

Installation Guide

# Electronic controller MCX15B2/20B2



080R9340



AN320819413085en-000401



**General features:**

MCX15B2/MCX20B2 is an electronic controller that stands on the top of the MCX range, thanks to the large number of its inputs and outputs, the enhanced CPU capabilities and connectivity features.

It holds all the typical functionalities of MCX controllers: programmability, connection to the CANbus local network, up to two Modbus RS485 serial interfaces with galvanic isolation.

Furthermore, it is fitted with an ultra wide range (24/110/230 V AC) power supply in the same product variant, with USB and Ethernet connection for embedded Web server and IP protocols management.

It is available in several models, with or without graphic LCD display and with 15 or 20 digital output.

	MCX15B2	MCX20B2
<b>ANALOG INPUTS</b>		
NTC, 0/1 V, 0/5 V, 0 / 10 V PT1000, selectable via software	4	6
Universal NTC, Pt1000, 0/1 V, 0/5 V, 0/10 V, ON/OFF, 0/20 mA, 4/20 mA, selectable via software	6	10
<b>Total number</b>	<b>10</b>	<b>16</b>
<b>DIGITAL INPUTS</b>		
Voltage free contact/24V AC sensing	18	18
24/230 V AC optoinsulated	4	4
<b>Total number</b>	<b>22</b>	<b>22</b>
<b>ANALOG OUTPUTS</b>		
0/10 V DC optoinsulated	6	6
0/10 V, PWM, PPM selectable via software	2	2
<b>Total number</b>	<b>6</b>	<b>6</b>
<b>DIGITAL OUTPUTS</b>		
SPDT relay 16 A (changeover contacts)	2	2
SPST relay 5 A (normally open contacts)	13	18
<b>Total number</b>	<b>15</b>	<b>20</b>
<b>OTHERS</b>		
Power supply 24-110-230 V AC / 40-230 V DC	•	•
Connection for programming key and for remote display and keyboard	•	•
Buzzer	-	-
RTC clock	•	•
Modbus RS485 serial interface	x1	x2
CANbus	•	•
Ethernet for Webserver/Modbus TCP	•	•
USB for firmware/application software update and datalogging	•	•
Dimensions (DIN modules)	16	16
Mounting	DIN rail	DIN rail

## General features and warnings

### Plastic housing features

- DIN rail mounting complying with EN 60715
- Self extinguishing V0 according to IEC 60695-11-10 and glowing/hot wire test at 960 °C according to IEC 60695-2-12
- Ball test: 125 °C according to IEC 60730-1. Leakage current:  $\geq 250$  V according to IEC 60112

### Other features

- Operating conditions CE: -20T60 / UL: 0T50, 90% RH non-condensing
- Storage conditions: -30T80, 90% RH non-condensing
- To be integrated in Class I and/or II appliances
- Index of protection: IP40 only on the front cover
- Period of electric stress across insulating parts: long
- Suitable for use in environments with degree of pollution 2
- Category of resistance to heat and fire: D
- Immunity against voltage surges: category II, category III for versions without display
- Software class and structure: class A

### Compliance

#### CE mark

This product is designed to comply with the following EU standards:

- Low voltage directive LVD 2014/35/EU:
  - EN60730-1: 2011 (Automatic electrical control for household and similar use. General requirements)
  - EN60730-2-9: 2010 (Particular Requirements for Temperature Sensing Controls)
- Electromagnetic compatibility EMC directive 2014/30/EU:
  - EN 61000-6-3: 2007 +A1: 2011 (Emission standard for residential, commercial and light-industrial environments)
  - EN 61000-6-2: 2005 (Immunity for industrial environments)
- RoHS directive 2011/65/EU and 2015/863/EU:
  - EN50581: 2012

#### UL approval:

- UL file E31024

### General warnings

- Every use that is not described in this manual is considered incorrect and is not authorised by the manufacturer
- Verify that the installation and operating conditions of the device respect the ones specified in the manual, specially concerning the supply voltage and environmental conditions
- This device contains live electrical components therefore all the service and maintenance operations must be performed by qualified personnel
- The device can't be used as a safety device
- Liability for injury or damage caused by the incorrect use of the device lies solely with the user

### Installation warnings

- Mounting position recommended: vertical
- The installation must be executed according the local standards and legislations of the country
- Always operate on the electrical connections with the device disconnected from the main power supply
- Before carrying out any maintenance operations on the device, disconnect all the electrical connections
- For safety reasons the appliance must be fitted inside an electrical panel with no live parts accessible
- Don't expose the device to continuous water sprays or to relative humidity greater than 90%.  
Avoid exposure to corrosive or pollutant gases, natural elements, environments where explosives or mixes of flammable gases are present, dust, strong vibrations or shock, large and rapid fluctuations in ambient temperature that in combination with high humidity can condensate, strong magnetic and/or radio interference (e.g. transmitting antennae)
- When connecting loads beware of the maximum current for each relay and connector
- Use cable ends suitable for the corresponding connectors. After tightening the screws of connectors, slightly tug the cables to check their tightness
- Use appropriate data communication cables. Refer to the Installation Guide "MCX hardware network specification" for the kind of cable to be used and setup recommendations
- Reduce the path of the probe and digital inputs cables as much as possible, and avoid spiral paths enclosing power devices. Separate from inductive loads and power cables to avoid possible electromagnetic noises
- Avoid touching or nearly touching the electronic components fitted on the board to avoid electrostatic discharges
- The product is not suitable to be exposed directly to the Internet

