

## PacDrive™ Controller Mx-4

Controller-based architecture

The PacDrive Controller Mx-4 is a Pentium II based controller using the VxWorks real-time operating system that provides logic and motion functions for a machine. A PacDrive Controller synchronizes, coordinates and generates the positioning functions for a maximum of 47 servo drives which are connected through the motion bus SERCOS interface.

Several standardized field bus interfaces are available, PROFIBUS DP, CAN, CANopen, DeviceNet, or Ethernet/IP. For HMI functions various standard HMI systems can be used. Whether low-cost text display or IPC - no problem for the flexible Mx-4.

### The technical data at a glance:

- CPU: Intel Pentium II, 266 MHz, 32 MB RAM, L2 Cache 512 KB
- Real-time operating system: VxWorks
- IEC 61131-3 programming languages for PLC and motion control
- Motion bus: SERCOS interface
- Field bus interface: Profibus DP, CAN, CANopen, DeviceNet, or Ethernet/IP
- Integrated IOs: digital inputs, digital outputs, analog inputs, interrupt inputs, fast touchprobe inputs
- Communication interfaces: RS 232, RS 485, Ethernet (TCP/IP)
- CompactFlash™ Disk (16 MB)
- Includes OPC server for Windows based HMI
- Remote diagnosis over web server or modem



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This Technical Data Sheet does not replace the Operating manual.

For a complete description of the PacDrive Controller see the Operating manual PacDrive Controller

For planning and project activities see the PacDrive Projecting manual

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## Technical Data

	Parameter	Value
<b>Product configuration</b>	Product ID code - MAx-4 up to 8 axes - MAx-4 up to 99 axes	MAx-4 / 11 / 02 / 016 / 08 / x / x / xx MAx-4 / 11 / 02 / 016 / 99 / x / x / xx
	Order code - MAx-4 up to 8 axes - MAx-4 up to 99 axes	13 13 02 51 - xxx 13 13 02 55 - xxx
<b>Processor</b>	CPU	Intel Pentium II 266 MHz
	RAM	32 MB
	L2 Cache	512 kB
	NVRAM	32 kB
	CompactFlash™ Disk	16 MB (internal)
	Real time clock (RTC)	yes, optional hardware required
	Watchdog	yes
	Diagnostics	status LEDs
<b>Operating System</b>	Real-time operating system	VxWorks
<b>Programming languages</b>	Programming languages IEC 61131-3	Continuous Function Chart (CFC) Function Block Diagram (FBD) Instruction List (IL) Ladder Diagram (LD) Sequential Function Chart (SFC) Structured Text (ST)
<b>Interfaces</b>	Communication interfaces COM1 COM2	RS232 <b>(X5)</b> RS485 <b>(X6)</b>
	Network interface	Ethernet (10 Base-T) <b>(X10)</b>
	Fieldbus interfaces	PROFIBUS DP Master (12 MBaud) <sup>1)</sup> PROFIBUS DP Slave (12 MBaud) <sup>1)</sup> CAN (2.0B) <sup>1)</sup> CANopen <sup>1)</sup> DeviceNet Slave <sup>1)</sup> Ethernet/IP Slave <sup>1)</sup>  <sup>1)</sup> optional hardware module required
	Motion bus interface	SERCOS interface (4 MBaud) <b>(X7, X8)</b>

	Parameter	Value
	PacNet interface	1 PacNet interface <sup>1)</sup>  1) optional hardware module required
	Encoder interface	1 SinCos encoders up to 10 incremental encoder <sup>1)</sup>  1) optional hardware module required
	HMI interface	Operator panels: RS485 using Modbus or PROFIBUS DP  HMI software tools: OPC server (Windows NT/2000/XP or Windows CE)
	Remote Diagnostics interface	Web server or modem
	Communication protocols	http, ftp, SMTP (email)
	Integrated trace recorder (software oscilloscope)	8 channels 1 ms resolution
	Integrated logger for diagnostic messages	27 kB
<b>Performance</b>	Motion performance	11 Servo axes @ 1 ms SERCOS cycle 23 Servo axes @ 2 ms SERCOS cycle 45 Servo axes @ 4 ms SERCOS cycle  max. 255 cam profiles running in parallel
	PLC performance	20 µs for 1000 Bit instructions  unlimited number of PLC tasks PLC task types: continuous, periodic or event-triggered  Cycle time Fast Task: 250 µs  Nominal I/O response time: 500 µs (reading input, processing data, setting output)
<b>PLS</b>	Programmable limit switches (PLS)	max. 256  Type: dynamic  Outputs: memory or digital outputs  Inputs: external master encoder, virtual master encoder, or axes position  Scan time: 250 µs

