Chapter 14

ICMK14F1-M / ICMK14N1-M

ICMK14F1-M and ICMK14N1-M

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ICMK14F1-M and ICMK14N1-M

This chapter wants to describe the general characteristics and operating conditions of ICMK14F1-M and ICMK14N1-M remote inputs and outputs on MODBUS® system bus.

1.1 Presentation

The ICMK14F1-M and ICMK14N1-M are used as a decentralised inputs and outputs on the MODBUS® system bus. It brings accessibility to beginners and experienced automation users alike, for any application with 14 to 200 inputs / outputs, using the same set of basic components.

The ICMK14F1-M and ICMK14N1-M modules allow a distributed I/O architecture on MODBUS® system bus that provide cost effective and flexible solutions for controlling and monitoring I/O signals over a wide area.

1.1.1   General set-up rules

Each ICMK14F1-M and ICMK14N1-M remote units incorporate a specific number of binary inputs / outputs. And it is possible, to increase this number of binary or analog inputs / outputs, by addition of different extensions directly connect to the ICMK14F1-M and ICMK14N1-M remote modules.
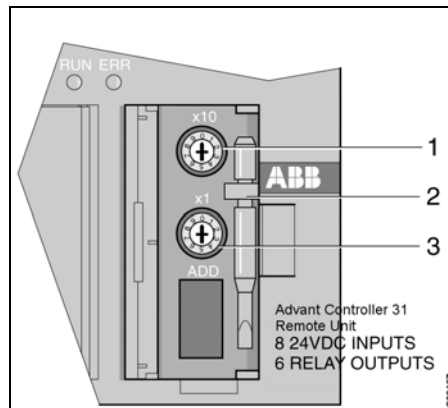
These extensions are the same that used with Central units 40 and 50 series.
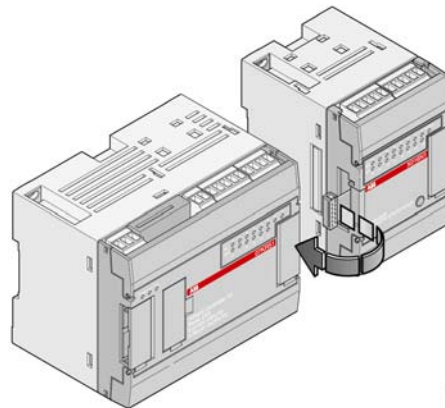
ICMK14F1-M and ICMK14N1-M
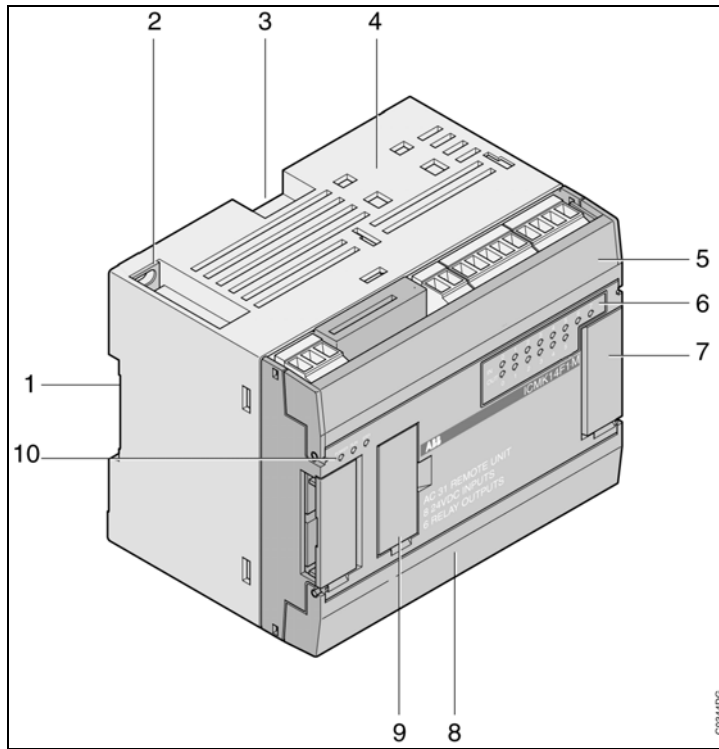
The front of the unit

Enlargement of item 9 without cover

ICMK14F1-M and ICMK14N1-M

1.1.2   The front (see Figure)

1 - Location for the DIN rail

2 - Plate fixture with unit earthing

3 - Lock for DIN rail mounting

4 - Location for external dual connector

5 - Location for the cabling connectors:

- of 24 V d.c. output power for the inputs
  (available only for the remote units with 120 / 230 V a.c. power)

- of the inputs

6 - Visualization set for the status of the 8 inputs / 6 outputs

7 - Location of the connector for the connection of input/output extensions

8 - Location of the cabling connectors:

- for the power supply

- for the outputs

9 - Location of the addressing rotate selectors (see enlargement)

10 - Unit status visualization area:

- POWER: power on

- RUN: Blinking indicates the valid message received

- ERR: On indicates error(s) present and blinking indicates configuration action

Enlargement of item 9 without cover (see Figure)

1 - Rotate switch for addressing, reserved for decade selection

2 - Screwdriver for settings adjustments

3 - Rotate switch, reserved for unit selection

ICMK14F1-M and ICMK14N1-M

1.2 General operating conditions

The ICMK14F1-M and ICMK14N1-M remote units were developed according to the European EC directives, the main national and international IEC 1131-1 and IEC 1131-2 standards and the EN61131-2 product standard concerning automation devices.

Ambient conditions	
- Temperature:	
operation: horizontal	0°C to + 55°C
vertical	0°C to + 40°C
storage	- 40°C to + 75°C
transport	- 25°C to + 75°C
- Humidity:	DIN 40040 class F without condensation
annual average	≤ 75%
up to 30 days per year	95%
occasionally	85%
- Atmospheric pressure:	DIN 40050
operation	≥ 800 hPA (≤ 2000 m)
storage	≥ 600 hPA (≤ 3500 m)
Mechanical data	
- Protection index	IP20
- Unit	UL V2
- Vibration stress	CEI68-2-6 test Fc
- Shock stress	CEI68-2-27 test Ea
Tolerances for mains voltages	
- 24 V d.c.	19.2 to 30 V (- 20%, + 25%)
- 120 V a.c. (50 / 60 Hz)	97.75 to 126.5 V (- 18,5%, + 5,5%)
- 230 V a.c. (50 / 60 Hz)	195.5 to 253 V (- 15%, + 10%)