## Technical specifications

### Power supply

- 21 – 265 V AC, 50/60 Hz. Maximum power consumption: 15 W. Insulation between power supply and the extra-low voltage: reinforced
- 40 – 230 V DC

I/O	TYPE	NUM	SPECIFICATIONS
Analog inputs			<b>Total number: 16 on MCX20B2; 10 on MCX15B2</b> Analog Input type selectable via software Max 13.5 V input voltage Do not connect voltage sources without current limitation (overall 80 mA) to analog inputs while unit is not powered Open circuit HW diagnostics available for all analog inputs
	NTC 0 / 1 V 0 / 5 V 0 / 10 V PT1000	16 (MCX20B2) 10 (MCX15B2)	<b>AI1 to AI16 on MCX20B2</b> <b>AI1 to AI10 on MCX15B2</b> NTC, default 10 k $\Omega$ at 25 °C, Beta 3435 0/xV type: impedance is greater than 1 M $\Omega$
	ON/OFF 0 / 20 mA 4 / 20 mA	10 (MCX20B2) 6 (MCX15B2)	<b>AI1 to AI6, AI11 to AI14 on MCX20B2</b> <b>AI1 to AI6 on MCX15B2</b> 100 $\Omega$ s as measuring resistance for current measurements. The inputs can be used to sense voltage free contacts with contact cleaning current 10 mA
	Auxiliary Supplies		15 V+ and 5 V+ 5 V+ max: 200 mA (total on all outputs) 15 V+ max: 200 mA (total on all outputs) All power outputs are protected against short circuit and have an automatic recovery from overload condition.
Digital inputs			<b>Total number: 22</b> Digital Input type selectable via software between 24 V AC or voltage free
	Voltage free contacts or 24 V AC	18	<b>DI5 to DI22</b> As the inputs are not isolated, caution has to be used when applying 24 V AC: the same polarity of the supply <b>MUST</b> always be used on COM/GND connection. Counting function with max frequency of 16.6 Hz (30 ms minimum pulse time)
	24 V opto-insulated	4	<b>DI1, DI2, DI3, DI4</b> Inputs opto isolated, 24 V AC 50/60 Hz or 24 V DC Rated current: 5 mA @24 V AC
	230 V opto-insulated	4	<b>DIH1, DIH2, DIH3, DIH4</b> Inputs opto isolated, 86 – 265 V AC / 50/60 Hz Reinforced isolation Rated current: 2,5 mA @ 265 V AC  <b>Note:</b> when the 230 V AC DH1 input is used, the corresponding 24 V DI1 input is not available anymore; the same for the couple of inputs DIH2 and DI2, DIH3 and DI3, DIH4 and DI4
Analog outputs			<b>Total number: 6</b>
	0 / 10 V	6	<b>AO1, AO2, AO3, AO4, AO5, AO6</b> Analog Outputs 0/10 V, galvanically isolated, minimum load 1K $\Omega$ (10 mA) for each output
	PWM-PPM	2	<b>AO5, AO6</b> <b>Asynchronous PWM</b> Voltage output: max $V_{LO}$ = 0.6 V, min $V_{HI}$ = 6.5 V Frequency range 15Hz...1kHz <b>Synchronous PWM and PPM</b> Voltage output: max $V_{LO}$ = 0.6 V, min $V_{HI}$ = 6.5 V Frequency: Mains frequency x2

<b>Digital output</b>	Relay	20 (MCX20B2) 15 (MCX15B2)	Concerning the insulation distance there are three groups of relays: <ul style="list-style-type: none"> <li>• group 1: relays 1 to 8</li> <li>• group 2: relays 9 to 13</li> <li>• group 3: relays 14 to 20</li> </ul> Insulation between relays of the same group: functional Insulation between relays of different groups: reinforced Insulation between relays and the extra-low voltage parts: reinforced Total current load limit: 65 A <b>C1-NO1 to C13-NO13, C16-NO16 to C20-NO20 on MCX20B2</b> <b>C1-NO1 to C13-NO13 on MCX15B2</b> Normally open contact relays 5 A Characteristics of each relay: <ul style="list-style-type: none"> <li>- 5 A 250 V AC for resistive loads - 100,000 cycles</li> <li>- 3 A 250 V AC for inductive loads - 100,000 cycles with <math>\cos(\phi) = 0.4</math></li> <li>- UL: 3 A resistive, 250 V AC, 100,000 cycles; 1/8 hp, 125/250 V AC, 30,000 cycles; C300 pilot duty, 125/250 V AC, 30,000 cycles</li> </ul> <b>C14-NO14-NC14, C15-NO15-NC15</b> Changeover contact relays 16 A Characteristics of each relay: <ul style="list-style-type: none"> <li>- 7 A 250 V AC for resistive loads - 100,000 cycles</li> <li>- 3.5 A 250 V AC for inductive loads - 230,000 cycles with <math>\cos(\phi) = 0.4</math></li> <li>- UL: NO contact: 6 A resistive, 240 V AC, 30,000 cycles; 1/2 hp, 240 V AC, 30,000 cycles; 470 VA pilot duty, 240 V AC, 30,000 cycles. NC contact: 6 A resistive, 6,000 cycles</li> </ul> <b>C3 NO3 to C6 NO6</b> Optionally they can be solid state relays Characteristics of each relay: 15-280 Vrms, 0.5 A UL: 0.5 A resistive, 240 V AC, 30,000 cycles
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### Communication interface

