

BREUER) MOTOREN



The 1020 kW Variable Frequency Drive

dkswa72UM/4-4

operating manual
information sheet
software documentation

version 4
version 1

ZHANGJIAKOU COAL MINING



Operating and Assembly Instructions for Variable Frequency Drives 变频电机使用说明书

Order-no. : 000-90-00-022

Edition: January 2012

Contents

Contents	1
A. General	3
A. 概述.....	3
A.1 General information on these operating instructions	3
A.1 使用说明书的总说明。	3
A.2 General safety information	4
A.2 总体安全说明.....	4
A.3 Safety-related terms.....	4
A.3 安全相关的条款和术语	6
A.4 Electrostatic sensitive devices (ESD)	7
A.4 静电敏感元件.....	7
A.5 Delivery	8
A.5 交付	8
A.6 Transport, storage.....	8
A.6 运输和储存	9
B. Assembly	9
B. 装配.....	9
B.1 Safety instructions.....	9
B.1 安全信息.....	11
B.2 Installation	12
B.2 安装	12
B.3 Connection	15
B.3 连接	15
B.4 Insulation test.....	18
B.4 绝缘试验.....	18
B.5 Start-up	19
B.5 试车	19
C. Operation.....	22
C 操作	22
C.1 Safety instructions.....	22
C.1 安全指南.....	22
C.2 Switching on, switching off, parameter settings.....	22
C.2 启动、停止、设置参数.....	23

C.3 Taking out of service.....	23
C.3 电机停用.....	23
D. Maintenance	23
D 维护	23
D.1 Safety instructions.....	23
D.1 安全指南.....	24
D.2 Inspections.....	24
D.2 检查.....	24
D.3 Repairs.....	27
D.3 修理.....	27
D.4 Spare parts	30
D.4 备件.....	30

A. General

A. 概述

A.1 General information on these operating instructions

These operating instructions and the relevant data sheet are intended to assist the user in operating the Variable Frequency Drive safely, properly and economically.

Taking into account the notes in these instructions, the user will:

- ◆ increase the reliability and extend the lifetime of the Variable Frequency Drive
- ◆ avoid dangers
- ◆ avoid repairs and downtime

These operating instructions, the relevant data sheet and the certification issued must:

- ◆ be available at all times during installation, operation, maintenance and repair work.
- ◆ be read, understood and applied by all persons carrying out work on the Variable Frequency Drive.



The machines concerned are components of high-voltage power plants for stationary and mobile applications. They are constructed in accordance with the state-of-the-art technology and the recognised rules on safety. However, inappropriate behaviour or improper handling and operation may cause danger to life and limb of the user or other persons and/or adverse effects on the machine and on other material assets. Therefore, please take note of all safety information in these operating instructions and the relevant data sheet.

A.1 使用说明书的总说明。

这些操作说明和相关的数据库的作用是帮助您更安全、恰当和经济地使用三相电机。

通过遵守这些说明信息，您将：

- 增加可靠性并且延长三相电机的使用寿命
- 避免危险
- 避免修理和故障停机时间

这些操作说明相关的数据库和证书必须：

- 在整个安装、操作、维护和修理期间一直是可用的
- 所有在三相电机上开展工作的人员都必须熟读并理解

这里涉及的机器是由固定和转运的高压元件组成。



他们是按被认可的技术规则进行制造的。但是，操作不当或不正确使用会造成使用者或其他人的肢体安全和生命危险。或者有害地影响操作的机器或其他设备，因此，请一定要注意这些操作说明和相关的数据库标明的所有安全信息。

A.2 General safety information

The sign "U", added to the certification number, specifies that this certification may not be confused with a certification issued for a device or protection system. This partial certification may only be used as the basis for the certification of a device or protection system.

In case an "X" is added to the certification number, special requirements for the safe use of the device or of the protection system are indicated in the appendix to this certification.

The symbols "U" and "X" are not used simultaneously.

Tapped holes, into which cable bushings or cable entries are screwed by means of a screw-in thread, must comply with the minimum requirements of EN 60079-1, section 5.3 (table 3) in conjunction with appendix C.2.2..

The bores underneath the bolt heads are realised as through holes "medium" with the fit tolerance H13 according to ISO 486-2.

Gap surfaces being the flameproof closure must be designed so that their average peak-to-valley value does not exceed $R_a 6,3 \mu\text{m}$. The surfaces must be flat and metallically bright.

The permanent operating temperature of adhesives, e.g. Loctite, used for the possible gluing of threads as anti-loosening protection must be at least 100 °C.

Concerning the working on high-voltage power plants, the prohibition relating to the assignment of unqualified persons is specified in DIN VDE 0105 or IEC 364.

A.2 总体安全说明

在证书编号后标有“U”字标志说明这种证书不可以与设备或保护系统发布的证书混淆，这种证书只能作为设备或安全系统的基本证明。

如果证书编号后标有“X”标志，请注意在证书附录中对设备和保护系系安全使用提出的特殊要求。

标志“U”和“X”不能同时使用

插入螺纹，电缆导管用螺纹压紧的必须符合EN 50018，第5.3部分(表3)对最短螺纹的要求，参照附录C.2.2

隔爆接合面必须设计成粗糙度不得大于 $R_a 6.3 \mu\text{m}$ ，表面必须是光亮平整的金属面。

永久使用的胶粘剂，如，LOCTITE. . 用来防止螺纹的松动，必须至少能耐100度。

按DIN VDE 0105或IEC 364（德国IEE章程）规定，在高压电机设备相关工作中禁止不够资格的人员参加。

A.3 Safety-related terms



DANGER / WARNING / CAUTION

Disregard of such a sign may lead to risk of injury or danger of life and/or may cause substantial property damage.



Note:

Particular attention is drawn to a technical connection which is possibly not clearly visible by qualified personnel.

Qualified personnel:

are persons who, on the basis of their vocational training, experience and instruction as well as their knowledge of the relevant standards, regulations, accident prevention regulations and operating conditions, are authorised by the person responsible for the safety of the plant to carry out the required activities and in doing so, are able to recognise and to avoid possible dangers.

They must be specially trained by the BREUER-MOTOREN GmbH Co. KG for this range of motors.

Furthermore, knowledge of first aid measures and local rescue facilities are required.

Equally indispensable is the notice of the other transport, assembly, service and maintenance instructions as well as of the technical data in order to avoid any interferences which could cause directly or indirectly serious personal injury or damage to property.

WARNING



Even though the shaft does not rotate the motors may be under voltage. Even after the switching off of the supply voltage, certain parts of the devices are under voltage (capacitor storage). The minimum discharge time indicated on the connection box covers has imperatively to be respected! Individual parts of the frequency converter and the associated electronics are not allowed to be dismantled as otherwise protective functions such as the discharge of capacitors are disabled and certain components may be under voltage.

The reliable and safe operation of the machine implies an appropriate transport, the professional storage, installation and assembly as well as the start-up of the complete system according to the Machinery directive 2006/42/EC and the carefully operation and maintenance.

It is assumed that all work on the machine will be carried out by qualified personnel trained to work on these motors and/or checked by responsible specialised personnel.

In accordance with these operating instructions, the personnel must be thoroughly acquainted with all warnings and maintenance measures.

The following operating instructions comprise general information and safety regulations to be respected with regard to the Variable Frequency Drives manufactured by BREUER-MOTOREN GmbH Co. KG.

The production program of BREUER comprises a variety of motor types. Due to this fact, there are special instructions to be respected for some motor types. These special instructions are separately composed (refer to the annexe) and have to be respected additionally to the general instructions in order to exclude damages and potential danger sources.

The machines concerned are components of high-voltage power plants for stationary and mobile applications. They are constructed in accordance with the state-of-the-art technology and the recognised rules on safety. However, inappropriate behaviour or improper handling and operation may lead to a reduction of performance and may cause danger to life and limb of the user. Therefore, please take note of all safety information in these operating instructions and the corresponding data sheet

Concerning the working on high-voltage power plants, the prohibition relating to the assignment of unqualified persons is specified in DIN VDE 0105 or IEC 364.

A.3 安全相关的条款和术语



危险/警告/注意

忽视这样标志将会导致严重的伤害甚至死亡，并且会导致实质性的损坏。



信息提示:

注意特定的技术的连接，即使是经过训练的人员也可能没注意到

取得资格的职员:

是那些可以基于他们的职业培训，对于他们的知识有相关的工作经验和教导的，他们的知识相包括相关的标准、条例、事故预防措施和工作条件，是那些从事相关工厂负责安全的人员的授权的活动的条件下，是可以认识和避免可能出现的危险。

对于这一系列的电动机，必须由保越电机公司对他们进行特别地训练。

另外，急救措施和当地营救设备也是需要的。

仔细阅读所有其他关于运输、安装、操作、和服务的说明和技术数据是同样不可或缺的，这样可以避免可能直接地或间接地造成严重的人身伤害或财产损失的干扰发生。

警告

这些电动机可能是带电的，尽管轴可能没有旋转。

甚至在关闭电源以后，这些机器的某些零件在一段时间内依然处于危险状态(电容存储)之下。

这表明接线盒的盖子上显示的最小放电时间必须遵守，

不能拆除变频器上的零部件，否则电容保护作用可能被终止，某些零件可能会带有危险的电压。

恰当地运输、存贮、安装和装配，和仔细保养设备一样，是安全操作的前提。

假定所有机器上开展的工作，都是有资格的人员，并且让负责任专家来进行监测。

工作人员必须完全明白这些操作说明中注明的所有的警告和维护措施。

下面的操作说明和和各项细节是保越公司变频调速电机必须遵守的。

由于制造了各种各样类型的电机，某些型号的电机会有一些特殊的说明。

除这些一般指示之外，一张特别的数据表总结与各自的单独的电动机类型相关，为了避免危险的损伤和来源必须逐个检查。

这里涉及的机器是由固定和转运的高压元件组成。

他们是按被认可的技术规则进行制造的。但是，操作不当或不正确使用会对使用者造成伤害，因此，请一定要留意这些操作说明和相关的数据库。

按DIN VDE 0105或IEC 364 (德国IEE章程)规定，在高压电机设备相关工作中禁止不够资格的人员参加。

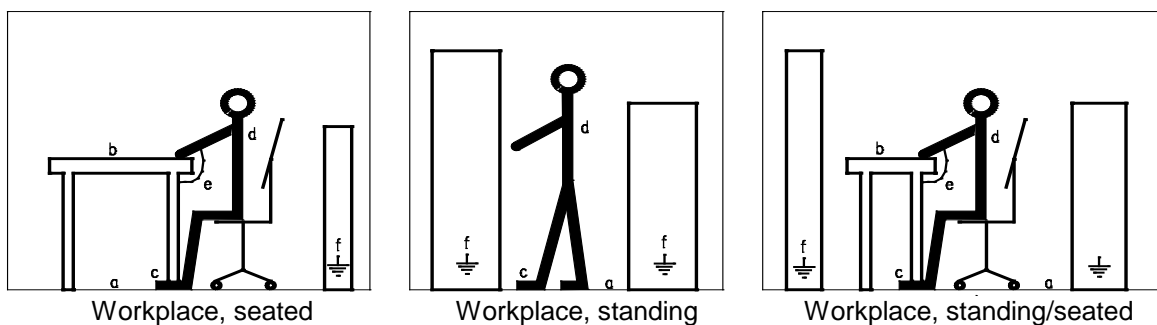
A.4 Electrostatic sensitive devices (ESD)

The frequency converter contains electrostatic sensitive devices (ESD). These devices can very easily be damaged by improper handling. The frequency converter is not allowed to be dismantled. In case work on electronic modules are required, please, respect the following notices:

- ◆ Electronic modules should be touched only in case work must be carried out on them.
- ◆ In case modules must be touched, the body of the person concerned must be discharged immediately prior to the operation.
- ◆ The components are not allowed to come into contact with highly-insulating materials e.g. plastic sheets, insulating table tops or clothes made of artificial fibre.
- ◆ Components may only be put down on conductive surfaces.
- ◆ When soldering components, the soldering-tip must be earthed
- ◆ Modules and components may only be stored or dispatched in conductive packages (e.g. in metallised plastic or metallic containers).
- ◆ In case packages are not conductive, modules must be wrapped in conductive material before being packed, e. g., conductive foam rubber or household aluminium foil.

The necessary ESD protective measures are illustrated once again in the following pictures:

- | | | | | | |
|---|---|------------------|---|---|------------------------------|
| a | = | conductive floor | d | = | ESD coat |
| b | = | ESD desk | e | = | ESD wristband |
| c | = | ESD shoes | f | = | Earth connection to cabinets |



A.4 静电敏感元件

变频器包含有静电敏感的元件，这些元件很容易被粗心或不熟练的操作所毁坏。变频器不能被拆除。

如果仍然需要在电子元件上工作，请注意下列说明：

- *电子元件只有在必要时才能被触及
- *在必须接触元件的任何情况下，操作者的身体必须在开始操作之前进行放电。
- *元件不能与高绝缘的材料进行接触，比如塑料纸、绝缘桌面、人造纤维的布料等。
- *元件只能放在导电的表面
- *焊接元件时，焊枪必须接地
- *元件和零件只能存储在导电的包装内（例如带电塑料或者金属容器）
- *如果包装不导电，元件必须用导电的包装纸进行包裹，导电海绵乳胶和普通铝箔均可

下图再次示例了必要的静电敏感保护措施：

A=导电的地面

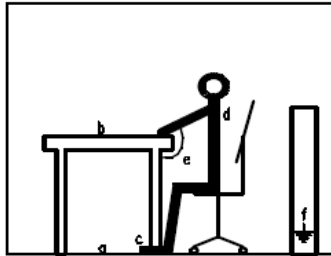
D=防静电外套

B=防静电桌子

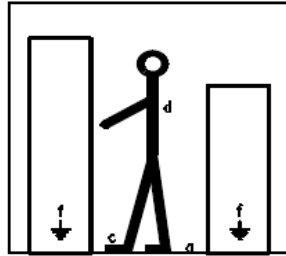
E=防静电手环

C=防静电鞋子

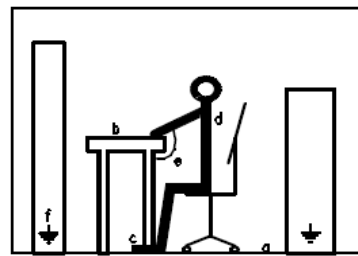
F=接地柜



车间，坐下状态



车间，站立状态



车间，坐下或者站立

A.5 Delivery

Prior to the delivery, the cooling ducts are flushed through with antifreeze agent (up to $-40\text{ }^{\circ}\text{C}$).

A.5 交付

冷却管在交付前用（抗 $-40\text{ }^{\circ}\text{C}$ ）的防冻液冲洗过

A.6 Transport, storage

WARNING



The motors are allowed to be hanged up only by using the lifting-points provided for. The lifting device has to be selected according to the total weight of the motor (refer to the data sheet).

Any further existing lifting eyes, e.g. mounted on fan hoods, are only suitable for lifting the respective component.

Transport locks possibly provided for the bearings of the motors are allowed to be removed only during the installation of the motor in the processing machine on site.

In case the motor is not directly put into service, it must be stored in a dry and vibration-free room.

The rotor must manually be rotated at regular intervals in order to avoid damages to the bearings.

The cooling ducts of water-cooled motors are flushed through with an anti-corrosion emulsion. The water connections are closed.

In order to avoid condensation gathering inside the motor the motor must not be exposed to extreme temperature fluctuations during its storage.



During storage of the motors with temperatures below freezing point the following has to be considered:

During the storage of the motors (as well as during the transport) precautions are to be taken against vibrations and variations in temperature (15 K/hour). Otherwise pre-

damages of components could be caused.

Before starting-up the motors they have to be slowly adapted to the normal operating temperatures (defrosting period approx. 12 hours).

After having carried out an insulation measurement and a visual inspection for damages, the motor should be operated some time at no-load conditions before operating it at full load.

A.6 运输和储存

警告

电机只能用指定的起吊点进行起吊，起吊装置的选择必须符合电机的重量。任何其它的起吊孔也可能存在，比如通风罩，只能用于起吊单独相关的设备。

电机提供运输过程中保护轴承的安全装置，这些装置只有在电机安装到它的使用位置后才能拆除。

如果电机没有立即投入使用，必须存储在一个干燥的房间内，并且不能遭受振动。

水冷电机的冷却管用防腐的乳液冲洗过，接头是密封的。



为了避免在电机内结露，在存储的时候，电机不能经受过大的温差。

当电机存放在零度以下的环境时，以下几点必须要注意：

在存放过程中（或者运输过程中）需要有防止共振和温度变化（15K/小时）的防范措施，否则，电机的部件会损坏。

在电机启动之前，他们需要慢慢的适应正常的工作温度（解冻时间大约12小时）。

电机在被进行绝缘测试和观察没有明显损坏之后，电机应该在空载状况下运转一段时间，然后才能满载运行。

B. Assembly

B. 装配

B.1 Safety instructions

WARNING



Please observe carefully the "General safety information"
(refer to section A.2).

Application notes for mounting parts

End members

The short-circuit current of the feeding protection device and/or monitoring device must not exceed 33 mA.

Bushings (according to the spare part list)

Bushings must be fitted into the electrical equipment so that they are secured against twisting and self-loosening.

Bushings, which are used as connectors and which are possibly exposed to a tightening torque during establishing or loosening the connection, must be mounted so that all parts are secured against twisting.

After having mounted the bushings, neither the duct bolt nor the bushing may twist in case the duct bolt is applied with a tightening torque.

The corresponding tightening torque test is specified in the EN 60079-0, section 26.6 (table 9). Tightening torque applied to duct bolts of bushings used as connectors".

Cable glands (according to the spare part list)

Cable glands must be fitted into the electrical equipment so that they are secured against twisting and self-loosening.

In case the cable glands are mounted with an intermediate adapter and the required tightening torques are not specified, the screw bushing must be tightly screwed into the intermediate adapter and the screws of the fixing clamps must be tightened by using suitable tools.

The bolts for fixing the flanges of the cable glands must end in blind holes.

Cable bushings (according to the spare part list)

Cable bushings must be fitted into the electrical equipment so that they are secured against twisting and self-loosening. Max. tightening torque 60 Nm.

Damaged bushings must be replaced.

Unused cables must be laid on connection terminals and are not allowed to be cut off.

Fibre-optic cable bushings (according to the spare part list)

Fibre-optic cables bushings are used for the optical connection of components. Outside the electrical equipment, fibre-optic cables must be routed through the explosion hazardous area without any joints. Its routing is a fixed installation and they must be laid so that they are adequately protected against mechanical damage.

Cable entries (according to the spare part list)

Cable entries may only be used for a fixed installation of cables. The cables must be safely fixed so that they are protected against tension and twisting.

Connection terminals (according to the spare part list)

Connection terminals may only be fixed by means of the corresponding screw and washer assemblies. The tightening torque may not exceed 0.4 Nm at maximum.

Connection terminals must be fitted into the electrical equipment so that they are secured against twisting and self-loosening. For the installation of a single 2-pole mini terminal, a special part is provided for its protection against twisting. This special part must be fitted on the groove side of the mini terminal.

Inspection port (according to the spare part list)

Installation and dismantling

Inspection ports must be screwed into appropriate threads with the thread quality of medium or better and with adequate thread length and must be secured against self-loosening.

When installing the inspection ports, care must be taken to ensure that no foreign bodies adversely affect the gap surfaces or thread gap.

Repair, modification and maintenance

Damaged inspection ports must immediately be replaced by original spare parts. In case of damaged inspection ports, the equipment must be switched off immediately.

Coupling module

Maintenance

Maintenance and settings of the circuit board are allowed to be carried out only by specially trained personnel.

Repair

Repair work may **only** be carried out by the manufacturer.

B.1 安全信息

警告



请仔细看“安全概述信息”（参考A.2章节）

安装部分使用说明

端部元件

保护或监视设备的电源短路电流不能超出33mA。

衬套（参照备件清单）

衬套必须在电气设备中合适地安装，它能可靠地防止转动和自松。

套管，常常用于连接器，在连接器连接和松开时，他可作为一个拧紧力矩，故套管必须被安装以保护所有的部件的扭曲。

在装上套管后，如果出现套管螺栓被扭动后，套管螺栓或者套管都不会被扭曲。

相应的扭转力矩详细说明在欧标EN 60079-0:2004,章节26.6（表格9）

“套管作为连接器应用的拧紧力矩”

电缆和导管（参照备件清单）

电缆和导管必须在电气设备中合适的安装，它能可靠地防止转动和自松

电缆和导管的安装用中间适配器，需要的预紧力没有详细指定，螺栓必需被拧紧到中间适配器中，夹子必须被可靠地固定，使用适当的工具。

安装电缆和导管的法兰安装到盲孔中。

电缆衬套（参照备件清单）

电缆衬套必须在电气设备中合适的安装，它能可靠地防止转动和自松，最大固定扭矩60Nm。

损坏的衬套必需更换。

未使用的电缆必须放置到连接终端，并且不能简单地切除。

光纤电缆（参考备件清单）

光纤电缆用来连接光学元件，在电气设备以外，无断点地连接到危险区域，必须被永久安装，并进行充分保护以防止机械损伤。

电缆导管（参照备件清单）

电缆导管只能用于固定电缆使用。必须安全地固定，以保证避免它们被拉伸和扭转。

连接终端（参照备件清单）

连接终端只能被一致的螺栓和垫圈安装，固定力矩最大不能超过0.4Nm。

连接终端必须被合适的安装在电气设备中，使连接终端可以避免扭曲和自松弛。

2极小夹子的安装，提供了一个特殊的部件防止翘曲，必须安装在小夹子开槽的一侧。

视察窗（参考备用零件清单）

安装与拆卸

视察窗必须用中等以上质量的螺纹拧紧，必须具有足够的长度，并且必须安全地防止自松。

当安装视察窗时，必须保证没有杂质影响空隙及螺纹表面。

服务，修改与维护

损坏的视察窗必须马上用原装配件进行更换。在视察窗被损坏时，必须立刻关掉设备。

连接模块

维护

必须由经过特殊训练的人员来对电路板进行维护和保养

修理

修理工作只能由制造商进行。

B.2 Installation

B.2 安装

B.2.1 Operating conditions

Please, take notice of the operating conditions, the technical data according to the rating plate and the technical documentation.

In case the motor shall be installed in firedamp and/or explosive hazardous areas, it must be checked prior to the installation whether the existing certification (refer to the data sheet) complies with the approval conditions of the country of use.

The competent authority is exclusively responsible for the assessment of explosion hazards of an operation site.

For the installation in areas of application of the VDE guidelines, the following must be observed:

- ◆ the Regulations DIN VDE 0118 (Installation of electrical equipment in underground mining), the Electrical Equipment Approval (Mining) Regulations (EIZulBergV) and §4 of the Explosion Protection Regulations (Directive 94/9/EG) for flameproof machines for the use in explosive hazardous mines (group I),
- ◆ the Installation Regulations DIN VDE 0165 (Installation of electrical equipment in explosive hazardous areas) for flameproof motors (groups IIA, IIB, IIC) for the use in explosive hazardous areas.

The appropriate national standards and installation regulations will apply for the installation in other countries.

B. 2. 1 使用条件

观察使用条件，铭牌和技术文件中标明的技术数据。

如果电机在爆炸性气体环境中操作，或在其它有爆炸危险的场所，在安装之前应先检查现有的许可证(参见数据表)是否符合使用国家法律的规定。

对任何危险爆炸操作地点的评估是当地政府的专有责任。

VDE指南适合安装地点，以下要求必须遵守：

- 机器保护的爆炸性气体属于(I区)爆炸性气体环境，符合DIN VDE 0118 (井下电气设备的安装)，电气设备许可(用矿)条件(EIZulBergV)和§4爆炸保护条例(指示94/9/EG)。
- 为保护电机不爆炸(IIA, IIB, IIC区)用爆炸性危险环境，安装条例DIN VDE 0165 (电气设备在爆炸性危险环境的安装)

在其他国家安装设施，适用申请的国家标准和安装条例。

B.2.2 Lubrication

For lubrication purposes, use only lithium grease with a consistency of class 3 and a dropping point of over 175 °C.

Refer to the data sheet concerning the required lubrication measures.

In case the time between delivery and start-up of the motor exceeds two years, the bearings must be re-lubricated.

Note:



Toxicological advice: The lubricant should not come in contact with the skin for a longer period of time. In case of contact with eyes, flush immediately with water. In case lubricant is accidentally swallowed up, do not stimulate vomiting; seek immediately medical attention.

B2.2 润滑

润滑，应使用3级浓度的锂基润滑脂，滴点应高于175度必要的润滑测量，参看数据表。

如果电机的交付和它试车之间的时间超出两年，轴承必须重加润滑油。



信息提示

有毒建议：

不应该允许润滑剂长时间保持与皮肤接触。进入眼睛的所有润滑脂应该立刻用大量清水进行彻底冲洗。如果误食了润滑剂，不要进行催吐；应立刻咨询医生。

B.2.3 Cooling

B2.3 冷却

B.2.3.1 Air-cooled motors

Concerning air-cooled motors, it must be ensured that the cooling air can freely stream in and out. Hot exhaust air is not allowed to be sucked in again. Especially, the air inlets have to be kept clear. The distance from a wall should be at least 50 cm. It must be avoided that larger deposits do build up on the cooling fins in order to ensure a sufficient heat dissipation.

B2.3.1 空冷电机

空冷电机，必须保证冷却空气能够顺畅地流进流出。排出的热气不能再被吸入。

要特别注意进气口要保持清洁。离任意一面墙，间距至少有50厘米。散热片上不能存积杂物，以保证足够的散热。

B.2.3.2 Liquid-cooled motors

The coolant inlet and outlet are respectively marked on the motor. These marks must imperatively be observed when connecting up the cooling system. The shut-off device of the cooling circuit has imperatively to be mounted before the motor in order to avoid ram pressure.

Generally, the coolant inlet is furnished with pressure relief valves (response pressure: refer to the data sheet) in order to protect the cooling system against damages in case of high inlet pressures.

Some motors are not furnished with a pressure relief valve for reasons of space (installation in a processing machine). In these cases, the user has to install a pressure relief valve in the upstream piping system in close vicinity to the motor. The response pressure must be in accordance with the one indicated in the data sheet.

In case the cooling water can be expected to become dirty or to have an unfavourable composition (chalky/sulphur), the water flow rate of the machine must be checked at least once per month and compared with the characteristic curve (refer to data sheet). In case of deviations, the cooling ducts must be cleaned.

The coolant must be chemically neutral and non-aggressive (pH value $\cong 7$). Furthermore, the coolant must be free of coarse impurities ($\leq 0,25$ mm); if required, additional filters to be cleaned regularly have to be installed.

In case the motor has to be dismantled underground, the cooling circuit must be flushed and then flushed through with a preservation agent for transport purposes and filled with an antifreeze agent for storage purposes.

The required coolant quantity and the maximum permitted inlet temperature are to be read from the data sheet. An inlet temperature below 15 °C should be avoided due to the danger of formation of condensation. After having switched off the motor, the cooling water must continue to flow for further 5 minutes in order to avoid the heat build-up in the Variable Frequency Drive.

B2.3.2 水冷电机

冷却液的出入口在发动机上有标记。连接冷却系统的时候，应仔细留意这些标记，关断阀应处于电机前面，以防止压力冲击。

一般来说，有安全阀在冷却液入口处(工作压力参见数据表)，可以在入口压力变得太高时保护冷却系统免受损伤。

在有些电机是为特殊机器设计的情况下，有时为了空间的原因将省去安全阀。

在这些情况下，顾客有责任在靠近电机附近的管路中设置一个安全阀，工作压力必与数据表显示的一致。如果冷却水预期是脏的或有不良的成分构成(含硫量或比例)，通过机器的冷却水的流速至少每月要检查一次，并且和标准曲线进行比较(参见数据表)。在不一致的情况下，必须清洗冷却管。

要防止污染和损伤冷却系统，冷却液必须是化学中性的，酸碱值度约等于7。另外，冷却液不能含有粗糙的污染物(小于等于0.25毫米)；如果适用，必须安装过滤器并经常进行清洗。

如果电机井下拆除，冷却回路必须冲洗，冲洗后充满冷却液进行储存。

需要大量的冷却液，它的最高允许入口温度可以从数据表中获得，。避免入口温度低于15度以防止形成结露。

在关闭电机以后，冷却液至少要持续流动5分钟以上，以避免变频电机内热量聚集。

B.2.4 Balancing

Generally, rotors manufactured since June 1996 were balanced dynamically with half-length parallel keys according to DIN ISO 8821 (balancing grade Q2,5). In this case, the letter 'H' is stamped next to the motor number at the face side of the output shaft end. In case this identification mark does not exist (motors being manufactured before the above-mentioned date), the rotors were balanced with full-length parallel keys. When selecting the coupling type, it must be ensured that the type of balancing matches the one of the rotor.

B2.4 平衡

电机制造厂从1996年6月开始，按照DIN ISO8821

(平衡质量阶段Q2, 5)用半键进行平衡，在电机编号的后面，在动力输出轴的端面标有“H”字母，如果这个标记不存在，(比如这是在上述日期前生产的)，则转子是用标准平键进行平衡的。

当选择联结时，必须保证它平衡的种类匹配电机的转子。

B.2.5 Noise emission

When running under no-load conditions, water-cooled motors emit at a distance of 1 metre a sound pressure level of 75 dB(A), Variable Frequency Drives and air-cooled motors a sound pressure level of 85 dB(A). The sound pressure level existing at the place of installation mostly depends on the conditions of installation and environment so that the noise behaviour in operation can only be defined on site.

B2.5 噪声发射

当在无载情况下运转时，电机在1米半径处的噪声在75 dB (A) (水冷)和85 dB (A) (空冷)之间。

在安装位置，噪声水平与安装和环境自身条件有很大关系，因此实际的噪声只能由具体位置确定。

B.2.6 Assembly conditions

In case parallel keys are part of the scope of supply, they are generally secured only against falling out during the transport.

Concerning motors with two shaft ends, of which one shaft end is not furnished with an output member, the corresponding unused parallel key has to be secured against falling out. The length of the key has to be selected according to the type of balancing (refer to section B.2.4).

The attachment of the coupling is only allowed to be carried out by aid of the thread being in the shaft stub and/or by other auxiliary devices which avoid any blows and shocks on the shaft. The motor must carefully be aligned when being attached to the processing machine.

The motors are allowed to be used only according to their type of construction (refer to the data sheet).

B2.6 装配条件

导向键是交付货物的一部分，这是作为一个运输中的惯例来执行的。

在有二个轴伸的电机上，一个键只能安装一端，未使用的导向键被固紧了防止拔出，键的长度是根据平衡的种类来选择的(参见B. 2. 4)

固定连接必须只能用螺栓在轴端进行，或用其它方式，但必须避免敲击，当连接到机器上时，电机必须进行仔细的调整。电机只能安装在符合设计型号的机器上。(参见数据表)

B.3 Connection

B.3 连接

B.3.1 General

Before starting the connection work, compare the existing mains voltage with the data indicated on the rating plate. The connection cables have to be adapted to the nominal current and to the conditions existing on site, e.g. ambient temperature, type of cable laying.

Concerning the protective conductor connection, the connection box is furnished respectively inside and outside with a corrosion-resistant terminal.

The connection work is allowed to be carried out only by qualified personnel.

B3.1. 纲要

在连接工作开始之前，将提供的电源与铭牌所给定的进行比较。接线柱适合额定电流和现有条件，例如，周围温度和电缆放置的类型。

连接夹适用终端空间，就象在接线腔外一样，接地要用防腐材料。

连接操作只能由经过特殊训练的有资格的人员进行操作。

B.3.2 Measures against EMC Interference

Harmonic interferences which arise during the operation of converters are unavoidable but permitted to a certain extent. In order to prevent problems due to mutual interferences of devices by insufficient electromagnetic compatibility (EMC), the following points have to be observed:

- ◆ Large spatial separation (decoupling) should be realised between high-voltage and low-voltage power supplies.
- ◆ Large spatial separation (decoupling) should be realised between high-voltage cables and signal cables and/or control cables. In case the cables must run in parallel, e.g. along the same cable route, the distance should be kept as great as possible.
- ◆ If possible, control cables should not cross power cables. In case it can not be avoided, crossing at right angles has to be realised.
- ◆ Sensitive functional groups (electronic components, radio equipment etc.) should be installed as far away as possible from functional groups possibly causing interferences (motors, power switches etc.).
- ◆ Only shielded and twisted cables are to be used for signal and control cables
- ◆ The cable shield (if existing) must correctly be connected (low HF resistance). For this purpose, all residues of dirt, paint and insulating material must completely be removed from the casing and the shielding within the area of connection. The cable shield must be mounted as flat as possible on the casing.
- ◆ The lengths of cable towards the Variable Frequency Drive should be as short as possible. The shorter the cable, the less the electromagnetic interference emissions.

B.3.2 防止电磁干扰的措施

操作变频器时产生谐波干扰是不可避免的，为了避免机器间的相互干扰问题，应遵守如下几点：

- 高低压电源应尽可能地远离。
- 高压电源和信号电缆应尽可能地远离，如果电缆必须平行地放置，比如放在同一个导管内，它们必须被尽可能地分开。
- 尽可能地，控制电缆不要横穿电源线，如果不能避免，则在可能的情况下一定要保持一个正确的角度。
- 敏感的设备（电子元件，无线电设备等），应尽可能地远离易引起干涉的设备（电机，电源开关等）。
- 信号线和控制线只能用带屏蔽的双绞线。
- 当存在屏蔽电缆时，必须正确地连接，（低电阻），因此，所有污垢、油漆和绝缘材料必须从电缆和相邻的连接上去掉，屏蔽电缆尽可能地平直布置
- 连接变频电机的电缆应尽可能地短，电缆越短，辐射越小。

B.3.3 Terminal designation

- a) Power supplies (motor voltage)**
Refer to the data sheet
- b) Power supply of the motor electronics**
Refer to the data sheet
- c) Data cables**
Refer to the data sheet
- d) Monitoring devices**
Refer to the data sheet

According to the DIN VDE 0118 and/or DIN VDE 0165, each motor must be protected against overheating on all phases by means of a current-dependent circuit breaker (refer also to the data sheet) or an equivalent device as per DIN VDE 0660.

In case the certification number of flameproof motors is supplemented with a "B" or "X", special measures are to be carried out in accordance with the test certificate (refer to the data sheet).

B. 3. 3 线夹标记

- a) 电源连接（电机电压）

参照数据表

- b) 电子元件电源

参照数据表

- c) 数据线

参照数据表

- d) 监控装置

参照数据表

每台电机都必须符合DIN VDE 0118 和/或 DIN VDE

0165，用过流开关（也参照数据表）或类似的装置，如DIN VDE 0660，进行保护以防止过热。

如果试验证书后附有“B”或“X”标记，则应采取经同意的安全保护措施。

B.3.4 Monitoring



CAUTION

Monitoring has to be realised in accordance with the separate certification of the registration authority as well as in accordance with the installation regulations for underground facilities.

B.3.4 监控



注意

监控要符合权威部门核发的证书，就象安装要符合地下设备规定一样。

B.3.5 Final preparations

Before closing the connection box, the following points must be checked:

- ◆ The power and control wires must be connected in accordance with the wiring diagram shown in the data sheet and attached inside of the connection box cover.
- ◆ The interior of the connection box must be free of impurities.
- ◆ All terminals, including those which are not used, must be firmly tightened.
- ◆ Air gaps between the parts under voltage and air gaps between parts under voltage towards the casing must correspond with the regulations applied in the country of use. Particular attention must be paid to wire ends sticking out.
- ◆ All connection cables must be disposed accessibly and the cable insulation must not be damaged.
- ◆ According to the type of ignition protection indicated in the certification, unused cable entries must be tightly closed by means of closure elements certified for this purpose. Detaching may only be possible by using a corresponding tool.
- ◆ All seals and sealing surfaces of the connection box must be properly engineered in order to maintain the protection class. The sealing surfaces must be cleaned and slightly greased. Sealing rings provided for the connection box cover must be present and they must be disposed so that no gaps arise between the sealing surfaces.
- ◆ The cable entries must be suitable with regard to the type of ignition protection, the mode of cable laying and the permissible cable diameter, etc. and have to be mounted according to the regulations.

B.3.5 最后准备

在关闭接线盒之前, 要检查以下几点:

- 电源和控制线必须按数据表中的接线图进行连接, 并固定在接线盒门内。
- 接线盒内必须进行彻底地清洁
- 所有接线夹, 包括没有使用的, 必须被可靠地固定。
- 电子元件和盒体之间的间隙必须符合使用国的规定, 必须特别注意未扣牢的直立线头。
- 所有连接电缆必须接近入口, 电缆绝缘不能损坏。
- 符合证书指明的保护型式, 未用的引入端口必须用经过鉴定的专作此用的不可轻易分开的方式进行密封, 要分开只能通过专用工具来实现。
- 接线盒的所用密封和接合面要进行必要的保护, 密封表面必须清洁并进行少量润滑, 设计的密封圈必须安装, 密封表面间不能有间隙。
- 关于保护的型式, 电缆放置的方式和直径, 电缆导管必须选择合适的以满足标准的需要。

B.4 Insulation test

The insulation resistance to ground of the motor's terminals must be determined before the first start-up and/or after a longer storage period or a longer downtime.

WARNING



During and immediately after this measurement, the terminals are under dangerous voltage and must not be touched.
In case of possibly connected mains cables, it has to be ensured that no mains voltage can be applied.
Please, take notice of the operating instructions of the respective insulation meter to be used.

Generally, insulation resistance measurements at low-voltage machines are permitted only with a measurement voltage of 500 V DC. A measurement voltage of 1000 V DC is exceptionally permitted only for new windings provided that the insulation resistance has previously been measured with a measurement voltage of maximal 500 VDC and the value was not below the permissible value.

During the measurement it has to be waited until the ending value has been reached (approx. 1 minute with regard to high-voltage machines).

The minimum insulation value amounts to 50 M Ω for new, cleaned or repaired windings (measurement voltage 500 V DC).

Dry and as good as new windings have insulation resistance values between 100 M Ω and 2000 M Ω and higher, as well.

In case the insulation resistance value is less than 50 M Ω , humidity and/or soiling could be the cause. The cause has to be found out and the winding must undergo a drying process, if necessary.

Note:



After the possibly drying process of cleaned windings, it has to be taken into account that the insulation resistance value is somewhat smaller. Correct measurement of the insulating resistance can only be carried out once the winding has cooled down to a room temperature of approx. 20 to 30°C.

WARNING



The capacitor can become charged during the measurements between the power supply terminals. Take into account the minimum discharge time (as stipulated in the data sheet (section B) and indicated on the motor cover plates).

B.4 绝缘试验

在长时间储存或未使用后，在开始试车前，必须确定线圈对地的绝缘电阻



警告：

在测试中和刚完成的一段时间内，有些线夹可能带有危险的电压，因此不能触摸。

在任何连接电源线，确保没有电源输入，注意查看绝缘摇表的操作指南。

在低压电器上测绝缘电阻一般用500V档，例外的是，在测量新线圈时可以用1000V档，

但必须是在用最大为500V档测量时没有低于允许值时才行。

在测量时，最后的电阻值必须能保持一段时间，高压电器一般是1分钟。

干净的新电机或刚换完线圈的电机，用500V档测量时应不低于50M Ω 。

干燥的，新的线圈绝缘电阻在100 M Ω 到2000 M Ω 之间，有时还更高，如果绝缘电阻低于50 M Ω ，有可能是脏或不干净或受潮引起的，必须确定真正的原因，必要时可以干燥线圈。



信息：

在必要时注意清洁和干燥完的电机，绝缘电阻在线圈热态时会降低，正确的测量方法是在线圈被冷却到20到30 $^{\circ}\text{C}$ 的室温时进行。



警告：

当测量是在两个电源夹之间进行，电容有可能被充电，必须注意它的最小放电时间。

B.5 Start-up

B.5 试车

B.5.1 Preparation

After assembly, after repair and/or after taking out of service, check or ensure that

- ◆ installation and operating conditions correspond to the data of the rating plate (voltage, current, frequency, circuit, type of construction, type of protection, cooling system etc.; refer also to the data sheet, if required).
- ◆ the machine is duly installed and aligned.
- ◆ the output elements have the correct adjustments depending on the type of application.
- ◆ the minimum insulation resistance values are respected – this applies also after longer intervals of operation.
- ◆ the cooling air ducts are not obstructed.
- ◆ the coolant is flowing.
- ◆ all fixing bolts and connecting elements as well as the electrical connections are firmly tightened
- ◆ earthing and potential connections are duly established.
- ◆ possibly existing additional devices (temperature monitoring of the windings or bearings, etc.) are duly connected and fully operational.
- ◆ all contact safety measures with regard to moving parts and parts under voltage are realised and that the parallel key of the possibly unused second shaft end is secured against falling out.
- ◆ the communication system is established between the superordinated control system and the Variable Frequency Drive.
- ◆ the supply voltage for the motor electronics is connected.

Note:



This list can not be regarded as exhaustive. Further tests may be necessary according to the enclosed data sheet or could additionally be required due to the specific condition on site.

B.5.1 准备

在安装、装配或修理后，检查确定如下项目：

- 安装和操作指南符合铭牌标明的数据（电压、相位、频率、开关、结构、保护型式、冷却系统等、需要时可以看数据表）
- 机器被正确地安装和连接
- 电源断开元件已按照它们的作用进行过正确调试
- 最小绝缘电阻已注意，这同样适用于长期未用过的电机
- 冷却空气入口未阻塞
- 冷却液通畅
- 所有固定和连接元件、电子元件都被拉紧了
- 接地和等电位连接都接好了
- 任何额外的附件（线圈和轴承的温度监测等）都正确地连接并处于工作状态
- 所有用于防护运动和带电部位的防护罩都有效安装在合适的位置，还应注意，在未用的轴端，导向键被安全地固定以防止被甩出
- 数据传输正确连接并处于工作状态
- 电机控制电路的支持电源处理连接状态

信息：



这个明细表不可能毫无遗漏，或者根据特殊的环境，按照数据表进行进一步的检查和试验可能是必须的

B.5.2 Switching on

After assembly, after repair and/or after taking out of service, the following measures are recommended additionally to the normal start-up:

- ◆ Close the circuit breaker and do not untimely switch off it.
- ◆ The motor can be switched to "ready for operation" via an acknowledgement message.
- ◆ Start the machine without load (switch-on command).
- ◆ Check the running with regard to noises or vibrations at the bearings and the bearing shields.
- ◆ In case of noisy running and/or abnormal noises, switch the machine off and find out the cause during its coasting.
- ◆ There are magnetic or electrical causes in case the running becomes better during coasting. Otherwise, there are mechanical causes, e.g.: imbalance of the electric motor or the processing machine, insufficient alignment of the machine components.
- ◆ In case the running is accurate, load the machine. Check the running smoothness, read and record the values of voltage, current and power output. Wherever possible, check and record also the corresponding values of the processing machine.
- ◆ As far as measuring instruments are available, monitor and record the temperatures of the bearings, windings, etc. until the motor reaches a steady output.
- ◆ Refer also to the binding agreement of the corresponding DLM-meeting.

