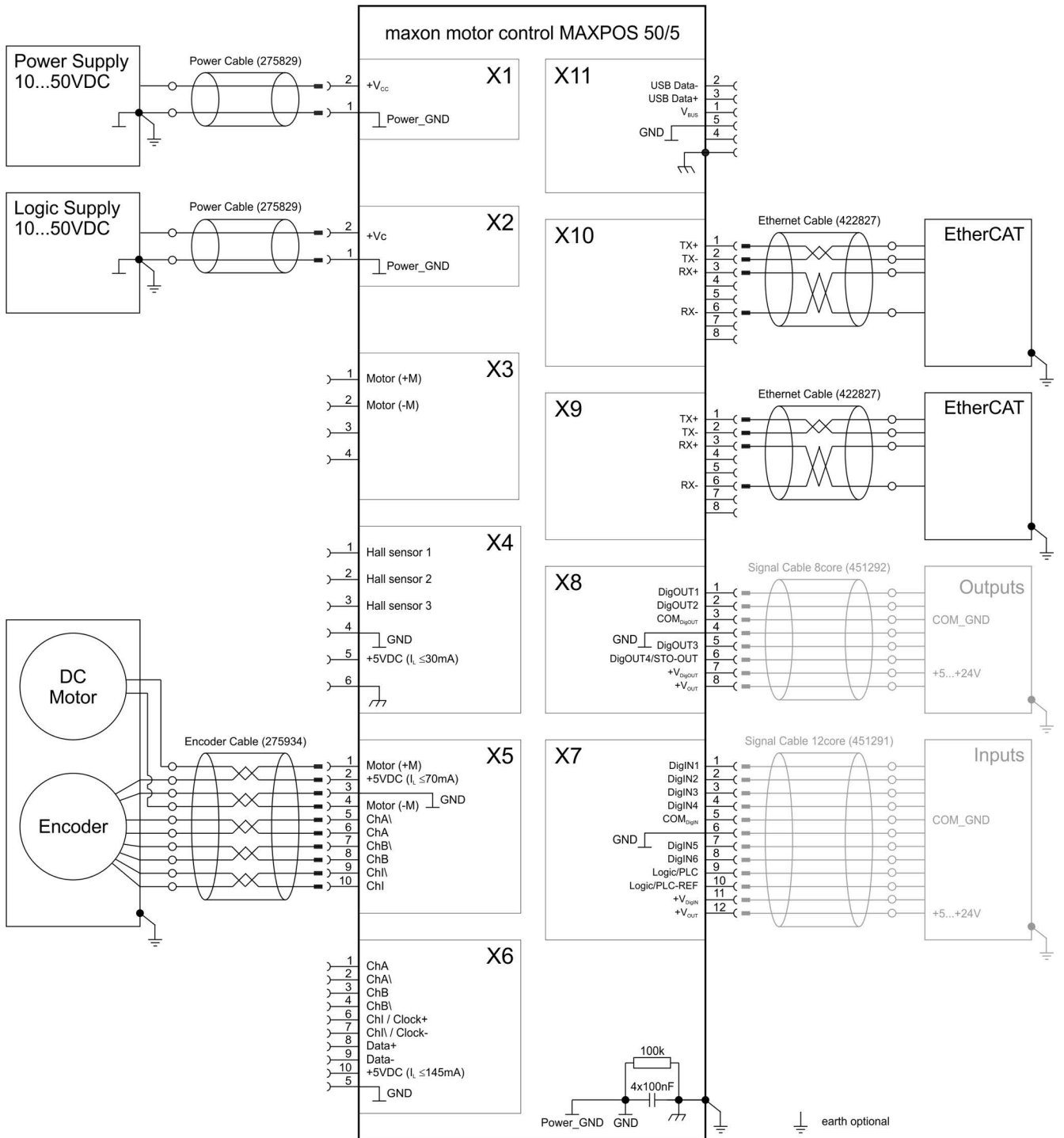


Figure 4-43 DC motor (integrated motor/encoder ribbon cable)



Note

For jumper settings → chapter “3.4.3.1 Hardware Settings” on page 3-18.

4.2.4 DC Motor – Digital Incremental Encoder (X6)

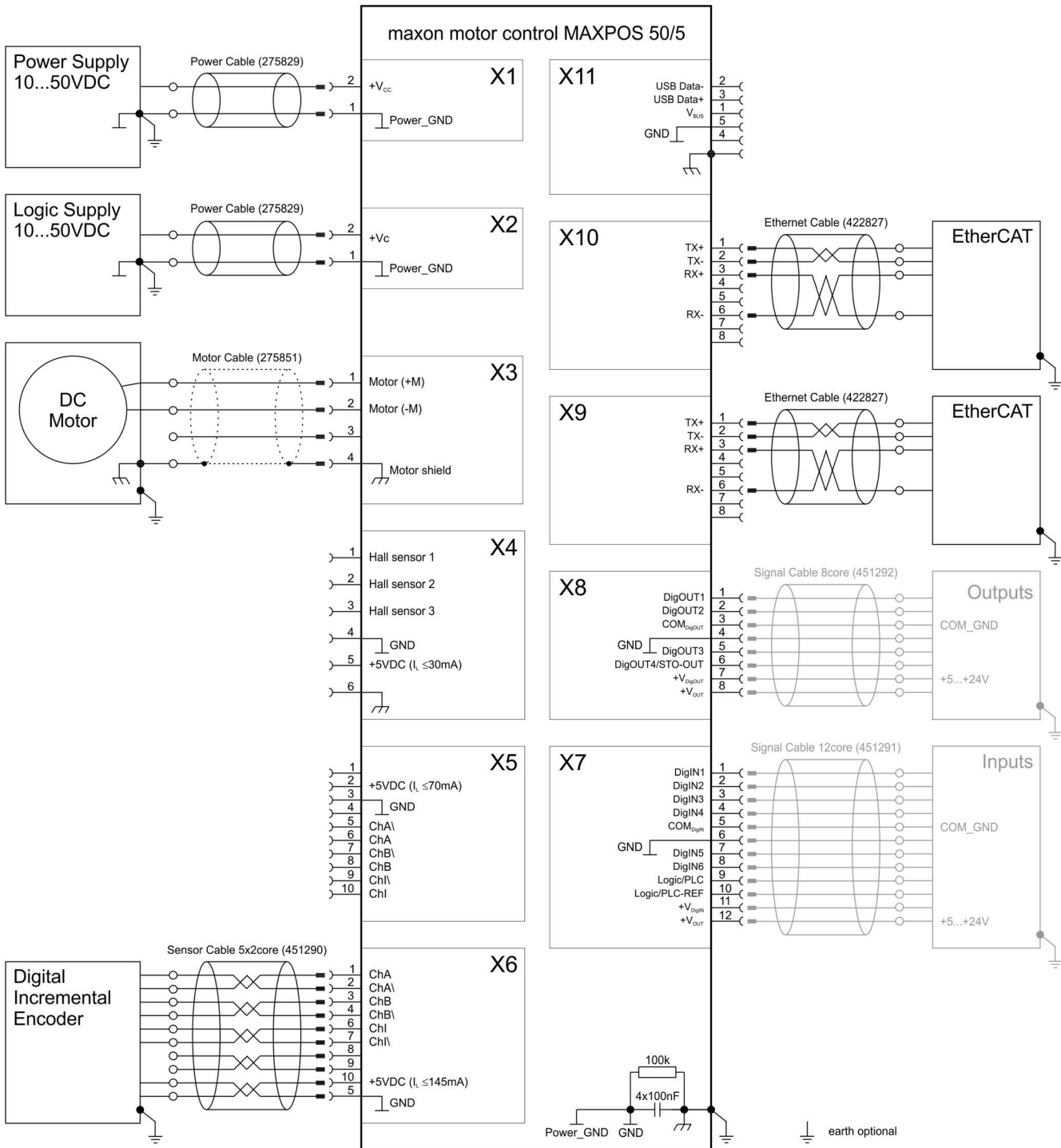


Figure 4-44 DC motor (digital incremental encoder – X6)

