MBC2K - *2kW Motor Brake Controller*

USER MANUAL

Index   **Pag.**

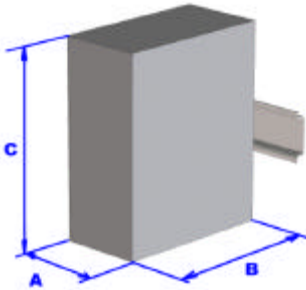| ORDERING INFORMATION	model	code
Standard version	**MBC2K**	**XMBC2K**

TECHNICAL DATA

|	
Nominal DC BUS Voltage range	24….110Vdc
Maximum braking current	50A for 1sec
Brake activation voltage	27….106V, threshold adjustable in 20 steps
Brake voltage hysteresis	3V or 6V selectable
User interface	- 2 setup push buttons (SET/RESET and MENU) - 2 x 7 segment LED displays - 1 LED for general alarm indication - 1 SPDT dry contact for general alarm remote warning
Protections	- Undervoltage on DC BUS < 22Vdc - Overvoltage on DC BUS > 110Vdc - Brake resistor overtemperature (if the temperature sensor is present) - Module Internal overtemperature > 90°C (194°F) - Brake resistor interrupted or not connected - Short circuit : braking current > 80A - Overload : braking time > 1sec
Parallel connection	Up to 4 units can be connected in parallel through synchronization bus for a total braking power of 8kW (4 x 2kW braking resistors are needed)

GENERAL TECHNICAL DATA

Maximum dissipated power	20W
Operating temperature	0..+70°C
Input/ground insulation	500Vac / 60 s
Protection degree	IP20
Overvoltage category	I
Pollution degree	2
Safety standards	IEC-EN60950 for SELV use up to 60Vdc; using the MBC2K at voltages greater than 60Vdc is not classifiable as SELV
EMC Standards	EN55011 Class B
Connection terminal blocks	**Input DC Bus + PE:** 3 poles pluggable, 2.5mm², 5.08mm pitch **Output Brake resistor:** 2 poles pluggable, 2.5mm², 5.08mm pitch **Resistor temp. sensor:** 2 poles pluggable, 1.5mm^2, 3.81mm pitch **Alarm dry contact:** 3poles pluggable, 1.5mm^2, 3.81mm pitch **Synchronization Bus** : 2poles, pluggable, 1.5mm^2, 3.81mm pitch
Housing material / size	Aluminium; H x W x D = 115 x 40 x 130 mm (4.52 x 1.57 x 5.11")
Approximate weight	0.2 kg
Mounting information	Vertical on horizontal DIN rail (see page 4)
Mounting rail	IEC 60715/TH35

Dimensions: millimeters (inches)	Vertical position

Dimensions	mm	inches
A	39	1.54
B	128	5.04
C	115	4.53
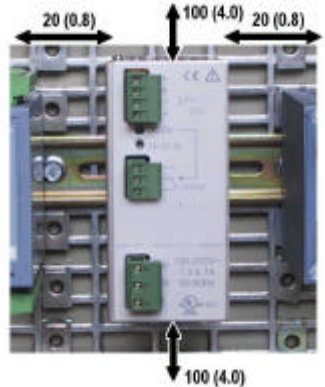
Mounting on rail	**Dismounting from rail**

	Operations
1	Push the power supply downwards
2	Rotate the power supply as shown in the drawing

	Instructions
1	Place the upper part of the clamp onto the rail
2	Press the power supply downwards and push it towards the rail, until the lower part is hooked on
3	Release the power supply and check that the hooking has been performed properly
Note	For increased stability, it is advised to fix the rail on to the panel, in a position corresponding to the center of the power supply

