ComatReleco PLC + HMI

BoxX 2

User Manual

BoxX 2 series PLC is an upgraded version of BoxX series PLC. Before you use the product, please kindly read the manual carefully so as to ensure proper use of the product.

Important information

ComatReleco reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular user documentation) does not constitute any further duty on the part of ComatReleco to provide information on modifications to products and/or technical documentation. You are responsible for verifying the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed. In general, the provisions of the current standard Terms and Conditions of ComatReleco apply exclusively, in particular as concerns any warranty liability.

This user manual contains important information for the commissioning, operation, maintenance and disposal of the device. You will also receive information and important tips for your safety and help with any issues. The user manual must be made physically or electronically available with the equipment and must be included in the supply when the equipment is transferred. It is also available on the ComatReleco web portal.

Copyright

This manual, including all illustrations contained herein, is copyright protected. Any changes to the contents or the publication of extracts of this document is prohibited.

ComatReleco reserves the right to register its own intellectual property rights for the product identifications of ComatReleco products that are used here. Registration of such intellectual property rights by third parties is prohibited.

Other product identifications may be afforded legal protection, even where they may not be indicated as such.

Disclaimer

The owner of this device is responsible for ensuring that the instructions and notes in this manual are read, understood and followed by the personnel concerned before putting the device into operation. Failure to observe the instructions may result in serious bodily injury and/or damage to property. ComatReleco assumes no liability for personal injury, damage to property or financial losses.

Unauthorized modifications and changes to the device can affect safety and are not permitted. This leads to a limitation of the warranty and may result in loss of product conformity.

Tabel of contents

1   Introduction

BoxX 2 series PLC is an upgraded version of old BoxX PLC, which is programmed by the use of a Function Block Diagram. The programming of BoxX 2 is simpler and easier to learn than that of a conventional PLC, which uses ladder diagrams and associated instructions. In the design concept of BoxX 2 series products, it adds power indicator, comes with 2-way 485 communication interface, supports standard MODBUS RTU protocol and can modify parameters and other functions through the LCD panel, which greatly reduces the user's cost investment, and for the operation It brings great convenience. The volume of BoxX 2 series products follows the old BoxX 2's small size, light weight and other characteristics, and is especially suitable for internal installation and use. Now BoxX 2 are being widely used in many fields such as industry, commerce, mining, agriculture, home automation, etc.
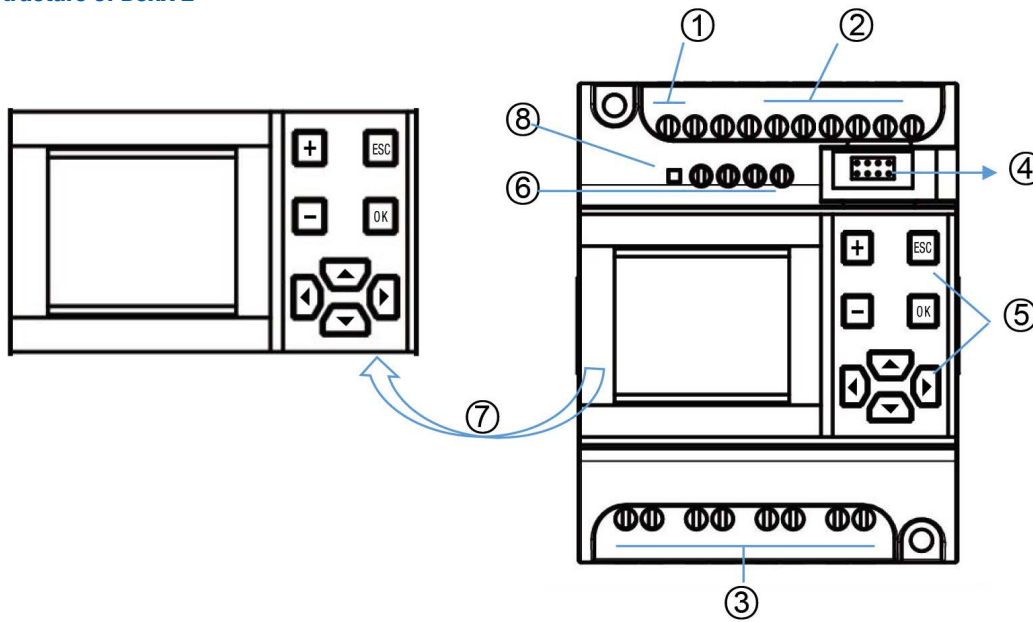
1.1   Structure of BoxX 2

Figure 1

① Power terminals   ⑤ Operating keys
② Input terminals   ⑥ Two channel of 485 communication interface (A1/B1 + A2/B2)
③ Output terminals (Relay or transistor)   ⑦ LCD display panel
④ Program download port   ⑧ Power Indicator (Red Indicator, Flashing frequency 1 Hz)

1.2   Specifications and models

Item	Type	Power supply	Input	Output
1	AF-10MR-A2	110 – 220 V AC	6 points AC digital input	4 points relay output
2	AF-10MR-E2	12 – 24 V UC	6 points AC/DC digital input	4 points relay output
3	AF-10MT-E2	12 – 24 V DC	6 points DC digital input	4 points transistor output (equivalent NPN)
4	AF-10MR-D2	12 – 24 V DC	6 points DC (with analog) digital input	4 points relay output
5	AF-10MT-D2	12 – 24 V DC	6 points DC (with analog) input	4 points transistor output (equivalent NPN)
6	AF-10MT-GD2	12 – 24 V DC	6 points DC (with analog) input	4 points transistor output (equivalent PNP)
7	AF-20MR-A2	110 – 220 V AC	12 points AC digital input	8 points relay output
8	AF-20MR-E2	12 – 24 V UC	12 points AC/DC digital input	8 points relay output
9	AF-20MT-E2	12 – 24 V DC	12 points DC digital input	8 points transistor output (equivalent NPN)
10	AF-20MR-D2	12 – 24 V DC	12 points DC (with analog) digital input	8 points relay output
11	AF-20MT-D2	12 – 24 V DC	12 points DC (with analog) input	8 points transistor output (equivalent NPN)
12	AF-20MT-GD2	12 – 24 V DC	12 points DC (with analog) input	8 points transistor output (equivalent PNP)
13	AF-HMI	The removable LCD panel that can modify parameters through the panel		
14	AF-C232-2	232 interface communication lines for downloading programs		
15	AF-DUSB2	USB interface communication lines for downloading programs		
16	RTD module	Detect the temperature signal directly		

1.3   BoxX 2 Features

1. Removable LCD display (AF-HMI)
AF-HMI (Removable LCD display) can be used flexibly according to your needs. When you need it, you can install and use the keys on the panel to query/set the BoxX 2 address, BoxX 2 system time, modify the function block parameters and manually calibrate the analog quantity, etc. When you don't need it, you can disassemble it and replace it with an ordinary panel, which will greatly reduce your cost of use. However, compared with AF-LCD, the AF-HMI operator panel cannot be programmed manually.

