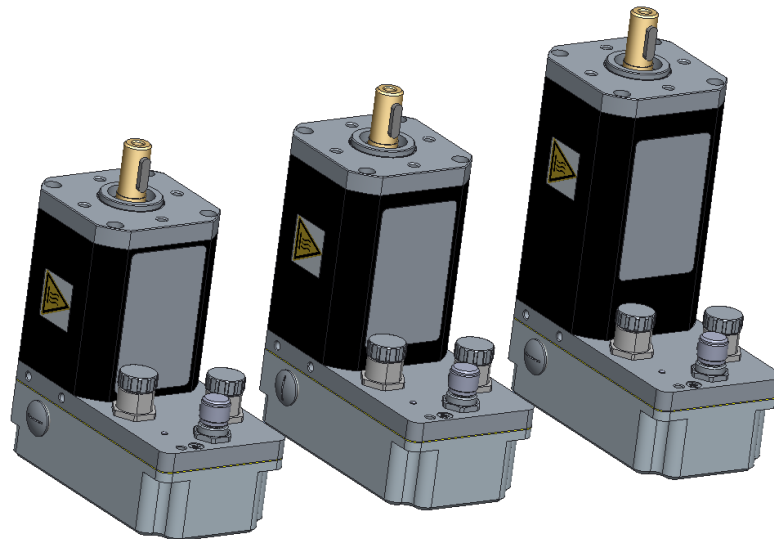


# PRODUCT USER MANUAL

## SMI22 CANopen



### Important Notes

- This manual is part of the product.
- Read and follow the instructions in this manual.
- Keep this manual in a safe place.
- Give this manual and any other documents relating to the product to anyone that uses the product.
- Read and be sure to comply with all the safety instructions and the section "Before you Begin - Safety-Related Information" in the document "Safety User Manual"
- Please consult the latest catalogue to find out about the product's technical specifications.
- We reserve the right to make modifications without prior notification.

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## About This Manual

This manual applies to SQ75 CANopen brushless products:

- 80350,
  - 80360,
  - 80370,
- And all gearboxes adaptation.

### *Reference source for manuals*

The manuals can be downloaded from our website at the following address:

<http://www.crouzet-motors.com/>

### *Units*

SI units are the default values.

## Risk Categories

In this manual, safety instructions are identified by warning symbols.

Depending on how serious the situation is, the safety instructions are split into 3 risk categories.

 **DANGER**

DANGER indicates a directly dangerous situation which, if the instructions are not followed, will **inevitably** lead to a serious or fatal accident.

 **WARNING**

WARNING indicates a possibly dangerous situation which, if the instructions are not followed, will **in some cases** lead to a serious or fatal accident or cause damage to equipment.

 **CAUTION**

CAUTION indicates a potentially dangerous situation which, if the instructions are not followed, will **in some cases** lead to an accident or cause damage to equipment.

## 1. INTRODUCTION

### 1.1. Motor Family

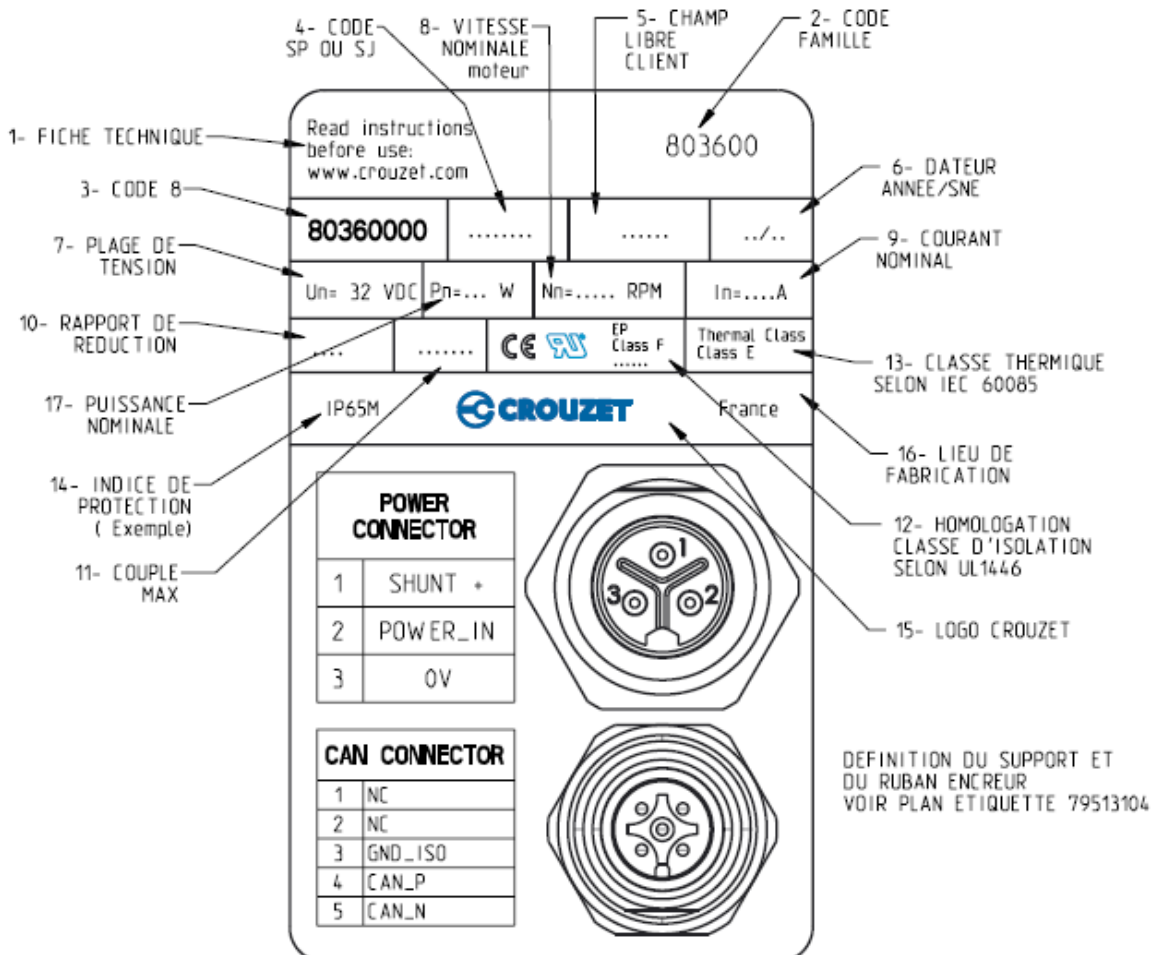
SQ75 brushless motors are brushless DC motors, with a control circuit board integrated in the motor.

### 1.2. Characteristics

SQ75 brushless motors are intelligent servomotors for speed, position and torque control applications. They can be configured via a Human-Machine Interface (HMI) with CANopen or USB communication bus. They are equipped with 3 industrial connectors, 1 for power, 1 for the control signals and 1 for the CANopen communication.

### 1.3. Identification Label

The label contains the following data:



### 1.4. Product Coding

Three firsts digits	4th digit	5th digit	6th digit	7th digit	8th digit
<b>803</b>	<b>5</b> = Rotor 37,5mm	<b>0</b> : direct motor IP69	<b>0</b> : with integrated drive	0 à 3: SMI22 CAN (if 6th digit = 0 ou 1)	from 0 to 9
	<b>6</b> = Rotor 50mm	<b>D</b> : P72	<b>1</b> : with integrated drive + brake	4 à 6: SMI22 (without CAN) (if 6th digit = 0 ou 1)	
	<b>7</b> = Rotor 75mm	<b>E</b> : P81	<i>4 : hall effects</i>		
		<b>2</b> : RAD20	<i>5 : Hall effects + brake</i>		

### **1.5. Standards and concepts**

The product is ROHS confirmed following European Directive 2011/65/CE. Following this confirmation, the product is CE marked.