4.2.5 DC Motor – Digital & Digital Incremental Encoder

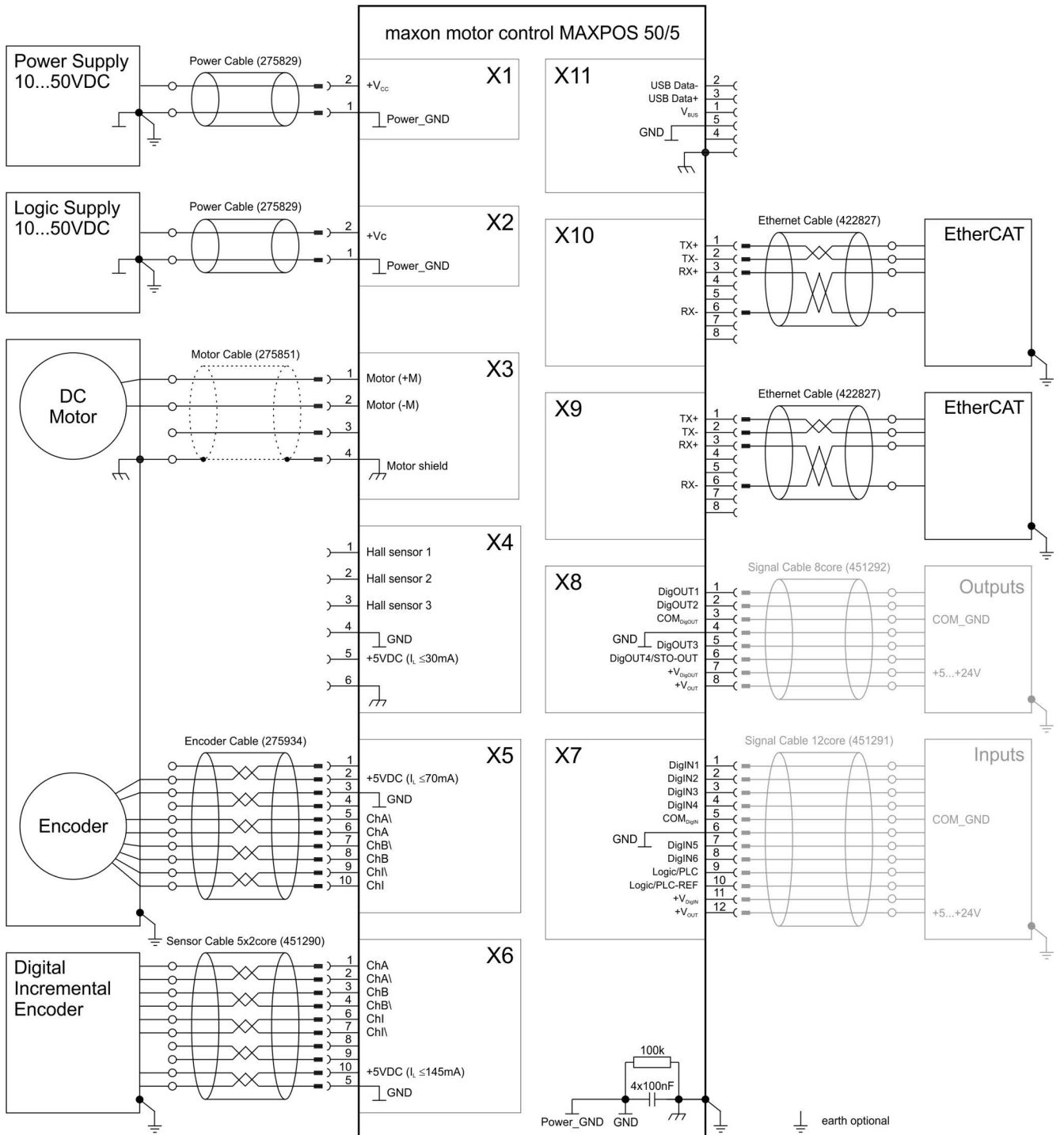


Figure 4-45 DC motor (digital & digital incremental encoder)

4.2.6 DC Motor – Integrated Motor/Encoder Ribbon Cable & Digital Incremental Encoder

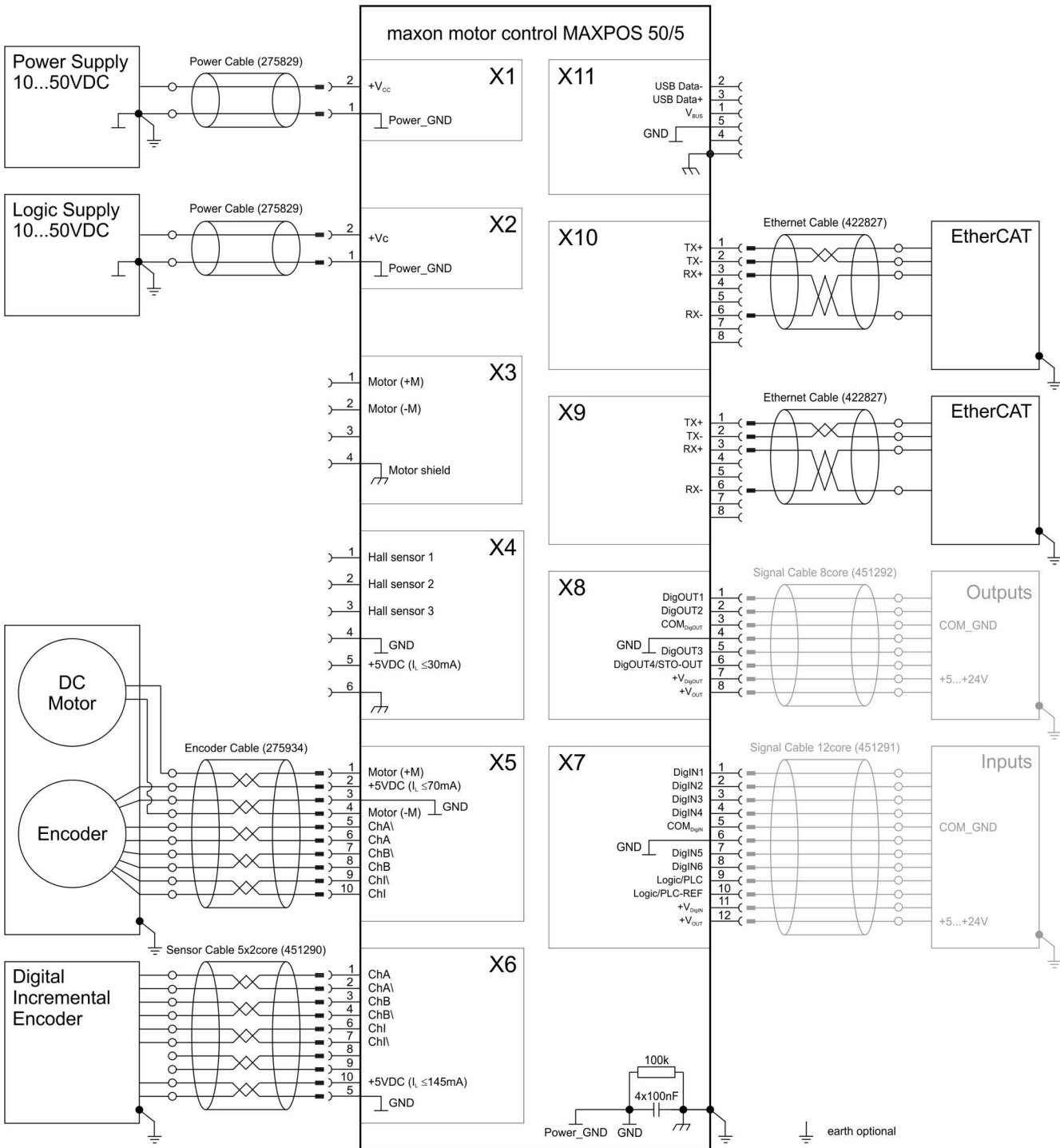


Figure 4-46 DC motor (integrated motor/encoder ribbon cable & digital incremental encoder)



Note

For jumper settings → chapter “3.4.3.1 Hardware Settings” on page 3-18.

