

Rexroth IndraDrive Mi Electronic Control System KCU

R911322419 Edition 02

Instruction Manual



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	Electronic Control System KCU		
of Doournontotion			

Type of Documentation Instruction Manual

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	DOK-INDRV*-KCU01*UL***-IB01-EN-P	2007/10	First edition
	DOK-INDRV*-KCU01*UL***-IB02-EN-P	2009/06	Changes in comparison to previous edition: Multi- lingual information chap- ter; EMC Measures; Ac- cessories; Service and Support; Environmental Protection and Disposal; technical data updated

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	Jeżeli brak jest dokumentów w Państwa języku, proszę się skontaktować z lokalnym partnerem handlowym Rexroth.

Český Před uvedením produktů do provozu pročtěte kompletní dokumentaci a bezpečnostní pokyny dodávané s produktem a zajistěte, že jim rozumíte a budete se jimi řídit.

Nejsou-li k dispozici podklady ve Vaší řeči, obraťte se na příslušného prodejce produktů Rexroth.

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Amennyiben a csomagban nem talál az Ön nyelvén írt dokumentumokat, vegye fel a kapcsolatot az illetékes Rexroth képviselővel.

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În cazul în care documentele nu sunt în limba dumneavoastră maternă, contactați furnizorul dumneavoastră competent pentru Rexroth.

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1 Important Notes

1.1 Safety Instructions

1.1.1 General Information

- Do not attempt to install and operate the electric components of the drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.
- If the supplied documents contain some information you do not understand, it is absolutely necessary that you ask Rexroth for explanation before you start working at or with the components.
- If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.
- Only qualified persons may work with components of the drive and control system or within its proximity.

In terms of this Instruction Manual, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the drive and control system, as well as with the hazards this implies, and who possess the qualifications their work requires. To comply with these qualifications, it is necessary, among other things,

- to be trained, instructed or authorized to switch electric circuits and components safely on and off, to ground them and to mark them,
- to be trained or instructed to maintain and use adequate safety equipment,
- to attend a course of instruction in first aid.
- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.
- If the components take the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software components or alter source codes.
- Do not mount damaged or faulty components or use them in operation.
- Only use accessories and spare parts approved by Rexroth.
- Follow the safety regulations and requirements of the country in which the electric components of the drive and control system are operated.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.



Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

Observe the safety instructions!

1.1.2 Protection Against Contact with Electrical Parts and Housings

		This section concerns components of the drive and control system with voltages of more than 50 volts .		
	Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.			
	High ele serious	ectrical voltage! Danger to life, risk of injury by electric shock or injury!		
WARNING	• Onl ele	ly qualified persons are allowed to operate, maintain and/or repair the ctric components of the drive and control system.		
	 Fol pov 	low the general installation and safety regulations when working on ver installations.		
	 Bef per con 	ore switching on, the equipment grounding conductor must have been manently connected to all electric components in accordance with the nection diagram.		
	 Eve equ point 	en for brief measurements or tests, operation is only allowed if the ipment grounding conductor has been permanently connected to the nts of the components provided for this purpose.		
	 Bef you er s 	ore accessing electrical parts with voltage potentials higher than 50 V, I must disconnect electric components from the mains or from the pow- supply unit. Secure the electric component from reconnection.		
	• Wit	h electric components, observe the following aspects:		
	Alw to c tric: equ	vays wait 30 minutes after switching off power to allow live capacitors discharge before accessing an electric component. Measure the elecal voltage of live parts before beginning to work to make sure that the uipment is safe to touch.		
	 Inst on. 	tall the covers and guards provided for this purpose before switching		
	 Nevis tu 	ver touch electrical connection points of the components while power urned on.		
	 Do ere 	not remove or plug in connectors when the component has been pow- d.		
	 As use 	a basic principle, residual-current-operated circuit-breakers cannot be ed for electric drives to prevent direct contact.		
	 Sec as con 	cure built-in devices from penetrating foreign objects and water, as well from direct contact, by providing an external housing, for example a trol cabinet.		

	High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!
WARNING	 Before switching on and before commissioning, ground or connect the components of the drive and control system to the equipment grounding conductor at the grounding points.
	 Connect the equipment grounding conductor of the components of the drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
	 Establish an equipment grounding connection with a copper wire of a cross section of at least 10 mm² (8 AWG) or additionally run a second equipment grounding conductor of the same cross section as the original equipment grounding conductor.

1.1.3 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

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Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A risk assessment must be prepared for the installation or machine, with its specific conditions, in which the components of the drive and control system are installed. As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
 - Safety fences
 - Safety guards
 - Protective coverings
 - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stop switches in the immediate reach of the operator. Before commissioning, verify that the emergency stop equipment works. Do not operate the machine if the emergency stop switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of an emergency stop circuit or use a safe starting lockout.
- Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
 - mechanically securing the vertical axes,
 - adding an external braking/arrester/clamping mechanism or
 - ensuring sufficient equilibration of the vertical axes.
- The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!
- Disconnect electrical power to the components of the drive and control system using the master switch and secure them from reconnection for:
 - Maintenance and repair work
 - Cleaning of equipment
 - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near electric/electronic components of the drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, before initial commissioning of the drive and control system, for possible malfunctions when operating such highfrequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

1.1.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric components!

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
 - Areas in which components of the drive and control systems are mounted, commissioned and operated.
 - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs greatly so that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

1.1.5 Protection Against Contact with Hot Parts



WARNING

Hot surfaces of components of the drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require up to 140 minutes! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait 15 minutes to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications and according to the respective safety regulations, the manufacturer of the machine or installation has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

1.1.6 Protection During Handling and Mounting



Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of slipping.

1.2 Appropriate Use

This product may only be used for the applications mentioned in the reference documentations (see index entry "Reference documentations") and under the described application, ambient and operating conditions.

This product is exclusively intended for use in machines and systems in an industrial environment. This is to be understood as applications according to IEC 60204-1 "Safety of machinery, Electric equipment of machines" and NFPA 79 "Electrical Standard for Industrial Machinery".

