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Instruction Manual



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Purpose of Documentation This documentation provides information on the installation and operation of the described products, by persons trained and qualified to work with electrical installations.

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D Deutsch	USA English	F Français
<p>▲ WARNUNG Lebensgefahr bei Nichtbeachtung der nachstehenden Sicherheitshinweise!</p> <p>Nehmen Sie die Produkte erst dann in Betrieb, nachdem Sie die mit dem Produkt gelieferten Unterlagen und Sicherheitshinweise vollständig durchgelesen, verstanden und beachtet haben.</p> <p>Sollten Ihnen keine Unterlagen in Ihrer Landessprache vorliegen, wenden Sie sich an Ihren zuständigen Rexroth-Vertriebspartner.</p> <p>Nur qualifiziertes Personal darf an Antriebskomponenten arbeiten.</p> <p>Nähere Erläuterungen zu den Sicherheitshinweisen entnehmen Sie Kapitel 1 dieser Dokumentation.</p>	<p>▲ WARNING Danger to life in case of non-compliance with the below-mentioned safety instructions!</p> <p>Do not attempt to install or put these products into operation until you have completely read, understood and observed the documents supplied with the product.</p> <p>If no documents in your language were supplied, please consult your Rexroth sales partner.</p> <p>Only qualified persons may work with drive components.</p> <p>For detailed explanations on the safety instructions, see chapter 1 of this documentation.</p>	<p>▲ AVERTISSEMENT Danger de mort en cas de non-respect des consignes de sécurité figurant ci-après!</p> <p>Ne mettez les produits en service qu'après avoir lu complètement et après avoir compris et respecté les documents et les consignes de sécurité fournis avec le produit.</p> <p>Si vous ne disposez pas de la documentation dans votre langue, merci de consulter votre partenaire Rexroth.</p> <p>Uniquement du personnel qualifié est autorisé de travailler sur les composants d'entraînement.</p> <p>Vous trouverez des explications plus détaillées relatives aux consignes de sécurité au chapitre 1 de la présente documentation.</p>
<p>▲ WARNUNG Hohe elektrische Spannung! Lebensgefahr durch elektrischen Schlag!</p> <p>Betreiben Sie Antriebskomponenten nur mit fest installiertem Schutzleiter.</p> <p>Schalten Sie vor Zugriff auf Antriebskomponenten die Spannungsversorgung frei.</p> <p>Beachten Sie die Entladezeiten von Kondensatoren.</p>	<p>▲ WARNING High electrical voltage! Danger to life by electric shock!</p> <p>Only operate drive components with a permanently installed equipment grounding conductor.</p> <p>Disconnect the power supply before accessing drive components.</p> <p>Observe the discharge times of the capacitors.</p>	<p>▲ AVERTISSEMENT Tensions électriques élevées! Danger de mort par électrocution!</p> <p>N'exploitez les composants d'entraînement que si un conducteur de protection est installé de manière permanente.</p> <p>Avant d'intervenir sur les composants d'entraînement, coupez toujours la tension d'alimentation.</p> <p>Tenez compte des délais de décharge de condensateurs.</p>
<p>▲ WARNUNG Gefahrbringende Bewegungen! Lebensgefahr!</p> <p>Halten Sie sich nicht im Bewegungsbereich von Maschinen und Maschinenteilen auf.</p> <p>Verhindern Sie den unbeabsichtigten Zutritt für Personen.</p> <p>Bringen Sie vor dem Zugriff oder Zutritt in den Gefahrenbereich die Antriebe sicher zum Stillstand.</p>	<p>▲ WARNING Dangerous movements! Danger to life!</p> <p>Keep free and clear of the ranges of motion of machines and moving machine parts.</p> <p>Prevent personnel from accidentally entering the range of motion of machines.</p> <p>Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.</p>	<p>▲ AVERTISSEMENT Mouvements entraînant une situation dangereuse! Danger de mort!</p> <p>Ne séjournes pas dans la zone de mouvement de machines et de composants de machines.</p> <p>Évitez tout accès accidentel de personnes.</p> <p>Avant toute intervention ou accès dans la zone de danger, assurez-vous de l'arrêt préalable de tous les entraînements.</p>
<p>▲ WARNUNG Elektromagnetische / magnetische Felder! Gesundheitsgefahr für Personen mit Herzschrittmachern, metallischen Implantaten oder Hörgeräten!</p> <p>Zutritt zu Bereichen, in denen Antriebskomponenten montiert und betrieben werden, ist für o.g Personen untersagt bzw. nur nach Rücksprache mit einem Arzt erlaubt.</p>	<p>▲ WARNING Electromagnetic / magnetic fields! Health hazard for persons with heart pacemakers, metal implants or hearing aids!</p> <p>The above-mentioned persons are not allowed to enter areas in which drive components are mounted and operated, or rather are only allowed to do this after they consulted a doctor.</p>	<p>▲ AVERTISSEMENT Champs électromagnétiques / magnétiques! Risque de santé pour les porteurs de stimulateurs cardiaques, d'implants métalliques et d'appareils auditifs!</p> <p>L'accès aux zones où sont montés et exploités les composants d'entraînement est interdit aux personnes susmentionnées ou bien ne leur est autorisé qu'après consultation d'un médecin.</p>
<p>▲ VORSICHT Heiße Oberflächen (> 60 °C)! Verbrennungsgefahr!</p> <p>Vermeiden Sie das Berühren von metallischen Oberflächen (z. B. Kühlkörpern). Abkühlzeit der Antriebskomponenten einhalten (mind. 15 Minuten).</p>	<p>▲ CAUTION Hot surfaces (> 60 °C)! Risk of burns!</p> <p>Do not touch metallic surfaces (e.g. heat sinks). Comply with the time required for the drive components to cool down (at least 15 minutes).</p>	<p>▲ ATTENTION Surfaces chaudes (> 60 °C)! Risque de brûlure!</p> <p>Évitez de toucher des surfaces métalliques (p. ex. dissipateurs thermiques). Respectez le délai de refroidissement des composants d'entraînement (au moins 15 minutes).</p>

D Deutsch	USA English	F Français
<p>⚠ VORSICHT Unsachgemäße Handhabung bei Transport und Montage! Verletzungsgefahr!</p> <p>Verwenden Sie geeignete Montage- und Transporteinrichtungen.</p> <p>Benutzen Sie geeignetes Werkzeug und persönliche Schutzausrüstung.</p>	<p>⚠ CAUTION Improper handling during transport and mounting! Risk of injury!</p> <p>Use suitable equipment for mounting and transport.</p> <p>Use suitable tools and personal protective equipment.</p>	<p>⚠ ATTENTION Manipulation incorrecte lors du transport et du montage! Risque de blessure!</p> <p>Utilisez des dispositifs de montage et de transport adéquats.</p> <p>Utilisez des outils appropriés et votre équipement de protection personnel.</p>
<p>⚠ VORSICHT Unsachgemäße Handhabung von Batterien! Verletzungsgefahr!</p> <p>Versuchen Sie nicht, leere Batterien zu reaktivieren oder aufzuladen (Explosions- und Ätzungsgefahr).</p> <p>Zerlegen oder beschädigen Sie keine Batterien. Werfen Sie Batterien nicht ins Feuer.</p>	<p>⚠ CAUTION Improper handling of batteries! Risk of injury!</p> <p>Do not attempt to reactivate or recharge low batteries (risk of explosion and cauterization).</p> <p>Do not dismantle or damage batteries. Do not throw batteries into open flames.</p>	<p>⚠ ATTENTION Manipulation incorrecte de piles! Risque de blessure!</p> <p>N'essayez pas de réactiver des piles vides ou de les charger (risque d'explosion et de brûlure par acide).</p> <p>Ne désassemblez ni endommagez des piles. Ne jetez pas des piles dans le feu.</p>

E Español	I Italiano
<p>⚠ ADVERTENCIA ¡Peligro de muerte en caso de no observar las siguientes indicaciones de seguridad!</p> <p>Los productos no se pueden poner en servicio hasta después de haber leído por completo, comprendido y tenido en cuenta la documentación y las advertencias de seguridad que se incluyen en la entrega.</p> <p>Si no dispusiera de documentación en el idioma de su país, dirijase a su distribuidor competente de Rexroth.</p> <p>Solo el personal debidamente cualificado puede trabajar en componentes de accionamiento.</p> <p>Encontrará más detalles sobre las indicaciones de seguridad en el capítulo 1 de esta documentación.</p>	<p>⚠ AVVERTENZA Pericolo di morte in caso di inosservanza delle seguenti indicazioni di sicurezza!</p> <p>Mettere in funzione i prodotti solo dopo aver letto, compreso e osservato per intero la documentazione e le indicazioni di sicurezza fornite con il prodotto.</p> <p>Se non dovesse essere presente la documentazione nella vostra lingua, siete pregati di rivolgervi al rivenditore Rexroth competente.</p> <p>Solo personale qualificato può eseguire lavori sui componenti di azionamento.</p> <p>Per ulteriori spiegazioni riguardanti le indicazioni di sicurezza consultare il capitolo 1 di questa documentazione.</p>
<p>⚠ ADVERTENCIA ¡Alta tensión eléctrica! ¡Peligro de muerte por descarga eléctrica!</p> <p>Active sólo los componentes de accionamiento con el conductor protector firmemente instalado.</p> <p>Desconecte la alimentación eléctrica antes de manipular los componentes de accionamiento.</p> <p>Tenga en cuenta los tiempos de descarga de los condensadores.</p>	<p>⚠ AVVERTENZA Alta tensione elettrica! Pericolo di morte in seguito a scosse elettriche!</p> <p>Mettere in esercizio i componenti di azionamento solo con conduttore di messa a terra ben installato.</p> <p>Staccare l'alimentazione prima di intervenire sui componenti di azionamento.</p> <p>Osservare i tempi di scarica del condensatore.</p>
<p>⚠ ADVERTENCIA ¡Movimientos peligrosos! ¡Peligro de muerte!</p> <p>No permanezca en la zona de movimiento de las máquinas ni de sus piezas.</p> <p>Impida el acceso accidental de personas.</p> <p>Antes de acceder o introducir las manos en la zona de peligro, los accionamientos se tienen que haber parado con seguridad.</p>	<p>⚠ AVVERTENZA Movimenti pericolosi! Pericolo di morte!</p> <p>Non sostare nelle zone di manovra delle macchine e delle loro parti.</p> <p>Impedire un accesso non autorizzato per le persone.</p> <p>Prima di accedere alla zona di pericolo, arrestare e bloccare gli azionamenti.</p>

