EN

DriveStar

A-DS 006.1 - 075.1

Operation Manual

Servoconverter

6 A - 75 A

LUST

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Operation Manual

Article: No. 181 - 00611

Issue: Date: 07.2004

Note: Technical data subject to modification without notice.

1 General

1.1 After-sales service

Note: Before consulting the after-sales service, please provide the following data:

1. customer
2. Manufacturer of the system
3. Type designation of the unit
4. Order-Ref.-No. of the unit
5. Fabrication-No. of the unit
6. In case of service requirement: brief description of the fault
7. If possible, parameter set and software version.

This measure saves unnecessary identification works and further inquiries.

The address for Service and Replacement Parts Sales is as follows:

Service adress

LUST DriveTronics GmbH

Hansastraße 120

D-59425 Unna

Telephone: +49 (0) 2303 779-0

Telefax: +49 (0) 2303 779-440

Should you require a Service Engineer, then please contact our ”Technical Service Department” at the above address.

1.2 Packing

The type of packing is dependent on the method of transport and the quantity of items to be supplied. The symbols applied to the packing must be observed.

1.3 Delivery condition

The servoconverter is supplied as fully assembled within a housing. The unit is tested for electrical function and is preset prior to shipment. The settings can be found on the accompanying customer-specific list as well as the parameter list.

1.4 Sensitivity

As theservoconverter is an electronic assembly, special care must be taken in transportation so as to prevent damage through impact or careless loading or unloading.

Both impacts and any large fluctuations in temperature which could lead to the generation of condensation water should be avoided.

1.5 Storage

The servoconverter should only be stored in a dry room in which no condensation water can generate within the servoconverter.

When not operating the converters for a longer period of time, the D.C. link capacitors have to be formated.
With a storage time of one year, no measures have to be taken. After that time, a formatting time of one hour per storage year has to be added, during which the connected controllable mains voltage rises in 4 steps over 30 minutes each up to the nominal value.

1.6 Items supplied

The delivery should be checked on receipt to ensure that nothing is missing. Compare the content with the pertinent packing list. Any transportation damage and/or missing parts should be reported immediately in writing.

1.7 Maintaining stocks of replacement parts

A stock of the most important replacement and wearing parts is crucial for the continuous operation and availability of the unit.

We can only guarantee original replacement parts supplied by ourselves. We would expressly point out that the fitting and/or use of original replacement parts not supplied by us may have an adverse effect on the design characteristics of the unit and may therefore reduce active and/or passive safety.

LUST DriveTronics GmbH cannot provide any guarantee whatsoever for damage caused by the use of non-original replacement parts and accessories.

Please note that special manufacturing and supply specifications often apply to our own and externally-sourced parts and that we will always offer you replacement parts which conform to the latest technical standards and the latest regulations.

To avoid servicing problems, we recommend that you purchase complete replacement subassemblies or have faulty subassemblies tested and repaired by **LUST DriveTronics GmbH**.

For a quick handling and settlement of spare parts orders, the unit data must be known. Particularly refer to variants as per the customer's specification. Please attach a copy of the unit accompanying list to your spare part order.

The following information must be given

- Order No.
- Type
- Fabrications - No.
- Item number and name of replacement part
- Trimming data (Unit accompanying list)
- Quantity ordered

1.8 Hints for waste management

LUST DriveTronics GmbH - servoconverter contain electronic components. After their utilization they must not be thrown to the normal houshold rubbish, but must be put to the **electronic scrap**.

For the environmentally friendly waste management please consult the local Environment Authority.

2 Technical data

2.1 Performance data

Type of device	A-DS 006.1	A-DS 012.1	A-DS 020.1	A-DS 035.1	A-DS 045.1	A-DS 055.1	A-DS 075.1
Regulator supply	24V DC ±20%, 1,5A to 2,5A depending on the load of the digital outputs Starting current 3A - 4A for 1,5 sec.						
DC link voltage	325V to 625V DC +10%, Peak voltage with brake operation up to 690V						
Output voltage (motor side)	3 x 0V to mains voltage AC						
Clock frequency of output stage	2 kHZ to 14 kHz with current reduction, nominal data with 4kHz (*1) (*2)						
Operating height	up to 1000m without reduction from 1000 m per 100 m height 1% output reduction max. operation height 4000m						
Operating temperature	0 to 40°C with nominal load, > 40°C to 55°C with reduced load, load reduction 2% / °C						
Humidity class	G (no bedew)						
Storage temperature	- 25°C to + 70°C						
DC link capacity	705 µF			1500 µF		1000 µF	
Nominal output current with 4 kHz switching frequency (*1)	6A eff	12A eff	20A eff	35A eff	45A eff	55A eff	75A eff
Pulse current (3sec on / 10sec pause) limited by I^2t-monitoring (*2)	12A eff	24A eff	40A eff	70A eff	70A eff	110A eff	150A eff
Motor nominal output with asynchronous motors up to:	2,75 kW	5,5 kW	11 kW	18 kW	22 kW	27 kW	37 kW
Digital inputs	8 Opto-coupling, 24V DC (10V to 30V DC)						
Digital outputs	8, Opto-coupling - transistor 24V, 125mA, max 0,5A sum current max. 1A						
Analog inputs	2 Setpoint inputs, differential inputs, ±10V						
Analog outputs	2 Monitor outputs, ±10V, 1,5mA, R_i>6,8kΩ, output quantity freely programmable						
Auxiliary voltages from the servoconverter	±10V, 5mA / 24V DC, 100mA						
Sensor system	Resolver, optionally ROD 426 incremental encoder, high-resolution sensor, e.g. ERN 1387 or absolute value encoder e.g. EQN 1325						
Encoder output (encoder simulation)	Pulse amplitude: 3V, Standard: 1024 increments, other number of increments on request						
Apparent power of unit with mains voltage 3 x 400V	3,9 kVA, maximum 3sec = 7,5 kVA	7,8 kVA, maximum 3sec = 15 kVA	13 kVA, maximum 3sec = 26 kVA	23 kVA, maximum 3sec = 46 kVA	30 kVA, maximum 3sec = 60 kVA	36 kVA, maximum 3sec = 72 kVA	49 kVA, maximum 3sec = 98 kVA
Power loss	approx. 150W	approx. 250W	approx. 350W	approx. 450W	approx. 500W	approx. 550W	approx. 650W
Motor protection	PTC, evaluation via encoder plug, I^2t - monitoring						
Converter protection	Overtemp. protection, overvoltage protection, overcurrent protection, braking chopper, Short circuit: Cable/ground, short circuit: Cable/cable						
Weight	6,5 kg	6,5 kg	6,8 kg	9,5 kg	9,5 kg	13 kg	13 kg
Dimensions (HxWxD)	362 x 85 x 258			362 x 155 x 258		423 x 185 x 258	

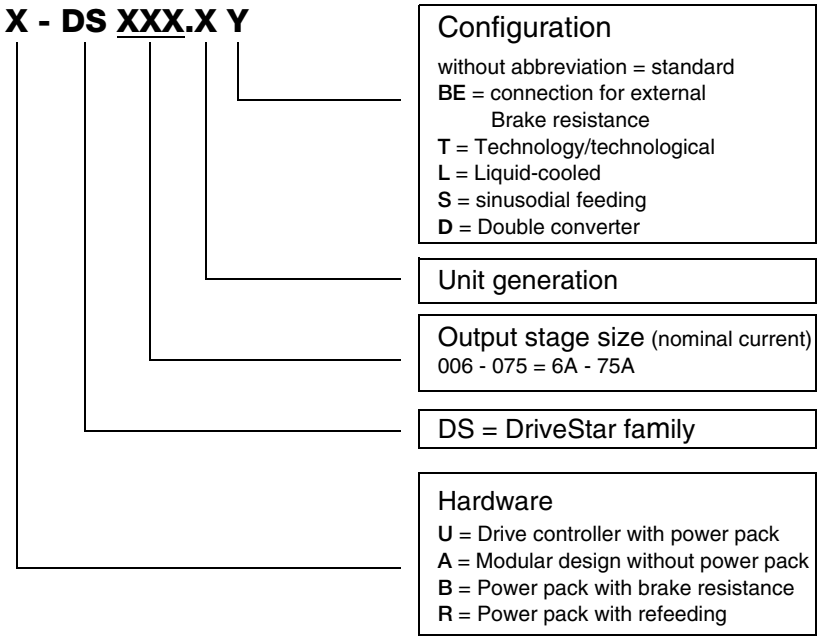
Table 2.1 Performance data

Remarks:

(*1) The technical data specified are based on a pulse frequency of 4 kHz. In the case of operation without pulse currents the specified nominal current is increased by 7%. A 1 kHz reduction in pulse frequency increases the nominal current by 5% respectively. A 1 kHz increase in pulse frequency reduces the nominal current by 5% respectively.

(*2) On average in 10 min. the I_{nom} must not be exceeded

2.2 Key to types



2.3 Device views

2.3.1 A-DS 006.1 - A-DS 020.1

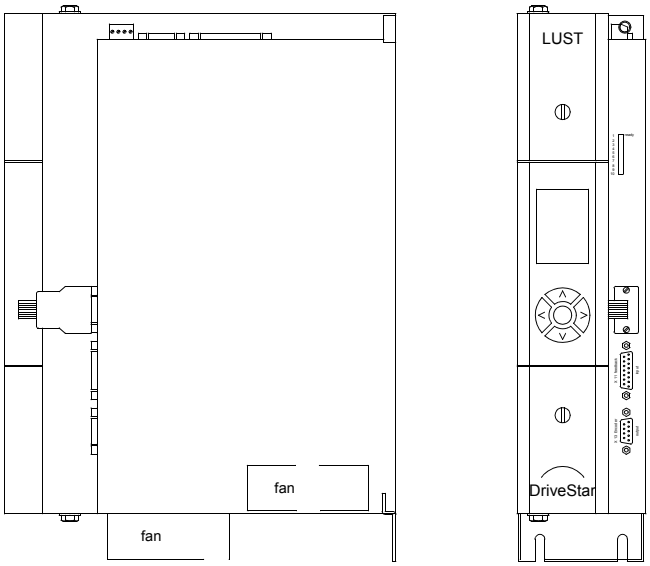


Fig. 2.1 B11-062 A-DS 006.1 - A-DS 020.1

2.3.2 A-DS 006.1 - A-DS 020.1 with technological card

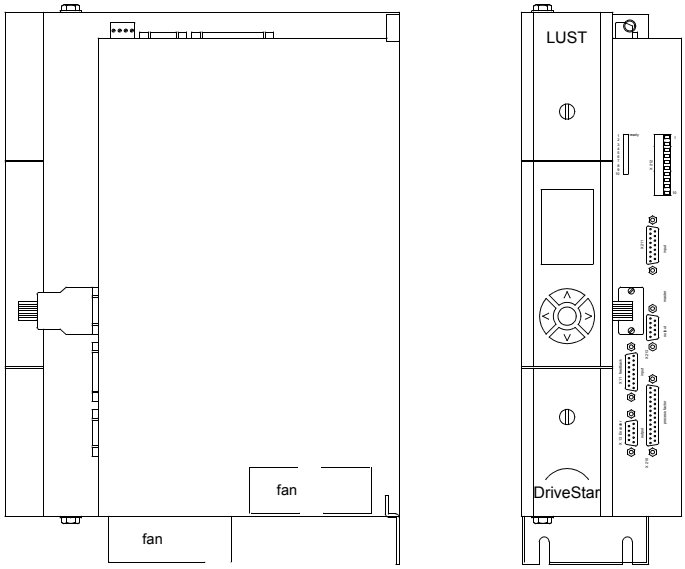


Fig. 2.2 B11-063 A-DS 006.1 - A-DS 020.1 with technological card

2.3.3 A-DS 035.1 / A-DS 045.1

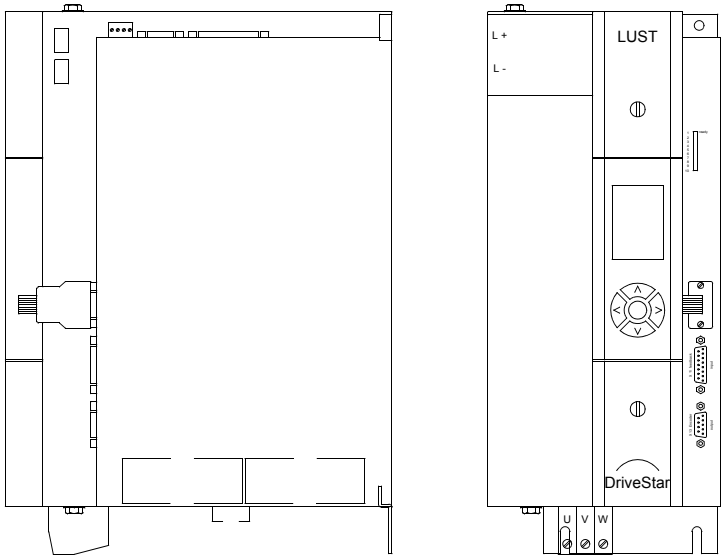


Fig. 2.3 B11-055 A-DS 035.1 / A-DS 045.1

2.3.4 A-DS 035.1 / A-DS 045.1 with technological card

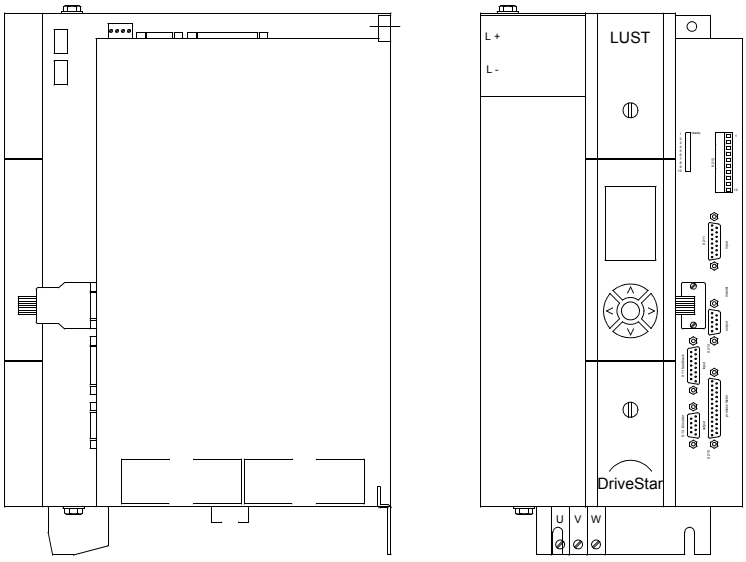


Fig. 2.4 B11-056 A-DS 035.1 - A-DS 045.1 with technological card

2.3.5 A-DS 055.1 / A-DS 075.1

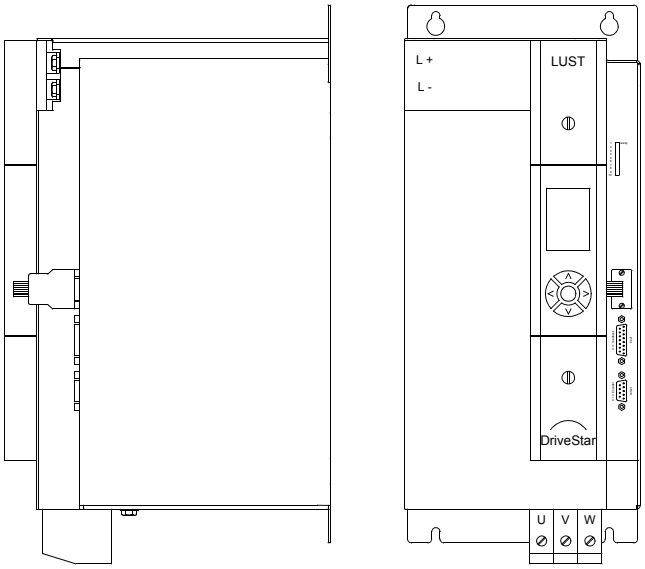


Fig. 2.5 B11-057 A-DS 055.1 / A-DS 075.1

2.3.6 A-DS 055.1 / A-DS 075.1 with technological card

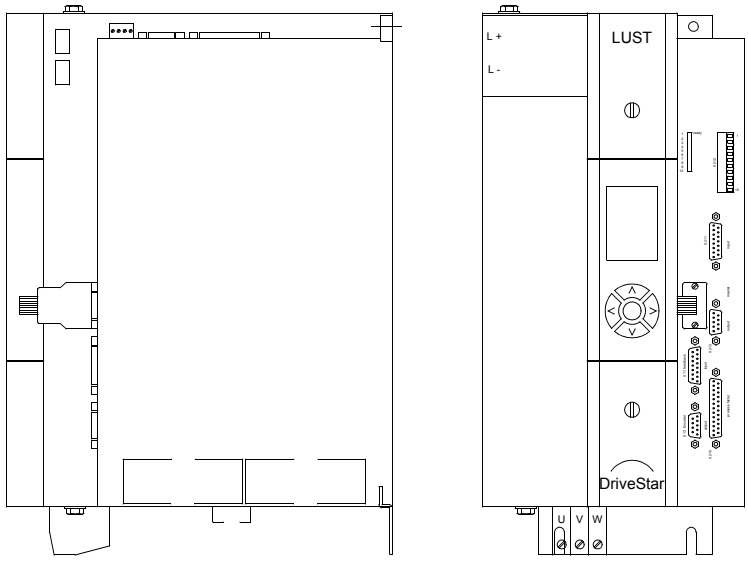


Fig. 2.6 B11-56 A-DS 055.1 - A-DS 075.1 with technological card

2.4 Applications and intended use

The servoconverter of series **DriveStar** are used for low-loss continuous speed and torque regulation.

DriveStar servoconverter are intended for the operation of:

- synchronous motors made by **LUST DriveTronics GmbH**.
- asynchronous motors with actual speed by **LUST DriveTronics GmbH**.
- asynchronous motors without actual speed by **LUST DriveTronics GmbH**.

Other motors must only be used when clearly authorized by **LUST DriveTronics GmbH.**

Adhere to the motor service instructions.

Theservoconverter **DriveStar** must be used only under the prescribed service conditions *(see chap. 8, Commissioning / Operation)*.

The specified fitting, removal, commissioning and maintenance instructions must also be observed.

Caution: Failure to observe such instructions or any usage over and above the specified applications will be deemed to be improper use. The manufacturer will not be liable for any damage caused by such actions and the user will bear sole responsibility in such cases.

In particular this applies to the operation of other electric units than described above.

Limited availability to EN 61800-3:

The sale of this servoconverter is restricted to dealers, customers or users who, individually or jointly possess technical EMC know-how regarding the implementation of electrical drives.

If the unit is to be used for purposes other than this agreed area of application, then the customer should seek the advice of **LUST DriveTronics GmbH** Service, as otherwise the warranty will be invalid, for address *(see chap. 1.1, After-sales service)*.

2.5 Operating conditions

The guidelines given in VDE 0160 and IEC 68, apply to the operating conditions which must be maintained for the proper operation of the amplifier module. The most important specifications are:

The most important specifications are:

• protection class	IP 00
• humidity class	G
• vibration test	VDE 0160 PKT. 7.2.2
• storage temperature	- 30°C....+ 70°C
• Temperature range	0...40°C with nominal load > 40°C.....55°C load reduction 2% pro °C

2.6 Conformity / Standards

The servoconverter are designed in accordance with the guidelines contained in:

- EN 50178 (VDE0160)
- EN 60204-1 (VDE 0113)
- EMV-product standard EN 61800-3

In this respect the following printed matter should be additionally observed:

- **EMV-instructions Nr. 180-00 000 byLUST DriveTronics GmbH**
- **the operating manuals of the motor manufacturers**

This document only describes the standard version of the servoconverter A-DS 006.1 - 075.1 with standard software.

The separate operating manuals should be observed in the case of customised software or when implementing additional communication or technology cards.

3 Safety information

3.1 Symbols

These symbols denote the safety instructions in this manual which deal with danger to life and limb of personnel. These instructions must be adhered to and particular caution exercised in these cases.
All users must be familiarised with the safety instructions.

Caution: Warning of general dangers.
Incorrect operation may lead to damage or malfunction.

Danger: Danger - electric current!
Incorrect conduct may endanger human life

Danger: Danger – moving parts!
Drive may start to run automatically

Note: Useful hint or
reference to another text section in this document.
Useful hint or reference to another text section in this document.

Note: Reference to another document with important hints on this subject.

3.2 Instructions caution

The term “instruction caution” denotes those sections in this manual which require particular attention so as to ensure that the guidelines, requirements, information and proper sequence of operations are adhered to and that any damage to the servoconverter is prevented.

3.3 Safety instructions for working

The herein described units carry electric voltage and control rotating, mechanical parts. The instructions of this service manual have to be adhered to; non-adherence can lead to death, strong bodily injury or considerable damage to property.

Caution: Electrical units contain the source of danger.

This unit may present certain dangers if for example it is used improperly by untrained personnel or for other than the intended purpose.

All persons in the user's company who are involved in the fitting, removal and refitting, commissioning, operation and maintenance (inspection, servicing, repairs) of the servoconverter must be properly authorised, trained and qualified electricians within the meaning of **VDE 0105**. They must have read and understood this manual in full, paying special attention to the safety instructions.

The leaflet No. 180-00 00 ”EMC-notes” by **LUST DriveTronics GmbH** is integral part of this service manual.

We do not accept liability for damage or malfunctioning, resulting from non-adherence to this manual.

No operational practice should be used which could adversely affect the safety of the servoconverter.

The user must notify the supplier immediately of any changes which occur to the servoconverter, which would adversely affect safety *(see chap. 1.1, After-sales service)*.

The servoconverter is designed exclusively for its intended usage.

