

Datasheet

WTC6 CM60MK2

Controller module typically used as main controller in wind turbine control systems. The controller works together with the other WTC6 modules and WTC3 modules.



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1 Introduction

The CM60MK2 is a core member of the sixth generation control system known as WTC6, developed by KK Wind Solutions. It is a controller module, which is typically used as main controller in a wind turbine control system.

It contains a powerful processor with fast working RAM, Flash, NVRAM, Ethernet port, EtherCAT master, USB, internal Real Time Clock, temperature monitoring and digital outputs.

Working memory is, for stability and safety purposes, subject to continual ECC control. ECC enables automatic correction of any single bit error and detection of multiple bit errors.

1.1 Part numbers

This datasheet covers the following part numbers.

CM60MK2..... : Standard edition.

2 Important note



ESD (Electro Static Discharge) sensitive devices on Printed Circuit Board. Take the necessary precautions when working on ESD sensitive parts.

3 Features

- Freescale Power Quicc II Pro 800 MHz processor
- Ethernet 100 Mbit/s (RJ45) interface
- Ethernet 100 Mbit/s (Fiber SC) interface
- USB 2.0 host, for external storage attachment
- 512 Mbyte fast working RAM with ECC supervision (Error-correcting code)
- 128 Mbyte program Flash
- 512 Kbyte NVRAM
- 8 Mbyte serial flash for data / log
- Internal DC / DC converters with supervision
- Internal temperature measurement
- Real Time Clock with capacitive power backup
- Output enable control for IO modules
- Power supply control for IO modules
- 2 digital inputs for general purpose
- Temperature range -35 °C to 70 °C
- Dual power supply for redundancy
- EtherCAT Master
- CANopen master and slave
- CODESYS runtime for PLC programming
- SW framework for building wind turbine control system
- SW framework for running C/C++ and Simulink applications
- Programmable web server for diagnostics and machine operation
- ModbusTCP master and slave
- IEC61400-25/MMS Server

4 Environmental data

4.1 Temperature

Operating temperature range..... : -35..70°C

Storage temperature range : -40..80°C

Altitude	< 1500 m	3000 m	4500 m
Max operating temperature	70°C	63°C	53°C

4.2 Humidity

Operating humidity range..... : 5 - 95 %RH non condensing

Storage humidity range..... : 5 - 95 %RH non condensing

4.3 Ventilation

Forced ventilation is needed dependent on altitude and ambient temperature, as can be seen below.

Altitude	< 1500 m	3000 m	4500 m
Ventilate when temperature is:	>55°C	>48°C	>38°C

5 On-board sensors

5.1 Temperature sensor

Input range..... : -55..125°C

Accuracy (-25..100°C)..... : ±2.0°C

Accuracy (-55..125°C)..... : ±3.0°C

5.2 Real time clock

Power backup time : >14 days

XTAL..... : 32768 Hz ± 20 ppm

6 Interfaces

6.1 X1 - USB

USB Standard : 2.0
 Max 5V load : 500 mA
 Connector type..... : USB type A receptacle
 Correspond to : USB type A plug

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	V+	Supply voltage
2	DATA-	USB Data, negative
3	DATA+	USB Data, positive
4	V-	Supply ground
Case	GND	

6.2 X2 - Ethernet

Speed..... : 100 Mbit/s
 Full/Half duplex..... : Auto-negotiation
 Feature : MDI/MDI-X
 Connector type..... : RJ45
 Correspond to : RJ45 cable part

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	TX+	Ethernet transmit, positive
2	TX-	Ethernet transmit, negative
3	RX+	Ethernet receive, positive
4	75R termination	Connected to pin 5, 75R termination to AC common
5	75R termination	Connected to pin 4, 75R termination to AC common
6	RX-	Ethernet receive, negative
7	75R termination	Connected to pin 8, 75R termination to AC common
8	75R termination	Connected to pin 7, 75R termination to AC common
Case	GND	

6.3 X3 & X4 - Ethernet/EtherCAT fiber

Speed : 100 Mbit/s
 Fiber : Multimode
 TX level minimum : -20 dBm
 RX sensitivity : -31 dBm
 Connector type : SC fiber socked
 Correspond to : SC fiber plug

<i>Pins</i>	<i>Value</i>	<i>Function</i>
X3	RX	Fiber pair RX
X4	TX	Fiber pair TX

6.4 X5 & X6 - Power supply

The CM60MK2 has two separate power supply input connectors. These can be used for redundant power supply. Additional information can be found in section 11.1.

