

AKO-16523
AKO-16520P

AKO-16520
AKO-16524A

AKO-16523D
AKO-16523-V

AKO-16523P
AKO-16523L

MODBUS map in AKOCore controllers

Introduction

This document is aimed at describing to the user the operation of the MODBUS RTU communications series protocol implemented by AKO in the AKOCore controllers. We should take into account that we assume that the user who wants to interact with any of our equipment with communication capacity has some knowledge of the protocol.



IMPORTANT: The functions and parameters described below are available depending on the chosen unit, for more information consult the device's user manual.

Technical specifications

RS-485 communications

Physically speaking, the AKOCore devices can be connected to a RS-485 communications bus with other units. This is a multipoint connection where the maximum distance is 1200* m. The configuration of this bus should be identical to the one presented in the following table:

RS-485 SERIES CONFIGURATION	
Baud Rate	9600**, 19200, 38400, 57600
Data length	8 bits
Parity bit	No
Stop Bits	1 bit

Modbus protocol

The protocol defines a network configuration where a network manager device (master) coexists with one or several slaves, up to a maximum of 32 networked devices (247 in the case of placing repeaters in the RS-485 network).

Among the two transmission modes defined by the protocol: ASCII and RTU (Remote Terminal Unit), AKO adopts the RTU mode. It must be said that in a network of devices connected via the MODBUS protocol, devices cannot be shared using different transmission modes.

The datagram format in RTU format is:

Start frame	Address	Function	Data	CRC	End frame
3.5T	1 byte (1 to 247)	1 integer	Max. 126 integers	1 integer	3.5T

←————— Maximum length 255 bytes —————→

The maximum data unit is the integer (2 bytes)

T is the time of transition of one character.

Defined MODBUS functions

AKO solves the management of its devices using several basic functions of the MODBUS protocol:

Function	Definition	Description of operation
03	Read holding registers	Reading of multiple logs
06	Preset single registers	Writing a log
16	Preset multiple registers	Writing of multiple logs

Definitions

Types of log	
N	Numeric value.
Nx10	Numeric value multiplied by 10, it has to be divided by 10 to represent it correctly.
Nx100	Numeric value multiplied by 100, it has to be divided by 100 to represent it correctly.
UTF8	2 bytes utf8 (to represent texts)
BITS	Bit map, each bit represents a value, 0 = not active, 1 = active.
Types of access	
R	Read-only. (Parameters to display to the user in the parameter section)
W	Read and write. (Parameters to display to the user in the parameter section)

* Maximum distance at 9600 baud, the distance is reduced on increasing the baud rate.

**Default value.

Parameters

It allows the user to display and edit the operating parameters.

Regulation and control (rE)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
200	Nx10	W	SP	Temperature setting (Set Point)	-500 - 990	-500	0	990
201	N	W	CE	SELDRIIVE mode	0 =Deactivated 1 = Activated	0	0	1
202	Nx10	W	C0	Probe 1 calibration (Offset)	-200 - 200	-200	0	200
203	Nx10	W	C1	Probe 1 differential (Hysteresis)	1 - 200	1	20	200
204	Nx10	W	C2	Set point top locking	-500 - 990	C3	990	990
205	Nx10	W	C3	Set point bottom locking	-500 - 990	-500	-500	C2
206	N	W	C4	Type of delay for the protection of the compressor	0 = Minimum time of compressor in OFF 1 = Minimum time of compressor in OFF and in ON in each cycle	0	0	1
207	N	W	C5	Protection delay time	0 - 120	0	0	120
208	N	W	C6	COOL relay status with fault in probe 1	0 = OFF; 1 = ON; 2 = Average prior 24 hours; 3 = According to C7 and C8	0	2	3
209	N	W	C7	Time of relay ON in the event of damaged 1 probe	0 - 120	0	10	120
210	N	W	C8	Time of relay OFF in the event of damaged 1 probe	0 - 120	0	5	120
211	N	W	C9	Maximum duration of the continuous cycle mode	0 - 48	0	0	48
212	Nx10	W	C10	Variation of the set point (SP) in continuous cycle mode	-1490 - 0	C3-SP	-500	0
213	Nx10	W	C12	Variation of the set point (SP) when the change set point change function is active	-1490 - 1490	C3-SP	0	C2-SP
214	N	W	C19	Maximum start time from Pump Down	0 - 120	0	0	120
215	N	W	C20	Maximum time for pump down	0 - 15	0	0	15
216	N	W	C21	Probe to be displayed	0 = All probes 1 = Temp. Probe Cold room 2 = Evap. probe 2 3 = Probe 3 4 = Weighted temperature	0	1	4
217	N	W	C22	Stop fans and compressor on opening door	0 = No; 1 = Yes	0	0	1
218	N	W	C23	Start-up delay for fans and compressor with door open	0 - 999	0	0	990
219	N	W	C24	Delay time of cold stop with door open	0 - 999	0	0	C23
220	N	W	C25	Influence of probe S3 when regulating with two temperature probes	0 - 95 %	0	0	95
221	Nx10	W	C27	Probe 3 calibration (Offset)	-200 - 200	-200	0	200