We reserve the right to implement technical changes necessary to improve the servoconverter relative to the information provided in these operating instructions.

We recommend that these instructions be included as an integral part of the user’s operating instructions.

Mounting and electric connection

Caution: Be particularly careful on mounting. Assure that no drilling chips, metal dust or mounting particles (screws, nuts, cable sections) are falling into the unit.

The safety systems used must be tested after any electrical fitting operations or electrical maintenance operations (e.g. earthing resistance).

VDE requirements

In all cases the applicable VDE requirements and all regional and local safety and accident prevention regulations will apply to use of this unit. The user must ensure that such regulations are adhered to.

The DC link voltage level must be taken into account during installation, especially in connection with insulation and safety measures. Care must be taken to ensure proper earthing, conductor dimensions and protection against short circuits.

servoconverter contain electrostatic-hazardous components. To avoid damage, assure that the own body is electrically discharged before and during any works at the servoconverter. It is recommended to wear protective shoes or wrist bands.
Discharging of the own body by touching conductive earthed units, only offers a short-time protection against electrostatic breakdowns and destructions.

EMV

servoconverter are components. The manufacturer of the system or machine has to adhere to the EMC-regulations.
Hints for EMC-suitable installation (lubrication, cable conduct, filter) are given in the leaflet:

- **EMV-instructions No. 180-00 000 by LUST DriveTronics GmbH.**

3.4 Operation and maintenance

The user must declare that he will only operate the servoconverter in a proper condition at all times.

No independent conversions or changes such as would affect safety are permissible, nor is the use of non-original accessories / components.

The DC link of the servoconverter charges up to maximum 690 V in relation to the connected mains voltage. This voltage is present at the output terminals **L+** and **L-**.

servoconverter must be operated in closed condition only. Operation without housing is forbidden!

servoconverter may still have dangerous voltages for up to 6 minutes after disconnection (residual capacitor charge).

Before carrying-out any maintenance works, it is therefore absolutely necessary to assure and to check that the current supply has been disconnected, made safe and that the D.C link is discharged.

Also assure that the external voltage supply of the regulator (24V) is disconnected.

Only perform work in the vicinity of the machine if the AC supply, resp. DC supply, is disconnected and made safe. Circuitry safety devices or disconnection of the enable function are no suitable inhibits and may lead to unintended movements of the drive if a fault occurs.

Perform commissioning operations with unloaded motors so as to avoid any mechanical damage, e.g. through incorrect direction of rotation.

Electronic equipment is not inherently fail-safe. The user must ensure that should the servoconverter fail his system will be switched to a safe condition.

4 Construction of unit and method of operation

4.1 Block diagram

The following illustration shows the basic design of the servoconverter as a block diagram.

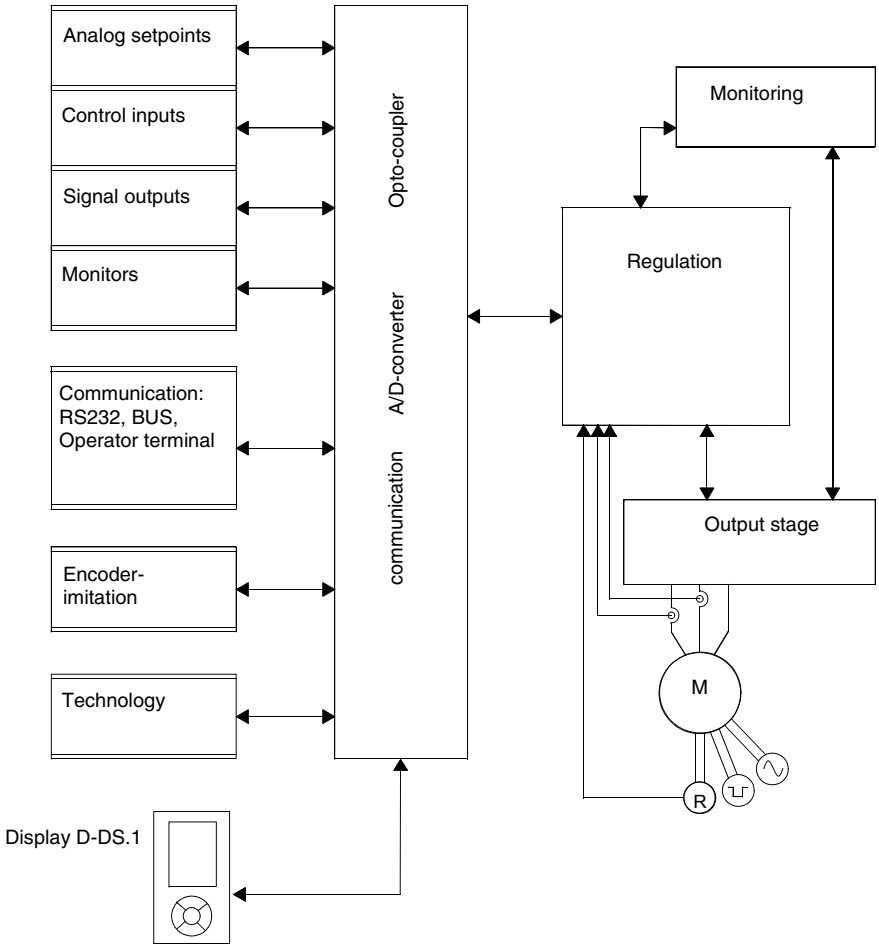


Fig. 4.1 B12-002 Block diagram

4.2 Method of operation

The servoconverter **DriveStar** are fully digitalised. They were designed for driving synchronous and asynchronous motors.

The output currents are sinusoidal and are controlled in pulse width modulation. The switching frequency is at 2 - 14kHz.

The servoconverter operates digitally with a regulation processor in a VeCon-chip having a cycle time of less than 62 µs.

Communication and operation are controlled through a 16 bit processor, which is integrated in the VeCon-chip.

Together the two processors form an ASIC (Application Specific Integrated Circuit), allowing optimum regulation characteristics, highest dynamics and a simple menu-guided operation.

The strict splitting of duties of the micro processors allows the linkage of complex technological regulations and customers' specific software.
I.e. same hardware with different regulation and technology duties.

DriveStar units are suitable for:

- Regulation for synchronous drives
- Regulation for asynchronous motors with detection of current vectors by a calculated flux (field-orientated regulation for asynchronous motors).
  In both cases the high regulation expenditure results in three phase drives requiring less maintenance having the behaviour of d.c. drives.
- Regulation for standard asynchronous motors as frequency converters and speed converters.

In relation to the type of regulation (synchronous/ asynchronous) the motor sensor can be a resolver, an incremental encoder, a high-resolution encoder or an absolute-value encoder.

4.3 Important characteristics

Overview of the main features of the **DriveStar** devices:

- Compact construction
- Low-loss IGBT output stage
  (2 kHZ - 14kHz with current reduction, from 4kHz)
- Sinusoidal output currents through vector modulation
- Excellent evaluation of resolver or incremental encoder signals
- Evaluation of high-resolution sensors (sine/cosine tracks)
- Encoder imitation, 1024 pulses/rev.
  (other resolution on request)
- Type of regulation: Synchronous, asynchronous, asynchronous field-orientated by software
- 2 freely-programmable analog monitors
  (e.g. speed, current, angle of rotation)
- Setpoint integrator with 4 separately-programmable ramps + quick stop ramp
- I^2t current reduction with signal
- Output signals n > n1, $n_{set} = n_{act.}$, n > 0
- Display of operational status via LEDs
- Simple menu-guided operation
- Display of all operational states and faults in plain text
- Comprehensive communication concept, RS 232 as standard, RS 485 or BUS-systems, e.g. Interbus-S, Profibus-DP, CAN-BUS as an option
- Integrated technology regulations optionally, e.g. positioning, flying saw, synchronization, winding
- Integrated display for diagnosis and parameterisation

All inputs and outputs for control purposes are electrically isolated via opto-couplers (level 10V-30V). This allows a simple reprocessing by stored-program controllers and CNC control systems.

Safety systems

The servoconverter **DriveStar** possess safety systems for monitoring of:

- Overcurrent, short-circuits and shorts to earth (UCE-measuring)
- Overspeed
- Evaluation of motor PTC thermistor
- Output stage temperature
- Overvoltage and undervoltage
- Supply voltage faults

In the event of a malfunction the controller is inhibited and standby mode switched off.

4.4 Visual signals

The most important status and fault signals are displayed by LEDs.

The LEDs have double functions.

- permanent light: status signal
- flashing light: fault signal

Note: The co-ordination of status and fault signals only applies to the standard software. With special software provided by the customers or with technological software (positioning, synchronization, etc.) adhere to the separate service manual.

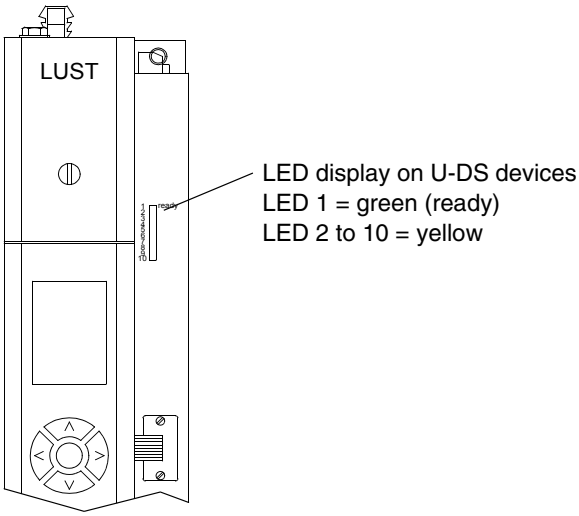


Fig. 4.2 B11-015 status LED´s

LED	Permanent light (status signal)	Flashing light (fault signal)
1	"Ready" signal	Acknowledgement with controller enable
2	Output stage enable	Overspeed
3	Controller enable	free
4	Setpoint integrator enable	Computer fault
5	C-axis-operation	Overtemperature motor
6	I^2t-signal	Short-circuit or shorts to earth on output stage
7	Release the brake (n > 0)	Encoder fault
8	n > n1	Fault supply voltage
9	$n_{act.} = n_{set}$	Overvoltage and undervoltage
10	free	Overtemperature on output stage

Table 4.1 Status LED´s

5 Planning information

5.1 Electrical installation

Electrical installation should be performed in accordance with the following general installation regulations:

- **EN 60204-1**
  Regulations governing the electrical equipment of tooling and processing machines.
- **EN 50178**
  Electrical equipment for power systems.
- **EN 61800-3**
  EMC product standard, electronic drives with variable speeds.

It may be necessary to observe other regulations if the equipment is to be used for special applications. The local protection measures are to be adhered to.

5.2 Switching devices

The mains module for the servoconverter must be connected to the mains in accordance with VDE regulations in such a way that they can be disconnected from the mains supply by means of suitable isolation devices (e.g. main switch, circuit breaker).

Gold-plated contacts or high contact-pressure contacts should be used for control contacts.

Precautionary interference suppression measures should be taken with switching systems, e.g. contactors and relays with RC elements or diodes.

5.3 Typical application

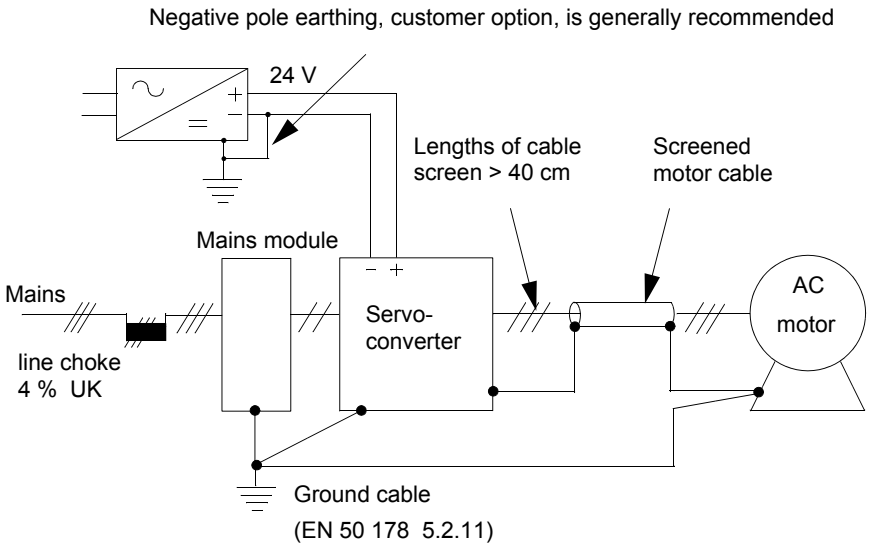


Fig. 5.1 B12-025 Typical application

5.4 Cable routing / earthing / EMC in cabling

The units are designed according to the protective aims of the EMC-law.

The manufacturer of the installation is held responsible to assure the CE-marking of the entire installation.

The correct operation of the servoconverter in relation to the requirements of the law is described in the leaflet.

– **EMV-instructions Nr. 180-00 000 byLUST DriveTronics GmbH**

The most important points are stated below:

- Motor cables and control cables should be laid in separate ducts
- Setpoint and signal cables should always be laid separately from power and/or contactor/control cables (avoid links), Minimum distance > 20 cm.
- Use screened cables for analog signals (setpoints, monitors)
- Twist cables for control connections and regulator supply (it is better to lay screened cables)
- Use screened cables not only for the signal cables but also for the motor cables. Lay the screen on both sides
- Ground the motor with sufficient cross section
- Only lay the screens of control cables on one side.
- Signal cables should be led into the electric cabinet from only one level.
- Unnecessary extra lengths of cable should be avoided.
- Connections and earthing of the units must be performed in accordance with local protection and safety regulations.
- Dimension the cross sections as per the local regulations.
- For another interference elimination to EN 50081/50082, corresponding filters can be purchased at the **LUST DriveTronics GmbH**.
- Practical hints in relation to standards and application are given in the following leaflet:

– **EMV-instructions Nr. 180-00 000 by LUST DriveTronics GmbH.**

5.5 Selection of unit

On composition of a complete drive (servoconverter and motor) we recommend to proceed as follows:

1. Selection of drive type
   - Synchronous
   - Asynchronous
   - Field-orientated
2. Detect the max. speed of the drive
3. Detect the effective torque, i.e. effective value of the sum of all loads

$$M_{eff} = \sqrt{\frac{M_1^2 \times t_1 + M_2^2 \times t_2 + M_n^2 \times t_n}{t_{ges}}}$$

4. In relation to the load ratios and the dynamics provide sufficient reserve (10%-20%) for the motor speed and the load torque.
   Respect the dynamics, required by the system to be driven in relation to:
   - acceleration output => max. drive output and
   - the braking output => max. pulse output of the braking chopper in the servoconverter.
     On principle, the mass moment of inertia of the motor has to be considered, too.
5. Determine the corresponding motor as per the output or torque, speed resp.
6. Determine the servoconverter from the motor parameters nominal current, max. current or nominal output, max. output resp.
   Here as well provide sufficient reserve in relation to the drive ratios at the machine.

5.6 Power stage clock frequency

In some special application cases, e.g. theatre technics, the switching noise of the servomotors is disturbing. A considerable reduction of the switching noise is achieved by an increase of the switching frequency of the output stage. Furthermore this measure improves the concentric run of the servomotor.

- Frequency adjusted in the works = 4 kHz.
- Frequency adjusted in the works = 14 kHz.

Adjustment via menu point 4.2.1.3

The increase of the switching frequency causes an output reduction of the servoconverter.

Output reduction

Factors of the output reduction:

- 4 kHz = 1,0
- 8 kHz = 0,8
- 10 kHz = 0,7
- 12 kHz = 0,6
- 14 kHz = 0,5

Max. unit current

Max. unit current:

- to 4 kHz = 2,0 x I_{nom} for 1,0 sec
- to 12 kHz = 1,8 x I_{nom} for 0,5 sec
- Motor with resolver maximum 8 kHz

5.7 Mounting

The servoconverter are designed for assembly into switch cabinets up to 300 mm. The bore dimensions are stated in fig. *(see chap. 10.3, Dimensions for mounting)*.

On unit arrangement adhere to the following:

- Assure free cooling air inlet/outlet
- Provide minimum free spaces for air circulation of approx. 100 mm above and under the servoconverter.
- do not cover the fan, if mounted
- Provide minimum free space of approx. 10 mm at the servoconverter sides for radiation of heat.
- provide minimum free space for the plug-type facilities and cabling of the unit front, approx. 20 mm.
- Provide a conductive not lacquered mounting plate in the switch cabinet. If necessary, remove the paint in the area of the converter mounting

Caution: Be particularly careful on mounting.
Assure that no drilling chips, wheel swarf or mounting parts (screws, nuts) fall into the housing.

5.8 Sensor cable

- For the sensor connection use the control cables of **LUST DriveTronics GmbH**, *(see chap. 10.2, Motor sensor - connections)*
- Cable length up to 50 m, longer cables on request.
- Customer-specific regulations must be agreed with **LUST DriveTronics GmbH**.

5.9 Motor conduct

- Use screened cables for the motor conduct.
- Cable length up to 50 m, longer cables on request.
- Embed the motor conduct separately from the other cables, e.g. control and setpoint cables.

5.10 Motor protection

- The units have an integrated posistor evaluation.
  When using **LUST DriveTronics GmbH** sensor cables, the thermal motor protection is assured, *(see chap. 10.2, Motor sensor - connections)*.
- The connection of other motors has to be agreed with **LUST DriveTronics GmbH**.
- A thermal motor overloading causes the disengagement of the ”readiness for operation”.

5.11 Motor holding brake

For motors with integrated holding brake adhere to the service instructions for the motor and the corresponding brake.

- The holding brake is not a working brake. It must only be operated with motor standstill.
- For voltage supply provide an external d.c. voltage of 24 V (± 20%) . The required intensity of current is stated in the brake data sheet.
- Brake control *(see chap 6-20, Release the brake (n > 0) Pin 17)*.