Parameter	Value
I/Os Integrated digital inputs (X3)	number: 20  range $U_{IN}$ 0 state: DC 0 ... 6 V range $U_{IN}$ 1 state: DC 20 ... 33 V input current: $I_{IN} = 5$ mA on $U_{IN} = 24$ V pole safe: yes input filter: 3.5 ... 5.5 ms
Integrated analog inputs (X2)	number: 2  range $U_{IN}$ : -7 ... 10 V (impedance 100 k) or range $I_{IN}$ : 0 ... 20 mA (impedance 500 R)
Integrated interrupt inputs (X4)	number: 4  range $U_{IN}$ 0 state: DC 0 ... 6 V range $U_{IN}$ 1 state: DC 20 ... 33 V input current: $I_{IN} = 5$ mA on $U_{IN} = 24$ V pole safe: yes input filter: 0.07 ... 0.17 ms
Integrated touchprobe inputs (X4)	number: 16  range $U_{IN}$ 0 state: DC 0 ... 6 V range $U_{IN}$ 1 state: DC 20 ... 33 V input current: $I_{IN} = 5$ mA on $U_{IN} = 24$ V pole safe: yes input filter TP0 to TP15: 100 $\mu$ s resolution time TP0 to TP3: 15.6 $\mu$ s @ 1, 2, 4 ms cycle time resolution time TP4 to TP15: 15.6 $\mu$ s @ 1 ms cycle time 32.25 $\mu$ s @ 2ms cycle time 62.5 $\mu$ s @ 4ms cycle time
Integrated digital outputs (X4)	number: 16  output voltage: $(+UL-3$ V) < $U_{OUT}$ < +UL rated current: $I_e = 100$ mA per output switch current: $I_{e\max} < 0.5$ A for 1 s leakage current 0 signal: < 0.4 mA transmission time: 0.04 ... 0.31 ms short-circuit-proof: yes relay outputs: DC 20 ... 30 V / 2 A
Integrated analog outputs	none
Additional digital and analog I/Os	via fieldbus  max. 3.584 Bytes digital/analog inputs and max. 3.584 Bytes digital/analog outputs  max. number of stations: 126 (PROFIBUS)

	Parameter	Value
<b>Power supply</b>	Additional fast digital I/Os	via PacNet max. 128 inputs and 128 outputs
	Additional touchprobe inputs	via PacNet max. 16 touchprobe inputs
	Power supply	DC 24 V (-15% / +25%) / max. 3.15 A
	Power consumption	max. 60 W
	Uninterruptable power supply UPS	external
	<b>Environment</b>	Product size
Box size		width: 100 mm height: 400 mm depth: 300 mm
Product weight Boxed weight		2.4 kg 3.0 kg
Ambient conditions - protection class - ambient temp.  - insulation - rel. humidity		IP20 +5 ... +55 °C (in operation) -25 ... +70 °C (for storage and transport) degree of pollution 2 ..., no dewing allowed 5% ... 85% climatic category 3K3 EN 60 721
Approvals		CE, UL , cUL

Remark: All technical data refer to the actual SW and HW versions:

- HW-Code: F464A8
- SW-Version: Firmware V00.15.xx

## Interfaces

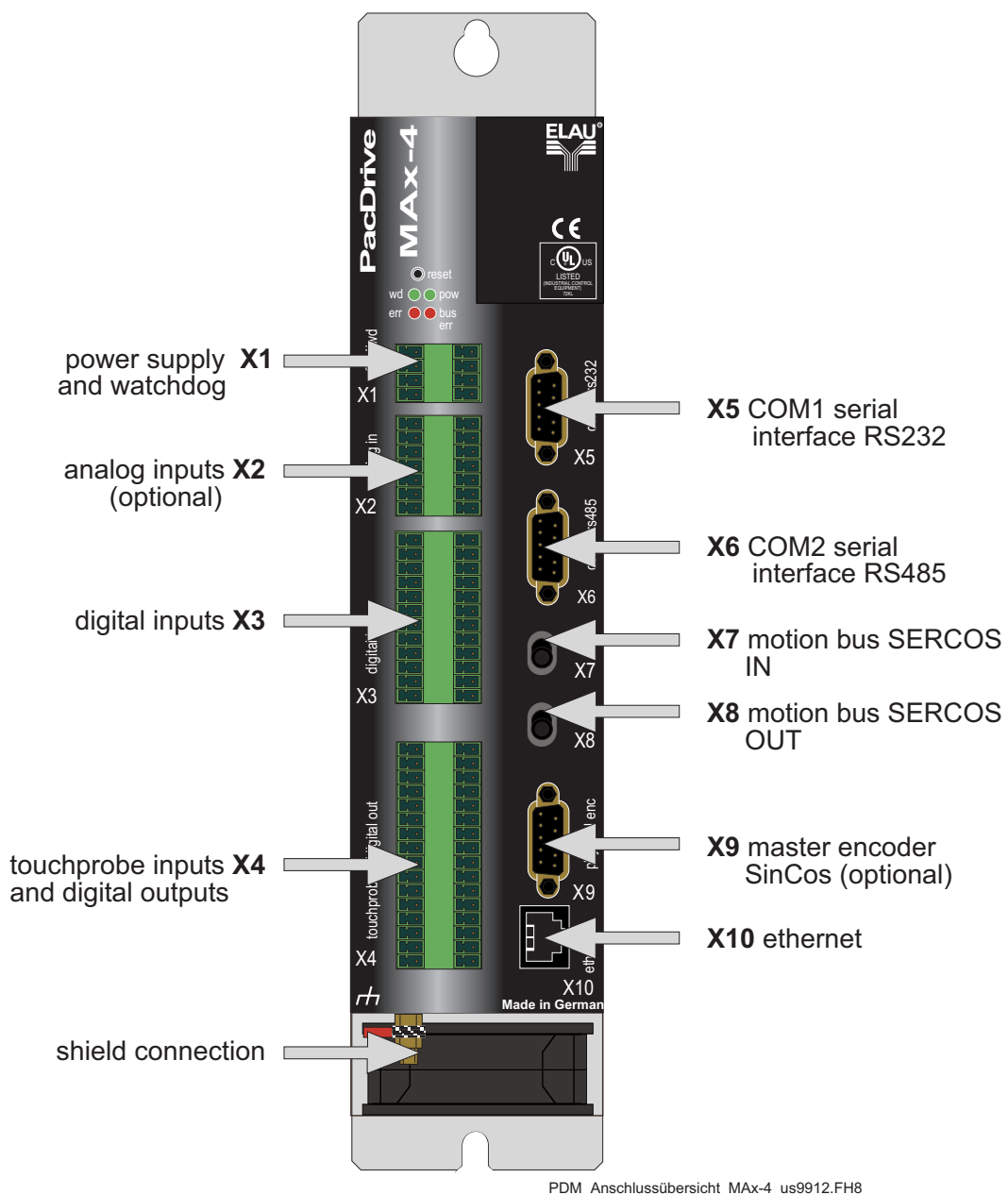


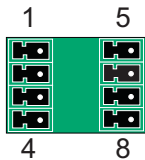
Fig. 0-1: Overview of the PacDrive Controller MAX-4





## Electrical Connections

### X1 - control voltage and watchdog



Pin	Designation	Meaning	Range	Max. cross section
1	DC +24 V	supply voltage	- 15% / +25%	1.5 mm <sup>2</sup>
2	0 V	supply voltage		1.5 mm <sup>2</sup>
3	+UL	for digital outputs	DC +24V -15% / +25%	1.5 mm <sup>2</sup>
4	L0	for digital inputs / outputs		1.5 mm <sup>2</sup>
5	DC +24 V	supply voltage	-15% / +25%	1.5 mm <sup>2</sup>
6	DC 0 V	supply voltage		1.5 mm <sup>2</sup>
7	WD	watchdog relay		1.5 mm <sup>2</sup>
8	WD	watchdog relay		1.5 mm <sup>2</sup>

Table 0-1: Electrical connections of MAX-4 / X1

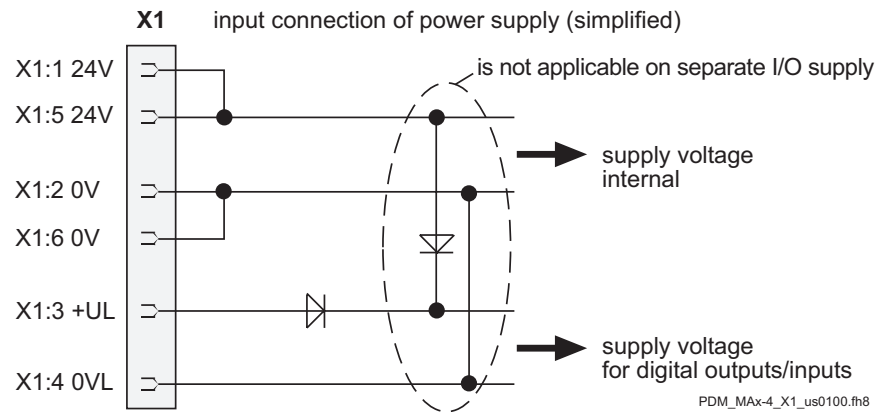


Fig. 0-1: Electrical connections of MAX-4 / X1 input connection



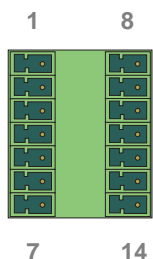
### CAUTION!

Disconnection of control voltage!

Risk of data loss or damage to flash disk!

- Use UPS, and the control voltage of the PacDrive Controller may only be switched off if all files are closed. See also Programming Manual -Reference- Function *SysShutdown()*.

**X2 - analog inputs**



Pin	Designation	Meaning	Range	Max. cross section
1	a1+	analog input 1+	differential input	1.5 mm <sup>2</sup>
2 *)	a1-	analog input 1-	-7 V ... +10 V	1.5 mm <sup>2</sup>
3	AGND	analog GND		1.5 mm <sup>2</sup>
4	PE	shield		1.5 mm <sup>2</sup>
5	12 V	output voltage	Ri = 1k	1.5 mm <sup>2</sup>
6	j1	bridge power input		1.5 mm <sup>2</sup>
7	j1	bridge power input		1.5 mm <sup>2</sup>
8	a2+	analog input 2+	differential input	1.5 mm <sup>2</sup>
9 *)	a2-	analog input 2-	-7 V ... +10 V	1.5 mm <sup>2</sup>
10	AGND	analog GND		1.5 mm <sup>2</sup>
11	PE	shield		1.5 mm <sup>2</sup>
12	12 V	output voltage	Ri = 1k	1.5 mm <sup>2</sup>
13	j2	bridge power input		1.5 mm <sup>2</sup>
14	j2	bridge power input		1.5 mm <sup>2</sup>

\*) Voltages and currents outside the specified ranges lead to wrong measuring values (AnalogIn.Value).  
 If the voltage to be measured relates to AGND, only positive voltages and currents from 0 V to +10 V or 0 mA to 20 mA can be processed.  
 This is equivalent to an AnalogIn.Value of 2048 to 4096.