2. FB programming and big program storage capacity
BoxX 2 uses a function block to realize the control function that the previous PLC needed a large section of the program to realize, and several functional blocks are connected in a certain way to complete more complicated control functions. The BoxX 2 can accommodate up to 127 function block programs. There are enough resources for you to implement complicated control requirements. Once the program is written, it will never be lost. BoxX 2 uses a larger memory capacity chip than BoxX.

3. Exquisite and compact design
If you are looking to make your device delicate, BoxX 2 will be your best partner.
AF-10 Series: 71.6 mm x 90.4 x 57.6 mm
AF-20 Series: 126.4 mm x 90.4 x 57.6 mm

4. Free programming software
The free QUICK II programming software is an extremely friendly human-machine programming interface. It not only can edit function charts, but also can provide functions such as off-line simulation of your programs and on-line monitoring of I/O status. It solves many inconveniences such as customer online testing.

5. Real-time clock function
The BoxX 2 has a clock-recording function that can run at any time you need, and you can set up to 127 different time periods, especially for systems that require time control. The timing is accurate to the second, and BoxX 2's RTC precision error is greatly improved to 20 s/month compared with BoxX, making your time control more accurate.

6. Analog inputs
BoxX 2 can receive analog input except for switch input so as to complete the control of temperature, humidity, pressure, flow, liquid level, etc., and can monitor the analog value status of the PC through short distance or long distance. And BoxX 2 simulation accuracy and BoxX greatly improved to 10 (0.1 V).

7. Security password lock function
BoxX 2 has absolute confidentiality for the program you write. You can set your own password before burning the program. You can modify the application only after entering the correct password. When the AF-HMI panel enters the function interface, it must enter the correct password and protect it with the * symbol.

8. Power indicator
BoxX 2 adds red power indicator to facilitate the customer to visually check whether the machine is properly connected to the power supply. When customers use BoxX before, it is necessary to use a multimeter to test the voltage across the power supply to determine whether the power supply is properly connected to the customer, causing inconvenience to the customer.

9. Communication interface
In addition to downloading the communication port, BoxX 2 also adds two 485 ports to save the cost and space for customers directly. BoxX 2's A1B1 interface supports the standard MODBUS RTU protocol and can communicate with other manufacturers' branded touch screens and other devices. BoxX 2's A2B2 interface is used to communicate with our SH300 text display. A detailed description of the communication interface is given chapter 4.

10. Communication protocol
In addition to the custom protocol for the download port, BoxX 2 adds the standard MODBUS RTU protocol. The old BoxX only supports custom protocols.

2　Installation and wiring

2.1　Installation

2.1.1　Methods

BoxX 2 is small so it is suitable to be fit inside panels or machinery. The installation of BoxX 2 is extremely easy.
1. Use standard 35 mm DIN rail mounting BoxX 2
2. Use screw mounting holes on BoxX 2 for direct mounting