6 Electrical connections

6.1 General overview A-DS 006.1 - 020.1

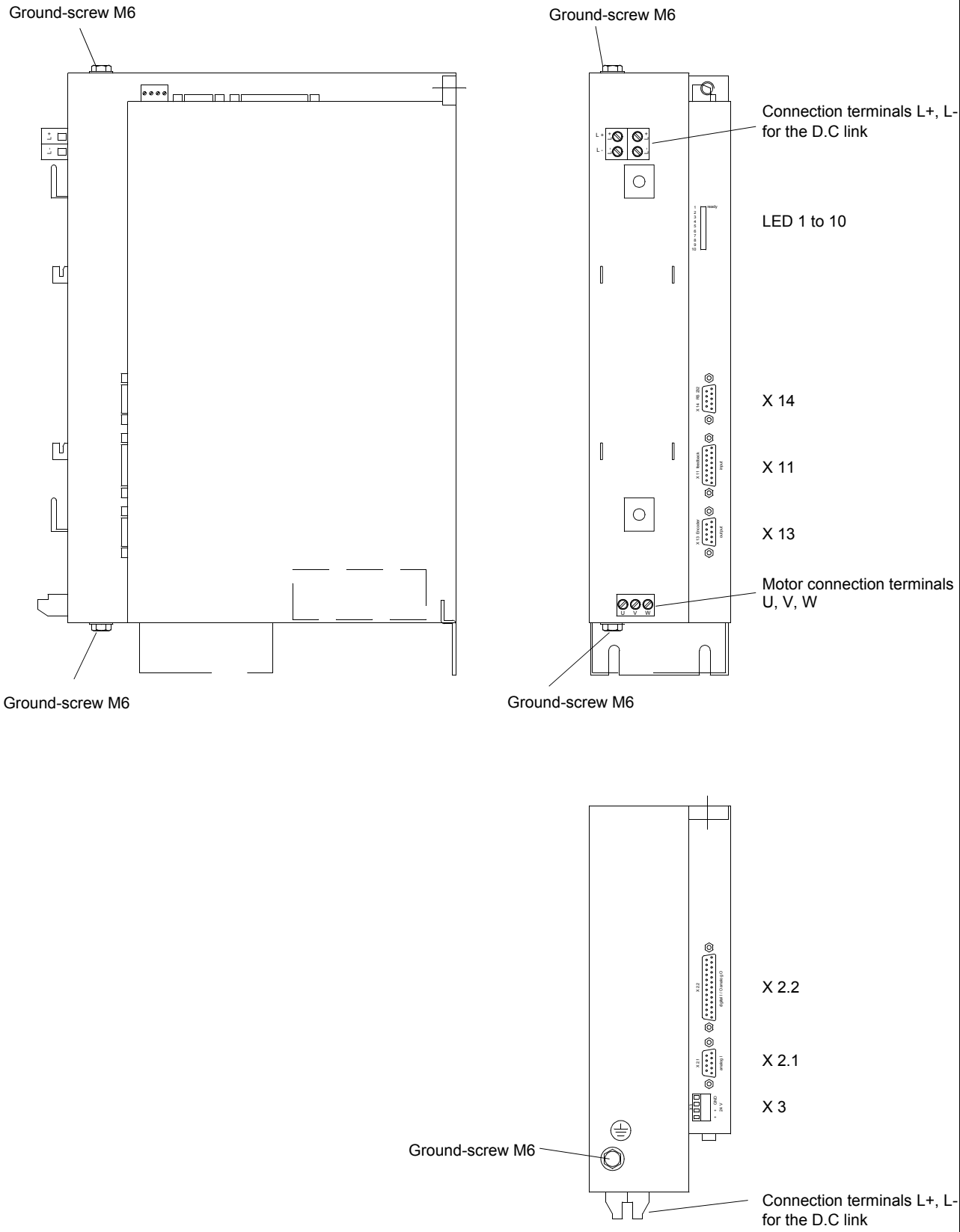


Fig. 6.1 B11-058 A-DS 006.1 - 020.1

6.2 General overview A-DS 035.1 - 045.1

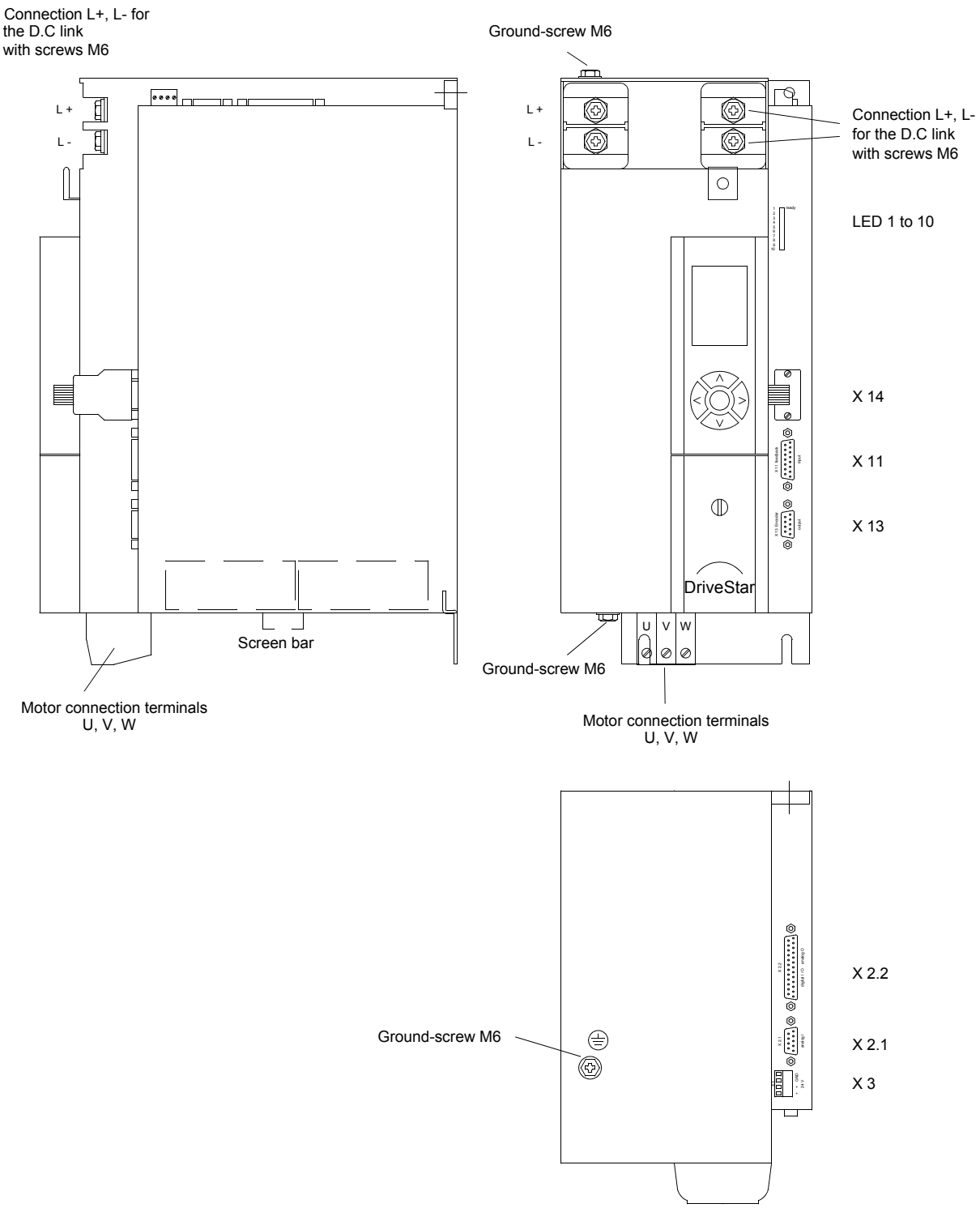


Fig. 6.2 B11-059 A-DS 035.1 und A-DS 045.1

6.3 General overview A-DS 055.1 - 075.1

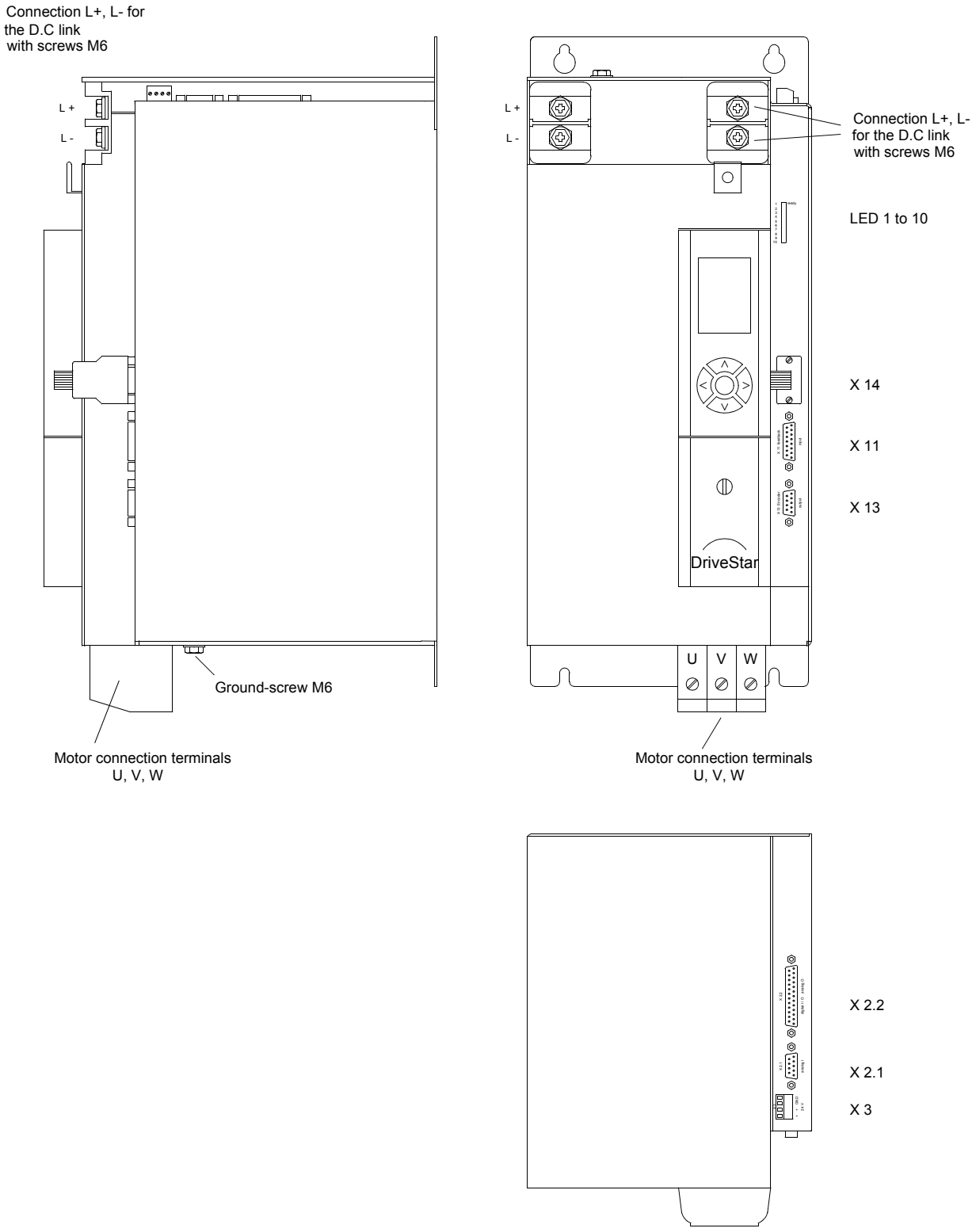


Fig. 6.3 B11-061 A-DS 055.1 - A-DS 075.1

6.4 Cable cross-section

The conductors should be selected for X1 maximum ambient temperatures, the max. motor nominal current (continuous rating) in accordance with the local regulations (VDE 0100, VDE 0113, etc.).

Connectable lead cross-section for the motor cable:

Connection	A-DS 006.1	A-DS 012.1	A-DS 020.1	A-DS 035.1	A-DS 045.1	A-DS 055.1	A-DS 075.1
flexible	0,2 mm^2 - 6 mm^2			0,5 mm^2 - 25 mm^2		16 mm^2 - 50 mm^2	
AWG	24 - 10			20 - 4		6 - 0	

Table 6.1 Cable cross-section

6.4.1 Power connections

Power connections
A-DS ... .1 with B-DS 1

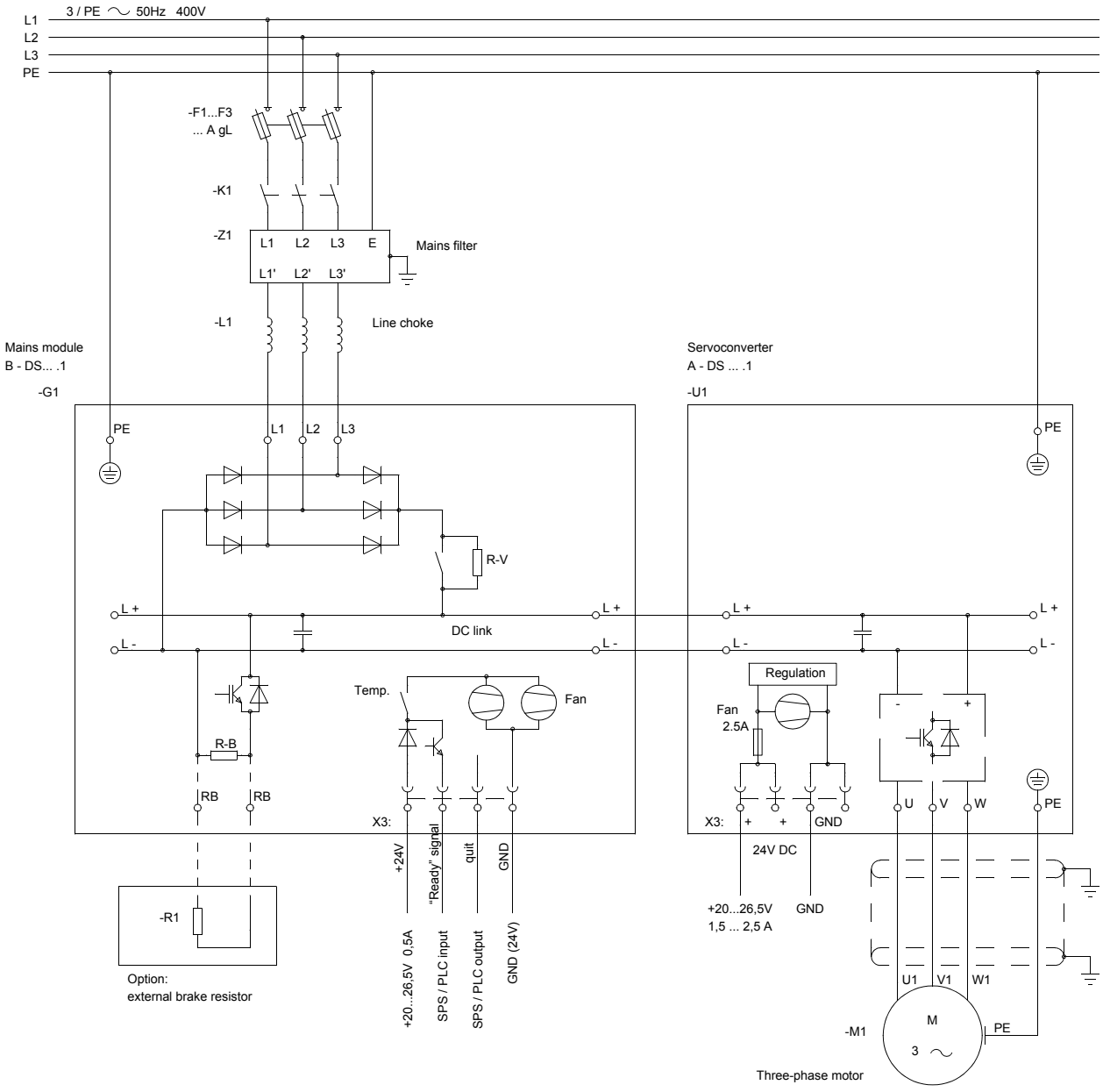


Fig. 6.4 B10-044 Connecting plan servoconverter A-DS ... .1 with mains module B-DS 1

Power connections
A-DS … .1 with R-DS … .1

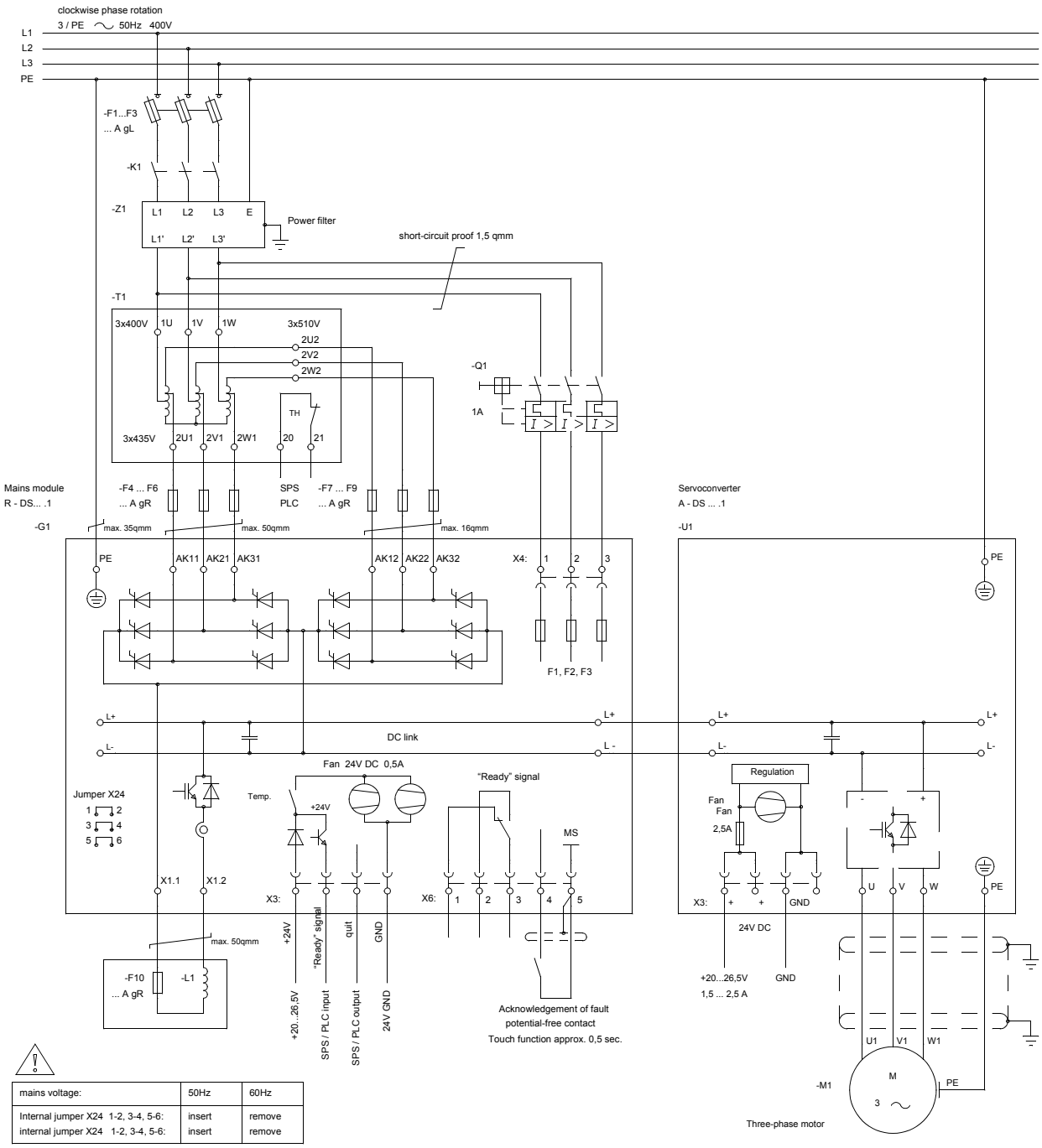


Fig. 6.5 B10-045 Connecting plan servoconverter A-DS ... .1 with mains module R-DS 1

6.4.2 D.C link connection L+, L-

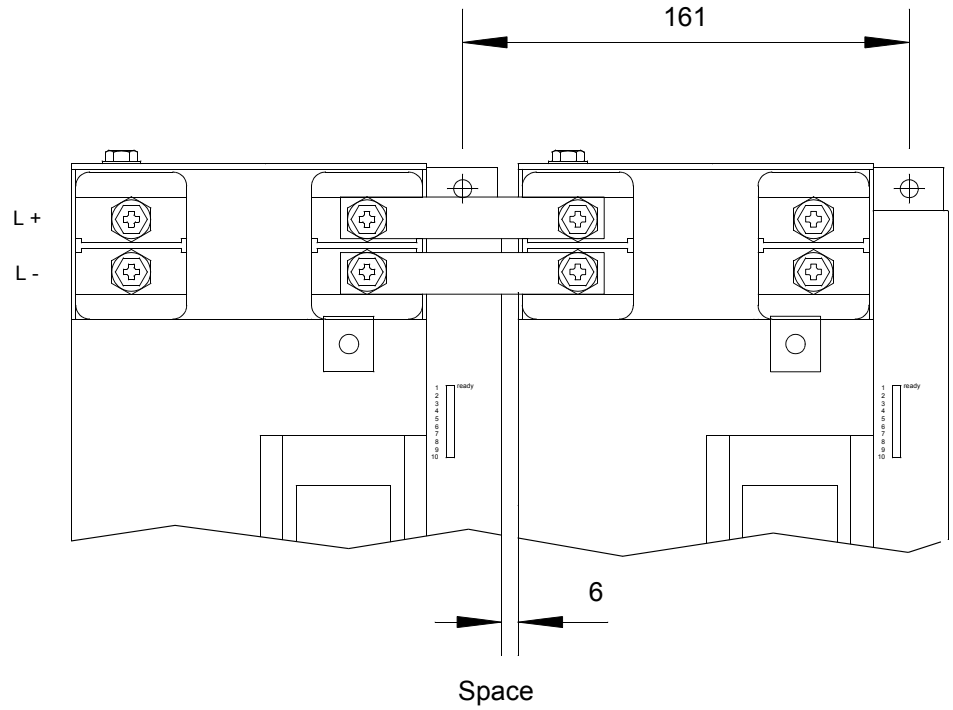


Fig. 6.6 *B11-060 D.C. link connection*
Example: 2 Servoconverter A-DS 035.1 or A-DS 045.1

The servoconverters are supplied by a B-DS ... .1 power module (with braking chopper and resistor) or R-DS ... .1 power module (with power recovery to system) via the **L+** and **L-** DC link with 325V to 625V direct voltage.

Danger: In braking mode voltage peaks up to 690 V may occur

Caution: With D.C feeding it is absolutely necessary to pay attention to the polarity. No protection against mispoling!
With mispoling the output stage is destroyed!

Caution: It must be ensured when establishing the DC link connections and fitting the cover plate that no electrical connection (earth fault) to the housing exists.

If necessary air gap and creepage distance cannot be kept according to VDE 0110, the connections are to be isolated additionally.

6.4.3 Motor connection

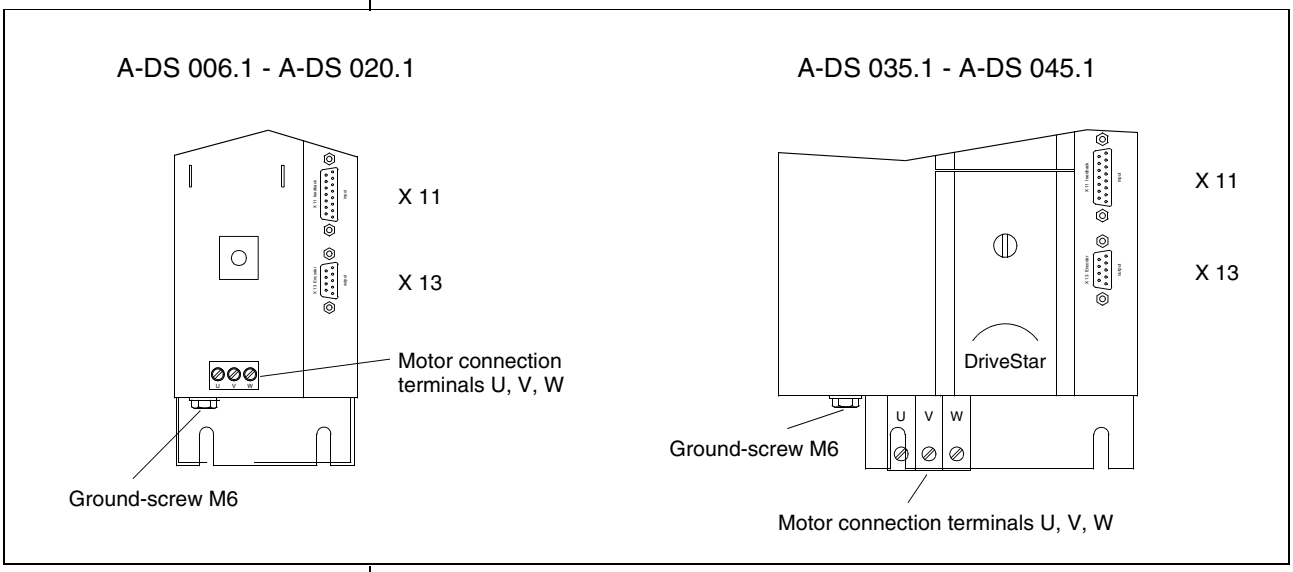


Fig. 6.7 Motor connection

The motor connection is made through the terminals: **U, V, W** and **Ground-screw**.

