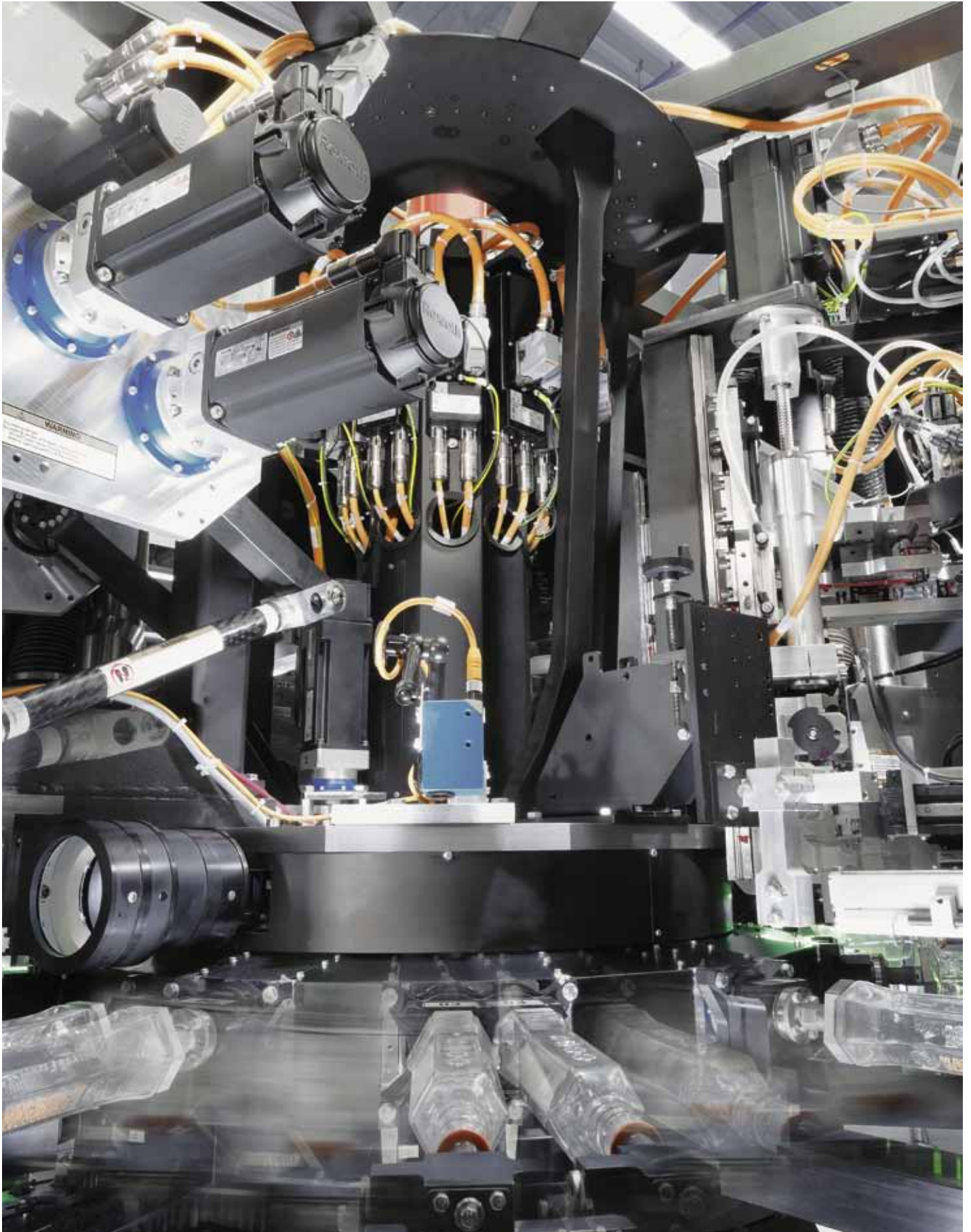


IndraDrive Mi – Intelligent, decentralized drive technology





Maximum flexibility in minimal space – The new generation of IndraDrive Mi

Consumer behavior is changing faster and faster. Producers are now required to bring new products into the market or modify their existing product offering in increasingly shorter intervals. Modular and scalable machines must stay abreast of this development. Intelligent drive systems are required, which impress above all through simple integration and maximum efficiency, in addition to their compact size. All this is offered by the new generation of IndraDrive Mi!