B.5.2 启动

在安装或修理后，要恢复机器的正常使用状态，下列措施是推荐的：

- 闭合断路器，不要随意打开
- 电机可通过一个确认信息设置至“准备操作”
- 不带负载启动电机（启动命令）
- 检查与轴承或轴承套相关的机械部件，以确定噪声、不平衡或振动的情况
- 如果运转不平滑或有异常噪声，则关断电源，在在惯性运行时查找原因
- 如果机器开关关闭后运转立即变得平滑，则原因是电磁方面的，否则是机械方面的，比如电机或机械不平衡，电机部件的不正常调整
- 如果运转没有问题，加载机器，检查是否仍然运转平滑，检查记录电压、电流、和输出功率值，在可能的时候，当机器运转时检查并记录这些值
- 监测轴承和线圈的温度，运用可用的手段进行测量直到电机达到一个稳定的输出并记录它们
- 测试其它设计联络会上议定的事项

B.5.3 Switching off

Set the switch-on command to "0", let the machine coast without braking.

In case the motor is disconnected from its supply voltage, the error "undervoltage / overvoltage" is signalled via the communication system. Now, the d. c. link capacitor installed in the motor is completely discharged within a defined time.



WARNING

THE DISCHARGE TIME FOR THE D. C. LINK CAPACITOR MUST IMPERATIVELY BE RESPECTED BEFORE OPENING THE MOTOR (as stipulated in the data sheet (section B) and indicated on the motor cover plates).

DANGER TO LIFE

B.5.3 停止

设置命令开关到“0”，不要刹车，让电机惯性运转至停下来。

如果电机从电源上断开，电机会通过通讯系统发出一个警示信号（电压过低/过高），现在电机中的直流电容将在一个特定的时间内完全放电。



警告

在电机打开前直流电容的放电时间应充分重视，

（数据表和电机盖板上均有标注）

带电危险

C. Operation

C 操作

C.1 Safety instructions



WARNING

Please, take notice of the "General safety information" as per section A.2 and of the special knowledge imperatively required for work on high-voltage power plants. Coverings preventing from contact with active or rotating parts or which are required for the duly air flow, and thus for proper cooling, must not be opened during operation.



NOTE:

It is the customer's responsibility to ensure the correct adjustment of the protective devices! In case of non-observance, claim under guarantee will become null and void.

C.1 安全指南



警告

请认真遵守A. 2 “安全指南概要”和高压电设备安全操作规定

设计来保护带电和旋转部位的外罩，保持空气和冷却液正确流动的设施，在操作过程中不能打开



信息:

确保正确使用安装的保护设施是用户的责任，不遵守这些规定将导致保修失效

C.2 Switching on, switching off, parameter settings

Parameters, switch-on and switch-off commands as well as checkback signals of error messages and process data are sent to the motor via the communication system.

WARNING



Changes compared to the normal operation, e.g. increased power consumption, increased temperatures, vibrations, unusual noises or smells, response of the temperature monitoring device, etc., indicate that the function of the machine is interfered. The responsible maintenance personnel has immediately to be informed in order to avoid any interferences which could cause directly or indirectly serious personal injury or damage to property,.

In case of doubt, **switch off immediately** the corresponding motor!

C.2 启动、停止、设置参数

支持电机参数和启停命令，错误信息和操作值等反馈信息是通过数据传输



警告

异常和正常操作比较，例如，高电流消耗、高温度、振动、异常噪声和气味，温度监控报警等，是机器出现异常的信号，为了避免出现直接或间接的人身伤害和财产损失，必须立即通知相关的服务人员
如果有任何疑问，**应立即停止电机**

C.3 Taking out of service

In case the machine is taken out of service, it has regularly to be put in operation (about once a month) or the rotor must manually be rotated in order to avoid damages to the bearings and the recommended measures described in section B.5 should be taken to an appropriate extent depending on the time the motor is out of operation.

Furthermore, in case the motor is taken out of service for longer periods, appropriate measures must be taken like corrosion protection, conservation, suitable package and dry storage.

C.3 电机停用

当电机长期不用时，电机必须有规律地-每月一次-

短时运转，或转子必须进行人工转动，以避免轴承损坏。并根据电机停用的时间按B. 5条提出的要求执行。

当电机更长时间不用，必须采取适当的防腐措施，为了保存，要进行合适地包装后干燥地储存。

D. Maintenance

D 维护

D.1 Safety instructions

Please, take notice of the "General safety information" as per section A.2 and of the special knowledge imperatively required for work on high-voltage power plants.

Before beginning of any work on the machines, and in particular before opening the coverings of active parts, it must be ensured that the machine or plant is disconnected from mains according to the regulations. In doing so, take also into account possibly existing additional or auxiliary circuits besides the main circuits.

Wearing of safety gloves insulated against heat is required as parts of the motor may be heated.

The usual "**5 Safety rules**" are (e.g. according to DIN VDE 0105):

- ◆ *Disconnection from mains*
- ◆ *Securing against unintentional restart*
- ◆ *Determining the absence of voltage*
- ◆ *Earthing and short-circuiting (for voltages over 1000 V)*
- ◆ *Covering or making inaccessible adjacent live parts*

WARNING



THE DISCHARGE TIME FOR THE D. C. LINK CAPACITOR MUST IMPERATIVELY BE RESPECTED BEFORE OPENING THE MOTOR.

DANGER TO LIFE

D.1 安全指南

请严格遵守A.2条“总体安全指南”，具备在高压设备上工作的特殊知识

在机器上开始任何工作之前，特别是在打开工作部件的盖之前，必须确保机器或设备未和电源连接，记住如果连接就可能会有辅助的或紧急备用电源可能被供应。

电机的部件可能会很烫，因此必须戴安全手套

通常的“5项安全法则”是这样的：（例如参照DIN VDE 0105）

- 切断主电源
- 闭锁防止无意识的重起
- 确定没有电压
- 接地并安装短路接线（电压超过1000V）
- 遮挡或覆盖工作部件附近



警告

在电机打开前中间电路电容的放电时间必须特别留意

带电危险

D.2 Inspections

D.2 检查

D.2.1 General

Careful and regular maintenance, inspections and overhauls are required in order to recognise at an early stage possible sources of failure and to remove them before causing extensive damages.

Due to the fact that operating conditions do considerably vary, only general periods of maintenance intervals can be given. Maintenance intervals have to be adapted to the local conditions and circumstances (amounts of dirt, operating frequency, operating load, etc.).

In cases of failure or other extraordinary conditions indicating an electrical or mechanical overload (e.g. overload, short circuit etc.), the corresponding inspections must be carried out immediately.

D.2.1 概述

认真周期地维护、检查和大修是非常必要的，这样可以在故障还未引起更大损坏之前就找出并进行纠正。

操作环境非常容易改变，只能给出一个通用的服务间隔，实际服务间隔不得不根据实际操作情况-

尘土落下的方式，开关的频率，操作负载等确定

在出现故障时，或其它异常情况，显示电气或机械过载（如过载、短路等），必须立即进行适当的检查。

D.2.2 Flushing the cooling ducts installed in water-cooled motors

In case the cross section of the cooling ducts are reduced due to soiling or unfavourable composition of the cooling water so that the required water flow is not reached any more, the cooling ducts must immediately be cleaned.

Diluted alkaline or acid solutions can be used for cleaning the cooling ducts. The solution is pumped through the ducts by using an external pump. Do not use high pressure (> 30 bar) for cleaning as otherwise permanent damages, and thus, a reduction in the cooling capacity will arise. The cleaning process must be continued until all deposits and sediments are completely removed. In case there is a complete blockage of the cooling circuit, solution must continually be pumped through the ducts until the blockage is removed.

Afterwards, the cooling ducts are to be flushed and neutralised.

Our recommendation for cleaning: 10% scale solvent WBD 177 or 50 % citric acid Xi; R36. The corresponding safety data sheets and delivery addresses are to be requested separately.



CAUTION

The regulations for the use of chemicals must be observed.



INFORMATION ON THE DISPOSAL OF SOLVENTS:

Solvents must not be disposed of in normal household waste and are not allowed to empty into drains.

Scale solvent: according to code 06 01 02

Citric acid: Chemical-physical treatment, hazardous waste incineration

D.2.2 冲洗水冷电机的冷却管

如果因为冷却水受污染或含有其它化学物质，使得冷却管的有效尺寸缩小，达不到指定的流量，则必须立即清洗冷却管

有轻微腐蚀性的酸液可以用来清洗冷却管，通过外接的泵将清洗液泵入冷却管，绝不能使用太大的压力（大于30bar），因为这将造成永久的损坏，并且降低冷却效果。清洗操作必须持续到所有沉淀物都被清除干净，在回路被完全堵塞的情况下，溶液必须被连续泵入直到堵塞物被完全去除。

在这之后，冷却管必须被漂洗成中性

我们推荐的清洗剂: 10%去水垢液WBD177或者50%柠檬酸Xi; R36。相关的数据表和交货清单应该有专门的要求。



警告

必须遵守化学品处理的相关规定



溶液处理的信息:

溶液不能和普通生活垃圾一起处理，也不能直接排入下水道。

水垢溶液: Eck号码06 01 02

柠檬酸: 化学物理处理，特殊的垃圾焚化

D.2.3 Inspections

During inspections it must be checked whether

- ◆ the foundations have suffered any subsidence or cracks,
- ◆ the adjustment of the machine is still within permitted tolerances,
- ◆ all fixing bolts for mechanical and electrical connections are firmly tightened,
- ◆ the insulation resistances of the windings are sufficient,
- ◆ possibly existing bearing insulations are not bridged (visual check),
- ◆ cables and insulation components, where accessible, are in proper condition and do not show any discolouration.

During running of the machine it must be checked whether

- ◆ the specified technical data are respected (power consumption, temperatures of the winding, bearings, coolant, etc.),
- ◆ no leakages do arise (oil, lubricant or water),
- ◆ the machine's running smoothness and the noises of the bearings have not worsened.

During normal inspections, it is generally not required to dismantle the machine. First dismantling is normally required when cleaning or renewing the bearings.



Note!

This list can not be regarded as exhaustive. Further tests may be necessary according to the enclosed data sheet or could additionally be required due to the specific condition on site.

Inadmissible deviations and/or modifications noted during the inspection must immediately be removed.

D2.3 检查

检查必须包含:

- 基础是否下沉或有裂缝
- 机器的调整在允许的公差范围之内
- 所有机械固定和电气连接螺栓都是紧的
- 线圈的绝缘电阻足够大
- 任何轴承绝缘都没被接通（目测）
- 电缆和易受影响的绝缘元件，都处在良好的状态，没有褪色的迹象。

在运转时，必须进行下列检查:

- 数据表规定的参数（功率消耗、线圈、轴承和冷却液的温度等）
- 油、润滑脂和水没有渗漏
- 机器操作平滑，轴承的声音正常。

通常情况下，进行常规检查没有必要拆开机器，在清洁或更换轴承时才有必要。



信息

这个明细表可能会不全面，根据技术数据表和特殊环境的需要可能有必要进行进一步的检查和试验。

在检查过程中发现的任何故障、错误或改变都必须立即进行纠正。

D.2.4 Re-lubrication

Concerning the intervals of re-lubrication refer to the data sheet.

D.2.4 再润滑

再润滑参见数据表

D.3 Repairs

D.3 修理

D.3.1 Admissible repairs

Concerning modifications and repairs of mining machinery, the regulations of the "Electrical Equipment Approval (Mining) Regulations" (EIZulBergV) or of the "Mining regulations relating to electrical equipment" (BVOE; §118 including the respective installation instructions) and/or the regulations of the "Directives concerning electrical equipment for the use in explosive hazardous mines" (ElexV or ExVO) for all other explosive installations do apply.

In case the explosion protection could be affected by repair work or modifications, they should be carried out at the premises of the original manufacturer. In case the work is carried out in notified and accredited repair shops, the motor must be labelled with an additional plate indicating date and the executing company as well as the exact nature and extent of the work. Furthermore, the work must be accepted by an officially recognised expert and be approved by his written test confirmation.

The lengths of the gaps preventing the transmission of the ignition of this Variable Frequency Drive are in part longer and the widths of the gaps preventing the transmission of the ignition are in part smaller than requested in table 1 (2) of EN 60079-1. In case the gap-forming elements must be repaired, the dimensions of the gaps must be respected according to the drawings indicated in the certification.

Technical details of the machine must correspond to the certification. In case of modifications, it must be checked whether these modifications are permitted within the framework of the version manufactured or whether the certification needs to be extended. For this purpose, the manufacturer has principally to be consulted. In case extensive modifications are carried out without supplement to the certification, the certification indicated on the test plate becomes null and void.

D.3.1 修理许可

改造和修理矿用机械，电气设备许可证（矿用）规定（EIZulbergV）或涉及电气设备的矿用规定（BVOE；

§ 118 安装服务指南）申请，和所有其它爆炸危险设备规定“爆炸危险场地电气设备的指导”（ElexV或ExVO）

当修理或改造工作影响防爆结构时，应尽可能由最初生产厂家进行，当这些工作在维修间内进行时，电机必须设置另外一个铭牌标明维修时间和地点，就象最初的工作一样。另外，该工作必须由一个具有资质的专家进行认可，他必须签署一个试验验收证明。

一些隔爆接合面有宽度和缝隙大小的要求，这些值在IEC

60079-

1中能查到。在修理或更换形成防爆接合面的零部件时，必须按照试验报告和检查证书规定的图纸进行。

机器的详细资料必须符合证书的规定，如果要进行改造，必须确定防爆结构是否允许，或者是否超出防爆证书的范围，这很有必要去咨询制造商，如果在证书规定的范围进行了较大的改造，则试验牌上的证书将失效。

D.3.2 Dismantling

It is not allowed to dismantle the frequency converter or its associated electronic components. The manufacturer has imperatively to be consulted.

Normal drawings and part lists do not include any details of types or dimensions of fixing elements or similar components. Therefore, during the dismantling it is required to identify each item for purposes of re-assembly.

Forcing screws or other suitable devices are to be used for the dismantling of centering parts.

Before removing screwed-on components, replace two of the upper fixing bolts by means of oversized bolts or threaded bolts so that they can carry the corresponding component after its loosening.

Machines being constructed vertically are allowed to be dismantled in horizontal position.



CAUTION in case the rotor is mounted vertically:

The centrings in the shaft ends (DIN 332) have recessed threads i. e., eye bolts according to DIN 580 would be unsuitable due to few number of thread turns.

The machines have narrow gaps at the shaft passages. Therefore, support the respective shaft end right before removing the bearing shields in order to avoid damages to the gap surfaces due to a possible oblique position of the rotor.

Make certain that the pieces are correctly marked for re-assembly in order to ensure that the type of ignition protection is maintained. This applies in particular for general overhauls of machines of the same type which are dismantled at the same time.

D.3.2 拆解

拆开变频器和它的电子元件是严格禁止的，有问题必须联系制造商

常规的图和备件清单不包括型号细节和修理基础，因此在拆开每个需重新安装的零部件必须特别标注，拆解中心零部件时，最好用抽出螺栓或其它合适的工具。

在拆除元件的螺栓之前，更换两根长螺栓以承提拆开后的重量。

垂直安装的机器可以水平拆除。



注意：转子是垂直安装的

轴端中心有螺纹（DIN 332），这意味着提升螺纹来满足DIN580

是不合适的，因为可用的螺纹太少了。

机器只有很窄的气隙在轴通过的地方，因此，在去掉轴承盖之前，准备一个轴端支撑，以避免在转子倾斜时损坏气隙表面。确认零部件被正确标注来重新安装，以保证防爆等级的保持，特别是在同样型号电机同时大修时更应注意。

D.3.3 Re-assembly

Seals

During the re-assembly it has to be ensured that all sealing surfaces are in proper condition. They must be undamaged, metallicly bright and greased. The mounting of additional seals at the flameproof closure is only permitted in case they are constructionally specified (e.g. o-rings).

In case sealing elements are installed, they must be checked and be replaced, if required.

Screw locking devices

Screws locking devices like safety plates, spring rings, etc. as well as positive safety elements must generally be replaced by new ones.

Tightening torques

Tightening torque (Nm, with a tolerance of $\pm 10\%$) for a thread sized of:

	M4	M5	M6	M8	M10	M12	M16	M20	M24
Case 1	1.2	2.5	4.0	8.0	13	20	40	-	-
Case 2	1.3	2.6	4.5	10	20	34	83	160	280
Case 3	3.3	6.5	11.2	27	55	94	230	470	800
Case 4.1	2,5	4,5	8	20	40	67	163	334	570
Case 4.2	3,2	6,3	11	26	53	90	221	451	770

Tightening torque - case 1

for electrical connections for which the permitted torque is limited by the screw material and/or by the admissible load of the insulators.

Tightening torque - case 2

for screws of the strength class from 5.6, or
for screws used for components having low strength (e.g. aluminium),

Tightening torque - case 3

for screws of the strength class 8.8, however, only when used for components having high strength (e.g. grey cast iron, steel or cast steel)

Tightening torque - case 4.1

for A2- type and A4-type screws of the strength class 70, however, only when used for components having high strength (e.g. grey cast iron, steel or cast steel)

Tightening torque - case 4.2

for A2- type and A4-type screws of the strength class 80, however, only when used for components having high strength (e.g. grey cast iron, steel or cast steel)

Installation instructions

Please, observe the information indicated in section B.2 for work on site after the assembly of the machine.

D.3.3 重新装配

密封

在重新装配时，确保所有密封面都处在正确的状态，它们必须没有损坏，有金属光泽并经润滑。隔爆面只能安装设计允许的额外密封（如O形圈）。

如果安装了密封件，必须进行详细检查，如果位置不正确，则必须更换。

螺栓锁紧装置

螺栓和锁紧装置如安全板、弹簧垫圈等一起使用，作为安全元件，必须全部更换成新的。

固定力矩

扭矩 (Nm, 容差 $\pm 10\%$)

根据螺纹大小

	M4	M5	M6	M8	M10	M12	M16	M20	M24
情况1	1.2	2.5	4.0	8.0	13	20	40	-	-
情况2	1.3	2.6	4.5	10	20	34	83	160	280
情况3	3.3	6.5	11.2	27	55	94	230	470	800
情况4.1	2,5	4,5	8	20	40	67	163	334	570
情况4.2	3,2	6,3	11	26	53	90	221	451	770

扭矩-情况1

电气连接, 许用扭矩被螺栓材料或绝缘成分所限制

扭矩-情况2

从5.6级开始的螺栓或连接有力矩限制的元件(如铝)

扭矩-情况3

8.8级的螺栓, 只能用于高强度元件(如灰铸铁, 钢或铸钢)

扭矩-情况4.1

强度70级的A2和A4螺栓, 只能用于高强度元件(如灰铸铁, 钢或铸钢)

扭矩-情况4.2

强度80级的A2和A4螺栓, 只能用于高强度元件(如灰铸铁, 钢和铸铁)

安装指南

在装配后在安装地点工作, 请遵照B.2条的规定

D.4 Spare parts

Only original spare parts are allowed to be used with the exception of standardised and commercially available parts.

In case of ordering spare parts, please indicate the motor type and its serial number besides the exact designation of the spare parts. The motor type and the serial number can be read from the rating plate.

The designation of the spare parts should correspond to the one indicated in the spare part list.

For organisational and technical reasons, certain subassemblies can only be delivered as complete functional units.

Commercially available standard parts can be purchased in the free market, however, the same type of construction, the dimensions and the strength classes have to be taken into account.

Besides the identification number, the suffix is also required with regard to the bearing design of antifriction bearings.

Both identification numbers can be read from the existing bearing.

Appendix: Refer to the corresponding data sheet

D.4 备件

除标准和商业上规定的以外, 只能用原厂的备件, 在订备件时, 除提供准确的备件描述外, 请同时提供电机的型号和序列号, 这些可以在铭牌上找到, 备件的名称应和备件清单上的一致, 这是可用的。

备件数量较多, 由于组织和技术上的原因, 有些元件需要按工作单元进行提供。

商业上可以获得的标准备件, 注意同的型号, 尺寸和强度等级。

对于减摩轴承, 除识别号以外, 还需要设计时用的后缀号。

两个标记都能在轴承上找到。

附录: 参照相应技术参数表



**Data sheet to the operating instructions
for Variable Frequency Drive
dksWa72UM/4-4**

dksWa72UM/4-4 变频电机 参数表

Order-no.: 072-90-00-066

Edition: January 2012

Table of contents:

目录:

Table of contents:.....	1
目录:.....	1
A. Description of the VFD.....	2
A. 变频电机的描述	2
B. Parameters	2
B. 电机参数	2
C. Special requirement for a safe usage	7
C. 安全使用的特殊要求	8
D. Intended Application	10
D. 预定的使用场合。	10
E. Rating plate	11
E. 铭牌。	11
F. Characteristic curve of the cooling system	12
F. 冷却系统的特性曲线。	12

A. Description of the VFD

The stator housing of the motor is designed with the type of protection "flameproof enclosure".

The connection box mounted on top of the stator housing is designed with the type of protection "flameproof enclosure", as well. It is used for the installation of the power electronics as well as the corresponding control electronics and the FSK modules.

A further box (mains choke housing), which is also designed with the type of protection "flameproof enclosure", is mounted at the NDE-side of the motor. It is used for the installation of contactors, 1 pc mains choke, the terminal elements, the encoders and the connection of feed lines.

For cooling purposes, the motor is equipped with cooling water ducts installed in the double-walled jacket of the stator housing, in the cooling plate inside the connection box and in the mains choke housing.

A. 变频电机的描述

电机的定子机壳被设计成“隔爆”结构。

装备在定子机壳上部的接线盒同样的也被设计成“隔爆”结构。它被用来安装功率元件、控制元件和FSK模块电路。内部的盒子（主电源电抗器盒），也是“隔爆”结构，它被装在电机非驱动端，在它上面安装接触器、1个电抗器、终端元件、编码器和供水管道的链接。

为了电机冷却的需要，电机在双层机壳、接线盒冷却板和电抗器壳内装有冷却管道。

B. Parameters

B. 电机参数

a) Total Drive 总体的驱动

Motor type 电机型号	: dksWa72UM/4-4
Shaft power 轴功率	: 1020 kW
Nominal voltage 额定电压	: 2 x 3 AC 1140V Tolerance (+10% ... -20%)
Nominal current, input 额定电流, 输入	: 2 x 326 A
Nominal current, winding side 额定电流, 线圈端	: 700 A
Nominal torque 额定扭矩	: 6530 Nm
Nominal speed 额定转速	: 1490 min⁻¹
Max. speed 最大转速	: 1800 min⁻¹
Nominal frequency 额定频率	: 50 Hz
Max. frequency 最大频率	: 60 Hz
Efficiency, incl. converter 效率（包括变频器）	: 93 %
Insulation class 绝缘等级	: F
Operating mode 工作制	: S9
Type of protection 保护类型	: EEx d I / MA
Protection class 防护等级	: IP 55

Inertia 转动惯量	: 34 kgm ²
Type of construction 安装型式	: IM B5
Total weight 总重	: 7000 kg
Lubricant 润滑剂	: BMQ 72-162 (Comp. Klüber, Munich)
Max. service life of lubricant 最大润滑剂使用时间	: 36000 operating hours
Re-lubrication interval *) 再润滑间隔*)	: approx. 12000 operating hours
Quantity of Re-lubrication 注油量	: 70 g
*) see re-lubrication *) 见注油间隔	

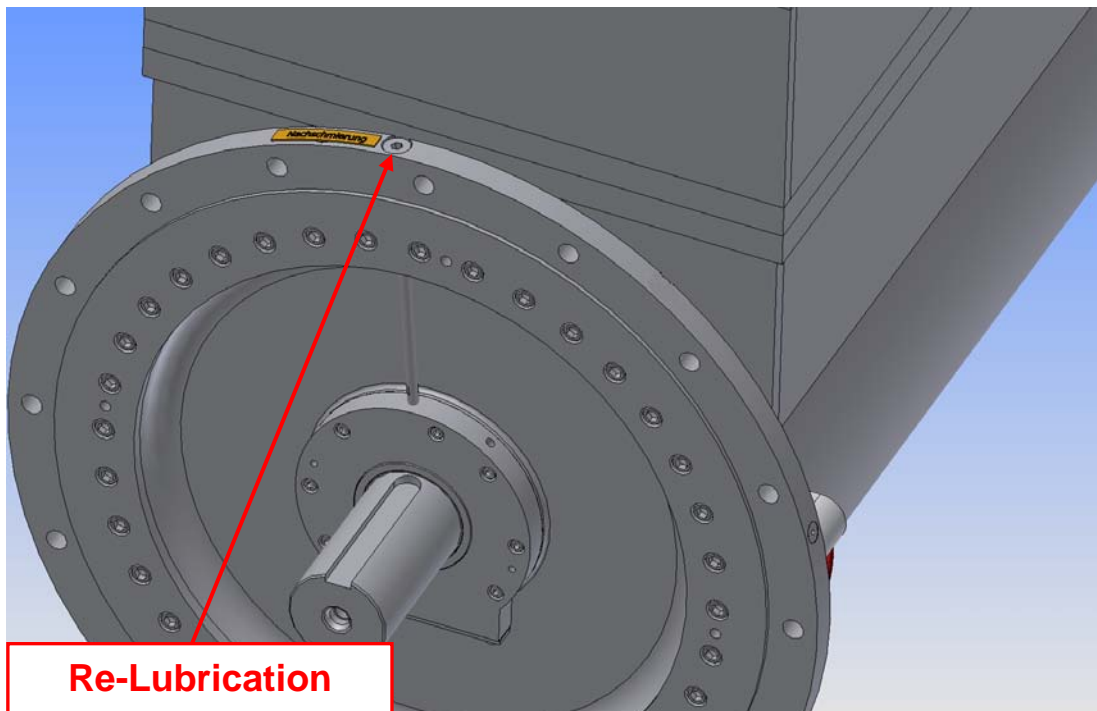
Imperatively, the closing plug of the box at the NDE-side has to be replaced and secured after having completed the re-lubrication work of the bearing!

EEx dl-closing-off

必须的，在完成注油工作之后，非驱动端油盒的密封塞必须放回原处并安装牢固。

After 36000 operating hours, the lubricant must completely be removed. The bearings have to be cleaned or to be replaced by new bearings. (That means that a re-lubrication can only be realised two times after the first lubrication (80% of the bearing clearance))

在电机运行36000小时后，润滑油必须被完全取出。轴承必须清理或者更换。（这就意味着在第一次注油后，实际只能进行2次注油）80%的轴承空间。



Concerning the re-lubrication at the DE-side, the closing plug of the re-lubrication hole ("re-lubrication") has to be removed. The closing plug has imperatively to be replaced and secured after having completed the re-lubrication work.

对于在驱动端的再润滑，须打开润滑油孔密封塞，在完成再润滑工作后，封封塞需放回原处并安装牢固。

b) Frequency converter 变频器

Type 类型	: inverter (electronic power stage) 逆变器 (功率电子脉冲)
Input current 输入电流	: 700 A
D.C. link capacity 直流母线电容	: 3 x 2300 µF
Capacitor - rated voltage 电容-额定电压	: 1650 V DC
Capacitor - discharge time 电容-放电时间	: 10 min

c) Control unit 控制单元

Type 型号	: BEKU02; Type II
Voltage 电压	: 127 V Tolerance (+10% ... -20%)
Max. power consumption 最大能量功耗	: 200 VA

d) Cooling system 冷却系统

Type of cooling system 冷却系统类型	: Water 水冷
Nominal flow 额定流量	: 25 l/min at Δp=6 bar
Inlet temperature of the cooling water 冷却水进入时的温度	: 15 ... 35 °C
Operating pressure 工作压力	: 10 ... 20 bar
Triggering pressure of the relief pressure valve 安全阀额定压力	: 30 bar

e) Motor monitoring 电机监控

Stator windings 定子线圈	: Thermal contacts 接触式测温元件 150°C (2x3)
Bearing, DE-side 轴承, 驱动端	: Thermal contacts 接触式测温元件 120°C (2x1)
Bearing, NDE-side 轴承, 非驱动端	: Thermal contacts 接触式测温元件 120°C (2x1)
IGBT Module IGBT模块	: Thermal contacts 接触式测温元件 70°C (2x1)
Mains choke 主电缆电抗器	: Thermal contacts 接触式测温元件 150°C (1x3)

f) Connector system 连接器系统

For main connection	: 2x Victor- type socket - A43SB bolted socket 3300V, 500A
For control connection:	: 1x Victor type-socket - A44SB bolted socket 1300/650V, 100A
主电缆连接:	: 2×Victor-插座-A43SB 螺栓固定式插座 3300V, 500A
控制电缆连接:	: 1×Victor 插座-A44SB 螺栓固定式插座 1300/650V, 100A



Note!

Do never touch electrical contacts of unplugged connectors or sockets.

注意: 不要接触还没有插入的连接器或者插座的电气接触点。

General notes concerning the cable connection of the male connector

It is not allowed to use these male connectors and apply voltage to the device without having ensured before that the male connector has appropriately been tightened and fixed.

Furthermore, it is not allowed to cut off a male connector in case the cable is applied with voltage.

Damaged or used sealing rings must never be reused due to the fact that gas sealing and protection are not assured any longer.

It is now allowed to adjust oversized diameter differences between cable and sealing ring by means of adhesive tape or any other aids. The sealing ring shall be fixed directly on the outer cable sheathing.

The dimensions and the material of the sealing rings have been defined in order to ensure the required features. Therefore, it is not allowed to use other sealing rings than the original ones.

The connection components of the male connectors must always suit to the cable diameter and to the section of the conductors in order to assure the appropriate connection and the appropriate assembly of the cable connection as well as to assure the type of protection "EEx d".

The O-ring between socket and motor housing has imperatively to be built-in in order to assure the protection class IP54.

The locking of the of assembly group "socket - male connector" is effected by means of the locking nib of the lock nut. This locking nib is secured by a screw (special lock). Before detaching the components of the connector system, it has imperatively to be ensured that the power supply is disconnected.

During the assembly of the socket A43SB / A44SB the tightening torque may not exceed 200 Nm, approximately.

The appropriate assembly of the cable with the admitted connector can be read from the corresponding operating manual which has to be demanded, if required, from the manufacturer. The tools required for the assembly of the connector can be ordered from the manufacturer.

关于电缆连接中外插头的一般注解

在没有确保这个外插头被合适的拉紧和固定，不允许用这些插头给设备供电。

此外，不允许切断一个有可能已经通电的电缆。

损坏的或者使用过的密封一定不要重复使用，由于气体密封和保护不再被确保。

在电缆和密封环之间存在过大的直径偏差时，允许使用胶布或者其他方式进行修整。这个密封环必须完全对电缆外皮进行包裹。

密封环的尺寸和材料是按要求定制的，因此不能用其它密封环替代。

为了保证电缆接头的合适的连接和安装，保证“EExd”保护类型，外插头连接的部分必须适应电缆的直径和导体的截面。

为了确保满足IP54的防护等级，在插座和电机外壳之间的O型圈必须是嵌入式的。

对于对应插座-

插头的锁定，是使用一个带有锁定削尖的防松螺母，这个锁定削尖被螺栓固定，在分离接头系统部件之前，有必要确认电源供应没有被连接。

在安装插座A43SB/A44SB时，扭紧力矩不能超过大约200Nm。

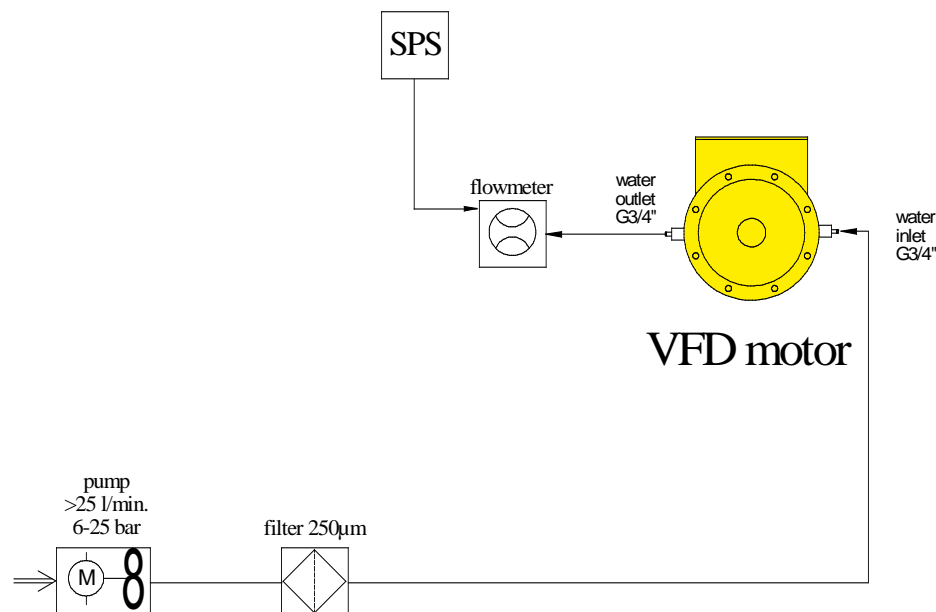
如果需要，从制造商那里可以从查询的相关使用说明书上读到给电缆合适的装配连接器，对于装配需要的工具可以制造商那里订购。

C. Special requirement for a safe usage

The VFD motor must never be operated without cooling water. The operation of the motor without cooling water causes immediately motor damages. The monitoring of the cooling system has to be ensured by the operator.

It has to be guaranteed that:

- the cooling system is in operation before starting the frequency converter.
- the nominal flow rate amounts to 25 l/min.
- the system is monitored by a flow meter (24 l/min at a minimum).
- the cooling system is not interrupted more than 10 sec.
- the operating pressure of the cooling system amounts to 10 - 20 bar.
- the triggering pressure of the relief pressure valve amounts to max. 30 bar.
- the inlet temperature of the cooling water amounts to 15 - 35°C.
- after having stopped the frequency converter the cooling system is continued to be operated for further 5 min. in order to eliminate overheating and mineral sediments within the converter.



A chemically neutral and non-aggressive coolant with a pH value of ~7 has to be used in order to prevent soiling and damages of the cooling system. Additionally, the coolant must be free of coarse pollutants (0,25 mm). If required, additional filters have to be installed which are to be cleaned regularly.

The motor has to be monitored by thermo contacts installed in the stator windings, at the IGBT modules and at the bearings.

The short-circuit current of the supplying protective and monitoring device for the end member of the type 8SX9006-0A*00 (DMT02ATEXE045U) must not exceed 33mA.

Minimum yield-strength of the used screws:

The screws used to fix the inner bearing cap on the NDE-side of the motor must have a minimum yield-strength of 360 N/mm².

The screws used to fix the three elongated caps of the mounting box must have a minimum yield-strength of 290 N/mm².

Near by the motor, a circuit-breaker has to be mounted by which all non-intrinsically safe feed lines towards the motor can be disconnected from the mains.

Re-Lubrication:

After approx. 12000 operating hours the bearings have to be re-lubricated with a lubricant quantity of 70 g/ ea. bearing.



Note!: It is not allowed to lubricate the motor during running!

Before restarting the motor the closing plug of the lubrication hole at the NDE-side has to be replaced and secured.

After 36000 operating hours, the lubricant must completely be removed. The bearings have to be cleaned or to be replaced by new bearings. That means that a re-lubrication can only be realised two times after the first lubrication (80% of the bearing clearance).

C. 安全使用的特殊要求

变频电机永远不能在冷却水没有的情况下运转。电机在冷却水没有的情况下运转会立即导致损坏。操作者必须确保冷却系统的监视。

下面的事项是必须需保证的:

-在启动变频器之前必须保证冷却系统的运转。

-额定流量要达到25L/min.

-系统要被流量计监视，流量计需设在电机出水口之后（最小值为24L/min）。

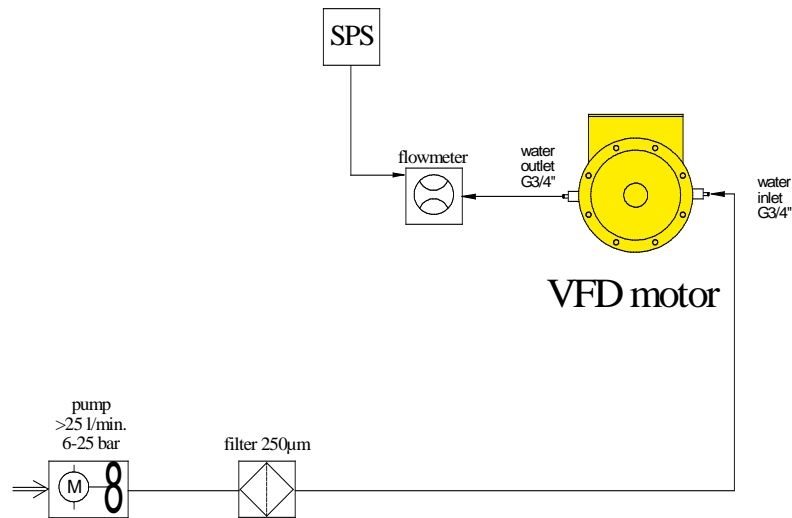
-冷却系统不能被中断10秒钟以上。

-冷却系统的运转压力要在10-20bar之间。

-触发安全阀动作的压力最大为30bar。

-冷却水进入时的温度要在15-40℃。

-在变频电机停止运转后，冷却系统需要再运转5分钟，以清除过热和矿物质沉淀物在变频器内部。



为了避免冷却系统的腐蚀和损坏，必须要使用中性的非侵蚀性的PH值约为7的冷却剂，另外，固体杂质不得大于0.25mm，如有必要，可以安装一个过滤器并定期清理。

安装在定子线圈、IGBT模块和轴承上的接触式测温元件用来监视电机。

各类提供的保护和监视装置在最终进入型号8SX9006-0A*00 (DMT02ATEXE045U)的短路电流不能超过33mA。

使用螺栓的最小屈服强度：

在电机非驱动端用来固定内部轴承盖的螺栓的最小屈服强度为 $360\text{N}/\text{mm}^2$ 。

在电机的安装盒用来固定3个细长盖子的螺栓的最小屈服强度为 $290\text{N}/\text{mm}^2$ 。

在电机的附近，应该装配一个断路器用来从主电源分离接在电机上非本安的供给电路。

再润滑：

在电机运转12000小时以后电机的轴承必须要被再润滑，润滑脂的量为70g/每个轴承。



注意：不允许在电机运转过程中加润滑油。

在重新启动电机之前，电机非驱动端的注油孔的密封塞必须重新安装并固定。

在电机运转36000小时后，润滑油必须完全被清除。轴承必须被清洗或者更换。那就意味着在第一次加润滑油后再润滑只需被实现2次（80%的轴承间隙）。

D. Intended Application

The operating safety of the VFD motor is ensured only in case of its intended application!

Intended application means that the following points have to be respected and to be met:

- The VFD motor is used for a speed-controlled drive for underground application.
- Concerning the data communication, the motor is connected to an superordinated intrinsically safe control system of the mine.
- Interferences which could affect the safety have to be immediately remedied by specialised staff correspondingly trained and instructed.
- Only authorized staff is allowed to operate the VFD. Those persons must have read and understood the operating manual.

Each other application which does not meet these points is not considered to be the intended application. The manufacturer will not assume liability for damages resulting from this. The risk for this is solely borne by the user. This also applies for constructive modifications of any kind (unless they are certified) like for example to carry out additional bore holes or the mounting of unsuitable spare parts.

