Operating instructions WAS.handling

Electro documentation

HP 140 1x208...230V
3x208...230V
3x400...480V

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1 Safety Instructions

1.1 *Description of Symbols*

Warnings are emphasized by a safety symbol and are shown as follows depending on the degree of risk:

 **Danger !**	**Imminent danger. Fatal injury, death or substantial material damage can be caused if the appropriate safety measures are not taken!**
 **Warning!**	**Minor injuries may occur if the appropriate safety measures are not taken.**
	**Electrical hazard** **Warning against hazardous voltage.**
	**Useful Information.**

1.2 *Safety Instructions*

Validity:
These instructions apply for the WEISS control system HP140T with B&R servo drive ACOPOS 8V1010.50-2.

Importance of the operating instructions:
This manual contains important information for working safely with the control system. It contains safety instructions which must be observed as well as information necessary for trouble-free operation.
The operating instructions must be kept with the device. It must be ensured that all persons who work at the device have access to the operating instructions at all times.
In addition to the operating instructions for the control system, the operating instructions for the mechanics, as well as the operating regulations subject to the labour protection laws must also be provided.
The operating instructions must be kept in a safe place for further use and must be passed on to every subsequent owner, user and end customer.

The HP140 may only be started up when the whole machine and control system, in particularly the safety system, correspond to the machinery directive 98/37/EC.

Target group:
The operating instructions are aimed at persons who are involved in the planning, installation, starting-up, and maintenance of the system and who have the qualifications and know-how appropriate for this work. Qualified personnel are persons who have the necessary qualifications and who are familiar with the execution of the work cited above and the operation of the system. All work in other areas such as transport, storage and disposal must be carried out by persons with the appropriate training.

General:
Prior to installation and starting up, please carefully read and observe all safety instructions, technical documentation and connection data accordingly. National accident prevention regulations and all internal company regulations must be observed.
Never install or operate damaged products.
The devices must be installed and cooled in accordance with these regulations.
The control system (PLC and servo drive) must be protected against overloading. The servo amplifier and PLC contain electrostatically sensitive components that can easily be damaged by improper handling. Electrical components may not be mechanically damaged or destroyed (possible health risk).

 **Danger!**	**In the case of unauthorized removal of the necessary cover, inappropriate usage, incorrect installation or operation, there is a risk of serious personal injury or material damage.**

 **Warning!**	**Depending on the type, some of the components (motor, servo drive) may have hot surfaces during operation. Operating temperatures > 60 ℃ (> 140 ℉) can occur. Skin contact will cause burns.**

WEISS devices conform to the relevant VDE regulations. The VDE regulations must also be observed in the case of modification or extension of the devices.

This documentation contains instructions for EMC installation - including screening, earthing and installation of the lines. Compliance with the limit values stipulated by EMC legislation is the responsibility of the manufacturer of the system or machine.

Unauthorized alterations and the use of spare parts and additional devices which are not recommended by the manufacturer can cause personal injury or damage to the mechanism and the control system.

Before switching on the control system you must ensure that the housing is correctly earthed (PE rail).
The servo drive may only be operated directly on earthed, three-phase industrial networks (TN, TT network).

	**Control and power connections may have voltage even if the motor is standing still. Never connect or disconnect the electrical connections of the device when it is live.**

Connection terminals may only be connected or disconnected when the power is off!
Do not touch live parts of the device or power connections (in particular the power line and the motor line) immediately after disconnection of the servo drive from the supply voltage due to the possibility that capacitors are still charged up.

	**After switching off the device, wait for at least 5 minutes and then check at the terminals "+DC1" and "-DC1" whether the capacitor has discharged to voltages < 42 VDC before touching live parts or disconnect connections.**

The fact that the LED's on the ACOPOS drive are off, are no indication that the device is disconnected from the power supply and voltage-free.

In the case of unauthorized removal of the necessary covers, inappropriate usage, incorrect installation or operation, there is a risk of serious personal injury or material damage..

Residual-current-operated circuit breaker (RCD):
Servo drives have an internal power rectifier. In the event of an earth contact, a flat fault direct current can prevent the triggering of an AC current or pulse current sensitive RCD and thus suspend the protective function for all devices connected to this network.
An AC/DC sensitive, selective RCD (Type B) in accordance with DIN-VDE 0644-100 must be used.
Take note that even if the correct RCD is used, there can still be spurious tripping due to high leakage current. We thus recommend a current rating > 100 mA.
Only install the residual-current-operated circuit breaker between the mains supply and the servo drive..

Emergency Stop:
Suitable protective devices in accordance with EN60204 Part 1 must be used.

 **Danger!**	**Adequate protective devices, e.g. covers, protective grids, light curtains or stop sensor must be installed for operation in order to protect the operating personnel from injury by the HP140.**

The clamp “Enable” at the ACOPOS drive (terminal X1/9) is implemented as a so-called “secure restart inhibit” to deactivate the system and prevent unexpected restart.
This allows maximum safety category:
Norm: EN 954-1: Category 3
Norm: EN ISO 13849: SL 2 / Pl d

Overview of individual safety functions that can be implemented:

Label according to standard:		**Short description**
EN 61800-5-2	**EN 60204-1**	
STO (Safe Torque off)	Stop Category 0	Shut-down by immediate switching-off of the energy supply to the drive machinery (i.e. an uncontrolled shut-down).
SS1 (Safe Stop 1)	Stop Category 1	Introduction of active braking and activation of the STO function after a defined amount of time has expired. (Implementation by user)

This is described in a separate chapter of these Operating Instructions (Section 4.1.2). This must be observed. A wiring diagram is also provided in this document (Section 3.2.2).

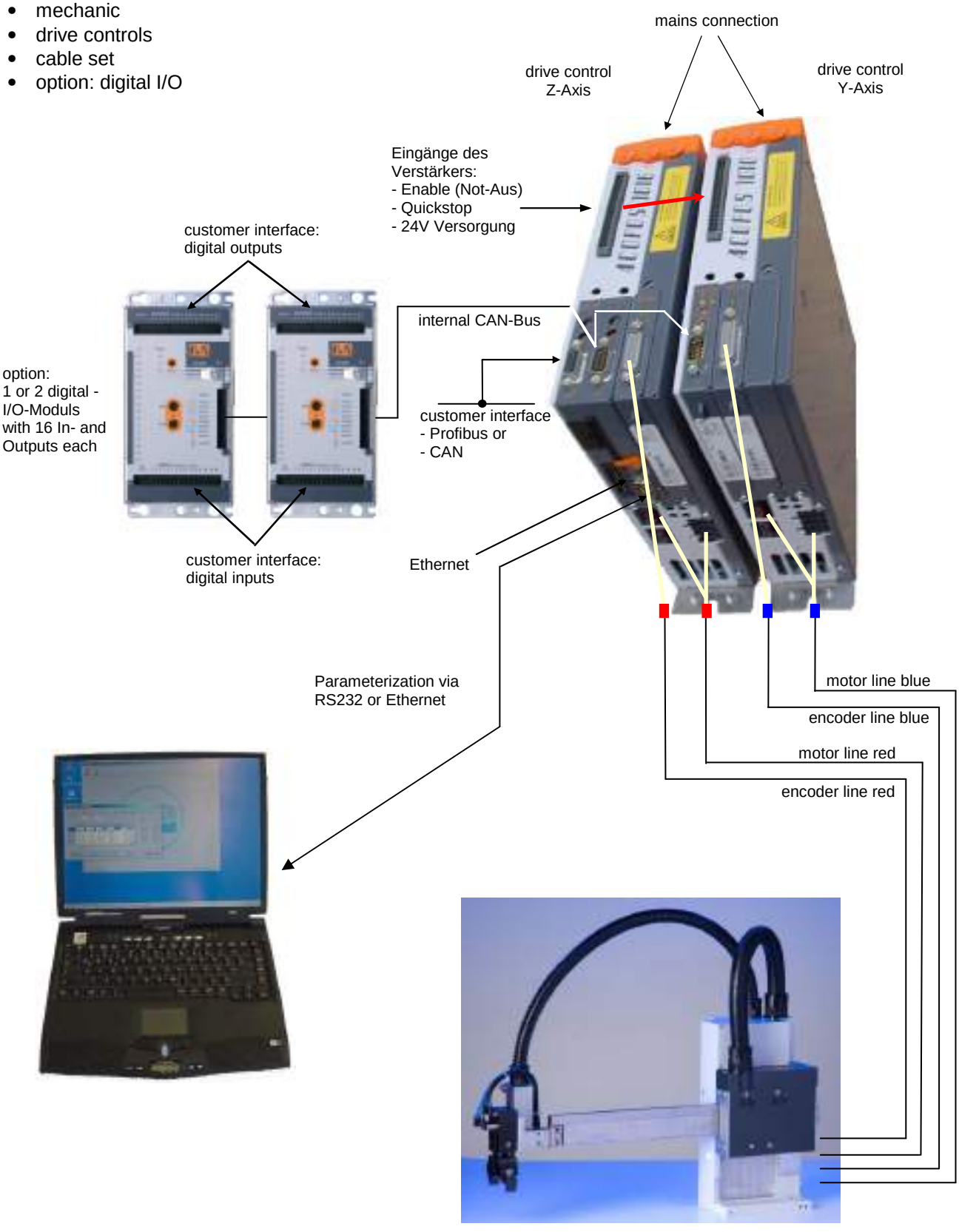
Designated use:
This device is designed for industrial and commercial systems and conforms to the valid standards and regulations. All of the instructions regarding technical data and the permissible conditions at the place of installation must be observed. This device is a component for installation in machines. Start-up (start of designated operation) is not permitted until it has been established that the machine is in conformance with the EMC directive 89/336/EEC and the end product is in conformance with the machinery directive 89/37/EC.

2 Product description

2.1 *Overview*

The device consists of the following assemblies:

- mechanic
- drive controls
- cable set
- option: digital I/O



2.2 *Technical Data*

2.2.1 Drive control – power section:

Depending on customer requirement, one of the following drive controls is used:

Model:	ACOPOS 8V1010.50-2	ACOPOS 8V1022.50-2
Permitted temperature ranges:	storage: -25℃...+55℃ operation: 0℃...+40℃	
Installation position:	vertical	
Air humidity:	5 to 95%, without condensation	
Mains input voltage:	3 x 110 VAC to 230 VAC ± 10 % or 1 x 110 VAC to 230 VAC ± 10 % Mains filter according to EN 61800-3-A11 second environment (Limits from CISPR11, Group 2, Class A)	3 x 400 VAC bis 480 VAC ± 10 % Mains filter according to EN 61800-3-A11 second environment (Limits from CISPR11, Group 2, Class A)
Frequency mains supply:	48 – 62 Hz	
Installed load:	max. 1,35 kVA	max. 3 kVA
main fuse:	10 A time delay (both axes together)	10 A time delay (both axes together)
Peak current:	7,8 A_{eff}	14 A_{eff}
Continuous current:	2,0 A_{eff}	2,2 A_{eff}
Starting current:	5 A (at 230 VAC)	4 A (at 400VAC)
Switch on interval:	> 30 sec	
Power loss:	< 80 W	< 120 W
EMC:	according to EC directive 89/336/EWG applicable harmonized standards: EN 61800-3 (noise resistance) EN 550011, class B (noise emission)	
Low voltage directive:	according to EC directive 73/23/EWG applicable harmonized standards: EN60204.1 / VDE113	
Protection according to IEC 60529:	IP 20	
C-UL-US listed:	yes	
Dimensions:	width: 58,5 mm height: 257 mm depth: 220 mm	width: 70,5 mm height: 375 mm depth: 235,5 mm
Weight:	2,5 kg	4,0 kg

