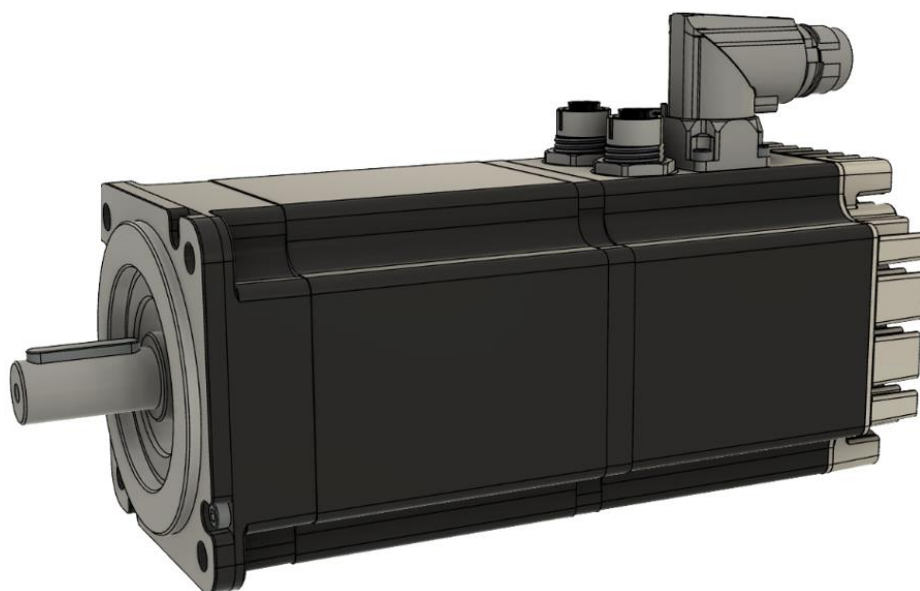


# Installation guide – Product Description Manual

*FOR DUET AD*



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## Notice:

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The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.

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Version	Date	Author	Note
1.0		Maurizio Piccinelli	First Release
2.0	19/01/2023	Michele Piacentini	Second release




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## 2 About this document

These operating instructions introduce you to the DUET AD device and provide you with information on all the stages required for the installation of the device.

	<p><b>Warning:</b></p> <p>Before commissioning, it is essential that the safety instructions in the relevant section are read and understood, and then observed! Non-observance can result in danger to persons or damage to the equipment.</p> <ul style="list-style-type: none"> <li>• Disconnect the electrical power supply before any operation on the device!</li> </ul>
	<p><b>NOTICE:</b></p> <p>Read and observe the warnings in this document. Warnings are there to protect you from danger, and to help you to avoid damage to the device.</p>
	<p><b>NOTICE:</b></p> <p>Instructions explain the advantages of certain settings and help you use the device to the best possible effect.</p>

## 3 General Description

### 3.1 DUET AD

The DUET AD represents EC-motors (brushless DC motor) with an integrated torque, speed, position control electronic and a 14 bit single-turn absolute encoder.

The desired command can be set via analogue signal input 0 ... +10 V. The four operating modes "clockwise rotation", "counter clockwise rotation", "Off" (rapid break- point with freewheel) and "Stop" (rapid breakpoint with holding torque) are controlled via the two digital inputs IN0 and IN1. Optional, two further digital inputs for additional functions are available. Therewith, among other things, 2 fixed motor speeds (e.g. for rapid movement and creep speed), acceleration ramp and braking ramp can be memorized on the device EEPROM. Two digital output signals are available additionally: one giving 12 pulses per turn (e.g. for position and speed control), the other showing "fault".

Additionally, the device can be operated via Modbus RTU/CAN Open (only available on CAN model) or via Industrial Ethernet Interface such as ProfiNet and EtherCAT (Only available in P or E model)

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By means of the integrated absolute single-turn encoder with a resolution 16384 increments per revolution, a very high positioning accuracy with very good regulating characteristics can be achieved.

In case of larger needs, customer specific solutions with special firmware are available on request.

The DUET AD has except of the ball bearings no expendable parts and is hence excellently suited for continuous operation. The motors Device can be combined with planetary or worm gears with a multitude of gear ratios.

### **3.2 Proper use**

The DUET AD is a supplied part and may be installed into (industrial) machinery and equipment in the described configuration.

The device must be securely fixed and may only be installed using cables and components specified by Motor Power Company.

The Device may only be put into operation once the entire system has been installed in accordance with EMC. Please follow the instructions in chapter 8.1

### **3.3 Standards and guidelines**




**EU guidelines:** the EU guidelines formulate the minimum requirements made on a product and must be observed by all manufacturers and dealers marketing the product in the member states of the European Union.

**Machine guideline:** the device is a machine in the sense of the EU guideline for machinery. It has moveable parts in accordance with its intended purpose: however, it may only be installed as a component of a machine or a system. The advice described in these instructions regarding installation and operation must be adhered to.


**EMC guideline:** the EU guidelines for EMC apply to devices which can cause electromagnetic interruptions or whose operation can be impaired by these interruptions. Compliance of the drive with the EMC guideline can only be tested once it has been installed. The information pertaining to EMC described in these instructions must be adhered to.

**Conformity:** by means of the conformity declaration of the product (see appendix), Motor Power Company confirms that the device complies with the safety standards listed therein and with EMC standards. The product may be sold and used within the European Union.

## 4 Safety instructions

	<p><b>Warning:</b></p> <p>Before commissioning, it is essential that the safety instructions in the relevant section are read and understood, and then observed! Non-observance can result in danger to persons or damage to the equipment.</p> <ul style="list-style-type: none"> <li>• Disconnect the electrical power supply before any operation on the device!</li> </ul>
	<p><b>NOTICE:</b></p> <p>The drive must only be installed and adjusted by qualified persons in accordance with the relevant standards. Qualified persons are those who:</p> <ul style="list-style-type: none"> <li>• based on their experience, can recognize and avoid potential dangers.</li> <li>• are familiar with the accident prevention regulations for the equipment deployed.</li> <li>• can connect circuits and install equipment in accordance with the standards and regulations.</li> </ul>
	<p><b>NOTICE:</b></p> <p>To ensure trouble-free operation, appropriate methods of transport and conditions of storage must be deployed.</p> <p>Please store the drive so that it is protected from:</p> <ul style="list-style-type: none"> <li>• dust, dirt and moisture</li> </ul> <p>Take care also at the storage conditions:</p> <ul style="list-style-type: none"> <li>• e.g. storage temperature! (See technical data)</li> </ul> <p>Transport the drive under storage conditions</p> <ul style="list-style-type: none"> <li>• protection against shock</li> </ul>

## 5 Transport condition

	<p><b>Warning</b></p> <p>Please follow the advices for best storage of the product. Improper transport and incorrect storage may damage the product.</p>
---	--

- Transport and store the product only in its original packaging, in a dry and protective environment.
- Comply with the maximum recommended storage time for the product of 2 years.
- Avoid temperature fluctuations.
- Protect the product from any mechanical loads such as impacts and vibrations.
- Observe the relative humidity.
- Protect the product from dust and contamination.
- Avoid harmful gases, such as ozone, sulphur compounds or hydrocarbons.

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- Protect the product from any sources of radiation, such as sunlight or technical radiation.

	<b><i>TEMPERATURE</i></b>
<b><i>Storage Temperature – Temporary (24h)</i></b>	-25 °C ... 70 °C
<b><i>Storage Temperature – Long Term</i></b>	-25 °C ... 50 °C

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## 6 Product Description

The DUET AD motor is brushless DC servomotor with integrated motion controller. The comfortable PC operating interface makes it easy to set drive parameters for a number of pre-installed basic operating modes.

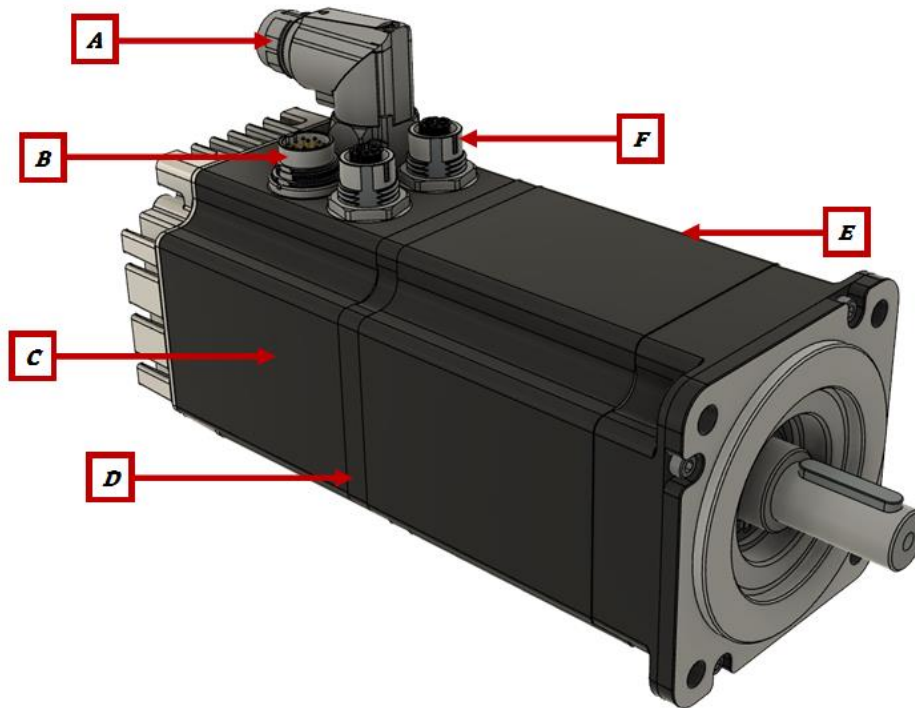


Figure 1-DUET AD parts description


<b>POSITION</b>	<b>DESCRIPTION</b>
<b>A</b>	Round connector M23, 6-pin (power supply and ballast)
<b>B</b>	Round connector M16, 12-pin (logic supply, inputs and outputs)
<b>C</b>	Integrated BLDC low voltage drive
<b>D</b>	Brake (if present)
<b>E</b>	Motor
<b>F</b>	Round connector M12, 5-pin (communication connector)

### 6.1 Electrical data

#### ELECTRICAL DATA

<b>Speed range adjustable</b>	0 ... 3000 RPM *
<b>Minimum device voltage</b>	7 V DC
<b>Maximum device voltage</b>	55 V DC
<b>Maximum ripple on supply voltage</b>	MAX. 5 %
<b>Recommended logic supply</b>	24 V $\pm 20\%$
<b>Undervoltage shutdown Logic</b>	< 16,5 V
<b>Demolition boundary</b>	> 70 V
<b>Required external fuse</b>	25 AT EXTERNAL
<b>Overttemperature protection</b>	> 110°C AT THE POWER OUTPUT STAGE
<b>Max. peak current (2.5 sec.) *</b>	70 A/50° ACCORDING TO MOTOR TYPE
<b>Max. peak current up to 100° C *</b>	30/50 A
<b>Current consumption of 24 V-logic supply</b>	100 MA + POWER OF DIGITAL OUTPUTS**
<b>Switching Threshold Low Digital Inputs/Outputs</b>	0...5 VDC
<b>Switching Threshold Not Defined Digital Inputs/Outputs</b>	5...13 VDC
<b>Switching Threshold High Digital Inputs/Outputs</b>	>13 VDC

\*Max peak current motor can support depends on motor model type

	<p><b>Warning</b></p> <p>**current consumption with brake will be higher. standard brake for DUET AD needs up to 500 mA. Logical consumption will be higher for Industrial Ethernet Models.</p>
---	---

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## 6.2 Mechanical data

<b>MECHANICAL DATA</b>	
<b>Device Temperature range</b>	-20 °C ... +100 °C HOUSING TEMPERATURE
<b>Recommended environmental temperature range *)</b>	0 °C ... 40 °C
<b>Storage Temperature – Long Term</b>	-25 °C ... 50 °C
<b>Relative humidity</b>	MAX. 90% (NOT CONDENSING)
<b>Protection class **)</b>	IP54 (IP65 WITH OIL SEAL)
<b>Altitude</b>	2000 msl ( <b>TBD</b> )

\*) The motor is specified for an ambient temperature of 40°C. The performance data refer to this ambient temperature.

