

High-Speed Spindle Motor ADS112B/C

Operating Guide

SYSTEM200

- Title** High-Speed Spindle Motor ADS112B/ADS112C

- Type of documentation** Operating Guide

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- What is the purpose of this document?** This documentation ...
 - gives guidelines on operating and troubleshooting of ADS112-motors.
 - should be a part of the machine documentation for end users.

Course of modifications

Document identification of previous and present output	Release Date	Comments
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Note This document has been printed on chlorine-free bleached paper.

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1 Product Information

This chapter introduces the product and the intended use. It also gives general information about the documentation.

1.1 Product description

High-speed spindle motors ADS are generally used as direct drives in machine tools. The main features are:

- asynchronous motor kit
- precision spindle bearing arrangement
- hollow shaft for tool cooling lubricant (optional)
- high-resolution motor encoder

Motor details Refer to following picture for identification of motor details.

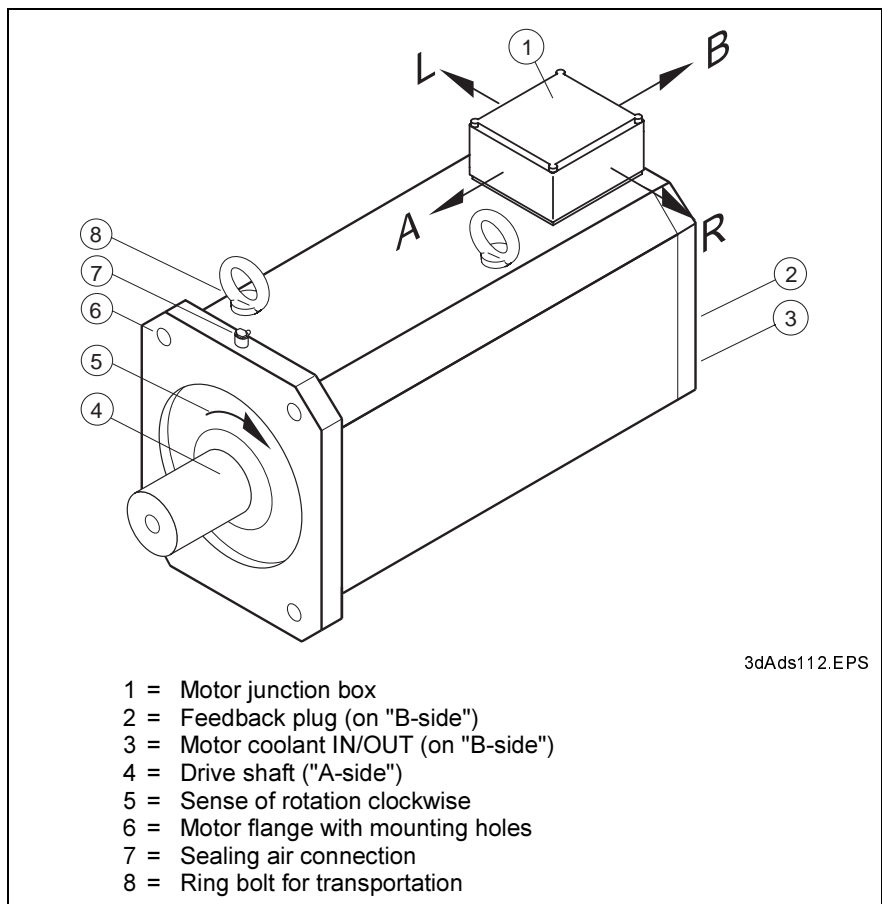


Fig. 1-1: Spindle motor ADS112

Some product features are optional and may not be present on every motor.

1.2 Intended Use

Spindle motors ADS are designed in accordance with the latest state of technology and will be delivered in operationally reliable condition. Operation and application of ADS-Motors are at any time restricted to certain uses, which are described in this documentation. Operating or using ADS-motors for any other use can cause hazardous conditions as well as bodily harm and machine damage.

Intended use ADS-motors may only be used as:

- Rotating direct drive with axial coupling to machines or machine units, such as spindle units or tool turrets.

Requirements For operation of ADS-motors in accordance with the intended use following requirements apply:

- Operation in compliance with all operating and environmental guidelines given in this ADS-documentation and given by the machine unit manufacturers.
- Inspections and maintenance measures being carried out in compliance with corresponding data in this documentation.

Restrictions For operation of ADS-motors in accordance with the intended use following limitations apply:

- limited range of operation acc. to technical data in this document.
- limited permissible mechanical stress during transportation, storage or operation.
- limited lifetime of bearings and lubricating grease.

Inappropriate Use Using ADS-motors inappropriately may cause hazardous conditions as well as bodily harm and machine damage. Following this the ADS-motors may not be operated...

- under conditions that exceed any operating limits given in this documentation.
- with radial coupling of machines or machine units to the motor shaft.
- under water or in environments with humidity that exceeds the permissible humidity level as given by the motor's class of protection (class of protection specified by EN 60068-2-1).

Consequences INDRAMAT GmbH is not liable for any damages resulting from failure to observe the warnings, operating guidelines or data given in this document or for damages resulting from inappropriate use.

All risks resulting from inappropriate use are to be taken by the user.

1.3 Indramat documentation

- Validity** This documentation is valid only for spindle motors ADS112B and ADS112C with the options included in the motor type code.
- Target group** This document is only for qualified personnel that has to carry out project planning, installation and operation of the described product. Refer to chapter 2 for more details on qualification of personnel.
- Purpose** This documentation includes many safety notes as well as operating guidelines with technical data. Studying and using the documentation contents helps the target group to handle and operate the ADS-motors safely and appropriately.
- The information in this document is not substituting
- professional education in mechanical and electrical engineering,
 - education given by Indramat training courses or
 - general knowledge and practical experience with spindle motors.

Note: Do not start-up or operate the product if you do not have a complete set of documentation for the product. Record the complete type code and serial number of the components you are using and order the latest documentation from your local Indramat representative.

The documentation you need depends on the equipment you use. Contact your local Indramat representative for details.

Following list represents only a brief overview.

Product	Documentation Code	Document No. ¹	Type
DIAX04	DOK-POWER*-HVE+HVR**••-AN••-EN-P	209-0074-4303-••-EN	Manual for supply modules HVE/HVR
DIAX04	DOK-DIAX04-HDD+HDS**••-PR••-EN-P	209-0074-4304-••-EN	Project planning drive modules HDD/HDS
DIAX01/04	DOK-DIAX01-DRIVE***LIQ-AU••-EN-P	209-0042-4131-••-EN	Project planning for liquid cooling systems

¹) • Instead of these dots the document's update index will be printed. Always ask for the latest document. EN names the English version. Documentation in other languages upon request (availability subject to change).