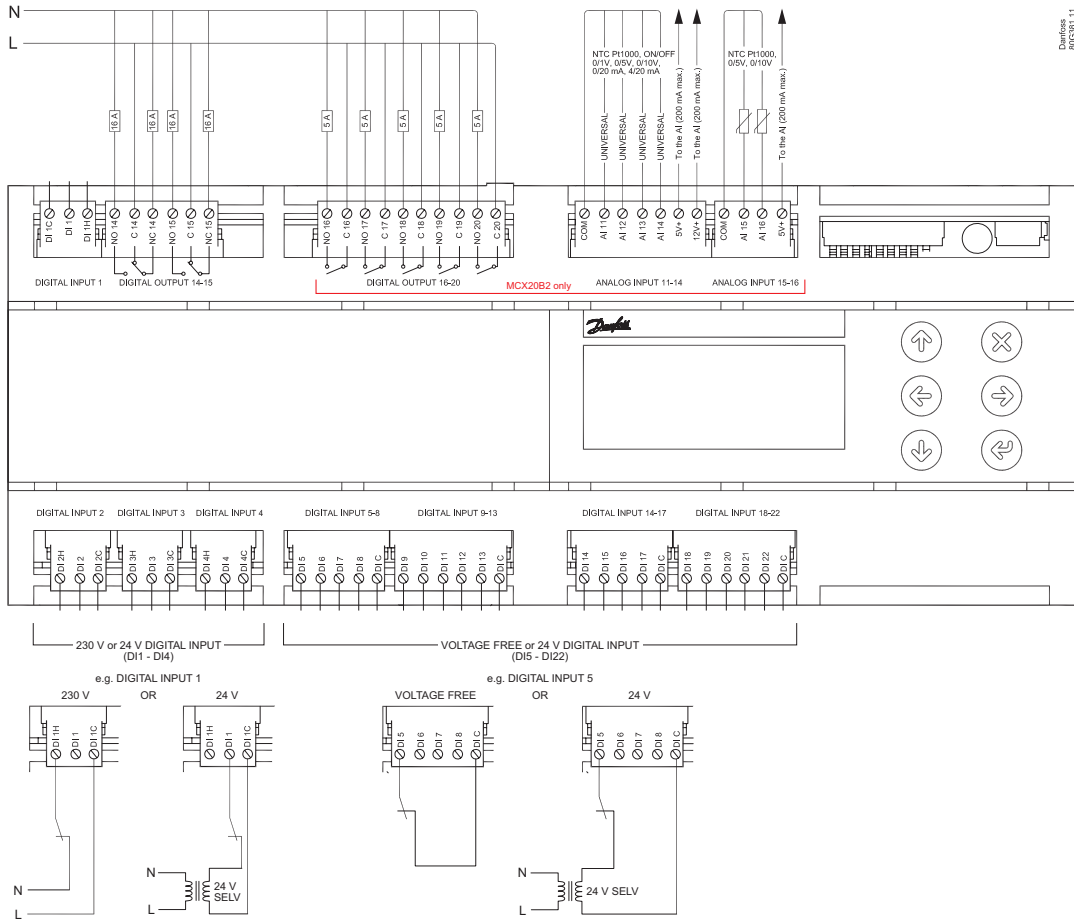
Interface	Use	Connector label	Technical data
CANbus	Fieldbus for connection to user interfaces, MCX controllers, service tools etc.	CAN CAN-RJ	Physical layer according to ISO 11898-2 High Speed CAN bus Frame format according to CAN 2.0B specification Transceiver not isolated (power supply has reinforced isolation)
USB device	Prepared for future use	USB-DEV	Plug: Type Mini B
USB host	For connection to Flash drive for application software update, datalogging and service	USB-H	Plug: Type A
RS485-1 RS485-2 (MCX20B2 only)	Communication bus to BMS (e.g. Modbus slave), service tools, smart devices (e.g. Modbus master) RS485-1 can be polarized as master from the application	RS485-1 RS485-2	Physical layer according to EIA 485 Ref3 Provide 500 V peak transient galvanic isolation
Ethernet	For web server functionality, integration (e.g. Modbus TCP) NOTICE! Do not route cable outside of buildings. Connect only to IT equipment compliant with EN 60950 or EN 62368 (Information technology equipment. Safety. General requirements)	ETHERNET	Interface type: 10 BASE-T and 100 BASE-TX, IEEE 802.3. MDI-X (Automatic medium-dependent interface crossover)