2.2.2 Drive control – 24V-control section:

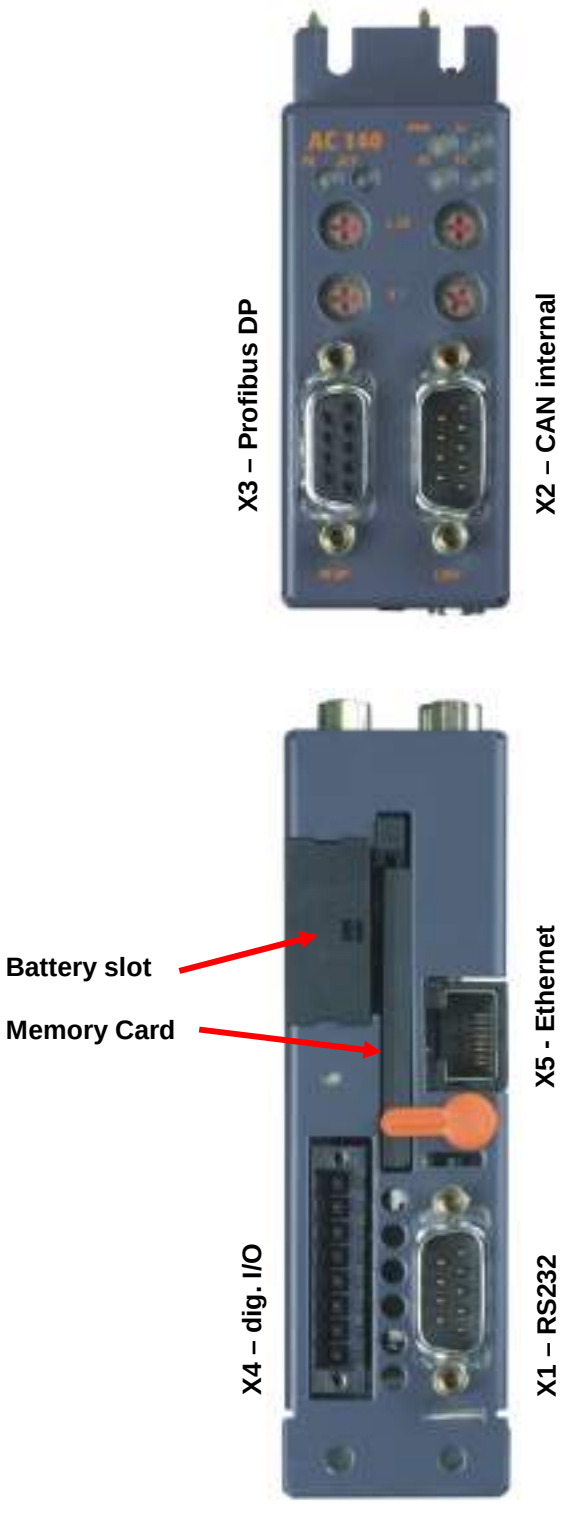
24 Volt control voltage:	24V DC +/-10%, residual ripple < 10%	
Power consumption 24 Volt:	max. 2.5A / 1.2A typical - note: 24V for fan is provided from DC-Bus - note: Fuse: 6A time delay	
Enable Input – X1/9	Input voltage	24V nominal / 30V max.
	Switching threshold	LOW <5V HIGH >15V
	Input current	approx. 30mA at 24V
	Switching delay	<2ms
Digital Inputs – CPU X4: (4.1; 4.2)	number of inputs	2
	level	LOW <5V HIGH >15V
	input current	approx. 4mA at 24V
	input filter	<1ms
Digital Outputs – CPU X4: (4.3)	number of outputs	1
	output current	max. 0.5A each Output
Profibus (optional)	Profibus DP Slave, ≤ 12Mbit, potential separation	
CAN-Bus (optional)	500kBit/s, potential separation	

In one of the drive controls, there is a Slot –PLC of type AC140 or AC141 integrated. These modules have an exchangeable program memory in the form of a compact flash card as well as a separate backup battery.
The AC140 is equipped with Profibus and the AC141 with CAN-bus

This Slot-PLC represents the hard- and software interface to customers PLC.

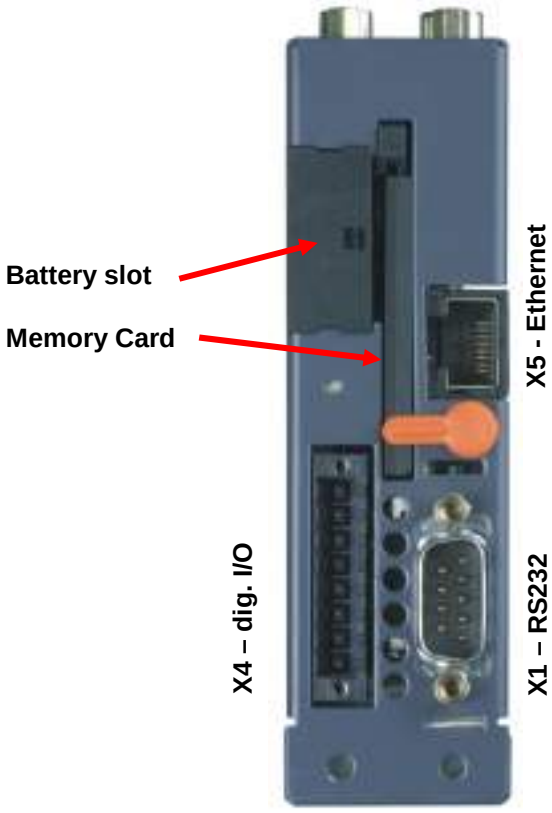
Slot-PLC AC140.61.3

CPU	
Processor clock	100MHz
SRAM	32kB
DRAM	32MB
Interface IF1	**X1**
Interface type	RS232
Potential separation	NO
Design	9pol. DSUB-plug
max. baud rate	115,2 kBaud
Indications	X1 LED
Interface IF2	**X2**
Interface type	CAN
Potential separation	YES
Design	9pol. DSUB-plug
max. baud rate	500 kBit/s (bis 60m)
Indications	RX / TX LED's
Bus terminating resistor	external
Interface IF3	**X3**
Interface type	Profibus DP (RS485)
Potential separation	YES
Design	9pol. DSUB-socket
Controller	ASIC SPC3
RAM	1,5 kByte
max. baud rate Bus length up to100m Bus length up to 200m Bus length up to 400m	 12 Mbit/s 1,5 Mbit/s 500 kBit/s
Indications	PB LED
Bus terminating resistor	external
Interface IF5	**X5**
Interface type	Ethernet
Potential separation	JA
Design	RJ45 socket
Baud rates	10/100 Mbit/s
Indications	ACT LED



Slot-PLC AC141.61.3

CPU	
Processor clock	100MHz
SRAM	32kB
DRAM	32MB
Interface IF1	**X1**
Interface type	RS232
Potential separation	NO
Design	9pol. DSUB-plug
max. baud rate	115,2 kBaud
Indications	X1 LED
Interface IF2	**X2**
Interface type	RS232
Potential separation	NO
Design	9pol. DSUB-plug
max. baud rate	115,2 kBaud
Indications	X1 LED
Interface type	RS232
Interface IF3	**X3**
Interface type	CAN like IF2
Interface IF5	**X5**
Interface type	Ethernet
Potential separation	JA
Design	RJ45 socket
Baud rates	10/100 Mbit/s
Indications	ACT LED



2.2.3 I/O – Module CX408 (Option):

Digital Inputs:	level	LOW <5V HIGH >15V
	input current	ca. 4mA at 24V
	input filter	<2ms
Digital Outputs:	output current A1-A12	max. 0.4A each output
	output current A13 – A16	max. 2.0A each output
Certifications:	CE, C-UL-US, GOST-R	
Air humidity:	5 - 95%, without condensation	
Permitted temperature ranges:	storage: -20℃...+70℃ operation: 0℃...+50℃	
Protection according to IEC 60529:	IP 20	

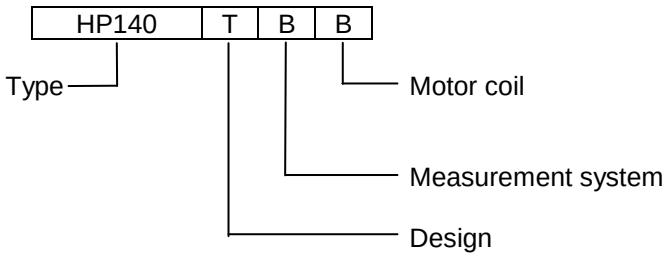
2.2.4 Linear motor:

Type:	Hub-Motor (Z-Axis)	Horizontal-Motor (Y-Axis)
Stroke:	max. 65mm	max. 268mm
Acceleration:	max. 35 m/s²	max. 40 m/s²
Speed:	max. 2.0 m/s	max. 4.0 m/s
Nominal voltage:	320 V DC	320 V DC
Nominal- / peak current:	2.8A / 5.8A	2.2A / 3.8A
Nominal- / peak torque:	60N / 180N	40N / 100N
Temperature sensor:	PTC-Switch	PTC-Switch
Air humidity:	5 to 95%, without condensation	
Permitted temperature ranges:	storage: 5℃...+55℃ operation: 5℃...+45℃	
Protection according to IEC 60529:	IP 20	

2.2.5 Measurement system:

Type:	EHP 1/90
Voltage supply:	5V ±5%, 35mA
Incremental signals:	Sin/Cos 1 Vss
Signal period:	1mm
Resolution	0.244µm (at 4096fach-Interpolation)
Accuracy	±10µm (Sensor + measuring tape)
Reference mark:	on request
Permitted temperature ranges:	storage: -30℃...+80℃ operation: 10℃...+60℃
Protection according to IEC 60529:	IP 67

2.3 *Terminology*



3 Installation

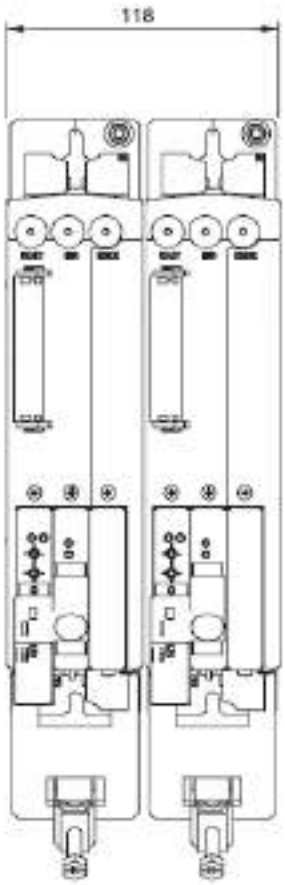
3.1 *Installation of ACOPOS drives*

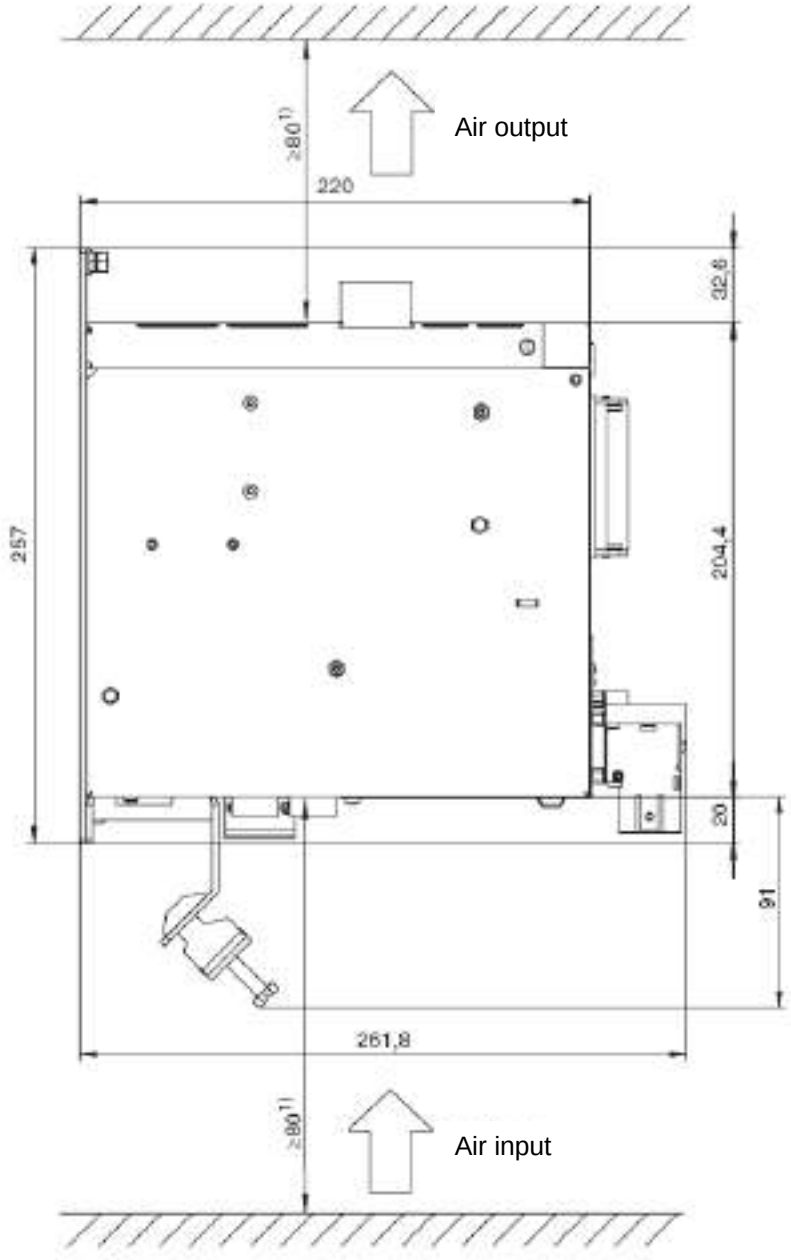
The ACOPOS drive may only be used in environments corresponding to pollution level II (non-conductive contamination). The maximum operating temperature of 40 ℃ (104℉) specified in the technical data as well as the protective type IP20 must be observed on installation of the devices.