The electrical design follows the IEC 60335-1 and IEC 60950-1 standards.

## **2. OPTIONS AND ACCESSORIES**

The motors can be supplied with options, such as:

- Different gearboxes
- A failsafe holding brake
- Different motor output shaft versions

### *2.1.1. Holding brake*

SQ75 brushless motors can be equipped as standard with a failsafe electromechanical brake.

The holding brake is designed to lock the motor shaft in a de-energized state.

The holding brake is not a safety function.

A motor with a holding brake needs a corresponding control logic which releases the holding brake at the start of the rotation movement, locking the motor shaft in time when the motor stops.

Nota : Outputs are able to drive the electromechanical brake.

Nota : Motor has to be completely stopped before activation of the brake.

### *2.1.2. Gearboxes*

SQ75 brushless motors can be equipped with different types of gearbox.

The gearboxes offered as standard in the catalogue are planetary gearboxes which combine compact size and robust design, and worm gearboxes that allow a shaft output at right-angles to the motor shaft.

### *2.1.3. Other*

Other types of adaptation are possible on request, please contact the sales department.

### *2.1.4. Starter Kit*

This kit consists of:


- a 2-meter long micro USB B to USB A (MOLEX 68784-0003) connecting cable **27 526 005**
- a power cable : this cable can be obtained by ordering part number **79 298 664**
- an I/O cable : this cable can be obtained by ordering part number **79 513 106**
- a CAN cable M12 M/F : this cable can be obtained by ordering part number **27 358 015**
- a bus terminating resistor : this resistor can be obtained by ordering part number **27 358 014**
- a D-Sub bus connector **27 358 017**
- an USB to CAN converter (PEAK System reference IPEH-002021) **27 358 016**
- an USB stick containing the "DCmind Soft + CANopen Interface" parameter-definition software and installation drivers for this HMI.
- A T (F-M/F) CAN connector **27 358 020**

This starter kit can be obtained by ordering part number **79 513 105**

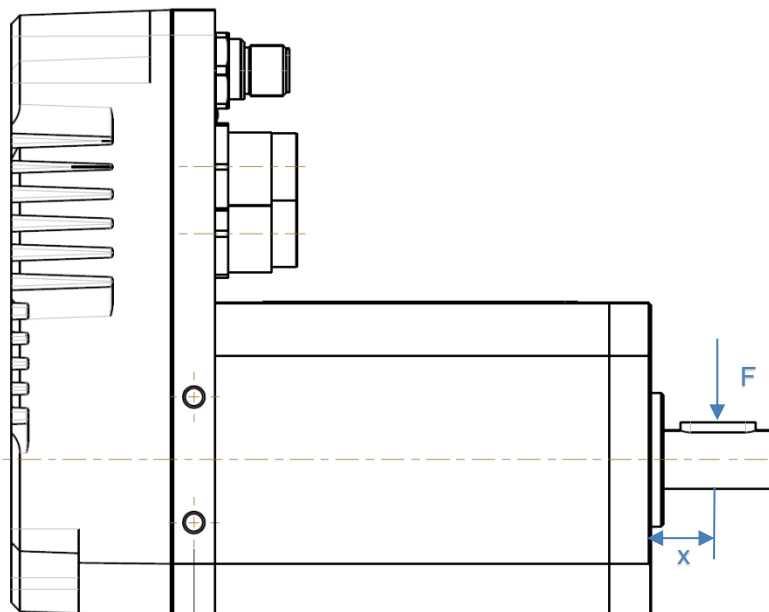


### 3. PRECAUTIONS FOR USE CONCERNING THE MECHANICS

#### 3.1. Data specific to the motor shaft

 <b>WARNING</b>
<p><b>MOTOR MECHANISM</b>                  Exceeding the maximum permissible forces on the shaft leads to rapid bearing wear, a broken shaft or damage to any accessories (encoder, brake, etc.)</p> <ul style="list-style-type: none"> <li>• Never exceed the maximum axial and radial forces.</li> <li>• Protect the shaft from any impact.</li> <li>• When press-fitting components, do not exceed the maximum permissible axial force.</li> </ul> <p><b>Failure to comply with these precautions can result in death, serious injury or damage to equipment.</b></p>

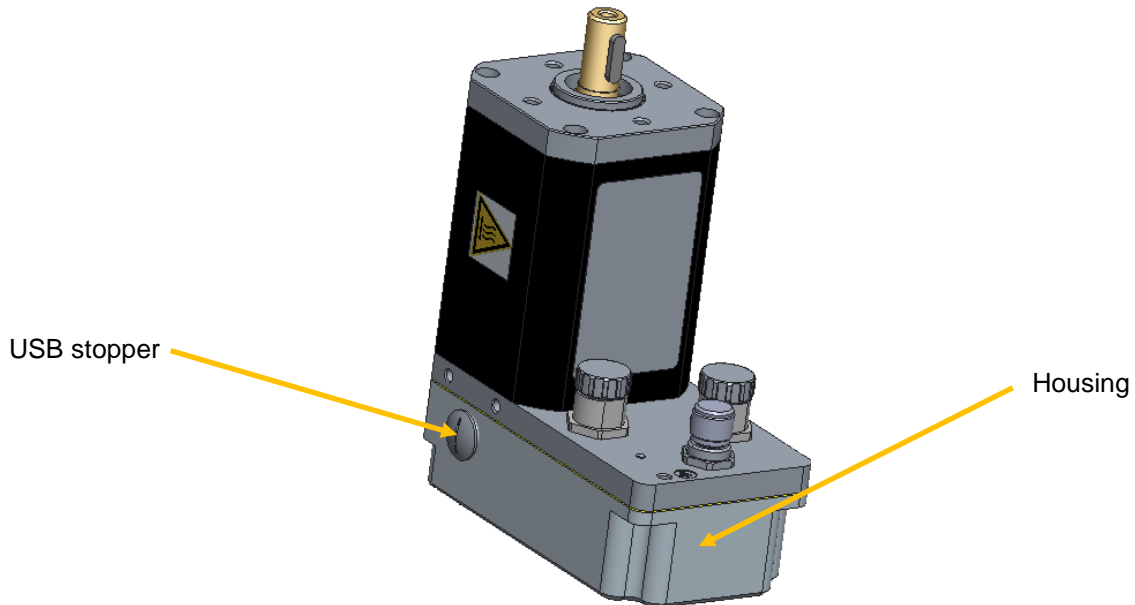
#### Radial load on the shaft



The application point **X** of the radial force **F** depends on the motor size.  
 This information appears in the motor technical data sheet.

The maximum axial and radial loads must not be applied simultaneously.

### 3.2. USB Connector



The motor is equipped with a micro USB connector, which can be accessed by removing the stopper from the housing.

The stopper prevents penetration of foreign bodies or fluids inside the motor.

The stopper prevents fingers or any inappropriate object making contact with the micro USB connector.

For any other connector, when not used, stoppers have to be mounted.

