MBC2K – 2kW Motor Brake Controller

■ ***Main Features:***

- Universal input DC BUS 24…110Vdc
- Braking current 50A
- CPU controlled
- Digital display interface
- User settable braking threshold and hysteresis
- Various integrated protections
- Parallelable up to 4 units (8kW)

INDEX

READ THIS CAREFULLY BEFORE INSTALLATION!	LEGGERE ATTENTAMENTE PRIMA DELL'INSTALLAZIONE!	A LIRE ATTENTIVEMENT AVANT L'INSTALLATION!
Before operating, read this document thoroughly and retain it for future reference. Non-respect of these instructions may reduce performances and safety of the devices and cause danger for people and property. The products must be installed, operated, serviced and maintained by qualified personnel in compliance with applicable standards and regulations. Don't open the device, it does not contain replaceable components, the tripping of the internal fuse (if included) is caused by an internal failure. Don't repair or modify the device, if malfunction or failure should occur during operation, send unit to the factory for inspection. No responsibility is assumed by TDK-Lambda Switzerland SA for any consequences deriving from the use of this material.	Prima dell'installazione, leggere attentamente questo documento istruzioni e conservarle per future consultazioni. L'inosservanza delle presenti istruzioni può compromettere le caratteristiche e la sicurezza dell'apparecchio e causare pericolo per le persone e le cose. Il prodotto deve essere installato, utilizzato e riparato da personale qualificato e nel rispetto delle normative vigenti. Non aprire il prodotto, esso non contiene componenti sostituibili, il guasto del fusibile interno (se previsto) è causato da un guasto interno. Non tentare di riparare o modificare il prodotto, se durante il funzionamento si verificano guasti o anomalie, inviarlo al produttore per il controllo. TDK-Lambda Switzerland SA non si assume nessuna responsabilità per qualunque conseguenza derivante dall'uso di questo materiale.	Lire ces instructions avant l'installation, conserver ce manuel pour référence future. Défaut de se conformer à ces instructions peut affecter les caractéristiques et la sécurité du dispositif, et causer du danger aux personnes ou aux biens. Les produits doivent être installés, exploités et entretenus par du personnel qualifié et en conformité avec les règlements. N'ouvrez pas le produit, il ne contient aucune pièce réparable, le déclenchement du fusible interne (le cas échéant) est causé par un défaut interne. Ne pas essayer de réparer ou modifier le produit ; si des défaillances se produisent pendant le fonctionnement, retourner le produit au fabricant pour inspection. TDK-Lambda Switzerland SA n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation des produits.
CAUTION	**ATTENZIONE**	**AVVERTISSEMENT**
RISK OF BURNS, EXPLOSION, FIRE, ELECTRICAL SHOCK, PERSONAL INJURY. Never carry out work on live parts! Danger of fatal injury! The product's enclosure may be hot, allow time for cooling product before touching it. Do not allow liquids or foreign objects to enter into the products. To avoid sparks, do not connect or disconnect the device before having previously turned-off input power and wait for internal capacitors discharge (minimum 1 minute).	**RISCHIO USTIONI, ESPLOSIONE, INCENDIO, SCOSSA, LESIONI GRAVI.** Non effettuare mai operazioni sulle parti sotto tensione! Pericolo di lesioni letali! Il contenitore può scottare, lasciar quindi raffreddare il dispositivo prima di toccarlo. Non far entrare liquidi o oggetti estranei nel dispositivo. Per evitare scintille, non collegare o scollegare l'apparecchiatura prima di avere tolto tensione di ingresso e prima che sia avvenuta la scarica dei condensatori interni (min. 1 minuto).	**RISQUE DE BRULURES, EXPLOSION, INCENDIE, ELECTROCUTION, DOMMAGE AUX PERSONNES.** Ne jamais effectuer des opérations sur les parties sous tension! Danger de mort! Le boîtier peut produire des brûlures, le laisser refroidir avant de toucher l'appareil. Ne faire pas pénétrer des liquides ou des corps étrangers dans l'appareil. Pour éviter des étincelles, ne pas connecter ou déconnecter l'équipement jusqu'à ce que la tension d'entrée a été supprimée et avant qu'il n'ait eut lieu la décharge des condensateurs internes (minimum 1 minute).
INTENDED USE	**USO PREVISTO**	**UTILISATION**
These are isolated devices suitable for **SELV** and **PELV** circuitry and are designed to be mounted on DIN rail and installed inside a protective enclosure. They are intended for general use such as in industrial control, communication, and instrumentation equipment. Don't use these devices in applications where malfunction may cause injury or death.	I dispositivi sono isolati, adatti per applicazioni **SELV** e **PELV**, sono dotati di aggancio per il montaggio su guida DIN all'interno di quadri elettrici o contenitori di protezione, per l'utilizzo con controllori industriali, unità di comunicazione o apparecchi di misura. Non utilizzare in applicazioni in cui un eventuale guasto può comportare rischio di lesioni o di morte.	Les produits sont isolés, appropriés pour les circuits **TBTS** et **TBTP** et sont équipés d'un crochet pour montage sur rail DIN dans des armoires ou conteneurs de protection, pour utilisation avec les contrôleurs industriels, des modules de communication ou des unités de mesure. Ne pas utiliser ces dispositifs dans une application où un dysfonctionnement pourrait entraîner le risque des blessures ou de mort.
ENVIRONMENTAL CHARACTERISTICS	**CARATTERISTICHE AMBIENTALI**	**CARACTÉRISTIQUES ENVIRONMENTALES**
Installation in a Pollution Degree 2 environment, Overvoltage Category I, according to IEC60664-1. Do not use in wet area or subject to moisture. Carefully recycle the product and related batteries according to local regulations. **Radio interference!** This is an electrical appliance according to EN55032, class A. It may cause radio interference in residential areas.	Usare in ambienti con Grado di Inquinamento 2 e Categoria di Sovratensione I, secondo IEC60664-1. Non far funzionare l'apparecchio in un ambiente umido o soggetto a formazione di condensa. Riciclare il prodotto e le batterie collegate, nel rispetto delle normative locali vigenti. **Interferenza radio!** Questo apparecchio è un dispositivo di classe A secondo lo standard EN55032. Può causare interferenze radio nelle aree residenziali.	Utiliser les produits dans des environnements avec degré de pollution 2, catégorie de surtension I selon IECN60664-1. Ne pas employer l'appareil dans un environnement humide ou soumis à la condensation. Recycler les produits et les batteries, conformément à la réglementation locale. **Perturbations radioélectriques!** Cet appareil est un dispositif de catégorie A selon le standard EN55032. Il peut causer des perturbations radioélectriques dans les zones résidentielles.