Input voltage : 18..56 VDC
 Power consumption max : 15 W
 Power consumption typical : 8 W
 Recommended fuse : 6 A C-characteristic
 Max inrush current..... : 25 A (0.02 J) @ RG=0.1 Ω, VG=48 V
 Connector type..... : WAGO 231-132
 Correspond to : WAGO 231-102/026-000

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	GND	GND
2	SUPPLY	Module supply 18..56 V

6.5 X7 - Console port (RS232)

The console on the CM60MK2 can be used for diagnostics.

Speed..... : Max 250 kbit/s
 UART..... : RS232
 Connector type..... : DSUB9 female socket
 Correspond to : DSUB9 male connector

<i>Pins</i>	<i>Value</i>	<i>Function</i>
2	TX	RS232 transmit data
3	RX	RS232 receive data
5	GND	GND
other	NC	Not connected

6.6 X8 - RS422/RS485

The CM60MK2 has a general purpose RS422/RS485 port. If used for RS485 an external short-circuit must be added in the connector. Additional information can be found in section 11.3.

Baud rate..... : 2400, 4800, 9600, 19200, 38400, 57600, 115200
 Data frame format : 7E1, 7O1, 8N1, 8E1, 8O1, 7E2, 7O2, 8N2, 8E2, 8O2
 Connector type..... : WAGO 231-135
 Correspond to : WAGO 231-105/026-000 & WAGO 231-2105

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	GND	GND
2	TX	Transmit
3	RX	Receive
4	TX#	Transmit inverted
5	RX#	Receive inverted

6.7 X9 - Digital inputs

The two digital inputs on the CM60MK2 is not dedicated to specific functionality, and can be used for application specific tasks. Additional information can be found in section 11.2.

Input type : Active high
 Input resistance..... : 2 kΩ
 High level..... : > 15 V, Max 30 V
 Low level : < 5.0 V, Min 0 V
 Input filter bandwidth typical .. : 18 kHz
 Connector type..... : WAGO 231-137
 Correspond to : WAGO 231-107/026-000

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	GND	GND
2	DI1	Digital input 1
3	DI2	Digital input 2

6.8 X10 - CAN bus

The CAN connector on the CM60MK2 module can be used for multiple protocols (e.g. CANopen).

Bus specification : CAN 2.0B
 Bus impedance..... : 120 Ω
 Termination..... : 120 Ω (Must be applied externally at end points)
 Connector type..... : WAGO 231-134
 Correspond to : WAGO 231-104/026-000 or WAGO 231-2104

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	SHIELD	Shield
2	GND	GND
3	CAN HI	CAN high
4	CAN LO	CAN low

6.9 X11 - Digital outputs

The two digital outputs on the CM60MK2 are dedicated to specific functionality, and cannot be used for application-specific tasks. Additional information can be found in section 11.4 and 11.5.

Output supply in connector : 18..28 VDC
 DO type : High side solid state
 Output resistance..... : < 100 mΩ
 Voltage drop max : 3 V
 Max load per channel : 3 A
 Recommended fuse : 10 A C-characteristic
 Thermal protection : Tj. 150 °C
 Connector type..... : WAGO 231-134
 Correspond to : WAGO 231-104/026-000 & WAGO 231-2104

<i>Pins</i>	<i>Value</i>	<i>Function</i>
1	GND	GND
2	OUT ENA	Output power enable (Controls supply for IO module outputs)
3	CON ENA	Control power enable (Controls supply for IO modules)
4	SUPPLY	Supply input for OUT ENA and CON ENA.

7 Ethernet and EtherCAT communication

The CM60MK2 has two Ethernet ports. One fiber and one copper (RJ45). The Fiber port is typically used for EtherCAT communication for IO60 modules and other EtherCAT slaves. The RJ45 port is typically used for diagnostics and machine operation, e.g. through the built-in web server.

The CM60MK2 has a built-in EtherCAT master which can be used for controlling standard EtherCAT slave modules. The CM60MK2 can control up to 65535 slaves connected in a daisy chain as can be seen in Figure 1.