ICMK14F1-M and ICMK14N1-M

Creepage distances and clearances	IEC 664 and DIN VDE0160
Insulation test	IEC 1131-2
Electromagnetic compatibility	
Immunity tests against:	
- Electrostatic discharge	IEC 1000-4-2 (level 3)
- Radiated fields	IEC 1000-4-3 (level 3)
- Fast transient bursts	IEC 1000-4-4 (level 3)
- High energy pulse	IEC 1000-4-5
- Conducted high frequencies	IEC 1000-4-6 (level 3)
Voltage drops and short power cutoffs	
- D.C. power supply	Duration of the power cutoffs: $\leq$ 10 ms Time between 2 voltage drops: $\geq$ 1 s
- A.C. power supply	Duration of the power cutoffs: $\leq$ 20 ms Time between 2 voltage drops: $\geq$ 1 s
Clearance	IEC 664-664A DIN VDE 0160
Dielectric test	IEC 1131-2
Mountings	
- DIN rail	35 mm
- Screw fittings	4 mm diameter screw (M4)
Connections	
- Connectors	Removable terminal blocks (2.5 mm²)
- Wires section for:	
Earth	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
Inputs	Rigid or multi-conductor wire AWG 18 (0.96 mm²) to AWG 14 (1.95 mm²)
Outputs	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
Power supply	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
Bus	Twisted pair AWG 24 (0.22 mm²) to AWG 18 (0.8 mm²)
- Screws tightening torque	0.5 Nm (given as an indication only)
Serial interface	
- For MODBUS System bus	RS 485

ICMK14F1-M and ICMK14N1-M

1.3 Technical specifications

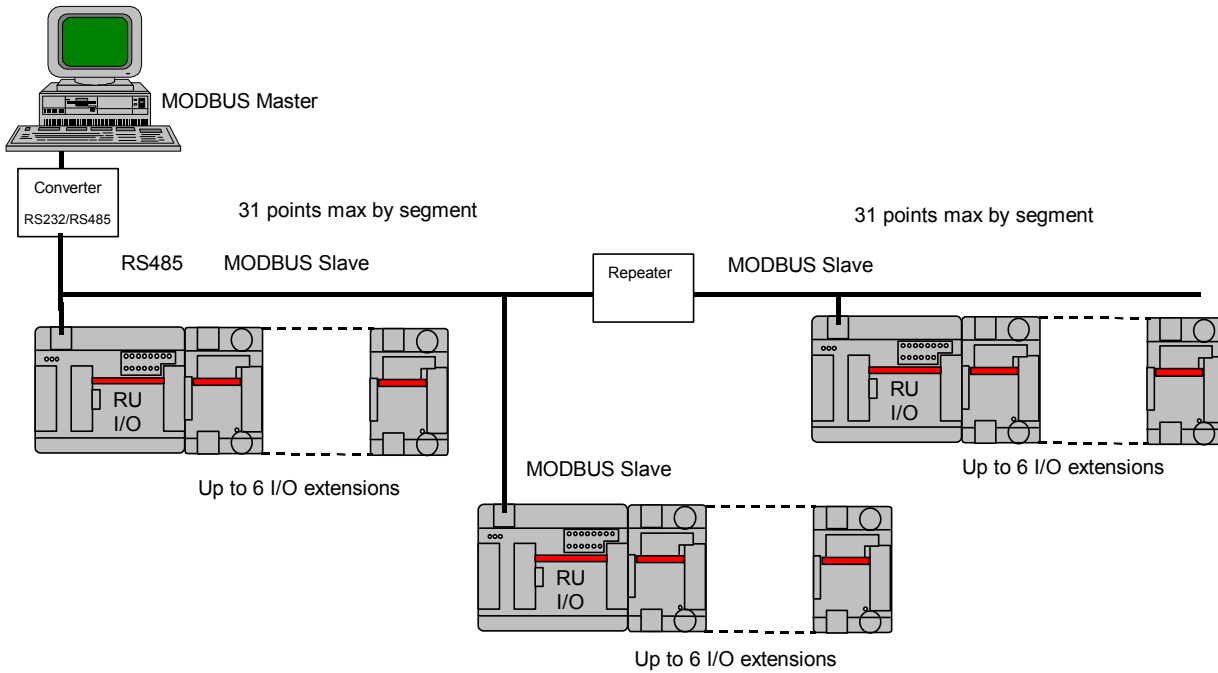| Products	Description	References
ICMK 14 F1 -M 24VDC	With 8 isolated inputs 24 V d.c and 6 relay outputs 250 V a.c. / 2A 24 V d.c. power supply.	1SBP260053R1001
ICMK 14 F1 -M 120/230VAC	With 8 isolated inputs 24 V d.c and 6 relay outputs 250 V a.c. / 2A 120 / 230 V a.c. power supply.	1SBP260054R1001
ICMK 14 N1 -M 24VDC	With 8 isolated inputs 24 V d.c and 6 transistor outputs 24 V d.c / 0.5 A 24 V d.c. power supply.	1SBP260055R1001

	ICMK 14 F1-M 24 V d.c.	ICMK 14 F1-M 120 / 230 V a.c.	ICMK 14 N1-M 24 V d.c.
Width x Height x Depth (in mm)	120 x 93 x 84		
Weight	400 g	800 g	400 g
Power supply			
- Mains voltage:			
Nominal value	24 V d.c.	120 / 230 V a.c.	24 V d.c.
Admissible range	19.2 to 30 V	97.75 to126.5 V 195.5 to 253 V	19.2 to 30 V
- Consumption:			
Unit alone (typical)	80 mA	30 mA	80 mA
Maximum configuration (typical)	400 mA	100 mA	400 mA
- Polarity reversal protection	yes	-	yes
- 24 V d.c. isolated power for inputs:	no	yes	no
Range of voltage value	-	19.2 to 30 V	-
Max. Output current	-	400 mA	-
Short circuit protection	-	yes	-
- Dissipation	5 W	10 W	6 W
Incorporated binary inputs			
- Number of inputs	8	8	8
- Isolation of the inputs / electronic	1500 V a.c.	1500 V a.c.	1500 V a.c.
- Input types	PNP and NPN	PNP and NPN	PNP and NPN
- Input voltage:			
Nominal value	24 V d.c.	24 V d.c.	24 V d.c.
Signal at 0 (IEC 1131-2)	0 to + 5 V	0 to + 5 V	0 to + 5 V
Signal at 1 (IEC 1131-2)	+ 15 to + 30 V	+ 15 to + 30 V	+ 15 to + 30 V
- Input current at 24 V d.c.:			
Inputs Ixx.02 to Ixx.07	7 mA	7 mA	7 mA
Inputs Ixx.00 and Ixx.01	9 mA	9 mA	9 mA
- Minimum filtering time	5 ms	5 ms	5 ms
- Cable length:			
unshielded	300 m	300 m	300 m
shielded	500 m	500 m	500 m