Screw mounting hole

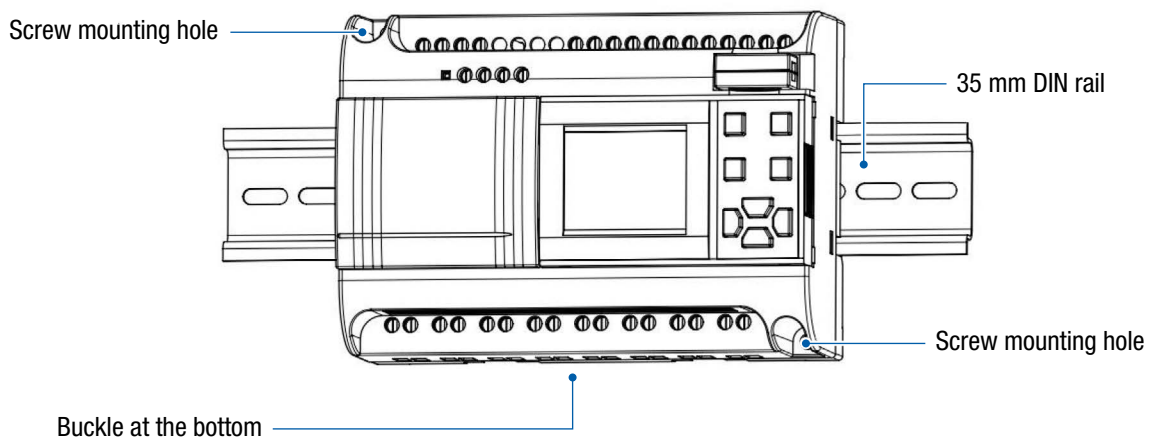35 mm DIN rail

Screw mounting hole

Buckle at the bottom

Figure 2.1 Use stand and DIN rail for installation of BoxX 2

Do not remove the AF-HMI while it is powered on. Otherwise it may cause mechanical damage and even endanger the safety of the operator. We recommend powering off and plugging the AF-HMI panel.
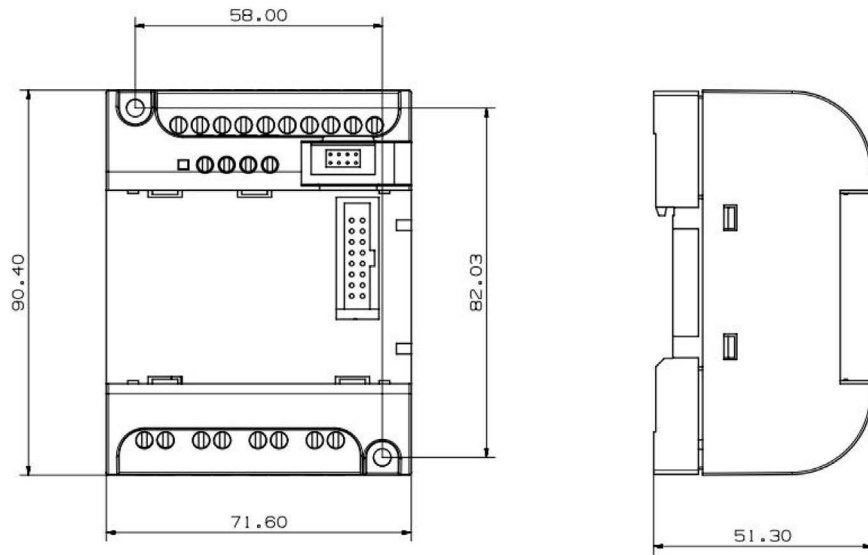
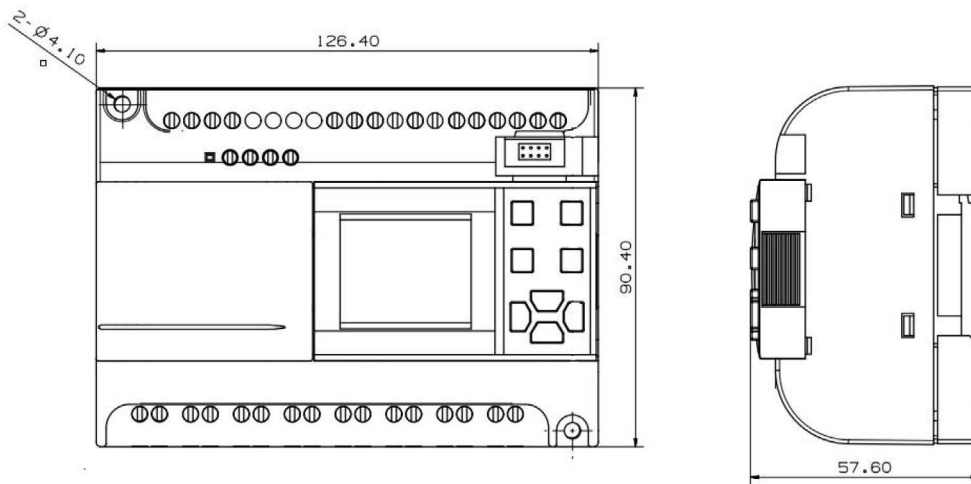### 2.1.2 Dimensions

Figure 2.2 AF-10 Series (mm)

Figure 2.3 AF-20 Series (mm)

2.2 Wiring of BoxX 2

Screwdriver with a spade tip width of 3 mm is needed for the wiring of BoxX 2 series. As for the cross section of a wire. The following two sizes are at choice:

- 1 × 2.5 mm^2
- 2 × 1.5 mm^2

COMATRELECO

ComatReleco AG | Bernstrasse 4 | 3076 Worb | Switzerland
Phone +41 31 838 55 77 | Fax +41 31 838 55 99
info@comatreleco.com | ComatReleco.com | WorldOfRelays.com

2.2.1   Connection of power supply

1. For BoxX 2s like AF-10MR-A2 and AF-20MR-A2, its applicable power supply is 100 ~ 240 V AC, 50/60 Hz.
The grid voltage fluctuation range is about 10 %.

2. For BoxX 2s like AF-10MR-D2, AF-20MR-D2, AF-10MT-D2, AF-20MT-D2, AF-10MT-GD2,
AF-20MT-GD2, AF-10MT-E2, AF-20MT-E2, Its applicable power supply voltage is 12 – 24 V DC.

3. For BoxX 2s like AF-10MR-E2 and AF-20MR-E2, its applicable power supply voltage is 12 – 24 V UC.

BoxX 2 series power wiring diagram is as shown in Figure 2.4 and Figure 2.5,
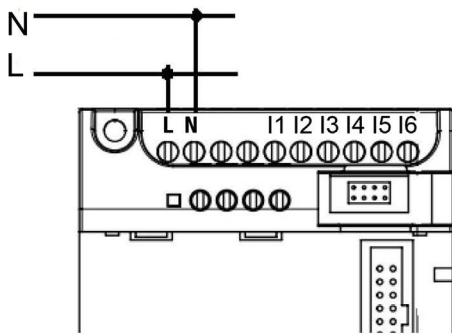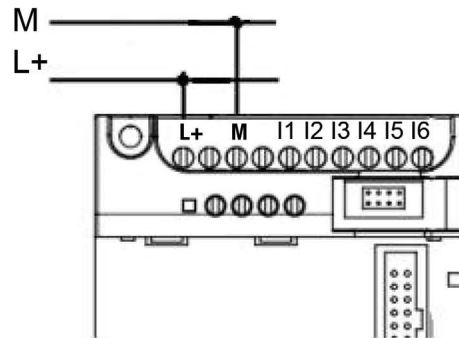

Figure 2.4 AC Type

Figure 2.5 DC Type

2.2.2   BoxX 2 Input Connection

BoxX 2 input can be either digital switch, such as on/off switches and photoelectric baffle and sunshine switch etc., or analog, such as pressure, temperature, humidity, flow and so on. The specific requirements are as follows:

Demand	AF-10MR-A2 AF-20MR-A2	AF-10/20MR-D2 AF-10/20MT-D2 AF-10/20MT-GD2	AF-10MR-E2 AF-20MR-E2	AF-10MT-E2 AF-20MT-E2
switch status 0	< 40 V AC	< 3.5 V DC	< 4.5 V UC	< 3.5 V DC
Input current	< 0.1 mA	< 0.4 mA	< 0.2 mA	< 0.5 mA
switch status 1	85 – 240 V AC	10 – 24 V DC	10 – 24 V UC	10 – 24 V DC
Input current	< 0.2 mA	< 2.5 mA	< 2 mA	< 2.5 mA

Proximity switch type with direct input 2-wire system/3-wire system/4-wire

ℹ️

Note:

1. Analog can be input into analog-receivable BoxX 2s like AF-10/20MR-D2, AF-10/20MT-D2, AF-10/20MT-GD2 through all the input ports (I1-I6/I1-IC). As long as the analog-related function blocks are used in the program, Its port is automatically set to analog input. If in the program do not use the analog-related function blocks, its port is automatically set to digit input.