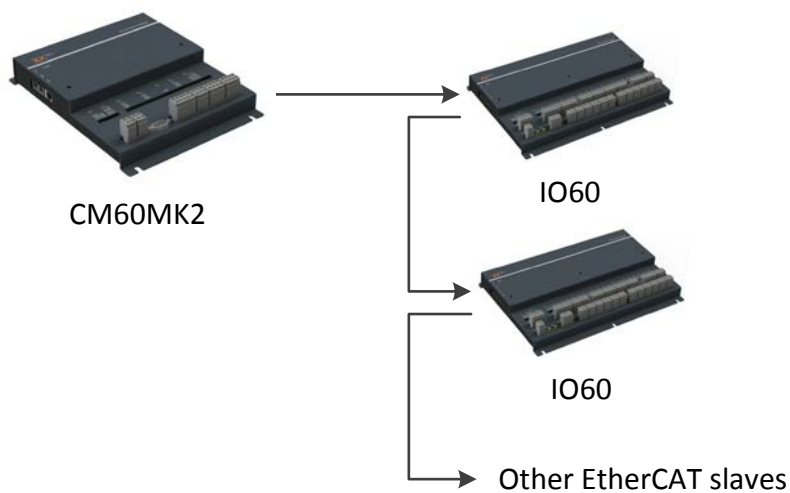
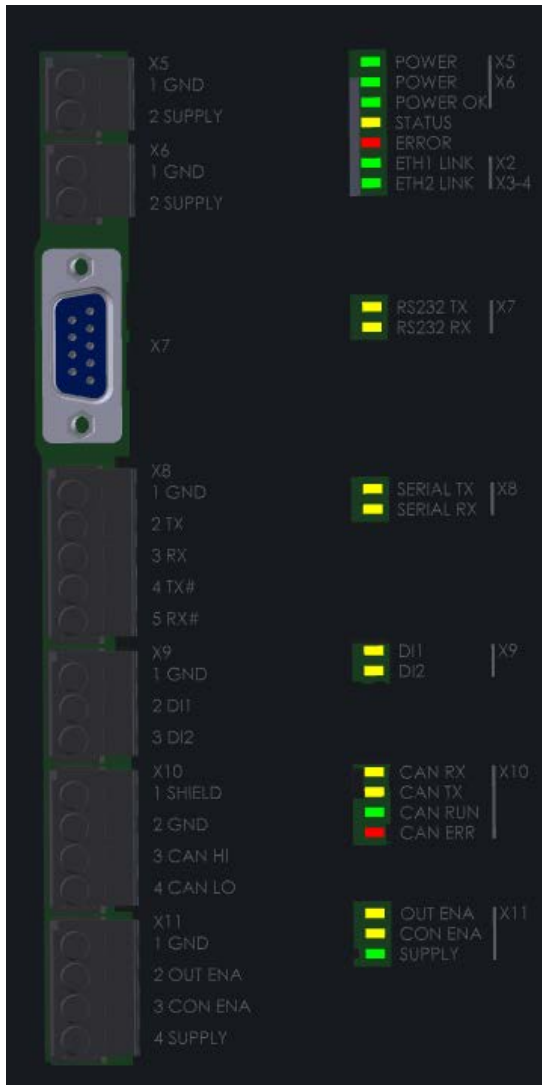


Figure 1: EtherCAT connection

8 LED Indicators

Information about the module status is indicated by several LEDs placed the module front.