DECLARATION OF CONFORMITY

TDK-LAMBDA SWITZERLAND SA
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This Declaration of Conformity is suitable to the European Standard EN45014 "General criteria for supplier's declaration of conformity".
We declare under our sole responsibility that the device included in this box, has passed all processing inspections and the final test and it is in conformity with the product requirements, including all reference codes and supply specifications.

ROHS compliance: the product respects the EC requirements related to ROHS substances, according to "Restriction of Hazardous Substances" as per document 2011/65/UE
REACH compliance: the product respects the EC requirements related to REACH SVHC directive (EC) 1907/2006
Note: all the reported information comes from our suppliers, TDK-LAMBDA SWITZERLAND SA has not run any test to evaluate if the specific elements are present.

All indicated devices are designed according to the latest Reference standards, if not expressly indicated through the official documents or files, they have been tested through our internal pre-compliance testing. Consult directly on www.nextys.com the reference standards applied to each model.

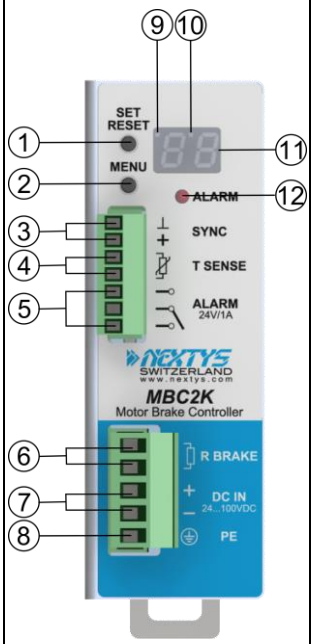
Code	Description
MBC2K	2kW Motor Brake Controller

Certifications and approvals	CE		RoHS 2011/65/EU	Pb lead-free

Reference standards	2014/35/EU (2014)	(Low Voltage Directive)
	2014/30/EU (2014)	(EMC directive)
	EN61010-1	(Safety Standard)
	EN61010-2-201	(Safety Standard)
	UL508	(Safety Standard)
	EN61000-6-2	(Generic immunity standard for industrial environments)
	EN61000-6-4	(Generic emission standard for industrial environments)