\*\*) The protective system only refers to the device casing. The shaft is to be sealed by the client. The drive may only be used in an environment complying with IP54 if the shaft outlet has been installed such that it is protected from dust and water.

## 6.3 Dimensions

Dimensions are different with respect to model and whether the brake is present or not.

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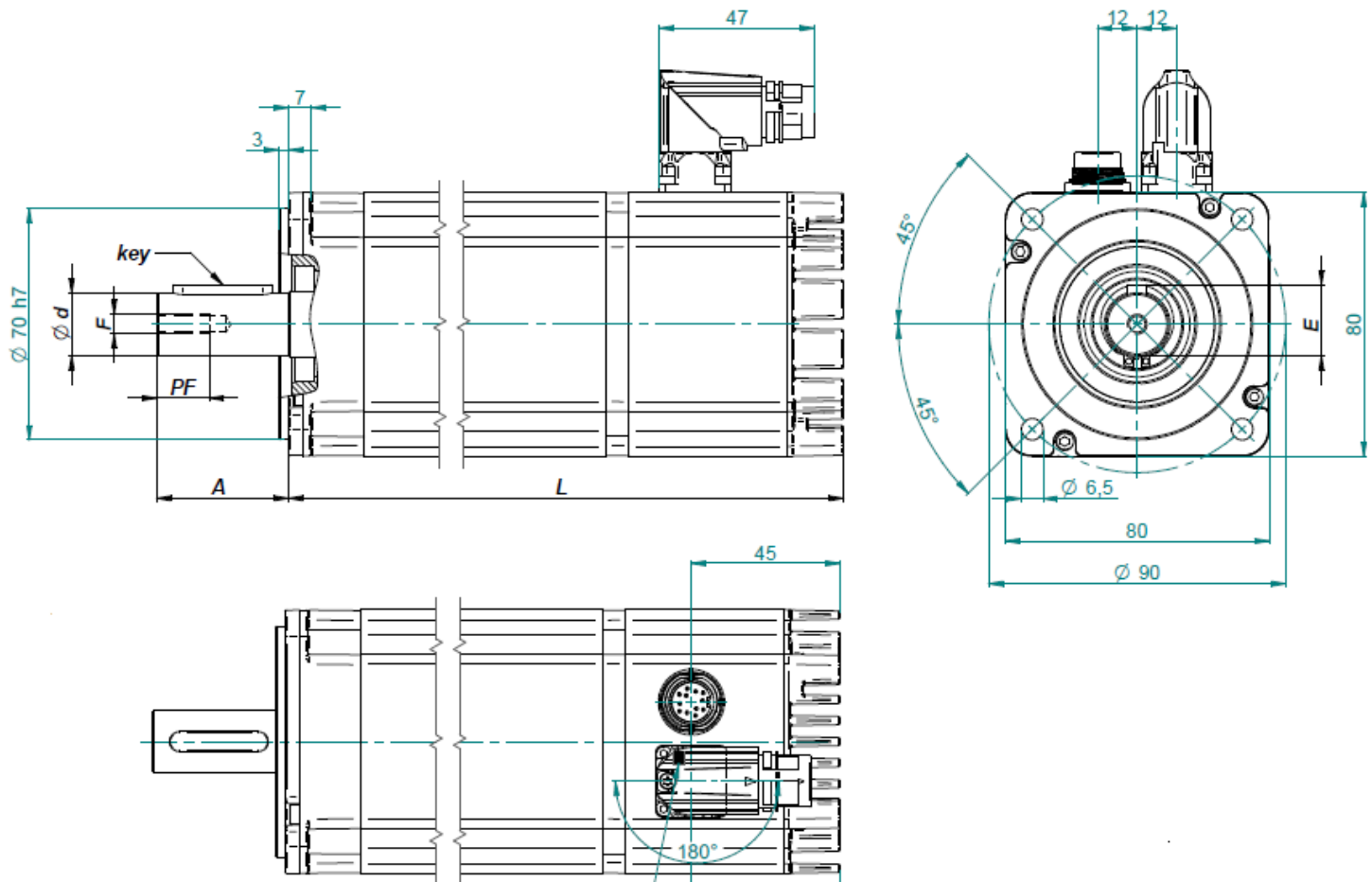


Figure 2 DUET AD CANopen version drawings

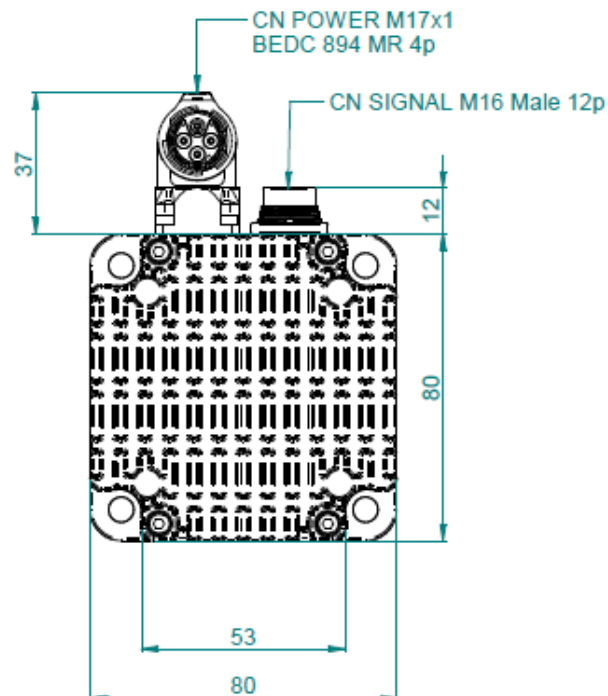


Figure 3 DUET AD CANopen version drawings back views

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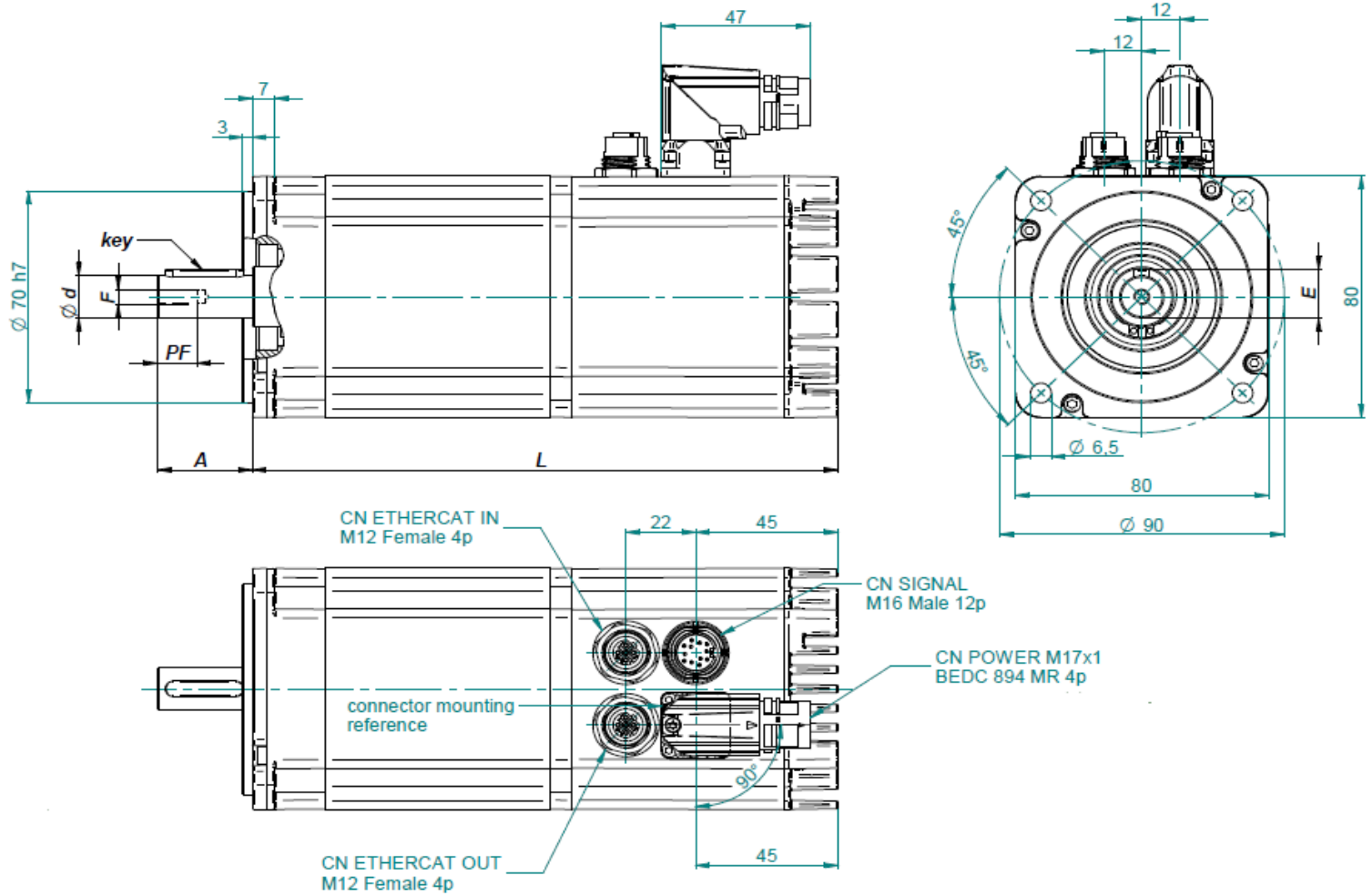


Figure 4 DUET AD Industrial Ethernet drawings

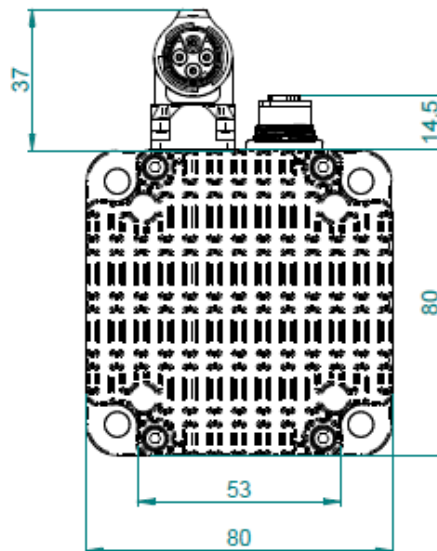


Figure 5 DUET AD Industrial Ethernet drawings back views

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## 6.4 DUETAD Dimensions

Note: Profinet and EtherCAT devices are grouped under Industrial Ethernet device.

<b>MODEL</b>	<b>LENGHT(CM)</b>
<b><i>DUETAD 1,5 03 CANopen</i></b>	<i>185</i>
<b><i>DUETAD 1,5 03 CANopen with Brake</i></b>	<i>227</i>
<b><i>DUETAD 1,5 03 Ethernet</i></b>	<i>185</i>
<b><i>DUETAD 1,5 03 Ethernet with Brake</i></b>	<i>227</i>
<b><i>DUETAD 2,8 02 CANopen</i></b>	<i>210</i>
<b><i>DUETAD 2,8 02 CANopen with Brake</i></b>	<i>252</i>
<b><i>DUETAD 2,8 02 Ethernet</i></b>	<i>210</i>
<b><i>DUETAD 2,8 02 Ethernet with Brake</i></b>	<i>252</i>

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## 6.5 DUET AD TYPE

DUET AD is available in 2 models for different applications type. More type could be available for quantity on demand.