Block Diagram
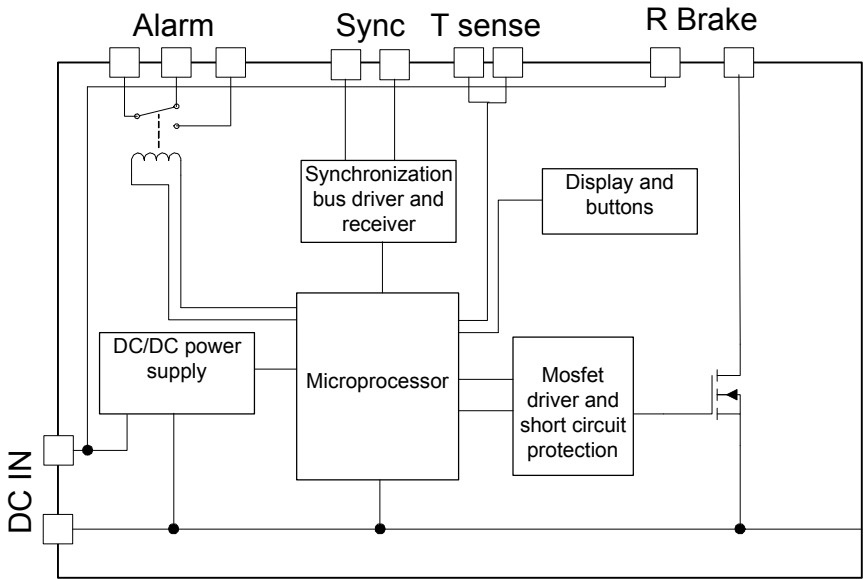
1–DC Bus voltage: DC IN=24100Vdc range 22-110Vdc ; connect PE (GND) wire before connecting +/- wires and keep it as short as possible ; PE(GND) wire must have cross section equal on higher than +/- wires.

2–Wiring: 2.5mm² / 1.5mm² stranded pluggable screw type terminal blocks; wire isolation stripping length 7mm, tightening torque 0.5-0.6Nm; use only 60/75 Class1 copper wires.

Warning disconnect DC IN, wait 60s before operating on device.

3–Mounting: snap on clamp on IEC60715/H35-7.5 rail; for better device stability fix the rail right on the point where the device is to be mounted ; to remove the device push towards bottom and then rotate it towards the top.

4–Configuration: the MBC2K needs to be configured before operating depending on the DC Bus voltage and the motor/brake resistor characteristics. See Chapter2 for a complete description.

5–Circuit protections: Every abnormal event requires the operator intervention to reset the protection; an error message is displayed on the LED display. See Chapter3 for a complete description.

6–Status signals: Alarm LED "OFF" = normal operation; Alarm LED blinking= the unit is in protection mode and the corresponding error message is displayed ; Alarm LED "ON" = the unit is in setup mode. MBC2K has an internal relay with SPDT contact 1A/24Vdc remote failure alarm and 1.5mm² connection terminal blocks. The relay is turned on only when the unit is ready to operate, i.e. when it is neither in protection mode, nor in setup mode.

7–Cooling: mount the MBC2K in vertical position, keep 2 inches (50 mm) free spacing on upper and lower sides, 0.8 inch (20 mm) free spacing to adjacent devices. The thermal protection turns off the device if surrounding air temperature is >60°C 140°F) along with continuous full load or overload operation. The MBC2K needs a manual reset of the protection even after cooling down. To get normal operation reduce the air temperature surrounding the MBC2K.

8–Parallel connection: Up to 4 MBC2K can be connected in parallel to increase the braking power up to 8kW peak. See Chapter4 for details.

9–Warranty: MBC2K Motor brake controllers are guaranteed to be free from factory defects for 3 years from delivery date. Failures caused by misuse, external and/or abnormal events (e.g. mains overvoltages, surges, etc.) or non respect of above points, are not covered by warranty. Opening the housing of the MBC2K voids the warranty.

Warning! Non respect of above indications may result dangerous and reduces safety and performances.

10–Technical data: unless specified, all technical data are typical and measured at 25°C (77°F). For continuous product improvement, CABUR has the right to change product specifications, ratings and data without previous advice.

1) MBC2K Description

The MBC2K is a device controlled by a microprocessor, that can automatically insert a power resistor into the DC BUS for braking a motor fed by the same DC Bus trough a motor drive. The function of the MBC2K is to dissipate the energy delivered by the motor in an external resistor thus damping the resulting overvoltage on the DC Bus

The resistor is disconnected when the DC voltage = VTL. (see fig. 3). On top of that the MBC2K provides several protections to ensure reliable operation (see Chapter 3). We recommend to provide MBC2K with a N.C. type Klixon temperature sensor for resistor protection.

MBC2K can be connected to any DC Bus within 24Vdc and 100Vdc. The simplified application diagram is shown in Figure 1, while the unit front view with all its controls is shown in Figure 2.

Up to 4 MBC2K units can be connected in parallel to increase the braking power up to 8kW max. (see Chapter 4).