2. The analog inputs require 0 ~ 10 V DC voltage signals, which are divided equally in 0.1 V increments. When you edit the program, all the block parameters related to the analog inputs are based on the minimum increment of 0.1 V.

3. When the input voltage is higher than 10.0 V DC, it can only be used as switch, not be used as analog.

4. For digit input,when the switch state changes from 0 to 1, the time of the 1 state must be greater than 50 ms.
When the switch state changes from 1 to 0, the 0 state must also exist for more than 50 ms.
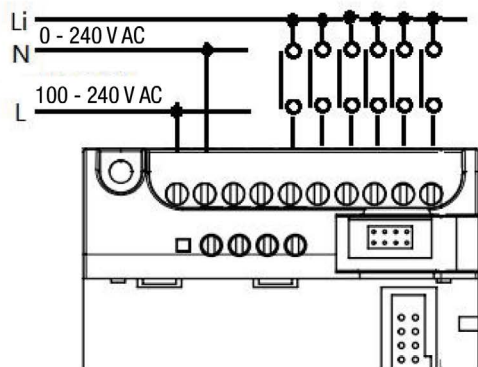
BoxX 2 input connection:
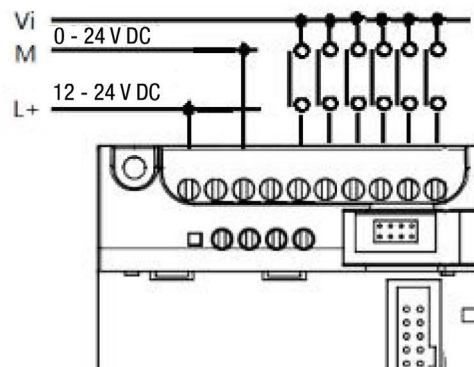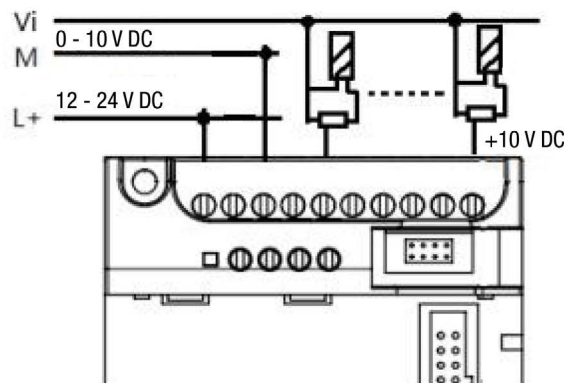

Figure 2.6 AC Type

Figure 2.7 DC Type

Figure 2.8 DC Type (D/GD)

2.2.3 BoxX 2 output connection

AF-10MR-A2/AF-20MR-A2/AF-10MR-E2/AF-20MR-E2/AF-10MR-D2/AF-20MR-D2 type BoxX 2 is the relay output, the relay's contact to the power and input is isolated. AF-10MT-D2/AF-20MT-D2/AF-10MT-GD2/AF-20MT-GD2/AF-10MT-E2/AF-20 MT-E2 type BoxX 2 is the transistor output.

1. Requirements for the relay outputs
Various loads can be connected to the output of BoxX 2, such as: incandescent lamps, fluorescent lamps, motors, contactors, etc. The maximum output current that BoxX 2 can provide is: non-inductive load 10 A, inductive load 2 A.

The connection is shown as shown in Figure 2.9:

Figure 2.9 Relay output

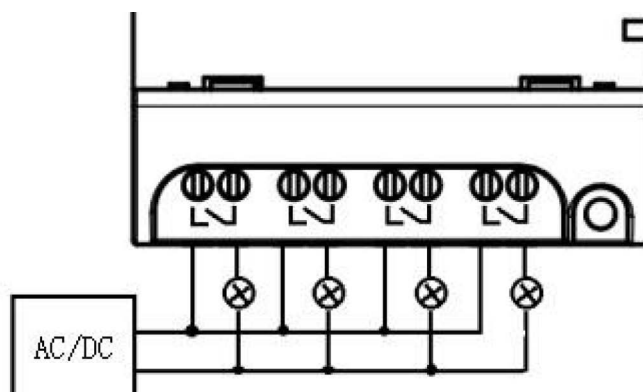2. Requirements for the transistors outputs
The transistor is divided into D type and GD type.
The load connected to BoxX 2 must have the following characteristics:
When the switch is ON (Q=1), the maximum current is 2 A.
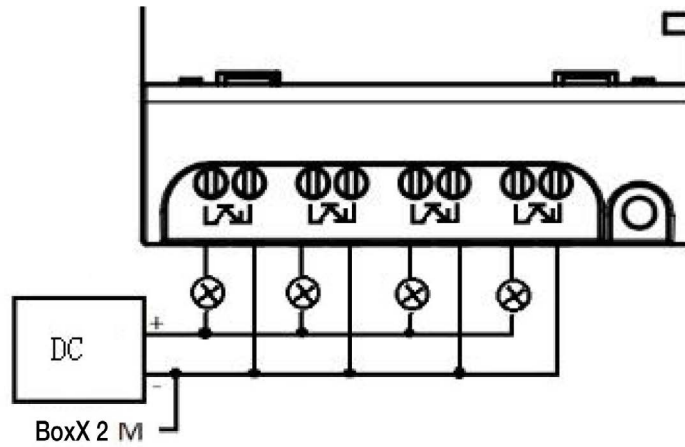
1) Type D connection is shown in Figure 2.10:

Figure 2.10 Transistor Output (D type)
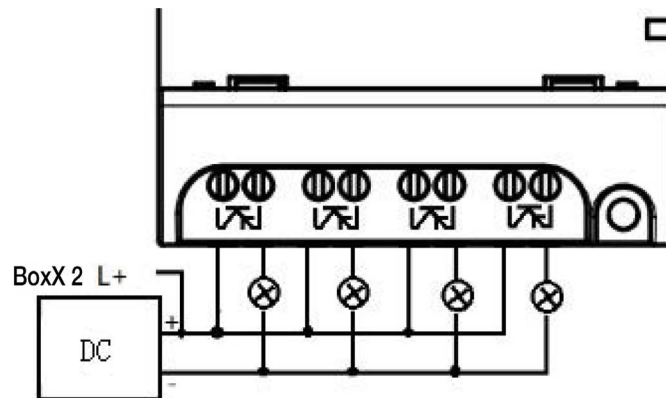
2) Type GD connection is shown in Figure 2.11:

Figure 2.11 Transistor Output (GD type)

3   Programming on BoxX 2 panel

BoxX 2 operation panel is a simple man-machine interface, which is completed by the following eight buttons to complete the panel operation.
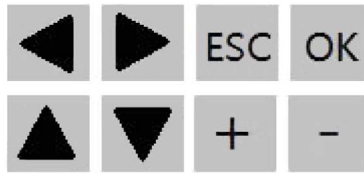

Figure 3.1 Operating buttons

3.1   BoxX 2 status display interface

After the BoxX 2 is powered on, the AF-HMI enters the BoxX 2 status display interface.
Take 10 points as an example, as shown in Figure 3.2,
The I listed above is input: the status of 6 input ports
The following Q is output: status of 4 output ports
(* indicate ON, i.e. status «1», ☐ indicates OFF, i.e. status «0»)
The time is displayed under the current day of the week.

Figure 3.2 Status display

3.2   Password confirming

When you observe the AF-HMI in the above status display interface, press the ESC and OK keys at the same time to enter the password confirmation screen, as shown in Figure 3.3, BoxX 2 needs to enter the password value at this time, and the cursor stays at the high position of the password. You can use the + and − keys to change the numeric value (0 - 9).

When you press the + and − key for the first time, the password value is *0*. You can use the ◀ and ▶ keys to move the password input position and enter the remaining number of password values. If the user password is entered correctly, it will enter the panel function interface; If the user password is not entered correctly, it will stay on the input password interface.

Four-digit password, every time you enter a digit to enter the next digit, the previous digit is hidden with the * symbol, and you must enter the four-digit number to enter the BoxX 2 function interface.
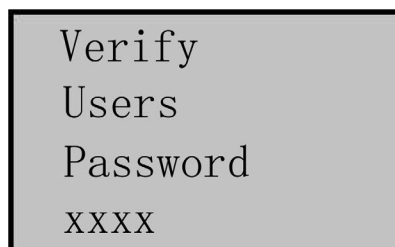

Figure 3.3 Password Interface

3.3 Function Interface

When you enter the following function interface, please kindly use and keys ▲ and ▼ to move the left **>** key and press OK key to select the function, including four options.

Editor..	Program Edit (System Reserved, BoxX 2 not enabled)
FAB/Rom	Read BoxX 2 program, simulate calibration, modify BoxX 2 address, etc.
Set..	Real time clock setting and password setting
Run	Run BoxX 2 program, click *RUN* to return to BoxX 2 status display interface

```
> Editor..
  FAB/Rom
  Set..
  Run
```
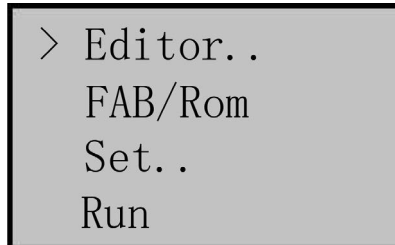
Figure 3.4 Function Interface

3.3.1 FAB/Rom Interface

When the user enters into the *FAB/Rom* interface as shown above, then when the user enters the Calibrate interface, *Rom→FAB* interface and *FAB_Addr* interface under the BoxX 2 function interface, the BoxX 2 machine will stop running.

```
> Calibrate
  Rom→FAB
  FAB_Addr
  MODEM
```

Figure 3.5 FAB/Rom Interface

Calibrate	Analog calibration
Rom→FAB	Read BoxX 2 program
FAB_Addr	View or set the BoxX 2 address (default address *000*)
MODEM	System Reserved (BoxX 2 is not enabled for this feature)

3.3.1.1 Analog Calibration Interface

The analog channel calibration method is as follows:

1. When you enter the Calibrate interface as above, please kindly press and hold the OK and ▶ keys on the LCD panel to enter the calibration page. Separate each analog channel by analog (AI: 01 corresponds to I1), and input the channel number to be calibrated, and press OK to confirm.

```
  C A L I B

   AI:00
 Value:0000
```
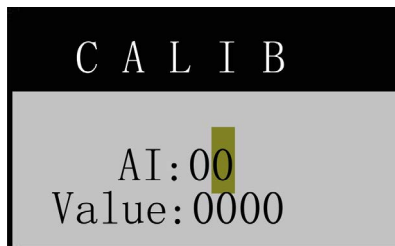
Figure 3.6 Analog Calibration Interface

2. When the minimum value is prompted, an external power supply is required to input the minimum voltage value for this channel, then press OK to confirm and mark as Vmin. When the maximum value is prompted, an external power supply is required to input the maximum voltage value for this channel. Then Press OK to confirm it and mark as Vmax. After calibrate successful, the screen will prompt succeed.

The V min and V max inputs must be between 0 V and 10 V. (The maximum calibration value of the value must be greater than the minimum calibration value)
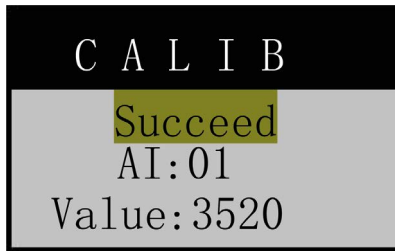
Figure 3.7 Analog Calibration Interface

3. After successful analog calibration, BoxX 2 needs to be powered on again.

4. Other channel calibrations is similar as above. After the analog calibrate successful, when using an analog-related module, the value of the analog input pin input (0 V – 10 V) is not the actual input voltage value, but follows the mathematical calculation formula (V input – V min)/
(V max – V min) * 10.

3.3.1.2   Rom→FAB Program Interface

You can view the function block number of the BoxX 2 program on this interface, and can modify the parameters of the function block number. Such as **DPR** (Delay Putting Relay), **DDR** (Delay Disconnection Relay) and **UCN** (Up Counter) and so on.
When you enter the **Rom→FAB** program interface through **FAB/Rom** interface, select the function block number to be viewed or modified by the ⊞ and ⊟ keys. The function block number in the AF-HMI panel starts from 0, and the B0 block number corresponds to the B1 block number in the QUICK II software.