D. 预定的使用场合。

只有在预定的场合，变频电机的使用安全才能被确保。

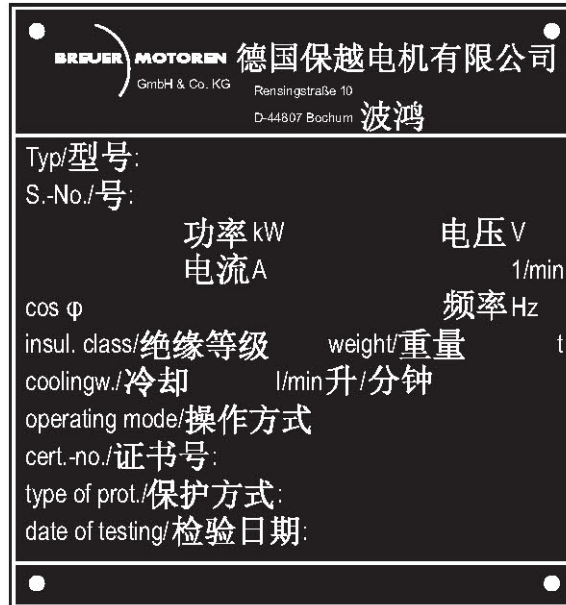
预定的使用场合意味着下面几点必须被重视和实现：

- 变频电机是井下可以进行速度控制的装置。
- 对于数据通讯，电机是连接在矿上一个上级的本质安全控制系统中。
- 会影响安全干扰，必须要被接受过培训或者教育的相关专业人员立即纠正。
- 只有经过授权的职员可以操作变频电机，这些人必须读过和懂得使用说明书。

任何其他的不适宜以上几点的场合都是不被认可的。制造商不对这些应用对电机的损坏的结果承担责任。这样做的危险全由使用者单独忍受。当然也可以提出有助益的任何变动的申请（除非他们是被证明的），例如实行附加的钻孔或者装备不相称的备件。

E. Rating plate

E. 铭牌。

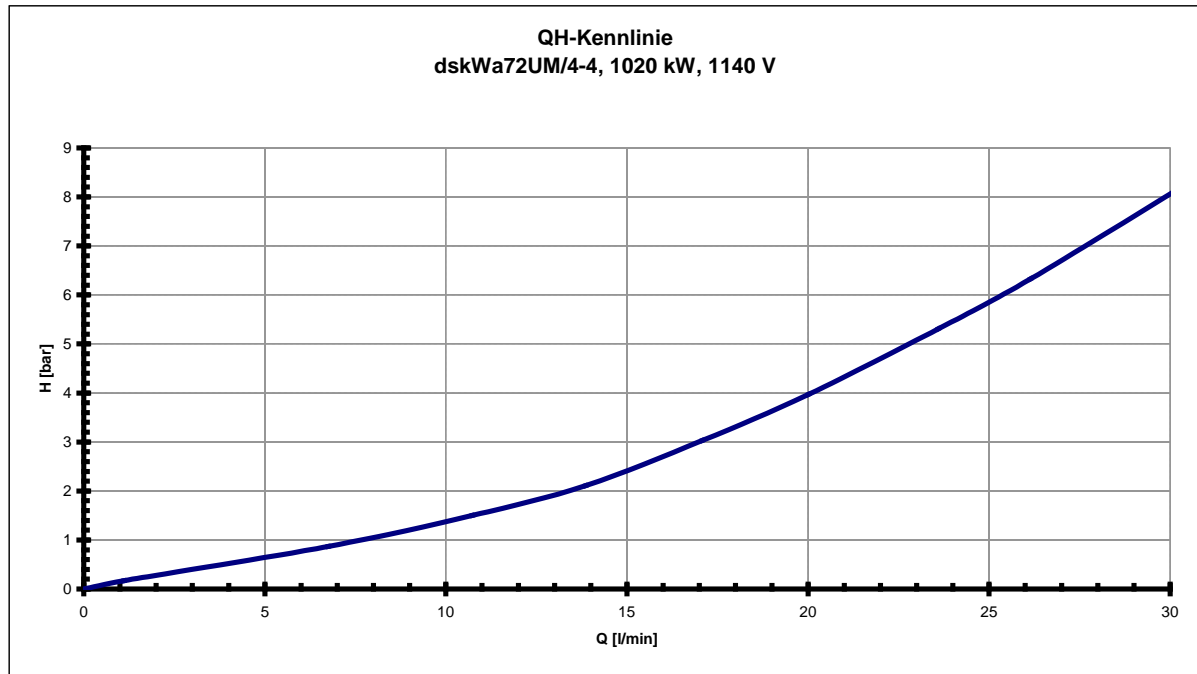


Information on the rating plate: 铭牌上的信息

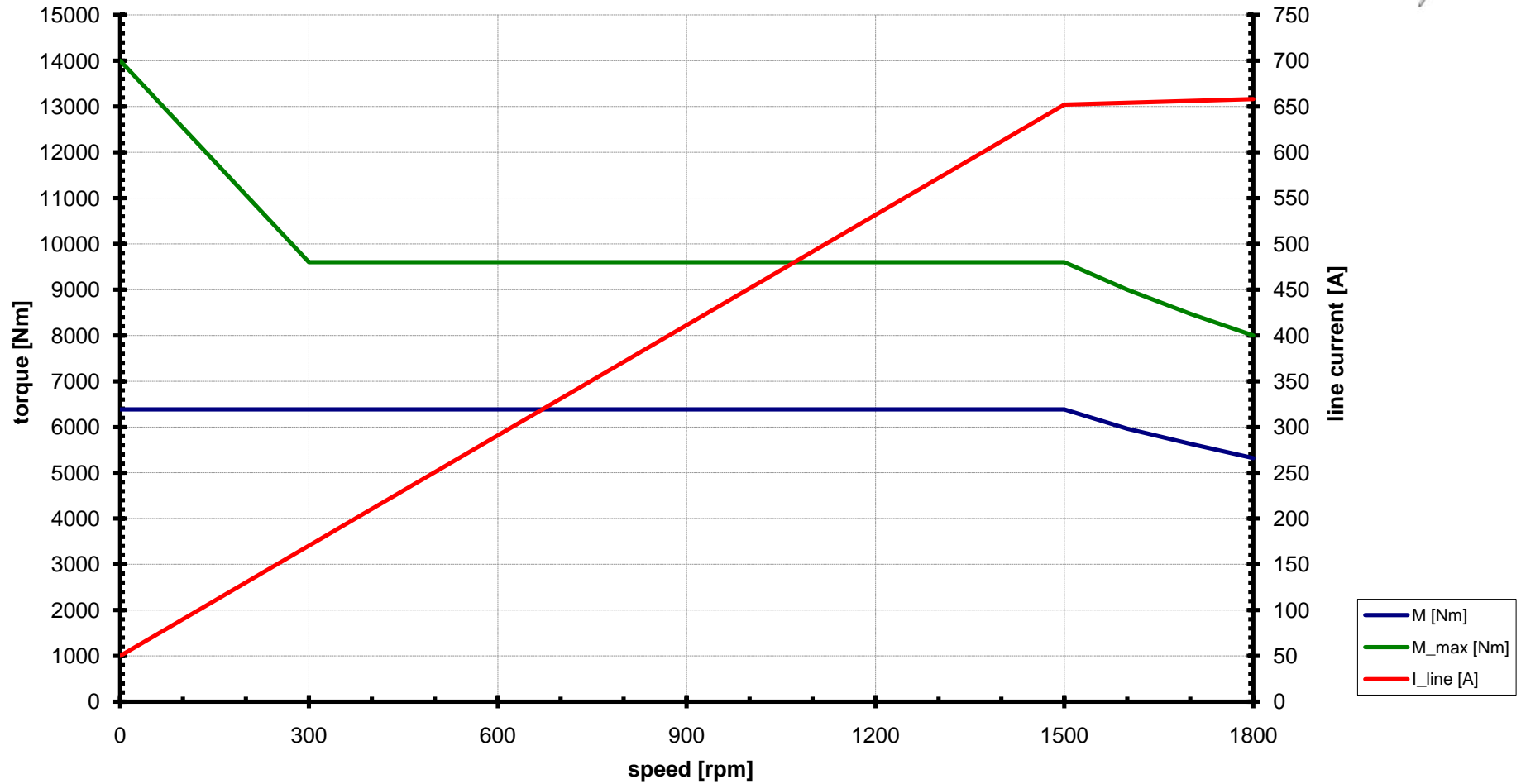
First line	: 制造商的信息
Type	: 变频电机的型号
S. -No	: 电机序列号
kW	: 功率
V	: 额定电压
A	: 额定电流
1/min	: 每分钟额定转速
Cos	: 功率因素
Hz	: 额定频率
Isol. class	: 绝缘等级
Weight	: 总重量
Coolingw.	: 额定流量L/min
Operating mode	: 工作制
Cert. -no.	: 证书号
Type of prof.	: 保护等级
date of testing	: 试验日期及姓名

F. Characteristic curve of the cooling system

F. 冷却系统的特性曲线。



torque diagram
dksWa72UM/4-4, 1020 kW, 1140 V



0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

documentation

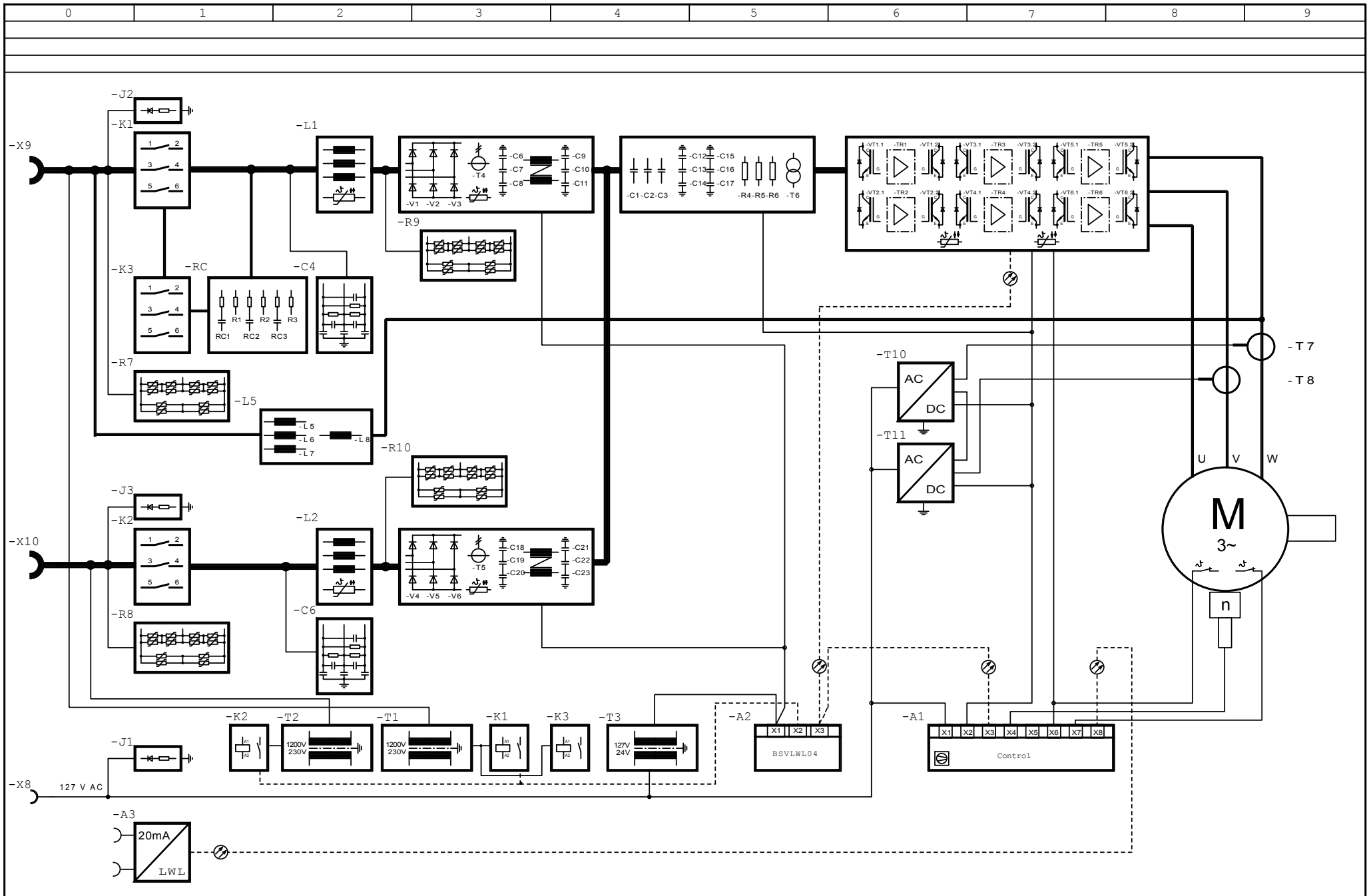
project :

customer-no.:

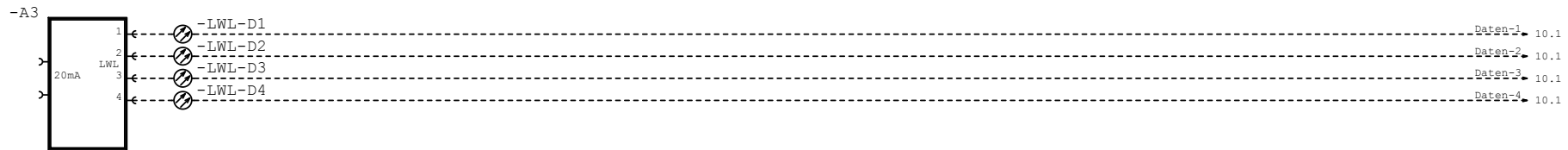
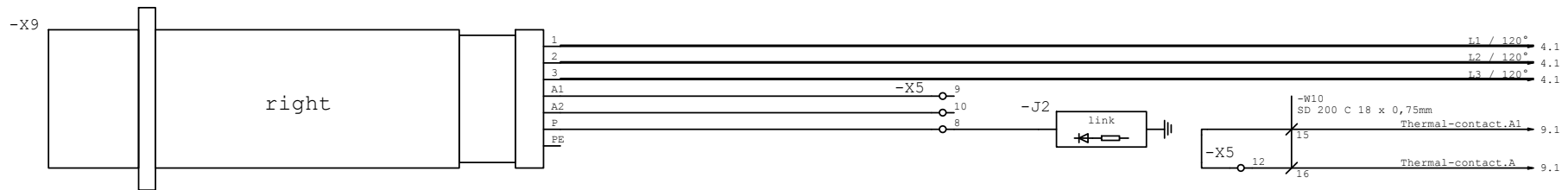
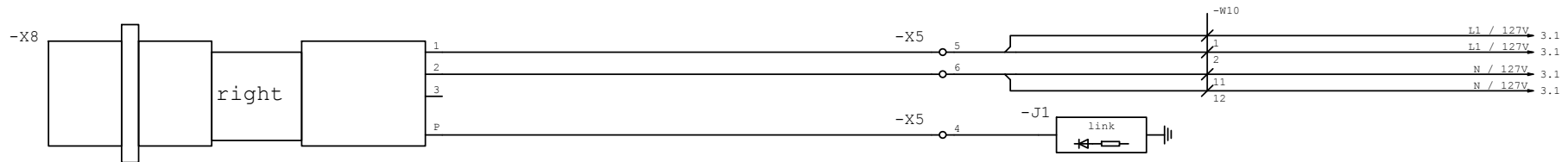
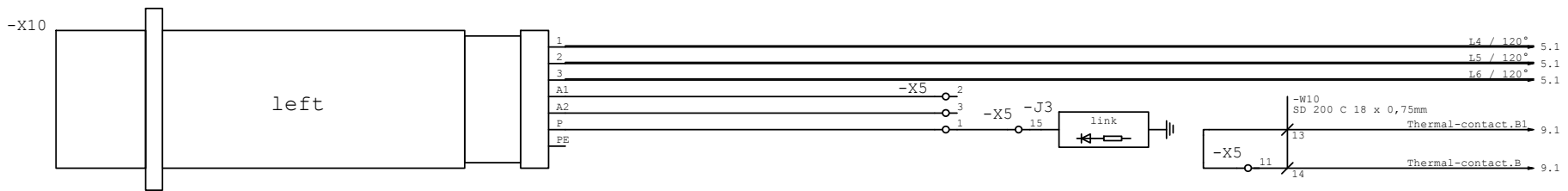
ZHANGJIAKOU COAL MINING

VFD motor dksWa72UM/4-4;1020kW

				date	16.04.2012	ZHANGJIAKOU COAL MINING	 Breuer Motoren <small>competence since 1877</small>	customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			+	
				check	Hellinger			equipment:	drawing-no:	sheet 1
state	change	date	name	norm	root	create for	cover sheet	dksWa72UM/4-4	072-1016767-09-04 E	of 1 sh.

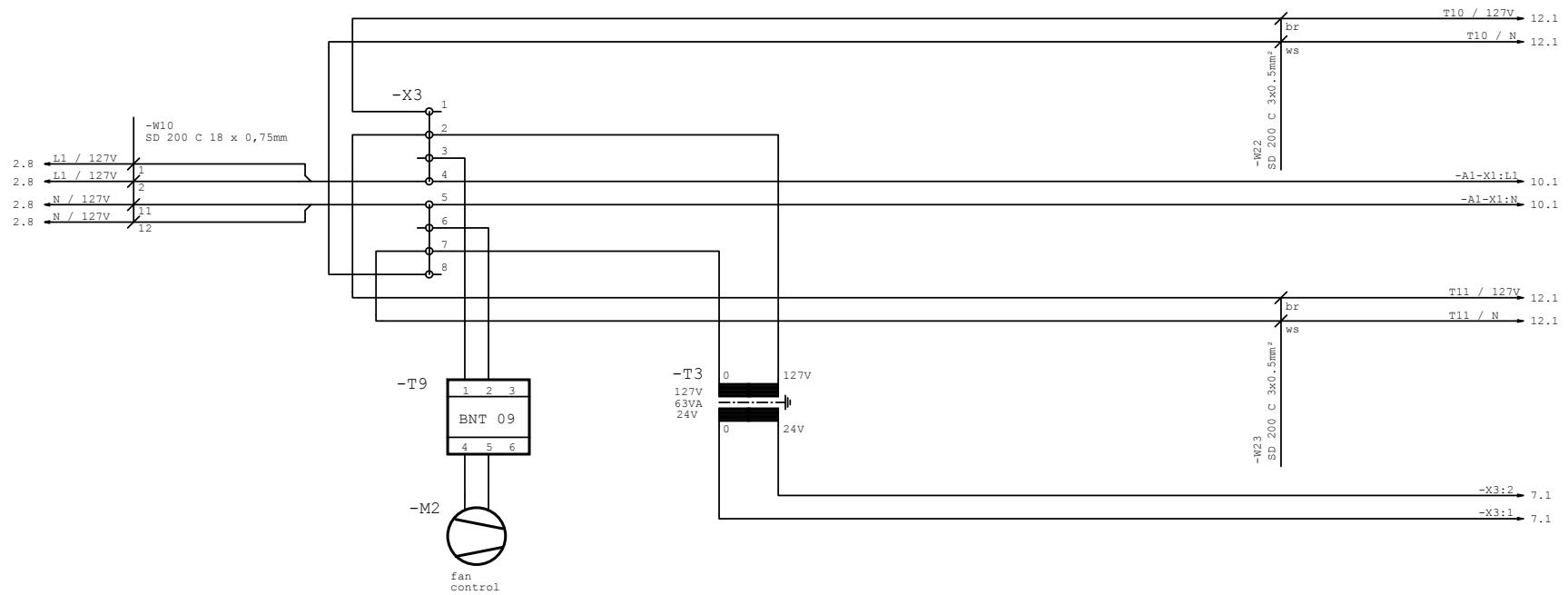


				date	16.04.2012	ZHANGJIAKOU COAL MINING		Breuer Motoren		layout	customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW		competence since 1877				+	
				check	Hellinger						equipment:	drawing-no:	sheet 1
state	change	date	name	norm	root	create for					dksWa72UM/4-4	072-1016767-09-04 E	of 12 sh.

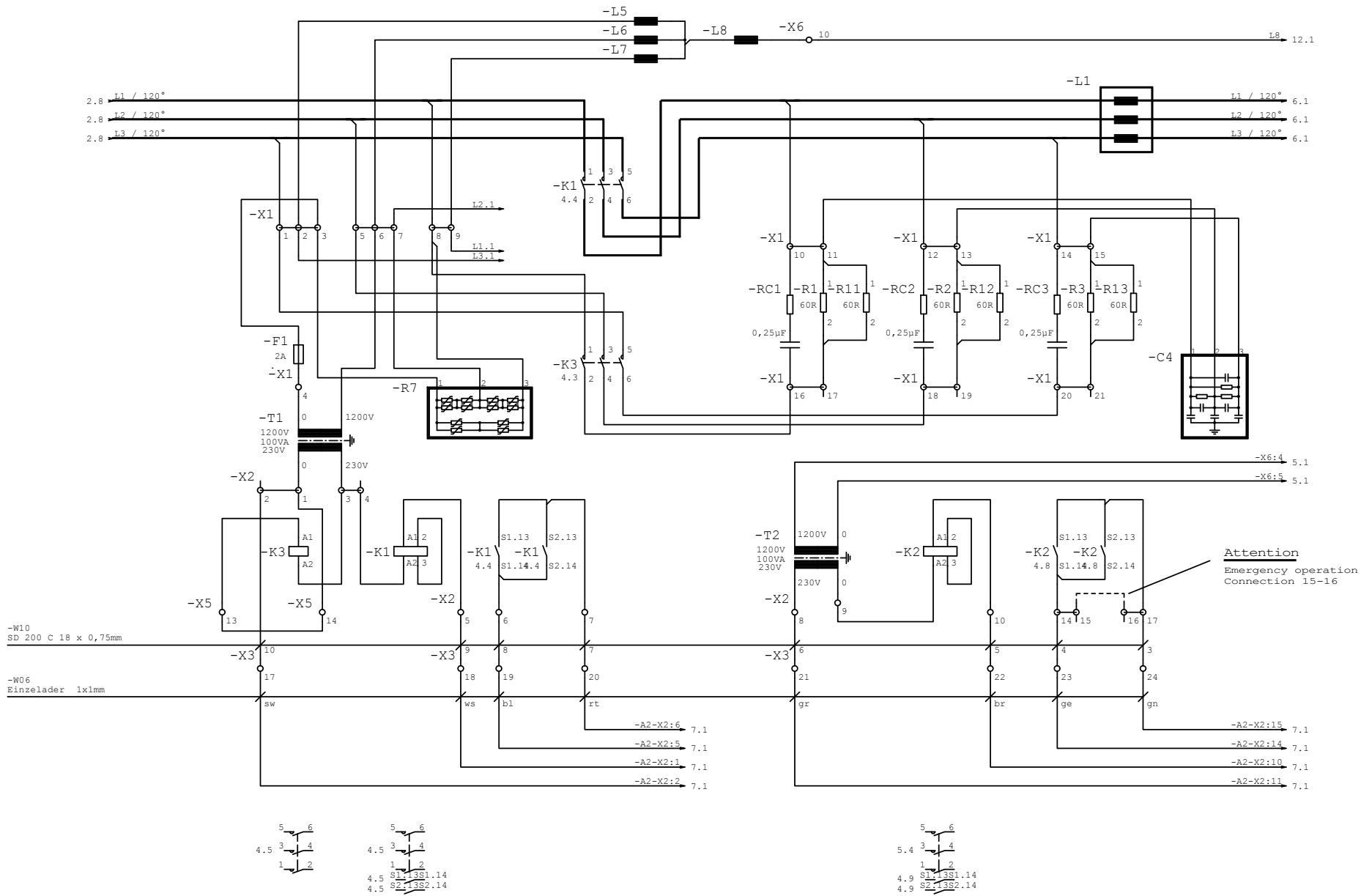


-X5 7

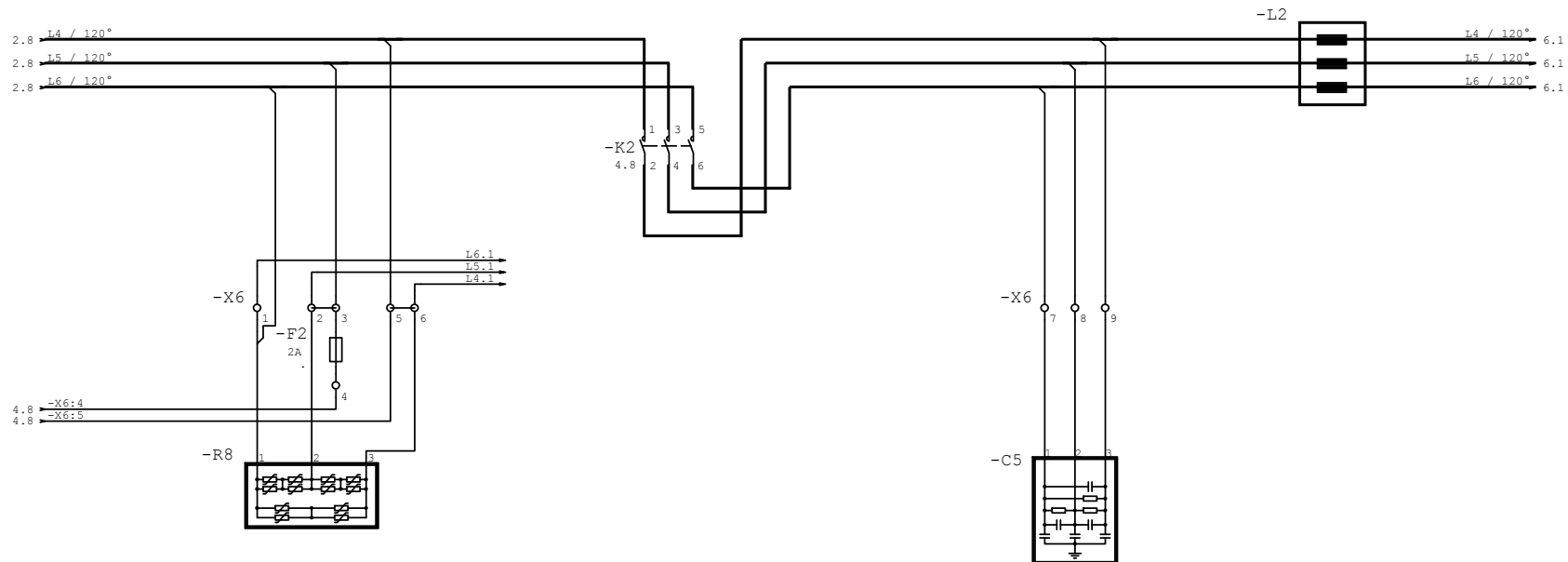
					date 16.04.2012		ZHANGJIAKOU COAL MINING		Breuer Motoren <small>competence since 1877</small>		customer-no.: =	
					worker Wieczorek		VFD motor dksWa72UM/4-4;1020kW				equipment:	
					check Hellinger				wiring diagram		sheet 2	
state change date name norm					root create for						of 12 sh.	



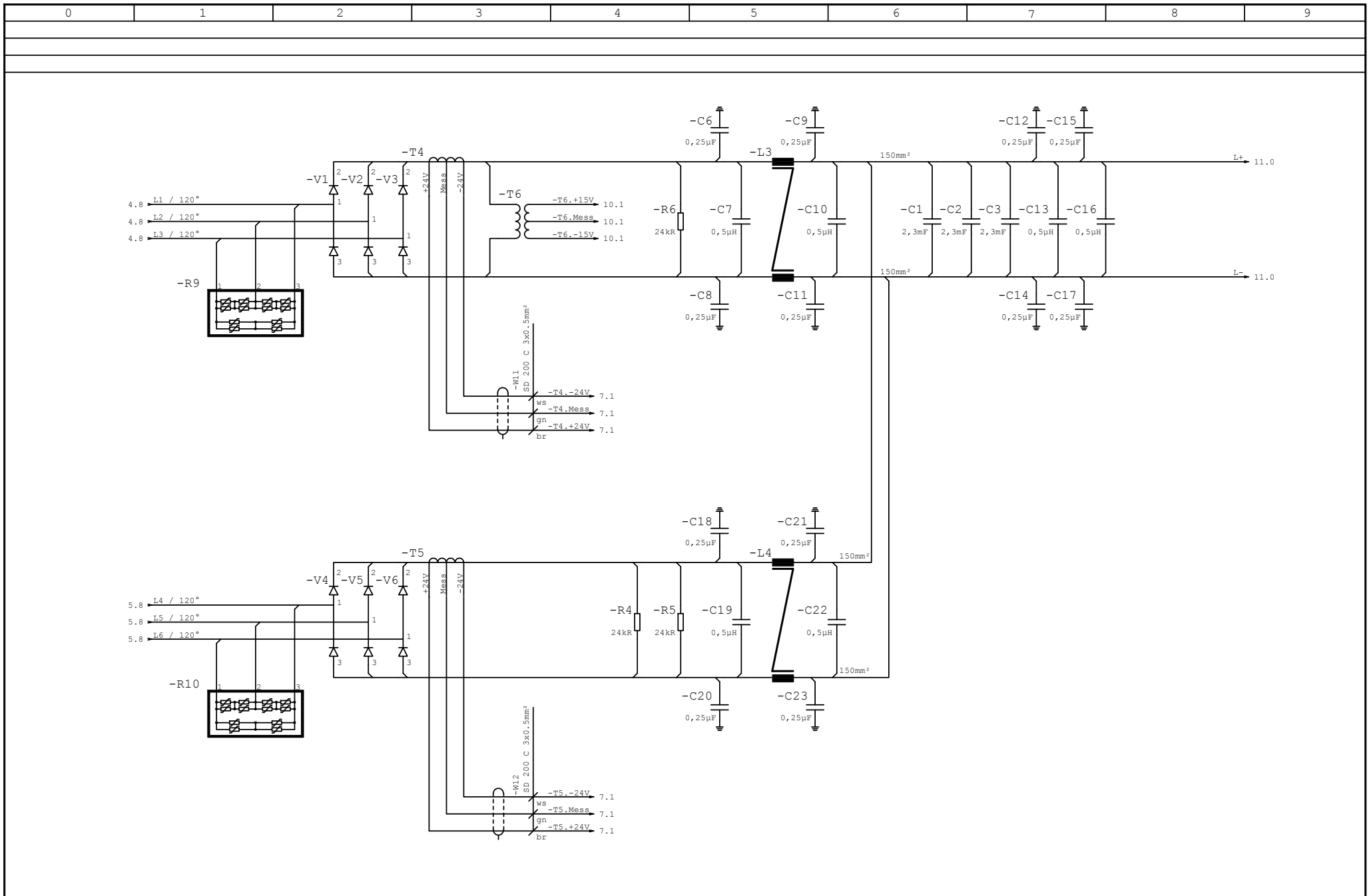
				date	16.04.2012	ZHANGJIAKOU COAL MINING		 Breuer Motoren <small>competence since 1877</small>	power supply		customer-no.:	=
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW					equipment:	+
				check	Hellinger				drawing-no:		dksWa72UM/4-4	072-1016767-09-04 E
state	change	date	name	norm	root	create for			wiring diagram		of 12	sh.



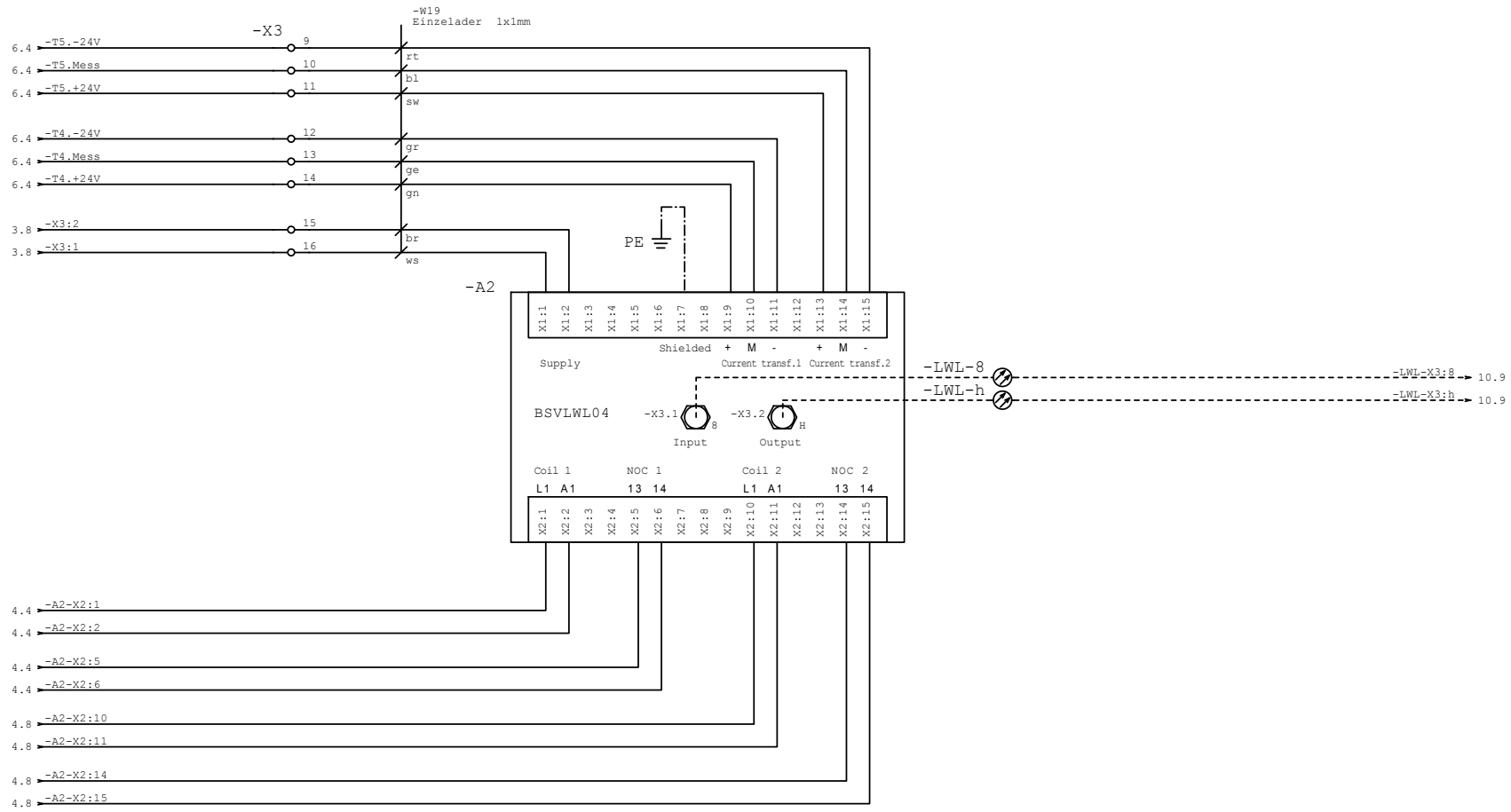
				date	16.04.2012	ZHANGJIAKOU COAL MINING			Precharge Control of contactor		customer-no.:		=
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			competence since 1877		equipment:		+
				check	Hellinger					drawing-no:		sheet 4	
state	change	date	name	norm	root	create for					dksWa72UM/4-4 072-1016767-09-04 E		of 12 sh.



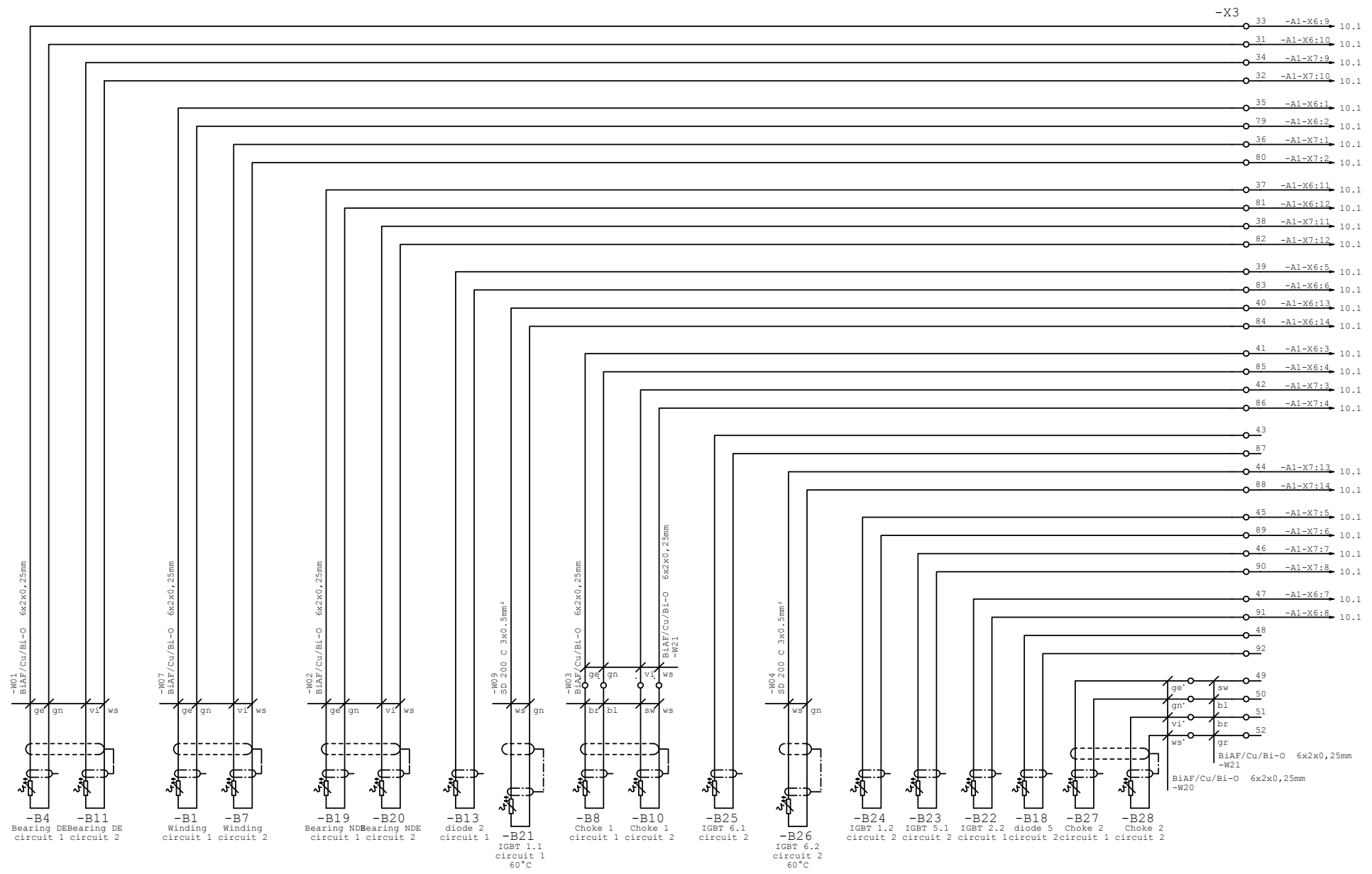
				date	16.04.2012	ZHANGJIAKOU COAL MINING		Breuer Motoren <small>competence since 1877</small>		Power circuit		customer-no.:		=
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW								+
				check	Hellinger									
state	change	date	name	norm	root	create for			wiring diagram		equipment:	drawing-no:	sheet 5	
										dksWa72UM/4-4	072-1016767-09-04 E	of 12 sh.		



date	16.04.2012	ZHANGJIAKOU COAL MINING	Breuer Motoren	d.c. link	customer-no.:	=
worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW	competence since 1877		equipment:	+
check	Hellinger			wiring diagram	drawing-no:	sheet 6
state	change	root	create for		072-1016767-09-04 E	of 12 sh.

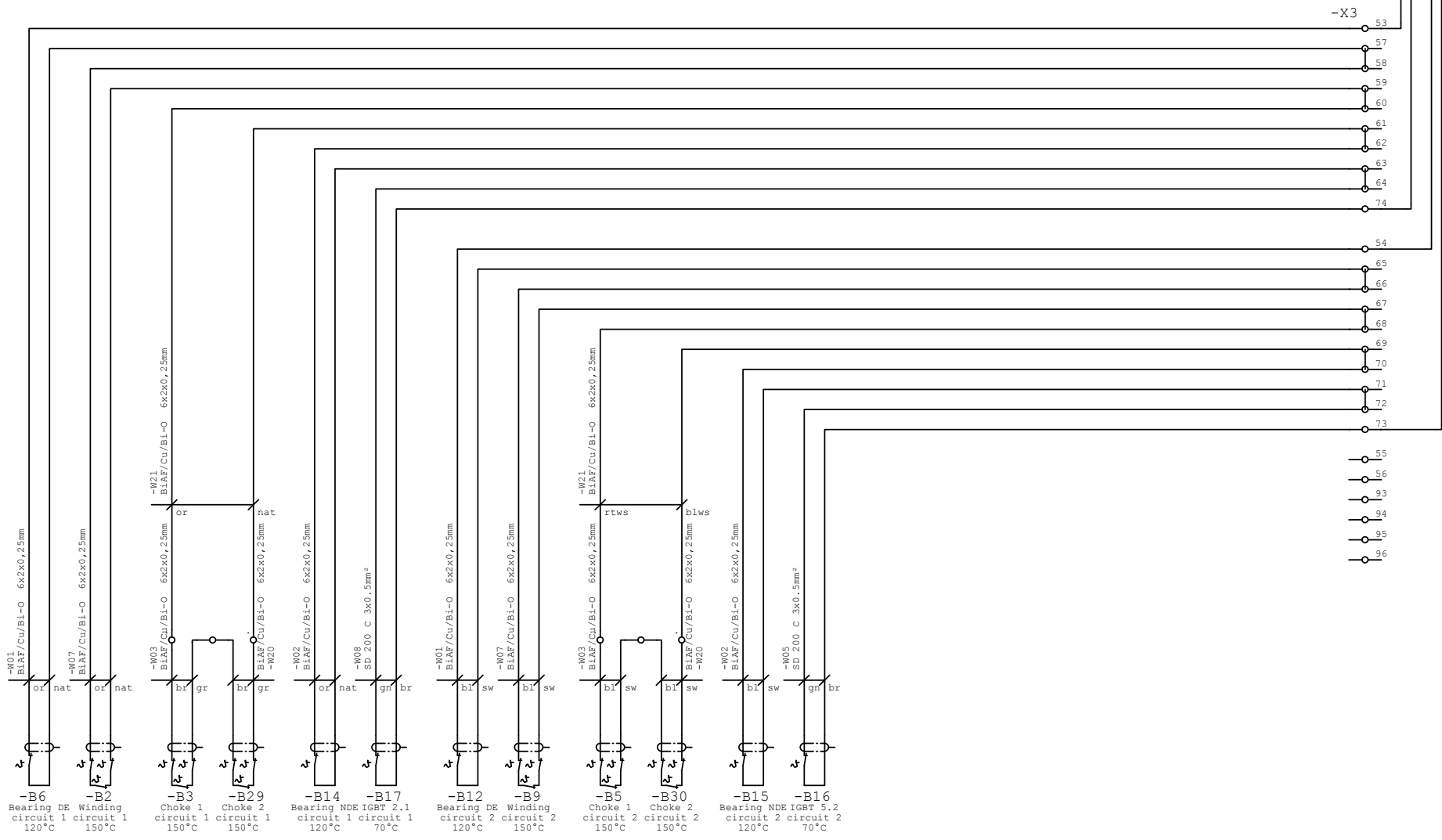


				date	16.04.2012	ZHANGJIAKOU COAL MINING		 Breuer Motoren competence since 1877		Control		customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW				BSVLWL04		equipment:		+
				check	Hellinger					wiring diagram		drawing-no:	072-1016767-09-04 E	sheet 7
state	change	date	name	norm	root	create for						of 12	sh.	