USER INSTRUCTIONS
1) DC Bus voltage: DC IN=24-100Vdc, range 24-110Vdc ; 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) Installation: use DIN-rails according to EN 60715. Installation should be made vertically (see Fig.6). For better device stability fix the rail to the wall close to the point where the device is to be mounted. In order to guarantee sufficient convection, we recommend observing a minimum distance to other modules (see Fig.3).
3) Connections: the device is equipped with pluggable screw terminals. To avoid sparks, do not connect or disconnect the connectors before having previously turned-off input power and waited for internal capacitors discharge (minimum 1 minute) In order to comply with UL certification, use appropriate copper cables of indicated cross section, designed for an operating temperatures of: 60°C for ambient up to 45°C 75°C for ambient up to 60°C 90°C for ambient up to 70°C Strip the connecting ends of the wires according to the indication and ensure that all strands of a stranded wire enter the terminal connection (see Fig.7)
4) Input/Output connection: The device is suitable for **SELV** and **PELV** circuitry (if you use a source that having Uout higher 60Vdc is not a SELV device) Check Uout before connecting the power supply to the load.
5) 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.
6) 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 >70°C 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.
7) Parallel connection: Up to 4 MBC2K can be connected in parallel to increase the braking power up to 8kW peak.

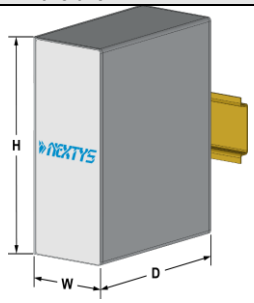
Fig.1
Connections



(1) SET/RESET button: used to reset the protections and to change setup values in setup mode.
(2) MENU button: used to enter into setup mode and to navigate trough menu pages.
(3) Synchronization bus connector: used to parallel up to 4 units
(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.
(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.
(12) Alarm LED: used to indicate a fault condition of the unit.

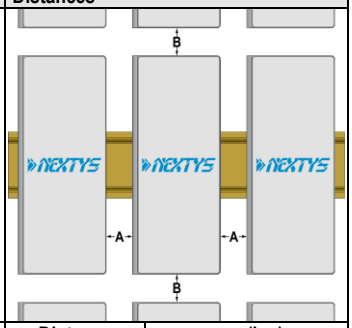
Input DC Line:
- DC IN + = Positive DC
- DC IN - = Negative DC
- ⏚= earth ground

Fig.2
Dimensions



Dimension	mm (inc)
W	35.0 (1.38)
D	104.0 (4.09)
H	103.0 (4.05)

Fig.3
Distances



Distance	mm (inc)
A	20 (0.8)
B	20 (0.8)

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.5). On top of that the MBC2K provides several protections to ensure reliable operation. 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 unit front view with all its controls is shown in Fig.1.
Up to 4 MBC2K units can be connected in parallel to increase the braking power up to 8kW max.
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.

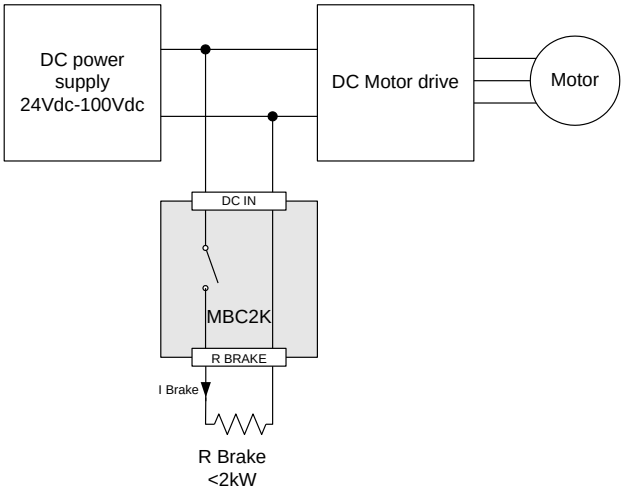


Fig.4 - Simplified application diagram

Set-up

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.

In order to set the parameters for menu page a) and b) refer to Figure 5 to adjust the parameters.