1. Timing function block Time unit:
Unit   Unit (1-hour, 2-minute, 4-second)
Int.   Integer bit
M   Decimal places

As shown in Figure 3.8, **B002** function block is **MPLR** single pulse function block, The parameter is 30.3 seconds. If you want to modify the parameter, pls kindly remove the cursor to the modified bit you need, then set up the parameter via ⊞ and ⊟ keys.
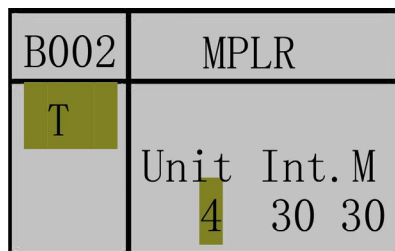
Figure 3.8 Timing function block

2. Counting function clock
Counting unit:
Consisting of six digits, the highest position is the leftmost, the lowest position is the rightmost, and his range is 1 - 999999
For example, as shown in Figure 3.9:
B018 function block is **COUNTU**, the parameter of Upward counting function block is 100. If you want to modify the parameter, pls kindly remove the cursor to the modified bit you need, then set up the parameter via ⊞ and ⊟ keys.
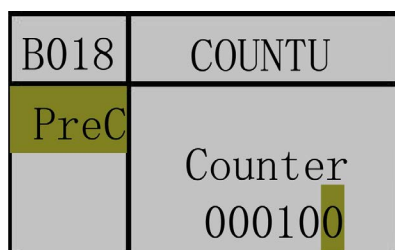
Figure 3.9 Counting function clock

3. Clock switching function

The parameter setting of the clock switch function block is divided into date type and week type.

For example week type, as shown in Figure 3.10:

B000 function block for **SCHD** clock switch week type, open Monday to Saturday 0:30 to 8:30. If you want to modify the parameter, you could remove the cursor to the modified bit you need, then set up the parameter via ⊞ and ⊟ key.

```
B000  │   SCHD
      │  W 1-6   ON
      │  00-00-00
      │  08-30-00
```

Figure 3.10 Week type

For example date type, as shown in Figure 3.11:

B008 function block is **SCHD** clock switch date type, July 2nd, 2017 Closed at 21:00. If you want to modify the parameter, you could remove the cursor to the modified bit you need, then set up the parameter via ⊞ and ⊟ key.

```
B008  │   SCHD
      │  Day    OFF
      │  17-07-02
      │  21-00-00
```

Figure 3.11 Date type

3.3.1.3   FAB_Addr Address Interface

You can view the address of BoxX 2 machine in Figure 3.12, and can modify his address.

When the user enters the **FAB_Address** interface through the **FAB/Rom** interface, the BoxX 2 address can be viewed or modified through the ⊞ and ⊟ keys.

```
      FAB_Addr
      001
```

Figure 3.12 FAB_Addr Address Interface

3.3.2   Setting Interface

When you enter the *Set..* setting interface on the BoxX 2 function interface, as shown in Figure 3.13:
When you enter the *Set..* setting interface under the BoxX 2 function interface, the BoxX 2 system time and BoxX 2 password can be viewed or modified.

Real clock time: 24 HR
Date: Y/M/D
Week: 0 for Sunday and 1-6 for Monday to Saturday
Password: BoxX 2 machine password (See chapter 3.2)

```
2 3 : 5 0 : 3 0
2 0 1 7-0 7-0 7
D A Y   0   SU
0 0 0 1
```
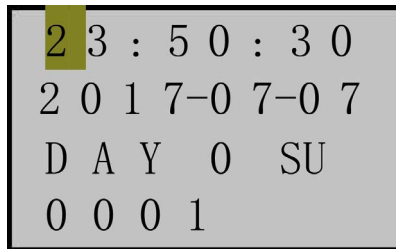
Figure 3.13 Setting Interface

4   Communication connection

BoxX 2 series PLC not only has a download port custom protocol, but also supports Modbus RTU protocol, and can communicate with other devices that support modbus RTU protocol.

The upper right side of the BoxX 2 is the program download port, as shown Figure 4.1. The upper left side of BoxX 2 front view is 485 interface (A1/B1 + A2/B2), as shown in Figure 4.1:
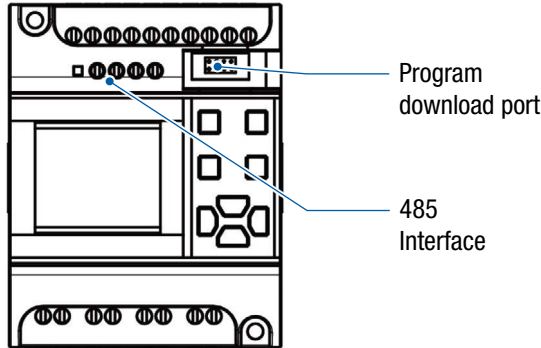
Figure 4.1 Communication connection

4.1   BoxX 2 download port

The user could communicate with BoxX 2 PLC and QUICK II directly through AF-C232-2 and AF-DUSB2 so as to realize read and write programs, read and write BoxX 2 address and online monitoring functions.

4.2   BoxX 2 485 interface

BoxX 2 supports 2-way 485 interface, One way is A1/B1 standard MODBUS RTU protocol, another way is A2/B2 and SH300 communication.

4.2.1   BoxX 2 A1/B1 interface

A1/B1 supports MODBYS RTU protocol. The address of MODBUS RTU is as below,

Address Type	Read-write Property	Function Code	Comment
0X	Only Read	01	Read the status of system (00-FF)
0X	Only Read	01	Read status of digit input (100-1FF)
4X	Only Read	03	Read status of AI (300-3FF)
0X	Only Read	01	Read status of Output Q (200-2FF)

1: BoxX 2 is act as Modbus slave device, which responds according to the requested data by Modbus master device.
2: Communication parameters: 19200 bps, 8 data bits, 1 stop bit and no parity.

