CDL - CAM DRIVEN LINE

TECHNICAL DOCUMENTATION

Arnstädter Werkzeug- und Maschinenbau AG

Status: 28/02/2023

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Content

1. Base machines

1.1 Structure

The AWM Cam Driven Line (CDL) offers a variety of different solutions for your assembly tasks. Depending on the task, you can choose from three different machine lengths. Up to 16, 24 or 32 stations are available. The combined arrangement with a linear transfer system of the machine platform combines maximum accessibility with a compact design. The integrated protective enclosure system - with roof-mounted control cabinet - completes our AWM Cam Driven Line system. Depending on your specific assembly task, you can choose the suitable modules individually out of our standardised construction kit with numerous pick & place handlings, assembly, and testing units.

1.2 Functions

The central main drive (1) of the base machine drives the horizontal main shaft (2) via a toothed belt and the indexing gearbox (3), which directly drives the indexing chain of the transfer system (4). The mentioned indexing gearbox has a shift angle of preferably 120 degrees. The required output movement of the gearbox is achieved by means of four stops for the tact chain. The main shaft is located below the table plate and carries the cam discs (5) that define the movements of the working stations. The described movements reach the respective stations (7) via cam rollers, deflection levers (6) and connecting rods. The deflection levers are loaded with tension springs or optionally with pneumatic elements.

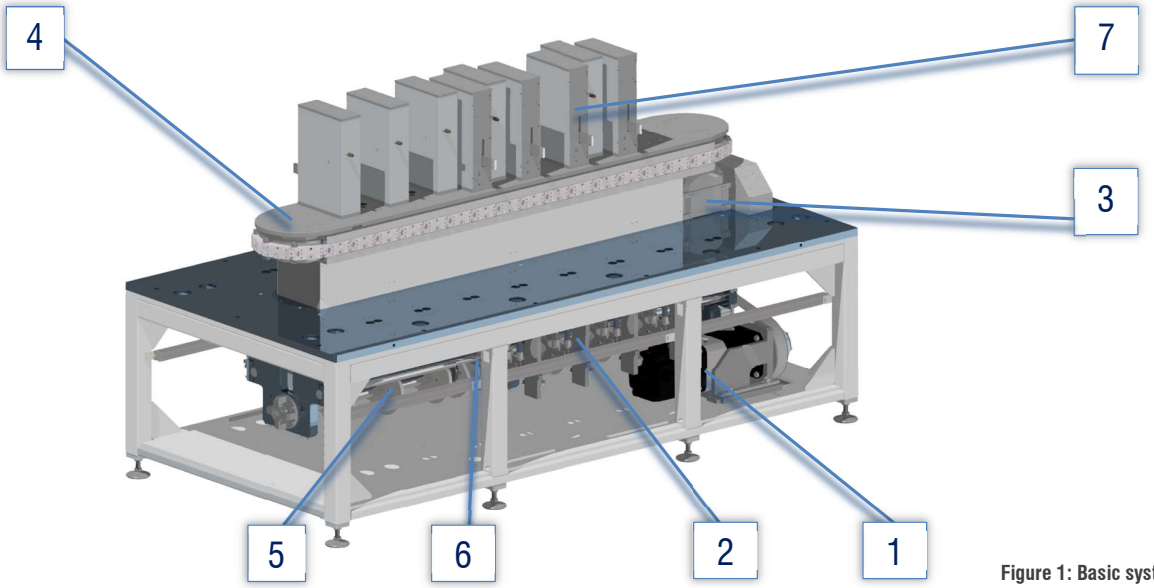


Figure 1: Basic system

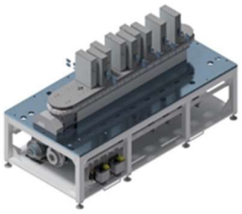
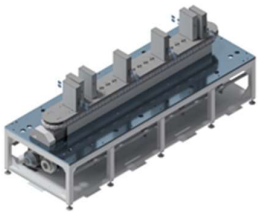
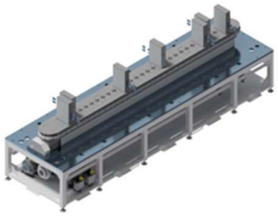
1.3 Technical data

1.3.1 General technical data

Cycle rate:	Up to 80 cycles per minute
Output:	160, 240, or 320 parts per minute depending on the number of workpiece mounts
Station distance:	250 mm
Shift angle:	120 degrees (= transfer time), 240 degrees (= available process time)
Horizontal travel of the units:	up to 120 mm
Vertical travel of the units:	up to 60 mm
Workpiece dimensions:	80 mm x 80 mm x 150 mm (LxWxH)
Workpiece weight:	Up to ca. 1000 gramms
Central lubrication for cam discs	yes
Implementation at least in clean room class ISO 6[1]	yes