ICMK14F1-M and ICMK14N1-M

	ICMK 14 F1 -M 24 V d.c.	ICMK 14 F1 -M 120 / 230 V a.c.	ICMK 14 N1 -M 24 V d.c.
Incorporated outputs			
- Number of outputs	6 relays	6 relays	6 transistors
- Isolation of the outputs / electronic	1500 Vrms 1 min	1500 Vrms 1 min	1500 V a.c.
- Total charging current, under voltage:	.		
direct 24 V d.c.			
resistive load / inrush current	2 A / 5 A	2 A / 5 A	1 A for Oxx.00
L / R = 20 ms	2 A	2 A	and Oxx.01 and
L / R = 30 ms	1 A	1 A	0.5 A for other
L / R = 40 ms	0.6 A	0.6 A	outputs
L / R = 60 ms	0.35 A	0.35 A	
alternate 24 to 230 V a.c.	2 A AC-1 0.5 A AC-15	2 A AC-1 0.5 A AC-15	
- Total charging current	6 x 2 A	6 x 2 A	4 x 0.5 A + 2 x 1 A
- Output leakage current			< 200 µA
- Output waste voltage			0.2 V to 500 mA max.
- Minimum cut-off values	10 mA under 12 V d.c.	10 mA under 12 V d.c.	12 V
- Breaking power under 120 V a.c. (contact rating code B300) (UL)	2 A	2 A	
- Breaking power under 250 V a.c. (contact rating code B300) (UL)	2 A (1.5 A according to UL)	2 A (1.5 A according to UL)	
- Number of common	2 (2+4)	2 (2+4)	
- Commutating frequency :			
for resistive loads	< 1 Hz	< 1 Hz	< 5 kHz
for inductive loads	< 0.2 Hz	< 0.2 Hz	
for lamps	< 0.2 Hz	< 0.2 Hz	
- Number of switches:			
for AC-1	1 million	1 million	-
for AC-15	100 000	100 000	
- Short circuit and overload protection	envisage externally	envisage externally	yes: thermic
- Surge voltage protection	envisage externally	envisage externally	yes : by transient volt. suppressor
- Outputs diagnosis	-	-	overload and short circuit
- Cable length:			
unshielded	150 m	150 m	150 m
shielded	500 m	500 m	500 m

ICMK14F1-M and ICMK14N1-M

MODBUS Master

Converter
RS232/RS485

31 points max by segment

31 points max by segment

RS485   MODBUS Slave

Repeater

MODBUS Slave

RU I/O

Up to 6 I/O extensions

MODBUS Slave

RU I/O

Up to 6 I/O extensions

RU I/O

Up to 6 I/O extensions

Network with only I/O remote units ICMK14F1-M or ICMK14N1-M

MODBUS Master

CS31 Bus

RS232

07KP53   50 Series

RU I/O

MODBUS Master   Up to 6 I/O extensions

Up to 6 I/O extensions

RS485

MODBUS Slave

MODBUS Slave

MODBUS Slave

07KP53   50 Series

Drives

RU I/O

MODBUS Master

TC50
Control panel
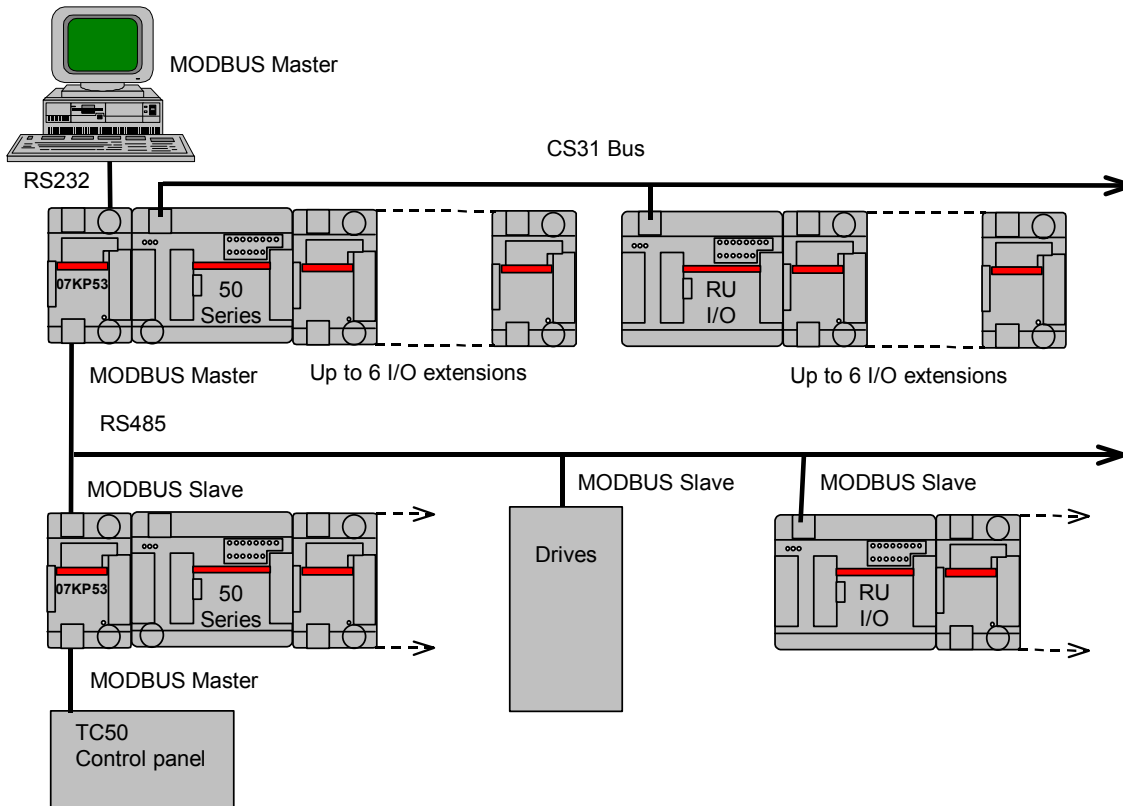
Network with multifunction modules and I/O remote units ICMK14F1-M or ICMK14N1-M

ICMK14F1-M and ICMK14N1-M

1.4 Presentation of MODBUS® system bus with ICMK14F1-M and ICMK14N1-M

1.4.1 Introduction

The ICMK14F1-M and ICMK14N1-M are remote units for MODBUS® system bus and they are used in order to decentralise inputs and outputs via a RS485 twisted pair connection.

The ICMK14F1-M and ICMK14N1-M possess the MODICON MODBUS® RTU protocol and are compatible with most of MODBUS® master devices. They can accept and recognize automatically different speed baud rates up to 187Kbauds depending of the MODBUS® master connected.

In addition, they have large input / output capacity and can manage from 14 to 200 inputs / outputs with additional extensions. The extensions used to increase the number of inputs / outputs on ICMK14F1-M and ICMK14N1-M can be binary or analog types. These extensions are the same used with AC31 series 40 and 50 (see references inside technical documentation – 1SBC260400R1001)

The ICMK14F1-M and ICMK14N1-M give a complete access to their inputs and outputs to MODBUS® master without a specific configuration action, It will just be necessary to the MODBUS® master to read or write the correct MODBUS® addresses corresponding to inputs and outputs of ICMK14F1-M and ICMK14N1-M.