Modern production lines are often made up of standardized basic modules, which are combined and modified according to the customer's requirements. This type of modular philosophy requires electric drive technology that can be integrated flexibly in any decentralized machine concept and keeps the installation effort low for extensions and conversions.

With a pioneering status in modular, ultra-compact drive technology, IndraDrive Mi has for years now been working effectively in a wide range of applications that rely on maximum flexibility with minimum space requirements. In addition, we – as engineering partners for machine construction – not only look at the drive itself, but also always at the market requirements as a whole: in terms of safety, profitability and environmental aspects.

The new generation of IndraDrive Mi drives can adapt to individual conditions like almost no other decentralized drive system. New and further developed features such as integrated safety technology, Ethernet-based communication, communication uncoupling, integrated control functions and more mean IndraDrive Mi is predestined for use in all machines with a modular design that wish to carry out their production tasks not only well, but also a good deal better, more safely and more efficiently.



- ▲ **IndraDrive Mi –
The new generation of
decentralized drive
technology from Rexroth**
- ◀ **Compact, modular
printing machine for
printing products with
complex geometries**

Tried and tested values retained, intrinsic values improved

Compact and space-saving, efficient and economical: these values have always made IndraDrive Mi impressive in daily operation. The new generation is even more intelligent and thus more flexible, with the result that it can demonstrate its worth in all engineering respects. Additional safety functions and extended communication options, such as multi-protocol capability, await you along with even more advantages for your individual application.



Energy-efficient power supply

- ▶ Compatible and can be easily combined with the IndraDrive drive system
- ▶ Energy saving through the use of the common DC-bus, power regeneration, energy buffering and energy deployment for other drives
- ▶ Several drive chains can be operated with one power supply unit

Intelligent communication

- ▶ Supports all relevant Ethernet-based communication protocols
- ▶ Standardized hardware, software-based protocol selection
- ▶ Communication uncoupling for integration of sensors and actuators (I/O, pneumatics, hydraulics, 3rd party)

Flexible control functions

- ▶ Drive-integrated motion logic for special tasks within the drive chain
- ▶ Prefabricated, industry-specific technology functions for fast parameter setting
- ▶ Programming in accordance with IEC 61131-3

Visionary safety technology

- ▶ Drive-integrated safety technology for effective protection of people, machines and workpieces
- ▶ Certified to Cat 4 PL e in accordance with EN ISO 13849-1 and to SIL 3 in accordance with EN 62061
- ▶ No higher level control required
- ▶ Safety zones can be formed

Time-saving installation

- ▶ Reduction of the control cabinet size by up to 70%
- ▶ Up to 85% less wiring due to hybrid cable technology for power supply and communication
- ▶ Reduction in power required to cool the control cabinet
- ▶ Simple extension of the drive chain thanks to hybrid cable technology