4.2.2   BoxX 2 A2/B2 interface

The A2/B2 interface is used for communication between our SH300 text display. His related parameters are as follows:

Item	content
SH300 Communication port	9-pin communication port
PLC Communication port	485 interface (A2/B2)
Communication parameters	9600 bps, 8 bit, 1 stop, none
Bureau number	The range of Bureau number 0-254
communication mode	485

comat RELECO

ComatReleco AG | Bernstrasse 4 | 3076 Worb | Switzerland
Phone +41 31 838 55 77 | Fax +41 31 838 55 99
info@comatreleco.com | ComatReleco.com | WorldOfRelays.com

Using Address Type Description in SH300 Software

Component type	Address type	Address range	Read/Write	Description
Indicator lamp	I	1 - 12	Read	Reading input status
	Q	1 - 8	Read	Reading output status
	M	Corresponding intermediate relay number in BoxX 2 program (0 - 127)	Read	Reading function block output status in BoxX 2 program
Function keys	Q	1 - 8	Write	Write empty output port status (unoccupied output port in BoxX 2 program)
Dynamic text	I	1 - 12	Read	Reading input analog value (DC PLC)
	B	Corresponding block number in BOXX 2 program (1 - 128)	Read	Reading parameter values of function blocks in BoxX 2 programs
Register	I	1 - 12	Read	Reading input analog value
	B	Corresponding block number in the BoxX 2 program (1 - 128)	Read	Reading parameter values of function blocks in BoxX 2 programs
			Write	Write parameter values of function blocks in BoxX 2 programs
Stick/Trend Chart	I	1 - 12	Read	Reading input analog values
	B	Corresponding block number in the BoxX 2 program	Read	Reading parameter values of function blocks in BoxX 2 programs

5 Functional comparison

The BoxX 2 series PLC is an upgraded version of the BoxX series PLC. The function comparison diagrams of the two are as follows:

Item	BoxX	BoxX 2
Basic features		
25 °C RTC buffer	100 h	160 h
RTC accuracy	150 s/month	20 s/month
Password Protection	Yes	Yes (*protection)
Expanded module	Yes (voice module)	None (without voice module)
Panel parameters	queried/modified	queried/modified
Panel programming	Yes	None
The function of Automatic Startup	None	Yes (0.5 second after Power on or download the program)
Quick II	Download free of charge https://www.comatreleco.com/en/service-and-support/downloads-de/softwaretools-und-treiber/	
Integration Communication		
RS485	None	Two Groups (One group SH300 + one modbus only read)
Communication Rate	9600	9600/19200
Communication Protocol	Self-defined protocol	Self-defined/Standard Modbus (Note 1)
AI Characteristics		
AD Resolution	8 bits (0.2 V)	10 bits (0.1 V)
Signal Type	0 – 10 V DC	0 – 10 V DC

6   Technical Parameters

6.1   General technical parameters

Item	Basis	Condition
Climate environment		
Humidity	Cold: EC68-2-1 Heat: IEC68-2-2	
Horizontal installation Vertical installation		-20 ° – 70 °C -20 ° – 70 °C
Storage/Transportation		-40 ° – 70 °C
Relative humidity	IEC68-2-30	5 - 95 % without condensation
Atmospheric pressure		795 – 1080 kpa
Pollutants	IEC68-2-42 IEC68-2-43	SO2 10 cm^3/m^3, 4 days H2S 1 cm^3/m^3, 4 days
Mechanical environment		
Protection type		IP20
Vibration 2	IEC68-2-6	10 – 57 Hz (constant amplitude 0.15 mm) 57 – 150 Hz (constant Acceleration 2 g)
Impact	IEC68-2-27	18 impacts (semi sine 15 g / 11 ms)
Fall	IEC68-2-31	Falling height 50 mm
Freely falling objects (with package)	IEC68-2-32	1 m
Electromagnetic compatibility (EMC)		
Static discharge	Severe grade 3	8 kV air discharge, 6 kV contact discharge
Electromagnetic field	IEC801-3	Field strength 10 V/m
Interference suppression	EN55011	Limitation grade B group 1
Shock pulse	IEC801-4 Severe grade 3	2 kV for power line 2 kV for power line
IEC/VDE safety information		
Insulation Intensity	IEC1131	Meet the requirements
25 °C clock buffer memory		Typical 100 h
RTC accuracy		± Max 20 s/Month

6.2   AF-10MR-A2/AF-20MR-A2

Power Supply	
The rated voltage of power supply	100 – 240 V AC
Allowable range of the rated input voltages VDE0631: IEC1131: Allowable main frequency:	85 – 260 V AC 85 – 260 V AC 47 ~ 63 Hz
Power consumption (220 V AC)	AF-10MR-A (6 W) AF-20MR-A (10 W)
Digital input	
Input voltage L1 Signal 0: Signal 1:	0 – 40 V AC 80 – 240 V AC
Input Current of signal 1	Typical 0.2 mA (230 V AC)
Delay Time Changed From 1 to 0: Changed From 0 to 1:	Typical 50 ms Typical 50 ms
Length of Power Line (without shield)	100 m
Digital output	

Output Type	Relay Output
Electrical Isolation	Yes
Group	1
Continuous Current Ith	Max 10 A
Incandescent Lamp Load (25,000 switch cycles)	1000 W (230 / 240 V AC) 500 W (115 / 120 V AC)
Fluorescent Light Tube with Electrical Controller (25,000 Switch cycles)	10 × 58 W (230 / 240 V AC)
Fluorescent Light Tube with Regular Compensation (25,000 Switch cycles)	1 × 58 W (230 / 240 V AC)
Fluorescent Light Tube without Compensation (25,000 Switch cycles)	10 × 58 W (230 / 240 V AC)
Short Circuit Protection cos1	Power Supply Protection B16 600 A
Output Relay Protection	Max. 20 A Feature B16
Switch Frequency	
Machine	10 Hz
Resistor Load/Lamp Load	2 Hz
Induced Load	0.5 Hz