4.2.7 DC Motor – Digital & Analog Incremental Encoder

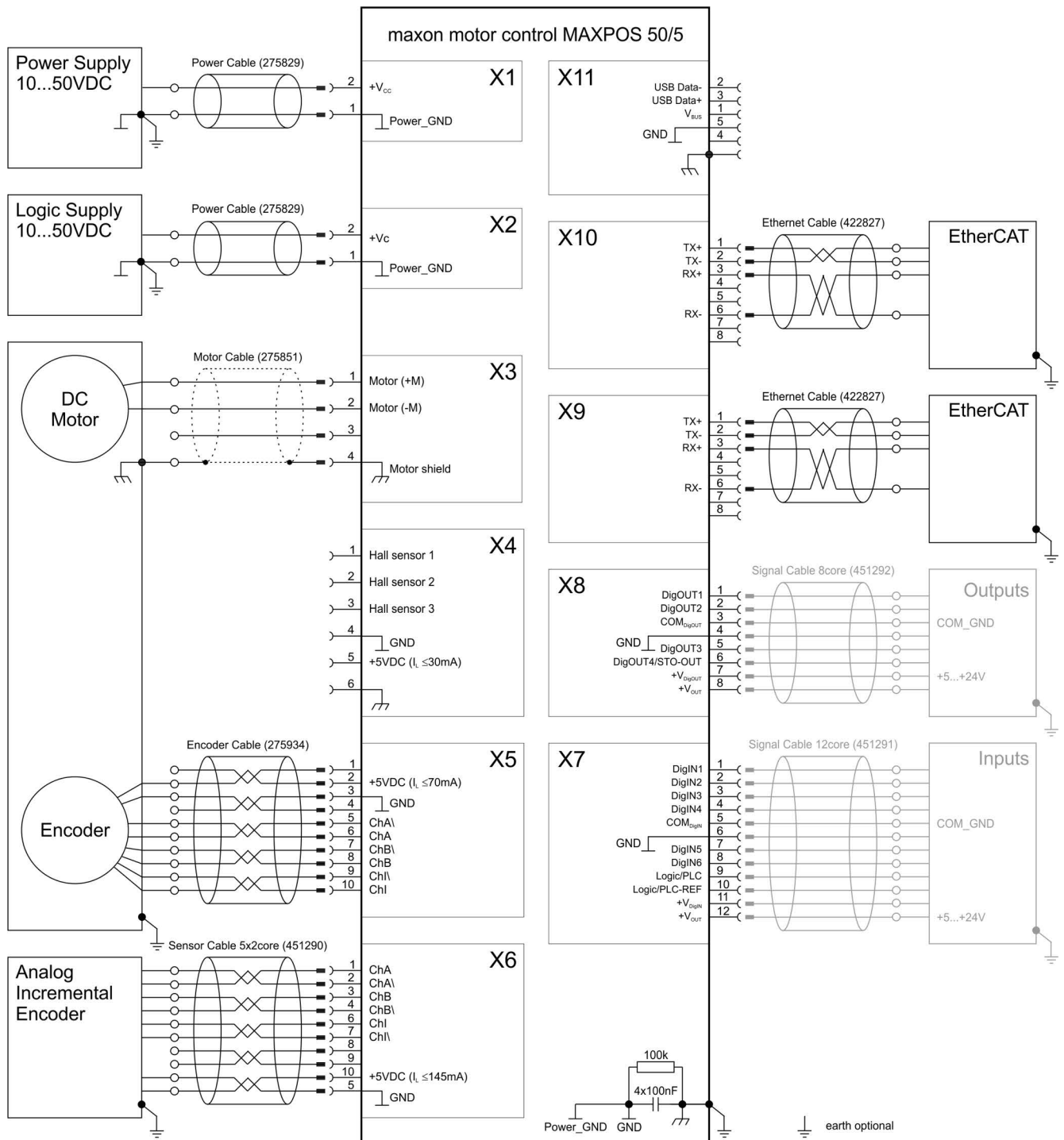


Figure 4-47 DC motor (digital & analog incremental encoder)

4.2.8 DC Motor – Integrated Motor/Encoder Ribbon Cable & Analog Incremental Encoder

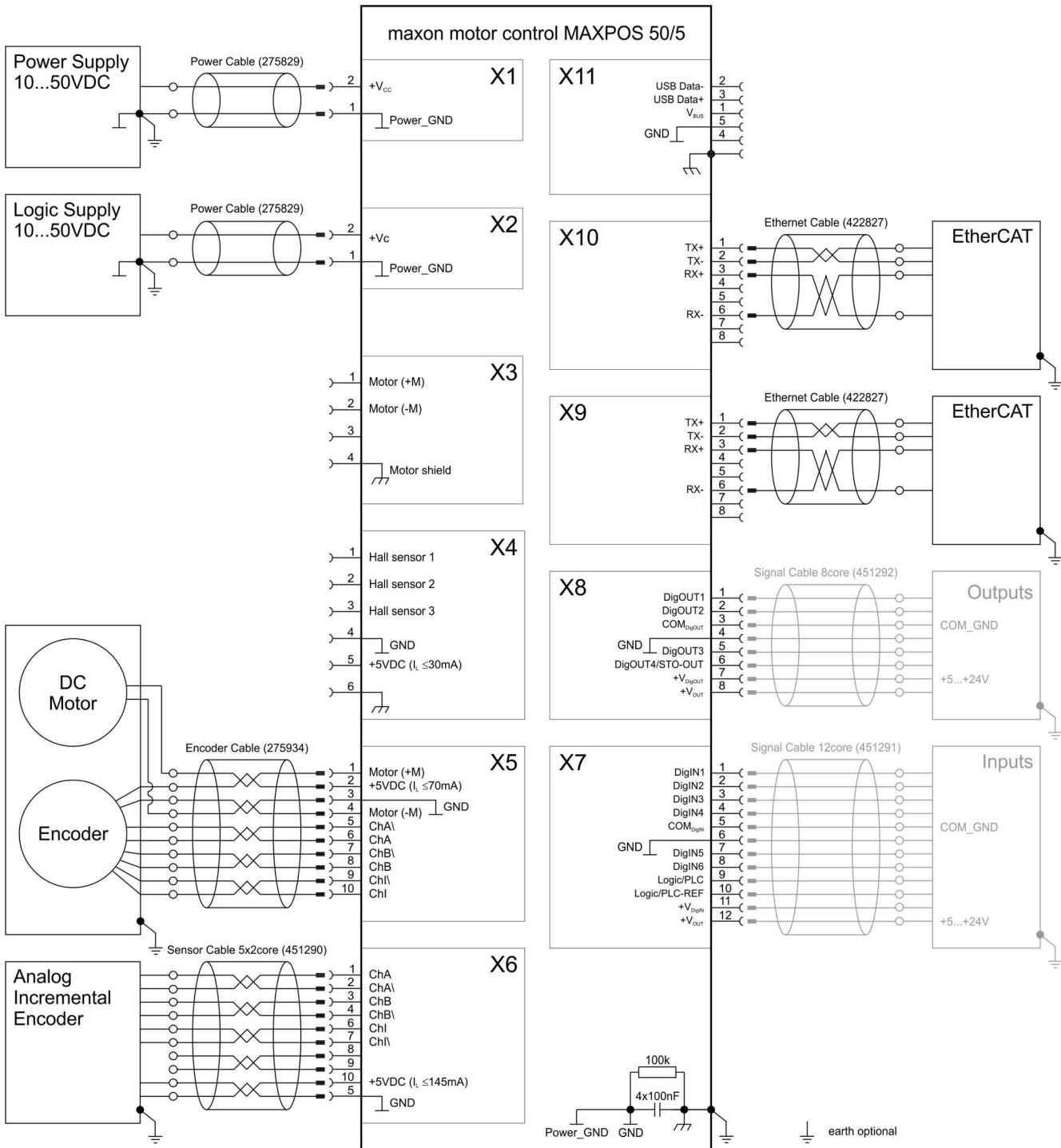


Figure 4-48 DC motor (integrated motor/encoder ribbon cable & analog incremental encoder)



Note

For jumper settings → chapter “3.4.3.1 Hardware Settings” on page 3-18.

4.2.9 DC Motor – Digital Incremental & SSI/BiSS Encoder

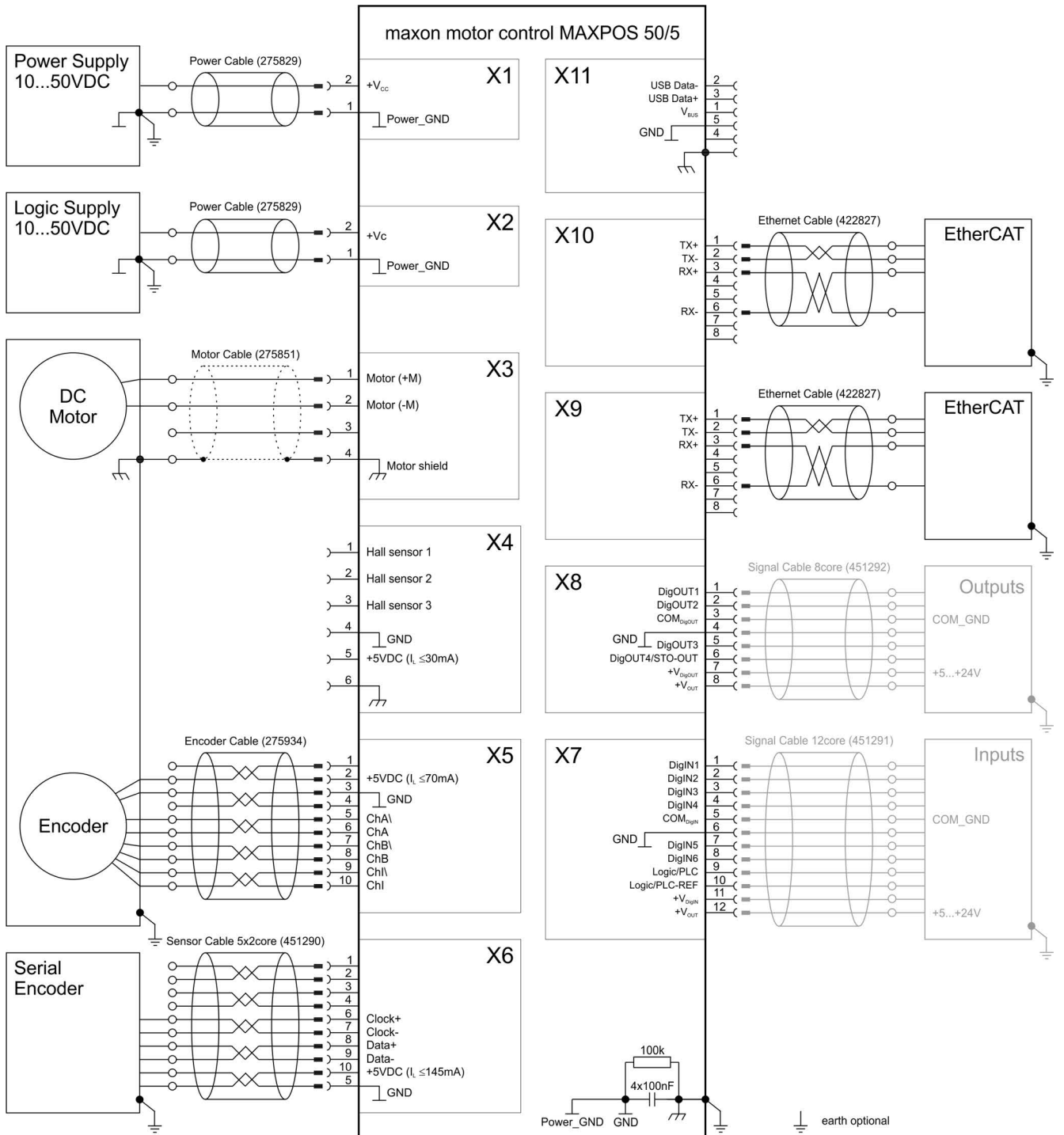


Figure 4-49 DC motor (digital incremental & SSI/BiSS encoder)