Identification

2 Identification

R

2.1 Type Code

The following figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

Abbrev.			5 6 7 8 0 0
		3 4 5 6 7 8 9 0 1 2 3 4 N T * 0 0 5 N N 0	
	<u> </u>	SE - 025 - NN - S	- N N - N VV
Product			
KCU = KCU			
Line			
1	1		
Design			
2	=2		
Configuration option			
Fixed configuration	= N		
Maatar communication /	Innut)		
SERCOS 2 (LVVL)	= 3E		
Master communication (Output)		
SERCOS 2 (RS422)	= SI	*	
DC Protection			
Nominal current: 25 A		= 025	
Safety option			
Without safety option		= NN	
Control panel			
Standard control panel		=5	
Other design			
Nono			- NN
		• • • • • • • • • • • • • • • • • • • •	
Firmware			
Without Firmware			= NW
			DT000053v01_en.FH11

Fig.2-1: Type Code

Identification



Fig.2-2: Type Plate

2.3 Scope of Supply

Standard		Optional
KCU		Basic accessory HAS01.1-050 ¹⁾
Instruction Manual (in the English lan- guage)		Connection accessory HAS02.1-015 for strain relief and shield connection ¹⁾
		Mounting accessory HAS03 ¹⁾
1) <i>Fig.2-3:</i>	For more information on H. "Rexroth IndraDrive Addition Scope of Supply KCU	AS accessory: See Project Planning Manual onal Components and Accessories"

Ratings and Dimensions

3 Ratings and Dimensions

UL Ratings and Dimensions

Description	Symbol	Unit	KCU01.2N-SE-SE*-025-NN-S-NN-NW
Listing according to UL standard (UL)			UL 508 C
Listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-05
UL files (UL)			E 134201
Degree of protection according to IEC60529			IP20
Mass (weight)	m	kg	3,80
Device height (UL) ¹⁾	Н	mm	352
Device depth (UL) ²⁾	Т	mm	206
Device width (UL) ³⁾	В	mm	50
Minimum distance on the top of the device $^{4)}$	d _{top}	mm	80
Minimum distance on the bottom of the device $^{5)}$	d _{bot}	mm	110
Horizontal spacing on the device ⁶⁾	d _{hor}	mm	0
Data control voltage - Input			
Rated control voltage input (UL)7)	U _{N3}	V	24 ± 20 %
Rated power consumption control voltage input at U_{N3} (UL) ⁸⁾	P _{N3}	W	675
Data control voltage - Output			
Rated control voltage output (UL)	U _{out}	V	42,0
Rated control power output (UL)	P _{out}	W	588,0
Data power section - Input			
Short circuit current rating (UL)	SCCR	A rms	42000
Rated input voltage, power (UL) 9)	$U_{\text{LN}_{nenn}}$	V	DC 540750
Rated input current (UL)	I _{LN}	A	25,0
Data power section - Output			
Output voltage (UL)	U _{out}	V	DC 540750
Output current (UL)	l _{out}	Α	25,0

1) 2) 3)	Housing dimension; see also related dimensional drawing
4) 5) 6)	See fig. "Air Intake and Air Outlet at Device"
7)	Observe supply voltage for motor holding brakes
8)	HMS, HMD, HCS plus motor holding brake and control section; HCS01 including control section
9)	DC bus L+, L-; mains input L1, L2, L3
Fig.3-1:	KCU - UL Ratings and Dimensions

Ratings and Dimensions



Reference Documentations

4 Reference Documentations

4.1 Drive Systems, System Components

Title	Kind of documentation	Document typecode ¹⁾	Part number
Rexroth IndraDrive		DOK-INDRV*	R911
Drive System	Project Planning Manual	SYSTEM****-PRxx-EN-P	309636
Mi Drive Systems	Project Planning Manual	KCU+KSM****-PRxx-EN-P	320924
Supply Units and Power Sections	Project Planning Manual	HMV-S-D+HCS-PRxx-EN-P	318790
Drive Controllers Control Sections	Project Planning Manual	CSH******-PRxx-EN-P	295012
Additional Components and Accesso- ries	Project Planning Manual	ADDCOMP****-PRxx-EN-P	306140
C Drive Controllers HCS02.1, HCS03.1	Operating Instructions	FU*******-IBxx-EN-P	314905
1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: PR01 is the first edition of a Project Plar			

Fig.4-1:

ning Manual) Documentations – Overview

4.2 Motors

Title	Kind of documentation	Document typecode ¹⁾	Part number
Rexroth IndraDyn …		DOK-MOTOR*	R911
A Series Asynchronous Motors	Project Planning Manual	MAD/MAF****-PRxx-EN-P	295781
H Frameless Synchronous Spindle Motors	Project Planning Manual	MBS-H*****-PRxx-EN-P	297895
L Synchronous Linear Motors	Project Planning Manual	MLF******-PRxx-EN-P	293635
S Synchronous Motors	Project Planning Manual	MSK******-PRxx-EN-P	296289
T Synchronous Torque Motors	Project Planning Manual	MBT******-PRxx-EN-P	298798
1) In the documen the documentat	t typecodes, "xx" is a wild card for th ion (example: PR01 is the first edition	e current edition of n of a Project Plan-

ning Manual)

Documentations - Overview

Fig.4-2:

4.3 Cables

Title	Kind of documentation	Document typecode ¹⁾ DOK	Part number R911
Rexroth Connection Cables	Selection Data	CONNEC-CABLE*STAND-AUxx- EN-P	282688
1) In the documer the documenta tation "Selectio	nt typecodes, "xx" is a wild card for th tion (example: AU03 is the third edition n Data") In <i>- Overview</i>	e current edition of on of the documen-

