Product Information

AC Drives for
Battery Supply

powersolutions.danfoss.com
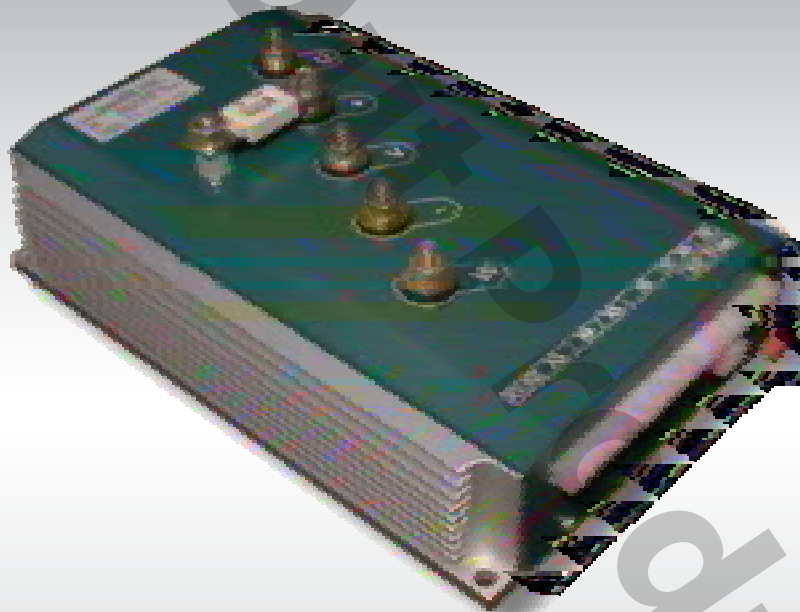
Product Matrix Overview

Series A

Series A is the first generation of our AC-controllers. It is based on a modular concept, which allows a maximum on flexibility. The controllers are available for traction drives, hydraulic pump drives and electronic steering.

This series will be replaced by the newer series B, C, D and E.

Size	24V	48V	80V
A1	60A	25A	20A
A2	120A	50A	40A
A4	240A	100A	80A
A6	360A	150A	120A
A8	480A	200A	160A
A10		250A	200A
A12		300A	240A
A14		350A	280A
A16		400A	320A
A18		450A	360A
A20		500A	400A
A22		550A	440A
A24		600A	480A

Series B

Series B is the first type of the second generation of our AC-controllers.
It is optimized for small pedestrian trucks and other small drives with 24V battery supply voltage.
Special versions for 12V and 36V are available.

Size	12V	24V	36V
B1	60A	60A	60A
B2	120A	120A	120A

Series C

Series C is optimized for battery powered material handling vehicles of the small and medium power range, like pedestrian trucks (walkies), order pickers and small lift trucks. The 80V version is mainly used for auxiliary hydraulic pump drives in bigger trucks.

Size	24V	36V	48V	80V
C2	120A	100A	75A	40A
C3	180A	150A	112A	60A
C4	240A			
C6	360A	300A	225A	120A
C8	480A	400A	300A	160A

Options:

-H   Hydraulic unit: All electronic components and driver-outputs for a hydraulic system with proportional lifting and lowering are included.

-C   with CAN-Bus interface

-AGV   Special version for automatic guided vehicles (AGV)

Series D

Series D is optimized for battery powered material handling vehicles of the medium and high power range, like counterbalance trucks, reach trucks and high level order pickers. A special version for dual drive application is available. CAN-Bus is optionally.

Size	24V	36V	48V	80V
D8	480A	400A	300A	160A
(D10)	600A	500A	375A	200A
D12	(720A)	600A	450A	240A
D16			600A	320A
(D20)			750A	400A
D24				480A
D24x				600A

Options:

-C   with CAN-Bus interface

-ZM   Dual drive, master

-ZS   Dual drive, slave

Series E

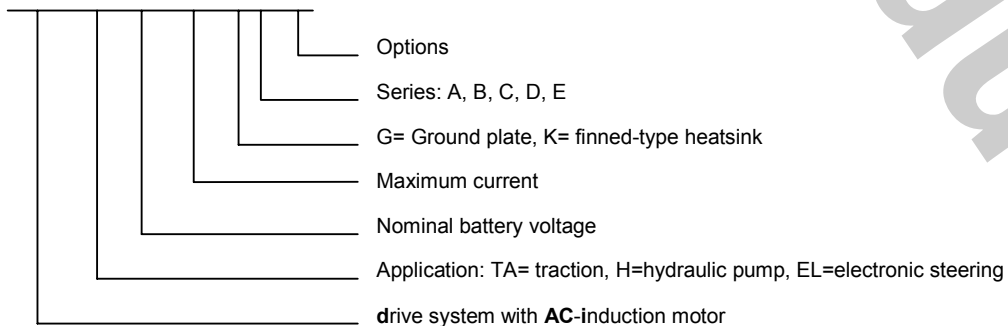Series E is the new generation of electronic steering controllers.

Size	24V	36V	48V	80V
E1	60A	50A		
E2	120A	100A	75A	40A
E3	180A	150A	112A	60A
E3x				75A

Remarks:

All indicated current values mean maximum current.
(…) : These types are not in series production yet.

Type Identification:

dACi-TA 24/240 GC-HC

- Options
- Series: A, B, C, D, E
- G= Ground plate, K= finned-type heatsink
- Maximum current
- Nominal battery voltage
- Application: TA= traction, H=hydraulic pump, EL=electronic steering
- **d**rive system with **AC**-**i**nduction motor
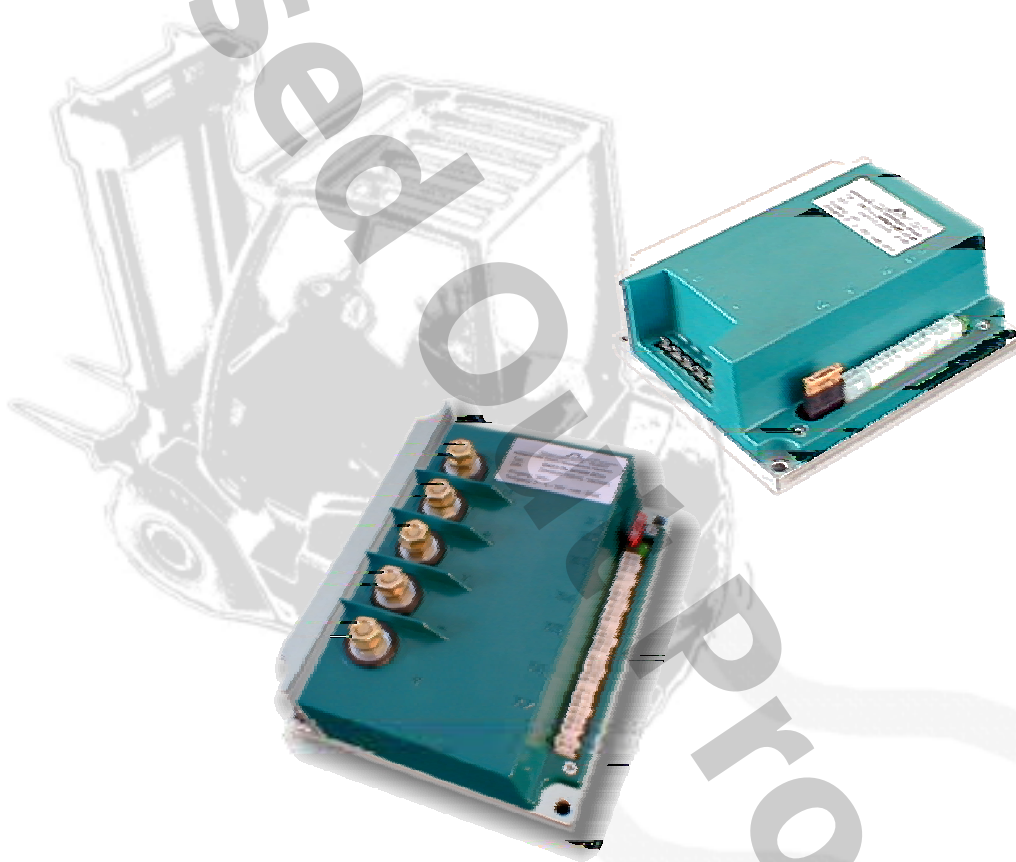
dACi
Series E

dACi - EL
Electronic Steering Control with AC Technology

dACi-EL ...

... is an electronic steering controller with AC-technology

dACi-EL operates without any mechanical connection between the steering assembly and the drive wheels. The set value for the steering angle is transmitted from an incremental encoder that is attached to a steering wheel, from a joystick or from a potentiometer that is attached to a tiller. Also a superordinated controller can transfer the set value via analogue or serial interface (RS485 or CAN).
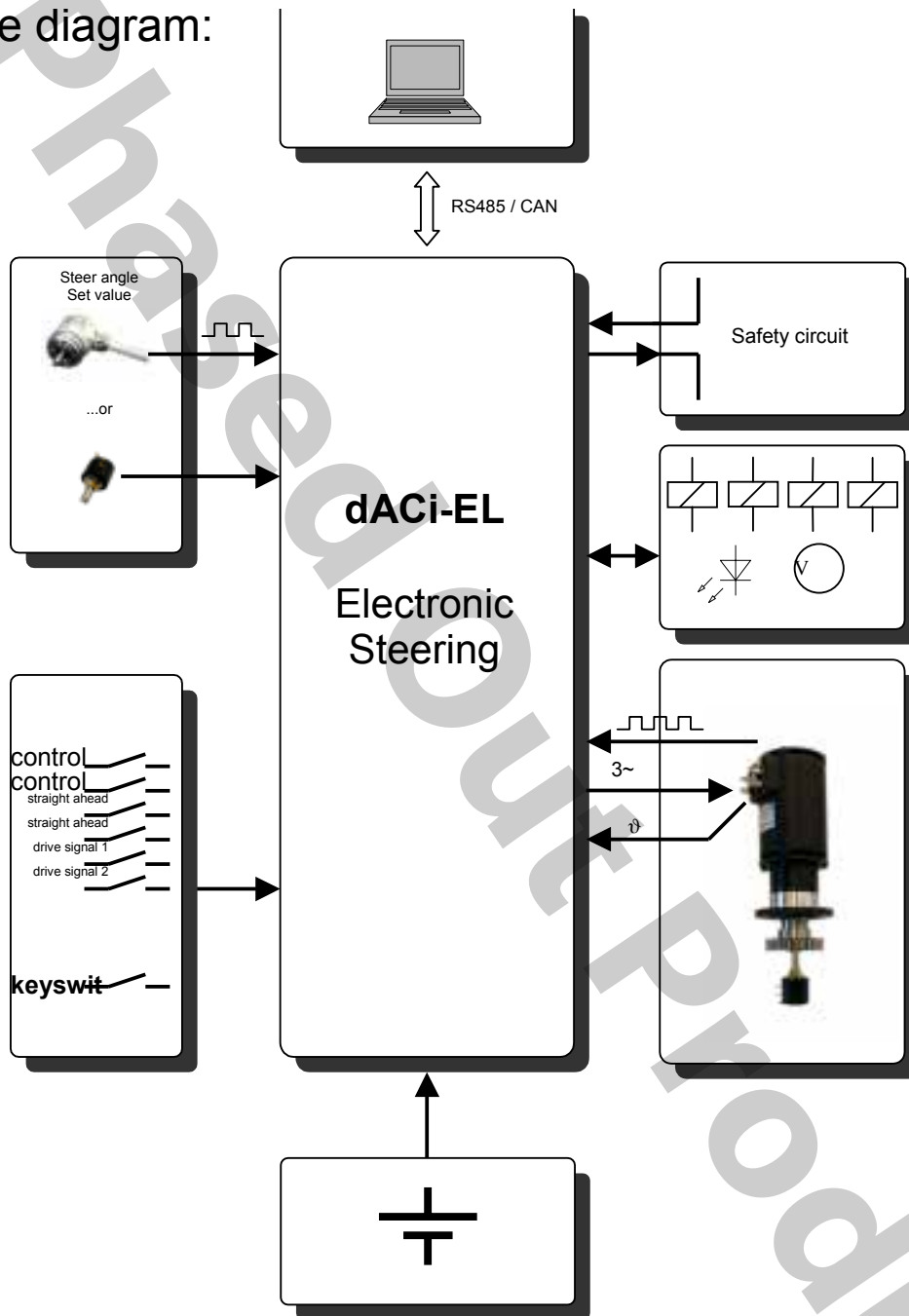
A digital closed loop controller ensures immediate steering movement synchronized exactly to the movement of the steering wheel. The systems high dynamics and steering accuracy gives the feeling of a rigid coupling between steering assembly and drive wheels.

As actuator a maintenance-free AC-induction motor is used. The necessary three phase sinusoidal current is generated by an inverter, powered by the supply-battery.

Features:

♦ **Closed loop angle control**
  - ➢ Gives real feeling of a rigid coupling between steering assembly and drive wheels
  - ➢ usable for automatic guided vehicles
  - ➢ usable for tiller steering (walkies)
  - ➢ usable for 360° endless steering

♦ **Adjustable ratio between the angles of steering and drive wheels**

♦ **Adjustable angle limits**
  - ➢ no limit switches necessary
  - ➢ reduces mechanical wear

♦ **Several set value inputs**
  - ➢ steering wheel with incremental encoder
  - ➢ joystick, potentiometer
  - ➢ analogue or serial interface

♦ **Straight ahead button**

♦ **Selectable digital outputs**
  - ➢ angle limit reached
  - ➢ steer angle > x

♦ **Safety-circuit**
  - ➢ to switch off the drive-system if a fault occurs in the steering system

♦ **Meets category 3 safety requirements**

Principle diagram:

RS485 / CAN

Safety circuit

dACi-EL

Electronic
Steering

3~

control
control
straight ahead
straight ahead
drive signal 1
drive signal 2

keyswit

Safety

Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

dACi-EL also includes:

- Continuous surveillance of the safety relevant sensorcables indicating possible cable breakage or shorted circuits

- Safety control features and redundant channels in the microcontroller-system

- A safety-circuit connector to switch an emergency brake or to disable the traction drive in case of failure.

Technical data
Power data

Type: dACi-EL	24/060 GE	24/120 GE	24/180 GE	48/075 GE	48/112 GE	80/040 GE	80/060 GE	80/075 GE
Size	E1	E2	E3	E2	E3	E2	E3	E3x
Nominal battery voltage [V]	24			48		80		
Input voltage range [V] permanent short-time (<30s)	17...30 17...35			30...60 30...70		48...100 48...115		
Nominal current [A] [1]	30	60	90	38	56	20	30	38
Maximum current [A] [2]	60	120	180	75	112	40	60	75
Output voltage [V~] [3]	3x0...16			3x0...32		3x0...53		
Dimensions [mm] w x h x d	140 x 160 x 60	155 x 200 x 70						
Power connectors	Screws M5	screw terminals M8						

[1] dependant on the temperature resistance of the mounting plate

[2] duration depends on the temperature resistance of the mounting plate

[3] at input voltage = nominal voltage

Interfaces

Type: dACi-EL	24/xxx GE	48/xxx GE	80/xxx GE
Digital Inputs			
Logic	high-active (optional low-active)		
Number	4 singles + 2 linked to OR		
Input resistance [Ω]	10k (with low-active input: 2k7 pull-up)	20k (with low-active input: 2k7 pull-up)	40k (with low-active input: 2k7 pull-up)
Low-level [V] max.	1	1,5	4
High-level [V] min	12	24	48
Analogue Inputs			
1. Voltage input [4]			
Voltage range [V]	0...10		
Input resistance [Ω]	86k	86k	86k
2. Set value potentiometer [4] incl. wire break surveillance	wire-wound potentiometer (usually 270°)		
recommended resistance of potentiometer [Ω]	5k		
3. Feedback potentiometer [5] incl. wire break surveillance	wire-wound potentiometer (multi turn, dependant on the mechanic)		
recommended resistance of potentiometer [Ω]	5k		
Inputs for incremental encoders			
1. Set value [4]			
Level [V]	0/5 A, #A, B, #B (RS422)		
Supply	5V, max 50mA		
2. Motor speed (Sensor bearing) [5]			
Level [V]	0/15 A,B (pull-up-resistor 750Ω included)		
Supply	ca. 18V (at typical current consumption for the sensor bearing with 15mA)		
Digital Outputs			
1. Programmable Outputs 1...4	open drain with 1,5kΩ Pull-up-resistor and reverse diode		
Nominal current [mA]	100	100	50
Maximum current [mA] (<10s)	150	150	75
2. Status indicator	LED directly connectable without series resistor, 7mA		

Safety circuit			
Circuit	two transistors in series connection incl. overcurrent protection and self-test, usable as high-side-switch		
Nominal current [A]	2,5	2,5	1,5
Maximum current [A] (<30s)	4	4	2
Internal resistance [Ω]	0,32	0,32	0,7

[4] With steering wheel: Set value with incremental encoder (RS422-encoder or two A/B-encoders, e.g. dual sensor bearing)
With tiller or Joystick: Set value with potentiometer (also a dual-potentiometer can be used)
[5] There are always two actual values evaluated: Motor speed by encoder (e.g. sensor bearing) and position of mechanic by potentiometer.

