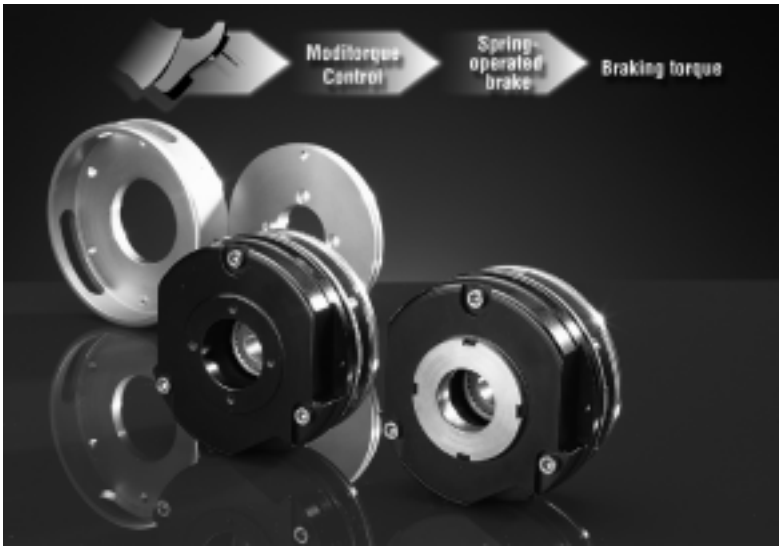
BA14.0173
00414550 EN

Lenze

Operating Instructions



Electronic Brake Control

Firmware V1.807

These Instructions are only valid for:

- Moditorque Control Brake Control Firmware V1.807,
- Moditorque Control Parameter Setting Software V2.18,

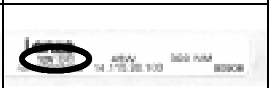
for operation together with:

- Spring-operated brakes type BFK458-xxN with 8 V DC or 12 V DC coil
- Electromagnetic brakes type 14.115.xx.xxx with 12 V DC or 24 V DC coil

These Operating Instructions are only valid together with the Operating Instructions for Lenze spring-operated brakes BFK458 or Lenze electromagnetic brakes 14.115.xx!

Caution!

Moditorque Control Brake Control is only permitted for the following combinations:

Moditorque Control	Brakes permitted	
	Spring-operated brake BFK458	Electromagnetic brake 14.115.xx
Operating voltage 48 V DC	12 V DC coil	24 V DC coil
		
Operating voltage 24 V DC	8 V DC coil	12 V DC coil
		

We have thoroughly collected all specifications in this documentation and have checked it for compliance with the described hardware and software. However, differences cannot be excluded completely. We are not responsible or liable for possible consequential damage. Required corrections will be made in the following editions.

Version 2.0 04/00

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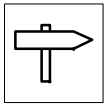

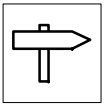

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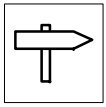
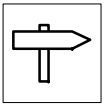




Contents

1 Preface and general information

1.1 Electronic brake control with Moditorque Control

1.1.1 The control unit Moditorque Control

Moditorque Control is an electronic control unit for Lenze spring-operated brakes BFK458 and Lenze electromagnetic brakes 14.115.xx. Together with the brake it forms the mechatronic brake system. Moditorque Control equips electromagnetically driven brakes with the “electrically adjustable brake pedal” and thus a variable brake torque. With spring-operated brakes, Moditorque Control sets the coil current of the brake so that the brake torque required is generated. With electromagnetic brakes, Moditorque Control acts as an adjustable current source which can be used to set the brake characteristic. In addition, Moditorque Control monitors the brake wear and thus increases the reliability of the brake.

Moditorque Control is a brake control for many applications and different brake systems: different control modes enable the flexibility of the brake to adapt it to your application. Parameter setting is easy via CAN interface via PC and Windows® program. The brake orders are entered via five inputs (analog or potentiometer input, frequency input, 2 switching inputs, enable input). Networking is possible via the CAN interface.

1.1.2 Functionality/How does Moditorque Control work?

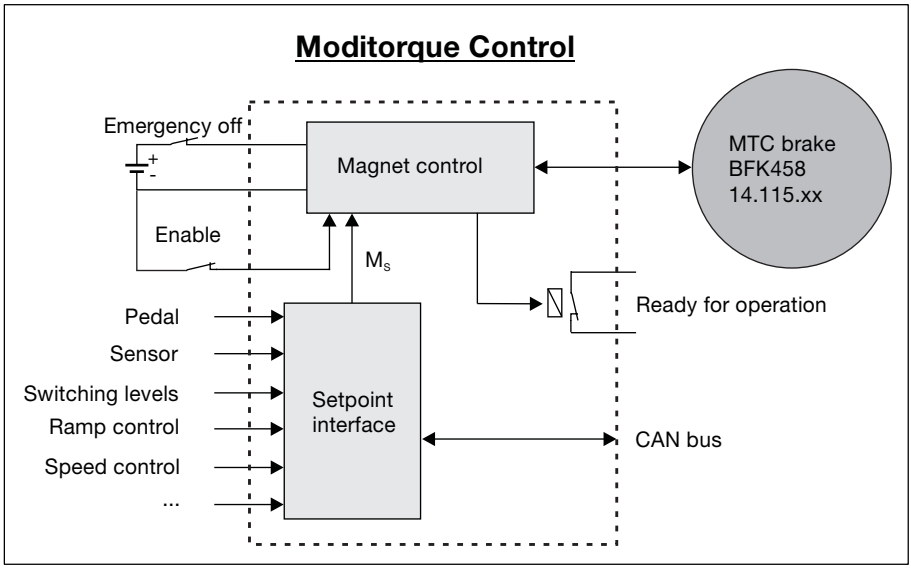


Fig. 1-1 Functionality of Moditorque Control, block diagram

Moditorque Control consists of:

- “Magnet control”
- Setpoint interface

“Magnet control”

The integrated power electronics control the spring-operated brake, the integrated sensors ensure internal monitoring.

To ensure braking when the brake is released, the magnet control must ensure that the armature plate of the spring-operated brake is opened. Immediately afterwards the current is changed so that the required brake torque can be generated. Braking is stopped by a current surge in the spring-operated brake. The then generated holding current ensures brake operation when the brake is released. The benefits are reduced heat generation and low energy consumption.

The braking characteristic of the spring-operated brake depends of the brake wear. The magnet control detects the changes and adapts the braking operation accordingly.

Setpoint interface

The setpoint interface conditions the setpoint for the brake torque. Thus it is possible to connect different setpoint encoders. By setting the control modes through parameters, it is determined how setpoints are transmitted to the control unit.

1.1.3 Control modes

The control modes determine how the setpoints for the brake torque are transmitted to the brake control.

Moditorque Control can be used with seven control modes. By this the spring-operated brake or the electromagnetic brake becomes a variable mechatronic brake system which is very reliable and does not need much maintenance.

1.1.4 Safety concept

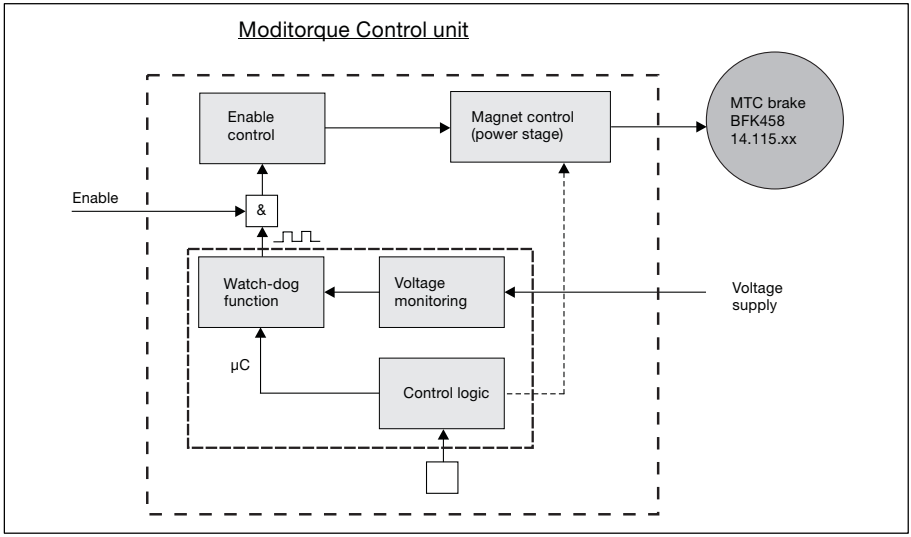


Fig. 1-2 Internal monitoring functions

Moditorque Control can control the entire braking process. The following safety measures and features ensure safe operation:

1. Watch-dog function
   In the event of failure of the micro-controller, the brake will be blocked.
2. Enable control
   Releases the power electronics through pulses. If the pulses are not received, the power electronics will be inhibited and the spring-operated brake will be blocked.
3. Current measurement
   Measures the resistance of the brake magnet. The reaction on current interruption, short circuit or wrong brake resistance can be set.
4. Temperature measurement
   Measures the temperature of the power electronics. The power electronics will be inhibited when the temperature exceeds a limit value and the spring-operated brake will be blocked.
5. Wear monitoring
6. Reaction on undervoltage and overvoltage
   Common short-term voltage drops in hoists are compensated.
7. Defined parameter setting
   Parameters can only be set in the configuration mode. The brake is not ready for operation during parameter setting.
8. Monitoring of the material resistance of the potentiometer in the operating mode “Pedal”
   Detects possible cable damage (short-circuit to frame, interruptions).
9. Pace evaluation via CAN bus
   Evaluates the “pace” of the vehicle via CAN bus. The CAN bus can take over the function of the emergency-off indication cable.

1.2 About these Operating Instructions ...

- These Operating Instructions are intended for all persons who install, set-up and adjust the mechatronic brake system Moditorque Control.
- Every chapter informs entirely about one topic:
  - Therefore, it is enough to read the chapter which provides the required information.
  - The index helps you to easily and quickly find information on a special keyword.
- These Instructions complement the Mounting Instruction delivered with the items supplied.
  - The features, functions and control modes are described in detail.
  - The parameter setting for typical applications is explained by means of examples.

1.2.1 Terminology used

Term	In the following text used for
Moditorque Control System	Moditorque Control brake system with programming environment
Brake	Moditorque Control brake Lenze spring-operated brake BFK458 or Lenze electromagnetic brake 14.115.xx
Brake system	The Mechatronic Moditorque Control brake system consists of • Moditorque Control unit with • Lenze spring-operated brake BFK458 or • Lenze electromagnetic brake 14.115.xx
Brake control	Moditorque Control electronic unit to control spring-operated brakes or electromagnetic brakes.
M_S	Setpoint for the brake torque
M_B	Brake torque
mtc.exe	Moditorque Control Software
Parameter setting	The Moditorque Control parameter setting is under Windows®
Programming adapter	The connection between Moditorque Control unit and PC consists of: • CAN adapter • Configuration and operation plug
Windows	Microsoft Windows®
🕮 xx-yyy	Cross reference to a page

1.2.2 What is new? / What has been changed?

Version	Id No.	Changes
2.0 04/00	00414550	Second edition

1.3 Items supplied

Product	Moditorque Control		
	Starter kit	**Brake**	**Control unit**
Items supplied	Software MtC.exe CAN adapter and drivers Configuration and operation plug Operating Instructions Plug assignment diagram	Brake	Control unit

Important	After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. Lenze does not accept any liability for deficiencies claimed subsequently. Claim • visible transport damage immediately to the forwarder. • visible deficiencies/incompleteness immediately to your Lenze representative.

1.4 Legal regulations

Labelling	**Nameplate**	**CE identification**	**Manufacturer**
	The components of the Lenze Moditorque Control brake system are unambiguously identified by the contents of the nameplates.	EMC-Directive conformity	Lenze GmbH & Co KG Postfach 101352 D-31763 Hameln
Application as directed	**Moditorque Control and accessories** • must only be operated under the conditions prescribed in these Operating Instructions. • are components – for the electronic open and closed loop control of Lenze spring-operated brakes BFK458 with 8 V coil or 12 V coil Lenze electromagnetic brakes 14.115.xx. with 12 V coil or 24 V coil – for assembly in electric drives. – for installation together with Lenze spring-operated brakes BFK458 and Lenze electromagnetic brakes 14.115.xx to form a brake system. • are designed for operation of material handling vehicles and comply with the DIN VDE 0117. • are not machines for the purpose of the EC Machinery Directive. • are not to be used as domestic appliances, but only for industrial purposes. **Drives with Moditorque Control** • comply with the CE Directive "EMC" if they are installed according to the guidelines for CE-typical drive systems. • can be used – at 24 V DC and 48 V DC battery voltage and at public and non-public mains with DC supply. – for operation in industrial premises and residential areas. • The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed as inappropriate!**		

Preface and general information

Liability	• The information, data and notes in these Operating Instructions met the state of the art at the time of printing. Claims for modifications of brake systems and components which have already been supplied cannot be derived from the information, illustrations, and descriptions. • The specifications, processes, and circuitry described in these Operating Instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. • The indications given in these Operating Instructions describe the features of the product without warranting them. • Lenze does not accept any liability for damage and operating interference caused by: – Disregarding these Operating Instructions – Unauthorized modifications of the Moditorque Control System or components – Operating errors – Improper working on and with the Moditorque Control System or the components		
Warranty	• Terms of warranty: see terms of sales and delivery of Lenze GmbH & Co KG. • Warranty claims must be made immediately after detecting defects or faults. • The warranty is void in all cases where liability claims cannot be made.		
Disposal	**Material**	**recycle**	**dispose**
	Metal	•	-
	Plastic	•	-
	Printed-board assemblies	-	•

2 Safety information

2.1 Safety and application notes for Lenze Moditorque Control

1. General

Improper application, wrong installation or operation bare the risk of severe damage to material assets.

For further information, please see the documentation.

All operations concerning installation and commissioning as well as maintenance of the brake control and brake system must be carried out by qualified, skilled personnel (Observe IEC 60364 or CENELEC HD384 or VDE 0100 and IEC-Report 664 or VDE 0110 and national regulations for the prevention of accidents).

According to the safety information, qualified and skilled personnel are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the qualification necessary for the job.

2. Application as directed

Moditorque Control is a component intended for being used together with a Lenze Moditorque Control spring-operated brake or a Lenze Moditorque Control electromagnetic brake in electrical drives or systems.

When installing the unit into machines, commissioning of the controller (i.e. operation as directed) is prohibited until it is proven that the machine corresponds to the regulations of the EC Directive 98/37/EC (Machinery Directive). EN 60204 (VDE 0113).

Commissioning (i.e. application as directed) is only allowed when the units comply with the EMC Directive (89/336/EEC).

The mechatronic brake system Moditorque Control is designed for operation of material handling vehicles and complies with the DIN VDE 0117 (operation at 70 % rated battery voltage).

The technical data as well as the connection conditions can be obtained from the nameplate and the documentation. They must be observed in all cases.

3. Transport, storage

Notes on transport, storage and appropriate handling must be observed.

4. Installation

Avoid touching electronic components.

Moditorque Control contains electrostatically sensitive components, which can be damaged easily by inappropriate handling. Electrical components may not be damaged or destroyed mechanically (health risks are possible!).

5. Electrical connection

When working on live brake systems the valid national regulations for the prevention of accidents (e.g. VBG 4) must be observed.

For electrical installation follow the corresponding instructions. Additional information can be obtained from the documentation.

Notes about wiring according to EMC regulations, such as shielding, grounding, filters and cable routing, are included in the documentation for the brake system. These notes must also be observed for CE-labelled brake systems. The compliance with limit values required by the EMC legislation is the responsibility of the manufacturer of the machine or vehicle.

6. Operation

During operation the brake equipped with Moditorque Control Brake Control interacts with the vehicle or system. Therefore, vehicle or system manufacturers must check the operating and braking behaviour of the vehicle or the system in detail. The use of the brake and the user-specific configuration of Moditorque Control Control Unit in a vehicle or drive is the responsibility of the vehicle or system manufacturer.

Do not use any other but the combinations of Moditorque Control Brakes and Moditorque Control Brake Controls indicated in chapter 3.

The brake type driven by Moditorque Control must be the same as the brake type set in the configuration.

Moditorque control compensates voltage drops and interruptions $\leq$ 40 ms. If necessary, Moditorque Control releases a brake automatically if a voltage drop occurs while a spring-operated brake is released.

Optimum brake operation can only be ensured if at least 20 test brake operations have been carried out after commissioning of the Moditorque Control brake system and every air gap adjustment. The time interval between the brake cycles must be $\geq$ 1 s.

7. Maintenance and service

Observe the manufacturer's documentation.

These safety notes must be kept!

The product-specific safety and application notes given in these Instructions must also be observed!