Table 0-2: Electrical connections of MAX-4 / X2

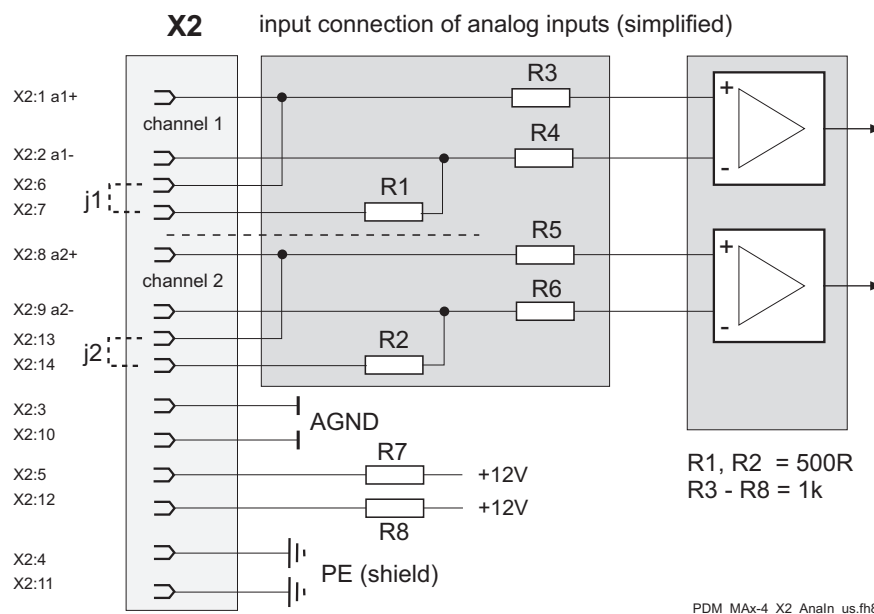
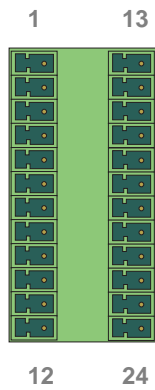


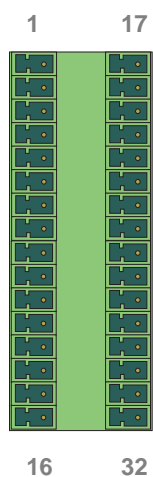
Fig. 0-2: Electrical connections of MAX-4 / X2 input connection

**X3 - digital inputs**

Pin	Designation	Meaning	Range	Max. cross section
1	0.0	standard input 0	DC 20 ... 30 V	1.5 mm <sup>2</sup>
2	0.1	standard input 1	DC 20 ... 30 V	1.5 mm <sup>2</sup>
3	0.2	standard input 2	DC 20 ... 30 V	1.5 mm <sup>2</sup>
4	0.3	standard input 3	DC 20 ... 30 V	1.5 mm <sup>2</sup>
5	0.4	standard input 4	DC 20 ... 30 V	1.5 mm <sup>2</sup>
6	0.5	standard input 5	DC 20 ... 30 V	1.5 mm <sup>2</sup>
7	0.6	standard input 6	DC 20 ... 30 V	1.5 mm <sup>2</sup>
8	0.7	standard input 7	DC 20 ... 30 V	1.5 mm <sup>2</sup>
9	0.8	standard input 8	DC 20 ... 30 V	1.5 mm <sup>2</sup>
10	0.9	standard input 9	DC 20 ... 30 V	1.5 mm <sup>2</sup>
11	0.10	standard input 10	DC 20 ... 30 V	1.5 mm <sup>2</sup>
12	0.11	standard input 11	DC 20 ... 30 V	1.5 mm <sup>2</sup>
13	0.12	standard input 12	DC 20 ... 30 V	1.5 mm <sup>2</sup>
14	0.13	standard input 13	DC 20 ... 30 V	1.5 mm <sup>2</sup>
15	0.14	standard input 14	DC 20 ... 30 V	1.5 mm <sup>2</sup>
16	0.15	standard input 15	DC 20 ... 30 V	1.5 mm <sup>2</sup>
17	0.16	standard input 16	DC 20 ... 30 V	1.5 mm <sup>2</sup>
18	0.17	standard input 17	DC 20 ... 30 V	1.5 mm <sup>2</sup>
19	0.18	standard input 18	DC 20 ... 30 V	1.5 mm <sup>2</sup>
20	0.19	standard input 19	DC 20 ... 30 V	1.5 mm <sup>2</sup>
21	1.0	interrupt input 0	DC 20 ... 30 V	1.5 mm <sup>2</sup>
22	1.1	interrupt input 1	DC 20 ... 30 V	1.5 mm <sup>2</sup>
23	1.2	interrupt input 2	DC 20 ... 30 V	1.5 mm <sup>2</sup>
24	1.3	interrupt input 3	DC 20 ... 30 V	1.5 mm <sup>2</sup>