LED	Color	Status	Meaning
POWER X5	Green	ON	Supply input present
		OFF	Supply input missing
POWER X6	Green	ON	Supply input present
		OFF	Supply input missing
POWER OK	Green	ON	All internal power supplies are within limits and reset is released
		OFF	Supply input missing or internal supply off limit
STATUS	Yellow	ON	Error
		BLINK ^{#2}	Software running
		OFF	Error
ERROR	Red	ON	Module error
		OFF	Module OK
ETH1 LINK X2	Green	ON	Link OK
		BLINK	Link OK – Data transfer active
		OFF	No link
ETH2 LINK X3-X4	Green	ON	Link OK
		BLINK	Link OK – Data transfer active
		OFF	No link
RS232 TX	Yellow	BLINK	Transmitting data on RS232
RS232 RX	Yellow	BLINK	Receiving data on RS232
SERIAL TX	Yellow	BLINK	Transmitting data on RS422/485
SERIAL RX	Yellow	BLINK	Receiving data on RS422/485
DI1 & DI2	Yellow	ON	Digital Input High
		OFF	Digital Input Low
CAN RX	Yellow	BLINK	Receiving data on CAN
CAN TX	Yellow	BLINK	Transmitting data on CAN
CAN RUN	Green	ON	CANopen network operational
		BLINK	CANopen network preoperational
		FLASH ^{#3}	CANopen network stopped
		OFF	CANopen not active
CAN ERR	Red	ON	No error
		FLASH ^{#3}	Warning/Error (CiA DR 303-3 V1.2)
		OFF	Bus off
OUT ENA	Yellow	On	DO Power Enable is enabled
		OFF	DO Power Enable is disabled
CON ENA	Yellow	On	Control Power Enable is enabled
		OFF	Control power enable is disabled
SUPPLY	Green	ON	Ext DO Supply present
		OFF	Ext DO Supply missing
USB CONNECTOR	Red	ON	USB power on
		OFF	USB power off

- #1 FLICK: 10 Hz, 50% duty cycle
- #2 BLINK: 2.5 Hz, 50% duty cycle
- #3 FLASH: 200 ms ON / 1000 ms OFF

During boot, STATUS and ERROR LEDs are used to indicate boot program progress.

9 Standards

9.1 EMC standards

DS/EN 61000-6-4:2007.....: Electromagnetic compatibility - Generic emission standard – Part 6 4: Industrial environment.

DS/EN 61000-6-2:2005.....: Electromagnetic compatibility - Part 6-2: Generic standards – Immunity for industrial environment. **Improved immunity for ESD, Burst and Surge. ESD tested to ±6KV Contact- and ±15KV Air Discharge. Burst tested to ±4KV, and Surge tested to ±2KV.**

9.2 Vibration

Vibration random.....: IEC 60068-2-64.	150 min. per axis. 3 axes. 1.6grms.
Vibration sine.....: IEC 60068-2-6	90 min. per axis. 3 axes. 2g.
Bump.....: IEC 60068-2-29	500 per axis. 3 axes. 25g. 6ms.
Shock.....: IEC 60068-2-27	6 per axis. 3 axes. 50g. 11ms.

9.3 PLC standards

IEC 61131-2:2007.....: Programmable controllers - Part 2: Equipment requirements and tests.

10 Mechanical

10.1 Dimension and weight

Height.....: 240 mm
Width.....: 190 mm
Depth.....: 38.5 mm
Weight.....: 1.5 kg

11 Application notes

11.1 Power supply

The power supply for the CM60MK2 can be feed by one power supply (single supply) or by two separate power supplies (redundant supply). Additional components are not required, sharing diodes are built in the CM60MK2. The power supply with the highest voltage will supply the CM60MK2. The power supply does not have to be stabilized, meaning the power can be drawn directly from a battery as long as the voltage is within the range of the CM60MK2.



Always remember to install a fuse in front of the CM60MK2.

Additional capacitor for backup can be installed directly on the CM60MK2. There is no maximum capacity.



The capacitor and charging resistor must be specified in cooperation with KK Wind Solutions.

Further details can be found in Figure 2.

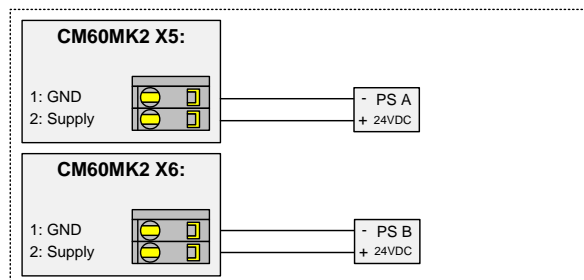


Figure 2: Redundant power supply

11.2 Digital inputs

Passive and active digital inputs can be connected directly to the CM60MK2 without additional relays. Further details can be found in Figure 3.