3.1.1 Model for 110 - 230VAC

Dimensions:

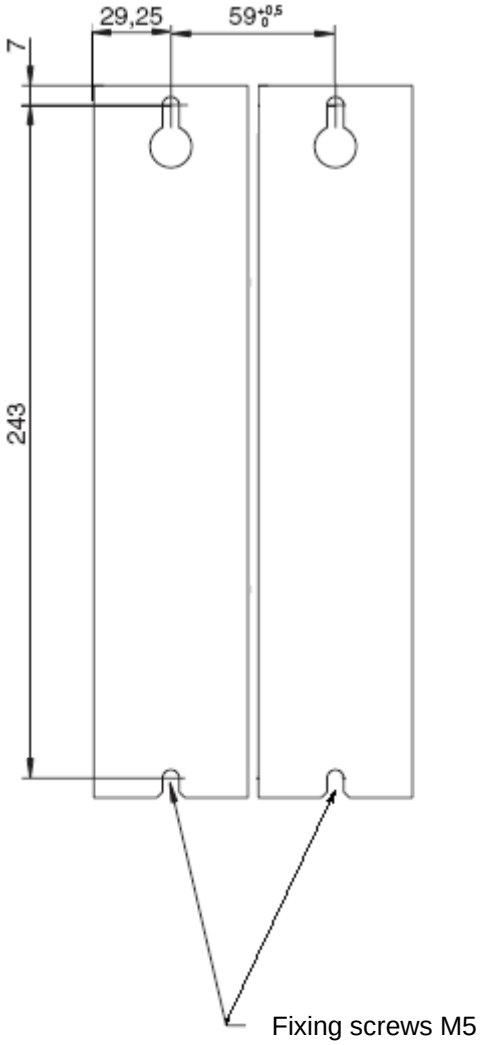
2 piece of Acopos 8V1010.50-2





1) A free space of 80 mm must be provided above and below the ACOPOS drive to ensure adequate air circulation.
For permitting an easy wiring, there must be a space of at least 100mm below the ACOPOS drive.

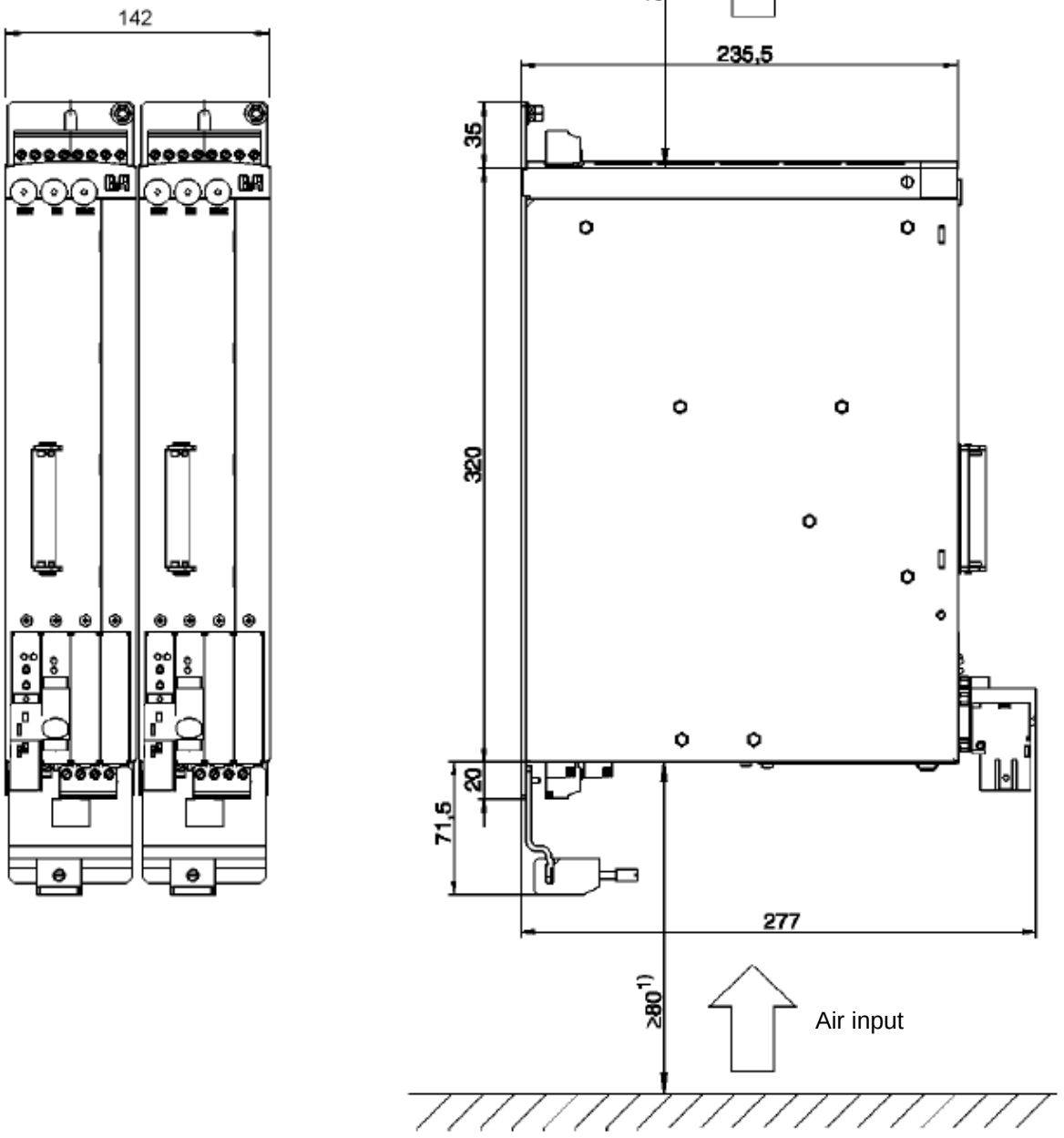
Drilling template:



3.1.2 Model for 400VAC

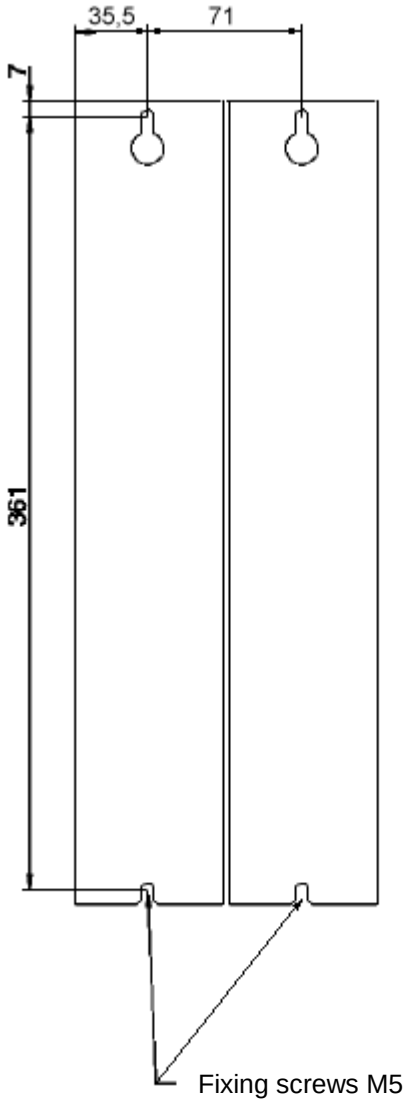
Dimensions:

2 piece of Acopos 8V1022.50-



2) A free space of 80 mm must be provided above and below the ACOPOS drive to ensure adequate air circulation.
For permitting an easy wiring, there must be a space of at least 100mm below the ACOPOS drive.

Drilling template:

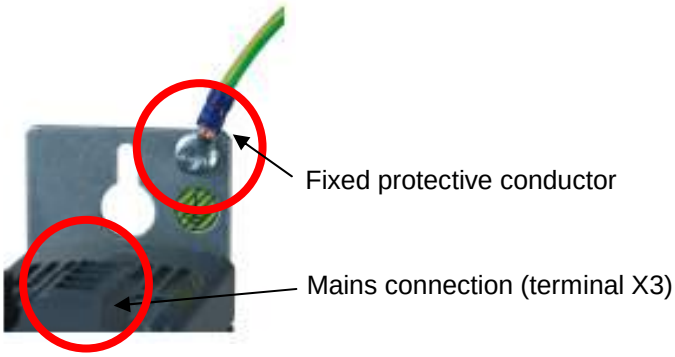


3.2 *Electrical installation ACOPOS drive*

The ACOPOS drive may only be operated on earthed, three-phase industrial networks (TN, TT network).

The mains is connected via the terminals X3
- For single phase connection use clamps: L1, N, PE.
- For three phase connection use clamps: L1, L2, L3, PE

Use lines of at least 1.5 mm² (or AWG 16). The protective conductor must also correspond to this cross section.
Servo drives are systems with increased leakage current (greater than 3.5 mA AC or 10 mA DC). For this reason a fixed (non-removable) protective conductor connection must be provided



Mains fuse:
The mains line must be protected by a circuit breaker or fuses. Time delay circuit breakers with trip characteristics C (in accordance with IEC 60898) or time delay fuses with trip characteristics M (in accordance with IEC 60269-1) should be used.

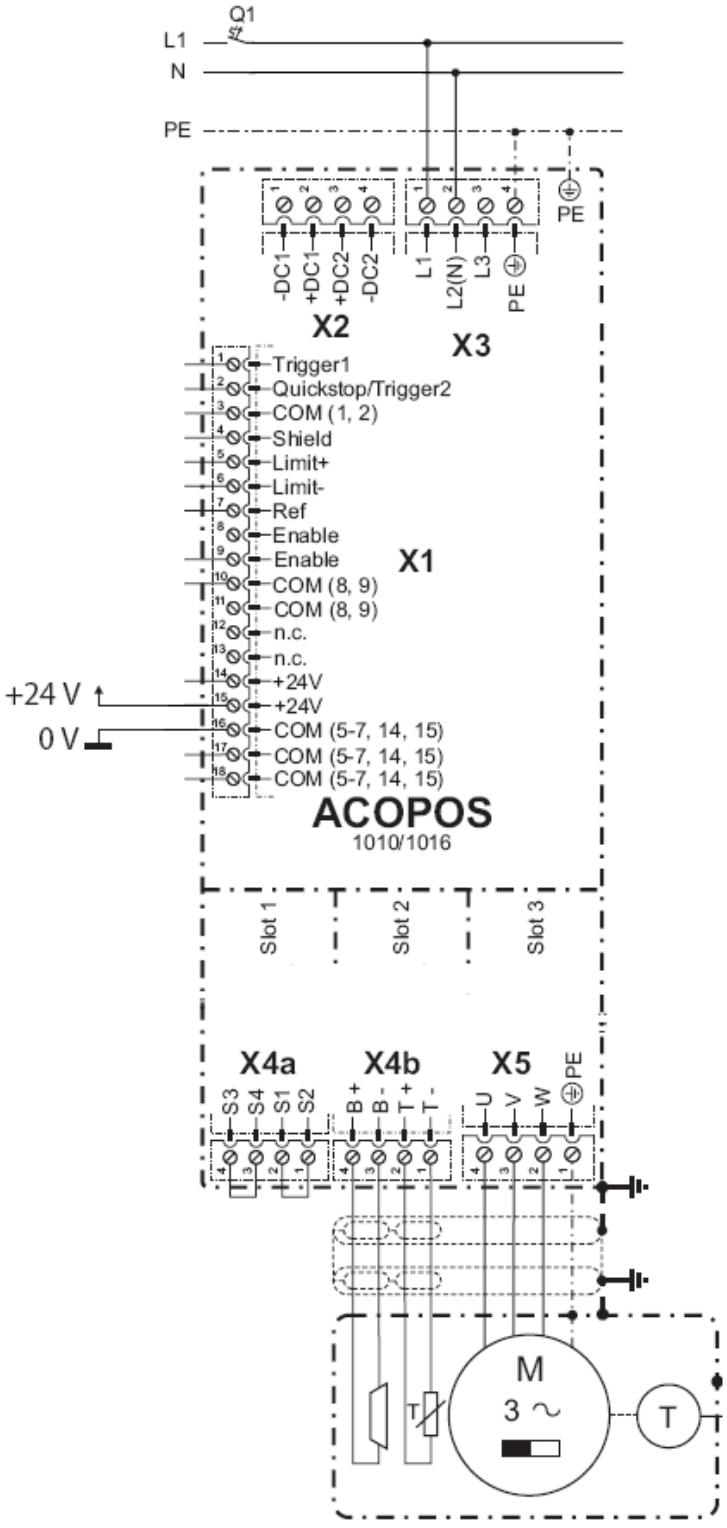
Fault Current:
Servo drives have an internal power rectifier. In the event of an earth contact, a flat DC fault direct current can block the triggering of an AC current or pulse current-sensitive residual-current-operated circuit breaker (RCD) and thus suspend the protective function for all of the devices operated on this residual-current-operated circuit breaker (RCD). The RCD must have a rated fault current ≥100 mA. If a RCD is used it must be an AC/DC-sensitive 4-pol type.
A generic RCD (0.03A, 50 Hz) will cause spurious tripping, because the built-in interference capacitors (Y-capacitors between L1, L2, L3 and PE, also at the motor output) and the current through the motor lines shield will also cause a fault current >0.03A.