E Español	I Italiano
<p>⚠ ADVERTENCIA ¡Campos electromagnéticos/magnéticos! ¡Peligro para la salud de las personas con marcapasos, implantes metálicos o audífonos!</p> <p>El acceso de las personas arriba mencionadas a las zonas de montaje o funcionamiento de los componentes de accionamiento está prohibido, salvo que lo autorice previamente un médico.</p>	<p>⚠ AVVERTENZA Campi elettromagnetici / magnetici! Pericolo per la salute delle persone portatrici di pacemaker, protesi metalliche o apparecchi acustici!</p> <p>L'accesso alle zone in cui sono installati o in funzione componenti di azionamento è vietato per le persone sopra citate o consentito solo dopo un colloquio con il medico.</p>
<p>⚠ ATENCIÓN ¡Superficies calientes (> 60 °C)! ¡Peligro de quemaduras!</p> <p>Evite el contacto con las superficies calientes (p. ej., disipadores de calor). Observe el tiempo de enfriamiento de los componentes de accionamiento (mín. 15 minutos).</p>	<p>⚠ ATTENZIONE Superfici bollenti (> 60 °C)! Pericolo di ustioni!</p> <p>Evitare il contatto con superfici metalliche (ad es. dissipatori di calore). Rispettare i tempi di raffreddamento dei componenti di azionamento (almeno 15 minuti).</p>
<p>⚠ ATENCIÓN ¡Manipulación inadecuada en el transporte y montaje! ¡Peligro de lesiones!</p> <p>Utilice dispositivos de montaje y de transporte adecuados.</p> <p>Utilice herramientas adecuadas y equipo de protección personal.</p>	<p>⚠ ATTENZIONE Manipolazione inappropriata durante il trasporto e il montaggio! Pericolo di lesioni!</p> <p>Utilizzare dispositivi di montaggio e trasporto adatti.</p> <p>Utilizzare attrezzi adatti ed equipaggiamento di protezione personale.</p>
<p>⚠ ATENCIÓN ¡Manejo inadecuado de las pilas! ¡Peligro de lesiones!</p> <p>No trate de reactivar o cargar pilas descargadas (peligro de explosión y cauterización).</p> <p>No desarme ni dañe las pilas. No tire las pilas al fuego.</p>	<p>⚠ ATTENZIONE Utilizzo inappropriato delle batterie! Pericolo di lesioni!</p> <p>Non tentare di riattivare o ricaricare batterie scariche (pericolo di esplosione e corrosione).</p> <p>Non scomporre o danneggiare le batterie. Non gettare le batterie nel fuoco.</p>

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1 Important Notes

1.1 Safety Instructions

1.1.1 General Information

- Do not attempt to install and operate the components of the electric 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 electric 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 electric 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 electric 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.

Important Notes

1.1.2 Protection Against Contact With Electrical Parts and Housings



This section concerns components of the electric 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 electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:
 - Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.
- Install the covers and guards provided for this purpose before switching on.
- Never touch electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.

Important Notes

- Connect the equipment grounding conductor of the components of the electric 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 minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm² (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer conductor	Minimum cross section equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1,5 mm ² (AWG 16)	10 mm ² (AWG 8)	2 × 1,5 mm ² (AWG 16)
2,5 mm ² (AWG 14)		2 × 2,5 mm ² (AWG 14)
4 mm ² (AWG 12)		2 × 4 mm ² (AWG 12)
6 mm ² (AWG 10)		2 × 6 mm ² (AWG 10)
10 mm ² (AWG 8)		-
16 mm ² (AWG 6)	16 mm ² (AWG 6)	-
25 mm ² (AWG 4)		-
35 mm ² (AWG 2)		-
50 mm ² (AWG 1/0)	25 mm ² (AWG 4)	-
70 mm ² (AWG 2/0)	35 mm ² (AWG 2)	-
...

Fig. 1-1: Minimum Cross Section of the Equipment Grounding Connection

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 electric 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.

Important Notes

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 electric 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 stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equipment works. Do not operate the machine if the emergency stopping switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to 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 counterbalancing 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 electric drive and control system using the master switch and secure them from reconnection ("lock out") 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 components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, 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 electric 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 so greatly 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

Hot surfaces of components of the electric 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 sufficient period of 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 in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final 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!

Important Notes

- 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 falling!

1.1.7 Battery Safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.



Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

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".



Components of the drive system Rexroth IndraDrive Mi are **products of category C3** (with restricted distribution) according to IEC 61800-3. These components are not provided for use in a public low-voltage mains supplying residential areas. If these components are used in such a mains, high-frequency interference is to be expected. This can require additional measures of radio interference suppression.

2 Identification

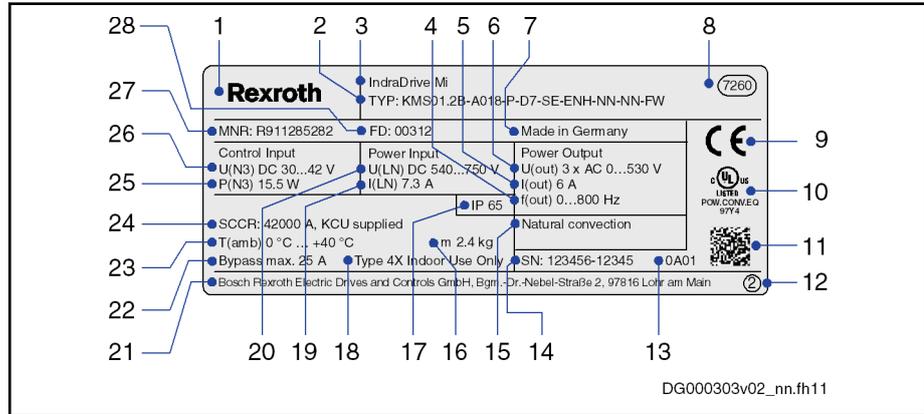
2.1 Type Code

Abbrev. column	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9		
Example:	K	M	S	0	1	.	2	B	-	A	0	1	8	-	P	-	D	7	-	S	E	-	E	N	H	-	N	N	-	N	N	-	F	W								
Product																																										
KMS	= KMS																																									
Line																																										
01.....	= 01																																									
Design																																										
2	= 2																																									
Performance																																										
Basic	= B																																									
Cooling mode																																										
Natural convection (heat sink is outside)	= A																																									
Maximum current																																										
E.g., 18 A.....	= 018																																									
Degree of protection																																										
IP 65.....	= P																																									
DC bus nominal voltage																																										
DC 750 V.....	= D7																																									
Master communication																																										
SERCOS interface (RS422)	= SE																																									
Encoder interface																																										
Encoder Hiperface®	= ENH																																									
None (without holding brake control).....	= NNN																																									
Safety option																																										
None	= NN																																									
Other design																																										
None	= NN																																									
Firmware																																										
Denotes that firmware must be ordered as separate subposition.....	= FW																																									
Standard reference																																										
Standard	Edition																					Title																				
DIN EN 60529	2000-09																					Degree of Protection (IP-Code)																				

Fig.2-1: Type Code KMS

Identification

2.2 Type Plates
 2.2.1 Structure



- 1 Trademark
- 2 Type designation
- 3 Product range
- 4 Output frequency range
- 5 Output current
- 6 Output voltage
- 7 Country of manufacture
- 8 Manufacturing plant
- 9 CE conformity label
- 10 UL label
- 11 2-D bar code
- 12 Manufacturer code
- 13 Hardware revision index
- 14 Serial number
- 15 Cooling type
- 16 Mass
- 17 Degree of protection in accordance with IEC 60529
- 18 Ambient conditions according to UL50/50E
- 19 Rated input current (UL)
- 20 Rated input voltage (UL)
- 21 Company address
- 22 Maximum bypass current (UL)
- 23 Allowed ambient temperature
- 24 Short circuit current rating (UL)
- 25 Rated power consumption control voltage input at U_{N3} (UL)
- 26 Rated control voltage input (UL)
- 27 Part number
- 28 Production date

Fig.2-2: Type Plate KMS

2.3 Scope of Supply

Standard	Optional
KMS	RKB0006 (interface cable X2 ↔ PC)
PFM02 (Memory card module [MultiMediaCard])	RKS0010 (interface cable X37 or X38 ↔ Control unit)
	HAS10 (fixing clip for hybrid cables)

Fig.2-3: Scope of Supply KMS

3 Ratings and Dimensions

3.1 Ratings



A distributed drive controller KMS may only be operated in conjunction with an electronic control system KCU.