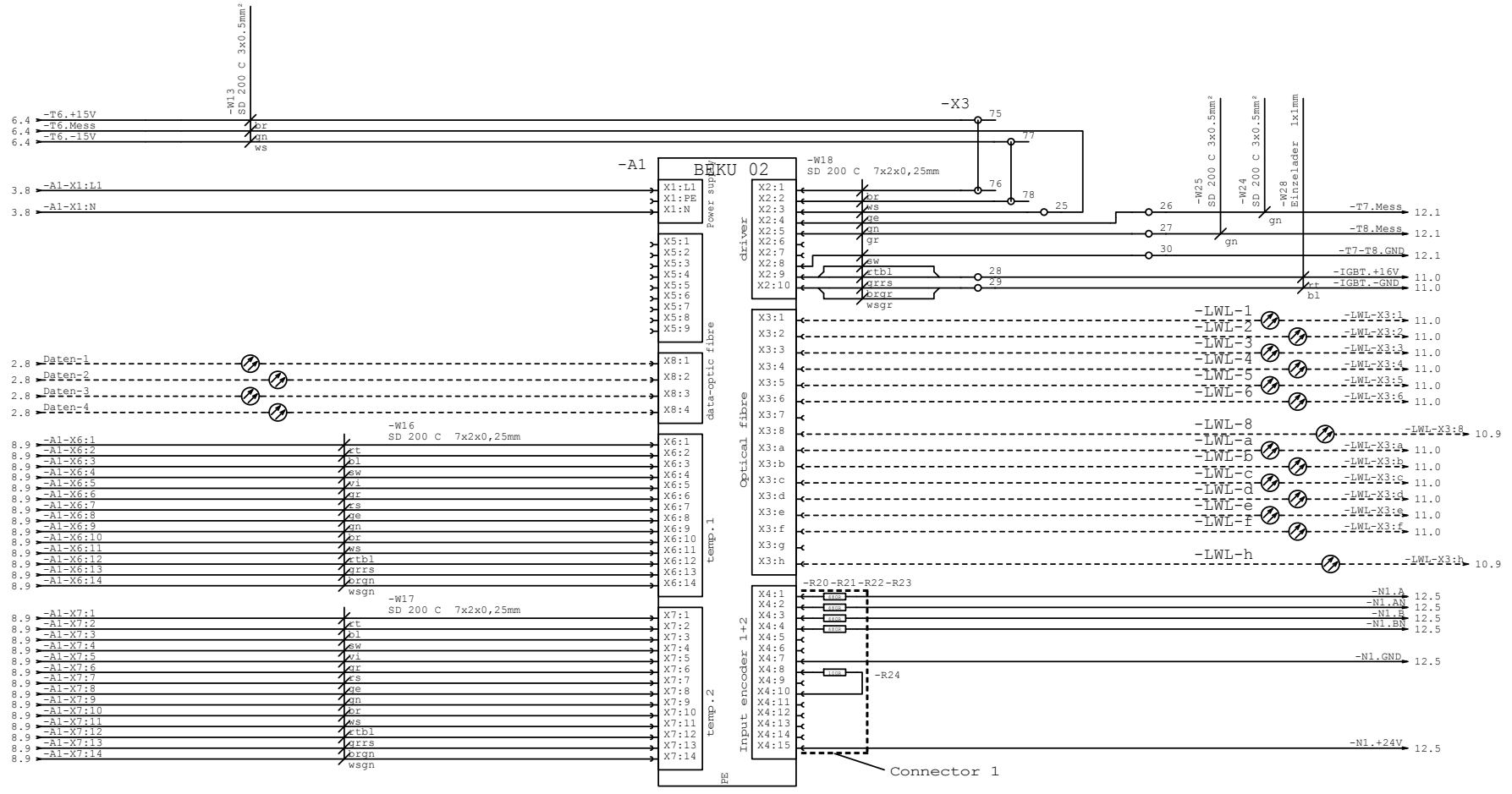


date		16.04.2012		ZHANGJIAKOU COAL MINING		Breuer Motoren		customer-no.:		=	
worker		Wieczorek		VFD motor dksWa72UM/4-4;1020kW		competence since 1877		equipment:		+	
check		Hellinger						drawing-no:		sheet 8	
state	change	date	name	norm	root	create for		dksWa72UM/4-4		of 12 sh.	
								072-1016767-09-04 E			

2.0 Thermal-contact.B
 2.0 Thermal-contact.B1
 2.0 Thermal-contact.A
 2.0 Thermal-contact.A1

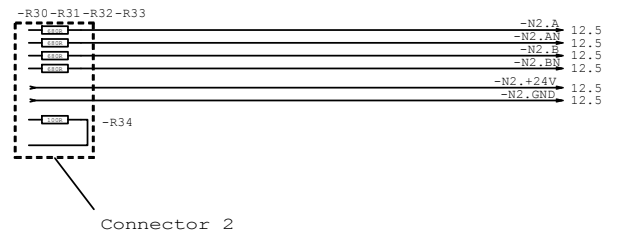


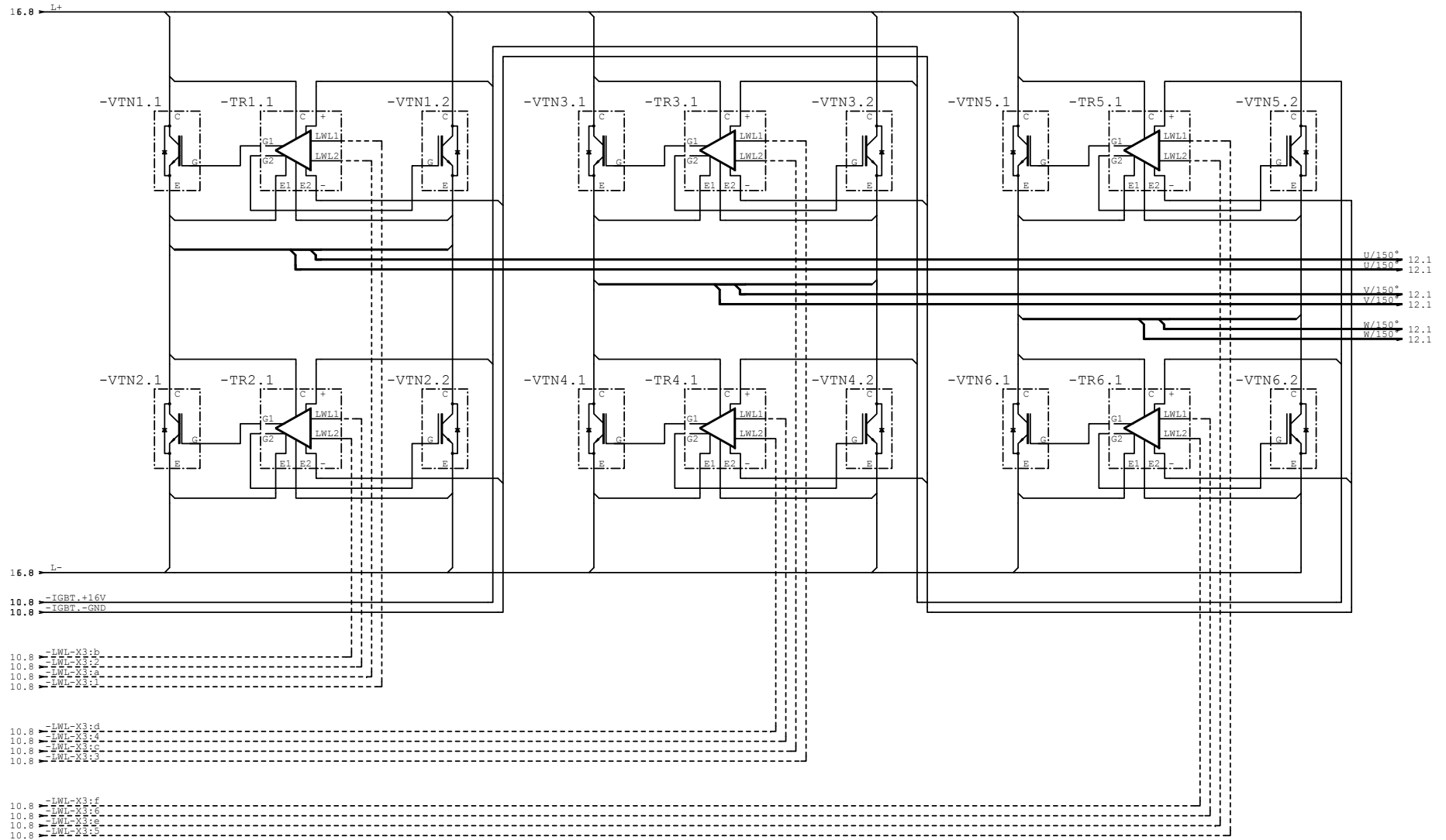
				date	16.04.2012	ZHANGJIAKOU COAL MINING		 Breuer Motoren <small>competence since 1877</small>		monitoring		customer-no.:		=		
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW				Thermal contacts		equipment:		drawing-no:		sheet 9
				check	Hellinger	root				wiring diagram		dksWa72UM/4-4		072-1016767-09-04 E		of 12 sh.
state	change	date	name	norm			create for									



temp.1			
Terminal block	name	temp-sensor	
-X6: 1 - 2	= PT100 winding	-B1	
-X6: 3 - 4	= PT100 choke	-B8	
-X6: 5 - 6	= PT100 Diode (-V3)	-B13	
-X6: 7 - 8	= PT100 IGBT (-VT2.2)	-B22	
-X6: 9 - 10	= PT100 bearing DE	-B4	
-X6: 11 - 12	= PT100 bearing NDE	-B19	
-X6: 13 - 14	= PTC 60°C IGBT (-VT1.1)	-B21	

temp.2			
Terminal block	name	temp-sensor	
-X7: 1 - 2	= PT100 winding	-B7	
-X7: 3 - 4	= PT100 choke	-B10	
-X7: 5 - 6	= PT100 IGBT (-VT1.2)	-B24	
-X7: 7 - 8	= PT100 IGBT (-VT5.1)	-B23	
-X7: 9 - 10	= PT100 bearing DE	-B11	
-X7: 11 - 12	= PT100 bearing NDE	-B20	
-X7: 13 - 14	= PTC 60°C IGBT (-VT6.2)	-B26	



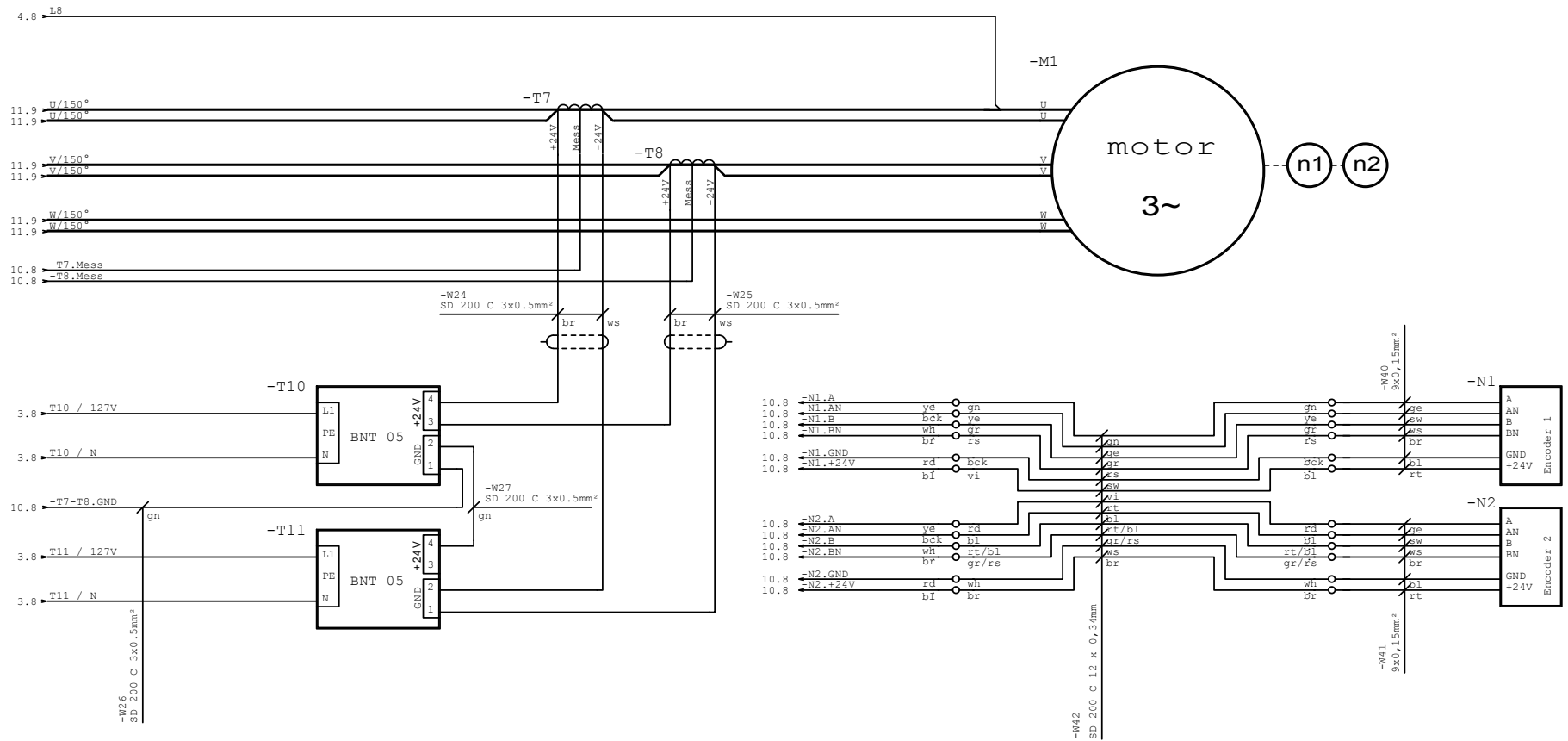


date	16.04.2012	ZHANGJIAKOU COAL MINING	
worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW	
check	Hellinger		
state	change	date	name
norm		root	create for

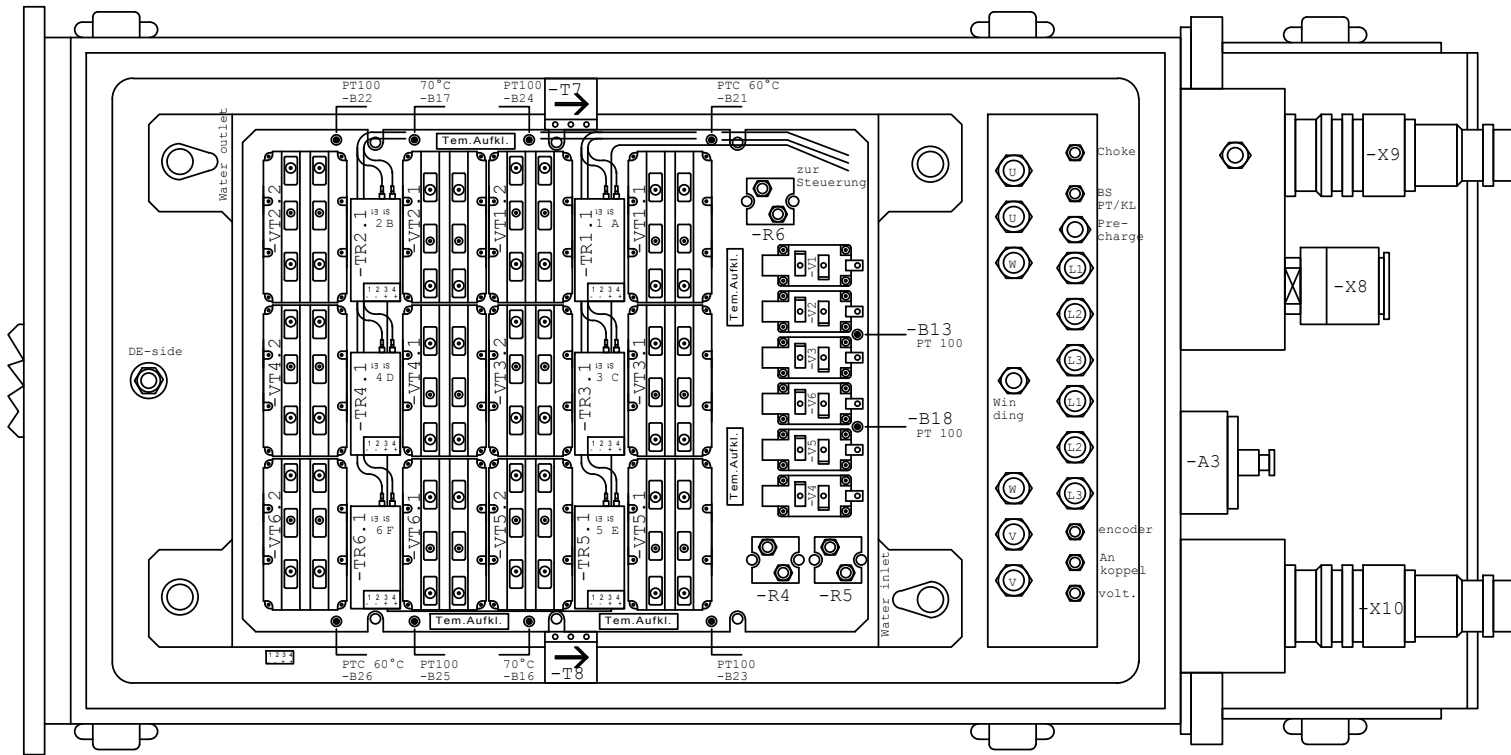


Control
IGBT
wiring diagram

customer-no.:	=
equipment:	+
drawing-no:	sheet 11
dksWa72UM/4-4 072-1016767-09-04 E	of 12 sh.

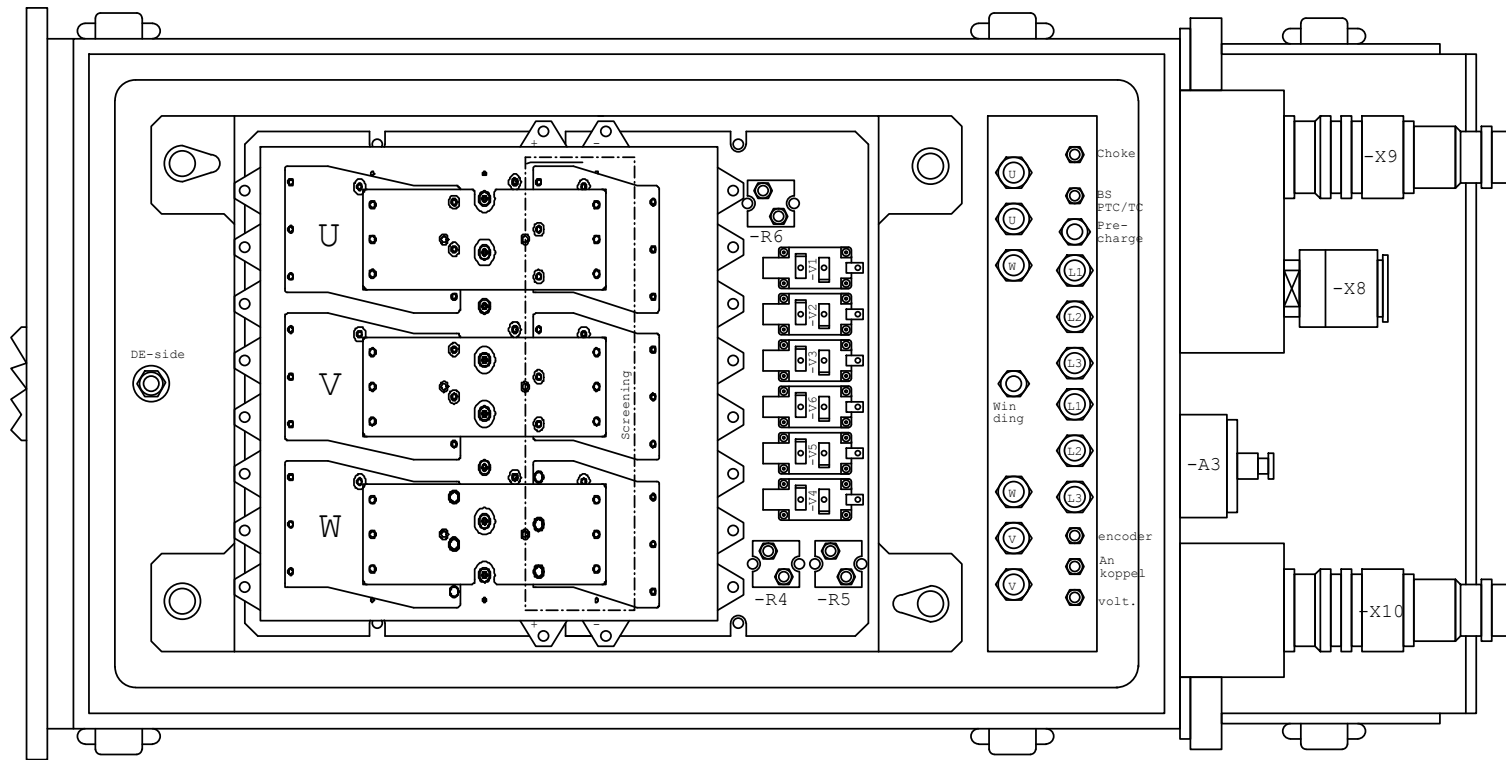


				date	16.04.2012	ZHANGJIAKOU COAL MINING		 Breuer Motoren <small>competence since 1877</small>	Current measur. encoder		customer-no.:	=
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW					equipment:	+
				check	Hellinger						drawing-no:	sheet 12
state	change	date	name	norm	root	create for			wiring diagram	dksWa72UM/4-4 072-1016767-09-04 E		of 12 sh.

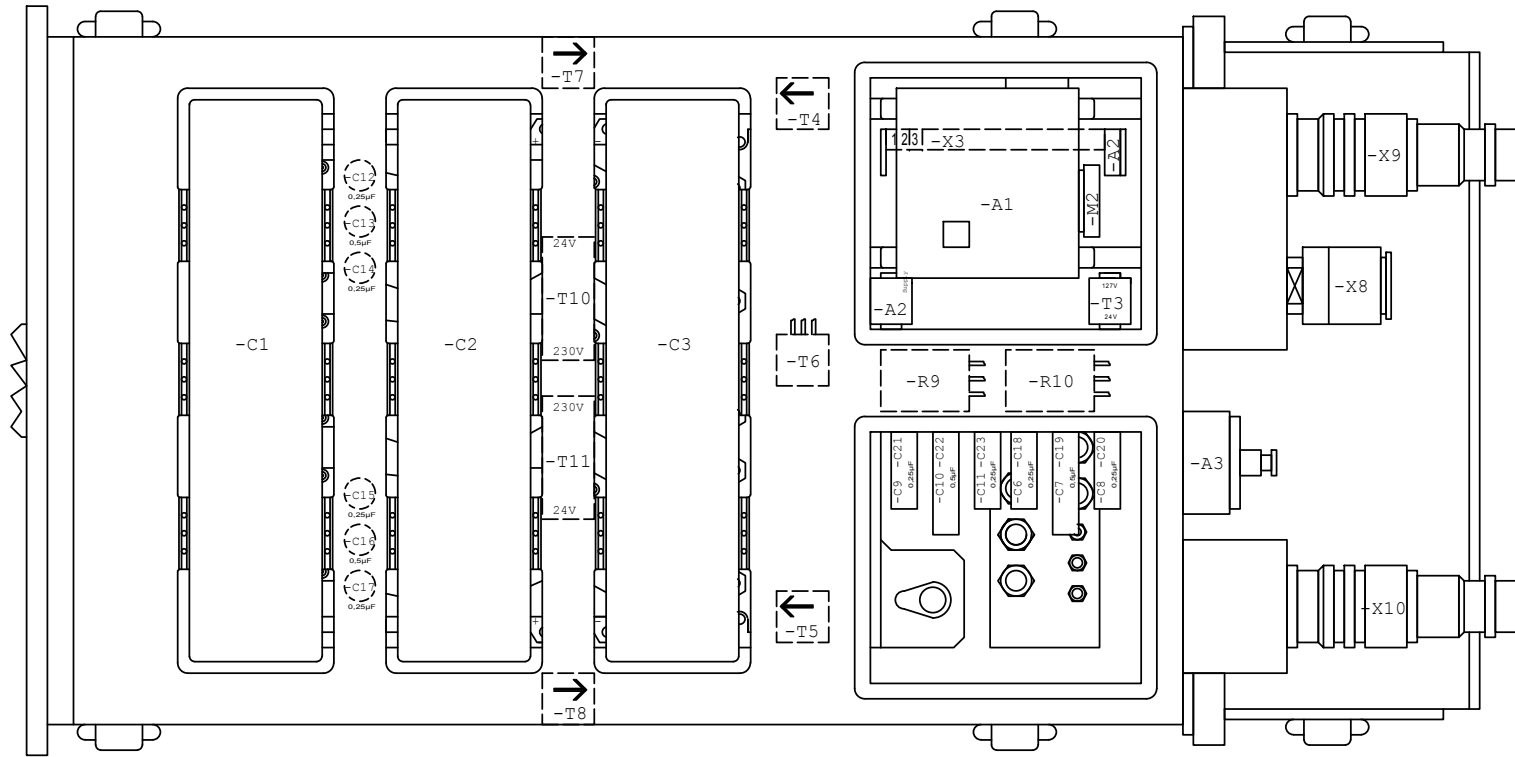


date	16.04.2012	ZHANGJIAKOU COAL MINING		Breuer Motoren <small>competence since 1877</small>	customer-no.:	=	
worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			equipment:	+	
check	Hellinger			drawing-no:	072-1016767-09-04 E	sheet 1	
state	change	date	name	norm	root	create for	of 7 sh.

schematic diagram



				date	16.04.2012	ZHANGJIAKOU COAL MINING	 <small>competence since 1877</small>	customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			+	
				check	Hellinger			equipment:	drawing-no:	sheet 2
state	change	date	name	norm	root	create for	schematic diagram	dksWa72UM/4-4	072-1016767-09-04 E	of 7 sh.



date	16.04.2012	ZHANGJIAKOU COAL MINING
worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW
check	Hellinger	
state	change	root create for



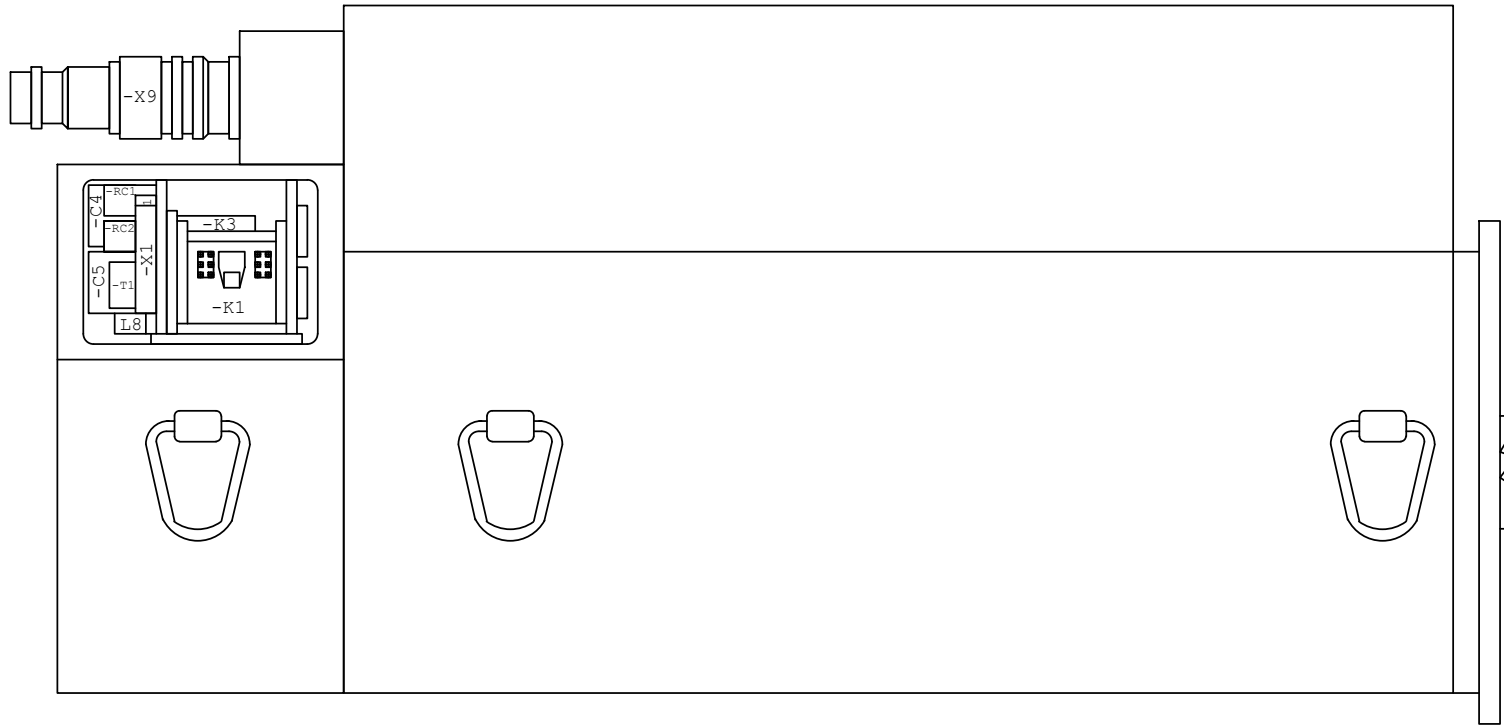
customer-no.:	=
equipment:	+
dksWa72UM/4-4	sheet 3
drawing-no: 072-1016767-09-04 E	of 7 sh.

schematic diagram



				date	16.04.2012	ZHANGJIAKOU COAL MINING		customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			+	
				check	Hellinger			equipment:	drawing-no:	sheet 4
state	change	date	name	norm	root	create for		dksWa72UM/4-4	072-1016767-09-04 E	of 7 sh.

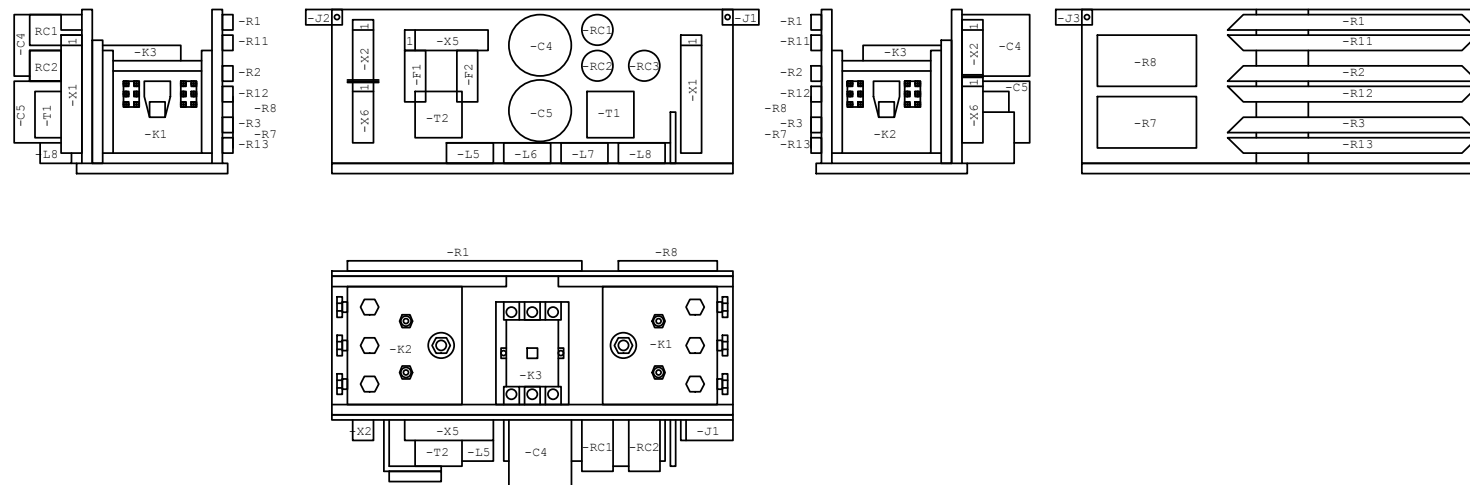
schematic diagram



				date	16.04.2012	ZHANGJIAKOU COAL MINING			customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW				+	
				check	Hellinger				equipment:	drawing-no:	sheet 5
state	change	date	name	norm	root	create for			dksWa72UM/4-4	072-1016767-09-04 E	of 7 sh.



schematic diagram



				date	16.04.2012	ZHANGJIAKOU COAL MINING	 Breuer Motoren <small>competence since 1877</small>	customer-no.:	=		
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			+		
				check	Hellinger			equipment:	drawing-no:	sheet	7
state	change	date	name	norm	root	create for		dksWa72UM/4-4	072-1016767-09-04 E	of	7 sh.

schematic diagram

bill of material

sheet: 2

ser.no	number	name	PPS / art.-no	name	producer
39	6	Diode module	1011477	-V1, -V2, -V3, -V4, -V5, -V6	Breuer-Motoren
40	12	IGBT module	0217915	-VTN1.1, -VTN1.2, -VTN2.1	Breuer-Motoren
				-VTN2.2, -VTN3.1, -VTN3.2	
				-VTN4.1, -VTN4.2, -VTN5.1	
				-VTN5.2, -VTN6.1, -VTN6.2	
41	28	Terminal	0219309	-X2, -X5	
42	97	Terminal	0222293	-X3, -X5	
43	31	High voltage terminal	0219308	-X1, -X6	
44	1	Connector Victor; 100A; 650V; X8	1012647	-X8	
45	2	Connector Victor; 500A; 3300V	1012645	-X9, -X10	

date	16.04.2012	ZHANGJIAKOU COAL MINING		customer-no.:	=					
worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW			+					
check	Hellinger			equipment:	sheet 2					
state	change	date	name	norm	root	create for	bill of material	drawing-no:	072-1016767-09-04 E	of 2 sh.



**The Variable Frequency Drive
with a
20 mA data interface**

11.08.2010

**This documentation is based on software
version dSMC**

Table of contents

The VSD technology	3
How to connect the Breuer VSD	4
The data protocol	11
Basic rules.....	14
Timing of the data-communication with VSD motors.....	15
VSD-Control-Timeouts at data transmission.....	15
Master-Slave-Rules	16
Typical timing values of the VSD-control.....	17
First steps	18
The use of torque control with more than one drive	19
The meaning of the telegrams	22
Telegrams PLC-unit → VSD-control-unit.....	22
PARAMETER-TELEGRAM	22
PARAMETER-TELEGRAM_2	27
SET VALUE-TELEGRAM.....	32
MEMORY DUMP.....	36
SET-COMMAND	37
ELECTRONIC-RESET	38
LIFE INDICATOR	38
Telegrams VSD-control-unit → PLC-unit.....	39
ACTUAL VALUES	39
digital value 1 (error indication high and low byte).....	40
ACTUAL VALUES-2	45
ACTUAL VALUES-3 (temperatures 1)	48
ACTUAL VALUES-4 (temperatures 2)	49
Temperatures	50
Recommended maximum values for the temperatures	51
ELECTRONIC-IDENTITY.....	52
MEMORY DUMP.....	54
ERROR MEMORY	55
The display of the control unit	56
The meaning of the information on the display.....	57
Variations	60

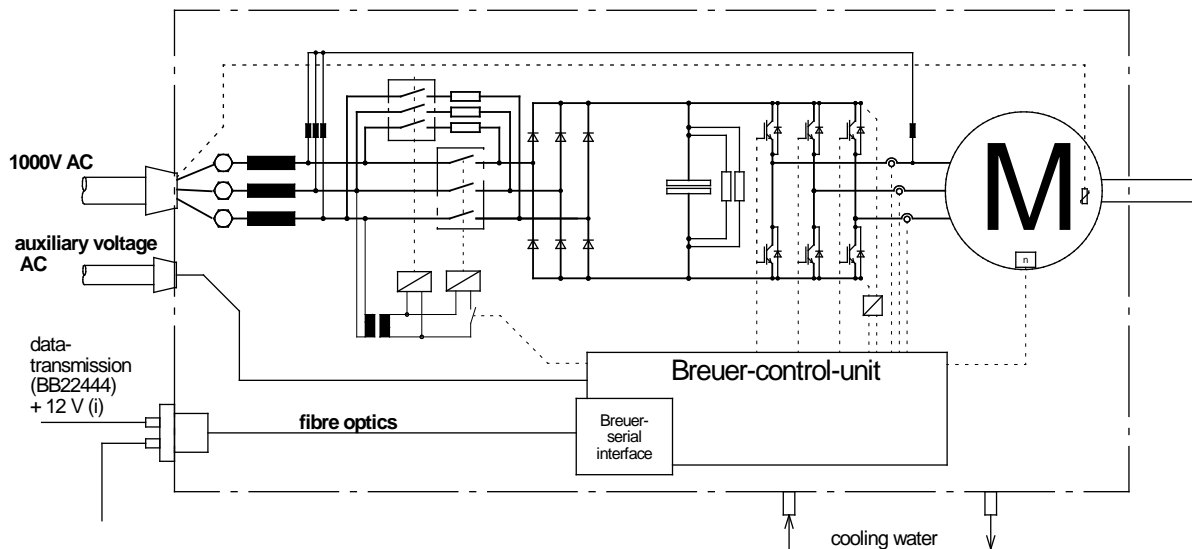
The VSD technology

The Breuer VSD motor is a combination of a normal three – phase asynchronous motor and a frequency converter. For this reason it is very easy to generate a variable drive speed, different acceleration times, a different direction of rotation and a torque control between several drives.

To control the drive you need a serial interface which is called Bergbau-Betriebsblatt-BB22444.

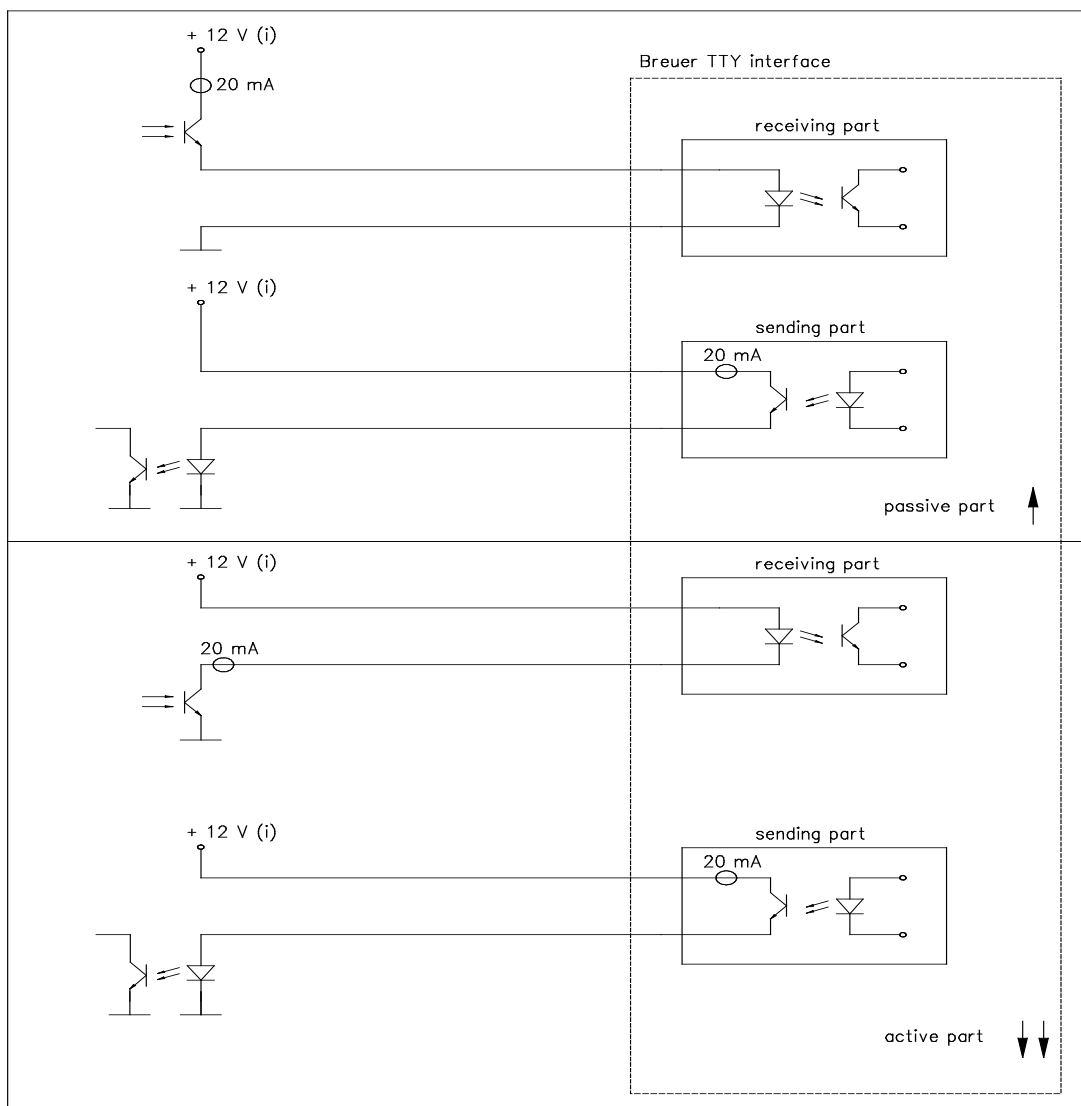
The Breuer-VSD technology offers a lot of advantages :

- longer lifetimes
- low current for acceleration
- variable drive speed
- torque control between several drives
- easy structure of the drive
- the drive is easy to handle and to install
- it is possible to display the internal processes



How to connect the Breuer VSD

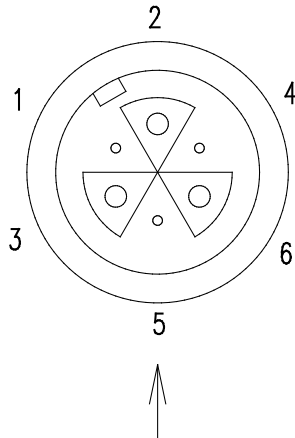
The Breuer 20 mA TTY interface needs an external power supply, so that you have to connect it with +12 V (i) and ground. Otherwise it will not work. This circuit is part of the german norm BB22444 T4.



basic circuit diagram

The 20mA-serial interface of the drive has to be powered – as mentioned before – by an external 12-V-DC (i) power supply.

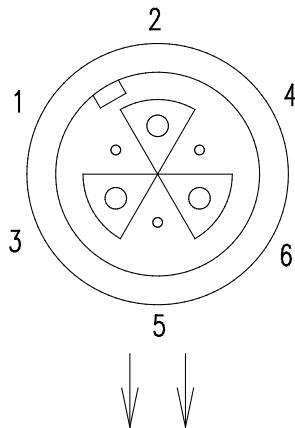
When you look at the interface you can see two sockets:



- 1 : + 12 V DC
- 2 : 0 V
- 3 : Tx + (VSD control unit)
- 4 : Tx -
- 5 : Rx + (VSD control unit)
- 6 : Rx -

The first socket (**marked with ↑**) is needed to connect the first drive to a main control system or to connect a second, third or fourth drive to a drive before.

With the second socket (**marked with ↓↓**) you are able to connect another drive to the data line:

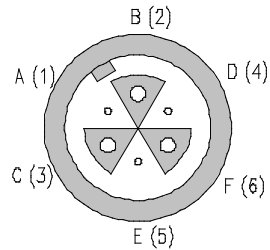


- 1 : + 12 V DC
- 2 : 0 V
- 3 : Rx + (VSD control unit)
- 4 : Rx -
- 5 : Tx + (VSD control unit)
- 6 : Tx -

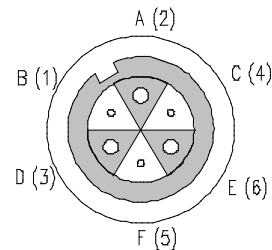
The circuit diagram of the interface is shown in the following picture.