Defrost (dEF)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
230	N	W	d0	Defrost frequency	0 - 96	0	6	96
231	N	W	d1	Maximum defrost duration	0 - 255	0	Inl	255
232	N	W	d2	Type of message during the defrost:	0 = Displays the real temperature 1 = Displays the temperature at the start of the defrost 2 = Displays the DEF message	0	2	2
233	N	W	d3	Maximum message duration	0 - 255	0	5	255
234	Nx10	W	d4	Final defrost temperature	-500 - 500	-500	80	500
235	N	W	d5	Defrost on connecting the unit	0 = No. First defrost according to d0 1 = Yes, first defrost according to d6	0	0	1
236	N	W	d6	Delay of the defrost start on connecting the unit	0 - 255	0	0	255
237	N	W	d7	Type of defrost:	0 = Resistors 1 = By air 2 = Hot gas 3 = Reverse cycle	0	Inl	3
238	N	W	d8	Count of time between defrost periods:	0 = Total real time 1 = Sum of the COOL operating time	0	0	1
239	N	W	d9	Drip time when a defrost finishes	0 - 255	0	1	255
240	N	W	d30	Defrost strategy in SELFDRIIVE mode	0 - 10	0	5	10
241	N	W	d31	Maximum time without defrosting	0 - 999	0	96	999
242	N	W	d32	Maximum time of cold room outside the temperature regulation range	0 - 10	0	2	10

Evaporator fans (FAn)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
250	Nx10	W	F0	Fans stop temperature	-500 - 500	-500	40	500
251	Nx10	W	F1	Probe 2 differential if fans are stopped	1 - 200	1	20	200
252	N	W	F2	Stop fans when compressor stops	0 = No; 1 = Yes,	0	0	1
253	N	W	F3	Status of the fans during the defrost	0 = Stopped 1 = Running	0	Inl	1
254	N	W	F4	Start-up delay after defrost	0 - 99	0	2	99

Alarms (AL)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
260	N	W	A0	Configuration of the temperature alarms	0 = Relative 1 = Absolute	0	1	1
261	Nx10	W	A1	Maximum in probe 1 alarm	-500 - 990	A2	990	990
262	Nx10	W	A2	Minimum in probe 1 alarm	-500 - 990	-500	-500	A1
263	N	W	A3	Delay of temperature alarms in the start-up	0 - 120	0	0	120
264	N	W	A4	Delay of temperature alarms from the end of a defrost	0 - 99	0	0	99
265	N	W	A5	Delay of temperature alarms from when the A1 or A2 value is reached	0 - 99	0	30	99
266	N	W	A6	Delay of external alarm/severe external alarm on receiving a signal in digital input	0 - 120	0	0	120
267	N	W	A7	Delay of external alarm/severe external alarm deactivation when the signal in digital input disappears	0 - 120	0	0	120
268	N	W	A8	Show warning if the defrost ends for maximum time	0 = No 1 = Yes	0	0	1
269	N	W	A9	Alarm relay polarity	0 = Relay ON in alarm 1 = Relay OFF in alarm	0	0	1
270	Nx10	W	A10	Differential of temperature alarms	1 - 200	0	10	200
272	N	W	A12	Delay to open door alarm	0 - 120	0	10	120

Basic configuration (bcn)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
280	N	W	b00	Delay of all functions on receiving power supply	0 - 255	0	0	255
281	N	W	b01	Cold room light timing	0 - 999	0	0	999
282	N	W	b10	Password function	0 = Inactive 1 = Block access to parameters 2 = Block keypad	0	0	2
283	N	W	PAS	Password	0 - 99	0	0	99
284	N	W	b20	MODBUS address	1 - 247	1	1	247
285	N	W	b21	Communication speed	0 = 9600bps 1 = 19200bps 2 = 38400bps 3 = 57600bps	0	0	3
286	N	W	b22	Acoustic alarm enabled	0 = No 1 = Yes	0	1	1
287	N	W	Unt	Work units	0 = °C 1 = °F	0	0	1