UL Ratings and Dimensions

Description	Symbol	Unit	KMS01.2B-A018
Listing according to UL standard (UL)			UL 508 C
Listing according to CSA standard (UL)			Canadian National Standard(s) C22.2 No. 14-10
UL files (UL)			E134201
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40
Degree of protection according to IEC60529			IP 65
Ambient conditions according to UL50/50E			4X Indoor Use Only
Mass	m	kg	2,40
Data control voltage			
Rated control voltage input (UL) ¹⁾	U_{N3}	V	DC 30...42
Rated power consumption control voltage input at U_{N3} (UL) ²⁾	P_{N3}	W	15,5
Data power section			
Short circuit current rating (UL)	SCCR	A rms	42000
Rated input voltage, power (UL) ³⁾	U_{LN_nenn}	V	DC 540...750
Rated input current (UL)	I_{LN}	A	7,3
Maximum bypass current (UL)		A	25,0
Output voltage (UL)	U_{out}	V	3 x AC 0...530
Output current (UL)	I_{out}	A	6,0
Output frequency range (UL) ⁴⁾	f_{out}	Hz	0...800
Power dissipation at continuous current and continuous DC bus power respectively (UL) ⁵⁾	P_{Diss_cont}	W	50,00
Last modification: 2010-09-20			

- 1) Observe supply voltage for motor holding brakes
- 2) HMS, HMD, HCS plus motor holding brake and control section; HCS01 including control section
- 3) DC bus L+, L-; mains input L1, L2, L3
- 4) Depending on switching frequency which was set in parameter P-0-0001
- 5) Plus dissipation of braking resistor and control section

Fig.3-1: KMS - UL Ratings and Dimensions

4 Reference Documentations

4.1 Drive Systems, System Components

Title Rexroth IndraDrive ...	Kind of documentation	Document typecode ¹⁾ DOK-INDRV*-...	Part number R911...
Drive Systems With HMV01/02 HMS01/02, HMD01, HCS02/03	Project Planning Manual	SYSTEM****-PRxx-EN-P	309636
Mi Drive Systems	Project Planning Manual	KCU+KSM****-PRxx-EN-P	320924
Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	Project Planning Manual	HMV-S-D+HCS-PRxx-EN-P	318790
Drive Controllers Control Sections CSB01, CSH01, CDB01	Project Planning Manual	CSH*****-PRxx-EN-P	295012
Additional Components and Accessor- ies	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 Planning Manual)

Fig.4-1: Documentations – Overview

Title	Kind of documentation	Document typecode ¹⁾	Part number R911...
Automation Terminals Of The Rexroth Inline Product Range	Application Manual	DOK-CONTRL-ILSYSINS***- AWxx-EN-P	317021

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: AW01 is the first edition of an Application Manual)

Fig.4-2: Documentations – Overview

4.2 Motors

Title Rexroth IndraDyn ...	Kind of documentation	Document typecode ¹⁾ DOK-MOTOR*-...	Part number R911...
A Asynchronous Motors MAD / MAF	Project Planning Manual	MAD/MAF****-PRxx-EN-P	295781
H Synchronous Kit Spindle Motors	Project Planning Manual	MBS-H*****-PRxx-EN-P	297895
L Synchronous Linear Motors	Project Planning Manual	MLF*****-PRxx-EN-P	293635
S MSK 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 document typecodes, "xx" is a wild card for the current edition of the documentation (example: PR01 is the first edition of a Project Planning Manual)

Fig.4-3: Documentations – Overview

Reference Documentations

4.3 Cables

Title	Kind of documentation	Document typecode ¹⁾ DOK-...	Part number R911...
Rexroth Connection Cables IndraDrive and IndraDyn	Selection Data	CONNEX-CABLE*INDRV-CAxx- EN-P	322949

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: CA02 is the second edition of the documentation "Selection Data")

Fig. 4-4: Documentations – Overview

4.4 Firmware

Title Rexroth IndraDrive ...	Kind of documentation	Document typecode ¹⁾ DOK-INDRV*-...	Part number R911...
Firmware for Drive Controllers MPH-08, MPB-08, MPD-08, MPC-08	Functional Description	MP*-08VRS**-APxx-EN-P	332643
Firmware for Drive Controllers MPH-07, MPB-07, MPD-07, MPC-07	Functional Description	MP*-07VRS**-FKxx-EN-P	328670
Firmware for Drive Controllers MPH-06, MPB-06, MPD-06, MPC-06	Functional Description	MP*-06VRS**-FKxx-EN-P	326766
Firmware for Drive Controllers MPH-05, MPB-05, MPD-05	Functional Description	MP*-05VRS**-FKxx-EN-P	320182
Firmware for Drive Controllers MPH-04, MPB-04, MPD-04	Functional Description	MP*-04VRS**-FKxx-EN-P	315485
Firmware for Drive Controllers MPH-03, MPB-03, MPD-03	Functional Description	MP*-03VRS**-FKxx-EN-P	308329
Firmware for Drive Controllers MPH-02, MPB-02, MPD-02	Functional Description	MP*-02VRS**-FKxx-EN-P	299223
Drive Controllers MPx-02 to MPx-08	Parameter Description	GEN-**VRS**-PAxx-EN-P	297317
MPx-02 to MPx-08 and HMV	Troubleshooting Guide	GEN-**VRS**-WAxx-EN-P	297319
Integrated Safety Technology	Functional and Application Description	SI*-**VRS**-FKxx-EN-P	297838
Integrated Safety Technology According to IEC61508	Functional Description	SI2-**VRS**-FKxx-EN-P	327664
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 document typecodes, "xx" is a wild card for the current edition of the documentation (example: FK02 is the second edition of a Functional Description)

Fig. 4-5: Documentations – Overview

Reference Documentations

Title	Kind of documentation	Document typecode ¹⁾	Part number R911...
Productivity Agent Extended Diagnostic Functions With Rexroth IndraDrive	Application Manual	DOK-INDRV*-MLD-PAGENT* AWxx-EN-P	323947

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: AW01 is the first edition of an Application Manual)

Fig. 4-6: Documentations – Overview

5 Instructions for Use

5.1 Mounting

5.1.1 Preparations

Make the following preparations for mounting:

1. Procure tools, auxiliary materials, measuring and test equipment.
2. Check all components for visible damage. Defective components mustn't be mounted.
3. Ensure that dimensions and tolerances on the installation side are suitable for attachment (for details, see dimensional drawing).
4. Check whether all components, mounting surfaces and threads are clean.
5. Ensure that mounting can be done in a dry and dust-free environment.

5.1.2 Mounting KMS

Mounting for Easy Servicing

To allow trouble-free servicing, make sure that the following aspects are fulfilled after you have mounted KSM:

- Connection points X2, X37 and X38 can be easily accessed
- MMC slot X7 can be easily accessed
- SERCOS address selector switches S4 and S5 can be easily accessed
- Diagnostic LED H14 is visible

Notes on Mounting

1. **Preferably mount KMS to a conductive surface.** If this is impossible, later on connect the second connection point of equipment grounding conductor at KMS to the equipment grounding system of the installation.
2. For the dimensions of the mounting holes, see the Dimensional Drawing KMS.
3. Data of the **mounting screws**:
 - Thread: M6
 - Head diameter: < 11 mm
 - Tightening torque: 6 Nm

5.2 Installation

5.2.1 General Information on How to Install the Drive Controller

WARNING

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

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

Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**.

Check whether voltage has 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:

Instructions for Use

NOTICE

Electrostatic charges can cause damage to electronic components and interfere with their operational safety!

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 packaging.



Rexroth connection diagrams are only to be used for producing installation 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 shielded 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 accordance with EN 60204-1). During their routine testing, Rexroth drive components are tested for high voltage (in accordance with EN 61800-5-1:2007, section 5.2.3.2) and insulation (in accordance with EN 60204-1:2006, section 18.3).

NOTICE

Risk of damage to the drive controller by connecting and disconnecting live connections!

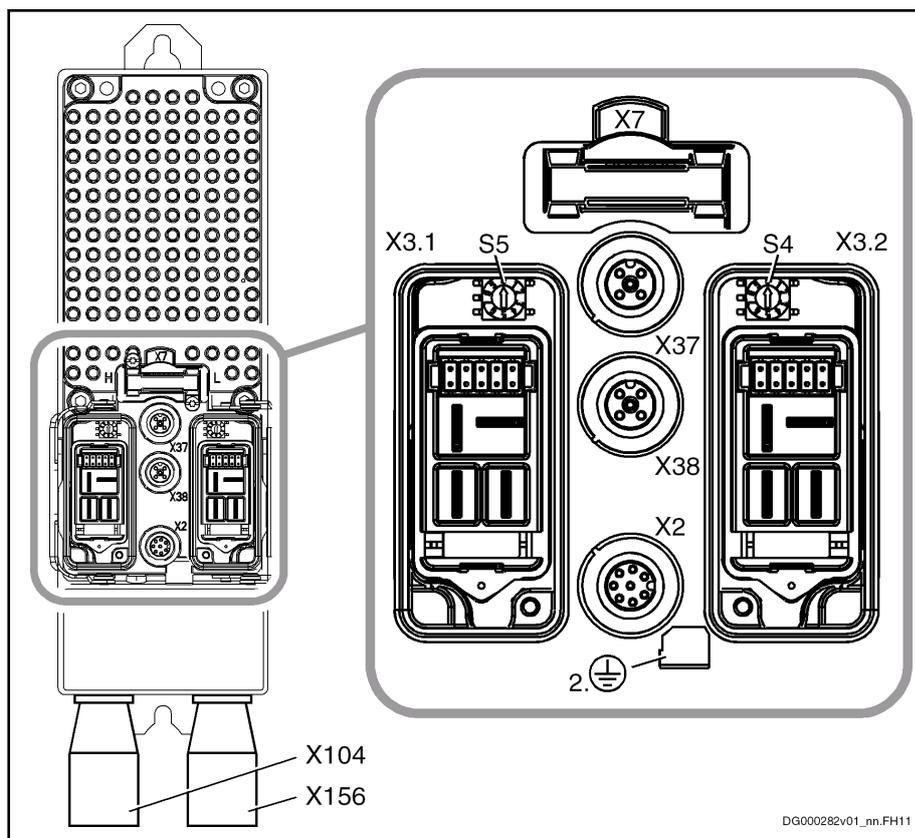
Do not connect and disconnect live connections.