Diagnosis on ICMK14F1-M and ICMK14N1-M is available and accessible through the MODBUS® master. It allows to identify if there is a bus extension error or one extension is disconnected and also if there are some output errors (Overload and short-circuit)

1.4.2 MODBUS® system bus technical specifications

| Type	
- Number of RS485	1x RS 485
Mode	Half-duplex
Number of connection points	
Support	Shielded twisted pair
- Section	0.22...0.8 mm²
- Twists	> 10 per meter
- Resistance	$\leq 300 \ \Omega$ / km
- Characteristic Impedance	100 à 150 Ω
- Capacity	< 150 nF / km
- Shielding	Braiding
- Line termination	Resistance 120 Ω, ¼,watt, connected to each extremity of the bus
- Line impedance adaptation	
- Line polarisation (high impedance level)	
Protocol	MODICON MODBUS® RTU
Isolation	yes by optocoupler
Speed	
- Maximum speed	187500 Bauds
- Self detection	1200, 2400, 4800, 9600, 19200, 38400, 57600, and 187500 Bauds

ICMK14F1-M and ICMK14N1-M
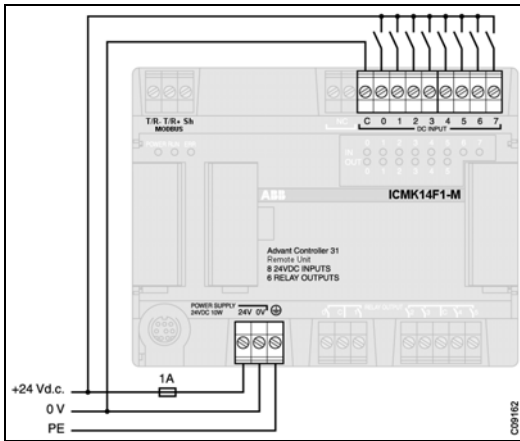
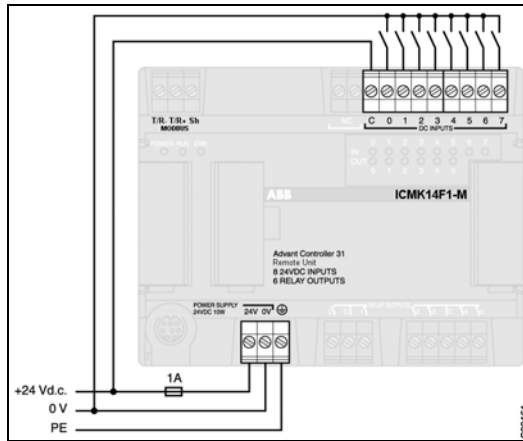**Figure:** **Positive logical inputs PNP 24 V d.c. unit power supply**

Figure: **Negative logical inputs NPN 24 V d.c. unit power supply**
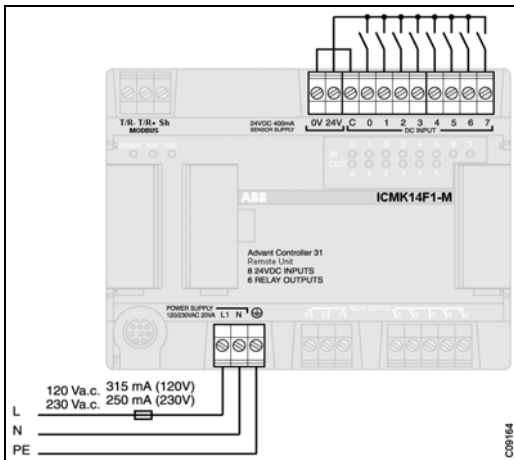

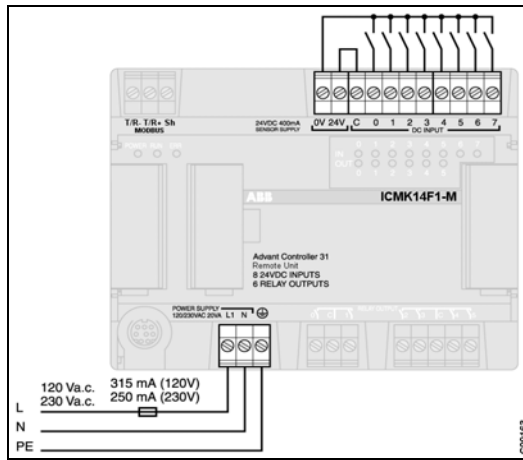**Figure:** **Positive logical inputs PNP 120/230 V a.c. unit power supply**

Figure: **Negative logical inputs NPN 120/230 V a.c. unit power supply**
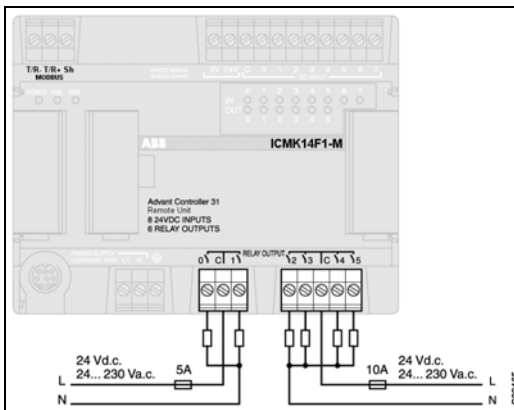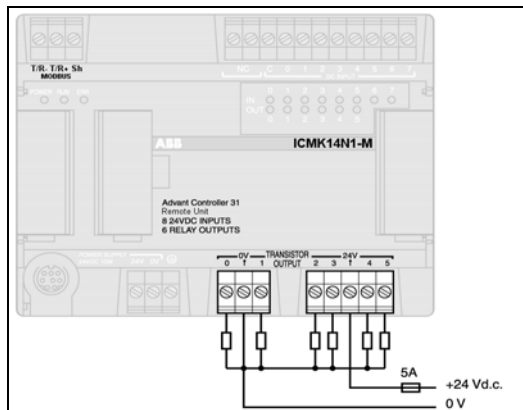

Figure: Relay outputs

Figure: Transistor outputs.

1.4.3   Installation

The ICMK14F1-M and ICMK14N1 products have been conceived for operation in extreme industrial environments. The correct operation of these products is only ensured if all EMC protection rules have been applied.

(see technical documentation 1SBC260400R1001 chapter 4) Assembly conditions

The ICMK14F1-M and ICMK14N1 must be mounted on a DIN rail (35 mm) by using the support lock . It may be installed vertically or horizontally.

For a cabinet assembly:

operating temperature from 0 to 55°C, envisage sufficient free volume around the units to allow the heat to dissipate correctly. It is recommended that the cabinet is fitted with a ventilation system.

Warning avoid placing heat generating devices next to the products (transformers, mains, power contactors, ...).

All electrical connections are realized through removable terminal blocks with an acceptable wire section equal to 2.5 mm^2.

The tightening torque, for reference, is equal to 0.5 Nm.

In order to guaranty the safety and error free data transmission over long distances, the selection of an appropriate MODBUS® communication cable is very important.

1.4.3.1   Power supply

Use rigid or multi-conductor AWG 14 (1.95 mm^2) wires.

The connection of an external thermal fuse is necessary to provides material protection.

It is possible to select 230 V a.c. or 120 V a.c. with the selector switch situated underneath the central units or extensible remote units. The products are delivered with the selector in the 230 V a.c. position.
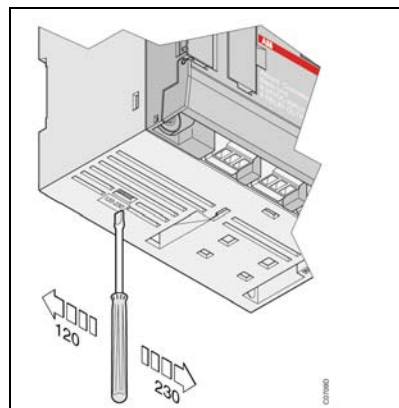
An internal 24 V d.c. power supply is available on 120 / 230 V a.c. versions. This power supply feeds the binary inputs of the unit and its extensions This internal power supply is protected against short circuits and overloads. In the case of a short circuit or overload it is available 10 seconds after the fault elimination.