 **WARNING****UNEXPECTED MOVEMENT DUE TO ELECTROSTATIC DISCHARGES**

Electrostatic discharges (ESD) on the micro USB connector can, in some cases, lead to deterioration or destruction of some system components and generate unexpected motor operation.

- Never touch the connector with your fingers or any inappropriate object.

**Failure to comply with these precautions can result in death, serious injury or damage to equipment.**

 **CAUTION****LOSS OF SEALING**

The stopper ensures the motor is sealed.

- Replace it after completing parameter definition.
- Make a visual check to ensure it is in place.

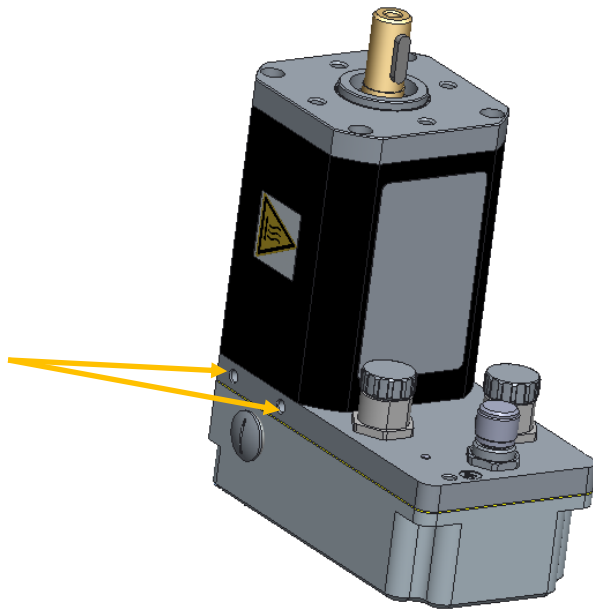
**Failure to comply with these precautions can result in injury or damage to equipment.**

### 3.3. Fixings

Fixing of the product has to be done by using 4 M6 screws with a screwing torque of 7N.m.

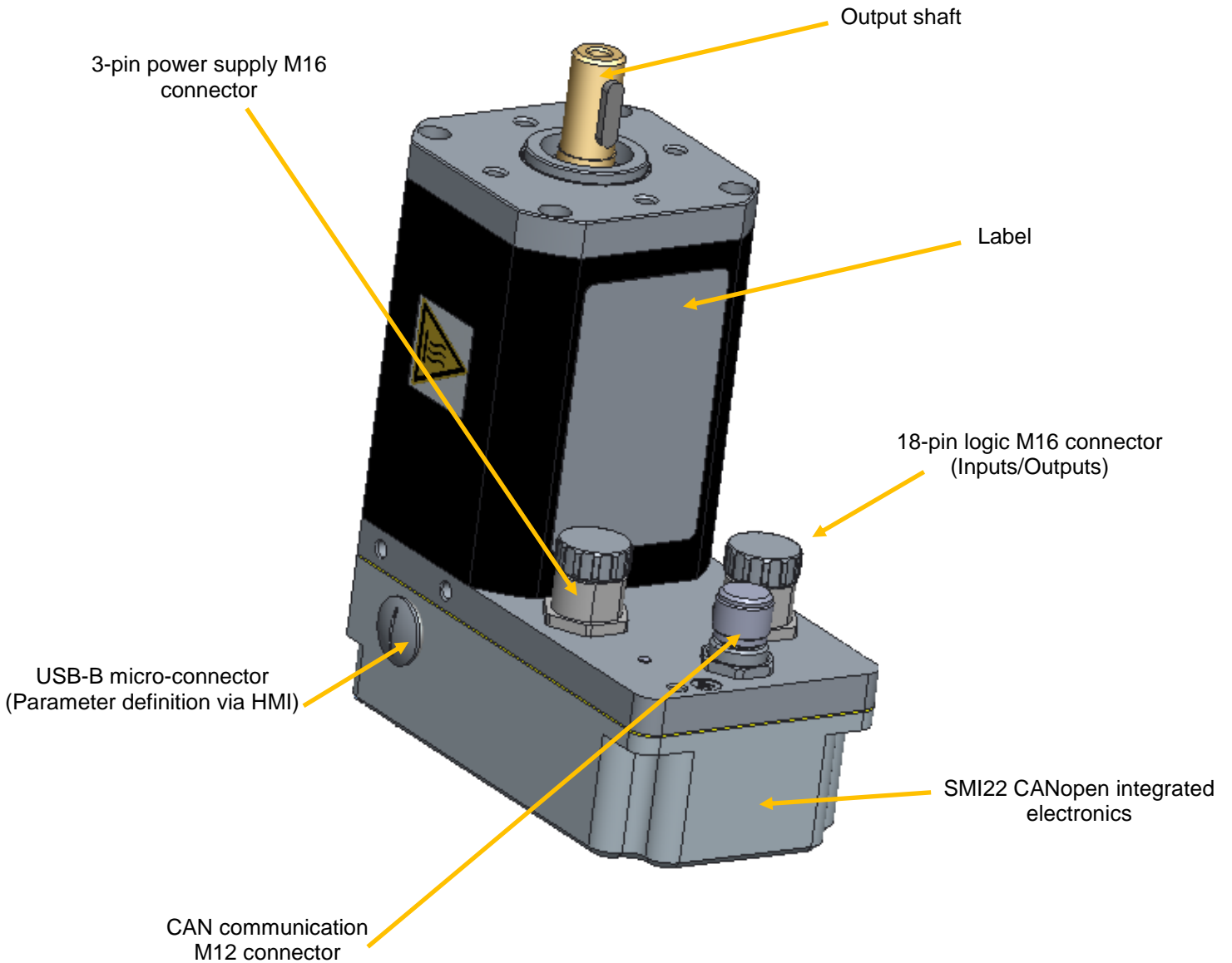
In case of gearmotors or for applications subject to strong vibrations, 4 M5 fixing holes can be used to support the weight of the product.( screwing torque of 5N.m)

4x M5 fixing holes  
to support the  
weight of the  
product.



**4. PRODUCT OVERVIEW**

**4.1. Description of the Product**



## 4.2. SMI22 CANopen Control Electronics

The SQ75 CANopen electronic control board contains the control electronics for a brushless motor, integrated in the motor body.

This electronics is used for:

- Power switching of the motor in sine mode (field-oriented control (FOC)) or trapezoidal mode.
- Position-Speed-Torque and Current control algorithms.
- CANopen CiA 301 standard – Application layer and communication profile
- CANopen CiA 402 standard – Drive and motion control device profile
- Use of preconfigured programs which can perform numerous routine applications (DCmind programs).
- Management of different types of operation:
  - "Stand-alone" motor without external PLC.
  - Use with other motors incorporating SMI22 or SMI21 electronics.
  - Use with a programmable controller, with the SMI22 simplifying motor management.
- The interface with parameter-definition software installed on the PC:
  - Easy to use, even by a layman, thanks to simplified application programs that are quick to get up and running.
  - Wide choice of expert programs covering a wide range of applications.
  - CAN connection via a commercially-available standard cable (can be supplied on request).
  - USB connection via a commercially-available standard cable (can be supplied on request).
- Management of 6 inputs, 4 outputs and 2 STO inputs (for safety) to control the motor:
  - 2 inputs that can be configured for 0-10 V 10-bit analog or PWM or digital control
  - 4 digital inputs
  - 2 isolated differential STO inputs (4 leads)
  - 1 output that can be configured as PWM or frequency or digital
  - 1 output that can be configured as PWM or digital
  - 2 digital outputs

As standard, the motors have an internal encoder with 4096 points per revolution that can reach high positioning and control resolutions.