Fig. 1-2: Documentation

- External systems** Documentation for external systems such as air supply and cooling systems are not supplied by Indramat. Contact the manufacturers of these systems directly for a complete set of documentation.
- Your feedback** Your experiences and your expertise will help us to improve and to adapt product and documentation to your needs.
- Whether you find errors in this documentation or just like to send in your comments, please do not hesitate send the respective page to:

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2 Safety Instructions for Electrical Equipment

2.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. You must contact your local Indramat representative if you do not have the user documentation for your equipment. Request your Indramat representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the product.



Inappropriate use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in product damage, personal injury, severe electrical shock or death !

2.2 Explanations

The safety warnings in this documentation describe individual classes of danger and hazards. For some hazards other symbols may be used.




Warning symbol with signal word in compliance with ANSI	Danger class in compliance with ANSI The danger class describes the consequences resulting from non-compliance with the safety guidelines.
 CAUTION	Bodily harm or product damage will occur.
 DANGER	Death or severe bodily harm may occur.
 WARNING	Death or severe bodily harm may occur.

Fig. 2-1: Classes of danger

2.3 Hazards by inappropriate use



DANGER

High voltage and high discharge current ! Danger to life, risk of severe electrical shock and risk of injury !



DANGER

Dangerous movements ! Danger to life and risk of injury or equipment damage by unintentional motor movements !



WARNING

High electrical voltage due to wrong connections ! Danger to life, severe electrical shock and severe bodily injury !



WARNING

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



CAUTION

Surface of machine housing could be extremely hot ! Danger of injury ! Danger of burns !



CAUTION

Risk of injury due to inappropriate handling ! Bodily injury caused by crushing, shearing, cutting and mechanical shock !



CAUTION

Risk of injury due to inappropriate handling of batteries !

2.4 General Information

- INDRAMAT GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Order operating, maintenance and safety instructions in your language before starting up the machine. If your language is not available, then numerous other languages are. Select one that you understand perfectly.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment :

Only trained and qualified personnel may work on this equipment or within its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.

Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.

- Use only genuine spare parts approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.
- Start-up is only permitted once it is sure that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.

European countries: see directive 89/392/EEC (machine guideline).

- Operation is only permitted if the national EMC regulations for the application are met.

The instructions for installation in accordance with EMC requirements can be found in the INDRAMAT document "EMC in Drive and Control Systems".

The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EEC (EMC Guideline).

U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

2.5 Protection against contact with electrical parts

Note : This section refers to equipment with voltages above 50 Volts.

Making contact with parts conducting voltages above 50 volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.



DANGER

High electrical voltage ! Danger to life, severe electrical shock and severe bodily injury !

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
- ⇒ Follow general construction and safety regulations when working on electrical installations.
- ⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
- ⇒ Do not operate electrical equipment at any time if the ground wire is not permanently connected, even for brief measurements or tests.
- ⇒ Disconnect mains or the voltage source from the equipment before beginning any work. Lock the equipment against being switched on while work is being performed.
- ⇒ Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.
- ⇒ Never touch the electrical connection points of a component while power is turned on.
- ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
- ⇒ A residual-current-operated protective device (r.c.d.) must not be used on an AC drive ! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.

European countries: according to EN 50178/1998, section 5.3.2.3.

- ⇒ Equipment that is built into machines must be secured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

**DANGER**

**High electrical voltage ! High leakage current !
Danger to life, danger of injury and bodily harm
from electrical shock !**

- ⇒ Before switching on power for electrical units, all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.
- ⇒ Leakage current exceeds 3.5 mA. Therefore the electrical equipment and units must always be firmly connected to the supply network.
- ⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection !
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178/1998, section 5.3.2.3.

USA: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must maintain the above noted instructions at all times.

2.6 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages between 5 and 50 Volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety :

- International: IEC 364-4-411.1.5
- EU countries: see EN 50178/1998, section 5.2.8.1.

**WARNING**

High electrical voltage due to wrong connections ! Danger to life, severe electrical shock and severe bodily injury !

- ⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and clamps with 0 to 50 Volts.
- ⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, an optoelectronic coupler or when battery-operated.

2.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. These causes are be various such as:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

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

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends upon the type of control and the state of operation.

**DANGER****Dangerous movements ! Danger to life and risk of injury or equipment damage !**

⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are instituted in accordance with the specific situation of the facility and a danger and fault analysis conducted by the manufacturer of the facility. All the safety regulations that apply to this facility are included therein. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage :

- ⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:
 - use protective fences
 - use protective railings
 - install protective coverings
 - install light curtains or light barriers
- ⇒ Fences must be strong enough to withstand maximum possible momentum.
- ⇒ Mount the emergency stop switch (E-stop) in the immediate reach of the operator. Verify that the emergency stop works before startup. Do not operate the machine if the emergency stop is not working.
- ⇒ Isolate the drive power connection by means of an emergency stop circuit or use a start-inhibit system to prevent unintentional start-up.
- ⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.
- ⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for :
 - maintenance and repair work
 - cleaning of equipment
 - long periods of discontinued equipment use
- ⇒ Avoid operating high-frequency, remote control and radio equipment near electronics circuits and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.

2.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



WARNING

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

- ⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
- ⇒ If it is necessary for a person with a pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemakers, that are already implanted or will be implanted in the future, have a considerable deviation in their resistance to interferences. Due to the unpredictable behaviour there are no rules with general validity.
- ⇒ Persons with hearing aids, metal implants or metal pieces must consult a physician before they enter the areas described above. Otherwise health hazards will occur.

2.9 Protection against contact with hot parts



CAUTION

Housing surfaces could be extremely hot ! Danger of injury ! Danger of burns !

- ⇒ Do not touch surfaces near the source of heat ! Danger of burns !
- ⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.
- ⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns !

2.10 Protection during handling and installation

Under certain conditions inappropriate handling and installation of drive components may cause injuries.



CAUTION

Risk of injury through incorrect handling ! Bodily harm caused by crushing, shearing, cutting and mechanical shock !

- ⇒ Observe general instructions and safety regulations during handling installation.
- ⇒ Use only appropriate lifting or moving equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- ⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- ⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stay under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

2.11 Battery safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or equipment damage.



CAUTION

Risk of injury through incorrect handling !

- ⇒ Konstruktion und Gestaltung nach den Normen
- ⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and corrosion).
- ⇒ Never charge batteries (danger from leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Handle with care. Incorrect extraction or installation of a battery can damage equipment.

Hinweis: Environmental protection and disposal ! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other refuse. Observe the legal requirements given in the country of installation.

