OSAI

OPEN Mill

Technology for Machining Centres

The OSAI solution for machining centres

Based on the OPEN*control* CNC paltform, OPEN*Mill* is a modern and flexible system managing the most simple, up to the more complex 5 axes roto-translated plane machining centres. The high integration between the OSAI OPEN*Mill* modular control system components for machining centres, guarantees productivity, high finishing quality and ease of use.

The solutions offered by the new OPEN*Mill* systems simplify installation and commissioning, optimizing the time-to-market thanks to the most advanced Software modules and Hardware components:

- HMI software with conversational Editor for on board programming of 2D machining and graphic control program execution
- Look ahead with 1024 pre-calculated blocks
- Algorithms for High Speed Cutting (HSC)
- Jerk control using advanced algorithms
- Spline algorithms on 5 axes
- Complete management of the 5 axes by using Tool Centre Point (TCP) programming
- Selection of the active kinematics from part program
- Volumetric compensation of both mechanical asymmetries and machine misalignments (Volumetric Compensation)
- Gantry and dual axes management
- Management of tool magazines, tool life, random tool, multi-pocket tool
- Different operator panel solutions
- Latest generation of OPEN*control* CNC
- Modular drives with rack structure for axes and spindle, with network recover, connected via Mechatrolink III fieldbus
- High performing brushless motors with absolute transducer
- Remote I/O connected via EtherCAT fieldbus

OPEN*Mill* Software

The OPEN*Mill* software is the intuitive and direct ambient that programs and controls the machining centre managing the execution of programs from either an external CAD-CAM or locally using graphic and parametric programming of cycles and profiles. The programmer does not require any knowledge of ISO language used by the CNC, thanks to the simple to use integrated conversational editor. Once the machining cycle is selected, the user is graphically helped in filling the parameters required, i.e. for a drilling matrix, linear tapping, slot milling or for milling of a profile defined by the user.

OPEN*Mill* is also the new OSAI HMI interface for milling. The end-user ambient, designed to optimize the CNC use, requires few commands, from soft-key of Touch Screen, to use all the main CNC functions. It also has integrated graphics for part preview and for outlining the parts already machined. A specific section of the interface allows the system customization via the graphic and functional definition of the screen buttons.

The OPEN*Mill* software perfectly matches the OPEN*control* Software configured as OPEN-20 and includes all the functions required to control machines with up to 4 interpolated axes:

- Axes:
  - Coordinated, Spindle, Auxiliary
  - Rotary and Linear, also Rollover type
  - Gantry and Dual axes
  - Geometric errors offset on single axis and on work planes (Cross compensation)
- Tool magazine:
  - Linear, Planar and Revolver magazines
  - Management of tool with fixed and random positions
  - Life tools and alternative tools management
  - Tool and offset configurable tables
- Movement:
  - Linear, Circular, Helical, Spline movements
  - Acceleration/deceleration parameters independent for each axis
    - Acceleration trapezoidal and sinusoidal ramps with Jerk limitation
    - Look Ahead (up to 1024 program blocks)
    - Filters on programmable axis movements
    - Velocity Feed Forward (VFF)
    - Zero Shift
    - Multi Block Retrace
    - Restart from interrupted programs
- Conversational editor:
  - Drilling & tapping standard cycles
  - Milling standard cycles
  - Definition of open/close milling profiles

For CAD programming, the solution is the OPEN*control* **software** configured as **OPEN-30**, specifically designed for complex machines with 5 or more interpolated axes at the same time and up to 64 axes controlled, adds to the OPEN-20 the following features:

- Tool Centre Point (TCP)
- TCP for Double Twist and Prismatic heads with 2 or 3 rotary axes, for tilting tables and non-standard kinematics
- TCP with spline (High Speed Machine)
- TCP on rotated planes

In this case the system executes complex programs for 3D machining also on several channels at the same time (multi-process) for the machining with different independent heads.