**Note :** For reset the motor by CANOpen (e.g. when Bootloader mode is required), index 0x2FFF sub index 0x00 has to be set at value=0x64747372.

**Note :** The two isolated differential STO inputs have to be connected at high level voltage (>4.6VDC, see '5.1 ELECTRICAL DATA') to allow that the motor operates. If STO inputs are not connected, power stage of the electronic drive is inhibited.

### 4.3. "DCmind-Soft + CANopen" PC Parameter-Definition Software

This software can be downloaded from the Internet at the following address: <http://www.crouzet-motors.com/>  
It can also be supplied as a kit, see "Starter Kit" section.

This "DCmind-Soft + CANopen" software is needed the first time the motor is used and for debugging if you don't have a CANopen master.

It is used for:

- Selecting the motor operating program:
  - Position
  - Speed
  - Torque
  - Homing
  - Quick and easy starting using preprogrammed applications.
  - Use of "expert" programs that provide access to all settings.
- The various settings needed for the application to work correctly.
- Updating the "firmware" motor program using the bootloader function.

For more information, see the HMI user manual dedicated for the "DCmind Soft + CANopen"

## 5. TECHNICAL SPECIFICATIONS

### 5.1. Electrical Data

Maximum Product Specifications				
Parameters	Value			Unit
Supply voltage $V_{DC\ MAX}$	75			V
Maximum current $I_{DC\ MAX}$ (2seconds)	75			A
Maximum input voltage $V_{IN\ MAX}$	90			V
Maximum output voltage $V_{OUT\ MAX}$	24			V
Maximum output current $I_{OUT\ MAX}$	10			mA
Operating Specifications				
Parameters	Min	Typical	Max	Unit
Supply voltage $V_{DC}$	9	24 / 32 / 48	75	V
Current $I_{DC}$	-	15	-	A
Motor consumption when stopped without holding $W_0$	-	1	-	W
Input Specifications				
Parameters	Min	Typical	Max	Unit
Input impedance In1 to In4	-	200	-	k $\Omega$
Input impedance AN5 to AN6	-	107.2	-	k $\Omega$
Low logic level on inputs In1 to In4	-90	-	2.4	V
High logic level on inputs In1 to In4	4.5	-	90	V
Low logic level on inputs AN5 to AN6	-90	-	2	V
High logic level on inputs AN5 to AN6	4.6	-	90	V
Low logic level on STO1 & 2	-2	-	4	V
High logic level on STO1 & 2	4.6	-	75	V
CAN Low level	0.5	1.5	2.25	V
CAN High level	2.75	3.5	4.5	V
Output Specifications				
Parameters	Min	Typical	Max	Unit
Low logic level on outputs Out1 to Out4 $V_{OL}$ $R_L = 4\ K\Omega$ , $V_{DC} = 24\ V$	-	5	10	mV
High logic level on outputs Out1 to Out4 $V_{OL}$ $R_L = 4\ K\Omega$ , $V_{DC} = 24\ V =$ voltage supply added from eventual rejective voltage	-	-	24	V

### 5.2. Generic Data

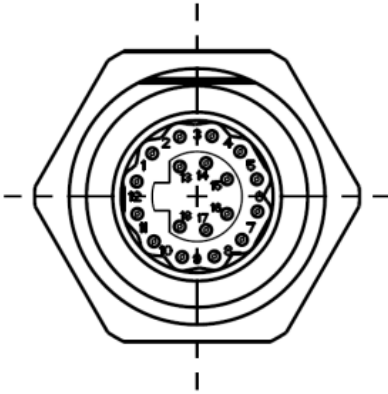
General Specifications		
Parameters	Value	Unit
Ambient motor temperature	-30 to +70	$^{\circ}C$
Insulation class (compliant with directive IEC 60085)	E	/
Ingress protection (excluding output shaft)	IP67 + IP69	/
CANopen compliance	CiA DS 301 and CiA DS 402	/

### 5.3. Logic M16 connector

It's a M16 18-pin industrial male connector

Recommended AWG for the associated cable: AWG24 for wires inside a shielded cable.

(See part "Starter Kit" of this document).



I/O CONNECTOR	
Header : HUMMEL	
7.850.000.000	
Pin : HUMMEL	
7.010.980.801	
Insulation :	
HUMMEL	
7.003.988.101	
1	VLOGIC
2	0V
3	AN_1 (INPUT_6)
4	AN_2 (INPUT_5)
5	INPUT_1
6	INPUT_2
7	INPUT_3
8	INPUT_4
9	0V
10	OUTPUT_1
11	OUTPUT_2
12	OUTPUT_3
13	OUTPUT_4
14	0V
15	STO 2-
16	STO 2+
17	STO 1-
18	STO 1+

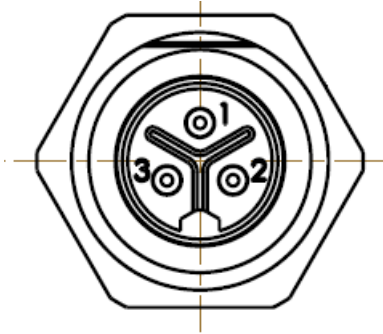
With cables more than 3 m long, tests must be performed in situ.



### 5.4. Power Supply M16 connector

It's a M16 3-pin industrial male connector.

Recommended AWG for the associated cable: AWG14 for wires inside a shielded cable.  
(See part "Starter Kit" of this document).



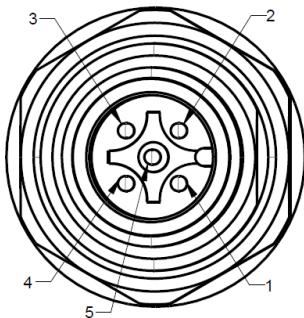
POWER CONNECTOR	
Header : HUMMEL	
7.850.000.000	
Pin : HUMMEL	
7.010.982.001	
Insulation : HUMMEL	
7.003.983.101	
1	SHUNT +
2	POWER_IN
3	0V

With cables more than 3 m long, tests must be performed in situ.

### 5.5. CAN communication M12 connector

It's a M12 5-pin industrial male connector with standard pinout according to CiA 303-1 recommendations.

Recommended AWG for the associated cable: AWG24 for wires inside a shielded cable.  
(See part "Starter Kit" of this document).



CAN CONNECTEUR	
M12/PG9 : MOLEX	
1200708205	
1	NC
2	NC
3	GND_ISO
4	CAN_P
5	CAN_N

Note that the maximum baud rate depends of the cable length.

**5.6. Connectors part numbers**

		<b>MOTOR</b>	<b>CABLE</b>	
<b>I/O connector</b>	Panel connector	HUMMEL 7.850.000.000	All HUMMEL M16	AWG24 cable
	Insert	HUMMEL 7.003.988.101	HUMMEL 7.003.988.102	
	Contact	HUMMEL 7.010.980.801	HUMMEL 7.010.980.802	
<b>Supply connector</b>	Panel connector	HUMMEL 7.850.000.000		AWG14 cable
	Insert	HUMMEL 7.003.983.101	HUMMEL 7.003.983.102	
	Contact	HUMMEL 7.010.982.001	HUMMEL 7.010.982.002	
<b>CAN connector</b>	MOLEX M12/PG9 1200708205		any compatible connectors (i.g : Weidmüller SAIL- M12GM12G-5S3.0U)	

## 6. MOTOR ELECTRICAL CONNECTION

These motors are not intended to be directly connected to the line supply.