### Wire lengths

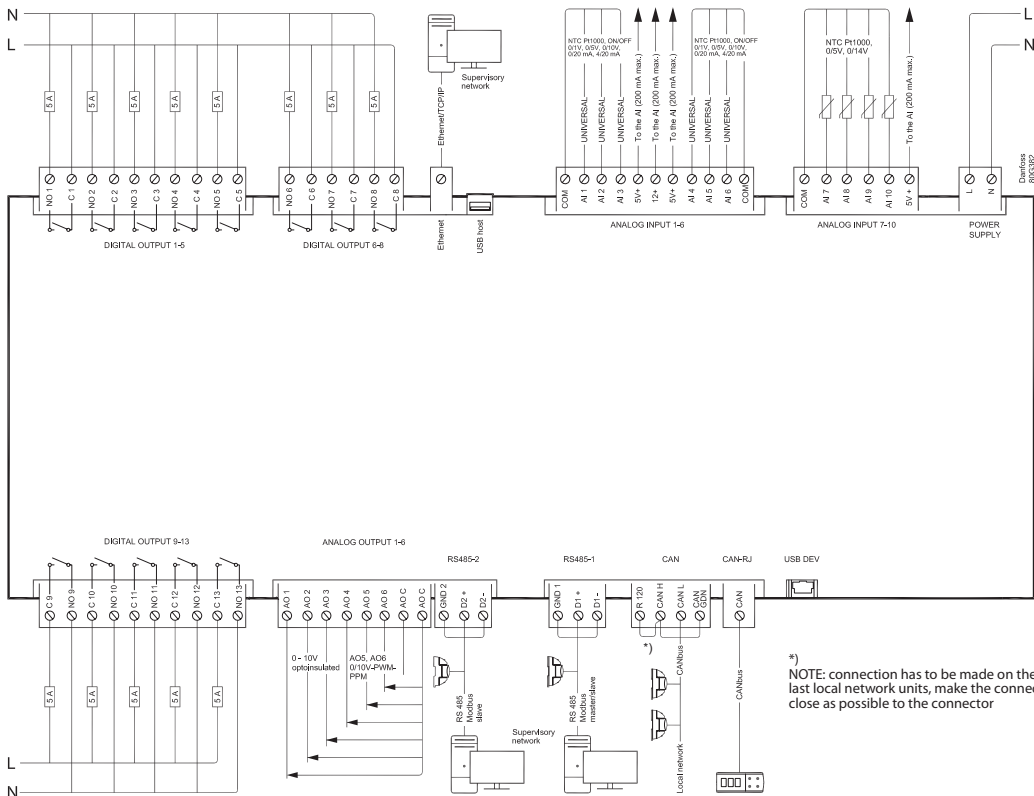
Interface	Max wire length (m)	Max. baudrate (bps)	Min. wire size
Ethernet	100	10/100 M	
CANbus	1000 500 250 80 30	50 K 125 K 250 K 500 K 1 M	AWG18 AWG22 AWG24 AWG26 AWG26
RS485	1000	125 K	AWG22
Signal wiring	30		

# Connection diagram

## TOP BOARD



## BOTTOM BOARD

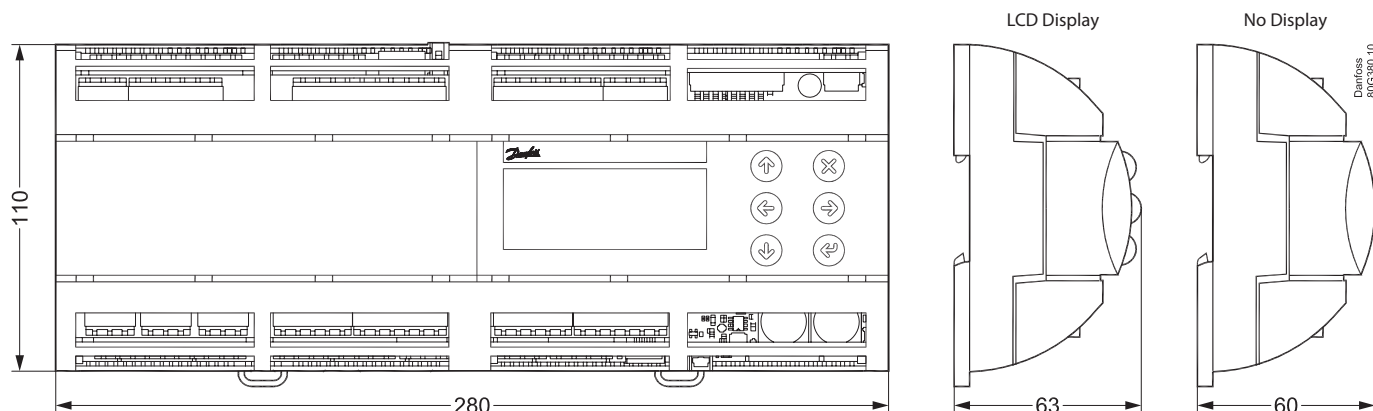


\*) NOTE: connection has to be made on the first and last local network units, make the connection as close as possible to the connector

## Connection

Connectors	Type	Dimensions
<b>Top Board</b>		
Digital input 1 connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital output 14-15 connector	6 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital output 16-20 connector (MCX20B2)	10 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Analog input 11-14 connector (MCX20B2)	7 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Analog input 15-16 connector (MCX20B2)	4 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 2 connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 3 connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 4 connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 5-8 connector	5 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 9-13 connector	6 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 14-17 connector	5 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital input 18-22 connector	6 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
<b>Bottom Board</b>		
Digital output 1-5 connector	10 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital output 6-8 connector	6 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Ethernet connector	8 / 8 way RJ 45 plug type	
USB host connector	USB Type A	
Analog input 1-6 connector	11 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Analog input 7-10 connector	6 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Power supply connector	2 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Digital output 9-13 connector	10 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
Analog output 1-6 connector	8 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
RS485 -2 connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
RS485-1connector	3 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
CAN connector	4 way screw plug-in connector type	<ul style="list-style-type: none"> <li>pitch 5 mm</li> <li>section cable 0.2 – 2.5 mm<sup>2</sup></li> </ul>
CAN-RJ connector	6/6 way telephone RJ12 plug type	
USB DEV connector	USB Mini B	

## Dimensions



## User interface

### LCD Display

display mode: STN blue transmissive  
back-light: white LED back-light adjustable via software  
display format: 128 x 64 dots  
active visible area : 58 x 29 mm  
contrast: adjustable via software

### Keyboard

number of keys: 6  
keys function is settled by the application software

### Display settings adjustment

Setting of the LCD display like contrast and brightness might need to be adjusted due to external ambient factors. Press and release simultaneously the Enter and X key after power ON to access the BIOS menu and select the DISPLAY menu. Use UP and DOWN arrow keys to adjust the contrast or the brightness of the display at the desired level.