5.2.2 Motors

Operate distributed drive controllers KMS01.2B-A018-P-D7-SE-ENH exclusively with the following motors:

- Rexroth IndraDyn S MSK
- Rexroth IndraDyn S MKE

5.2.3 Position of Connection Points



S5	SERCOS address selector switch (10×)
S4	SERCOS address selector switch (1×)
X2	Serial interface (RS232)
X3.1, X3.2	Hybrid cable
X7	MultiMediaCard
X37, X38	Digital inputs/outputs
X104	Encoder evaluation (optional)
X156	Motor (power, motor temperature monitoring, control of motor holding brake (optional))
2.	Second connection point of equipment grounding conductor

Fig. 5-1: Connection Points of KMS

5.2.4 X104, Connection for Motor Encoder

Description For encoders with a supply voltage of 12 volt (max. 60 mA):

Sin-cos encoder 1 V_{pp}; HIPERFACE®

The connection only exists at devices with an ENH encoder interface (see Type Code KMS).

Instructions for Use

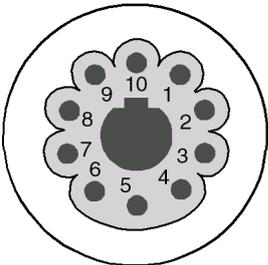
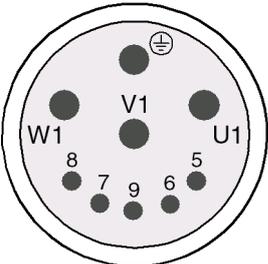
View	Connection	Signal name S1, M1 (HIPERFACE®)	Function
 <p>DA000310v01_nn.fh11</p>	1	VCC_Encoder	Power supply
	2	GND_Encoder	Power supply reference potential
	3	A +	Track A positive
	4	A -	Track A negative
	5	B +	Track B positive
	6	B -	Track B negative
	7	EncData+	Data transmission
	8	EncData-	Data transmission
	9	n. c.	-
	10	n. c.	-
	Overall shield via connector housing		
10-pin, female connector	Unit	Min.	Max.
Connection cable stranded wire	mm ²	n.s.	n.s.
Order type of cable	RKG4201		
Allowed length	m	n.s.	7,5

Fig.5-2: X104, Motor Encoder

5.2.5 X156, Connection for Motor

View	Connection	Signal name	Function
 <p>DA000311v01_nn.FH11</p>	U1, V1, W1	-	Power output
		-	Equipment grounding conductor
	5	MotTemp+	Input temperature measurement (temperature sensor KTY84)
	6	MotTemp-	
	7 (optional)	Br+ / +24V	Output for controlling the motor holding brake
	8 (optional)	Br- / 0V	
	9	GND_shld	Shield
10-pin, female connector	Unit	Min.	Max.
Connection cable stranded wire	mm ²	n.s.	n.s.

Output for controlling the motor holding brake (X156.7/8)			
Output current (A)	A	n.s.	1
Continuous power overvoltage protection (B)	W	n.s.	1,5
Energy absorption (B)	Ws	n.s.	3
Order type of cable		RKL4305	
Allowed length	m	n.s.	7,5

Fig. 5-3: X156, Motor

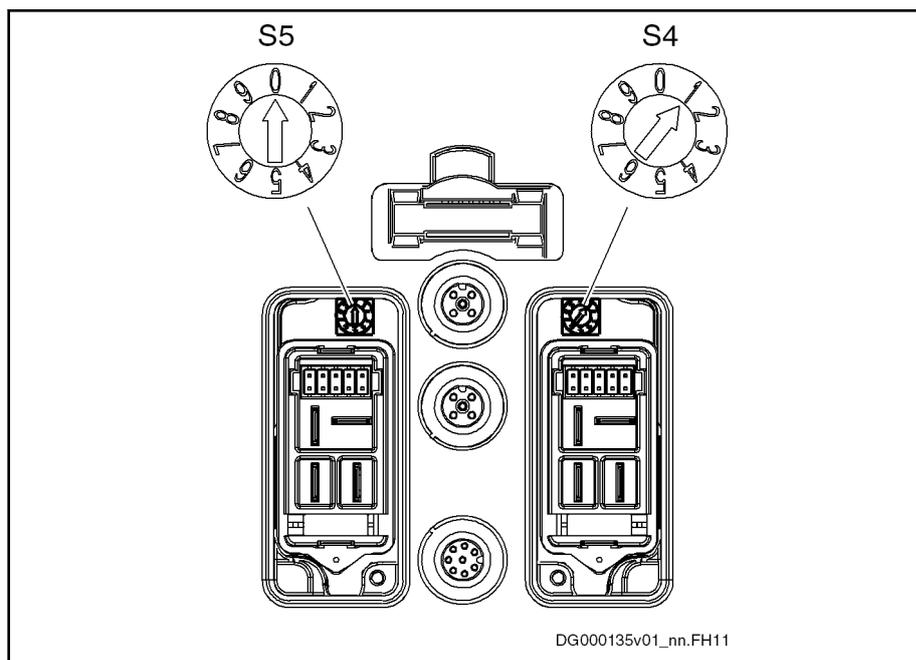
5.2.6 SERCOS Address Selector Switches

⚠ WARNING

High electrical voltage! Danger to life by electric shock!

Before examining the address which has been set, always switch power off and then remove connector.

The SERCOS address must be set at each KSM/KMS. To do this, use the two turn-switches S5 and S4 which are to be found under the connector covers of X3.1 and X3.2.



- S5 SERCOS address selector switch (×10)
- S4 SERCOS address selector switch (×1)

Fig. 5-4: SERCOS Address Selector Switches

Instructions for Use

Setting	Description
"00" S5 = 0 S4 = 0	"00" is the factory setting of the address selector switches. This setting is not applied. You have to set the individual drive address in parameter "P-0-4025, Drive address of master communication", e.g. via the serial interface X2. The factory setting in P-0-4025 is "01".
"01" ... "99" S5 = 0 ... 9 S4 = 0 ... 9 Drive address = S5×10 + S4	Setting of address selector switches is applied to P-0-4025. Example for setting drive address "14": S5 = 1, S4 = 4 ⇒ drive address = 1×10 + 4 = 14
See also documentation Parameter Description: <ul style="list-style-type: none"> • "P-0-4025, Drive address of master communication" • "P-0-4031, Overview of device addresses" 	

Fig.5-5: Setting the Drive Address at S4 and S5



Order in string of drives

The order of the addresses in a string is without significance.

5.2.7 Selecting Hybrid Cable for Appropriate Connection

Hybrid cable RKH (with different outgoing directions from connection point X3.1 or X3.2 at KSM and KMS)									
		KCU	X3.1	X3.1	X3.1	X3.2	X3.2	X3.2	RKH0700
	KCU	-	-	-	-	RKH030 1	RKH0401	RKH0501	RKH0501
	X3.1	-	RKH000 1	RKH010 0	RKH020 2	-	-	-	RKH0202
	X3.1	-	RKH010 0	RKH020 0	RKH020 4	-	-	-	RKH0204
	X3.1	-	RKH020 2	RKH020 4	RKH060 0	-	-	-	RKH0600

Instructions for Use

Hybrid cable RKH (with different outgoing directions from connection point X3.1 or X3.2 at KSM and KMS)										
		KCU	X3.1	X3.1	X3.1	X3.2	X3.2	X3.2	X3.2	RKH0700
	X3.2	RKH030 1	-	-	-	RKH000 2	RKH0101	RKH0203	RKH0203	
	X3.2	RKH040 1	-	-	-	RKH010 1	RKH0201	RKH0205	RKH0205	
	X3.2	RKH050 1	-	-	-	RKH020 3	RKH0205	RKH0601	RKH0601	
	RKH070 0	RKH050 1	RKH020 2	RKH020 4	RKH060 0	RKH020 3	RKH0205	RKH0601	-	

Fig.5-6: Hybrid Cable RKH

Instructions for Use

Selection of Hybrid Cables

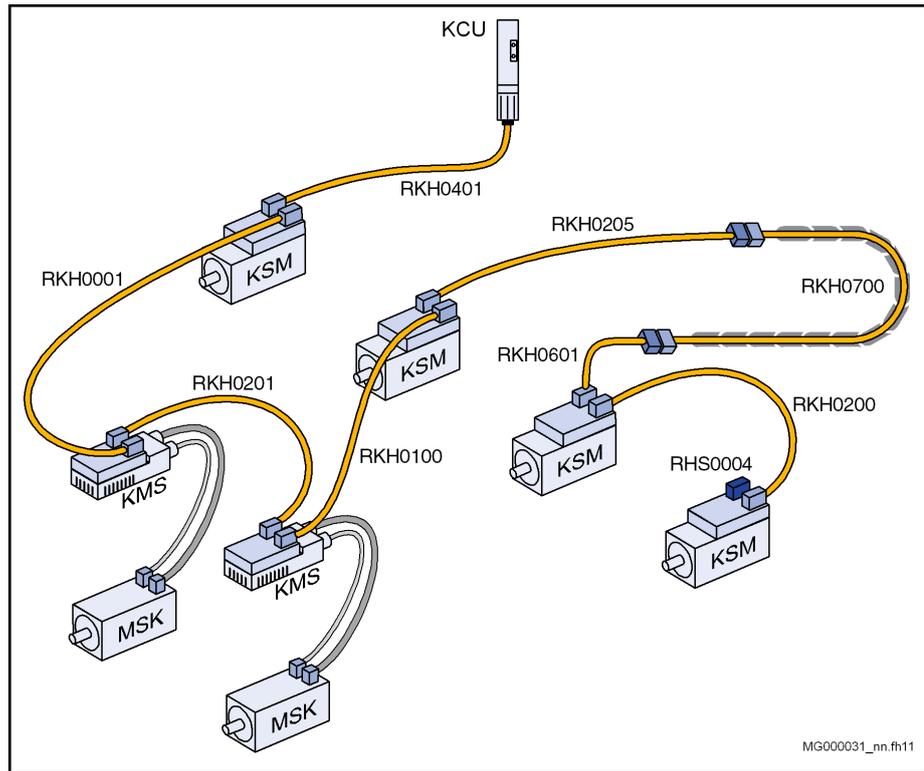


Fig.5-7: Example of Drive System With Hybrid Cable

Each string of distributed servo drives KSM must be terminated with the terminal connector RHS0004.