Reference Documentations

4.4 Firmware

Title	Kind of documentation	Document typecode ¹⁾	Part number
Rexroth IndraDrive		DOK-INDRV*	R911
Firmware for Drive Controllers	Functional Description	MP*-05VRS**-FKxx-EN-P	320182
Firmware for Drive Controllers	Functional Description	MP*-04VRS**-FKxx-EN-P	315485
Firmware for Drive Controllers	Functional Description	MP*-03VRS**-FKxx-EN-P	308329
Firmware for Drive Controllers	Functional Description	MP*-02VRS**-FKxx-EN-P	299223
Firmware for Drive Controllers	Parameter Description	GEN-**VRS**-PAxx-EN-P	297317
Firmware for Drive Controllers	Troubleshooting Guide	GEN-**VRS**-WAxx-EN-P	297319
Integrated Safety Technology	Functional and Application Description	SI*-**VRS**-FKxx-EN-P	297838
Rexroth IndraMotion MLD	Application Manual	MLD-**VRS**-AWxx-EN-P	306084
Rexroth IndraMotion MLD Library	Library Description	MLD-SYSLIB*-FKxx-EN-P	309224
1) In the documen	t typecodes, "xx" is a wild card for th	e current edition of

In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: PA02 is the second edition of a Parameter Description)

Fig.4-4:

Documentations – Overview

5 Instructions for Use

5.1 General

R B	The electronic control system KCU01 may only be used in con- junction with HMV01, HMV02, HCS02 or HCS03.
R	Short circuit current rating (SCCR)
	Suitable for use on a circuit capable of delivering not more than 42000 rms symmetrical amperes.

5.2 Connection Points

5.2.1 Wiring Diagrams

Wiring Diagram With HMV as Supply Unit und KSM as Power Section



Wiring Diagram With HCS02 as Supply Unit und KSM as Power Section



Wiring Diagram With HCS03 as Supply Unit und KSM as Power Section



- RKH
 - Hybrid cable Encoder cable
- RKG RKL Motor cable
- X3.2 Connection of hybrid cable at first KSM
- Fig.5-3: Drive System Rexroth IndraDrive Mi With HCS03

5.2.2 Connection Diagram



Fig.5-4:

Connection Diagram KCU

5.2.3 Position of Connection Points



5.2.4 Terminal Block, 24 - 0V (24V Supply)

PELV¹⁾ for 24V power supply unit

For the 24V supply of the devices of the Rexroth IndraDrive Mi range, use a power supply unit or a control-power transformer with protection by PELV according to IEC 60204-1 (section 6.4).

In the scope of CSA/UL, the data of the control-power transformer are limited to:

- Max. output voltage: 42.4 V_{peak} or 30 V_{ac}
- Max. output power: 10000 VA

Technical Data of the Connection Point

View	Identifica- tion	Function	
	+24V	Power supply	
		Connection to neighboring dev cessory HAS01.1	ices with contact bars from ac-
0V O O 0V	0V	Reference potential for power	supply
DA000175v01_nn.FH11		Connection to neighboring dev cessory HAS01.1	ices with contact bars from ac-
	•		
Screw connection	Unit	Min.	Max.
M6 thread at device (terminal block)			
Tightening torque	Nm	5,5	6,5
Power consumption	W	P _{N3} (see technical data)	
Voltage load capacity	V	U _{N3} (see technical data)	
Polarity reversal protection		Within the allowed voltage ran	ge by internal protective diode
Current carrying capacity "looping through" from 24V to 24V, 0V to 0V			
(contact bars in scope of supply of accessory HA	S01)		
With contact bars -072	Α	220	

Fig.5-6:

Function, Pin Assignment, Properties





5.2.5 Terminal Block L+, L- (DC Bus Connection)



Lethal electric shock caused by live parts with more than 50 V!

Before working on live parts: De-energize the installation and secure the power switch against unintentional or unauthorized re-energization.

Wait at least **30 minutes** after switching off the supply voltages to allow discharging. To shorten the waiting time until voltage has fallen below 50 V, you can use a discharging device (see chapter "Appendix").

Check whether voltages have fallen below 50 V before touching live parts!

Technical Data of the Connection Point

View	Identifica- tion	Function
	L+	Connection points for connecting DC bus connections
L+	L-	
L-		
DA000176v01_nn.FH11		

Screw connection	Unit	Min.	Max.	
M6 thread at device (terminal block)				
Tightening torque	Nm	5,5	6,5	
Short circuit protection		Via fusing elements connected mains connection	t in the incoming circuit to the	
Overload protection		Via fusing elements connected mains connection	t in the incoming circuit to the	
Current carrying capacity "looping through" from	L+ to L+, L-1	to L-		
(contact bars in scope of supply of accessory HAS01)				
With contact bars -072	А		220	
Additionally with contact bars -042 and end piece	А		245	





5.3	Installation	
5.3.1	General Info	rmation on How to Install the Drive Controller
		Lethal electric shock caused by live parts with more than 50 V!
		Before working on live parts: De-energize the installation and secure the power switch against unintentional or unauthorized re-energization.
	WARNING	Wait at least 30 minutes after switching off the supply voltages to allow discharging. To shorten the waiting time until voltage has fallen below 50 V, you can use a discharging device (see chapter "Appendix").
		Check whether voltages have fallen below 50 V before touching live parts!
		Damage can be caused to the drive controller or circuit boards if electrostatic charging present in people and/or tools is discharged across them. For this reason, please observe the following information:
		Electrostatic charges can cause damage to electronic components and interfere with their operational safety!
	CAUTION	Exposed conductive parts coming into contact with components and circuit boards must be discharged by means of grounding. Otherwise errors may occur when controlling motors and moving elements.
		Such exposed conductive parts include:
		The copper bit when soldering
		• The human body (ground connection by touching a conductive, grounded object)
		 Parts and tools (place them on a conductive support)
		Endangered components may only be stored or dispatched in conductive pack- aging.
		Rexroth connection diagrams are only to be used for producing in- stallation circuit diagrams! The machine manufacturer's installation circuit diagrams must be used for wiring the installation!
		• Lay signal lines separately from the load resistance lines because of the occurrence of interference.
		• Transmit analog signals (e.g. command values, actual values) via shiel- ded lines.
		• Do not connect mains, DC bus or power cores to low voltages or allow them to come into contact with these.
		 When carrying out a high voltage test or an applied-overvoltage withstand test on the machine's electrical equipment, disconnect all connections to the devices. This protects the electronic components (allowed in accord- ance with EN 60204-1). During their routine testing, Rexroth drive com- ponents are tested for high voltage and insulation in accordance with EN 50178.
		Risk of damage to the drive controller by connecting and disconnecting live connections!
		Do not connect and disconnect live connections.