Pin layout of the ME-plug-socket-system

pin layout of the socket
6 pins ME 2A 10 d
(view into the socket)



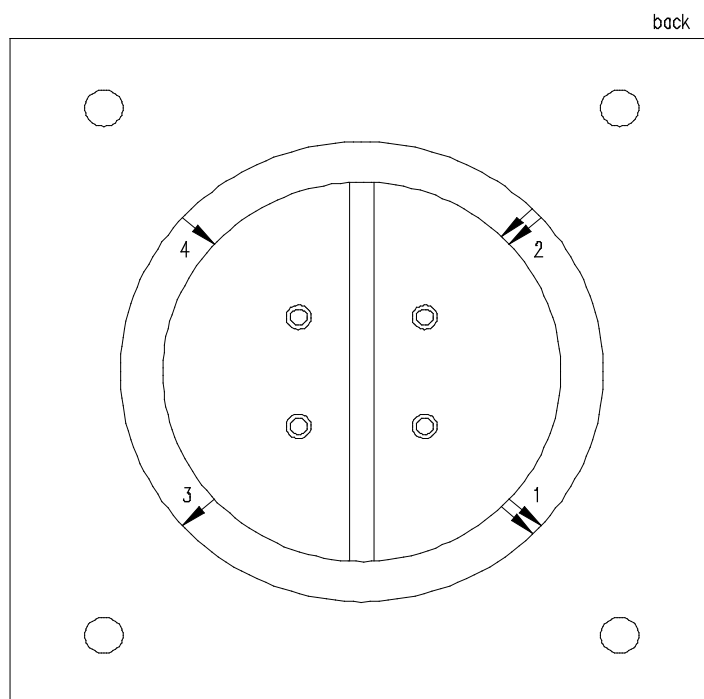
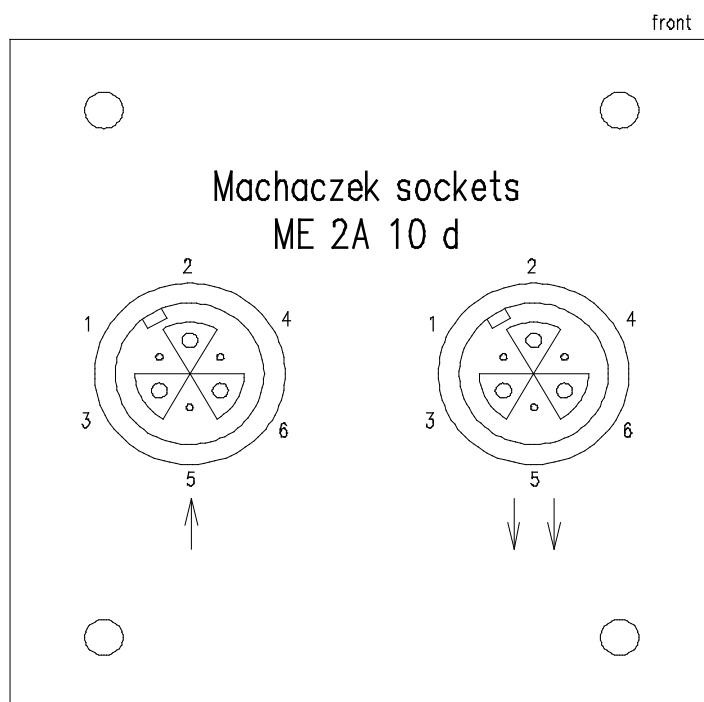
pin layout of the plug (cable)
6 pins ME 2A 00
(view into the plug)



BREUER MOTOREN
Kornstraße 1877

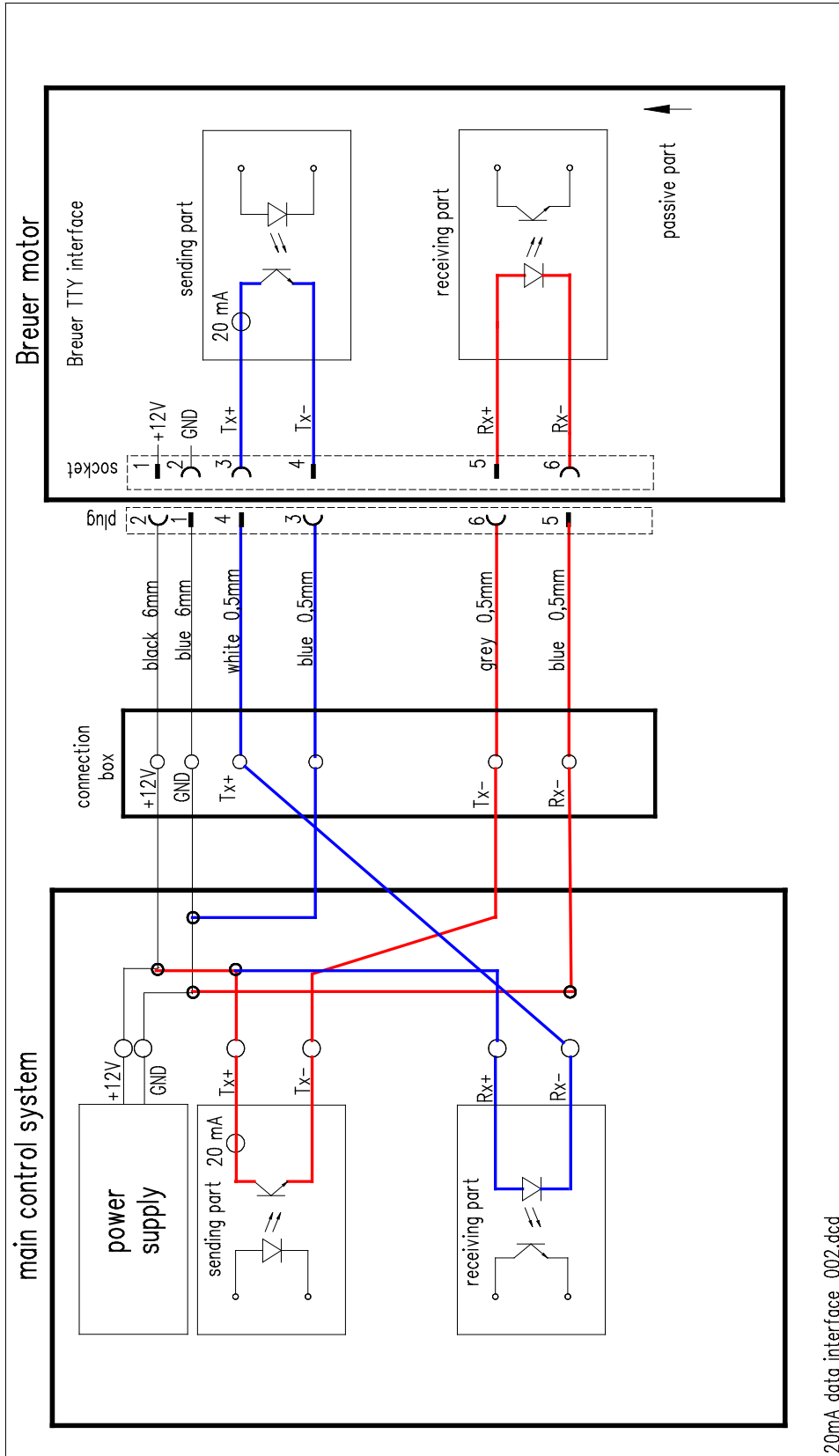
20.1.2004 D: Tischkewitz
Dok.Nr.: FBA-7b-003-eng

One peculiarity of this plug-socket-system is the internal pin marking. In this case the connections of the plug and socket pins are not (1–1), (2–2), but (1 – 2), (2 – 1), (3 – 4), (4 – 3), (5 – 6) and (6 – 5) !

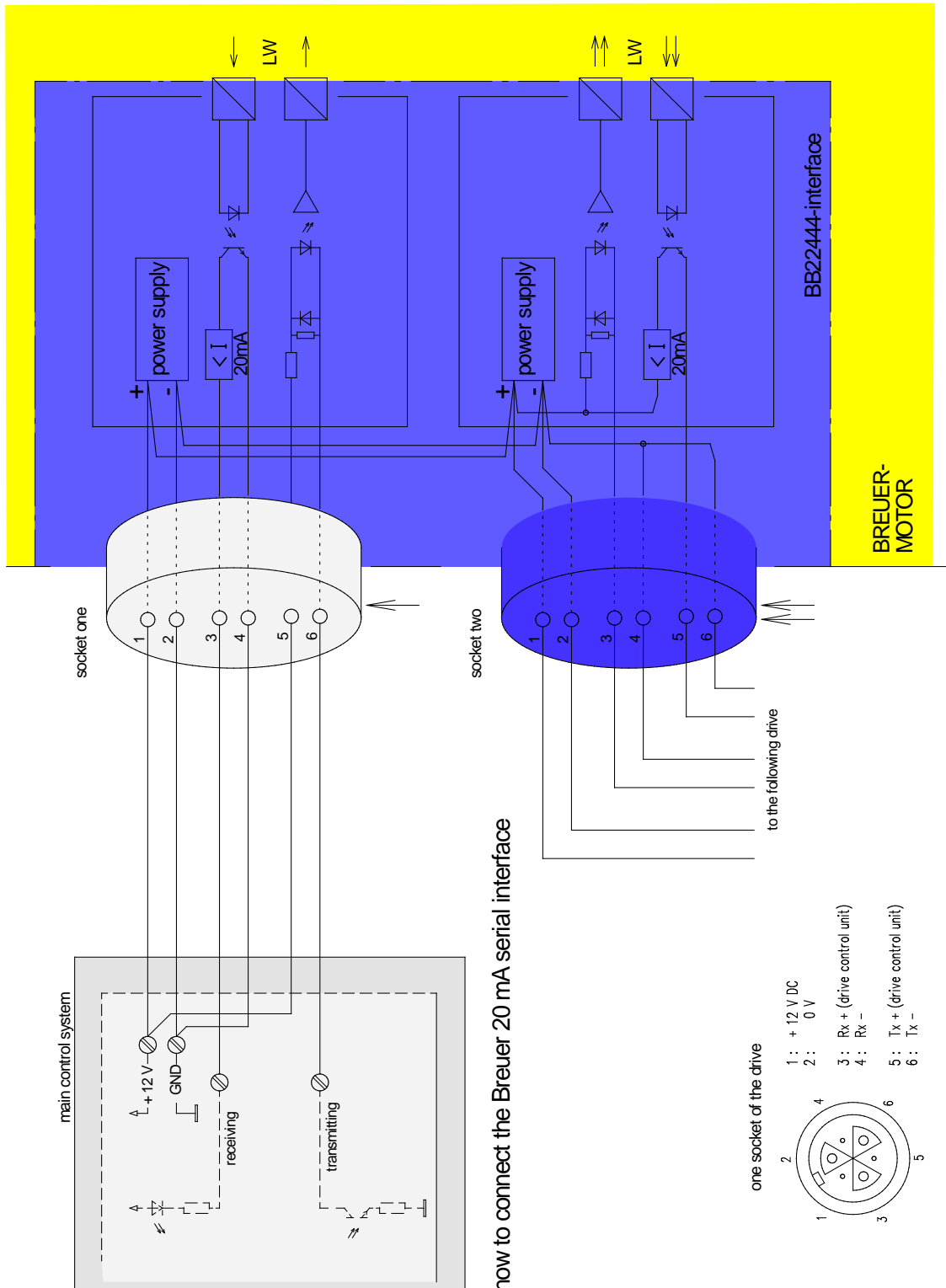


passive electronic

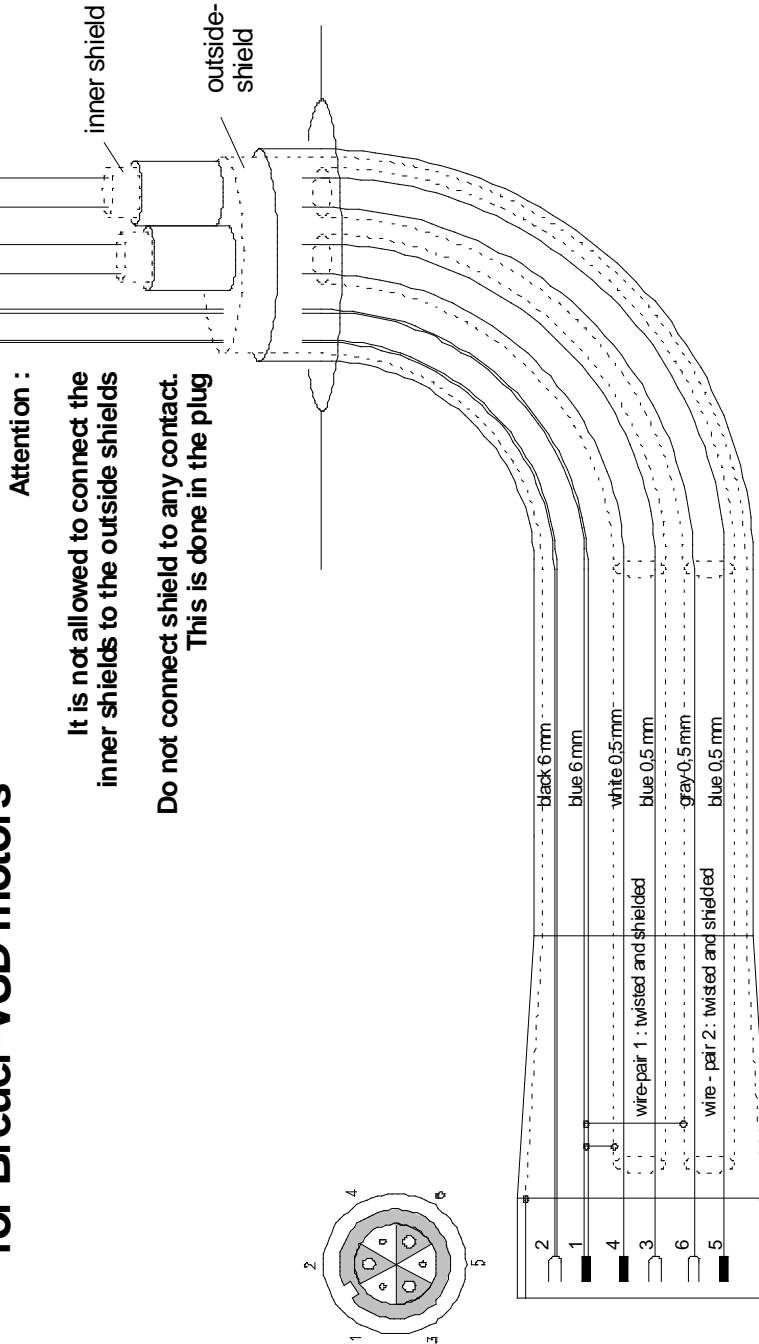
active electronic



20mA data interface_002.dcd



Installation-Direction for Breuer-VSD-motors



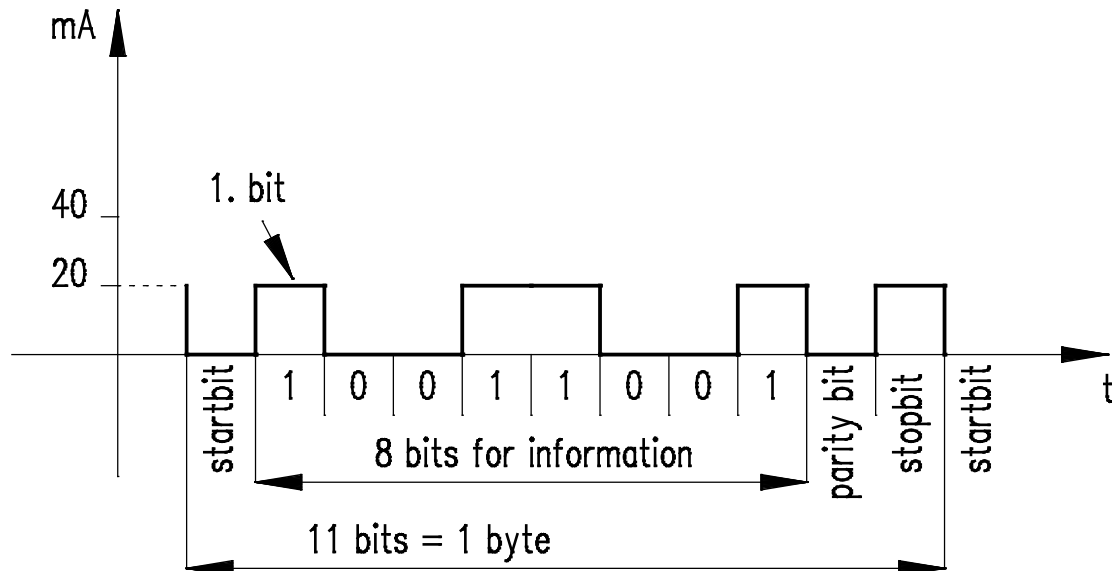
Data is special for Breuer-drives

BREUER-MOTOREN
 AC MOTORS AND CONTROLS

The data protocol

The data protocol of the Breuer VSD motor is a standard DSK (Deutsche Steinkohle) serial protocol which is called „**Bergbau Betriebsblatt Teil 4**“ **BB22444 T4**.

The transfer rate is adjustable between 4800 – 19200 baud. You can see the structure of a byte in the following picture. The parity is even !



structure of a byte

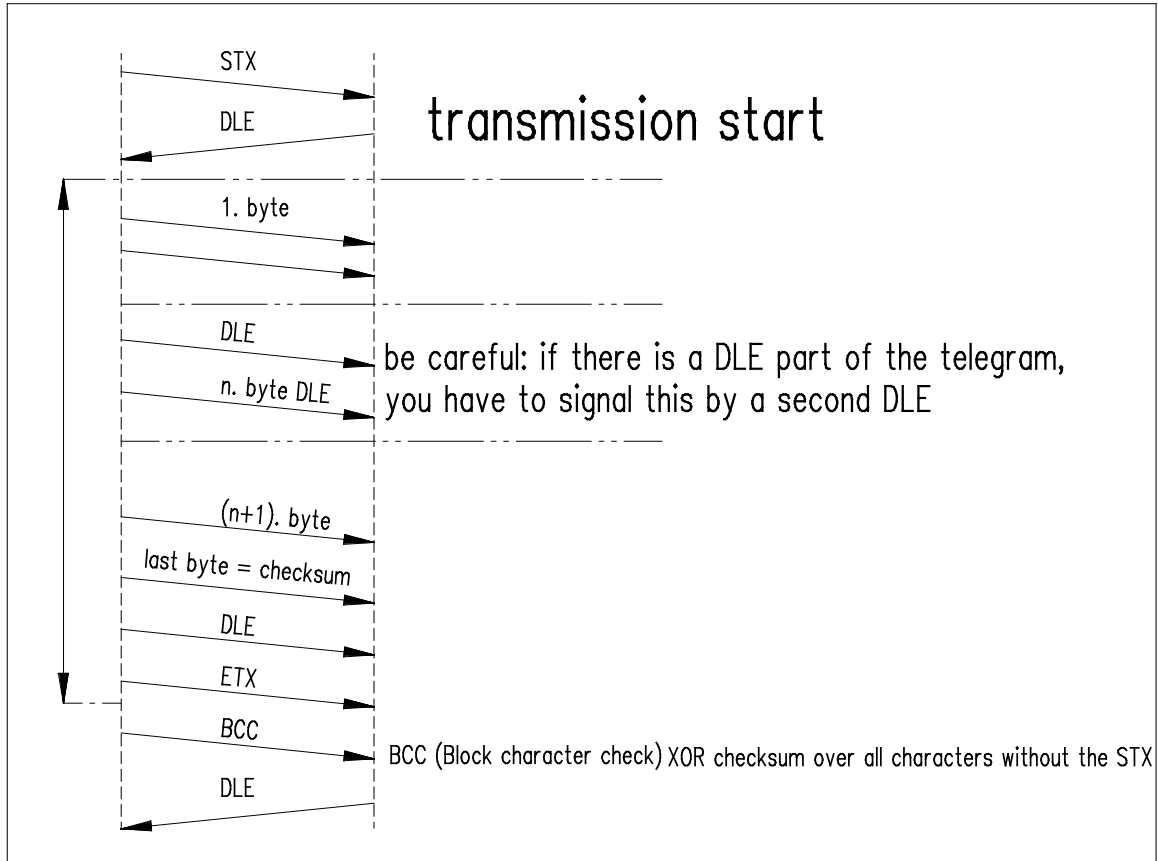
The communication between the electronic of the Breuer VSD motor and the control system has to work with different telegrams which are subdivided into several kinds of telegrams for parameters, set values, dumps and sets. Each telegram consists of a head (so you can say what kind of telegram you want to transmit), a telegram-list and a data field (have a look at the next picture). In the appendix you can find all possible telegrams to control a Breuer motor.

telegram structure:

telegram length (= 46 (0x2e))	telegram number = 0x80
1. telegram counter	2. telegram identity
3. 0x00 (not used)	4. number of the electronic
5. 0x00 (not used)	6. 0x00 (not used)
7. length of the data field = 32 (0x20)	8. 0x00 (not used)
9. status of the communication unit	10. 0x00 (not used)
11. 0x00 (not used)	12. 0x00 (not used)
13. data field 1	14. data field 2
15. data field 3	16. data field 4
17. data field 5	17. data field 6
19. data field 7	20. data field 8
21. data field 9	22. data field 10
23. data field 11	24. data field 12
25. data field 13	26. data field 14
27. data field 15	28. data field 16
29. data field 17	30. data field 18
31. data field 19	32. data field 20
33. data field 21	34. data field 22
35. data field 23	36. data field 24
37. data field 25	38. data field 26
39. data field 27	40. data field 28
41. data field 29	42. data field 30
43. data field 31	44. data field 32
checksum high *)	checksum low *)

*) checksum = word-wise addition of the whole telegram except of the head
 (length and telegram-number)

A transmission starts with a starting byte (STX=start of text = 0x02). When the motor electronic receives this byte, it will send an answer (DLE=data link escape=0x10) to signal the control system its readiness. After receiving the DLE the control system can send the whole telegram to the motor. To signal the drive the end of the telegram, the system has to send a DLE (0x10) and an ETX (end of text = 0x03), too. If the telegram is correct (checksum), the motor will send a DLE (look at the next picture).



It is necessary to send a telegram to the motor every 200 - 500 ms, because the drive will not work if there is a cut in the data line. Each telegram is mirrored by the motor, that means, the electronic will send the same telegram back to the control system. If you don't want to mirror the telegrams (because this procedure needs a lot of time), Breuer can neutralize them !

Basic rules

- the PLC control system is the master, so that a STX will always be accepted
- a BCC (block character check) is part of the data protocol
- the second byte of the head of the telegram gets the value 0x80
- each telegram gets a different telegram-counter (0, 1, 2, 3, 4,....., 255, 0, 1...)
- the transfer rate is set to 9600 bits/sec.
- do not change the number of the electronic after sending the first telegram
- if the Breuer-control-unit is not able to receive telegrams for longer than 2 seconds the drive will be stopped automatically. After that it is necessary to send a new parameter telegram.

Before you can start the drive you have to send a parameter telegram (if the drive is ready for values, you can see a 128 in the KE-status → appendix !) If there is a 129 the drive has got no correct parameter – telegram and is not ready to work.

Timing of the data-communication with VSD motors

Telegrams will be sent automatically from the VSD-control-unit after receiving the first regular telegram from the data-line.

actual-values-telegram (telegram-id = 31)	every 240 ms
actual-values-2-telegram (telegram-id = 32)	every 2 sec.
temperature-1-telegram (telegram-id = 33)	every 5 sec.
temperature-2-telegram (telegram-id = 34)	every 5 sec.
electronic-identity (telegram-id = 30)	every 5 sec.

All the other telegrams will be sent by a request.

VSD-Control-Timeouts at data transmission

Rx-Data-Timeout [1 - 4 s (2s default); depends on parameter-telegram]

Max. waittime for receiving valid telegrams, before going "offline" and "not initialised".

-> This timeout will switch off the motor

Tx-Data-Timeout [3 - 6 s (4s default); depends on parameter-telegram]

Max. waittime if it is not possible to transmit valid and acknowledged telegrams, before going "offline" and "not initialised".

-> This timeout will switch off the motor

DLE-Timeout [400 ms]

Max. waittime for a DLE (0x10) after sending a STX or after sending a message, before quit the procedure and try again.

Rx-Msg-Timeout [240 ms if kaskaded ; 320 ms if only one motor]

Max. waittime for a message after sending a DLE (DLE after receiving a STX)

Master-Slave-Rules

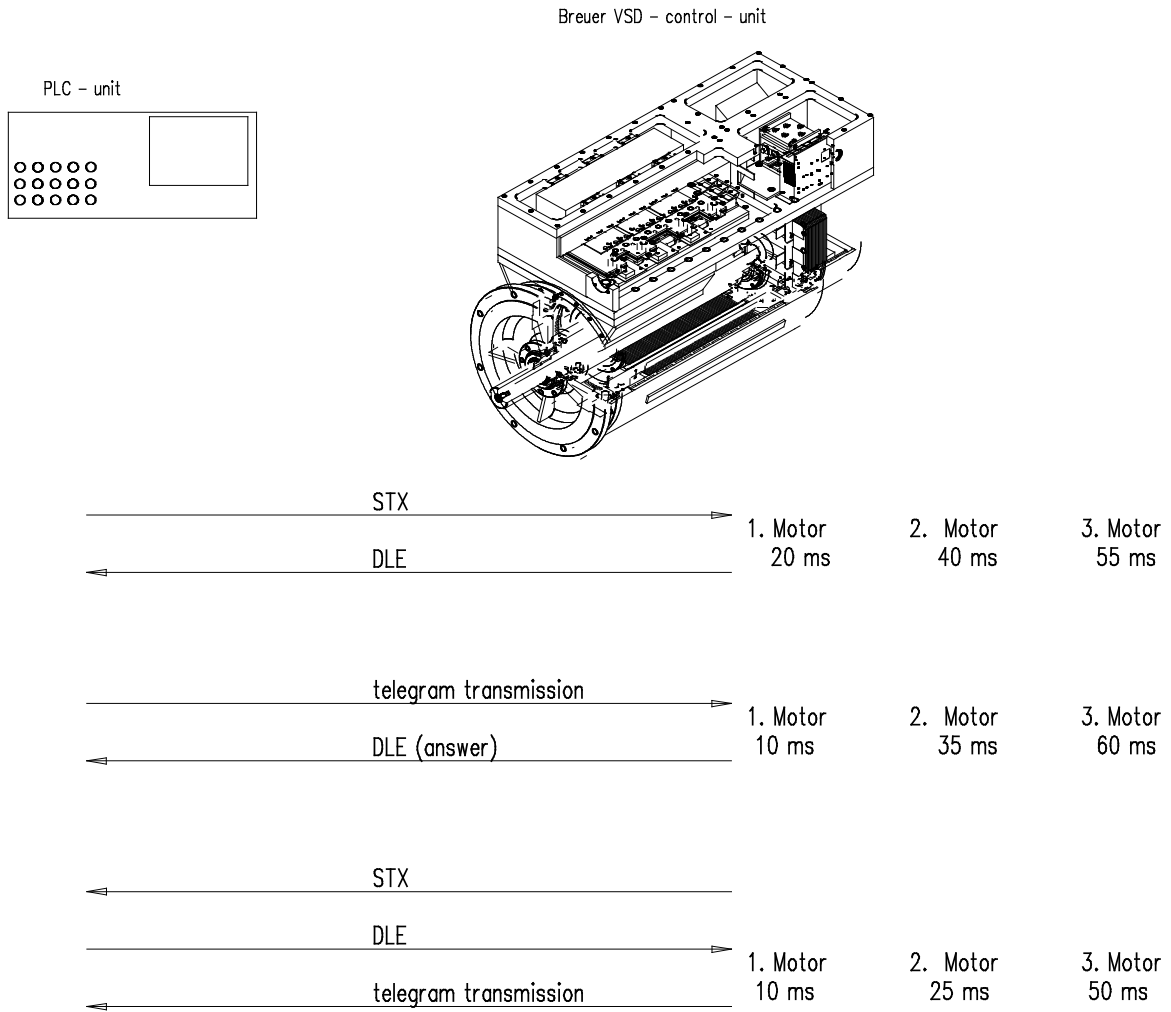
The PLC must be the master-station in the communication.

That means :

If the PLC and the VSD-control-unit are sending a STX (0x02) at nearly the same time, the PLC will have to ignore the received STX and will have to wait for a DLE (0x10).

The VSD-control-unit is the Slave in data-communication and will always answer a received STX by transmitting a DLE (ignore own transmitted STX).

Typical timing values of the VSD-control



After sending a telegram by the PLC and receiving a DLE (0x10) or a NACK (0x15) from the VSD-control-unit, the PLC has to wait min. 80 ms (better 100 ms) before sending the next STX.

Otherwise it can happen that the VSD-control-unit will not get into the sending-mode. In that case the time to send a STX is too short.

First steps

Before it is possible to turn on the Breuer VSD motor you have to be sure that the VSD electronic is initialised. Please have a look at the telegrams VSD motor → PLC-unit. In the telegrams you can find a status byte, which is called KE-status (communication unit). If bit 2⁰ of this byte is 1 the electronic needs an initialisation by a parameter-telegram. If bit 2⁰ of the KE-status byte is 0 the electronic is o.k. and set value telegrams will be accepted.

Notice: if the communication between the control system and the VSD motor is cut for longer than 2 seconds, the motor will stop automatically and the electronic will need a new initialisation.

Here is a list of default values for the parameter-telegram:

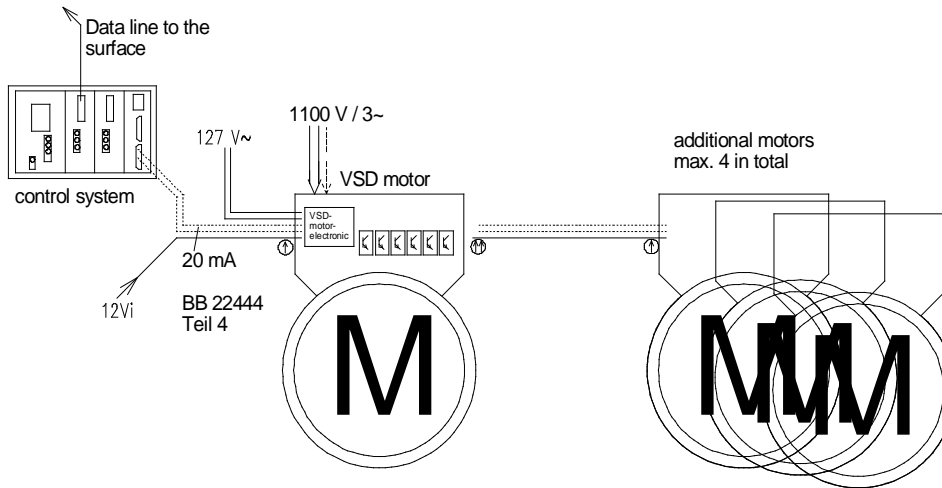
speed difference (tolerance):	0	
current limiter:	225 (= 225 %)	*)
maximum speed:	60 (= 1800 rpm)	
I-control range:	10	*)
P-control range:	10	*)
acceleration time:	20	
braking time:	20	

*) if these values are 0, the converter will turn on, but no torque will be generated

Whenever the motor-electronic locates an error the motor stops by itself and signals the error in the status byte **digital value 1** !

As long as there is an error, it is not possible to turn on the motor again. First you have to clear the error by the help of the digital value in the set value telegram. Please pay attention to the fact that it is not possible to clear an error when the mode of operation is not 0. Otherwise the motor would turn automatically after clearing an error.

The use of torque control with more than one drive



actual values		set value-telegram	
length = 46 (0x2e)	0x80	length = 46 (0x2e)	0x80
tel.-counter	identity = 31	tel.-counter	identity = 41
00	electronic-number	00	electronic-number
ana = 00	bin = 00	ana = 00	bin = 00
dig = 32 (0x20)	00	dig = 32 (0x20)	00
anz.1 = KE-status	00	anz.1 = KE-status	00
anz.2 = 00	00	anz.2 = 00	00
digital value 1		mode of operation	reserve
drive current	set value for current	set value of speed	set value of speed
total current	capacitor voltage	digital value	
actual value of speed	actual value of speed	has to be 0	reserve
drive 2	drive 2	mode of operation	reserve
drive 2	drive 2	set value of speed	set value of speed
drive 2	drive 2	digital value	
drive 2	drive 2	current of master	reserve
drive 3	drive 3	mode of operation	reserve
drive 3	drive 3	set value of speed	set value of speed
drive 3	drive 3	digital value	
drive 3	drive 3	current of master	reserve
drive 4	drive 4	mode of operation	reserve
drive 4	drive 4	set value of speed	set value of speed
drive 4	drive 4	digital value	
drive 4	drive 4	current of master	reserve
checksum	checksum	checksum	checksum

this is job of the control system

If you have more than one drive and you want torque control between all drives, the control system has to send the current of the master drive to all slave drives. In the example (picture) drive 1 is the master.

The master has to be initialised by the following parameters:

(default !)

Parameters for the master drive

speed difference (tolerance):	0
current limiter:	150 (= 150 %)
maximum speed:	60 (= 1800 rpm)
I-control range:	10
P-control range:	10
acceleration time:	20
braking time:	20
load factor:	0
load limit 1:	0
load limit 2:	0
start delay:	0

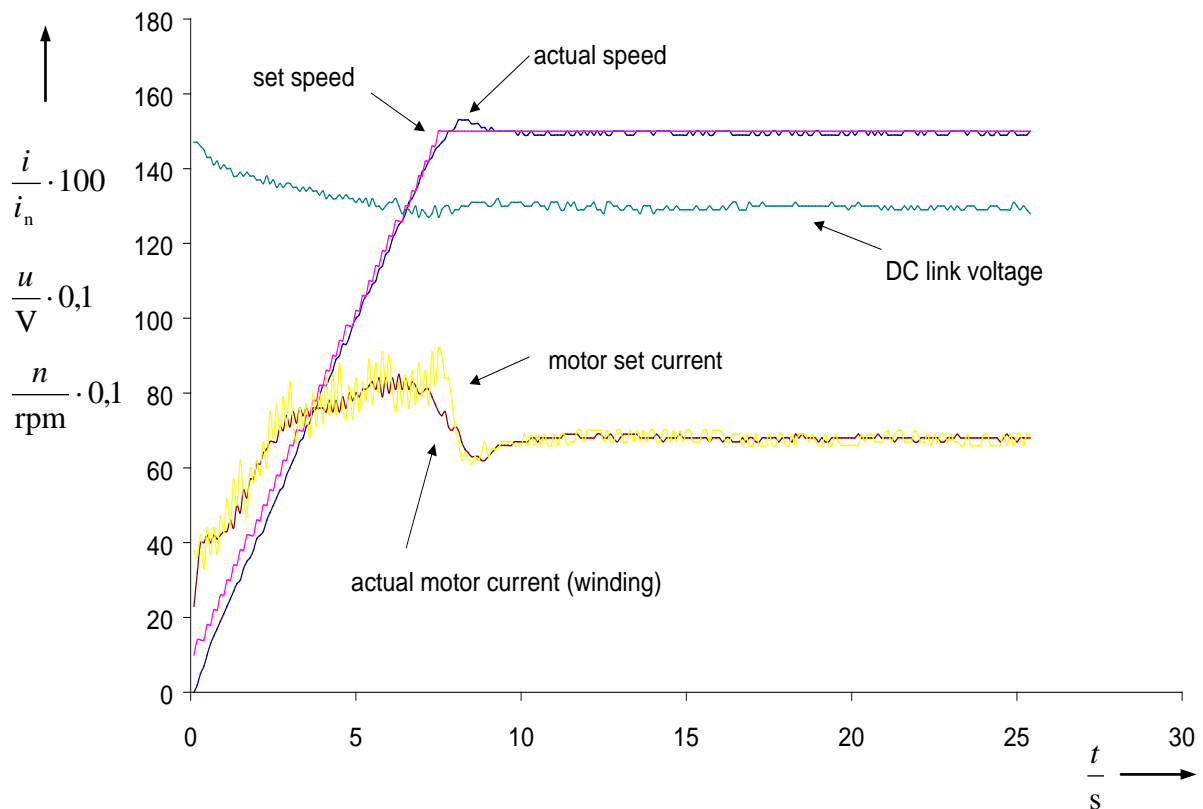
all the other (slave) drives should get the same parameters except of the I-control range. These values have to be 0.

Parameters for the slave drives

speed difference (tolerance):	0
current limiter:	150 (= 150 %)
maximum speed:	60 (= 1800 rpm)
I-control range:	0
P-control range:	10
acceleration time:	20
braking time:	20
load factor:	0
load limit 1:	0
load limit 2:	0
start delay:	0

In the following example you can see how you can optimize the speed control parameters (I and P) of a VSD motor.

It is important that there is no overshoot in the actual speed during the acceleration time. Under normal condition you do not have to vary the default values for the P and I control algorithm.



start of a Breuer - VSD motor

The meaning of the telegrams

Telegrams PLC-unit → VSD-control-unit

PARAMETER-TELEGRAM

(for initialisation, *1)

length = 46 (0x2e)	0x80	
tel.-counter	identity = 40	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
speed difference	power limiter in %	
current limiter in %	maximum speed	drive1
I – control range	P – control range	
acceleration time	braking time	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

speed difference in rpm:

resolution (0 – 255); one byte

Sometimes it can be useful to allow a tolerance between the set value of speed and the actual speed value of the drive.

Speed difference (= set speed +/- speed tolerance) in rpm.

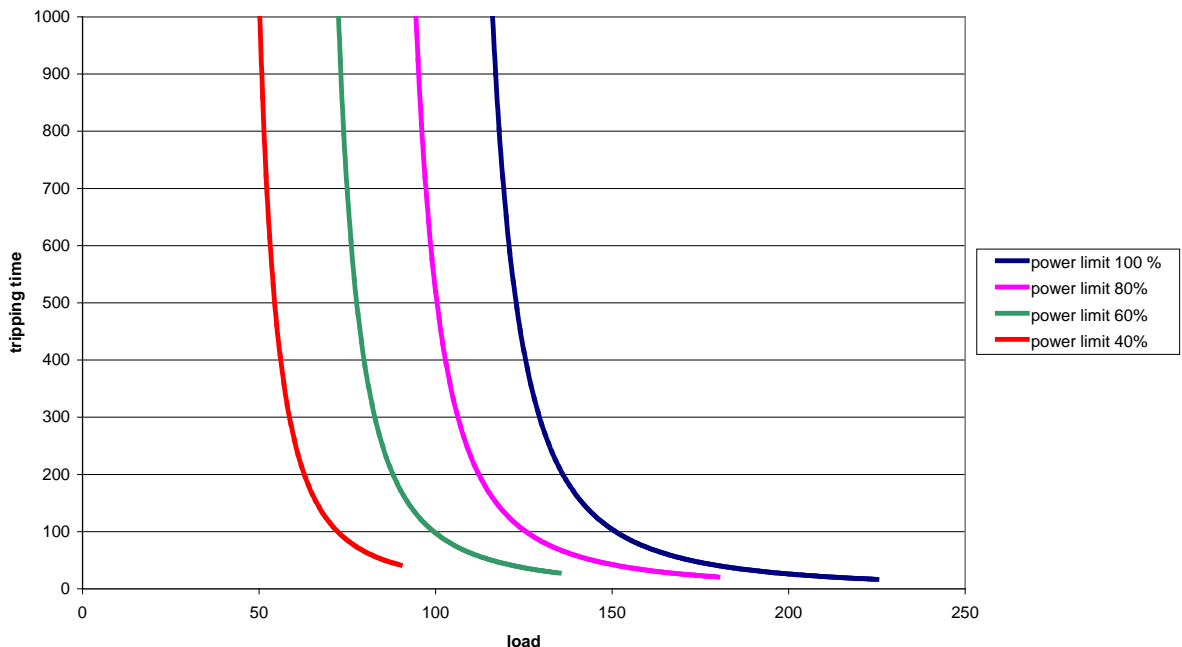
power limiter in %

resolution (10 – 100); one byte

You can use this value to limit the power of the drive. By using this parameter you change the nominal operating point of the I^2t -function (page 35). After 17 seconds with $i_{sq} = (2,25 \cdot \text{power limit})$ the drive will stop automatically and will indicate an I^2t -error. With the help of this parameter you are **not** limiting the torque of the drive !

E.g.: If you want a 400 kW drive to operate like a 200 kW drive with 1.5 overload this value should be set to 50 (that means 50% of a normal 400 kW I^2t -function) and the current limit should be set to 75 (that means 75 % torque in max. of a normal 400 kW).

variable power definition of a 400 kW VSD



current limiter in %:

resolution (0 – 255); one byte

This value can be used to limit the maximum current of the drive
(0- 255 %).

Torque calculation:

(without temperature, without voltage drops)

e.g. 500 kW

$i \leq 100 \%$:

$$y = \frac{3180 [Nm]}{100 [\%]} \cdot x [\%]$$

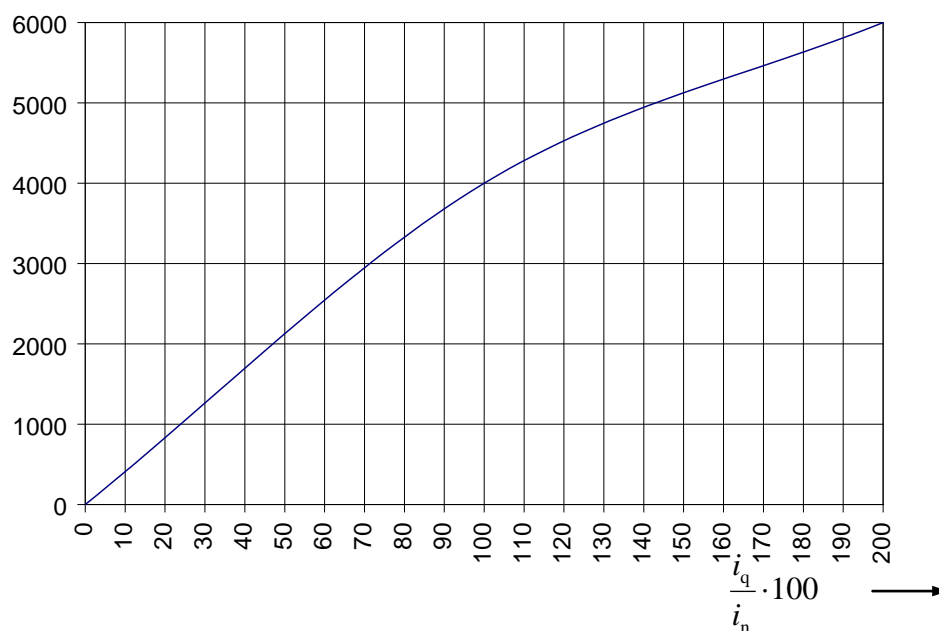
e.g. 1000 kW

$i \leq 100 \%$:

$$y = \frac{4000 [Nm]}{100 [\%]} \cdot x [\%]$$

$i > 100 \%$:

$$y = \frac{(6000 - 4000) [Nm]}{(200 - 100) [\%]} \cdot (x - 100) [\%] + 4000 [Nm]$$



maximum speed:

resolution (0 – 255); one byte

You can use this value to limit the maximum speed of the drive. The result of this byte multiplied with 30 is the maximum speed. (The VSD motor is adjustable between 0 and 1800 rpm) It is not useful to choose a value for this parameter which is the same like the set speed of the drive. To get good results for the speed control of a VSD motor it is necessary to allow a difference between the set speed and the max. speed. Is the actual speed of the drive higher than max. speed the drive will generate the error indication „*speed is too high*“.

$$\text{max. speed} = \text{value} \cdot \frac{7650}{255} = \text{value} \cdot 30$$

I-control range:

resolution (0 – 255); one byte

please use default values !