4.2.10 DC Motor – Integrated Motor/Encoder Ribbon Cable & SSI/BiSS Encoder

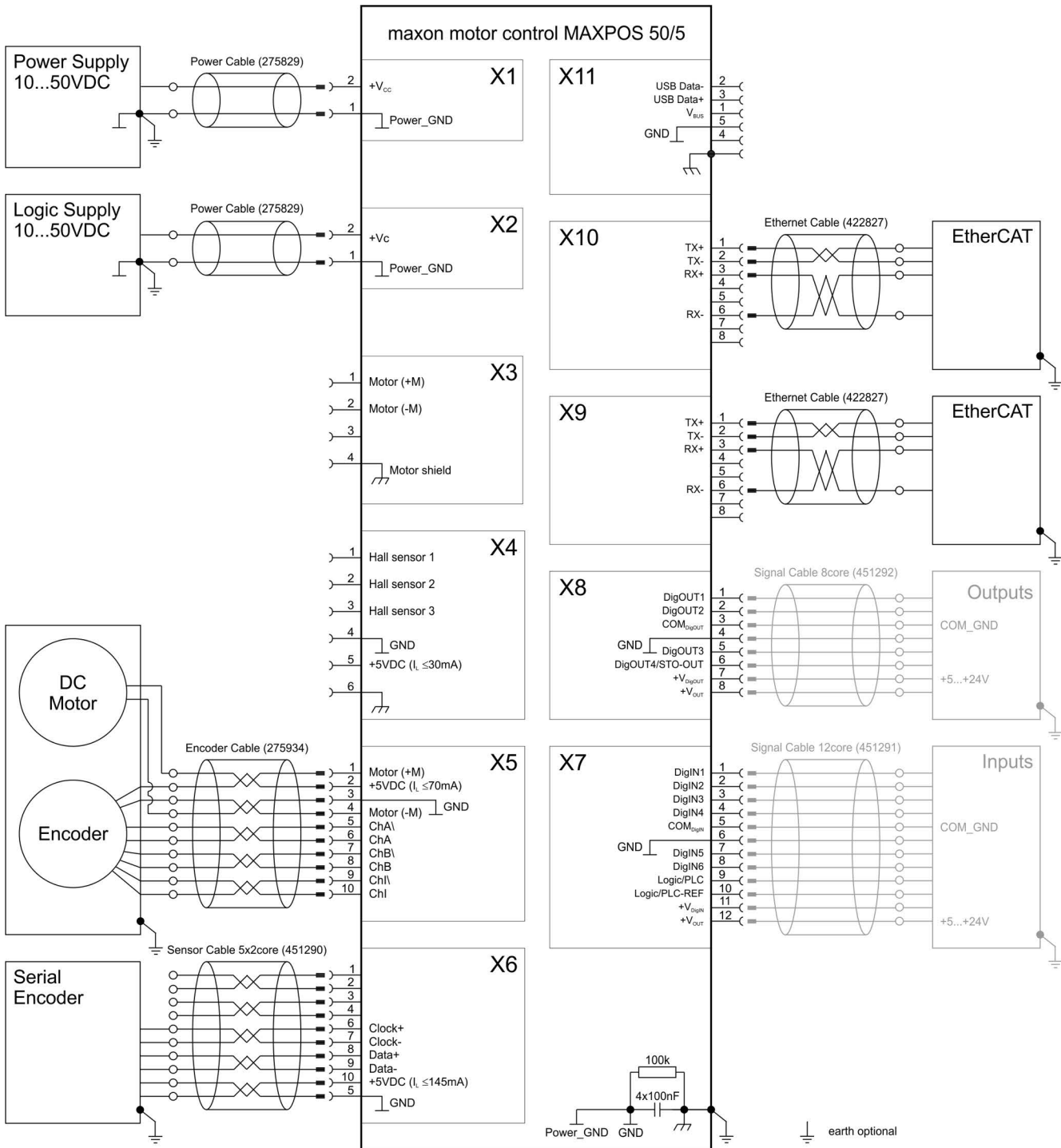


Figure 4-50 DC motor (integrated motor/encoder ribbon cable & SSI/BiSS encoder)



Note

For jumper settings → chapter “3.4.3.1 Hardware Settings” on page 3-18.

4.2.11 DC Motor – Analog Incremental Encoder

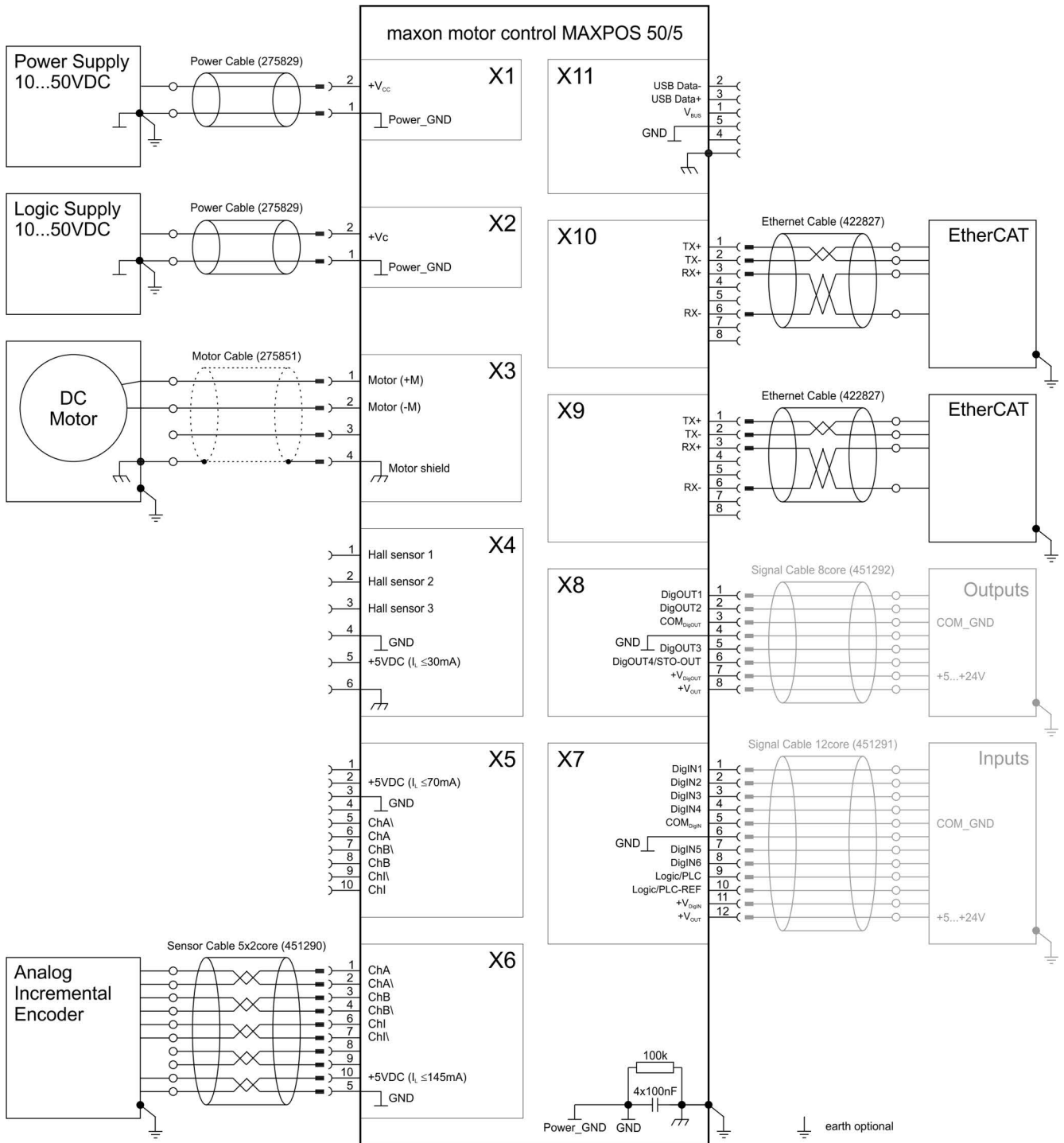


Figure 4-51 DC motor (analog incremental encoder)