5.3.2 Touch Guard at Devices

Cutouts



Lethal electric shock caused by live parts with more than 50 V!

- The appropriate touch guard must be mounted for each device following connection work.
- Never mount a damaged touch guard.
- Immediately replace a damaged touch guard by an undamaged touch guard.
- Keep the cutouts at the touch guard as small as possible. Only remove the cutouts if necessary.



Fig.5-10: Cutouts at the Touch Guard

- If the DC bus and the control voltage are connected by means of contact bars, only cutout A may be removed from the touch guard.
- If the DC bus and the control voltage are connected by means of cables (e.g. in the case of multiple-line arrangement), the cutouts A, B and C may be removed from the touch guard.
- At the first and last device in a line of interconnected devices, you must **not remove any** cutout at the outer side of the touch guard.

Mounting





Max. 2.8 Nm

The touch guard is fixed to the device with screws.

Tightening Torque

5.4 Diagnoses



Fig.5-12: LEDs at KCU

LED	Color	/ status	Significance	Measures
H52.1	0	Off	E-Stop not activated	Deactivate E-Stop, if necessary
E-Stop	¥	Red	E-Stop active (/E_Stop)	Activate E-Stop, if necessary (see connection point X50)
H52.2 Power Supply	¥	Green	Supply unit without error, regular status	None
	*	Red	Supply unit signals error (/Bb_V)	 Check power supply, see also "F2086 Error supply module" Check whether terminal connector RHS is missing at X3.1 or X3.2 at last KSM of a string of drives
H52.3 Warning	¥	Green	Supply unit without warning (/Warn), regular status	None
	¥	Red	Supply unit signals warning	Check supply unit, see also "E2086 Pre- warning supply module overload"
H52.4	0	Off	DC bus voltage (L+; L-) too low	Switch power on at supply unit
DC Bus In	¥	Green	DC bus voltage (L+; L-) without error (Ud), regular status	None
H52.5 Drives	¥	Green	No error at module bus, regular status	None
	*	Red	Module bus error (/Bb_A)	 Check module bus wiring Check control voltage supply of the devices; see also "F2087 Module group communication error"
		Red/ green flashing	Drive system carries out error reaction (Bb_A)	Bring device at module bus to readiness for operation; see also diagnostic message "E2810 Drive system not ready for opera- tion"
H53 42V Out	¥	Green	Control voltage for KSM at output X53 okay	None
	*	Red	Control voltage for KSM at output X53 faul- ty	Overload at output: • Check voltage at X53 • Reduce load • Remove short circuit
H54 DC Bus Out	0	Off	DC bus (L+, L-) not ready for power output	Voltage at X54 is only monitored, if DC bus voltage at input (L+, L-) without error (see LED H52.4)
	¥	Green	DC bus voltage (L+; L-) at output X54 okay (U > 50 V)	None
	¥	Red	DC bus voltage (L+; L-) at output X54 not okay	Check fuses F4, F5 and replace them, if necessary

Fig.5-13: LED Displays KCU

Replacement of Fuses F4 and F5



Lethal electric shock caused by live parts with more than 50 V!

Before working on live parts: De-energize the installation and secure the power switch against unintentional or unauthorized re-energization.

Wait at least **30 minutes** after switching off the supply voltages to allow discharging. To shorten the waiting time until voltage has fallen below 50 V, you can use a discharging device (see chapter "Appendix").

Check whether voltages have fallen below 50 V before touching live parts!



Fig.5-14: Fuses F4 and F5

Replacement of fuses F4 and F5

- 1. Switch off power voltage to drive system.
- 2. Wait at least 30 minutes to allow DC bus capacitors to discharge or use discharging device.
- 3. Open fuse carriers F4 and F5.
- 4. Remove fuses F4 and F5.

Note: Always replace both fuses, even if only one of them is defective. The intact fuse probably was already damaged

- 5. Insert new WP-30A14Fa fuses by BUSSMANN.
- 6. Close fuse carriers F4 and F5.

6 EMC Measures for Design and Installation

6.1 Rules for Design of Installations With Drive Controllers in Compliance With EMC

	The following rules are the basics for designing and installing drives in compli- ance with EMC.			
Mains Filter	Correctly use a mains filter recommended by Rexroth for radio interference suppression in the supply feeder of the drive system.			
Control Cabinet Grounding	Connect all metal parts of the cabinet with one another over the largest possible surface area to establish a good electrical connection. This, too, applies to the mounting of the mains filter. If required, use serrated washers which cut through the paint surface. Connect the cabinet door to the control cabinet using the shortest possible grounding straps.			
Line Routing	Avoid coupling routes between lines with high potential of noise and noise-free lines; therefore, signal, mains and motor lines and power cables have to be routed separately from another. Minimum distance: 10 cm. Provide separating sheets between power and signal lines. Ground separating sheets several times.			
	The lines with high potential of noise include:			
	 Lines at the mains connection (incl. synchronization connection) 			
	Lines at the motor connection			
	Lines at the DC bus connection			
	Generally, interference injections are reduced by routing cables close to groun- ded sheet steel plates. For this reason, cables and wires should not be routed freely in the cabinet, but close to the cabinet housing or mounting panels. Sep- arate the incoming and outgoing cables of the radio interference suppression filter.			
Interference Suppression Elements	Provide the following components in the control cabinet with interference suppression combinations:			
	Contactors			
	Relays			
	Solenoid valves			
	 Electromechanical operating hours counters 			
	Connect these combinations directly at each coil.			
Twisted Wires	Twist unshielded wires belonging to the same circuit (feeder and return cable) or keep the surface between feeder and return cable as small as possible. Wires that are not used have to be grounded at both ends.			
Lines of Measuring Systems	Lines of measuring systems must be shielded. Connect the shield to ground at both ends and over the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.			
Digital Signal Lines	Ground the shields of digital signal lines at both ends (transmitter and receiver) over the largest possible surface area and with low impedance. In the case of bad ground connection between transmitter and receiver, additionally route a bonding conductor (min. 10 mm ²). Braided shields are better than foil shields.			
Analog Signal Lines	Ground the shields of analog signal lines at one end (transmitter or receiver) over the largest possible surface area and with low impedance. This avoids low-frequency interference current (in the mains frequency range) on the shield.			