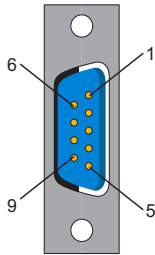
Table 0-3: Electrical connections of MAX-4 / X3

**X4 - touchprobe inputs and digital outputs**



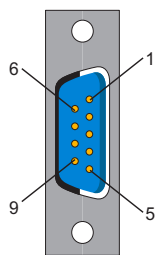
Pin	Designation	Meaning	Range	Max. cross section
1	2.0	touchprobe input 0	DC 20 ... 30 V	1.5 mm <sup>2</sup>
2	2.1	touchprobe input 1	DC 20 ... 30 V	1.5 mm <sup>2</sup>
3	2.2	touchprobe input 2	DC 20 ... 30 V	1.5 mm <sup>2</sup>
4	2.3	touchprobe input 3	DC 20 ... 30 V	1.5 mm <sup>2</sup>
5	2.4	touchprobe input 4	DC 20 ... 30 V	1.5 mm <sup>2</sup>
6	2.5	touchprobe input 5	DC 20 ... 30 V	1.5 mm <sup>2</sup>
7	2.6	touchprobe input 6	DC 20 ... 30 V	1.5 mm <sup>2</sup>
8	2.7	touchprobe input 7	DC 20 ... 30 V	1.5 mm <sup>2</sup>
9	2.8	touchprobe input 8	DC 20 ... 30 V	1.5 mm <sup>2</sup>
10	2.9	touchprobe input 9	DC 20 ... 30 V	1.5 mm <sup>2</sup>
11	2.10	touchprobe input 10	DC 20 ... 30 V	1.5 mm <sup>2</sup>
12	2.11	touchprobe input 11	DC 20 ... 30 V	1.5 mm <sup>2</sup>
13	2.12	touchprobe input 12	DC 20 ... 30 V	1.5 mm <sup>2</sup>
14	2.13	touchprobe input 13	DC 20 ... 30 V	1.5 mm <sup>2</sup>
15	2.14	touchprobe input 14	DC 20 ... 30 V	1.5 mm <sup>2</sup>
16	2.15	touchprobe input 15	DC 20 ... 30 V	1.5 mm <sup>2</sup>
17	0.0	standard output 0	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
18	0.1	standard output 1	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
19	0.2	standard output 2	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
:	:	:	:	:
27	0.10	standard output 10	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
28	0.11	standard output 11	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
29	0.12	standard output 12	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
30	0.13	standard output 13	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
31	0.14	standard output 14	DC20..30 V/0.1A	1.5 mm <sup>2</sup>
32	0.15	standard output 15	DC20..30 V/0.1A	1.5 mm <sup>2</sup>

Table 0-4: Electrical connections of MAx-4 / X4

**X5 - Com 1 (RS232)**

Pin	Designation	Meaning	Range	Max. cross section
1	DCD	Data Carrier Detect		0.25 mm <sup>2</sup>
2	RxD	Receive Data		0.25 mm <sup>2</sup>
3	TxD	Transmit Data		0.25 mm <sup>2</sup>
4	DTR	Data Terminal Ready		0.25 mm <sup>2</sup>
5	GND	Signal Ground		0.25 mm <sup>2</sup>
6	DSR	Data Set Ready Clear To Send		0.25 mm <sup>2</sup>
7	RTS	Request To Send		0.25 mm <sup>2</sup>
8	CTS	Clear To Send		0.25 mm <sup>2</sup>
9	RI	Ring Indicator		0.25 mm <sup>2</sup>

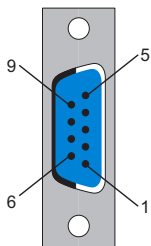
Table 0-5: Electrical connections of MAx-4 / X5

**X6 - Com 2 (RS485)**

Pin	Designation	Meaning	Range	Max. cross section
1	+5 VM	supply voltage		0.25 mm <sup>2</sup>
2	TxD-	RS485 Transmit -		0.25 mm <sup>2</sup>
3	TxD+	RS485 Transmit+		0.25 mm <sup>2</sup>
4	RxD+	RS485 Receive +		0.25 mm <sup>2</sup>
5	RxD-	RS485 Receive -		0.25 mm <sup>2</sup>
6	GNDR	GND receive RS485		0.25 mm <sup>2</sup>
7	-	reserved		0.25 mm <sup>2</sup>
8	GNDM	supply voltage		0.25 mm <sup>2</sup>
9	GNDR	GND receive RS485		0.25 mm <sup>2</sup>

Table 0-6: Electrical connections of MAx-4 / X6

**X9 - master encoder (SinCos, optional)**



Pin	Designation	Meaning	Range	Max. cross section
1	REFSIN	sinus reference signal		0.25 mm <sup>2</sup>
2	SIN	sinus trace		0.25 mm <sup>2</sup>
3	REFCOS	cosine reference signal		0.25 mm <sup>2</sup>
4	COS	cosine trace		0.25 mm <sup>2</sup>
5	+12 V	supply voltage		0.25 mm <sup>2</sup>
6	RS485-	parameter channel -		0.25 mm <sup>2</sup>
7	RS485+	parameter channel +		0.25 mm <sup>2</sup>
8	SC_SEL	encoder connected (bridge to GND)		0.25 mm <sup>2</sup>
9	GND	supply voltage		0.25 mm <sup>2</sup>

Table 0-7: Electrical connections of MAX-4 / X9

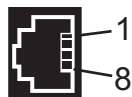


**CAUTION!**

Disconnection of SinCos encoder plug while unit is powered on!  
SinCos encoder may be damaged!