On motor connection pay attention to the phase sequence.

As normally ”numbered cables” are used, the following connection presents itself:

DriveStar	=	U V W
Cable No.	=	1 2 3
Motor terminal	=	U1 V1 W1

To adhere to the generic standard EN 50081, a screened motor cable is required.

Cable length up to 50 m, longer cables on request.

Lay the screen in wide range on the central screen bar and connect it to the motor. EMC cable glands are recommended for the motor.

6.5 Control connections X2

The control connections are made to the upper side of the module via SUB-D plugs X 2.1 and X 2.2.

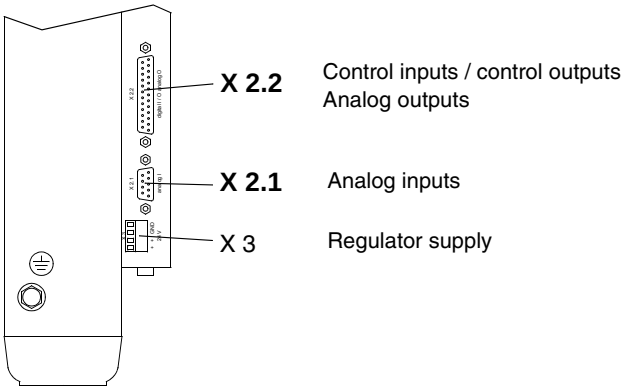


Fig. 6.8 B11-063 Control connections

Caution: The below descriptions of functions are only applicable to standard units.
Units with user software (positioning, synchronisation etc.) have different functional characteristics at the various inputs and outputs.
In such cases the additional service instructions „Technology“ must be observed

Note: For the connection control cables with prepared plugs are available which can be purchased from
LUST DriveTronics GmbH.
- for X 2.1: Art. No. 182-01811
- for X 2.2: Art. No. 182-01810
(see chap. 10.4, Accessories)

6.6 Analog inputs X 2.1

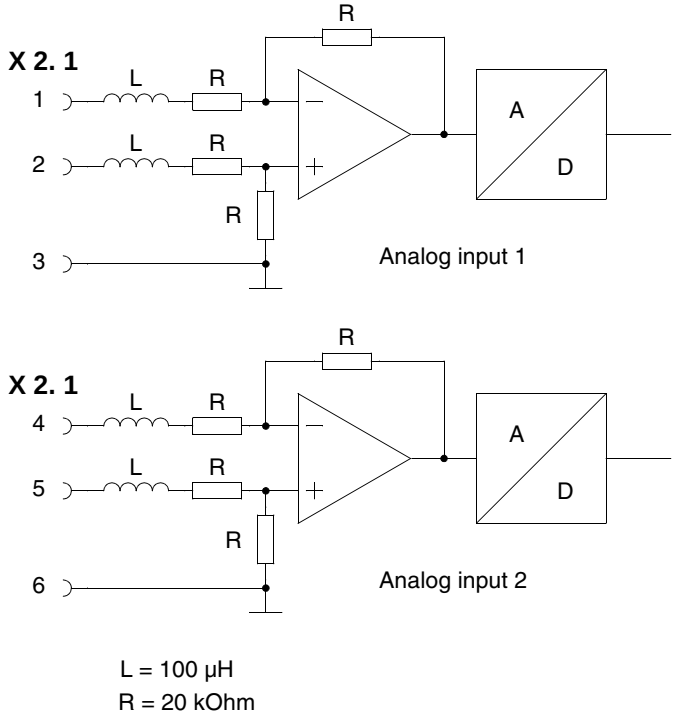


Fig. 6.9 B10-015 Analog inputs

Pin	X 2.1	Function
1		Input 1: inverted
2		Input 1: not inverted
3		Input 1: GND
4		Input 2: inverted
5		Input 2: not inverted
6		Input 2: GND
7		n. c.
8		+10V, auxiliary voltage
9		- 10V, auxiliary voltage

Table 6.2 Connection X2.1

The setpoint can be preselected differently. Two analog inputs are available. They can be used as follows:

- ➢ reference speed
- ➢ torque setpoints (0-100% x I_max.)
- ➢ external current limit (0-100% x I_max.), setpoint input 2 only
- ➢ quick analog input (input 1 only)

The analog inputs are designed as differential amplifiers.

The input resistance is 20 k-Ohm.

Input voltage range ±10V

Caution: Embed screened setpoint cables only.

Further setpoint preselections are:

- ➢ digitally through the operator terminal **D-DS_1** (option)
- ➢ via PC (option)
- ➢ via field bus systems (option)
- ➢ via RS 2332

reference voltage

The servoconverter offers the possibility to scan a voltage of ±10V for the supply of setpoint potentiometers.

- – Terminal X 2.1: 8, +10V
- – Terminal X 2.1: 9, - 10V

Caution: The voltage outputs can be charged with max. 5 mA and are short-circuit proof.

6.7 control inputs X2.2

servoconverter communication is mainly performed via connector X2.2.
The following signals are supplied at this connector:

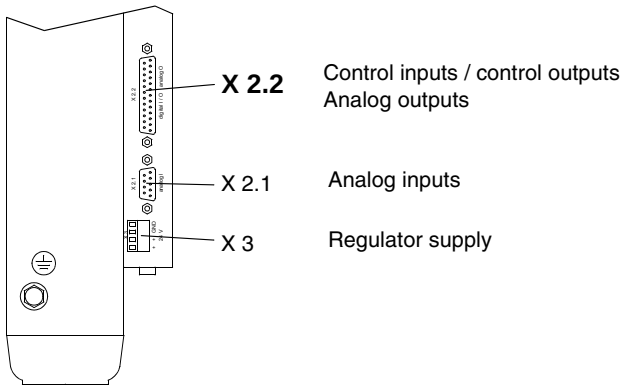


Fig. 6.10 B11-063 Control inputs

- ➢ Control inputs (pin 1 to pin 12)
- ➢ Signal outputs (pin 13 to pin 20)
- ➢ Analog outputs (pin 21 to pin 25)

Control inputs

All control functions can be triggered via switching contacts (e.g. switches) or via direct connection of a voltage (e.g. from a stored-program controller).
Trigger voltages of 10 V to 30 VDC are processed as H signal.
The inputs are electrically isolated from the control electronics by means of opto-coupler.

Caution: Pin 1 on X2.2 is the 24 V output

Pin	X 2.2	Function
1		+ 24V Output, max. 100 mA
2		GND analog
3		GND (24V)
4		Technology option
5		Torque regulation
6		C-axis-operation
7		Controller enable
8		Output stage enable
9		Acknowledge fault
10		Setpoint integrator enable (ramp generator)
11		Limit switch 1 for clockwise running
12		Limit switch 2 for anticlockwise running

Table 6.3 Control inputs X2.2

Torque regulation Pin 5

The controller regulates the drive to the prescribed current setpoint.

Caution: Only operate motors when loaded as otherwise the drive will accelerate to the set maximum speed.

C-axis-operation Pin 6, LED 5

When C-axis operation is switched on, the setpoint is reduced by the factor 0,1.
Then the max. speed reduces by the factor 0,1, too.

Thus increasing the accuracy in the low speed range with position regulation of a continuous-path control.

Caution: When activating the input during operation, the speed changes discontinuously up to current limit.

Controller enable Pin 7, LED 3

Controller Enable enables the controller and setpoints.
When enable is switched off, the drive brakes to a halt at the set rapid stop ramp t5 *(see Fig. 6.11, page 16)*.

When the drive has stopped the Output Stage Enable is also switched off internally.

Note: The drive has no torque.

Controller enable Pin 8, LED 2

Output Stage Enable enables the electrically power switch to function. Power switch enable. If the enable is not engaged, then the drive receives no current. If enable is cancelled during operation the drive runs down in an uncontrolled manner.

Output Stage Enable should always be running in normal operation. It is normally only required when a drive has to be interrupted immediately.

Note: The output module hardware enable must always be switched on via a 24V signal so that the start-up relay is triggered and the output module enabled.

Acknowledge fault Pin 9

A pulse at the input causes -after elimination of the fault- the acknowledgement of a fault signal sent by the servoconverter. This acknowledgement of fault also occurs after every engagement of the controller supply 24V.

Note: Acknowledgement is possible only with switched-off regulator enable.

Setpoint integrator enable
Pin 10, LED 4

Setpoint integrator Enable enables the ramp generator to function.
The set setpoints are delayed with the set ramps (t1-t5), *(see Fig. 6.11, page 16)*.

When enable is switched off, the drive brakes to a halt at the set rapid stop ramp (t5). The drive stands still with holding torque as long as ”Controller Enable” is switched on.

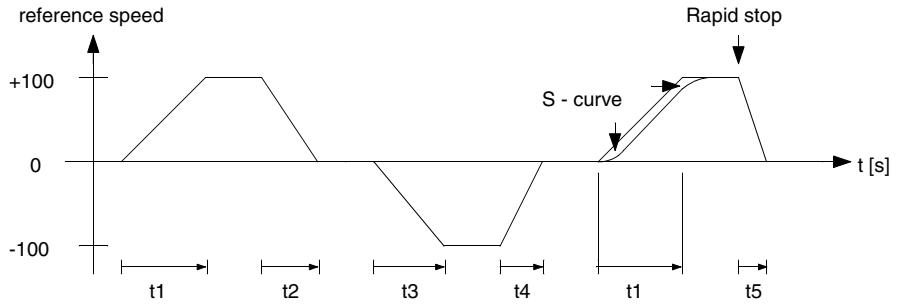


Fig. 6.11 B12-0006 Acceleration and braking ramps

t1	=	ramp for acceleration, clockwise running
t2	=	ramp for deceleration, clockwise running
t3	=	ramp for acceleration, anticlockwise running
t4	=	ramp for deceleration, anticlockwise running
t5	=	Ramp for rapid stop Ramp for deceleration clockwise and anti- clockwise with ”regulator enable” off and setpoint integrator enable off.

Table 6.4 Acceleration and braking ramps

The ramp times can be selected from the ”Commissioning” and ”Parameter” menu; (menu 42231 - 42235).

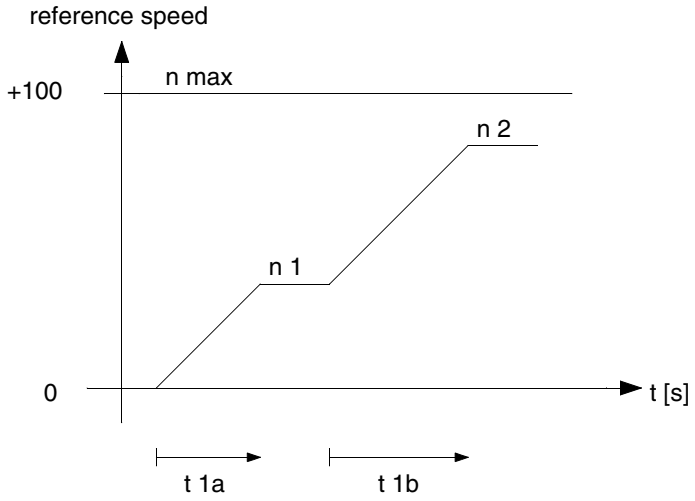


Fig. 6.12 B12-007 ramp times

The times t1-t5 refer to the max. speed programmed in the menu 42312. With this ramp steepness all set point jumps are delayed.

Acceleration time calculation t_{1a}:

Acceleration time t 1a

$$t_{1a} = \frac{(n_1 \times t_1)}{n_{max}}$$

Acceleration time t 1b

$$t_{1b} = \frac{(n_2 - n_1) \times t_1}{n_{max}}$$

t1	=	programmed setpoint integrator-time
n_{max}	=	max. speed programmed (menu 42312)
n1	=	run speed 1
n2	=	run speed 2
t1a	=	Acceleration time from n=0 to n1
t1b	=	acceleration time from n1 to n2

Table 6.5 Acceleration and braking ramps

Note: Calculation with time t1 also applies for times t2 - t5.

Note: The setpoint-function is only active in the setpoint channel 1

Limit switch 1 Pin 11
Limit switch 2 Pin 12

When activating these inputs, e.g. by approaching the limit switches, the setpoints for clockwise running (limit switch 1) or anticlockwise running (limit switch 2) are blocked.

The limit switch inputs can be actively programmed to normally-closed or normally-open contact in the menu 125.

Note: On delivery the inputs are actively programmed to normally-open contacts.

Selection of rotational direction

By selection of the setpoints the defined ref. speed can be controlled in both directions of rotation through the inputs X 2.2 Pin 11 and x 2.2 Pin 12.

- X2.2: Pin 11 on, clockwise direction
- X2.2: Pin 12 on, anticlockwise direction

6.8 Signal outputs X 2.2

All signal outputs are electrically isolated from the electronic regulation and the power pack by means of opto-couplers. The outputs are switched through transistors and can be used to be switch SPC-inputs or coupling relays.

Caution: The load current per output is 125 mA, max. 500 mA.
The sum current of the 8 outputs must not exceed 1 A.

Pin	X 2.2	Function
13		"Ready" signal
14		Limit of the current I^2t
15		$n_{act.} = n_{set}$
16		n > n1
17		Release the brake (n > 0)
18		Overtemperature motor
19		output stage over-temperature
20		Reserve

Table 6.6 Signal outputs X2.2

„Ready signal" Pin 13
LED 1, green

H level signalises the servoconverter is ready for operation.
In case of an internal fault signal, the readiness for operation is cancelled, thus resulting in an immediate switching-off of the enables for the controller and the output stage.

Note: The drive runs down in uncontrolled manner.

Limit of the current I^2t, Pin 14
LED 6, yellow

H-level signalises the limitation of the current to the programmed motor nominal current.
The output stage is designed for the unit nominal current. Short-dated the output stage can supply the double nominal current (1,5-fold at A-DS 045.1).
For output stage protection, the motor current is integrated to a square-function, above the programmed nominal current. If the calculated value exceeds the limit load integral of the output stage, the current is limited to the nominal value.

Note: The unit is not disengaged.

To reset the function, a return integration has to be made. It begins when falling below the load current (0,9 x I_{nom}).
The integration times are adjusted in the works; they must not be changed.

Caution: The I^2t-reduction only acts as an overload protection for the servoconverter. Complete motor protection is only ensured if PTC thermistors are connected.

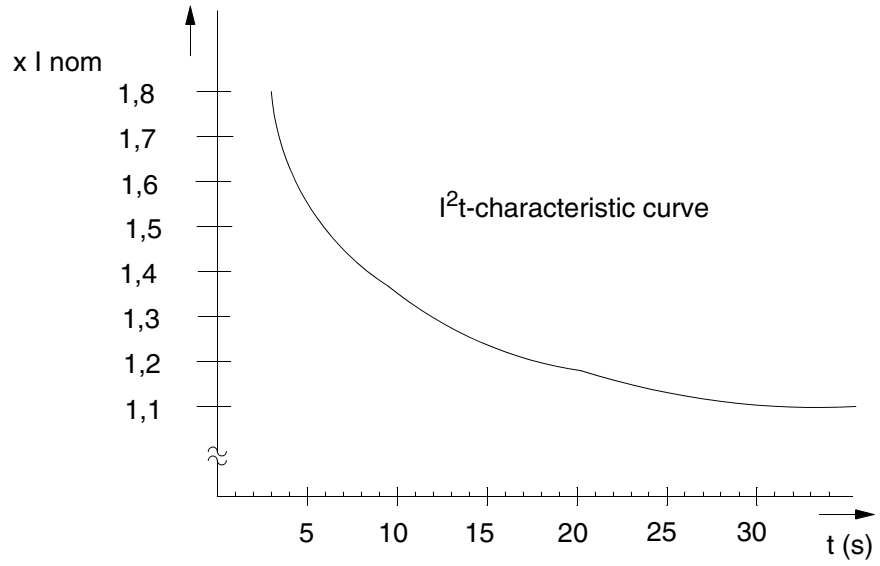


Fig. 6.13 B12-008 I^2t-characteristic curve

$n_{act.} = n_{set}$ Pin 15
LED 9, yellow

H level signalises that the actual speed is equal to the set speed.
The tolerance band can be programmed in the menu item 42253 (hysteresis).

n > n1 Pin 16
LED 8, yellow

H level signalises that the actual speed is higher than the reference speed n1, menu point 42251.
The tolerance band can be programmed in the menu item 42252 (hysteresis).

Release the brake (n > 0) Pin 17

The signal can be used to ref. command a holding brake.

H level is connected when controller enable is operated. Simultaneously the set speed is switched through.

During that switching time of the brake t' assure that the set speed is = 0, to prevent the drive from operating against the brake. → tv > t´ *(see Fig. 6.14, page 20)*

When switching-off the controller enable at control input X2.2 Pin 7, the drive brakes down to speed 0.

When reaching the speed 0, the output X2.2 Pin 17 is set back. For a certain period of time tx the regulation still places at disposal the standstill torque (disengaging delay).

During that time the brake must be actuated (menu 4244). → tx > t´

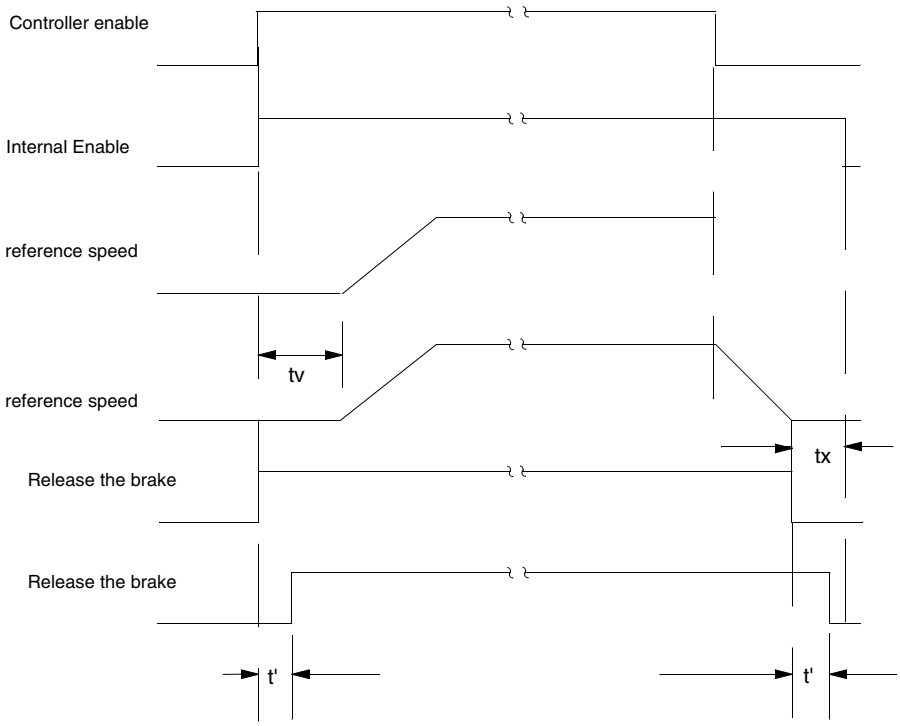


Fig. 6.14 B12-009 times for holding brake ON/OUT

- ➢ tv= delay time of the setpoint, customer
- ➢ t´=mechanical switching delay of the brake
- ➢ tx= disengaging delay menu 4244

If the delay time tx is set to 0, the function operates like that one of a standstill logic (H-signal with n = 0 and the hysteresis, menu 42254).

Motor overtemperature Pin 18
LED 5, yellow flashes

H level signalises that the motor limit temperature is exceeded (posistor in the motor winding).
Simultaneously the readiness for operation of the servoconverter is cancelled.
When cancelling the readiness for operation, the motor is running down in an uncontrolled manner, as it is no longer connected to current.
The readiness for operation is cancelled after a programmable delay time only to allow the system to run controlled in a safety position after having got the signal ”motor over-temperature”.

Note: Set the delay time between the „motor overtemperature“ message and switching-off of standby mode to 0 - 10s
.Menu 4245.

Caution: The time offset between the „motor overtemperature“ message and switching-off of standby mode must not be set to too long a duration as otherwise the motor will be damaged.

Output stage overtemperature
Pin 19
LED 10, yellow flashes

H level signalises that the temperature of the brake resistance or the output stage is exceeded.
Simultaneously the readiness for operation of the servoconverter is cancelled.
The readiness for operation can be re-provided after sufficient cooling-down of the brake resistance resp. the output stage.

Reserve Pin 20
LED 10, yellow

The output X2.2 Pin 20 is a reserve output which is used for technological software or a special customer’s software.

Analog outputs (Monitors)

The servoconverter offers 2 monitor outputs for the analogue representation of various system variables.

The assignment of system variable to monitor output may be freely selected. (Menu option 3.5 for analogue monitor 1 and menu option 3.6 for analogue monitor 2)

System variables:

- reference speed
- actual speed
- phase current ir
- Active current isq
- reactive current isd
- Rotor position
- actual speed amount
- Torque setpoint

Pin	X 2.2	Function
21		Monitor 1
22		GND analog
23		Monitor 2

Table 6.7 Analog outputs (monitors) X2.2

Load capacity of the monitor outputs:

The monitor outputs at pin 21 and pin 23 may be loaded as follows:

➢ ref. command: ±10 V
➢ Charge: max. 1,5 mA, 6,8 kOhm
➢ resolution: 5 ms

Standardisation of the monitor outputs:

In relation to the size the output voltage is standardized as follows:
With system size 10V correspond to

- speed: n-max. (menu 42312)
- current: max. unit current
- rotor position: 360°

6.9 Regulator supply X3

The servoconverter is supplied from an external supply voltage. From this voltage the voltages required for the regulator and the processors are generated.