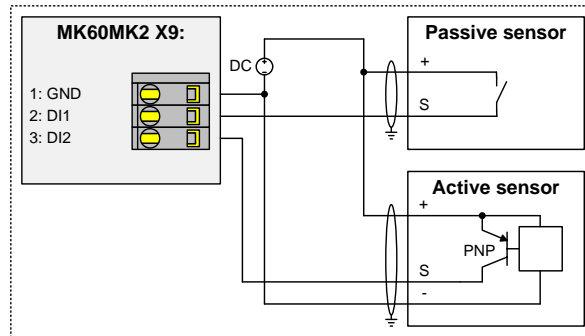


Figure 3: Digital input



The minimum switching capacity of the connected sensors should always be considered to avoid oxidation of the contact set in the sensors. The CM60MK2 draws 12mA at high level (input resistance 2k Ω).

11.3 RS422/RS485

For RS422 the serial connection should be connected as shown in Figure 4.

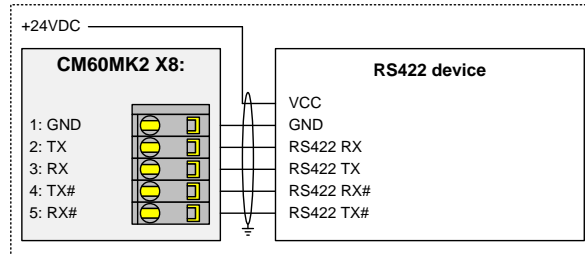


Figure 4: RS422 connection

When using RS485 the TX and RX signals (Pin 2 to 3) should be short-circuited. The same should be the TX# and RX# (Pin 4 to 5). The short-circuit can be made with a jumper in the double row WAGO connector. Further details can be found in Figure 5.

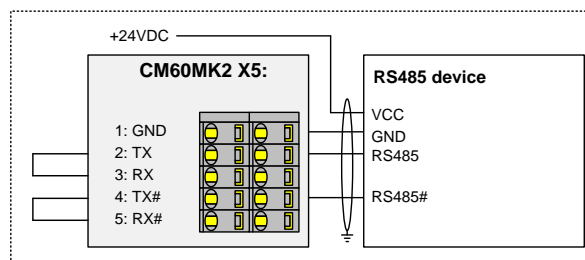


Figure 5: RS485 connection

11.4 Control power enable

The CM60MK2 has a “Control power enable” output. This output can be used to control power supply for EtherCAT slave modules e.g. IO60. The CM60MK2 will control the output according to the EtherCAT state, and toggle it during initialization, to reboot EtherCAT slaves. Further details can be found in Figure 6.

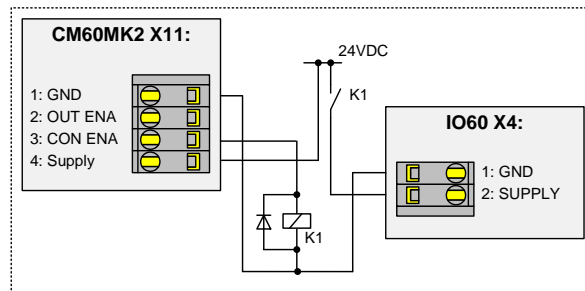


Figure 6: Control power enable

11.5 Output power enable

The CM60MK2 has an “Output power enable” function. This output can be used to control output power supply for EtherCAT slave modules e.g. IO60. The CM60MK2 will control the output according to the EtherCAT state. Further details can be found in Figure 7.

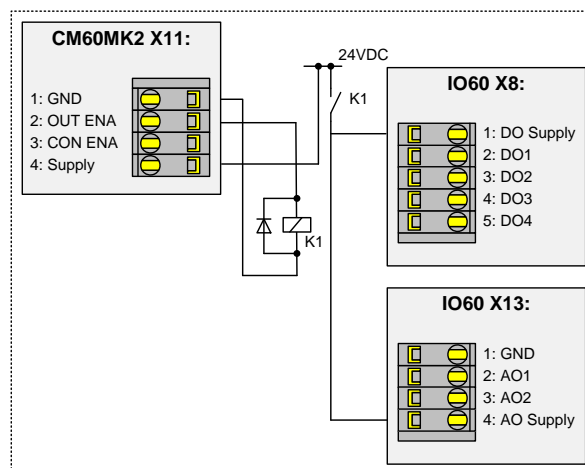


Figure 7: Output power enable

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