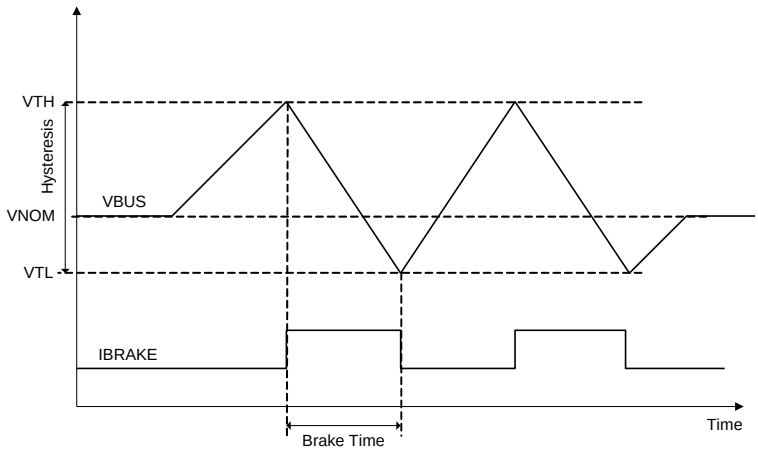


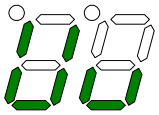
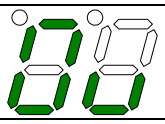
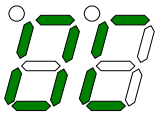
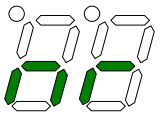
Fig.5 - Typical braking waveforms

Menu page a) : Brake intervention threshold
Figure 5 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 (see the VTH steps in the table below).
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 Fig.1). 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.
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.

STEP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VTH	27	34	40	45	47	50	54	55	60	66	71	74	76	81	86	91	94	96	101	106

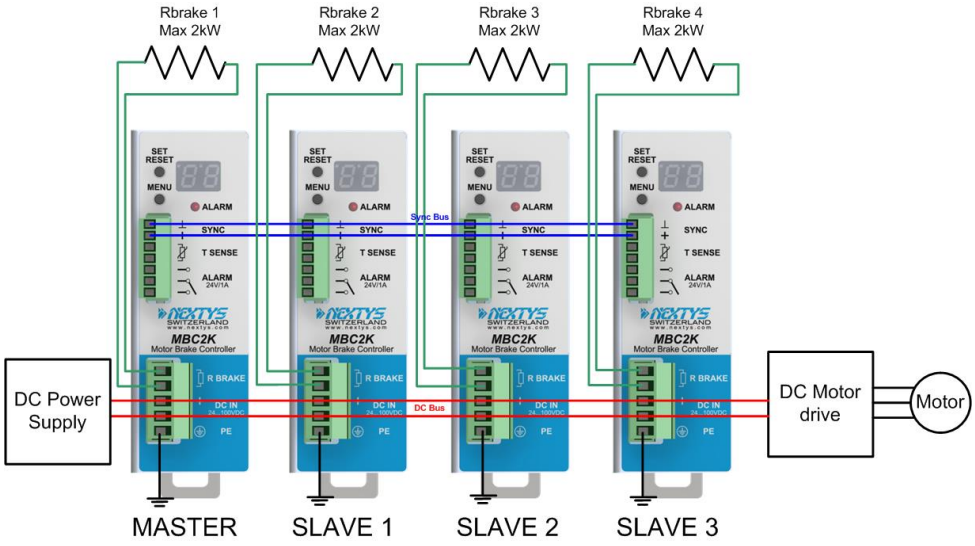
Protection and errors code			
The MBC2K unit integrates several active protections to guarantee reliable operations in normal conditions. As soon as a faulty event is detected the MBC2K power stage is switched off so that no uncontrolled current flow trough the brake resistor is possible. A fault condition 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 2s 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 - increase this value - Press SET/RESET button - The MBC2K unit should be now operational

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 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.



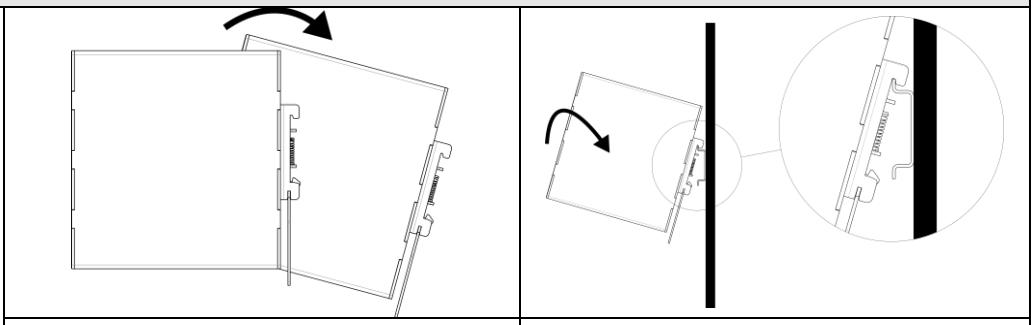
Typical connection of MBC2K units using the Synchronization BUS