3.2.1 Connecting diagram

ACOPOS 1010

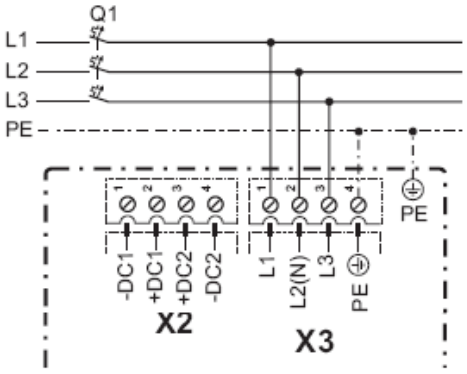
single phase connection

1 x 208V - 230V~



three phase connection

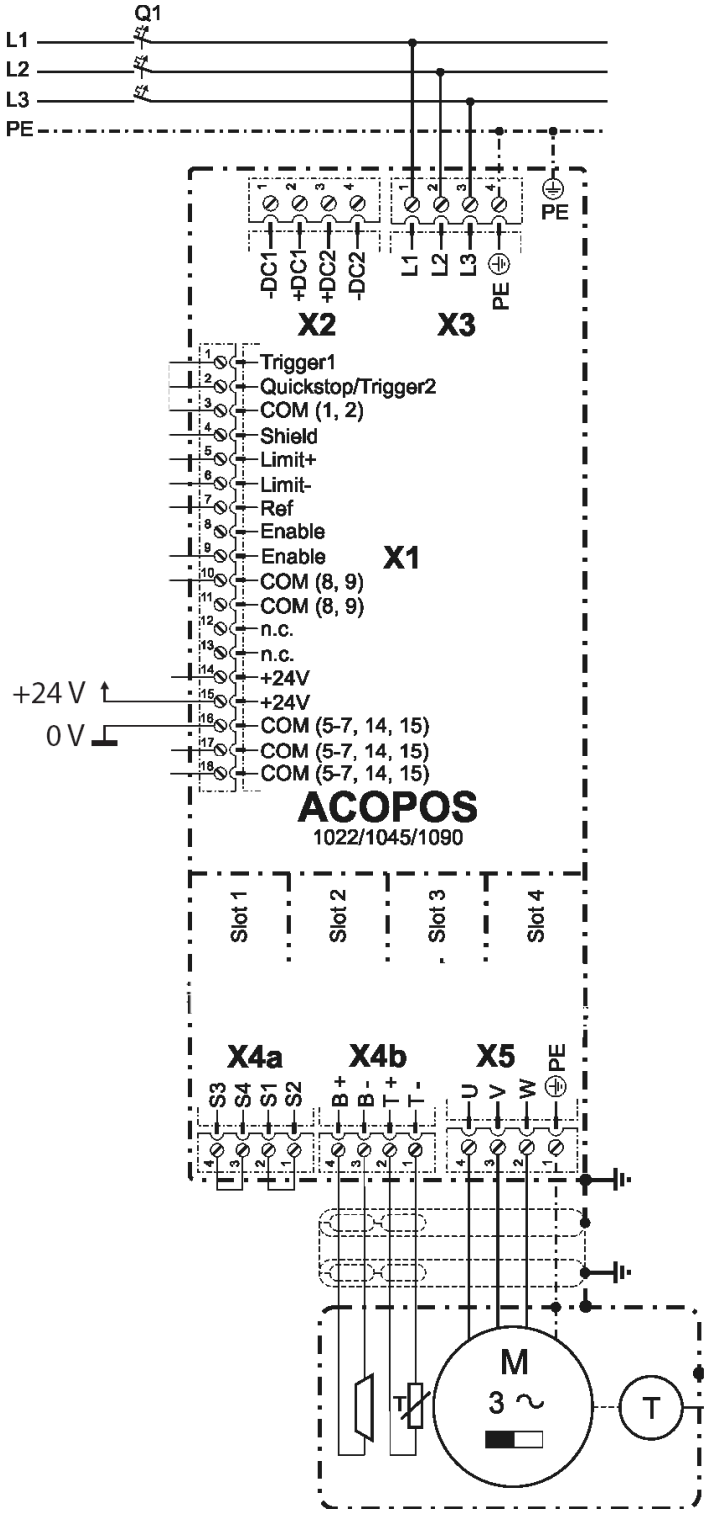
3 x 208V - 230V~



ACOPOS 1022

three phase connection

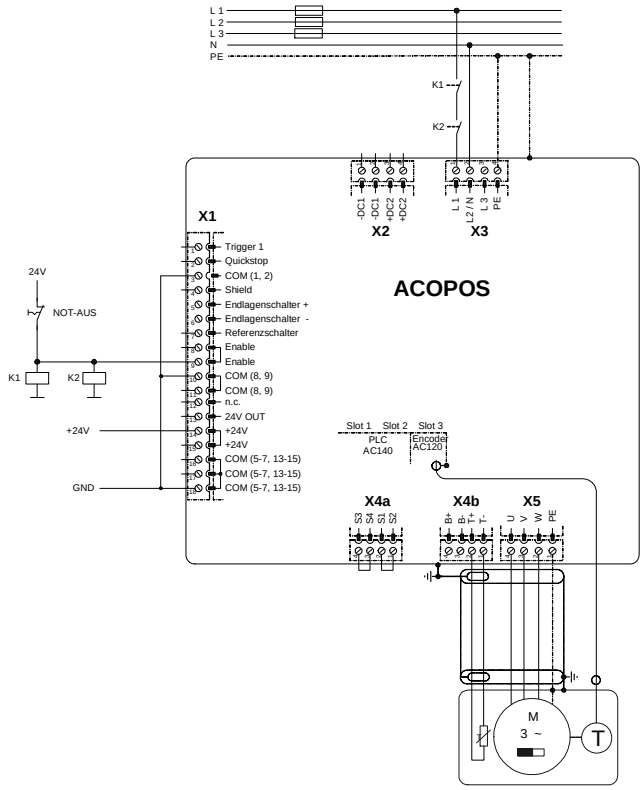
3 x 400V – 480V~



3.2.2 Circuits for EMERGENCY STOP

The customer must assign the Pick & Place to a safety category that corresponds to the risk potential for the whole machine.
For the interruption of the energy supply in the case of an E-Stop, below we have provided examples of three options. The customer must decide which version to use.
For more information see chapter 4.1.2.

Version 1a: Interruption of mains feed



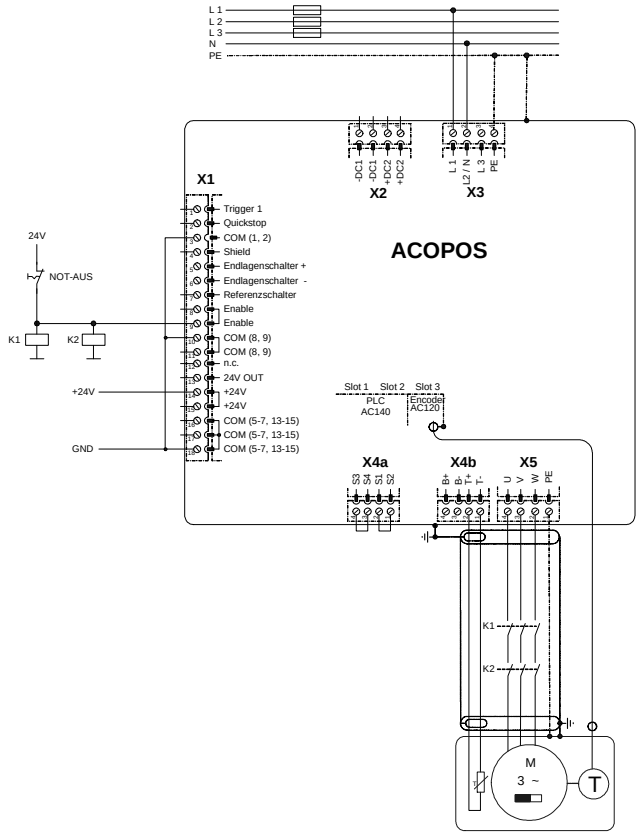
The following must be taken into consideration:

- Adequate sizing of the mains contactors
- Terminal X1/9 on the amplifier should open parallel with the opening of the mains contactors. Due to time overlap an error (“main power low”) can occur.
- Switch-on interval: > 30sec. Please note!
- Wait at least 5 minutes after the system has been switched off before touching live parts or disconnecting connections.
- Rapid start-up is not possible (required when using a light curtain), please consider switch-on interval.

Please note the following disadvantages of this type of circuit:

- Longer E-Stop time
  When you shut down the mains voltage, the DC-bus capacitor is still charged. It can still pass energy on to the motor. This extends the stopping time of the indexing table.
- Increases the wear / early failure of the drive
  Every switch-on of the mains puts stress on the charge circuit. Switching on the mains too rapidly in succession can lead to early defects in the charge circuit. The complete servo drive has to be replaced.
  This is why all servo manufacturers advise against this version!
  The switch-on interval (> 30 sec) must be considered!
  Excessively frequent switching often occurs during the start-up, or if you use door contacts without locks.
- If the Motor is in move at power off, the Axis Y/Z could be run onto its block or damage the part or gripper.

Version 2a: Interruption of the motor line



The following must be taken into consideration:

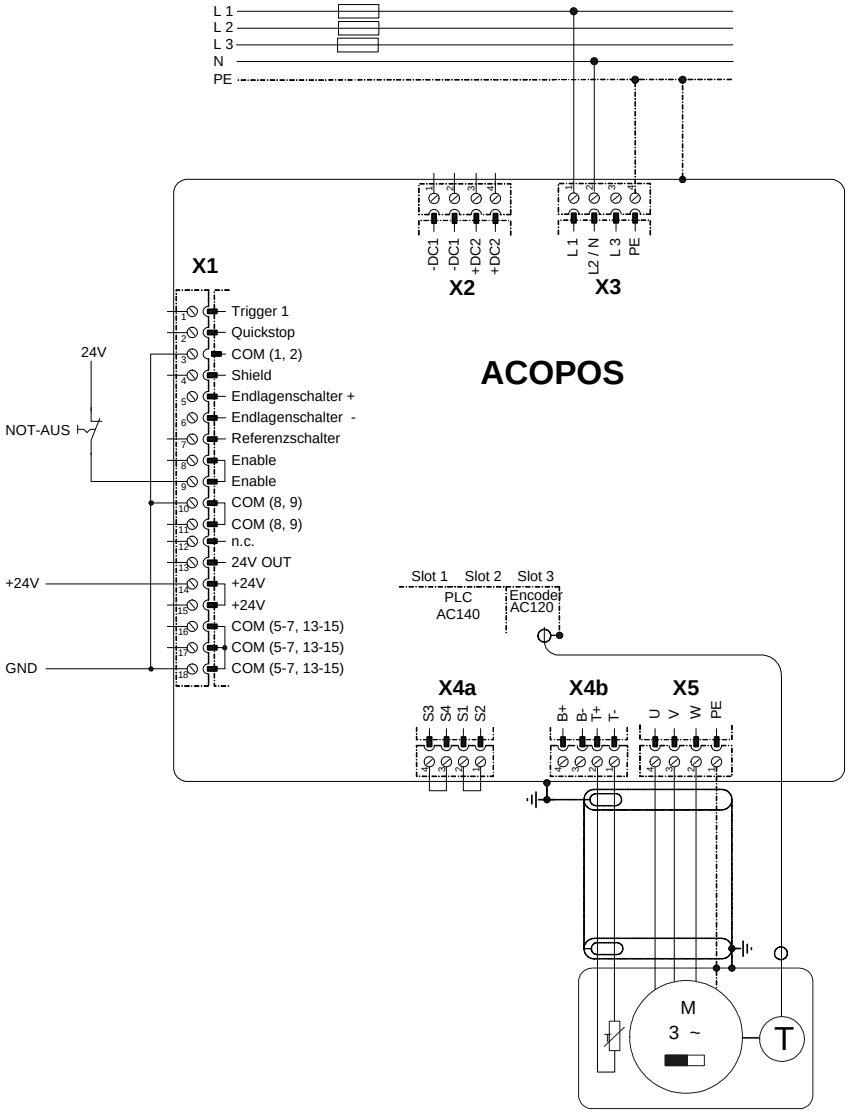
- Adequate sizing of the contactors
- Terminal X1/9 on the amplifier should open parallel with the opening of the mains contactors. If the time is exceeded there may be a fault message: “Fault in the motor phase”. If the terminal X1/9 is not opened, this can lead to a defect in the drive. Opening terminal X1/9 also protects the contactor as the drive is disabled before the contactors are opened (powerless switching of the contacts).
- A rapid start-up is possible (required when using a light curtain).