All hybrid cables are suited for use in flexible cable tracks. In the example, the cable RKH0700 is used in a flexible cable track. To quickly replace the flexible cable track cable for servicing, the cable in the example used in the flexible cable track has been equipped with connectors at the inputs. Observe the maximum allowed length of the hybrid cable in the flexible cable track.

Identification of Hybrid Cables

Hybrid cables are marked according to the following example.

RKH0100/030,5

The cable designation is made up of:

Cable number ⇒ e.g. **RKH0100**

and

Cable length ⇒ e.g. **30.5 m**

Terminal Connector

Each string of distributed servo drives KSM must be terminated with the terminal connector.

	KSM X3.1 / X3.2
Terminal connector	RHS0004

Fig.5-8: Order Code of Terminal Connector

5.2.8 Second Connection Point of Equipment Grounding Conductor

Parts of the installation with attached KSM/KMS must be connected to the equipment grounding system of the installation. The housings of the KSM/KMS then are connected to the equipment grounding system of the installation via the flange. This connection is required in addition to the equip-

ment grounding conductor in the hybrid cable, because the leakage current of a distributed servo drive KSM/KMS is greater than 3.5 mA.

Additionally connect the KSM/KMS housing via a **second** equipment grounding conductor to the equipment grounding system of the installation, when KSM/KMS is attached to parts of the installation which

- have bad electroconductive properties
or
- cannot be connected to the equipment grounding system of the installation.

⚠ WARNING

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

In addition to the connection via the hybrid cable, connect the **second connection point of equipment grounding conductor** at KSM/KMS to the equipment grounding system of the installation, when the electric resistance between the mechanical holder of the flange and the equipment grounding system of the installation is greater than **5 ohm**.



The **first** equipment grounding conductor is routed via the hybrid cable from **X3.1 / X3.2 (KSM/KMS)** to the connection point **X54 (KCU)** and connected to the equipment grounding system of the installation via KCU.

Second Connection Point of Equipment Grounding Conductor at KSM/KMS Housing

View	Connection	Signal name	Function
		Equipment grounding conductor	Second connection point of equipment grounding conductor Is used to connect KSM/KMS to a grounded part of the installation, e.g. the machine base
Thread M5 (for ring cable lug)	Unit	Min.	Max.
Tightening torque	Nm	2,6	3,1
Cable cross section stranded wire	mm ²	2,5	4
Connection cable	AWG	14	12

Fig. 5-9: *Second Connection Point of Equipment Grounding Conductor, Properties*

Instructions for Use

5.3 Commissioning, Operation, Diagnoses and Maintenance

5.3.1 Notes on Commissioning

General Information

⚠ WARNING**High electrical voltage! Danger to life, electric shock and severe bodily injury!**

Read and observe the detailed safety instructions contained in this documentation in chapter "Important Notes".

Preparation

1. Keep the documentation of all used products ready.
2. Check the products for damage.
3. Check all mechanical and electrical connections.
4. Activate safety devices and monitoring systems of the installation.

How to Proceed

When all requirements have been fulfilled, commission the drive system according to the instructions contained in the corresponding product documentation. See the Functional Description of the firmware for the corresponding information.

The commissioning of controllers and control unit can require additional steps. The check of functionality and performance of the installations is not part of motor commissioning; instead, it is carried out within the scope of the commissioning of the machine as a whole. Observe the information and regulations of the machine manufacturer.

5.3.2 Notes on Operation

Make sure that the ambient conditions described are complied with during operation.

5.3.3 Diagnostic Functions

Diagnostic Display KSM/KMS

LED H14

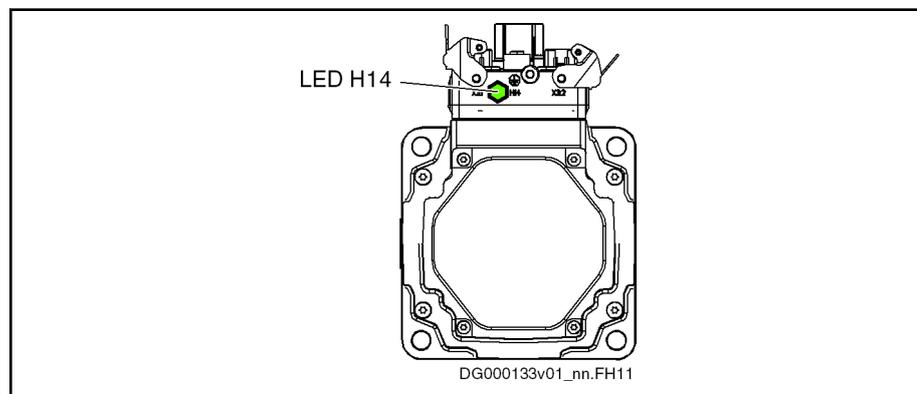


Fig.5-10: LED H14 (Example KSM)

At the device, there is a tricolor LED which displays the drive status.

Diagnostic Display as of MPB-07V12 / MPx-08VRS

LED H14 Color / status		Significance	Measures
	Off	Supply unit not switched on	Check supply unit and, if necessary, switch it on
		Cable interrupted	Check cable and connector
		Hardware defective	Replace hardware
	Flashing green	Drive is error-free (phases 2, 3 and 4); in phase 4, drive is ready for drive enable ("Bb")	If necessary, read exact status via "S-0-0095, Diagnostic message"
	Green	Power on and DC bus voltage available ("Ab")	Drive is error-free in operation and runs according to inputs NOTE! If you remove the connectors from the device in this status, this might damage the device!
		Drive in control ("AF", "AH" or drive command active (Cxxx))	
	Flashing green-yellow	Transition command (C2xxx/C1xxx) Transition command error (C2xxx/C1xxx)	If necessary, read exact status via "S-0-0095, Diagnostic message"
	Flashing yellow	Warning (E2xxx ... E8xxx)	Read exact status via "S-0-0095, Diagnostic message" and carry out service function
		Drive command error (Cxxx)	
	Yellow	Firmware update running	During the firmware update, do not interrupt the 24V supply and do not unplug connectors
	Flashing red-yellow	Drive is error-free (phase 1), but not yet ready for drive enable ("Bb")	If necessary, read exact status via "S-0-0095, Diagnostic message"
		Communication error (F4xxx)	
	Flashing red-green	Baud rate scan (P-1)	If necessary, read exact status via "S-0-0095, Diagnostic message"
		Drive is error-free (phase 0), but not yet ready for drive enable ("Bb")	
	Flashing red	Error (F2xxx, F3xxx, F6xxx, F7xxx, F8xxx)	Read exact status via "S-0-0095, Diagnostic message" and carry out service function
	Red	Booting phase	Wait until booting phase is over (approx. 2 minutes)
		System error (F9xxx, E0800)	Switch off and on; replace hardware, if necessary

Fig. 5-11: LED Displays KSM/KMS (as of MPB-07V12 / MPx-08VRS)

Diagnostic Display up to MPB-07V10

LED H14 Color / status		Significance	Measures
	Off	Supply unit not switched on	Check supply unit and, if necessary, switch it on
		Cable interrupted	Check cable and connector
		Hardware defective	Replace hardware
	Flashing green	Drive is error-free, but not yet ready for drive enable ("Bb") Parameter Mode	If necessary, read exact status via "S-0-0095, Diagnostic message"
	Green	Drive in control ("AF", "AH" or drive command)	Drive is error-free in operation and runs according to inputs NOTE! If you remove the connectors from the device in this status, this might damage the device!
		Power on and DC bus voltage available ("Ab")	
	Flashing yellow	Warning	Read exact status via "S-0-0095, Diagnostic message" and carry out service function
	Yellow	Firmware update running	During the firmware update, do not interrupt the 24V supply and do not unplug connectors

Instructions for Use

LED H14 Color / status		Significance	Measures
	Flashing red	Errors	Read exact status via "S-0-0095, Diagnostic message" and carry out service function
	Red	Booting phase	Wait until booting phase is over (approx. 2 minutes)
		System error	Switch off and on; replace hardware, if necessary

Fig. 5-12: LED Displays KSM/KMS (up to MPB-07V10)

Firmware Functions

Easy Startup Mode

The easy startup mode is intended for initial commissioning. Easy startup can be carried out with the commissioning software "Rexroth IndraWorks D". For this purpose, connect KSM/KMS via the serial interface X2 to a PC (e.g. laptop for commissioning).

For easy startup, the digital inputs have been preset as follows:

- I_1 (X37.4): +24 V to activate positive direction of rotation
- I_2 (X37.2): +24 V to activate negative direction of rotation
- I_3 (X38.4): +24 V to activate drive enable

 See Functional Description of firmware → "Easy Startup Mode".

Analog Outputs

KSM/KMS have **no** analog outputs!

Oscilloscope Function

You can use the integrated oscilloscope function described in the Functional Description of the firmware!

 See Functional Description of firmware → "Oscilloscope Function".

Patch Function

KSM/KMS have a patch function which allows reading or writing controller-internal memory cells.

 See Functional Description of firmware → "Patch Function".

Monitoring Function

For extended diagnostic possibilities, KSM/KMS have a monitoring function.

 See Functional Description of firmware → "Monitoring Function".

5.3.4 Service Functions / Troubleshooting

General Information

⚠ WARNING

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

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

Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**.

Check whether voltage has fallen below 50 V before touching live parts!

The following section explains the tasks required to eliminate errors or malfunction.

We distinguish the following actions:

- Replacement of fuses F4 and F5
- Deactivation
- Dismounting
- Replacement of KSM/KMS

Deactivating and Dismounting the Drive

Deactivation

In the case of malfunction, maintenance measures or to deactivate the motors, proceed as follows:

1. Observe the instructions contained in the machine documentation.
2. Use the machine-side control commands to bring the drive to a controlled standstill.
3. Switch off the power voltage and control voltage of the controller.
4. Switch off the main switch of the machine.
5. Secure the machine against accidental movements and against unauthorized operation.
6. Wait to allow the electric systems to discharge and then disconnect all electrical connections.
7. Before dismantling them, secure the motor and, if necessary, the blower unit against falling or movements, before unfastening the mechanical connections.

