Motion SYSTEM Overview

Servo Motor and Drive:

This machine comprises for 4 servo Motors with individual drives(Inovance Make) for each motor

Motor 1 = X1 Axis

Motor 2 = X2 Axis

Motor 3 = Y axis

Motor 4 = Z axis

X1 and X2 Motor moves the cutting head in X direction(Front and Back)

Y Motor moves the cutting head in Y Direction(Left and Right)

Z Motor Moves the cutting head in Z Direction(Up and Down)

TRUMPF

Motion System Overview

Motor 1 and 2 (X1 and X2 axis)

MS1H3-29C15CD-A331Z-ZJ-V is manufactured by INOVANCE, AC brushless rotary servo motors, MS1 series servo motor, model MS1H3-29C15CD, type A331Z-ZJ-V, medium inertia 130/180 mm flange, 1500 RPM, 2900 W, 400V, 23-bit single & multi-turn without Battery Supported,keyed + tapped hole shaft, oil seal,10 stator pole.

This Axis moves the cutting head in Front/Back X-direction
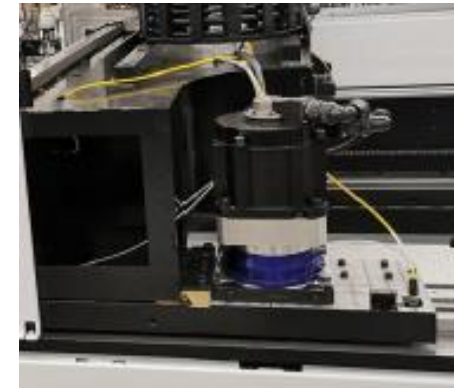
INOVANCE SV660NT012I-FS

Drive Features:

Improved performance with ultra-fast current loop

High speed EtherCAT communications – 125 µs

Functional safety – STO SIL3 EN/IEC 61800-5-2 compliant*1

High resolution feedback encoder

TRUMPF

Motion System Overview

Motor 3 (Y axis)

MS1H3-13C15CD-A331Z-ZJ-V is manufactured by INOVANCE, AC brushless rotary servo motors, MS1 series servo motor, model MS1H3-13C15CD, type A3341-ZJ-V, medium inertia 130/180 mm flange, 1500 RPM,   1300 W, 400V, 23-bit single & multi-turn Absolute with Battery Supported,keyed + tapped hole shaft, oil seal,10 stator pole.

This Axis moves the cutting head in Left/Right Y-direction
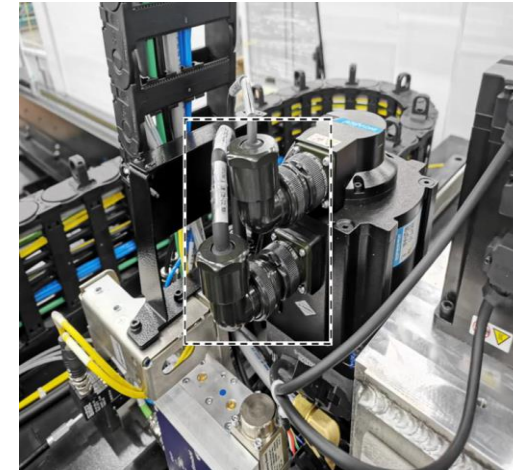

INOVANCE SV660NT5R4I-FS

Drive Features:

Improved performance with ultra-fast current loop

High speed EtherCAT communications – 125 µs

Functional safety – STO SIL3 EN/IEC 61800-5-2 compliant*1

High resolution feedback encoder

TRUMPF

Motion System Overview

Motor 4 Z axis

MS1H4-75B30CB A334Z-S is manufactured by INOVANCE, AC brushless rotary servo motors, MS1 series servo motor, model MS1H4-75B30CB, type A334Z-S, medium inertia 60/80 mm flange, 3000 RPM,   750 W, 220V, 23-bit single & multi-turn with Battery Supported absolute,   keyed + tapped hole shaft,   brake + oil seal,10 stator pole.