Please note the following disadvantages on this type of circuit:

- When the drive is enabled, you may be switching a DC current with the contactor. The motor winding is an inductivity.
- The resulting induction voltage can damage the drive. For this reason you must always first switch off the terminal X1/9 (Enable) at the ACOPOS drive before opening the contactor.
- Consider the correct design for the contactor. In the worst case scenario you switch 800 V_{DC} 30 A_{DC}.

Note: Many customers also loop additional contacts into the motor line in order to achieve the safety category 4. Whether or not this is actually fulfilled (overall machine: electronics and indexer mechanism), this decision must be made by the individual customer.
It has to be taken into consideration that, although the motor can be switched powerless in accordance with safety category 4, this does not guarantee that the Axes are coming immediately to a standstill.

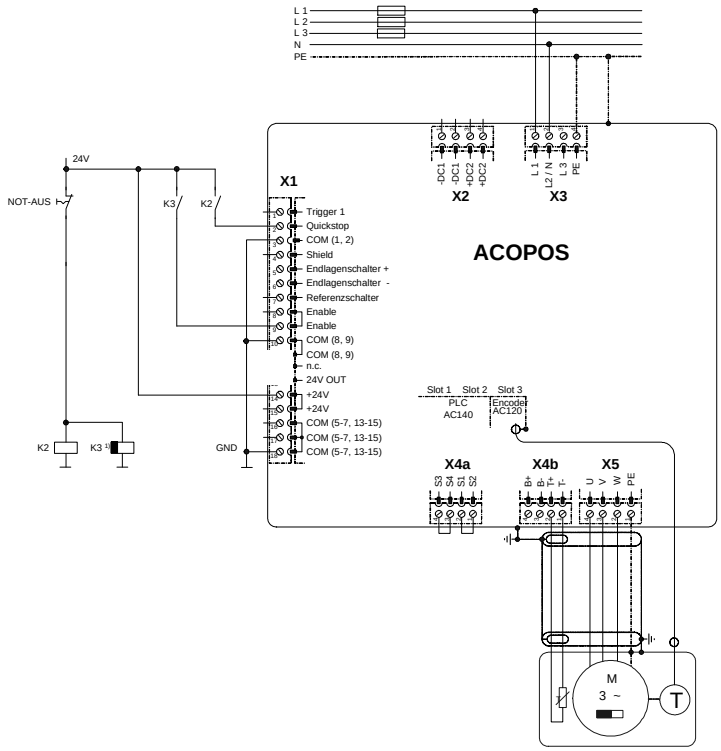
Version 3a: Interruption of terminal X1/9 at the ACOPOS drive



The following must be taken into consideration:

- Observe chapter 4.1.2 (Secure restart inhibit)
- For frequent switching (no switch-on interval)
- Wear free
- Rapid starting possible (light curtain)
- Fulfils safety category 3 pursuant to EN 954-1 (Stop functions of categories 0, 1, 2)
- Motor terminals (U,V,W) can still be carrying voltage after the switch-off (of terminal X1/9).
- Electrical work on the motor line is not permitted. The mains supply line must first be interrupted for this purpose.
- If the Motor is in move at power off, the Axis Y/Z could be run onto its block or damage the part or gripper.

Version 3b: Additional wiring of the Quickstop input



[1] The relays K2 / K3 must fulfill the respective safety category..

When the E-Stop switch S1 is pressed, the relay K2 is released. This triggers an active braking via the ACOPOS input “Quickstop” (clamp X 1/2). If the drive etc. fails, the release-delayed auxiliary relay K3 is released after a defined time period and causes a shutdown of the energy supply to the motor (clamp X 1/9). The delay time is set to the calculated time for the stop ramp (max. 0,1s for the horizontal Axes of the HP140).

Thus the shortest possible braking distance is achieved.

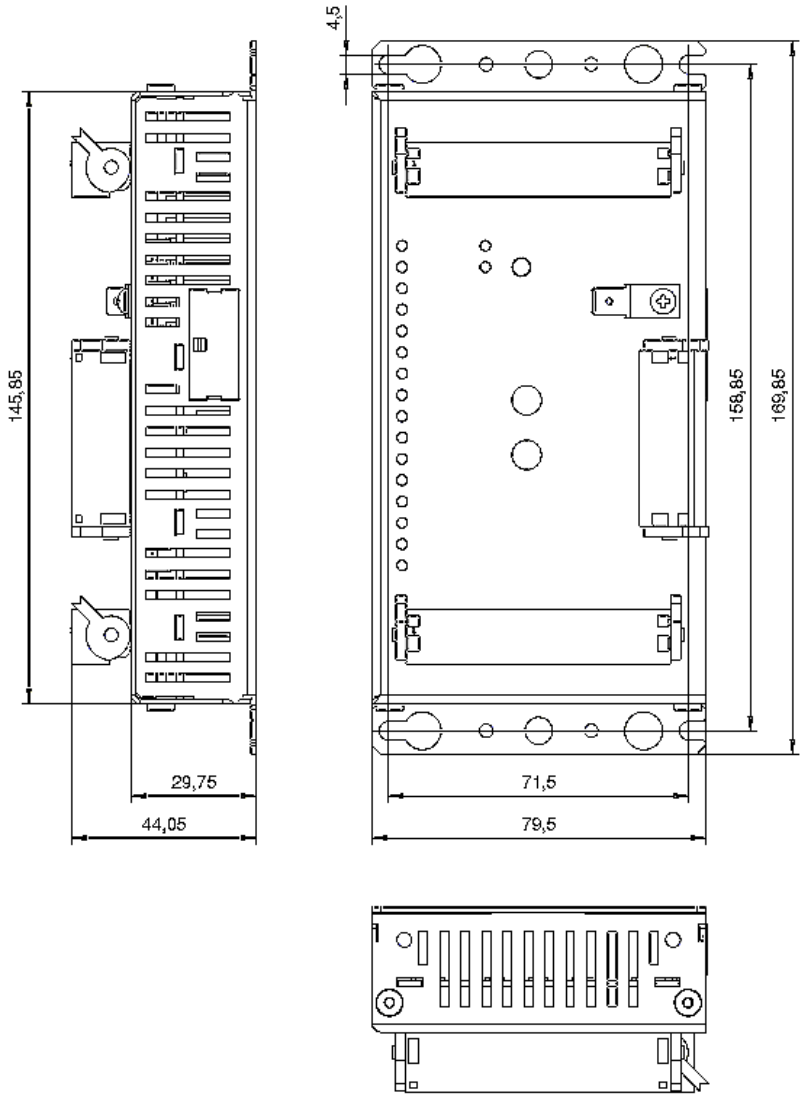
Loose of 24V or faults like Overtemperature will cut the Quickstop – ramp.

With use of this wiring, the Axes will not run their blocks. On switching Power of, the vertical axis will be hold or pushed to the top by a spring (depending on position and load).
At switching on the Axis, their position was lost. It is necessary to do a homing (no referencing).

	**The “Quickstop” input must be configured by the windows program. => see Documentation for Windows – Program**

3.3 *Installation of external I/O-Module*

The optional available I/O-Module can be mounted directly or onto a DIN-rail.
The Dimensions are as follows:

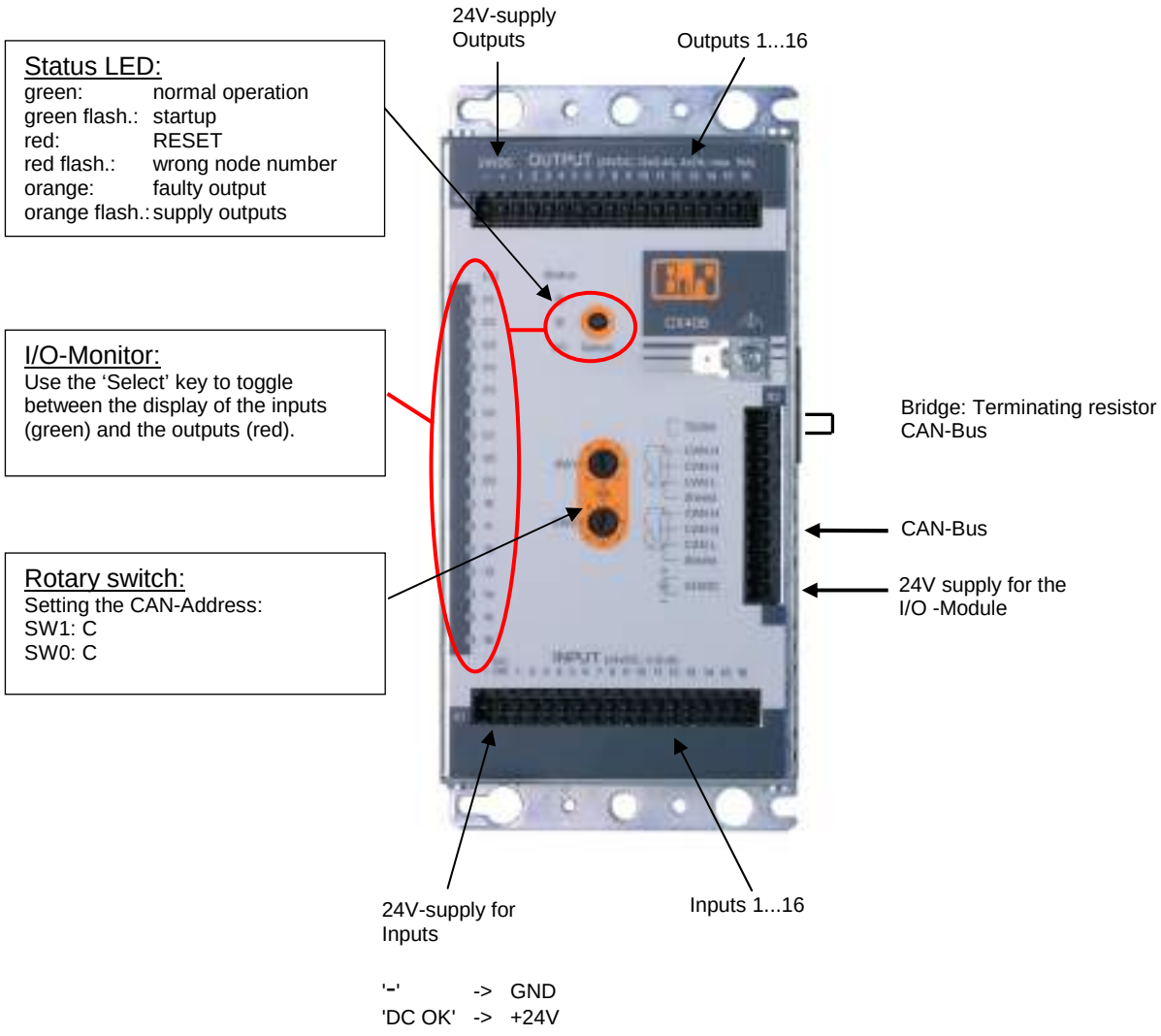


3.4 *Electrical installation of I/O-Module*

One or two I/O-Modules can be applied. The connection to the drives takes place via the internal CAN-Bus. Adequate cables are within the shipment.

One Module has 16-In- and 16-Outputs, 24VDC.
Outputs 1-12 can supply up to 0,4A, the Outputs 13-16 can supply up to 2A. The sum of all currents is max. 10A.

Control elements:



3.5 *Connection Diagram for control cables*

3.5.1 CAN-Bus – without I/O-Module

The drive controls will be connected to each other with the preconfigured cable 563-200000200. Terminal resistors are inside the plugs.