2.2 Residual hazards

Protection of persons	• The spring-operated brake or electromagnetic brake driven by Moditorque Control must comply with the brake type set in the basic configuration. (📖6-8) – Otherwise the brake system might fail. • After commissioning, "Download" of configuration data and air gap adjustment – carry out at least 20 test braking operations. – Time interval between the braking operations: at least 1 s • Check before working on the Moditorque Control brake system, – whether the brake system is free of voltage, – whether the pins of the plug-in connector are free of voltage, Otherwise the brake system might be damaged.
Controller protection	• The plug-in connectors must only be connected or disconnected when no voltage is applied!

2.3 Layout of the safety information

All safety information given in these Operating Instructions has the same layout:

Signal word (characterized the severity of danger)
Note (describes the danger and gives information how to avoid it)

	Icons used		Signal words	
Warning of damage to persons		Warning of hazardous electrical voltage	**Danger!**	Warns of **impending danger**. Consequences if disregarded: Death or very severe injuries
		Warning of a general danger	**Warning!**	Warns of **potential, very hazardous situations**. Possible consequences if disregarded: Death or very severe injuries
			Caution!	Warns of **potential, hazardous situations**. Possible consequences if disregarded: Light or minor injuries
Warning of damage to material			**Stop!**	Warns of **potential damage to material**. Possible consequences if disregarded: Damage of the control unit/brake system or its environment
Other notes			**Note!**	Designates a general, useful note. If you observe it, handling of the brake control/brake system will be made easier.

3 Technical data

3.1 General data / application conditions

Standards and application conditions		
Conformity	CE	EMC Directive (89/336/EEC)
Climatic conditions	Class 3K3 to EN 50178 (without condensation, average relative humidity 85 %)	
Degree of pollution	VDE 0110 part 2 pollution degree 2	
Packaging (DIN 4180)	Dust packaging	
Permissible temperature range	Storage	-30 °C … +70 °C
	Operation	-30 °C … +70 °C
Mounting position	Freely selectable	
Free assembly space	Above	100 mm
	Below	100 mm

General electrical data			
Noise emission	Requirements to EN 50081-1 Limit value class A to EN 55011 Limit value class B to EN 55022		
Noise immunity	Requirements to EN 61800-3		
	Requirements	**Standard**	**Severities**
	Running time	EN 61000-4-2	3, i.e. 8 kV with air discharge, 6 kV with contact discharge
	RF interference (enclosure)	EN 61000-4-3	3, i.e. 10 V/m; 27…1000 MHz
	Burst	EN 61000-4-4	3/4, i.e. 2 kV/5 kHz
Type of protection	IP20		
Protection measures against	Short circuit, earth fault Overtemperature		

Open and closed loop control	
Control method	Control/adaptation of the brake system by means of 7 control modes; the control mode determines the transfer of the values and the values themselves for M_S (📖7-1)
Input resistance	100 kΩ
Compensation of voltage drops/voltage interruptions	up to 40 ms
Power consumption	25 - 50 % of rated coil power while brake release: 200 - 300 % of rated coil power
Analog inputs	1 input
Digital inputs	2 switching inputs, 1 enable input, 1 input for frequency measurement
Fieldbus system	CAN
Relay output	60 V / 0.3 A; 30 V DC / 1.0 A
Brake torque range	Spring-operated brake BFK 458: M = 20 … 100 % M_r Electromagnetic brake 14.115.xx: M = 0 … 100 % M_r

Auxiliary voltage for parameter setting using the CAN adapter	11.5 V DC, 300 mA

3.2 Rated data for spring-operated brakes BFK 458 together with Moditorque Control

3.2.1 Brakes for operating voltage 24 V DC (rated coil voltage 8 V DC)

Operating voltage	Size	Brake torque [Nm]	Variation [%]	Spring-operated brake type BFK458-	File - basic configuration
24 V DC (16.8 … 31.2 V	08	8	20 … 100	08N8Nm 8 V DC	BFK458-08N8NmMtC24.mtc
	08	12	30 … 100	08N12Nm 8 V DC	BFK458-08N12NmMtC24.mtc
	10	16	20 … 100	10N16Nm 8 V DC	BFK458-10N16NmMtC24.mtc
	10	23	30 … 100	10N23Nm 8 V DC	BFK458-10N23NmMtC24.mtc
	12	23	30 … 100	12N23Nm 8 V DC	BFK458-12N23NmMtC24.mtc
	12	32	20 … 100	12N32Nm 8 V DC	BFK458-12N32NmMtC24.mtc
	12	46	30 … 100	12N46Nm 8 V DC	BFK458-12N46NmMtC24.mtc

3.2.2 Brakes for operating voltage 48 V DC (rated coil voltage 12 V DC)

Operating voltage	Size	Brake torque [Nm]	Variation [%]	Spring-operated brake type BFK458-	File - basic configuration
48 V DC (33.6 … 57.6 V)	12	32	20 … 100	12N32Nm 12 V DC	BFK458-12N32NmMtC48.mtc
	12	46	30 … 100	12N46Nm 12 V DC	BFK458-12N46NmMtC48.mtc
	14	60	20 … 100	14N60Nm 12 V DC	BFK458-14N60NmMtC48.mtc
	14	80	30 … 100	14N80Nm 12 V DC	BFK458-14N80NmMtC48.mtc
	16	80	20 … 100	16N80Nm 12 V DC	BFK458-16N80NmMtC48.mtc
	16	125	30 … 100	16N125Nm 12 V DC	BFK458-16N125NmMtC48.mtc
	18	150	20 … 100	18N150Nm 12 V DC	BFK458-18N150NmMtC48.mtc
	18	235	30 … 100	18N235Nm 12 V DC	BFK458-18N235NmMtC48.mtc
	20	260	20 … 100	20N260Nm 12 V DC	BFK458-20N260NmMtC48.mtc
	20	400	30 … 100	20N400Nm 12 V DC	BFK458-20N400NmMtC48.mtc

Stop!

Mains operation of the brake system is possible with the following DC supply:

- 24 V/48 V DC smoothed
- 3 A continuous current, peak 5 A

3.3 Rated data for electromagnetic brakes 14.115.xx together with Moditorque Control

3.3.1 Brakes for operating voltage 24 V DC (rated coil voltage 12 V DC)

Operating voltage	Size	Brake torque [Nm]	Variation [%]	Electromagnetic brake type 14.115.	File - basic configuration
24 V DC (16.8 … 31.2 V	06	7.5	0 … 100	06.☐.☐ 12 V DC	14.115.06MtC24.mtc
	08	15	0 … 100	08.☐.☐ 12 V DC	14.115.08MtC24.mtc
	10	30	0 … 100	10.☐.☐ 12 V DC	14.115.10MtC24.mtc
	12	60	0 … 100	12.☐.☐ 12 V DC	14.115.12MtC24.mtc
	16	120	0 … 100	16.☐.☐ 12 V DC	14.115.16MtC24.mtc

3.3.2 Brakes for operating voltage 48 V DC (rated coil voltage 24 V DC)

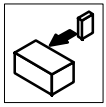
Operating voltage	Size	Brake torque [Nm]	Variation [%]	Electromagnetic brake type 14.115.	File - basic configuration
48 V DC (33.6 … 57.6 V)	20	240	0 … 100	20.☐.☐ 24 V DC	14.115.20MtC48.mtc
	25	480	0 … 100	25.☐.☐ 24 V DC	14.115.25MtC48.mtc

Stop!

Mains operation of the brake system is possible with the following DC supply:

- 24 V/48 V DC smoothed
- 3 A continuous current, peak 5 A

Technical data



4 Installation

4.1 Important notes

4.1.1 Protection of persons

Danger with hoists!

Before working on the brake the system must be protected against unintended start.

4.1.1.1 Other measures to protect persons

Plug-in connector	All connection work must be carried out when no voltage is applied!
Replace defective brake linings	See the Operating Instructions for the spring-operated brake BFK458 or the electromagnetic brake 14.115.xx!
Disconnect the brake system from the mains	Safety-relevant mains separation of the brake system only at the voltage supply connections.

4.1.2 Brake protection

Do not use any other but Lenze brakes indicated in these Operating Instructions.

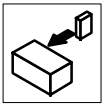
- Spring-operated brake BFK458 with
  - 8 V coil must only be driven via a brake control with 24 V DC
  - 12 V coil must only be driven via a brake control with 48 V DC
- Electromagnetic brake 14.115.xx with
  - 12 V coil must only be driven via a brake control with 24 V DC
  - 24 V coil must only be driven via a brake control with 48 V DC

4.1.3 Specification for the cables used

- Max. permissible cable length for the plug-in connector: 3 m

4.1.4 Circuitry protection

- Do not bore any holes into the housing and do not open it



4.2 Mechanical installation

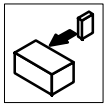
4.2.1 Mechanical brake installation

See the Operating Instructions for spring-operated brakes and electromagnetic brakes.

Caution!
It must be ensured that the brake type used matches the brake type of the configuration file.

4.2.2 Mechanical control unit installation

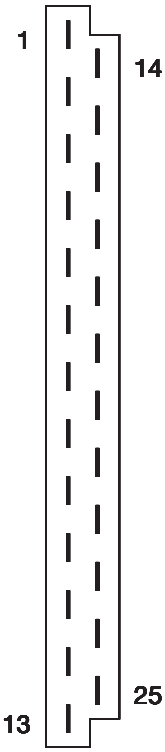
- Do not bore into housing
- Fasten the plug so that it cannot fall out when being installed in vibrating systems.



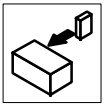
4.3 Electrical installation

The brake control is electrically connected through plug connectors.
Plug connector AMP Junior Timer plug 25 pole (order No.: AMP 828 661-1)

4.3.1 Plug assignment

Pin	Function	View of control unit
1		
2		
3		
4	+ V_{batt}	
5		
6	GND	
7	CAN_GND	
8	CAN_H	
9	Ready for operation - contact 1	
10	CAN_L	
11	Potentiometer, upper end (+5 V)	
12	Potentiometer, lower end (0 V)	
13	Digital 1	
14	Brake magnet 1	
15		
16		
17	Brake magnet 2	
18		
19	GND	
20	GND	
21	Ready for operation - contact 2	
22	Enable input	
23	Digital 2	
24	Analog 1 (0 … 10 V, potentiometer slider)	
25	Pulse input	

The brake control has 4 connections to earth. Therefore all components can be connected with one wire per contact.



4.3.2 General information on circuits for the control modes

Stop!

- Pressing of the emergency off switch must disconnect the brake control from the voltage supply.
- The brake control must be protected by a fuse.

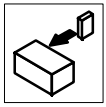
These Safety Notes are to be observed with all connections.

4.3.3 Control mode “Pedal-controlled braking”

This control mode is commonly used for material handling vehicles. A pedal sets M_S.

Stop!

- During operation of the vehicle a battery voltage must be applied. The voltage supply can be interrupted to enable the parking brake.
- The lower pedal switch must be connected. It opens when the pedal is pushed as far as possible and effects full braking, indepently of the configuration.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.



4.3.3.1 Pedal-controlled braking with potentiometer

The following diagram shows the connection in the vehicle.

Stop!

- Required resistance of the pedal potentiometers: 1 … 10 kΩ
- Permissible slider protection resistance: ≤ 10 kΩ

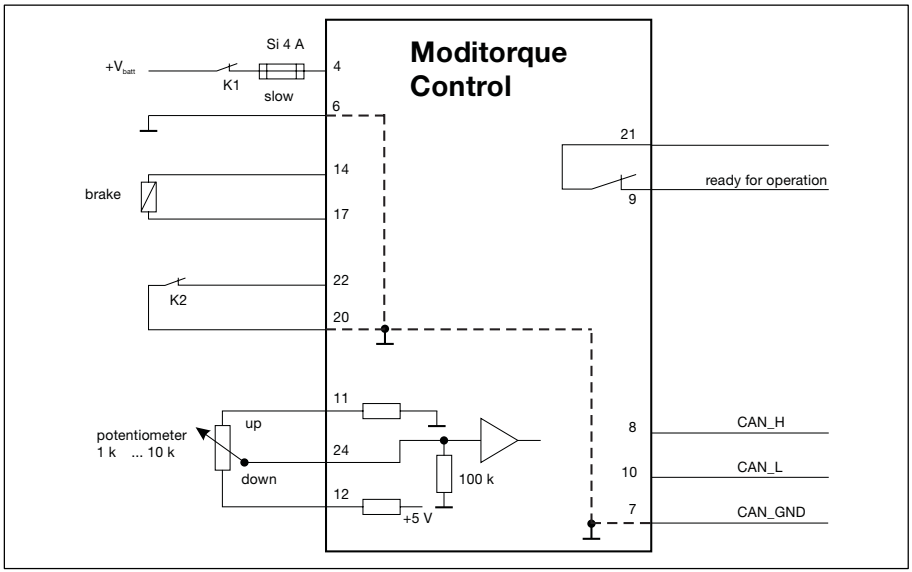


Fig. 4-1 Connection diagram "Pedal-controlled braking with potentiometer"

K1 Emergency off

K2 Lower pedal switch, opens when the pedal is pushed down

4.3.3.2 Pedal-controlled braking with analog encoder

The following diagram shows the connection in the vehicle.

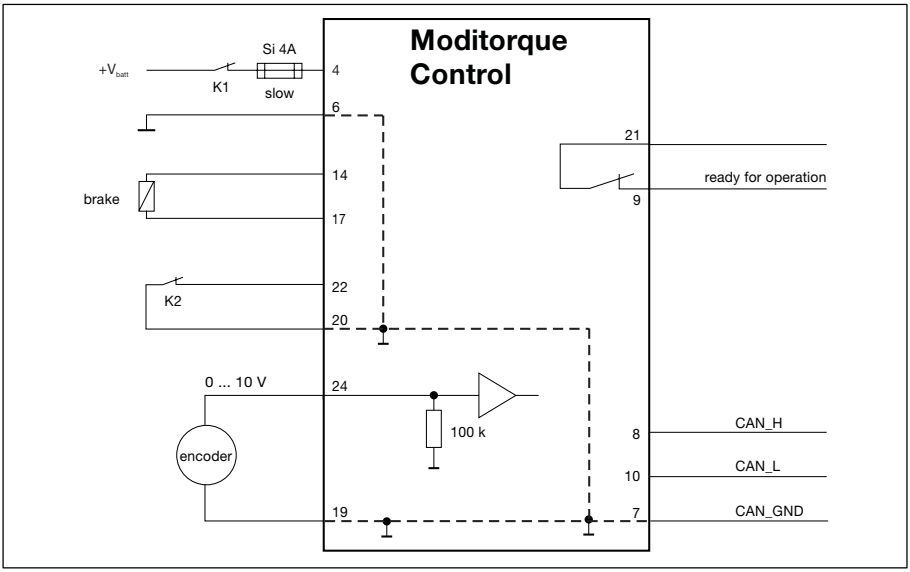


Fig. 4-2 Connection diagram "Pedal-controlled braking with analog encoder"

K1 Emergency off

K2 Lower pedal switch, opens when the pedal is pushed down

4.3.4 Control mode “Ramp-controlled braking”

This control mode selects the parameters for the brake control M_S. (📖7-10). Ramp-controlled braking substitutes multi-stage brakes with automatic time control.

The following diagram shows the connection:

Stop!

- During operation of the vehicle a battery voltage must be applied. The voltage supply can be interrupted to enable the parking brake.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.

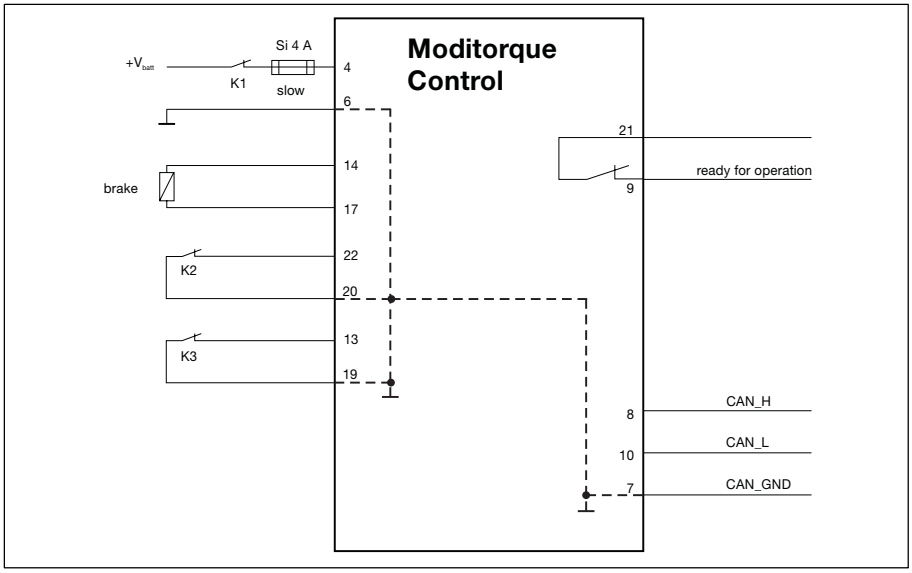
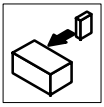


Fig. 4-3 Connection diagram “Ramp-controlled braking”

K1 Emergency off

K2 Enable switch, opened: maximum brake torque

K3 Contact opens for start “Ramp-controlled braking”



4.3.5 Control mode “Pedal-ramp controlled braking”

This control mode combines the features of “Pedal-controlled braking” and “Ramp-controlled braking” and is commonly used in material handling vehicles. The brake is activated by the higher setpoint of the values for M_S.