3 Technical Information

This chapter informs about general technical data of ADS112-motors.

3.1 Identification

The motor type plate (see following sample) carries information about motor type, delivery and general technical data. Each Indramat product is identified by type code, material number and serial number. Use this information to identify the product in any communication with Indramat about shipping or servicing.

Motor type plate

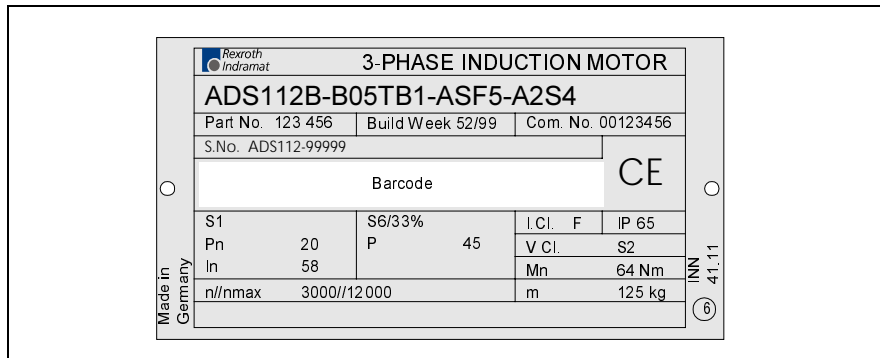


Fig. 3-1: Type plate (sample)

3.2 Handling

Transportation Spindle motors ADS are highly precise and sensitive components. Handle these motors always with special care. For transportation and storage...

- ⇒ Put the motor into the original wooden box and secure the motor inside the box.
- ⇒ Use only appropriate equipment for transportation and lifting.
- ⇒ Protect shaft and housing from any mechanical shock and crash.

Storage ⇒ Store ADS-motors only in clean and dry places and protect motor from humidity, corrosion and contamination. Keep motor in the original box.

Installation The machine manufacturer installs the motor in the appropriate position. After service or troubleshooting measures, a re-installation of the motor might be required.

- ⇒ Mount the motor according to the directions given by the machine manufacturer and the machine documentation.
- ⇒ Do not mount or connect the motor in any other way than the original installation by the machine manufacturer.
- ⇒ If installation guidelines are not complete then contact the machine manufacturer.

3.3 Technical data

Designation	Symbol	Unit	ADS112	
Housing length			B	C
Winding design			AS	AS
Rated power ¹⁾	P_n	kW	20	20
Rated torque ¹⁾	M_n	Nm	64	64
Rated speed ¹⁾	n_n	min ⁻¹	3000	3000
Rated voltage ²⁾	U_{neff}	V	380	380
Rated current	I_n	A	58	58
Min. cable cross section ³⁾	A	mm ²	16	16
Max. speed ⁴⁾	n_{max}	min ⁻¹	18000	
Rotor inertia ⁵⁾	J_m	kgm ²	0,02967	
Class of insulation acc. to DIN VDE 0530, Teil 1			F	
Class of protection acc. to EN 60068-2-1			IP 54	
Sealing air ⁷⁾	p_{max}	bar	1,5	
Max. vibrational speed ⁸⁾	v_{eff}	mm/s	1,8	
Cooling system:				
Rated power loss	P_{Vn}	kW	4,0	4,0
Coolant input temperature	v_n	°C	20...40	
Coolant temperature raise at P_{Vn} ⁶⁾	Δv_n	K	10	
Ambient temperature		°C	5...45	
Min. required coolant flow at Δv_n	Q_n	l/min	5,4	5,4
Pressure drop at Q_n	Δp_n	bar	0,2	0,2
Max. system pressure	p_{max}	bar	3	
Volume motor cooling	V	l	0,7	0,7
Filter cartridge		µm	≤ 100	
Material of cooling jacket: aluminum, hardcoat-surface Material of O-rings: Viton				
¹⁾ Data refers to S1-operation with drive controller RAC. For other drive combinations refer to corresponding diagram for S1-operation . ²⁾ Motor not suitable for direct connection to mains. ³⁾ Only valid for genuine Indramat cables. ⁴⁾ Depends on type of bearing and lubrication. See type plate. ⁵⁾ Standard motor only. Without tool or adapters. ⁶⁾ Valid for water only. Recalculate data when using other coolants (i.e. oil). Refer to machine coolant flow diagram. ⁷⁾ Air supply requires oil-water separator and filter 5 µm. Connection R1/8". ⁸⁾ Refers to Indramat standard S2 (beyond DIN ISO 2373 / DIN VDE 0530)				

Fig. 3-2: Data sheet ADS112

4 Connections

This section gives in-depth information on how ADS-motors are connected.

4.1 General

Note: The machine manufacturer installs the motor with all connections that are required for operation. Since some of the motor connections are optional due to different technical features, not every motor may be connected identically.

After service or troubleshooting measures, a re-installation of the motor might be required.

- ⇒ Connect the motor according to the directions given by the machine manufacturer and the motor connecting plan in the machine documentation.
- ⇒ Do not mount or connect the motor in any other way than the original installation by the machine manufacturer .
- ⇒ If installation guidelines are not complete then contact the machine manufacturer.



DANGER

Risk of death or bodily harm through inappropriate connections and high electrical voltage !

- ⇒ Make all connections according to the original setup given by the machine manufacturer, refer to machine documentation for details.
- ⇒ Check all connections for appropriate and secure connection.

Key plan Following key plan shows all possible connections for ADS-motors (some connections are optional).

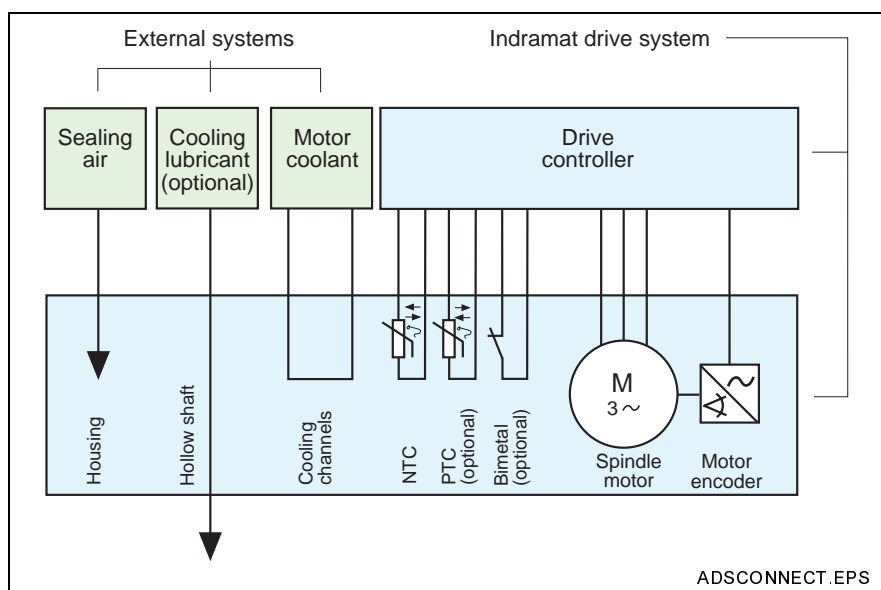


Fig. 4-1: Connection key plan

Rear side Following picture shows the connections at the motor's rear side. Due to different features and options, rear sides of ADS112B and ADS112C look different.