- Disconnect and connect the SinCos encoder plug only in voltage-free state (disconnect MC-4 MotorController from 24 V power supply!).

**X10 - Ethernet**



Pin	Designation	Meaning	Range	Max. cross section
1	Tx+	OutputTransmitData+		
2	Tx-	OutputTransmitData-		
3	Rx+	InputReceiveData +		
4	-	reserved		
5	-	reserved		
6	Rx-	InputReceiveData -		
7	-	reserved		
8	-	reserved		

Table 0-8: Electrical connections of MAX-4 / X9

**NOTE**

Depending on the application, different cables are required for the connection to the PacDrive MAX-4 via the RJ-45 connector plug.

- Connection PacDrive Controller <-> „corporate network“ mit RJ-45  
-> straight twisted-pair cable
- Connection PacDrive Controller <-> Hub  
-> straight twisted-pair cable
- Connection PacDrive Controller <-> PC  
-> crossover twisted-pair cable

In doubt, please contact your network administrator.

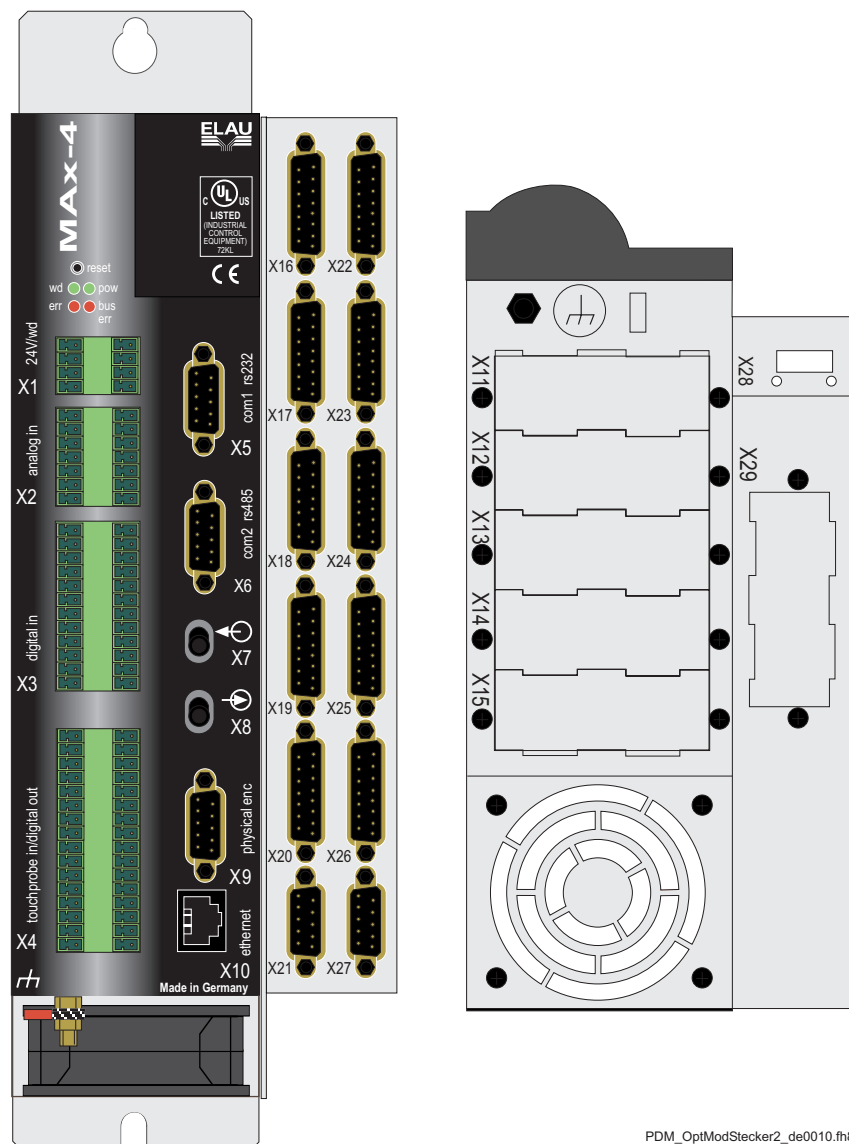
**Connector plugs of MAX-4 optional modules**

Fig. 0-3: Connector plug on the front side and the bottom side of the MAX-4 „special casing“