PLC applications for Milling Machines and Machining Centres

The real-time SoftPLC, integrated in the CNC, is extremely versatile. This is a development ambient with several functions available, to interface the control with any type of machine. The performances:

- Multitasking real-time execution
- Up to 250 task with 10 priority levels
- Cycles task, with 250 µSec minimum scheduling
- More than 450 functions available
- Possible to include external software algorithms implemented with high-level languages

For more standardized machines, OPEN*Mill* has a default configurable application that allows, with minimal customization, machine commissioning in a very short time.

Numerical Control

The OPEN*control* family of CNC's are scalable and with a computing power easily adaptable to any customised requirement with no modifications to the software or the application.

The **OPEN-S COMPACT** with 12" operator panel is designed to control medium-complex machines. The user interface is softkey based and guarantees the ease of use of the system. All the buttons of the OPEN-S COMPACT are full stroke type to guarantee the full perception of the operation done.

OPEN-S COMPACT 12"

The **OPEN-M** model, with **OPEN*console* COMPACT** 15" touch screen operator panel, is a CNC that suits more complex machines such as multi-axis machining centres.

The system consists of an operator panel with integrated keyboard and customizable console, and indipendent CNC, to be installed in the electric cabinet.

The **OPEN-XLi** model has a structure similar to the OPEN-M but, thanks to the i5 CPU, is the solution that best fits machining centres, where high performances are required. OPEN-XLi can be completed with the **OPEN*console*** operator panel.

Configuration of the OPEN*control* systems using OPEN*Mill* technology.

OPEN*console* COMPACT 15"

Servo drives and Servo-motors

The OPEN*Mill* solution requires the use of modular drives with up to 480 VAC power supply, CNC interfaced via **Mechatrolink III** fieldbus, that guarantees high speed data exchange from CNC to drives.

Only one **regenerative power supply**, with power up to 22kW at 480V, is used for both axis drives and the spindle drive. The power supply also features a 350% high overload capability for 3 to 5 seconds to improve the dynamic performance during axes acceleration.