[1] DIN EN ISO 14644-1

1.3.2 Overview of variants of the base machines

Variant	Type CDL 2000	Type CDL 3000	Type CDL 4000
Centre distance [mm]	2000	3000	4000
Station distance [mm]	250	250	250
Number of stations	16	24	32
Number of active workpiece carriers	24	32	40
Weight	4000 kg	5000 kg	6000 kg
Frame LxWxH [mm]	3000 x 1280 x 2800	4000 x 1280 x 2800	5000 x 1280 x 2800
			
Cycled chain (LFA 25)			
Positioning accuracy in feed direction			
▪ **at the drive [mm]**	±0,04	±0,05	±0,06
▪ **at the deflection [mm]**	±0,07	±0,07	±0,07
Positioning accuracy transverse to feed [mm]	±0,05	±0,05	±0,05
vertical runout [mm]	±0,03	±0,03	±0,03

2. Overview of a basic configuration

Assemblies	Type CDL 2000	Type CDL 3000	Type CDL 4000
CDL base frame	X	X	X
Protective cladding including cell lighting and roof switch cabinet (without contents)	X	X	X
Main drive	X	X	X
Main shaft	X	X	X
Cycled chain	X	X	X
Central lubrication (cam discs)	X	X	X
Basic pneumatic installation	X	X	X
Basic electrical installation	X	X	X
CPU	X	X	X
Control panel	X	X	X
Options			
Handling[2]	Optional	Optional	Optional
▪ Pick and Place			
▪ Divider			
▪ Special units			
Central lubrication (handling)	Optional	Optional	Optional
Vacuum pumps	Optional	Optional	Optional
Laminar flow boxes	Optional	Optional	Optional

[2] Cf. handling modular system, p. 13

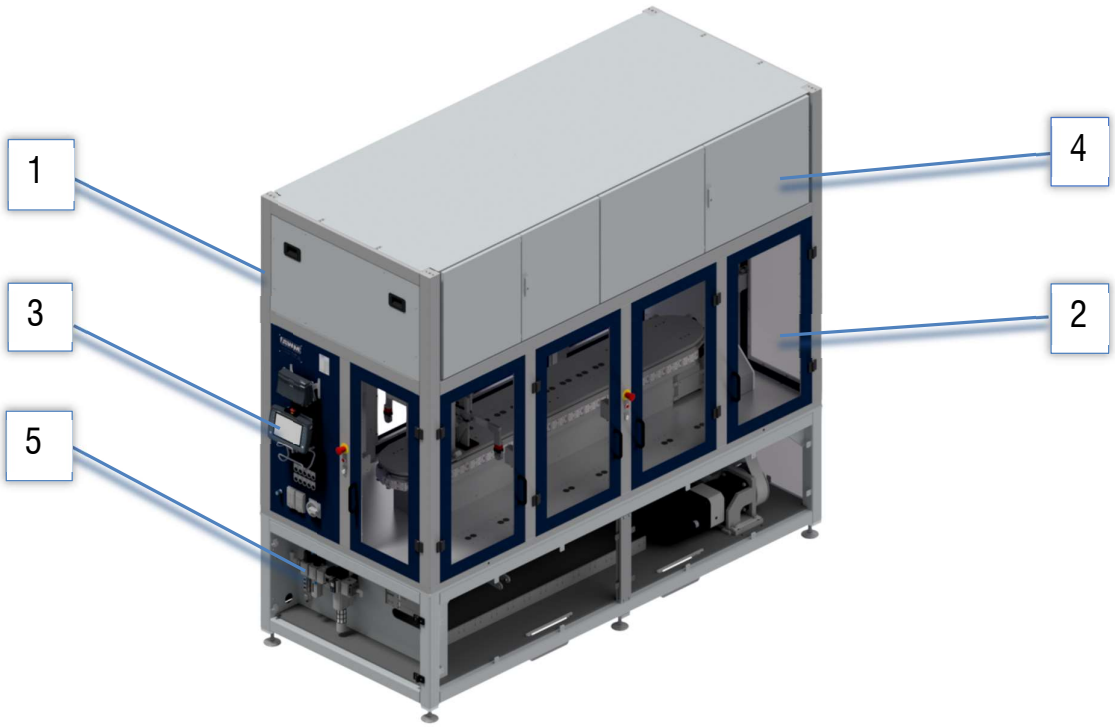
2.1 CDL Basis

2.1.1 Base frame

AWM AG's special machine construction traditionally uses welded steel frames as the basis for the functional units of our machines and systems. We also rely on this proven principle for the Cam Driven Line. As a further element of our solid construction, our cam-driven basic machines always use solid table plates made of nickel-coated steel. This solid design ensures that all functional assemblies are reliably accommodated and guarantees a safe stand and long-term low vibration running behaviour, even under high utilisation.