Others

| Switching frequency	16kHz standard; adjustable 4, 8, 12, 16, 20 kHz
Efficiency	about 95% at nominal output
Output frequency	0...300 Hz
Temperature range	-40°C ... 50°C (mounting plate)
Relative humidity	max. 90%, no condensation
Signal line connectors	Molex mini fit junior
IP protection	IP40, IP54 optional

Features:

- different inputs for steering angle set value:
  - incremental encoder
  - joystick / potentiometer
  - voltage input 0 ... +10V

- variable ratio: rotations of the steering wheel to move the entire steering range

- adjustable angle limits, left and right limit separately adjustable

- input for redundant incremental encoder

- adjustable set value curve

- set value source selection by digital input
  - safety input: 2 separate input channels
  - open: set value from incremental encoder / joystick / potentiometer
  - closed: set value from a superordinated controller (voltage input)

- straight ahead by digital input
  - safety input: 2 separate input channels
  - open: regular steering function
  - closed: wheels in straight ahead position
  - adjustable time delay
  - adjustable moving-speed

- standby-mode
  - in standby-mode the power stage is disabled, all other functions operate normally
  - standby-mode is activated, if for an adjustable preset time period no steering movements are made and the traction drive is inactive
  - standby-mode will be left, if the traction drive is enabled or the steering set value is changed more than a predetermined amount (e.g. if steering wheel will be turned more than 20°)

- key switch input

- safety circuit
  - safety output: 2 semiconductors (MOSFET) in series, supervised separately
  - current limitation

- steering function surveillance
  - lag error surveillance (monitoring the difference between steering angle set value and actual steering angle value)
  - plausibility monitoring: value comparison between steering angle measured separately by a potentiometer and an incremental encoder

- fault detection of incremental encoder for
  - cable breakage
  - shorted circuits

- fault detection of potentiometer for
  - cable breakage
  - shorted circuits

- battery voltage monitoring
  - adjustable minimum- and maximum voltage limits

- motor temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- power stage temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- current limiter

- operation signal (LED)

- 4 digital outputs, selectable for
  - left angle limit attained
  - right angle limit attained
  - left or right angle limit attained
  - status signal
  - steering angle > threshold value (adjustable)
  - difference of steering angle > threshold value (adjustable)
  - power stage high temperature warning
  - motor high temperature warning

- analogue output, selectable for
  - steering angle set value
  - steering angle actual value (position of wheel)
  - motor speed actual value
  - motor speed set value
  - motor speed-deviation
  - torque
  - motor frequency
  - fixed value

- special operating modes for usage as an actuator for superordinated steering angle controller
  - torque control
  - closed loop speed control

- parameter setting possibilities
  - PC software under MS-Windows
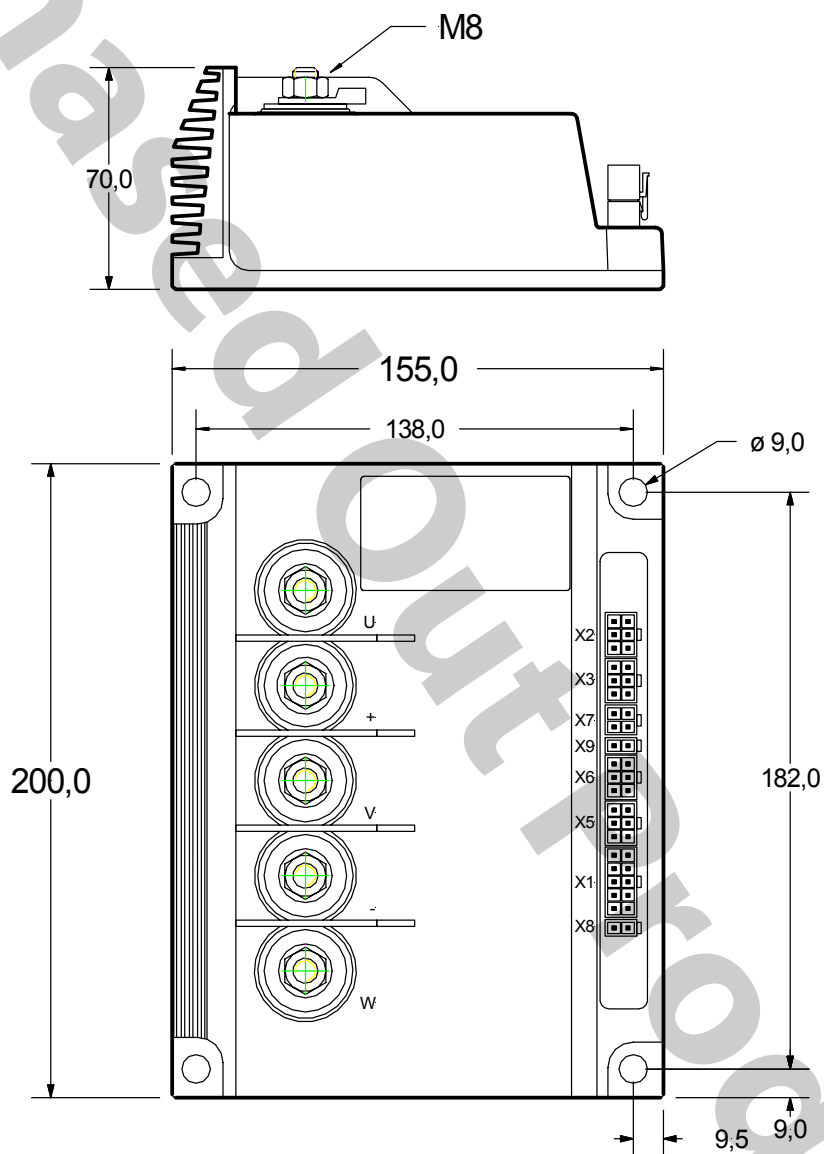 - BPK: handheld console

Wiring Diagram
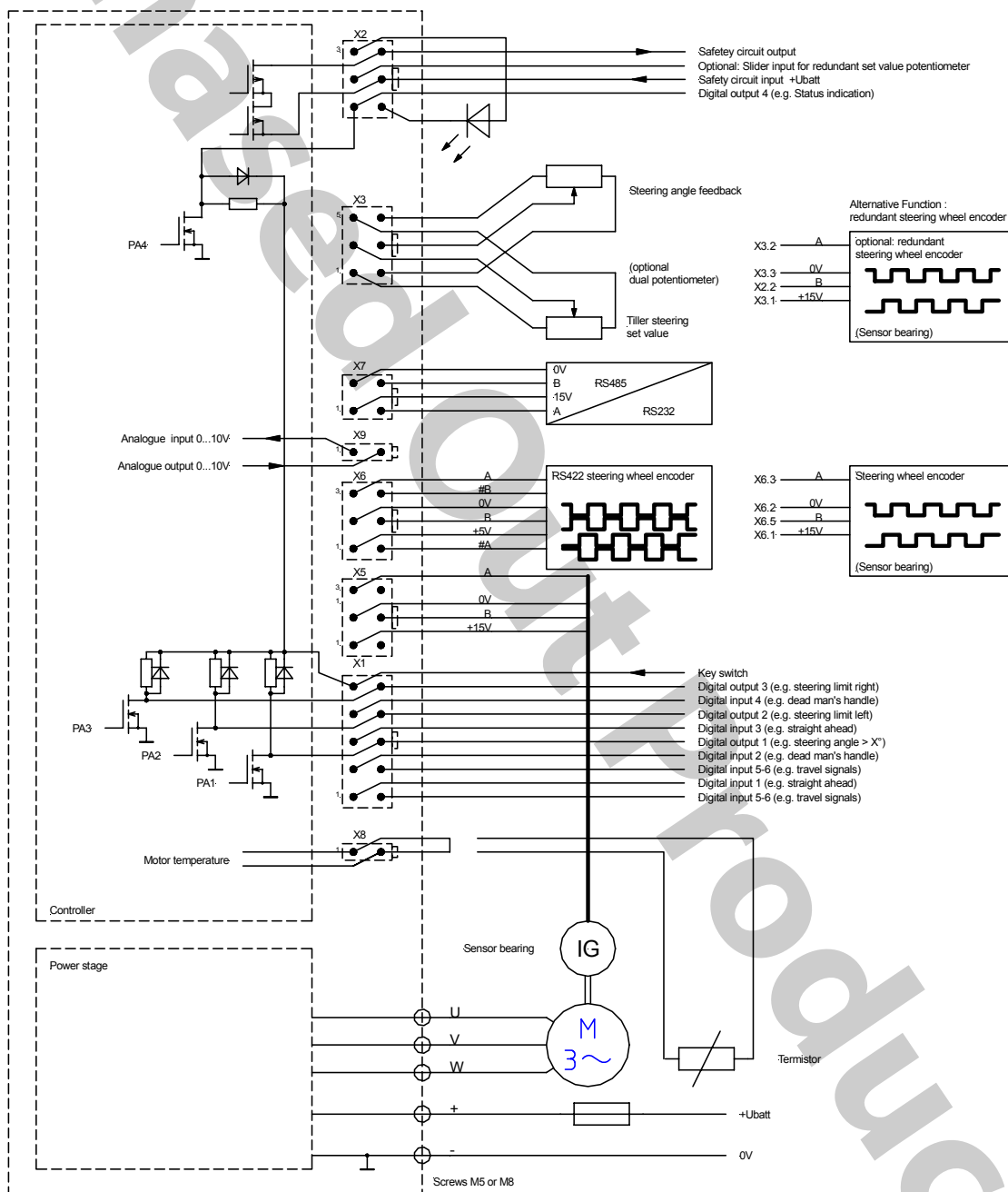
Dimensions

Size E1
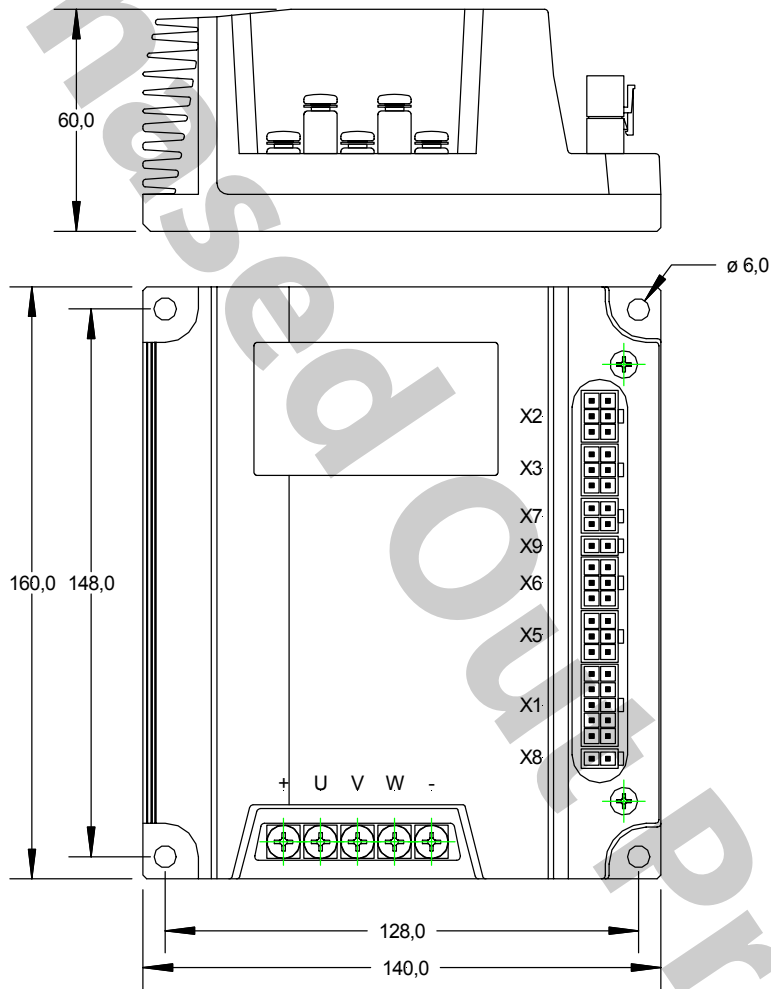
Dimensions

Size E2 and E3:

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dACi

Series D

Also for Dual-Drive applications

dACi - TA

AC-Controller for Traction Drive Units

dACi Series D ...

... is an AC-controller, optimized for battery powered material handling vehicles of the medium and high power range, like counterbalance trucks, reach trucks and high level order pickers.

The electronic consists of a three-phase inverter and a control unit.
AC- technology offers the following advantages in comparison to DC- technology:

- **Maintenance-free operation**

  - no mechanical wear and tear on the motor

  - no mechanical switch contacts (contactors) for
    direction reversal or recuperation

- **Recuperation**

  - without any additional components

- **Higher efficiency**

- **More flexibility in construction**

  - less wiring

  - the motor does not need to be openly accessible, because it operates maintenance-free

- **Explosion protection**

  - easy realizable due to no sparking in the motor

Features

- **Proportional drive reaction**

  - vehicle speed is directly dependant upon the position of the acceleration pedal (speed control)

  - stalled torque

  - sensitive driving over bumps and on ramps

  - no unintentional acceleration while driving down steep grades

- **Individual possibilities of adjustment**

  - acceleration pedal sensitivity

  - max. acceleration

  - max. deceleration

  - adjustable drive curve generator

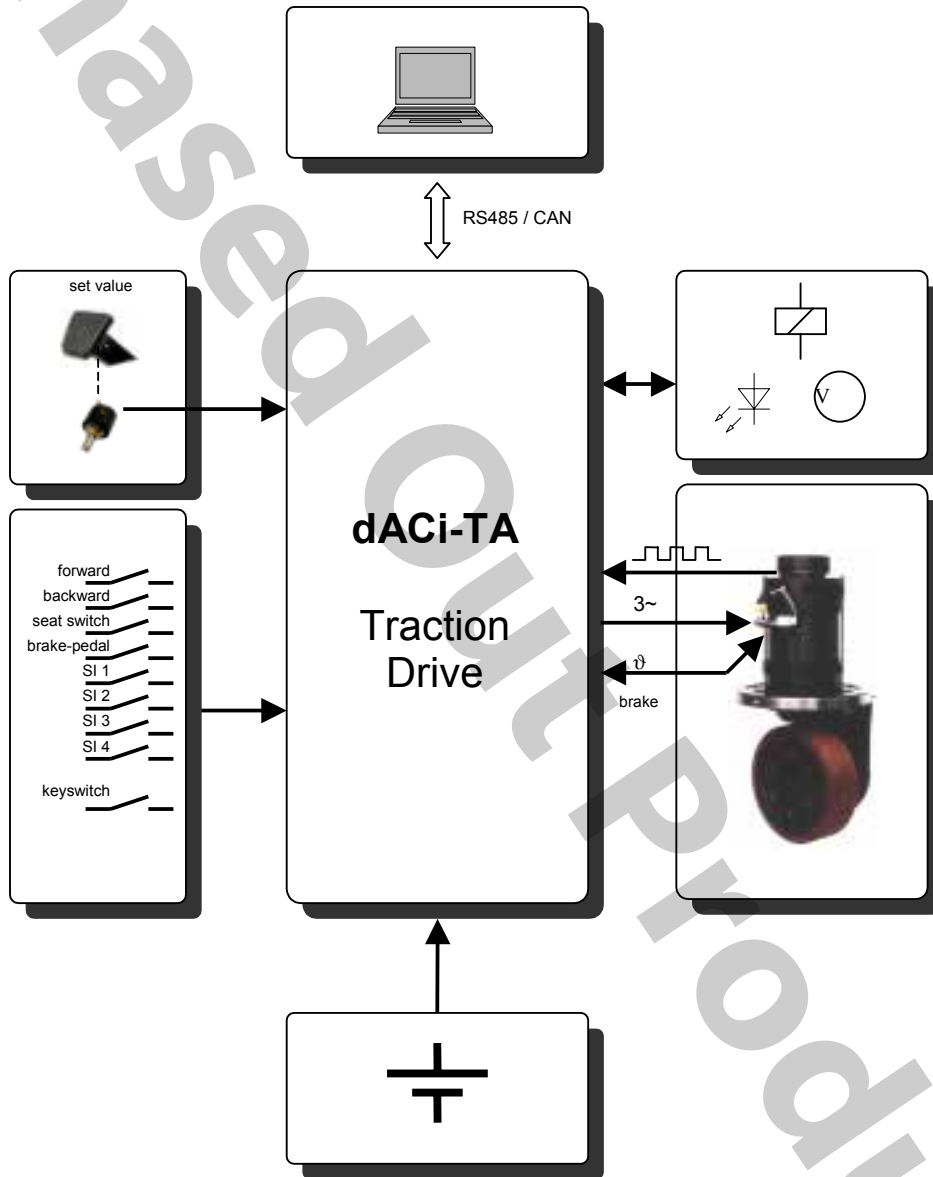- **Special fork lift truck functions**

  - seat switch surveillance

  - creeping speed

  - driver output for main-contactor with voltage-reduction

  - driver output for magnetic brake

  - all inverse diodes for external components already mounted on-board

- **Special Version for dual-drive application available**

  - Communication between the two drive-controllers via CAN-Bus.