Optimal design

- ▶ Easy to clean
- ▶ Protection category IP65

◀ **Multi-Ethernet uncoupling for integration of sensors and actuators**

▶ **New generation IndraDrive Mi with easy to clean housing design**



The system design – As simple as it is efficient

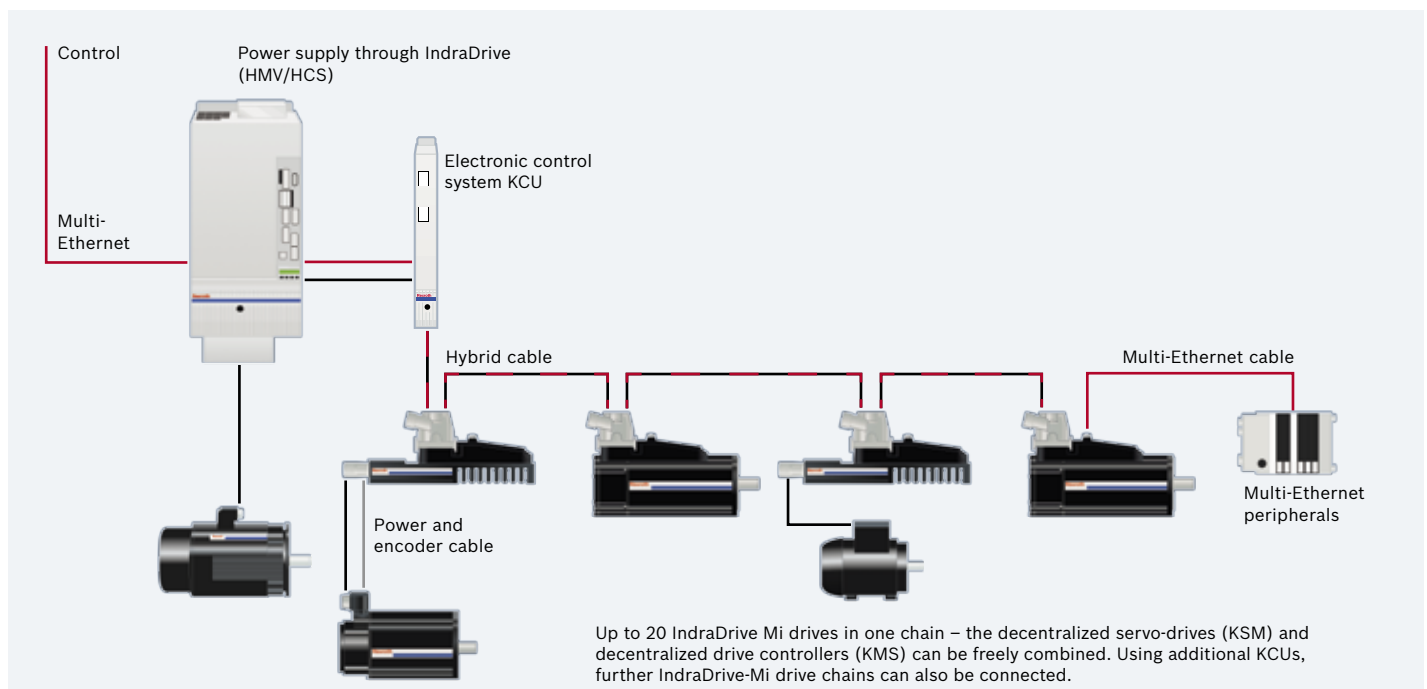
IndraDrive Mi's decentralized drive system design allows it to meet the extensive requirements of high economic efficiency. Up to 20 drives can be connected in succession in a chain via a hybrid cable. This allows for a significantly smaller control cabinet size, reduces the installation effort and, last but not least, reduces energy consumption for cooling to the necessary minimum.

IndraDrive Mi can be operated with just one electronic control system (KCU), which is positioned in the control cabinet next to a power supply unit. This provides the electric protection and the voltage and communication supply for a drive chain with up to 20 IndraDrive Mi units.

From the control electronics, the hybrid cable supplies the drives, which are connected directly in succession in a daisy chain. There is no need for distribution boxes.

The decentralized servo-drives (KSM) consist of a Rexroth servo-motor with integrated inverter. Cooling is provided via the surface of the motor housing.

If installation space is limited or if motors without integrated inverter electronics have to be used, the decentralized drive controller (KMS) is the first choice. The separate inverter electronics are fitted in the machine decentrally and connected to the motor.