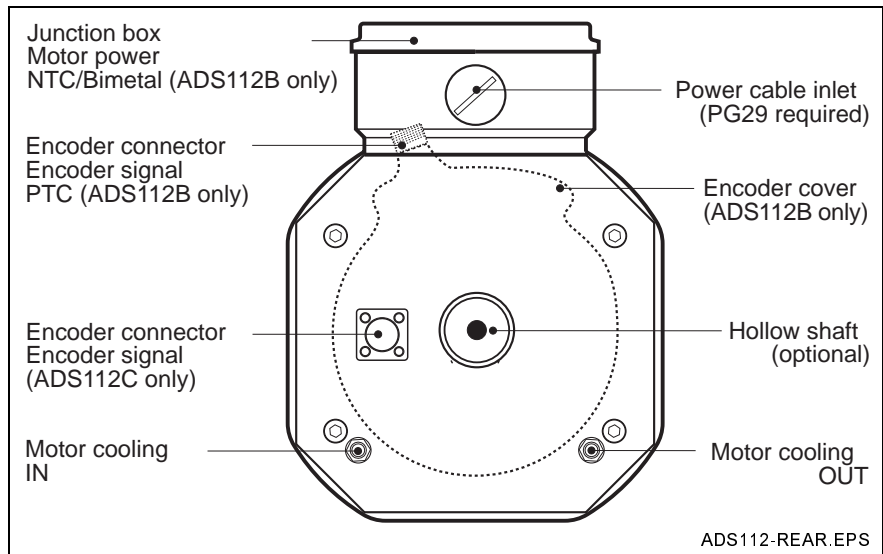


Fig. 4-2: ADS112 rear side

Concerning the encoder connections shown in the picture above, ADS112B and ADS112C are not compatible.

Junction box

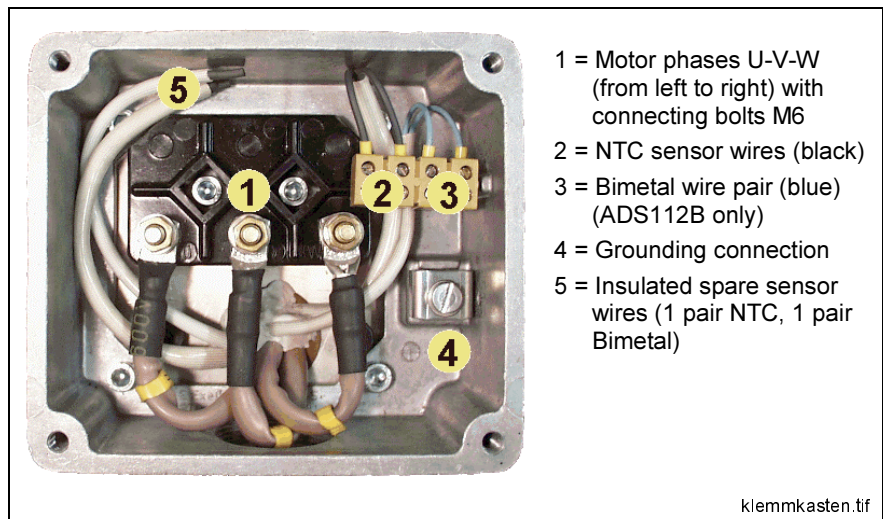


Fig. 4-3: Junction box

If working on the motor junction box is necessary...

- ⇒ Shut down drive controller before you remove junction box cover and wait for system discharge.
- ⇒ Remove cover carefully to avoid damage of cover gasket
- ⇒ Secure all connections appropriate
- ⇒ Make sure the cable throughlead is tightened and re-install cover only with original gasket inside to maintain class of protection.

Temperature sensors Temperature sensors are connected through the power cable or the encoder cable, depending on the type of drive controller. Refer to following wiring plans for details.

4.2 Power connection

ADS-motors can be operated with different drive controllers, requiring different cable hardware to match corresponding controller connections. Refer to machine documentation and controller documentation for details. Following picture shows the general cable layout for ADS112.

Power cable

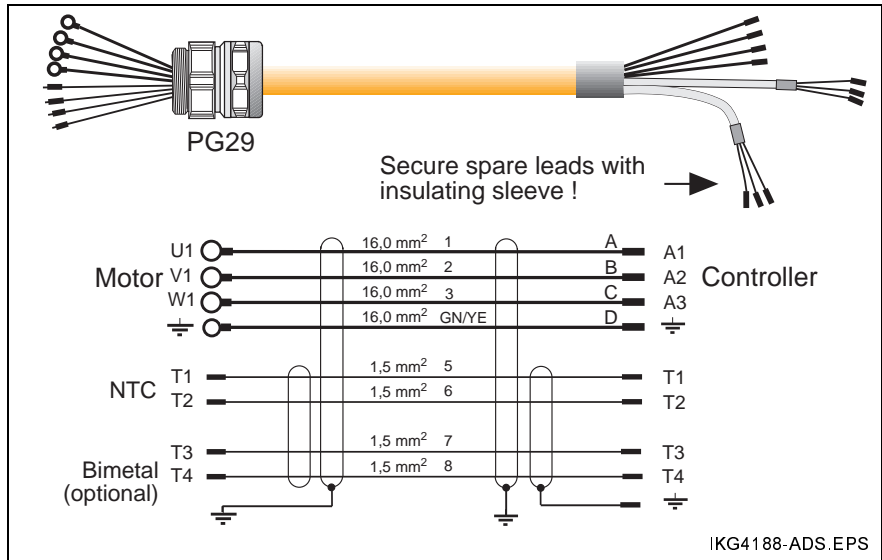


Fig. 4-4: Sample of power cable

4.3 Encoder connection

ADS112B is equipped with a 1V_{pp}-encoder, ADS112C is equipped with a standard Indramat-encoder, both requiring different encoder cables and therefor being connectionwise not compatible.