Fig.6
Mounting / Dismounting Instructions

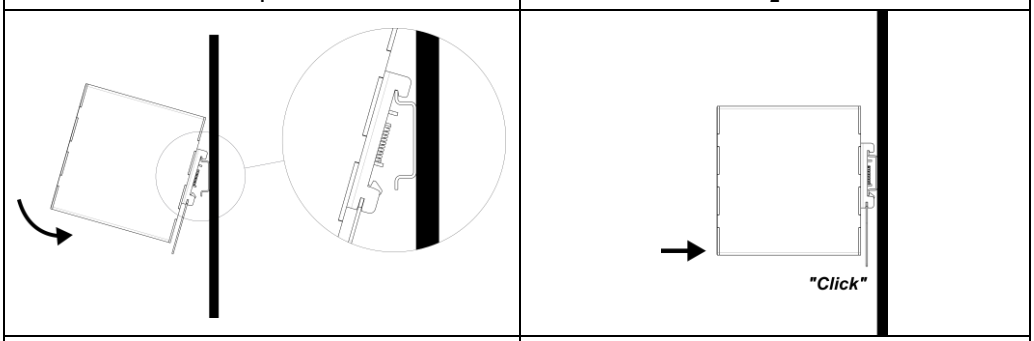
For DIN rail fastening according to IEC 60715 TH35-7.5(-15)
Mounting as shown in figure, with input terminals on lower side, with suitable cooling and maintaining a proper distance between adjacent devices as specified in the I.S. manual of each family.

Mounting:

1. Tilt the unit slightly backwards.
2. Fit the unit over the top edge of the rail.
3. Slide it downward until it hits the stop.
4. Press against the bottom for locking.



1 2



3 4

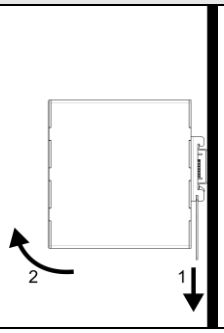
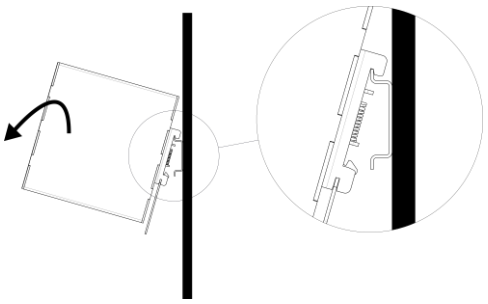
Dismounting:		
1. Pull down the slide clamp lever **2.** Tilt the unit upward **3.** Unhook the unit from the rail		
	1 & 2	**3**

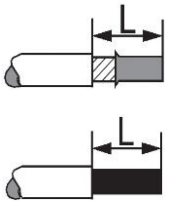
Fig.7 Recommended connecting cable			
	**Recommended Tightening torque** **Input / output** 0.5-0.6Nm 4.42-5.30 lbf in **Signals** 0.2-0.25Nm 1.17-2.21 lbf in		**Input / output** Solid: 2.5mm² / 12AWG Stranded:1.5mm² / 12AWG L: 6.0-7.5mm / 0.24-0.30in **Signals** Solid: 0.05-1.5mm2 / 30-14AWG Stranded: 0.05-1.5mm2 / 30-14AWG L: 5-6mm / 0.20-0.24in

Fig.8 Protection
▪ Undervoltage on DC BUS < 22Vdc ▪ Overvoltage on DC BUS > 110Vdc ▪ Brake resistor overtemperature (if temperature sensor is present) ▪ Module Internal overtemperature > 90°C ▪ Brake resistor interrupted or not connected ▪ Short circuit: braking current > 80A ▪ Overload: braking time > 1sec

Fig.9 Environment	
Operating temperature	**Derating**
- 40°C…70°C 5…95% r.H. non condensing	No Derating

Note:
▪ **Data may change without prior notice in order to improve the product.** ▪ **Please refer to the latest version of the "Instruction Manual" for each product by visiting *www.nextys.com***

See also the products below that can be used in conjunction with MBC2K units:
▪ **This device can be used in conjunction with every each our power supply that is able to provide an regulated Uout included between 24…100Vdc**