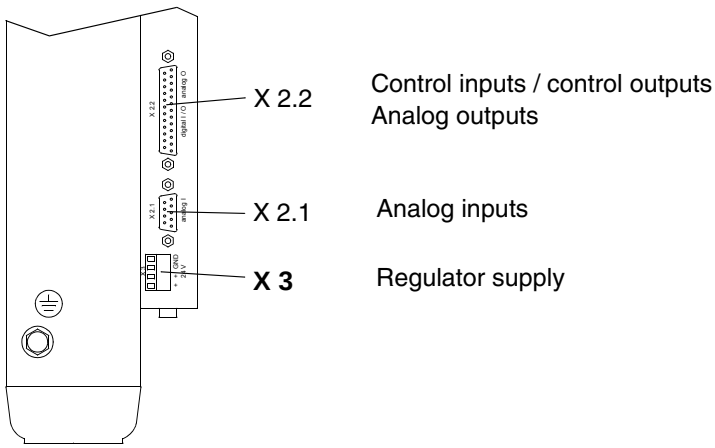


Fig. 6.15 B11-063 Regulator supply

+	=	+ 24V DC (standard converter: 24V DC ±20%, 1,5A)
+	=	+ 24V DC
-	=	0V DC
-	=	0V DC

Table 6.8 Connection regulator supply

Note: After engagement of the 24 V regulator voltage, a short-time flowing of starting current of 3 to 4 A is possible.

Note: By the regulator supply, no inductive loads, e.g. valves, may be fed. With extensive installations, separate current supplies are recommended to feed the servoconverter.

The supply cable for regulator supply has to be screened. Under the described conditions the input has a burst factor of > 2kV. For reasons of operational safety this supply cable has to be embedded separately from the power cables.

6.9.1 Fan supply

The servoconverter contain fans, which dissipate the thermal loss generated in the electronic components to the surroundings.
The fans are internally connected to the 24 V regulator supply.
The fans operate with connection of the regulator supply.

6.10 Motor sensor X 11

The motor sensor connection is made through Sub-D-plug X 11.

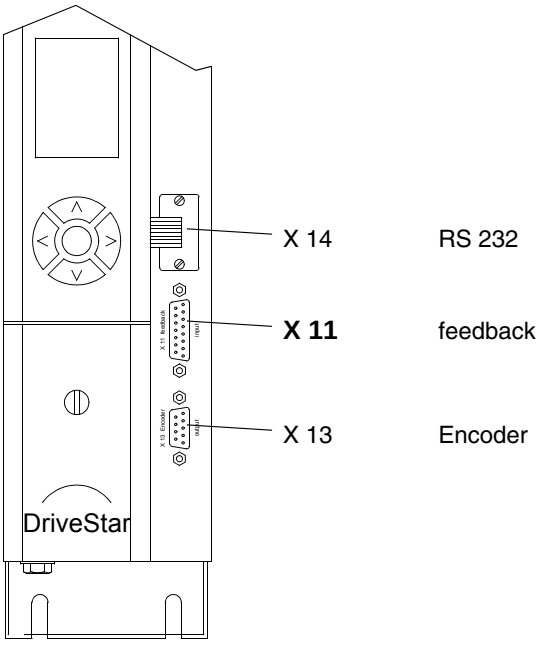


Fig. 6.16 B11-016 Motor sensor

For sensor connection use **LUST DriveTronics GmbH** control cables with already connected plug-type facilities.
Solutions meeting customer's special requirements need to be agreed with **LUST DriveTronics GmbH**, as otherwise the warranty will no longer apply.
The following generator types may be connected to the servoconverter:

- ➢ Resolver
- ➢ High-resolution encoder, absolute value encoder
- ➢ Pulse generator

Note: The plug connections depend on the sensor type.
(see chap. 10.2, Motor sensor - connections).

6.11 Encoder output X 13

From the sensor signals of the motor, applicable at the input X11, a pulse sensor signal is detected. Load of +5V output = max. 25mA.

Plug connections:

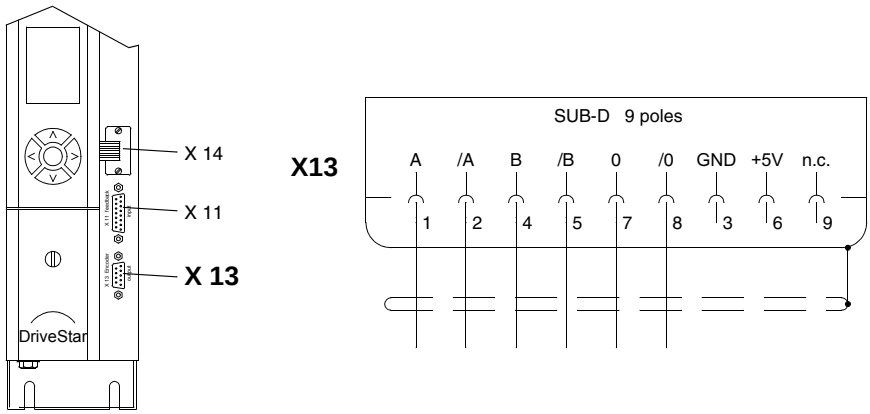


Fig. 6.17 B11-016 Plug connections

Encoder output signals:

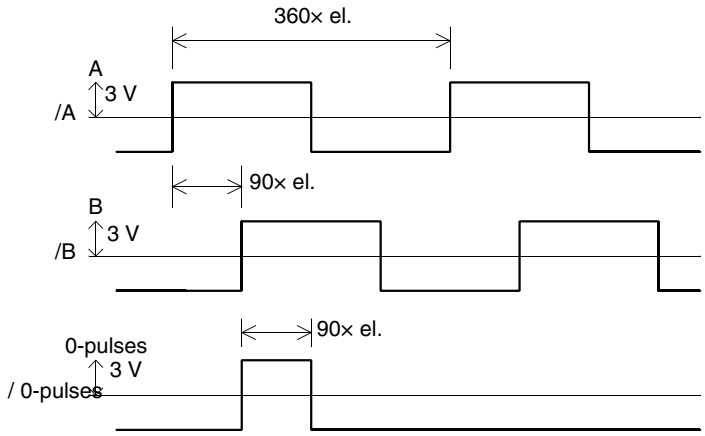


Fig. 6.18 B12-010 Encoder output signals

The signal complies with the form of an incremental encoder.

The number of increments of the encoder output is adjustable (Menu 4243, maximum 8192 pulse)

Output is via a 3 V push-pull signal as standard, *(see Fig. 6.18, page 25)*.

As an option, these signals can be electrically isolated or output as 24V-level with electric isolation.

6.12 Communication interfaces

Communication interfaces are available at the Sub-D-plugs X 14, X 15 and X 16.

The connections are:

- ➢ X 14 RS 232, **D-DS_1**, H-DS.1, *(see Fig. 6.19, page 26)*
- ➢ X 16 RS 485
- ➢ X 15 and X 16 Profibus-DP or Interbus-S or CAN-BUS

Note: As a standard the interface RS232 is provided. All other interfaces are available on request.

6.12.1RS 232 X 14

By means of the interface RS 232 the servoconverter can be parameter set and controlled via a PC or any other control. For this duty the LUST PC terminal program **LUST DriveTronics GmbH** is required.

Description and programming are given in the leaflet:

- **LUST DriveTronics GmbH,**
  Terminal program VecWin Nr. 192-00 307

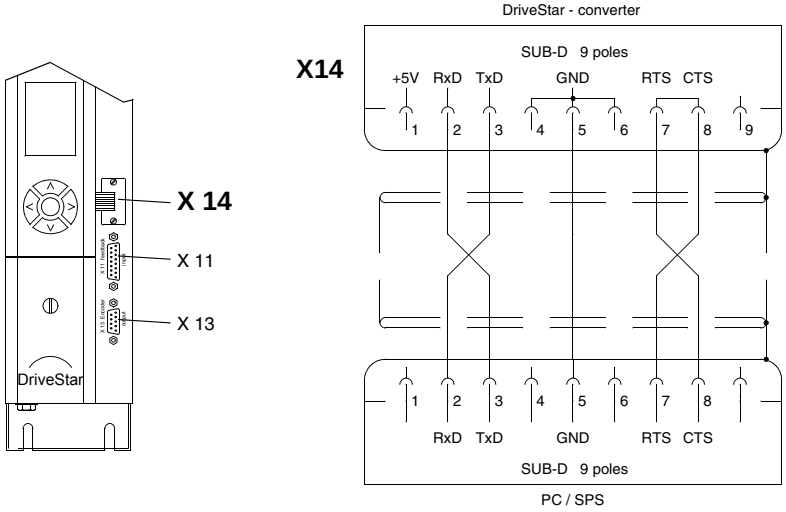


Fig. 6.19 B10-017 Connection serial interface RS 232

The PC-programming allows a simple menu-orientated commissioning and also be used for memorizing and loading of parameter sets for the servoconverter.
Through the interface communication is not only possible with VecWin but also with other software logs. This has to be agreed with **LUST DriveTronics GmbH** from case to case.
For connection a three-core or five-core screened cable is necessary. At both ends a 9-poles SUB-D plug (plug and bushing) must be provided. **LUST DriveTronics GmbH** offer this cable as connection assy.

Via connector X 14 the servoconverter can be parameter set **LUST DriveTronics GmbH** operating terminal **D-DS_1**.

Description and programming are given in the leaflet:

- **LUST DriveTronics GmbH,**
  Control unit D-DS.1 Nr. 182-02 792

6.13 Starting inhibit

Inhibit of the output stage by means of a safety relay.

This option offers another protection against unintended starting of the drive - supplementary to the standard ”electronic output stage inhibit”.

Caution: The starting inhibit is no „disengaging device“ to avoid unintended starting, as per EN 60204-1. It is intended to stop drives not involved in service duties or other safety measures.

With the ref. command input X2.2: Pin 8 a safety relay is commanded (approved by the TÜV) besides the ”electronic output stage inhibit”.

The contacts of the relay switch the driver supply of the output stage directly ON or OFF resp. Simultaneously an auxiliary contact with feedback ”output stage inhibited” is available. Connection to terminal X2.2: Pin 24 and Pin 25.

The contacts of the relay are guided so that the information about the switching stage is sure.

Caution: For a safe application of the inhibit it is absolutely necessary to link the feedback ”output stage inhibited” into the control.

Output stage inhibit with safety relay

.

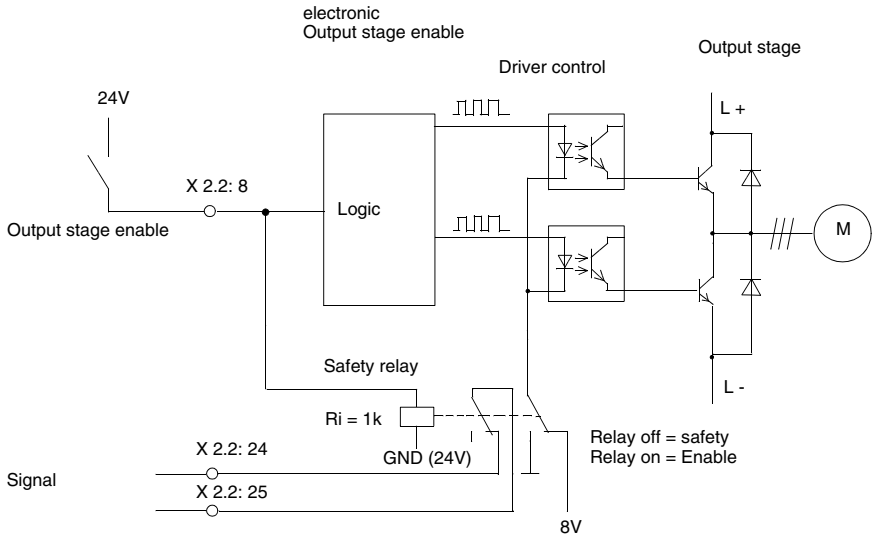


Fig. 6.20 B12-011 Output stage inhibit

Service hints:

- Disengagement of the ”output stage enable” causes an inhibit of the output stage. The drive becomes currentless. When switching the inhibit during operation, the drive runs down **uncontrolled**.
- In case of emergency stop, the ”output stage enable” must be disengaged only provided that at first the drive has been stopped ”as quickest as possible” (e.g. by disengagement of the ”regulator enable”).
- By ref. command of the setpoints, “setpoint integrator enable” or ”regulator enable” it has to be assured that no unintended starting happens due to faulty switching stages.
- contact load capacity of the outputs X2.2: Pin 24 and Pin 25:
  - I max = 3 A
  - U max = 30 V DC / AC
  - Minimum power: 50 mA, 12V DC / AC

7 Parameter setting

The parameter setting allows a variety of applications for the servoconverter. E. g. by:

- selection of the type of motor (synchronous, asynchronous).
- Pre-selection of the setpoints of different interfaces.

Simultaneously the parameter setting is the decisive factor for an optimum regulation behaviour of the drive.

7.1 General

The parameterisation is made via the PC-terminal program **VecWin**. The program functions with a PC-AT through the interface RS232 of the servoconverter. This manual consists of two sections.

Terminal program VecWin

How to handle the parameterisation via terminal program is explained in the special leaflet.

- **LUST DriveTronics GmbH, manual No. 192-00307**
- Part a.: Parameter setting
- Part b.: Function of oscillograph

***Control unit* D-DS_1**

Optionally the parameterisation can be made via the operator terminal **D-DS_1** which is placed onto the front plate of the servoconverter.

How to handle the parameterisation via control unit is explained in the special leaflet.

- **LUST DriveTronics GmbH, manual No. 182-02 792**

7.2 Description of parameters

Three parameter sets are memorized in the converter.

Parameter set 1

The parameter set 1 (basic parameter set) is deposited in an E-PROM and cannot be modified. Values for a standard parameter setting (default-values) are adjusted in this set. By this parameter set a connected motor can only be moved for rotation in a limited way.
The basic parameter record is required in order to be able to reset the parameters for the servoconverter following a check sum error *(see chap. 9, Fault-finding)*.

Parameter set 2

The parameter set 2 contains the parameter setting made in the works in compliance with the customer's application. It allows to move the idle-running motor to rotation.

The adjustments of the parameter set 2 are listed on the accompanying lists, which are attached to the servoconverter.

Parameter set 3

The parameter set 3 is the actual parameter set. All changes during parameterisation are saved in it. Simultaneously it is that parameter set which is used for the regulation after engagement of the unit.

The actual parameter set can be memorized as parameter set 2 (menu 4.2.5.2.1). It is used to memorize an intermediate stage on parameter setting and to carry-out any further modifications.

Should these modifications not offer any advantage, the previous condition can be re-made quickly by loading the parameter set 2 as actual parameter set (menu 4.2.5.2.2).

When loading the parameter set 2 or the basic parameters, the actual parameter set is overprinted.

When memorizing the actual parameter set as parameter set 2, the old parameter set 2 is overprinted.

Input ranges

Speed inputs can be made and displayed in Hz or rpm. The type of input or display can be selected (menu 4221).

In the following text, the speed input ranges are stated in rpm.

Note: Some parameters are transferred only with disengaged regulator enable or after a disengagement and re-engagement of the servoconverter.

Following parameters are transferred after disengagement and engagement of the servoconverter only.

- Clock frequency
- Number of increments of the incremental encoder
- Type of device
- Operation mode
- Number of pole pairs
- Kind of sensor

The parameters ”setpoint 1” and ”setpoint 2” are only transferred with disengaged regulator enable.
All other parameters are modified during the running operation.

7.2.1 Unit parameters

Note: The following numbers refer to those menu points, which are selected via the **D-DS_1**.

Unit type 4.2.1

Here the output stage type of the unit is selected. The output stage type results from the unit designation.

Note: In the works it is already adjusted correctly and must be changed only by the after-sales service.

Switching frequency 4.2.1.3

Here the switching frequency of the output stage is adjusted in steps of 1kHz (range: 2-14kHz).

Note: Please note that the nominal data can only be reached up to 4kHz. In case of higher switching frequencies, a load reduction is required. (Motor with resolver maximum 8 kHz)

7.2.2 Motor data

Number of pole pairs 4.2.4.1

Here the number of pole pairs of the motor is adjusted. In case of a wrong number of pole pairs the motor does not rotate.

Note: To allow the transfer of a newly input number of pole pairs, the servoconverter has to be disengaged and then re-engaged.

Type of drive 4.2.4.6

Here the motor type is input, i.e. asynchronous, synchronous or controlled by U/F-characteristic.

Note: To allow the acceptance of the drive type change, disengage and re-engage the servoconverter.

Voltage constant 4.2.4.7

Here the voltage constant Kv of synchronous machines is input ($V/1000min^{-1}$).
The value complies with the effective value of the induced voltage against the star point with a speed of 1000 rpm^{-1}. For **LUST DriveTronics GmbH** motors the value is indicated on the nameplate.

Note: In case of doubt input value 0V.

Nominal current 4.2.3.2.4

Here the nominal current in percent is adjusted.
100% correspond to the unit max. current.

- A-DS 006.1: 0 - 50% = 0 - 6 A (with 4 kHz)
- A-DS 012.1: 0 - 50% = 0 - 12 A (with 4 kHz)
- A-DS 020.1: 0 - 50% = 0 - 20 A (with 4 kHz)
- A-DS 035.1: 0 - 50% = 0 - 35 A (with 4 kHz)
- A-DS 045.1: 0 - 65% = 0 - 45 A (with 4 kHz)
- A-DS 055.1: 0 - 50% = 0 - 55 A (with 4 kHz)
- A-DS 075.1: 0 - 50% = 0 - 75 A (with 4 kHz)

Caution: Pay attention to the motor data. The here adjusted nominal current must not exceed the motor nominal current.

Max. current 4.2.3.2.3

Here the max. current in percent is adjusted (0-100%).
100% correspond to the unit max. current.

- A-DS 006.1: 100% = 12 A
- A-DS 012.1: 100% = 24 A
- A-DS 020.1: 100% = 40 A
- A-DS 035.1: 100% = 70 A
- A-DS 045.1: 100% = 70 A
- A-DS 055.1: 100% = 110 A
- A-DS 075.1: 100% = 150 A

The unit max. current is intended for the pulse generator. It cannot be made available permanently, *(see chap. 2, Technical data)* and *(see chap 6-18, Signal outputs X 2.2)*

Caution: With current parameter setting pay attention to the motor data. With excessive pulse current (Imax) a demagnetisation of the motor can occur.

Max. speed 4.2.3.1.2

Here the max. speed is input (0-9000 min^{-1}).
When reaching the adjusted max. speed the setpoint and consequently the speed are limited.

Caution: Pay attention to the max. speed of the motor.

Delay time motor temperature 4.2.4.5

When reaching the motor limit temperature the readiness for operation of the servoconverter is cancelled.

This cancellation causes an immediate disengagement of the regulator and output stage enable. The drive runs down in uncontrolled manner.
Due to the normally very high thermal time constant of the motor it is possible to provide a time delay between the signal ”motor overtemperature” and the cancellation of the readiness for operation. During that time the superimposed control has the possibility to run the drive into a safe position.
The time delay can be adjusted between 0-10 sec.

Caution: Pay attention to the motor data. An extremely long delay time can result in a motor damage, e.g. with full utilisation of the dynamics.

Delay time holding brake 4.2.4.4

The here adjusted delay time has the function to delay the cancellation of the regulator enable on its way to the input signal at terminal X2.2: Pin 7 is made.

After cancellation of the regulator enable the drive is braked to speed 0 along the quick-stop ramp*(see chap 6-16, Setpoint integrator enable Pin 10, LED 4)* and *(see chap 6-15, Controller enable Pin 7, LED 3)*. From that point, the drive places at disposal the holding torque for the period of the adjusted delay time. After expiration of the delay time the regulator enable is cancelled and the drive is without torque, *(see chap 6-20, Release the brake (n > 0) Pin 17)*.

When the delay time is set to 0 sec., the function becomes a standstill logic (H-signal with n = 0).

Caution: Pay attention to the switching times of the holding brake.

Kind of encoder 4.2.4.2

Here it is adjusted which encoder is fitted into the motor.

- ➢ Resolver
- ➢ Incremental encoder
- ➢ High-resolution encoder (absolute value encoder)

Hardware modifications in the converter are necessary for the connection of an absolute value generator.

In case of an incremental encoder, its resolution (260-9000 incr./rev.) has to be input, (menu point 42422).

Note: To allow the acceptance of a change of the kind of encoder, disengage and re-engage the servoconverter.

Encoder adjustment 4.2.2.4.2

Commutation

Here the electric 0°-position of the encoder can be adapted to the mechanical 0°-position of the rotor (commutation).

As far as possible, this parameter should be in 0°-position and the encoder adjustment should be made mechanically. With **LUST DriveTronics GmbH** motors, the encoder is already adjusted with the rotor position of the motor.

With 2-poles synchronous motors, e.g. FLP 10-40, an offset of 180° has to be adjusted.

This value must be set to 0° as standard.

7.2.3 Reference selector 1 and 2

Setpoint channels

Here the analog input is adjusted, from which the setpoint channel 1 (2) receives its setpoint, *(see chap. 6.6, Analog inputs X 2.1)*.