It is also possible to use an external 24 V d.c. power supply. In this case do not forget to connect the earth of the external 24 V d.c. to that common to the inputs (terminal C).

1.4.3.2   Inputs/outputs cabling

Use rigid or multi-conductor AWG 18 (0.96 mm^2) to AWG 14 (1.95 mm^2) wires for inputs and the rigid or multi-conductor AWG 14 (1.95 mm^2) wires for the outputs.

- Input cabling: see Figure to Figure. The common C of inputs has to be linked to the 0 V or 24 V d.c. according to the sensor type.
- Output cabling: see Figure and Figure.

1.4.3.3   Output protection

The relay outputs may be protected externally against parasites generated by an inductive load with:

- a varistor or an RC module, in alternating current
- a free-wheel diode, in direct current

The presence of an external thermal fuse, connected to the common power supply of the outputs, protects to the output connected devices.

The transistor outputs are protected internally against short circuits and overloads. However with an inductive load, with L/R greater than 40 ms, it is necessary to add a free-wheel diode.

If an error occurs at one of the transistor outputs, it is indicated by the status of the CPU.

The presence of an external thermal fuse, connected to the common power supply of the outputs, protects the output connected devices and also avoids unit damage should numerous outputs overload.

Warning: In the case of the terminal O V is disconnected and in the same time the 24 V d.c. is connected, the leakage current on output is 16 mA.

1.4.3.4 MODBUS® network connection

MODBUS® connection on ICMK14F1-M and ICMK14N1-M is a RS485 serial interface and consists of a shielded twisted pair.

The ICMK14F1-M and ICMK14N1-M may be connected at any point of MODBUS® network.

The MODBUS® network should be terminated with a 120 Ω 1/4 W resistance connected to the bus extremities.

Use a AWG 24 (0.22 mm^2) to AWG 18 (0.18 mm^2) twisted pair.
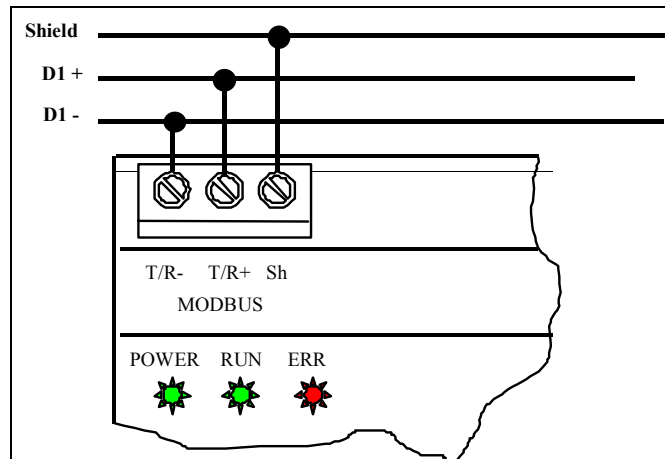
Figure 1-1 : Cabling MODBUS® network on ICMK14F1-M and ICMK14N1-M

ICMK14F1-M and ICMK14N1-M
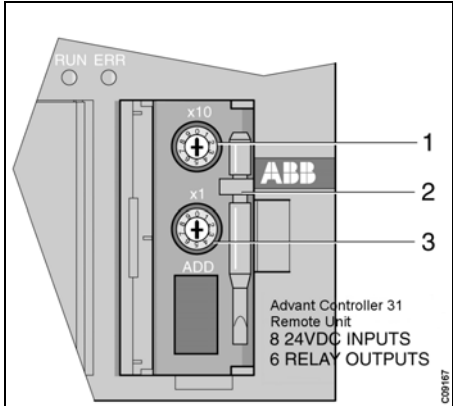
Figure 1-2 : Rotative switches for addressing ICMK14F1-M and ICMK14N1 units

ICMK14F1-M and ICMK14N1-M

1.4.4   Configuration and operation

1.4.4.1   Speed of communication

The ICMK14F1-M and ICMK14N1-M can be used with all type of master MODBUS® modules.

The ICMK14F1-M and ICMK14N1-M are able to work with different speeds from 1200 Bauds to 187500 Bauds.

The speed is automatically detected by the ICMK14F1-M and ICMK14N1, when the MODBUS® master sends frames, the reaction time to identify the master speed depends to speed used.

Speed (Bauds)	Minimum of frames to identify automatically the speed	Cable maximum length (Meters)
1200	10	1200
2400	10	1200
4800	10	1200
9600	2	1200
19200	10	1200
38400	10	1000
57600	20	1000
187500	60	500

1.4.4.2   Function and error codes

Only the following MODBUS® operation codes may be processed with ICMK14F1-M and ICMK14N1-M

Function codes		Description
In Hexadecimal	In Decimal	
0	0	Broadcast
01 or 02	01 or 02	Read n bits
03 or 04	03 or 04	Read n words
05	05	Write a bit
06	06	Write a word
07	07	Fast reading of 8 bits
08	08	Diagnosis / initialisation
0F	15	Write n bits
10	16	Write n words

The function code 7 allows to read the bits M0,0 to M0,7

The function code 8 send back the same frame

The following error codes can generated by ICMK14F1-M and ICMK14N1-M

Error codes		Description
In Hexadecimal	In Decimal	
00	00	No error
01	01	Unknown function code
02	02	Address error
03	03	Data error
09	09	Time-out
0A	10	Checksum error

1.4.4.3 Addressing

The MODBUS® slave number of the ICMK14F1-M and ICMK14N1-M units is given by the rotative switches situated beneath the first cover on the front face. Each switch can be set to 0 to 9. The switch 1 is for tens and the switch 3 is for units (see Figure).

⇨ Values greater than 79 are not available ($1 \leq X \leq 79$).

⇨ Addresses 0 and 80 are forbidden. (MODBUS® address 0 is used for Broadcast function)

⇨ If the addresses from 80 to 99 are selected, they correspond to addresses from 0 to 19.

The MODBUS® slave number of the ICMK14F1-M and ICMK14N1-M is only used to allow the communication with the MODBUS® master and it doesn't interfere with writing or identification of variables from ICMK14F1-M or ICMK14N1-M or its extensions.

All binary variables of ICMK14F1-M or ICMK14N1-M units and binary or analog extensions are available in the following MODBUS® areas. All variables can be read or write in Bit or Word configuration.

<u>Warning</u> : Number of XC32L1/XC32L2 used on ICMK14F1-M or ICMK14N1-M :

<u>Limits due to XC32L1 and XC32L2</u>:

⇨ The XC32L1 reserves 2 address places (1 for input and 1 for output)

⇨ The XC32L2 reserves 3 address places (1 for input and 1 for output and 1 for analog input)

<u>Limits due to ICMK14F1-M or ICMK14N1-M remote units</u>:

⇨ On MODBUS® extensible remote units. 10 address places available for extensions.