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EMC Me	asures for Design and	Installation	
Co	nnection of Mains Choke	Keep cor possible a	nection lines of the mains choke at the drive controller as short as and twist them.
Installati	on of Motor Power Cable	 Use duct 	shielded motor power cables or run motor power cables in a shielded
		• Use	the shortest possible motor power cables
		 Groussurfa 	und shield of motor power cable at both ends over the largest possible ace area to establish a good electrical connection
		 Run 	motor lines in shielded form inside the control cabinet
		• Dor	ot use any steel-shielded lines
		• The com	shield of the motor power cable mustn't be interrupted by mounted ponents, such as output chokes, sine filters or motor filters
6.2	EMC-Optin	nal Insta	Illation in Facility and Control Cabinet
6.2.1	General Info	rmation	
		For EMC- (mains co is recomr	optimal installation, a spatial separation of the interference-free area onnection) and the interference-susceptible area (drive components) nended, as shown in the figures below.
		R.	For EMC-optimal installation in the control cabinet, use a separate control cabinet panel for the drive components.
6.2.2	Division Into	Areas (Z	ones)
		Exemplar Mounting page 33.	y arrangements in the control cabinet: See section Control Cabinet According to Interference Areas - Exemplary Arrangements,
		We distin	guish three areas:
		1. Inter	ference-free area of control cabinet (area A):
		This	includes:
		•	Supply feeder, input terminals, fuse, main switch, mains side of mains filter for drives and corresponding connecting lines
		•	Control voltage or auxiliary voltage connection with power supply unit, fuse and other parts unless connection is run via the mains filter of the AC drives
		•	All components that are not electrically connected with the drive system
		2. Inter	ference-susceptible area (area B):
		•	Mains connections between drive system and mains filter for drives, mains contactor
		•	Interface lines of drive controller
		3. Stro	ngly interference-susceptible area (area C):
		•	Motor power cables including single cores
		Never rur that there and that t possible o	a lines of one of these areas in parallel with lines of another area so isn't any unwanted interference injection from one area to the other he filter is jumpered with regard to high frequency. Use the shortest connecting lines.
		Recommond and the c	endation for complex systems: Install drive components in one cabinet ontrol units in a second, separate cabinet.

Badly grounded control cabinet doors act as antennas. Therefore, connect the control cabinet doors to the cabinet on top, in the middle and on the bottom via short equipment grounding conductors with a cross section of at least 6 mm² or, even better, via grounding straps with the same cross section. Make sure connection points have good contact.

6.2.3 Control Cabinet Mounting According to Interference Areas - Exemplary Arrangements

Supply Units With Regeneration	Do not operate any additional loads at the main	Do not operate any additional loads at the mains filter!
		Do not operate any other loads at the connection from the mains filter output to the mains connection of the supply unit.
		For motor blowers and power supply units, for example, use sepa- rate mains filters.

HMVxx.xR Supply Unit



E1...E5

Equipment grounding conductor of the components

K1	External mains contactor for supply units without integrated mains con- tactor
ML	Motor blower
NT	Power supply unit
Q1, Q2, Q3	Fusing
Т	Transformer
Z1, Z2	Shield connection points for cables
Fig.6-1:	HMVxx.xR – EMC Areas in the Control Cabinet





E1...E5

Mains choke (optional)

Equipment grounding conductor of the components

K1	External mains contactor for supply units and converters without inte
ML	Motor blower
NT	Power supply unit
Q2	Fusing
Т	Transformer
Z1, Z2	Shield connection points for cables
*	Not allowed at HNF mains filter
Fig.6-2:	HMVxx.xE; HCSxx.xE – EMC Areas in the Control Cabinet

6.2.4 Design and Installation in Area A - Interference-Free Area of Control Cabinet

Arrangement of the Components in Comply with a distance of at least 200 mm (distance d1 in the figure): the Control Cabinet Between components and electrical elements (switches, pushbuttons, fuses, terminal connectors) in the interference-free area A and the components in the two other areas B and C Comply with a distance of at least 400 mm (distance d4 in the figure): Between magnetic components (such as transformers, mains chokes and DC bus chokes that are directly connected to the power connections of the drive system) and the interference-free components and lines between mains and filter including the mains filter in area A If these distances are not kept, the magnetic leakage fields are injected to the interference-free components and lines connected to the mains and the limit values at the mains connection are exceeded in spite of the installed filter. Cable Routing of the Interference-Comply with a distance of at least 200 mm (distance d1 and d3 in the figure): Free Lines to the Mains Connection Between supply feeder or lines between filter and exit point from the control cabinet in area A and the lines in area B and C If this is impossible, there are two alternatives: 1. Install lines in shielded form and connect the shield at several points (at least at the beginning and at the end of the line) to the mounting plate or the control cabinet housing over a large surface area. 2 Separate lines from the other interference-susceptible lines in areas B and C by means of a grounded distance plate vertically attached to the mounting plate. Install the shortest possible lines within the control cabinet and install them directly on the grounded metal surface of the mounting plate or of the control cabinet housing. Mains supply lines from areas B and C must not be connected to the mains without a filter. R In case you do not observe the information on cable routing given in this section, the effect of the mains filter is totally or partly neutralized. This will cause the noise level of the interference emission to be higher within the range of 150 kHz to 40 MHz and the limit values at the connection points of the machine or installation will thereby be exceeded. Routing and Connecting a Neutral If a neutral conductor is used together with a three-phase connection, it must Conductor (N) not be installed unfiltered in zones B and C, in order to keep interference off the mains. Motor Blower at Mains Filter Single-phase or three-phase supply lines of motor blowers, that are usually routed in parallel with motor power cables or interference-susceptible lines, must be filtered:

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EMC Measures for Design and I	nstallation
	• In drive systems with regenerative supply units , via a separate single- phase (NFE type) or three-phase filter (HNF type) near the mains con- nection of the control cabinet
	 In drive systems with only infeeding supply units, via the available three- phase filter of the drive system
	When switching power off, make sure the blower is not switched off.
Loads at Mains Filter of Drive Sys- tem	Only operate allowed loads at the mains filter of the drive system!
	At the three-phase filter for the power connection of regenerative supply units, it is only allowed to operate the following loads:
	 HMV supply unit with mains choke and, if necessary, mains contactor
	Do not operate any motor blowers, power supply units etc. at the mains filter of the drive system.
Shielding Mains Supply Lines in Control Cabinet	If there is a high degree of interference injection to the mains supply line within the control cabinet, although you have observed the above instructions (to be found out by EMC measurement according to standard), proceed as follows:
	Only use shielded lines in area A
	• Connect shields to the mounting plate at the beginning and the end of the line by means of clips
	The same procedure may be required for long cables of more than 2 m between the point of power supply connection of the control cabinet and the filter within the control cabinet.
Mains Filters for AC Drives	Ideally, mount the mains filter on the parting line between area A and B. Make sure the ground connection between filter housing and housing of the drive controllers has good electrically conductive properties.
	If single-phase loads are connected on the load side of the filter, their current may be a maximum of 10% of the three-phase operating current. A highly imbalanced load of the filter would deteriorate its interference suppression capacity.
	If the mains voltage is more than 480 V, connect the filter to the output side of the transformer and not to the supply side of the transformer.
Grounding	In the case of bad ground connections in the installation, the distance between the lines to the grounding points E1, E2 in area A and the other grounding points of the drive system should be at least $d4 = 400$ mm, in order to minimize interference injection from ground and ground cables to the power input lines.
	See also 6.2.2 Division Into Areas (Zones), page 32.
Point of Connection for Equipment Grounding Conductor at Machine, Installation, Control Cabinet	The equipment grounding conductor of the power cable of the machine, instal- lation or control cabinet has to be permanently connected at point PE and have a cross section of at least 10 mm² or to be complemented by a second equip- ment grounding conductor via separate terminal connectors (according to EN50178/ 1997, section 5.3.2.1). If the cross section of the outer conductor is bigger, the cross section of the equipment grounding conductor must be ac- cordingly bigger.
6.2.5 Design and la Control Cabi	nstallation in Area B - Interference-Susceptible Area of net

Arranging Components and Lines

Modules, components and lines in area B should be placed at a distance of at least **d1 = 200 mm** from modules and lines in area A.

Alternative: Shield modules, components and lines in area B by distance plates mounted vertically on the mounting plate from modules and lines in area A or use shielded lines.

Only connect power supply units for auxiliary or control voltage connections in the drive system to the mains via a mains filter. See 6.2.2 Division Into Areas (Zones), page 32.

Install the shortest possible lines between drive controller and filter.

Control Voltage or Auxiliary Voltage Connection

Only in exceptional cases should you connect power supply unit and fusing for the control voltage connection to phase and neutral conductor. In this case, mount and install these components in area A far away from the areas B and C of the drive system. For details see section 6.2.4 Design and Installation in Area A - Interference-Free Area of Control Cabinet, page 37.

Run the connection between control voltage connection of the drive system and power supply unit used through area B over the shortest distance.

Line Routing Run the lines along grounded metal surfaces, in order to minimize radiation of interference fields to area A (transmitting antenna effect).

6.2.6 Design and Installation in Area C - Strongly Interference-Susceptible Area of Control Cabinet

Area C mainly concerns the motor power cables, especially at the connection point at the drive controller.

Influence of the Motor Power Cable The longer the motor power cable, the greater its leakage capacitance. To comply with a certain EMC limit value, the allowed leakage capacitance of the mains filter is limited. For the calculation of the leakage capacitance, see the documentation on the drive system of the drive controller used.

- Run the shortest possible motor power cables.
 - Only use shielded motor power cables by Rexroth.

Routing the Motor Power Cables and Motor Encoder Cables surfaces, both inside the control cabinet and outside of it, in order to minimize radiation of interference fields. If possible, route the motor power cables and motor encoder cables in metal-grounded cable ducts.

Route the motor power cables and motor encoder cables

 with a distance of at least d5 = 100 mm to interference-free lines, as well as to signal cables and signal lines

(alternatively separated by a grounded distance plate)

in separate cable ducts, if possible

Routing the Motor Power Cables For and Mains Connection Lines DO

For converters (drive controllers with individual mains connection), route motor power cables and (unfiltered) mains connection lines **in parallel for a maximum distance of 300 mm**. After that distance, route motor power cables and power supply cables in opposite directions and preferably in separate **cable ducts**.

Ideally, the outlet of the motor power cables at the control cabinet should be provided in a distance of at least d3 = 200 mm from the (filtered) power supply cable.



IndraDrive C and Cs - Routing the Motor Power Cables

Fig.6-5:

Routing of Cables for IndraDrive C and Cs



IndraDrive M - Routing the Motor Power Cables

Fig.6-8: Routing of Cables for IndraDrive M

6.3 Ground Connections

Housing and Mounting Plate	By means of appropriate ground connections, it is possible to avoid the emis- sion of interference, because interference is discharged to ground on the shortest possible way.
	Ground connections of the metal housings of EMC-critical components (such as filters, devices of the drive system, connection points of the cable shields, devices with microprocessor and switching power supply units) have to be well contacted over a large surface area. This also applies to all screw connections between mounting plate and control cabinet wall and to the mounting of a ground bus to the mounting plate.
	The best solution is to use a zinc-coated mounting plate. Compared to a lac- quered plate, the connections in this case have a good long-time stability.
Connection Elements	For lacquered mounting plates, always use screw connections with tooth lock washers and zinc-coated, tinned screws as connection elements. At the con- nection points, remove the lacquer so that there is safe electrical contact over a large surface area. You achieve contact over a large surface area by means of bare connection surfaces or several connection screws. For screw connec- tions, you can establish the contact to lacquered surfaces by using tooth lock washers.
Metal Surfaces	Always use connection elements (screws, nuts, plain washers) with good elec- troconductive surface.
	Bare zinc-coated or tinned metal surfaces have good electroconductive prop - erties.