The MBC2K is provided with a 2.5 digits 7 segments LED display, used to display the DC Bus voltage (with +/- 1V accuracy), to help the user during the setup phase and/or to show error messages.
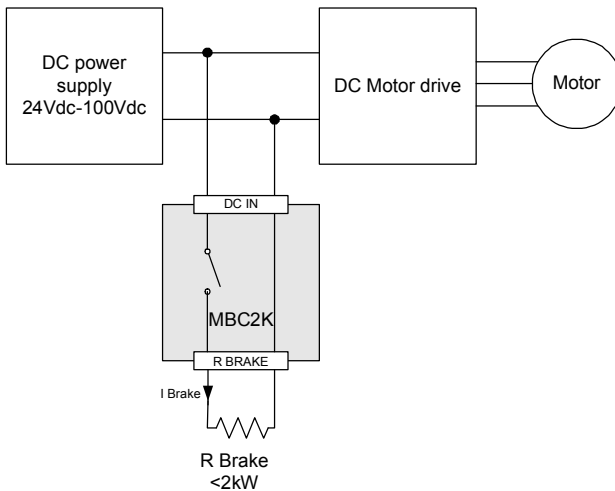

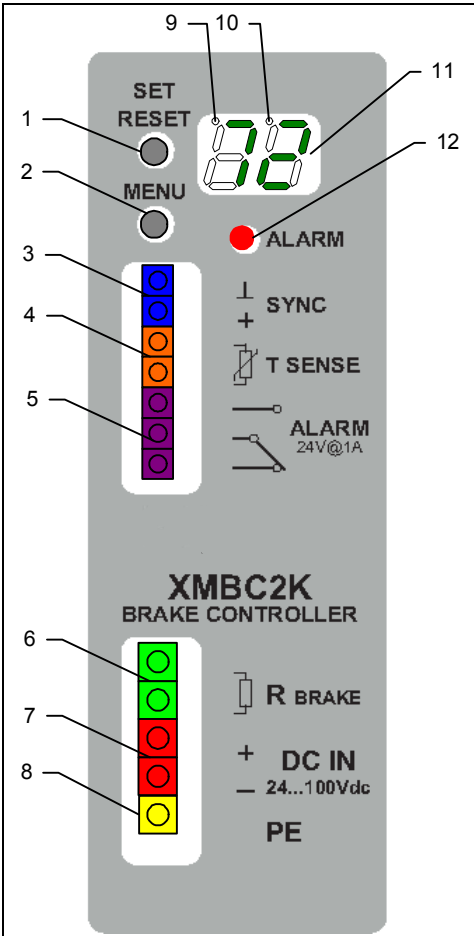Figure 1: Simplified application diagram

Figure 2: MBC2K Front View

1. SET/RESET button: used to reset the protections and to change setup values in setup mode (see Chapter 2).

2. MENU button: used to enter into setup mode and to navigate trough menu pages (see chapter 2).

3. Synchronization bus connector: used to parallel up to 4 units (see chapter 4).

4. Resistor temperature sensor connector: used to connect the brake resistor temperature sensor (N.C Klixon type)**;** if not used connect the 2 terminals with a jumper wire.

5. Alarm dry contact connector: an SPDT contact provide remote failure signal (see chapter 3).

6. Brake resistor connector: used to connect the brake resistor wires 2.5mm²

7. DC Bus connector: used to connect the MBC2K unit to the power supply Bus (24….100Vdc).

8. Protective earth (PE) connection: to connect the module to the protective earth.

9. LED display 100's indicator: used to display numbers >99 on 2 digits; when this indicator is lit and the display shows "03" this means 103V.

10. Brake indicator LED: used to display braking activity; when lit it means that there is a current flow trough the brake resistor.

11. 2.5 digits 7-segment display: in operating mode it shows the voltage measured on the DC Bus (accuracy +/- 1V); it's used also to show menu items and error codes (see Chapters. 2, 3).

12. Alarm LED: used to indicate a fault condition of the unit. (see Chapters 2 and 3).

2) MBC2K Setup

The MBC2K unit needs to be set up before operating. The setup mode is accessed by pressing the MENU button for more than 2 seconds. Once the setup mode is accessed the Alarm LED lights on and the Alarm relay is open. This means that during the setup phase the MBC2K is not ready to operate; it will be ready as soon as the setup phase is finished. The setup phase consists of 3 menu pages. The user can navigate trough the menu pages by pressing the MENU button and the values on each menu page can be changed by pressing SET / RESET button. The three menu pages are the following:

 a) Brake intervention threshold (VTH) setup
 b) Hysteresis around the brake intervention threshold voltage
 c) Master / Slave mode, used for parallel connection up to four modules (see chapter 3)