4.2.12 DC Motor – SSI/BiSS Encoder

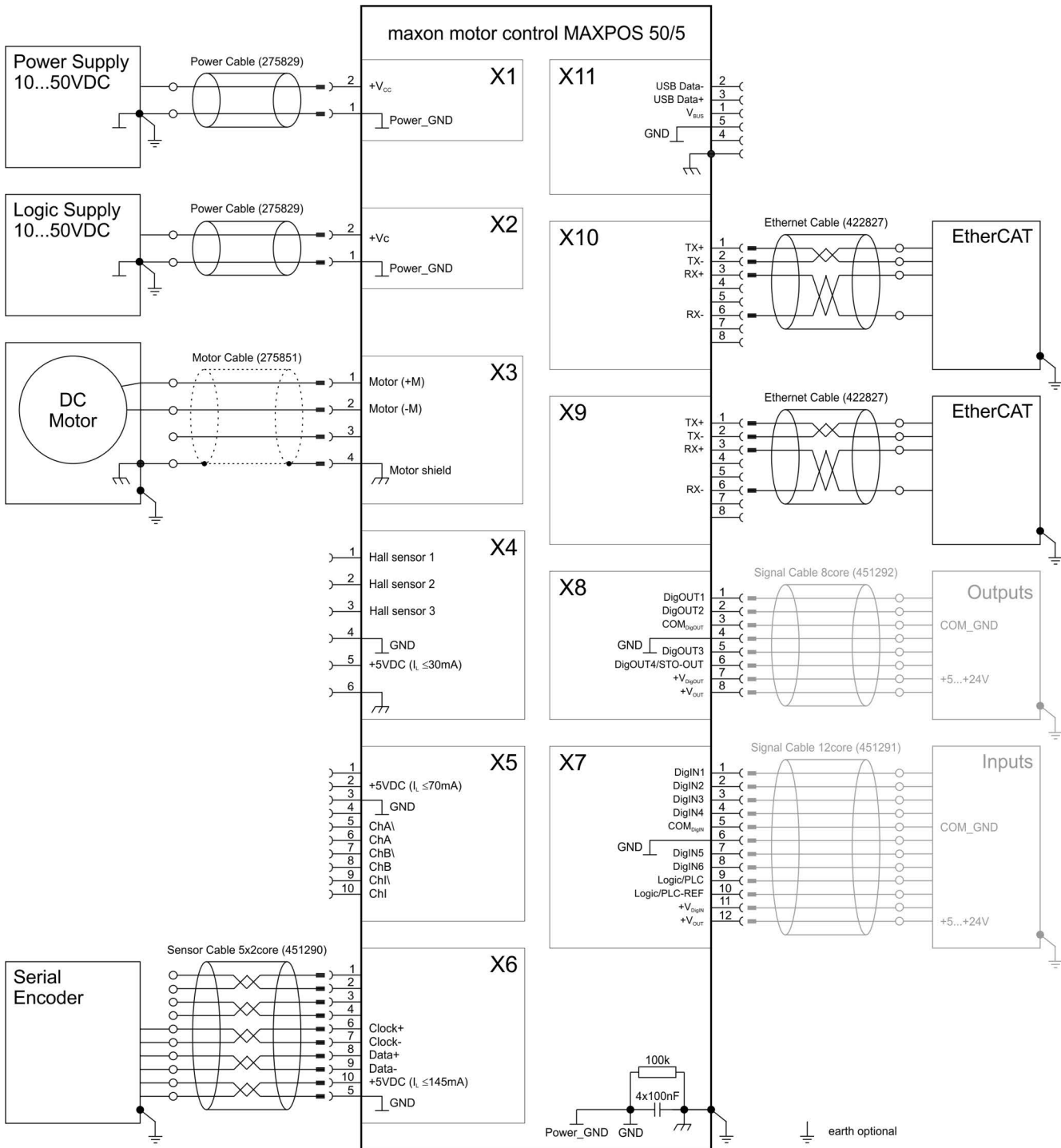


Figure 4-52 DC motor (SSI/BiSS encoder)

4.3 EC Motors (BLDC, brushless)

4.3.1 EC Motor – Hall Sensors

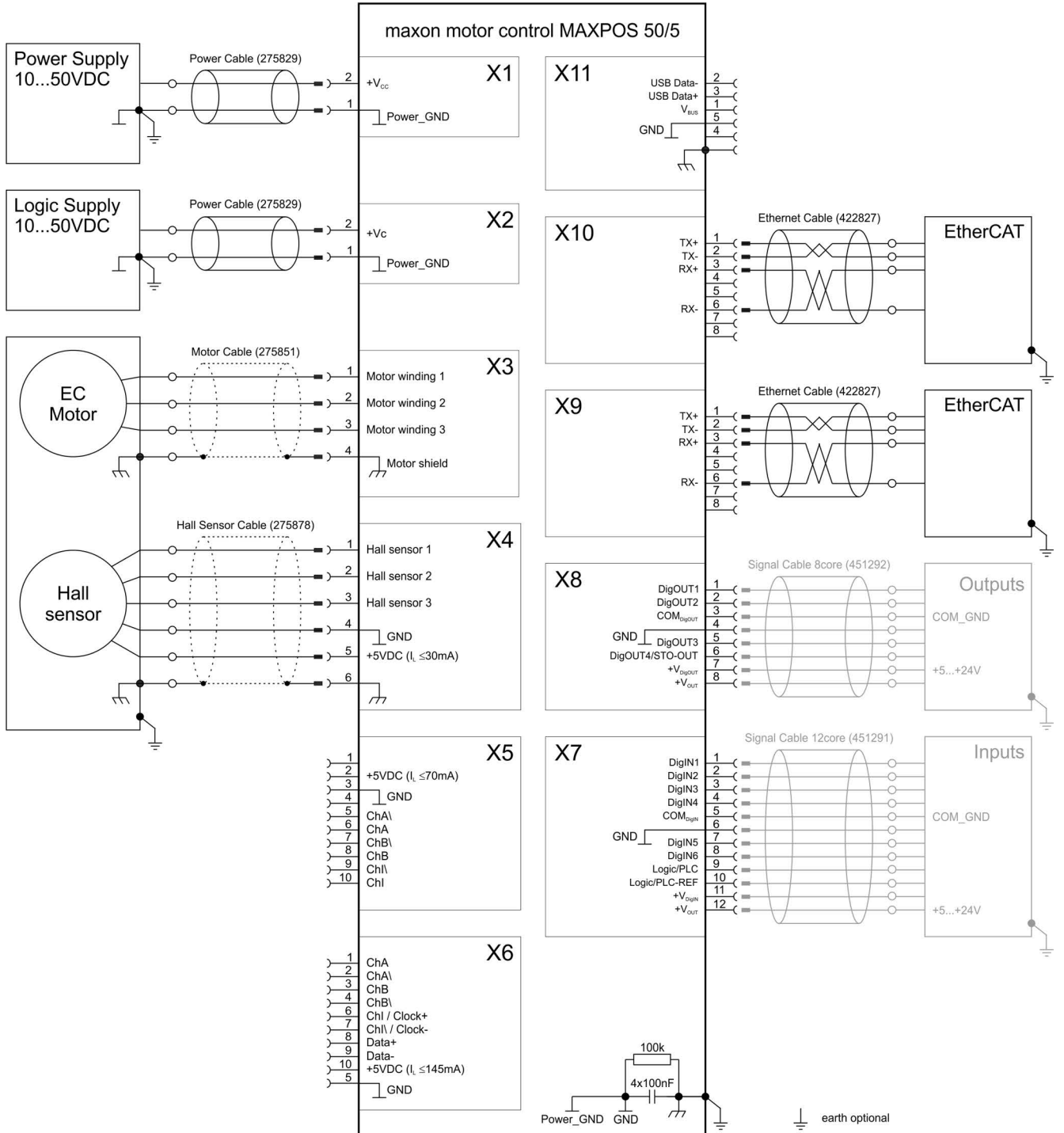


Figure 4-53 EC motor (Hall sensors)