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afh.co	EMC Me	easures for Design and I	nstallation
5480 • www.cm	Ground N	Wires and Shield Connec- tions	Anodize ces have For com but the s ence cu Always
) 426-	61	Installing Si	ground
heumatic • Electrical • Mechanical • (800		Line Routing	For mea respecti Ro mir (Zc is t the If s orc Gra Ava Ru pol pip ins
Motion Control • Hydraulic • PI		Shielding	 Ave the tran flex Connect direct por Connect normally to groun Connect and in s end of th compen
ydradyne - l			section You abs grounde In the ca return ca
-lodyne/H	6.5	General Me lays, Conta	asures
Courtesy of CMA/I			If, in con as chok propriat ● By

Anodized, yellow chromatized, black gunmetal finish or lacquered metal surfaces have bad electroconductive properties.

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For connecting ground wires and shield connections, it is not the cross section but the size of contact surface that is important, as the high-frequency interference currents mainly flow on the surface of the conductor.

Always connect cable shields, especially shields of the motor power cables, to ground potential over a large surface area.

nal Lines and Signal Cables

tric Drives

Controls

For measures to prevent interference, see the Project Planning Manuals of the respective device. In addition, we recommend the following measures:

- Route signal and control lines separately from the power cables with a minimum distance of d5 = 100 mm (see 6.2.2 Division Into Areas (Zones), page 32) or with a grounded separating sheet. The optimum way is to route them in separate cable ducts. If possible, lead signal lines into the control cabinet at one point only.
- If signal lines are crossing power cables, route them in an angle of 90° in order to avoid interference injection.
- Ground spare cables, that are not used and have been connected, at least • at both ends so that they do not have any antenna effect.
- Avoid unnecessary line lengths. .
- Run cables as close as possible to grounded metal surfaces (reference • potential). The ideal solution are closed, grounded cable ducts or metal pipes which, however, is only obligatory for high requirements (sensitive instrument leads).
- Avoid suspended lines or lines routed along synthetic carriers, because they are functioning like reception antennas (noise immunity) and like transmitting antennas (emission of interference). Exceptional cases are flexible cable tracks over short distances of a maximum of 5 m.
- Connect the cable shield immediately at the devices in the shortest and most direct possible way and over the largest possible surface area.

Connect the shield of **analog signal lines** at one end over a large surface area, normally in the control cabinet at the analog device. Make sure the connection to ground/housing is short and over a large surface area.

Connect the shield of digital signal lines at both ends over a large surface area and in short form. In the case of potential differences between beginning and end of the line, run an additional bonding conductor in parallel. This prevents compensating current from flowing via the shield. The guide value for the cross section is 10 mm².

You absolutely have to equip separable connections with connectors with grounded metal housing.

In the case of non-shielded lines belonging to the same circuit, twist feeder and return cable.

asures of Radio Interference Suppression for Retors, Switches, Chokes and Inductive Loads

If, in conjunction with electronic devices and components, inductive loads, such as chokes, contactors, relays are switched by contacts or semiconductors, appropriate interference suppression has to be provided for them:

By arranging free-wheeling diodes in the case of d.c. operation

 In the case of a.c. operation, by arranging usual RC interference suppression elements depending on the contactor type, immediately at the inductance

Only the interference suppression element arranged immediately at the inductance does serve this purpose. Otherwise, the emitted noise level is too high which can affect the function of the electronic system and of the drive.

If possible, mechanical switches and contacts should only be realized as snap contacts. Contact pressure and contact material must be suited for the corresponding switching currents.

Slow-action contacts should be replaced by snap switches or by solid-state switches, because slow-action contacts strongly bounce and are in an undefined switching status for a long time which emits electromagnetic waves in the case of inductive loads. These waves are an especially critical aspect in the case of manometric or temperature switches.

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	and Controls	

Accessories

Accessories Overview 7

7.1

Overview	Content and usage	
	Accessory HAS01 contains:	
	a) Screws to fix the device in the control cabinet	
	b) Adhesive labels with notes on safety in the English and French languages. Place the adhesive labels clearly visibly at the device or in the immediate vicinity of the device, if the adhesive labels existing at the device are hidden by neighboring devices.	
	c) Contact bars for connecting	
	• the DC bus	
	the control voltage supply	
HAS03	• For high-performance devices, there are additional elements which increase the current carrying capacity of the DC bus connections and which are screwed to the contact bars:	
HAS02 DG000330v01_nn.fh11		
	d) Joint bar to connect the equipment grounding connections of neighboring devices	
	The accessory HAS02 is screwed to the bottom of the device and used to	
	• connect the motor cable shield to the device	
	provide strain relief of the motor cable	
	The accessory HAS03 (control cabinet adapter) is used to compen- sate different mounting depths of devices mounted to a common mounting surface.	
	• Maximum allowed tightening torque: 6 Nm	
	 Mechanical stability of a device with HAS03 requires the rigid connection via DC bus contact bars to a neighboring device without HAS03. 	



Accessories – Overview

Accessories

7.2 Information on Accessory HAS02



The supplied product insert shows how the parts of the accessory are arranged.

Fig.7-2:

Product Insert

Mounting Example Accessory HAS02.1-002



- 1 Screw in thread at bottom of device
- 2 Fixing device
- 3 Shielding plate
- 4 Shield of motor cable
- 5 Clip

Fig. 7-3: Strain Relief and Shield Connection of Motor Cable

How to mount the accessory

- 1. Unscrew bottom mounting screw of device.
- 2. Put fixing device to bottom of device and screw down mounting screw of device again.
- 3. Screw supplied screw in thread at bottom of device.
- 4. Screw shielding plate to fixing device according to desired cable routing of motor cable. (The figure illustrates cable routing with 45°.)
- 5. According to diameter of motor cable, fix motor cable at corresponding point of shielding plate with a clip. Make sure that shield of motor cable has good contact with shielding plate.