## Product part numbers

Description	Code No.
MCX15B2, RS485, S	080G0327
MCX15B2, LCD, RS485, S	080G0328
MCX20B2, 2xRS485, I (12 pieces)	080G0329
MCX20B2, LCD, 2xRS485, S	080G0330
MCX20B2, LCD, 2xRS485, I (12 pieces)	080G0331
MCX20B2, LCD, 4 SSR, 2xRS485, S	080G0332

**Note:** single pack codes (S) include standard kit connectors, industrial pack codes (I) don't include standard kit connectors

## Accessories part numbers

Description	Code No.
MCX20B2 CONNECTORS KIT	080G0404

## Replacement of MCX15B-20B with MCX15B2-20B2 through wiring kit

You can replace MCX15/20B with an equivalent model of MCX15/20B2. The same application software runs on both versions without any change and the universal power supply (24 V AC - 110 V AC - 230 VAC) of MCX15/20B2 facilitates the selection of the equivalent model.

But there are the following differences that must be taken into consideration:

- The pinout is slightly different for some of the Input/Output (see below the suggested connection diagram)
- The NC (Normally Closed) signals for relay DO10, DO11, DO12 and DO13 are not available in MCX15/20B2. But they are available for DO14 (as in MCX15B) (and for DO15 as in MCX15/20B). An external relay must be used if these signals are needed. Alternatively, the application can be changed to take advantage of the additional NC14 signal of MCX20B2.
- The Analogue Outputs (AO) in MCX15/20B2 are internally powered, therefore you must not connect the L1 signal
- 24 V DC power supply is not supported by MCX15/20B2 (40 – 230 V DC)
- The Digital Inputs are both contact free and 24 V sensing in MCX15/20B2, but the DI common signals (DIC) in MCX15/20B2 are internally connected, therefore you must ensure that DIC are connected to the same phase before the replacement.