Dismounting

⚠ WARNING

Lethal injury caused by errors when controlling motors and working at moving parts!

- Do not work at running or unsecured installations.
- Before starting to dismount, secure the machine against accidental movements and unauthorized operation.
- Before dismantling them, secure the motor and the supply lines unit against falling or movements, before unfastening the mechanical connections.

⚠ CAUTION

Burns caused by hot surfaces with temperatures of more than 100 °C!

- Before beginning to work, let the motors cool down. The thermal time constant specified in the Technical Data is a measure for the time required for cooling down. Cooling down can require up to 140 minutes!
- Do not work at hot surfaces.
- Wear safety gloves.

-
1. Observe the instructions contained in the machine documentation.
 2. Observe the Safety Instructions and carry out all steps according to the instructions for "deactivation".

Instructions for Use

3. Before dismantling them, secure the motor and the supply lines unit against falling or movements, before unfastening the mechanical connections.
4. Dismount the motor from the machine.
5. Store the motor appropriately.

Replacement of KSM or KMS

In case servicing becomes necessary, the motor with the electronic system is replaced by a new motor of the same type. This requires the following steps:

1. De-energize the machine (switch off 24V supply, too!)
2. **WARNING!** High electrical voltage! Danger to life by electric shock!
Before you start replacing KSM or KMS, wait 30 minutes to allow discharging.
3. Ensure isolation from supply
4. Dismount the defective KSM/KMS
5. Remove the MMC from the defective KSM/KMS at X7
6. Set the SERCOS address at the new KSM/KMS
7. Plug the removed MMC into the new KSM/KMS, mount the cover and make sure the sealing ring is undamaged
8. Mount the new KSM/KMS and establish the electrical connections
9. Switch on 24V supply
10. Load the parameter set
11. Reestablish the position data reference (homing procedure)

Service Function "Release Holding Brake"

Via the interface X2, you can "release" the integrated holding brake.

To carry out this function, the 24V supply must have been applied.

WARNING

Lethal injury caused by errors when controlling motors and working at moving parts!

- Do not work at running or unsecured installations.
- Before starting to dismount, secure the machine against accidental movements and unauthorized operation.
- Before dismantling them, secure the motor and the supply lines unit against falling or movements, before unfastening the mechanical connections.

For the purpose of commissioning and servicing, release the holding brake via connection point X2 by connecting the contacts X2.1 and X2.2.

Saving Parameters

For servicing, the drive parameters must be saved and archived at initial commissioning (e.g. with the software Rexroth IndraWorks D); this is necessary, because you won't probably be able to read the parameters of the defective drive.

Parameters can be administrated in the control unit or saved and loaded via the RS232 interface (X2) and the software "Rexroth IndraWorks D".

Firmware Update

See Functional Description of firmware → "Firmware Replacement".



If the firmware of the MMC differs from the internal firmware, the device is operated with the MMC firmware.

Firmware ≥ MPB05: If the firmware update has failed, the drive tries to load the firmware from the MMC after previous switching off and on.

MMC

After you have unscrewed the cover, you can remove the MMC (MultiMedia-Card) from the MMC slot X7. The MMC contains firmware and parameters which allow easily programming the drive during commissioning.

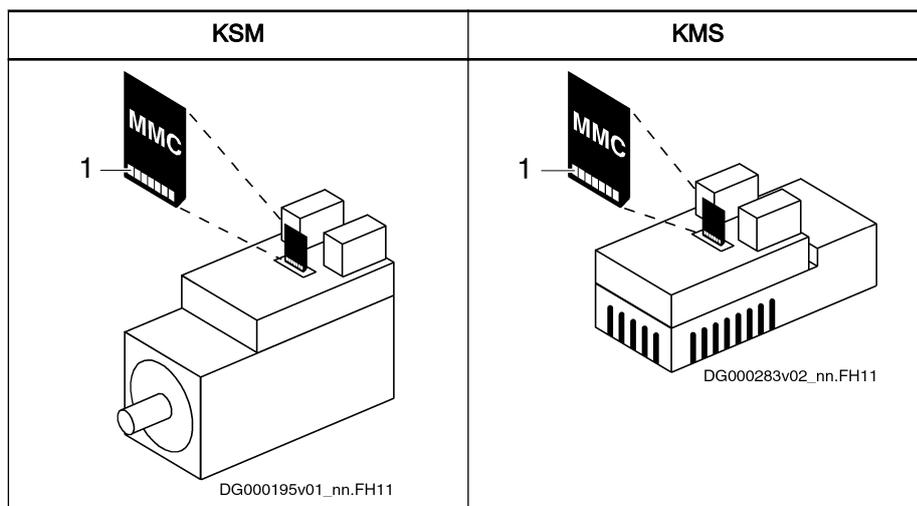


Make a backup copy of the content of the MMC (saving parameters) before changing firmware or parameters.

NOTICE

Risk of damage by MMC incorrectly plugged in!

When you plug in the MMC, the contacts must point at the heat sink! Otherwise, the MMC or the device might be damaged when you screw the MMC cover.



1 Contacts of MMC
 Fig. 5-13: Plugging in the MMC

Use the software "Rexroth IndraWorks D" to configure the data transfer from the MMC after control voltage has been switched on.

5.3.5 Maintenance

Maintenance of the Motor Component

General Information

The **motors** operate in a maintenance-free way within the given operating conditions and service life. However, operation under unfavorable conditions can lead to limitations in availability.

Instructions for Use

- Increase the availability with regular preventive maintenance measures. Observe the information in the maintenance schedule of the machine manufacturer and the maintenance measures described below.

⚠ CAUTION

Risk of burns by hot surfaces with temperatures of more than 100 °C!

Before beginning to work, let the motors cool down. The thermal time constant specified in the Technical Data is a measure for the time required for cooling down. Cooling down can require up to 140 minutes!

Do not work at hot surfaces.

Wear safety gloves.

Cleaning

Excessive dirt, dust or shavings may affect the function of the motors adversely, may in extreme cases even cause a failure of the motors. For that reason, you should clean the cooling ribs of the motors in regular intervals (at the latest, after one year is over).

Bearings

The nominal service life of the bearings is L10h > 30000 h (according to DIN ISO 281, ed. 1990), if the permissible radial and axial forces are not exceeded.

The motor bearings should be replaced, if

- the nominal bearing service life has been reached
- running noise can be heard



We recommend that you have the bearings replaced by Rexroth.

Connection Cables

Check connection cables for damage in regular intervals and replace them, if necessary.

Check any optionally present flexible cable tracks for damage and replace them, if necessary.

⚠ WARNING

Danger to life by live parts with more than 50 V!

Do not repair any connection cables provisionally. If the slightest damage is detected in the cable sheath, you must immediately put the installation out of operation and replace the connection cable.

Check the equipment grounding conductor for proper connection and tight fit in regular intervals.

Holding Brake—Commissioning and Maintenance Instructions

In order to ensure proper functioning of the holding brake, it must be checked before the motors are commissioned. The test as well as the resurfacing may be carried out "mechanically by hand" or "automatically by means of the software function".

Measure the holding torque (M4) of the holding brake. If necessary, resurface the holding brake.

Checking and resurfacing of holding brakes by hand

Measuring the Holding Torque (M4) of the Holding Brake

1. De-energize the motor and secure it against re-energization.
2. Measure the transferable holding torque of the holding brake with a torque wrench. For holding torque (M4) refer to the technical data.

If the holding torque (M4) is achieved, the motor is ready for assembly. If the holding torque (M4) **is not achieved**, the subsequent resurfacing-process can be used to reconstitute the holding torque.

Resurfacing the Holding Brake

1. At closed holding brake, turn the output shaft by hand, e.g. with the help of a torque wrench, by about 5 revolutions.
2. Measure the holding torque (M4).

If the holding torque (M4) is achieved, the motor is ready for assembly. If the specified holding torque (M4) is not attained after several grinding-in processes, the holding brake is not operable. Please, contact the Rexroth Service.

Checking and resurfacing of holding brakes by means of the software function

Checking the Holding Torque (M4) via P-0-0541, C2100 Command Holding system check

1. The efficiency of the holding brake and the opened state are checked by the control device by starting the routine "P-0-0541, C2100 Command Holding system check".

If the holding brake is operational, the drive is in an operational state after the routine was run through. If the braking torque is too low, the control device outputs a corresponding message.



The brake test can also be carried out cyclically in the framework of a preventive maintenance.

Restoring the Holding Torque (M4) by means of the Software Function

The following possibilities are available:

1. Realization of the resurfacing routine IndraDrive "Restoring the holding torque "(see"P-0-0544, C3900 Command Resurfacing of motor holding brake"). A repeated realization of the resurfacing routine is possible.

Upon the execution of the command C3900 it is not checked whether the resurfacing of the holding brake was successful. It is recommended to execute the command C2100 (Command Holding system check) once again.

2. Resurfacing routine by superior control. Here, special control programs adapted to the machine and system concepts are required. If necessary, please contact your Bosch Rexroth distribution partner and discuss the resurfacing routine parameters for your application.



For more detailed information about software functions refer to the functional description "Rexroth IndraDrive Firmware for Drive Control Devices MPx-xx, DOK-INDRV*-MP*-xxVRS**-FKxx-EN-P."

Maintenance of the Electronic System of the Drive

The electronic system of the drive (power section and control section) operates without wear within the given operating conditions and service life. How-

Instructions for Use

ever, operation under unfavorable conditions (e.g. increased ambient temperature) can lead to limitations in availability.

⚠ CAUTION

Risk of burns by hot surfaces with temperatures of more than 60 °C!

After switching the devices off, wait 15 minutes to allow them to cool down before touching them. Do not work at hot surfaces.