P-control range:

resolution (0 – 255); one byte

please use default values !

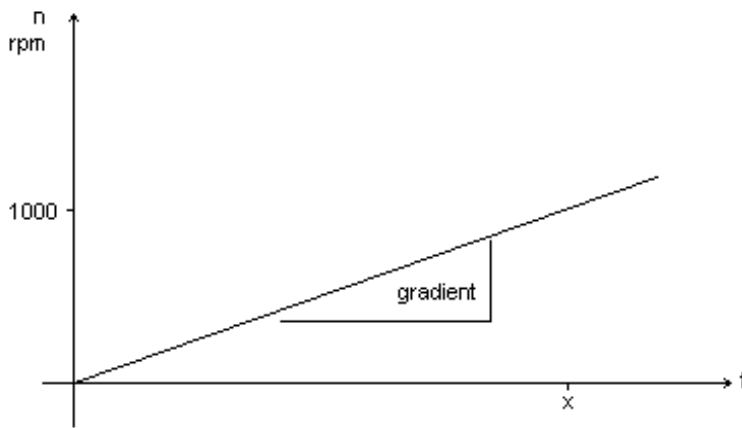
The internal speed control needs two parameter to avoid any swinging effects so that it works like a stabilizer.

If you are working with more than one drive and torque control, the I-control range of the **slave drives** has to be **0**.

acceleration time in sec.:
braking time in sec.:

resolution (0 – 255); one byte

It is possible to increase / decrease the speed of the drive by using ramps. These values represent the gradient (leap of the speed / time for the leap) for acceleration and for braking.



$$gradient = \frac{1000 \text{ rpm}}{x \text{ seconds}}$$

Please use this formula to calculate the correct time:

$$parameter = \frac{1000 \text{ rpm}}{\text{set value of speed}} \cdot \text{acceleration time}$$

example:

set value of speed : 1500 rpm
acceleration time: 10 seconds

$$parameter = \frac{1000}{1500} \cdot 10 = 6,66 \quad parameter \approx 7$$

PARAMETER-TELEGRAM_2

length = 46 (0x2e)	0x80	
tel.-counter	identity = 51	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
load factor in %	load limit 1 in %	
load limit 2 in %	start delay	drive1
dn in rpm	dt in 10ms	
set-speed high	set-speed low	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

load factor in %:

resolution (0 – 255); one byte

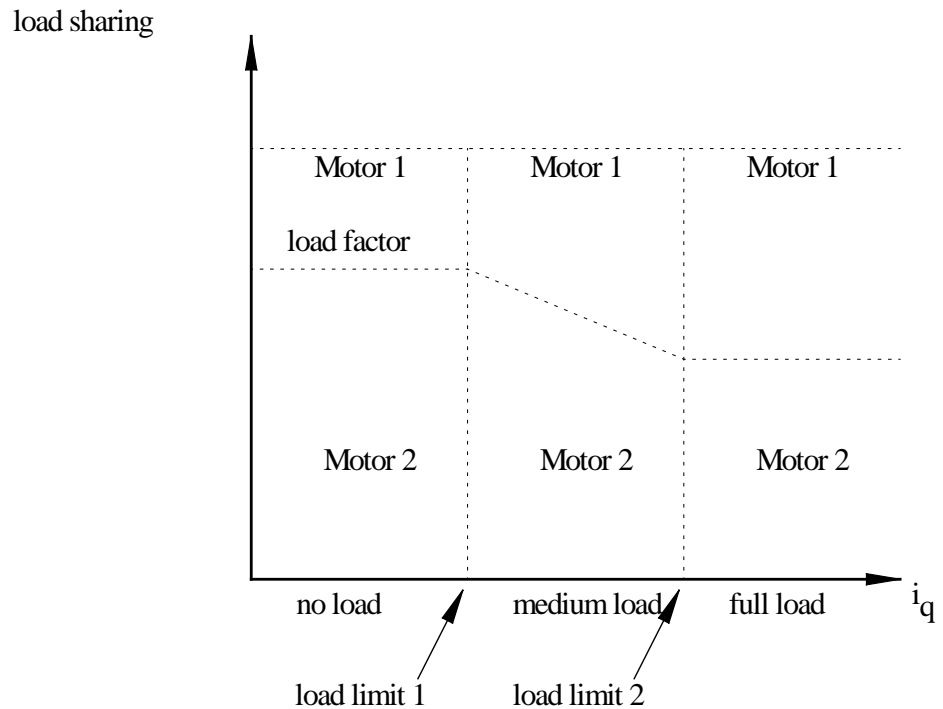
load limit 1 + 2 in %

resolution (10 – 100); one byte

These parameter can be used to modify the load sharing between several drives.

To avoid chain problems it can be useful to allow the drive at the tail end to operate with more load than the drive at the head end.

The load factor [%] is realizing this.



Example:

Motor 2 (master); Motor 1 (slave)

no load area: 0 – 30 % i_q

medium load area: 31 – 70 % i_q

full load area: 71 – 170 % i_q

Motor 1 should take **30 %** less than the motor 2

necessary parameter:

load limit 1 = 30

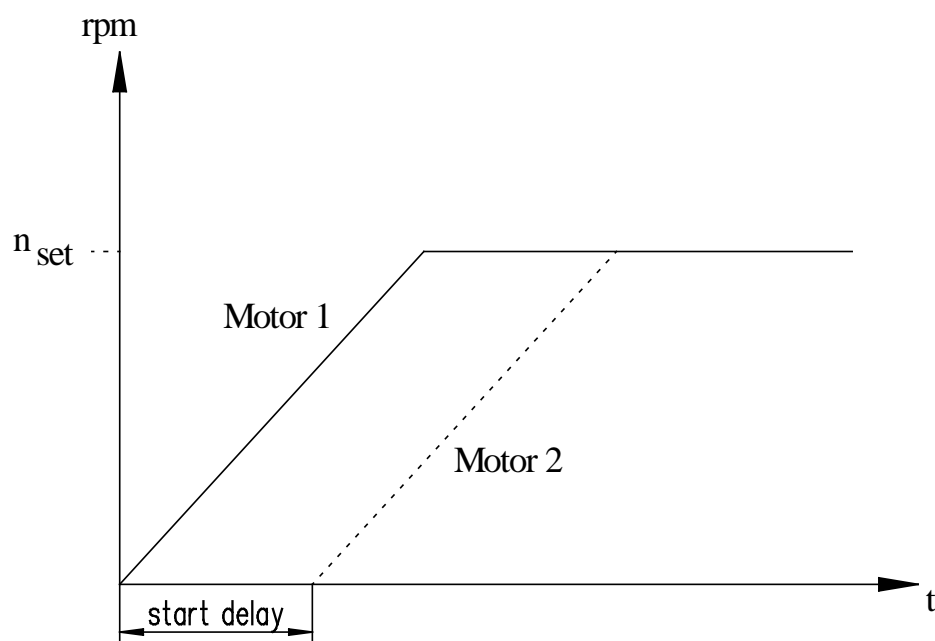
load limit 2 = 70

load factor = 70 (100 % - 30 %)

start delay:

resolution (10 – 100); one byte

This parameter can be used for a start delay after a given starting command.



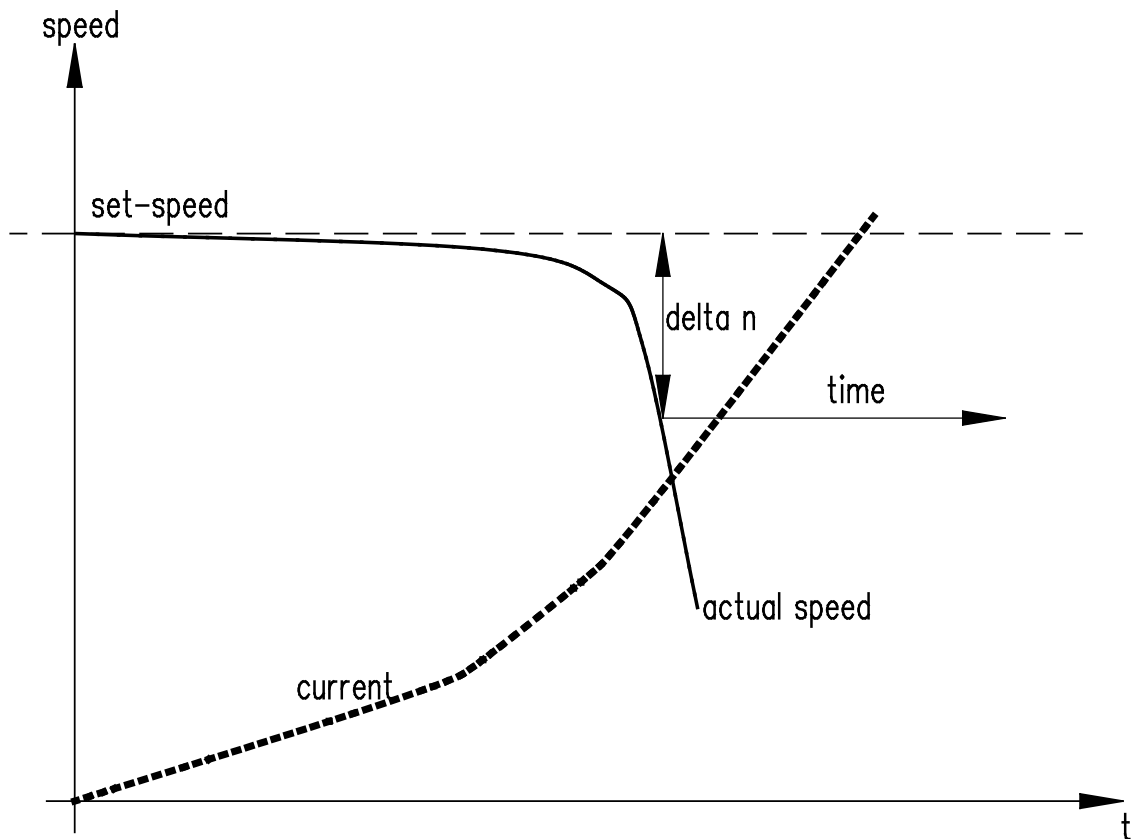
$$delay\ time = parameter \cdot 0,2s$$

dn in rpm:

resolution (0-255 rpm); one byte

This parameter can be used to detect a jammed condition of the chain under ground.

If the value is 0 the detection is disabled.



dt in 10ms:

resolution (0-255 = 0 – 2550ms); one byte

This parameter can be used to detect a jammed condition of the chain under ground.

If the value is 0 the detection is disabled.

set-speed in rpm

resolution (0-1800 rpm); two bytes

If the speed is below the set-speed the jam detection is disabled

SET VALUE-TELEGRAM

length = 46 (0x2e)	0x80	
tel.-counter	identity = 41	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
mode of operation	reserve	
set speed high	set speed low	drive1
digital value high	digital value low	
current of the master/2 in % reserve		
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

mode of operation:

resolution (0 – 255); one byte

mode of operation = 0 → converter drive off

mode of operation = 1 → converter on (turning direction right)

mode of operation = 2 → converter on (turning direction left)

set value of speed in rpm:

resolution (0 – 65535); two bytes

Instruction of the set speed for each drive of the application in rpm.

Set speed high (MSB: Most Significant Byte)

Set speed low (LSB: Lowest Significant Byte)

The maximum set speed of the 400 kW-VSD motor is:

1800 rpm (encoder mode)

900 rpm (encoderless mode)

The minimum set speed of the 400 kW-VSD motor is:

150 rpm

(current of the master) / 2 in %:

resolution (0 – 255); one byte

Please have a look at chapter „The use of torque control with more than one drive“.

(0 - 112): 0 bis 225 % drive is working like a motor

(143 - 255): -225 bis -1 % drive is working like a generator

MEMORY DUMP

```
length =46 (0x2e)          0x80
tel.-counter              identity = 49
00                        electronic-number
ana = 00                  bin= 00
dig = 32 (0x20)          00
anz.1 00                  00
anz.2 00                  00
adresse high-word-----
adresse low-word-----
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
----- checksum -----
```

After a telegram request „MEMORY DUMP identity 49“ the VSD-control-unit will send the telegram „MEMORY DUMP identity 39“ telegram.

SET-COMMAND

length =46 (0x2e)	0x80
tel.-counter	identity = 48
00	electronic-number
ana = 00	bin= 00
dig = 32 (0x20)	00
anz.1 00	00
anz.2 00	00
adresse high-word-----	*)
adresse low-word-----	
00	set-byte
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
----- checksum -----	

*) adresse high-word :
1. byte = drive-number (0 = all drives).

address high word:	resolution two bytes
address low word:	resolution two bytes
setbyte:	resolution (0 – 255); one byte

ELECTRONIC-RESET

length =46 (0x2e)	0x80
tel.-counter	identity = 47
00	electronic-number
ana = 00	bin= 00
dig = 32 (0x20)	00
anz.1 00	00
anz.2 00	00
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
----- checksum -----	

LIFE INDICATOR

length = 6	0x80
tel.-counter	identity = 5
00	electronic-number
----- checksum -----	

Telegrams VSD-control-unit → PLC-unit

ACTUAL VALUES

length = 46 (0x2e)	0x80
tel.-counter	identity = 31
00	electronic-number
ana = 00	bin = 00
dig = 32 (0x20)	00
anz.1=KE-Status *1)	00
anz.2=00	00
digital value 1 high	digital value 1 low
drive current/2 in %	set value for current/2 in %ldrive1
total current in %	capacitor voltage in %l
actual speed high byte	actual speed low byte
*	
*	ldrive2
*	
*	
*	
*	ldrive3
*	
*	
*	
*	ldrive4
*	
*	
-----checksum-----	

*1) KE-Status (KE = **K**ommunikations**E**inheit = communication unit)

1xxx xxxx

| |
 2^0:

1 = electronic needs an
 initialisation; drive can not be
 started.

| |
 0 = electronic is o.k., set values
 will be accepted

| |
 2^7 : == 1;

digital value 1 (error indication high and low byte)

```
xxxx  xxxx  xxxx  xxxx
|||  |||  |||  |||
|||  |||  |||  ||| 2^0 : voltage is too low
|||  |||  |||  ||| 2^1 : speed is too high
|||  |||  |||  ||| 2^2 : (reserve)
|||  |||  |||  ||| 2^3 : I2t - error
|||  |||  |||  ||| 2^4 : jam detected (dn/dt function)
|||  |||  |||  ||| 2^5 : initialisation is needed
|||  |||  |||  ||| 2^6 : voltage is too high
|||  |||  |||  ||| 2^7 : error power line
|||  |||  |||  ||| 2^8 : Motor temperature is too high
|||  |||  |||  ||| 2^9 : current error (Hardware)
|||  |||  |||  ||| 2^10 : error encoder
|||  |||  |||  ||| 2^11 : reset electronic
|||  |||  |||  ||| 2^12 : current error (total)
|||  |||  |||  ||| 2^13 : temperature of the inverter is too high
|||  |||  |||  ||| 2^14 : error checksum (program error !)
|||  |||  |||  ||| 2^15 : current error (Software)
```

Each error stops the VSD motor automatically.

That means, before you can start the drive, you have to clear all errors by setting the digital value high byte (set value telegram) of each drive to from 0 to 32 and back to 0. **The drives are needing a pulsating signal.**

„voltage is too low“.

The DC link voltage of the capacitor is / was lower than (566 V DC).

Basically it is possible to clear this error after switching on the 1000 V AC (capacitor voltage 1414 V DC).

„speed is too high“:

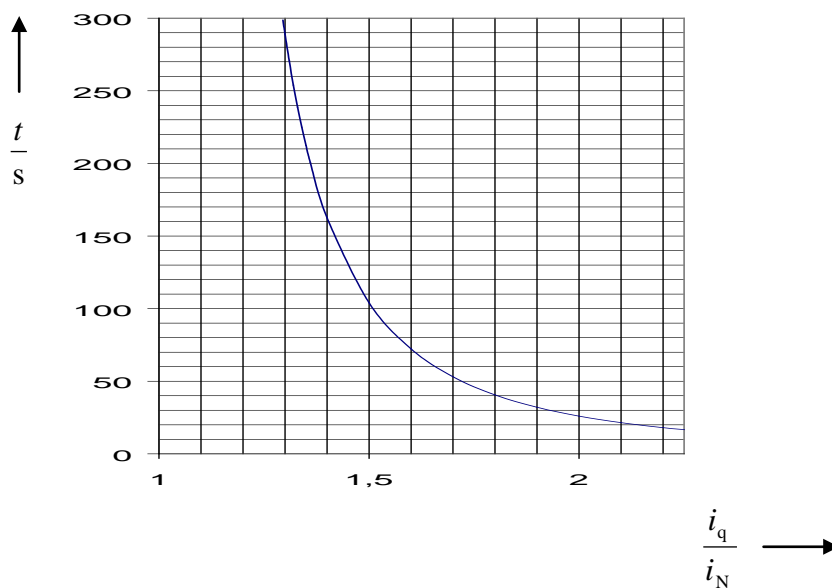
The actual value of speed is / was higher than max. speed.

You can clear this error immediately.

„ i^2t – error“:

The VSD electronic has an internal supervision for current overloading.

You can clear this error immediately.



„initialisation is needed“:

The VSD electronic needs an initialisation. The drive is not ready to start. Maybe the communication between the VSD-control-unit and the PLC-unit is not o.k. (timeouts: the drive has not received a set telegram for **more than 2 seconds!**) or the drive **has not** received a parameter telegram.

It is not possible to clear this error. This error will be cleared automatically after receiving a parameter telegram.

„*voltage is too high*“:

The DC link voltage of the capacitor is / was higher than 2000 V DC.

It is possible to clear this error if the voltage is lower than 2000 V DC.

„*error power line*“:

This error indicates a problem of the on board contactor (charging unit) if you switch on the 1000 V AC and it is not possible to clear this error. Basically this error will always occur if you switch off the 1140 V AC on the main and the capacitor voltage is higher than 566 V DC.

You can clear this error immediately.

„*Motor temperature is too high*“:

The temperature of the internal PT100 is / was too high.

You can clear this error immediately.

„*current error (hardware)*“:

The current of the winding was too high or an IGBT is faulty.

You can clear this error immediately. If it is not possible to clear this error you have to change the corresponding component (IGBT or driver board „IGBT status:ACTUAL-VALUES-3“).

„*encoder error*“:

The encoder of the drive is faulty or disturbed.

You can clear this error immediately.

„*reset electronic*“:

There was a reset of the VSD electronic.

You can clear this error immediately.

„*current error (total)*“:

There was a current error (please have a look at hardware or software).

You can clear this error immediately.

„*temperature of the inv. is too high*“:

The temperature of the inverter is / was higher than 70°C.

You can clear this error if the temperature is lower than 70°C.

„*error checksum*“:

The internal program of the controller is not correct.

It is not possible to clear this error.

„*current error (software)*“:

The electronic has localized a very high current peak.

You can clear this error immediately.

(drive current) / 2 in % :

resolution (0 – 255); one byte

0 – 112 correspond to 0 – 225 %

143 – 255 correspond to (–225) – (-1) %

This byte shows the actual current in the winding of the drive.

(500 kW: $I_N = 310$ A) ; (1000 kW: $I_N = 640$ A)

(set value for current) / 2 in %:

resolution (0 – 255); one byte

0 – 112 correspond to 0 – 225 %

143 – 255 correspond to (–225) – (-1) %

This value is **very important** for torque control between two or more drives. If you want this feature, you have to send this „**master current**“ value to all slave-drives as the current of the master (have a look at the set-value telegram). **The set value of the master has to be 0 (chapter „The use of torque control with more than one drive“).**

total current in %:

resolution (0 – 255); one byte

(0 - 225) = 0 - 225 %

$$= \sqrt{i_q^2 + i_d^2} \quad i_q = \text{active current}; \quad i_d = \text{reactive current}$$

capacitor voltage in %:

resolution (0 – 255); one byte

1414 V DC correspond to 100 %.

actual value of speed (high + low) in rpm:

resolution (0 – 65535) in rpm; two bytes

ACTUAL VALUES-2

length = 46 (0x2e)	0x80	
tel.-counter	identity = 32	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE-Status *1)	00	
anz.2=00	00	
digital value 2 high byte	digital value 2 low byte	
starting counter high byte	starting counter low byte	drive1
hour meter high byte	hour meter low byte	
minute meter	second meter	
*		
*		drive2
*		
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

digital value 2 (status indication high + low byte):

```
xxxx  xxxx  xxxx  xxxx
|||||  |||||  |||||  |||||
|||||  |||||  |||||  ||||| 2^0 : reserve
|||||  |||||  |||||  ||||| 2^1 : encoderless operation
|||||  |||||  |||||  ||||| 2^2 : n > 0 (drive turns right)
|||||  |||||  |||||  ||||| 2^3 : n < 0 (drive turns left)
|||||  |||||  |||||  ||||| 2^4 : reserve
|||||  |||||  |||||  ||||| 2^5 : reserve
|||||  |||||  |||||  ||||| 2^6 : reserve
|||||  |||||  |||||  ||||| 2^7 : reserve
|||||  |||||  |||||  ||||| 2^8 : stand-by
|||||  |||||  |||||  ||||| 2^9 : inverter start
|||||  |||||  |||||  ||||| 2^10 : inverter start
|||||  |||||  |||||  ||||| 2^11 : reserve
|||||  |||||  |||||  ||||| 2^12 : inverter start
|||||  |||||  |||||  ||||| 2^13 : reserve
|||||  |||||  |||||  ||||| 2^14 : reserve
|||||  |||||  |||||  ||||| 2^15 : clear errors is active
```

„ $n > 0$ “: The shaft of the drive is turning clockwise.

„ $n < 0$ “: The shaft of the drive is turning anticlockwise.

„stand-by“: The drive is ready to start.

„inverter start“: The inverter of the drive is working without any error.

„clear errors is active“: The VSD-control-unit has received a clear error command (SET VALUE TELEGRAM „digital value“).

starting counter (high + low byte):

resolution (0 – 65535); two bytes

Whenever you start the drive this word will be increased.

hour meter (high + low byte):

resolution (0 – 65535); two bytes

Here you can see the operating hours of the VSD-motor electronic.

minute meter:

resolution (0 – 255); one byte

This byte represents the operating minutes of the VSD-motor electronic.

second meter:

resolution (0 – 255); one byte

This byte represents the operating seconds of the VSD-motor electronic.

ACTUAL VALUES-3 (temperatures 1)

length = 46 (0x2e)	0x80	
tel.-counter	identity = 33	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE-Status *1)	00	
anz.2=00	00	
winding 1	diode (1000kW only)	
bearing A	bearing B	drive1
cooling plate	inductor	
PTC-value	IGBT - status	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		drive4
*		
*		
-----checksum-----		

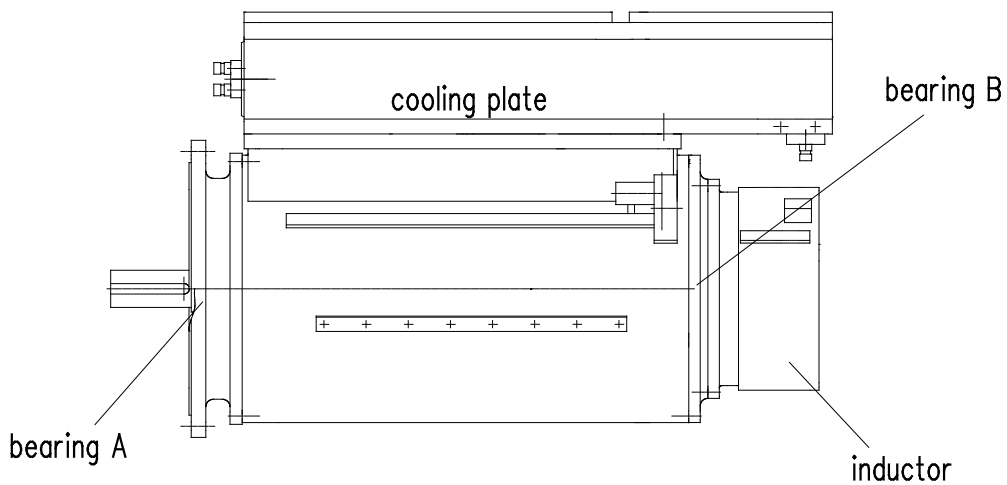
IGBT – status (error indication) = 0: there is no problem

```

xxxx xxxx
|||||  |||||
|||||  ||| 2^0 : IGBT 1 - error
|||||  || 2^1 : IGBT 2 - error
|||||  | 2^2 : IGBT 3 - error
|||||  2^3 : IGBT 4 - error
||| 2^4 : IGBT 5 - error
|| 2^5 : IGBT 6 - error
| 2^6 : reserve
2^7 : reserve
    
```

ACTUAL VALUES-4 (temperatures 2)

length = 46 (0x2e)	0x80	
tel.-counter	identity = 34	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE-Status *1)	00	
anz.2=00	00	
reserve	reserve	
reserve	reserve	drive1
reserve	reserve	
reserve	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		



Temperatures

All the temperatures are measured with the help of PT100 elements in °C.

Basically you should use these values to display the thermal conditions of the drive. If the temperature values are higher than critical values („**Recommended maximum values for the temperatures**“) it is necessary to stop the drive and to check the cooling water. Otherwise you will damage the inverter (IGBTs) of the VSD.

Do not run the drive without cooling water because you will overheat the IGBTs of the inverter part of the VSD. The drive is fitted out with a selfprotection against overheating which is based on PTC-elements. These elements are not fast enough to detect a very fast temperature rise of the cooling plate.

This is the reason why you have to check the temperatures of the drive all the time.

However, the customer is responsible for stopping and for protecting the drive against overheating!

Recommended maximum values for the temperatures

winding	150 °C
inductor	140 °C
bearing (A and B)	115 °C
diode	70 °C
cooling plate (IGBT 1 - 6)	70 °C

ELECTRONIC-IDENTITY

length=46 (0x2e)	0x80	
tel.-counter	identity = 30	
00	electronic-number	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE-Status *1)	00	
anz.2=00	00	
firmware-type-number	firmware-number	
-----serial number-----		drive1
01	reserve	
00	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

firmware-type-number:

resolution (0 – 255); one byte

The type-number of the loaded firmware (motor-type).

1000 kW : Typ **66**

500 kW : Typ **61**

firmware-number:

resolution (0 – 255); one byte

The version-number of the loaded firmware.

1000 kW: Version **8**

500 kW: Version **4**

serial-number (high + low byte):

resolution (0 – 65535); two bytes

Number of the controller of the VSD-motor.

MEMORY DUMP

```
length = 46 (0x2e)          0x80
tel.-counter                identity = 39
00                          electronic-number
ana = 00                    bin = 00
dig = 32 (0x20)            00
anz.1=KE-Status *1)       00
anz.2=00                    00
address+0                   address+1      |
address+2                   address+3      |drive1
address+4                   address+5      |
address+6                   address+7      |
address+0                   address+1      |
address+2                   address+3      |drive2
address+4                   address+5      |
address+6                   address+7      |
address+0                   address+1      |
address+2                   address+3      |drive3
address+4                   address+5      |
address+6                   address+7      |
address+0                   address+1      |
address+2                   address+3      |drive4
address+4                   address+5      |
address+6                   address+7      |
-----checksum-----
```

ERROR MEMORY

```
length =46 (0x2e)          0x80
tel.-counter               identity = 50
00                         electronic-number
ana = 00                   bin= 00
dig = 32 (0x20)           00
anz.1 = KE-Status *1)    00
anz.2=00                   00
last error                error before last error!
.. error                  .. error          |drive1
.. error                  .. error          |
.. error                  .. error          |
*                           |
*                           |drive2
*                           |
*                           |
*                           |
*                           |drive3
*                           |
*                           |
*                           |
*                           |drive4
*                           |
*                           |
*                           |
----- Blocksicherung -----
```

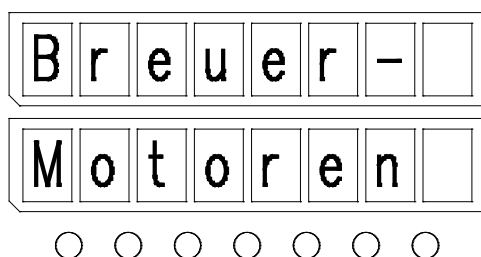
error numbers

```
0: checksum error
1: temperature of the inverter is too high
2: voltage of the capacitor is too low
3: (reserve)
4: encoder error
5: current is too high
6: temperature is too high
7: electronic error
8: error power line
9: drive speed is too high
```

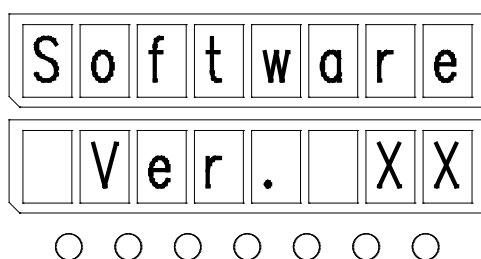
The display of the control unit

On the display of the control unit you can see the condition of the frequency converter drive and errors as well. The display is segmented into two lines with eight letters. Underneath the second line there are seven LED's. These LED's indicate the funktion of various DC/DC – converter. They should shine all the time.

As soon as the control unit is powered with the operating voltage (127 V ~/ 240 V~) you can see the following letters on the display:

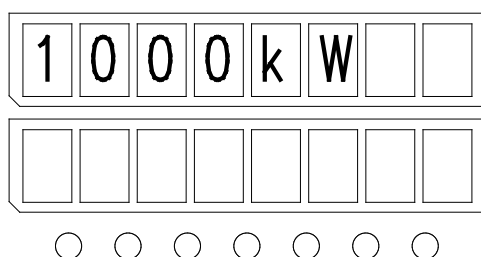


5 seconds later you can read the version of the implemented software (XX = version).



After another 5 seconds appears in the first display line the firmware-type version.

(for example: 1000 kW B; 250 kW)



Now the display is ready to show conditions and errors. If there is no error you can see a little flashing point in the second line of the display. This point signals the funktion of the microcontroller of the control unit.

If the control until wants to indicate errors or conditions of the drive you will see them in the first line of the display.

The meaning of the information on the display

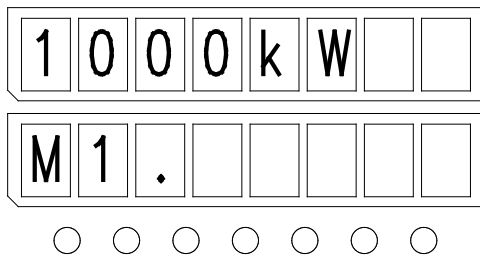
offline: there is **no data communication** between the drive and a control system

online: the communication between the drive and a control system is o.k. but the drive **has not** received a parameter telegram

if the display has switched from active to online:

the drive has not received a set telegram for **more than 2 seconds**

active: the data communication is o.k., the drive has received a parameter telegram and the drive is receiving set telegrams. **If there is no current error you will see now the data position of the drive in the second line**



M1 = first Drive

M2 = second drive

M3 = third drive

M4 = fourth drive

low volt: the DC link voltage of the drive capacitor is lower than 565,6 V

reason: there is no power on the main

speed !: the speed of the drive shaft is faster than the set max. speed

voltage: the operation voltage of the control unit is defective

I-t !: I²-t – error

reason: the drive current was very high for a long time

high vol: the DC link voltage of the drive capacitor was higher than 2000 V

P. line: condition of the on board contactor

PTC: the temperature of the drive is too high

current: the current was too high / an IGBT is faulty *)

*)

if an IGBT is faulty you will see the number of the IGBT (1-6) on the second display.

encoder: the encoder of the drive is faulty

temp. inv: the temperature of the inverter is too high

checksum: software error of the firmware

reset: there was a reset of the control unit

right: the mode of operation is set to 1

when you look to the shaft the turning direction is clockwise

left: the mode of operation is set to 2

when you look to the shaft the turning direction is not clockwise

Variations

Page 21 / 22:	power limiter in %
page 27	load factor, load limit 1 + 2
page 28	start delay
page 26	dn/dt function



变频调速一体式电动机

20mA 数据接口

21.11.2009

本文件基于 DSMC 版本的软件

北京华海基业机械设备有限公司

目录

变频调速一体式电动机技术-----	3
保越变频电机的连接安装方法-----	4
数据协议-----	10
基本规则-----	13
数据通讯的时间-----	14
数据传输中控制单元超时-----	14
主从规则-----	15
电机控制器典型的通讯时间-----	16
必要步骤-----	17
多台电机之间转矩控制的使用-----	18
数据报文的含义-----	21
从 PLC 端到电机控制器的数据报文-----	21
参数数据报文-----	21
参数数据报文_2-----	26
设置数据报文-----	30
数据转储-----	34
设置命令-----	35
电子器件重启-----	36
寿命指示-----	36
从电机控制器端到 PLC 的数据报文-----	37
实际值-----	37
数字量数据（故障指示）-----	38
实际值-2-----	43
实际值-3(温度值 1)-----	46
实际值-4(温度值 2)-----	47
温度-----	48
推荐的最高温度值-----	49
电子元件指示-----	50
数据转储-----	52
故障记录-----	53
控制单元显示-----	54
显示信息的含义-----	55
更改-----	58

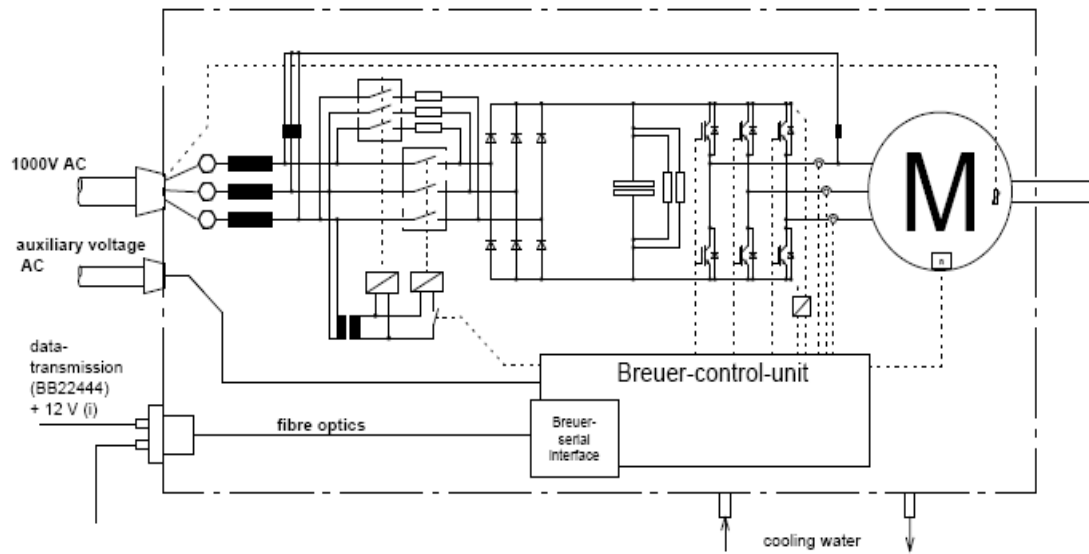
变频调速一体式电动机技术

保越变频一体驱动电机是一种普通的集成了变频器的三相异步电机。正是这个原因，电机很容易就能实现可变的转速，不同的加速时间，不同的电机转向和多台电机之间的转矩控制。

符合德国 **BB22444** 标准的串口接口用来控制电机驱动器。

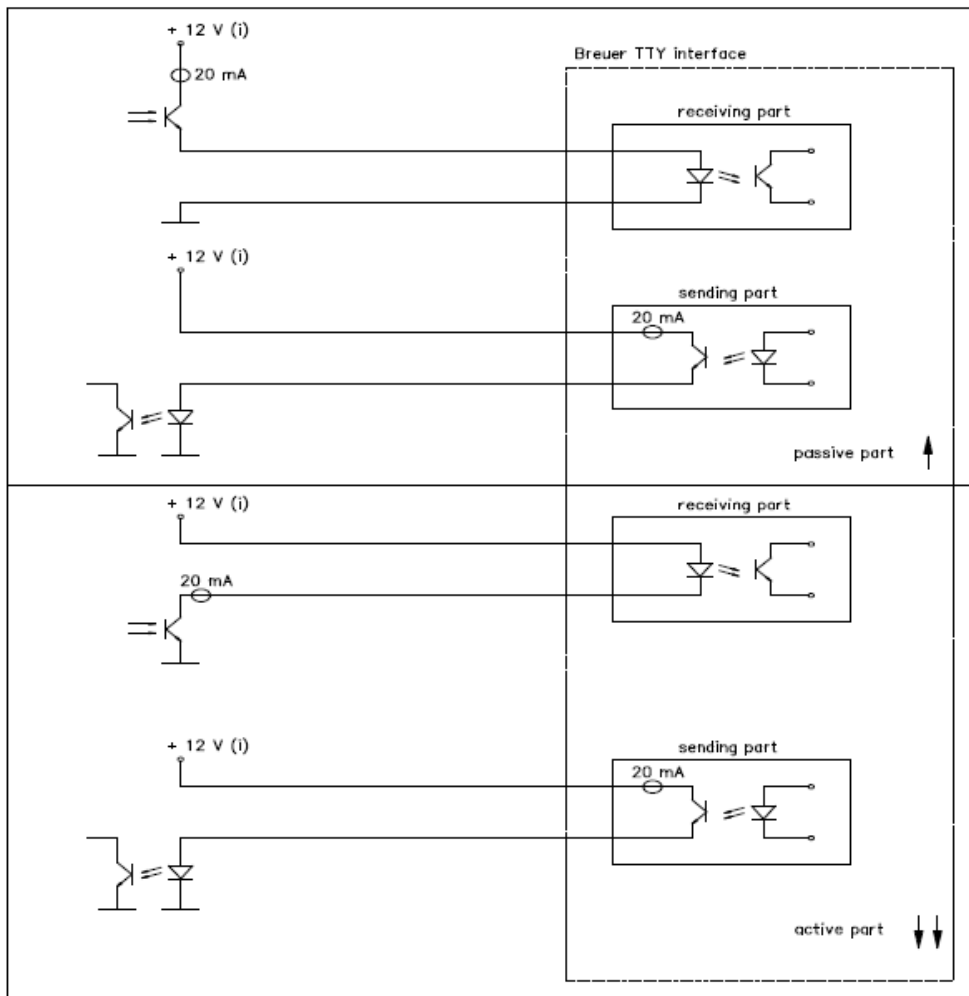
保越变频一体电机有以下优点：

- 更长的寿命
- 加速时电流低
- 可变的驱动速度
- 多台电机间的转矩控制
- 驱动器结构简单
- 驱动器处理和安装简单
- 可以显示内部的工作过程



保越变频电机的连接安装方法

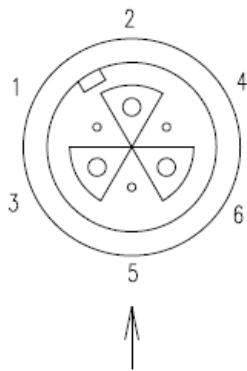
保越电机的 20mA 电流环接口需要 1 个外部提供的 12V 直流的本安型的供电电源，否则该接口不能工作。这个电路是基于德国 BB22444 T4 标准实现的。



基本电路图

正如上述的，电机的 20mA 电流环串口接口由一个外部的 12V 直流本安型电源供电。

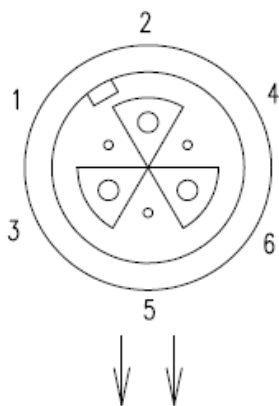
这个接口共有两种接头：



- 1: + 12 V DC
- 2: 0 V
- 3: Tx + (VSD control unit)
- 4: Tx -
- 5: Rx + (VSD control unit)
- 6: Rx -

第一种接头（标有↑）必须将第一台电机与外部主控系统相连或者是将第二台/第三台/第四台电机连接至该电机之前的电机。

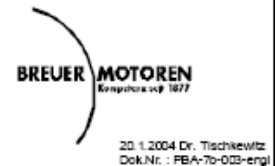
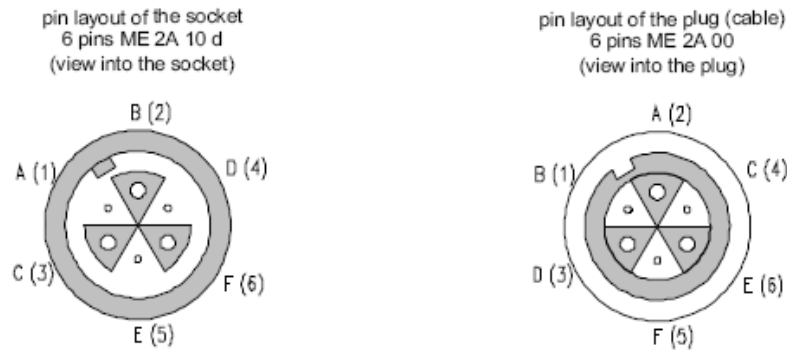
第二种接头（标有↓↓）允许将其他电机接入数据回路中。



- 1: + 12 V DC
- 2: 0 V
- 3: Rx + (VSD control unit)
- 4: Rx -
- 5: Tx + (VSD control unit)
- 6: Tx -