Priority	optional module	standard connector plug (alternative connector)	more alternative connector plug with special case
1 (highest)	PacNet PN-4	X15	-
2	PROFIBUS DP master	X11	-
3	PROFIBUS DP slave	X11 (X12)	X12
4	CANopen master	X11 (X12)	X12
5	CANopen slave	X11 (X12)	X12
6	CAN layer 2	X11 (X12)	X12
7	DeviceNet	X13	-
8	INC-4 (OPT-5 / 01) - 1st input (Incln_0) - 2nd input (Incln_1) - output - 24 V supply (encoder)	X14 X13 X12 X11 (X15)	X16 X17 X21 X28
9	INC-4 (OPT-5 / 02) - 1st input (Incln_0) - 2nd input (Incln_1) - 3rd input (Incln_2) - 4th input (Incln_3) - 5th input (Incln_4) - output - 5V/24V supply (enc.)		X16 X17 X18 X19 X20 X21 X28
10	INC-4 (OPT-5 / 03) - 1st input (Incln_0) - 2nd input (Incln_1) - 3rd input (Incln_2) - 4th input (Incln_3) - 5th input (Incln_4) - 1st output - 6th input (Incln_5) - 7th input (Incln_6) - 8th input (Incln_7) - 9th input (Incln_8) - 10th input (Incln_9) - 2nd output - 5V/24V supply (enc.)		X16 X17 X18 X19 X20 X21 X22 X23 X24 X25 X26 X27 X28

Fig. 0-4: Priority of the optional modules when allocating connector plugs



**NOTE**

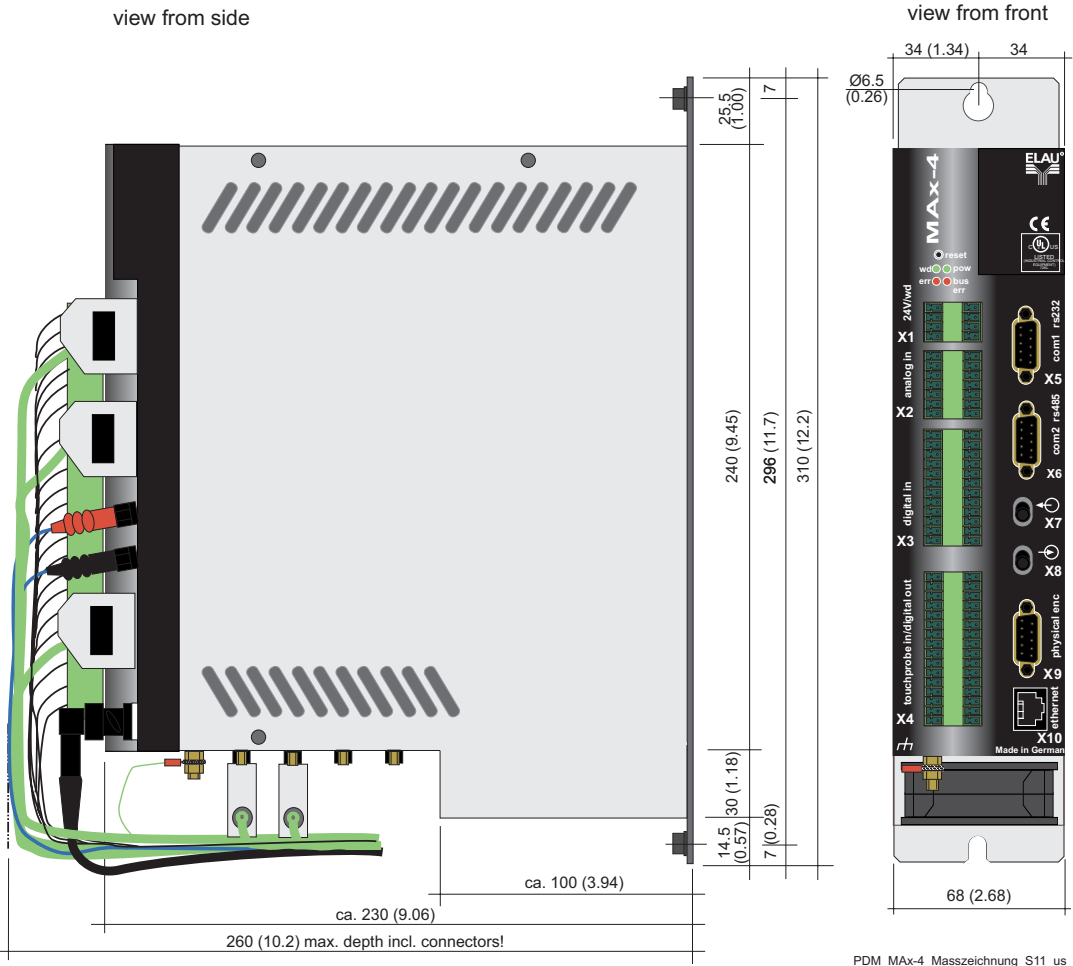
Only one CAN or CANopen optional module can be installed per PacDrive MAX-4.

With the application of an „special casing“ the encoder supply 5 V / 24 V is always on X28.

Max. 3 option modules may be built in the PacDrive MAX-4.