<b>DUET AD 1,5 03</b>	
<b>Nominal voltage</b>	48 VDC
<b>Nominal power</b>	480 W
<b>Rated speed</b>	3000 RPM
<b>Maximum Speed</b>	3600
<b>Rated Torque</b>	1,53 NM
<b>Peak Torque</b>	4,5 NM
<b>Rated current</b>	11 ARMS
<b>Peak Current</b>	35,1 ARMS
<b>Weight</b>	APPROX. 2,3 KG
<b>Torque Constant</b>	0,141 NM/ARMS
<b>Rotor Inertia</b>	0,64 Kg/cm <sup>2</sup>

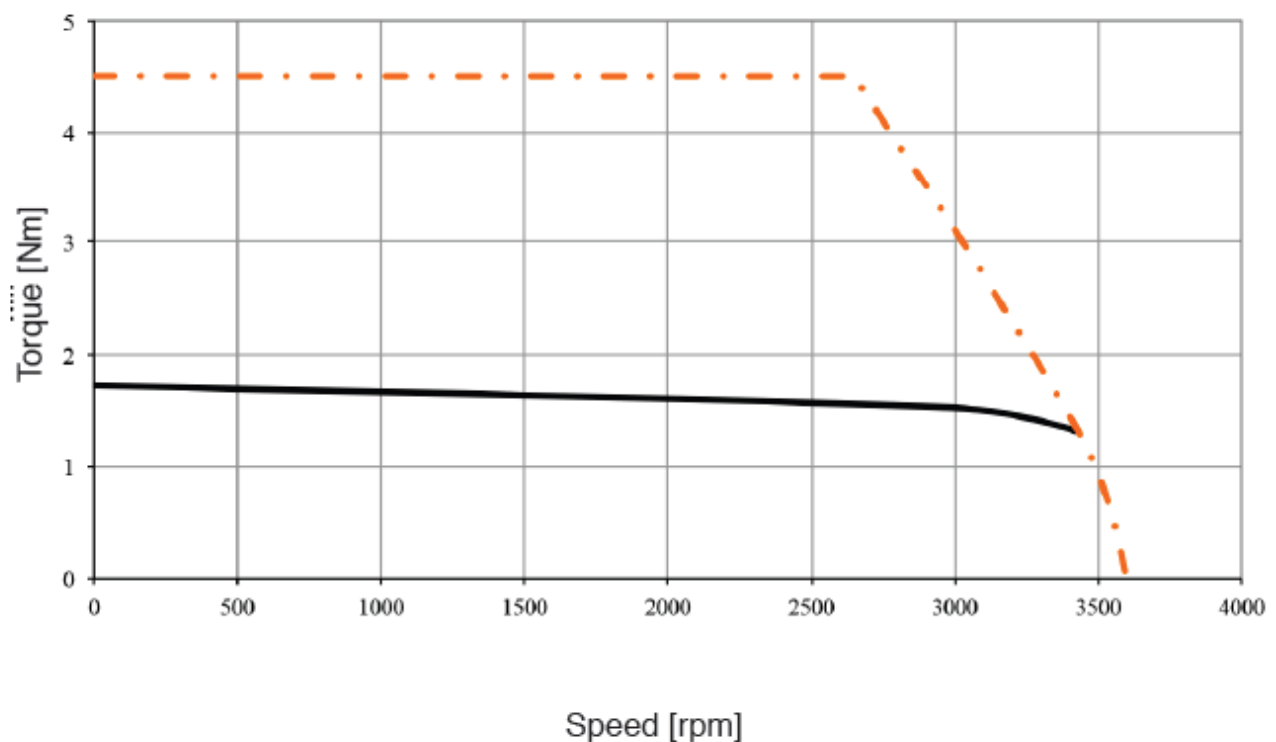


Figure 6- DUET AD 80 1,5 03

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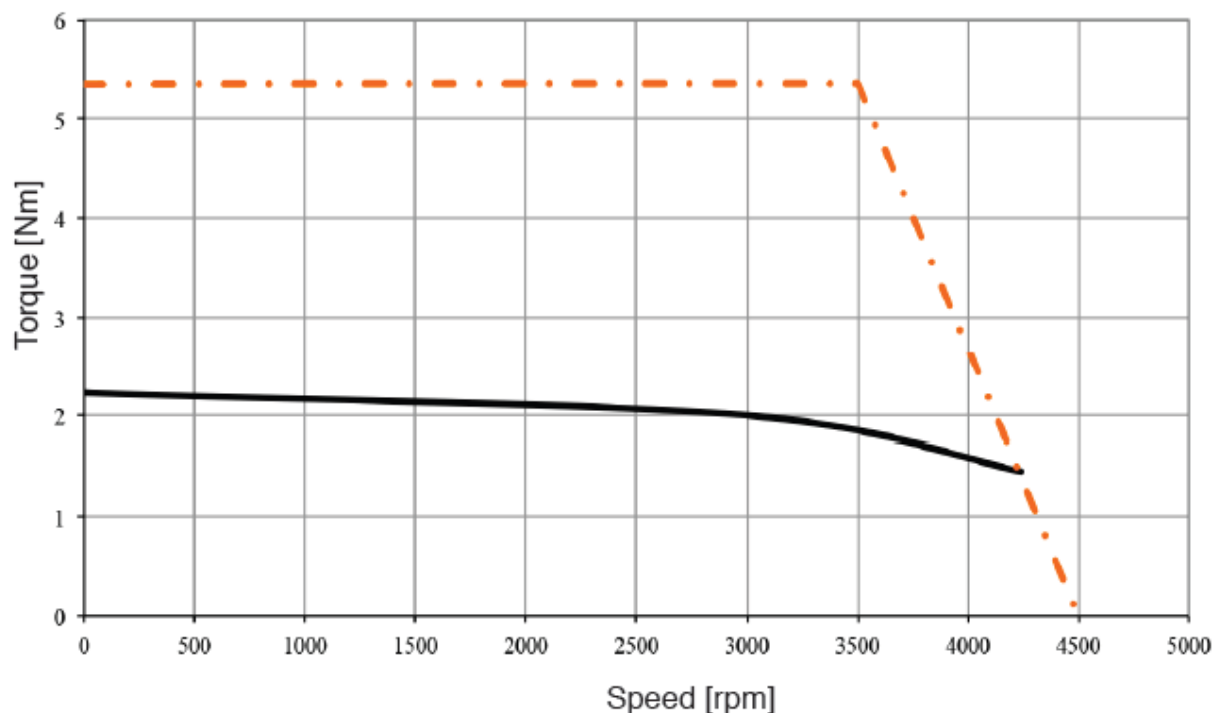
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**DUET AD 2,8 02**

<b>Nominal voltage</b>	48 VDC
<b>Nominal power</b>	630 W
<b>Rated speed</b>	3000 RPM
<b>Maximum Speed</b>	3600
<b>Rated Torque</b>	2 NM
<b>Peak Torque</b>	5,36 NM
<b>Rated current</b>	17,7 ARMS
<b>Peak Current</b>	50 ARMS
<b>Weight</b>	APPROX. 3,1 KG
<b>Torque Constant</b>	0,113 NM/ARMS
<b>Rotor Inertia</b>	1,16 Kg/cm <sup>2</sup>

**Figure 7 DUET AD 80 2,8 02**

\*) Rated output with 250x250x6mm heat sink flange.

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## 6.6 Accessories

### 6.6.1 Planetary gear:

Available high efficiency planetary gears, with very compact design. Configuration "direct coupling" also available.

Available gear ratio from 3:1 ... 216:1

### 6.6.2 Brake:

The device can be fitted with a power-off brake option. The brake it is handled automatically by the drive when the axis is enabled.

### 6.6.3 User Interface

The Motor Power Company User Interface is available at [www.motorpowerco.com](http://www.motorpowerco.com)

UI connect to DUET AD via RS485-USB converter (default from Motor Power Company usb2-h-5001-m).

A MODBUS serial connection is used for configure and parametrize the drive. Please refer to UI user manual for more details.