  - Torque-allocation-controller, to perform best feed with lowest energy.

Principle Diagram:

SI: Selectable Input

RS485 / CAN

set value

forward
backward
seat switch
brake-pedal
SI 1
SI 2
SI 3
SI 4

keyswitch

dACi-TA

Traction
Drive

3~

ϑ

brake

Safety

Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

Furthermore dACi possesses various safety equipments and also meets the requirements of the EN 11 75-1 and DIN EN 954-1 standards.

Features:

- operating modes:
  - open loop speed control
    (no incremental encoder necessary)
  - closed loop speed control
    (incremental encoder necessary)
  - torque control (incremental encoder
    necessary)

- adjustable set value curve (e.g. characteristic
  of acceleration pedal)

- 2 analogue inputs, usable as
  - potentiometer input (with fault detection)
  - voltage input 0...+10V

- adjustable travel characteristics
  - adjustable drive curve generator
  - maximum speed forward
  - maximum speed backward
  - max. acceleration
  - deceleration when reducing the set value
  - deceleration when activating an opposite
    travel direction
    (adjustable continuously with the set value
    input)
  - deceleration when brake pedal is activated
    (digital input)
  - deceleration when activating creeping
    speed (e.g. while making turns)

- 3 creeping speeds

- 2 modes for the travel signals
  - direction forward; direction backward
  - enable; direction

- different modes of stopping
  - turn off motor and roll until standstill
  - turn off motor and close magnetic brake
  - stop by leading

- seat switch surveillance
  - adjustable time delay

- integrated fuse for control-lines

- integrated fuse for power-line

- driver output for main-contactor with voltage-
  reduction

- magnetic brake driver-output
  - short-circuit protected output
  - adjustable delay time

- key switch input

- fault detection of incremental encoder for
  - cable breakage
  - shorted circuits

- fault detection of the potentiometers for:
  - cable breakage
  - shorted circuits

- battery voltage monitoring
  - adjustable minimum- and maximum voltage
    limits

- motor temperature monitoring with fault
  detection of the temperature sensor for cable
  breakage and shorted circuits

- power stage temperature monitoring with fault
  detection of the temperature sensor for cable
  breakage and shorted circuits

- operation signal (LED)

- 6 digital inputs, selectable for
  - creep speed
  - seat switch
  - brake pedal switch
  - enable
  - custom specific function

- 2 digital outputs, selectable for
  - ready-signal
  - active brake
  - chosen direction
  - torque > threshold value (adjustable)
  - status signal
  - high temperature warning of the power
    stage
  - high temperature warning of the motor

- 4 digital driver-outputs to switch hydraulic
  valves or contactors

- analogue output, selectable for
  - speed set value
  - speed actual value
  - speed deviation
  - torque
  - motor frequency
  - fixed value

- serial interface RS485 or CAN, each with a
  busmastering record

- all functions can also be performed via serial
  interface (RS485 or CAN)

- possibilities of parameter settings:
  - PC software under MS-Windows
  - BPK: handheld console

Technical data

Power data

Type: dACi-TA	24/480 GD	24/600 GD	24/720 GD	36/400 GD	36/500 GD	36/600 GD
Size	D8	D10	D12	D8	D10	D12
Nominal battery voltage [V]	24			36		
Input voltage range [V] continuous maximum (<30s)	17...30 17...35			25...45 25...50		
Nominal current [A] [1]	240	300	360	200	250	300
Maximum current [A] [2]	480	600	720	400	500	600
Output voltage [V] [3]	3x 0...16			3 x 0 ... 24		
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 230 x 95		220 x 330 x 95
Power connectors (screw terminals)	M8	M10	M10	M8	M10	M10

Type: dACi-TA	48/300 GD	48/375 GD	48/450 GD	48/600 GD	48/750 GD
Size	D8	D10	D12	D16	D20
Nominal battery voltage [V]	48				
Input voltage range [V] continuous maximum (<30s)	30...60 30...70				
Nominal current [A] [1]	150	190	225	300	375
Maximum current [A] [2]	300	375	450	600	750
Output voltage [V] [3]	3 x 0 ... 32				
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 430x100	
Power connectors (screw terminals)	M8	M8	M8	M10	M10

Type: dACi-TA	80/160 GD	80/200 GD	80/240 GD	80/320 GD	80/400 GD	80/480 GD	80/600 GD
Size	D8	D10	D12	D16k	D20	D24k	D24k
Nominal battery voltage [V]	80						
Input voltage range [V] continuous maximum (<30s)	48...100 48...115						
Nominal current [A] [1]	80	100	120	160	200	240	300
Maximum current [A] [2]	160	200	240	320	400	480	600
Output voltage [V] [3]	3 x 0 ... 53						
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 330x100		220 x 430x100	220 x 430x100
Power connectors (screw terminals)	M8	M8	M8	M10	M10	M10	M10

[1] dependant on the temperature resistance of the mounting plate

[2] duration depends on the temperature resistance of the mounting plate

[3] at input voltage = nominal battery voltage

Interfaces

Type: dACi-TA	24/xxx GD	36/xxx GD 48/xxx GD	80/xxx GD
8 Digital Inputs (X6.2, .3, .4, .5, .7, .8, .9, .10)			
Logic		high-aktiv	
Input resistance [Ω]	3,5k	10k	25k
Low-level [V] max	2	3	8
High-level [V] min	12	24	48
2 Analogue Inputs (X6.6, X5.7)			
Resolution		10 bit	
Input resistance [Ω]		94k	
Selected as potentiometer input			
Voltage range [V]		2...8	
Resistance of the ext. potentiometer [Ω]		5k	
Selected as voltage input			
Voltage range [V]		0...10	
Digital Outputs			
Main Contactor driver-output (X2.2)		low-side-switch with inverse diode	
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition		1s 100% on-period, then 60% on-period	
Magnetic Brake driver-output (X4.5)		low-side-switch with inverse diode	
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition		1s 100% on-period, then 60% on-period	
Programmable Outputs 1 u. 2 (X1.3, .6)		low-side-switch with inverse diode	
Nominal current [A]	1,0	0,7	0,3
Maximum current [A]	1,5	1,0	0,5
Programmable Outputs 3 u. 4 * (X3.6, .7)		low-side-switch with inverse diode	
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Programmable Outputs 5 u. 6 * (X3.3-8, X3.4-9)		high-side-switch with inverse diode	
Nominal current [A]	3,0	2,0	0,7
Maximum current [A]	4,5	3,0	1,0
Analogue Output (X1.2-5)			
Voltage range [V]		0...10	
Output resistance [Ω]		100	
Incremental encoder 1 (X4.3, .4, .7, .8)			
Level [V]		0 / 15 A,B (e.g. sensor bearing)	
Supply		15V, max 100mA	
Incremental encoder 2 * (X8)			
Level [V]		0 / 5 A, #A, B, #B (RS422)	
Supply		5V, max 100mA	

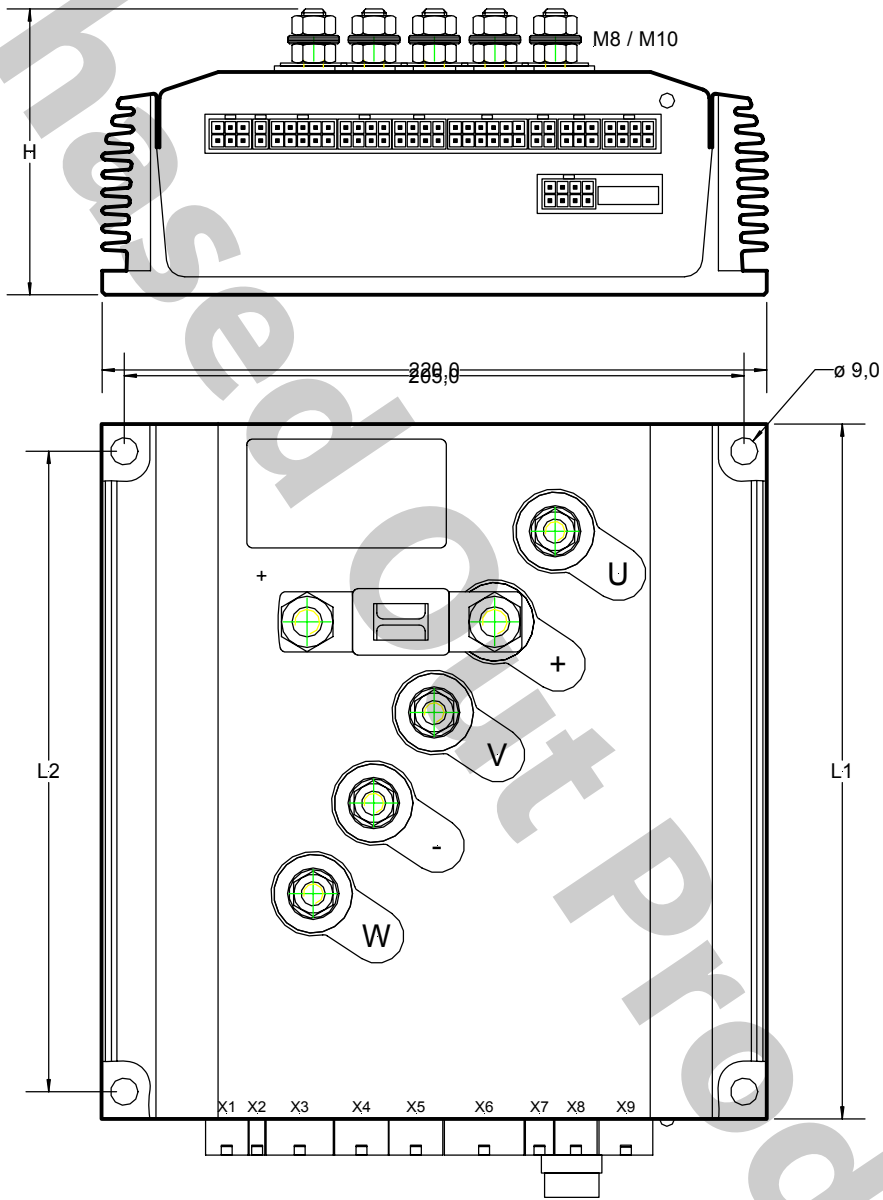| **Motor temperature sensor** (X4.2-6)	
Type	PTC
Serial interface	
RS485 (X7)	
Supply for ext. Converter	15V, max 100mA
CAN * (X9)	V2.0A (V2.0B passive)
connectable terminal resistor	120 Ω

Others

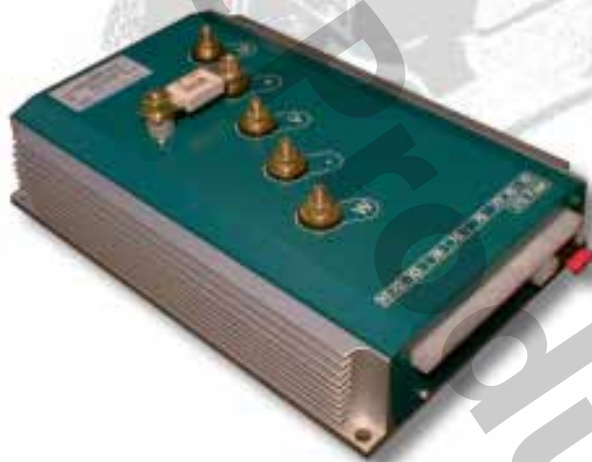|	
Switching frequency	16kHz standard; adjustable 4, 8, 12, 16, 20 kHz
Efficiency	about 95% at nominal output
Output frequency	0...300 Hz
Temperature range	-40°C ... 50°C (mounting plate)
Relative humidity	max. 90%, no condensation
Operation signal	built-in LED
Signal line connectors	Molex mini-fit junior
IP protection	IP40, IP54 optional

* optional

Wiring Diagram

Dimensions

M8 / M10

H

200,0

ø 9,0

L2

U

+

+

V

-

L1

W

X1 X2 X3   X4   X5   X6   X7 X8   X9

Size	L1	L2	H
D08	230 mm	212 mm	95 mm
D12	330 mm	312 mm	95 mm
D16k	330 mm	312 mm	100 mm
D16	430 mm	412 mm	100 mm
D24k	430 mm	412 mm	100 mm

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d A C i
Series D

dACi - H

AC-Controller for
*H*ydraulic Pump Drives

dACi-H...

...is an AC-Controller for hydraulic pump drives with AC-induction motor.