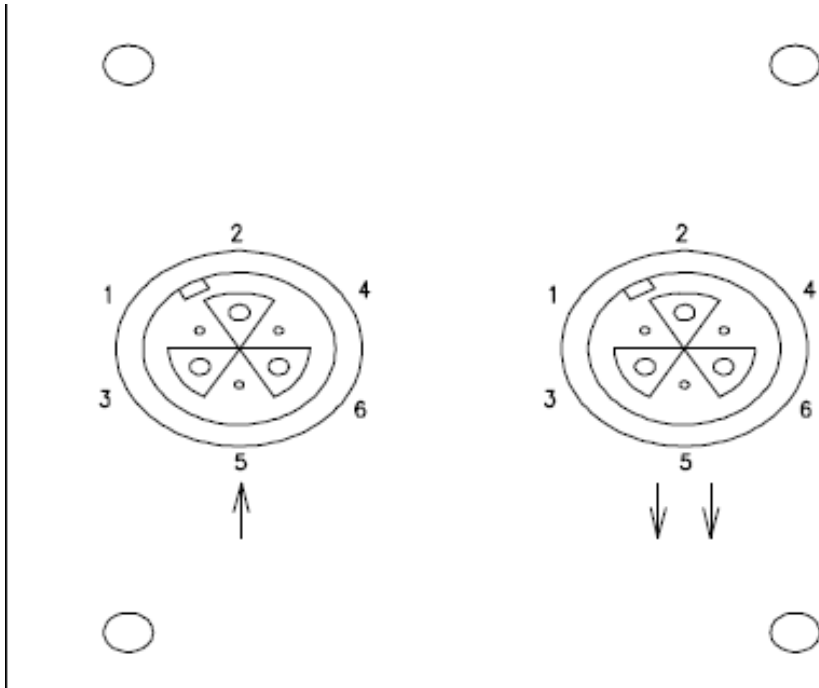
接口的回路原理图如下图所示：

Pin layout of the ME-plug-socket-system

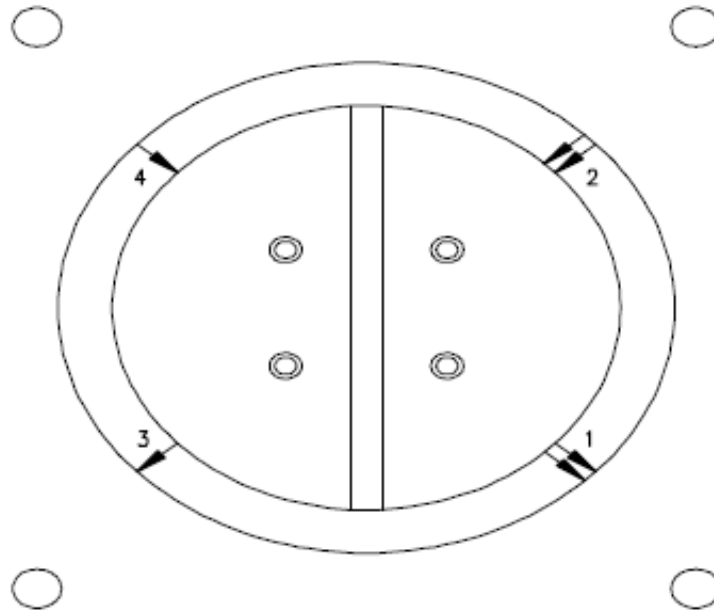


这个接头和插头的特点是在内部的管脚有编号。在本电机情况下，接头和插头的连接并不是按顺序连接的（1-1），（2-2），而是（1-2），（2-1），（3-4），（4-3），（5-6）和（6-5）！

正面

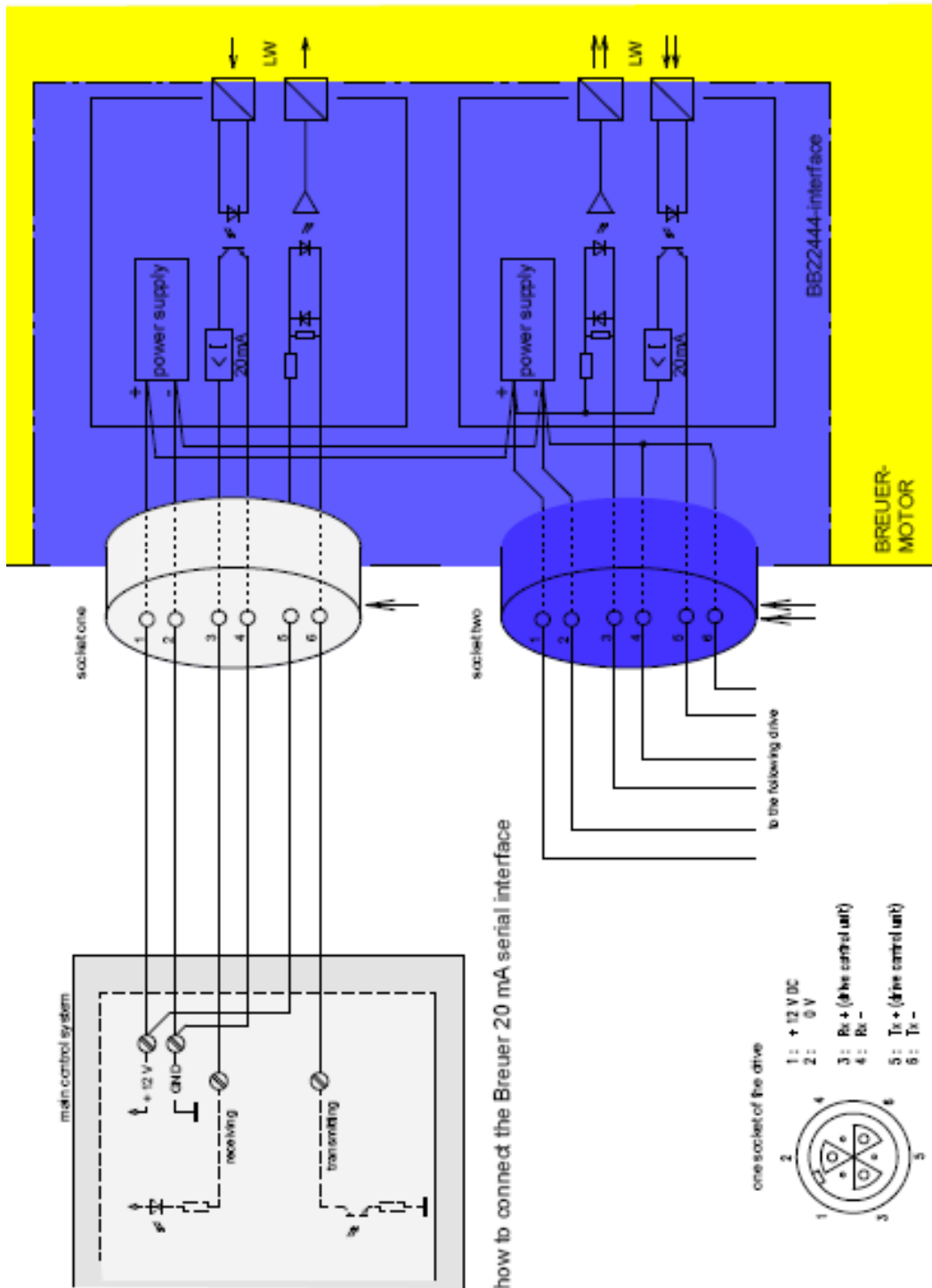


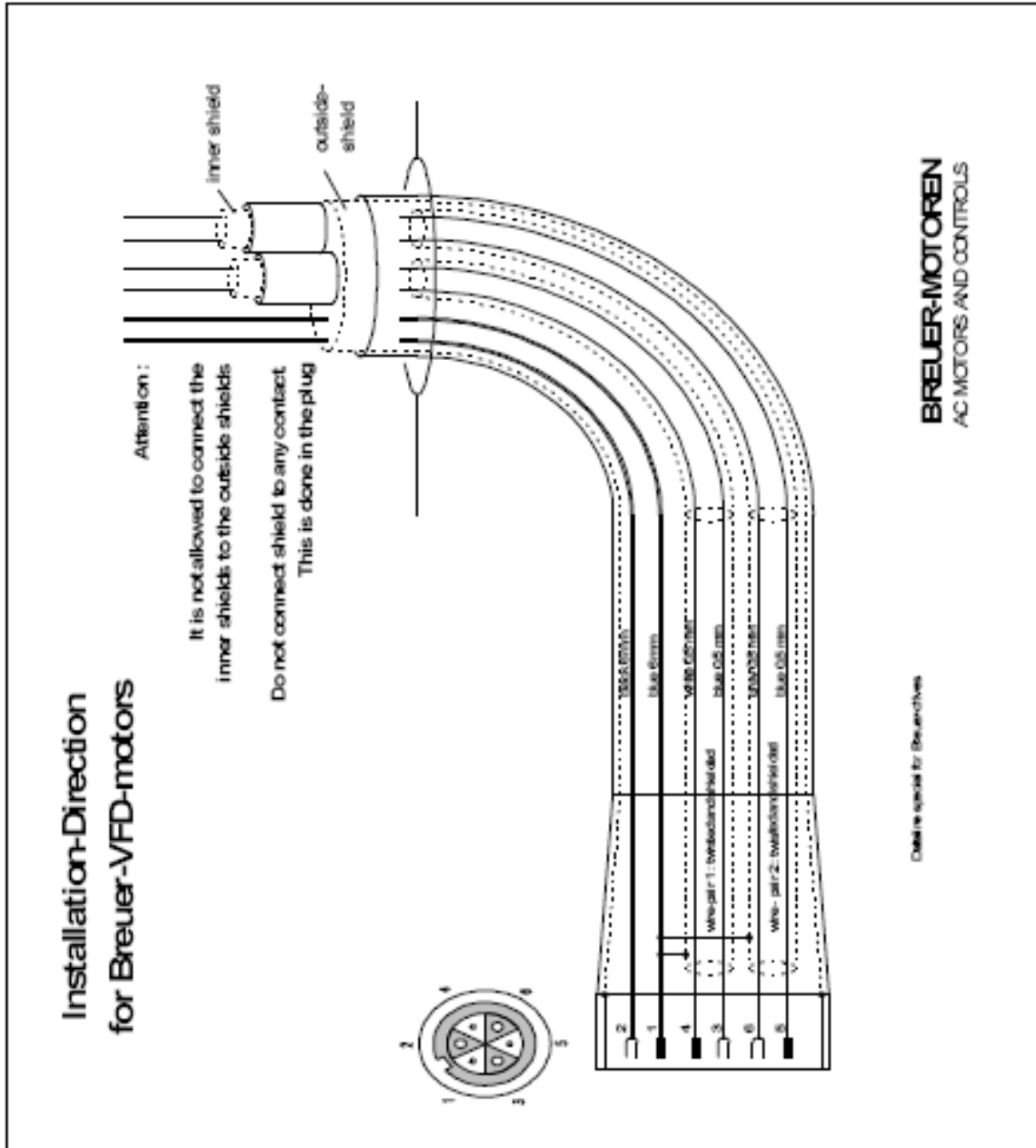
反面



从机端

主机端

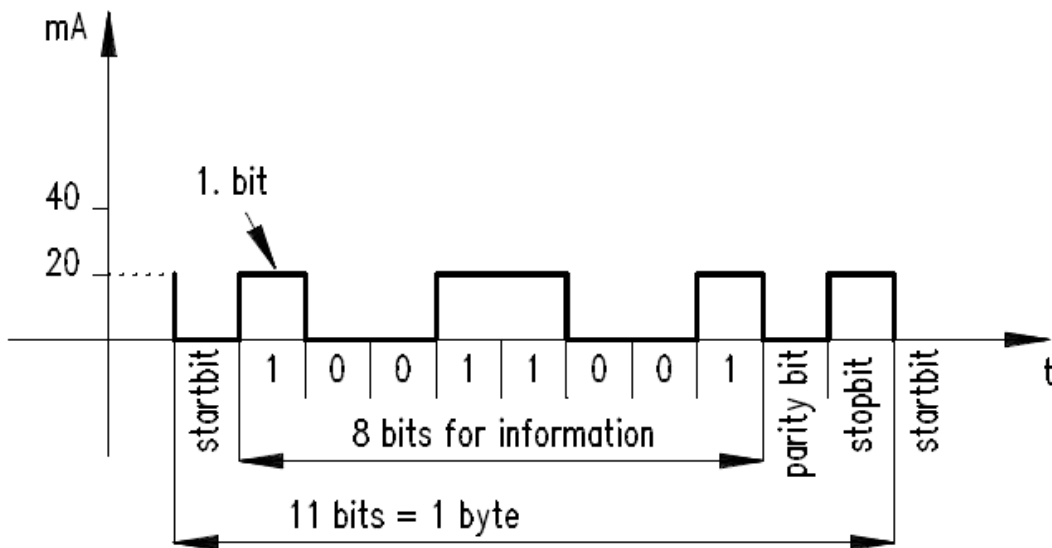




数据协议

保越变频一体电机的数据协议是符合德国 **BB22444-T4** 标准的串行通讯协议。

比特率适应从 4800 到 19200 波特 (bit/s)。每个字节的结构如下图所示。校验位为偶校验。



保越电机内部的控制器与外部的主控 PLC 的通讯是通过很多不同的数据报文 (参数, 赋值, 存储和设置)。每种数据报文都包含一个报文头 (因此每种被传送的数据报文都能被正确接收), 报文清单和数据区。下面的附件显示了所有用于控制保越电机的数据报文。

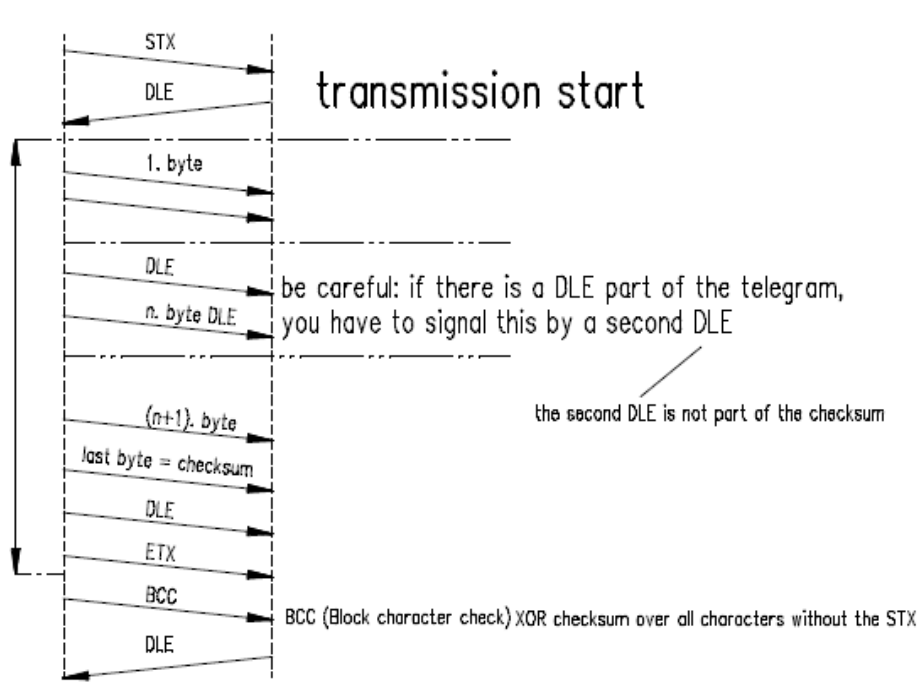
Telegram structure:

Telegram length (= 46 (0x2e))	Telegram number = 0x80
1. telegram counter	2. telegram identity
3. 0x00 (not used)	4. number of the electronic
5. 0x00 (not used)	6. 0x00 (not used)
7. length of the data field = 32 (0x20)	8. 0x00 (not used)
9. status of the communication unit	10. 0x00 (not used)
11. 0x00 (not used)	12. 0x00 (not used)
13. data field 1	14. data field 2
15. data field 3	16. data field 4
17. data field 5	17. data field 6
19. data field 7	20. data field 8
21. data field 9	22. data field 10
23. data field 11	24. data field 12
25. data field 13	26. data field 14
27. data field 15	28. data field 16
29. data field 17	30. data field 18
31. data field 19	32. data field 20
33. data field 21	34. data field 22
35. data field 23	36. data field 24
37. data field 25	38. data field 26
39. data field 27	40. data field 28
41. data field 29	42. data field 30
43. data field 31	44. data field 32
checksum high *)	checksum low *)

*) Checksum= 除报文头以外的整个报文部分（长度以及数据位号）

数据传输是由一个起始字节（STX=起始文本=0x02）。当电机内部的控制器接收到该字节后，那么它会发送一个应答信息（DLE=数据交换码=0x10）给外部 PLC 主控系统。当接收到该数据交换码后，外部的系统就可以向电机发送所有的数据报文。结束报文时，PLC 系统必须发送一个数据交换码 DLE

(0x10) 和一个结束字节 (结束文本=0x03)。如果数据报文都被正确接收，电机将返回一个数据交换码 DLE (见下图)。



每 200-500ms 就向电机发送一个报文是必要的因为在数据通讯回路被中断的情况下电机会停止工作。每个数据报文都被电机所监控，同样电机也必须返回同样的数据报文给主控系统。如果用户不希望监视数据报文，保越公司可以取消该项功能。

基本规则

- PLC 控制系统是主站所以要求必须接收 STX（起始文本）
- BCC（数据块确认）是数据协议的一部分
- 数据报文头的第二个字节赋值为 0x80
- 每个数据报文都有不同的报文计数器（0,1,2,3,4,...,255,0,1...）
- 通讯波特率设置为 9600bit/s
- 在发送第一个数据报文后不要修改电机内部控制器的编号
- 如果保越电机内部的控制器在超过 2 秒未接收到报文，电机将会自动停止。在这之后，必须发送新的设置参数的数据报文。

设置参数的数据报文必须在电机启动前发送（如果电机处理准备接收数据那么在 KE 状态中会显示 128→参见附录!）。如果显示了 129，说明电机没有收到正确的参数设置报文并且电机当前处于未预备状态。

多台电机之间通讯的时间

在接收到第一个初始化报文之后电机的控制器就会自动的发送其他的一些报文数据。

实际值数据报文（报文标识=31）	每 240ms
实际值 2 数据报文（报文标识=32）	每 2 秒
温度 1 数据报文（报文标识=33）	每 5 秒
温度 2 数据报文（报文标识=34）	每 5 秒
控制器标识数据报文（报文标识=30）	每 5 秒

其他的数据报文只有在有请求的时候才发送。

数据传输过程中变频电机控制器的超时

RX 数据超时[1-4s（缺省值 2s）；取决于参数设置数据报文]

在系统转为“离线模式”和“未初始化”状态之前等待接收有效数据报文的
最大时间。

如果发生此超时会自动停止电机。

TX 数据超时[3-6s (缺省值 4s); 取决于参数设置数据报文]

在系统转为“离线模式”和“未初始化”状态之前如果无法传输有效并且确认过的数据报文是的最大等待时间。

如果发生此超时会自动停止电机。

DLE 超时[400ms]

对 DLE (0x10) 在发送一条 STX 或者信息后系统推出进程并且再次重复该动作的最大等待时间。

Rx-Msg 超时[240ms, 如果串联多台电机, 那么对单台电机需 320ms]

发送 DLE (DLE 在收到 STX 之后) 之后等待信息的最大时间。

主从规则

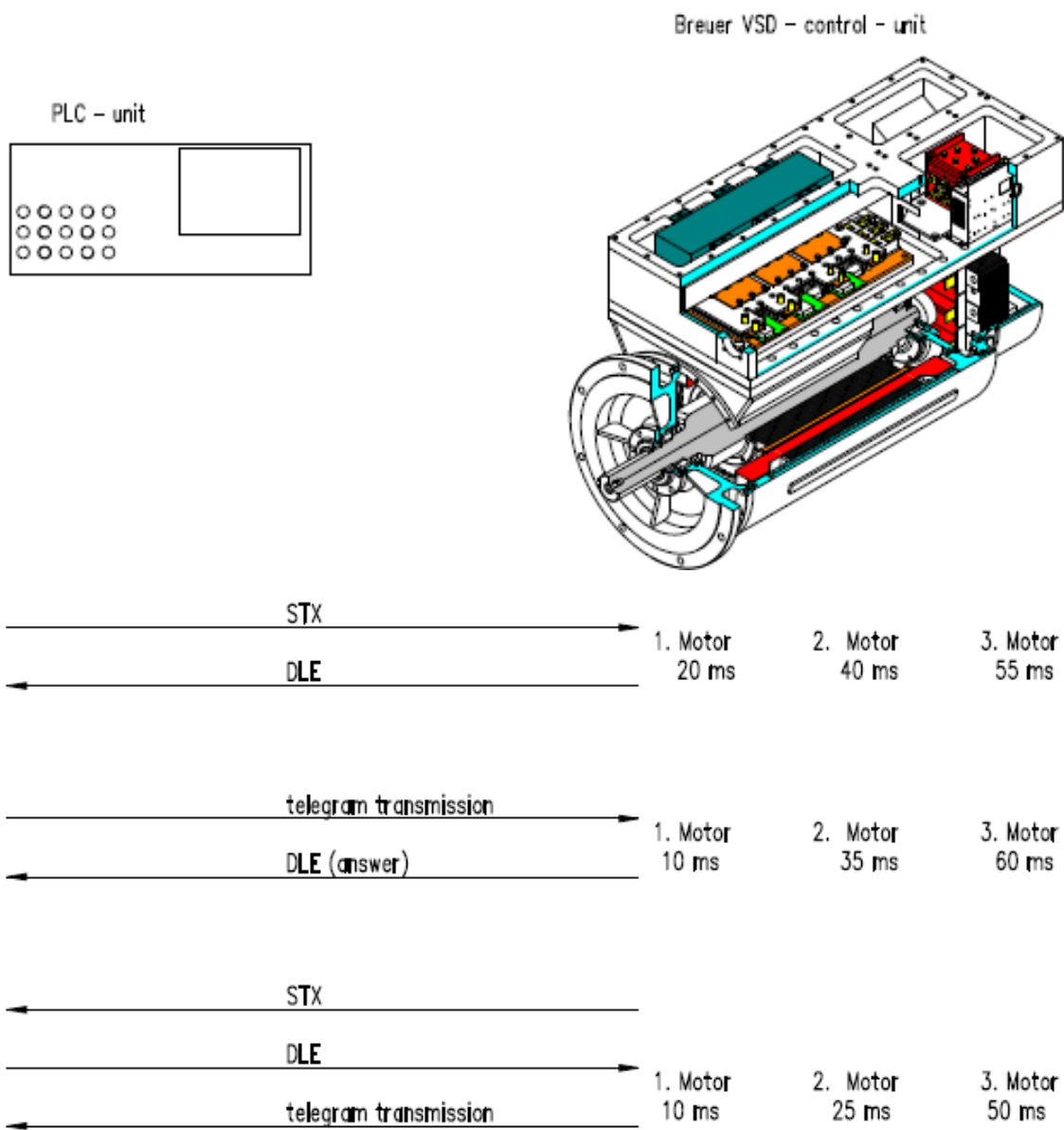
在整个通讯系统当中 PLC 必须作为主站。

这意味着 “、

如果 PLC 和变频电机的控制器几乎在同时发送了 STX (0X02), 那么 PLC 必须忽略该接收到的 STX 并且等待 DLE (0x10)。

变频一体电机的控制器在通讯系统中是作为从站, 在接收到 STX 之后, 控制器会一直发送 DLE 信息以给予回应 (将会忽略自身发送的 STX 信息)。

电机控制器典型的通讯时间



在发送一个数据报文并且接收到一个来自电机控制器的 DLE (0x10) 或者 NACK (0x15) 后, PLC 必须等待最少 80ms (最好为 100ms) 再发送下一个 STX。

否则可能会发生电机控制器无法进入传输模式, 这种情况下是由于发送 STX 间隔时间太短。

必要步骤

在启动保越变频一体式电机之前请务必确认电机内的控制器已经完成初始化。请查看由控制器发往 Allen Bradley PLC 的数据报文。在该数据报文中可以找到一个称为 KE 状态的字节 (通讯单元), 如果该字节第 2⁰ 位为 1 那么该控制器则需要通过一个参数设置报文来进行初始化; 如果该字节第 2⁰ 位为 0 那么说明控制器状态正常, 并且设置参数的报文将会被正常接收。

注意: 如果控制系统和 VFD 电机之间的通讯被切断 2 秒以上, 那么电机将会自动停止, 电机控制器也需要重新进行初始化。

以下是上述参数设置报文中各参数的缺省值:

速度差 (误差): 0

电流限制: 225 (=225%) *)

最高速度: 60 (=1800rpm)

PID 积分参数: 10 *)

PID 比例参数: 10 *)

加速时间: 20

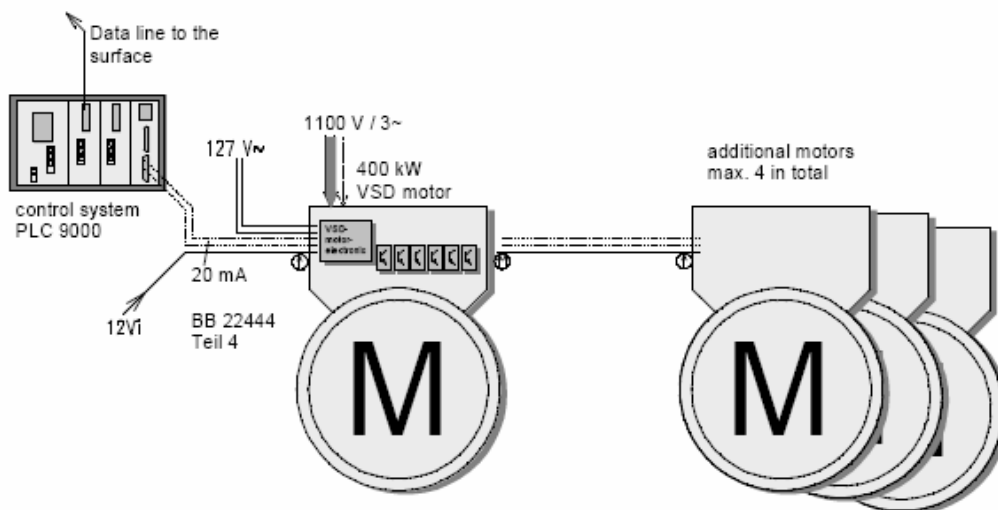
制动时间: 20

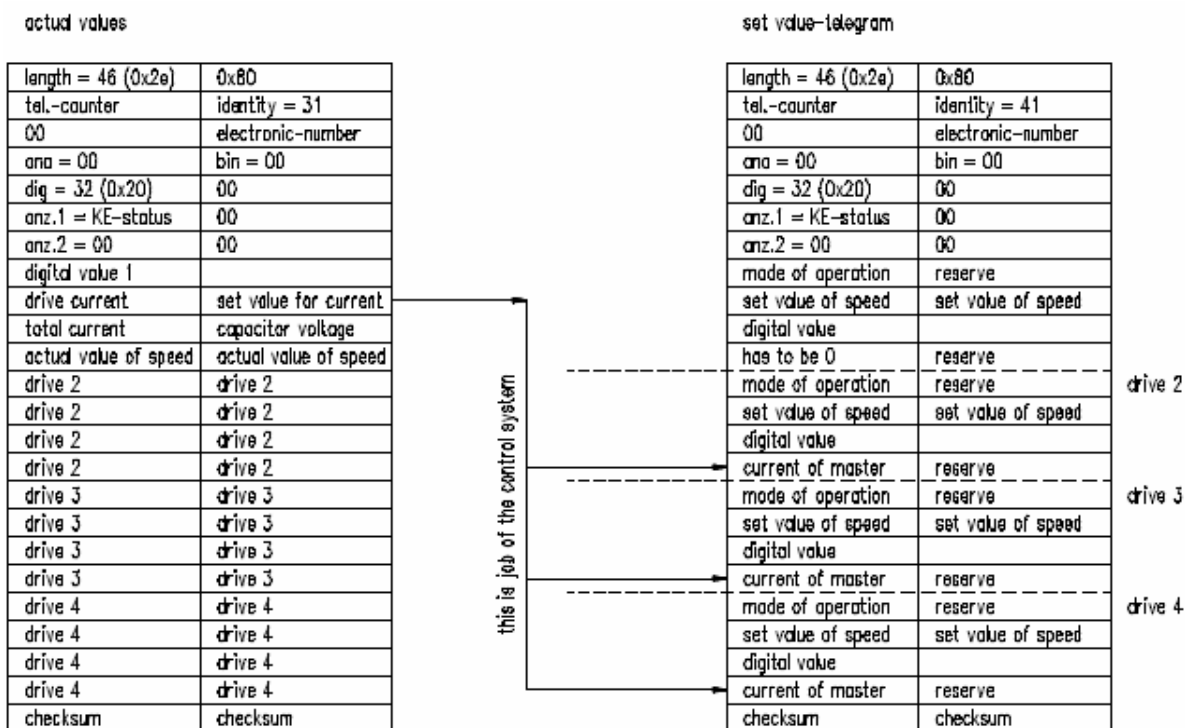
*) 如果这些值为 1, 变频器将会启动, 但不会输出转矩。

只要控制器发生任何一个故障，电机都将会自动停止，故障信号在digital value 1的状态字中显示！

只要当前存在故障，那么是不可能将电机重新启动的。首先必须通过set value 数据报文中的digital value来清除故障。请注意当运行模式为0时是不能将故障清除的，否则在清除完故障后电机将自动运行。

多台电机之间转矩控制的使用





如果有超过1台电机需要控制，并且需要对所有电机实现转矩控制，那么系统必须将主电机的电流发给各台从电机，在本例中，1号电机为主电机。

主电机必须按以下参数进行初始化（缺省值）：

速度差（误差）： 0

电流限制： 150 (=150%)

最高速度： 60 (=1800rpm)

PID积分参数范围： 10

PID比例参数范围： 10

加速时间： 20

制动时间： 20

负载因数： 0

负载限制1: 0

负载限制2: 0

启动延时: 0

所有其他的（从）电机除PID 积分参数范围外都应主电机的参数相同。这些值都应该是0。

从电机参数:

速度差（误差）: 0

电流限制: 150 (=150%)

最高速度: 60 (=1800rpm)

PID 积分参数范围: 0

PID比例参数范围: 10

加速时间: 20

制动时间: 20

负载因数: 0

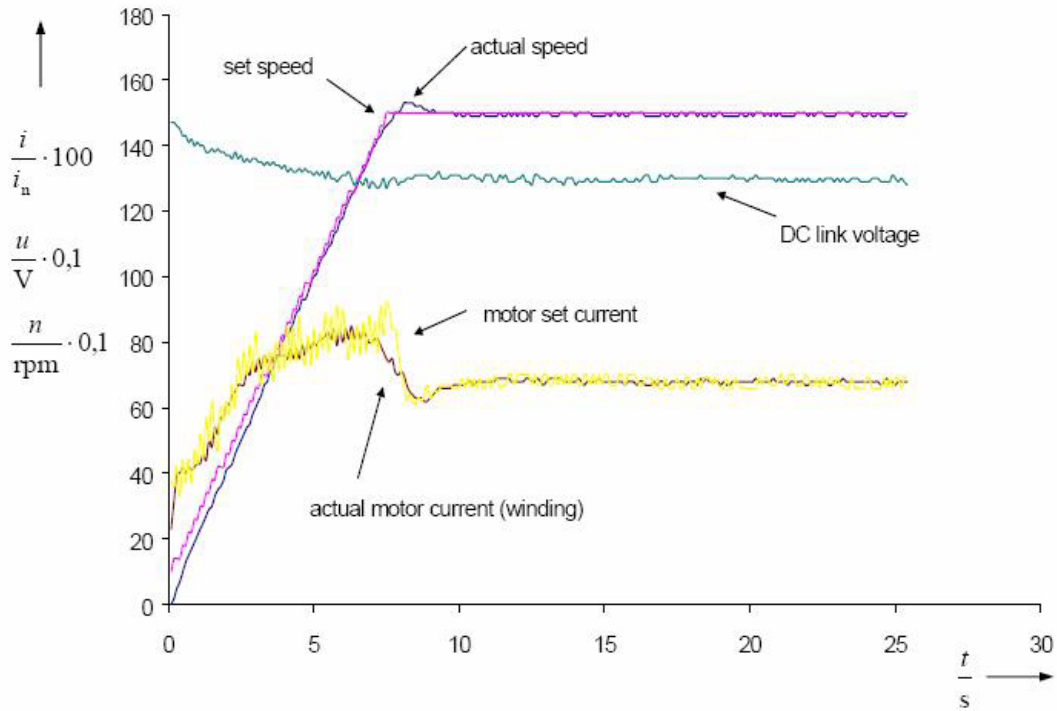
负载限制1: 0

负载限制2: 0

启动延时: 0

下例中可以看到如何优化电机速度控制的参数（积分和比例参数）。

图中可以看到在加速时间内实际速度并未发生超调。在正常情况下是没有必要去修改PI算法的参数的。



起动一台保越电机

从 PLC 端到电机控制器的数据报文

PARAMETER TELEGRAM

(For initialisation, *1)

length = 46 (0x2e)	0x80	
telegram counter	identity = 40	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
speed difference	power limiter in %	
current limiter in %	maximum speed	drive1
I – control range	P – control range	
acceleration time	braking time	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

速度差 (rpm) :

范围 (0-255) ; 1个字节

有时候允许在速度设定值与实际值之间有所差值会很有用。

速度差 (rpm) (=设定值+/- 速度公差)

功率限制 (%) :

范围 (10-100) , 1个字节

可以使用该参数来限制电机的功率。通过这个参数可以改变I2t功能(第35 页)

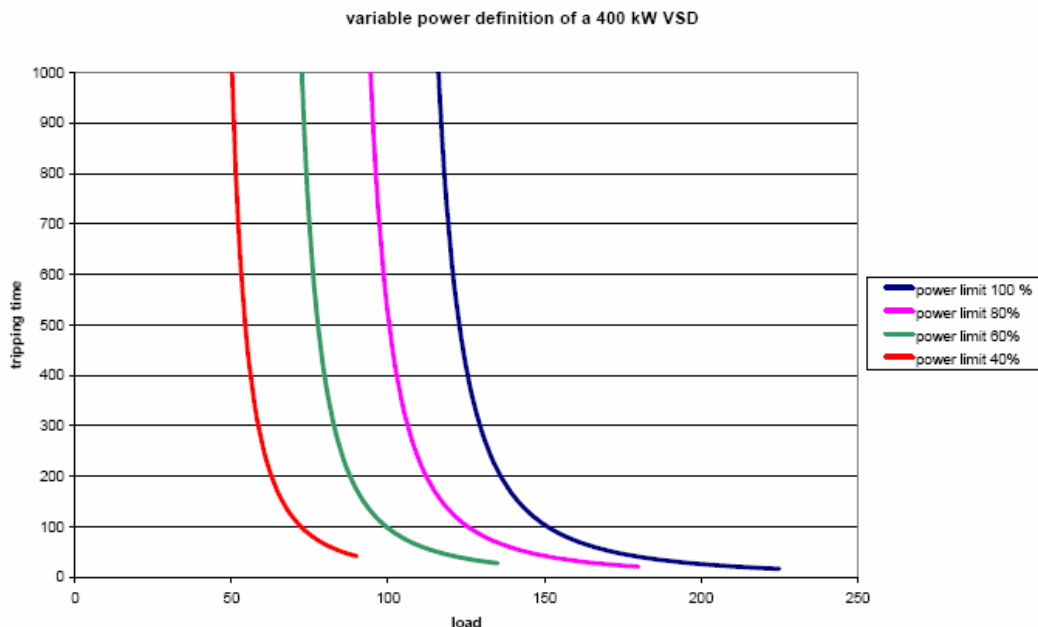
中的额定功率点。在17 秒以后电机将会自动停止并且会显示I2t 故障

($isq=2.25 \times \text{功率限制值}$)。通过这个参数并不是限制电机的转矩!

如果需要将一台400kW 的电机用作200kW 运行并且可以有1.5倍的过载容

量, 那么这个值应当设置成50 (意味着以额定功率400kW I2t 功能的50%运行)

并且电流限制值应该设置成75 (意味着以额定功率400kW的75%)



电流限制 (%) :

范围 (0-255) ; 1个字节

可以使用此参数来限制电机的最大电流。(0-255%)

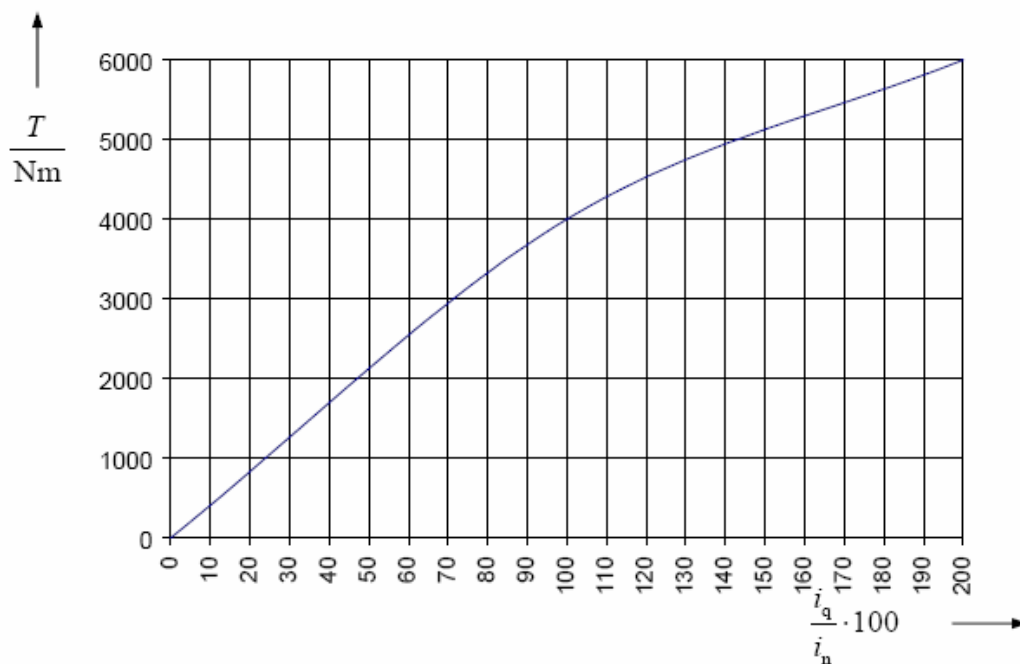
转矩计算方法: (在无温度和电压下降的情况下)

$i \leq 100 \%$:

$$y = \frac{4000 [Nm]}{100 [\%]} \cdot x [\%]$$

$i > 100 \%$

$$y = \frac{(6000 - 4000) [Nm]}{(200 - 100) [\%]} \cdot (x - 100) [\%] + 4000 [Nm]$$



最高速度:

范围 (0-255) ; 1个字节

可以通过此参数来限制电机的最高转速。此参数乘以30后的结果就是电机设定的最高转速。(该电机可以在0 至1800rpm 的转速之间运行) 如果通过此参数设置电机的最高转速与实际电机默认的最高转速相同时, 那么设置此参数是没有必要的。为了达到良好的速度控制运行效果, 有必要通过设置此参数使得电机转速与最高转速存在一个差值。如果实际转速高于最高转速那么电机将会产生一个“速度过快”的报警信息。

$\text{Max.speed} = \text{value} * 7650 / 255 = \text{value} * 30$

积分控制参数:

范围 (0-255) ; 1个字节

请使用缺省值!

比例控制参数:

范围 (0-255) ; 1个字节

请使用缺省值!