In order to set the parameters for menu page a) and b) refer to Figure 3 to adjust the parameters.
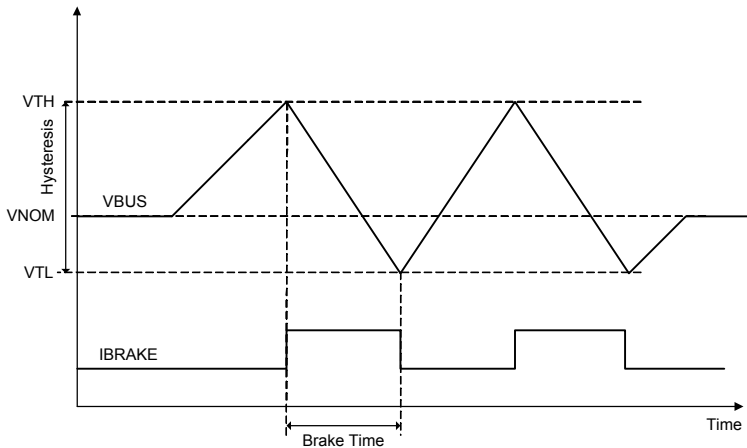

Figure 3 : Typical braking waveforms

Menu page a) Brake intervention threshold

Figure 3 VTH represents the brake intervention point. VTH shall be always greater than the nominal DC Bus voltage to avoid continuous intervention of the MBC2K. The user can set the Brake intervention threshold (VTH) through menu page a) in a range from 27Vdc to 106Vdc in 20 steps. The VTH value is shown on the LED display and can by adjusted using the SET/RESET button. Once the required VTH value is chosen, go to the next menu page by pressing MENU button. During the VTH selection the DC Bus voltage is measured by the MBC2K ; the user selection is accepted only if VTH > VBUS + 3V, otherwise the display blinks and the user must select a higher voltage.

Menu page b) Hysteresis

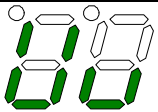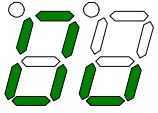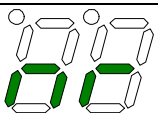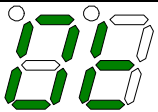Page b) allows to set the hysteresis value (refer to Figure 2). The Hysteresis can be set to 2 values: Lo=3V, Hi=6V. It is recommended to use the "Hi" setting when DC Bus voltages are higher than 50Vdc to increase the noise immunity of the MBC2K and avoiding spurious high frequency oscillations of the MBC2K power stage. Once the desired Hysteresis value is chosen, go to the next menu page by pressing MENU button.

Menu page c) : Operating mode

Page c) sets the operating mode of the MBC2K. When the MBC2K is used as a single unit (not paralleled with other devices) the master mode shall be selected. If more than one MBC2K are used in parallel on the same DC Bus to reach 8kW of peak breaking power, refer to Chapter 4 for more details about the parallel connection.

The two options are "MA=Master Mode" and "SL=Slave Mode". Once the desired operating mode is chosen, pressing MENU button saves the selected values in an internal EEPROM memory, switch off the Alarm LED and close the Alarm relay. This means that the MBC2K is now ready to operate with the selected values. The internal EEPROM memory allows saving the selected values so that even if the DC Bus is removed the last programmed configuration is used.

3) MBC2K protection and error codes

The MBC2K unit integrates several active protections to guarantee reliable operations in normal conditions. As soon as a faulty event is detected the MBC2K power stage is switched off so that no uncontrolled current flow trough the brake resistor is possible. A fault condition is indicated by the continuous blinking of the Alarm LED. Remote sensing of the status of the MBC2K unit is possible thanks to the Alarm relay dry contact. To help the user to understand which faulty event occurred, an error code is displayed on the 7 segments LED display. Every protection is latched, so that to put back the MBC2K unit in "operation mode", to push the SET / RESET button is needed to reset the protection event. In the following table all the protections and corresponding error codes are described.