Following picture shows the connection for ADS112C with Indramat's standard spindle encoder.

ADS112C, Indramat encoder

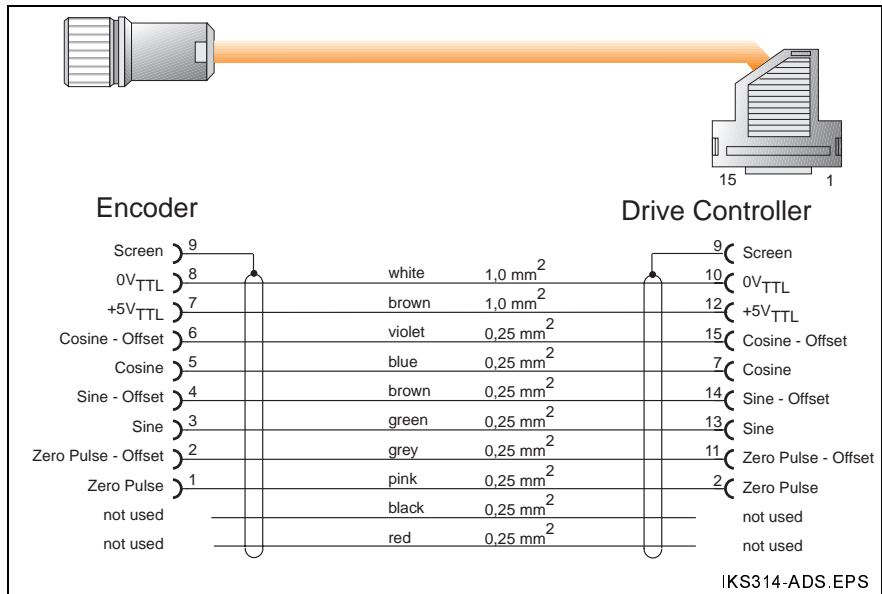


Fig. 4-5: ADS112C encoder connection

ADS112B, 1 V_{SS}-encoder ADS112B are equipped with a 1V_{SS}-encoder. There is no standardized Indramat cable yet to connect the motor's 17pin-flange socket with the required encoder-interface DZF03.1M.

Machine manufacturers install a cable that corresponds to following wiring plan. Preferably there will be no additional plug connection within the cable thus avoiding electrical interferences.

Following wiring plan is valid only for ADS112B with 1V_{SS}-encoder.

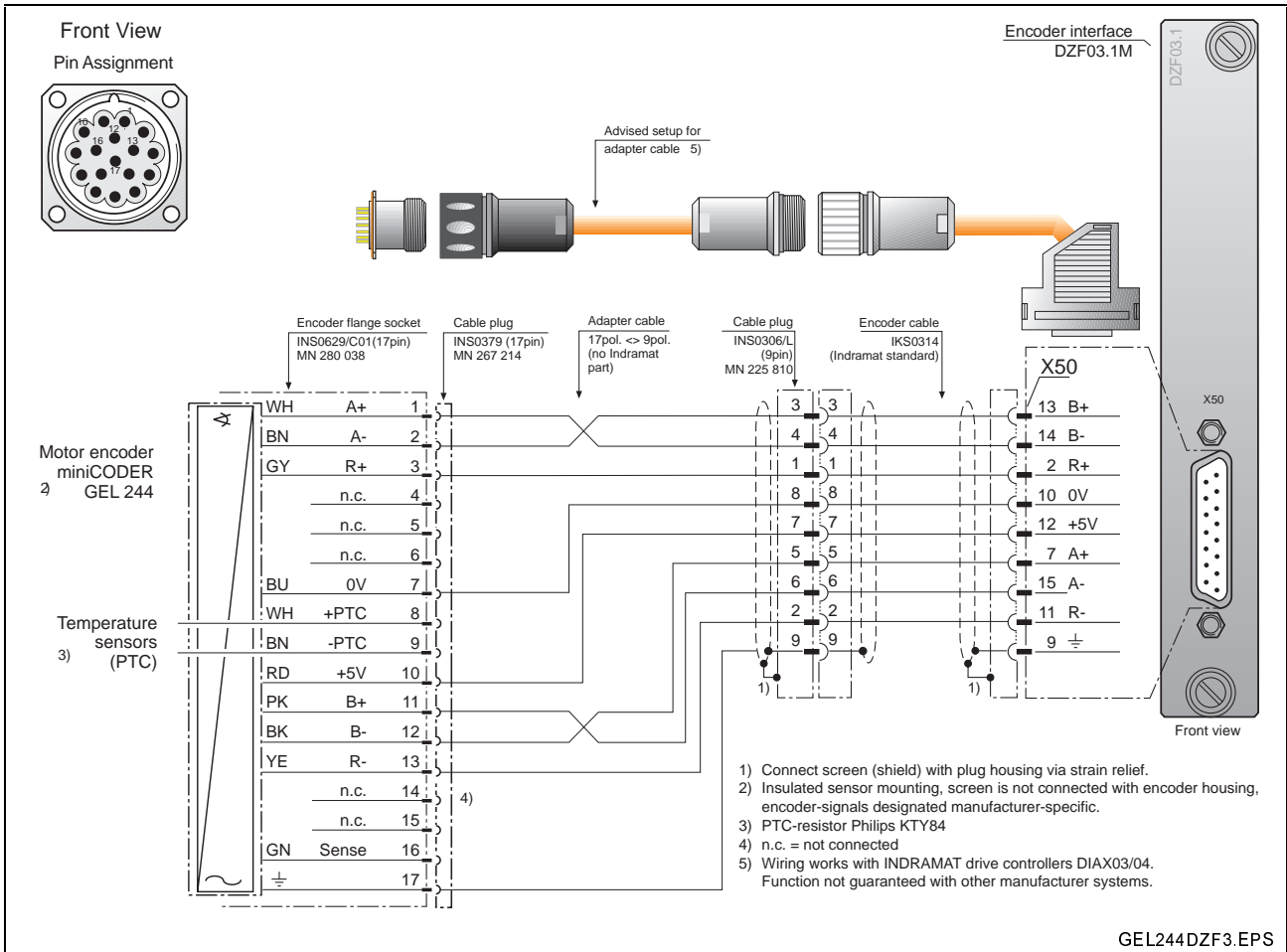


Fig. 4-6: ADS112B encoder connection

4.4 Sealing air

ADS112-motors are supplied with sealing air to avoid contamination of the motor housing and to maintain the motor's class of protection. Supply systems for sealing air are not provided by Indramat. Refer to machine documentation for details.