Inputs and outputs (In0)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.	
290	N	W	I00	Probes connected	1=Probe 1 (Cold room) 2=Probe 1 + Probe 2	1	2	2	
291	N	W	I10	Configuration of digital input 1	0 = Deactivated 1 = Door contact 2 = External alarm 3 = Severe external alarm 4 = Change of SP 5 = Remote defrost 6 = Defrost lockout 7 = Low pressure switch 8 = Remote Stand-by	0	Inl	8	
292	N	W	I11	Polarity of digital input 1	0 = Activates on closing contact 1 = Activates on opening contact	0	0	1	
293	N	W	I20	Input 2 configuration	AKO-16523x / AKO-16520x	0	Inl	10	
					0 = Deactivated 1 = Door contact 2 = External alarm 3 = Severe external alarm 4 = Change of SP 5 = Remote defrost				6 = Defrost lockout 7 = Register probe 8 = Probe 2° evaporator 9 = High pressure switch 10 = Remote Stand-by
					AKO-16524A / AKO-16525A				0 = Deactivated 1 = Door contact 2 = External alarm 3 = Severe external alarm 4 = Change of SP 5 = Remote defrost 6 = Defrost lockout
294	N	W	I21	Polarity of digital input 2	0 = Activates on closing contact 1 = Activates on opening contact	0	0	1	
295	N	W	o00	AUX1 relay configuration	0 = Deactivated 1 = Compressor / Crankcase resistor 2 = Light 3 = Virtual control	0	Inl	3	
296	N	W	o10	AUX2 relay configuration	0 = Deactivated 1 = Alarm 2 = Light 3 = Virtual control 4 = Resist. Door frame 5 = 2nd evaporator 6 = Same cool 7 = Same unit status 8 = Resis. Drainage	0	2	8	

HACCP alarm (HCP)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
301	Nx10	W	h1	HACCP alarm maximum temperature	0 - 990	0	990	990
302	N	W	h2	Maximum permitted time for activation of the HACCP alarm	0 - 255	0	0	255

Information (tid)

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
798	N	R	InI	Option chosen in the configuration wizard	1 - 13	1	-	13
799	N	R	Pd	Pump down active?	0 = No; 1 = Yes	0	InI	1
801	N	R	PU	Program version	2200= 4 relays 2201= 5 relays 2202= Advanced			
802	N	R	Pr	Program revision				
803	N	R	bU	Bootloader revision	2200= 4 relays 2201= 5 relays 2202= Advanced			
804	N	R	br	Bootloader revision				
805	N	R	PAr	Parameter map revision				

Parameters only available with the CAMM module installed

Register	Type	Access	Parameter	Description	Range	Min.	Def.	Max.
811	N	R	C40	Days/s of SP Change mode activation by programming	0 = Deactivated 1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday 8 = Monday to Sunday 9 = Monday to Saturday 10 = Monday to Friday 11 = Saturday and Sunday	0	0	11
812	N	R	C41	Start time of the Change of SP by programming	0 - 23	0	0	23
813	N	R	C42	Minutes of the Change of SP programming	0 - 59	0	0	59
814	N	R	C43	Duration of the Change of SP by programming	0 - 24	0	0	24
815	N	R	d10	Start time defros 1	-1 - 23*	-1	-1	23
816	N	R	d11	Start time defros 2	-1 - 23*	-1	-1	23
817	N	R	d12	Start time defros 3	-1 - 23*	-1	-1	23
818	N	R	d13	Start time defros 4	-1 - 23*	-1	-1	23
819	N	R	d14	Start time defros 5	-1 - 23*	-1	-1	23
820	N	R	d15	Start time defros 6	-1 - 23*	-1	-1	23
821	N	R	L1	Log interval	0 = 1 minute 1 = 5 minutes 2 = 15 minutes 3 = 30 minutes 4 = 60 minutes	0	2	4
822	N	R	L2	Delete record and event log	0 = No; 1 = Yes	0	0	1
823	N	R	L3	Start day of the log	0 = Monday 1 = Tuesday 2 = Wednesday 3 = Thursday 4 = Friday 5 = Saturday 6 = Sunday	0	0	6
824	N	R	L4	Decimal separator in .csv file	0 = , 1 = .	0	0	1

* -1 =Deactivated

Unit status

Allows the user to consult the status of the unit.