It is the responsibility of the installer to define the electrical protections to be implemented according to the regulations applicable to the end product range of application.

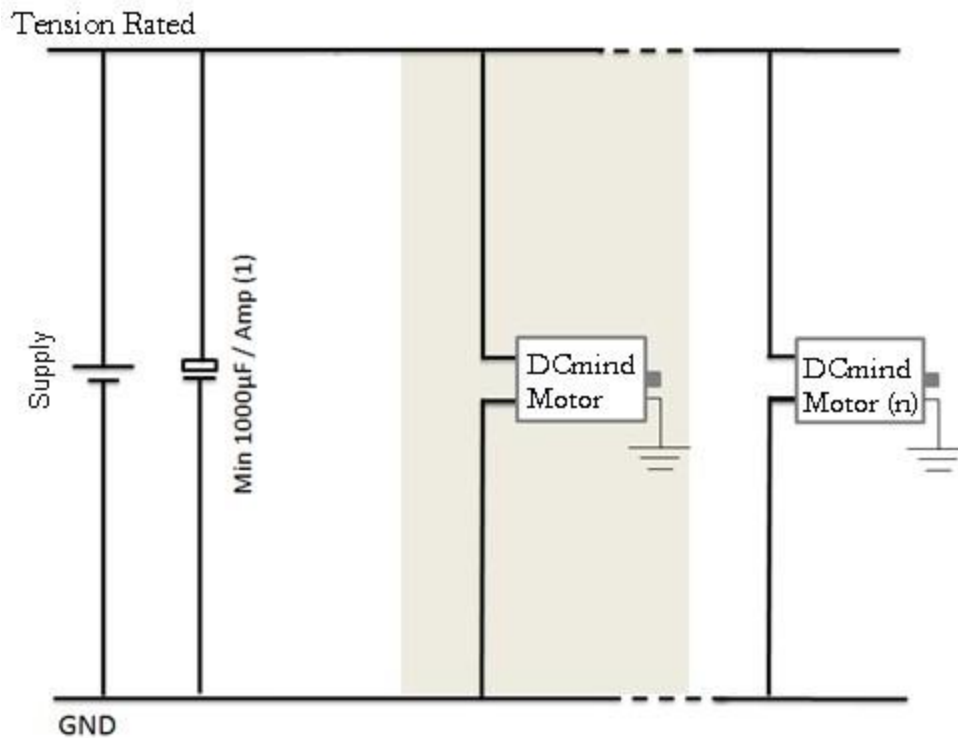
We recommend the use of fuses in accordance with UL248-5 Test 1.3 & 5.

Any precaution must be taken to avoid when, in the event of a first fault, the primary voltage does not go through the supply, and cannot be found on the motor supply connections.

### 6.1. Power Connection

We recommend grounding the motor housing.

*Power connection diagram.*



<sup>(1)</sup> Include capacitors to smooth out inrush currents. Recommended value 1000 µF/A drawn.

### 6.1.1. Ballast Circuit

When the motor brakes, the kinetic energy stored in the inertias during rotation is returned to the power supply and generates a voltage surge. This voltage surge can be destructive for the motor or for devices connected to the power supply.

In the event of frequent braking, **an external ballast resistor must be used**, all the circuitry is integrated in the product. Ballast parameters are available through CANopen communication.

For more information, see the HMI user manual dedicated for the “DCmind Soft + CANopen”

It is always necessary to conduct tests to check what size it should be.



#### **WARNING**

In case of incorrect setting of ballast activation threshold, or in case of incorrect sizing of the ballast resistor (value and power), the ballast resistor can be damaged, can burn or explode.

The activation voltage threshold must be higher than the power voltage, and value/power of resistor must be in accordance with the amount of energy that the motor has to brake.

### *6.1.2. EMC Protection*

In order to ensure that the product is compatible with EMC standards IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3, IEC 61000-6-4, EN55022 Class B we recommend:

- Connecting the motor to ground while limiting length of the grounding strip,
- Adding capacitors on the main power supply.  
We recommend 1000  $\mu$ F per amp drawn.
- 

### *6.1.3. Earth connection*

A taped hole on the housing is dedicated to the earth connection. Use M5x6mm screw class 8.8 to connect product with a screwing torque of  $4\text{N.m} \pm 15\%$ . Use AWG12 gauge lead for earth connection.

## 6.2. Protection

 **DANGER****PROTECTION**

The product has internal protection devices that switch off the motor power supply when activated. As the motor is no longer controlled, driving loads can decrease.

- The system manufacturer is responsible for complying with all the applicable safety rules in the event of product failure.

**Failure to comply with these precautions will result in death or serious injury.**

### 6.2.1. Voltage Protection

The product incorporates protection against voltage surges and undervoltages.

Protection against voltage surges:

The voltage surge threshold can be set in the HMI.

When the supply voltage exceeds the threshold, the product automatically switches to ERROR mode. In ERROR mode the motor is no longer controlled.

To reset the motor:

- The supply voltage must be at least 1 V below the threshold value.
- It is necessary to pass in DISABLE mode then ENABLE mode.

Protection against undervoltages:

The under voltage threshold can be set in the HMI.

When the supply voltage falls below this threshold, the product automatically switches to ERROR mode. In ERROR mode the motor is no longer controlled.

To reset the motor:

- The supply voltage must be at least 1V higher than the threshold value
- It is necessary to pass in DISABLE mode then ENABLE mode.

### 6.2.2. Temperature Protection

- The product incorporates a first temperature protection in the form of a temperature sensor on the motor pilot control card.

#### Temperature protection:

The under and over temperature thresholds can be set in the HMI (set at -40°C and +110°C by default).

In this case, when the internal temperature exceeds 110°C (or is below than -40°C), the product automatically switches to ERROR mode. In ERROR mode the motor is no longer controlled.

To reset the motor:

- The temperature must be between the 2 thresholds.
- The motor inputs must be set to DISABLE mode then ENABLE mode.

- The product incorporates second temperature protection with 3 thermistors into the stator coils.

#### Temperature protection:

In this case, when the stator temperature exceeds 120°C, the product automatically switches to ERROR mode. In ERROR mode the motor is no longer controlled.

To reset the motor:

- The temperature must be under 120°C.
- The motor inputs must be set to DISABLE mode then ENABLE mode.
- .

### 6.2.3. Current Limiting

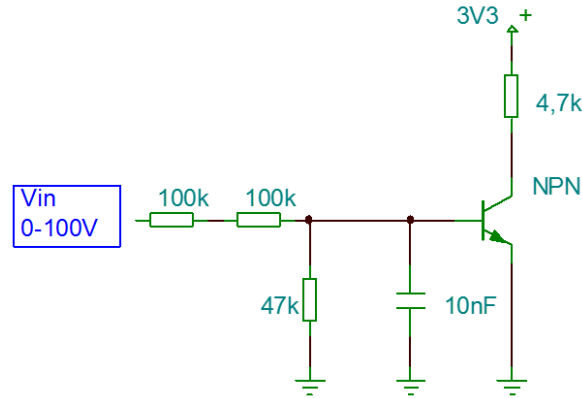
The product incorporates internal current limiting. This limiting directly affects the motor in terms of hardware. If this limit is reached, it results in a loss of motor performance.

This product is not designed to operate continuously with this limiting (see the "Electrical Data" section).