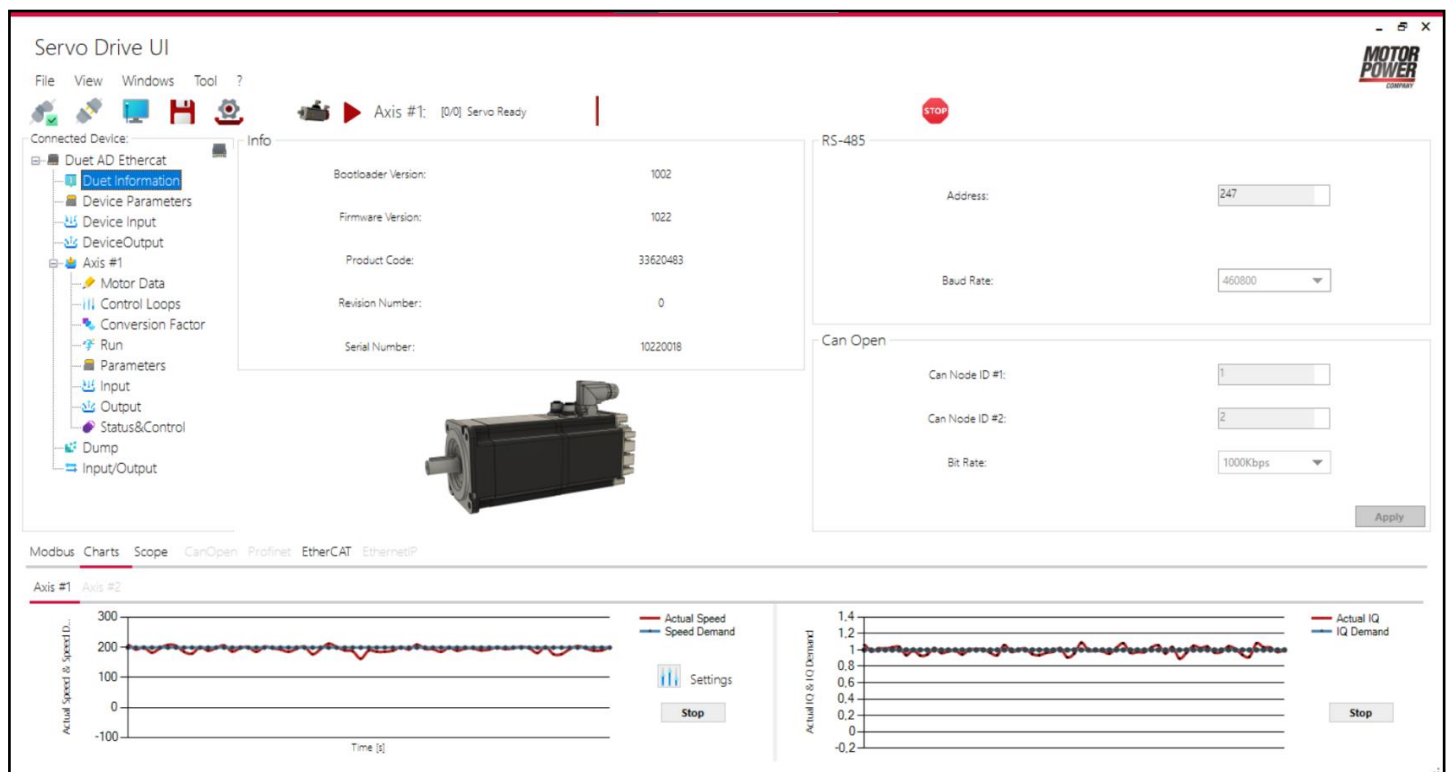


Figure 8 UI for DUET AD

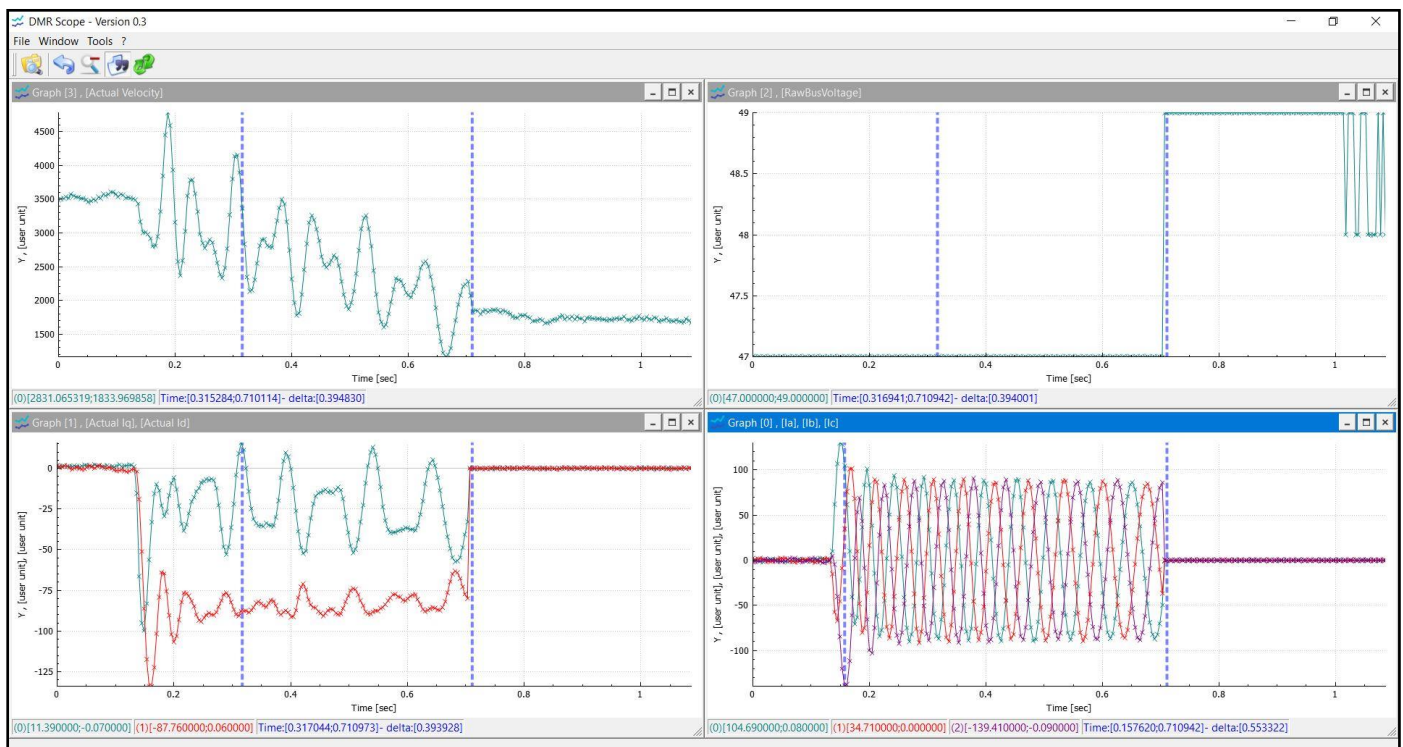
Several features are available in UI interface, such as:

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- Tuning Functions
- Parameters save/store/load
- Advanced scope with several variables
- Firmware update via RS485
- IOs configuration



**Figure 9 Scope Function in UI interface**

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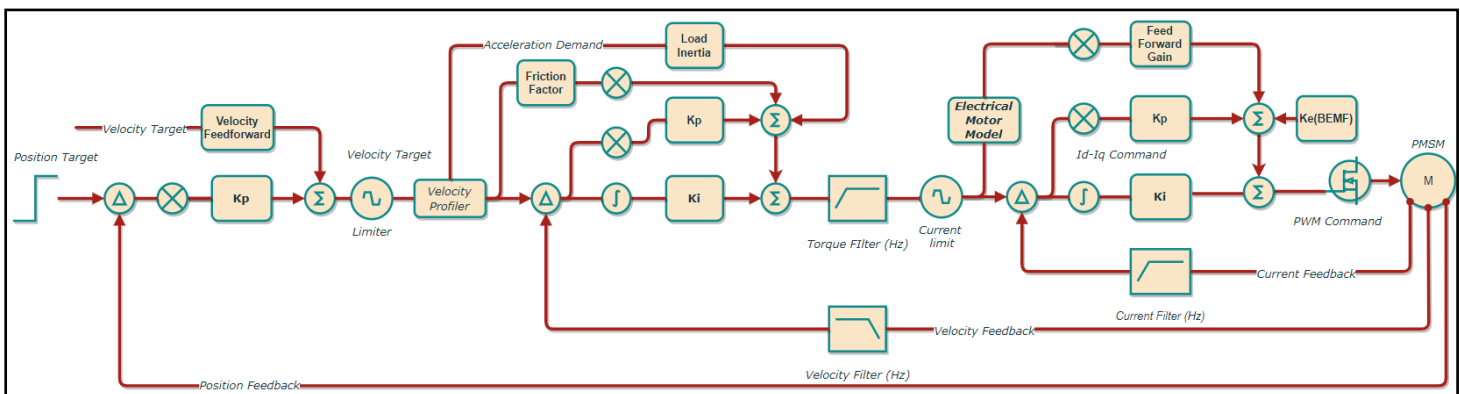
## 6.7 Functions

The DUET AD is available with CANopen, EtherCAT, PROFINET, IO and MODBUS over RS485.

Various functions are available for any selected control:

- Cascade controllers for current, speed and position with ramp generator.
- Various position operating modes (absolute and relative positioning, round axis function/modulo, interpolation mode).
- Digital inputs (can be used as input for reference and/ or as limit switches).
- Digital outputs.
- A brake (optional) can be controlled automatically (automatic opening and closing).
- Analogue input( $\pm 10V$ ).
- Ballast circuit with parametrisable activation threshold.
- Various reference run methods.
- Absolute single turn encoder up to 14bits.
- User Programs for custom functions at request.
- Homing function (DS402).

New or additional functions can be implemented on request.



**Figure 10 Complete Position Cotroller for the device**

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## 6.8 CANopen interface



The communication protocol CANopen supports you in linking complex devices. In addition to the network management and device monitoring, communication between various nodes is supported as well. The CANopen interface CiA 402 can be used to enter parameters of a path curve, such as position, speed and acceleration values.

For a complete description please refer to CANopen manual for DUET AD at [www.motorpowerco.com/en/download-area/](http://www.motorpowerco.com/en/download-area/).

Various type of Modes of Operation are available in this mode

### 6.8.1 Profile Position Mode (CiA 402 Mode 1)

The "Profile Position Mode" serves positioning from a start to a target point. Positioning takes place with reference to a zero point (absolute) or the current position (relative).

### 6.8.2 Profile Velocity Mode (CiA 402 Mode 3)

In "Profile Velocity Mode", the nominal motor speed is preset. The speed is controlled and kept until a new speed is preset.

### 6.8.3 Torque Profile Mode (CiA 402 Mode 4)

The "Torque Profile Mode" is used to maintain a preset torque. The torque is controlled and kept until a new torque is preset. The speed results from the current load.

### 6.8.4 Homing Mode (CiA 402 Mode 6)

"Homing Mode" serves referencing to a specific mechanical point, e.g. after reactivation of the machine.

### 6.8.5 Interpolated Position Mode (CiA 402 Mode 7)

In "Interpolation Position Mode", a path through basic points comprising a position and speed formation is preset. The interim values are interpolated by the motor electronic. By presetting the time until the basic points are reached (Position and Velocity versus Time, PVT), synchronous operation of several axes can be achieved via the control system.

### 6.8.6 Cyclic Sync Position Mode (CiA 402 Mode 8)

The master calculates the path planning and sends the target position cyclically and synchronously to the motor. The position control circuit runs in the motor. It supplies the current position, speed and current values measures via the integrated encoders to the master. This mode is only available in EtherCAT model wit CoE.

A firmware update via RS485 is possible.

## 6.9 EtherCAT interface



DUET AD supports CoE (CAN over EtherCAT) with DS402. It supports distributed Clocks and can be controlled by different manufacturer's controllers.

The products can be operated in the following operating modes:

- Profile Torque Mode ((CiA Mode 4)
- Profile Position Mode (CiA 402 Mode 1)
- Profile Velocity Mode (CiA 402 Mode 3)
- Homing Mode (CiA 402 Mode 6)
- Cyclic Sync Position Mode (CiA 402 Mode 8)

In order to take products with dPro EC functionality into operation, you either need the „Drive Assistant 5“ software or a Beckhoff control system with the corresponding commissioning. The commissioning via Beckhoff TwinCAT is fully supported and very simple. Various type of mapping/configuration for PDOs are possible.

For a complete reference guide please use EtherCAT reference manual for DUET AD at [www.motorpowerco.com/en/download-area/](http://www.motorpowerco.com/en/download-area/).

A firmware update via FoE (file over EtherCAT) is supported.

## 6.10 PROFINET interface



DUET AD PN operates with PROFINET RT. It supports various type of modes of operation. A complete configuration of the device is possible via profinet records (acyclic messages).

The products can be operated in the following operating modes:

- Profile Torque Mode ((CiA Mode 4)
- Profile Position Mode (CiA 402 Mode 1)
- Profile Velocity Mode (CiA 402 Mode 3)
- Homing Mode (CiA 402 Mode 6)

For a complete reference guide please use PROFINET reference manual for DUET AD at [www.motorpowerco.com/en/download-area/](http://www.motorpowerco.com/en/download-area/).

A firmware update via PROFINET is supported.

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## 6.11 IO mode

In IO mode, the DUET AD can be operated “stand-alone”. The motor is then controlled via digital or analogue Inputs. In the delivery condition, the nominal speed and the maximum motor current (phase current) of the motor can be preset via an analogue input voltage. Two fixed speeds can be called up.

The service and commissioning software UI interface permits comprehensive parameter settings for the motor, followed by work in standalone operation.

### 6.11.1 Function of the digital inputs IN0 & IN1& AIN

In standard configuration, valid for DUET AD IO model, IN1 and IN0 can be used with Analogue In to run the motor in velocity mode .

The target velocity value is given by the AIN differential value (0 to 10VDC) and can be calculated as follow:

$$Velocity\ Target = \frac{Max\ Motor\ Speed * AIN(mV)}{10000\ mV}$$

Where:

- Max motor speed is the maximum speed that motor can reach; to change this value use the UI interface
- AIN is the diffencial value of analogue in to give to the motor
- Velocity Target is the corresponding velocity command obtained with AIN value. Velocity Target will follow the polarity of IN1 to determine the rotation direction

**NOTE:** A not connected analogue input equals 0 rpm velocity.

Set value voltages over +10V are allowed, but do not effect any increase of motor speed.

INO	IN1	FUNCTION
0	0	CONTROL NOT ACTIVE. MOTOR DISABLED
1	0	COUNTER CLOCKWISE ROTATION DIR
1	1	CLOCKWISE ROTATION DIR

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IN2 and IN3 are not associated to any function for standard configuration.

The following functions are possible, among other things:

<b>INPUT FUNCTION</b>	<b>DESCRIPTION</b>
<i>Positive Limit Switch</i>	<i>HOMING FUNCTION DS402</i>
<i>Negative Limit Switch</i>	<i>HOMING FUNCTION DS402</i>
<i>Enable</i>	<i>STANDARD FUNCTION IN0</i>
<i>Emergency Stop</i>	<i>IT STOP THE MOTOR AS HALT</i>
<i>Fault Reset</i>	<i>RESET FAULTS ON RISING EDGE</i>
<i>Home Switch</i>	<i>HOMING FUNCTION DS402</i>
<i>Positive JOG</i>	<i>JOG AT JOT VEL</i>
<i>Negative JOG</i>	<i>JOG AT JOT VEL</i>
<i>Positive Torque Limit</i>	<i>LIMIT THE TORQUE OF THE MOTOR IN POSITIVE DIR</i>
<i>Negative Torque Limit</i>	<i>LIMIT THE TORQUE OF THE MOTOR IN POSITIVE DIR</i>
<i>Torque Limit</i>	<i>LIMIT THE TORQUE OF THE MOTOR IN BOTH DIR</i>
<i>Analog Input Polarity</i>	<i>STANDARD FUNCTION IN1</i>
<i>Enable and Dir CW</i>	<i>ENABLE AND ROTATE AT POS DIR</i>
<i>Enable and Dir CCW</i>	<i>ENABLE AND ROTATE AT NEG DIR</i>

### 6.11.2 Function of the digital output

OUT1 and OUT2 are configurable with output functions by UI interface. In the DUET AD IO model they have a standard configuration:

- OUT1: Fault function
- OUT2: Not configured

The Fault protection function serves for protecting the motor against destruction e.g. at external strain. Confirmable protection functions turn off the output stage when achieving a marginal value. This is announced by the fault-output OUT1.