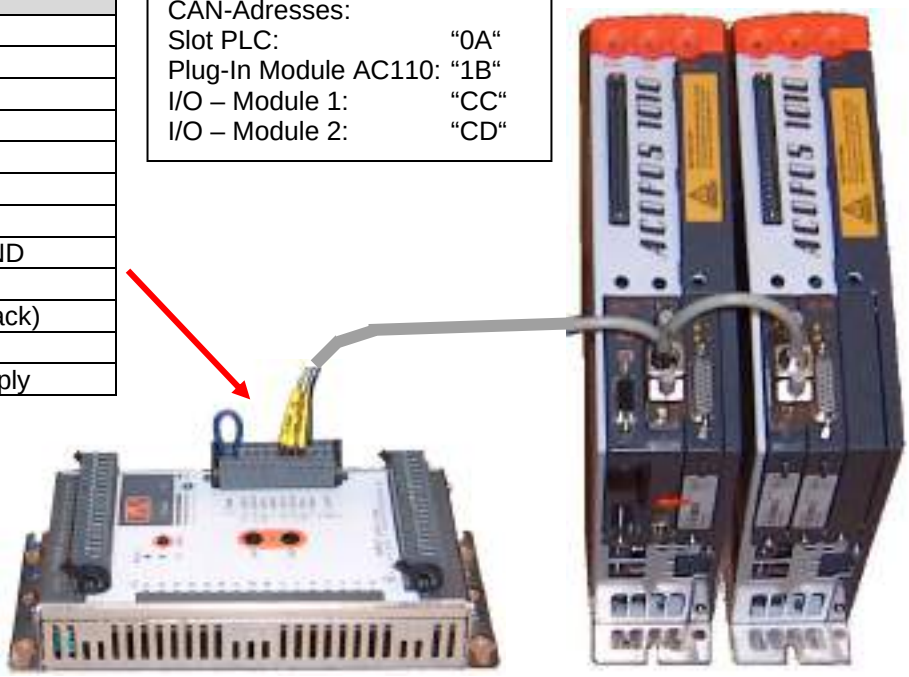
CAN-Adresses:
Slot PLC: “0A“
Plug-In Module AC110: “1B“

3.5.2 CAN-Bus – with one I/O-Module

Both drive controls and the I/O-Module will be connected together via cable 563-200000202. In the plug at the end of the line, a terminal resistor is integrated. Onto the I/O-Module, the bridge ‘Term’ has to be wired.

Clamp	Function
Pin 1	Bridge
Pin 2	Bridge
Pin 3	n.c.
Pin 4	n.c.
Pin 5	n.c.
Pin 6	n.c.
Pin 7	CAN – H
Pin 8	CAN – GND
Pin 9	CAN – L
Pin 10	Shield (black)
Pin 11	GND
Pin 12	+24V Supply

CAN-Adresses:
Slot PLC: “0A“
Plug-In Module AC110: “1B“
I/O – Module 1: “CC“
I/O – Module 2: “CD“



3.5.3 CAN-Bus – two of I/O-Modules

At the version with two I/O-Modules and two drive controls, the cable 563-200000204 has to be used. The Wiring is similar as with one I/O-Module, but the bridge “TERM” is necessary only at the end of the line.

3.6 *Motor connection*

The delivered Lines are completely pre-configured. To prevent interchanging the lines of the two axis, the lines are signed as follows:

Vertikal axis: **red** left drive control (with Slot-PLC "**AC140**")

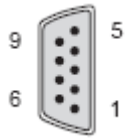
Horizontal axis: **blue** right drive control (with module "**AC110**")

The wires of the motor lines are signed with specified indications. The motor lines have to be fixed with the supplied cable brackets to ensure, the shield is also well connected.

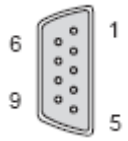
Observe the allocation of shield

3.7 *Customers interface*

3.7.1 Profibus

D-Sub – Socket (female)	Pin	Description	Function
	1	-	-
	2	-	-
	3	DATA	Data
	4	CNTRL	Transmit Enable
	5	Profibus_GND	Profibus_GND (potential separated)
	6	+5V / 50mA	+5V Supply / 50mA (potential separated)
	7	-	-
	8	DATA\	Data\
	9	CNTRL\	Transmit Enable\

3.7.2 CAN Bus

D-Sub – Plug (male)	Pin	Description	Function
	1	-	-
	2	CAN_L	CAN Low
	3	CAN_GND	CAN 0V
	4	-	-
	5	-	-
	6	-	-
	7	CAN_H	CAN High
	8	-	-
	9	-	-

3.7.3 Digital In- and Outputs

The Slot PLC is equipped with one digital Output and two digital Inputs. This is enough for a lubrication pump or one gripper. For more complex wiring, one or two I/O-Modules can be connected.

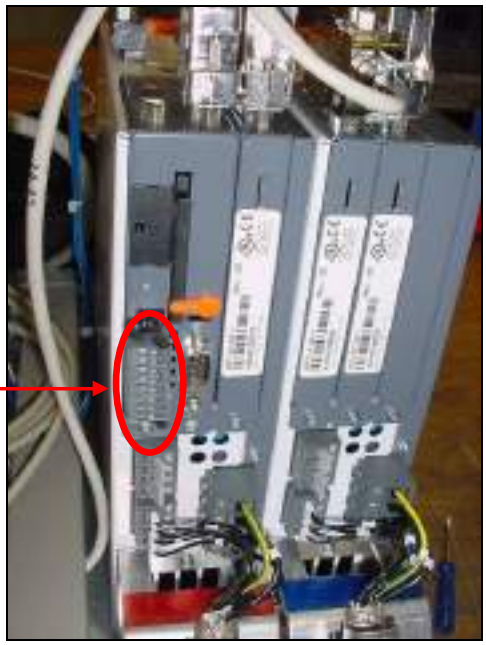
All In- and Outputs are freely configurable via Software. For this reason, here is no circuit shown.

For connecting more powerful devices, the Outputs 13-16 onto the additional I/O-Module are available.

Digital In- and Outputs on Slot-PLC:

On the lower side of the Slot-PLC, there is a 8-pin Plug which is supplying one digital Output (24V, 500mA) and two digital Inputs (24V).

8-pin clamp with
In- and Outputs



Clamp	Function
Pin 1	GND
Pin 2	+24V Supply
Pin 3	Input 4.1
Pin 4	Input 4.2
Pin 5	Output 4.3
Pin 6	n.c.
Pin 7	n.c.
Pin 8	n.c.

Digital In- and Outputs I/O-Module:

Inputs:

Clamp on I/O-extension (CX408)	Function	Description
X1-1	GND (0V)	24V-Supply of Inputs
X1-2	+24V / DC_OK	24V-Supply of Inputs
X1-3	E 1.1	Configurable via Windows-Program
X1-4	E 1.2	Configurable via Windows-Program
X1-5	E 1.3	Configurable via Windows-Program
X1-6	E 1.4	Configurable via Windows-Program
X1-7	E 1.5	Configurable via Windows-Program
X1-8	E 1.6	Configurable via Windows-Program
X1-9	E 1.7	Configurable via Windows-Program
X1-10	E 1.8	Configurable via Windows-Program
X1-11	E 1.9	Configurable via Windows-Program
X1-12	E 1.10	Configurable via Windows-Program
X1-13	E 1.11	Configurable via Windows-Program
X1-14	E 1.12	Configurable via Windows-Program
X1-15	E 1.13	Configurable via Windows-Program
X1-16	E 1.14	Configurable via Windows-Program
X1-17	E 1.15	Configurable via Windows-Program
X1-18	E 1.16	Configurable via Windows-Program

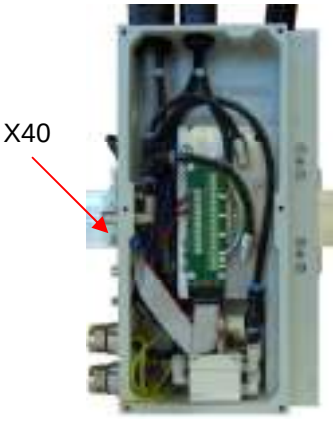
Outputs:

Clamp on I/O-extension (CX408)	Function	Description
X2-1	GND (0V)	24V-Supply of Outputs
X2-2	+24V	24V-Supply of Outputs
X2-3	A 1.1	Configurable via Windows-Program
X2-4	A 1.2	Configurable via Windows-Program
X2-5	A 1.3	Configurable via Windows-Program
X2-6	A 1.4	Configurable via Windows-Program
X2-7	A 1.5	Configurable via Windows-Program
X2-8	A 1.6	Configurable via Windows-Program
X2-9	A 1.7	Configurable via Windows-Program
X2-10	A 1.8	Configurable via Windows-Program
X2-11	A 1.9	Configurable via Windows-Program
X2-12	A 1.10	Configurable via Windows-Program
X2-13	A 1.11	Configurable via Windows-Program
X2-14	A 1.12	Configurable via Windows-Program
X2-15	A 1.13	Configurable via Windows-Program
X2-16	A 1.14	Configurable via Windows-Program
X2-17	A 1.15	Configurable via Windows-Program
X2-18	A 1.16	Configurable via Windows-Program

3.7.4 Connection of control lines HP140 – X40 + Tool-Connector

I/O – Module (CX408)

Terminal block HP140



Tool-Connector SBS4

As described before, the use of In- and Outputs is freely configurable. For connecting I/O's with the HP140, there is a preconfigured cable delivered.

If pneumatic valves and Tool-Connector are requested, the wiring is as follows:

Sensor / Actor	Color SBS4	Terminal block	Pin X40	color of wire
+ 24V	brown	(+)	1, 9	black + white
24V GND	blue	(-)	2, 10	violet + brown
Valve 1		A1	13	white/green
Valve 2		A2	6	rose
		A3	14	brown/green
		A4	7	blue
		A5	15	rot
Sensor 1	white	E1	3	green
Sensor 2	green	E2	11	green/red
Sensor 3	yellow	E3	4	yellow
Sensor 4	gray	E4	12	red/blue
		E5	5	gray

4 Getting started

4.1 *Drive controls*

For controlling both Motors, matching drive controls will be delivered. This drive controls are designed for digital stroke and position controlling.

The first controller is equipped with the following modules:
- Slot-PLC “AC140“ or “AC141“
- Sin/Cos feedback-Interface “AC120“.

The second controller is equipped with two modules too:
- CAN-Interface “AC110“
- Sin/Cos feedback-Interface “AC 120“.

The drive controls are communicating to each other and to digital I/O-Modules “CX408” via an internal CAN-Bus. Therefore the regulations for the CAN bus cabling must be observed (terminator resistances at both ends of the CAN bus). Please use the preconfigured cable for this.

For active braking of the axis, the drive controls are equipped with a Quickstop – Input. The Function called “secure restart inhibit” to deactivate the system and prevent unexpected restart is realized with a digital input on clamp X1/9 – the “Enable”. Superfluous brake energy is given to an internal brake resistor.

4.1.1 Indications

The ACOPOS controller is equipped with three LED’s for direct diagnostics:

Illustration	LED	Designation	Colour	Description
	❶	READY	green	- Lights up when the ACOPOS drive is ready for operation (400 V power supply is ON AND terminal X1/9 (Enable) is HIGH).
	❷	RUN	orange	- Lights up when the axis is enabled (Hardware Enable AND Software Enable are HIGH)
	❸	ERROR	rot	- Lights up during POWER ON (booting) - Lights up when Hardware Enable (terminal X1/9) is LOW (EMERGENCY STOP) - Lights up when an error occurs on the ACOPOS drive.

	Note: **When the red LED (3) ‘ERROR’ lights up, this is often mistaken with a fault.** **In most cases only the terminal X1/9 is low.**

4.1.2 Secure restart inhibit

ACOPOS servo drives use integrated safe pulse disabling for secure shutdown and to prevent unwanted startup. This is designed to meet the following safety classifications depending on the external circuit:

Criteria:	Characteristic value
Max. performance level acc. EN ISO 13849	PL d
Max. safety integrity level acc IEC 62061	SIL 2
Max. safety integrity level acc IEC 61508	SIL 2
Max. safety category according to EN 954-1 [1)]	CAT 3
PFH (Probability of dangerous Failure per Hour)	$<4*10^{9}$
HFT (Hardware Fault Tolerance)	0
PT (Proof Test interval)	10 years
DC (Diagnostic Coverage)	99 %
CCF (Common Cause Failure)	5 %
SFF (Safe Failure Fraction)	>99 %
MTTFD (Mean Time To Failure dangerous)	>140 years

[1)] Die EN 954-1 is no longer valid and has been replaced by EN ISO 13849.

