

MODBUS RTU for CAMRegis dataloggers

1. INTRODUCTION

The purpose of this document is to describe to the user the functioning of the MODBUS RTU series communications protocol implemented by AKO in CAMRegis data loggers (AKO-15740/42, AKO-15750/52 and AKO-15780/82). It is assumed in this document that a user wishing to interact with any of our systems with communication capacity has a minimum knowledge of the protocol.

2. TECHNICAL SPECIFICATIONS

2.1 RS-485 COMMUNICATIONS

At the physical level, CAMRegis systems admit connection to an RS-485 communications bus with other systems. This is a multi-point connection where the maximum distance is 1200m. This bus' configuration must be identical to the one detailed in the following table:

RS-485 SERIES CONFIGURATION	
Baud Rate	9600 baud
Data length	8 bits
Parity bit	No
Stop bits	1 bit

2.2 MODBUS PROTOCOL

The protocol defines a network configuration in which a network administrator device (master) cohabits with one or several slaves, up to a maximum of 32 devices connected in network (250 where placing repeaters on the RS-485 network).

Of the two transmission modes defined by the protocol: ASCII and RTU (Remote terminal unit), AKO adopts RTU. We should point out that on a network of devices connected by means of the MODBUS protocol devices that use different transmission modes cannot be shared.

The datagram format in RTU mode is:

Frame Start	Address	Function	Data	CRC	Frame End
3.5T*	1 byte Range [1..249]	1 full	Max 125 full	1 full	3.5T*

← Maximum length 255 bytes →

- *NOTE: the minimum data unit is the full unit (2 bytes)*

* T being the transmission time for one character.

3. MODBUS FUNCTIONS DEFINED

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

Function	Definition	How it works
03	Read Holding Registers	Reads multiple registers
06	Preset Single Register	Writes a register
16	Preset Multiple Registers	Writes multiple registers
20	Read File Record	Reads files
21	Write File Record	Writes files

3.1 FUNCTION 03, 04: Read Holding Registers

This function code is used to read the content of a continual block of registers in a remote device. In the data request executed by the network's master device, MODBUS indicates the initial register and the total number of registers to read. In the response to the request data registers are packaged in full format, i.e., 2 bytes per register, with the binary content left-justified in each byte. For each register the first byte contains the higher order bits and the second the lower order bits.

Read Register Request Format		
Function Code	Size 1 Byte	0x03 and 0x04
Initial Register	Size 2 Bytes	Range in Hexadecimal [0x0000:0xFFFF] Range in Decimal [0:65535]
No. Registers	Size 2 Bytes	1 to 125 [0x7D in hexadecimal]

Read Register Response Format		
Function Code	Size 1 Byte	0x03
No. of Bytes	Size 1 Byte	2 x N*
No. Registers	N* x 2 Bytes	

* N = Number of registers.

Error in Read Register Request Format		
Error Code	Size 1 Byte	0x83
Exception Code	Size 1 Byte	01 or 02 or 03 or 04

3.2 FUNCTION 06: Preset Single Register

This function code is used to read the content of a continual block of registers in a remote device. In the data request executed by the network's master device, MODBus indicates the initial register and the total number of registers to read. In the response to the request data registers are packaged in full format, i.e., 2 bytes per register, with the binary content left-justified in each byte. For each register the first byte contains the higher order bits and the second the lower order bits.

Write Register Request Format		
Function Code	Size 1 Byte	0x06
Register Index	Size 2 Bytes	Range in Hexadecimal [0x0000:0xFFFF] Range in Decimal [0:65535]
Register value	Size 2 Bytes	Range in Hexadecimal [0x0000:0xFFFF] Range in Decimal [0:65535]

Write Register Response Format		
Function Code	Size 1 Byte	0x06
Register Index	Size 2 Bytes	Range in Hexadecimal [0x0000:0xFFFF] Range in Decimal [0:65535]
Register value	Size 2 Bytes	Range in Hexadecimal [0x0000:0xFFFF] Range in Decimal [0:65535]

Error in Write Register Request Format		
Error Code	Size 1 Byte	0x86
Exception Code	Size 1 Byte	01 or 02 or 03 or 04


4. PARAMETERS OF AKO-15740/42, AKO-15750/52 and AKO-15780/82 DATA LOGGERS




Symbols used:

FIELD	MEANING
Unit	Basic measuring unit used in the parameter.
Min	Minimum accepted value expressed in the units defined for the parameter.
Def.	Default value expressed in the units defined.
Max.	Maximum accepted value expressed in the units defined for the parameter.
Flow	Indicates whether the parameter is a write (W) read (R) or both (RW).
Index	Access index, the "+" sign indicates the number of registers to read/write (by default 1).
Function	MODBus function code [mode of accessing the data logger's internal registers].
Value	Values assignable to the parameter defined.


4.1 CONFIGURATION OF PARAMETERS

The AKO-15780/82 have two probe inputs, the AKO-15750/52 5 probe inputs and the AKO-15740/42 10 probe inputs.