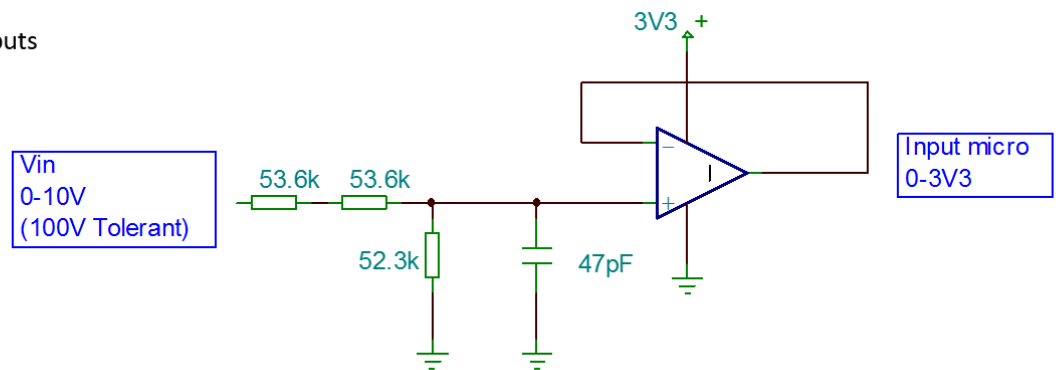
### 6.3. Input/Output Connection

#### 6.3.1. Equivalent Input Diagram

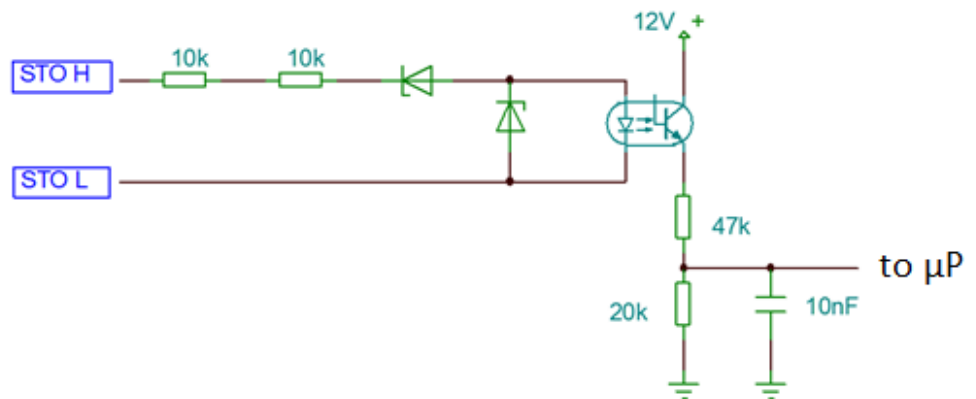
Digital Inputs



Analog Inputs



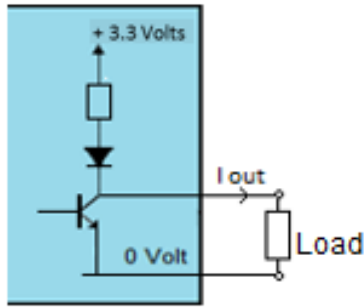
STO inputs



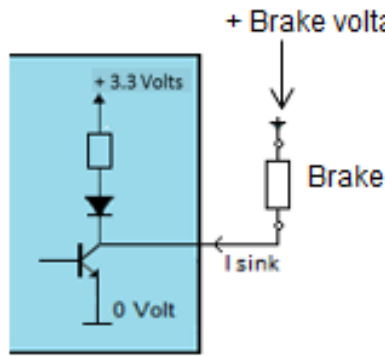


6.3.2. Equivalent Output Diagram

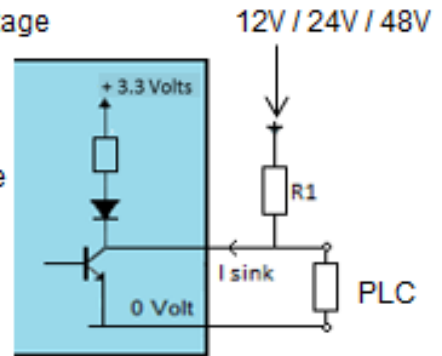
**Output 1,2,3,4**



I out max = 5 mA



I sink max = 600 mA



I sink max = 600 mA  
ex: R1 = 10 Kohms - 1/2W  
R1 = 2 Kohms - 2W

## 6.4. Terminology and Abbreviations

### *Encoder*

Mounted on the motor, the angular position sensor provides frequency pulses proportional to the motor speed.

### *Degree of protection*

The degree of protection is a standard definition used for electrical equipment that aims to describe the protection against penetration of solids and liquids inside the motor casing (for example IP54M). The M indicates that the tests are conducted with the motor running.

This value cannot take account of the seal around the output shaft, for which the installer must take responsibility.

### *Axial forces*

Longitudinal traction or compression forces affecting the shaft.

### *Radial forces*

Radial forces affecting the shaft.

### *Direction of rotation*

Positive or negative direction of rotation of the motor shaft. The positive direction of rotation is clockwise rotation of the motor shaft, when looking at the motor from the output shaft.

### *Nominal speed*

Motor speed of rotation when nominal torque is applied.

### *Nominal current*

Current drawn by the motor when nominal torque is applied.

### *Nominal torque*

Maximum applicable torque in continuous duty on the motor shaft.

### *Firmware*

Control software embedded in the motor.

### *Bootloader*

Function available in the HMI which can be used to update the firmware.

### Commonly used abbreviations:

HMI:	Human-Machine Interface
SMI22:	Trade name of the new CROUZET brushless range
Homing:	Initialization phase for finding the limits
AON:	Type of digital inputs/outputs (All Or Nothing)
PWM:	Pulse Width Modulation
FWD:	Forward
REV:	Reverse
NO:	Normally Open
NC:	Normally Closed
EMC:	Electromagnetic Compatibility

## 7. APENDIX A : STATUS LED

The two-color "STATUS LED" must inform about the state of the CiA 301 machine as follows:

LED light in GREEN (« RUN LED ») :