The following table provides an overview of the individual safety functions that can be implemented:

label according to standard:		Short description
EN 61800-5-2	EN 60204-1	
STO (Safe Torque off)	Stop Category 0	Shut-down by immediate switching-off of the energy supply to the drive machinery (i.e. an uncontrolled shut-down).
SS1 (Safe Stop 1)	Stop Category 1	Introduction of active braking and activation of the STO function after a defined amount of time has expired. (Implementation by user)

The restart inhibit interrupts the energy supply to the drive by blocking the pulses to the IGBT's. This means that no rotary field can be built up in the servo motor. This function is realized by the terminal X1/9 on the front of the ACOPOS drive. The terminal X1/10 is the ground (GND) for terminal X1/9, these terminals are electrically isolated from the 24 V supply.

 **Danger !**	**Take note that multiple faults in the IGBT bridge can lead to a brief jerking. The maximum stroke of the axis depends on the used motor. For the HP140 this is about 5mm.**

Please note that the integrated "secure restart inhibit" does not interrupt the voltage supply to the motor. It only prevents the development of a rotary field and thus reliably prevents a restart of the motor. If electrical work is performed on the motor, the mains supply must be cut off by a mains contactor or a master switch.
Please also observe the discharge time of the DC-bus of at least 5 minutes before electrical work can be start. When the LED's on the ACOPOS drive go off, this is not an indication that the voltages are shut down and the DC-bus has discharged to less than 42 V.

 **Danger !**	**A fault in the IGBT bridge can result in a fatal direct voltage at the motor clamps. If electrical work is being carried out on the HP140, the mains line must be cut off by a mains contactor or a master switch.**

An appropriate safety category must be selected individually for each indexing table in a machine on the basis of a risk assessment. This risk assessment is part of the overall risk assessment for a machine.

On the CD-ROM supplied you will find the manual of the drive manufacturer as well as the TÜV approval certificate (file: ACOPOS_mdt_V131_04_2004.pdf, ACOPOS_SafePulseDisablingCertificate_x_00.pdf). You will find further information in chapter 1.3 of the manual “Secure restart inhibit”.

4.2 *Slot-PLC*

The PLC is a user-friendly interface between customer interface and ACOPOS drive. It provides the required movement commands at the correct time. Positions and Drive – Sequences are handled and stored by the Slot-PLC.

The Slot-PLC is available in two different versions:
- AC140: with user interface Profibus
- AC141: with user interface CAN-Bus (also for DeviceNet)

The following interfaces are standard included in both PLCs:
- RS232
- Ethernet
- 1 digital Output / 2 Inputs
- CAN-Interface for internal connection of the drives an the I/O-Module

The Data is stored on an integrated CompactFlash – memory card. Additionally, there is a battery buffered static ram disc available, where for example the part counter and the counter of operating hours is stored. For parameterization of the software on the Slot-PLC there is a Windows – Program provided. For example the load, positions and drive sequences can be adjusted by this program. The connection between Windows-PC (Laptop) and Slot-PLC is via serial interface (RS232) or via Ethernet.

The PLC - Software supports the following operating modes:
- reference run
- jogging mode
- machine zero point teaching
- position teaching
- move to position 1...127 (absolute or relative)
- 32 sequences each with 32 commands
- 8 freely programmable cams
- 8 Outputs for free use
- 8 Inputs for free use
- 1 demo sequence
- Controlling of Lubrication pump

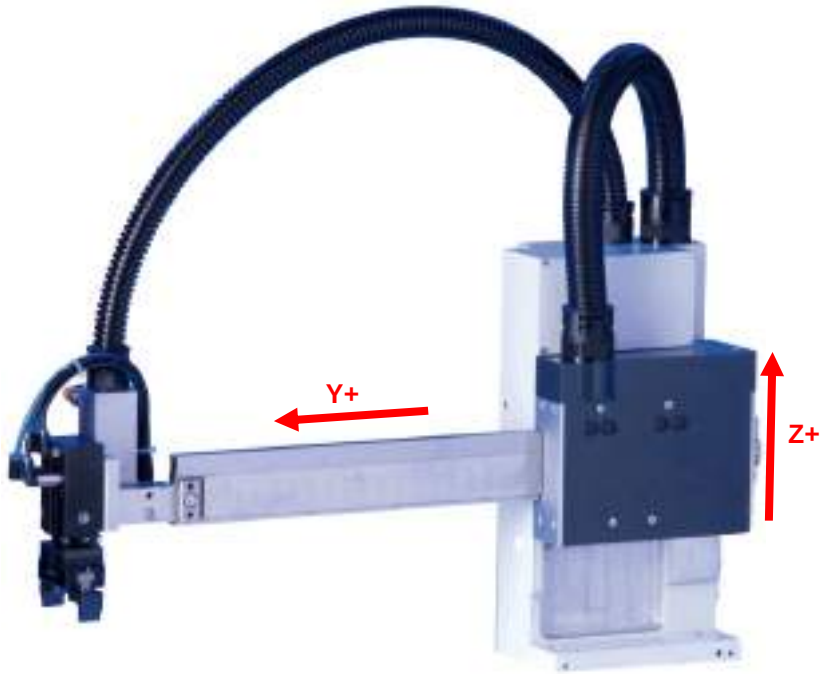
Indications

Illustration	LED	Descr.	Colour	Description
	❶	Status (RUN)	red red with orange flashing red/green flashing (1 Hz) orange green green with orange flashing	ERROR/RESET Loading/unpacking/starting BOOT AR Start-up of the BOOT or CF - AR SERVICE/DIAG/BOOT mode RUN RUN - BATTERY LOW
	❷	RS232 (X1)	orange flashing	Data transfer to user interface IF 1 (RS232)
	❸	Profibus (PB)	orange	Data transfer to user interface IF 3 (Profibus)
	❹	Ethernet (ACT)	orange orange flashing	Ethernet LINK (IF6) Ethernet ACTIVE (IF6)
	❺	CAN (RX)	orange	Data received on user interface IF2 (CAN)
	❻	CAN (TX)	orange	Send data on user interface IF2 (CAN)

4.3 *Mechanics, Motors and Feedback*

The mechanics consists of two linear motors which are coupled to Y/Z-axes. The use of linear motors gives an increase of dynamics. With less load (up to 1.5kg), accelerations up to 40m/s² are possible which however going back with increasing load. The maximum linear speed is 4m/s.
The motors are internal development. A patented winding technique holds the temperature low. The motor is optimized to a minimum engaging. It is protected by a temperature sensor (PTC-Switch) in the winding as well as extensive calculation models in the drive.
As measuring system, a robust magnetic length measuring system is used. The magnetic division of poles is 1mm. The interpolation of the Acopos-drive is by factor 4096, what an electrical resolution of 0.244µm yields.

The used measuring system belongs to the family of the incremental measuring systems. Because off this, the motor phase (commutation) and the reference position must be found after each Power ON.



Motor commutation:
With the first enablement of the axis after Power ON the drive automatically searches the motor commutation. For this, the drive gives a frequency model onto the axis and is calculated from the encoder signal the motor commutation. You hear this at the short "humming" (like a buzzer).
The usual method to find the motor commutation is the so called “frequency method” with the disadvantage that the axis must swing freely for this. Is the axis blocked or is the linear axis at the left or right limit, this method calculates a wrong motor commutation without an alarm. Therefore, we are using drives which are using the reluctance method. This gives a correct result independent to whether the axis is free or blocked. However, this method is only offered by few manufacturers.

Reference run
Because the used incremental encoder system is not equipped with a reference signal, a reference search must be done before the first positioning can start. The only possibility which the mechanics offers consists in taking the end of the axis as a reference point (reference on limit stop). For this, the axis moves in a specified direction with slow speed and reduced torque, until it recognizes a block (following error increases). The order of the axes as well as the torque can be defined.
The disadvantage of this method is that the System does not recognize if it is actually at the end of the axis or the axis is only blocked by a part in the way.
One must also ensure that the end of the axis is always clean. A pollution (pollution with dust creeping e.g.) results in a displacement of the reference point (offset), which gives a wrong position.
Because of the small dimensions of the axis and the high dynamics of the linear motors, a crash at full speed to the mechanical limit may deform it. Normally this is prevented by the Software, but in case of emergency stop or power loss, the axes could run to their limits.

	**- Never move with full speed to the mechanical limit!** **- Keep the end of the axis clean!** **- Make sure that no parts block the way during the reference search!**

4.4 *Machine Zero Position*

Depending on the application, the adjustment of machine zero position could be necessary. After setting up the hardware and connection of the handling, the machine zero position has to be determined exactly. For this you move the axes via jog mode exact to the position where 0/0 should be. Then give the command "Set Zero" via the Windows program or via the digital input. As a result, you will see that the current position is changing to 0.000mm. After mounting the handling you must do this only one time.

	**The machine zero position is invalid after disassembly of the mechanics, replacement of the encoder or memory card in the ACOPOS drive!**

Note:
Mark this position permanently. So you can find and re-teach the machine zero position quickly after repair.

4.5 *Windows User Interface - Software*

The parameterization of the software running on the Slot PLC has to be done using the Windows Software ‘WAS.Handling’. For doing this, a connection between PC and PLC via RS232 or ethernet has to be established. For connecting via RS232, there is a so called “Null Modem Cable” necessary. The assignment can be found in the electric manual.

This parameterization is only necessary one time after the implementation of the HP140. All important parameters are placed to disposal via Interface to customers PLC.

For further Information please read the manual ‘WAS.handling Windows-Program’

5 Service und Maintenance

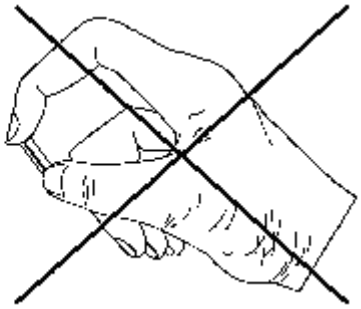
5.1 *Battery Replacement*

The battery of the controller has to be replaced every 4 years to prevent data loss. The control computer monitors the battery voltage and gives a warning (digital output / field bus) if the voltage drops.
The replacement of the battery may take place when the control computer is switched of or when the 24 V supply voltage is on. In some countries changing batteries is not permitted if the operating voltage is on. The data in RAM (stored positions, movement sequences, zero position...) are lost when the battery is removed without supply voltage! Save the data in advance (Windows Program -> Store parameters).

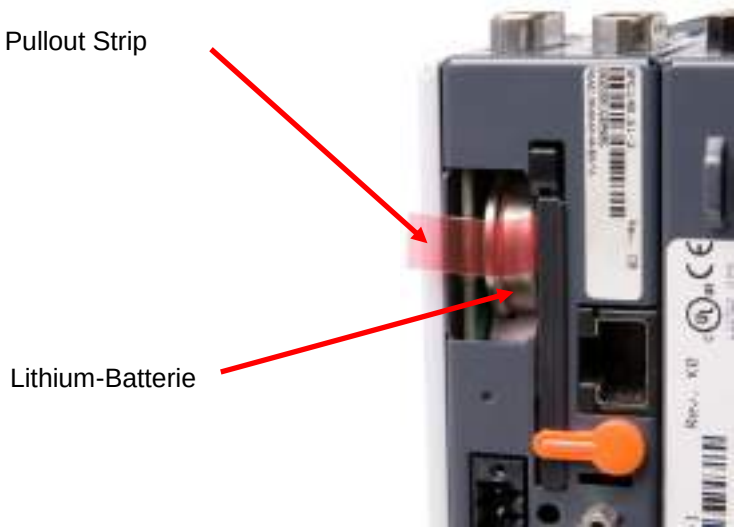
Procedure for battery replacement:
1. Drain electrostatic charge at the top-hat rail or the ground connection (do not reach into the power supply!).
2. Remove the cover for the Lithium battery with a screwdriver.
3. Pull on the pullout strip to remove the battery (do not grip the battery with a pair of pliers or pincers -> Short).
   The battery may only be touched by hand at the front and backside.

correct:

wrong:



4. Insert new battery with correct polarity. Lift the pullout strip and push the battery with the "+"-side towards the left into the battery compartment. To make it possible to pull the battery out again, the pullout strip must be on the right side of the battery.



5. Push the end of the pullout strip that stands out under the battery, so that it does not extend from the battery compartment.