This Axis moves the cutting head in up/down Z-direction

INOVANCE SV660NT5R4I-FS

Drive Features:

Improved performance with ultra-fast current loop

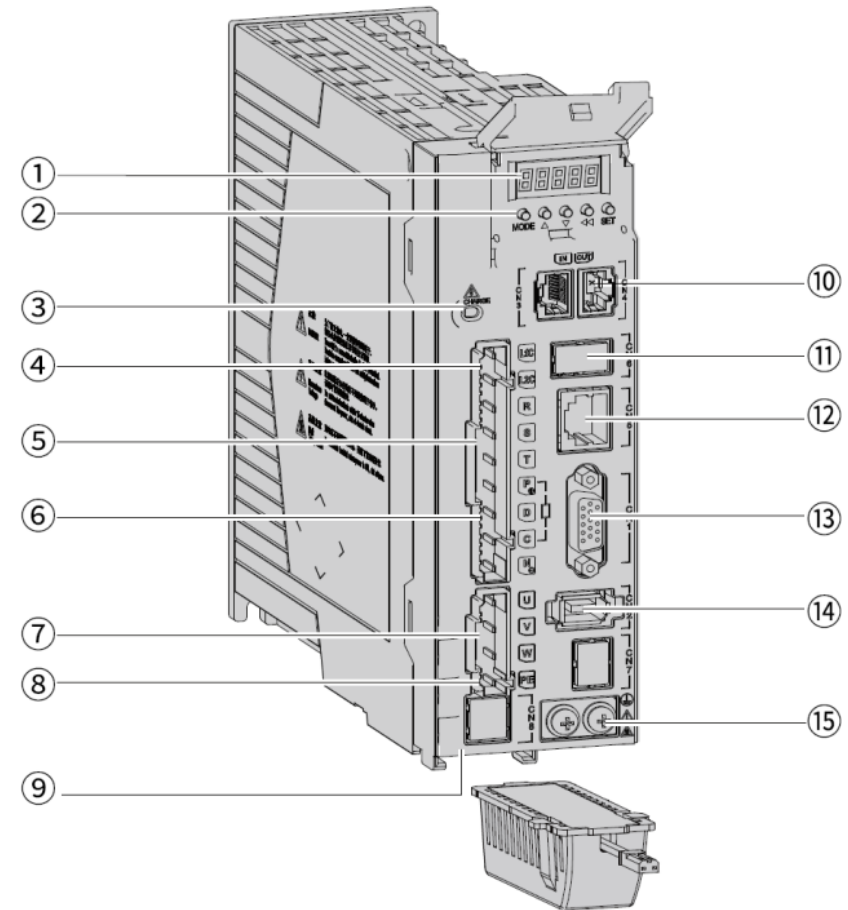High speed EtherCAT communications – 125 µs

Functional safety – STO SIL3 EN/IEC 61800-5-2 compliant*1

High resolution feedback encoder

TRUMPF

Motion System Overview

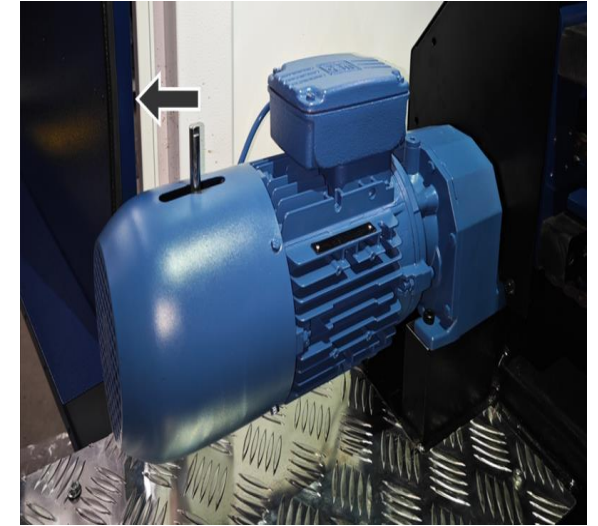| No.	Name	Description
1	LED display	Used to display servo drive operation states and parameter settings.
2	Buttons	MODE: Used to switch the parameter in sequence. △ : Used to increase the set value of the blinking digit. ▽ : Used to decrease the set value of the blinking digit. ◁◁ : Used to shift the blinking digit leftwards. (hold on: Used to turn to the next page when the display value is comprised of more than five digits.) SET: Used to save modifications and enter the next level of menu.
3	Charge (bus voltage indicator)	Used to indicate that the bus capacitor carries electric charge. When this indicator lights up, electric charge may be still present in the internal capacitor of the servo drive even if the main circuit power supply if cut off. Do not touch the power terminals when this indicator lights up.
4	L1C, L2C	Control circuit power input terminals.
5	R, S, T	Main circuit power input terminals.
6	P, D, C (terminals for connecting external brake resistor)	Before Connecting the brake resistor between P and C as needed, remove the jumper between terminals P and D.
6	P, N (DC bus terminals)	Used as the common DC bus for multiple servo drives.
7	U, V, W	Terminals for connecting the servo motor.
8	PE	Connected to the motor grounding terminal.
9	Battery location	/
10	CN3, CN4 (EtherCAT terminal)	CN3 (IN): Connected to the master or the last slave. CN4 (OUT): Connected to the next slave.
11	CN6 (STO terminal)	Connected to the external safety signal.
12	CN5	Software tool communication terminal.
13	CN1	I/O interface.
14	CN2	Encoder interface.
15	PE	Connected to the power supply grounding terminal.