The output is performed as a PNP transistor 24 V-pulse switching, with a max. permissible current strain of 250 mA. Thereby, following logic is essential:

<b>OUT 1(LOGIC VALUE)</b>	<b>DESCRIPTION</b>
<b>0</b>	<i>Fault</i>
<b>1</b>	<i>No fault</i>

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For confirmation of a fault message, the motor must be set into status "OFF" (IN0, IN1 = 0). If the cause of fault is debugged (e.g. switch-on voltage threshold achieved, temperature o.k.), this is shown via OUT2 = 1, and the motor can be started again. For a complete fault list and for debugging use UI.

The following functions are possible, among other things:

<b>INPUT FUNCTION</b>	<b>DESCRIPTION</b>
<i>Fault</i>	<i>FAULT PROTECTION FUNCTION</i>
<i>In Position</i>	<i>TARGET POSITION REACHED</i>
<i>Drive Homed</i>	<i>HOMING FUNCTION ATTAINED</i>
<i>Pulse Output</i>	<i>It generates 12 pulses per motor turn when active</i>

A firmware update via the RS485 interface is possible.

## 6.12 Modbus RTU operation



Modbus operation are possible on the drive, as it is a Modbus rs485 node. For more information download the Modbus manual at [www.motorpowerco.com/en/download-area/](http://www.motorpowerco.com/en/download-area/).

A firmware update via the RS485 interface is possible.

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## 7 Protective functions

### 7.1 Ballast circuit

During braking operations, kinetic energy is stored as electrical energy in an intermediate part of the regulation circuit. This can cause excessive voltage in the intermediate circuit, which, in an extreme case, could cause damage to electrical components. To prevent this, a DC-power supply should be used which has a bridge rectifier and a smoothing capacitor of at least 1000  $\mu\text{F}$  per 1 A nominal motor current.

In addition, an external ballast resistor (drop resistor) is necessary.

Motor Power Company recommends a resistor of 4,7 $\Omega$  .

The ballast resistor must be defined depending on the braking power (at least 50watts). It is necessary to use a fuse of 6,3AT against overloading of the ballast resistor.

The ballast circuit switches on at 58V and off at 55V device voltage. This thresholds are programmable via UI interface. It does only work and protect the device (and supply) if the ballast resistor is connected like shown in chapter 9.

According to standard, Motor Power Company offers the braking resistor (must be ordered separately).

**NOTE:** the ballast resistor should be chosen to best fit the application.

### 7.2 Voltage Control Braking

Since regeneration voltage during braking could cause device demolition or undesired voltage in the system, optionally a Voltage Control Braking function can be activated. This will limit deceleration of motor when voltage overtake a limit value.

### 7.3 Undervoltage Switch-Off of the Power-

If the supply voltage drops below the threshold set in the parameters, the power stage will switch off. The failure can be acknowledged via the communication interface if the power voltage that can be read via the communication interface is under the threshold.

### 7.4 Overvoltage Switch-Off of the Power-

If the supply voltage rise above the threshold set in the parameters, the power stage will switch off. The failure can be acknowledged via the communication interface if the power voltage that can be read via the communication interface is under the threshold.

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## 7.5 Overtemperature Protection

To protect the motor at overload, a temperature sensor is integrated in the electronic output stage to measure the PCB temperature and switch off the controller if the temperature is too high. The failure must be acknowledged in order to take the drive unit back into operation after deactivation.

## 7.6 Current limitation

The motor is protected from thermal overload by an  $I^2t$  based algorithm. It calculates the heat supply caused by the phase current and limits the nominal current if the calculated motor temperature exceeds the critical threshold. This protection mechanism permits overloading of the motor for a defined period without any risk of thermal damage to the motor winding or the electronics. When the critical threshold is reached, the nominal current is limited to the conditions current. Once the estimated temperature drops below the hysteresis, the nominal current is no longer limited and the maximum current is permitted again. (The maximum current can be limited by other current limitations: Static current limitation and  $I^*t$ ). The calculated temperature drops when the nominal current is less than the continuous current.

The Overload Protection is configurable via UI interface, once the  $I^2t$  algorithm overtakes the maximum motor load value (100%) a specific parameter can define if an error will be generated (motor rated current error) or it will limit maximum current of drive to the nominal value of the current to protect both motor and electronics.

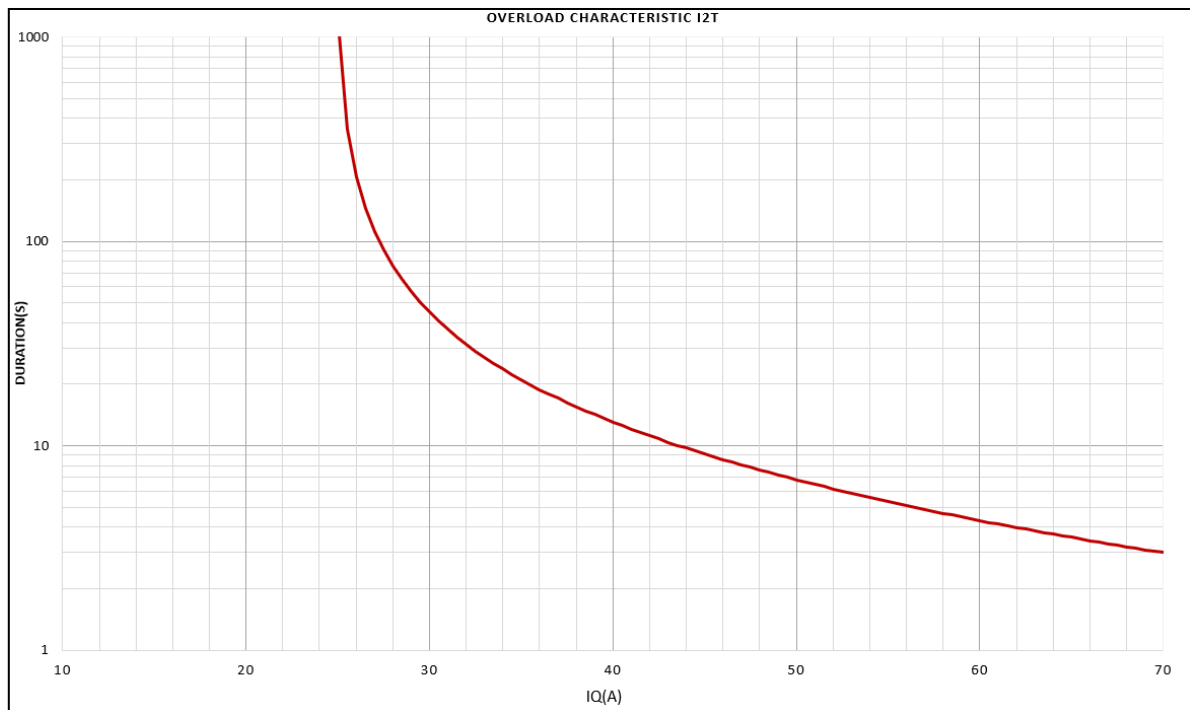
It depends on the type of motor, the starting temperature and the overcurrent. The resulting duration for an operating point may be determined via the enclosed figures.

**NOTE:** The  $I^2t$ -algorithm loses information when the logic supply is switched off. In certain situations, this may cause severe thermal damage to the motor.

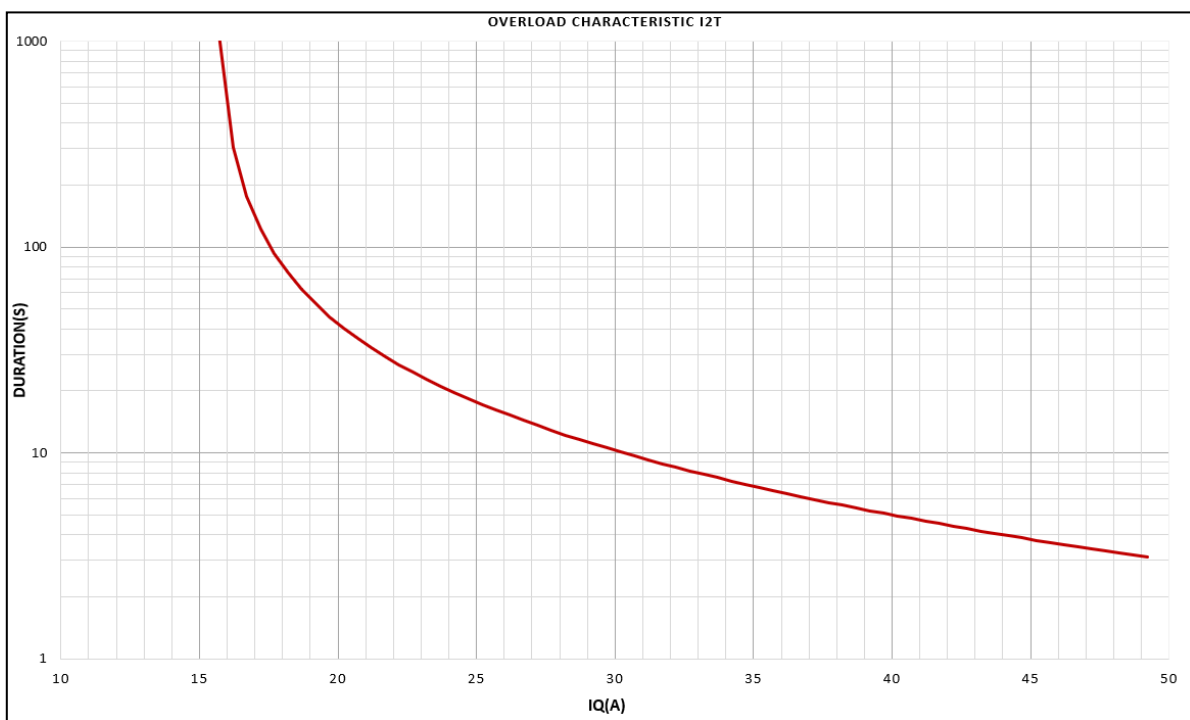
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**Figure 11 I2t characteristic for DUET AD 2,8 02 at 40°C**



**Figure 12 I2t characteristic for DUET AD 1,5 03 at 40°C**

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## 7.7 Protection Threshold Values

<b>PROTECTION TYPE</b>	<b>THRESHOLD</b>	<b>ERROR</b>
<b>Overtemperature Protection</b>	$>105\text{ }^{\circ}\text{C}$	YES
<b>Undervoltage Power Supply</b>	$>62\text{V}^*$	YES
<b>Undervoltage Power Supply</b>	$<12\text{VDC}^*$	YES
<b>Voltage-controlled braking</b>	$>58\text{VDC}^*$	NO
<b>Ballast Circuit</b>	$>58\text{VDC}^*$	NO

\* Parametrisable with UI

## 8 Installation



### Warning:

Before commissioning, it is essential that the safety instructions in the relevant section are read and understood, and then observed! Non-observance can result in danger to persons or damage to the equipment.

- Disconnect the electrical power supply before any operation on the device!

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## 8.1 Mechanical assembly



### Warning:

During installation, ensure that connectors are not damaged. Bent pins can cause a short circuit and destroy the device.

Check the drive for visible damage before carrying out the installation. Do NOT install damaged devices.

The device must be fastened to a flat surface using 4 screw connections. The flange screws must be prevented from distortion by means of spring washers.

The motor shaft axial and radial loads are:

<b>STRESS TYPE</b>	
<b>Radial load</b>	<i>350N (applied on the shaft center)</i>
<b>Axial load</b>	<i>110N (applied on the shaft center)</i>

## 8.2 EMI compatibility

Electromagnetic radiated interferences occur in the DUET AD and the machine in which the drive is installed. Should no suitable protective measures be implemented, these interferences can influence the signals of control panel wirings and can endanger the system operational safety.

For complying with limits in accordance with DIN EN 61000-6-4 (emission standard for industrial environments), it is necessary to use shielded connection cables as well as low-inductive shield connection for all components.