The power supply – Valuable energy used intelligently

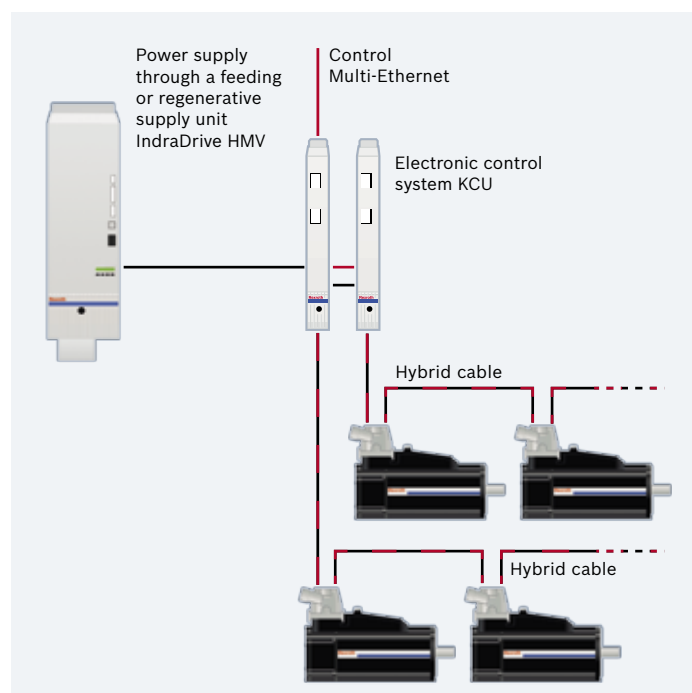
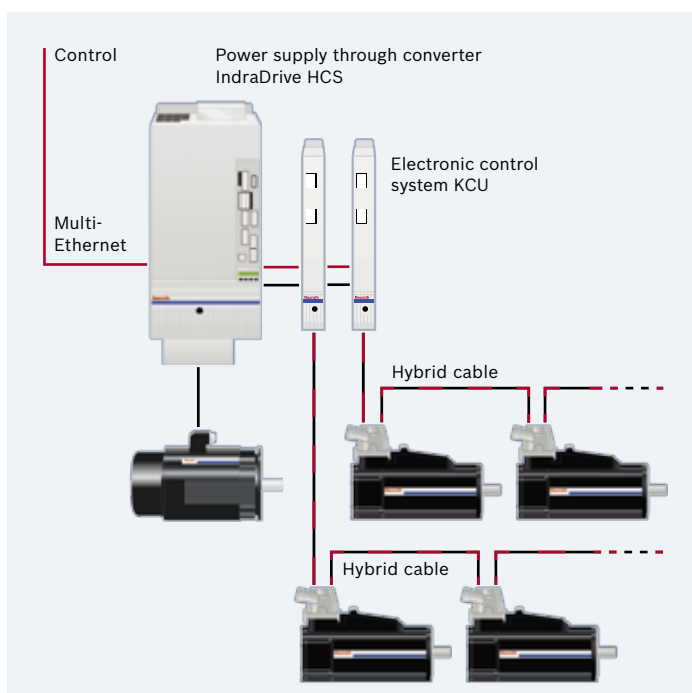
4EE
**ENERGY
EFFICIENCY**

Take a tried and tested drive system and make it even more intelligent, more energy-efficient and more environmentally acceptable. IndraDrive Mi not only stands for optimum power supply, which also opens up extensive possibilities for you, but also for maximum integration capacity in existing and newly developed machine concepts.

IndraDrive Mi can adapt easily to all modular general conditions. Thus, an existing converter (HCS) can be used for the power supply.

A DC bus coupling is provided in order to enable optimum energy exchange between the generating axes and the motor axes. The energy remains in the system!

The DC power supply can also be provided via modular power supply units (HMV). Here, feeding and regenerative variants with regulated DC-bus voltage can be used. In this case, it is possible to achieve intelligent supply concepts such as Smart-Energy-Mode. Vast saving potentials can be achieved through the regeneration of excess energy.



Communication – Built-in intelligence

Our mission is to significantly advance communication in automation and to design a wide range of applications in as user-friendly fashion as possible. Multi-protocol-capable hardware plus software significantly increases the flexibility and modularity of machines, and there are also seemingly fewer details, such as a single hybrid cable which combines power supply and communication intelligently.

sercos
the automation bus

EtherNet/IP

IndraDrive Mi's multi-protocol-capable communication hardware meets the higher openness and consistency requirements. The protocols of the Ethernet-based interfaces are selected by software. The following protocols are available to you:

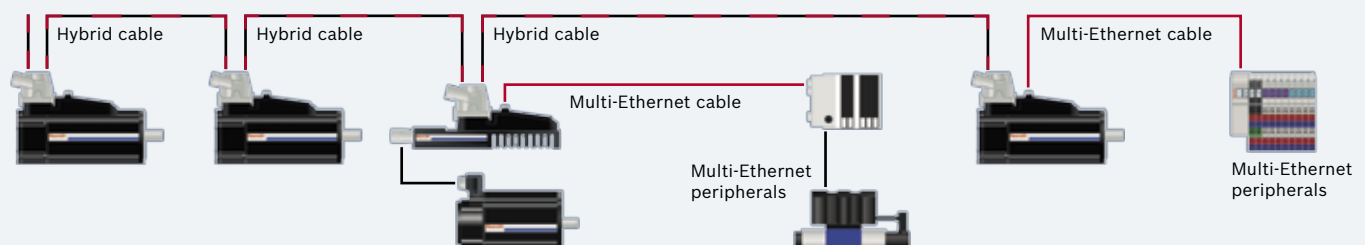
- ▶ sercos III
- ▶ PROFINET IO
- ▶ EtherNet/IP
- ▶ EtherCat

PROFI
NET

EtherCAT

With the help of the optional uncoupling of the control communication, you can combine I/O units or pneumatic and hydraulic actuators cost-effectively in one IndraDrive Mi drive chain.