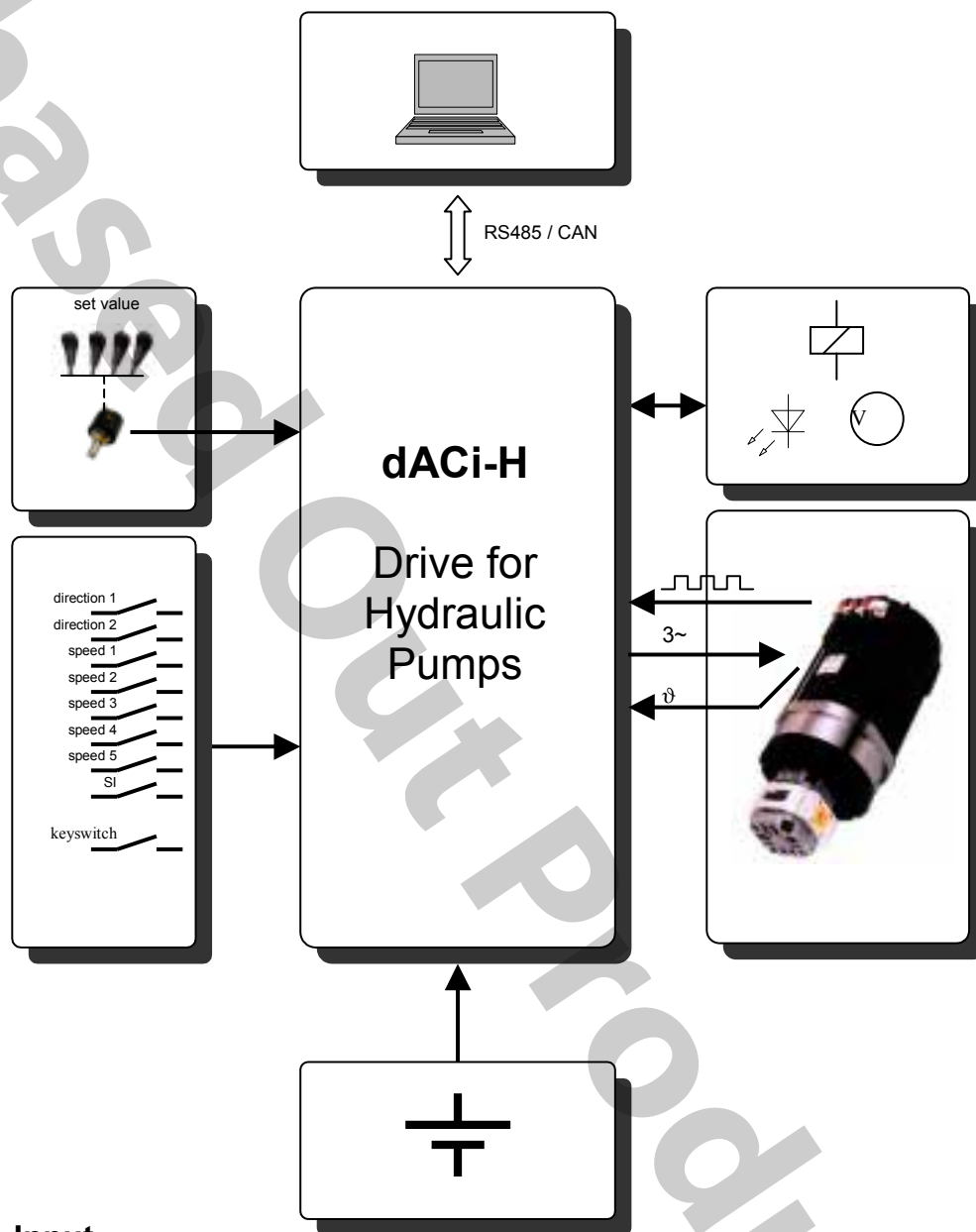The electronic consists of a three-phase inverter and a control unit.
AC- technology offers the following advantages in comparison to DC- technology:

♦ **Maintenance-free operation**

   ➢ no mechanical wear and tear on the motor

   ➢ no mechanical switch contacts (contactor)

♦ **Recuperation**

   ➢ without any additional components

♦ **Higher efficiency**

♦ **More flexibility in construction**

   ➢ less wiring

   ➢ the motor does not need to be openly accessible because it operates maintenance-free

♦ **Explosion protection**

   ➢ easy realizable due to no sparking in the motor

Features:

♦ **Open loop mode**

   ➢ no incremental encoder necessary

   ➢ current limiting

♦ **Closed loop mode**

   ➢ constant speed, independent on load

   ➢ adjustable torque limit

♦ **Different set value inputs**

   ➢ analogue-input for continuous set value

   ➢ digital-inputs for selection of fixed set values

Principle Diagram

RS485 / CAN

set value

dACi-H

Drive for
Hydraulic
Pumps

direction 1
direction 2
speed 1
speed 2
speed 3
speed 4
speed 5
SI

keyswitch

3~

SI: Selectable Input

Safety
Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

Features:

- operating modes:
  - open loop speed control
    (no incremental encoder necessary)
  - closed loop speed control
    (incremental encoder necessary)

- adjustable set value curve

- 2 analogue inputs, usable as
  - potentiometer input
  - voltage input 0...+10V

- adjustable speed process
  - maximum speed for counterclockwise rotation
  - maximum speed for clockwise rotation
  - acceleration
  - deceleration

- 5 fixed set values for speed (activated by digital inputs)

- 2 modes for control signals:
  - start counterclockwise operation; start clockwise operation
  - enable; direction of rotation

- different stopping modes:
  - turn off motor
  - stop by leading

- key switch input

- integrated fuse for control-lines

- integrated fuse for power line

- driver-output for main-contactor with voltage-reduction

- fault detection of the incremental encoder for:
  - cable breakage
  - shorted circuits

- fault detection of the potentiometers for:
  - cable breakage
  - shorted circuits

- battery voltage monitoring
  - adjustable minimum- and maximum voltage limits

- motor temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- power stage temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- current limiter

- operation signal (LED)

- 6 digital inputs, selectable for
  - fixed speed set values
  - enable
  - custom specific function

- 2 digital outputs, selectable for
  - ready-signal
  - active drive
  - torque > threshold value (adjustable)
  - status signal
  - high temperature warning of the power stage
  - high temperature warning of the motor

- 4 digital driver-outputs to switch hydraulic valves or contactors

- analogue output, selectable for
  - speed set value
  - speed actual value
  - speed deviation
  - torque
  - motor frequency
  - fixed value

- serial interface RS485 or CAN, each with a busmastering record

- all functions can also be performed via a serial interface

- parameter setting possibilities:
  - PC software under MS-Windows
  - BPK: handheld console

Technical data
Power data

Type: dACi-H	24/480 GD	24/600 GD	24/720 GD	36/400 GD	36/500 GD	36/600 GD
Size	D8	D10	D12	D8	D10	D12
Nominal battery voltage [V]	24			36		
Input voltage range [V] continuous maximum (<30s)	17...30 17...35			25...45 25...50		
Nominal current [A] [1]	240	300	360	200	250	300
Maximum current [A] [2]	480	600	720	400	500	600
Output voltage [V] [3]	3x 0...16			3 x 0 ... 24		
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 230 x 95		220 x 330 x 95
Power connectors (screw terminals)	M8	M10	M10	M8	M10	M10

Type: dACi-H	48/300 GD	48/375 GD	48/450 GD	48/600 GD	48/750 GD
Size	D8	D10	D12	D16	D20
Nominal battery voltage [V]	48				
Input voltage range [V] continuous maximum (<30s)	30...60 30...70				
Nominal current [A] [1]	150	190	225	300	375
Maximum current [A] [2]	300	375	450	600	750
Output voltage [V] [3]	3 x 0 ... 32				
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 430x100	
Power connectors (screw terminals)	M8	M8	M8	M10	M10

Type: dACi-H	80/160 GD	80/200 GD	80/240 GD	80/320 GD	80/400 GD	80/480 GD	80/600 GD
Size	D8	D10	D12	D16k	D20	D24k	D24k
Nominal battery voltage [V]	80						
Input voltage range [V] continuous maximum (<30s)	48...100 48...115						
Nominal current [A] [1]	80	100	120	160	200	240	300
Maximum current [A] [2]	160	200	240	320	400	480	600
Output voltage [V] [3]	3 x 0 ... 53						
Dimensions [mm] W x H x D	220 x 230 x 95		220 x 330 x 95	220 x 330x100		220 x 430x100	220 x 430x100
Power connectors (screw terminals)	M8	M8	M8	M10	M10	M10	M10

[1] dependant on the temperature resistance of the mounting plate

[2] duration depends on the temperature resistance of the mounting plate

[3] at input voltage = nominal battery voltage

Interfaces

Type: dACi-H	24/xxx GD	36/xxx GD 48/xxx GD	80/xxx GD
8 Digital Inputs (X6.2, .3, .4, .5, .7, .8, .9, .10)			
Logic	high-aktiv		
Input resistance [Ω]	3,5k	10k	25k
Low-level [V] max	2	3	8
High-level [V] min	12	24	48
2 Analogue Inputs (X6.6, X5.7)			
Resolution	10 bit		
Input resistance [Ω]	94k		
Selected as potentiometer input			
Voltage range [V]	2...8		
Resistance of the ext. potentiometer [Ω]	5k		
Selected as voltage input			
Voltage range [V]	0...10		
Digital Outputs			
Main Contactor driver-output (X2.2)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
Magnetic Brake driver-output (X4.5)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
Programmable Outputs 1 u. 2 (X1.3, .6)	low-side-switch with inverse diode		
Nominal current [A]	1,0	0,7	0,3
Maximum current [A]	1,5	1,0	0,5
Programmable Outputs 3 u. 4 * (X3.6, .7)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Programmable Outputs 5 u. 6 * (X3.3-8, X3.4-9)	high-side-switch with inverse diode		
Nominal current [A]	3,0	2,0	0,7
Maximum current [A]	4,5	3,0	1,0
Analogue Output (X1.2-5)			
Voltage range [V]	0...10		
Output resistance [Ω]	100		
Incremental encoder 1 (X4.3, .4, .7, .8)			
Level [V]	0 / 15 A,B (e.g. sensor bearing)		
Supply	15V, max 100mA		
Incremental encoder 2 * (X8)			
Level [V]	0 / 5 A, #A, B, #B (RS422)		
Supply	5V, max 100mA		

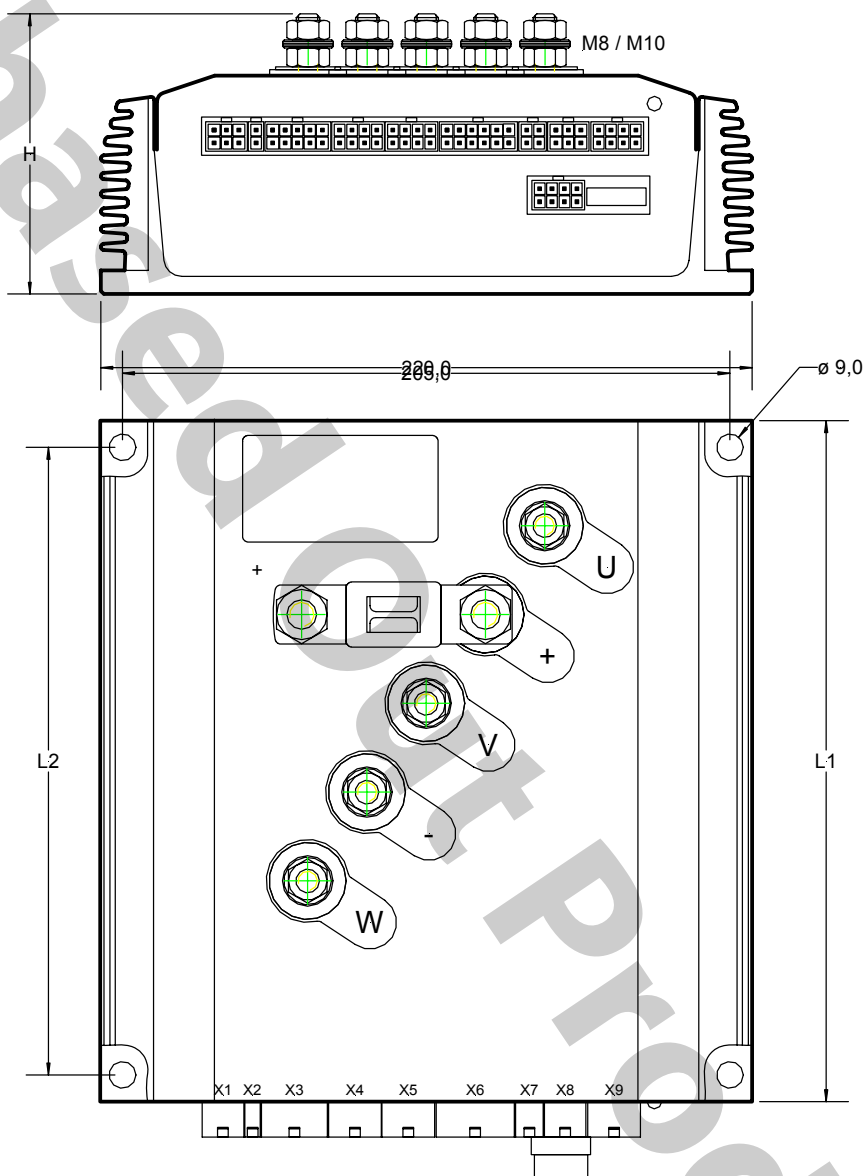| Motor temperature sensor (X4.2-6)	
Type	PTC
Serial interface	
RS485 (X7)	
Supply for ext. Converter	15V, max 100mA
CAN * (X9)	V2.0A (V2.0B passive)
connectable terminal resistor	120 Ω

Others

Switching frequency	16kHz standard; adjustable 4, 8, 12, 16, 20 kHz
Efficiency	about 95% at nominal output
Output frequency	0...300 Hz
Temperature range	-40°C ... 50°C (mounting plate)
Relative humidity	max. 90%, no condensation
Operation signal	built-in LED
Signal line connectors	Molex mini-fit junior
IP protection	IP40, IP54 optional

* optional

Wiring Diagram

Dimensions

Size	L1	L2	H
D08	230 mm	212 mm	95 mm
D12	330 mm	312 mm	95 mm
D16k	330 mm	312 mm	100 mm
D16	430 mm	412 mm	100 mm
D24k	430 mm	412 mm	100 mm

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dACi

Series C

The 2nd Generation

dACi series C ...

... is an AC-controller, optimized for battery powered material handling vehicles of the small and medium power range, like pedestrian trucks, order-pickers and small lift trucks.

The electronic consists of a three-phase inverter and a control unit. Besides the well known features of Series A, the Series C includes drivers for direct connection of contactors and valves.
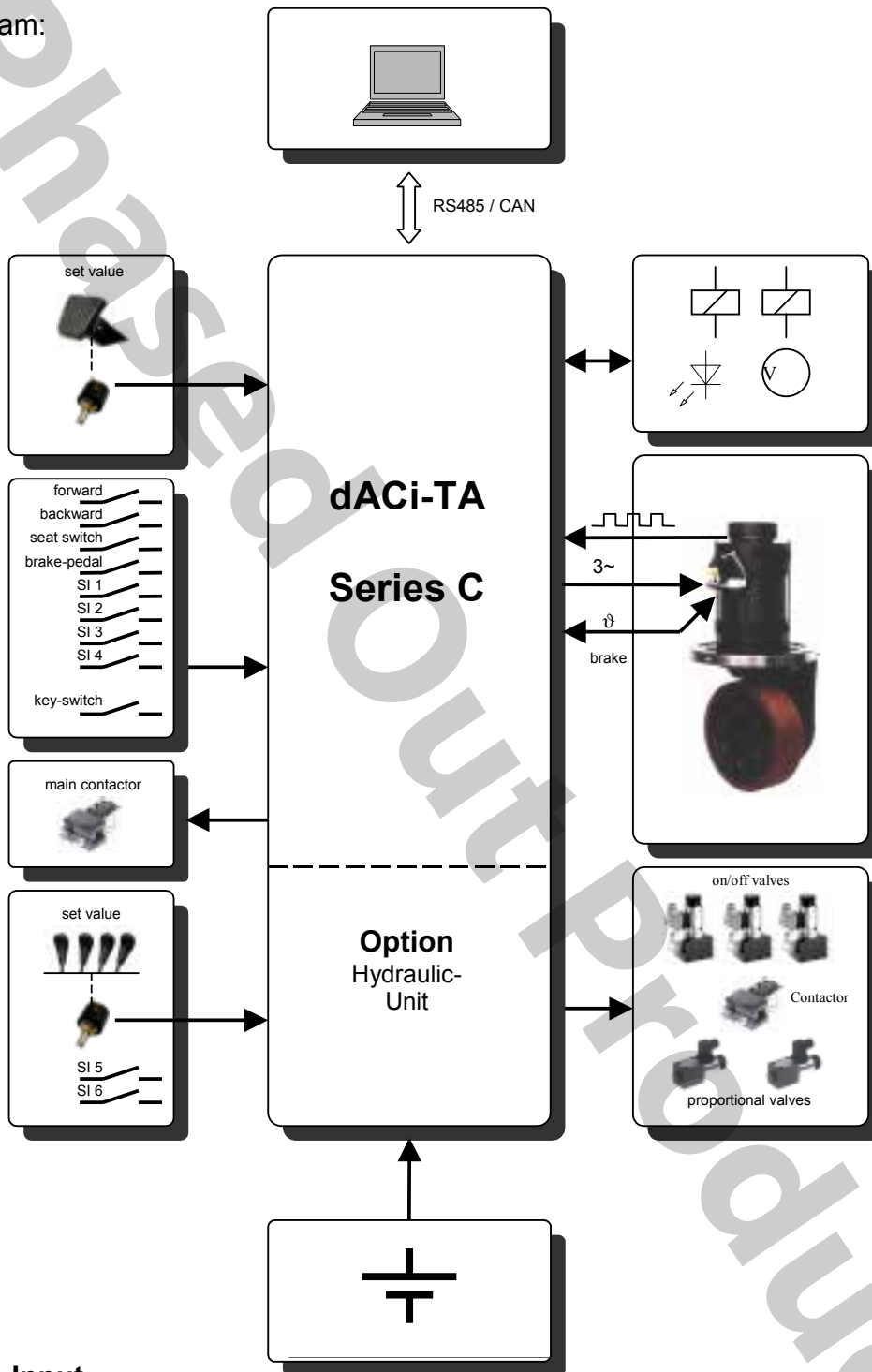
AC- technology offers the following advantages in comparison to DC- technology:

♦ **Maintenance-free operation**
  ➢ no mechanical wear and tear on the motor
  ➢ no mechanical switch contacts (contactors) for direction reversal or recuperation.