**For facilitating the replacement of MCX15/20B with B2, you can build a wiring kit following these instructions:**

### Wiring kit specifications:

#### Cables:

L = 200 mm H05V-K WHITE

DO: section = 1 mm<sup>2</sup>

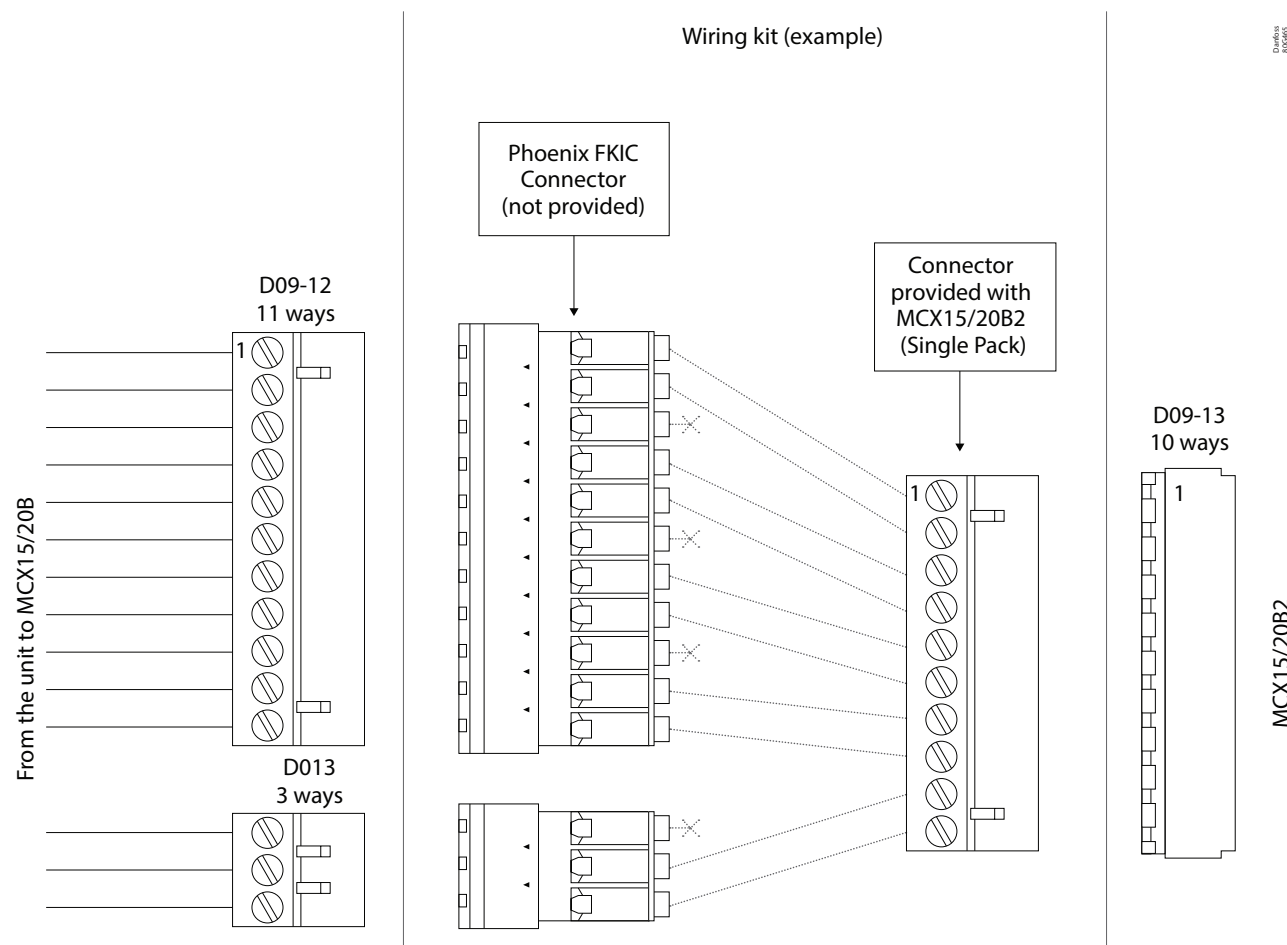
DI: section = 0.5 mm<sup>2</sup>

AO: section = 0.5 mm<sup>2</sup>

#### Connectors:

Phoenix FKIC (or equivalent): Wire strip length = 10 mm

Phoenix MSTP (or equivalent): End sleeves = PKD 508/PKD 108 (Danfoss P/N: 080G0404, provided with MCX15/20B2 Single Pack)