4.3.2 EC Motor – Hall Sensors & Digital Incremental Encoder

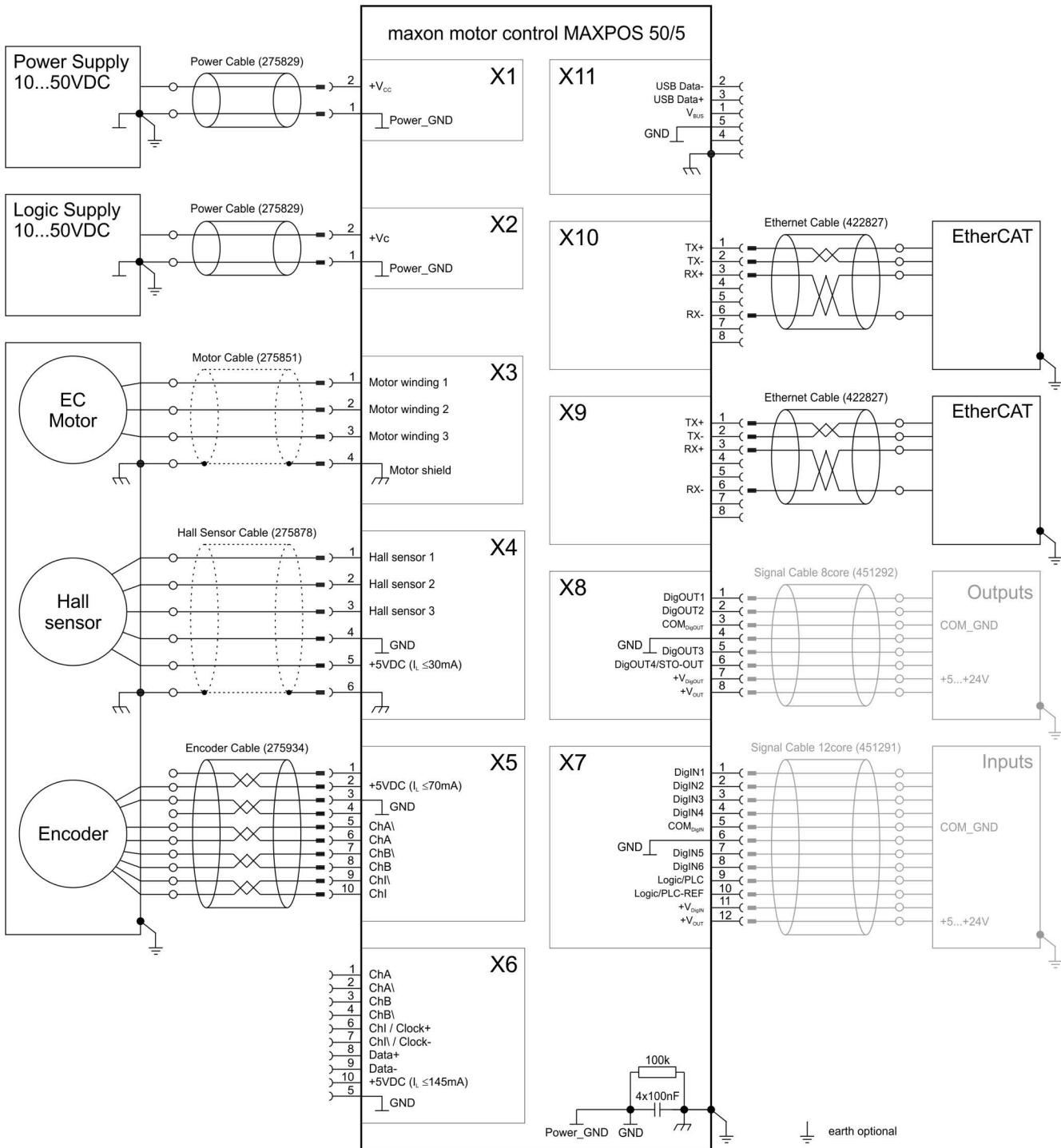


Figure 4-54 EC motor (Hall sensors & digital incremental encoder)

4.3.3 EC Motor – Hall Sensors & Digital Incremental Encoder (X6)

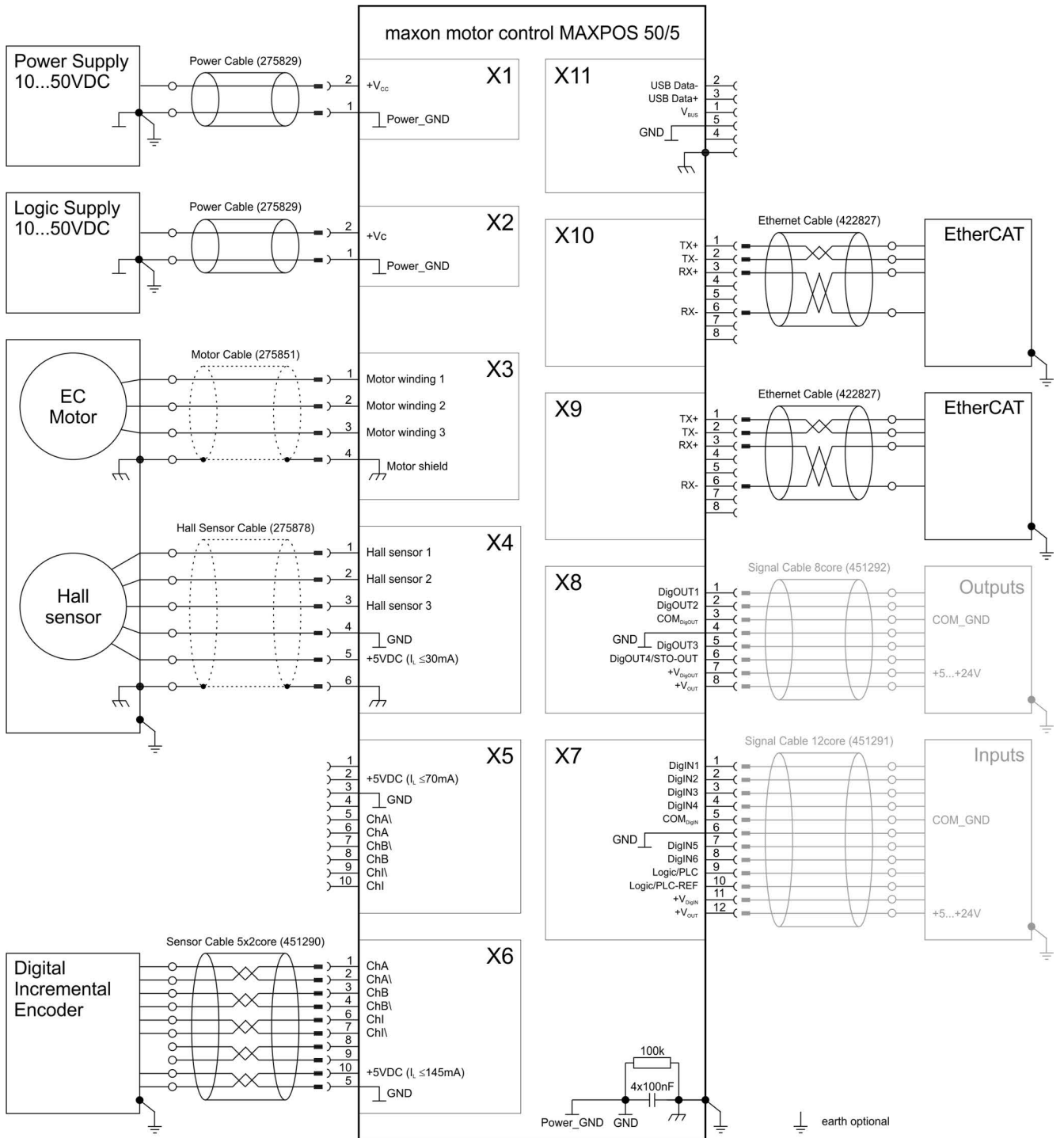


Figure 4-55 EC motor (Hall sensors & digital incremental encoder – X6)