The mounting of the accessory is similar for all devices. Exception: With HAS02.1-010 (at HMS02.1N-W0028 / 54), the fixing device is screwed to the equipment grounding conductor connections of the device.

Service and Support

Service and Support 8

Our service helpdesk at out headquarters in Lohr, Germany, will assist you with all kinds of enquiries. Out of helpdesk hours please contact our German service department directly.

	Helpdesk	Service Hotline Germany	Service Hotline Worldwide
Time ¹⁾	Mo-Fr 7:00 am - 6:00 pm CET	Mo-Fr 6:00 pm - 7:00 am CET Sa-Su 0:00 am - 12:00 pm CET	Outwith Germany please con- tact our sales/service office in your area first.
Phone	+49 (0) 9352 40 50 60	+49 (0) 171 333 88 26 or +49 (0) 172 660 04 06	For hotline numbers refer to the sales office addresses on the Internet.
Fax	+49 (0) 9352 40 49 41	-	
e-mail	service.svc@boschrexroth.de	-	
Internet	 http://www.boschrexroth.com You will also find additional notes regarding service, maintenance (e.g. delivery addresses) and training. 		
	1) Central European Time (CET)		(CET)
	Preparing Information For g	uick and efficient help please h	ave the following information re

For quick and efficient help please have the following information ready:

- detailed description of the fault and the circumstances •
- information on the type plate of the affected products, especially type codes and serial numbers
- your phone, fax numbers and e-mail address so we can contact you in • case of questions.

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	and Controls	

Environmental Protection and Disposal

Environmental Protection and Disposal 9

Environmental Protection 9.1

Production Processes	The products are made with energy- and resource-optimized production pro- cesses which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment- friendly alternatives.		
Prohibited Substances	We guarantee that out products include no substances according to the chem- icals-ban-decree. We furthermore declare that our products are free of mercury, asbestos, PCB and chlorinated hydrocarbons.		
No Release of Hazardous Substan- ces	Our products do not contain any hazardous substances which may be released in the case of appropriate use. Normally, our products will not have any negativ influences on the environment.		
Significant Components	Basically, out products contain the following components:		
	Electronic devices • Steel • Aluminum • Copper • Synthetic materials • Electronic components and modules	Motors • Steel • Aluminum • Copper • Brass • Magnetic materials • Electronic components and modules	
9.2 Disposal			

Return of Products Our products can be returned to our premises free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt. Furthermore, the products returned for disposal must not contain any undue foreign material or foreign components.

Send the products "free domicile" to the following address:

Bosch Rexroth AG **Electric Drives and Controls** Buergermeister-Dr.-Nebel-Strasse 2 97816 Lohr am Main, Germany

Packaging The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem.

> For ecological reasons, please refrain from returning the empty packages to US.

Recycling Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual modules.

> Metals contained in electric and electronic modules can also be recycled by means of special separation processes. The synthetic materials remaining after these processes can be thermally recycled.

> If the products contain batteries or accumulators, these have to be removed before recycling and disposed of.

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	and Controls	

Appendix

10 Appendix

10.1 Discharging of Capacitors

10.1.1 Discharging of DC Bus Capacitors

In the drive system Rexroth IndraDrive, capacitors are used in the DC bus as energy stores. In drive controllers and particularly in supply units, such capacitors have already been integrated.

Energy stores maintain their energy even when the supply voltage has been cut off and have to be discharged before somebody gets in contact with them.

Discharging devices have been integrated in the components of the drive system Rexroth IndraDrive; within the indicated discharging time, these devices discharge the voltage below the allowed 50 V.

If additional capacitors (such as DC bus capacitor units) are connected, these capacitors, too, have to be discharged before somebody gets in contact with them.

Due to the operating principle, the discharging time is the longer

- the bigger the energy store (the capacitance value)
- the higher the voltage to which the energy store has been charged
- the greater the resistance for discharging the capacitors

Components of the drive system Rexroth IndraDrive have been dimensioned in such a way that after the supply voltage was cut off, the voltage value falls below 50 V within a discharging time of a maximum of 30 minutes.

To shorten the waiting time until voltage has fallen below 50 V, you can take the following measures:

- When using HMV01 supply units (exception: HMV01.1R-W0120):
 Activate the function "ZKS" (ZKS = DC bus short circuit)
 - Activate the function ZRS (ZRS DC bus short (
- Use the discharging device described below

10.1.2 Discharging Device

Operating Principle

A contactor is installed to switch a resistor to the terminals L+ and L- of the DC bus connection to discharge the capacitors. The contactor is activated via a control input which is supplied with appropriate control voltage.



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	The • • • • • • • • • • • • •	 individual components have to be sufficiently dimensioned: Value of the discharging resistor: 1000 ohm and at least 1000 W The discharging resistor and the contactor contact have to withstand the loads of practical operation (for example in the case of frequent use of the discharging device of the occurring continuous power). The contactor contact has to withstand the occurring direct voltage of a minimum of 1000 V. The contactor contact has to withstand the occurring discharge current according to the resistance value that is used, i.e. 1 A with 1000 ohm. thal electric shock caused by live parts with more than 50 V! fore working on live parts: De-energize the installation and secure the power itch against unintentional or unauthorized re-energization.
	cha Ch	arging. eck whether voltages have fallen below 50 V before touching live parts!
Activation	Ris Du hea ser Ho 1 2 Ob 1. 2.	 sk of damage by intense heat! ring the discharging process, the discharging resistor generates intense at. Therefore, place the discharging resistor as far as possible from heat-isitive components. w to install the discharging device Preferably install discharging device before switching on supply voltage for the first time. If you install discharging device after having switched on supply voltage for the first time, wait 30 minutes to allow discharging. Check whether voltage has fallen below 50 V before touching live parts! Place discharging resistor as far as possible from heat-sensitive components. serve the following order for activating the discharging device: De-energize installation and secure power switch against unintentional or unauthorized re-energization. Activate discharging device.

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