

# 400V MDU POWER MODULE AND MDU CONTROL MODULE SET

## APPLICATION MANUAL V 1.1



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## CAUTION

- This product is designed to drive a four-phase 10 kW Switched Reluctance Motor manufactured under the license issued by the KASKOD-MTRONIX OÜ.  
Read through this instruction manual and be familiar with the handling procedure for correct use.
- Improper handling might result in incorrect operation, a short life, or even a failure of this product as well as the motor.

All MDU modules undergo a final test, and sealed before delivery. Inwards goods tests of the components at the recipient's site are therefore not required. In case of violation of the sealing the warranty will not be accepted.

After an additional and final visual inspection, the components ready for shipping are packaged in an ESD protected transport box.

Once the user has removed the components from the ESD protected shipping box, further processing should occur in accordance with the directive according to chapter 1.

### 1. MDU MODULES ARE ELECTROSTATIC SENSITIVE DEVICES (ESD)

IGBT semiconductors are electrostatic sensitive devices which require to be handled according to the ESD directives. Uncontrolled discharge, voltage from non-earthed operating equipment or personnel as well as static discharge or similar effects may destroy the devices. The collector - emitter control terminals are electrostatic sensitive contacts.

Electrostatic discharge (ESD) may partially or even completely damage MDU modules.

The user must observe all precautions in order to avoid electrostatic discharge during handling, movement and packing of these components.

#### **Important notice:**

**In order to avoid destruction or pre-damage of the semiconductor components through electrostatic discharge the devices are delivered in suitable ESD packaging according to the ESD directives.**

**The installation of ESD workstations is required to unpack the modules and thus remove the ESD protection as well as handling the unprotected modules.**

- Subsequent work steps are only to be carried out at special work stations complying with the following requirements
  - High impedance ground connection
  - Conductive workstation surface
  - ESD wrist straps
  - All transport equipment and have to be brought to the same potential prior to further processing of the ESD sensitive components.

Further information can be derived from the standards in their current versions.

- IEC 61340-5-2, Electrostatics–protection of electronic devices from electrostatic phenomena – general requirements
  - ANSI/ESD S2020
  - MIL-STD 883C, Method 3015.6 for testing and Classification
  - DIN VDE 0843 T2, identical with IEC801-2

## 2. MDU MODULES EPOXY POTTING

Very simply described, potting is when a 1 or 2-component liquid potting compound is applied over a bordered printed circuit board or a housing, until all components are covered.

When the potting compound is dried and hardened, all components are encased into a solid mass. This protects the electrical circuit from humidity, dust, pollution, vibrations and shock. It also enhances electrical insulation, the flame retardation, assembly robustness during transportation and installation. Encapsulated PCB assemblies also significantly increase the affection safety against electrical shocks at the point of usage.

Potting process:

Removing the modules from the ESD protected antistatic bag, further processing should occur in accordance with the directive according to chapter 1.

Potting area must be cleaned without any dust, grease, oil and metal powder particles.

To ensure the optimum level of protection and avoid harming delicate components, care must be taken when applying and curing potting compounds. Inner MDU modules surface are cleaned from grease in order to achieve good adhesion. During application, the liquid potting material must flow easily so that it completely covers the component, leaving no voids. If air becomes trapped in the housing, the moisture it contains may cause corrosion — eventually leading to component or product failure.

Most epoxy and silicone potting compounds are two-part systems (resin and hardener). They take 24 to 48 hours or longer to cure, although the cures can be accelerated by adding heat. Do not exceed cure temperature more than 80°C, otherwise this temperature can damage electronic components.

After the potting and cure procedure, modules have to be placed again in ESD protected antistatic bag.

Important notice:

Applying power supply high voltage and operation is not permitted of the unpotted modules.

## 3. ENVIRONMENTAL PRECAUTION

The environment will directly affect the proper operation and the life of the MDU modules, so install the MDU module in an environment complies with the following conditions:

- Ambient operating temperature: -10°C - +55°C;
- Ambient storage temperature: -40°C - +60°C;
- Avoid exposure to water or moisture.
- Avoid direct sunlight.
- Avoid smoke and salinity.
- Avoid erosive liquid and gas.
- Avoid dust, bats, and small metal pieces.
- Keep away from radiative and flammable materials.