Minimum requirements for sealing air:

- ⇒ Keep supply system for sealing air operating whenever the machine is in operation.
- ⇒ Do not remove the air connection fitting from the motor. For connection of air tubes only the fitting's front face screw for tube connection may be opened (size G-1/8").
- ⇒ Maintain the required air filter quality of 5 µm through frequent inspections and replacement of defective parts.
- ⇒ Maintain the air system's oil-water-separator through frequent inspections and replacement of defective parts.
- ⇒ Make sure the maximum air pressure of 1,5 bar (effective motor input) is never exceeded.

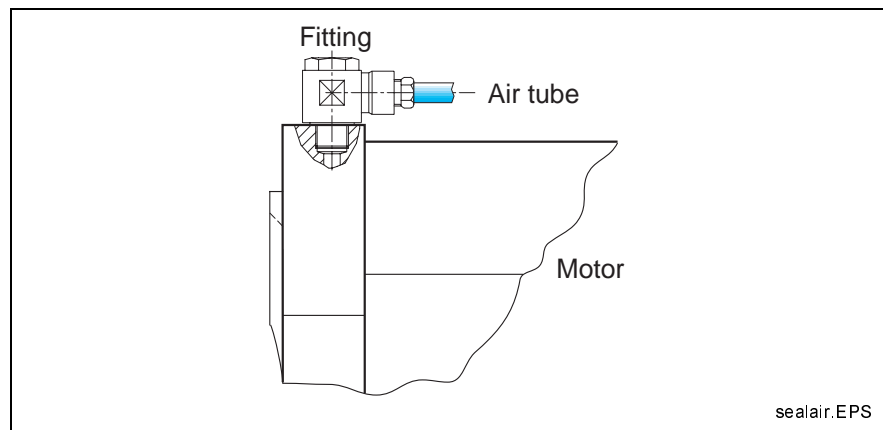


Fig. 4-7: Sealing air connection

4.5 Motor cooling

ADS-motors require permanent cooling supplied by external cooling systems. These supply systems are not provided by Indramat. Refer to machine documentation and motor data sheet for details.

Minimum requirements for liquid cooling system:

- ⇒ Keep coolant supply circuit operating whenever the machine is in operation.
- ⇒ Do not remove the cooling connection fitting from the motor. For connection of coolant tubes only the front face screw of the fitting may be opened (size CK-1/8"-PK6).
- ⇒ Maintain the required coolant filter quality of 100 µm through frequent inspections and replacement of defective parts.
- ⇒ Monitor the coolant system's operation through flow-control devices and temperature monitoring.
- ⇒ Make sure the maximum coolant pressure of 3 bar (effective motor input) is never exceeded.
- ⇒ After motor or cooling failure do not restart cooling on a hot motor. First let the motor cool down to 40° C or lower before cooling system restart.

4.6 Rotating union

Rotating unions on ADS-motors are installed by the machine manufacturer (no Indramat part). The rotating union is screwed into a thread at the rear side of the motor shaft ("B"-side). Refer to machine documentation for details.

5 Operation

This section contains detailed information about operating and troubleshooting ADS112-motors.

5.1 Start-up

- Prerequisites** Before motor start-up following measures must be carried out:
- ⇒ Make sure all parts of the machine documentation and the machine manufacturer's commissioning protocol are present.
 - ⇒ Contact the machine manufacturer if operating data or machine documentation are incomplete.
 - ⇒ Make all connections and drive system adjustments according to the machine documentation.
 - ⇒ Carry out complete commissioning and programming of drive systems and external systems.
 - ⇒ Power up all external systems to normal operation according to the machine documentation.



CAUTION

Bodily harm or product damage will occur !

⇒ Make sure all conditions and requirements mentioned above are fully accomplished before you carry out start-up of the motor.

- ⇒ Record an additional protocol of the procedures you will carry out and keep protocol available for further records.

Run-in sequence After extended periods of transportation, storage or no-operation, ADS-motors with permanent grease lubrication require a sequence of run-in measures.

Note: If motors are stored for a long time (i.e. spare motors) it is recommended to carry out the run-in sequence frequently to maintain the motor operating ability. Fix the motor securely onto a massive groove bench and you can perform the run-in sequence outside the machine.

If all conditions are fully accomplished, carry out following steps:

Step	Duration	Motor Speed	Rotation ¹⁾
1	15 Minutes	1000 min ⁻¹	
2	15 Minutes	3000 min ⁻¹	
3	10 Minutes	1000 min ⁻¹	
4	15 Minutes	5000 min ⁻¹	
5	10 Minutes	3000 min ⁻¹	
6	15 Minutes	7500 min ⁻¹	
7	10 Minutes	3000 min ⁻¹	

1) Sense of rotation with view on motor front shaft ("A-side")

Fig. 5-1: Run-in sequence

Start If all conditions are fully accomplished, carry out motor start-up procedures and operation according to machine documentation. Refer to drive & control system documentation for details on these components.

5.2 Maintenance



DANGER

Dangerous movements ! Danger to life and risk of injury or equipment damage by machine movements !

- ⇒ Stop machine operation and keep moving parts in secure position before carrying out maintenance or troubleshooting procedures.
- ⇒ Refer to machine documentation for instructions.

ADS-motors (like any other motor with spindle bearings) are not free of maintenance. Motor maintenance and repair should be carried out at Indramat's service centre, but some on-site-measures can enhance availability and reliability of the product.

Note: Indramat is not liable for any on-site maintenance or troubleshooting action that is carried out by users or the machine manufacturer.

- ⇒ Refer to the maintenance plan provided by the machine manufacturer. Record all maintenance actions in the machine protocol and keep protocol available for further records.

Maintenance procedures

Action	Interval	Troubleshooting
Check rotating union visually on leakage.	Weekly	Replace rotating union (no Indramat part)
Check motor manually on smooth run and vibrations.	Weekly	Contact machine manufacturer or Indramat service. Replace motor.
Check all filters for contamination.	Once every month.	Clean filters. Replace defective parts.
Install new air filter (5 µm)	Every 6 months or every 2000 hrs. of operation	Replace filter.
Install new filter for oil-water-separator.	Every 6 months or every 2000 hrs. of operation	Replace filter.
Install new filter for motor cooling circuit (100 µm).	Every 6 months or every 2000 hrs. of operation	Replace filter.

Fig. 5-2: Maintenance

Note: If ADS-motors are operated under heavy-duty conditions or in extremely contaminated environment, it is recommended to carry out maintenance procedures in shorter intervals.

Refer to documentation of other system components and to next section for further information on troubleshooting.

5.3 Troubleshooting



DANGER

Dangerous movements ! Danger to life and risk of injury or equipment damage by machine movements !