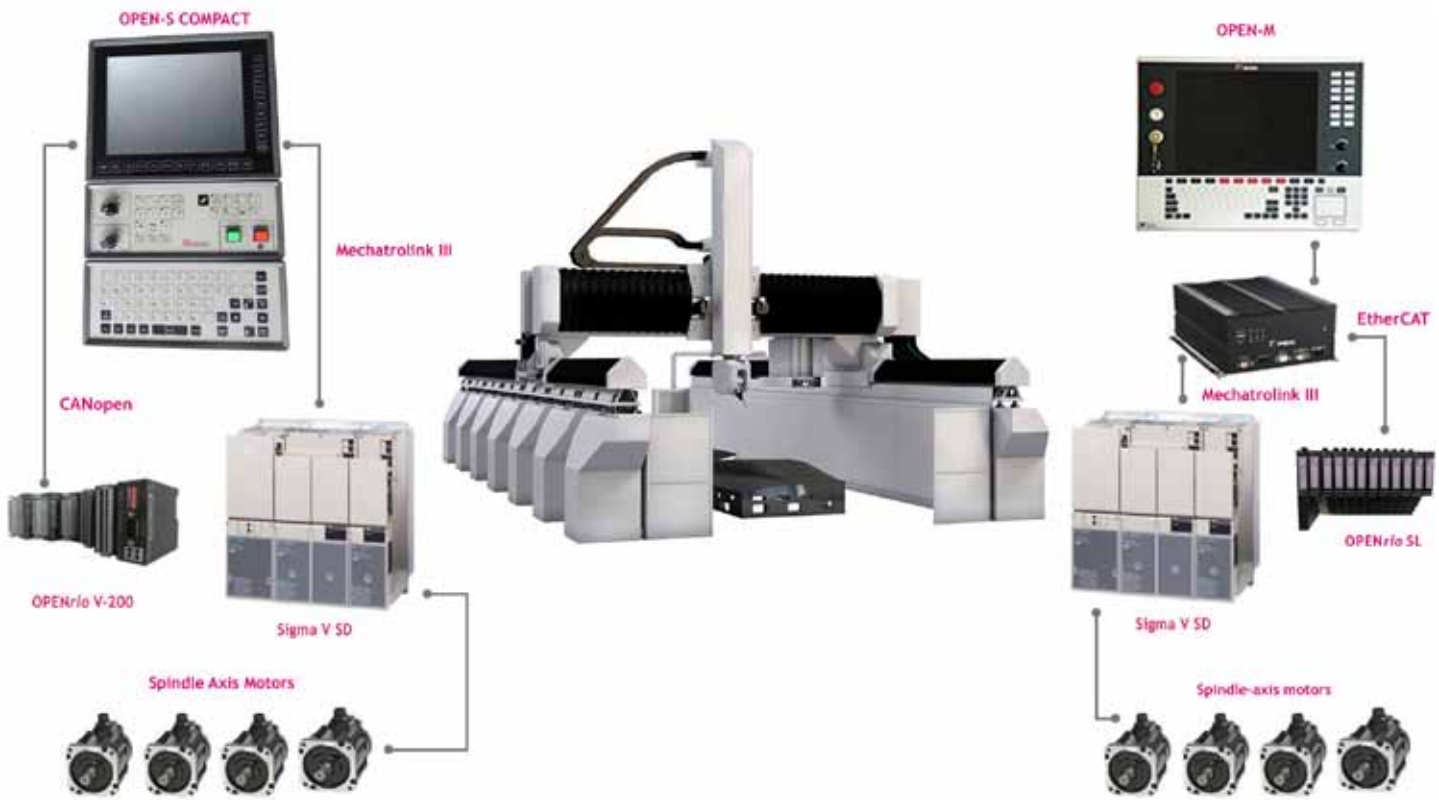
The drives, with power up to 11kW for axes and 18kW for spindles, are equipped with integrated Safe Torque OFF and the possibility to manage the main Safety Integrate.

The servo motors with medium inertia and continuous torque from 3 to 48 Nm, are equipped with absolute transducer with 20 bit resolution. With maximum torque up to 3 times nominal torque and motor speeds up to 5,000 rpm.

Spindle motors, from 4 to 18 kW and speeds up to 10,000 rpm, allow all the metal removal machining typical of machining centres.

OPEN*console* 17" or 19"

Configuration scheme of the OPEN*control* systems using the OPEN*Mill* technology



Retrofit kit

The OPEN*Mill* solution technology, characterized by a high configurability and modularity level, match different retrofit solutions to upgrade milling machines and machining centres. The modules allow the option to replace only the CNC or the complete control chain of the machine, from the HMI up to servo-motors. The two solutions for standard Retrofit, both include the OPEN*Mill* sotware and are:

Retrofit Kit 1 (suitable for analog or P&D motors and drives already installed on the machine):

- OPEN-S CNC with 12'' operator panel, keyboard and machine console or OPEN-M CNC with 15'' integrated operator panel with touch screen, keyboard and machine console
- Analog and feedback encoder interface bridge module for axis drives and spindle, with analog and digital I/O

Retrofit Kit 2 (complete solution):

- OPEN-S COMPACT CNC with 12'' operator panel, keyboard and machine console or OPEN-M CNC with OPEN*console* COMPACT 15" integrated operator panel with touch screen, keyboard and machine console with OPEN-M CNC
- Modular system of I/O OPEN*rio*
- Sigma V SD drives
- Brushless spindle and motor axes