2.1.2 Protective enclosure including LED-illumination and control cabinets

Part of our modular concept is the optional equipment for all CDL machines with a complete protective housing. Based on a sheet steel construction (1), this contains standardised safety doors (2) including door protection switches as well as the base plate for control panel(s). Above the safety doors are the switch and control cabinet enclosures (4), in which all hardware components can be accommodated. The pneumatic maintenance unit (5) is installed in the lower part of the base frame. The interior of the machine is illuminated by 6 LED lights.



2.2 Drive assemblies

2.2.1 Main drive

As a Siemens Solution Partner, we use a SIEMENS servo motor out of SIMOTICS S-1FK7 series. Coupled with a planetary gearbox, the drive train generates constantly high torque for delay-free start-up and controlled, reliable synchronisation. The main drive transmits the movement, synchronised via toothed belts, to the indexing gearbox of the tact chain as well as to the main shaft of the cam drive.

2.2.2 Main shaft

The standardised main shaft of the cam drive is designed with keyways for one double cam per station, so that later conversions and extensions are possible. In order to do so, the cam discs are designed and manufactured in a split design. The bearing plates suspended from the table plate ensure precise multiple shaft support. Thereby proven roller bearings are used. The central shafts are realized in a one-piece design.

2.2.3 Cycled chain

The linear transport along the working stations is carried out by the high-precision LFA 125 linear transfer system by Taktomat, whose feed is controlled by the associated indexing gearbox. The indexing gearbox is coupled to the drive train by the toothed belt drive mentioned above.

2.2.4 Central lubrication of the cam discs

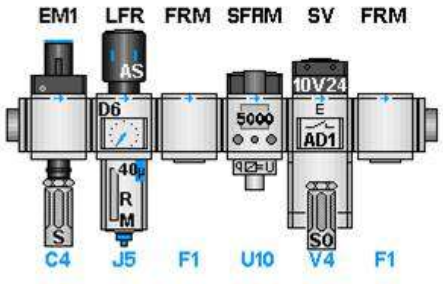
The cam discs, as roller tracks of the bell crank, are case-hardened and hard milled. Nevertheless, it is recommended to provide the running surfaces with dosed lubricating oil at regular intervals to ensure long-term, low wear running. For this purpose, AWM offers the installation of lubricating oil pumps including lubricant tank as well as corresponding lines and metering valves as a standardised assembly group.

2.3 Control

2.3.1 Basic pneumatic installation

Each base machine has a pneumatically and electrically maintenance unit as well as a valve terminal fitted as standard.

The Festo maintenance unit is provided with the following configuration:



EM1	Switch-on valve, manual
LFR	Filter regulating valve
FRM	Branching module
SFRM	Flow sensor
SV	Pressure build-up and venting valve
FRM	Branching module

Each cell has a safety switching valve as standard.

The valve terminal (type MPA-FB-VI) is equipped with a fieldbus node for ProfiNET IO and a CPX pneumatic interface as standard. Of the valve terminals, one module is equipped with 4x K 2x3/2-way valves as standard.

The valve terminal is mounted directly above the tact chain to ensure the most direct actuation possible. Depending on requirements, the number of valve terminals above the tact chain can be extended to a maximum of 6.

2.3.2 Basic electrical installation

Each base machine is equipped with two separate control cabinet groups (supply side and control side). The supply side is equipped with a 3-phase 400V AC connection. An AC&DC converter provides the control voltage of 24V DC (20A). Control panel buttons are mounted redundantly on the front of the housing. The machine is switched on via a central main switch with rotary drive.

2.3.3 HMI

For operation of the control system and visualisation of parameters and operating states, a Siemens mobile operating panel of the type SIMATIC HMI TP1000F Mobile is provided as standard on one of the two front sides of the basic machine. Optionally, a second connection box can be added to the second end face.

Likewise, five metres of connection cable and two brackets as well as a Simatic HMI connection box Advanced are part of the standard basic equipment of our production cell.