Protection event	Error code on LED display	Cause of failure	System restore
Undervoltage		The DC Bus voltage is below 22Vdc	- Increase Bus voltage to at least 24Vdc - Press SET/RESET button - The MBC2K unit should be now operational
Overvoltage		The DC Bus voltage is above 110Vdc	- Decrease Bus voltage to max 100Vdc - Press SET/RESET button - The MBC2K unit should be now operational
Overcurrent		The current trough the brake resistor is greater than 80A. After that event the power stage is switched off in maximum 2μs to avoid damaging the MBC2K unit	- Check for short circuits on the brake resistor connections and fix the problem - Press SET/RESET button - The MBC2K unit should be now operational
Brake resistor connection		The brake resistor is not properly connected to the MBC2K unit	- Check for open circuits on the brake resistor connections and fix the problem. - Press SET/RESET button - The MBC2K unit should be now operational
Resistor Overtemperature		The brake resistor temperature is too high	- Check the brake resistor temperature - Wait until the resistor temperature decreases. - Press SET/RESET button - The MBC2K unit should be now operational **Note:** The resistor overtemp. protection sensor is designed to be normally closed. This means that when the resistor temperature is within safe limits the contact connected on T SENSE terminals should be closed.

Internal Overtemperature		The MBC2K internal temperature is grater than 90°C	- The MBC2K unit is operating in a too hot environment of with not enough cooling air flow - Change the position of the MBC2K unit in order to reduce the operating temperature - Press SET/RESET button - The MBC2K unit should be now operational
Overload		There is current flow through the brake resistor for more than 1s **continuously**.	- The brake intervention threshold is set too low (see Chapter 3) - increase this value - Press SET/RESET button - The MBC2K unit should be now operational

4) Paralleling up to 4 MBC2K units

The MBC2K brake controller provides a feature allowing connecting up to 4 identical MBC2K units to increase the peak braking power up to 8kW. In any case every MBC2K unit can handle only 2kW of peak braking power therefore every MBC2K unit need its own 2kW brake resistor.

To realize this feature the MBC2K is equipped with a Synchronization Bus used to synchronize the operation of all the units connected to the synchronization bus. The principle of operation relies on one MBC2K unit configured as the master and others MBC2K units (up to 3) configured as slave (see Chapter 2, menu page c).

The master measures the DC Bus voltage and decides when to insert its brake resistor in the circuit; on top of that it sends a command on the synchronization bus.

The slaves connected on the synchronization bus are waiting for the command sent by the master; when they receive the command they insert their brake resistors in the circuit too. Please note that even when the MBC2K is configured in slave mode, all its circuits protections are functional.

In operation mode with paralleled MBC2K units, the units configured as the master continuously shows the DC Bus voltage on its LED display, while the slaves show "SL" on their LED displays, informing the user they are in slave mode.

Please note that when only one MBC2K unit is used it is mandatory to configure it as master, otherwise it will never be able to perform the braking action.

Note: keep the synchronization bus wires shorter than 1m and twist together the two wires to improve noise immunity.

In Figure 4 the typical connection for MBC2K parallel connection is shown.
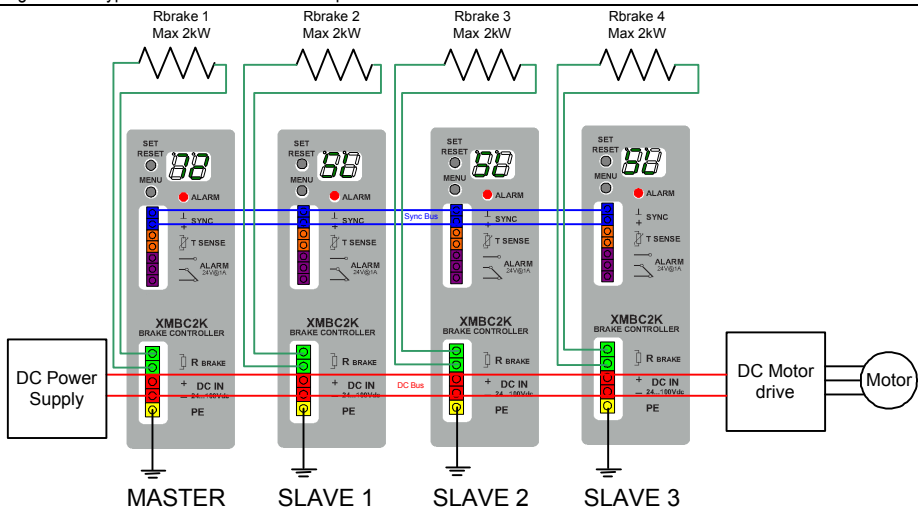

Figure 4: Typical connection of 4 MBC2K units using the Synchronization Bus