The following diagram shows the connection in the vehicle.

Stop!

- During operation of the vehicle a battery voltage must be applied. The voltage supply can be interrupted to enable the parking brake.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.

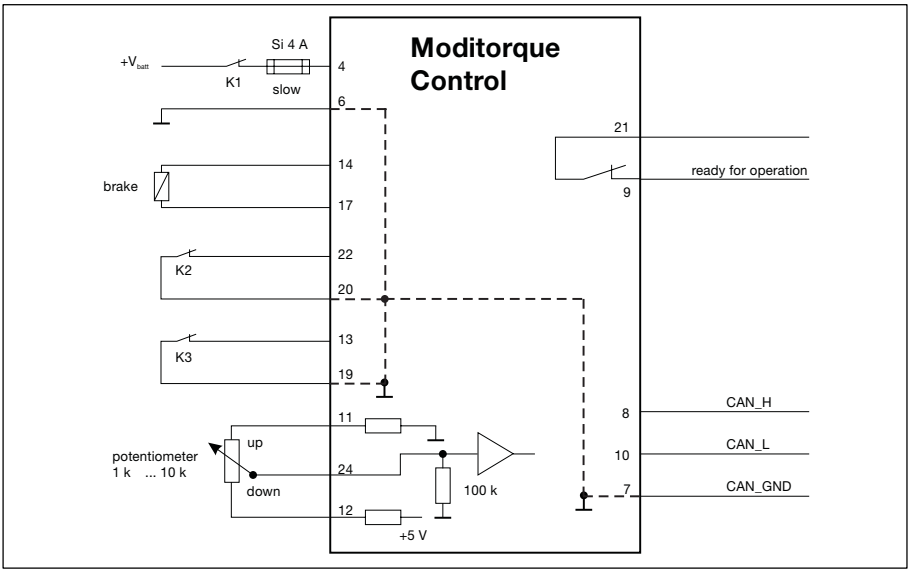


Fig. 4-4 Connection diagram “Pedal-ramp controlled braking”

K1 Emergency off

K2 Lower pedal switch, opens when the pedal is pushed down

K3 Contact opens for start “Ramp-controlled braking”

With this control mode the potentiometer can be exchanged by an analog encoder. (📖4-6).

4.3.6 Control mode “Sensor-controlled braking”

This control mode is used for load-independent braking. The load of the vehicle is measured by means of a pressure or force sensor with voltage output. At first the vehicles brakes with the brake torque given by the sensor. After the selected time is over, the full brake torque is applied.

STOP

Stop!

- Encoder voltage ≤ 10 V!
- Voltage rise of the sensor used ≥ 1 V!
  This is the only way to ensure a sufficient resolution through the A/D converter.
- During operation of the vehicle a battery voltage must be applied. The voltage supply can be interrupted to enable the parking brake.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.

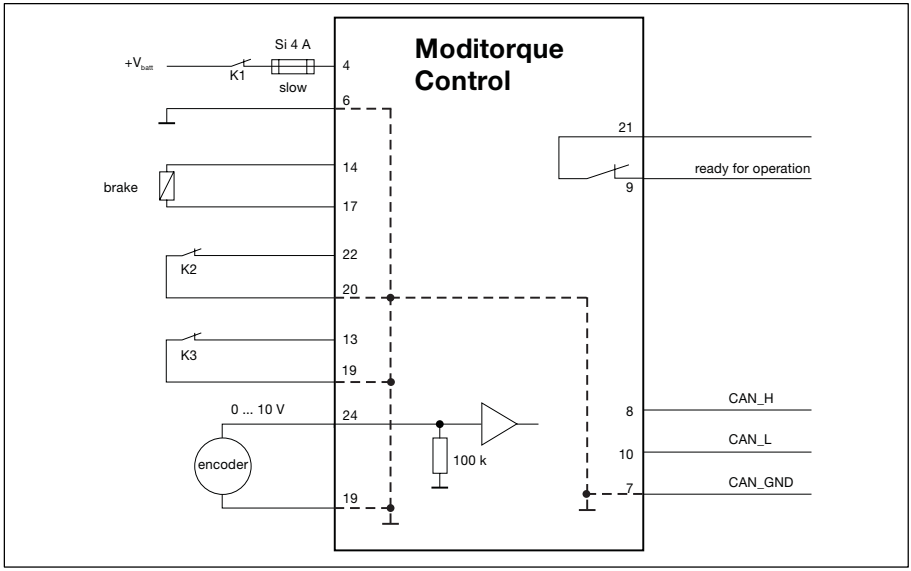
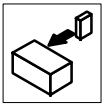


Fig. 4-5 Connection diagram “Sensor-controlled braking”

K1 Emergency off

K2 Enable switch, opened: maximum brake torque

K3 Contact opens for start “Sensor-controlled braking”



4.3.7 Control mode “Speed-controlled braking”

With this control mode the brake control controls the speed during braking. The speed setpoint is generated through a ramp function. In addition, the brake control acts as speed limiter and avoids acceleration to high speed.

Note!

The brake control needs information about the drive speed. This can be achieved by:

- analog tacho generator (analog 1 is input)
- pulse encoder (frequency measurement) with open collector output
- CAN bus

The digital input activates speed-controlled braking.

Stop!

- Pulse encoder: 1000 … 3000 pulses/s at max. speed
- Analog tacho generator:
  - Encoder voltage = 0 V at 0 V/min
  - Encoder voltage = +5 … +10 V at max. speed
- During operation of the vehicle a battery voltage must be applied. The voltage supply can be interrupted to enable the parking brake.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.

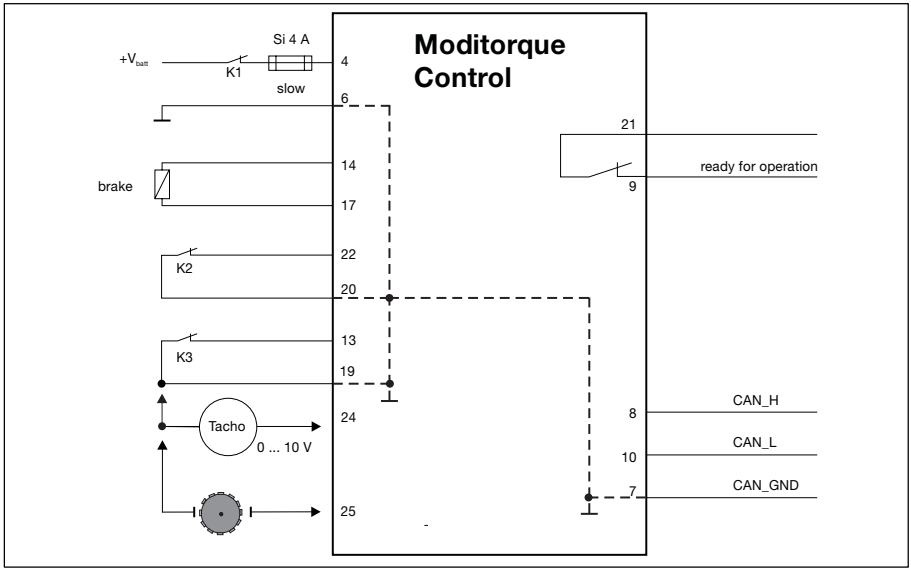
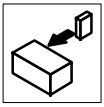


Fig. 4-6 Connection diagram “Speed-controlled braking”

K1 Emergency off

K2 Enable switch, opened: maximum brake torque

K3 Contact opens for start “Speed-controlled braking”



4.3.8 Control mode “CAN direct”

With this control mode M_S is directly used for brake control.

Stop!

With the control mode “CAN direct” the CAN bus reads M_S.

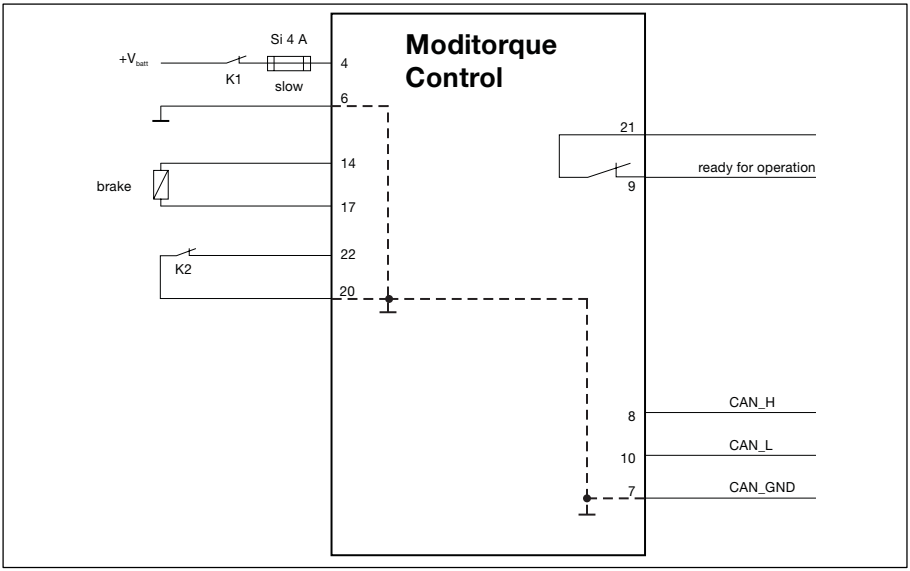


Fig. 4-7 Connection diagram “CAN direct”

K1 Emergency off

K2 Enable switch, opened: maximum brake torque

4.3.9 Control mode “Electromagnetic brake 14.115.xx”

With this control mode Moditorque Control is a controllable current source. Thus operation of an operating-current actuated electromagnetic brake with through Moditorque Control becomes possible.

Stop!

- The brake does not provide any brake torque if
  - the brake control is switched off because of an alarm. The current supply of the brake is interrupted.
  - the voltage supply is interrupted.
  - the enable switch is open.
- When the contact “ready for operation” is open, the vehicle must stop or reduce its speed.

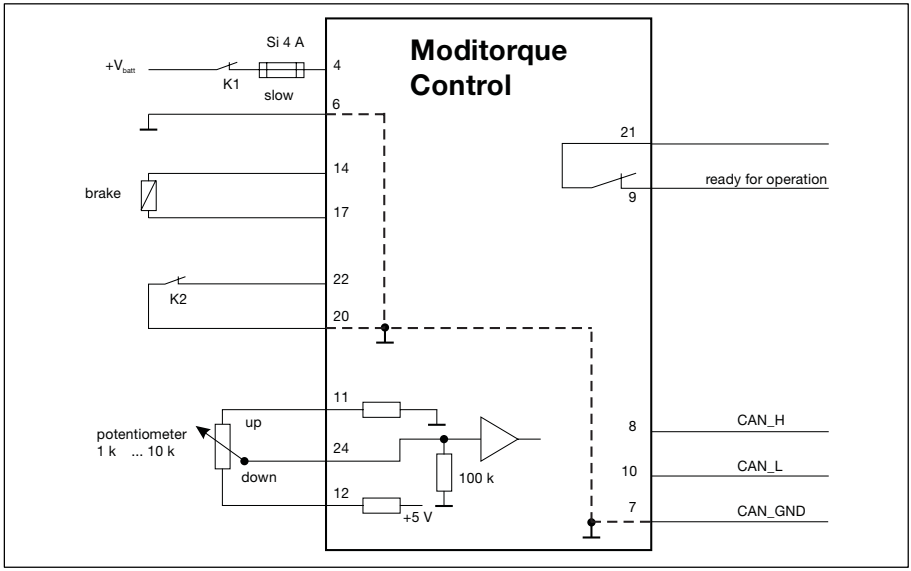
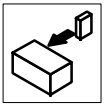


Fig. 4-8 Connection diagram “Electromagnetic brake 14.115.xx with pedal control”

K1 Emergency off (when pressed, the brake does not provide a brake torque)

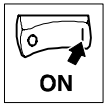
K2 Enable switch, opened: no brake torque

With this control mode the potentiometer can be exchanged by an analog encoder. (📖4-6).



4.4 PC connection for parameter setting

The programming is made via the CAN adapter, which connects the PC printer interface and the CAN bus. (📖6-2).



5 Commissioning

5.1 Important notes

- The brake control is designed for operation at the following battery voltage:
  - 24 V DC
  - 48 V DC
  - Mains operation is possible with the corresponding DC supply for smoothed DC.
- Check before voltage supply:
  - the wiring for completeness, short circuit and earth fault
  - Is the connected brake type designed for the voltage supplied?
    Spring-operated brake BFK458: 8 V coil for 24 V DC, 12 V coil for 48 V DC
    Electromagnetic brake 14.115.xx: 12 V coil for 24 V DC, 24 V coil for 48 V DC
  - Does the brake type of the basic configuration comply with the brake type of the brake connected? (📖6-8)
- Check before commissioning:
  - Do connection type and control mode required match?

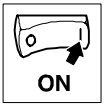
5.2 Commissioning

Caution!

During commissioning:

- A minimum of 20 test braking operations is required.
- The time interval between the braking operations must be at least 1 s.

After successful braking tests, the brake system will be ready for operation.



Commissioning

6 Moditorque Control parameter setting

Moditorque Control Parameter Setting is a programming tool for parameterizing the brake control. By setting the parameters, the brake system is adapted to your application and the different configurations are maintained. The Operating System used is Windows.

6.1 System requirements

The following minimum hardware and software requirements must be met to ensure successful parameter setting:

Computer	IBM compatible; 486 processor or higher
Operating system	Win32 platform • Windows® 95 • Windows® 98 • Windows NT®
Hard disk memory	2 MB for the installation
Drives	3.5” floppy drive
Monitor	VGA card; min. 800 x 600 resolution
RAM	16 MB
Other requirements	• Mouse • Free parallel port with 5 V level for connecting the PC to the brake control

6.2 PC connection

The parameters are set via the programming adapter, which connects the PC via the parallel port and the CAN bus to the Moditorque Control unit. The programming adapter is included in the starter kit. It comprises:

- CAN adapter
- Configuration and operation plug (AMP plug)

Connect programming adapter

Connect

- the configuration and operation plug with the Moditorque Control unit.
- the configuration and operation plug via 9 pole Sub-D plug using the CAN adapter.
- the CAN adapter with the parallel port of your PC (printer port LPT1 or LPTx).
- the supply plug of the CAN adapter with the keypad connect of your PC.

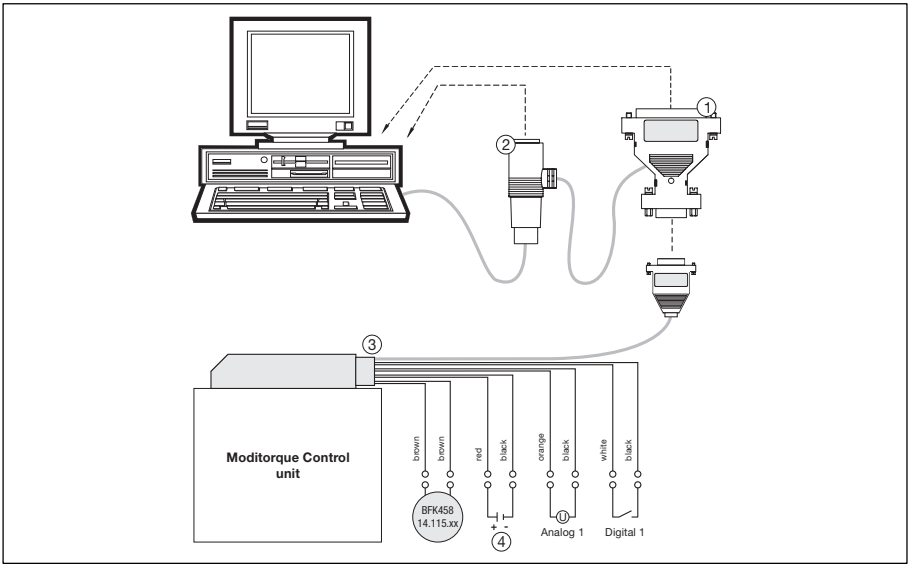


Fig. 6-1 Connection diagram Programming Adapter

① CAN adapter

② Supply plug for CAN adapter

③ Configuration and operation plug

④ Voltage supply
Operating voltage 24 V DC or 48 V DC or auxiliary voltage 11.5 V DC, 300 mA

6.3 Installation of the parameter setting environment

Note!