2.3.4 CPU

As a Siemens Solution Partner, AWM relies on CPU solutions from Siemens for reliable operation and maximum system availability. For our base machines we provide the CPUs of the SIMATIC CPU 1517TF-3 PN/DP series, central module with 3MByte working memory, FailSafe and technology function. Digital input/output modules of the system are likewise from SIEMENS and part of the ET200SP series, designed for normal as well as fail-safe control tasks.

2.4 Options

The extensive equipment of the base machine can be extended by a wide range of options according to the assembly task at hand.

2.4.1 Central lubrication of handling units

To ensure reliable, long-term performance, we provide the guideways of the handlings with grease lubrication both vertically and horizontally. The lubricant is supplied via a central dosing pump with lubricant tank. Appropriate supply lines and dosing valves are installed on each handling unit.

2.4.2 Vacuum pumps

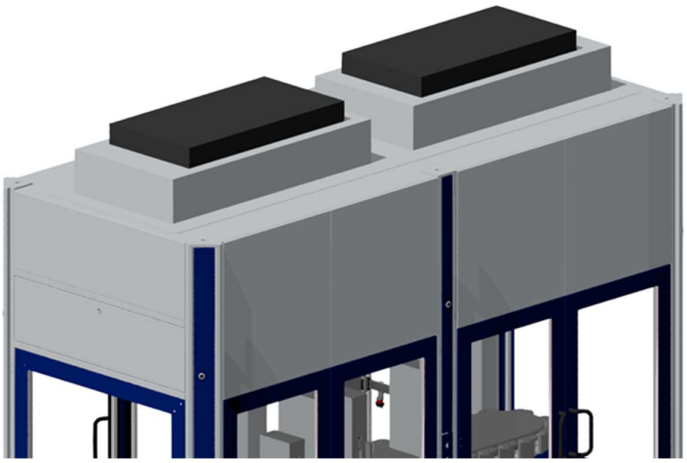
Depending on the assembly task, the provision of vacuum as an optional process component is also possible. Here, for example, a rotary vane pump would be used as an electric dry-running, oil-free pump with a suction capacity of max. 8m³/h.

2.4.2 Laminar Flow Boxes

Depending on the requirements regarding technical cleanliness and the assembly task to be realised, the use of flow boxes (e.g. applications in medical technology) may be necessary to create a laminar air flow with a slight overpressure within the cell housing.

For this purpose, ventilation filter modules are installed above the control cabinets to supply clean air. The ceiling of the cell enclosure is equipped with corresponding openings and air deflector plates.

Optimum air filtration is achieved by installing HEPA H14 filters as standard. Alternatively, ULPA or PTFE filters can also be implemented.



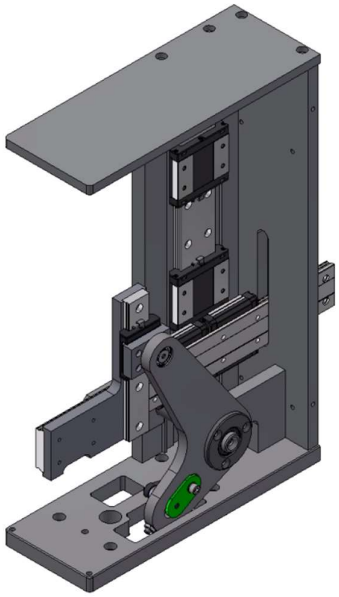
3. Overview handling modular system

The equipment of the basic machine can be extended by a wide range of pick and place applications and special units according to the specific assembly task.

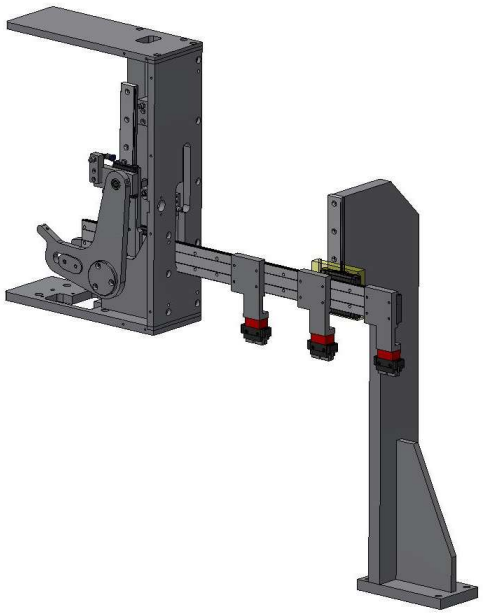
3.1 Pick and Place

3.1.1 Horizontal/vertical translator (up to three stations)

- Horizontal travel of the units: up to 120mm
- Vertical travel of the units: up to 60 mm
- Pneumatic as well as electrical grippers
- Mounting on the centre plate on top of the transfer system or the tabletop.
- Handling dimensions:
  271.5 x 104 x 410 (LxWxH, [mm])