Technical Specifications

CNC

	OPEN-S	OPEN-M	OPEN-XLi
Operator Panel	12” softkeys	15” touch screen	17” or 19” touch screen
Keyboard	Separate module	Integrated	Separate module
Machine Console	Separate module	Integrated	Separate module
Front USB port	NO	YES	
CPU	Atom® 1.8 GHz	Celeron® M 2 GHz	Intel® Core i5
Drive interfaces	Mechatrolink III, EtherCAT, P&D, Analog		
I/O interfaces	EtherCAT, CANopen		
Axes n°	8	32	64
n° parallel processes	2	4	24
n° blocks/sec	2620 (4 axes)	>5300 (5 axes)	>7000 (5 axes)
n° look ahead blocks	256	512	1024
Min. Interpolation time	2 mSec	0.5 mSec	0.25 mSec
Memory programs	Up to 8192 MB		
OPEN*Mill* Software			
OPEN-20	YES		
OPEN-30	NO	YES	
Conversational editor for milling cycles	YES		
Conversational editor to define milling profiles	YES		
Graphic display of the profile under machining	YES		
Graphic preview of the program during the selection	YES		

I/O modules

	OPEN*rio* V-200			
Fieldbus	CANopen			
Mounting	DIN rail mounting - modules connected via modular backplane			
I/O signals isolation	Optical for digital modules, galvanic for analog modules			
Digital modules	16 In	16 Out	8 In	8 In/Out
Current for each output	-	0.5A	-	1 A
Analog modules	2 In +2 Out		4 In	
Input/Output field	Configurable 10V, 1÷5V, 0÷10V, 20mA, 4÷20mA, 0÷20mA		-10÷10V	
Resolution	12 bit			

OPENrio SL		
Fieldbus	EtherCAT	
Assembling	DIN rail mounting - modules connected with side contacts	
Dimensions (W x H x D)	15 x 109 x 76.5 mm	
I/O signals isolation	Electrically isolated	
Digital modules	8SMPM021-1BF00	8SMPM022-1BF00
Number of I/O	8 Input	8 Output
Current for each output	-	0.5A (max 4A per module)
Low level input signal	0÷5 VDC	-

OPENrio SL				
High level input signal	15÷28.8 VDC		-	
Power modules	8SMPM022-1BD20		8SMPM022-1HB10	
Number of I/O	4 Output		4 Relay Output	
Current for each output	2A (max 4A per module)		3A 30 VDC / 230 VAC	
Analog modules	8SMPM031-1BB40	8SMPM031-1BB70	8SMPM031-1BD70	8SMPM032-1BB70
Number of I/O	2 Input		4 Input	2 Output
Input/Output field	0/4....20mA	±10VDC	±10VDC	
Resolution	12 bit		12 bit	
PWM Module	8SMPM022-1BB90			
Number of I/O	2 Output			
Current for each output	0.5A			
Switching frequency	Max 40 kHz			
Encoder Input Module	8SMPM050-1BA10			
Input voltage for signal "0"	Differential signal RS422			
Input voltage for signal "1"	Differential signal RS422			
Maximum input frequency	500 kHz			
Input resistance	120 Ω			

Drives and motors

Single-axis Drive					
Power (kW) per axes	3	5	6	7,5	11
Power (kW) per spindles	/	5,5/7,5	11/15	15/18,5	18,5/22
Width (mm)	50		75	150	
Integrated secuirty	STO, optional board with SS1, SS2 and SLS Safety				

Dual-axis Drive			
Power (kW) per axes is	1,5	2	3
Width (mm)	75	75	75
Integrated secuirty	STO		

Supply		
Power (KW)	15	22
Width (mm)	75	150
Supply	380 ÷ 480 Vac, 50 ÷ 60Hz	
Regenerative	YES	

Axis Motors								
Flange (mm)	90	130			180			
Standstill torque (Nm)	2,9	5,3	8,3	11,5	18,6	28,4	35	48
power (Kw)	0,5	0,8	1,3	1,8	2,9	4,4	5,5	7,5
n. nominal revolutions/max	3000 / 5000							
Transducer	20 bit absolute							
Brake	Optional							

Spindle Motors						
Flange (mm)	174		204		250	
Power (Kw)	4	5,5	7,5	11	15	18
n. nominal revolutions	1500					
N. max revolutions	10000				7000	

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