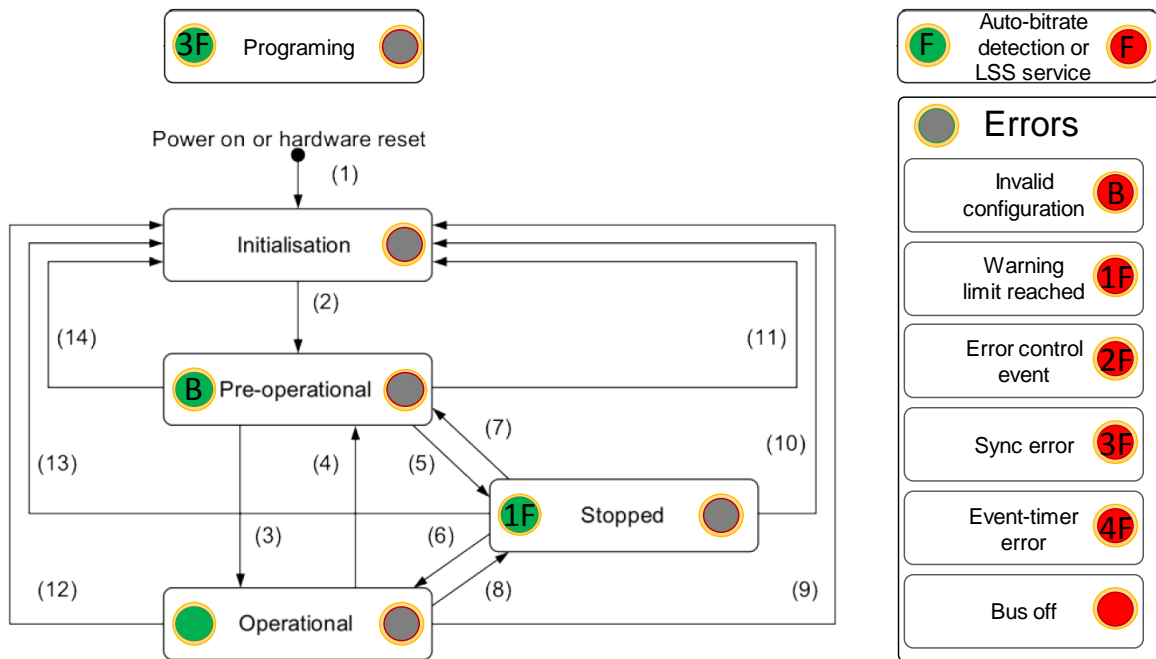
RUN LED	State	Description	Category
Flickering	AutoBitrade/LSS	The auto-bitrate detection is in progress or LSS services are in progress (alternately flickering with error LED)	Optionnal
Blinking	Pre-operational	The device is in state PREOPERATIONAL	Mandatory
Single Flash	Stopped	The device is in state STOPPED	Mandatory
Double Flash	-	Reserved for further use	-
Triple Flash	Program/Firmware download	A software download is running on the device	Optionnal
On	Operational	The device is in state OPERATIONAL	Mandatory

LED light in RED (« ERROR LED ») :

RUN LED	Etat	Description	Categorie
Off	No error	The device is in working condition	Mandatory
Flickering	AutoBitrade/LSS	The auto-bitrate detection is in progress or LSS services are in progress (alternately flickering with run LED)	Optionnal
Blinking	Configuration non valide	General configuration error	Optionnal
Single Flash	Niveau d'alerte atteint	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)	Mandatory
Double Flash	Evènement d'erreur de contrôle	A guard event (NMT-slave or NMTmaster) or a heartbeat event (heartbeat consumer) has occurred	Mandatory
Triple Flash	Erreur de synchronisation	The sync message has not been received within the configured communication cycle period time out (see object dictionary entry 1006h)	Mandatory if 0x1016
Quadruple Flash	Erreur d'event-timer	An expected PDO has not been received before the event-timer elapsed	Optionnal
On	Bus off	The CAN controller is bus off	Mandatory

**If there is a conflict between turning on the LED in green or red, it should be lighth in red.**

So the following behavior of LEDs:



**F** = Flickering   **B** = Blinking   **1F** = Single Flash   **2F** = Double Flash   **3F** = Triple Flash   **4F** = Quadruple Flash

LED state	Description
On	The LED shall be constantly on.
Off	The LED shall be constantly off.
Flickering	That shall indicate the iso-phase on and off with a frequency of approximately 10 Hz: on for approximately 50 ms and off for approximately 50 ms.
Blinking	That shall indicate the iso-phase on and off with a frequency of approximately 2,5 Hz: on for approximately 200 ms followed by off for approximately 200 ms.
Single flash	That shall indicate one short flash (approximately 200 ms) followed by a long off phase (approximately 1000 ms).
Double flash	That shall indicate a sequence of two short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).
Triple flash	That shall indicate a sequence of three short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).
Quadruple flash	That shall indicate a sequence of four short flashes (approximately 200 ms), separated by an off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1000 ms).

## 8. APENDIX B : CANOPEN ERROR MANAGEMENT

### 8.1. OVERVIEW

Emergency object transmission is triggered by the occurrence of an internal error on a device connected to a CANopen network, and they are transmitted from an emergency producer (generally a node) to one or more emergency object consumers (generally the master, but other nodes could also interpret this object value, or it could even be ignored by them all). An emergency object is sent only once per error event.

The data content of the emergency message uses the following structure:

COB-ID (hex)	Byte number	1	2	3	4	5	6	7	8
80 + Node ID		<u>Emergency error codes</u> (Object 0x603F)		<u>Error registers</u> (Object 0x1001)		Reserved (zero values)			

Example :

COB-ID (hex)	Number of bytes	Data field (hex)	Description
89	8	06 73 80 00 00 00 00 00	Node 9 sends a differential encoder broken wire error (0x7306) emergency message.

Page Break

### 8.2. EMERGENCY ERROR CODES

A list of emergency error codes, presented in hexadecimal format, is shown in the following table:

Error code	Description
<b>0x0000</b>	<b>No error</b>
<b>0x2280</b>	<b>Over-current peak has been detected in phase or DC-Bus line (HW system protection).</b> It could indicate a short circuit between phase and ground. This is a generic error without information of the phases involved in the error.
<b>0x2290</b>	<b>Over-current peak has been detected in phase (FW system protection).</b> It could indicate a short circuit between two phases or between a phase and DC-Bus input. This is a generic error without information of the phases involved in the error.
<b>0x2291</b>	<b>Over-current peak has been detected in phase A (FW system protection).</b> It could indicate a short circuit between phase A and another phase or DC-Bus input.
<b>0x2292</b>	<b>Over-current peak has been detected in phase B (FW system protection).</b> It could indicate a short circuit between phase B and another phase or DC-Bus input.
<b>0x2293</b>	<b>Over-current peak has been detected in phase C (FW system protection).</b> It could indicate a short circuit between phase C and another phase or DC-Bus input.
<b>0x22A0</b>	<b>Initial current reading out of range (FW system protection).</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x22A1</b>	<b>Initial current reading of Phase A out of range (FW system protection).</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x22A2</b>	<b>Initial current reading of Phase B out of range (FW system protection).</b> This error indicates a Hardware malfunction, please contact Couzet or your local vendor.
<b>0x22A3</b>	<b>Initial current reading of Phase C out of range (FW system protection).</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x2350</b>	<b>An I<sup>T</sup> over-current has been detected (FW system protection).</b> The maximum phase peak current (Overload capacity) allowed by the controller has been reached.
<b>0x2380</b>	<b>Saturation of current measurement system has been detected.</b>