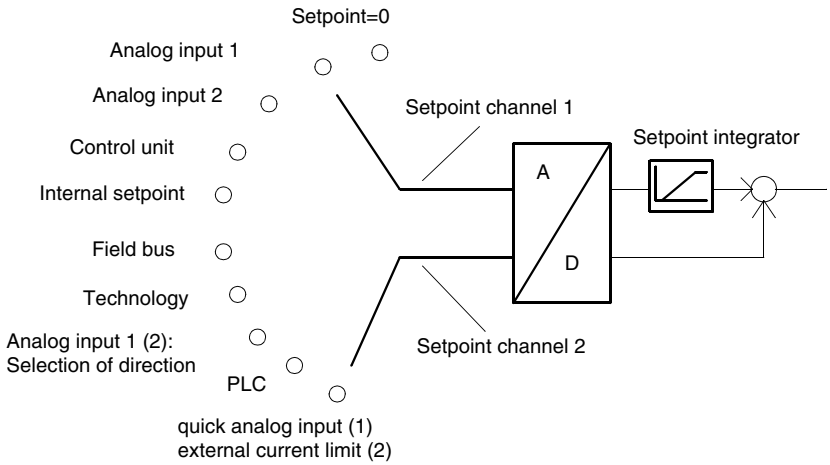


Fig. 7.1 B12-013 Setpoint channels

Both setpoint channels can read simultaneously values from different inputs.

Note: Always the sum from both setpoint channels is taken forming the basis for the regulation.

Each setpoint channel can be permanently set to the value 0 so that one channel only is active.

Quick analog input 1 (2.1.9)

The setpoint channel 1 disposes of the option to select the analog input 1 as quick analog input . Thereby its scanning time is reduced from 5 ms to 500 µs. It has to be assured, however, that the setpoint signal is not noisy, which would cause an unquiet rotation of the drive.

Preselection of an external current limit (2.2.9)

The setpoint channel 2 disposes of the option ”preselection of an external current limit”.

If a setpoint channel is put on the serial interface, the setpoint can be preselected via that interface.

Adaptation, smoothing and offset of the analog inputs 1 and 2 (4.2.2.2.x)

Adaptation:
4.2.2.2.1, 4.2.2.2.2

Here it is fixed which speed rating corresponds to +10V at the analog inputs (-9000 to +9000min^{-1}).
For torque regulation 10V are the equivalent of the maximum device current *(see chap. 2, Technical data)*.

Smoothing:
4.2.2.2.3, 4.2.2.2.4, 4.2.2.2.5

The setpoints are filtered through a low-pass filter. The time constant of the low-pass filter can be preselected at that point (5-100 ms).
For the quick analog input extended low-pass constants (0.13-99.99 ms) are available.

Offset:
4.2.2.2.6, 4.2.2.2.7

Here an offset for the analog inputs can be input (-100 to +100 $^{-1}$).
The offset alignment has to be made with speed regulation. Automatically it is also applicable to the torque regulation.
If the drive drifts with preselected 0V, this speed can be read in the terminal program **VecWin**. Inputting the speed with reversed sign will then compensate the existing offset.
Due to the Bit resolution the input offset can differ slightly from the displayed offset.

Setpoint integrator-times 4.2.2.3.x

The times for the reference value integrator slopes are set here (0.00-99.99s), *(see Fig. 6.11, page 16)*.

Setpoint integrator S-curve 4.2.2.3.9

The start and end of the reference value slopes may be additionally rounded by setting the S curve in the 0 - 1s range.

7.2.4 Regulator parameters

Due to the cascade structure of the regulation, the optimisation has to begin with the inner regulation circuits:

- ➢ Current regulator
- ➢ Speed regulator
- ➢ Flux regulator (only for asynchronous machines)
- ➢ Positon regulator (Option)

Current regulator 4.2.2.7.1/2

The current regulator can be optimised by the parameters v_{pi} (4.2.2.7.1) (0.01-1.00) and T_{ni} (4.2.2.7.2) (0.1-20 ms).

The best way is to optimise the jump reaction of the current regulator.

The regulator is well optimised when the actual value adapts as quickly as possible and with rather low over-shooting to the setpoint.

Before optimisation, read the instructions as per chap. 8 „Commissioning / Operation“ and adhere to them.

Proceed as follows for current control optimisation:

- – Set the ramp times (t1-t4, 4.2.2.3.1-4) to 0,
- – Lay setpoint channel 1 to serial interface (2.1.4)
- – Fix internal setpoint (2.3) to 500min^{-1}
- – Lay monitor 1 to torque setpoint (≡ I_{sq_set}) (3.5.8)
- – Lay monitor 2 to torque setpoint (≡ I_{sq_act}) (3.6.4).

By actuation of the setpoint integrator enable the jump is released. Current setpoint and actual current shall have the same course.

Now vary the parameters in such a way that the required course is reached approximately. Here the thumb rule applies:

- ➢ Increase of v_p and reduction of T_n accelerate the regulator.
- ➢ The quicker the regulator the more tendency to (over-) shooting

The active current setpoint can still be smoothed (4.2.2.7.3). To that effect input a time constant for the low-pass filter (0-9.99 ms).

Speed regulator 4.2.2.6.1(2)

The speed regulator can be optimized by the parameters vpn (4.2.2.6.1 (0.01-1.00)) and Tnn (4.2.2.6.2 (0.1-50 ms)).

The same instructions as to the current regulator apply (parameter v_{pi} and T_{ni}), i.e. the speed regulator as well is optimised through its jump reaction.

Provide the monitors with the corresponding speed values,

- ➢ monitor 1 with speed setpoint (3.5.1)
- ➢ monitor 2 with actual speed (3.6.2)

Speed actual value-smoothing 4.2.2.4.1

The speed regulation often requires a compromise between the dynamics and the concentricity. By means of actual speed smoothing (4.2.2.4.1) another parameter (0.00-9.99 ms) is available for this duty.

With large machines this time constant can be increased without influencing the dynamics, whereas simultaneously the concentricity is improved.

On principle the time constant shall be selected as low as possible.

Flux regulator 4.2.2.8.1-8 (only with asynchronous machines)

The flux regulator can be optimised by the parameters v_{p_psi} (4.2.2.8.1 (0.01-1.00ms)) and T_{n_psi} (4.2.2.8.2 (0.1- 500ms)).

The same instructions as to the current regulator apply (parameter v_{pi} and T_{ni}), i.e. the flux regulator as well is optimised through its jump reaction.

The state variables of the flux regulator cannot be read-out through the standard motor.

The parameters 4.2.2.8.3-5 are stated on the motor nameplate and can be calculated from its data as follows.

Nominal magnetizing current (4.2.2.8.3)

The data is given in percent related to the unit max. current.

$$I_{mr} = I_n \times \sqrt{\frac{(1 - \cos\varphi_n)}{(1 + \cos\varphi_n)}}$$

(see chap. 2, Technical data).

Nominal speed (4.2.2.8.4)

The nominal speed is stated on the motor nameplate (0.0 - 9000.0min^{-1}).

Rotor time constant (4.2.2.8.5)

$$T_r = \frac{(\sqrt{I_n^2 - I_{mr}^2})}{I_{mr} \times \omega_r}$$ with nominal slippage

$$\omega_r = 2\pi f_n \times \frac{(n_s - n_n)}{n_s}$$

- I_n = Nominal current of the motor
- I_n = Nominal frequency of the motor
- n_s = synchronous speed
- n_n = Nominal speed, (menu point 4.2.2.8.4)
- $\cos_\varphi$ = Nominal output factor

With high frequencies the voltage placed at disposal by the servoconverter is no longer sufficient to connect the leakage inductances to high current. I.e. from a defined speed a current reduction is required. This means that a current reduction is required from a certain speed onwards.

Release speed 4.2.2.8.6, release current 4.2.2.8.7

From a defined speed point (4.2.2.8.6) the current setpoint 1q-set is linearly reduced to an adjustable min. current value I-abl (4.2.2.8.7), thus keeping the output voltage of the servoconverter below the max. value.

7.2.5 Command

Type of regulation 1.2.4

Here the type of regulation (torque or speed regulation) is adjusted.

Limit switch 1.2.5

Here it is adjusted whether the inputs for the limit switches (X2.21/X2.22) are active with a H-level (10-30V) or with a L-level, *(see chap 6-14, Control inputs)*.

Brake operation 1.2.6

Here the brake operation is engaged and disengaged.
Brake operation means the engagement and disengagement of the brake quadrants in both directions of rotation.

7.2.6 Output signal and displays

Display unit 4.2.2.2.1

Here it can be adjusted whether to display or to input the speed values in Hz or rpm.

Monitors 3.5 (6).x

Here it is adjusted which system size is displayed on the monitor 1 or 2 *(see chap 6-22, Analog outputs (Monitors))*.

Encoder output 4.2.4.3

Here it is adjusted the number of increments per revolution to be generated by the encoder output X 13 (±16-8192 incr./rev.).
The signal at the encoder output is directly generated from the encoder signals (X 11) (± corresponds to the direction of rotation of the drive).
With the incremental encoder the number of increments should not be selected higher than its resolution.

Speed signals 4.2.2.5.x

Here the data for the signal outputs (hysteresis, low-pass filter constant, trigger n1) X2.2: Pin 15 (LED 9) and X2.2: Pin 16 (LED 8) are input.

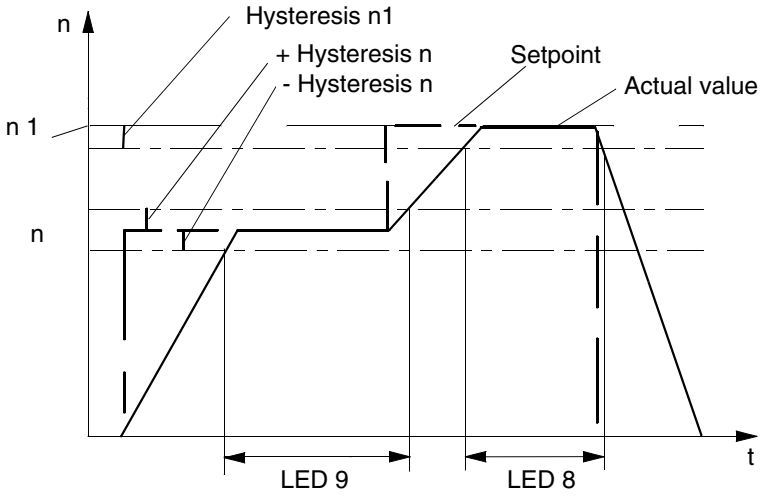


Fig. 7.2 B12-014 Hysteresis with speed triggering

Actual value display 3....

Here the actual values are adjusted which are indicated in the actual value display 1 and 2 at the PC or operator terminal **D-DS_1**.
The following actual values are displayed:

- 3.1.1 Actual speed
- 3.1.2 Set speed
- 3.2.1 Active current
- 3.2.2 Reactive current
- 3.2.3 Apparent current
- 3.3 Rotor position
- 3.4.1 Temperature in the servo amplifier
- 3.4.2 Temperature in the motor
- 3.51 Monitor 1 (n_{set})
- 3.5.2 Monitor 1 ($n_{act.}$)
- 3.5.3 Monitor 1 (phase current)
- 3.5.4 Monitor 1 (active current)
- 3.5.5 Monitor 1 (reactive current)
- 3.5.6 Monitor 1 (rotor position)
- 3.5.7 Monitor 1 ($n_{act.}$-rating)
- 3.5.8 Monitor 1 (torque setpoint)
- 3.6 Monitor 2, (see Monitor 1)
- 3.7 hours of operation
- 3.8 D.C. link voltage

7.2.7 Interface RS 232

Note: Modifications of the parameters after disengagement and engagement of the servoconverter only.

Baud rate 7.1.2

Here the transmission speed between the serial interface and the connected unit (PC with terminal program **VecWin** or SPC) can be indicated (600-38400 baud).

Parity 7.1.3

Here the parity is adjusted:

- 0 = none
- 1 = odd
- 2 = even

Data bits 7.1.4

Input of the number of data bits (7 or 8).
If 7 data bits are selected, the option ”parity = none” is not available.

Stop bits 7.1.5

Input of the number of stop bits (1 or 2).

Unit address 7.1.6

Input of unit address (1.2.5.4).

7.2.8 Other parameters

I^2t-limit values 4.2.3.3.1/2

The works set upwards (4.2.3.3.1) and downwards integration time t_(4.2.3.3.2) may be read off.

Code 4.2.6

Here the code can be changed which is scanned with parameter modifications (0-9999).

Language 6.1.x

Input of the required language (German, English, French, Italian only **VecWin**)

Software version 6.2

Here the version numbers of the drive software and the communication software can be read.
For **D-DS_1** (menu 6.2) and PC (information)
Behind the letter A the software version number for the regulation is indicated.
Behind the letter B the software version for the communication interfaces (RS232/485, **D-DS_1** and technology) are stated.

Scanning time 6.3

Here it can be read the max. cycle times the drive regulation (1st value) uses, and the setpoints (2nd value) (µs) can be scanned.
The cycle time of the drive regulation is influenced by the selected switching frequency.

7.3 Terminal program VecWin

7.3.1 General

With this terminal program VecWin, **LUST DriveTronics GmbH** servoconverter of series CD_/WD_/UD_/AD_..3/ U-DS...1 can be parameter set via the interface RS232 by PC-AT and can be set into service.

Caution: Using the terminal program presupposes that the service manual of the corresponding amplifier module has been read and understood.
In particular adhere to the safety guidelines.
Loading or sending of files (parameter sets) from or to the amplifier must only be made with disengaged regulator enable.

7.3.2 Cable connection between PC and servoconverter

the connection is described in *(see chap. 6.12.1, RS 232 X 14)*.

7.3.3 PC, configuration and installation

A PC-AT is necessary which meets the following requirements:

- PC-AT 486 or Pentium
- Windows 95/98/NT/ME/2000/XP
- min. 16 MB RAM
- VGA - graphics

In the currently usual standard configurations no problems occur. Should you experience any problems on installation, please consult our after-sales service.

7.3.4 Working with VecWin

How to handle the parameterisation via terminal program is explained in the special leaflet.

- **LUST DriveTronics GmbH, manual No. 192-00307**

8 Commissioning / Operation

Danger: Before commissioning the whole chapter must have been read and understood.

Caution: Commissioning may only be performed by qualified personnel with electrical engineering training who are instructed in accident prevention measures.

Caution: The trained personnel must have read and understood the power module operating manual prior to servoconverter A-DS 006.1 - 075.1 commissioning.

8.1 Procedure

The commissioning is made in steps:

- ➢ a) Checking and switch positions
- ➢ b) Engagement
- ➢ c) Parameter setting
- ➢ d) Optimisation

Caution: None of the steps may be skipped!

Assure that on commissioning of several units the steps a) to c) for each unit are followed individually. The other servoconverter should be disengaged during that time.

Caution: On initial engagement, motor and load should still be separated.

Caution: Fix the motor to prevent it from making any uncontrolled and hazardous motion in case of a speed jump.
To that effect select the type of operation ”speed regulation” in the menu ”parameters” sub-menu ”selection of type of operation”.

8.1.1 Checking and switch positions

Check the mechanical assembly of the servoconverter and the electrical connections.
In particular check whether:

- the phase sequence of the motor connection has been adhered to.
- the amplifier module has been connected safely to the blank mounting plate of the switch cabinet.
- the motor and data cable screens have been layed separately on the two screen terminals.
- all wire connections and connected sub-D- plugs are firm.
- the sensor cable has been connected correctly.
- the 24V supply has been connected correctly.

Caution: Assure that the output stage enable is switched-off. Furthermore disengage the regulator and setpoint integrator enable.

Then the output stage enable can be made at terminal X2.2: Pin 8.

The controller and reference integrator enables may be switched via terminal X2.2: Pin 7 and X2.2: Pin 10 and RS 232 (e.g. via terminal program **VecWin**), **D-DS_1** or a bus system.

8.1.2 Engagement

Note: Assure that motions of the drive can be detected immediately.

The 24V supply for the servoconverter is switched on.
Switch on the 24V and power module supply.

Caution: With motor acceleration, disengage the unit immediately. Check the connections, check in particular whether the output stage enable is disengaged.

8.1.3 Parameter setting with motor standstill

For the parameter setting use the terminal program VecWin, the operator terminal **D-DS_1** or special customers' programs.

The following statements refer to the menu designations used in the terminal program **VecWin**.

Caution: In the works the servoconverter is parameter pre-set with the special data given by the customer. See the attached accompanying lists.

With disengaged regulator enable, setpoint integrator enable and output stage enable, input the following parameters:

1. Input of:

- number of pole pairs of the motor, menu 4.2.4.1
- type of drive (type of motor), menu 4.2.4.6

Voltage constant of the motor (with synchronous motor only) in the menu "parameters" sub-menu "motor data"
After a modification of the parameters "number of pole pairs" or "type of drive", disengage the converter and re-engage it after some seconds. Otherwise the converter does not accept the modifications.

2. Input of max. speed, menu 4.2.3.1.2

In the menu "parameters" sub-menu "limit values" sub-menu "speed limit values".

Caution: Adhere to the motor and system data.

3. Input of the current limit values for:

- max. current, menu 4.2.3.2.3
- nominal current, menu 4.2.3.2.4

In the menu "parameters" sub-menu "limit values" sub-menu "current limit values".

100% correspond to the unit max. current.

The maximum device current cannot be provided permanently if it is greater than the set nominal current *(see chap 6-18, Limit of the current I^2t, Pin 14 LED 6, yellow)*.

Caution: Adhere to the motor data, in particular to the motor nominal current, *(see chap 7-4, Motor data)*.

4. Input of the sensor type fitted into the motor, menu 4.2.4.2

In the menu ”parameters” sub-menu ”kind of sensor”.

Disengage the converter after a modification of the parameter ”sensor type” and re-engage it after some seconds. Otherwise the modification is not taken over by the converter.

Note: Hardware modifications in the converter are necessary for the connection of an absolute value generator!

5. Input of the setpoint source for:

- setpoint channel 1, menu 2.1
- setpoint channel 2, menu 2.2

In the menu „setpoints“ submenu „setpoint 1 (2)”.

The setpoint channels 1 and 2 must not be connected identically. The only exception is point ”0”.

Only reference values supplied to reference value channel 1 pass through the reference value integrator, *(see chap 7-8, Setpoint integrator S-curve 4.2.2.3.9)*.

Modifications in this menu point are accepted with disengaged regulator enable only. Otherwise the modification is not taken over by the converter.

6. input of setpoint adaptation, menu 4.2.2.2.1(2)

In the menu ”parameters” sub-menu ”limit values” sub-menu ”speed limit values”.

Only required, if analog input 1, 2 or quick analog input 1 has been selected for one of the two channels, *(see point 5)*.

The input speed value is the scaling value for the max. input voltage of 10V.

7. Input of the regulator parameters for:

- current regulator, menu 4.2.2.7...
- speed regulator, menu 4.2.2.6...
- flux regulator, (only with asynchronous machines), menu 4.2.2.8....

In the menu ”parameters” sub-menu ”unit parameters” sub-menu ”current regulator” or ”speed regulator” or ”flux regulator”.

8. Input of the setpoint integrator-ramps, menu 4.2.2.3

In the menu ”parameters” sub-menu ”limit values” sub-menu ”setpoint integrator-ramps”.

At this point the setpoint integrator-times have to be input, when the motor has already been connected to the load and the load must not be accelerated too quickly. With motor still in idle-run operation, this parameter can be adjusted on optimisation.

The setpoint integrator-ramps are only applied to setpoints of the setpoint channel 1.

8.1.4 Parameter setting with rotating motor

9. Pre-select a low setpoint

By the next step the ref. command of the motor can be released.

Caution: Assure that the motor is separated from the load and that the drive can be observed from the switching point.

10.Switching of:

- output stage enable, X2.2: Pin 8
- regulator enable, X2.2: Pin 7
- Setpoint integrator enable, (only necessary if the setpoint is preselected through the setpoint channel 1). X2.2: Pin 10

Check at that point if:

- the co-ordination of the direction of rotation is correct.
- the adaptation on utilization of the analog inputs is correct.

With satisfactory basic functions of the drive (clockwise, counter-clockwise rotation, stage signals of the LEDs, signal outputs, etc.) the next step is to optimise the drive.

8.1.5 Optimisation

Disengage the servoconverter and connect the motor to the load.

Change the parameters ”max. speed clockwise”, ”max. speed counter-clockwise” and the setpoint adaptation to avoid any damage to the system.

The behaviour of the regulator can be optimised by means of the parameters in the menu ”parameters” sub-menu ”unit parameters” sub-menus ”current regulator”, ”speed regulator” and ”flux regulator”.

The flux regulator is adjustable for asynchronous machines only.

For optimisation of the regulators look at the jump reaction of the regulator. This reaction can be observed with the monitors, *(see chap 6-22, Analog outputs (Monitors))*.

Generally the following applies:

- Increase of v_p and reduction of T_n accelerate the regulator.
- The quicker the regulator the more tendency to (over-) shooting.

For the adjustment of further options (number of increments encoder output, sensitiveness of the speed signal, limit switch logic, etc.) *(see chap. 7.2, Description of parameters)*.

The commissioning is finished.

8.2 Operating the unit

Caution: Regardless of the following instructions, the legally-applicable safety and accident prevention regulations in force at the place of use (e.g. VDE) must always be applied when operating the amplifier module. The user must ensure that such regulations are adhered to.

Caution: The air drawn in by utilisation of unit fans must be free from conductive particles such as graphite, drilling dust etc. (Protection class IP20 to DIN 40050).

8.3 Duty factor

The servoconverter are designed for 100% duty factor in nominal load operation, up to 40°C ambient temperature.

With 1°C each ambient temperature above 40°C, up to 55°C, a load reduction of 2% has to be considered.

If the system operates with load cycles, the effective load torque has to be detected, *(see chap. 5.5, Selection of unit)*.