♦ **Recuperation**
  ➢ without any additional components

♦ **Higher efficiency**

♦ **More flexibility in construction**
  ➢ less wiring
  ➢ the motor does not need to be openly accessible, because it operates maintenance-free

♦ **Explosion protection**
  ➢ easy realizable due to no sparking in the motor

Features:

♦ **Proportional drive reaction**
  ➢ vehicle speed is directly dependant upon the position of the acceleration pedal (speed control)
  ➢ stalled torque
  ➢ sensitive driving over bumps and on ramps
  ➢ no unintentional acceleration while driving down steep grades

♦ **Individual possibilities of adjustment**
  ➢ acceleration pedal sensitivity
  ➢ max. acceleration
  ➢ max. deceleration
  ➢ adjustable drive curve generator

♦ **Special functions for pedestrian trucks (walkies)**
  ➢ emergency reverse switch (belly switch)
  ➢ tiller joint switch
  ➢ set value input: potentiometer or 3-step-switch
  ➢ driver output for main-contactor with voltage-reduction
  ➢ hydraulic-unit (optional) with
    - potentiometer input
    - 3 switch inputs
    - 2 outputs for proportional control valves
    - 3 outputs for on/off valves
    - output for universal contactor (e.g. for DC-pump-motor)
  ➢ no external wiring necessary
  ➢ all inverse diodes for external components already mounted on-board

Principle diagram:

RS485 / CAN

set value

forward
backward
seat switch
brake-pedal
SI 1
SI 2
SI 3
SI 4

key-switch

dACi-TA

Series C

3~

ϑ

brake

m ... tor

Option
Hydraulic-
Unit

Contactor

proportional valves

SI 5
SI 6

SI: Selectable Input

Safety

Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

Furthermore dACi possesses various safety equipments and also meets the requirements of the EN 11 75-1 and DIN EN 954-1 standards.

Features

- operating modes:
  - open loop speed control
    (no incremental encoder necessary)
  - closed loop speed control
    (incremental encoder required)

- adjustable set value curve

- different set value inputs
  - potentiometer (with fault detection)
  - voltage input 0...+10V
  - 3-step-switch

- adjustable travel characteristics
  - adjustable drive curve generator
  - maximum speed forward
  - maximum speed backward
  - max. acceleration
  - deceleration when reducing the set value
  - deceleration when activating an opposite
    travel direction
    (adjustable continuously with the set value
    input)

- 3 creeping speeds

- different stopping modes
  - turn off motor and roll until standstill
  - turn off motor and close magnetic brake
  - stop by leading

- key switch input

- integrated fuse for control-lines

- seat switch surveillance
  - adjustable time delay

- driver output for main-contactor with voltage-
  reduction
  - short-circuit protected output
  - adjustable delay time

- magnetic brake driver output with voltage-
  reduction
  - short-circuit protected output
  - adjustable delay time

- battery voltage monitoring
  - adjustable minimum- and maximum voltage
    limits

- fault detection of the potentiometers for
  - cable breakage
  - shorted circuits

- motor temperature monitoring

- power stage temperature monitoring

- special functions for pedestrian trucks
  (walkies)
  - emergency reverse switch surveillance
  - tiller joint switch surveillance

- integrated hydraulic unit
  - control unit for proportional control valves
    - ✓ input for set value potentiometer
    - ✓ input for potentiometer zero switch
    - ✓ 2 outputs for proportional control valves
  - control unit for directional control valves
    - ✓ 2 switch inputs
    - ✓ 3 outputs for on/off valves
  - driver for universal contactor
    (e.g. for DC-pump motor)

- operation signal (LED)

- 8 digital inputs, selectable for
  - forward
  - backward
  - creep speed
  - seat switch
  - brake pedal switch
  - emergency reverse switch
  - tiller joint switch
  - enable

- 2 digital outputs, selectable for
  - ready-signal
  - error code
  - power stage enabled
  - torque > threshold value (adjustable)
  - high temperature warning of the power
    stage
  - high temperature warning of the motor

- analogue output, selectable for
  - speed set value
  - speed actual value
  - speed deviation
  - torque
  - motor frequency
  - fixed value

- all functions can also be performed via serial
  interface (RS485 or CAN)

- possibilities of parameter setting:
  - PC software under MS-Windows
  - BPK: handheld console

Technical data
Power data

Type: dACi-TA 24/xxx GC	24/120	24/180	24/240	24/360	24/480
Size	C2	C3	C4	C6	C8k
Nominal battery voltage [V]	24				
Input voltage range [V]	permanent: 17…30; short-time: 17…35 (30s)				
Nominal current [A] [1]	60	90	120	180	240
Maximum current [A][2]	120	180	240	360	480
Output voltage [V][3]	3 x 0 ... 16				
Dimensions [mm] (w x h x d)	155 x 200 x 70			155 x 300 x 80	
power connectors	screw terminals M8			screw terminals M10	

Type: dACi-TA 36/xxx GC	36/100	36/150	36/300	36/400
Size	C2	C3	C6	C8k
Nominal battery voltage [V]	36			
Input voltage range [V]	permanent: 25…45; short-time:25…50 (30s)			
Nominal current [A] [1]	50	75	150	200
Maximum current [A][2]	100	150	300	400
Output voltage [V][3]	3 x 0 ... 24			
Dimensions [mm] (w x h x d)	155 x 200 x 70		155 x 300 x 80	
power connectors	screw terminals M8		screw terminals M10	

Type: dACi-TA 48/xxx GC	48/075	48/112	48/225	48/300
Size	C2	C3	C6	C8k
Nominal battery voltage [V]	48			
Input voltage range [V]	permanent: 30…60; short-time: 30…70 (30s)			
Nominal current [A] [1]	37	56	112	150
Maximum current [A][2]	75	112	225	300
Output voltage [V][3]	3 x 0 ... 32			
Dimensions [mm] (w x h x d)	155 x 200 x 70		155 x 300 x 80	
power connectors	screw terminals M8		screw terminals M10	

Type: dACi-TA 80/xxx GC	80/040	80/060	80/120	80/160
Size	C2	C3	C6	C8k
Nominal battery voltage [V]	80			
Input voltage range [V]	permanent: 48…100; short-time: 48…115 (30s)			
Nominal current [A] [1]	20	30	60	80
Maximum current [A][2]	40	60	120	160
Output voltage [V][3]	3 x 0 ... 53			
Dimensions [mm] (w x h x d)	155 x 200 x 70		155 x 300 x 80	
power connectors	screw terminals M8		screw terminals M10	

[1] dependant on the temperature resistance of the mounting plate

[2] duration depends on the temperature resistance of the mounting plate

[3] at input voltage = nominal battery voltage

Others

Switching frequency	16kHz standard; adjustable 4, 8, 12, 16, 20 kHz
Efficiency	about 95% at nominal output
Output frequency	0...300 Hz
Temperature range	-40°C ... 50°C (mounting plate)
Relative humidity	max. 90%, no condensation
Operation signal	built-in LED
Signal line connectors	Molex mini-fit junior
IP protection	IP40, IP54 optional

Standard Version
Interfaces

Type: dACi-TA	24/xxx GC 24/xxx GC-H	36/xxx GC 36/xxx GC-H 48/xxx GC 48/xxx GC-H	80/xxx GC 80/xxx GC-H
8 Digital Inputs (X6.2, .3, .4, .5, .7, .8, .9, .10)			
Logic	high-active		
Input resistance [Ω]	3,5k	10k	25k
Low-level [V] max	2	3	8
High-level [V] min	12	24	48
Analogue Input (X6.6)			
Resolution	10 bit		
Input resistance [Ω]	86k		
Selected as potentiometer input			
Voltage range [V]	2...8		
Resistance of ext. potentiometer [Ω]	5k		
Selected as voltage input			
Voltage range [V]	0...10		
Digital Outputs			
Main Contactor driver-output (X2.2)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
Magnetic Brake driver-output (X4.5)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
2 Programmable Outputs (X1.3 and X1.6)	low-side-switches with inverse diodes		
Nominal current [A]	1,0	0,7	0,3
Maximum current [A]	1,5	1,0	0,5
Analogue Output (X1.2-5)			
Voltage range [V]	0...10		
Output resistance [Ω]	100		
Incremental Encoder (X4.3, .4, .7, .8)			
Level [V]	0 / 15 A,B (e.g. sensor bearing)		
Supply	15V, max 100mA		
Motor Temperature Sensor (X4.2-6)			
Type	PTC		

Serial Interface (X7)	
RS485	
Supply for ext. Converter	15V, max 100mA

Hydraulic unit

Only types: dACi-TA	24/xxx GC-H	36/xxx GC-H 48/xxx GC-H	80/xxx GC-H
3 Digital Inputs (X5.2, .3, .6)			
Logic	high-active		
Input resistance [Ω]	3,5k	10k	25k
Low-level [V] max	2	3	8
High-level [V] min	12	24	48
1 Analogue Input (X5.4)			
Resolution	10 bit		
Input resistance [Ω]	86k		
Selected as potentiometer input			
Voltage range [V]	2...8		
Resistance of the ext. potentiometer [Ω]	5k		
Selected as voltage input			
Voltage range [V]	0...10		
4 Digital Outputs for on/off Valves or contactors (X3.7, .8, .9, .10)	low-side-switches with inverse diodes		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
2 Outputs for Proportional Valves (X3.5-11, .6-12)	high-side-switches with inverse diodes current controlled, superposed with dither-signal		
Nominal current [A]	3,0	2,0	0,7
Maximum current [A]	4,5	3,0	1,0

Remark: The two outputs for proportional valves can not work simultaneously.

CAN-Bus Version
Interfaces

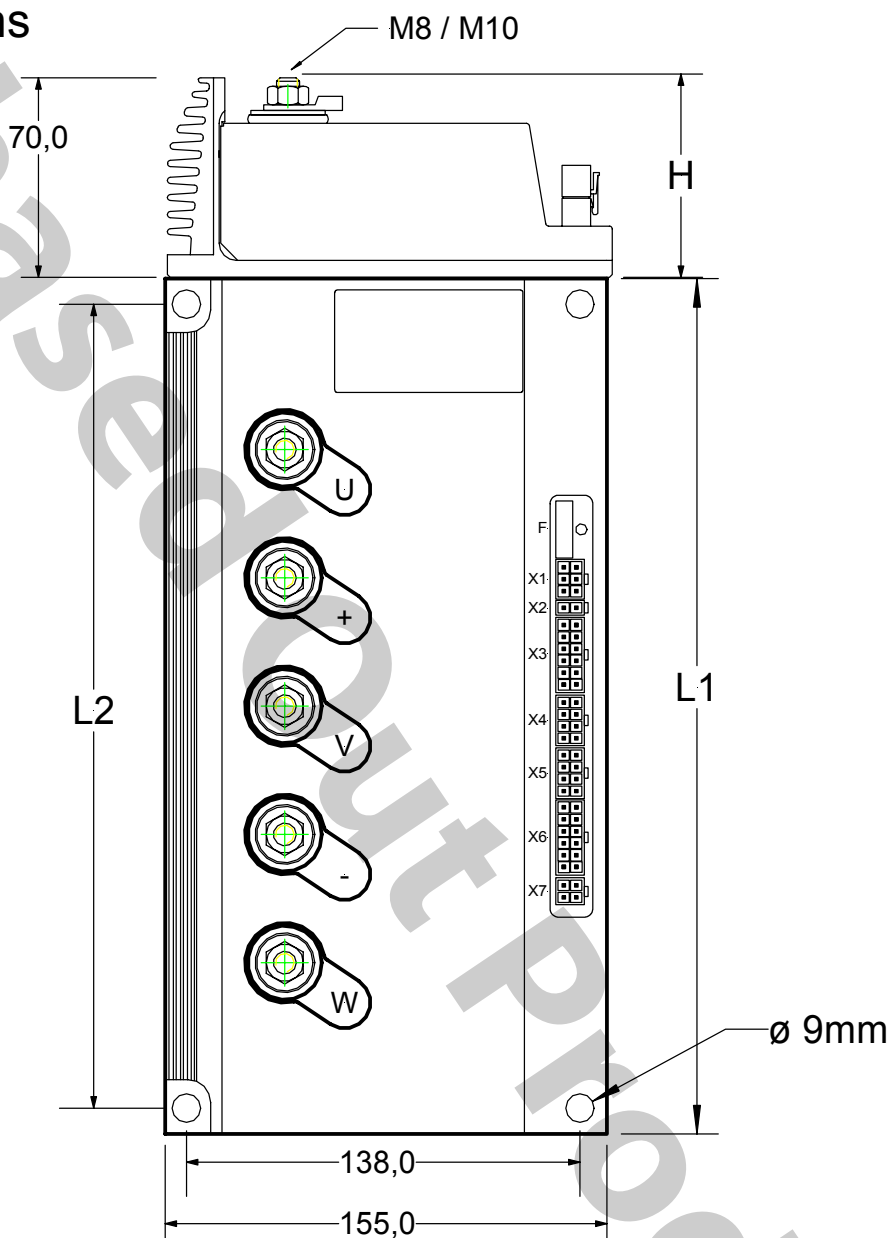| Type: dACi-TA	24/xxx GC-C 24/xxx GC-HC	36/xxx GC-C 36/xxx GC-HC 48/xxx GC-C 48/xxx GC-HC	80/xxx GC-C 80/xxx GC-HC
3 Digital Inputs (X6.3, .5, .6)			
Logic	high-active		
Input resistance [Ω]	4,2k	16k	30k
Low-level [V] max	2	4	6
High-level [V] min	12	24	40
Digital Outputs			
Main Contactor driver-output (X2.2)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
Magnetic Brake driver-output (X4.5)	low-side-switch with inverse diode		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
Signal-condition	1s 100% on-period, then 60% on-period		
2 Programmable Outputs (X1.3 and X1.6)	low-side-switches with inverse diodes		
Nominal current [A]	1,0	0,7	0,3
Maximum current [A]	1,5	1,0	0,5
Analogue Output (X1.2-5)			
Voltage range [V]	0...10		
Output resistance [Ω]	100		
Incremental Encoder (X4.3, .4, .7, .8)			
Level [V]	0 / 15 A,B (e.g. sensor bearing)		
Supply	15V, max 100mA		
Motor Temperature Sensor (X4.2-6)			
Type	PTC		
Serial interface (X7)			
RS485			
Supply for ext. Converter	15V, max 100mA		
CAN (X5)	V2.0A (V2.0B passive)		
connectable terminal resistor	120Ω		

Hydraulic unit

Only types: dACi-TA	24/xxx GC-HC	36/xxx GC-HC 48/xxx GC-HC	80/xxx GC-HC
4 Digital Outputs for on/off Valves or Contactors (X3.7, .8, .9, .10)	low-side-switches with inverse diodes		
Nominal current [A]	2,0	1,0	1,0
Maximum current [A]	3,0	1,5	1,5
2 Outputs for Proportional Valves (X3.5-11, .6-12)	high-side-switches with inverse diodes current controlled, superposed with dither-signal		
Nominal current [A]	3,0	2,0	0,7
Maximum current [A]	4,5	3,0	1,0

Remark: The two outputs for proportional valves can not work simultaneously.