For successful installation the sequence of the steps indicated must be observed.

1. If Windows is not active yet, start your operating systems.
2. Insert the floppy for your operating system into the drive.
3. Install the CAN driver by pressing “setup.exe”:

Windows 95 / Windows 98	Windows NT
• Start the program “setup.exe” from the floppy.	• The driver installation can only be carried out by the system administrator. Log in as system administrator for your PC. • Start the program “setup.exe” from the floppy.

4. Select the configuration for your hardware:
   – Use a PEAK CAN dongle.
   – The I/O address and the interrupt for your parallel port can be obtained from the BIOS (usually E/A 0378 and interrupt 7).
5. Installation of the parameter setting environment:
   – Copy the file “MtC.exe” to any directory on your harddisk.
   – Copy the file “BFK458-□□N□□NmMtC24STARTER-KIT.mtc” to any directory on your harddisk.
6. Restart Windows.
7. Start the parameter setting environment with “mtc.exe”.
8. When programming or reading for the first time, the menu for the configuration of your hardware will be displayed. Select the port address (usually 0378) and the interrupt (usually 7). Check the addresses with your BIOS.

Now the parameter setting environment can be started. (📖6-4)

Note!

The menu for the configuration of the hardware is displayed once when calling the parameter setting window. Later changes can be made via the dialog box **Configuration** in the menu **Set-up** (📖7-2). The parameters are entered under **CAN adapter set-up** (📖7-42).

6.4 First steps in the parameter setting window

Caution!

The software is provided in the present form. All risks regarding quality and the results made with the software remain the user's responsibility. Corresponding safety measures against possible faulty operation must be provided by the user.

We do not take any liability for direct or indirect damage, such as profit losses, order losses or any business losses.

6.4.1 Start the program

Start parameter setting by double clicking the program "mtc.exe".

The main window appears after program start:

Fig. 6-2 Main window "Moditorque Control"

The contents of the main window

Number	Bar	Information
①	Title bar	🕮 6-5
②	Menu bar	🕮 6-5
③	Symbol bar	🕮 6-6
④	Status bar	🕮 6-7

6.4.2 The parameter setting window

6.4.2.1 Title bar

The title bar contains the symbol of Moditorque Control, the brake type used, the name of the active menu and the Windows standard symbols “Minimize”, “Maximize” and “Close”.

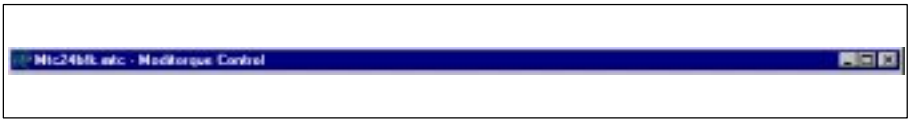


Fig. 6-3 Title bar

6.4.2.2 Menu bar

The menu bar enables access to the parameter setting via the corresponding menu titles. In addition to general functions, the menu bar provides special functions for setting and operating your brake system.

Fig. 6-4 Menu bar

Menu	Functions	Description	Notes
File	• File manager	Save, load, print current configuration	
View	• Symbol bar / status line on/off		
Set-up	• Enter brake system parameters • Enter password • Query status	Dialog box **Configuration** • Only Lenze Service!	📖 7-2
Download	• Programming of the brake control using the programming adapter	**Download** or **Upload** is only possible with the CAN bus!	📖 7-39 📖 7-41
Upload	• Reading the brake control with the programming adapter		
Language	• Selection of the dialog language desired		
?	• Information on the parameter setting window	Software version of the parameter setting window	

If the CAN adapter is not connected to the PC and the functions “Download” or “Upload” are called, an error message will be displayed.

6.4.2.3 Symbol bar

The symbol bar provides symbols which help to execute frequently used functions without going to the corresponding menu. Information on the symbol activated are indicated in the status bar.

Fig. 6-5 Symbol bar

Symbol	Name	Function
	New file	Generates a new configuration file
	Open file	Opens an existing configuration file
	Save	Saves the current configuration
	Print	Prints the current configuration
	Export	Exports the current configuration as text file
	Lenze Service	Password
	Lenze Service	System configuration
	Lenze Service	Change contents of memory locations
	Lenze Service	Display of contents of memory locations
	User configuration	Opens dialog box **Configuration**
	Download	Send configuration data to control unit Data transfer PC → Control unit 📖 7-39

Symbol	Name	Function
	Upload	Read configuration data from control unit Data transfer control unit → PC 📖 7-41
	Status display	Operating data of the control unit

6.4.2.4 Status bar

The status bar at the bottom edge of the program window displays information on the active symbol and the firmware version of the control unit. For short information on the symbols move the mouse pointer on the corresponding symbol.

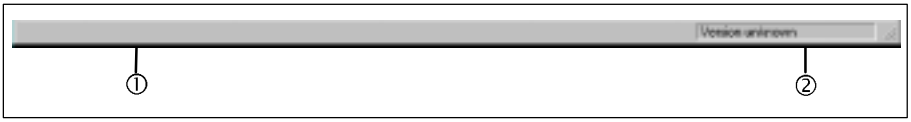


Fig. 6-6 Status bar

Information displayed in the status bar	
①	Information on the symbols
②	Firmware version of the control unit connected (updated during “Download” or ”Upload”)

6.5 Load basic configuration

The basic configuration is the configuration of the brake used. The corresponding configuration file “Brake type.mtc” = “BFK... .mtc” or “14.115 ... .mtc” contains the default setting for all parameters.

Caution!

The brake type of the configuration file must comply with the brake type used.

Proceed as follows to load the brake configuration:

1. Start the parameter setting window with a double click on the file “mtc.exe”. The main window will be opened.
2. Activate **Open file** under **File.**
3. Select the folder containing the files of the basic configuration (file name = brake type mtc. in the dialog box **Open file**. Select the brake type used.

Thus the configuration = the default setting of the parameters of the brake used is loaded.

Now it is possible to start the user-specific parameter setting. (📖7-1)

Note!

Save the user-specific parameter setting under an unambiguous file name which indicates the brake type or the application.

This applies to changes of the default setting and already existing configurations.

7 Parameter setting

With the parameter setting window the brake control can be adapted to your application by setting the parameters of the brake system accordingly.

7.1 Application-specific parameter setting

After the parameters of the default setting have been loaded into the configuration file for the brake used, set the parameters for the brake control for your special application. The following shows the steps required for parameter setting:

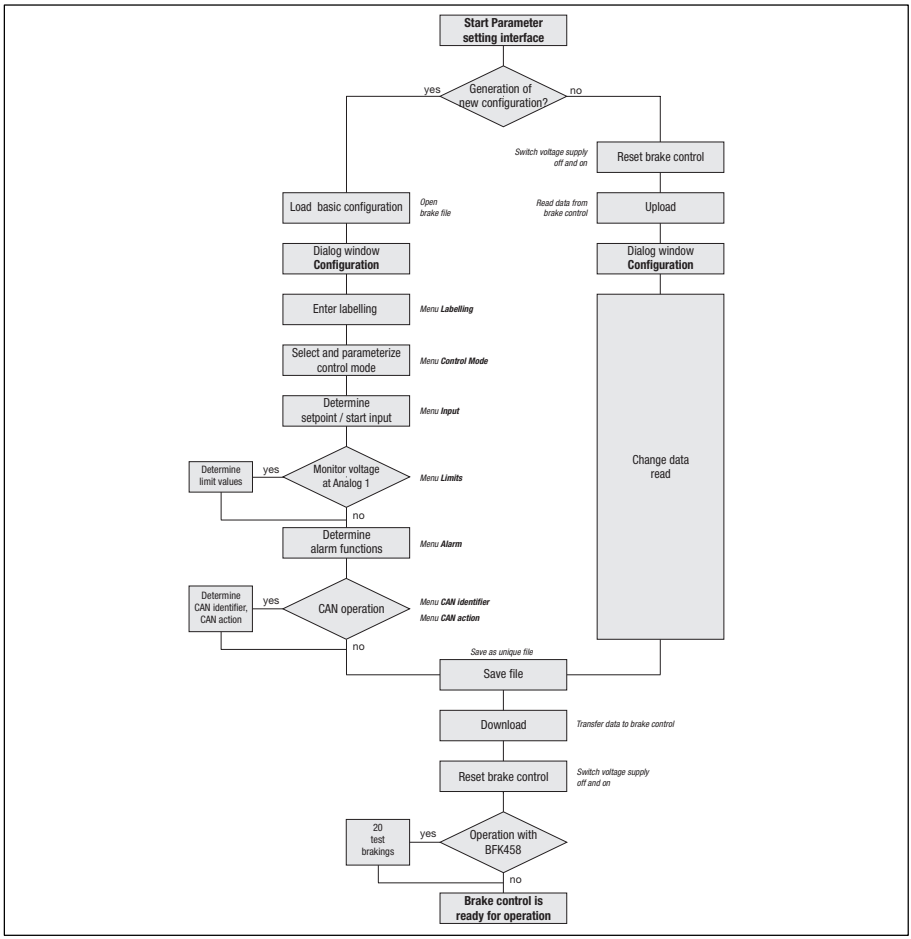
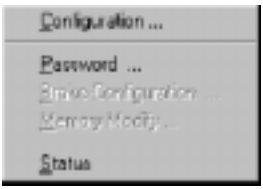


Fig. 7-1 Application-specific parameter setting

Parameter setting

The steps lead you through the menu in the dialog box **Configuration** which is to be called as follows:

Either: Menu "Settings" 🕮 6-5	**Dialog box "Configuration"**
 click activates ...	
Or: Symbol bar 🕮 6-6	
 click activates ...	

*The menus in the dialog box **Configuration***

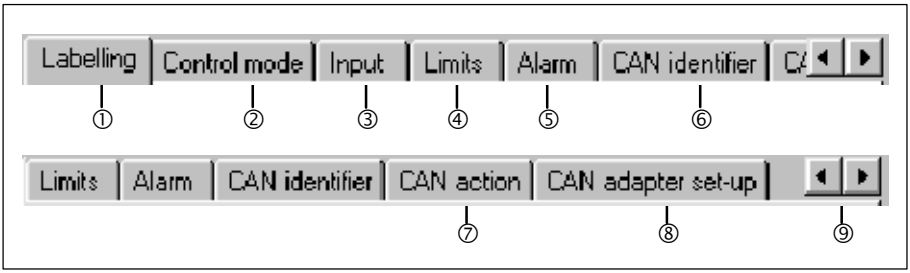


Fig. 7-2 Menu bar of the dialog box **Configuration**

Function of the menu items

	Menu	Function	Description
①	**Labelling**	Enter project labelling	📖 7-5
②	**Control mode**	Select the control mode required and enter the corresponding parameter	📖 7-6
③	**Input**	Select the input for setpoint encoder according to the control mode set: Analog input, frequency input, digital inputs, CAN inputs	📖 7-25
④	**Limits**	Enter limit values for the potentiometer resistance and the input voltage	📖 7-27
⑤	**Alarm**	Enter monitoring parameters: Set the parameters for the event and the system reactions	📖 7-30
⑥	**CAN identifier**	Determine baud rate, identifier and identifier length	📖 7-33
⑦	**CAN action**	Set action number and time intervals	📖 7-35
⑧	**CAN adapter set-up**	Set the configuration of the hardware	📖 7-42
⑨	**Scroll field**	Moves the bar of the submenu by 1 field to the right or to the left	

Use the application-specific parameter setting to adapt the preset parameters to your application:

1. Set your parameters in the control mode selected. (📖7-6)

Stop!

The voltage values measured analoguously (range 0 … 10 V) of the setpoint encoder are converted in the number range 0 … 1023.

The following signal conditioning converts the number range of the setpoint encoder into the number range -1 … 16383 for M_S:

- < 0 = Brake released
- 0 … 16383 = Brake reduced; min. … max. brake torque
  - BFK 458: 20 … 100 % of the rated brake torque
  - 14.115.xx: 0 … 100 % of the rated brake torque
- 16383 = Full braking

2. Determine the input for the setpoint encoder according to the control mode. (📖7-25)
3. If the brake control is to react, if the limit values are exceeded:
   Determine the limit values for the input voltage and the potentiometer resistance. (📖7-27)
4. Determine the corresponding reactions for the brake control reacting on the fault in the brake system. (📖7-30)
5. Select the CAN identifier and the number of the CAN action for communication of the brake control via the CAN bus (📖7-35).
6. After all parameters have been entered, close the dialog box **Configuration**. Save the data under an unambiguous project name.
7. Start a Download".  (📖7-39)

Note!

Save the user-specific parameter setting under an unambiguous file name which indicates the brake type or the application after the parameters have been set.

Parameter setting

Signal flow chart for Moditorque Control brake control

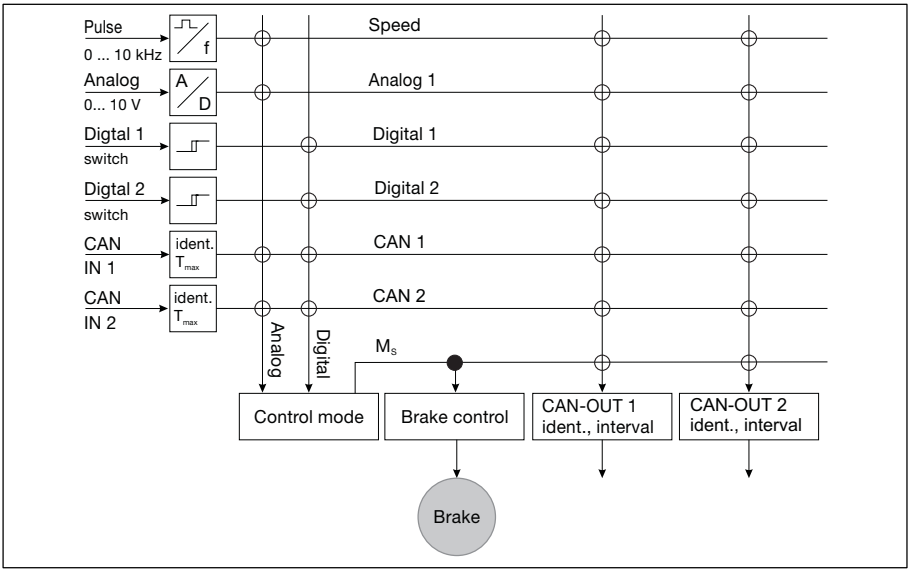


Fig. 7-3 Signal flow chart for the brake control

7.2 Enter labelling

The labelling is for the documentation of your Moditorque Control project. The optimized parameters can be documented and called for other applications of the brake control.

Fig. 7-4 Parameter setting: The dialog box **Configuration**, Menu **Labelling**

- The preset configuration of the brake used with the corresponding data is entered under **Brake type**.
  The description of the brake type will **not** be transferred to the brake control during "Download".
- Enter the labelling of the project under **Labelling**.
  The label consists of 8 characters which help to identify the brake control in a network. The controller labelling can be read through CAN output 11 if the output was assigned to an identifier in the CAN configuration.
- Enter a short description of the project which is saved together with the configuration file **Description** for your documentation.
  The project description will **not** be transferred to the brake control during "Download".

7.3 Select control mode

Use the control mode to determine how the brake control gets M_S (= setpoint encoder) and which input is to be used.

The brake system Moditorque Control can be used in 7 control modes. Select the control mode matching your application from the menu **Control mode**, list menu **Control mode**. The window corresponding to every control mode is displayed by entering the parameters required for your application.

Stop!

- The control mode “Electromagnetic brake 14.115.xx” is only permitted for running electromagnetic brakes 14.115.xx at the brake control.
- All other control modes are only permitted for running spring-operated brakes BFK 458 at the brake control.

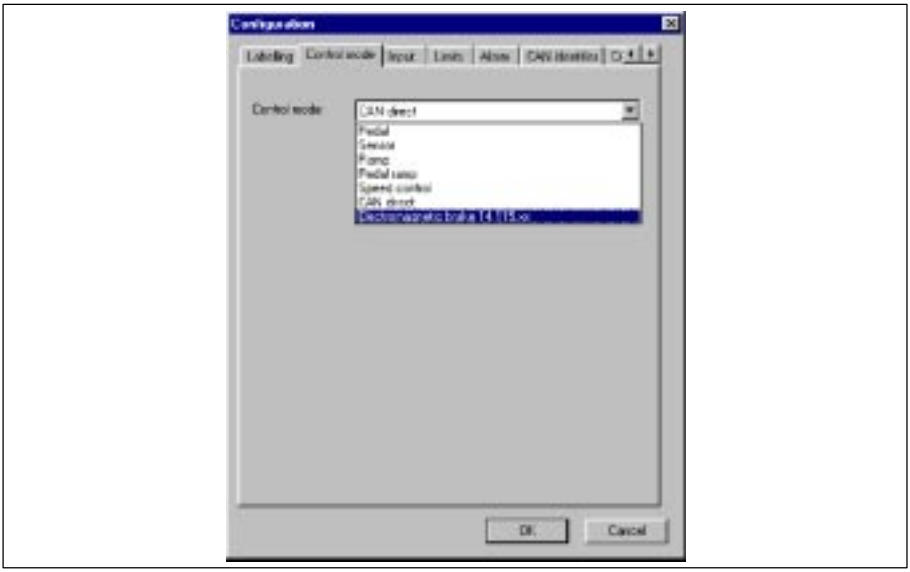


Fig. 7-5 Parameter setting: The dialog box **Configuration**, Menu **Control mode**

7.4 The control modes

Caution!
The brake type of the configuration file must comply with the brake type used.