- ⇒ Stop machine operation and keep moving parts in secure position before carrying out maintenance or troubleshooting procedures.
- ⇒ Refer to machine documentation for instructions.

Following Q&A-list contains information and experience gathered from working with ADS-motors. Due to the wide range of different applications this list may not be complete. Please forward your experiences to Indramat (see chapter 1.4).

Refer to documentation for the machine or other drive & control system components for further guidelines on troubleshooting. If you cannot find a workaround for your problem, then contact the machine manufacturer or Indramat Customer Service for troubleshooting guidelines.

The following answers may list several measures. The measure that will most likely solve the problem will be listed first.

Q: When powering up drive system a message occurs on the control display: F229 Motor encoder error: Quadrant error (drive system DIAX03/04 only).

A: There might be noise signals on the encoder line.

- ⇒ Check shielding of encoder cable and cable connectors. Shield connections should be large-surfaced. Renew shielding if necessary.
- ⇒ Place encoder cable away from power cables. Use shielded cable channels.
- ⇒ Reduce number of cable disconnecting points by using a single encoder cable.
- ⇒ If error persists, replace encoder cable, encoder interface DZF03.1 or drive controller.

Q: When powering up drive system a message occurs on the control display: C217 Error when reading motor encoder data (DIAX03/04).

A: Cable problem, incorrect parameter or configuration, encoder fault.

- ⇒ Check encoder cable for appropriate wiring.
- ⇒ Set drive parameter P-0-0074 to value 9. Refer to drive documentation.
- ⇒ Replace encoder interface DZF03.1 in drive controller.
- ⇒ Replace motor.

Q: When powering up drive system a message occurs on the control display: F822 Motor encoder error: Signal amplitude faulty (DIAX03/04).

A: Cable problem, incorrect wiring or encoder fault.

- ⇒ Check encoder cable and connections for appropriate wiring, shielding and breakage.
- ⇒ Check encoder function of 1V_{ss}-encoder with encoder tester (i.e. from Lenord&Bauer).

If an encoder tester is not available, some encoder functions may be tested with multimeter.

Multimeter check conditions :

- ⇒ Shut down drive power safely and supply separate + 5 V_{DC} to encoder (see wiring plan for details).
- ⇒ Use measuring equipment only free of electrical potential.
- ⇒ Turn motor shaft slowly and steadily during measurement to generate a constant output signal.

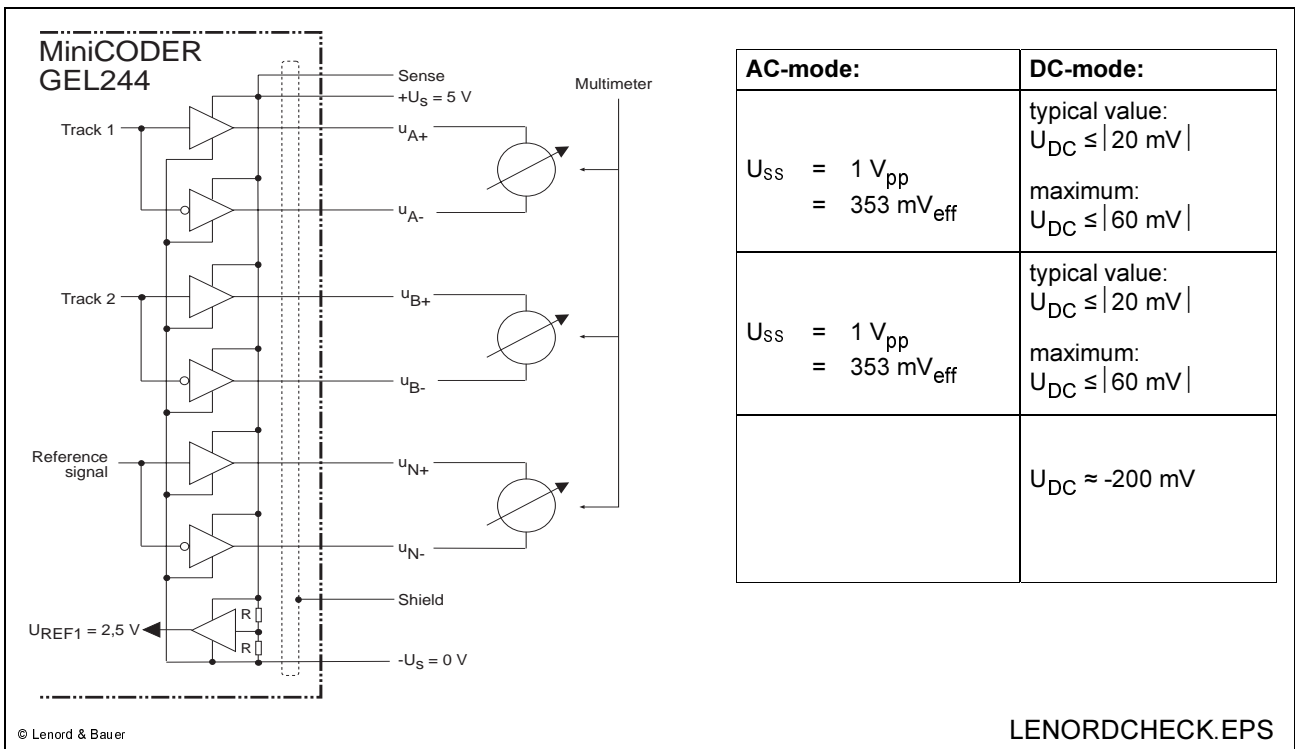


Fig. 5-3: Encoder-check with multimeter

Contact machine manufacturer or Indramat customer service if diagnosis proofs encoder malfunction.

Q: When enabling drive set-point the motor does not turn or oscillates erratically.

A: Wiring problem, incorrect parameter or configuration, encoder fault.

- ⇒ Check encoder cable for appropriate wiring.
- ⇒ Set drive parameter P-0-0074 to value 9. Refer to drive documentation.
- ⇒ Replace encoder interface DZF03.1 in drive controller.
- ⇒ Replace motor.

Q: When enabling positioning command the motor continues turning without drive fault message.

A: Incorrect encoder wiring.

- ⇒ Check encoder cable for appropriate wiring.

Q: Motor gets hot after short time.

A: Motor overload through exceeded duty cycle, failure of motor cooling circuit or bearing damage.

- ⇒ Check machine program for compliance with motor operational data and change program if required.
- ⇒ Check cooling circuit. Install flow control devices for further monitoring.
- ⇒ Check motor run manually for noise and vibration caused by damaged bearings. Replace motor.
- ⇒ Restart motor only after down-cooling time (max. 40° C motor temperature before restart).

Q: Motor bearings cause vibrations or noise.