Menu	Parameter.	Options.	Max.	Mix.	Default	Units	Coments	MODBUS
	Date/Time ⁽¹⁾	DD MM YY / HH MM SS	(*)	1	1	Day	by month	803 timestamp_high 804 timestamp_low
	Date format:	0:DD/MM/YYYY 1:MM/DD/YYYY 2:YYYY/MM/DD	12	1	1			805
	Automatic time change	0:No 1:Yes	1	0	1			806
	Log interval	0:5 minuts 1:15 minuts 2:30 minuts	2	0	1	Minutes		807
	Log start day	0: Monday 1: Tuesday 2: Wednesday 3: Thursday 4: Friday 5: Saturday 6: Sunday	6	0	0			808
	Temperature units	0:°C 1:°F	1	0	0	°C / °F		809
	Mute Alarm	0:No 1: Buzzer only 0: Relay only 1: Buzzer & Relay	3	0	1			810
	Delete log	0:No 1:Yes	1	0	0			811
	Default parameters	0:No 1:Yes	1	0	0			812
	Modbus adress	NNN	255	1	255			813
	Modbus speed	0: 9600 BAUD 1: 19200 BAUD 2: 38400 BAUD 3: 57600 BAUD	3	0	0			814

Menu	Parameter.	Options.	Max.	Mix.	Default	Units	Coments	MODBUS
	Acces rights	0:No 1:Yes	1	0	0			815
	User name 1				USER 1		If Acces rights =1	816 - 819
	User password 1		999	0	1234			820
	User name 2				USER 2			821 - 824
	User password 2		999	0	1234			825
	User name 3				USER 3			826-829
	User password 3		999	0	1234			830
	User name 4				USER 4			831-834
User password 4		999	0	1234		835		
	Language	0: Spanish 1: English 2: French 3: German 4: Portuguese 5: Italian 6: Russian	6	0	0			841
	Contrast		100	0	50	%		842

4.2 Setup of inputs / probes

Menu	Parameter.	Options.	Max.	Mix.	Default	Units	Coments	MODBUS
	Type	0: Disabled 1: NTC 2: Pt100 3: Pt1000 4: 4/20 mA 5: DI-NO 6: DI-NC	6	0	0			2000+100*n
	Value at 4 mA	NNN.N	999.9	-999.9	0	A		2001+100*n
	Value at 20 mA	NNN.N	999.9	-999.9	100			2002+100*n
	Offset	NN.N	20.0	-20.0	0.0			2003+100*n
	Display units	CC						2004+100*n
	Description	CCCCCCCC				Input n		2006+100*n 2013+100*n
	Enable alarm	0: No 1: Min. 2: Max 3: Min y Max	3	0	0			2014+100*n
	Max. alarm level	NNN.N	999.9	-999.9	999.9			2015+100*n
	Min. alarm level	NNN.N	999.9	-999.9	-999.9			2016+100*n
	Alarm delay		120	0	0	Minutes		2017+100*n
	Alarm output	0: No output 1: Buzzer only 2: Relay only 3: Buzzer + Relay	3	0	0			2018+100*n

n= Input number, from 1 to 10 according to model.

The parameters are changed on a copy and are block recorded on exiting programming with menu or on writing 1 in the 1033 record of modbus.

(1)= It reads and records in records 803 and 804 grouped in a single value of 32 bits. Record 803 has the high part and 804 the low part. The value of this 32 bit record is the number of seconds that have passed since 1 January 1970.

4.6 STATUS RECORDS

Description	Units	Min.	Max.	Address
Pu – Programme version		1300	1300	801
Pr – Programme revision		0	9999	802
Buzzer		0d	1d	1010
Probe / digital input 1	°C / °F	7FFFh	8001h	1011
Probe / digital input 2	°C / °F	7FFFh	8001h	1012
Probe / digital input 3	°C / °F	7FFFh	8001h	1013
Probe / digital input 4	°C / °F	7FFFh	8001h	1014
Probe / digital input 5	°C / °F	7FFFh	8001h	1015
Probe / digital input 6	°C / °F	7FFFh	8001h	1016
Probe / digital input 7	°C / °F	7FFFh	8001h	1017
Probe / digital input 8	°C / °F	7FFFh	8001h	1018
Probe / digital input 9	°C / °F	7FFFh	8001h	1019
Probe / digital input 10	°C / °F	7FFFh	8001h	1020
Keypad		0d	15d	1021
Relay 1 output		0d	1d	1022
Relay 2 output		0d	1d	1023
Alarms high		0d	FFFFh	1027
Alarms low		0d	DFFFh	1028

*3 to 10 probe inputs are available according to datalogger models.

4.7 Clarifications

Temperature

Probes: Value expressed in degrees / unit 4-20 x10

Maximum value: 8001h (circuit open / modbus error)

Minimum value: 7FFFh (Closed circuit)

Digital inputs

Maximum value: 1 (active)

Minimum value: 0 (inactive)

Relay and buzzer outputs

Output activated: 0d (ON)

Output deactivated: 1d (OFF)

Keypad

The value simulates pressing one of the available keys.

Key	Value
SET	0
▲	1
▼	2
◀	3
▶	4
⌂	5
ESC	6
▲+▼	7
▲+◀	8
▲+▶	9
No key pressed	15

Alarms

After converting to binary, each bit defines the status of each of the active (1) or inactive (0) alarms.

Bit	Alarm	Bit	Alarm
0	Min. Input 1	15	Min. Input 6
1	Max. Input 1	16	Max. Input 6
2	Digital Input 1	17	Digital Input 6
3	Min. Input 2	18	Min. Input 7
4	Max. Input 2	19	Max. Input 7
5	Digital Input 2	20	Digital Input 7
6	Min. Input 3	21	Min. Input 8
7	Max. Input 3	22	Max. Input 8
8	Digital Input 3	23	Digital Input 8
9	Min. Input 4	24	Min. Input 9
10	Max. Input 4	25	Max. Input 9
11	Digital Input 4	26	Digital Input 9
12	Min. Input 5	27	Min. Input 10
13	Max. Input 5	28	Max. Input 10
14	Digital Input 5	29	Digital Input 10



AKO ELECTROMECÀNICA, S.A.L.

Av. Roquetes, 30-38 | 08812 Sant Pere de Ribes | Barcelona | España

Tel. (34) 938 142 700 | Fax (34) 938 934 054 | e-mail: ako@ako.com | www.ako.com

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