	On MODBUS® remote units ICMK14F1-M or ICMK14N1-M
Max of XC32L1	5
Max of XC32L2	3

1.4.4.4 MODBUS® addresses area for inputs:

The structure of MODBUS® addresses area is not fixed and depends of situation and type of different extensions present on ICMK14F1-M or ICMK14N1-M, the MODBUS® addresses start always by all the binary variables presents, and then the analog variables present follow up immediately after.

Each binary extension reserves a package of 16 bits or 1 word, even if the extension possesses less than 16 inputs.

<u>Caution</u>:

The first MODBUS® addresses 0000H to 0007H (0000D to 0007D) in bit format are fixed for the 8 binary inputs from ICMK14F1-M or ICMK14N1-M.

The MODBUS® addresses 0008H to 000FH (0008D to 0015D) in bit format are reserved and must not be used, these MODBUS® addresses don't associate any external binary input at all.

The MODBUS® addresses for binary inputs extensions start at 0010H (0016D) in bit format or 0001H (0001D) in word format

XC32L1 and XC32L2 configurable extensions reserved two packages of 16 bits.

Each analog extension reserves a package of 8 words or 128 bits, even if the extension possesses less than 8 inputs.

<u>Caution</u>:

The first MODBUS® address 0000H for analog input is reserved and must not be used and this MODBUS® addresses doesn't associate any external binary input at all.

The MODBUS® addresses for analog inputs extensions start at 0001H (0001D) in word format or at 0010H (0016D) in bit format.

XC32L2 configurable extension reserved 1 packages of 8 words.

ICMK14F1-M and ICMK14N1-M

<table>
<tr><th rowspan="2"></th><th rowspan="2"></th><th colspan="2">Bit format</th><th colspan="2">Word format</th></tr>
<tr><th>Addresses in Hexadecimal</th><th>Addresses in decimal</th><th>Addresses in Hexadecimal</th><th>Addresses in decimal</th></tr>
<tr><td rowspan="19">Binary area available</td><td>Input 0 (ICMK14F1-M)</td><td>0000</td><td>0000</td><td>0000</td><td>0000</td></tr>
<tr><td>Input 1 (ICMK14F1-M)</td><td>0001</td><td>0001</td><td></td><td></td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 7 (ICMK14F1-M)</td><td>0007</td><td>0007</td><td></td><td></td></tr>
<tr><td>Not used (reserved)</td><td>0008➜000F</td><td>0008➜0015</td><td></td><td></td></tr>
<tr><td>Input 0 (1st package.)</td><td>0010</td><td>0016</td><td>0001</td><td>0001</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 15 (1st package.)</td><td>001F</td><td>0031</td><td></td><td></td></tr>
<tr><td>Input 0 (2nd package)</td><td>0020</td><td>0032</td><td>0002</td><td>0002</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>Input 0 (10th package)</td><td>00A0</td><td>0160</td><td>000A</td><td>0010</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>Input 0 (12th package)</td><td>00C0</td><td>0192</td><td>000C</td><td>0012</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 15 (12th package)</td><td>00CF</td><td>0207</td><td></td><td></td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2"></th><th colspan="2">Bit format</th><th colspan="2">Word format</th></tr>
<tr><th>Addresses in Hexadecimal</th><th>Addresses in decimal</th><th>Addresses in Hexadecimal</th><th>Addresses in decimal</th></tr>
<tr><td rowspan="14">Analog area available</td><td>Not used (reserved)</td><td>0000➜000F</td><td>0000➜0015</td><td>0000</td><td>0000</td></tr>
<tr><td>Input 0 (1st package.)</td><td>0010➜001F</td><td>0016➜0031</td><td>0001</td><td>0001</td></tr>
<tr><td>Input 1 (1st package.)</td><td>0020➜002F</td><td>0032➜0047</td><td>0002</td><td>0002</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 7 (1st package.)</td><td>0080➜008F</td><td>0128➜0143</td><td>0008</td><td>0008</td></tr>
<tr><td>Input 0 (2nd package)</td><td>0090➜009F</td><td>0144➜0159</td><td>0009</td><td>0009</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 7 (2nd package)</td><td>0100➜010F</td><td>0256➜0271</td><td>0010</td><td>0016</td></tr>
<tr><td>Input 0 (3rd package)</td><td>0110➜011F</td><td>0272➜0287</td><td>0011</td><td>0017</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 7 (3rd package)</td><td>0180➜018F</td><td>0384➜0399</td><td>0018</td><td>0024</td></tr>
<tr><td>Input 0 (4th package.)</td><td>0190➜019F</td><td>0400➜0415</td><td>0019</td><td>0025</td></tr>
<tr><td>…</td><td>…</td><td>…</td><td></td><td></td></tr>
<tr><td>Input 7 (4th package.)</td><td>0200➜020F</td><td>0512➜0527</td><td>0020</td><td>0032</td></tr>
</table>

1.4.4.5 MODBUS addresses area for outputs:

The structure of MODBUS® addresses area is not fixed and depends of situation and type of different extensions present on ICMK14F1-M or ICMK14N1-M, the MODBUS® addresses start always by all the binary outputs presents, and then the analog outputs present follow up immediately after.

Each binary extension reserves a package of 16 bits or 1 word, even if the extension possesses less than 16 outputs.

Caution:

The first MODBUS® addresses 1000H to 1005H (4096D to 4101D) in bit format are fixed for the 6 binary outputs from ICMK14F1-M or ICMK14N1-M.

The MODBUS® addresses 1006H to 100FH (4102D to 4111D) in bit format are reserved and must not be used, these addresses don't associate any external binary output at all.

The MODBUS® addresses for binary outputs extensions start at 1010H (4112D) in bit format or at 1001H (4097D) in word format.

XC32L1 and XC32L2 configurable extensions reserved two packages of 16 bits.

Each analog extension reserves a package of 8 words or 128 bits, even if the extension possesses less than 8 outputs.

Caution:

The first MODBUS® address 1000H (4096D) in word format is reserved and must not be used and this MODBUS® addresses doesn't associate any external binary output at all.

The MODBUS® addresses for analog inputs extensions start at 1001H (4097D) in word format or at 1010H (4112D) in bit format.