7.4.1 Pedal-controlled braking

Pedal-controlled braking is commonly used for material handling vehicles. A pedal preselects M_S via

- a potentiometer as setpoint encoder; circuit diagram for connection in the vehicle (📖4-5)
- an analog encoder as setpoint encoder; circuit diagram for connection in a vehicle (📖4-6)

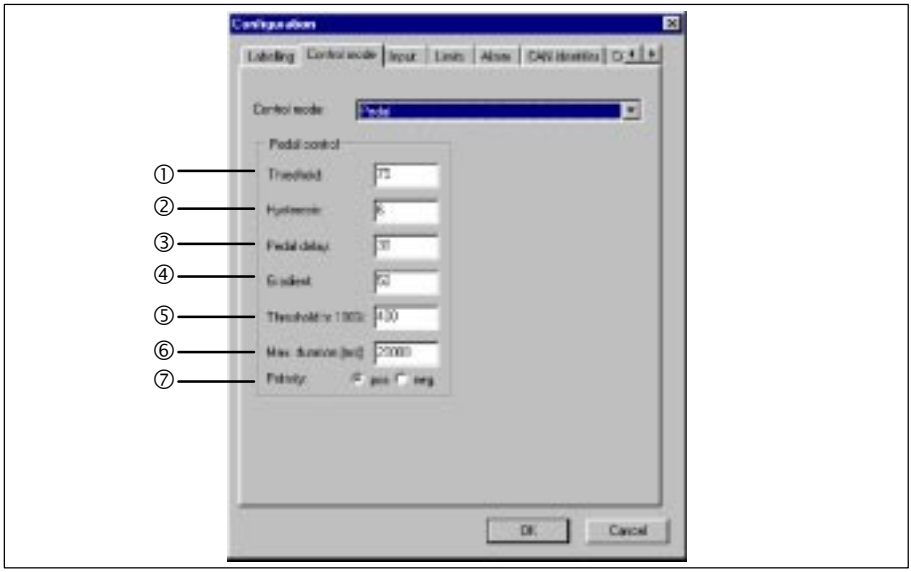


Fig. 7-6 Parameter setting: The window **Control mode for pedal-controlled braking**

Parameter setting

Pedal-controlled braking parameterizes the values for the pedal characteristic (📖7-8). For this the following parameters must be determined and entered in the window **Control mode - Pedal**:

	Parameter	Function	Note
①	Threshold	threshold when braking starts	do not set the value too low, otherwise a simple touch of the brake pedal would activate brake operation
②	Hysteresis	defines the safe and unambiguous change between released and reduced braking	
③	Dosing start	determines the range between threshold and dosing start	in this range the minimum brake torque is applied, thus smooth driving can be achieved
④	Gradient	defines the gradient of the dosing characteristic	determines the reaction of the brake system for the dosing range: M_S = (PEDAL - dosing start - threshold) x gradient
⑤	Threshold to 100 %	threshold when full brake torque is applied	if necessary, set the threshold to 100 % is reached before the pedal is pushed down completely
⑥	Max. duration [ms]	avoids permanent brake dosing	after the time entered is over, the brake switches off automatically to full braking; thus faulty operation and continuous motor operation against the brake is avoided
⑦	Polarity	considers the mounting position of the potentiometer.	pos: Voltage at analog input rises when pushing the pedal

Determine brake characteristic for pedal-controlled braking

Use the pedal characteristic to define the brake characteristic for your brake system.

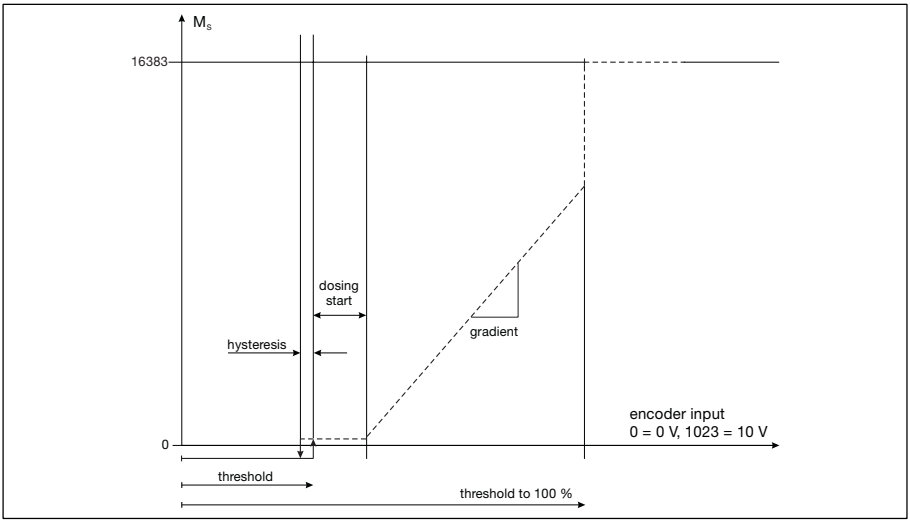


Fig. 7-7 Pedal characteristic

The voltage of the setpoint encoder is converted into the value for M_S.

Range	Voltage setpoint encoder	Brake
< 0	$V_S < 10\ V \cdot \frac{threshold}{1023}$	released
0 … 16383		reduced
0		minimum brake torque
16383	$V_S > 10\ V \cdot \frac{threshold\ to\ 100\ \%}{1023}$	maximum brake torque

The value for "Threshold to 100 %" will be automatically reduced when the pedal characteristic reaches 16383 for M_S.

When using a potentiometer the value at the analog input is calculated as follows:

$$Analog\ 1,\ min = \frac{470\ \Omega}{940\ \Omega + R_P} \cdot 512$$

$$Analog\ 1,\ max = \frac{470\ \Omega + R_P}{940\ \Omega + R_P} \cdot 512$$

Analog 1: Encoder input
R_P: Potentiometer resistance

Recommended values for pedal control

Parameter	Potentiometer 10 kΩ	Potentiometer 1 kΩ	Analog encoder 1 … 4 V
Threshold	32	150	130
Hysteresis	6	6	6
Dosing start	35	20	23
Gradient	39	75	64
Threshold to 100 %	435	353	370
Max. duration [ms]	20.000	20.000	20.000

Determine the input for the setpoint encoder under **Input**:

- Analog input
  - Analog 1

With analog setpoint encoders, encoder monitoring is possible. Enter the corresponding limit values under **Limits**. (📖7-28)

7.4.2 Ramp-controlled braking

A ramp gives the value for M_S. Ramp-controlled braking is the control mode which replaces directly multi-stage brakes with automatic time control. The features of the multi-stage brake are set via parameters.

Connection diagram for use in vehicles: (📖4-7)

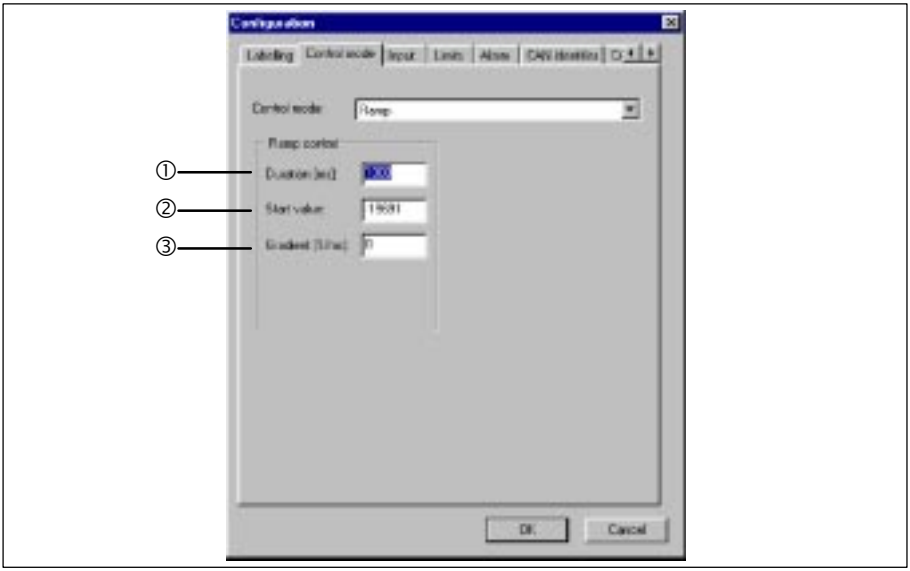


Fig. 7-8 Parameter setting: The window **Control mode ramp-controlled braking**

The control mode "Ramp-controlled braking" is parameterized with the values for the ramp characteristic. (📖7-11). For this the following parameters must be determined and entered into the window **Control mode - Ramp**:

	Parameter	Function
①	Duration [ms]	Time after which the maximum brake torque is set
②	Start value	Initial brake torque value: 0 ≡ 20 %, 16383 ≡ 100 %
③	Gradient	Increase (+) / decrease (-) of the brake torque per ms

Determine brake characteristic for ramp-controlled braking

Use the parameters for the ramp characteristic to set the control mode “Ramp-controlled braking”.

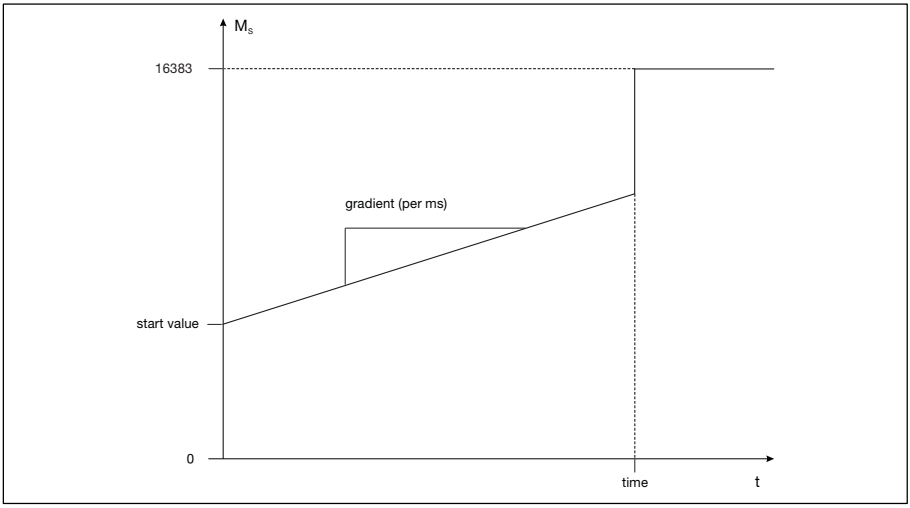


Fig. 7-9 Ramp-characteristic

Determine the ramp using parameters.	0	Minimum brake torque
	16383	Maximum brake torque

Equation for brake torque - time

M_S = Start value + increase x time [ms]	for the ramp time
$M_S = M_{max}$	after the ramp is over

The value for “Duration” will be automatically reduced when the ramp characteristic reaches 16383 for M_S.

Settings recommended when using a two-stage brake

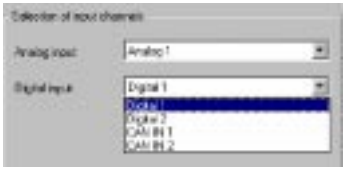
Duration [ms]	Start value	Gradient
3000	5000	0

Caution!

The brake characteristic can change for every brake type.
Therefore every brake type must be adapted once to the application.

Set the input for the brake release under **Input** :

- Digital input
  - Digital 1 or 2



7.4.3 Pedal-ramp controlled braking

Pedal-ramp controlled braking combines pedal-controlled braking and ramp-controlled braking. A pedal and the ramp selected set M_S. When ramp-controlled braking is activated, the brake uses the setpoint of the ramp characteristic. In all other cases, the setpoint of the pedal characteristic is being used.

Connection diagram for use in vehicles: (📖4-8)

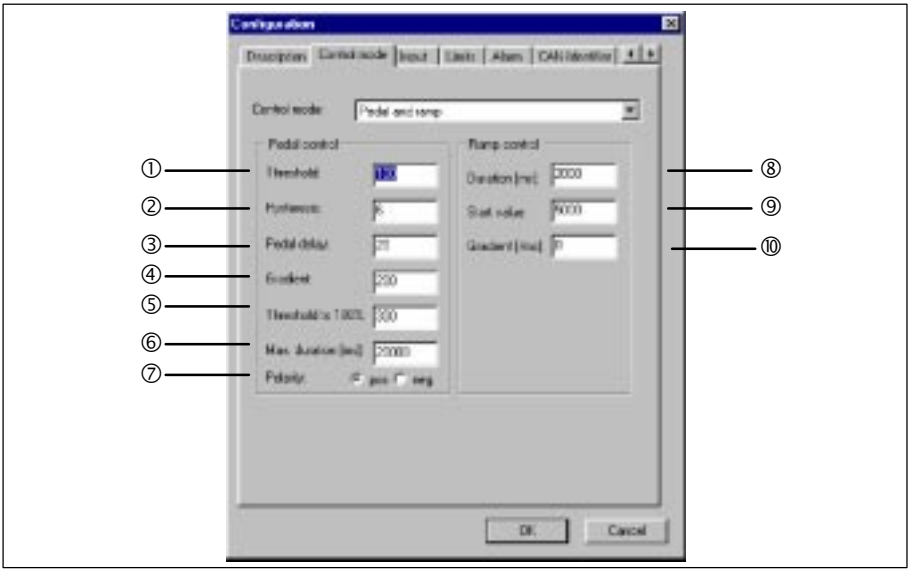


Fig. 7-10 Parameter setting: The window **Control mode pedal-ramp controlled braking**

For pedal-controlled braking the following parameters must be set and entered into the window **Control mode - Pedal ramp**:

	Parameter Pedal	Function	Note
①	Threshold	threshold when braking starts	do not set the value too low, otherwise a simple touch of the brake pedal would activate brake operation.
②	Hysteresis	defined the safe and unambiguous change between released and reduced braking	
③	Pedal delay	determines the range between threshold and dosing start	in this range the minimum brake torque is applied, thus smooth driving can be achieved.
④	Gradient	defines the gradient of the dosing characteristic	determines the reaction of the brake system for the dosing range: M_S = (PEDAL - dosing start - threshold) x gradient
⑤	Threshold to 100 %	threshold when full brake torque is applied	if necessary, set the threshold to 100 % is reached before the pedal is pushed down completely.
⑥	Max. duration [ms]	avoids permanent brake dosing	after the time entered is over, the brake switches off automatically to full braking; thus faulty operation and continuous motor operation against the brake is avoided
⑦	Polarity	considers the mounting position of the potentiometer.	pos: Voltage at analog input rises when pushing the pedal
	Parameter Ramp	**Function**	
⑧	Duration [ms]	time after which the maximum brake torque is set	
⑨	Start value	initial brake torque value: 0 ≡ 20 %, 16383 ≡ 100 %	
⑩	Gradient [1/ms]	increase (+) / decrease (-) of the brake torque per ms	

Determine brake characteristic pedal-ramp controlled braking

The control mode “Pedal-ramp controlled braking” is parameterized with the parameters for pedal characteristic and for ramp characteristic. A detailed description can be obtained under “Pedal-controlled braking” (📖7-7) and “Ramp-controlled braking” (📖7-10).

Setting values recommended for pedal-ramp control

Setting values for pedal control

Parameter	Potentiometer 10 kΩ	Potentiometer 1 kΩ	Analog encoder 1 … 4 V
Threshold	32	150	130
Hysteresis	6	6	6
Dosing start	35	20	23
Gradient	39	75	64
Threshold to 100 %	435	353	370
max. time [ms]	20.000	20.000	20.000

Setting values for the ramp for the use as two-stage brake

Time [ms]	Start value	Gradient [1/ms]
3000	5000	0

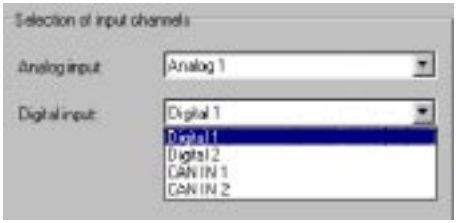
Parameter setting

Caution!

The brake characteristic can change for every brake type.
Therefore every brake type must be adapted once to the application.

Determine the inputs for the setpoint encoder under **Input**.