Wiring Diagram, Standard Version

Controller

Power stage

X1 — Analogue output / Key switch +24V / 0V
X2 — Main contactor
X3 — Prop.-valve 1 / Prop.-valve 2 / Valve 6 / Valve 5 / Valve 4 / Valve 3 or contactor for DC pump motor — only with option "H"
X4 — Sensor-bearing (B / 0V / A / +15V) / Thermistor / Brake
X5 — Set value lift/lower / Enable lift/lower / Initial lift / Initial lower — only with Option "H"
X6 — Set value driving speed / Creep speed 2 / Safety circuit / Creep speed 1 / Tiller joint switch / Backwards / Belly button / Forwards / Creep speed 3 — *
X7 — RS485 (0V / B / 15V / A) RS232
Main contactor
+ / - / U / V / W
M 3~

* Example for programmable inputs

Wiring Diagram, CAN-Bus Version

Dimensions

M8 / M10

70,0

H

L2

U

+

V

-

W

L1

F

X1
X2
X3
X4
X5
X6
X7

ø 9mm

138,0

155,0
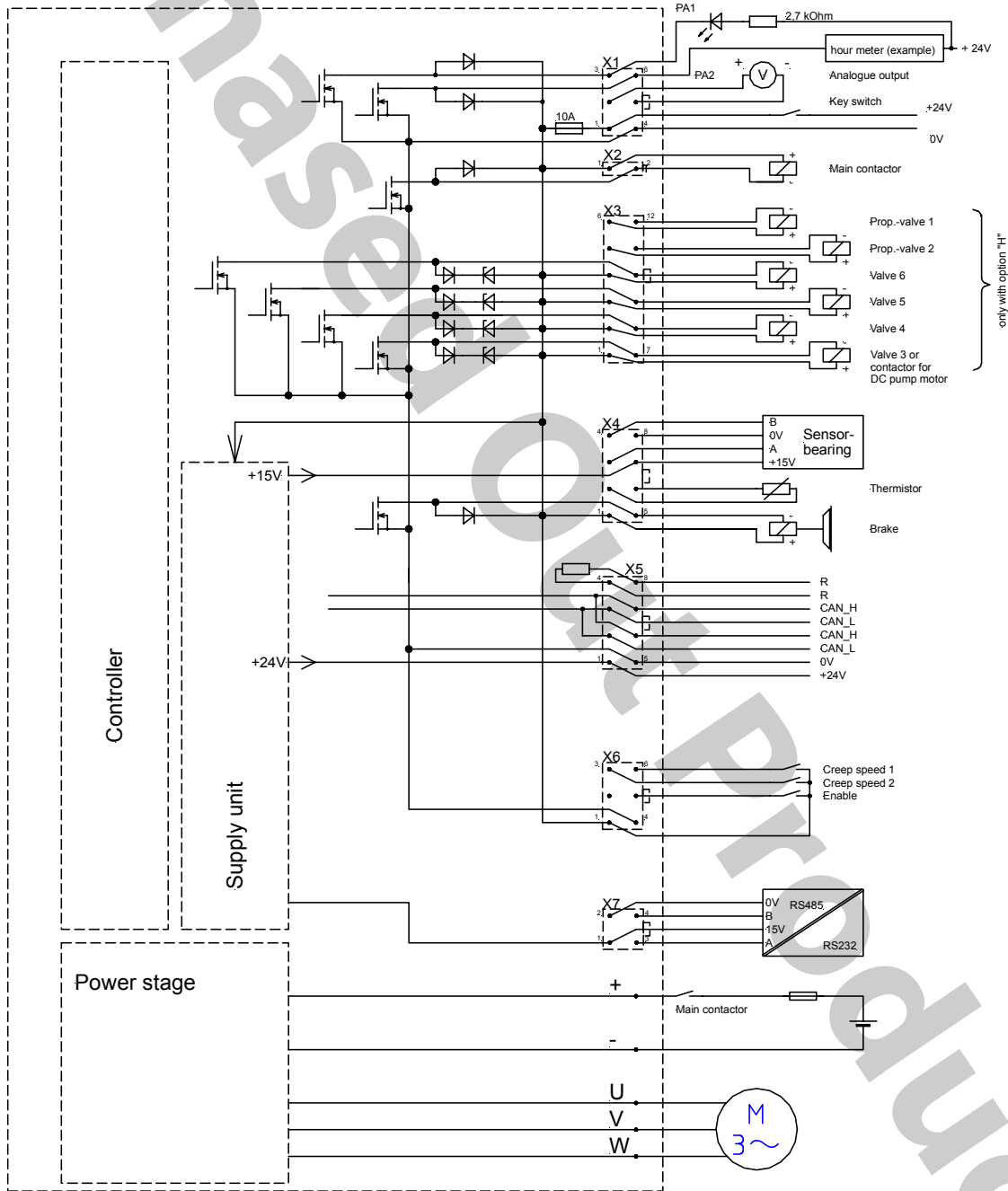
Size	L1	L2	H	Screw terminals
C2, C3, C4	200 mm	182 mm	70 mm	M8
C6, C8k	300 mm	282 mm	80 mm	M10

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Edition: 03/2002

d A C i

Series B

AC-Controller for
Pallet Trucks

dACi series B ...

... is an AC-controller, optimized for small pallet trucks and other small drives with battery supply voltage from 12V up to 36V.

The electronic consists of a three-phase inverter and a control unit.
AC- technology offers the following advantages in comparison to DC- technology:

- **Maintenance-free operation**
  - ➢ no mechanical wear and tear on the motor
  - ➢ no mechanical switch contacts (contactors) for direction reversal or recuperation.

- **Recuperation**
  - ➢ without any additional components

- **Higher efficiency**

- **More flexibility in construction**
  - ➢ less wiring
  - ➢ the motor does not need to be openly accessible, because it operates maintenance-free

- **Explosion protection**
  - ➢ easy realizable due to no sparking in the motor

Features:

- **Proportional drive reaction**
  - ➢ vehicle speed is directly dependant upon the position of the acceleration throttle (speed control)
  - ➢ stalled torque
  - ➢ sensitive driving over bumps and on ramps
  - ➢ no unintentional acceleration while driving down steep grades

- **Individual possibilities of adjustment**
  - ➢ acceleration throttle sensitivity
  - ➢ max. acceleration
  - ➢ max. deceleration
  - ➢ adjustable drive curve generator

- **Special functions for pedestrian trucks (walkies)**
  - ➢ emergency reverse switch (belly switch)
  - ➢ tiller joint switch
  - ➢ set value input: potentiometer or 3-step-switch
  - ➢ direct connections for hydraulic unit
    - lift button
    - lower button
    - contactor for DC pump motor
    - lift limit switch
    - lowering valve
  - ➢ no external wiring necessary
  - ➢ all inverse diodes for external components already mounted on-board

Features

- operating modes:
  - open loop speed control
    (no incremental encoder necessary)
  - closed loop speed control
    (incremental encoder required)

- adjustable set value curve

- different set value inputs
  - potentiometer (with fault detection)
  - voltage input 0...+10V
  - 3-step-switch

- adjustable travel characteristics
  - adjustable drive curve generator
  - maximum speed forward
  - maximum speed backward
  - max. acceleration
  - deceleration when reducing the set value
  - deceleration when activating an opposite
    travel direction
    (adjustable continuously with the set value
    input)

- 3 creeping speeds

- different stopping modes
  - turn off motor and roll until standstill
  - turn off motor and close magnetic brake
  - stop by leading

- key switch input

- integrated fuse for control-lines

- magnetic brake driver output

- battery voltage monitoring
  - adjustable minimum- and maximum voltage
    limits

- motor temperature monitoring

- power stage temperature monitoring

- special functions for pedestrian trucks
  (walkies)
  - emergency reverse switch surveillance
  - tiller joint switch surveillance

- direct connections for hydraulic unit
  - inputs for
    - ✓ lift button
    - ✓ lower button
    - ✓ lift limit switch
  - outputs for
    - ✓ lowering valve
    - ✓ contactor for DC pump motor

- operation signal (LED)

- all functions can also be performed via serial
  interface RS485

- possibilities of parameter setting:
  - PC software under MS-Windows
  - BPK: handheld console

Technical data
Power data

Type: dACi-TA	24/060 GB	24/120 GB
Size	B1	B2
Nominal battery voltage [V]	24	
Input voltage range [V]	17...35	
Nominal current [A] [1]	30	60
Maximum current [A] [2]	60	120
Output voltage [V~] [3]	3 x 0 ... 16	
Dimensions [mm] (w x h x d)	140 x 160 x 70	140 x 200 x 70
power connectors	Faston 6,3 mm	screw terminal M5

[1] dependant on the temperature resistance of the mounting plate
[2] duration depends on the temperature resistance of the mounting plate
[3] at input voltage = nominal value

Interfaces

Type: dACi-TA	24 / xxx GB
8 Digital Inputs [*)]	
Logic	high-active
Input resistance [Ω]	2,2k
Low-level [V] max	1,2
High-level [V] min	12
Analogue Input	
Resolution	10 bit
Input resistance [Ω]	86k
Resistance of the ext. potentiometer [Ω]	1k…10k
Voltage range [V]	0...5
Digital Outputs	
Magnetic Brake driver-output	low-side-switch with inverse diode
Nominal current [A]	2,0
Maximum current [A]	3,0
Signal-condition	1s 100% on-period, then 60% on-period
1 Programmable Output [*)]	low-side-switch with inverse diode
Nominal current [A]	0,1
Maximum current [A]	0,15
Incremental Encoder	
Level [V]	0 / 15 A,B (e.g. sensor bearing)
Supply	15V, max 100mA
Motor Temperature Sensor	
Type	PTC
Serial Interface	
RS485	
Supply for ext. Converter	15V, max 100mA

*) 8 digital inputs or 7 digital inputs and 1 digital output

Others

| Switching frequency	16kHz standard; adjustable 4, 8, 12, 16, 20 kHz
Efficiency	about 95% at nominal output
Output frequency	0...300 Hz
Temperature range	-40°C ... 50°C (mounting plate)
Relative humidity	max. 90%, no condensation
Operation signal	built-in LED
Signal line connectors	Molex mini-fit junior
IP protection	IP20

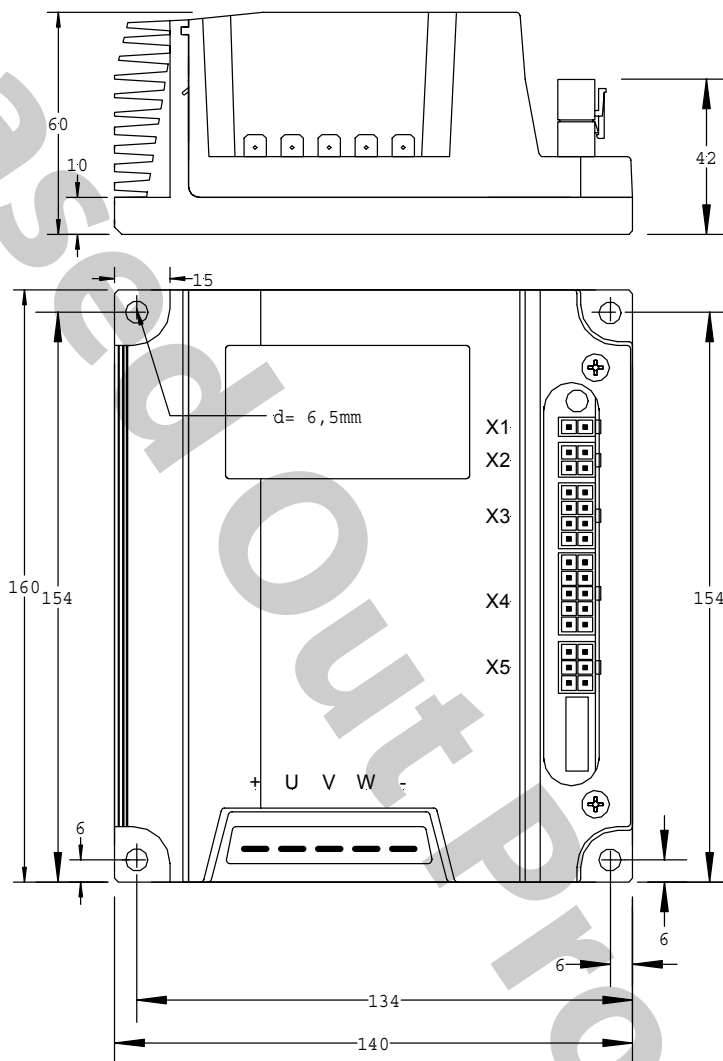Special versions for 12V or 36V on request.
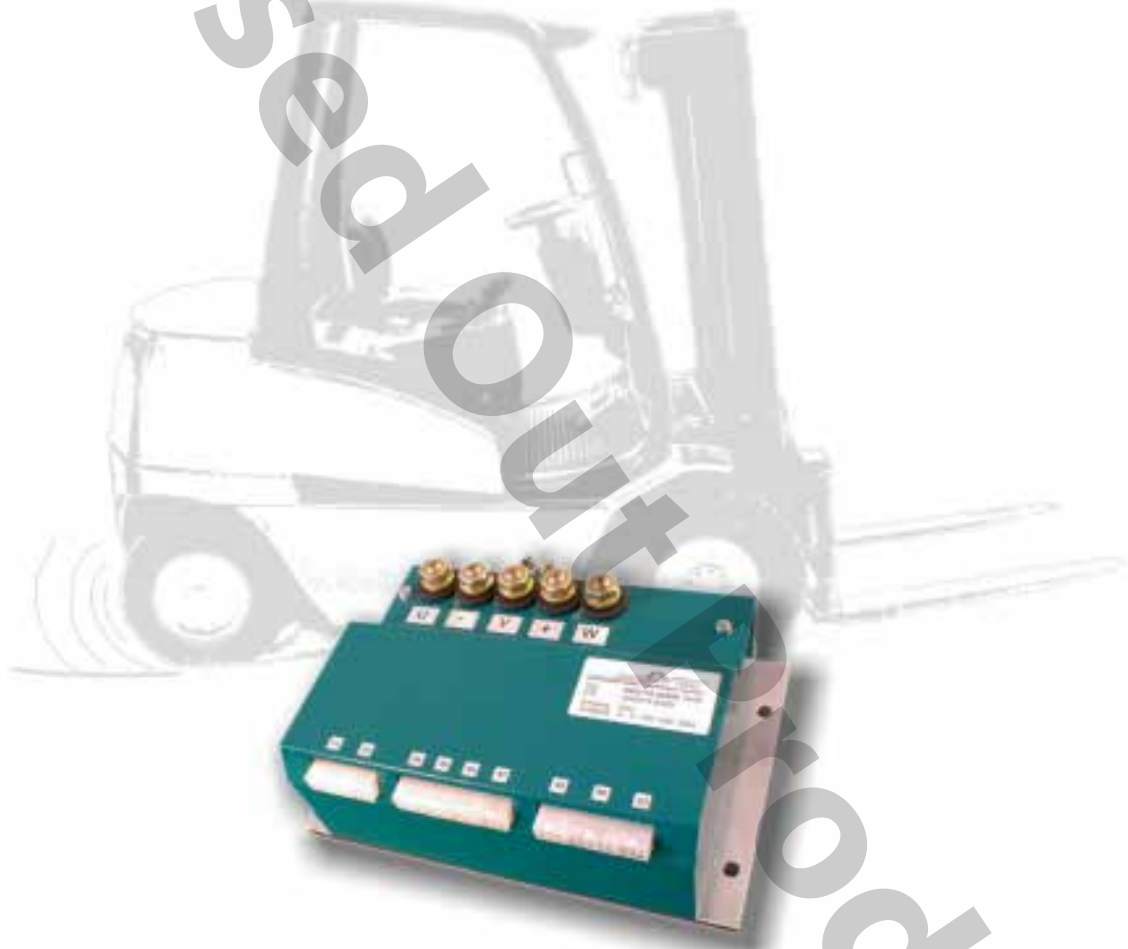
Wiring Diagram