A: Grease lifetime or mechanical bearing lifetime exceeded. Bearing mechanically damaged.

- ⇒ Check machine for inappropriate mechanical stress and load onto motor shaft.
- ⇒ Replace motor.

Q: Motor temperature sensors not detected or failure (drive controller diagnosis depends on controller type).

A: Failure of stator temperature sensors.

- ⇒ Check sensor resistance with multimeter.
- ⇒ Connect spare sensor leads. If unclear, locate corresponding lead pair through resistance measurement.

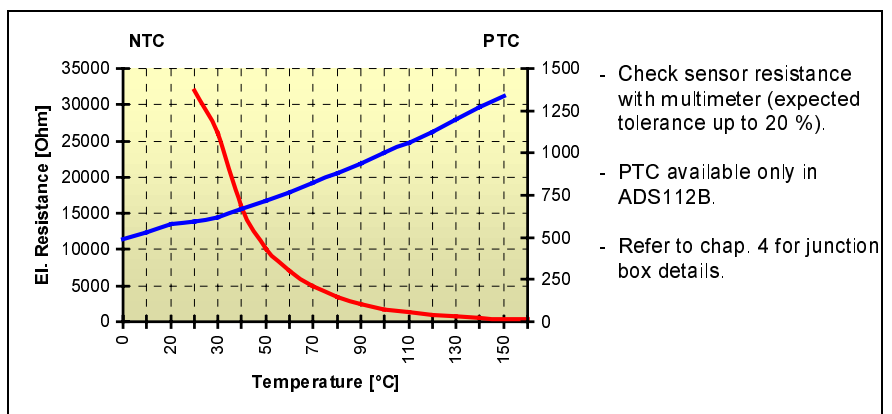


Fig. 5-4: Temperature sensors

Q: Leakage at rotating union. Lubricant or oil drops off permanently.

A: Sealing or bearing of rotating union is worn out or mechanically damaged.

- ⇒ Replace rotating union (no Indramat part). Send defective parts back to manufacturer (some manufacturer offer cost-effective revisions).
- ⇒ Make sure there is no mechanical force on rotating union via supply tubes. Use only flexible tubes ! Refer to manufacturer documentation.

5.4 Service

Indramat-customers have access to a worldwide network of sales representations and service stations. If you need assistance, contact your local Indramat representative (for addresses see appendix).

Note: Collect all information about the problem and the equipment in use (i.e. type, serial-no. etc.) before contacting Indramat service. This will speed up communications and provide the best assistance to solve the problem.

Central Service-Hotline In addition to local service contacts Indramat's central service hotline in Germany can be contacted as follows:

- Phone +49 (0) 172 66 00 406 or
- Phone +49 (0) 171 33 38 826

Opening hours for Indramat's central service hotline in Germany:

- Monday to Friday 07:00 – 23:00
- Saturday 08:00 – 20:00
- Sunday, Holidays 09:00 – 19:00

Shipping back When sending equipment back to Indramat please fill out the repair sheet. This will make repair easier and faster.

Environmental protection and disposal Whenever old Indramat equipment is not used anymore we will take care of appropriate disposal. Just mark the package clearly as disposal and send it back to Indramat with prepaid freight. There will be no additional charge through Indramat.

Training Indramat offers a complete training program for all products. Contact your local Indramat representative or Indramat training center directly.

Indramat Training Centre Germany:

- Phone +49 (0) 9352 - 40 43 25 or - 40 46 96
- Fax +49 (0) 9352 - 40 43 26

Repair card Fill out repair card and attach copy to the package you ship back to Indramat.

REPAIR CARD for INDRAMAT equipment and components			
Name:		Co./loc.:	Date:
If single parts replaced, then part designation:	SN:		Del. cons. no.:
	SN:		Del. date:
Mach. manuf.:	Type	Mach. no.:	Commissioning date:
Fault in axis:	<input type="checkbox"/> horizontal <input type="checkbox"/> vertical <input type="checkbox"/>	Ref. time:	Date of fault:
Problem: Fault _____ _____ <input type="checkbox"/> always present <input type="checkbox"/> occurs sporadically <input type="checkbox"/> occurs after approx. hrs. <input type="checkbox"/> occurs after vibrations <input type="checkbox"/> temperature-dependent <input type="checkbox"/> other * _____ * _____ * _____	Add. notes: (e.g., LED diagnostics, fault message on displ.) _____ _____ _____ _____ _____ _____	Cause: <input type="checkbox"/> unknown <input type="checkbox"/> terminal fault <input type="checkbox"/> ext. short-circuit <input type="checkbox"/> mech. damage <input type="checkbox"/> loose wiring/line <input type="checkbox"/> other * _____ * _____ * _____	
Additional notes			
General information: <input type="checkbox"/> no function <input type="checkbox"/> drive not running smooth <input type="checkbox"/> uncontr. drive movements <input type="checkbox"/> fault in one direction only <input type="checkbox"/> supply fuse blown <input type="checkbox"/> other	Additional problems: <input type="checkbox"/> problem with mechanics <input type="checkbox"/> mains failure <input type="checkbox"/> control unit failure <input type="checkbox"/> motor failure <input type="checkbox"/> break in failure <input type="checkbox"/> other	Drive, supply unit, amplifier, mains: <input type="checkbox"/> control volt. fault <input type="checkbox"/> mains failure, fuse F <input type="checkbox"/> blower def. <input type="checkbox"/> bleeder res. def. <input type="checkbox"/> power supply fault <input type="checkbox"/> bolt torn off <input type="checkbox"/> other	
Control unit <input type="checkbox"/> no function <input type="checkbox"/> no display <input type="checkbox"/> no command value output <input type="checkbox"/> diagnostics <input type="checkbox"/> dim. offset in direction <input type="checkbox"/> E-stop loop interrupt <input type="checkbox"/> pos. control loop won't close <input type="checkbox"/> program seq. fault <input type="checkbox"/> aux. func. int. fault (outputs) <input type="checkbox"/> acknowledgements not acc. (inputs) <input type="checkbox"/> other _____ _____ _____	Motor <input type="checkbox"/> defective <input type="checkbox"/> thermocouple <input type="checkbox"/> defective brake <input type="checkbox"/> defective blower <input type="checkbox"/> defective feedback <input type="checkbox"/> defective speed <input type="checkbox"/> enc. signal <input type="checkbox"/> defective BLC signal <input type="checkbox"/> ground short-circuit <input type="checkbox"/> overheating <input type="checkbox"/> other _____ _____ _____ _____	Remarks: _____ _____ _____ _____ _____ _____	

Rben.EPS

Fig. 5-5: Repair card

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