6.3 AF-10MT-D2/AF-20MT-D2

Power Supply	
The rated voltage of power supply	12 / 24 V DC
Allowable range of the rated input voltage Power Consumption (24 V DC) (Output full load)	10 – 28 V DC Typical 80 mA Typical 2 W
Input section (digital input)	
Signal 0 Signal 1	< 3.5 V DC 10 – 24 V DC
Input current of signal 1	< 2.5 mA
Input section (analog input)	
Signal 1	0 – 10 V DC
Input current of signal 1	< 0.8 mA
Delay Time Changed From 1 to 0: Changed From 0 to 1:	Typical 50 ms Typical 50 ms
Length of Power Line (without shield)	100 m
Digital output	
Output type Output voltage Output Current	Transistor output (equivalent NPN) ≤ 80 V DC Max 2 A
Short Circuit and Overload Protection	No
Current limit of short circuit	about 2 A
Reduction of the rated value	No (even in the whole temperature range)

6.4 AF-10MR-D2/AF-20MR-D2

Power Supply	
The rated Voltage of power supply	12 / 24 V DC
Allowable range of the rated input voltage	10 – 28 V DC
Power Consumption (24 V DC) (Output full load)	AF-10MR-D2 (4 W) AF-20MR-D2 (5 W)
Input section (digital input)	

Signal 0 Signal 1	< 3.5 V DC 10 – 24 V DC
Input current of Signal 1	< 2.5 mA
Input section (analog input)	
Signal 1	0 – 10 V DC
Input current of Signal 1	< 0.8 mA
Delay Time Changed from 1 to 0 Changed from 0 to 1	 Typical 50 ms Typical 50 ms
Length of Power Line (without shield)	100 m
Digital output	
Output Type	Relay output
Electrical Isolation	Yes
Group	1
Continuous Current Ith	Max. 10 A
Incandescent Lamp Load (25,000 switch cycles)	1000 W
Fluorescent Light Tube with Electrical Controller (25,000 Switch cycles)	10 × 58 W
Fluorescent Light Tube with Regular Compensation (25,000 Switch cycles)	1 × 58 W
Fluorescent Light Tube without Compensation (25,000 Switch cycles)	10 × 58 W
Short Circuit Protection cos1	Power Supply Protection B16 600 A
Short Circuit Protection cos0.5 - 0.7	Power Supply Protection B16 900 A
Output Relay Protection	Not allowed
Switch Frequency	Max. 20 A Feature B16
Machine	
Resistor Load/Lamp Load	10 Hz
Induced Load	2 Hz
Output Type	0.5 Hz

6.5   AF-10MT-E2/AF-20MT-E2

Power Supply	
The rated Voltage of power supply	12 / 24 V DC
Allowable range of the rated input voltage	10 – 28 V DC
Power Consumption (24 V DC) (Output full load)	Typical 80 mA Typical 2 W
Input section (digital input)	
Signal 0 Signal 1	< 3.5 V DC 10 – 24 V DC
Input current of Signal 1	< 2.5 mA
Input section (analog input)	Typical 50 ms Typical 50 ms
The length of power line (without shield)	100 m
Digital Output	
Output type Output voltage Output Current	Transistor output (equivalent NPN)
Short Circuit and Overload Protection	≤ 80 V DC
Current limit of short circuit	Max. 2 A
Reduction of the rated value	No

Output type Output voltage Output Current	2 A

6.6 AF-10MR-E2/AF-20MR-E2

Power Supply	
The rated Voltage of power supply	12 – 24 V UC
Allowable range of the rated input voltage	10 – 28 V UC
Power Consumption (24 V AC / DC) (Output full load)	AF-10MR-E (3 W) AF-20MR-E (5 W)
Digital Input	
Signal 0 Signal 1	< 4.5 V UC 10 – 24 V UC
Input current of Signal 1	Typical 2 mA
Input section (analog input)	Typical 50 ms Typical 50 ms
The length of power line (without shield)	100 m
Digital output	
Output Type	Relay output
Electrical Isolation	Yes
Group	1
Continuous current Ith	Max. 10 A
Incandescent Lamp Load (25,000 switch cycles)	1000 W
Fluorescent Light Tube with Electrical Controller (25,000 Switch cycles)	10 × 58 W
Fluorescent Light Tube with Regular Compensation (25,000 Switch cycles)	1 × 58 W
Fluorescent Light Tube without Compensation (25,000 Switch cycles)	10 × 58 W
Short Circuit Protection cos1	Power supply protection B16 600 A
Short Circuit Protection cos0.5 - 0.7	Power supply protection B16 900 A
Parallel connected output for increased power	Not allowed
Output Relay Protection	Max. 20 A Feature B16
Switch Frequency	
Machine	10 Hz
Resistor Load/Lamp Load	2 Hz
Induced Load	0.5 Hz

6.7 AF-10MT-GD2/AF-20MT-GD2

Power Supply	
Supply voltage rating	12 / 24 V DC
Fluctuation voltage allowable range Consumption (24 V DC) (Output full load)	10 – 28 V DC Typical 80 mA Typical 2 W
Input section (digit input)	
Signal 0 Signal 1	< 3.5 V DC 10 – 24 V DC
Input current of signal 1	< 2.5 mA
Input section (analog input)	
Signal 0 Signal 1	0 – 10 V DC
Input current of Signal 1	< 0.8 mA

Input section (analog input)	Typical 50 ms Typical 50 ms
The length of power line (without shield)	100 m
Digital Output	
Output type Output Voltage Output Current	Transistor output (equivalent PNP) ≤ 80 V DC Max. 2 A
Short circuit and Overload Protection	No
Current limit of short circuit	Circa 2 A
Reduction of the related value	The entire temperature range does not degrade the rating

7   Disposal

Disposal information for users of electrical and electronic equipment waste according to the WEEE directive (Waste of Electrical and Electronic Equipment):

For private households

The above pictogram means that electrical and electronic equipment must not be mixed with general household appliances. For proper treatment, recovery and recycling, take this product to designated collection points where it will be accepted free of charge.
Correct disposal of this product will help to conserve valuable resources and prevent potential negative impacts on human health and the environment which could otherwise be caused by inappropriate waste handling.
Contact your local authority for details of the nearest designated collection point.
Penalties may be imposed for the improper disposal of this waste, depending on national legislation.

For professional users in the European Union

If you wish to dispose of electrical and electronic equipment, please contact your dealer or supplier for further information. Please also observe the country-specific regulations.

For disposal in countries outside the European Union

The above symbol is only valid in the European Union (EU). If you wish to dispose of this product, contact your local authorities or your dealer and ask for the correct method of disposal.

Packaging material

Dispose of packaging material in accordance with the applicable national regulations.