4.3.4 EC Motor – Hall Sensors & Analog Incremental Encoder

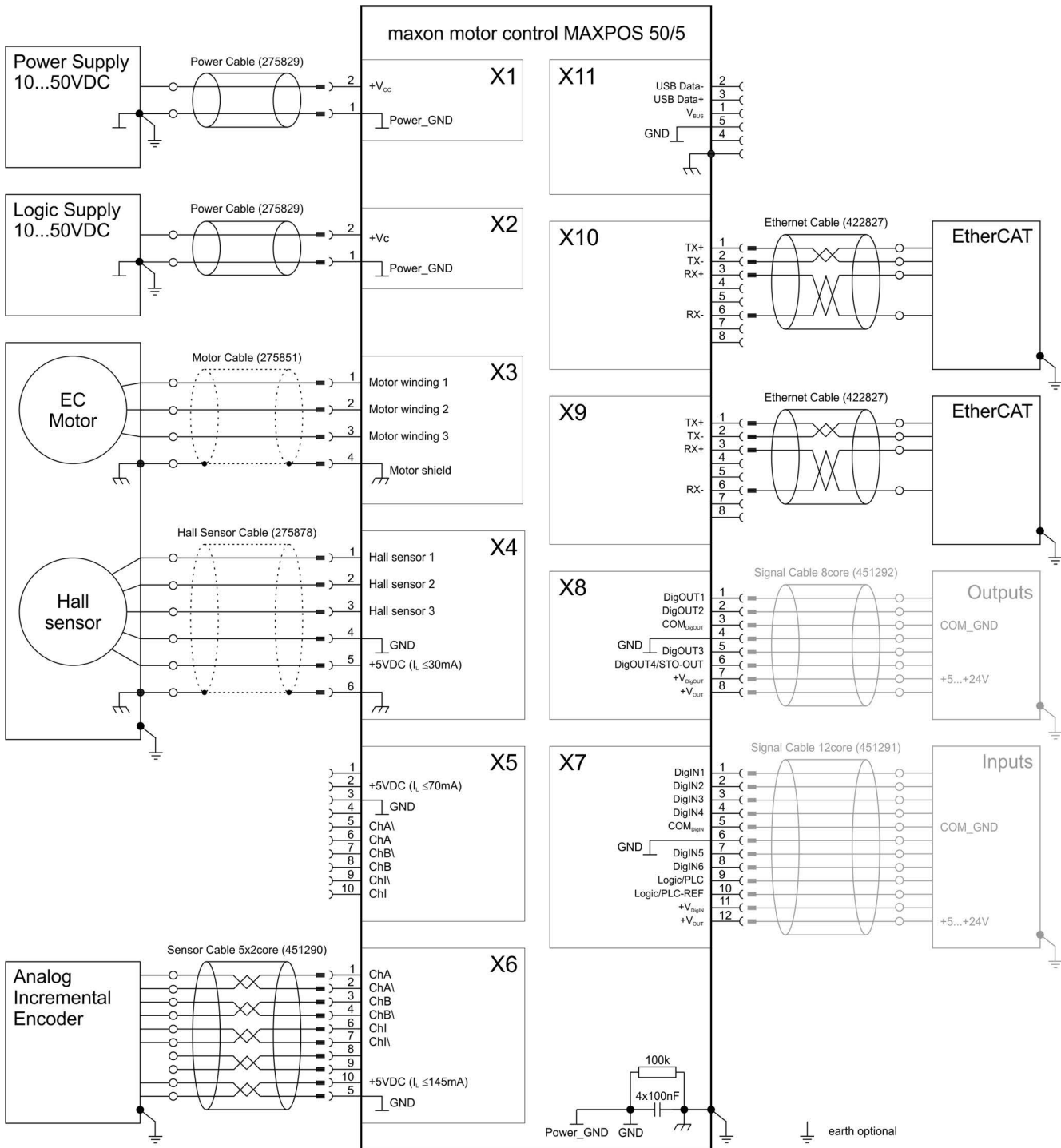


Figure 4-56 EC motor (Hall sensors & analog incremental encoder)

4.3.5 EC Motor – Hall Sensors & SSI/BiSS Encoder

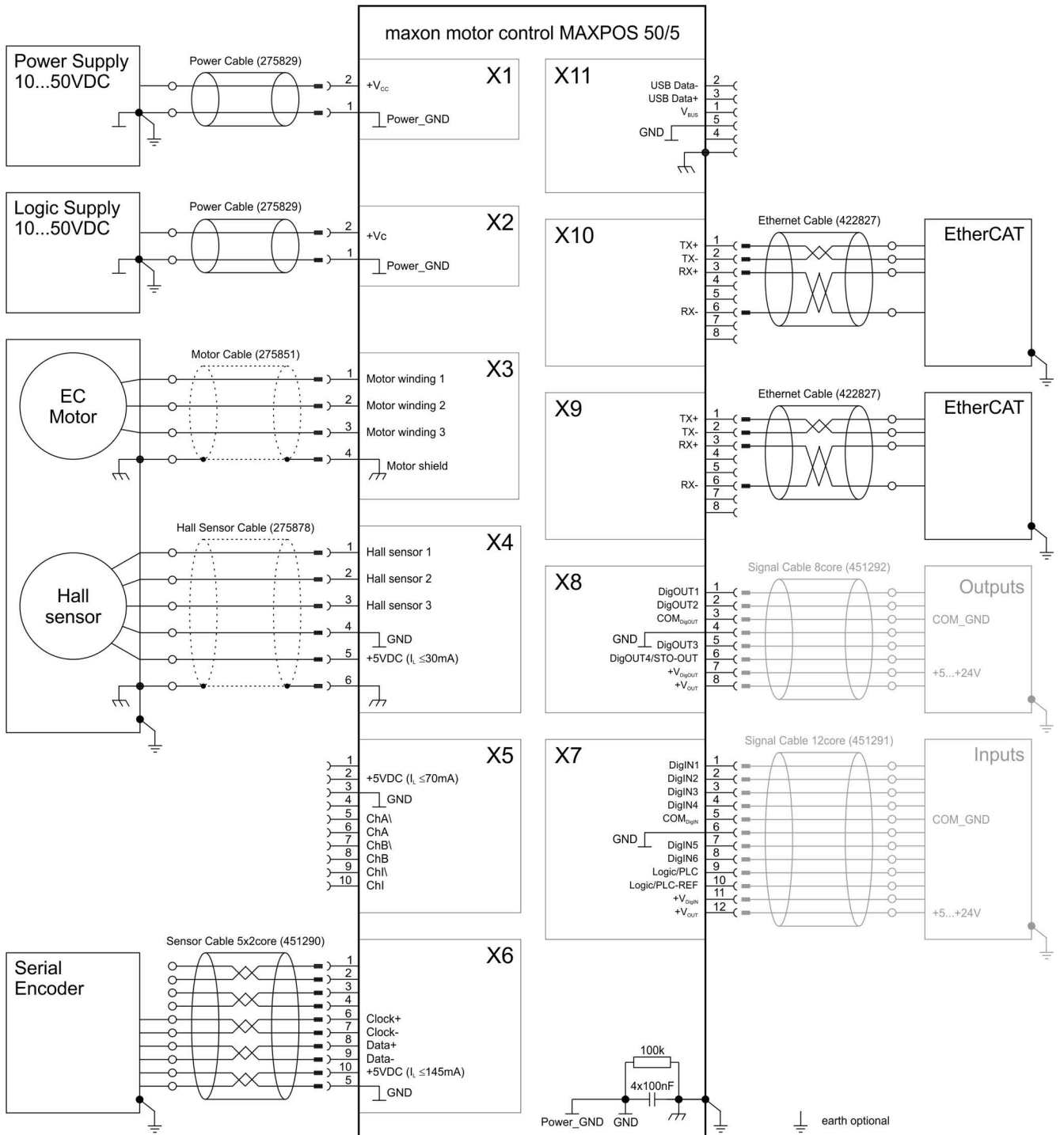


Figure 4-57 EC motor (Hall sensors & SSI/BiSS encoder)

4.3.6 EC Motor – Hall Sensors & Digital & Digital Incremental Encoder

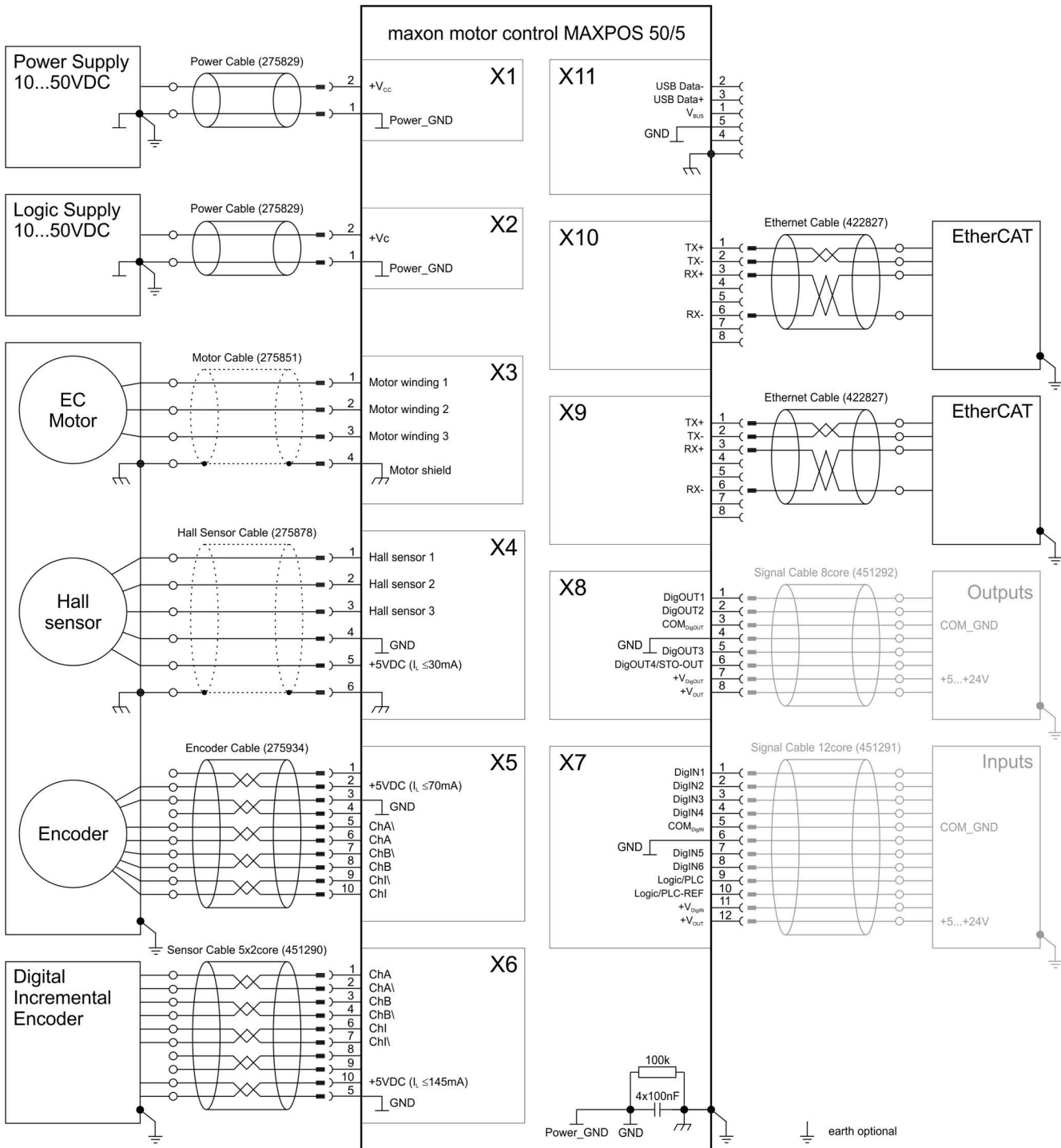


Figure 4-58 EC motor (Hall sensors & digital & digital incremental encoder)