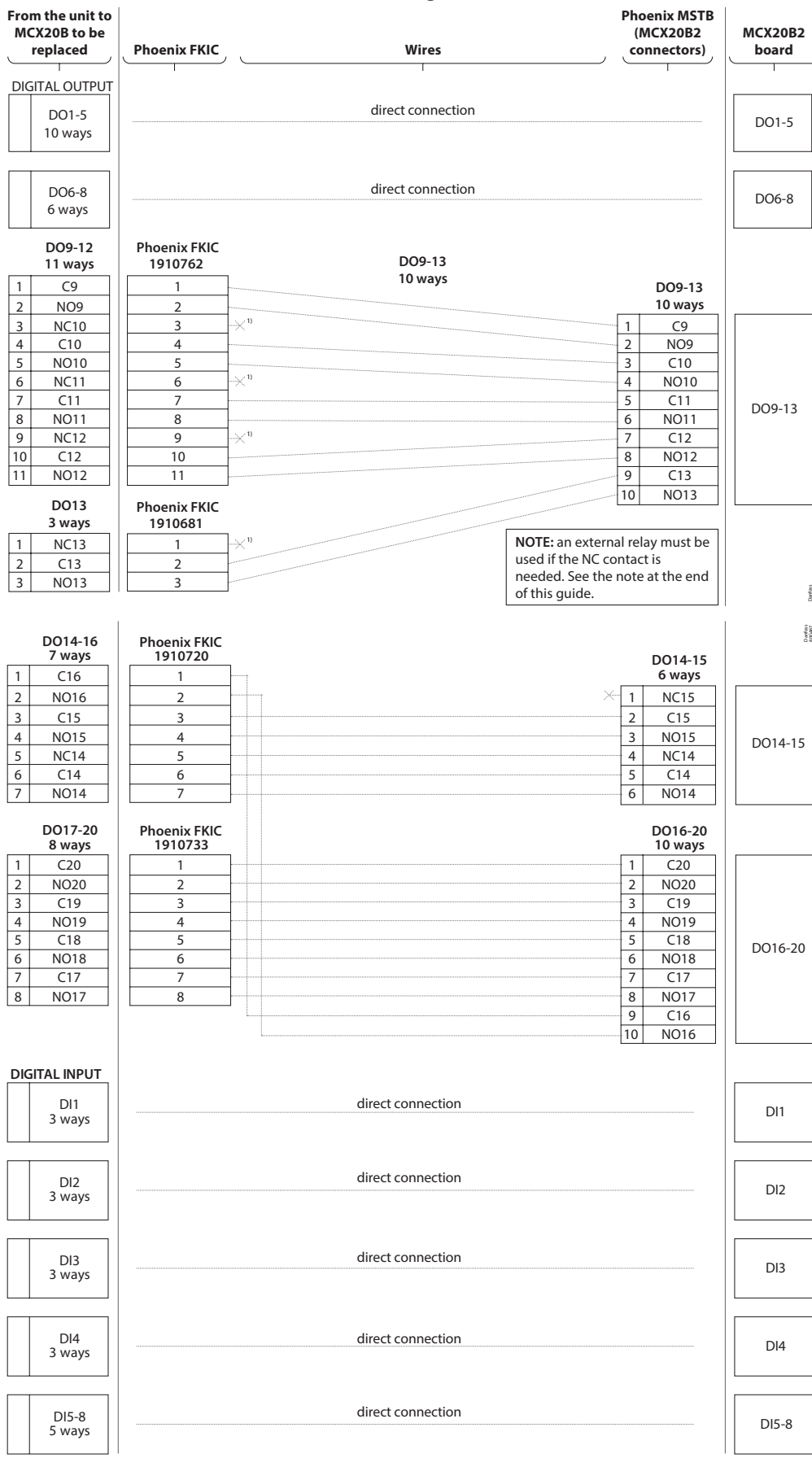


Danfoss  
806065



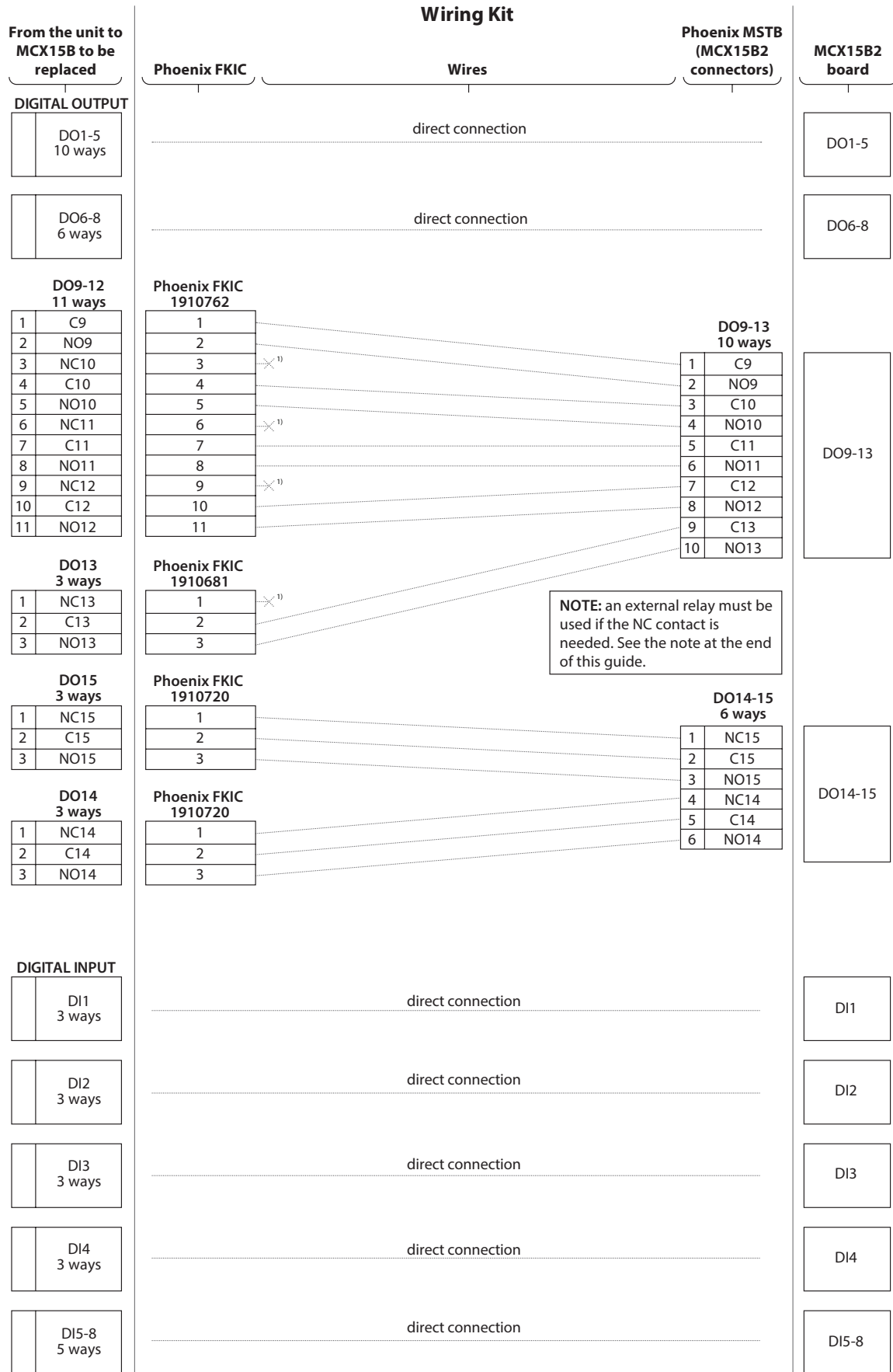
## Connection diagram – from MCX20B to MCX20B2