9 Fault-finding

Danger: If necessary to take the unit out of the housing to eliminate a fault, the system must be disconnected from the mains supply and must be protected against unintended re-engagement.

Danger: After disconnection, for a period of a few minutes, the unit contains components subject to hazardous voltage causing the death or strong bodily injuries in case of touching (capacitor residual charge).

Danger: Before carrying-out any maintenance works, it is therefore absolutely necessary to assure and to check that the current supply has been disconnected, made safe and that the d.c. link is discharged.
Immediately before maintenance work the DC link to terminals **L+** and **L-** must always be measured
(When DC operation 0 - 1000V).

9.1 Fault signal via LED

The LEDs located on the front plate of the servo-amplifier signalise in flashing mode any fault within or at the periphery of the unit.

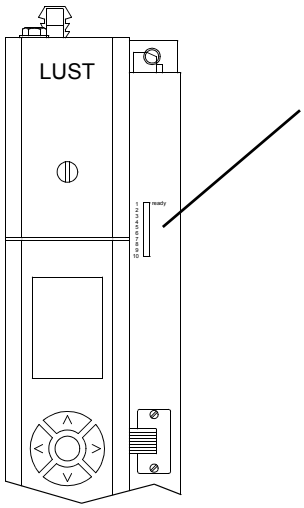


Fig. 9.1 B11-015 status LED´s

LED	Permanent light (status)	Flashing light (fault signal)
1	"Ready" signal	Acknowledgement with controller enable
2	Output stage enable	Overspeed
3	Controller enable	free
4	Setpoint integrator enable	Computer fault
5	C-axis-operation	Overtemperature motor
6	I^2t-signal	Short-circuit or shorts to earth on output stage
7	Release the brake (n > 0)	Encoder fault
8	n > n1	Fault supply voltage
9	$n_{act.} = n_{set}$	Overvoltage and undervoltage
10	free	Overtemperature on output stage

Table 9.1 Status LED´s

9.2 Fault finding / remedies

No "ready signal", no LED flashes:

Possible cause 1
1. Fuse failure of the 24V-supply

Remedy
➢ Check the voltage supply and the fuses
➢ check the fuses in the conduct

Possible cause 2
2. Unit type adjusted wrongly

Remedy
➢ Check the parameter "unit type", menu 4.2.1.1

LED 1 flashes (ready signal with regulator enable)

Possible cause 1
1. Acknowledgement of fault with engaged regulator enable.

Remedy
➢ Disengage and re-engage regulator enable.
Additional acknowledgement not necessary

LED 2 flashes (Overspeed)

Possible cause 1
1. Wrong sensor at the motor, wrong number of incr. of the sensor.

Remedy
➢ Check the motor sensor

Possible cause 2
2. Motor speed is overshooting due to non-optimised parameters.

Remedy
➢ Check the regulator parameters

Possible cause 3
3. Setpoint integrator, t1 or t3 resp. programmed to 0 s.
With a setpoint jump from 0 to n_{max} the speed is overshooting.

Remedy
➢ Program the time for setpoint integrator-ramps

LED 3 flashes (no function)

LED 4 flashes
a. Computer fault, b. check sum fault

The function monitors the processors. With fault signal the readiness for operation is interrupted

Possible cause 1
1. Computer fault
Fault of the processor due to an internal defect or strong EMC-disturbances.

Remedy
➢ Disengage regulator enable
➢ Acknowledgement
➢ Engage regulator enable
➢ If computer fault cannot be acknowledged, disengage the unit and re-engage it after 10 sec.
➢ With repeated fault
➢ Check the EMC-measures
➢ Ship the unit to the after-sales service

Possible cause 2
2. Check sum fault
The sum of the parameter content changed after the last disengagement and re- engagement.
When using a different software version the fault can be displayed.
The check sum fault also signalises the computer fault.

Remedy

- ➢ Disengage regulator enable
- ➢ Acknowledgement
- ➢ Load set of basic parameters
- ➢ Parameter set the unit anew
- ➢ Disengage the unit and re-engage it after 10
- ➢ Set the unit into operation

LED 5 flashes (Motor overtemperature)

The fault signal is released after having exceeded a resistance value of the posistor provided in the motor winding. Readiness for operation is interrupted.

Possible cause 1

1. Motor overheated by overload

Remedy

- ➢ Assure motor cooling
- ➢ Perhaps weaken the regulation
  - Vp lower
  - Tn higher

Possible cause 2

2. The sensor cable, in which the motor posistor is also guided (X11), is not connected.

Remedy

- ➢ Check the plug link of the sensor cable
- ➢ Check the soldering links in the plug connections

Possible cause 3

3. Defective posistor or cable (wire breakage).

Remedy

- ➢ Check the cable resistance between pin 14 and 15 in the sensor plug *(see chap 6-24, Motor sensor X 11)*.

Possible cause 4

4. Defective posistor evaluation in the servo-regulator

Remedy

- ➢ Check the evolution as follows:
- ➢ Check whether the speed setpoints are in 0-position
- ➢ Bridge pin 14 and pin 15 in the plug unit X11
- ➢ Acknowledge fault
- ➢ => if fault cannot be acknowledged, the evaluation in the regulator is defective

LED 6 flashes (Short-circuit / short to ground)

Overcurrent and overtemperature are monitored with the U_{CE}-voltage on IGBT. With fault signal the readiness for operation is interrupted

Possible cause 1

1. Short-circuit or short to ground in the motor, in the motor cable or in the servoconverter.

Remedy

- ➢ Disconnect the motor
- ➢ measure the motor winding
- ➢ Detect the resistance against the motor housing by means of a hand generator or a similar device
- ➢ Disconnect the motor cable at the amplifier module
- ➢ Switch on the power module for the servocontroller
- ➢ If short-circuit/short to ground is signalised via LED 6, the servoconverter is defective.
- ➢ => Ship the regulator to the **LUST DriveTronics GmbH** after-sales service

Possible cause 2

2. Undervoltage on IGBT driver

Remedy

➢ Regulator voltage X 3 (24 V) beyond the tolerance

LED 7 flashes (Encoder fault)

Possible cause 1

1. Sensor cable not connected to the motor or amplifier (X11)

Remedy

➢ Check the plug connection

Possible cause 2

2. Defective sensor cable

Remedy

➢ Check for damage/cable breakage

Remarks: The fault detection refers to incremental and high-resolution encoders only.

LED 8 flashes (Fault of the supply voltage)

The supply voltage is the voltage supplying the regulator. It is connected to the terminals X3+ and X3-, *(see chap 6-23, Regulator supply X3)*. Readiness for operation is interrupted.

Possible cause 1

1. Excessive load or short-circuit in the peripheral units which are connected via the plugs X11-X16 (SUB-D)

Remedy

➢ Disengage the amplifier module

➢ Disengage the regulator and output stage enable

➢ Remove the plugs X11-X16

➢ Engage the amplifier module, connect 24V (X3+ and X3-) supply

➢ =>flashes LED 8, fault in the module,
ship the unit to **LUST DriveTronics GmbH** after-sales service.

➢ If no fault is signalised, fit the SUB-D plugs one after the other until the fault occurs.

➢ Check the faulty cable or unit for cable short-circuit

➢ The supply voltage could also be influenced by excessive mains load or other consumers.

LED 9 flashes (Over- /undervoltage)

Voltage in the D.C. link is monitored. When exceeding the top and bottom voltage values, the readiness for operation is interrupted.

Trigger threshold: A-DS 006.1 - 075.1
Undervoltage: 240V DC
Overvoltage: 690V DC
Checking of the D.C. link voltage at the terminals **L+** and **L-**.

Possible cause 1

1. Overvoltage with braking only

➢ Excessive braking energy for brake resistance

Remedy

➢ Reduce the brake output by increasing the braking slope time on the reference value integrator

Possible cause 2

2. Overvoltage also with low brake output

➢ Brake resistance or its ref. command is defective

Remedy

➢ Send in the device together with the power module to the **LUST DriveTronics GmbH** customer care service

Possible cause 3

3. Undervoltage on acceleration

Remedy

➢ Acceleration ramp too steep

➢ Reduce the acceleration energy by extension of the acceleration ramp time on the setpoint integrator

➢ Mains conduct too weak, check the mains

Possible cause 4

4. Undervoltage also with less power output as a phase in the conduct is missing

Remedy

➢ check the fuses in the conduct

➢ Check terminal connection

LED 10 flashes (Overtemperature output stage)

Fault signal with overheating of the brake resistance. Readiness for operation is interrupted.

Possible cause 1

1. Output stage overloaded

Remedy

➢ Heat accumulation in the module, check aeration

➢ Excessive ambient temperature

➢ Excessive clock frequency with nominal current

9.3 Fault signal via operator terminal D-DS_1

At the operator terminal **D-DS_1** , actual faults are indicated in clear text in the menu 51. In addition up to 32 fault signals, memorized in the sequence of time, can be inquired in menu 52.

Types of fault

The types of fault are coded as per the following numbers:

Fault No.:	Cause
1	Overtemperature output stage
2	Over- / undervoltage D.C. link
3	Internal supply voltage
4	Sensor fault, motor sensor
5	Overcurrent, short-circuit
6	Overtemperature motor
7	Computer fault
8	free
9	Overspeed
16	Check sum fault

The operator terminal and **VecWin** display the fault “check-sum fault” in clear text, besides the above mentioned faults.

Fault memory menu 52

Fault memory

Example for display of a fault:

Fault No.:	5 7 00:04:34
5	Current fault No.
7	Type of fault
00:04:34	Period of fault

The displayed fault is:

- Fault No. 5
- Type of fault 7 = computer fault
- Period of fault
  hh:mm:ss = 4 min., 34s
  after the last ”cancel fault memory” (menu 522).

9.4 Fault diagnosis, abridged version, independent of the LED fault signals

Consequence	possible cause
All LED´s dark	– missing 24 volts supply – Internal defect of the mains unit – Short-circuit to 24 V outputs
Check sum fault	– Parameter set not suitable for the unit version
Encoder fault	– Inexpert motor mounting, shock load of the shaft – Defective encoder – Defective encoder cable – Earthing / screen inexpert / transition resistances – Wrong encoder type selected
I^2t - signal	– Motor demagnetised / bearing damage – Mechanical tightness – Brake not released – Ref. command of the holding brake insufficient or too high
Short circuit / shorts to earth	– Winding short circuit in the motor or motor cable – Faulty isolation of the motor cable – Ambient conditions with metal dust or graphite dust – Defective output stage – Water in the motor terminal box or switch cabinet

Consequence	possible cause
motor **does not rotate or is jerking, unquiet running**	– Missing enable signals – Missing / wrong setpoint preselections – Wrong parameterisation of the setpoint selector – Wrong number of pole pairs selected – Motor phases mixed-up – Encoder cable of a different motor connected – wrong number of incr. of the sensor – Defective encoder / encoder adjustment – Screen not fitted – Interrupted earthing / encoder cable / output cable – Motor grounded incorrectly – Wrong belt tension / loose effect of the mechanics – Mechanical unbalanced mass – Wrong parameterisation speed/ current regulator – Defective motor / demagnetisation / bearing damage
Computer fault	– Disturbed EMC-surroundings (radio plants / welding machines) – Inexpert earthing / screening – Defective cable (screening / earthing) – Engagement / disengagement cycle shorter than 3 sec. – Wrong parameter files
Interface **Unit does not respond to commands through RS-interface**	– EMC surroundings – Faulty interface protocol
Overtemperature motor	– Excessive ambient temperature – Excessive load / cycle / mechanical tightness – Brake not released – Motor demagnetised – Heating due to not-circular running / see motor

Consequence	possible cause
Overtemperature servoamplifier	– Defective unit fan – Covered unit fan – not enough space for the cold air – Excessive ambient temperature – Filter meshes of the switch cabinet polluted – Defective switch cabinet fan or air conditioner – Units overloaded – Excessive clock frequency of the output stages selected
Undervoltage/overvoltage	– No AC/DC output feeding available – With AC feeding: missing phase – Fed AC/DC voltage outside the tolerance – Mains downfalls / dissymmetries in the mains – Inexpert cabling of the DC Bus / EMC – With D.C link feeding from the main drive: defective mains module or defective main drive