Variant 1
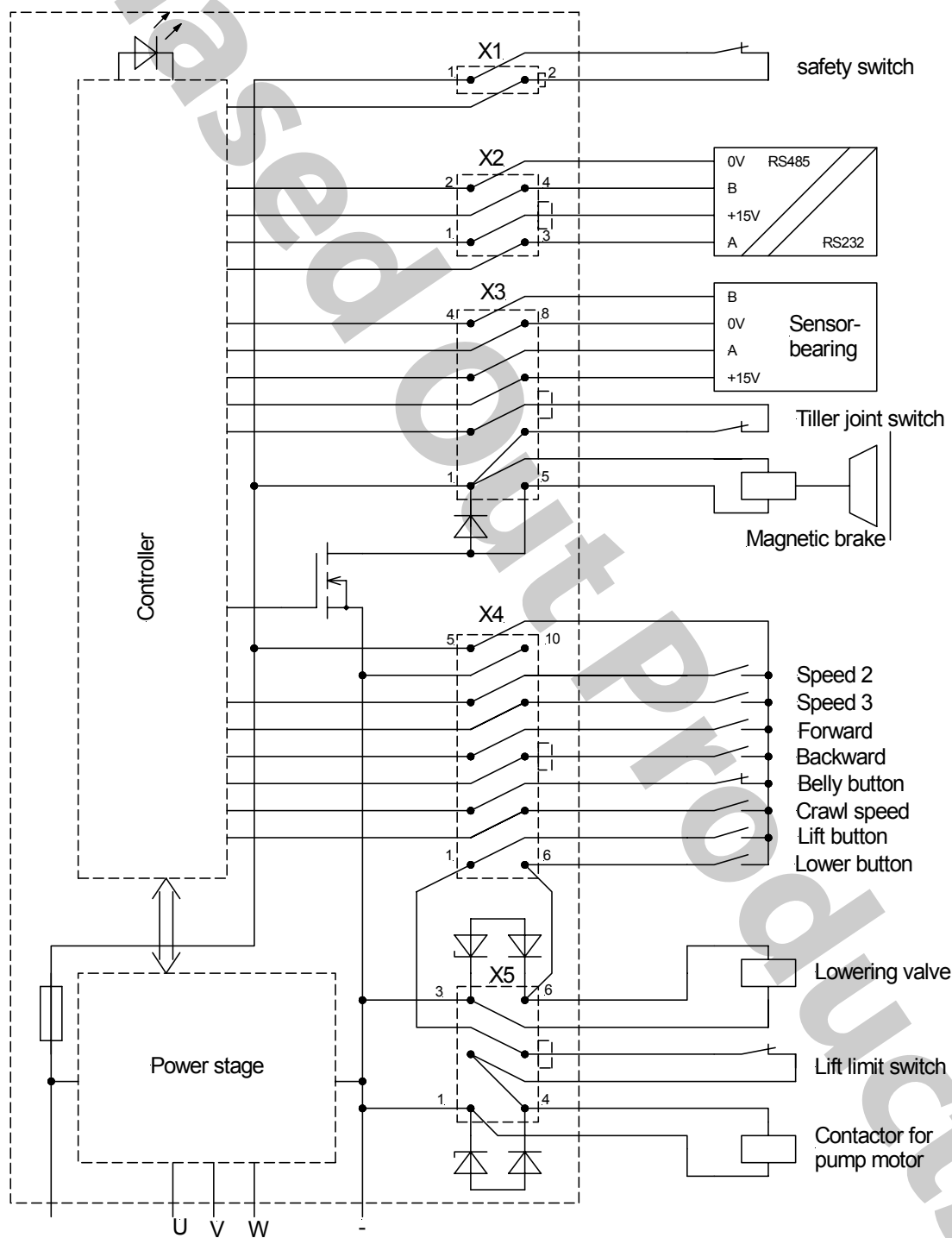
Wiring Diagram

Variant 2
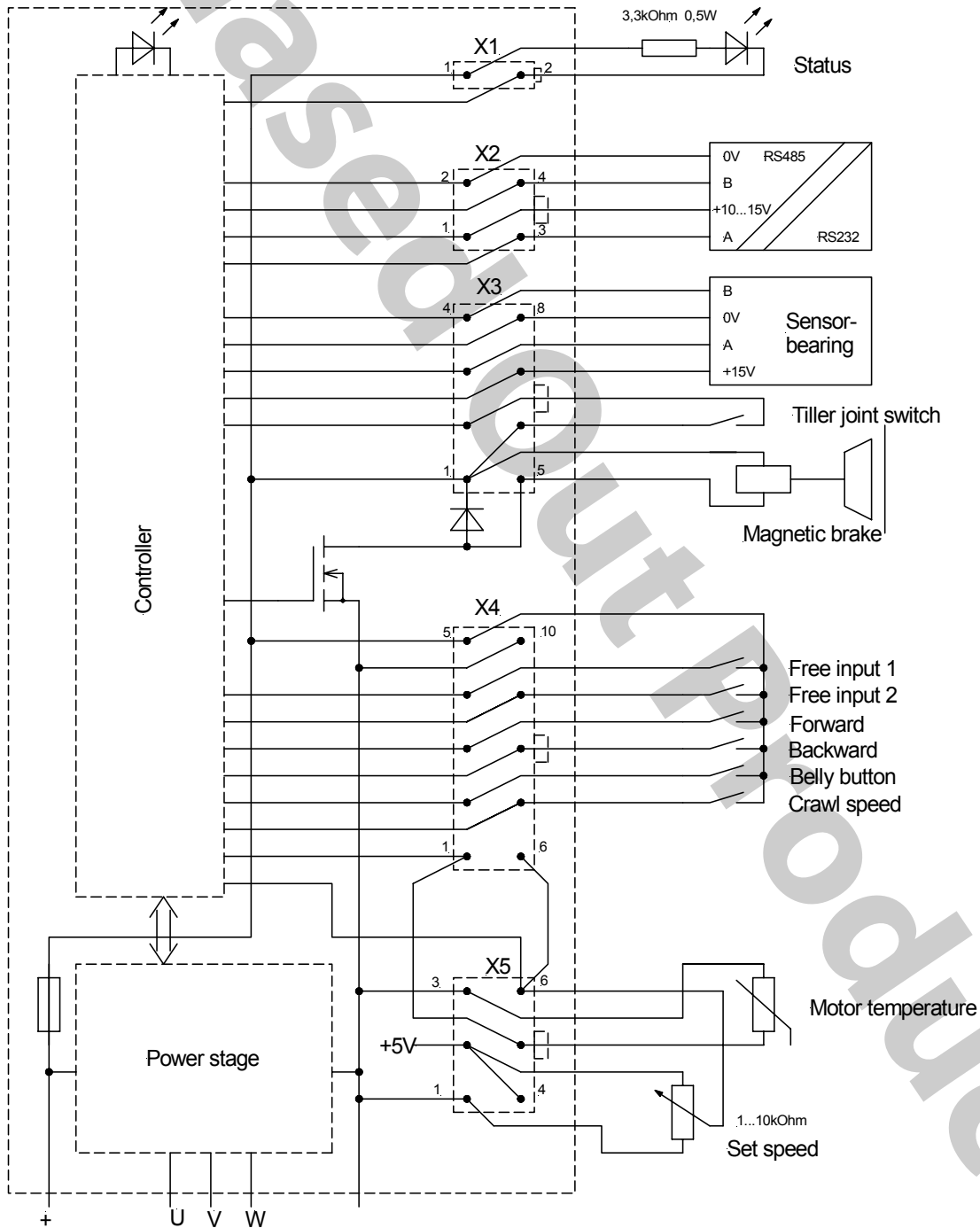
Dimensions

Size B1:

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Edition: 03/2002

d A C i
Series A

dACi - TA
AC-Controller for Traction Drive Units

dACi-TA ...

... is an AC-Controller for traction drive units in battery operated material handling vehicles, fork lift trucks or other drives with AC-induction motors.

The electronic consists of a three-phase inverter and a control unit.
AC- technology offers the following advantages in comparison to DC- technology:

♦ **Maintenance-free operation**

   ➢ no mechanical wear and tear on the motor

   ➢ no mechanical switch contacts (contactor) for
      direction reversal or recuperation

♦ **Recuperation**

   ➢ without any additional components

♦ **Higher efficiency**

♦ **More flexibility in construction**

   ➢ less wiring

   ➢ the motor does not need to be openly accessible, because it operates maintenance-free

♦ **Explosion protection**

➢ easy realizable due to no sparking in the motor

Features

♦ **Proportional drive reaction**

   ➢ vehicle speed is directly dependant upon the position of the acceleration pedal (speed control)

   ➢ stalled torque

   ➢ sensitive driving over bumps and on ramps

   ➢ no unintentional acceleration while driving down steep grades

♦ **Individual possibilities of adjustment**

   ➢ acceleration pedal sensitivity

   ➢ max. acceleration

   ➢ max. deceleration

   ➢ adjustable generatic deceleration

♦ **Special fork lift truck functions**

   ➢ seat switch surveillance

   ➢ creeping speed

   ➢ emergency reverse switch for pedestrian trucks
      (walkies)

Connection diagram:

SI: Selectable Input

RS485 / CAN

set value

dACi-TA

Traction
Drive

forward
backward
seat switch
brake-pedal
SI 1
SI 2
SI 3
SI 4

keyswitch

3~

ϑ

brake

Safety

Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

Furthermore dACi possesses various safety equipments and also meets the requirements of the EN 11 75-1 and DIN EN 954-1 standards.

Technical data

Power data

type: dACi-TA-	24/...	48/...	80/...
nominal battery voltage [V]	24 (36)[2]	48 (60)[2]	80 (72,96)[2]
input voltage range [V]	16 ... 35 (50)[2]	24 ... 70 (90)[2]	48 ... 115 (144)[2]
nominal current $I_{nominal}$ [A]	33 ... 400	17 ... 400	13 ... 320
maximum current I_{max} [A][1]	50 ... 600	25 ... 600	20 ... 480
output voltage [V]	3 x 0...16	3 x 0...32	3 x 0...53
continuous output [kVA]	0,83 ...8,3	0,86 ...22,2	1,3 ... 29,4
recommended nominal motor output [kW]	0,3 ... 6	0,5 ... 15	0,75 ...22

[1] duration depends on temperature resistance of the mounting plate
[2] special version, the given voltages and outputs will accordingly differ from the data in the table.

Interfaces

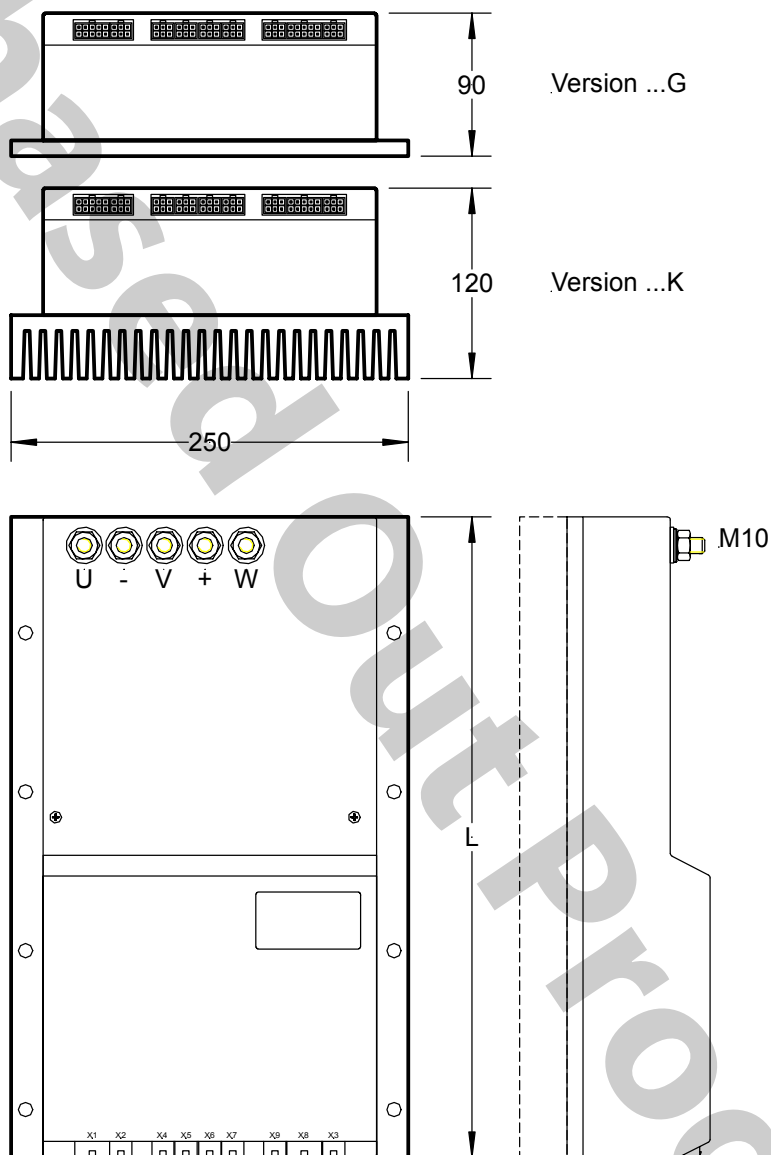| serial interface	RS485; CAN optional
digital inputs	low-active, switching to battery minus
selectable report output	open drain: U_{max}:200V; I_{max}: 300mA
output for magnetic brake	open drain: U_{max}: 50V, I_{max}: 3A for 24V version, R_i= 0,31Ω U_{max}:100V, I_{max}:2.5A for 48V version, R_i= 0,87Ω U_{max}:200V, I_{max}:1.2A for 80V version, R_i= 3,47Ω
analogue output	0 ... 10V, Ri= 200 Ω
encoder input	5V or 15V; RS422 or A-B; 50....1024 incr./per rot.
potentiometer	resistance range: 500Ω ... 10kΩ $\pm$2% (fault detected of shorted circuits, cable breakage, change in resistance)

Others

precision of analogue inputs	0,1%
switching frequency	16 kHz standard; adjustable: 4; 8; 12; 16; 20kHz
efficiency	about 95% at nominal output
output frequency	0 ... 300 Hz
temperature range	-25°C...+50°C (mounting plate)
signal line connectors	Molex Mini-Fit JR
power connectors	screw terminal M5 or M10
IP protection	IP20, optional IP54
type of motor	AC- induction

Features:

- operating modes:
  - open loop speed control
    (no incremental encoder necessary)
  - closed loop speed control
    (incremental encoder necessary)
  - torque control (incremental encoder
    necessary)

- adjustable set value curve (e.g. characteristic
  of acceleration pedal)

- different set value inputs
  - potentiometer (pedal, joystick)
  - voltage input 0...+10V
  - current input 0...20mA

- adjustable travel characteristics
  - maximum speed forward
  - maximum speed backward
  - max. acceleration
  - deceleration when reducing the set value
  - deceleration when activating an opposite
    travel direction
    (adjustable continuously with the set value
    input)
  - deceleration when brake pedal is activated
    (digital input)
  - deceleration when activating creeping
    speed (e.g. while making turns)

- 3 creep speeds

- 2 modes for the travel signals
  - direction forward; direction backward
  - enable; direction