6. Replace the cover. The recess for the screwdriver should point upwards.

	**Lithium batteries are hazardous waste! Spent batteries have to be disposed of appropriately.**

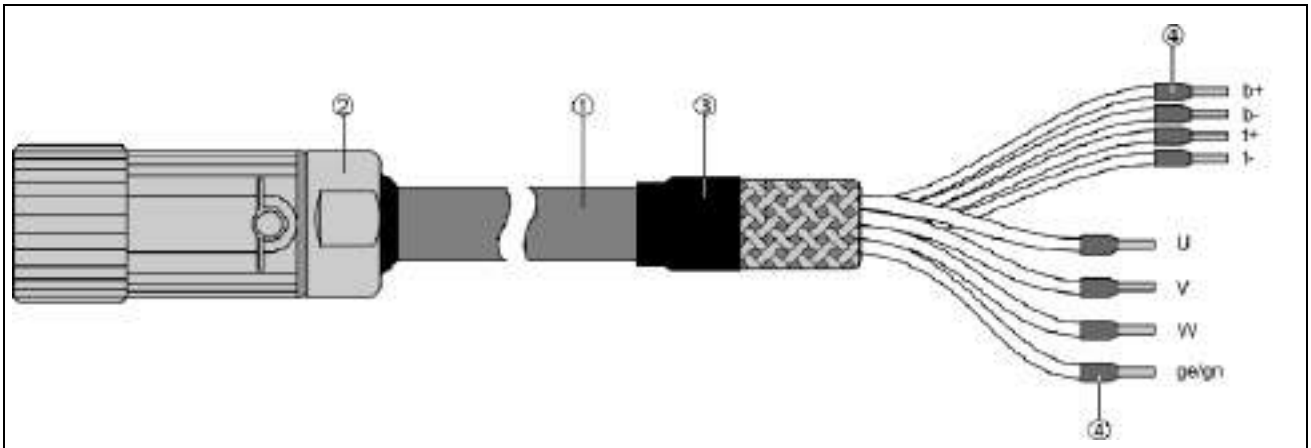
The battery has the type: CR2477N with a Voltage of 3V.

6 Appendix

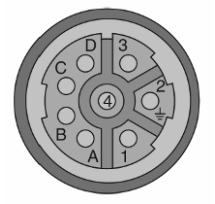
6.1 *Assignment of Cables*

The following lines are available in length 5m, 10m, 15m, 20m, 25m.

6.1.1 Assignment of Motor line (563-100000070…74 to 563-100000080…84):

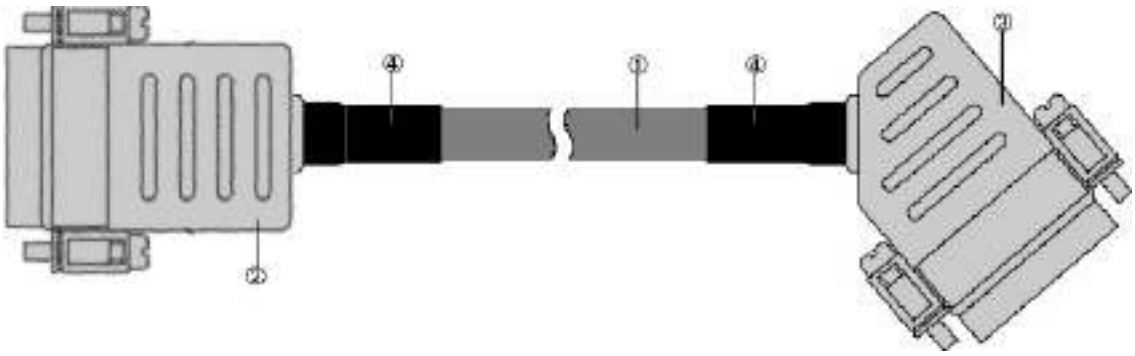


Item	Description	Remark
1	Motor line	4 x1,5mm² + 2 x 2 x 0,75 mm²
2	Circular Connector	BSTA 108 FR 19 08 0006 000
3	Shrink wrap	
4	Wire tip sleeve	

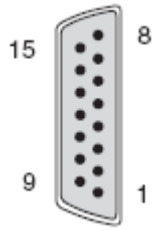
Circular Connector	Pin	Designation	Function
	1	U	Motor connection U
	4	V	Motor connection V
	3	W	Motor connection W
	2	PE	protective ground connector
	A	T+	Temperature sensor
	B	T-	Temperature sensor
	C	B+	Break +(Reserved)
	D	B-	Break - (Reserved)

Rote Marking = vertical motor (Z - Axis)
Blue Marking = horizontal motor (Y - Axis)

6.1.2 Assignment of Feedback line (563-200000070…74 to 563-200000080…84):

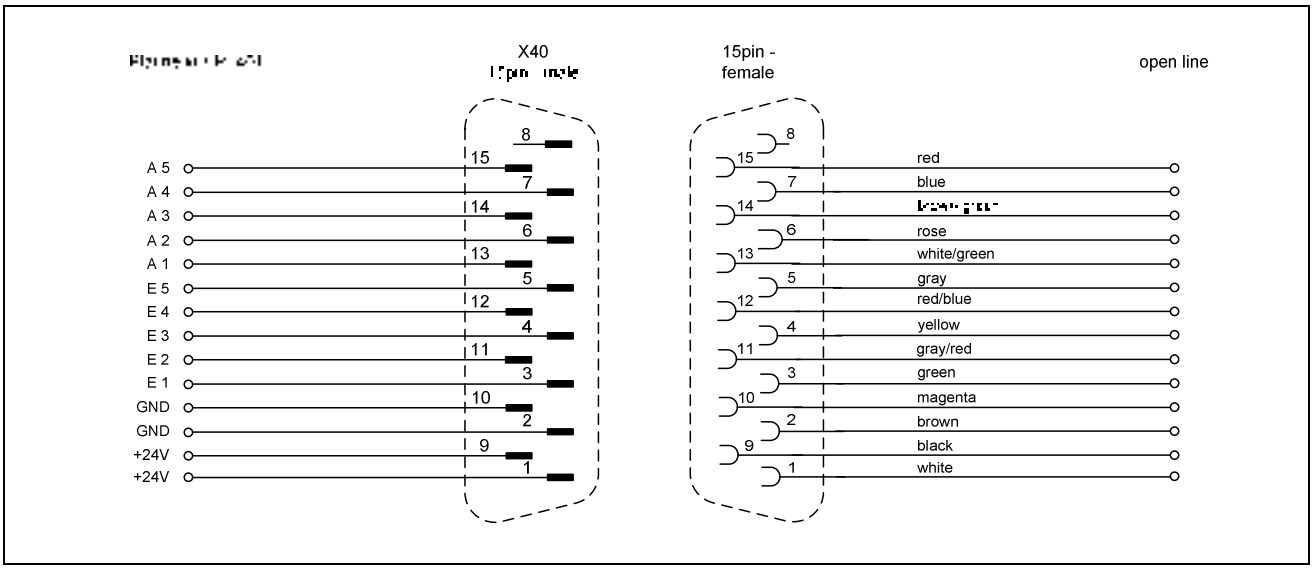


Item	Description	Remark
1	Encoder Cable	5 x 2 x 0,25mm² + 2 x 0,5mm²
2	DSUB-Housing, metallized, 15pin Female	
3	DSUB-Housing 45°, metallized, 15pin Male	
4	Shrink Wrap for Designation	

D-Sub – male connector	Pin	Designation	Function
	1	A	Channel A
	2	COM(1, 3-9, 11, 13-15)	Encoder supply 0V
	3	B	Channel B
	4	+5V out / 0.25A	Encoder supply +5V
	5	D	Data
	6	---	Reserve
	7	/R	Reference inverted
	8	T	Clock
	9	\A	Channel A inverted
	10	Sense COM	Sense 0V
	11	\B	Channel B inverted
	12	Sense +5V	Sense +5V
	13	\D	Data inverted
	14	R	Reference
	15	\T	Clock inverted

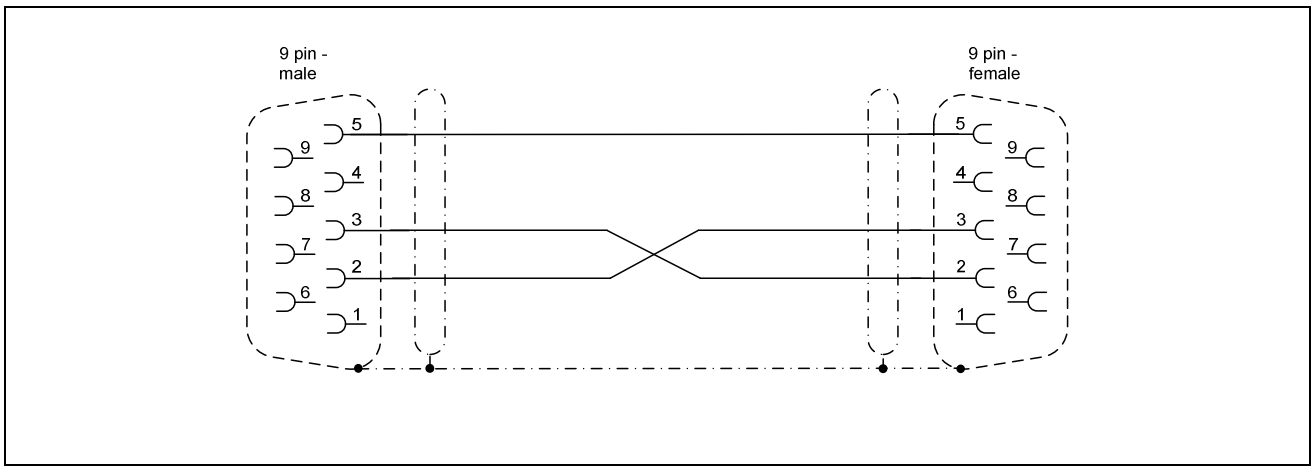
Red Marking = Feedback vertical motor
Blue Marking = Feedback horizontal motor

6.1.3 Assignment control cable for valves & gripper (563-200000100…104):

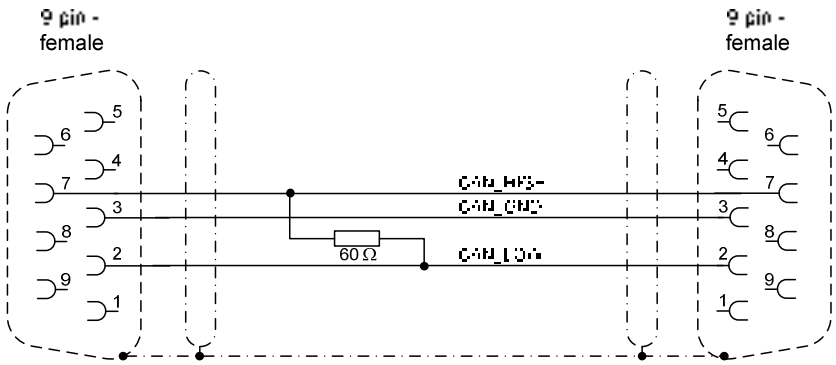


6.1.4 Assignment Null Modem Cable (563-200000010):

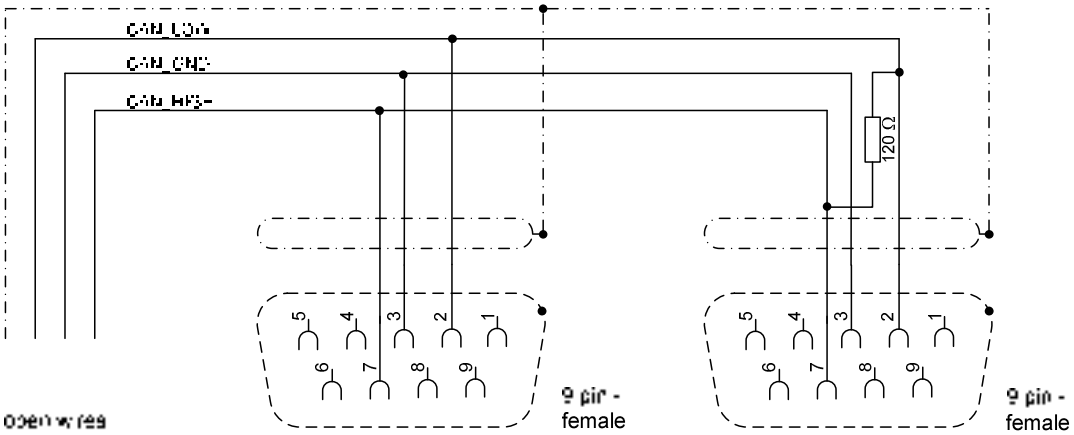
The Null Modem Cable is used for connecting the Laptop to Slop PLC – X1.



6.1.5 Assignment CAN-Adapter (563-200000200):



6.1.6 Assignment CAN-Adapter (563-200000202):



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