TRUMPF

Motion System Overview

Pallet Motor and Drive:

Induction Motor with brake is employed in this machine for the movement of Pallet. There are two pallet in the machine that is used to load and unload the Sheet.

Both Pallet are coupled in a way that when one pallet moves inside the machine ,the other pallet will move outside the machine automatically.

The VFD(variable Frequency drive)is used to control the speed of the induction motor.

TRUMPF

Motion SYSTEM Overview (contd.)

Module Description:

The Laser control uses Eckelmann controller with NC drive components, these components must be powered on/off in a certain sequence to operate correctly. This module shows how these components are connected to the system and the require

Module objective:

Upon completion of this module, you will know how the drive components of the Laser system

system are integrated and how the power to these components should be applied and removed

TRUMPF

Control System Overview

Confidential

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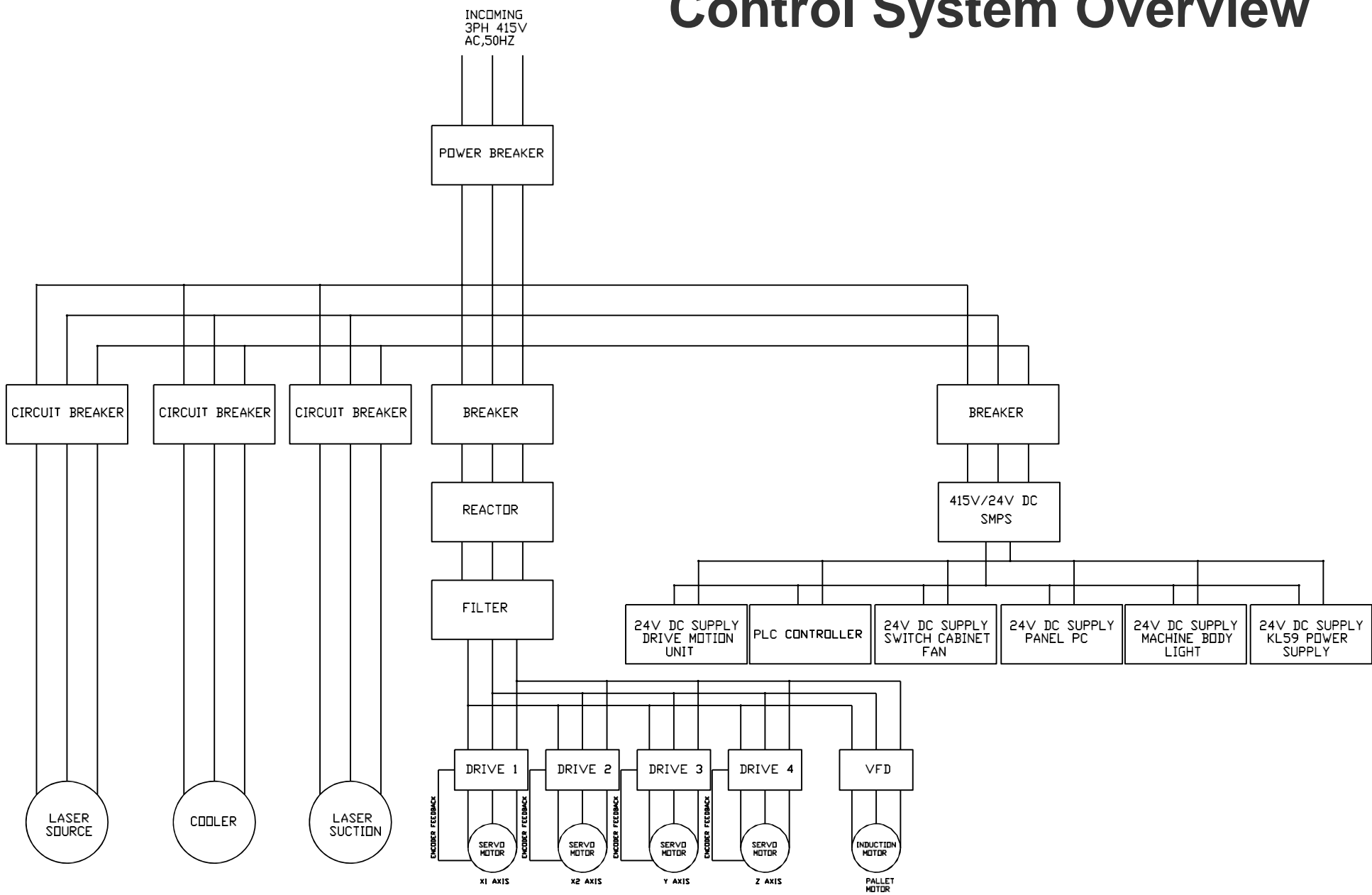
Control SYSTEM Overview