In regular intervals (at the latest, after one year is over), check the heat sink of the electronic system of the drive for accumulated dirt (e.g. dust deposits). Remove accumulated dirt.

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 compliance 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	<p>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.</p> <p>The lines with high potential of noise include:</p> <ul style="list-style-type: none">• Lines at the mains connection (incl. synchronization connection)• Lines at the motor connection <p>Lines at the DC bus connection</p> <p>Generally, interference injections are reduced by routing cables close to grounded 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. Separate the incoming and outgoing cables of the radio interference suppression filter.</p>
Interference Suppression Elements	<p>Provide the following components in the control cabinet with interference suppression combinations:</p> <ul style="list-style-type: none">• Contactors• Relays• Solenoid valves• Electromechanical operating hours counters <p>Connect these combinations directly at each coil.</p>
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.

EMC Measures for Design and Installation

Connecting the Mains Choke Keep connection lines of the mains choke at the drive controller as short as possible and twist them.

- Installing the Motor Power Cable**
- Use shielded motor power cables or run motor power cables in a shielded duct
 - Use the shortest possible motor power cables
 - Ground shield of motor power cable at both ends over the largest possible surface area to establish a good electrical connection
 - Run motor lines in shielded form inside the control cabinet
 - Do not use any steel-shielded lines
 - The shield of the motor power cable mustn't be interrupted by mounted components, such as output chokes, sine filters or motor filters

6.2 EMC-Optimal Installation in Facility and Control Cabinet

6.2.1 General Information

For EMC-optimal installation, a spatial separation of the interference-free area (mains connection) and the interference-susceptible area (drive components) is recommended, as shown in the figures below.



For EMC-optimal installation in the control cabinet, use a separate control cabinet panel for the drive components.

6.2.2 Division Into Areas (Zones)

Exemplary arrangements in the control cabinet: See section [Control Cabinet Mounting According to Interference Areas - Exemplary Arrangements, page 41](#).

We distinguish three areas:

1. Interference-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. Interference-susceptible area (**area B**):

- Mains connections between drive system and mains filter for drives, mains contactor
- Interface lines of drive controller

3. Strongly interference-susceptible area (**area C**):

- Motor power cables including single cores

Never run lines of one of these areas in parallel with lines of another area so that there isn't any unwanted interference injection from one area to the other and that the filter is jumpered with regard to high frequency. Use the shortest possible connecting lines.

Recommendation for complex systems: Install drive components in one cabinet and the control units in a second, separate cabinet.

EMC Measures for Design and Installation

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



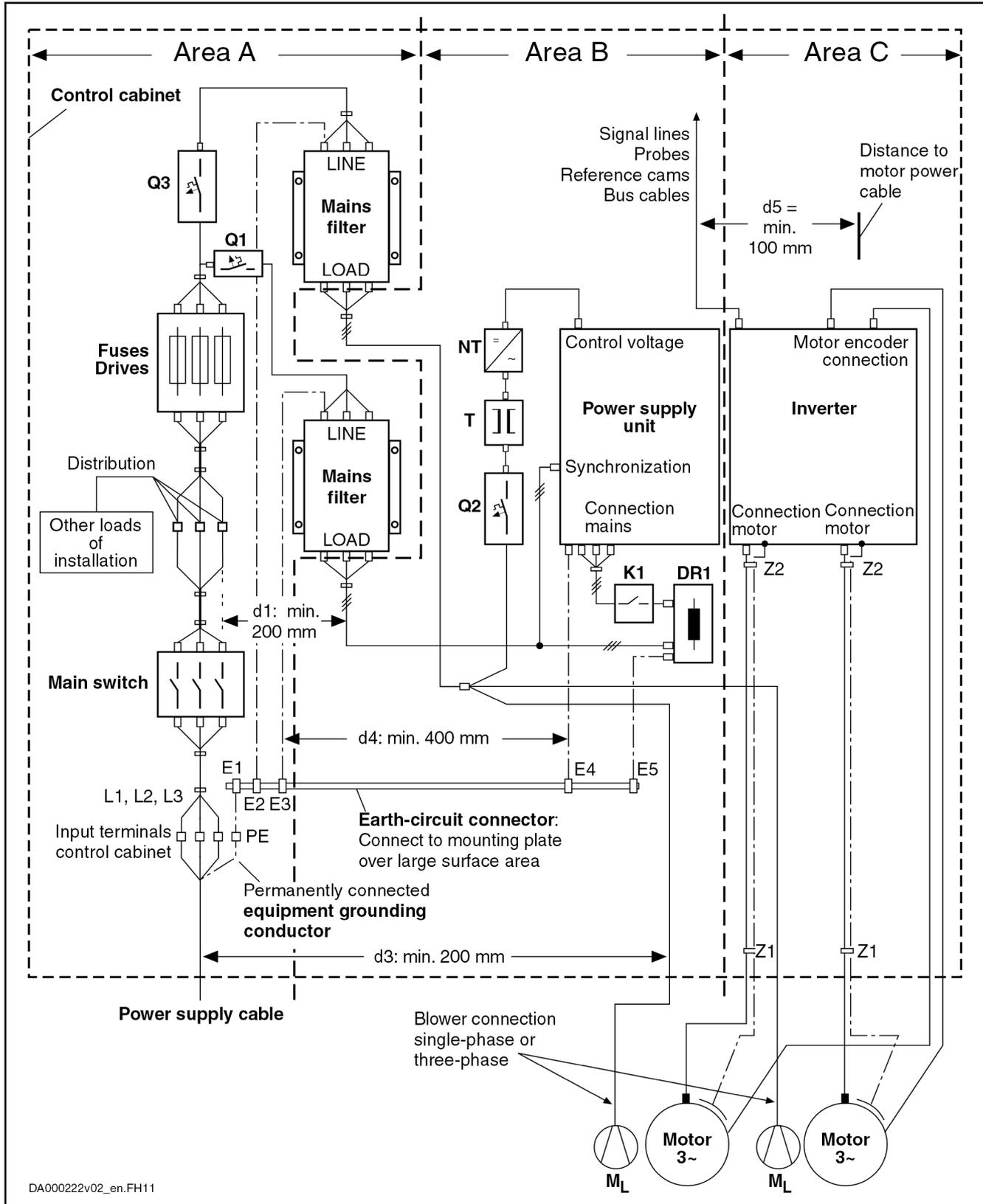
Do not operate any additional loads at the mains filter!

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 separate mains filters.

EMC Measures for Design and Installation

Regenerative Supply Unit

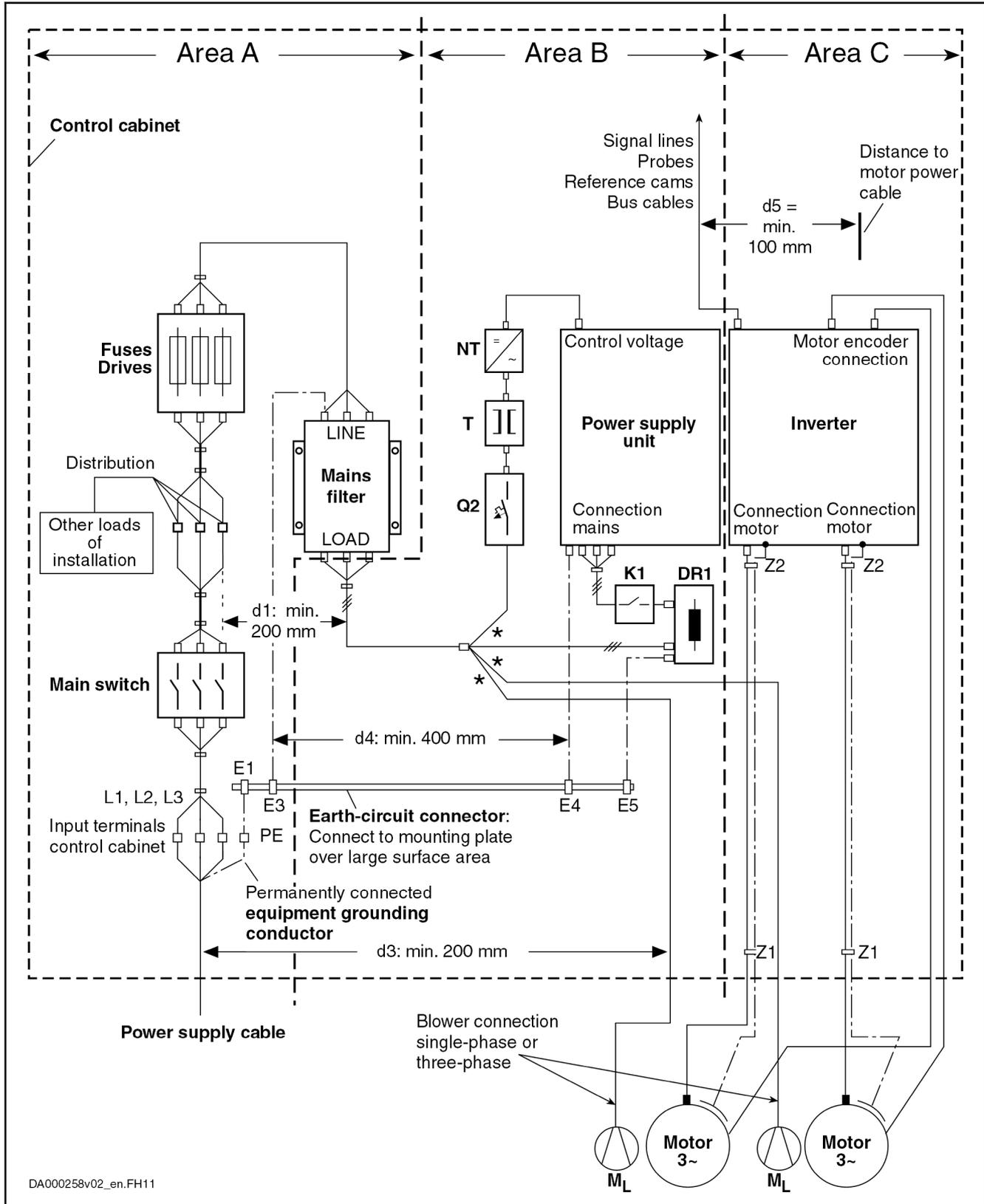


EMC Measures for Design and Installation

DR1	Mains choke
E1...E5	Equipment grounding conductor of the components
K1	External mains contactor for supply units without integrated mains contactor
M _L	Motor blower
NT	Power supply unit
Q1, Q2, Q3	Fusing
T	Transformer
Z1, Z2	Shield connection points for cables
<i>Fig. 6-1:</i>	<i>Regenerative Supply Unit – EMC Areas in the Control Cabinet</i>