## 4. MDU MODULES POWER REQUIREMENT

### For US market:

#### **Tree phase input power:**

Rated Input Power Voltage 480V must be within +10% and -10%

- Frequency range must be within 50 - 60Hz;
- Max power consumption - 12 kW;

#### **Single phase input power:**

Rated Input Power Voltage 230V must be within +10% and -10%

- Frequency range must be within 50 - 60Hz

This machine may be powered by a generator or transformer which fulfills the following conditions:

#### **Tree phase alternator:**

- AC voltage, output power not less 20 kVA
- The operating voltage 480V must be within + 10% and -10%
- Frequency range must be within 50 - 65Hz;
- Automatic voltage regulation with starting boost

#### **Single phase alternator:**

- AC voltage, output power not less 6 kVA
- The operating voltage 230V must be within +10% and -10%
- Frequency range must be within 50 - 65 Hz;
- Automatic voltage regulation with starting boost

**Do not operate at the same time more than one motor or other power devices, with a generator or transformer.**

**Switching other machines or devices on and off may cause overvoltage peaks, resulting in damage to the MDU electronic units.**

#### **Important notice:**

**Overvoltage threshold protection - 550V AC  $\pm$ 20%**

### For EU market:

#### **Tree phase input power:**

- Rated Input Power Voltage 400V must be within +10% and -10%
- Frequency range must be within 50 - 60Hz
- Max power consumption - 12 kW;

#### **Single phase input power:**

- Rated Input Power Voltage 230V must be within +10% and -10%
- Frequency range must be within 50 - 60Hz;

This machine may be powered by a generator or transformer which fulfills the following conditions:

#### **Tree phase alternator:**

- AC voltage, output power not less 20 kVA
- The operating voltage 400V must be within +10% and -10%
- Frequency range must be within 50 - 65Hz
- Automatic voltage regulation with starting boost;

**Single phase alternator:**

- AC voltage, output power not less 6 kVA
- The operating voltage 230V must be within +10% and -10%
- Frequency range must be within 50 - 65 Hz;
- Automatic voltage regulation with starting boost

**Do not operate at the same time more than one motor or other power devices, with a generator or transformer.**

**Switching other machines or devices on and off may cause overvoltage peaks, resulting in damage to the MDU electronic units.**

**Important notice:**

**Overvoltage threshold protection - 550V AC  $\pm$ 20V**

## 5. MDU POWER MODULE OUTPUT PARAMETERS

Number of output phases -	4
Max Peak Current -	80 A
PWM Frequency -	15 kHz

## 6. MDU EMC FILTER

EMC Filter compliant with standards EN(IEC) 61000-6-2:2005, EN(IEC) 61000-6-4:2007

## 7. MDU MODULES MOUNTING MECHANICAL REQUIREMENTS

It is recommended to have an assembly which leaves the power in the middle of the modules (potted area) free of mechanical stress. It must be ensured that the direction of the bias force always acts in the direction of the circumferential end of heatsink. The suitability of the support must be evaluated individually in the structure.

The inter-module connections have to be connected accordingly, observing the common ESD guidelines.

**NOTE: During the MDU module mounting do not exceed the number of connector life-mating cycles!**

**MDU Connectors:**

**HARTING:**

**09 32 000 6107 - Male Contact**

**09 32 000 6207 - Female Contact**

**Mechanical working life-mating cycles:  $\leq$  100**

**SAMTEC:**

**ESQ-104-14-G-D - Elevated Socket, 2x4 Pins**

**Mechanical working life-mating cycles:  $\leq$  100**

## 8. RECTIFIR MOUNTING REQUIREMENTS

The application of thermal paste is one of the most critical steps in the assembly process. It is necessary to achieve an even, homogeneous and reproducible paste layer. Uneven paste layers may lead to mechanical stress at the rectifier and the substrate and inadequate distribution of the thermal resistance between the base plate and the heat sink.

The first step should be the cleaning of the heat sink and the base plate surface with isopropanol or ethyl alcohol. Use a non-fuzzing rag and wearing gloves. The contact surface of the module and the heat sink must be free from damage and contaminants like grease, paste residues or particles.

1. Apply a sufficient amount of paste (Keratherm KP97 of KERAFOL GmbH).
2. Dispense the paste by a crosswise move of a scraper or putty knife. Make sure that the entire surface of the heatsink is properly filled.
3. Finally mount the module with screw M4 to the heat sink with mounting torque  $2Hm \pm 10\%$ .

**NOTE: Edition 01.02.2015 For modules starting with the number 405131, inclusive.**

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