系统内部的速度控制需要以上2 个参数, 避免出现震荡现象, 使运行过程稳定。

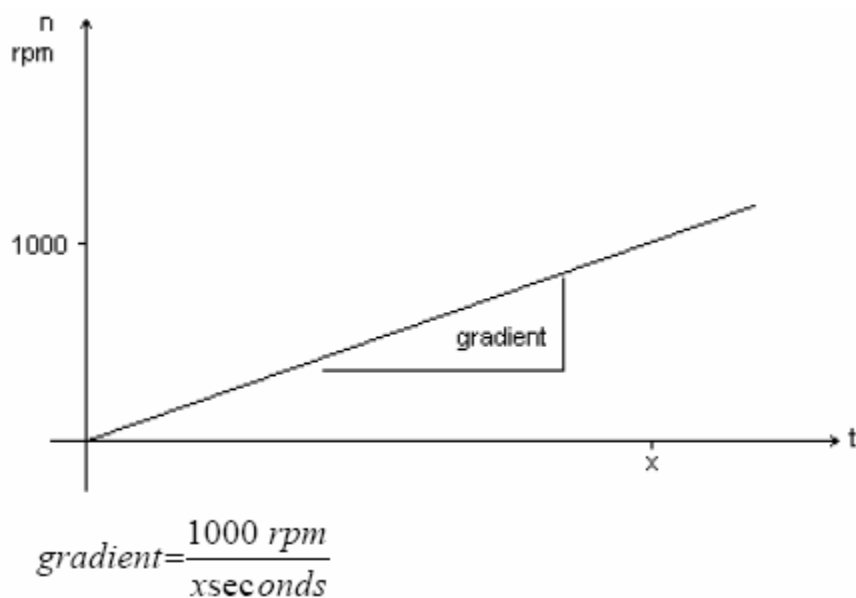
如果系统中有超过一台电机在实现转矩平衡运行, 那么从电机的积分参数必须设置为 0。

加速时间（秒）：

制动时间（秒）：

范围（0-255）；1个字节

可以通过斜坡函数来实现电机转速的增大或减小。这两个参数代表电机在加速或制动过程中的坡度（即速度变化值/速度变化持续时间）。



使用以下公式来计算时间：

参数=1000rpm/速度设定值*加速时间

例如：

速度设定值： 1500rpm

加速时间： 10秒

参数=1000/1500*10=6.66 参数≈7

参数报文_2

length = 46 (0x2e)	0x80	
telegram counter	identity = 51	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
load factor in %	load limit 1 in %	
load limit 2 in %	start delay	drive1
reserve	reserve	
reserve	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

负载因数：（%）：

范围（0-255）；1个字节

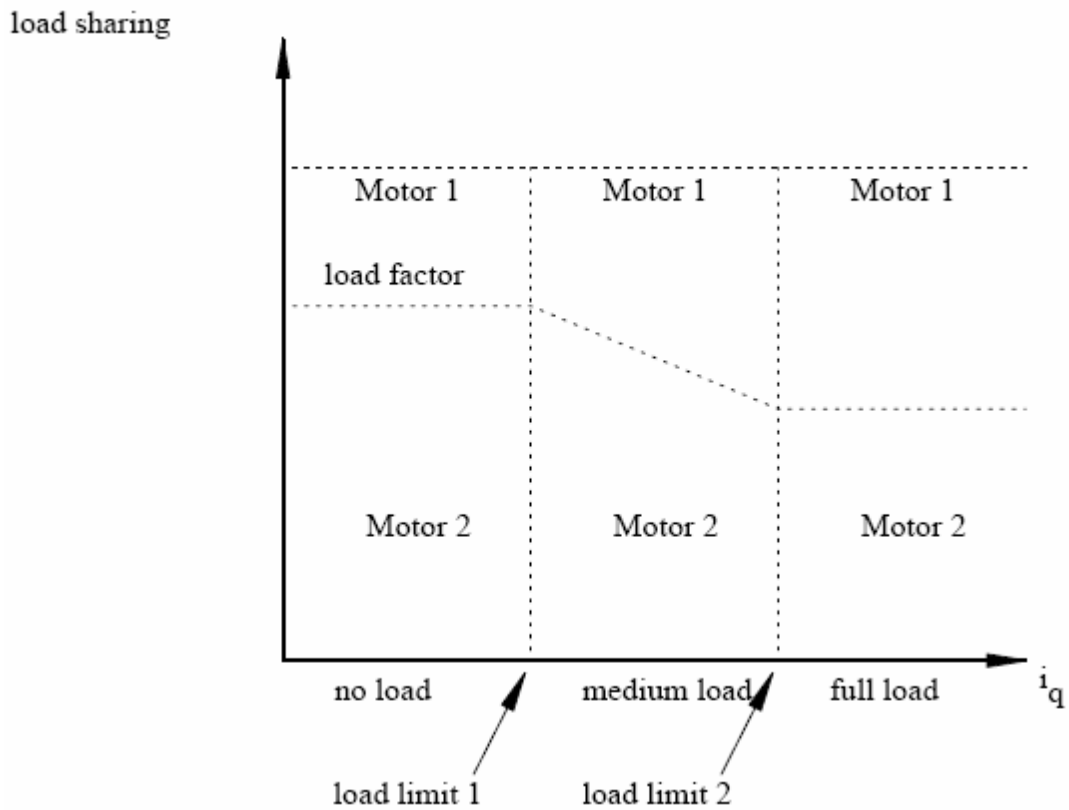
负载限制1+2（%）：

范围（10-100）；1个字节

这些参数可以用来修改多台电机之间的功率平衡。

为避免链条故障可以通过此参数来允许机尾电机以比机头电机更大的转矩来运行。

负载因数（%）通过以下实现：



例如：

2号电机（主电机）； 1 号电机（从电机）

无负载区： 0-30% i_q

半负载区： 31-70% i_q

满负载区： 71-170% i_q

1号电机应当比2号电机少输出30%

必要的参数设置:

负载限制1 = 30

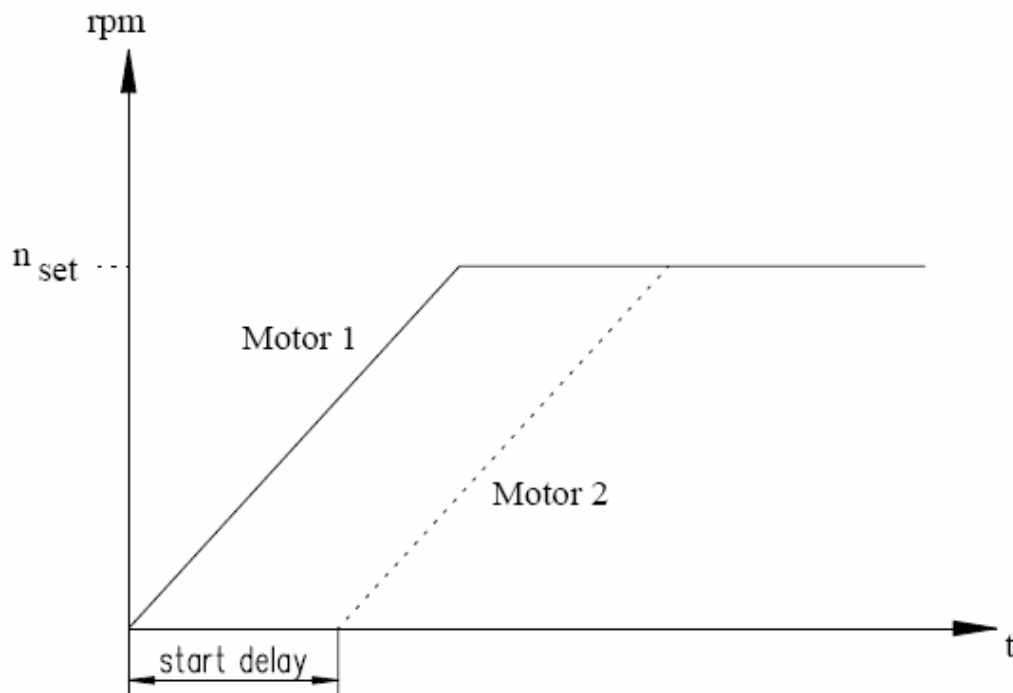
负载限制2 = 70

负载因数 = 70 (100%-30%)

启动延时:

范围 (10-100) ; 1个字节

此参数可以用来在给出启动命令之后产生一个延时。



$$\text{delay time} = \text{parameter} \cdot 0,2s$$

延时时间 = 参数*0.2 秒

设置报文值

length = 46 (0x2e)	0x80	
telegram counter	identity = 41	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1 = 00	00	
anz.2 = 00	00	
mode of operation	reserve	
set speed high	set speed low	drive1
digital value high	digital value low	
current of the master/2 in %	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

运行模式:

范围（0-255）；1个字节

运行模式 = 0 →变频器关闭

运行模式 = 1 →变频器启动（顺时针旋转）

运行模式 = 2 →变频器启动（逆时针旋转）

速度设定值：（rpm）

范围（0-65535）；2个字节

各电机速度设定值（rpm）说明：

速度设定值高位（**MSB**：最重要字节）

速度设定值低位（**LSB**：次重要字节）

1000KW电机的速度设定值的最高值为：

1800 rpm（有旋转编码器模式）

900 rpm（无旋转编码器模式）

1000KW电机的速度设定值的最低值为：

150 rpm

digital value (high + low byte):

```
xxxx xxxx  xxxx xxxx
||||  ||||  ||||  ||||
||||  ||||  ||||  |||2^0
||||  ||||  ||||  ||2^1
||||  ||||  ||||  || 00 : Timeout = 2s (Standard)
||||  ||||  ||||  || 01 : Timeout = 3s (Siemens S5)
||||  ||||  ||||  || 10 : Timeout = 4s
||||  ||||  ||||  || 11 : Timeout = 1s
||||  ||||  ||||  ||
||||  ||||  ||||  |2^2 : reserve
||||  ||||  ||||  2^3 : reserve
||||  ||||  |||2^4 : reserve
||||  ||||  ||2^5 : reserve
||||  ||||  |2^6 : reserve
||||  ||||  2^7 : reserve
||||  |||2^8 : error memory
||||  ||2^9 : switch on converter without voltage *)
||||  |2^10 : reserve
||||  2^11 : reserve
|||2^12 : reserve
||2^13 : clear errors
|2^14 : reserve
2^15 : reserve
```

*) 无电压状态启动变频器:

该参数只作故障诊断使用，请不要调用!!!

使用该字第 14 位来清除所有故障。

(主机电流) /2 (%) :

范围 (0-255) ; 一个字节

请参阅“多台电机之间的转矩控制的使用”章节。

(0-112) : 0 bis 255% 驱动器作为电动机运行

(143-255) : -255bis-1% 驱动器作为发电机运行

数据转存

```
length =46 (0x2e)          0x80
telegram counter          identity = 49
00                        number of the electronic
ana = 00                  bin= 00
dig = 32 (0x20)          00
anz.1 00                  00
anz.2 00                  00
address high word-----
address low word-----
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
reserve
----- checksum -----
```

在要求一个“MEMORY DUMP identity 49”报文后,变频控制单元将送一个“MEMORY DUMP identity 49”报文。

设置命令

length =46 (0x2e)	0x80
telegram counter	identity = 48
00	number of the electronic
ana = 00	bin= 00
dig = 32 (0x20)	00
anz.1 00	00
anz.2 00	00
address high-word-----	*)
address low word-----	
00	set byte
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
----- checksum -----	

*) 高位地址字节

1. 字节=电机序号 (0=所有电机)

高位地址字节：决定 2 个字节

低位地址字节：决定 2 个字节

设置字节：决定 (0-255) ; 1 个字节

ELECTRONIC RESET

length = 46 (0x2e)	0x80
telegram counter	identity = 47
00	number of the electronic
ana = 00	bin= 00
dig = 32 (0x20)	00
anz.1 00	00
anz.2 00	00
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
reserve	
----- checksum -----	

LIFE INDICATOR

length = 6	0x80
telegram counter	identity = 5
00	number of the electronic
----- checksum -----	

Telegrams VFD control unit → PLC-unit

ACTUAL VALUES

length = 46 (0x2e)	0x80
telegram counter	identity = 31
00	number of the electronic
ana = 00	bin = 00
dig = 32 (0x20)	00
anz.1=KE status *1)	00
anz.2=00	00
digital value 1 high	digital value 1 low
drive current/2 in %	set value for current/2 in %ldrive1
total current in %	capacitor voltage in %l
actual speed high byte	actual speed low byte
*	
*	ldrive2
*	
*	
*	
*	ldrive3
*	
*	
*	
*	ldrive4
*	
*	
-----checksum-----	

*1) KE status (KE = KommunikationsEinheit = communication unit)

1xxx xxxx	
2^0:	1 = electronic requires an initialisation; drive can not be started.
	0 = electronic is okay, set values will be accepted
2^7 : == 1;	

Digital value 1 (error indication high and low byte)

```
xxxx xxxx  xxxx xxxx
||||  ||||  ||||  ||||
||||  ||||  ||||  |||2^0 : voltage is too low
||||  ||||  ||||  |||2^1 : speed is too high
||||  ||||  ||||  |2^2 : (reserve)
||||  ||||  ||||  2^3 : I2t - error
||||  ||||  |||2^4 : reserve
||||  ||||  ||2^5 : initialisation is required
||||  ||||  |2^6 : voltage is too high
||||  ||||  2^7 : error power line
||||  |||2^8 : (PTC) temperature is too high
||||  ||2^9 : current error (Hardware)
||||  |2^10 : error encoder
||||  2^11 : reset electronic
|||2^12 : current error (total)
||2^13 : temperature of the inverter is too high
|2^14 : error checksum (program error !)
2^15 : current error (Software)
```

发生任何以上故障时电机都将自动停止。

这样就意味着在启动电机前所有的故障状态都必须通过置位该双字的0到32位，确认故障清除后还需将这些值复位为0。这些动作都是需要脉冲信号。

“voltage is too low 电压过低”：电容直流母线上的电压低于或者是曾经低于（566V DC）。

一般来说，可以在重新上电
(1140V AC) 后清除该故障。
(电容电压为1612V DC)。

“speed is too high” :

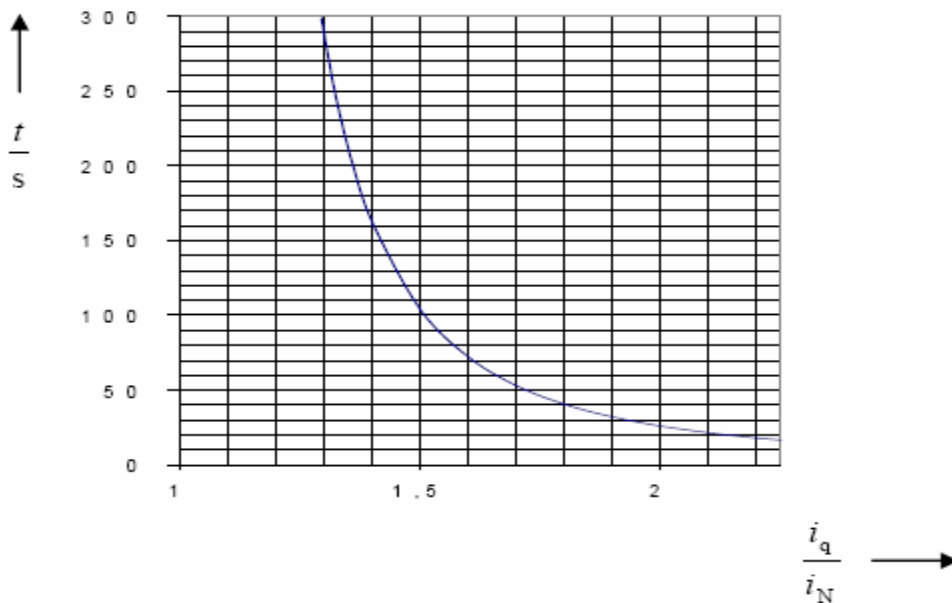
电机的实际速度值比（或曾经比）最高速度值高。

该故障可以在发生后立即清除。

“i2t故障”

该驱动器控制单元有一个内部监视电流过载的功能。

该故障可以在发生后立即清除。



“initialization is required” :

该驱动器的控制单元需要进行初始化。驱动器不处在预备启动的状态。可能是由于驱动器控制单元与PLC控制单元之间的通信问题（超时：驱动器控制单元在2秒之内没有收到指令报文！或者是没有收到参数报文。）

清除该故障是不可能的。这个故障在接收到参数报文后会自动清除。

“boltage is too high电压过高” 电容直流母线上的电压高于或者曾经高于2000V DC。

当电压低于2000V DC时可以清除此故障。

“error power line主电路故障”： 这个故障表示在1140V AC接通后接触器（位于预充电开关内）存在故障，该故障不能清除掉。一般地，这个故障会在主电路1140V AC切断并且充电电容电压高于566V DC 之后发生。

这个故障可以在发生后立即清除。

“PTC temperature is too high PTC 电阻温度过高”

电机内部的PTC 电阻温度过高（或者是曾经过高）。

这个故障可以在发生后立即清除。

“current error (hardware) 电流故障（硬件）”：

电机线圈电流过高或者IGBT 模块存在故障。这个故障可以在发生后立即清除。如果该故障无法清除，那么相应的组件就需要更换（IGBT 或者驱动板）“IGBT状态：actual-values-3”。

“编码器故障”： 电机编码器故障或者工作不正常。

这个故障可以在发生后立即清除。

“重启电子设备”

电机内的电子设备重启过。

这个故障可以在发生后立即清除。

“电流故障（总）”

当前存在电流故障。（请检查硬件或
软件故障）。

这个故障可以在发生后立即清除。

“temperature of the inv. is too high 变频器温度过高”：

变频器的温度高于70℃。

这个故障可以在温度低于70℃后清除。

“error checksum” 确认信息故障：

控制器内部的程序异常。

无法清除此故障。

“current error (software) 电流故障（软件）”：

电子设备曾遇到过很高的电流峰值。

这个故障可以在发生后立即清除。

驱动器电流/2 (%)

范围 (0-255) ; 1个字节

0-112对应0-255%

143-255对应 (-255) - (-1) %

这个字节显示驱动器线圈中的实际电流。

(1000kW: IN=690A)

电流设定值/2 (%)

范围 (0-255) ; 1个字节

0-122对应0-255%

143-255对应 (-255) - (-1) %

此参数对多台电机之间的转矩控制是非常重要的。如果希望实现转矩控制，必须将该“主机电流”发送给其他所有的从电机以使得从电机与主机电流相同。主电机该设定值必须为0（参阅“多台电机之间转矩控制”章节）。

总电流 (%) : 范围 (0-255) ; 1个字节

(0-255) =0-255%

$$= \sqrt{i_q^2 + i_d^2} \quad i_q = \text{active current}; \quad i_d = \text{reactive current}$$

Active current:有功电流

Reactive current:无功电流

电容电压 (%) :

范围 (0-255) ; 1个字节

1414V DC对应100%

速度实际值 (rpm) :

范围 (0-65535) ; 2个字节

ACTUAL VALUES-2

length = 46 (0x2e)	0x80	
telegram counter	identity = 32	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE-Status *1)	00	
anz.2=00	00	
digital value 2 high byte	digital value 2 low byte	
starting counter high byte	starting counter low byte	drive1
hour meter high byte	hour meter low byte	
minute meter	second meter	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

digital value 2 (status indication high + low byte):

```
xxxx xxxx  xxxx xxxx
||||  ||||  ||||  ||||
||||  ||||  ||||  |||2^0 : reserve
||||  ||||  ||||  |||2^1 : encoderless operation
||||  ||||  ||||  |2^2 : n > 0 (drive turns right)
||||  ||||  ||||  2^3 : n < 0 (drive turns left)
||||  ||||  |||2^4 : reserve
||||  ||||  ||2^5 : reserve
||||  ||||  |2^6 : reserve
||||  ||||  2^7 : reserve
||||  |||2^8 : stand-by
||||  ||2^9 : inverter start
||||  |2^10 : inverter start
||||  2^11 : reserve
|||2^12 : inverter start
||2^13 : reserve
|2^14 : reserve
2^15 : clear errors is active
```

“n>0” 电机转轴转向为顺时针。

“n<0” 电机转轴转向为逆时针。

“预备” 电机处于准备状态。

“变频器启动” 驱动器变频器部分正常工作。

“清除故障激活” 电机控制器收到了清除故障命令。

启动计数器:

范围 (0-65535) ; 2个字节

无论什么时候启动电机这个数字都会累加。

运行小时计时器:

范围 (0-65535) ; 2个字节

通过此参数可以知道电机控制器的运行小时数。

运行分钟计时器:

范围 (0-255) ; 1个字节

此字节显示电机控制器的运行分钟数。

运行秒计时器:

范围 (0-255) , 1个字节

此字节显示电机控制器的运行秒数。

ACTUAL VALUES-3 (temperatures 1)

```
length = 46 (0x2e)          0x80
telegram counter           identity = 33
00                          number of the electronic
ana = 00                   bin = 00
dig = 32 (0x20)            00
anz.1=KE status *1)       00
anz.2=00                   00
winding 1                  winding 2      |
bearing A                  bearing B      |drive1
cooling plate              inductor      |
PTC-value                  IGBT status  |
*                            |
*                            |drive2
*                            |
*                            |
*                            |
*                            |drive3
*                            |
*                            |
*                            |
*                            |drive4
*                            |
*                            |
```

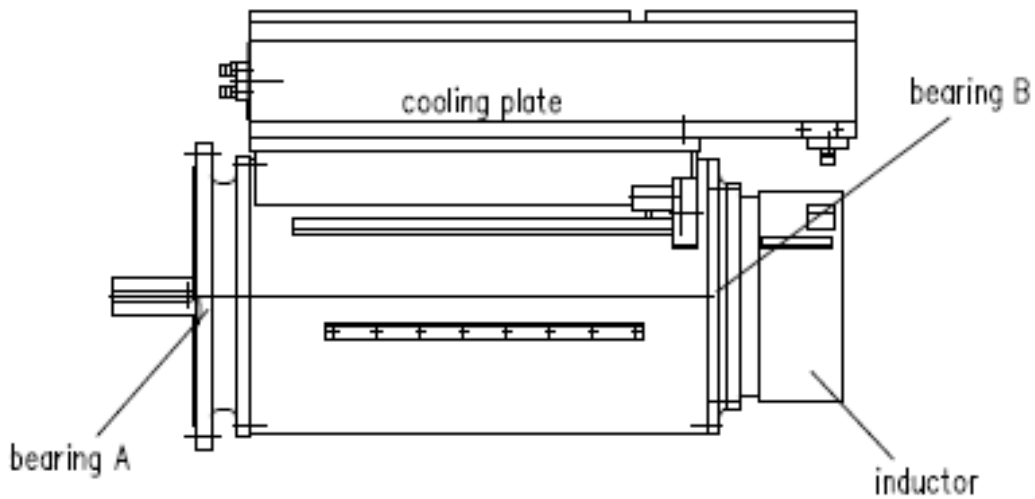
-----checksum-----

IGBT status (error indication) = 0: there is no problem

```
XXXX XXXX
|||| ||||
|||| |||2^0 : IGBT 1 - error
|||| ||2^1 : IGBT 2 - error
|||| |2^2 : IGBT 3 - error
|||| 2^3 : IGBT 4 - error
|||2^4 : IGBT 5 - error
||2^5 : IGBT 6 - error
|2^6 : reserve
2^7 : reserve
```

ACTUAL VALUES-4 (temperatures 2)

length = 46 (0x2e)	0x80	
telegram counter	identity = 34	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE status *1)	00	
anz.2=00	00	
reserve	reserve	
reserve	reserve	drive1
reserve	reserve	
reserve	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		drive4
*		
*		
-----checksum-----		



温度:

所有温度都是通过PT100元件测量并以°C为单位显示的。

通常可以使用这些值来显示电机驱动器的各部分的温度情况。如果这些温度值超过临界值（**推荐的温度最大值**），那么停止电机并且检查水冷系统是很必要的。否则有烧毁变频器（IGBT）的危险。

不要在没有冷却循环水的情况下运行电机，因为有可能导致电机变频器部分的IGBT 模块过热。驱动器本身有PTC元件来实现过热保护，但是这些元件并不能够很快的就探测到散热板上的快速温升。

这就是为何需要一直监视驱动器的所有温度点的原因。

重申一遍：当电机过热时停止及采取响应的保护措施是由客户实现的！

推荐的温度最大值

Recommended maximum values for the temperatures

winding	130 °C
inductor	130 °C
bearing (A and B)	100 °C
cooling plate (IGBT 1 - 6)	60 °C

无论如何，当电机过热时，用户一定要负责及时停机以保护电机。

ELECTRONIC IDENTITY

length=46 (0x2e)	0x80	
telegram counter	identity = 30	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE status *1)	00	
anz.2=00	00	
firmware type number	firmware number	
-----serial number-----		drive1
01	reserve	
00	reserve	
*		
*		drive2
*		
*		
*		
*		drive3
*		
*		
*		
*		drive4
*		
*		
-----checksum-----		

固件软件型号:

范围 (0-255) ; 1个字节

装载在电机控制器内的固件软件的型号

1000kW: Type66

固件版本号:

范围 (0-255) ; 1个字节

装载在电机控制器内的固件版本号

1000kW: Version 1

序列号: (高位+低位):

范围 (0-65535) ; 2个字节

电机控制器的序列号。

MEMORY DUMP

length = 46 (0x2e)	0x80	
telegram counter	identity = 39	
00	number of the electronic	
ana = 00	bin = 00	
dig = 32 (0x20)	00	
anz.1=KE status *1)	00	
anz.2=00	00	
address+0	address+1	
address+2	address+3	drive1
address+4	address+5	
address+6	address+7	
address+0	address+1	
address+2	address+3	drive2
address+4	address+5	
address+6	address+7	
address+0	address+1	
address+2	address+3	drive3
address+4	address+5	
address+6	address+7	
address+0	address+1	
address+2	address+3	drive4
address+4	address+5	
address+6	address+7	
-----checksum-----		

ERROR MEMORY

```
length =46 (0x2e)          0x80
telegram counter          identity = 50
00                         number of the electronic
ana = 00                  bin= 00
dig = 32 (0x20)          00
anz.1 = KE status *1)    00
anz.2=00                  00
last error                error before last error!
.. error                  .. error          ldrive1
.. error                  .. error          |
.. error                  .. error          |
*                          |
*                          ldrive2
*                          |
*                          |
*                          |
*                          ldrive3
*                          |
*                          |
*                          |
*                          ldrive4
*                          |
*                          |
----- Blocksicherung -----
```

error numbers

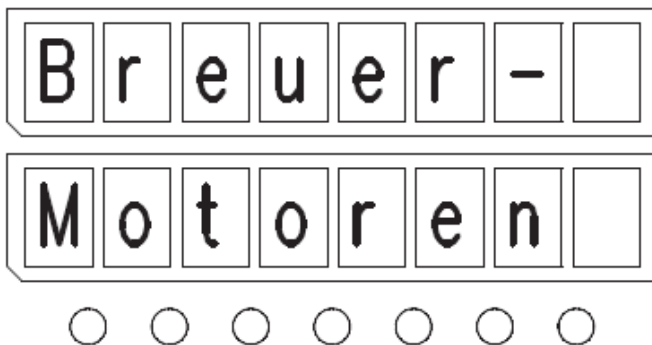
```
0: checksum error
1: temperature of the inverter is too high
2: voltage of the capacitor is too low
3: (reserve)
4: encoder error
5: current is too high
6: temperature is too high
7: electronic error
8: error power line
9: drive speed is too high
```

控制器单元显示:

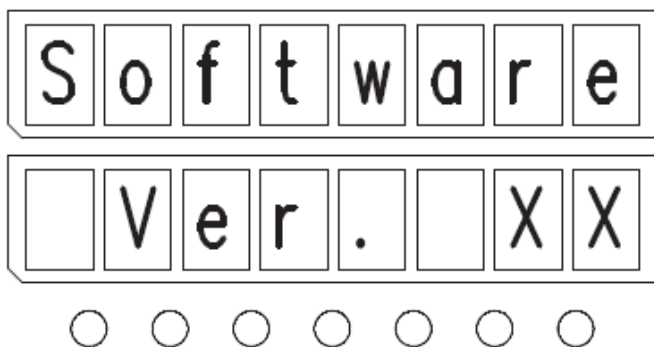
控制器显示窗口显示了变频一体电机的状态以及故障信息。显示屏为 2 行，每行显示 8 字符。在第二行下有 7 个 LED 显示灯。这些 LED 显示灯显示了不同的变频器的功能，如下:

L1 (黄)	~127V –mains
L2 (绿)	+24VDC –bus
L3 (绿)	+16VDC –driver
L4 (绿)	+7VDC –supply PC
L5 (绿)	+15VDC –电流/电压互感器
L6 (绿)	-15VDC –电流/电压互感器
L7 (绿)	+15VDC 旋转编码器

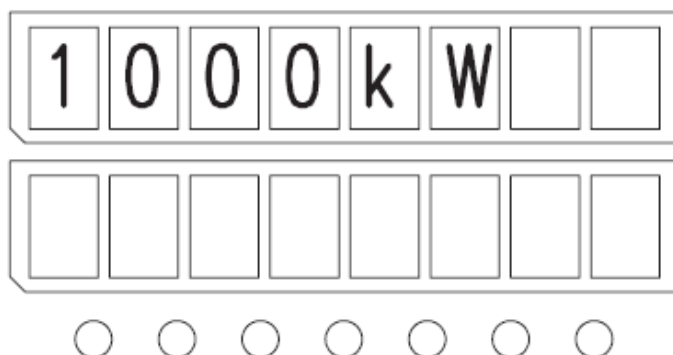
在给控制器接通电源 (127V) 后以下字符将会显示:



5 秒钟之后可以读取到当前软件的版本号 (xx=版本号)。



5 秒之后，底层固件软件的版本将在第一行显示。(e.g.:1000kW B; 250kW)



现在显示部分已经准备好，并且将开始显示状态和故障信息。如果当前没有故障，那么在显示屏的第二行可以看到一个闪动的点。这个点表示了控制器中的微型控制器的功能。

如果控制器在显示电机的故障或状态信息，那么这些信息可以在显示屏的第一行读取。

显示屏上信息的含义：

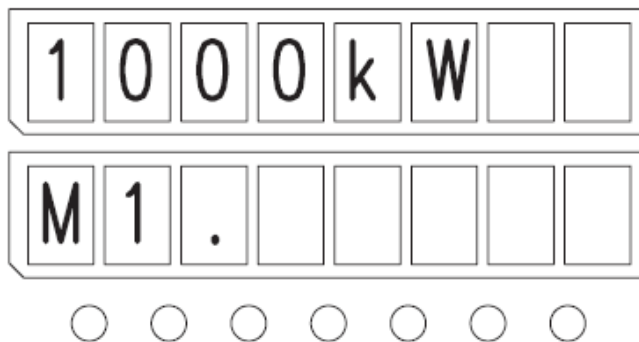
offline: 在外部控制系统和电机之间没有通讯。

online: 外部控制系统和电机之间通讯正常。但电机控制器还未接收到参数报文。

如果显示屏上的信息由“active”转为“online”那么就表示电机已经超过 2 秒未收到设置报文。

active: 数据通讯正常,电机已经接收到了参数报文并且正在接收设置报文。

如果当前不存在电流故障,那么电机信息将在第二行显示。



M1= 一号驱动电机

M2= 二号驱动电机

M3= 三号驱动电机

M4= 四号驱动电机

Low volt: 电机充电电容的直流母线电压低于 565.6V

原因: 主回路未送电。

speed !: 电机实际轴速度高于设定的最大速度。

voltage: 控制器供电电压欠压。

I-t!: I²t-故障

原因：电机电流长时间过高（过载故障）。

High vol: 电机充电电容的直流母线电压高于 2000V。

P. LINE: 接触器的状态。

PTC: 电机温度过高

current: 电流太高/某个 IGBT 模块故障*)

*)

如果 IGBT 模块存在故障，那么在显示屏第二行会显示出存在故障的 IGBT 模块的序号。

encoder: 电机的编码器存在故障

temp.inv: 变频器部分的温度太高

checksum: 底层固件软件故障。

reset: 控制器完成过一次重启动作。

- right:** 运行模式被设置为 1
 从轴侧观看，转向为顺时针
- left:** 运行模式被设置为 2
 从轴侧观看，转向为逆时针

更改:

- 21/22 页: Power limiter in %
- 27 页: load factor, load limit 1+2
- 28 页: start delay

BREUER) MOTOREN

contract
document



CERTIFICATE

- (1) **about acknowledgement of quality assurance production**
- (2) - Directive 94/9/EC -
Equipment and protective systems intended for use in potentially explosive atmospheres
- (3) Certificate number: **BVS 09 ATEX ZQS/E154**
- (4) Product category: **Electrical equipment and devices, equipment-groups I and II, categories M1, M2, 1 and 2: Motors**



- (5) Manufacturer: **Breuer-Motoren GmbH & Co. KG**
- (6) Site of manufacture: **Rensingstraße 10, 44807 Bochum, Germany**
- (7) The certification body of DEKRA EXAM GmbH, notified body N° 0158 in accordance with Article 9 of the Directive 94/9/EC of the European Parliament and the Council of 23 March 1994, certifies that the manufacturer has a production quality system, which complies with Annex IV of the Directive. In the updated annex all equipment and protective systems and their certificate numbers are listed.
- (8) This certificate is based on audit report ZQS/E154/09, issued 2009-04-03 and is valid until 2012-02-25.
This certificate can be withdrawn if the manufacturer no longer satisfies the requirements of Annex IV.
Results of periodical re-assessments of the quality system are a part of this certificate.
- (9) According to Article 10 (1) of the Directive 94/9/EC the CE marking shall be followed by the identification Number 0158 of DEKRA EXAM GmbH as notified body involved in the production control stage.

DEKRA EXAM GmbH

Bochum, 2009-04-03

Certification body

Special services unit

This is a translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

Page 1 of 1

SGS

Certificate DE04/52778

The management system of

Breuer Motoren GmbH & Co. KG

Rensingstr. 10

DE-44807 Bochum



has been assessed and certified as meeting the requirements of

ISO 9001:2008

For the following activities

Development, Production, Maintenance of Flame and Pressure Proof and none Flame Proof AC-Motors and Variable Frequency Drives as well as Electronic Components for their control

Further clarifications regarding the scope of this certificate and the applicability of ISO 9001:2008 requirements may be obtained by consulting the organization

This certificate is valid from 15/11/2010 until 14/11/2013
Issue 3. Certified since 16/11/2004

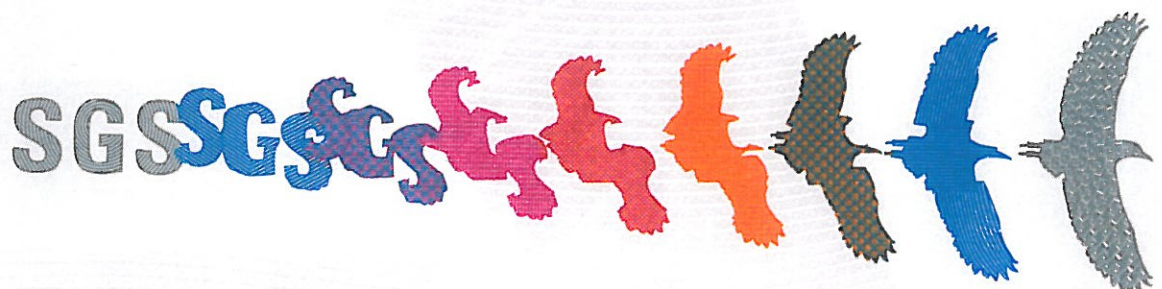
Authorised by

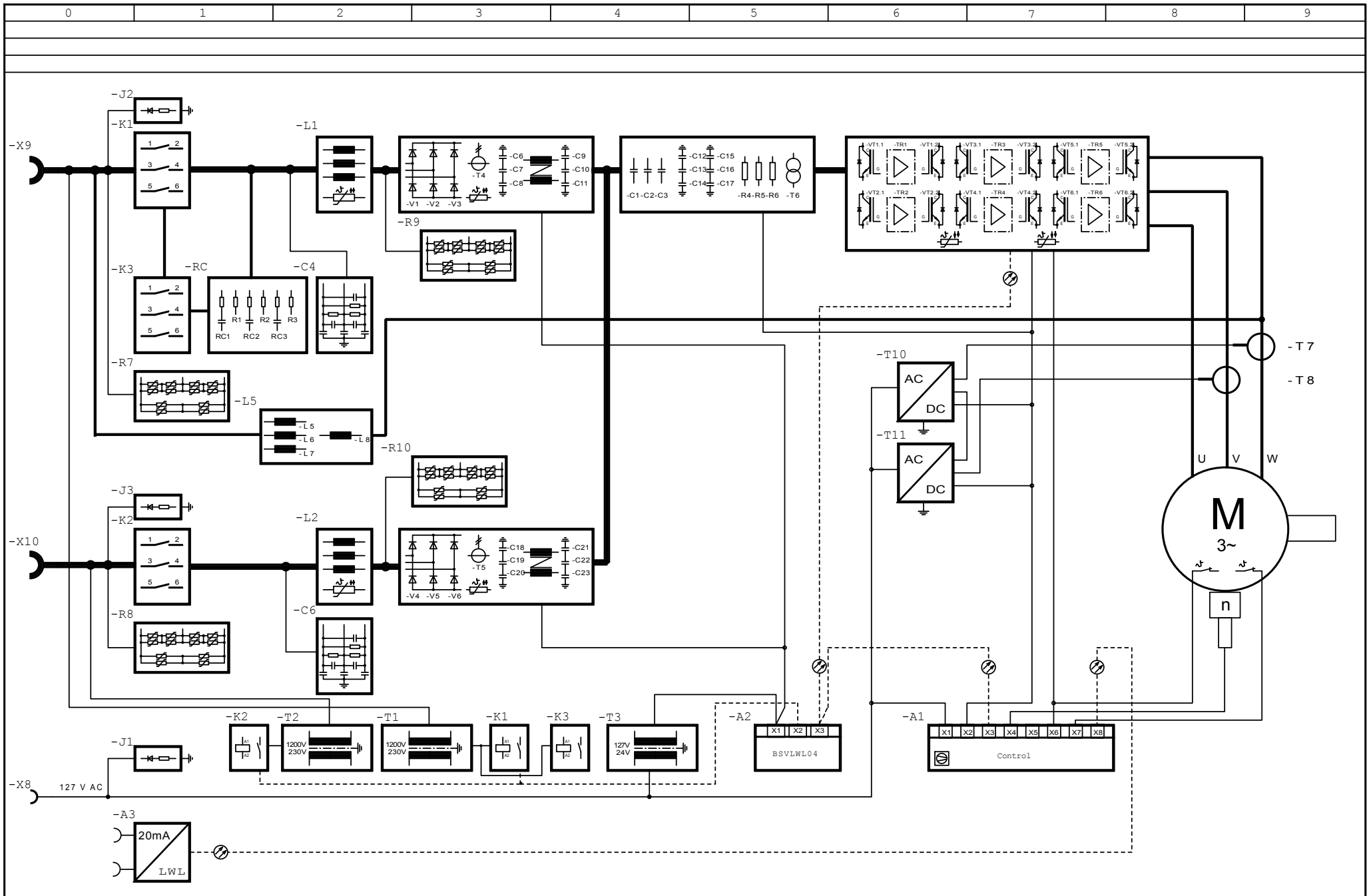


SGS-International Certification Services GmbH
Raboisen 28 D-20095 Hamburg (Germany)

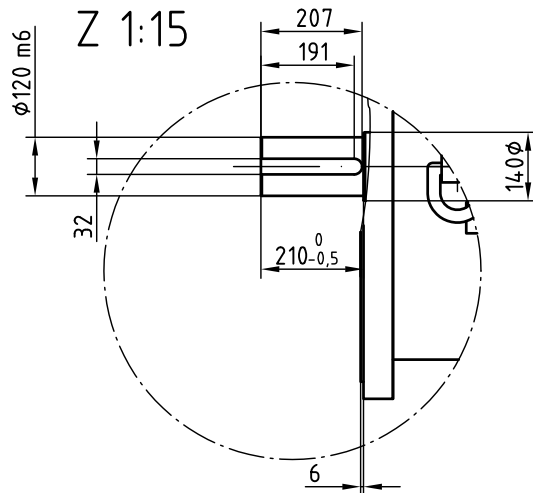
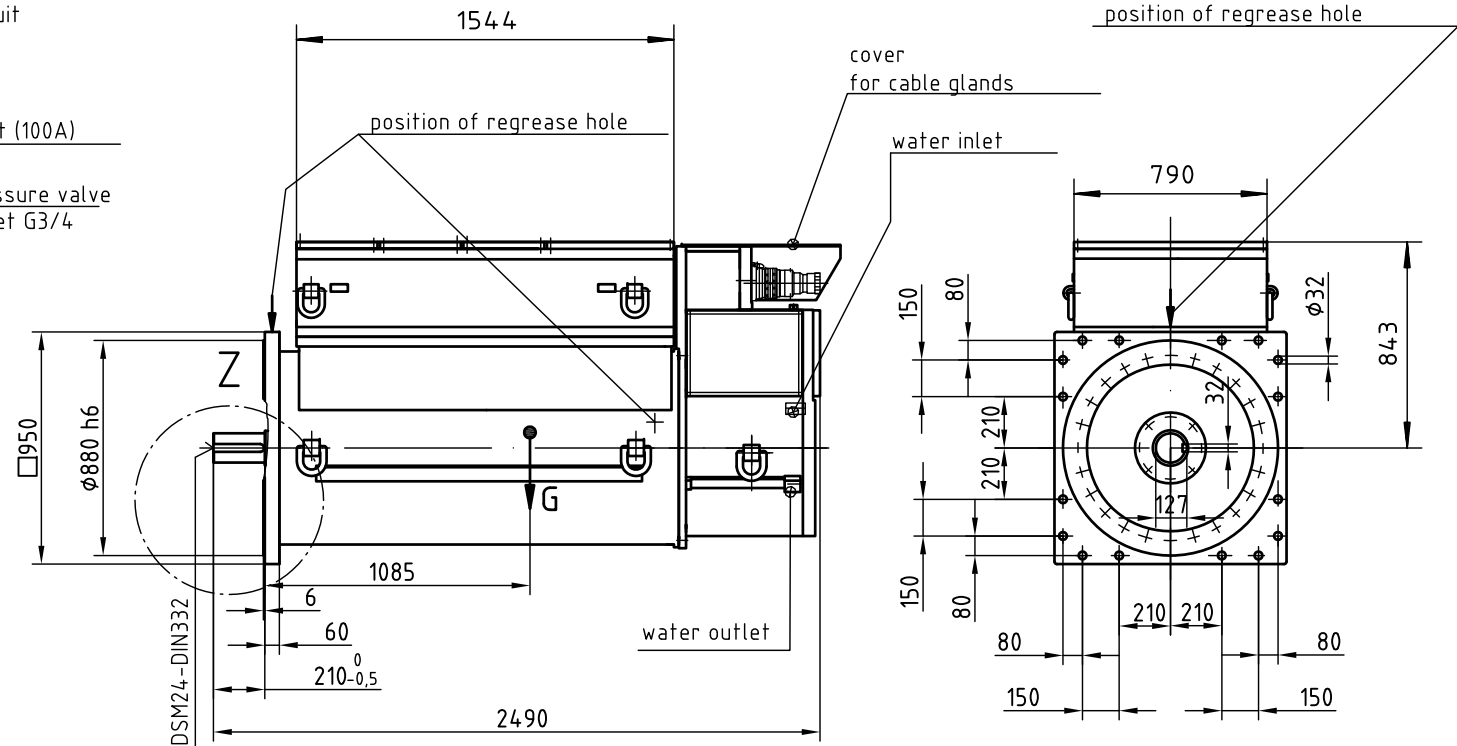
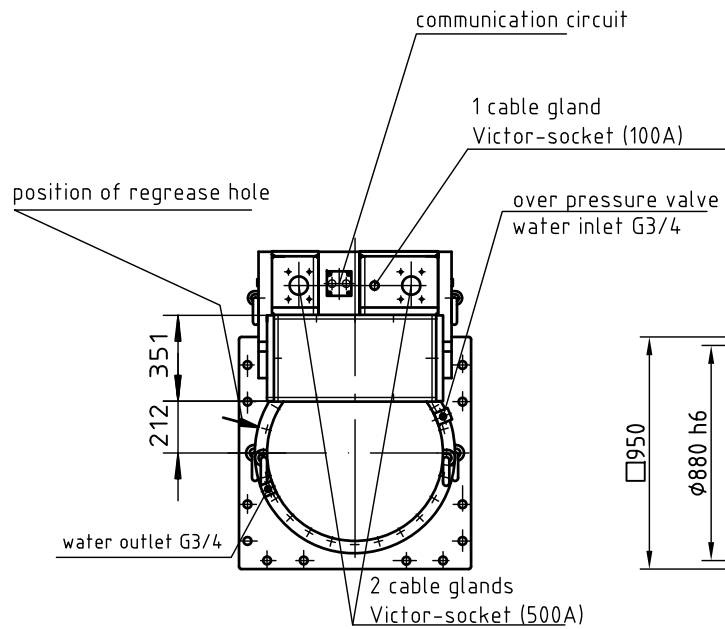
t +49 (0)40 30.101.361 f +49 (0)40 33.04.08 www.de.sgs.com

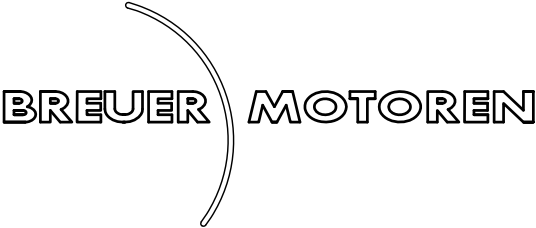
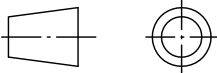
Page 1 of 1





				date	16.04.2012	ZHANGJIAKOU COAL MINING		Breuer Motoren		layout	customer-no.:	=	
				worker	Wieczorek	VFD motor dksWa72UM/4-4;1020kW		competence since 1877				+	
				check	Hellinger						equipment:	drawing-no:	sheet 1
state	change	date	name	norm	root	create for					dksWa72UM/4-4	072-1016767-09-04 E	of 12 sh.



Code-No:		dksWa72UM/4-4			
Material:		1020kW, 1140V			
Scale: 1:30		General tolerances as per ISO 2768 m H			
Signed 22.03.2011		Niestrath			
Date		Name			
Revie.					
A.V.					
Designation		VFD-motor		Drawing-No.	
				A072-00-E0-068	
Compass-Nr: ENG-024344		PDF erstellt 0		Blatt A4	