# Dimensions



PDM\_MAX-4\_Masszeichnung\_S11\_us

Fig. 0-1: Dimensions of the PacDrive MAX-4 / "standard casing"

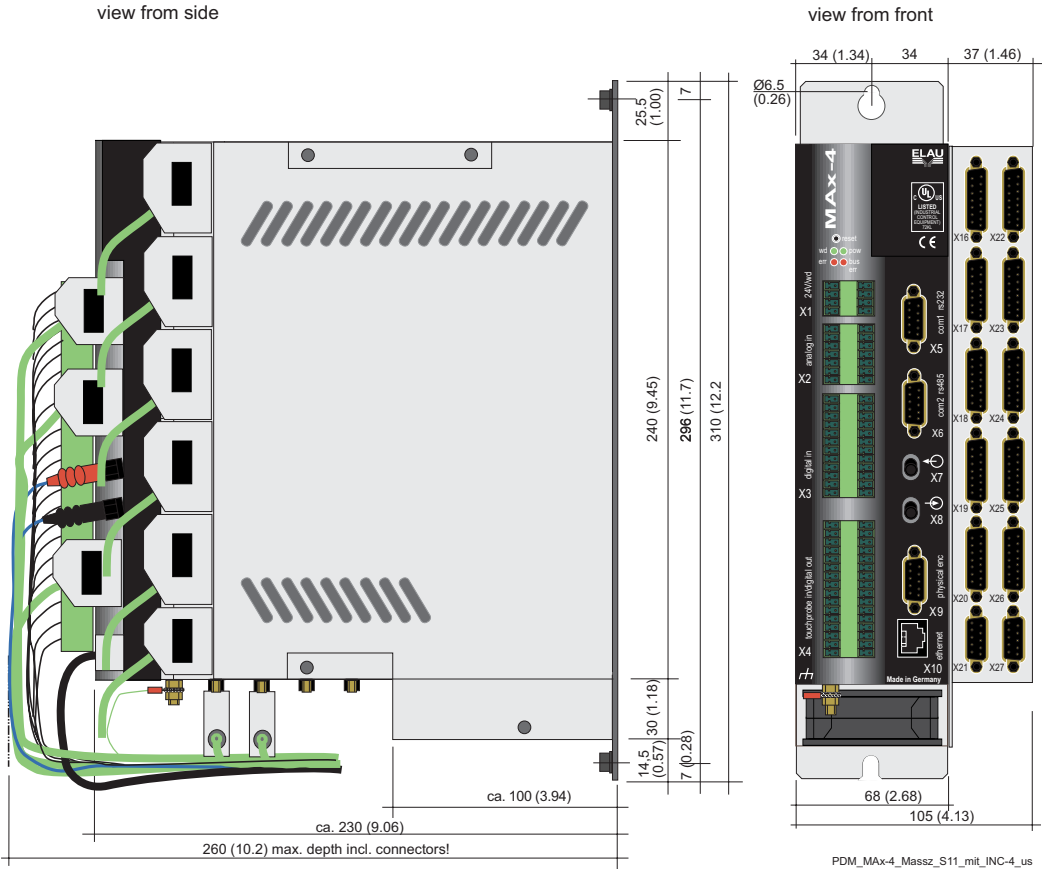


Fig. 0-2: Dimensions of the PacDrive MAX-4 / "special casing" for additional connector plugs

## Option Modules

Article	Article description Article number
PROFIBUS DP Master	OM/MAX-4/PROFIBUS DP-Master 51130237
PROFIBUS DP Slave	OM/MAX-4/PROFIBUS DP-Slave 51130232
CAN Layer 2 (2.0B)	OM/MAX-4/CAN Layer 2 51130231
CANopen	OM/MAX-4/CAN-OPEN M/S 51130238
DeviceNet Slave	OM/MAX-4/DEVICE-NET Slave 51130240
Ethernet/IP Slave	in preparation
INC-4 (2 In / 1 Out)	OM/MAX-4/INC-4/10 2 In / 1 Out 51130244-001
INC-4 (5 In / 1 Out)	OM/MAX-4/INC-4/10 5 In / 1 Out 51130244-002
INC-4 (10 In / 2 Out)	OM/MAX-4/INC-4/10 10 In / 2 Out 51130244-003
INC-4 (2 In / 1 Out 24V)	OM/MAX-4/INC-4/10 2 In / 1 Out 24V 51130244-011
INC-4 (5 In / 1 Out 24V)	OM/MAX-4/INC-4/10 5 In / 1 Out 24V 51130244-012
INC-4 (10 In / 2 Out 24V)	OM/MAX-4/INC-4/10 10 In / 2 Out 24V 51130244-013
PacNet PN-4	OM/MAX-4/PN-4/10 51130258



**Product ID code****MAx-4 / 11 / 03 / 016 / 08 / 0 / 0 / XX****HW-Variant**

11 (RJ-45 Ethernet connector)

**Processor \*)**

00 = not recognized

03 = Profive T5, Intel PII 266 MHz, 32 MB RAM, L2 Cache 256 KB

**Flash memory**

e.g.: 016 = 16 MB

**Max. no. of axes**

08 = up to 8 axes

99 = more than 8 axes

**Master encoder evaluation**

0 = no

1 = yes

**Analog input**

0 = without analog input

1 = with 2 analog inputs

**Optional functions**

00 = none

01 = separate I/O supply

**\*) Note**

Previous version of the processor:

01 = Profive P5, AMD K6 266 MHz, 16 MB RAM, L2 Cache 256 KB

02 = Profive P5, AMD K6 266 MHz, 32 MB RAM, L2 Cache 256 KB