Machine



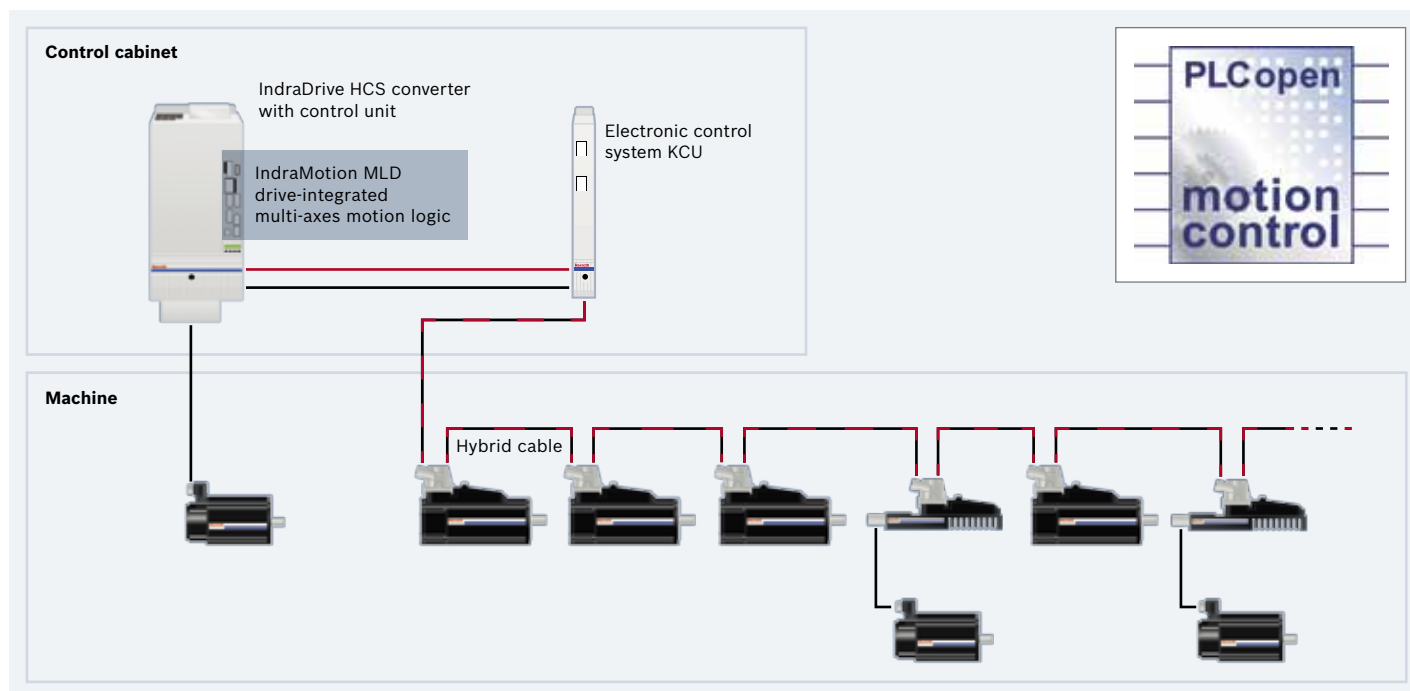
The control functions – More possibilities for your application

You can also design the control of your application flexibly according to your wishes. With IndraMotion MLD – the drive-integrated control from Rexroth – drive functions, motion control and process logic merge into a modern, open automation platform for modular machine concepts. This means control-independent applications can be implemented.

For applications with a limited number of axes, a sercos master drive can coordinate up to nine IndraDrive Mi drives and thus also resolve more complex motion tasks at drive level and without a higher level control.

Here, you can choose between or combine simple and quick parameter setting of ready-made, industry-specific technology functions and free programming – of course based on IEC 61131-3.

In order to relieve the higher level control, the system also offers the possibility of shifting individual drive tasks to individual drives.



