

MODBUS RTU in DARWIN controllers

1- INTRODUCTION

This document is aimed at describing to the user the operation of the MODBUS RTU communications series protocol implemented by AKO in the DARWIN dataloggers. 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.

2- TECHNICAL SPECIFICATIONS

RS-485 COMMUNICATIONS: Physically speaking, the DARWIN devices with integrated communications can be connected to a RS-485 communications bus with other devices. 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 bauds
Data length	8 bits
Parity bit	No
Stop Bits	1 bit
Resists termination	No
Number of devices	30

3- MODBUS FUNCTION SUPPORTED

Functions	
WRITE SINGLE REGISTER	06h
WRITE MULTIPLE REGISTER	10h
READ HOLDING REGISTER	03h
READ INPUT REGISTER	04h
READ DEVICE IDENTIFICATION	2Bh

4- DARWIN PARAMETER MAP

Depending on the parameter, the temperature values are expressed in degrees x10

Maximum value: 0X8001 (Open circuit)

Minimum value: 0X7FFF (Closed circuit)



IMPORTANT: The parameters available in each device depend on the device functions; therefore some parameters may not be present in your device.

CONTROL:

	Description	Units	Address
SP	Temperature setting (Set Point) (limits according to type of probe)	(°C/°F)	200
C0	Probe 1 calibration (Offset)	(°C/°F)	201
C1	Probe 1 differential (Hysteresis)	(°C/°F)	202
C2	Set Point upper blocking (it cannot be set above this value)	(°C/°F)	203
C3	Set Point lower blocking (it cannot be set under this value)	(°C/°F)	204
C4	Type of delay to protect the compressor (COOL relay): 0 =OFF/ON (From the last disconnection); 1 =OFF-ON/ON-OFF (From the last stop/start)		205
C5	Protection delay time (Value of the option selected in parameter C4)	(min.)	206
C6	COOL relay status with fault in probe 1: 0 =OFF; 1 =ON; 2 =Average according to last 24 h before the probe error; 3 =ON-OFF according prog. C7 and C8		207
C7	Time of relay ON in the event of damaged 1 probe (If C7=0 and C8≠0, the relay will always be OFF disconnected)	(min.)	208
C8	Time of relay OFF in the event of damaged 1 probe (If C8=0 and C7≠0, the relay will always be ON connected)	(min.)	209
C9	Maximum duration of the fast freezing mode (0 =deactivated)	(min.)	210
C10	Variation of the set point (SP) in fast freezing mode, when it reaches this point (SP+C10), it returns to the normal mode. (SP+C10 ≥ C3) (0 =OFF) The value of this parameter is always negative, except if it is 0.	(°C/°F)	211
C11	Time of inactivity in the digital input to activate the ECO mode (Only if P10 or P11 = 1 and P0=0) (0 =OFF)	(h.)	212
C12	Variation of the set point (SP) in ECO mode (SP+C12 ≤ C2) (0 = deactivated)	(°C/°F)	213

	Description	Units	Address
C13	Time past in ECO1 mode to enter into ECO2 mode	(h.)	214
C14	Value of the increase in the set point for the ECO2 function mode	(°C/°F)	215
C15	ECO mode activation		216
C16	Duration of the variation Set Point (Relay R1) per digital input	(min)	217
C17	OFF-ON delay time for R1 (from the last disconnection)	(min)	218
C18	ON-OFF delay time for R1 (from the last connection)	(min)	219
SP2	Relay R2 temperature setting (Set Point)	(°C/°F)	250
C51	Differential of R2 and SP2 (Hysteresis)	(°C/°F)	252
C52	Upper lock of the Set Point (Relay R2) (it cannot be set above this value)	(°C/°F)	253
C53	Lower lock of the Set Point (Relay R2) (it cannot be set under this value)	(°C/°F)	254
C56	State of relay R2 with damaged probe 0 =OFF; 1 =ON; 2 =Average according to last 24h prior to probe error; 3 =ON-OFF according to prog. C57 and C58		257
C57	Time of relay R2 in ON in the event of damaged probe (If C57=0 and C58≠0, the relay will always be OFF disconnected)	(min.)	258
C58	Time of relay R2 in OFF in the event of damaged probe (If C58=0 and C57≠0, the relay will always be ON connected)	(min.)	259
C62	Variation of Set Point 2 (Relay R2) per digital input (if P35 = 2) (SP2+C62≤ C52) (0 = deactivated)	(°C/°F)	263
C66	Duration of the variation Set Point 2 (Relay R2) per digital input	(min)	267
C67	OFF-ON delay time for R2 (from the last disconnection)	(min)	268
C68	ON-OFF delay time for R2 (from the last connection)	(min)	269

DEFROST CONTROL:

	Description	Units	Address
d0	Defrost frequency (Time between 2 starts)	(h.)	300
d1	Maximum defrost duration (0 =defrost deactivated)	(min.)	301
d2	Type of message during the defrost: 0 =Sign of the real temperature; 1 =Sign of the temperature at the start of the defrost; 2 =Displays the dEF message		302
d3	Maximum duration of the message (Time added at the end of the defrost)	(min.)	303
d4	Final defrost temperature (by probe) (if P4 ≠ 1)	(°C/°F)	304
d5	Defrost on connecting the unit: 0 =NO, First defrost according to d0; 1 =YES, First defrost according to d6		305
d6	Delay of the defrost start on connecting the unit	(min.)	306
d7	Type of defrost: 0 =resistors; 1 =cycle inversion;		307
d8	Count of time between defrost periods: 0 =Total real time; 1 =Sum of compressor connected time		308
d9	Drip time when a defrost finishes (Compressor and fan stop) (if P4 ≠ 1)	(min.)	309
d10	Start time 1st defrost (Only with RTC function)	(h.)	310
d11	Start time 2nd defrost (Only with RTC function)	(h.)	311
d12	Start time 3rd defrost (Only with RTC function)	(h.)	312
d13	Start time 4th defrost (Only with RTC function)	(h.)	313
d14	Start time 5th defrost (Only with RTC function)	(h.)	314
d15	Start time 6th defrost (Only with RTC function)	(h.)	315

FAN CONTROL:

	Description	Units	Address
F0	Stop temperature of the fans by probe (if P4 ≠ 1)	(°C/°F)	400
F1	Probe 2 differential (if P4 ≠ 1)	(°C/°F)	401
F2	Stop fans when the compressor stops 0 =No; 1 =Yes		402
F3	Status of the fans during the defrost 0 =Stopped; 1 =Running		403
F4	Delay of start-up after defrost (if F3=0) It will only actuate if it is higher than d9.	(min.)	404
F5	Stop fans on opening the door 0 =No; 1 =Yes (Requires a digital input configured as door P10 or P11=1)		405

ALARM CONTROL:

	Description	Units	Address
A0	Configuration of the temperature alarms 0=Relative at SP; 1=Absolute	(°C/°F)	500
A1	Alarm for maximum in probe 1 (It should be higher than the SP)	(°C/°F)	501
A2	Alarm for minimum in probe 1 (It should be lower than the SP)	(min.)	502
A3	Delay of temperature alarms in the start-up	(min.)	503
A4	Delay of temperature alarms from the end of a defrost	(min.)	504
A5	Delay of temperature alarms from when the A1 or A2 value is reached.	(min.)	505
A6	Delay of the external alarm on receiving a signal in digital input (P10=2 or 3 ; P11=2 or 3)	(min.)	506
A7	Delay of external alarm deactivation when the signal in digital input disappears (P10 or P11=2 or 3)	(min.)	507
A8	Show warning if the defrost ends for maximum time 0=No; 1=Yes		508
A9	Polarity relay alarm 0= Relay ON in alarm (OFF without alarm); 1= Relay OFF in alarm (ON without alarm)		509
A10	Differential temperature alarms (A1 and A2)	(°C/°F)	510
A11	HACCP delay	(min.)	511
A12	Delay of open door alarm (if P10 or P11 = 1)	(min.)	512
A13	Dirty condenser maximum alarm		513
A14	Slow cooling alarm. Value of the temperature variation in the evaporator		514
A16	Disconnection of the alarm relay after pressing the ESC key 0= Yes; 1= No		516

GENERAL STATUS:

	Description	Units	Address
P0	Type of operation 0=Direct, Cold; 1=Inverse, Heat		600
P1	Delay of all functions on receiving power supply	(min.)	601
P2	Access code (Password) function 0= Inactive; 1= Access to parameters locked; 2= Keypad locked		602
P2*	Keypad operation: 0=Stand-by active; 1=Stand-by inactive; 2=Access to Programming with password locked (L5), Stand-by active; 3=Access to Programming with password locked (L5), Stand-by inactive; 4=Access to Programming and Set Point with password locked (L5), Stand-by active; 5=Access to Programming and Set Point with password locked (L5), Stand-by inactive; 6=Access to use of keypad with password locked (L5), Stand-by active; 7=Access to use of keypad with password locked (L5), Stand-by inactive		602
In1	Configures the default parameters according to the type of application 1= Varied product 2= Frozen food 3= Fruit and vegetables 4= Fresh fish 5= Soft drinks 6= Bottle racks 7= Air conditioning 8= Heat/Incubators		603
P4	Selection of type of inputs 1=1 probe + 2 digital inputs; 2=2 probes+ 1 digital input; 3=3 probes (1)		604
P5	Modbus address		605
P6	AUX relay configuration 1=Defrost / 2nd Defrost (1) 2=Alarm 3=Light 4=Gas collection (2) 5=Master defrost (2)		606
P62	AUX relay configuration 1=Defrost / 2nd Defrost (1) 2=Alarm 3=Light 4=Gas collection (2) 5=Master defrost (2)		607
P7	Temperature display mode 0=Integers in °C 1=One decimal point in °C 2=Integers in °F 3=One decimal point in °F		608
P8	Probe to be displayed (According to parameter P4) 0=All probes configured (P4); 1=Probe 1; 2=Probe 2; 3= Probe 3 (2)		609

ESTADO GENERAL:

	Description	Units	Address
P9	Selection of type of probe 0 =NTC; 1 =PTC		610
P10	Configuring digital input 1 0 = Off 1 =Door contact 2 =External alarm 3 =Severe external alarm 4 =Slave defrost 5 =Act. ECO mode by pushbutton 6 =Act. Fast Freezing 7 = Low pressure switch (2) 8 =Remote defrost 9 =Act. ECO mode by switch		611
P11	Configuring digital input 2 0 = Off 1 =Door contact 2 =External alarm 3 =Severe external alarm 4 =Slave defrost 5 =Act. ECO mode by pushbutton 6 =Act. Fast Freezing 7 = Not used 8 =Remote defrost 9 =Act. ECO mode by switch		612
P12	Polarity of digital input 1 0 =Activates on closing contact; 1 =Activates on opening contact		613
P13	Polarity of digital input 2 0 =Activates on closing contact; 1 =Activates on opening contact		614
P14	Maximum time for start-up after gas collection	(seg.)	615
P15	Maximum time for gas collection	(min.)	616
P16	Function of probe 1		617
P17	Function of probe 2		618
P18	Function of probe 3		619
P19	Light operation in ECO1 mode		620
P22	Cold room light timer		623
P30	Type of R2 operation 0 =Direct, Cold; 1 =Reverse, Heat (if P31=1)		631
P31	Type of relation between R1 and R2 1 = 2 separate stages 2 = 2 related stages 3 = Neutral zone 4 = One stage + alarm		632
P32	Maximum scale value (If 4-20 mA)		633
P33	Minimum scale value (If 4-20 mA)		634
P34	Scale locked with probe 4-20 mA 0 = Without lock 1 = Locked according to P32 and P33		635
P35	Configuration digital input 0 = Deactivated 1 = External alarm 2 = Variation of SP and SP2 3 = Reversal of type of operation of R1		636

CLOCK:

	Description	Units	Address
r1	Clock configuration:TIME	(h.)	700
r2	Clock configuration:MINUTES	(min.)	701

ACCESS CONTROL AND INFORMATION:

	Description	Units	Address
L5	Access code (Password)		800
PU	Programme version (Information)		801
Pr	Programme revision (Information)		802

(1): The 2nd defrost is only available in devices with 4 relays.

(2): Only available in **AKO-D14412-RC**, **AKO-D14423-RC** and **AKO-D14423-P-RC**

* The options available in parameter P2 may vary according to model

5- CONTROLLER STATUS














Description	Units	Min	Max.	Address
Buzzer		-256d	0d	1000
Probe 1	(°C/°F)	7FFFh	8001h	1001
Probe 2	(°C/°F)	7FFFh	8001h	1002
Probe 3	(°C/°F)	7FFFh	8001h	1003
Digital input 1		0d	1d	1004
Digital input 2		0d	1d	1005
Keypad		0d	15d	1006
Relay 1 output		-256d	0d	1008
Relay 2 output		-256d	0d	1009
Relay 3 output		-256d	0d	1010
Relay 4 output		-256d	0d	1011
Alarms low				1021
Alarms high				1040

TEMPERATURE (PROBES): Value expressed in degrees x10
 Maximum value: 8001h (Open circuit)
 Minimum value: 7FFFh (Closed circuit)

DIGITAL INPUTS: The meaning of each value will depend on the configuration of the P12 and P13 parameters
 Maximum value: 1 (active)
 Minimum value: 0 (inactive)


OUTPUTS (RELAYS and BUZZER):
 Relay OFF = 0d
 Relay ON = -256d (0XFF00)

KEYPAD: The value simulates pressing one of the available keys, depending on the controller model.

Value	Key pressed	Application
0		Panel-mounted thermometers
1		BigDarwin controllers
2		BigDarwin controllers
3		3 and 4 key panel-mounted controllers
4		3 and 4 key panel-mounted controllers Wall-mounted controllers
5		3 and 4 key panel-mounted controllers
7		3 and 4 key panel-mounted controllers Wall-mounted controllers
8		3 and 4 key panel-mounted controllers with ECO key
10		Wall-mounted controllers with Fast Freezing mode
11		Wall-mounted controllers
12		Wall-mounted controllers with 4 relays
13		Wall-mounted controllers
14		Wall-mounted controllers
15		No key pressed

ALARMS:

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

		Description	Message to the Display
LSB	bit 0	Temperature of probe 1 > A1	AH
	bit 1	Temperature of probe 1 > A2	AL
	bit 2	Defrost finished by time	Adt
	bit 3	Door open	Pab
	bit 4	External alarm	AE
	bit 5	Severe external alarm	AES
	bit 6	Error probe 1	E1
	bit 7	Error probe 2	E2
	bit 8	Error probe 3	E3
	bit 9	RTC out of time	Ar
	bit 10	Pump Down stop finished by time	Pd
	bit 11	Temperature probe 2 > 30 °C at start of defrost (Probe 2 damaged by humidity)	E2
	bit 12	Temperature probe 3 > 30 °C at start of defrost (Probe 2 damaged by humidity)	E3
	bit 13	Dirty condenser alarm	ACS
	bit 14	Slow cooling alarm	EnL
MSB	bit 15	Mains voltage out of range	
	bit 16	Pump Down start finished by time	LP