Further measures can be necessary depending on the application.

For complying with limits in accordance with DIN EN 61000-6-3 (emission standard for residential environments), further measures are required.

These measures can be:

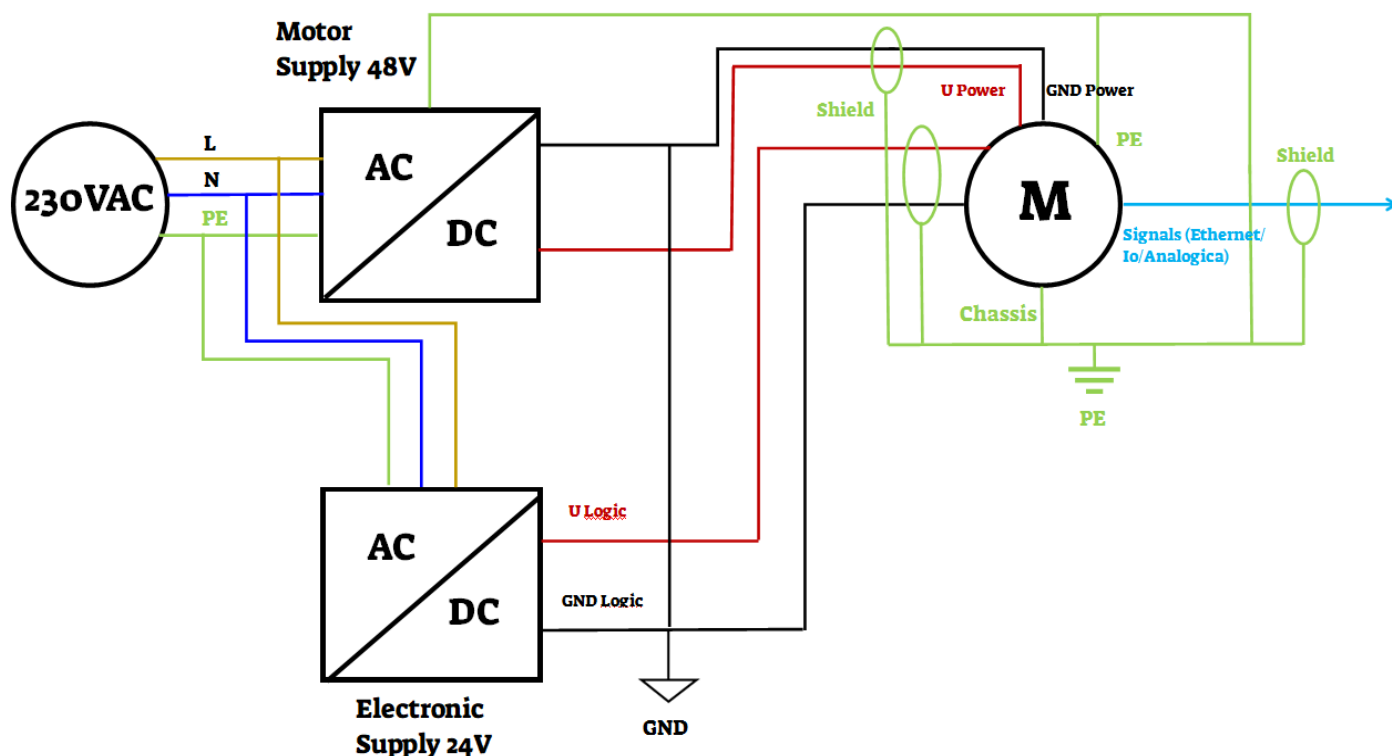
- Assembling the device in metal housing, or metallizing plastic housing
- Low-inductive connection of all components in the system
- Hidden shielded cable routing in metal ducts
- Using additional suppression components (ferrite or filter modules).
- Additional storage capacitors

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The electromagnetic compatibility of the machine must be tested and ensured before it is put into operation.



**Figure 13 EMV Compliant Installation**

- PE: Power Earth/Functional Earth
- Shield all connecting cables or use shielded cables and connect them at both ends to PE
- Only use CE-compliant power supplies.



#### Electromagnetic compatibility

Electromagnetic interferences may be generated that can have a harmful effect on components of the equipment or on other equipment. The equipment may suffer interferences from outer electromagnetic influences. Compliance with CE conformity concerning electromagnetic compatibility and interference-free operation of the equipment is only possible in compliance with the wiring provisions included in these instructions. Further measures may be required.

- Before commissioning, check electromagnetic conformity of your equipment concerning the necessary requirements.
- Install interference filters.
- Earth the equipment additionally.
- Reduce the cable lengths.
- Ensure that the connectors are not damaged during installation.
- Damaged connectors must be replaced before commissioning.

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**Warning:**

High-frequency interference (radio interference)  
If the motor/control electronics are not installed accordingly the instructions in operation, it can create Interference with radio transmission.

- Install interference filters.
- Earth the system additionally.

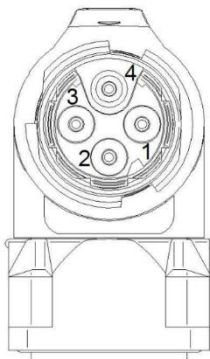
### 8.3 Ground wire

- The motor housing must be connected to the machine earth via a separate earth wire.
- Please do not touch the connector pins.
- If possible, the device should only be handled by persons wearing protective ESD equipment.

**NOTICE:**

To protect the drive against damage or destruction by static discharge (ESD), the motor housing must be earthed. As far as possible, the device should only be handled by persons wearing ESD-protective clothing.

### 8.4 Motor power supply



CONNECTOR PIN	CONNECTION
1	U POWER
2	BALLAST
3	GND
4	PE

**Figure 14 BEDC 894 MR**

For lead colors refers to standard connection cables of Motor Power Company.

**NOTICE:**

Not turning the connector of more than 180°!

**Consequence:**

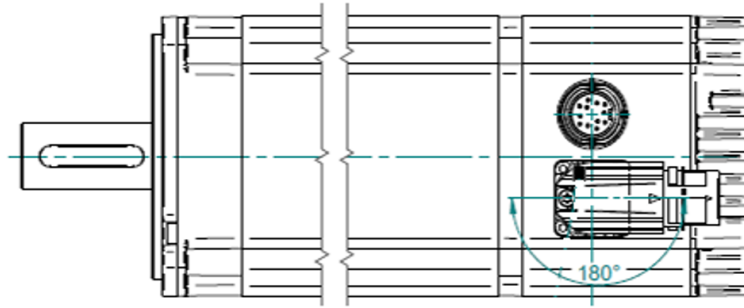
Short circuit, short circuit to frame or malfunction by unfixed wires at the solder point possible

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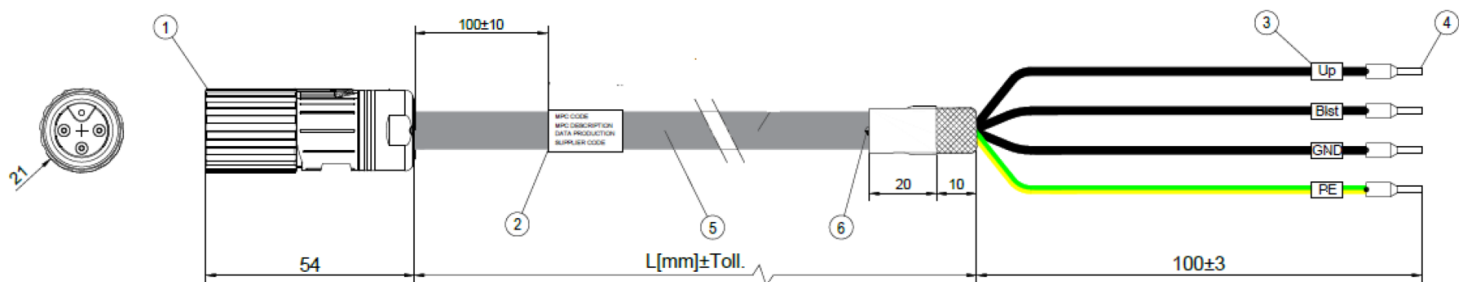
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**Figure 15 Admissible rotation of the power connector arm**



**Figure 16 Mating Power Cable for DUET AD**

#### 8.4.1 Mating connector with cable (please order in addition)

For DUET AD with 4-pin connector, pre-assembled connection cables are available in a range of lengths from stock. On one end these cables have the appropriate 4-pin right-angle connector already fitted.

The following cable lengths are available:

- Cable length 5000mm MPC code 003108020546
- Cable length 1000mm MPC code 003108020575

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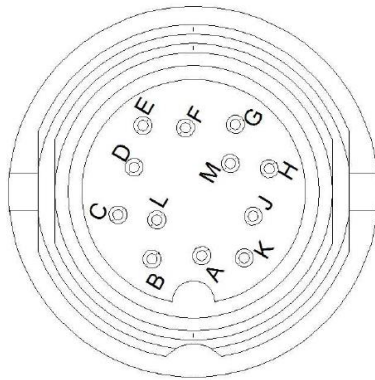
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## 8.5 Signal interface supply

The connector is round plug to DIN 45326, Binder, Series 723

The 12pin motor connector is for logic supply of the motor.



**Figure 17 Din 45236 12-pin**

CONNECTOR PIN	CONNECTION	FUNCTION	STANDARD COLOUR OF THE CABLE
<b>A</b>	IN0	Enable Motor	
<b>B</b>	IN1	Input Polarity	
<b>C</b>	IN2	Parameterisable via UI	
<b>D</b>	IN3	Parameterisable via UI	
<b>E</b>	OUT1	ERROR	
<b>F</b>	OUT2	Parameterisable via UI	
<b>G</b>	AI+	Analogue set value N+ (0...+10V)	
<b>H</b>	AI-	Analogue set value N- (reference for N+)	
<b>J</b>	UC	Logic supply 24V	
<b>K</b>	GND	Ground for UC	
<b>L</b>	SERVICE+	RS485 A for UI connection	
<b>M</b>	SERVICE-	RS485 B for UI connection	



### NOTICE:

Not turning the connector of more than +45°/ - 45°.

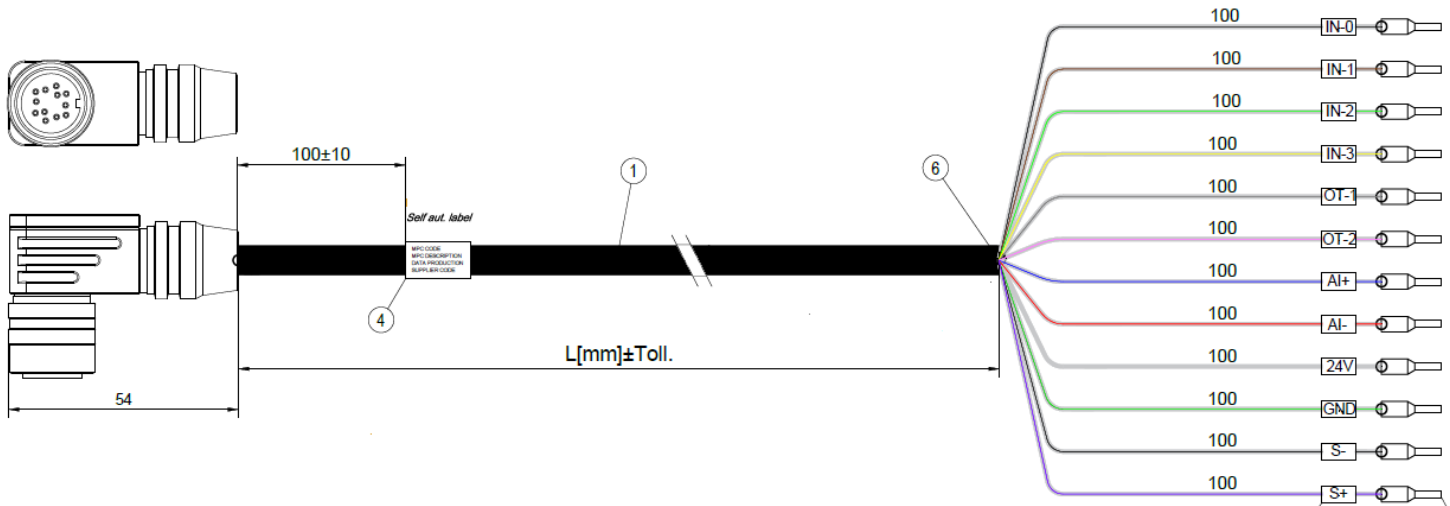
### Consequence:

Short circuit, short circuit to frame or malfunction by unfixed wires at the solder point possible.