The safety functions – Dynamics "under control"

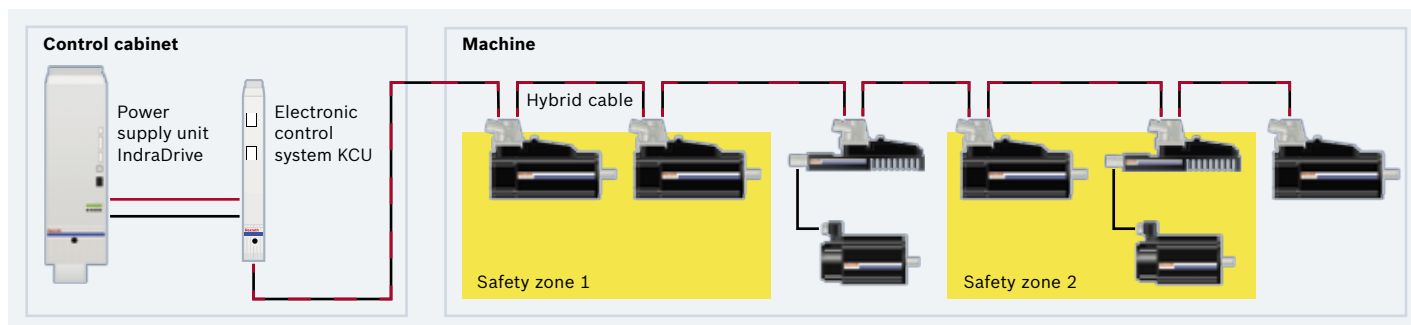
**SAFETY
ON
BOARD**

Whether for machine tools, printing or packaging machines, for assembly, handling or robotic applications: the protection of people against uncontrollable machine movements has absolute priority. IndraDrive redefines the state of technology, for it integrates safety directly into the drive. Thanks to extremely short response times, IndraDrive Mi shows what safety technology is really capable of today: if movement is monitored precisely where it is generated.



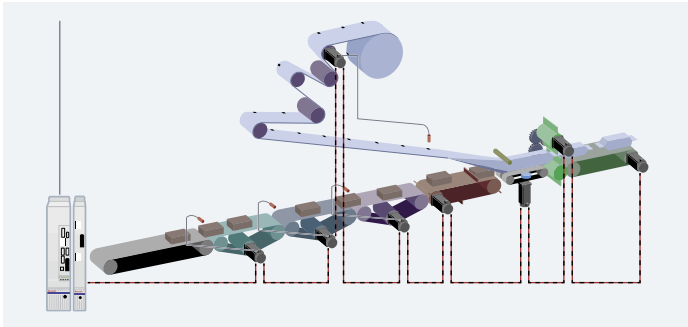
The STO (Safe Torque Off) safety function saves hardware and reduces the wiring effort. Appropriately equipped axes guarantee safety without detours via a higher level control. When the STO function is activated, the drive interrupts the torque and field-building current to the connected motor within a few milliseconds. This prevents, for example, undesired start-up of the motor at a standstill. The STO function on the IndraDrive Mi is certified to Cat 4 PL e in accordance with EN ISO 13849-1 and to SIL 3 in accordance with EN 62061.

Safety technology consistently supports the flexibility of the entire system. In this way, the torque disabling can be activated not only for all drives at the same time, but also for different safety zones each created with a selectable number of IndraDrive Mi drives. Thus, you can activate the STO function specifically for individual system modules, while other modules continue to run uninterrupted.



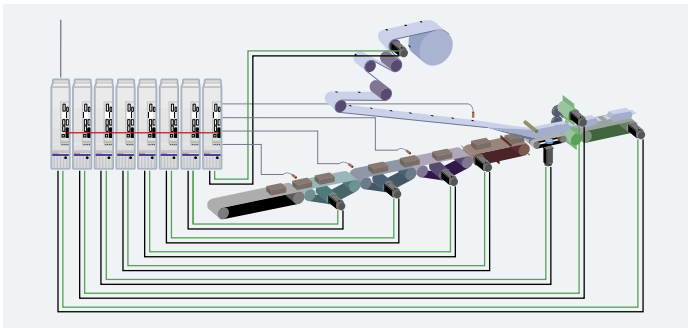
Installation – Simple and easily extendible

Thanks to the simple system design, IndraDrive Mi contributes to cost reduction not only in terms of the components, but also with regard to installation effort. There is less wiring to contend with, reduced control cabinet sizes and lower cooling requirements. Rexroth thinks along with you – and, in terms of extendibility, also a good deal ahead.