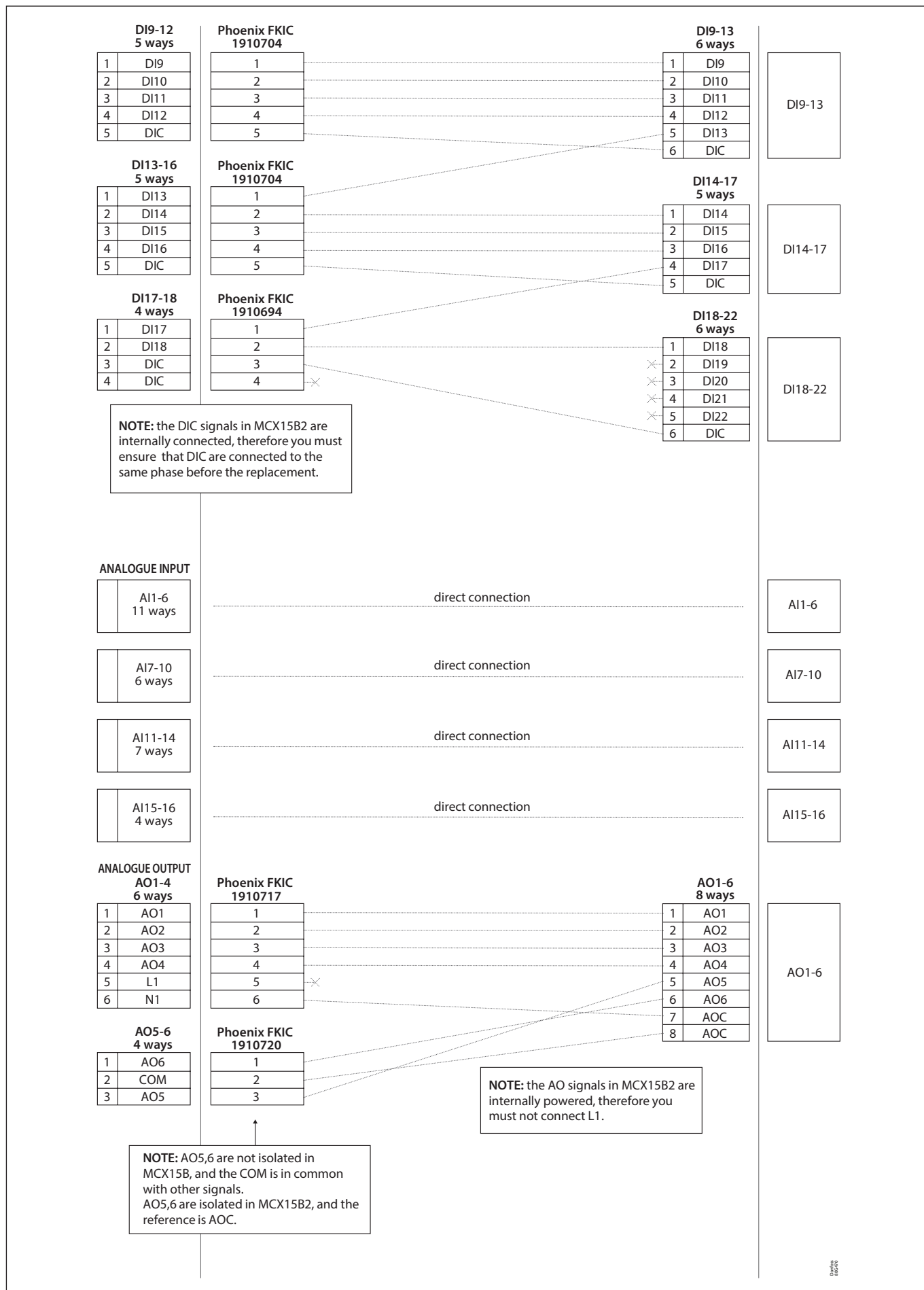
### Wiring kit



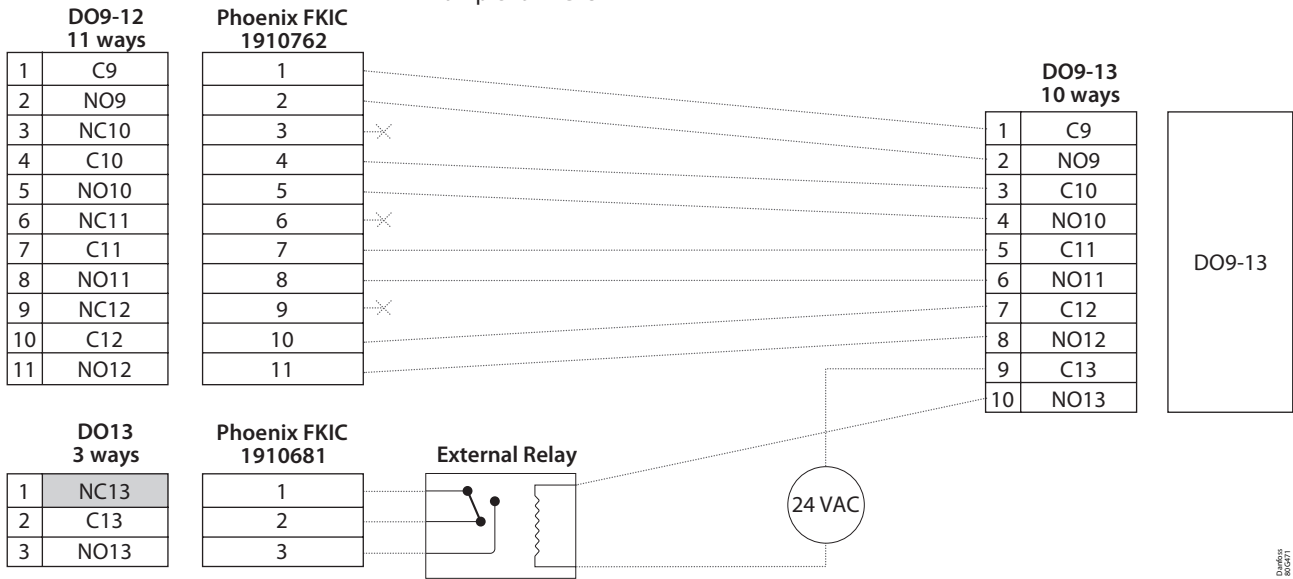


## Connection diagram – from MCX15B to MCX15B2





1) External Relay connection diagram  
 (when the NC10, NC11, NC12, NC13 signals are needed).  
 Example for NC13



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