ICMK14F1-M and ICMK14N1-M

		Bit format		Word format	
		Addresses in Hexadecimal	Addresses in Decimal	Addresses in Hexadecimal	Addresses in Decimal
Binary area available	Output 0 (ICMK14F1-M)	1000	4096	1000	4096
	Output 1 (ICMK14F1-M)	1001	4097		
	…	…	…		
	Output 5 (ICMK14F1-M)	1005	4101		
	Not used (reserved)	1006→100F	4102→4111		
	Output 0 (1st package.)	1010	4112	1001	4097
	…	…	…		
	Output 15 (1st package.)	101F	4127		
	Output 0 (2nd package)	1020	4128	1002	4098
	…	…	…	…	…
	…	…	…	…	…
	Output 0 (10th package)	10A0	4256	100A	4106
	…	…	…	…	…
	…	…	…	…	…
	Output 0 (12th package)	10C0	4288	100C	4108
	…	…	…		
	Output 15 (12th package)	10CF	4303		

		Bit format		Word format	
		Addresses in Hexadecimal	Addresses in Decimal	Addresses in Hexadecimal	Addresses in Decimal
Analog area available	Not used (reserved)	1000→100F	4096→4111	1000	4096
	Output 0 (1st package.)	1010→101F	4112→4127	1001	4097
	Output 1 (1st package.)	1020→102F	4128→4143	1002	4098
	…	…	…		
	Output 7 (1st package.)	1080→108F	4224→4239	1008	4104
	Output 0 (2nd package)	1090→109F	4240→4255	1009	4105
	…	…	…	…	…
	Output 7 (2nd package)	1100→110F	4352→4367	1010	4112
	Output 0 (3rd package)	1110→111F	4368→4383	1011	4113
	…	…	…	…	…
	Output 7 (3rd package)	1180→118F	4480→4495	1018	4120
	Output 0 (4th package.)	1190→119F	4496→4511	1019	4121
	…				
	Output 7 (4th package.)	1200→120F	4608→4623	1020	4128

ICMK14F1-M and ICMK14N1-M

1.4.4.6   Example of Configuration in word format

ICMK14F1-M	XC08L1	XI16E1	XO16N1	XE08B5	XM06B5	XC32L2

	MODBUS addresses	Inputs			MODBUS addresses	Outputs	
Word 01	0000H	ICMK14F1-M		Word 01	1000H	ICMK14F1-M	Binary area
Word 02	0001H	XC08L1		Word 02	1001H	XC08L1	
Word 03	0002H	XI16E1		Word 03	1002H	XO16N1	
Word 04	0003H	XC32L2 00à15		Word 04	1003H	XC32L2 8à15	
Word 05	0004H	XC32L2 16à31		Word 05	1004H	XC32L2 16à31	
Word 06	0005H	XE08B5 input 0		Word 06	1005H	Reserved	Analog area
Word 07	0006H	XE08B5 input 1		Word 07	1006H	Reserved	
Word 08	0007H	XE08B5 input 2		Word 08	1007H	Reserved	
Word 09	0008H	XE08B5 input 3		Word 09	1008H	Reserved	
Word 10	0009H	XE08B5 input 4		Word 10	1009H	Reserved	
Word 11	000AH	XE08B5 input 5		Word 11	100AH	Reserved	
Word 12	000BH	XE08B5 input 6		Word 12	100BH	Reserved	
Word 13	000CH	XE08B5 input 7		Word 13	100CH	Reserved	
Word 14	000DH	XM06B5 input 0		Word 14	100DH	XM06B5 output 0	
Word 15	000EH	XM06B5 input 1		Word 15	100EH	XM06B5 output 1	
Word 16	000FH	XM06B5 input 2		Word 16	100FH	Reserved	
Word 17	0010H	XM06B5 input 3		Word 17	1010H	Reserved	
Word 18	0011H	Reserved		Word 18	1011H	Reserved	
Word 19	0012H	Reserved		Word 19	1012H	Reserved	
Word 20	0013H	Reserved		Word 20	1013H	Reserved	
Word 21	0014H	Reserved		Word 21	1014H	Reserved	
Word 22	0015H	XC32L2 input 0		Word 22	1015H	Reserved	
Word 23	0016H	XC32L2 input 1		Word 23	1016H	Reserved	
Word 24	0017H	XC32L2 input 2		Word 24	1017H	Reserved	
Word 25	0018H	XC32L2 input 3		Word 25	1018H	Reserved	
Word 26	0019H	XC32L2 input 4		Word 26	1019H	Reserved	
Word 27	001AH	XC32L2 input 5		Word 27	101AH	Reserved	
Word 28	001BH	XC32L2 input 6		Word 28	101BH	Reserved	
Word 29	001CH	XC32L2 input 7		Word 29	101CH	Reserved	

ICMK14F1-M and ICMK14N1-M

1.4.4.7 MODBUS addresses area for internal variables

Some internal M or MW variables can be used for configuration or diagnosis,

All these internal variables can be read or write in Bit or Word configuration.

The internal registers MW000 up to MW015 are used for read Internal binary area.

		Bit format		Word format	
		Addresses in Hexadecimal	Addresses in Decimal	Addresses in Hexadecimal	Addresses in Decimal
Internal binary area available	M000	2000	8192	2000	8192
	…	…	…		
	M015	200F	8207		
	M016	2010	8208	2001	8193
	…	…	…		
	M240	20F0	8432	200F	8207
	M255	20FF	8447		
Internal register area available	MW016	2100→210F	8448→8453	2010	8208
	MW017	2110→211F	8454→8479	2011	8209
	…	…	…		
	MW127	27F0→27FF	10224→10239	207F	8319
	MW128	2780→278F	10240→10255	2080	8320
	…	…	…		
	MW511	3FF0→3FFF	16368→16383	21FF	8703

1.4.4.8 Configuration of analog extensions used on ICMK14F1-M or ICMK14N1-M

It is possible to configure the type (voltage, current or PT100/Pt1000), change the filtering time, change the scale of the display value and lock and unlock the configuration for all analog channels of one analog extension used with ICMK14F1-M or ICMK14N1-M.

The analog channel configuration is set through MODBUS® frames from MODBUS® master with management value of special internal registers instead of the push button on the front face of the analog extension.

The configuration of parameters follows the same rules that for the parameters used for the function block CONFIO. The configuration is stored in an internal EEprom in the analog extension.

The following internal register area is used for analog extension configuration:

Internal registers	Word format		Configuration parameters
	Addresses in Hexadecimal	Addresses in Decimal	
MW472	21D8	8664	Enable configuration
MW473	21D9	8665	Address of analog extension
MW474	21DA	8666	Channel identification
MW475	21DB	8667	Type of analog channel
MW476	21DC	8668	Position of the dot on the display value
MW477	21DD	8669	Value of the Offset for the display value
MW478	21DE	8670	Value of the multiplication for the display value
MW479	21DF	8671	Filtering time

MW472 = The configuration is processed when value is equal to 1 up to 255

MW473 = Address of analog extension, first analog extension, value = 1 etc…2, 3…

MW474 = Channel identification, depending of type of analog extension used.

Values = 0 up to 7 for the analog inputs. (XM06B5 or XE08B5 extensions)
Values = 100 and 101 for analog outputs. (XM06B5 extension)

MW475 = Type of analog signal. It is possible to configure the type of each channel. If the analog extensions removed, The configuration must be load again to the new one.

Value = 0   correspond to +/- 10V configuration
Value = 1   correspond to 0-20 mA configuration
Value = 2   correspond to 4-20 mA configuration
Value = 3   correspond to Pt100 configuration
Value = 4   correspond to Pt1000 configuration
Value = 5   correspond to Pt100 3 wires configuration
Value = 6   correspond to Pt1000 3 wires configuration
Value = 8   correspond to NI1000 configuration
Value = 9   correspond to Balco500 configuration
Value = 14   correspond to the configuration is unlocked (all channels)
Value = 15   correspond to the configuration is locked (all channels)

It is also possible to lock the configuration. The lock function means that the configuration can not be modified with the push button. The locked function is never stored and has to be sent every time that the extension is supplied.