Alarms

Register	Type	Access	Description	Values
1566	BITS	R	Alarms A Bit 0 = Max. alarm probe 1 (AH) Bit 1 = Min. alarm probe 1 (AL) Bit 2 = Open door alarm (AdO) Bit 3 = External alarm (AE) Bit 4 = Severe external alarm (AES) Bit 5 = Error in probe 1 alarm (E1) Bit 6 = Error in probe 2 alarm (E2) Bit 7 = Error in probe 3 alarm (E3) Bit 8 = Not in use Bit 9 = Moisture entry in probe 2 alarm (E2) Bit 10 = Moisture entry in probe 3 alarm (E3) Bit 11 = HACCP alarm (HCP) Bit 12 to 15 = Not in use	0 = Inactive; 1 = Active
1567	BITS	R	Alarms B Bit 0 to 5 = Not in use Bit 6 = Alarm of change in configuration from 1 to 2 evaporators and vice versa (E16) Bit 7 to 15 = Not in use	0 = Inactive; 1 = Active
1572	BITS	R	Alerts A Bit 0 = Defrost ended by time alert (Adt) Bit 1 = Error in pump down alert (Stop) (Pd) Bit 2 = Error in pump down alert (Start-up) (LP) Bit 3 = HACCP alert due to power supply failure (HCP/PF) Bit 4 = HACCP alert (HCP) Bit 5 to 15 = Not in use	0 = Inactive; 1 = Active
1614	BITS	R	Alerts B Bit 0 = Alert of defrost finished by time during the calibration (Evaporator 1). (E10) Bit 1 = Alert of insufficient temperature difference between Probes of the cold room and of evaporator 1 during the calibration. (E11) Bit 2 = Alert of fault in the calibration due to lack of stability of the system. (E12) Bit 3 = Alert of insufficient temperature difference between Probes of the cold room and of evaporator 1 in normal operation (SELFDRIIVE ON Mode). (E13) Bit 4 = Alert of lack of system stability in normal operation (SELFDRIIVE ON Mode). (Evaporator 1). (E14) Bit 5 = The persistent lack of stability has deactivated the SELFDRIIVE mode. (E15) Bit 6 = Not in use Bit 7 = Alert of excessive door openings during calibration. (E17) Bit 8 = Alert of SELFDRIIVE Mode deactivation due to excessive door openings. (E18) Bit 9 = Not in use Bit 10 = Alert of defrost finished by time during the calibration (Evaporator 2). (E20) Bit 11 = Alert of insufficient temperature difference between Probes of the cold room and of evaporator 2 during the calibration. (E21) Bit 12 = Alert of fault in the calibration due to lack of system stability. (E22) Bit 13 = Alert of insufficient temperature difference between Probes of the cold room and of evaporator 2 in normal operation (SELFDRIIVE ON Mode). (E23) Bit 14 = Alert of lack of system stability in normal operation (SELFDRIIVE ON Mode). (Evaporator 2). (E24) Bit 15 = The persistent lack of stability has deactivated the SELFDRIIVE mode. (E25)	0 = Inactive; 1 = Active

Reading of inputs and outputs

1582	N	R	Displays the effective temperature of the Set Point, after applying the possible variables (set point change function, continuous cycle, etc.).	
1000	Nx10	R	Reading of temperature in probe 1	
1001	Nx10	R	Reading of temperature in probe 2	
1002	Nx10	R	Reading of temperature in probe 3	
1003	N	R	Reading of digital input 1	0 = Inactive; 1 = Active
1004	N	R	Reading of digital input 2	0 = Inactive; 1 = Active
1007	N	R	COOL relay status	0 = Inactive; 1 = Active
1008	N	R	DEFROST relay status	0 = Inactive; 1 = Active
1009	N	R	FAN relay status	0 = Inactive; 1 = Active
1010	N	R	AUX 1 relay status	0 = Inactive; 1 = Active
1011	N	R	AUX 2 relay status	0 = Inactive; 1 = Active

Keyboard

Register	Type	Access	Description	Values
20000	BITS	W	Activation of functions Bit 0 = Activation of Stand by Bit 1 = Activation of change of Set Point (According to C12) Bit 2 = Activation of the defrost Bit 3 = Activation of continuous cycle Bit 4 = Activation of the light Bit 5 = Activation of the mute Bit 6 = Not in use Bit 7 = Activation of AUX 1 relay (If o00=3) Bit 8 = Activation of AUX 2 relay (If o10=3)	0 = Inactive; 1 = Active
20001	BITS	R	Function status Bit 0 = Stand by Bit 1 = Change of Set Point (According to C12) Bit 2 = Defrost Bit 3 = Continuous cycle Bit 4 = Light Bit 5 = Mute Bit 6 = Not in use Bit 7 = AUX 1 relay (If o00=3) Bit 8 = AUX 2 relay (If o10=3)	0 = Inactive; 1 = Active
20002	BITS	R	Pending functions (Request made and pending execution) Bit 0 = Stand by Bit 1 = Change of Set Point (According to C12) Bit 2 = Defrost Bit 3 = Continuous cycle Bit 4 = Light Bit 5 = Mute Bit 6 = Not in use Bit 7 = AUX 1 relay (If o00=3) Bit 8 = AUX 2 relay (If o10=3)	0 = Inactive; 1 = Active

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