The use of existing converters in the control cabinet saves additional components – and offers you many advantages:

- ▶ Reduction of the control cabinet size by up to 70%
- ▶ Up to 85% less wiring due to hybrid cable technology for power supply and communication
- ▶ Reduction of the required cooling power in the control cabinet



Each drive has four digital, configurable inputs/outputs for the integration of I/O peripherals. In addition, you can also connect additional Ethernet actuators and peripheral devices directly to the drive. This saves you wiring the individual components through to the control cabinet and further reduces the installation costs.

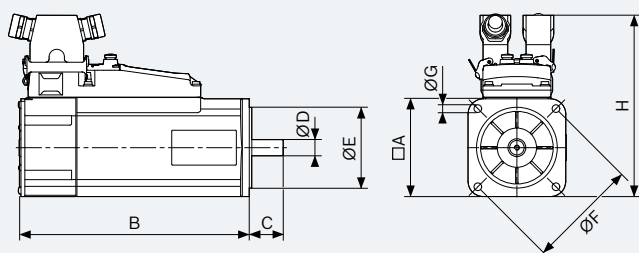


A system with 40 decentralized drives, for example, can be achieved with minimum control cabinet size for a power supply plus two KCUs.



Decentralized servo-drive KSM – Technical description

The compact power and control electronics of the decentralized servo-drive KSM use the housing surface of a MSK servo-motor as the cooling element. This reduces the overall installation volume by over 50% in comparison with classic servo-drive solutions and by up to 30% compared with other integrated solutions.



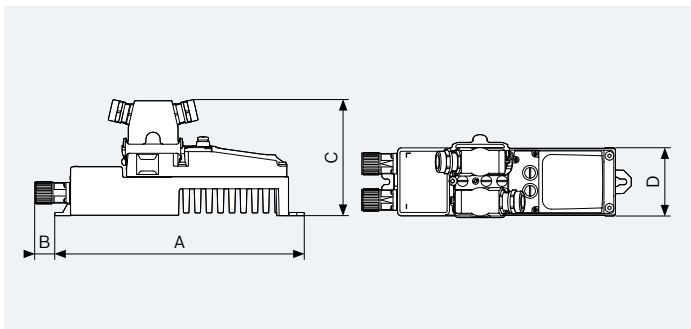
Features and options

- ▶ Encoder
 - Optical encoder, singleturn/multiturn-absolute
 - Capacitive encoder, singleturn/multiturn-absolute
- ▶ With/without holding brake
- ▶ Smooth shaft/shaft with keyway
- ▶ Multi-Ethernet control communication
- ▶ With/without safety function (STO)
- ▶ With/without Multi-Ethernet communication uncoupling
- ▶ 4 digital inputs and outputs, 2 of which can be used as quick inputs for probes
- ▶ Firmware option: integrated motion logic in accordance with IEC 61131-3

Decentralized servo-drive			Maximum speed	Continuous torque at standstill	Maximum torque	Continuous current at standstill	Maximum current	Moment of inertia	Dimensions								Mass
			n_{Max}	$M_{0.60K}$	M_{Max}	I_0	I_{Max}	J_R	A	B	C	Ø D	Ø E	Ø F	Ø G	H	m
			[min ⁻¹]	[Nm]	[Nm]	[A]	[A]	[kgm ²]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
KSM02.1B -041 C-42	5500	2.2	94	1.4	6.8	0.00017	82	252	30	14	50	95	6,6	194	5.6/5.9		
KSM02.1B -061 C-35	4300	6	25	3.3	14.9	0.00087	115	271	40	19	95	130	9	219	9.5/10.1		
KSM02.1B -061 C-61	6000	5.5	18	5	14.9	0.00087	115	271	40	19	95	130	9	219	9.5/10.1		
KSM02.1B -071 C-24	3400	10.5	35	4.4	17.7	0.0173	140	307	58	32	130	165	11	247	14.1/15.1		
KSM02.1B -071 C-35	4700	10	28	5.7	17.7	0.0173	140	307	58	32	130	165	11	247	14.1/15.1		
KSM02.1B -076 C-35	4700	8.7	29	5.7	17.7	0.0043	140	290	50	24	130	165	11	247	14.1/15.1		

Decentralized drive electronics KMS – Technical description

The decentralized drive controller KMS allows for integration of a wide range of motors in an IndraDrive Mi drive chain. It is intended for jobs where smaller servo-motors from Rexroth or 3rd party motors have to be integrated.