- Analog input for the pedal
  - Analog 1
- Digital input for start ramp control
  - Digital 1 or 2



With analog setpoint encoders, encoder monitoring is possible. Enter the corresponding limit values under **Limits**. (📖7-28)

7.4.4 Sensor-controlled braking

A sensor (e.g. pressure sensor, force sensor) presets M_S. With sensor-controlled braking, the setpoint given by the sensor is used first. After the time set is over, the full brake torque is used. Sensor controlled braking is necessary for load-independent braking when the vehicle load is measured by a sensor.

Connection diagram for use in vehicles: (📖4-9)

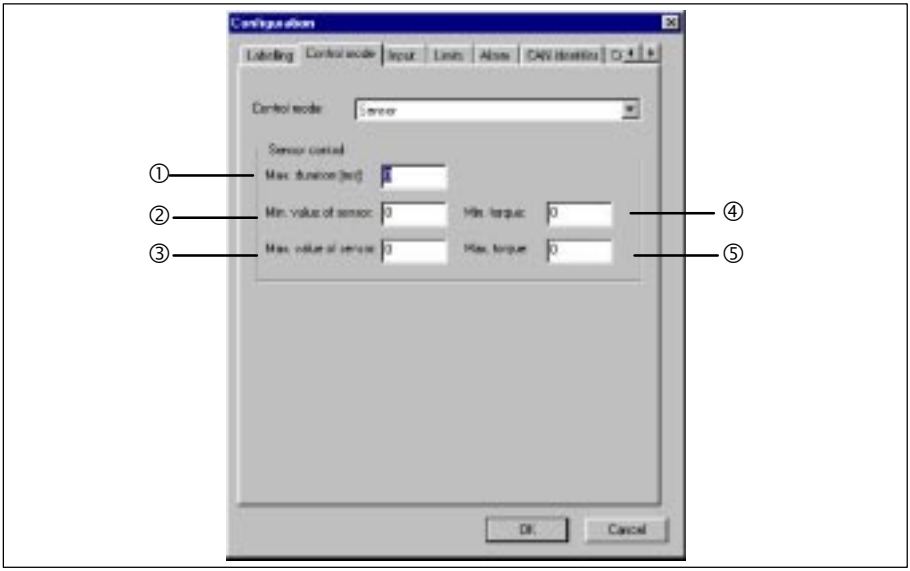


Fig. 7-11 Parameter setting: The window **Control mode sensor-controlled braking**

Sensor-controlled braking is parameterized with the values for the sensor characteristic. (📖7-16). For this the following parameters must be determined and entered in the window **Control mode - Sensor** must be entered.

	Parameter	Function	Note
①	Duration [ms]	Time after which the maximum brake torque is set	
②	Min. value of sensor V_{Smin}	Lowest value sent by the sensor	0 ≡ 0 V; 1023 ≡ 10 V
③	Max. value of sensor V_{Smax}	Highest value sent by the sensor	0 ≡ 0 V; 1023 ≡ 10 V
④	Min. torque M_{min}	Brake torque required for min. sensor value	0 ≡ 20 %; 16383 ≡ 100 %
⑤	Max. torque M_{max}	Brake torque required for max. sensor value	0 ≡ 20 %; 16383 ≡ 100 %

The control calculates a linear sensor characteristic from the values entered.

Parameter setting

Determine brake characteristic sensor-controlled braking

The brake characteristic for your brake system is parameterized with the sensor characteristic.

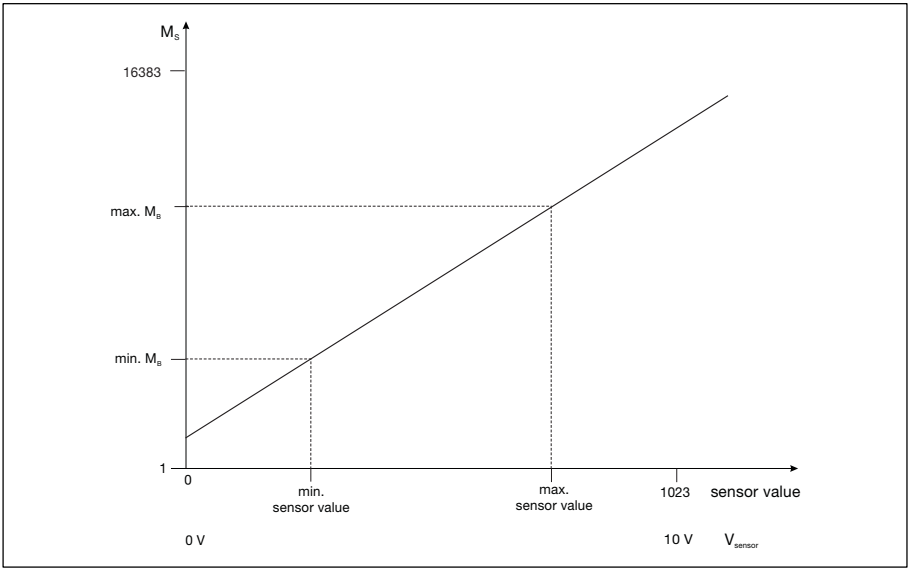


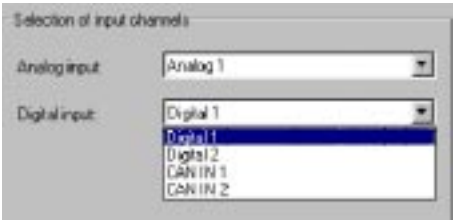
Fig. 7-12 Sensor characteristic

The voltage of the setpoint encoder is converted into the value for M_S.

$M_S < 0$	Brake released
M_S 0 … 16383	Brake reduced; minimum … maximum brake torque
M_S = 16383	Maximum brake torque

Determine the following inputs under **Input**:
For the sensor
- Analog input
  - – Analog 1

For the activation of braking
- Digital input
  - – Digital 1 or Digital 2



7.4.5 Speed-controlled braking

After braking has been activated, the brake control controls the brake force so that the speed is reduced evenly. The drive is braked to standstill after the time set. Controlled braking requires the feedback of the actual speed via a pulse encoder or a tacho generator which is mounted to the motor shaft.

This control mode is activated through a digital input. Braking is continued as long as the digital input is open. If the drive is braked to standstill within this time, it switches to maximum brake torque (parking brake function).

Connection diagram: (📖4-10)

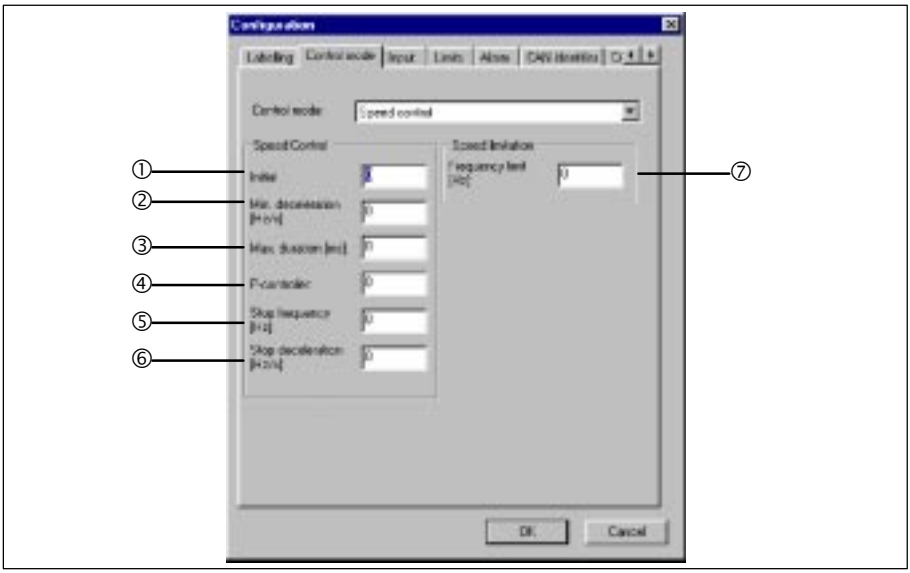


Fig. 7-13 Parameter setting: The window **Control mode speed-controlled braking**

Speed-controlled brakes are parameterized with the parameters for speed control circuits (📖7-18), which are entered into the window **Control mode - Speed control**:

Parameter setting

	Parameter	Function	Note	Additional information
①	Initial	brake torque at which braking starts	0 ≡ 20 %; 16383 ≡ 100 %	
②	Min. deceleration [Hz/s]	minimum delay value of the drive (exception: Frequency < Stop frequency)	should be set to "0", if not wanted	
③	Max. duration [ms]	braking time until the drive reaches standstill		
④	P-controller	determines the reaction of the speed control	if the value is too high, the brake must be readjusted and the running is not very smooth during braking.	📖 7-19
⑤	Stop frequency [Hz]	frequency of the speed encoder as of which the drive is decelerated according to the stop delay.	should be set to "0", if not wanted	
⑥	Stop deceleration [Hz/s]	delay of the drive below the stop frequency	lower value = smooth stopping	
⑦	Frequency limit [Hz]	frequency value of the speed encoder at which the brake is activated	if not wanted enter a frequency which is higher than the highest possible frequency	

With analog tacho generators, the input voltage must be converted into pulses (Hz):

$$f = \frac{V}{10\ V} \cdot 1023\ Hz$$

Speed control circuit

The following diagram shows the speed control circuit and the speed setpoint selection.

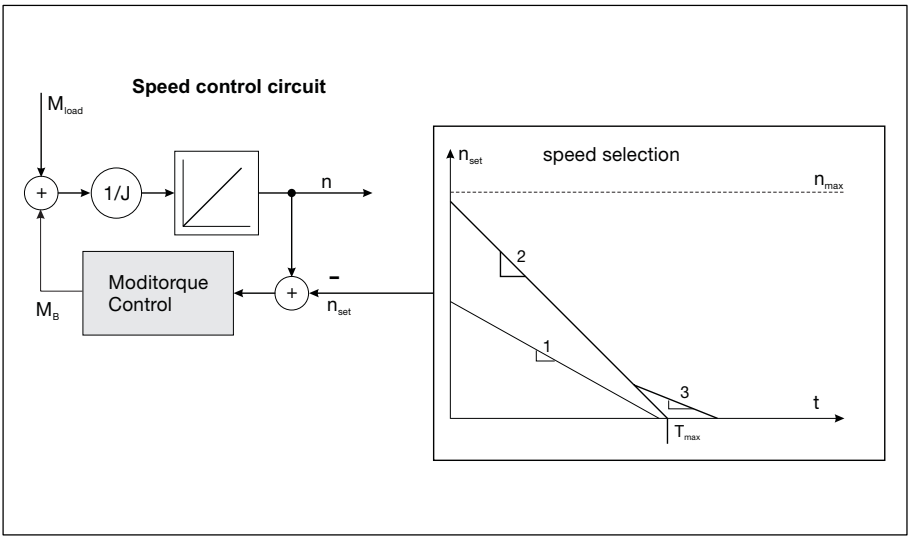


Fig. 7-14 Speed control circuit with speed preselection

Speed control circuit	• The brake system decelerates the drive • Can vary the brake torque between 20 … 100 % of the rated brake torque	• Minimum delay of the drive: 20 %
Speed preselection	• Is calculated by the brake control • n_{set} sets the speed setpoint ramps for the brake control • The actual speed is saved when the start command is set. The actual speed is then used to calculate the speed setpoint ramp.	• The brake control is the speed limiter: With impermissibly high speeds Moditorque Control brakes the drive automatically until n_{max} is higher than this speed value.

Speed preselection		
Speed setpoint ramp		
Profile 1	The minimum deceleration determines the braking time at low speeds.	
Profile 2	Is calculated that the speed setpoint n_{set} = 0 is reached within the maximum time T_{max}	The drive is decelerated even stronger
Profile 3	Is the second speed setpoint ramp Determines a lower stop deceleration for speeds which are below the stop speed.	Ensures smooth stopping of the drive

Additional information about the parameters

Parameter	**Information**	
Initial	• Is the brake torque when braking is started • If the initial brake torque deviates from the torque that corresponds to the deceleration wanted, the initial brake torque changes sooner or later to the final brake torque depending on KP when braking is started.	
Minimum deceleration Set to "0" if not wanted.	• Is the minimum deceleration (exception: below stop speed). • The following speed-dependent minimum stopping time t is the result.	
	Pulse encoder	Analog tacho generator
	$t = \frac{\text{pulses/revolution} \cdot \text{speed [1/min]} \cdot \frac{1\ \text{min}}{60\ \text{s}}}{\text{min. delay [Hz/s]}}$	$t = \frac{\frac{V\,[V]}{10\ V} \cdot 1023\ \text{Hz}}{\text{min. delay [Hz/s]}}$
P-controller	• Good results can be expected for 50 < P-controller < 100. • The reason for unstable and rough running during braking is the vibration resistance of the mechanical system. – Decrease of P-controller • If the control is too weak: – Increase of P-controller	

Parameter setting

<table>
<tr><th>Parameter</th><th colspan="2">Information</th></tr>
<tr><td rowspan="4">Stop frequency /stop deceleration
Set to "0" if not wanted.</td><td colspan="2">The stop delay of the drive can be reduced directly before standstill to achieve smooth stopping features. The stop frequency below which the stop delay is activated equals speed or voltage.</td></tr>
<tr><td>Pulse encoder</td><td>Analog tacho generator</td></tr>
<tr><td>$n = \frac{\text{stop frequency}}{\text{pulses/revolution}} \cdot \frac{60\ \text{s}}{1\ \text{min}}$</td><td>$V = \frac{\text{stop frequency} \cdot 10\ \text{V}}{1023\ \text{Hz}}$</td></tr>
<tr><td colspan="2">Braking continuous below the stop frequency:
$t = \frac{\text{stop frequency}}{\text{stop delay}}$</td></tr>
<tr><td rowspan="3">Frequency limit
If not wanted, set the frequency limit to a value which cannot be reached.</td><td colspan="2">• Is the speed limitation.
• Braking is activated above the frequency entered here. Braking is stopped when the limit fall below the frequency limit.
• The frequency is:</td></tr>
<tr><td>Pulse encoder</td><td>Analog tacho generator</td></tr>
<tr><td>$f = \text{pulses/revolution} \cdot \text{maximum speed [1/min]} \cdot \frac{1\ \text{min}}{60\ \text{s}}$</td><td>$f = \frac{V_{max}\ [V]}{10\ V} \cdot 1023\ \text{Hz}$</td></tr>
</table>

Recommended setting values for speed control

Initial brake torque	Min. deceleration [Hz/s]	Max. duration [ms]	P-controller	Stop frequency [Hz]	Stop deceleration [Hz/s]	Frequency limit
5000	0	3000	75	50	200	Variable, depending on the application

Determine the input for the corresponding setpoint encoder under **Input**.

- Analog input for the tacho generator
  - Analog 1
- Analog input for the speed control
  - Speed
- Digital input for braking start
  - Digital 1 or Digital 2

7.4.6 CAN direct

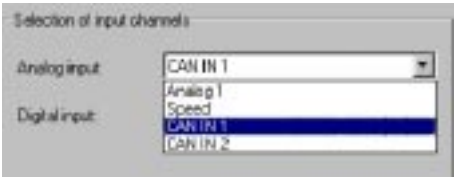
With this control mode M_S is directly selected via the CAN bus and used for brake control. (📖7-33)
Connection diagram: (📖4-12)

Fig. 7-15 Parameter setting: The window **Control mode CAN direct**

Set the input for the setpoint encoder in the menu **Input**:

- Analog input
  - CAN IN1 or CAN IN2

Select the indentifier for the corresponding input in the menu **CAN identifier**.



- The action No. of the corresponding CAN input must be set to "1" under **CAN action**. Select a corresponding interval if you want to check cyclic data transmission. (📖7-35).
- The brake control receives with the identifiers set 2 byte data:
  1. byte = LOW-byte, 2. byte = HIGH-byte

The spring-operated brake is controlled by these bytes as follows:

CAN data	Brake torque
-1	Brake released
0	Minimum brake torque (= 20 %)
0 … 16383	Reduced brake torque (= 20 … 100 %)
16383	Maximum brake torque (= 100 %)

7.4.7 Electromagnetic brake 14.115.xx

Even operating-current actuated Lenze electromagnetic brakes 14.115.xx can be used with the brake control.

With this control mode Moditorque Control is a controllable current source. The brake characteristic is similar to pedal control. (📖7-8) . With the electromagnetic brake 14.115.xx, the brake torque can be set between 0 … 100 %.