	In system with VGA it could indicate a selected measurement range too narrow.
<b>0x2381</b>	<b>Saturation of current measurement system has been detected in phase A.</b> In system with VGA it could indicate a selected measurement range too narrow.
<b>0x2382</b>	<b>Saturation of current measurement system has been detected in phase B.</b> In system with VGA it could indicate a selected measurement range too narrow.
<b>0x2383</b>	<b>Saturation of current measurement system has been detected in phase C.</b> In system with VGA it could indicate a selected measurement range too narrow.
<b>0x3210</b>	<b>System over voltage detected.</b> Indicates that maximum absolute voltage of the controller has been exceeded. This error could be the consequence of a regenerative movement when working on power supplies with low capacitance or negative current protection. In such case use an external shunt to dissipate the excess of energy generated by the load.
<b>0x3211</b>	<b>User over voltage detected.</b> Indicates that the maximum voltage indicated by the user has been over passed. This error is only generated in systems without shunt resistor.
<b>0x3220</b>	<b>System under voltage detected.</b> Indicates that minimum absolute voltage of the controller is not reached.
<b>0x3221</b>	<b>User under voltage detected.</b> Indicates that the minimum voltage indicated by the user has not been reached.
<b>0x4300</b>	<b>User temperature out of range detected.</b> Indicates that the temperature of the controller is out of the range specified by the user.
<b>0x4310</b>	<b>System over temperature detected (FW system protection).</b> Indicates that the maximum allowed temperature of the controller has been exceeded.
<b>0x4320</b>	<b>System under temperature detected (FW system protection).</b> Indicates that the minimum allowed temperature of the controller is not reached.
<b>0x4400</b>	<b>Motor temperature out of range detected.</b> Indicates that the temperature of the motor is out of the range specified by the user.
<b>0x5210</b>	<b>Internal VGA communication problem detected.</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x5400</b>	<b>Output power section problem detected (system protection).</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x5430</b>	<b>Input stage problem detected. Voltage not stable or not available (system protection).</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x5530</b>	<b>Internal NVM communication problem detected.</b> This error indicates a Hardware malfunction, please contact Crouzet or your local vendor.
<b>0x6185</b>	<b>Internal EEPROM full error.</b> This error indicates that size of object dictionary data is higher than the space available in EEPROM. NA
<b>0x6186</b>	<b>Internal EEPROM full error (Communication Dictionary).</b> This error indicates that size of Communication object dictionary is higher than assigned space in EEPROM. NA
<b>0x6187</b>	<b>Internal EEPROM full error (Manufacturer Dictionary).</b> This error indicates that size of Manufacturer object dictionary is higher than assigned space in EEPROM. NA
<b>0x6188</b>	<b>Internal EEPROM full error (Device Dictionary).</b> This error indicates that size of Device object dictionary is higher than assigned space in EEPROM. NA
<b>0x7121</b>	<b>Motor blocked.</b> This error indicates that the motor has been blocked. Only applies to stepper with encoder position feedback. NA
<b>0x7124</b>	<b>Motor not detected.</b> This error indicates that the motor has not been detected. Only applies to stepper motors when entering in Operation Enable state. NA
<b>0x7303</b>	<b>Error in resolver signals detected.</b> This error indicates a loss or degradation of resolver signals. NA
<b>0x7306</b>	<b>Differential encoder broken wire detected.</b>

	Indicates that one of the differential signals of the quadrature incremental encoder, probably due to the breakage of the line. NA
<b>0x7380</b>	<b>SSI encoder error.</b> Indicates that an error occurs during the decodification of a SSI frame. Usually it means that an error flag in the SSI frame is enabled. NA
<b>0x7390</b>	<b>Magnetic sensor error.</b> Indicates that an error occurs during the decodification of the magnetic interface SPI frame. Usually it means that an error flag in the frame header is enabled, or that the read back value after a write is different than the intended value.
<b>0x8110</b>	<b>CAN bus over-run.</b> Indicates that one or more CAN message has been lost.
<b>0x8120</b>	<b>CAN in error passive mode.</b> Indicates that have been detected more than 127 reception errors, or more than 127 but less than 255 transmission errors.
<b>0x8130</b>	<b>Lifeguard error.</b> It indicates that the node has not received a Node Guard message within its Lifetime.
<b>0x8140</b>	<b>Recovered from CAN bus off.</b> Indicates that the controller has been recovered from a previous CAN bus off situation.
<b>0x8141</b>	<b>CAN Bus off occurred.</b> Indicates that has been detected more than 255 errors during transmission of messages.
<b>0x8210</b>	<b>PDO not processed due to length error.</b> This error indicates that a CAN RPDO has not been processed because the received data length does not match the expected one.
<b>0x8280</b>	<b>Error decoding serial message.</b> This error indicates that the serial message sent to the driver is incorrect.
<b>0x8613</b>	<b>Homing timeout detected.</b> Indicates that the homing has not been able to finish the process within the maximum allowed time.
<b>0xFF02</b>	<b>Not allowed digital hall combination detected.</b> Indicates that a not allowed combination of digital halls feedback has been detected (i.e all zero or all ones).
<b>0xFF03</b>	<b>Not allowed sequence of digital halls has been detected.</b> Indicates that a not allowed sequence of digital halls combination has been detected.
<b>0xFF04</b>	<b>Angular error in forced alignment method is out of tolerance.</b> Indicates that the result of forced alignment method during initial angle determination process for brushless motor has been out of specified tolerance during all retries.
<b>0xFF05</b>	<b>Interpolated position mode buffer full.</b> Indicates that the interpolation data input buffer has reached its limit.
<b>0xFF06</b>	<b>Error in Analog hall signals detected.</b> Indicates that one of the analog signals has been disconnected or it is out of allowed range. NA
<b>0xFF10</b>	<b>A stand-alone divide by zero instruction detected.</b> Indicates that a division instruction has been executed with a zero divisor.
<b>0xFF20</b>	<b>RS232 reception overflow.</b> Indicates that some of the RS232 characters have been lost. NA
<b>0xFF30</b>	<b>Executing a non-existing macro or instruction address.</b> Indicates that a macro or instruction higher than the allowed 64 has been executed. NA
<b>0xFF31</b>	<b>Macro stack full.</b> Indicates that the macro calling stack is full due to an excess of nested execution. NA
<b>0xFF33</b>	<b>Detected interrupt without associated macro function.</b> Indicates that an interrupt has been activated and generated but it does not have an associated macro function. NA
<b>0xFF34</b>	<b>Saving or restoring out of learned position space.</b> Indicates that an access to a not existing learned position table has been done.
<b>0xFF40</b>	<b>EtherCAT synchronization error.</b> Indicates that a synchronization error has occurred using EtherCAT in DC mode. NA

<b>0xFF41</b>	<b>EtherCAT plugin board disconnected.</b> Indicates that the Crouzet drive with the EtherCAT firmware has been powered up without the EtherCAT plugin board. NA
<b>0xFF50</b>	<b>Incorrect object access.</b> This error appears if the application tries to access to a nonexistent object, write in a read-only object or read a write-only object. Other incorrect access situations are signaled with this error.
<b>0xFF60</b>	<b>Safe torque off activated.</b> Indicates that the power stage has been deactivated due to the STO mechanism

## 8.3. RELATED OBJECTS

### 8.3.1. Error register

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1001	0x00	Error register	UINT8	RO	No	No	-	-	-

This object provides error information. The *emcI* maps internal errors into this object. It is a part of an emergency object.

#### Data description:

Bit	Meaning
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (overrun, error state)
5	Device profile specific
6	Reserved (always 0)
7	Crouzet specific error

### 8.3.2. Pre-defined error field

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x1003	0x01	Standard error field	UINT32	RO	No	No	UINT32	0x00000000	-
0x1003	0x02	Standard error field	UINT32	RO	No	No	UINT32	0x00000000	-
0x1003	0x03	Standard error field	UINT32	RO	No	No	UINT32	0x00000000	-
0x1003	0x04	Standard error field	UINT32	RO	No	No	UINT32	0x00000000	-

This object provides the errors that occurred on the *emcI* and were signaled via the emergency object. In doing so it provides an error history.

The object entry at SubIndex 0x00 contains the number of actual errors that are recorded in the array starting at SubIndex 0x01.

Every new error will be stored at SubIndex 0x01 and older errors will be moved to the next higher sub-index.

Writing a 0 value in the subindex 0x00 will reset the errors stored. [Page Break](#)



### 8.3.3. Error code

Index	Sub Index	Name	Data Type	Acc.	Pdo Map.	NVM	Value range	Default value	Units
0x603F	0x00	Error code	UINT16	RO	Yes	No	UINT16	0x0000	-

The Error code captures the last error detected in the controller.