- All-in-one-solution

- Embedded controller with integrated IO-functions for PLC, motion and NC applications

- PLC programming with CODESYS® V3 according to IEC 61131-3

- NC operating system, DIN programming, up to 32 NC and 64 motion axes according to PLC Open Part I and II (combinable), 6 simultaneously interpolating axes

- NC kernel with extended instruction set and a lot of technology specific additional functions e.g. reverse travel and restart on the contour, tangential tracking

- 20 digital inputs, 16 digital outputs, 4 analog inputs, 4 analog outputs

- 2 galvanic isolated CAN buses (e.g. for CANopen® drives), termination switchable

- Analog axis interface for 4 axes

- Optional: EtherCAT® Master

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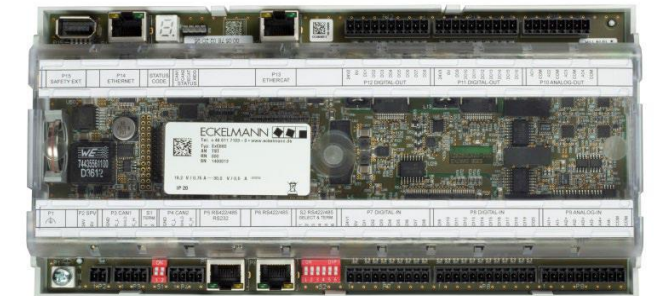
Control SYSTEM Overview (contd.)

Numerical control (NC/CNC): A machine control system that uses coded instructions to automatically operate machines.

- NC systems use a specific programming language (EIA/ISO or G-code) to control the movements and operations of machines.

  - The main difference between CNC and motion control systems is that CNC controllers process programs, while motion controllers coordinate the movement of the machine:

**TRUMPF**

Connections

Module Description:

For the controller to function correctly the hardware must be correctly connected, the PLC Architecture of these interfaces is described in this module

Module objective:

Upon completion of this module, you will be able to understand the status LED's and relevance to the status of the Laser controller.

You will also be able to locate all the hardware connections and know their functionality

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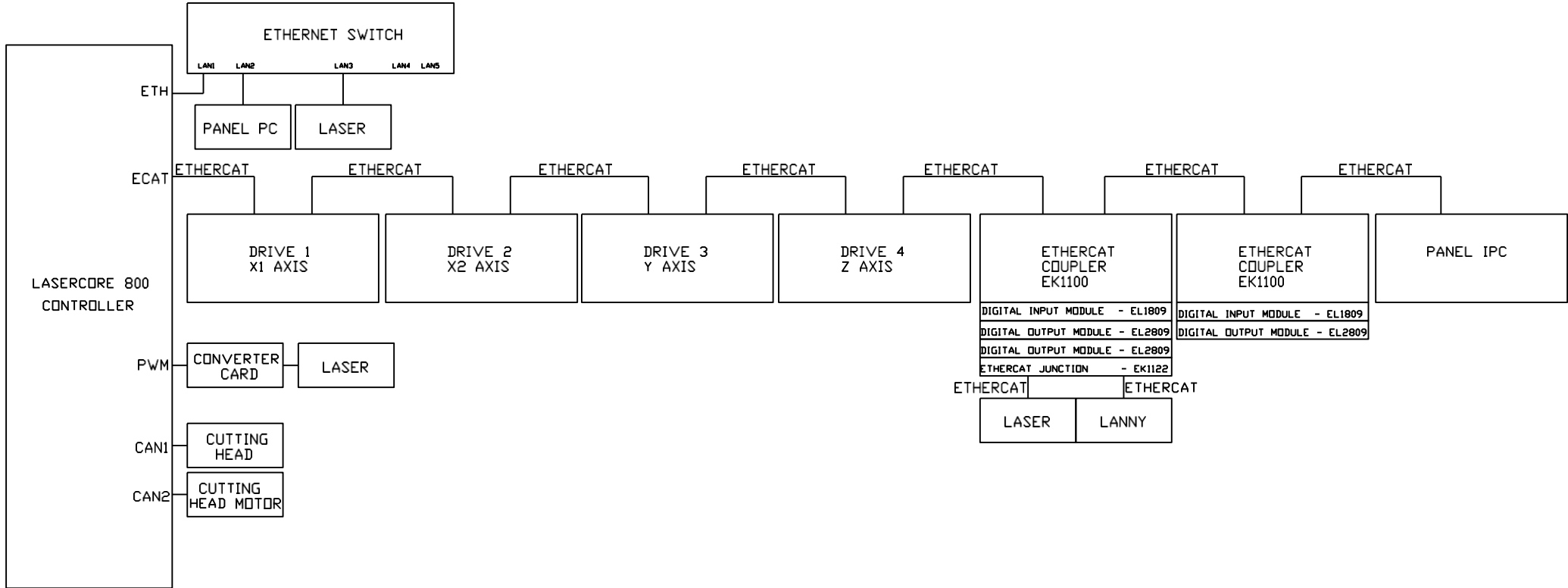
Connections