Connection diagram for use in vehicles: (📖4-13)

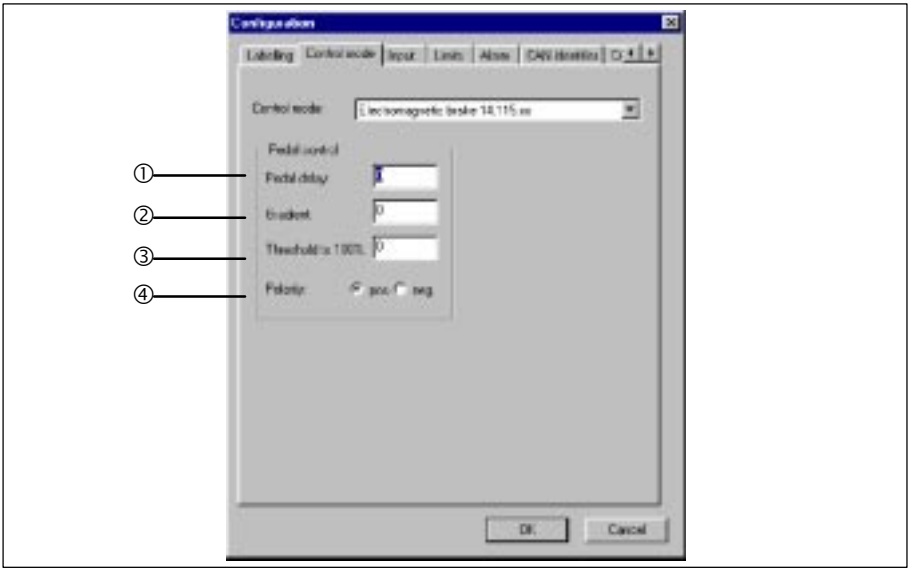


Fig. 7-16 Parameter setting: The window **Control mode electromagnetic brake 14.115.xx**

For the pedal characteristic (📖7-23) the following parameters must be set and entered in the window **Control mode - Electromagnetic brake 14.115.xx**

	Parameter	Function	Note
①	Pedal delay	value, when braking starts	
②	Gradient	defines the gradient of the dosing characteristic	determines the reaction of the brake system Dosing range: M_S = (PEDAL - dosing start) x gradient
③	Threshold to 100 %	threshold when full brake torque is applied	if necessary, set the threshold to 100 % is reached before the pedal is pushed down completely.
④	Polarity	considers the mounting position of the potentiometer.	pos: Voltage at analog input rises when pushing the pedal

Determine brake characteristic for 14.115.xx electromagnetic brake

The brake characteristic for your brake system is parameterized with the pedal characteristic.

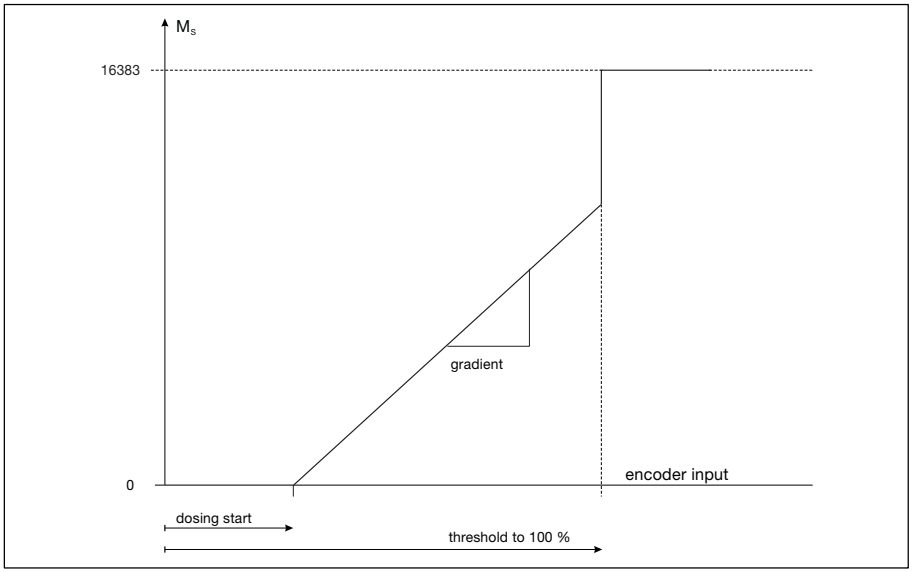


Fig. 7-17 Characteristic 14.115.xx electromagnetic brake

The voltage of the setpoint encoder is converted into the value for M_S.

Range	Voltage setpoint encoder	Brake torque
< 0	$V_S < 10\ V \cdot \frac{\text{dosing start}}{1023}$	0 %
0 … 16383		0 ... 100 %
16383	$V_S > 10\ V \cdot \frac{\text{threshold to 100 \%}}{1023}$	Maximum brake torque

When using a potentiometer the value at the analog input is calculated as follows:

$$\text{Analog 1, min} = \frac{470\ \Omega}{940\ \Omega + R_P} \cdot 512$$

$$\text{Analog 1, max} = \frac{470\ \Omega + R_P}{940\ \Omega + R_P} \cdot 512$$

Analog 1: Encoder input
R_P: Potentiometer resistance

Parameter setting

Recommended values for pedal control

Parameter	Potentiometer 10 kΩ	Potentiometer 1 kΩ	Analog encoder 1 ... 4 V
Dosing start	32	150	130
Gradient	36	69	59
Threshold to 100 %	435	353	370

Set the input for the setpoint encoder in the menu **Input**:

- Analog input
  - Analog 1

7.5 Select input for the setpoint encoder

Select the corresponding input or inputs for the setpoint encoder according to the control mode used.

Note!

If only one input is required and selected, the setting for the other input does not influence the control mode.

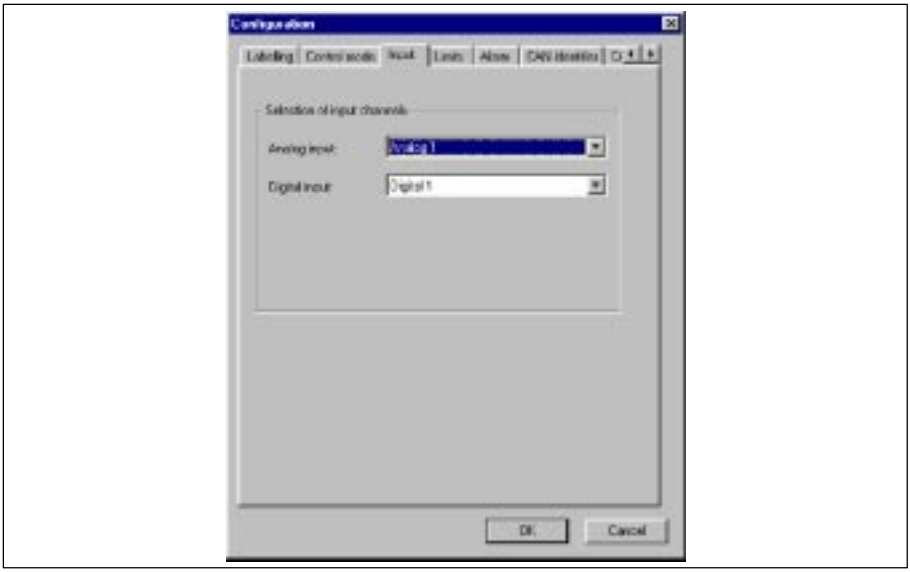
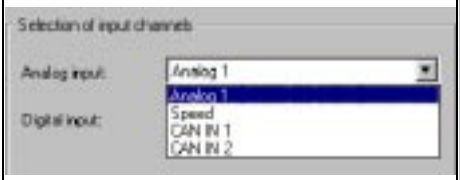
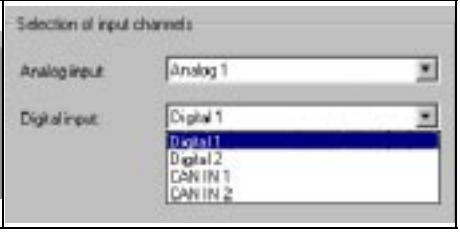


Fig. 7-18 Dialog box **Configuration**, Menu **Input**

Selection of input channels	
Analog input	**Digital input**
	

It is also possible to use one or two CAN inputs for all control modes. For this, set the corresponding identifiers in the menu **CAN identifier**. (📖7-35)

Parameter setting

The action No. "1" must be assigned to the corresponding CAN input or CAN inputs in the menu **CAN action**. (📖7-35). A setting of the interval is only required if cyclic data transmission is to be checked. (📖7-30).

When selecting a CAN input the brake control with the corresponding identifier receives 2 byte data which are interpreted as follows:

CAN input:					
Analog input		Frequency input		Digital input	
CAN data	**Input voltage**	**CAN data**	**Pulse frequency at speed input**	**CAN data**	**Status at digital input**
0	0 V	0	0 Hz	< 0	Input open (starts brake operation)
1023	10 V	1000	1000 Hz	≥ 0	Input closed
		5000	5000 Hz		

7.6 Enter limit values

The analog input of the analog setpoint encoder (potentiometer or analog encoder) can be monitored. Enter the limit values for the input voltage or the potentiometer resistance under **Limits**. (📖7-28)

Fig. 7-19 Parameter setting: Dialog box **Configuration**, Menu **Limits**

By monitoring the voltage values it is possible to check the functionality of the setpoint encoder and detect cable damage and short circuits.

Parameter setting

Limit values potentiometer resistance

When using a potentiometer, the limit values for the potentiometer resistance must be entered for monitoring the cable condition and short circuit. (7-31).

The rated value of the potentiometer resistance is calculated as follows:

$$R_N = 860 \cdot \frac{R_P}{R_P + 940\ \Omega}$$

R_N: Rated value of the potentiometer resistance
R_P: Potentiometer resistance

Limit values potentiometer resistance			
Potentiometer resistance [kΩ]	**Rated value**	**Minimum value**	**Maximum value**
1	443	355	532
1.5	529	423	634
2	585	468	702
2.5	625	500	750
3	655	524	786
3.5	678	542	814
4	696	557	836
4.5	711	569	854
5	724	579	869
5.5	734	588	881
6	744	595	892
6.5	751	601	902
7	758	607	910
7.5	764	611	917
8	770	616	923
8.5	774	619	929
9	779	623	934
9.5	783	626	939
10	786	629	943

Minimum value = rated value - 20 %

Maximum value = rated value + 20 %

Limit values for input voltage

If the input voltage of the analog encoder or potentiometer slider is to be checked, the correponding limit values must be entered (📖7-31).

The limit value is calculated as follows:

Analog encoder

Minimum value N_{Vmin}	Maximum value N_{Vmax}
$N_{Vmin} = 0.8 \cdot \frac{V_{min}}{10\ V} \cdot 1023 - 50$	$N_{Vmax} = 1.2 \cdot \frac{V_{max}}{10\ V} \cdot 1023$
$N_{Vmin} = 0$, if result < 0	

V_{min}: minimum input voltage

V_{max}: maximum input voltage

Potentiometer

Minimum value N_{Vmin}	Maximum value N_{Vmax}
$N_{Vmin} = 0.6 \cdot \frac{470\ \Omega}{R_P + 940\ \Omega} \cdot 512$	$N_{Vmax} = 1.2 \cdot \frac{R_P + 470\ \Omega}{R_P + 940\ \Omega} \cdot 512$

R_P: Potentiometer resistance

Limit values input voltage analog encoder				Limit values input voltage potentiometer slider		
V_{min} [V]	Minimum value	V_{max} [V]	Maximum value	Potentiometer resistance [kΩ]	Minimum value	Maximum value
0	0	1	123	1	74	466
0.5	0	1.5	184	1.5	59	496
1	32	2	246	2	49	516
1.5	73	2.5	307	2.5	42	530
2	114	3	369	3	37	541
2.5	155	3.5	430	3.5	33	549
3	196	4	492	4	29	556
3.5	237	4.5	553	4.5	27	561
4	278	5	614	5	24	566
4.5	319	5.5	676	5.5	22	570
5	360	6	737	6	21	573
5.5	401	6.5	799	6.5	19	576
6	442	7	860	7	18	578
6.5	482	7.5	922	7.5	17	580
7	523	8	983	8	16	582
7.5	564	8.5	1044	8.5	15	584
8	605	9	1106	9	15	585
8.5	646	9.5	1167	9.5	14	587
9	687	10	1229	10	13	588

7.7 Alarm messages

If the setpoint encoder is not also the voltage encoder, the brake control can monitor many other input values (📖1-3) and thus react to certain events. The reaction of the brake system is to be set under **Alarm**. Enter the required system reaction by setting a tick correspondingly.

7.7.1 Menu “Alarm”

Fig. 7-20 Dialog box **Configuration**, Menu **Alarm**

Note!

Because of safety reasons the reactions indicated in the grey marked areas are always active. These reactions cannot be switched off.

7.7.2 Possible results

The following events can activate a reaction:

Event			Active at brake		Description	Note
			BFK458	14.115.xx		possible reason
1.	Air gap	too small	x		Air gap set incorrectly, air gap small than rated air gap.	
2.		too wide	x		Permissible maximum air gap exceeded	Wear
3.	Drop out current	Minimum	x		Armature plate of brake is released extremely early	Wrong brake connected?!
4.		Maximum	x		Armature plate of brake is released extremely late	Wrong brake connected?!
5.	Voltage supply	too low	x	x	Undervoltage in the brake control supply	**Do not activate with material handling vehicles** (many voltage drops caused by operation)
6.		too high	x	x	Overvoltage in the brake control supply	
7.	Coil resistance	too low	x		Resistance of the brake coil too low	Because of interturn fault
8.		too high	x		Resistance of the brake coil too high	Corroded contacts
9.	Overtemperature		x	x	Temperature of the brake control too high	
10.	Potentiometer resistance	too low	x	x	Resistance of the connected potentiometer too low	Earth fault or short circuit
11.		too high	x	x	Resistance of the connected potentiometer too high	Open circuit or earth fault
12.	Input voltage	too low	x	x	Voltage at analog input is lower than the minimum limit value	Fault of the analog sensor, open circuit or earth fault
13.		too high	x	x	Voltage at analog input is higher than the minimum limit value	Fault of the analog sensor or earth fault
14.	Not enabled		x	x	Enable input of the brake control is not connected to 0 V	
15.	Time out alarm flag		x	x	Can be set by the events 16. and 17.	
16.	Input CAN IN1		x	x	No CAN IN1 receiving signal with the identifier after the time interval set for CAN IN1. 📖 7-35	Only active if action No. “1” is set for CAN IN1.
17.	Input CAN IN2		x	x	No CAN IN2 receiving signal with the identifier after the time interval set for CAN IN2. 📖 7-35	Only active if action No. “1” is set for CAN IN2.

7.7.3 Events and system reactions

For the events 1. … 15. select one of the following system reactions:

Event	System reaction	Description
1. … 15.	Switch off	• Brake control is switched off – Spring-operated brake generates maximum brake torque – Electromagnetic brake does not generate a brake torque any more • Recommissioning by switching the operating voltage off and on again
	Relay	• Relay "ready for operation" releases (Connection between contacts for ready for operation at the brake control is opened)
	CAN alarm	• ALARM-STATUS (byte 0 = LOW byte, byte 1 = HIGH byte; 📖 7-32) is sent with the identifier set for the output CAN OUT ALARM – Transmission within the interval set 📖 7-35 – Only active if action No. "1" is set for the output 📖 7-35

7.7.4 Possible time out reactions

One of the two time out reactions can be selected for the events 16. and 17.

Event	Time out reaction	Description
16. and 17.	Braking	• Braking with maximum brake torque (for spring-operated brake and electromagnetic brake) – Back to original operating status as soon as the event is over.
	Alarm flag	• Setting of the time out alarm flag – can activate the reactions "Switch off", "Relay", "CAN alarm"

7.7.5 ALARM status

Meaning of the bits in ALARM status

Bit	Event
0x0001	Air gap too small
0x0002	Air gap too wide
0x0004	Min. drop out current
0x0008	Max. drop out current
0x0010	Undervoltage
0x0020	Overvoltage
0x0040	Coil resistance too low
0x0080	Coil resistance too high
0x0100	Overtemperature
0x0200	Potentiometer resistance too low
0x0400	Potentiometer resistance too high
0x0800	Input voltage too low
0x1000	Input voltage too high
0x2000	CAN time out alarm flag
0x8000	Not enabled

7.8 Operation of Moditorque Control through CAN bus

The brake control is equipped with a CAN bus connection which enables

- networking of brake controls (📖8-3 Application example),
- operation of brake controls at already existing CAN bus networks,
- reading information about the brake system during operation, e.g. brake wear.

The transmission rate of the data for the CAN bus is set under **CAN identifier**. (📖7-35)

7.8.1 Operation in control mode “CAN direct”

With “CAN direct” the brake can be controlled via the CAN bus (📖7-21). The CAN bus sends the value of the required brake torque to the brake control. The analog input is set to CAN IN1 or CAN IN2 under **Input**.

The brake control receives 2 byte data (1. byte = LOW byte, 2. byte = HIGH byte), which control the spring-operated brake as follows:

CAN data	Brake torque
-1	Brake released
0	Minimum brake torque (= 20 %)
0 … 16383	Reduced braking (= 20 … 100 %)
16383	Maximum brake torque (= 100 %)

7.8.2 Other control modes to be controlled via CAN bus

Also other control modes can be controlled via the CAN bus. For this, set the inputs to CAN IN1 or CANIN2 under **Input**. (📖7-25)

Also combined controlling is possible.