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**Figure 18 Connector Signal Cable 12-pin**

Lead colors refer to standard connection cables of Motor Power Company.

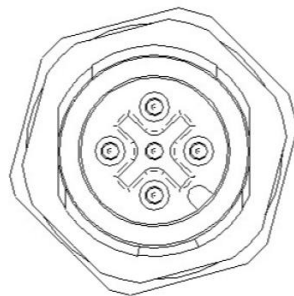
The following cable lengths are available

- Cable length 5000mm MPC code 003108009843
- Cable length 3000mm MPC code 003108009615
- Cable length 1000mm MPC code 003108009576

## 8.6 CANopen Fieldbus Connection (only for CO/IO versions)

The CANopen interface and the connectors used correspond to the CiA 303-1-standard. This standard contains all notes necessary for wiring, topology and cable lengths.

Occupation and function correspond to the CiA standard 5-pin micro style connector.



**Figure 19 CN M12 5p Male Type A**

The 5-pin motor connector serve as interfaces with the CAN bus.

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Several length of cables are available on the market. Motor Power Company can supply cables on demand.

<b>N°PIN</b>	<b>CONNECTION</b>
<b>1</b>	<i>n.c.</i>
<b>2</b>	<i>n.c.</i>
<b>3</b>	<i>CAN GND</i>
<b>4</b>	<i>CAN-H</i>
<b>5</b>	<i>CAN-L</i>

## 8.7 Industrial Ethernet Connection

The Industrial Ethernet interface comprises an input and an output socket. They are suitable for d-coded M12 connectors. Notes on network setup and relevant standards are available from the user organizations of the respective Industrial Ethernet interfaces, e.g. PI (Profibus & Profinet International) for Profinet.

Several length of cables are available on the market. Motor Power Company can supply cables on demand.



**Figure 20 CN M12 4p Female Type D IN&OUT**

<b>N°PIN</b>	<b>CONNECTION</b>
<b>1</b>	<i>TD+</i>
<b>2</b>	<i>RD-</i>
<b>3</b>	<i>TD-</i>
<b>4</b>	<i>RD-</i>

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## 8.8 Maximum cable length and power supply

<b>MIN. POWER SUPPLY [V]</b>	<b>MAX. CURRENT [A]</b>	<b>CONDUCTOR CROSS SECTION [MM<sup>2</sup>]</b>	<b>MAX. RECOM- MENDED CABLE LENGTH [M]</b>	<b>STANDARD CABLE LENGTH [M]*</b>
21,6	50	2,5	4,4	1
24,0	50	2,5	8,7	5

The table above is referred to DUETAD 1,5 03

\*) Can be ordered at Motor Power Company

If the supply of power and logic electronic is processed by separate power sources, the following cable lengths are available:



### NOTICE:

If the power supply and logic are plugged together to 24V DC power source, a safe operation is not always guaranteed!

- Possible consequence:
- Low voltage cut off
- Destruction of Logic for overvoltage
- Motor reset




**Mind the maximum cable length for low voltage!**

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## 9 Connection schematic

	<p><b>Warning:</b></p> <p>Before commissioning, it is essential that the safety instructions in the relevant section are read and understood, and then observed! Non-observance can result in danger to persons or damage to the equipment.</p> <p><b>Disconnect the electrical power supply before any operation on the device.</b></p>
	<p><b>CAUTION:</b></p> <p>Incorrect connection of motor power electronics. The motor is not equipped with reverse polarity protection. Consequence: Destroying of the power electronics possible.</p> <p><b>Check the right polarity.</b></p>
	<p><b>NOTICE:</b></p> <p>Loops must be avoided for all grounding concepts. Shielded cable must be used for the whole cable system without interruption. Up to a length of 10m a common power and signal cable can be used. If the cable is longer than 10m it is recommended to separate power and signal in different shielded cables. When standard wires from Motor Power Company are used, the shielding must be spaciouly applied inside the control cabinet.</p>

Failure to follow them can result in danger to persons or damage to the equipment.

### 9.1 Schematic circuit for power supply controller

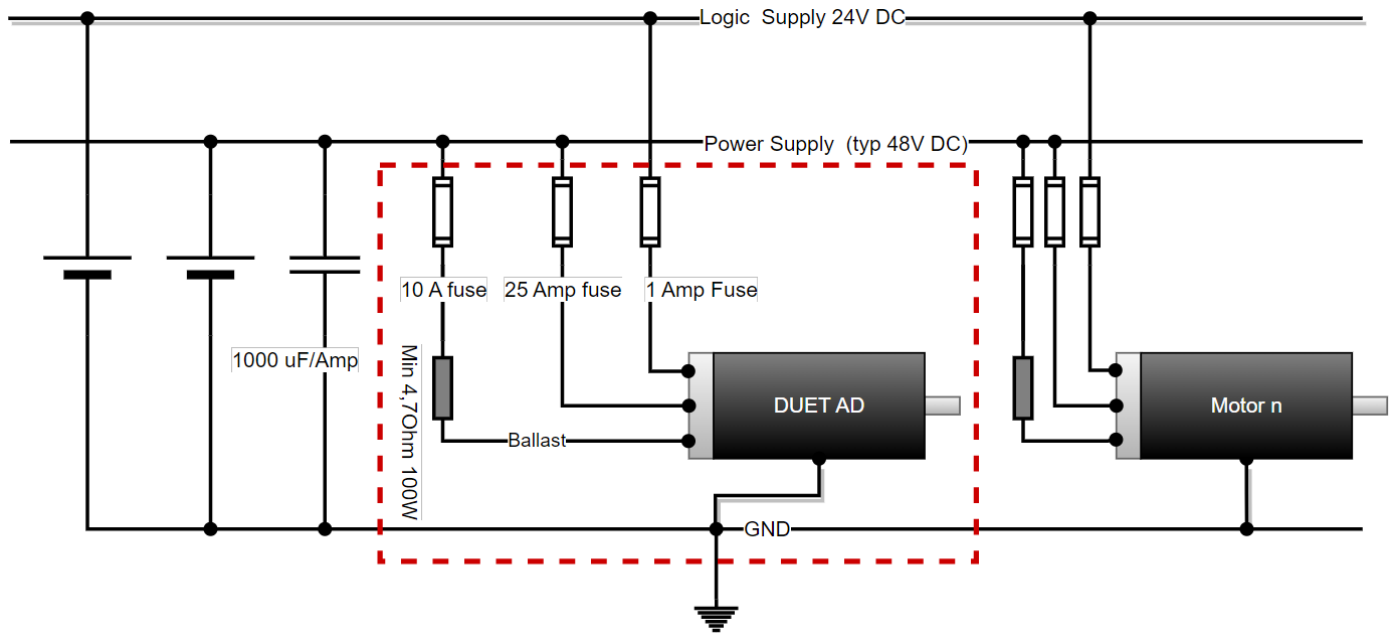
	<p><b>CAUTION:</b></p> <p>Peak current by switching-on of a variety of series-connected motors.</p> <p><b>Consequence:</b></p> <p>Destroying of the integrated electronics possible.</p> <p>► <b>Using a soft start resistor or adequate power supply.</b></p>
---	--

The inrush current must be realized by a soft start function when a variety of motors will be switched on. This is either possible by using of an adequate power supply unit or with a proper circuit.

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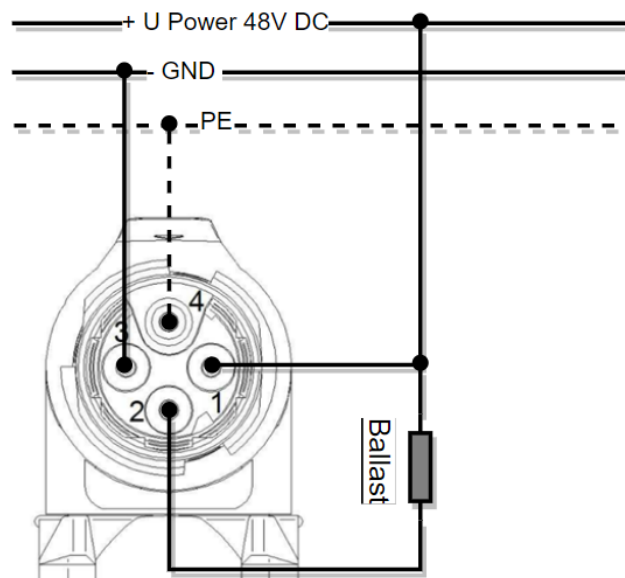




**Figure 21 Schematic Circuit for power supply DUET AD**

The red box of the schematic circuit shows the precisely connection of DUET AD. It is also possible to connect in series more devices as shown.

### 9.1.1 Connection motor power supply

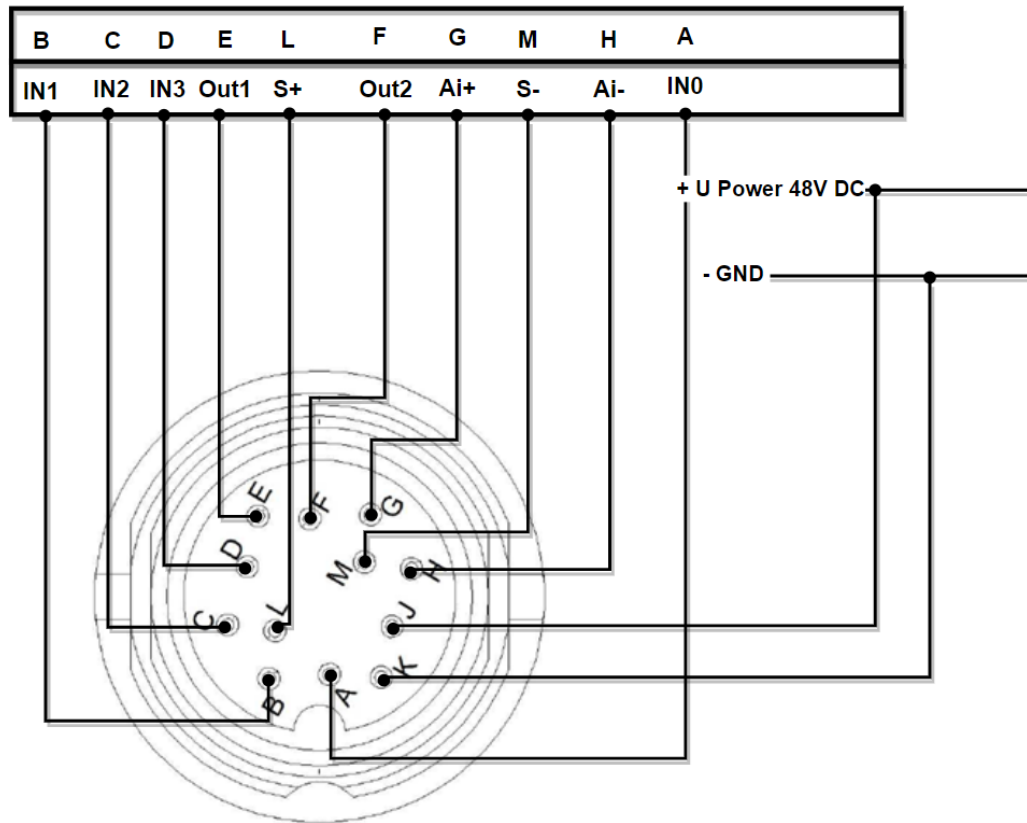


**Figure 22**

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### 9.1.2 Connection signal interface supply