10 A - Appendix

10.1 Schematic circuit diagram of control loop

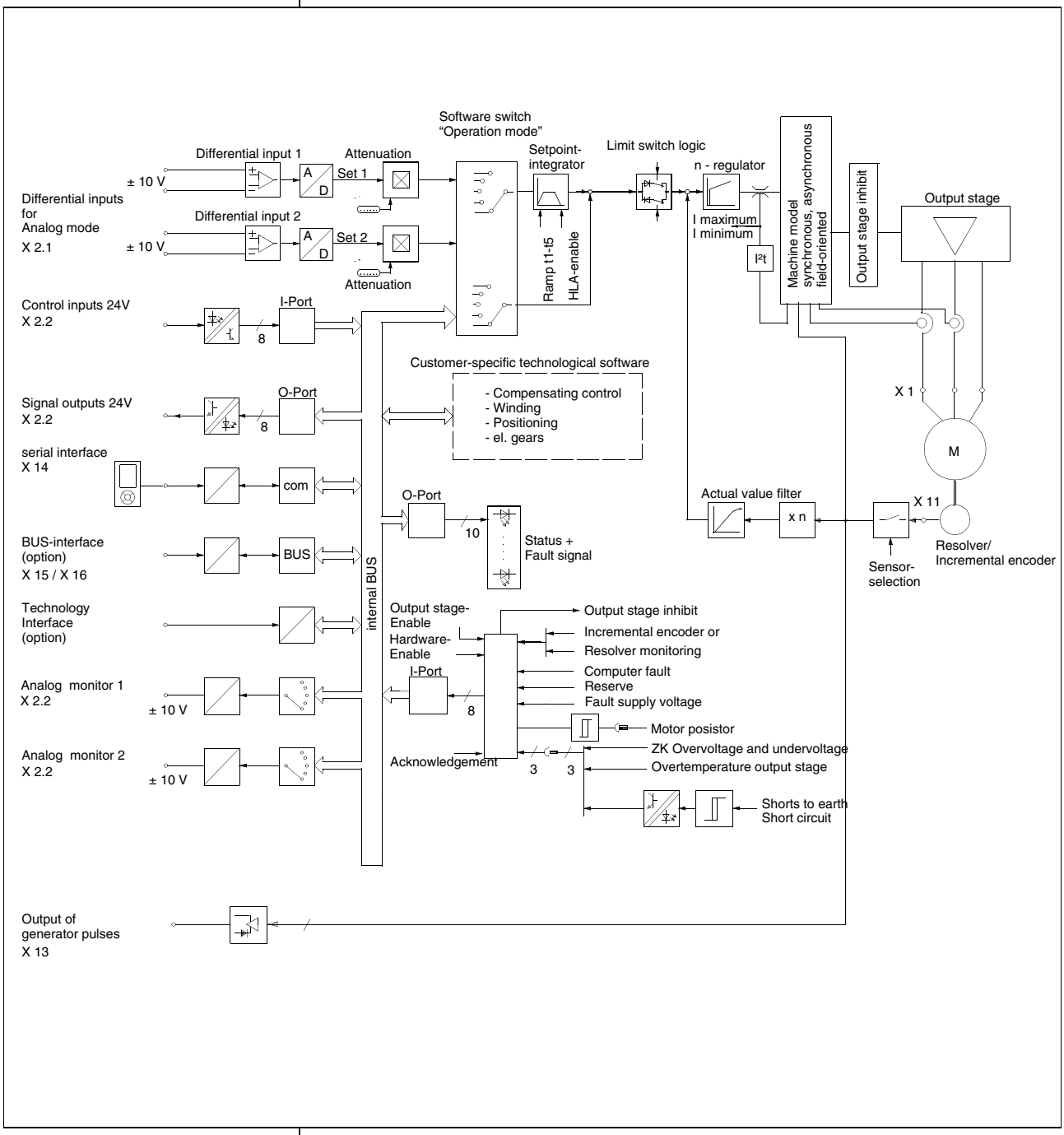


Fig. 10.1 B12-015 Schematic circuit diagram

10.2 Motor sensor - connections

10.2.1Resolver

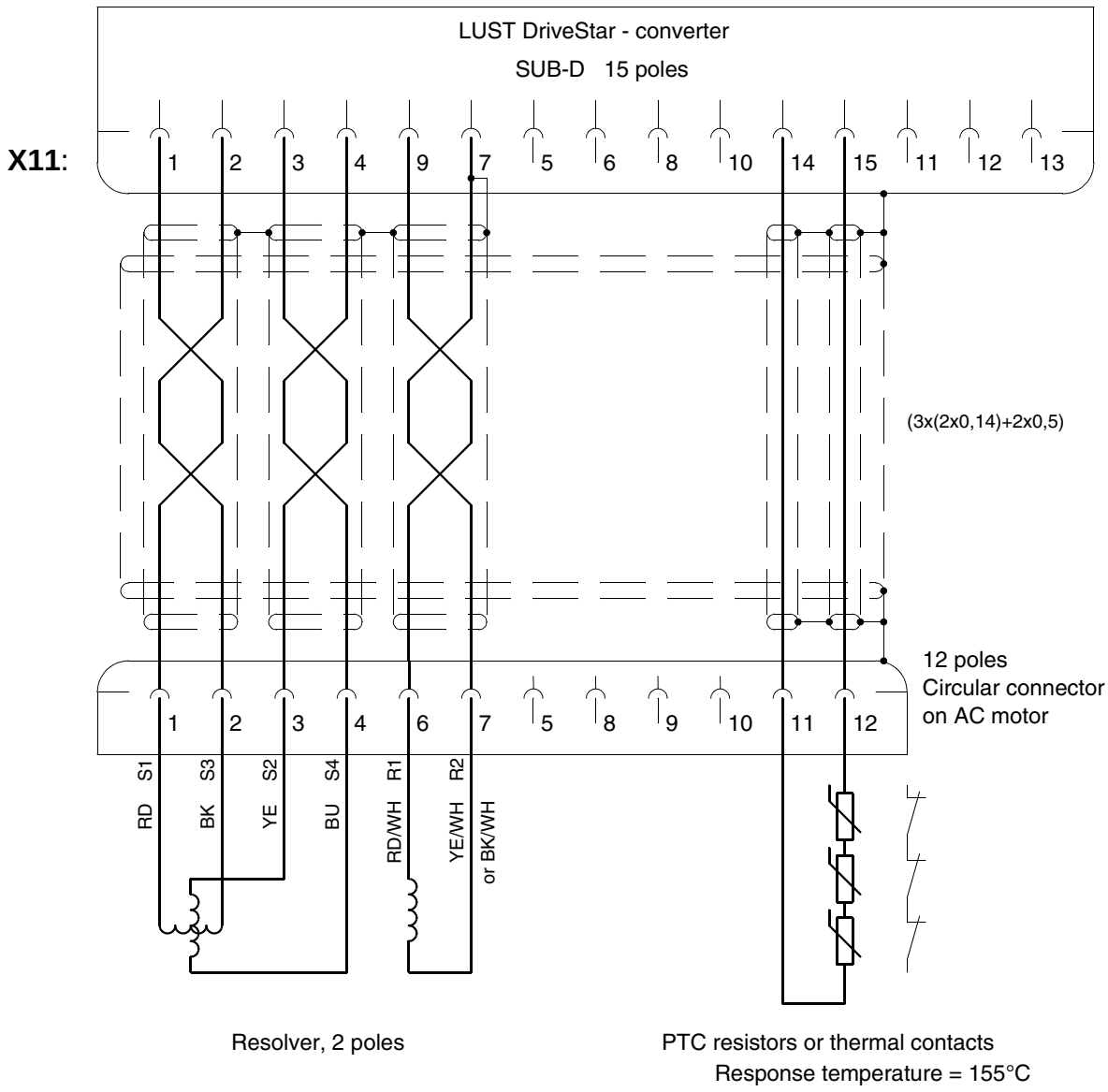


Fig. 10.2 B10-006 Connection resolver

10.2.2 High-resolution encoder
Absolut value encoder

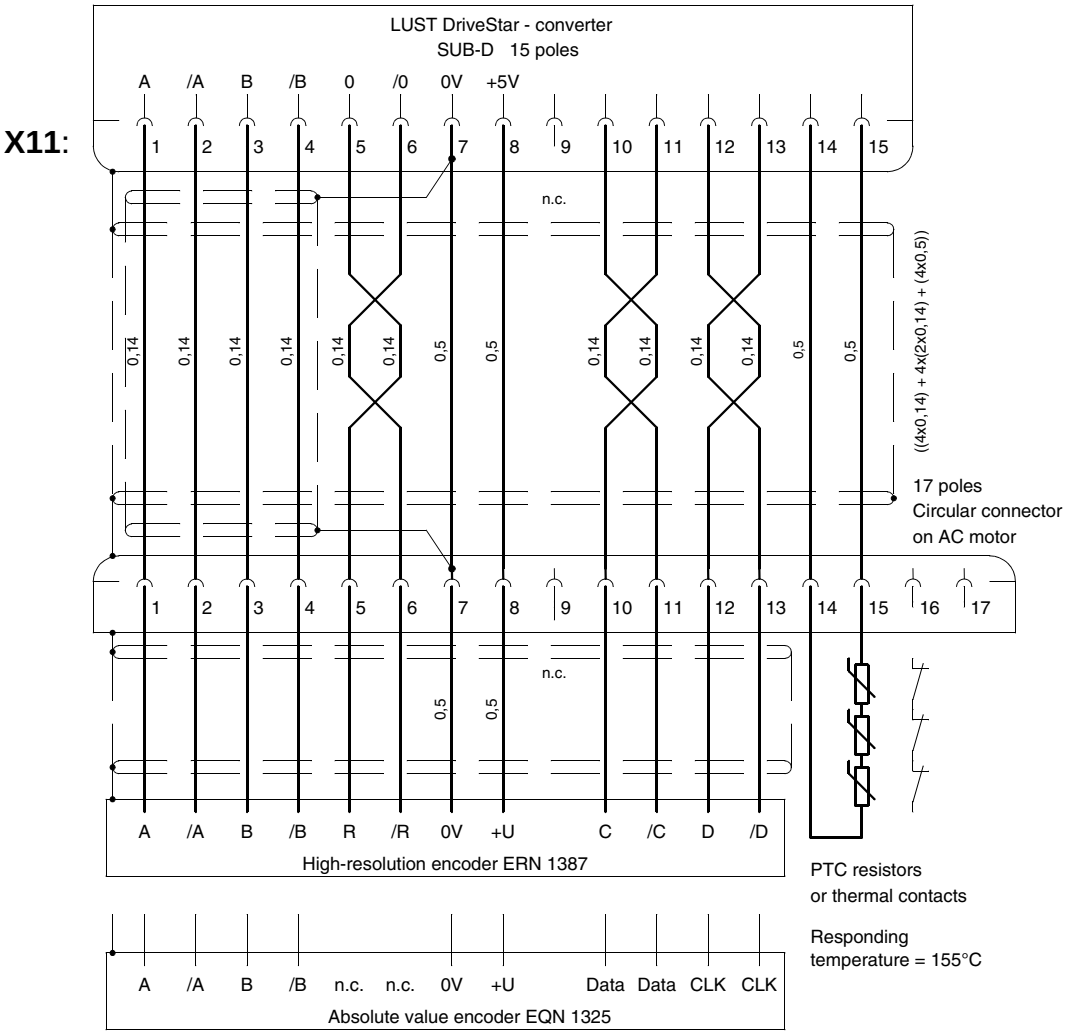


Fig. 10.3 B10-018 Connection high-resolution encoder

10.2.3Rotary pulse generator

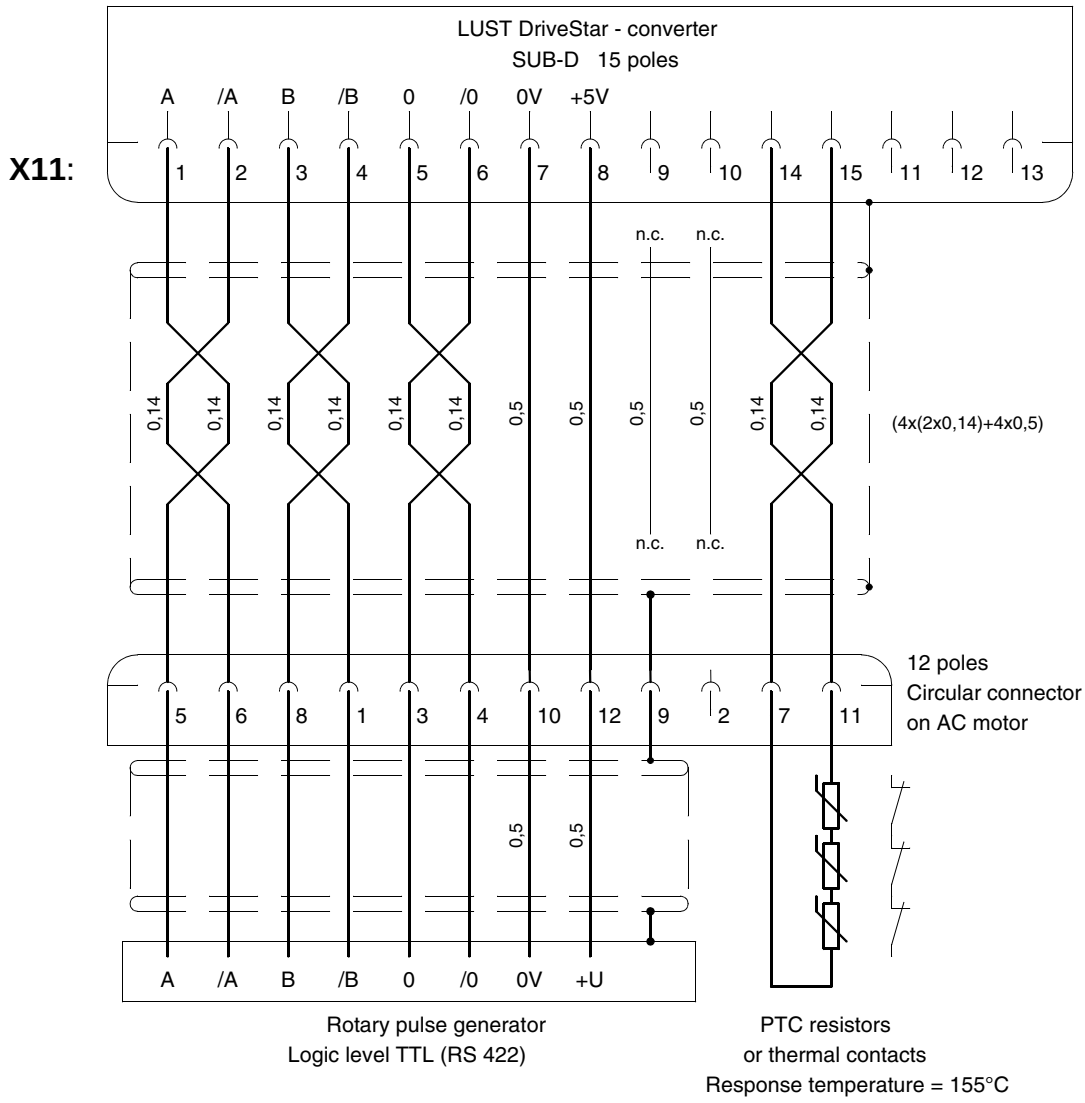


Fig. 10.4 B10-007 Connection rotary pulse generator

10.3 Dimensions for mounting

10.3.1A-DS 006.1 bis A-DS 020.1

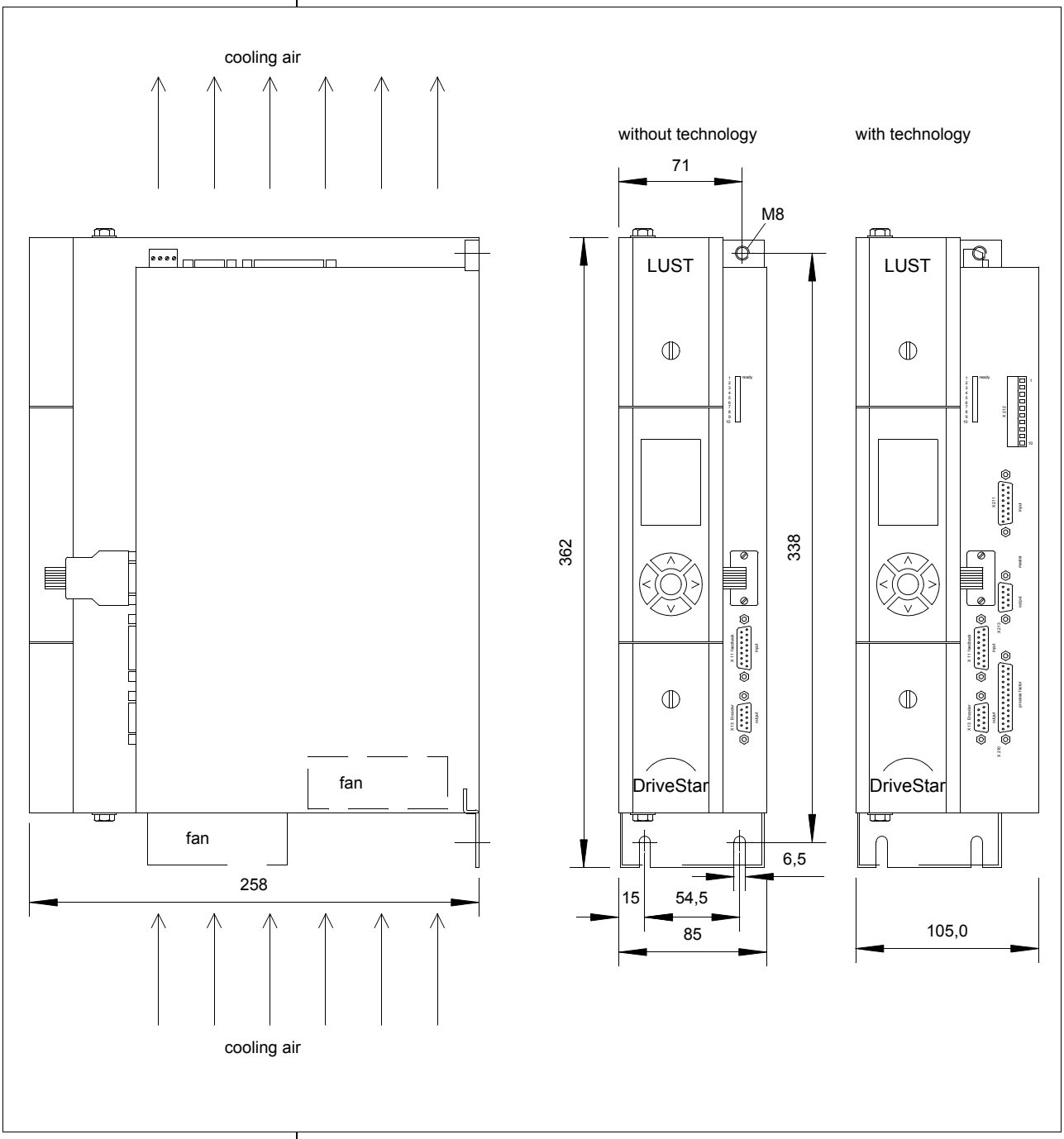


Fig. 10.5 B11-050 Dimensions A-DS 006.1 to A-DS 020.1

10.3.2A-DS 035.1 and A-DS 045.1

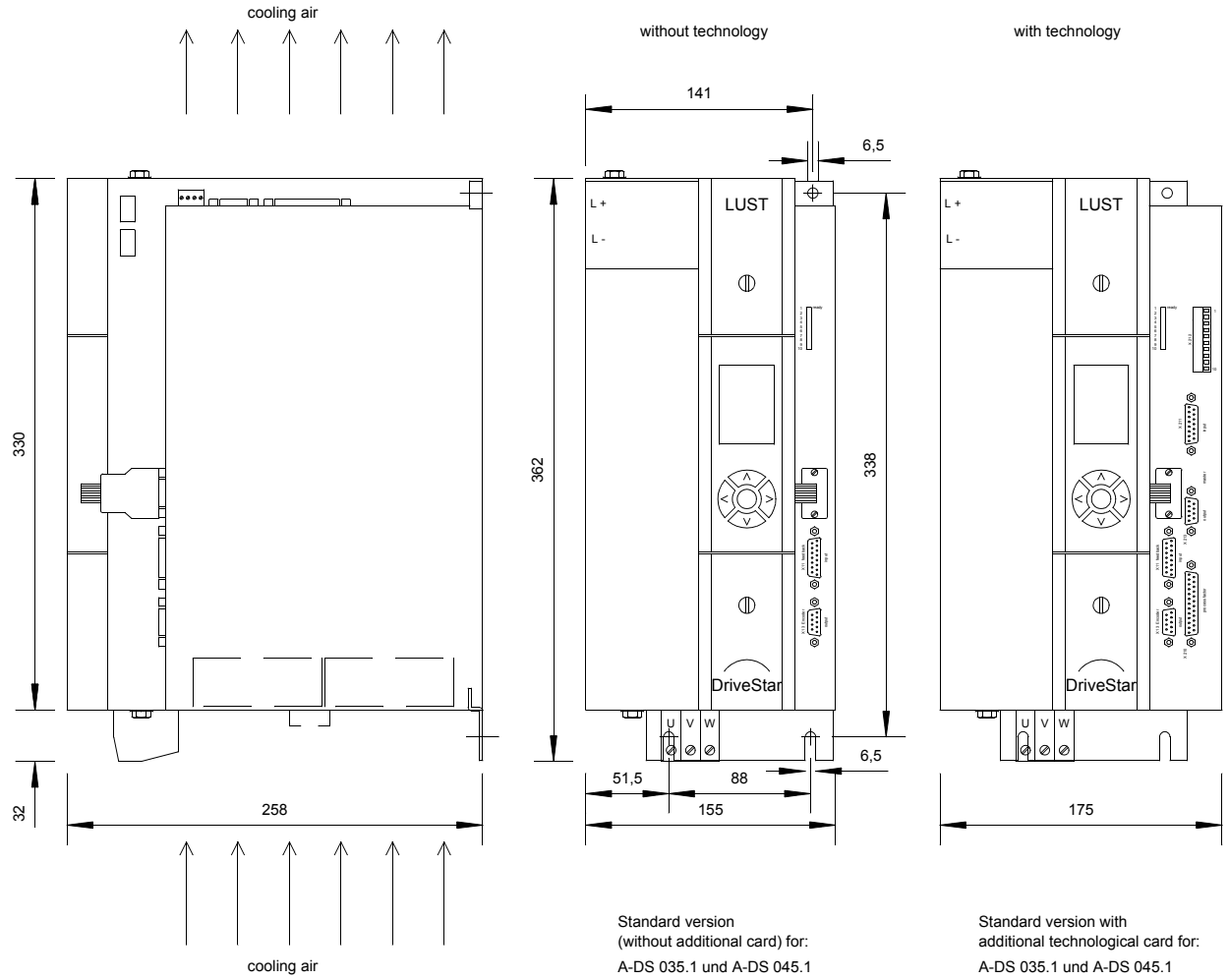


Fig. 10.6 B11-051 Dimensions A-DS 035.1 and A-DS 045.1

10.3.3A-DS 055.1 and A-DS 075.1

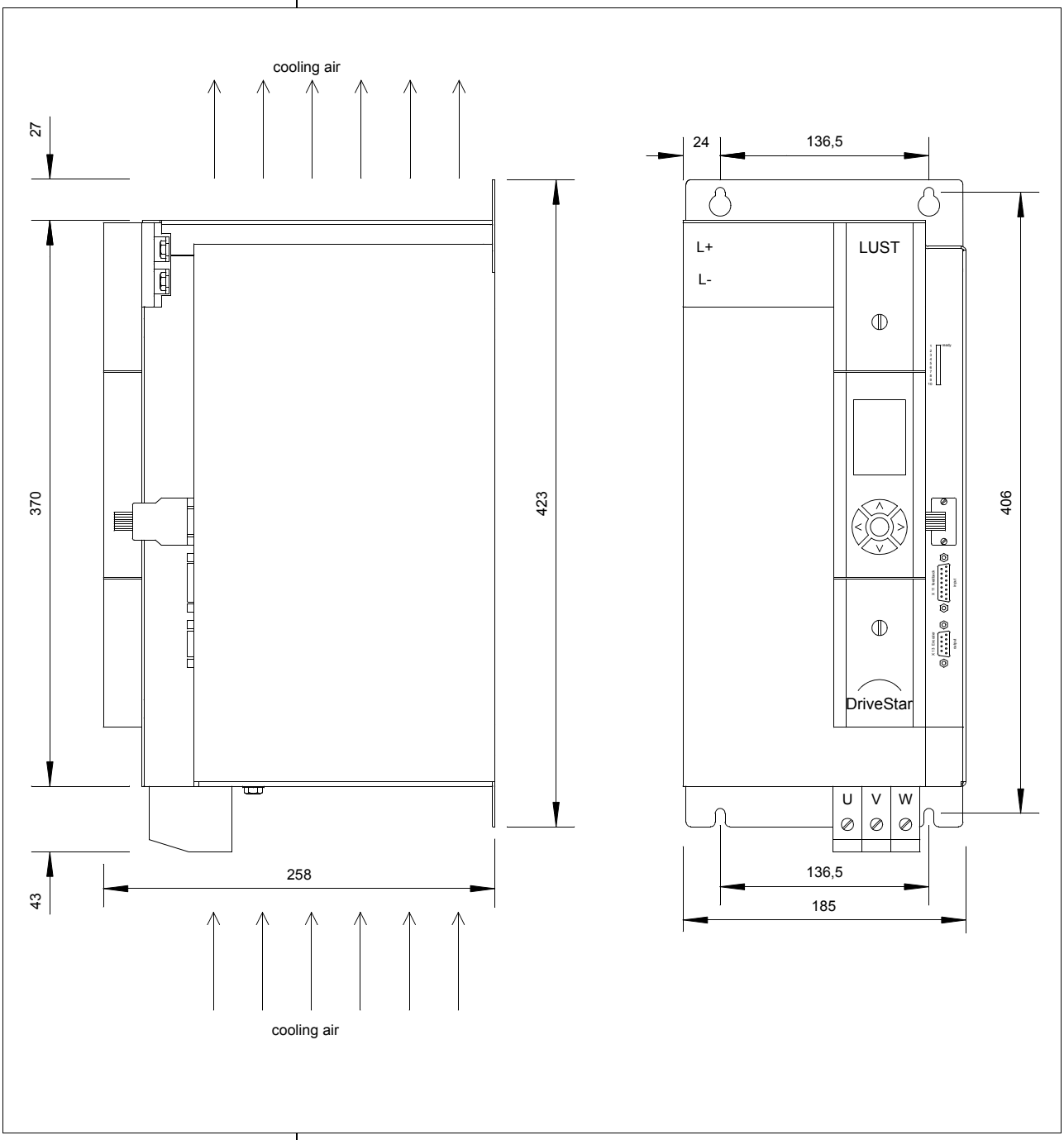


Fig. 10.7 B11-052 Dimensions A-DS 055.1 and A-DS 075.1

10.3.4Mounting dimensions for D.C link connection

A-DS 035.1 or A-DS 045.1

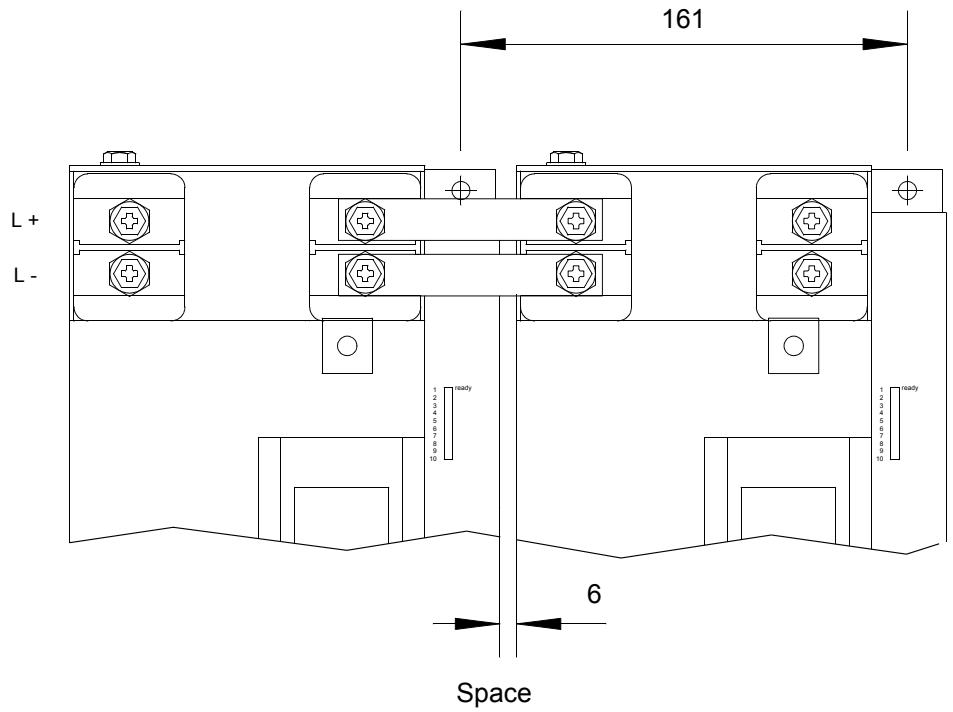


Fig. 10.8 *B11-060 Mounting dimensions for D.C link connection*
Example: 2 Servoconverter A-DS 035.1 or A-DS 045.1

Fig. 10.9

10.4 Accessories

10.4.1 Control cables for X 2.1

Assembled cables SUB-D 9 pol. plug

Pin	Signal	
1	Analog input 1+	
2	Analog input 1-	
3	GND analog	
4	Analog input 2+	
5	Analog input 2-	
6	GND analog	
7	GND analog	
8	Auxiliary voltages + 10V	
9	Auxiliary voltages -10V	
Housing	Screen	

Table 10.1 *Control cables for X 2.1*

Caution: Not used wire must be isolated

Cable length: 9m

Article No. 182-01811

10.4.2Control cables for X 2.2

Assembled cables SUB-D 25 pol. plug

Pin	Signal	
1	Output, +24V, 100mA	
2	GND analog	
3	GND 24V	
4	Input, reserve	
5	Torque regulation	
6	C-axis-operation	
7	Controller enable	
8	Output stage enable	
9	Acknowledge fault	
10	HLA-enable	
11	Limit switch 1 for clockwise running	
12	Limit switch 2 for anticlockwise running	
13	“Ready” signal	
14	I^2t	
15	n-act. = n-set	
16	n > n1	
17	Release the brake (n > 0)	
18	Overtemperature motor	
19	output stage over-temperature	
20	Output reserve	
21	Monitor 1	
22	GND analog	
23	Monitor 2	
24	signal contact	
25	Starting inhibit (option)	
Housing	Screen	

Table 10.2 *Control cables for X 2.2*

Caution: Not used wire must be isolated

Cable length: 9m

Article No. 182-01810

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