E.g. control mode "Sensor-controlled braking" 📖 7-15

- Analog input = CAN IN1 — Transfer of sensor values through CAN bus
- Digital input = Digital 1 — Braking activated via a switch which is connected to the brake control

When selecting a CAN input the brake control with the corresponding identifier receives 2 byte data which are interpreted as follows:

CAN input:					
Analog input		Frequency input		Digital input	
CAN data	Input voltage	CAN data	Pulse frequency at speed input	CAN data	Status at digital input
0	0 V	0	0 Hz	< 0	Input open (starts brake operation)
1023	10 V	1000	1000 Hz	≥ 0	Input closed
		5000	5000 Hz		

7.8.3 Sending information on CAN bus

The following information can be output to the CAN bus:

- All signals assigned to the inputs of the brake control
- Many operating values of the brake, such as brake torque, wear

7.8.4 CAN bus configuration

Via the menus **CAN identifier** and **CAN action** the CAN bus can be configured.

7.8.4.1 The menus “CAN identifier” and “CAN action”

For the output to be used for sending and for the inputs to be used for receiving, set the corresponding identifiers under **CAN identifier**.

Set the corresponding action No. for the CAN inputs and outputs under **CAN action**.

7.8.4.2 Settings for sending and receiving data

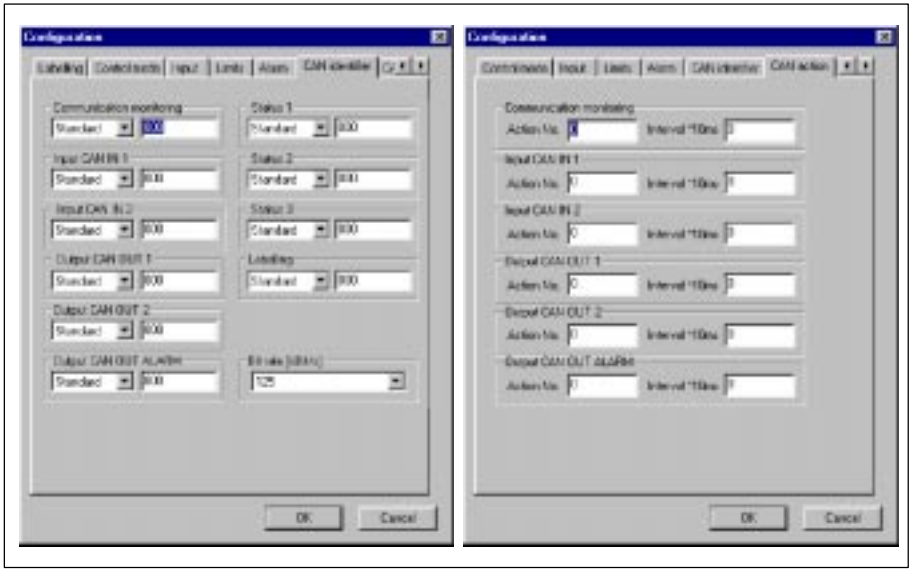


Fig. 7-21 Parameter setting: CAN bus configuration
Dialog box **Configuration**, Menu **CAN identifier** and menu **CAN action**

Menu “CAN identifier”	**Menu “CAN action”**
• The identifier length is set via the list selection. • The identifiers must be entered as decimal numbers. • Select the required data transfer rate.	• The interval time for the inputs must be entered for monitoring the cyclic data transfer at the inputs CAN IN1, CAN IN2. – If the identifier does not receive any data during the interval entered, the reaction set in the menu will be activated. **Alarm** (📖7-30) • If “Communication monitoring” is activated (action No. 1 or action No. 2), the interval time must be entered. • Enter the interval time for cyclic transfer to the output CAN OUT1, CAN OUT2, CAN OUT ALARM.

Parameter setting

Settings for data received from the CAN bus

Input	CAN identifier		CAN action		Function
	Length	Identifier	Action No.	Interval time	
Communication monitoring Identifier receiving data	Deactivated	empty	0	0	None
	Standard Extended	11 bit 29 bit	1	1 … 255 x 10 ms	No identifier for longer than the interval time set: → Maximum M_B until next identifier comes
			2	1 … 255 x 10 ms	No identifier for longer than the interval time set: → Switch off the control until the supply voltage has been switched off and on again.
CAN IN1 Reception of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	0	0	None
	Standard Extended	11 bit 29 bit	1	0	Active without monitoring
				1 … 255 x 10 ms	Active with monitoring No data for longer than the interval time set: → Reaction according to settings in the menu **Alarm** (📖7-30)
CAN IN2 Reception of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	0	0	None
	Standard Extended	11 bit 29 bit	1	0	Active without monitoring
				1 … 255 x 10 ms	Data reception No data for longer than the interval time set: → Reaction according to settings in the menu **Alarm** (📖7-30)

Settings for sending data from the CAN outputs to the CAN bus

Output	CAN identifier		CAN action		Function
	Length	Identifier	Action No.	Interval time	
CAN OUT1 CAN OUT2 Sending of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	0	0	None
	Standard Extended	11 bit 29 bit	1	1 … 255 x 10 ms	Cyclic sending of the signal to Analog 1 with identifier set for the interval set: 0 … 1023 ≡ 0 … 10 V
			2	1 … 255 x 10 ms	Cyclic sending of M_B with identifier set for the interval set: < 0: no M_B 0 … 16383 ≡ min … max M_B
			3	1 … 255 x 10 ms	Cyclic sending of the signal at the frequency input with identifiers set for the interval set: 0 ≡ 0 Hz 5000 ≡ 5000 Hz
			4	1 … 255 x 10 ms	Cyclic sending of the signal to Analog 1 **and** the status of Digital 1 with the identifier set for the interval set: • Highest value bit (MSB) – 0 ≡ Digital 1 closed – 1 ≡ Digital 1 opened • All other bits ≡ signal to Analog 1 – 0 … 1023 ≡ 0 … 10 V
			5	1 … 255 x 10 ms	Cyclic sending of the signal to analog CAN IN1 with identifier set for the interval set:
			6	1 … 255 x 10 ms	Cyclic sending of the signal to analog CAN IN2 with identifier set for the interval set:
CAN OUT ALARM Sending of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	0	0	None
	Standard Extended	11 bit 29 bit	0	0	Sending of the alarm status word (📖7-32) with identifier set after query via the remote package
			1	0	Sending of the alarm status word (📖7-32) with identifier set, if the menu **Alarm** for "CAN alarm" (📖7-32) has been assigned to a certain reaction
				1 … 255 x 10 ms	Cyclic sending of the alarm status word (📖7-32) with the identifier set for the interval set

Parameter setting

Settings for sending status 1 ... 3 and labelling to the CAN bus

Output	CAN identifier		Function
	Length	Identifier	
Status 1	Deactivated	empty	None
	Standard Extended	11 bit 29 bit	Sending of the switch-on time of the brake control [s] (byte 1 ... 4) and number of braking operations (byte 5 ... 8) with identifier after query via the remote package Every first byte = LOW byte, every last byte = HIGH byte
Status 2	Deactivated	empty	None
	Standard Extended	11 bit 29 bit	Sending of the reduced braking time [s] (byte 1 ... 4) and the release time [s] (byte 5 ... 8) with identifier after query via the remote package Every first byte = LOW byte, every last byte = HIGH byte
Status 3 Sending of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	None
	Standard Extended	11 bit 29 bit	Sending of the wear value, temperature, battery voltage and coil resistance with identifier set after query via the remote package.
Labelling Sending of 2 byte data 1. byte = LOW byte 2. byte = HIGH byte	Deactivated	empty	None
	Standard Extended	11 bit 29 bit	Sending of the labelling which is entered in the menu **Labelling** with the identifier set after query via the remote package.

7.9 Sending and reading of configuration data

- Sending configuration data = “Download”:
  - After parameter setting is completed, the saved data is send to the brake control.
- Reading configuration data = “Upload”:
  - Reading of the data from the brake control to the PC

Wiring required for the brake control (📖6-2)

Voltage conditions

“Download” and “Upload” can be carried out with

- operating voltage
- 11.5 V DC auxiliary voltage

“Upload” / “Download” at operating voltage	“Upload” / “Download” at auxiliary voltage
During data transfer, the brake control automatically changes in programming mode.	After the auxiliary voltage has been connected, the brake control is immediately in programming mode.
In programming mode, the brake coil is not supplied with current, i.e. • maximum brake torque for spring-operated brakes • no brake torque for electromagnetic brakes	
The brake control can be reset to operating status by switching the operating voltage off and on again.	After the operating voltage has been connected, the brake control is in operating status again.

Stop!

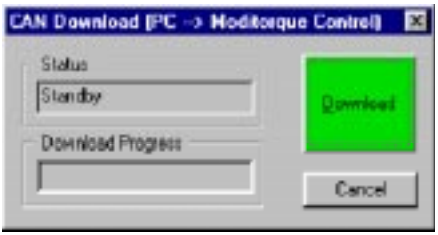
Faultfree data transfer at operating voltage is only possible if the brake control is not inhibited by the alarm reaction “Switch off”.

Note!

During “Download” the wear value saved in the configuration data is transferred. It is therefore necessary to read the current data from the brake control with “Upload” before changing the configuration data.

If “Upload” has not been carried out before changing the configuration data, the 20 test braking operations ensure safe brake control, the optimum functionality is however only reached during operation.

7.9.1 “Download”

Sending of configuration data to brake control		
Symbol “Download” (📖6-6)		**The menu “CAN Download”**
	click activates ...	
The menu “Download” (📖6-5)		
	click activates ...	

By clicking the green button, the transfer of configuration data to brake control is started.

- After successful transfer, the status line displays “Ready”.
- If the CAN connection is interrupted during data transfer, the status line displays the error message “Verify-Error in addr. 00h”.

Stop!

After “Download”

- “Reset” must be carried out: Switch voltage off and on again.
- With spring-operated brakes:
  - A minimum of 20 test braking operations is required.
  - The time interval between the braking operations must be at least 1 s.

7.9.2 Reading of configuration data

Stop!

Before “Upload” can be carried out, a “Reset” is required: Switch the voltage supply off and on again.

Reading of configuration data from brake control		
Symbol “Upload” 🕮 6-6		**The menu “CAN Upload”**
	click activates ...	
The menu “Upload” 🕮 6-5		
	click activates ...	

By clicking the green button, the transfer of configuration data to brake control is started.

- After successful transfer, the status line displays “Ready”.
- If the CAN bus connection is interrupted during data transfer, the status line displays the error message “CAN dongle error”.

Note!

Brake type and project description will not be saved in the brake control. During “Upload” the menu “Labelling” will not be updated.

If the information needs to be updated, open the corresponding configuration file from the harddisk before starting the “Upload”.

7.10 CAN adapter set-up

Fig. 7-22 Parameter setting: Dialog box **Configuration**, Menu **CAN adapter set-up**

With this menu the parameter setting window can always be adapted to your hardware.

8 Application examples

8.1 Speed-controlled braking for escalator drives

Control mode “Speed-controlled braking”

Fig. 8-1 Dialog box **Configuration**, Menu **Control mode speed-controlled braking**

Use of a pulse encoder with 60 pulses/revolution
Idle running speed: 1500 V/min ≡ 1500 Hz

Requirements

– Brake drive to standstill, t ≤ 4 s

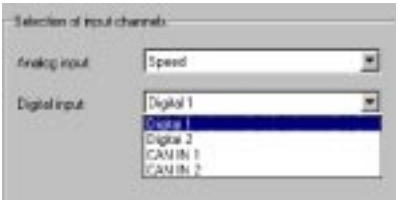
Parameter setting

Parameter	Required	Input value	Information
Initial brake torque		5000	Equals the average delay value of the drive which was calculated during commissioning.
Min. deceleration [Hz/s]	No function	0	
Max. duration [ms]	3 s	3000	
P-controller		50	Determines the reaction of the speed control P-controller > 100: Brake must be readjusted Unstable running during braking Danger of excessive operation
Stop frequency [Hz]	No function	0	
Stop deceleration[Hz/s]	No function	Any	
Frequency limit [Hz]	3000 pulses/s	3000	Pulse encoder drive: 60 pulses/revolution Motor: 3000 pulses/s at 3000 Hz

Application examples

Inputs for the setpoint encoder

- Analog input for the speed control
  - Speed
- Digital input for braking start
  - Digital 1 or Digital 2



Notes

- The brake must be selected so that the drive can be braked to standstill within the time required even under heavy load (high load, driving load).
  For safety reasons, select the brake 10 - 20 % larger than required.
- The brake control can reduce the brake torque down to 20 %. Thus the required braking distance can be maintained even under different load conditions.

8.2 Synchronous operation of 2 Moditorque Control systems

For some applications, two or several brakes must be synchronized to each other. For instance, several vehicle brakes in crane building.

Control mode “CAN direct”: M_S is read from the CAN bus.

The brake control can only be used in group drives, e.g. Moditorque Control brake control with frequency inverter, 2 Moditorque Control brake controls.

Synchronous operation of 2 Moditorque Control brake systems

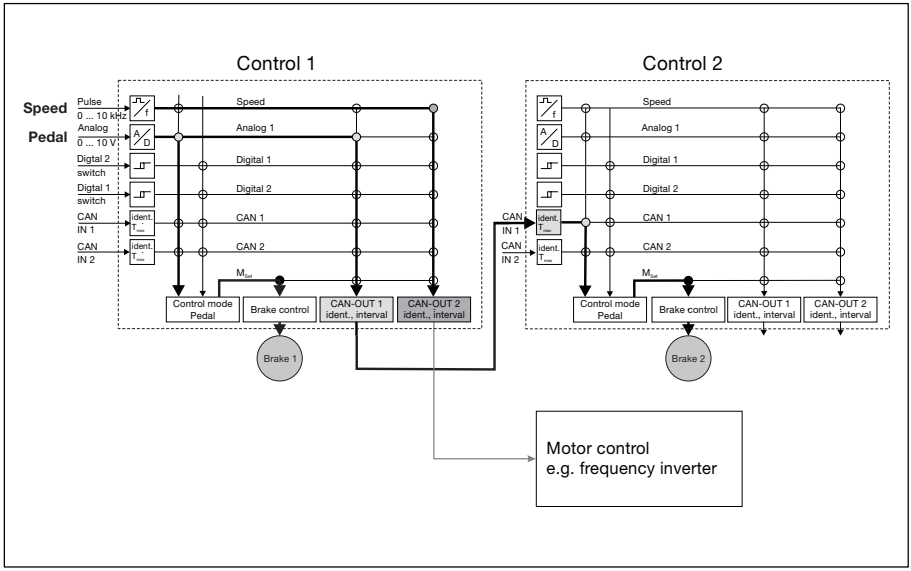


Fig. 8-2 Signal flow chart for synchronous operation of 2 Moditorque Control brake systems

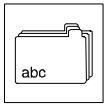
Application examples

Input: CAN-IN1 is set for the identifier 0x051, monitoring interval = 120 ms

Control 1	Control 2	Note
Brake pedal connection		
Control mode “Pedal-controlled braking”		
Input: Analog 1	Input: CAN IN1 set for the identifier 0x051 Monitoring interval = 120 ms • CAN identifier CAN IN1 to standard 051 • CAN action for CAN IN1: Action No. 1; Interval: 12 · 10 ms	Control 2 receives the pedal position from control 1 via CAN IN1 and transfers the information as if it came from Analog 1. The pedal characteristics of the two controls can be set differently.
• The pedal value is set for CAN OUT1. • CAN OUT1 sends cyclic information about the pedal position to the identifier 0x051. • Interval = 50 ms. • CAN identifier CAN OUT1 to standard 052 • CAN action for CAN OUT1: Action No. 2 • Interval: 5 · 10 ms		If the identifer does not receive any data package for more than 120 ms, control 2 brakes the drive fully. • The time out reaction ”Braking” must be activated for CAN IN1 under **Alarm**.

Control 1 can additionally measure the motor speed by means of a pulse encoder and transfer the values to the motor control via CAN OUT2.

The brake control can also be used as CAN pedal and thus receive CAN bus commands for braking. A 4 quadrant motor control can thus evaluate and control the brake pedal and determine the brake torque for motor and brake control. As a result, motor and brake form a unit in the sense of Mechatronics. By this, the brake range of a 4 quadrant inverter is extended by the functionality of the spring-operated brake.

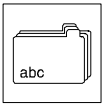


9 Table of keywords

A

B

C



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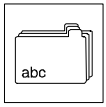

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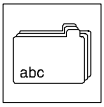

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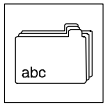
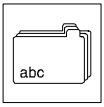


S



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