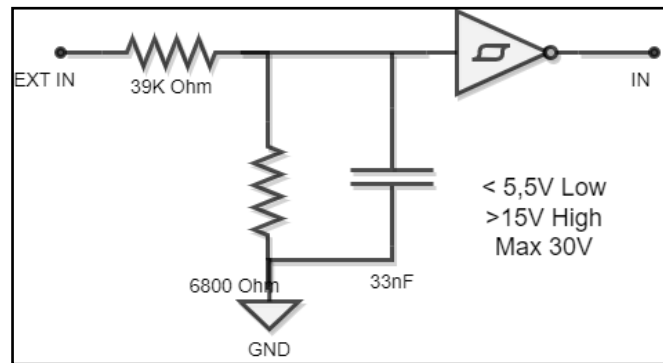
**Figure 23**

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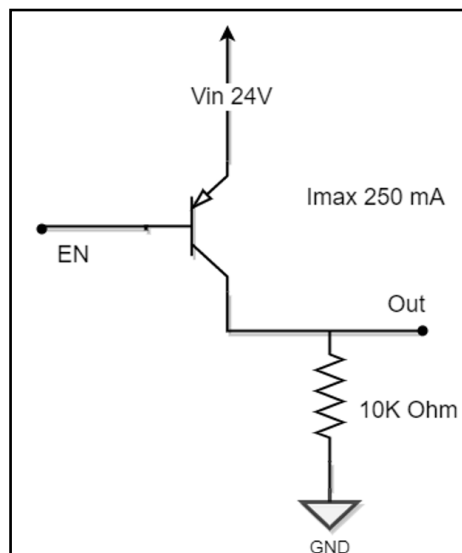


### 9.1.3 Schematic circuit of the digital inputs



**Figure 24 Digital Input Circuit Diagram**

### 9.1.4 Schematic circuit of the digital outputs

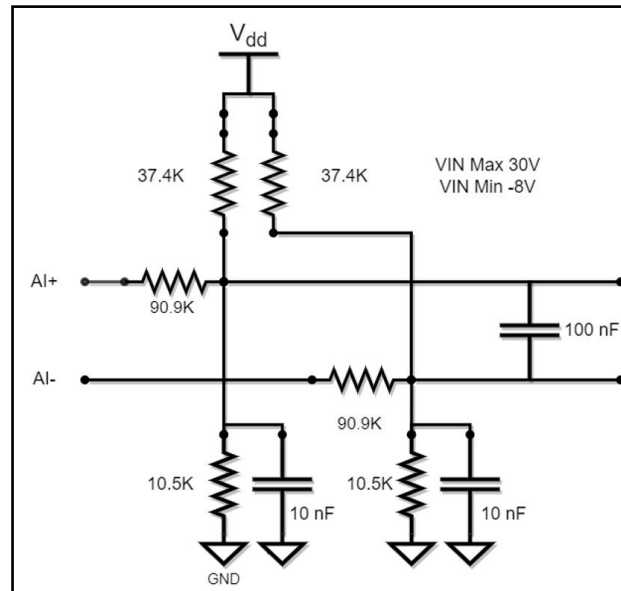


**Figure 25 - Figure 18 Digital Output Circuit Diagram**

### 9.1.5 Schematic circuit of the Analog Inputs

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**Figure 26 Analog Input Circuit Diagram-Range +/- 10V**

## 10 Starter Kit For Duet AD – Connecting UI to device

The starter kit establishes a connection between the commissioning computer and the motor electronics. This allows DUET AD to be extensively parameterised and optimised. UI commissioning software is required for this as well as the usb to rs485 converter.

Please order the USB/RS485 converter form Motor Power Company:

- USB/485 USB2-H-5001 MPC code 005016000175



### NOTICE:

Be sure that deep-switches of the device will set as follow (Echo OFF - Termination ON)



- Install and open UI servo interface
- Connect DUET AD to USB/485 Converter as follow:

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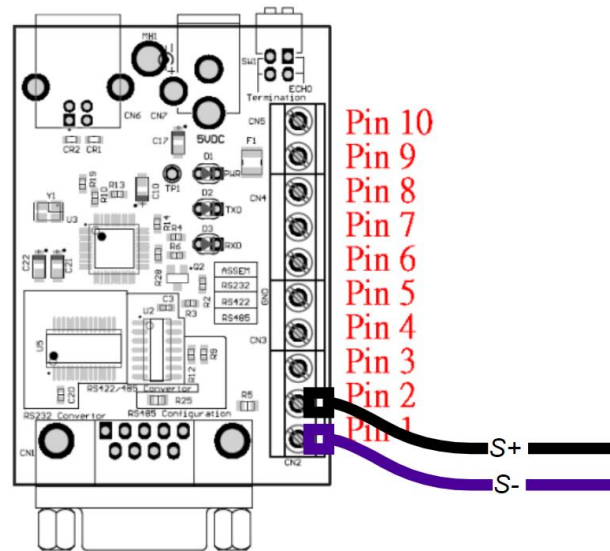


Figure 27

- Open UI and select Tool tab, then select Connection parameters

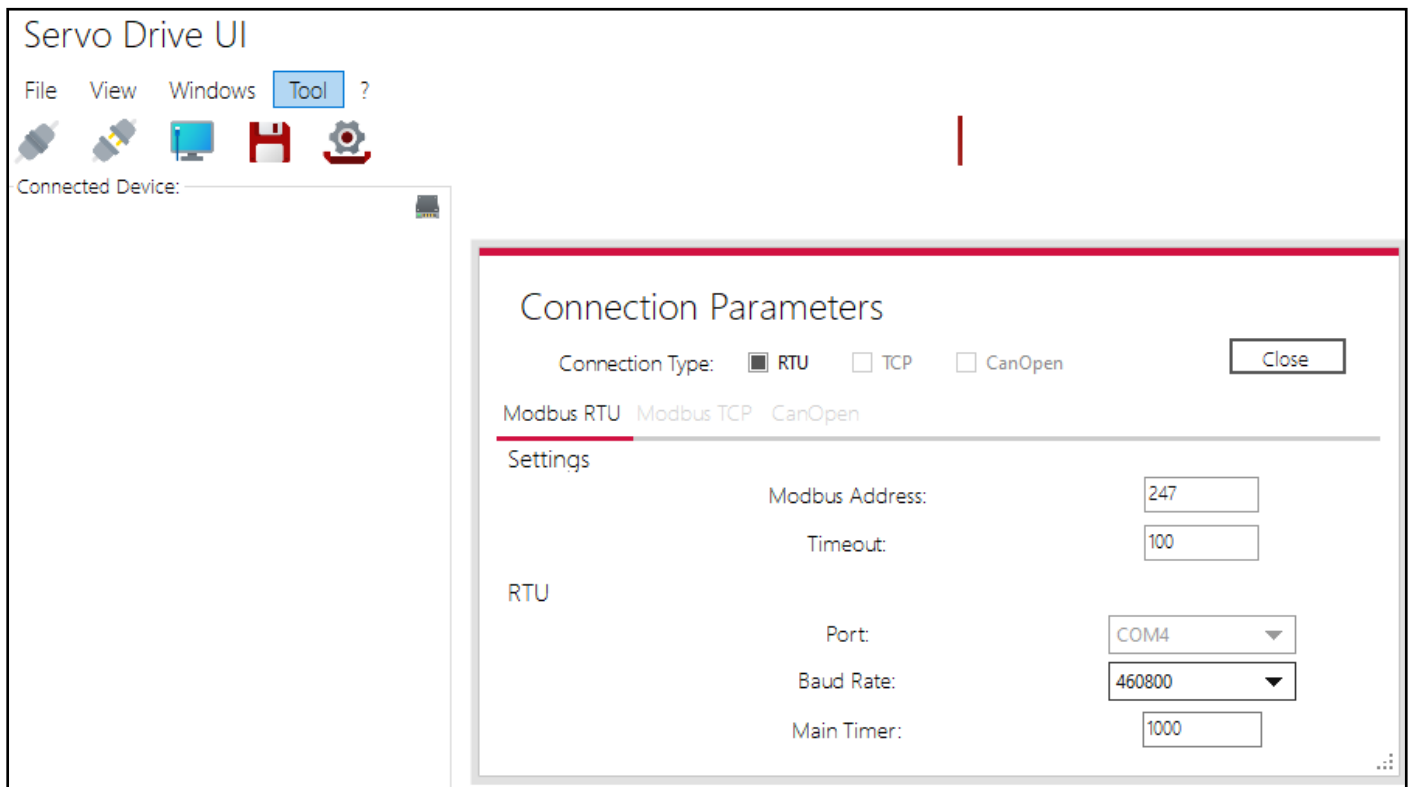


Figure 28

- Set the proper COM Port for your device
- Please ensure that connection parameters are as follow:

PARAMETER	VALUE
<b>Modbus Address*</b>	247
<b>Baud Rate*</b>	460800-

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**\*NOTICE:**

Changing this values may cause device to disconnect/not connect anymore to UI interface. Only expert users are allowed to do that

- Power on the device and click connect to device button

Servo Drive UI

File View Windows Tool ?

Axis #1: [0/0] Servo Ready | Axis #2: [0/0] Servo Ready

Connected Device:

- Pallet Conveyor Profinet
  - Pallet Conveyor Information
  - Device Parameters**
  - Device Input
  - DeviceOutput
  - Axis #1
  - Axis #2
  - Dump
  - Input/Output

Generic Parameters

Address	Parameter	Data	Unit
2	Bus Nominal Voltage	48	V
3	PWM Frequency	8	kHz
5	Serial Port Baud Rate	3	-
6	Modbus Address	247	-
8	CanOpen Node ID 1	1	ID
9	CanOpen Node ID 2	2	ID
10	CanOpen Bit Rate	0	Enum
14	User Program Enable	1	bool
15	User Program Type	5	bool
16	User Program Axis Sel	1	Enum
17	User Program Paramet...	0	Enum
18	User Program Paramet...	0	-
19	User Program Paramet...	0	-
20	Input 1 Function	0	-
21	Input 2 Function	0	-

Modbus Charts Scope CanOpen Profinet EtherCAT EthernetIP

[Timer: 85 ms - 8,50% ]  
 [Timer: 77 ms - 7,70% ]  
 [Timer: 85 ms - 8,50% ]  
 [Timer: 78 ms - 7,80% ]  
 [Timer: 94 ms - 9,40% ]  
 [Timer: 92 ms - 9,20% ]  
 [Timer: 95 ms - 9,50% ]  
 [Timer: 78 ms - 7,80% ]  
 [Timer: 94 ms - 9,40% ]  
 [Timer: 78 ms - 7,80% ]  
 [Timer: 94 ms - 9,40% ]  
 [Timer: 98 ms - 9,80% ]

**Figure 29**

Please contact Motor Power Company support for operations. Follow UI manual and device Modbus manual for any need.

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## 11 Maintenance & Service

### 11.1 Maintenance, taking out of service and disposal

	<p><b>Injury</b></p> <p>The drive units may move unexpectedly in spite of continuous maintenance or servicing, since third parties may start them up. This situation may cause death or severe injuries.</p> <ul style="list-style-type: none"> <li>• Ensure that no one can start the electrical drive unit while you are working on it.</li> </ul>
--	--

The drive unit is maintenance-free if properly integrated and operated as intended. In case of a fault, contact us directly and have any repairs on the drive unit only performed by Motor Power Company.

#### Taking Out of Service:

	<p><b>NOTICE:</b></p> <p>The safety instructions must be read and observed prior to taking the unit out of service.</p>
	<p><b>Risk of crushing</b></p> <p>Note that magnets may be contained with strong magnetic fields that are attracted by other magnets or ferromagnetic materials.</p> <p>Remove and dispose of magnets only with upmost care.</p>

#### Disposal:

Take the drive out of service (see above). Dismantle the drive ready for disposal and break it up into its individual components. Sort the individual parts according to material and forward for disposal. Adherence to the requirements of legislation governing disposal and environmental guidelines in the country of use must be ensured when disposing of electronic components and gear lubricant.

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## **11.2 Service & Support**

Should you have any questions or problems, please contact:

- Our local distributor
- Our Location Worldwide

You can also visit our online support at:

<http://www.motorpowergroup.com>

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