MW476 = Position of the dot on the value of display

Value = 0   4 digits are displayed without dot.
               Example: analog value = 1234   display will be 1234
Value = 1   4 digits are displayed with dot on position 1.
               Example: analog value = 1234   display will be 123.4
Value = 2   4 digits are displayed with dot on position 2.
               Example: analog value = 1234   display will be 12.34
Value = 3   4 digits are displayed with dot on position 3.
               Example: analog value = 1234   display will be 1.234

MW477 = Value of Offset for the display value. (-32767 <= value <= +32767)

MW478 = Value of the multiplication for the display value. (-32767 <= value <= +32767)

The display value is calculated according to the formula:

DISPLAY = (Aanalog value * MW478) / 32767 + MW477

For example:

ANALOG value is 8000 (2V in voltage configuration)

MW478 =100

MW477 = 25

MW476 = 1

DISPLAY = (8000 * 100) / 32767 + 25 =49

The display value will be **4.9**

MW479 = Filtering time

Value = 0	Internal filter (according to analog extension documentation)
Values = 1-127	Integration number (according to analog extension documentation)
Value = 128	Internal filter (according to analog extension documentation)
Value = 144	Internal filter with degree Fahrenheit configured
Value = 160	Fast refresh time (50ms instead of 120 ms in standard)
Value = 176	Fast refresh time with degree Fahrenheit configured
Value = 192	60Hz Filter
Value = 208	60Hz Filter with degree Fahrenheit configured
Value = 224	50Hz Filter
Value = 240	50Hz Filter with degree Fahrenheit configured

All channels of one extension will be affected by this parameter.

Warning: If the multiplication parameter MW478 = 0 the Offset, dot and filtering time parameters are not used and in this case, the scale is set to the factory setting scale.

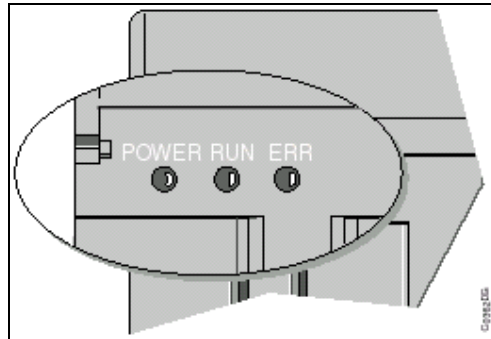# ICMK14F1-M and ICMK14N1-M

1.4.4.9 Diagnostic available on ICMK14F1-M and ICMK14N1

Led displays on the front face allow indicating and controlling information about communication process and status of ICMK14F1-M and ICMK14N1-M.

POWER	Green Led Indicates presence of supply voltage.
RUN	Green Led Indicates reception of valid MODBUS® frame from master, is blinking for each valid frame received.
ERR	Red Led

When ERR Led is fixed, it indicates an error (Bus extension error or overload and short-circuit)

When ERR Led is blinking, it indicates a configuration action.

Slow blinking = during initialisation of the ICMK14F1-M and ICMK14N1-M

Fast blinking = during speed initialisation of communication.

The speed of communication is automatically detected by the ICMK14F1-M and ICMK14N1-M, they can work with different speed from 1200 Bauds up to 187500 Bauds. When the MODBUS® master sends frames, the reaction time to identify the master speed depends to speed used.

Warning: If modification of Address selector on ICMK14F1-M and ICMK14N1-M during communication, the ICMK14F1-M and ICMK14N1-M is in reset, and all outputs fall down at 0 (on ICMK14F1-M and ICMK14N1-M and its extensions) and necessary for the MODBUS master to resend a new MODBUS frames to activate again the outputs.

The following internal register area is used for diagnosis:

Diagnosis on ICMK14F1-M and ICMK14N1-M is available and accessible through the MODBUS® master. It allows to identify if there is a bus extension error or one extension is disconnected and also if there are some output errors (Overload and short-circuit)

In case of one extension is disconnected:

Internal registers	Word format		Diagnosis designations
	Addresses in Hexadecimal	Addresses in Decimal	
MW480	21E0	8672	Extension number
MW481	21E1	8673	Type of extension
MW482	21E2	8674	Error code = 15
MW483 to MW487	21E3 to 21E7	8675 to 8679	Variables reserved

The extension number of the first binary extension is seen as number = 1 (the number = 0 is reserved for Inputs and outputs of ICMK14F1-M and ICMK14N1-M).

The extension number of the first analog extension is seen as number = 0

ICMK14F1-M and ICMK14N1-M

In case of error overload or short-circuit on transistor outputs:

Internal registers	Word format		Diagnosis designations
	Addresses in Hexadecimal	Addresses in Decimal	
MW488	21E8	8680	Extension number
MW489	21E9	8681	Type of extension
MW490	21EA	8682	Error code = 12
MW491	21EB	8683	Counter of number of error
MW492	21EC	8684	Channel number
MW493 to MW494	21ED to 21EF	8685 to 8687	Variables reserved

When the counter of number error is greater or equal to 3 the ERR red led is fixed.

Table in order to identify the type of extension:

- Unit type: 000 Binary inputs
001 Analog inputs
002 Binary outputs
003 Analog outputs
004 Binary inputs / outputs
005 Analog inputs / outputs
016 XO 08 R1
017 XI 16 E1
018 XC 08 L1
023 XK 08 F1
024 XO 16 N1
025 XO 08 Y1
026 XO 08 R2
027 XC31L1
080 XM 06 B5
081 XE 08 B5
082 XTC 08
128 XC32L2

Acknowledgement and update of errors:

The information word values are updated with each new error. Resetting these words to 0 is not automatic when acknowledged but may be realized by writing of one MODBUS® frame from MODBUS® master, with 0 value in these words.

ICMK14F1-M and ICMK14N1-M

The following internal register area is used for diagnosis of communication:

Internal registers	Word format		Diagnosis designations
	Addresses in Hexadecimal	Addresses in Decimal	
MW496	21F0	8688	Counter of all MODBUS frames seen, even when it is not the addressee of those ones. (Low Word)
MW497	21F1	8689	Counter of all MODBUS frames seen, even when it is not the addressee of those ones. (High Word)
MW498	21F2	8690	Counter of all MODBUS frames seen, only when it is the addressee of those ones. (Low Word)
MW499	21F3	8691	Counter of all MODBUS frames seen, only when it is the addressee of those ones. (High Word)
MW500	21F4	8692	Counter of CRC error
MW501	21F5	8693	Counter of function code error
MW502	21F6	8694	Counter of data error and MODBUS address error
MW503	21F7	8695	Counter of bus extension error
MW504	21F8	8696	Configuration of number of characters for detection end of frame (value = 3 up to 127 – default setting = 5 characters)
MW505	21F9	8697	Time for watchdog on outputs (value = 3 up to 32767 – default setting = 3 time base = 0.1 second, possibility to configure the time = 300 ms up to 1 hour)
MW506 to MW511	21FA to 21FF	8698 to 8703	Variables reserved

ICMK14F1-M and ICMK14N1-M

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