Connections- Communications

Control System deploys different types of communication interface :

- **EtherCAT Interface**

- **Ethernet Interface**

- **CAN Interface**

TRUMPF

Connections understanding EtherCAT

Ether CAT Interface: Ether CAT (Ethernet for Control Automation Technology)is an Ethernet-based fieldbus system that allows devices to communicate in real time.

- The **Ether CAT MASTER device** is the only one allowed to transmit data across the network!

- Ether CAT frames are embedded within a standard Ethernet frame and are identified in the Ether Type field by the value 0x88A4

- The frames are received by the **Ether CAT slave devices** (nodes) that it is addressed to. The slave devices process data and add back whatever was requested by the master and send the frame along to the next node in the ring.

- Increased Speed: Only one device sends the data, together with a technique called "processing on the fly." result increased speed. With "processing on the fly", the node reads the header and sends the data along simultaneously, saving time and improving efficiency.

  - Unlike conventional ethernet, Ether CAT allows incoming and outgoing data from more than one device on the network to be combined into single frames. This again optimizes speed.

Note: In case, a particular node does not have the processing power to handle the data the bus speed can be adjusted by the master, ensuring that no data is lost by any device on the network.

TRUMPF

Connections

Ethernet Interface

- An Ethernet interface refers to a network interface card that allows devices to connect to an Ethernet network. It can support different speeds such as 10/100 Fast Ethernet or Gigabit Ethernet.

CAN Interface

- The Controller Area Network (CAN) protocol: This is a message-based communication system that allows devices to communicate with each other in a reliable and prioritized way.

  - CAN open is a communication protocol for embedded systems that's based on the Controller Area Network (CAN) protocol.

TRUMPF

Tools
E-PLC Designer

Module Description:

To integrate the Vulcan Control to a machine tool, software tools are required. The tools enable the OEM to create the PLC program for the machine and assist in the drive configuration.

The tools, including service tools are :

- E-PLC Designer (PLC user programming software designed for Eckelmann Control)
- E- ConSet (Configuration, Debugging Tool)

Module objective:

Upon completion of this module the course participant will be able to do the following:

Install the software tools

Connect to the controller with each of the software packages

TRUMPF

E°PLC Designer – Programming Environment

CODESYS V3 Setup - Adapted to Eckelmann

- The E°PLC Designer contains CODESYS V3 and all extensions and supplements for all E°EXC controllers.

- Configuration and programming the PLC functionality integrated in the controller in accordance with IEC 61131-3.

- The PLC program, which was created in the E°PLC Designer, can be loaded onto the controller.
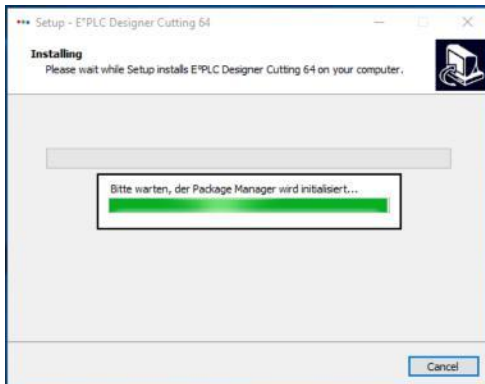
Whenever "CODESYS" is used in the following, this always refers to the CODESYS V3 part integrated

in the E°PLC Designer. **With costs**