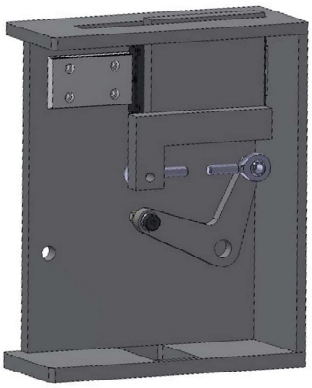


- Can be used as a gripper bar
- Additional support stand on the table plate



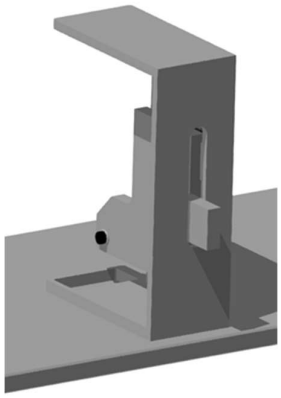
3.1.2 Horizontal unit (single)

- Travel up to 120 mm
- Pulling and pushing possible
- Mounting on table plate or on top of the transfer system



3.1.3 Vertical unit (single)

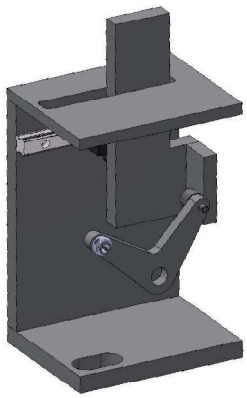
- Travel up to 60 mm
- Mounting on table top or on top of the transfer system



3.2 Divider

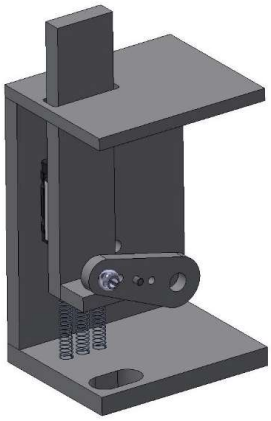
3.2.1 Horizontal

- Compartment movement via spring (overload protection)
- Stroke up to 60mm (adjustment via stop and lever grid)



3.2.2 Vertical

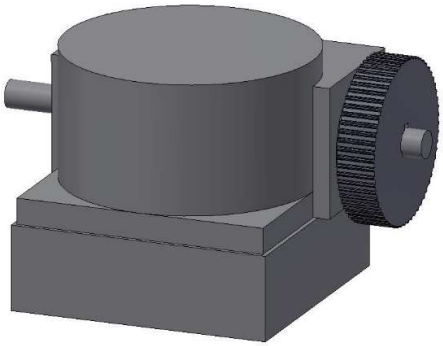
- Compartment movement via spring (overload protection)
- Stroke up to 60mm (adjustment via stop and lever grid)



3.3 Special units

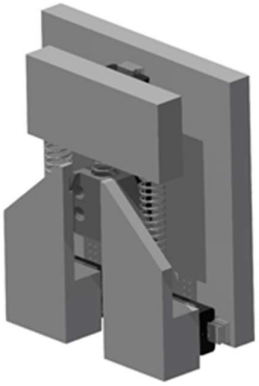
3.3.1 Satellite rotary table

- Satellite rotary table, 4 or 8-way
- Use as rotary table or rotary divider
- Direct drive via auxiliary shaft



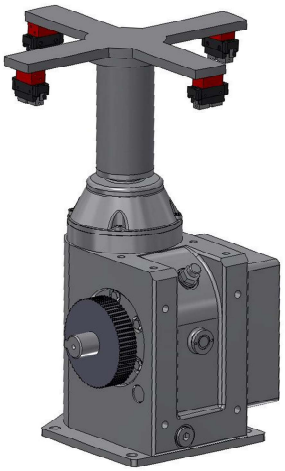
3.3.2 Centric gripper

- For centring the assembly parts
- Closes spring-loaded (overload protection)
- Actuation by vertical movement of the handlings (see above)
- Stroke max. 10mm per jaw



3.3.3 Rotary feeder

- Lift-swing gear
- Direct drive via auxiliary shaft



4. Imprint

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Sales tax identification no. DE 813605400
Tax no.: 156/100/00409
DUNS no.: 332333954, Customs no.: 5182557