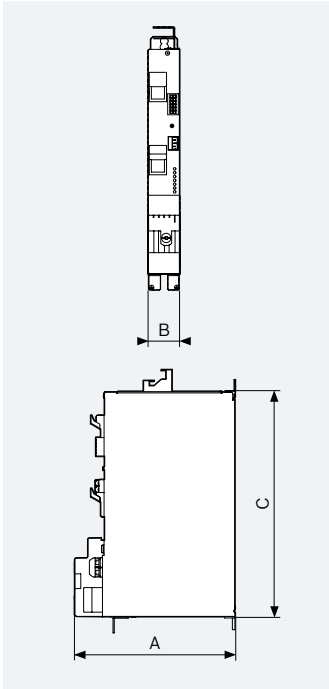
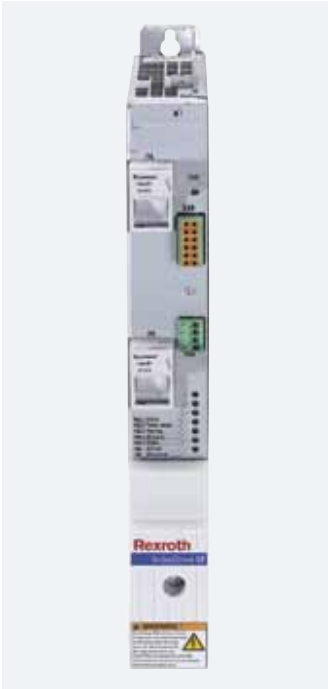
Features and options

- ▶ With/without Hiperface-encoder
- ▶ Multi-Ethernet control communication
- ▶ With/without safety function (STO)
- ▶ With/without Multi-Ethernet communication uncoupling
- ▶ 4 digital inputs and outputs, 2 of which can be used as quick inputs for probes
- ▶ Firmware option: integrated motion logic in accordance with IEC 61131-3

Decentralized drive controller	Continuous current at standstill	Maximum current	Dimensions				Mass
	I_D	I_{Max}	A	B	C	D	m
	[A]	[A]	[mm]	[mm]	[mm]	[mm]	[kg]
KMS02.1B-A018	6	18	316	24	147	85	2.5

Electronic control system KCU – Technical description

The compact electronic control system KCU provides all required connections to the IndraDrive Mi drive chain at a common connection point and supplies electrical protection to it. In addition, it transmits status and diagnostic messages between the drives and the power supply unit.



Features and options

- ▶ Multi-Ethernet command communication
 - Input
 - Output
- ▶ DC-bus fuse
- ▶ Control voltage supply
- ▶ Exchange of status and diagnostic messages
- ▶ Forwarding of power supply from the DC bus
- ▶ Forwarding of Multi-Ethernet communication

Control electronics	Nominal voltage	Nominal current	Dimension			Mass
	$U_{LN,nom}$	I_{LN}	A	B	C	m
	[VDC]	[A]	[mm]	[mm]	[mm]	[kg]
KCU02.1N	540-750	25	352	50	252	3.8

Components and accessories

Experience the almost unlimited possibilities of Rexroth automation systems and benefit from all control and drive components for technically and economically optimum engineering. IndraDrive Mi offers a wide range of possibilities in terms of components and accessories for your individual application. This is just a glimpse. For more information, go to: www.boschrexroth.com

A significant advantage of the IndraDrive Mi is the much reduced installation effort – a single cable is sufficient for the power supply and for communication via Multi-Ethernet.

Hybrid cable

You receive the hybrid cable ready-assembled. The coded connectors guarantee connection with the correct polarity.

End connector

Every drive chain with one or more IndraDrive Mi drives is terminated with an end connector.

Interface cable

Use the ready-assembled cable to connect sensors to the digital I/O of IndraDrive Mi.

Various cables are available for integrating other multi-Ethernet-capable components in the IndraDrive Mi drive chain via communication uncoupling.

The safety technology is connected with a cable at the start of a safety technology zone.

All other subscribers are simply fitted with a safety zone connector.



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