EMC Measures for Design and Installation

Infeding Supply Unit or Converter



EMC Measures for Design and Installation

DR1	Mains choke (optional)
E1...E5	Equipment grounding conductor of the components
K1	External mains contactor for supply units and converters without integrated mains contactor
M _L	Motor blower
NT	Power supply unit
Q2	Fusing
T	Transformer
Z1, Z2	Shield connection points for cables
*	Not allowed at HNF mains filter

Fig. 6-2: *Infedding Supply Unit or Converter – EMC Areas in the Control Cabinet*

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

Arranging the Components in the Control Cabinet

Comply with a distance of at least **200 mm** (distance d1 in the figure):

- 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-Free Lines to the Mains Connection

Comply with a distance of at least **200 mm** (distance d1 and d3 in the figure):

- 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.



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 Conductor (N)

If a neutral conductor is used together with a three-phase connection, it must not be installed unfiltered in zones B and C, in order to keep interference off the mains.

EMC Measures for Design and Installation

Motor Blower at Mains Filter	<p>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:</p> <ul style="list-style-type: none"> • In drive systems with regenerative supply units, via a separate single-phase (NFE type) or three-phase filter (HNF type) near the mains connection of the control cabinet • In drive systems with only infeeding supply units, via the available three-phase filter of the drive system <p>When switching power off, make sure the blower is not switched off.</p>
Loads at Mains Filter of Drive System	<p> Only operate allowed loads at the mains filter of the drive system!</p> <p>At the three-phase filter for the power connection of regenerative supply units, it is only allowed to operate the following loads:</p> <ul style="list-style-type: none"> • HMV supply unit with mains choke and, if necessary, mains contactor <p>Do not operate any motor blowers, power supply units etc. at the mains filter of the drive system.</p>
Shielding Mains Supply Lines in Control Cabinet	<p>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:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>
Mains Filters for AC Drives	<p>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.</p> <p>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.</p> <p>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.</p>
Grounding	<p>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 $d_4 = 400 \text{ mm}$, in order to minimize interference injection from ground and ground cables to the power input lines.</p> <p>See also 6.2.2 Division Into Areas (Zones), page 40.</p>
Point of Connection for Equipment Grounding Conductor at Machine, Installation, Control Cabinet	<p>The equipment grounding conductor of the power cable of the machine, installation 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 equipment grounding conductor via separate terminal connectors (according to EN 61800-5-1:2007, section 4.3.5.5.2). If the cross section of the outer conductor is bigger, the cross section of the equipment grounding conductor must be accordingly bigger.</p>

6.2.5 Design and Installation in Area B - Interference-Susceptible Area of Control Cabinet

Arranging Components and Lines	<p>Modules, components and lines in area B should be placed at a distance of at least $d1 = 200 \text{ mm}$ from modules and lines in area A.</p> <p>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.</p> <p>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 40.</p> <p>Install the shortest possible lines between drive controller and filter.</p>
Control Voltage or Auxiliary Voltage Connection	<p>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 45.</p> <p>Run the connection between control voltage connection of the drive system and power supply unit used through area B over the shortest distance.</p>
Line Routing	<p>Run the lines along grounded metal surfaces, in order to minimize radiation of interference fields to area A (transmitting antenna effect).</p>

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

Influence of the Motor Power Cable	<p>Area C mainly concerns the motor power cables, especially at the connection point at the drive controller.</p> <p>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.</p>
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- Run the shortest possible motor power cables.
- Only use **shielded** motor power cables by Rexroth.

6.3 Ground Connections

Housing and Mounting Plate	<p>By means of appropriate ground connections, it is possible to avoid the emission of interference, because interference is discharged to ground on the shortest possible way.</p> <p>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.</p> <p>The best solution is to use a zinc-coated mounting plate. Compared to a lacquered plate, the connections in this case have a good long-time stability.</p>
Connection Elements	<p>For lacquered mounting plates, always use screw connections with tooth lock washers and zinc-coated, tinned screws as connection elements. At the connection 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</p>

EMC Measures for Design and Installation

	connections, you can establish the contact to lacquered surfaces by using tooth lock washers.
Metal Surfaces	<p>Always use connection elements (screws, nuts, plain washers) with good electroconductive surface.</p> <p>Bare zinc-coated or tinned metal surfaces have good electroconductive properties.</p> <p>Anodized, yellow chromated, black gunmetal finish or lacquered metal surfaces have bad electroconductive properties.</p>
Ground Wires and Shield Connections	<p>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.</p> <p>Always connect cable shields, especially shields of the motor power cables, to ground potential over a large surface area.</p>

6.4 Installing Signal Lines and Signal Cables

Line Routing	<p>For measures to prevent interference, see the Project Planning Manuals of the respective device. In addition, we recommend the following measures:</p> <ul style="list-style-type: none"> • 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 40) 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.
Shielding	<p>Connect the cable shield immediately at the devices in the shortest and most direct possible way and over the largest possible surface area.</p> <p>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.</p> <p>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.</p> <p>You absolutely have to equip separable connections with connectors with grounded metal housing.</p> <p>In the case of non-shielded lines belonging to the same circuit, twist feeder and return cable.</p>

6.5 General Measures of Radio Interference Suppression for Relays, Contactors, 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.

7 Accessories

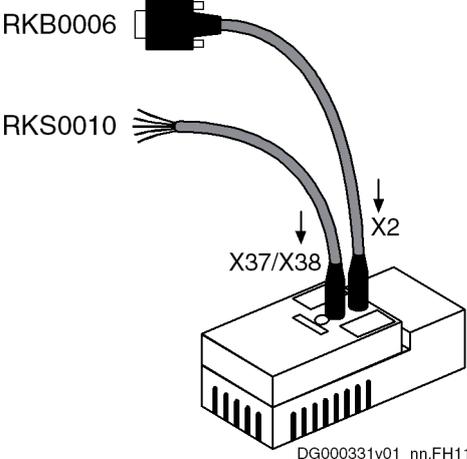
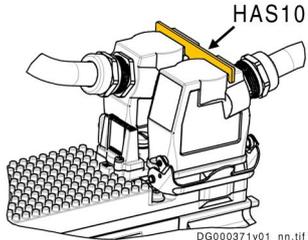
 <p>RKB0006</p> <p>RKS0010</p> <p>X37/X38</p> <p>X2</p> <p>DG000331v01_nn.FH11</p>	<p><i>Cables</i></p> <ul style="list-style-type: none">• RKB0006 Interface cable (X2 ↔ PC)• RKS0010 Interface cable (X37 or X38 ↔ Control unit)
 <p>HAS10</p> <p>DG000371v01_nn.tif</p>	<p>HAS10</p> <p>Fixing clip for hybrid cables</p>

Fig.7-1: Accessories

8 Service and Support

We provide a worldwide service network for an optimum and fast support of your needs. Our experts are there for you. You can contact us **24/7**.

Service Germany Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related concerns for electric drive and controls.

Contact the **Service Helpdesk & Hotline** under:

Phone: **+49 (0) 9352 40 50 60**
Fax: **+49 (0) 9352 18 49 41**
E-mail: service.svc@boschrexroth.de
Internet: <http://www.boschrexroth.com>

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide Outside Germany, please contact your service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information We can help you more quickly and efficiently if you have the following information ready:

- Detailed description of malfunction and circumstances leading to the malfunction
- Type plate name of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your email address)

9 Environmental Protection and Disposal

9.1 Environmental Protection

Production Processes	The products are made with energy- and resource-optimized production processes 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.														
No Release of Hazardous Substances	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, our products contain the following components: <table><tr><td>Electronic devices</td><td>Motors</td></tr><tr><td>• steel</td><td>• steel</td></tr><tr><td>• aluminum</td><td>• aluminum</td></tr><tr><td>• copper</td><td>• copper</td></tr><tr><td>• synthetic materials</td><td>• brass</td></tr><tr><td>• electronic components and modules</td><td>• magnetic materials</td></tr><tr><td></td><td>• electronic components and modules</td></tr></table>	Electronic devices	Motors	• steel	• steel	• aluminum	• aluminum	• copper	• copper	• synthetic materials	• brass	• electronic components and modules	• magnetic materials		• electronic components and modules
Electronic devices	Motors														
• steel	• steel														
• aluminum	• aluminum														
• copper	• copper														
• synthetic materials	• brass														
• electronic components and modules	• 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: <p style="text-align: center;">Bosch Rexroth AG Electric Drives and Controls Buergermeister-Dr.-Nebel-Strasse 2 97816 Lohr am Main, Germany</p>
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.
Batteries and Accumulators	Batteries and accumulators can be labeled with this symbol.  The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin. The end user within the EU is legally obligated to return used batteries. Outside the validity of the EU Directive 2006/66/EC keep the stipulated directives. Used batteries can contain hazardous substances, which can harm the environment or the people's health when they are improper stored or disposed of. After use, the batteries or accumulators contained in Rexroth products have to be properly disposed of according to the country-specific collection.
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.

Environmental Protection and Disposal

Metals contained in electric and electronic modules can also be recycled by means of special separation processes.

Products made of plastics can contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the valid legal requirements.

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