4.3.7 EC Motor – Hall Sensors & Digital & Analog Incremental Encoder

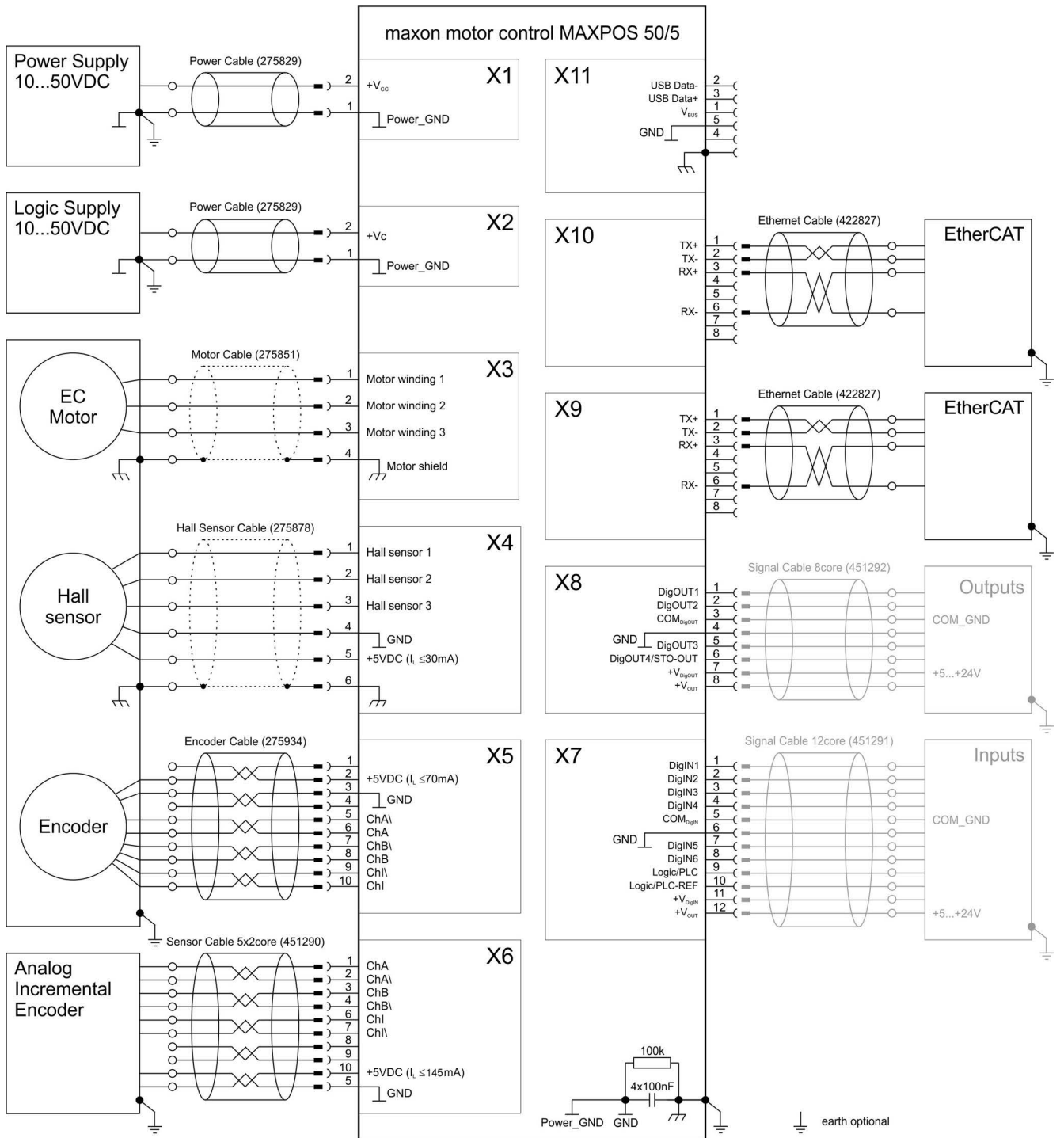


Figure 4-59 EC motor (Hall sensors & digital & analog incremental encoder)

4.3.8 EC Motor – Hall Sensors & Digital Incremental & SSI/BiSS Encoder

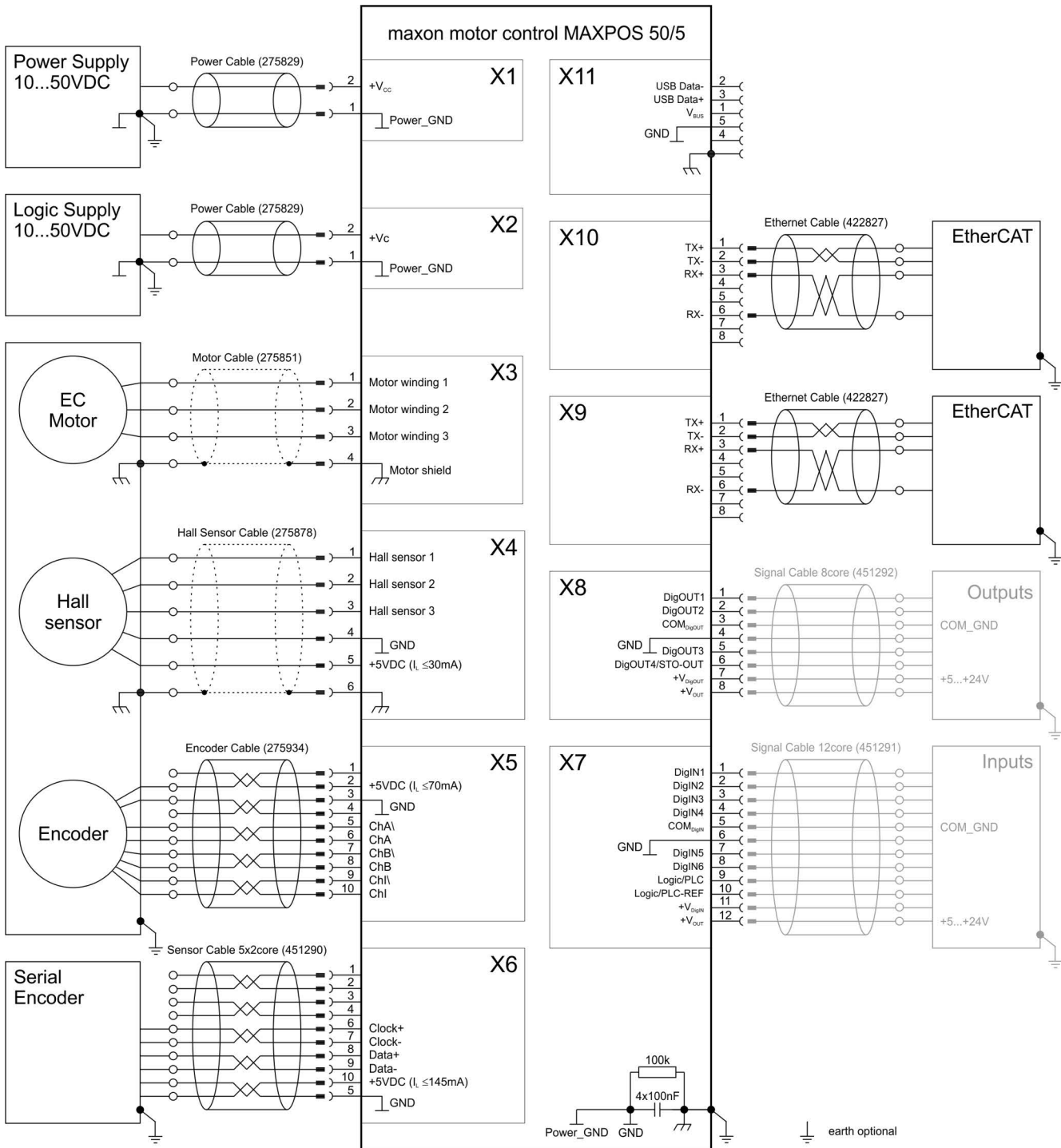


Figure 4-60 EC motor (Hall sensors & digital incremental & SSI/BiSS encoder)

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