- different modes of stopping
  - turn off motor and roll until standstill
  - turn off motor and close magnetic brake
  - stop by leading

- seat switch surveillance
  - adjustable time delay

- emergency reverse switch for pedestrian
  trucks (walkies)

- key switch input

- magnetic brake driver
  - short-circuit protected output
  - adjustable delay time

- fault detection of incremental encoder for
  - cable breakage
  - shorted circuits

- fault detection of the potentiometers for:
  - cable breakage
  - shorted circuits
  - change in resistance

- battery voltage monitoring
  - adjustable minimum- and maximum voltage
    limits

- motor temperature monitoring with fault
  detection of the temperature sensor for cable
  breakage and shorted circuits

- power stage temperature monitoring with fault
  detection of the temperature sensor for cable
  breakage and shorted circuits

- current limiter

- operation signal (LED)

- 4 digital inputs, selectable for
  - creep speed 1
  - creep speed 2
  - creep speed 3
  - body protection switch
  - status signal
  - enable
  - tiller angle
  - commissioning

- 1 digital output, selectable for
  - ready-signal
  - active brake
  - chosen direction
  - torque > threshold value (adjustable)
  - status signal
  - high temperature warning of the power
    stage
  - high temperature warning of the motor

- analogue output, selectable for
  - speed set value
  - speed actual value
  - speed deviation
  - torque
  - motor frequency
  - fixed value

- serial interface RS485 or CAN, each with a
  busmastering record

- all functions can also be performed via a serial
  interface

- possibilities of parameter settings:
  - PC software under MS-Windows
  - BPK: handheld console
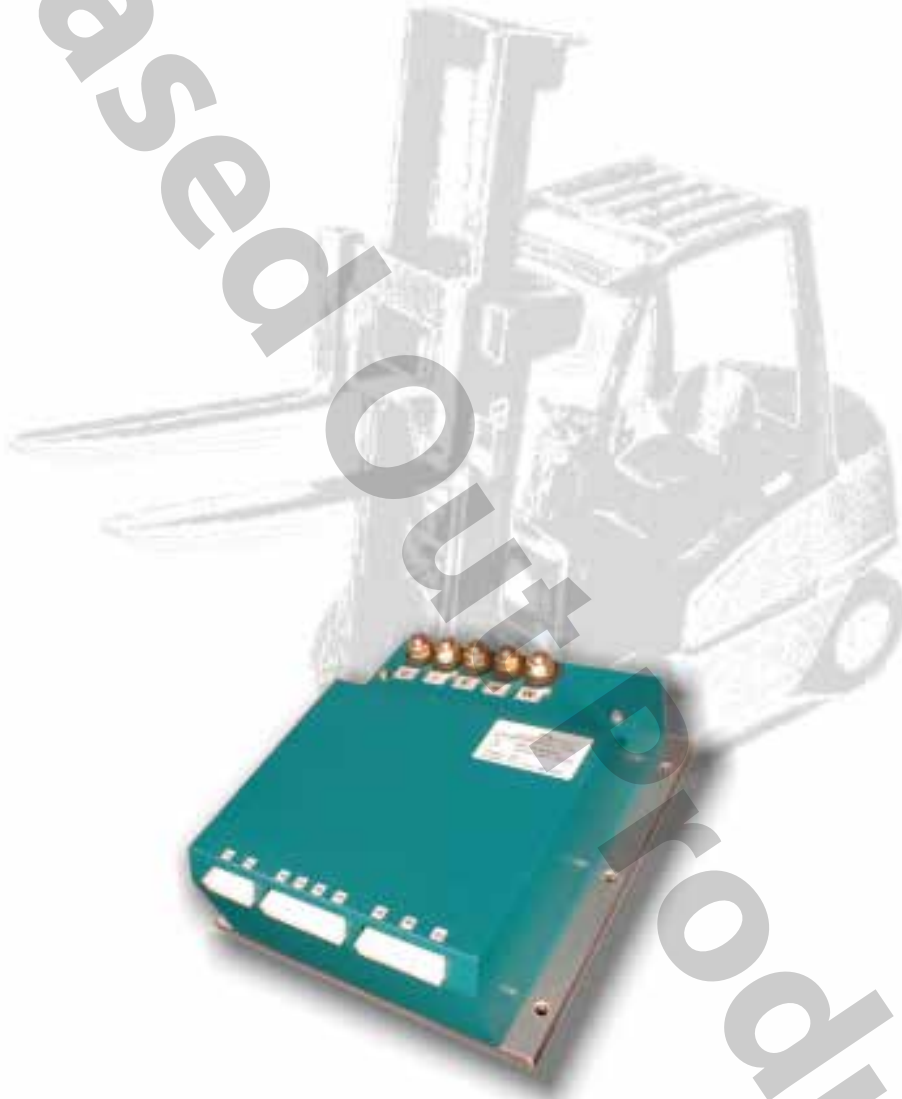 - parameter key with 15 user-defined sets of
    parameters

Dimensions

90   Version ...G

120   Version ...K

250

U - V + W

M10

L

L: 120mm ... 474mm, depends on maximum current

dACi

Series A

dACi - H

AC-Controller for
*H*ydraulic Pump Drives

dACi-H...

...is an AC-Controller for hydraulic pump drives with AC-induction motor.

The electronic consists of a three-phase inverter and a control unit.
AC- technology offers the following advantages in comparison to DC- technology:

♦ **Maintenance-free operation**

  ➢ no mechanical wear and tear on the motor

  ➢ no mechanical switch contacts (contactor)

♦ **Recuperation**

  ➢ without any additional components

♦ **More efficiency**

♦ **More flexibility in construction**

  ➢ less wiring

  ➢ the motor does not need to be openly accessible because it operates maintenance-free

♦ **Explosion protection**

  ➢ easy realizable due to no sparking in the motor

Features:

♦ **Open loop mode**

  ➢ no incremental encoder necessary

  ➢ current limiting

♦ **Closed loop mode**

  ➢ constant speed, independent of load

  ➢ adjustable torque limit

♦ **Different set value inputs**

  ➢ analogue-input for continuous set value

  ➢ digital-inputs for selection of fixed set values

Connection diagram:
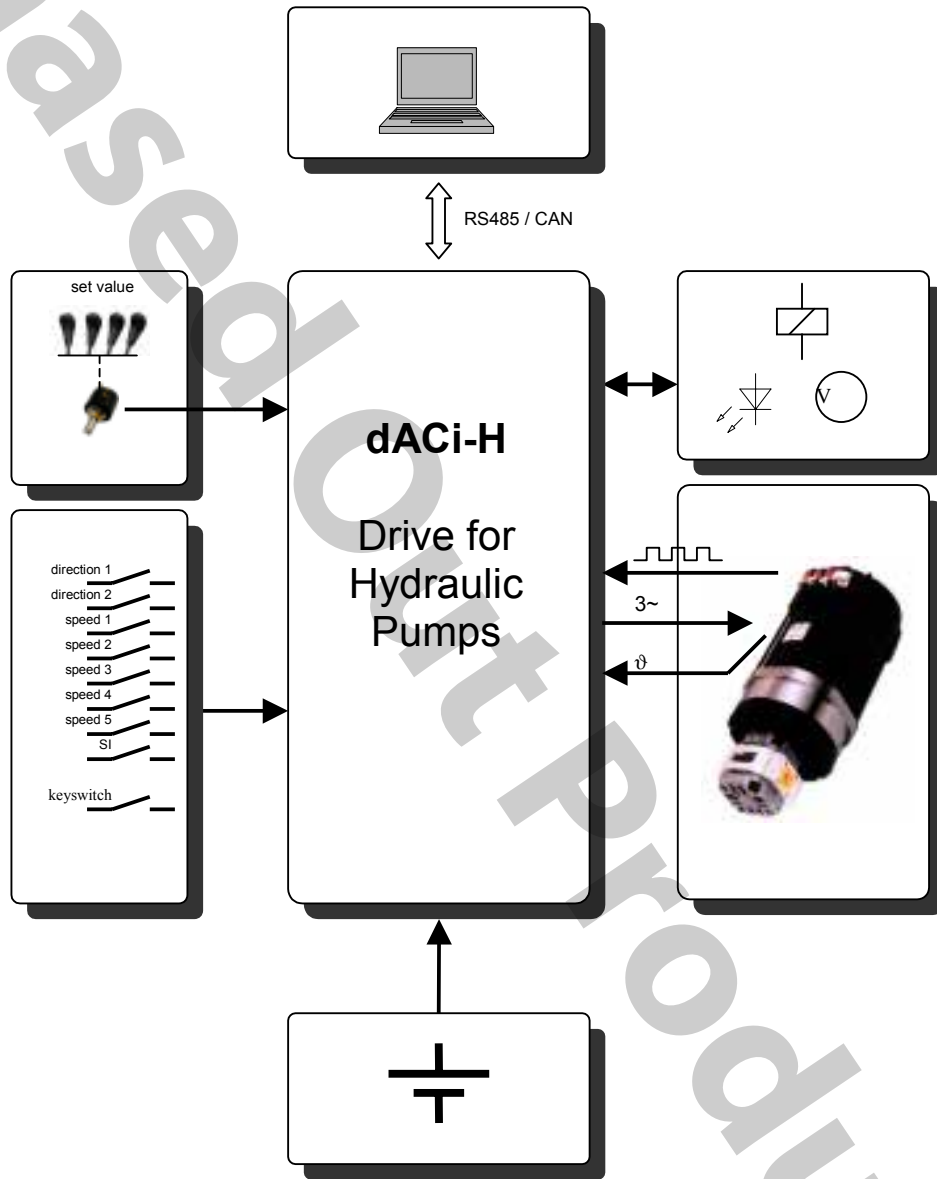
SI: Selectable Input
Safety

Apart from its maintenance-free operation, an AC-induction motor also offers additional safety. An error in the power stage or in the motor always reduces the torque and never can produce an unintentional maximum torque like it could with a DC drive.

Furthermore dACi-H possesses various safety equipments and also meets the requirements of the EN 11 75-1 and DIN EN 954-1 standards.

Technical data

Power data

type: dACi-H-	24/...	48/...	80/...
nominal battery voltage [V]	24 (36)[2]	48 (60)[2]	80 (72,96)[2]
input voltage range [V]	16 ... 35 (50)[2]	24 ... 70 (90)[2]	48 ... 115 (144)[2]
nominal current $I_{nominal}$ [A]	33 ... 300	17 ... 400	13 ... 320
maximum current I_{max} [A][1]	50 ... 450	25 ... 600	20 ... 480
output voltage [V]	3 x 0...16	3 x 0...32	3 x 0...53
continuous output [kVA]	0,83 ...8,3	0,86 ...22,2	1,3 ... 29,4
recommended nominal motor output [kW]	0,3 ... 6	0,5 ... 15	0,75 ...22

[1] duration depends on temperature resistance at the mounting plate
[2] special version, the given voltages and outputs will accordingly differ from the data in the table

Interfaces

| serial interface	RS485; CAN optional
digital inputs	low-active, switching to battery minus
selectable report output	open drain: U_{max}:200V; I_{max}: 300mA
analogue output	0 ... 10V, Ri= 200 Ω
encoder input	5V or 15V; RS422 or A-B; 50....1024 incr./per rot.

Others

precision of analogue inputs	1%
switching frequency	16 kHz standard; adjustable: 4; 8; 12; 16; 20kHz
efficiency	about 95% at nominal output
temperature range	-25°C...+50°C (mounting plate)
signal line connectors	Molex Mini-Fit JR
power connectors	screw terminal M5 or M10
IP protection	IP20, optional IP54
type of motor	AC-induction

Features:

- operating modes:
  - open loop speed control
  (no incremental encoder necessary)
  - closed loop speed control
  (incremental encoder necessary)

- adjustable set value curve

- different set value inputs
  - potentiometer
  - voltage input 0...+10V
  - current input 0...20mA

- adjustable speed process
  - maximum speed for counterclockwise operation
  - maximum speed for clockwise operation
  - acceleration
  - deceleration

- 5 fixed values for speed (activated by digital inputs)

- 2 modes for control signals:
  - start counterclockwise operation; start clockwise operation
  - enable; direction of rotation

- different stopping modes:
  - turn off motor
  - stop by leading

- key switch input

- fault detection of the incremental encoder for:
  - cable breakage
  - shorted circuits

- fault detection of the potentiometers for:
  - cable breakage
  - shorted circuits
  - change in resistance

- battery voltage monitoring
  - adjustable minimum- and maximum voltage limits

- motor temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- power stage temperature monitoring with fault detection of the temperature sensor for cable breakage and shorted circuits

- current limiter

- operation signal (LED)

- 1 digital output, selectable for
  - ready-signal
  - active drive
  - torque > threshold value (adjustable)
  - status signal
  - high temperature warning of the power stage
  - high temperature warning of the motor

- analogue output, selectable for
  - speed set value
  - speed actual value
  - speed deviation
  - torque
  - motor frequency
  - fixed value

- serial interface RS485 or CAN, each with a busmastering record

- all functions can also be performed via a serial interface

- parameter setting possibilities:
  - PC software under MS-Windows
  - BPK: handheld console
  - parameter key with 15 user-defined sets of parameter

Dimensions

90   Version ...G

120   Version ...K

250

U   -   V   +   W

M10

L

X1 X2   X4 X5 X6 X7   X9 X8 X3
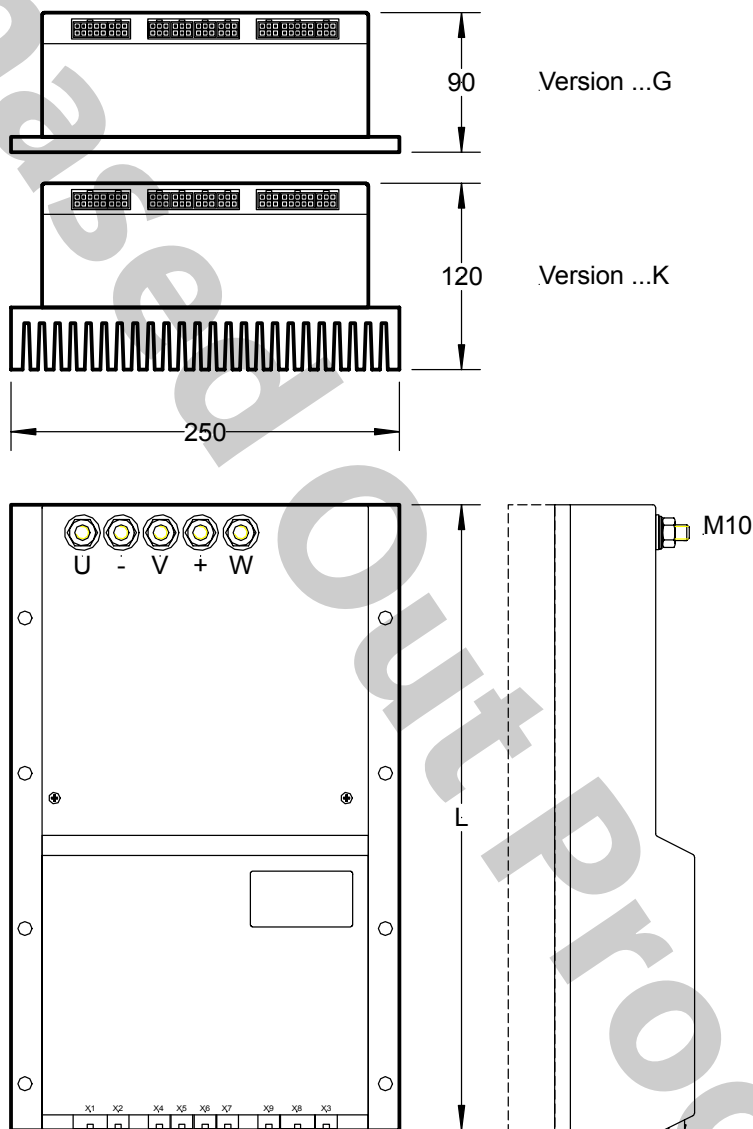
L: 120mm ... 474mm, depends on maximum current

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