

By6150-S-485

MODBUS – J BUS Communication

TECHNICAL NOTES

General descriptions

1RAEM4CS485 speaks using the MODBUS protocol managed in RTU (and JBUS) mode.

3 Function codes only are available:

03 (Read Holding Registers)

04 (Read Input Registers)

06 (Write Single Registers)

Function Codes 03 e 04 are perfectly superimposable, namely act in the same way on all the registers accessible in reading mode.

All Function Codes are completely supported by the relative Error Codes and Exception Codes.

The addresses of described registers refer to the standard MODBUS RTU, and remain valid for the JBUS also.

Please refer to the MODBUS specifications for further details.

1. Hardware communication

The standard interface is **RS485**, optoinsulated 3KV, with high baud rate

2. Parameters communication

Parameter	Formulation
Baud rate	9600 – 19200 – 38400 – 57600 – 115200
Parity	None (N)
Bit of data	8
Bit of stop	1
Handshaking	None

3. Function Codes

Function	Command
READING	0x03 (Read Holding Registers)
	0x04 (Read Input Registers)
WRITING	0x06 (Write Single Register)

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4. Basic structure of registers

The architecture and identification of registers is different from the classic “device oriented” forecasted by the standard MODBUS. The reason of this choice because better and easy management of communication more suitable for this system.

Registers were identified and grouped verifying the homogeneous functions:

Group type	Description
WO (Write Only)	The defined WO registers can be written only with command [06] but not read.
RW (Read/Write)	The defined RW registers can be whether read and written [03]=[04] / [06].
RO (Read Only)	The defined RO registers can be readed only [03]=[04].

This fact permits to define a “map” of groups assuming that the max dimension of each group is 255 / 256 registers and that the max numbers of groups is 256.

Really, 2 groups will be used by the system. Between these we identify the 3 basic groups.

Map of basic groups	Addresses range	
	HEX	DECIMAL
WO Basic register	0x001 – 0x0FF	001 - 255
RW Basic register	0x100 – 0x1FF	256 - 511
RO Basic register	0x200 – 0x2FF	512 - 767

At the moment, groups WO are not used.

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5. Reading of registers

Reading on RW and RO registers is permitted indifferently as Holding(03) and as Input(04) registers. Response will be made by the instrument with the same node number of the request ONLY, which must be the SOLE on the net.

- **Reading of registers in binary mode (RTU)**

Conversation happens in binary Bytes.

RTU reading function			
Binary request Frame		Binary response Frame	
	Range		Description
Node	1 – 255	Node	The same of the request
Function	3 – 4	Function	The same of the request
Address -HIGH	1 – 65535 (0-0xFFFF)	Bytes number	Length in BYTES of data sent back. Double of requested registers.
Address - LOW			
Requested register N° - H	Always 0	Requested Bytes (2 x Register)	
Requested register N° - L	1 – 125 (1-0x7D)		
CRC - LOW	Calculated between 0 and 65535 (0-0xFFFF)	CRC - LOW	Calculated between 0 and 65535 (0-0xFFFF)
CRC - HIGH		CRC - HIGH	
TOTAL : 8 Bytes		TOTAL: 5 Bytes + Requested Bytes	

The associated response in case of error is the following:

Error framing reading function RTU		
	Range	Description
Node	The same of the request	
Function	The same of the request + 128 (0x80)	If request is 3, function is 131 (83 Hex) otherwise if it is 4, function is 132 (84 Hex)
Exception Code	1 - 4	1 = Function not supported 2 = Registers address or range not valid 3 = Quantity of requested registers not valid 4 = Not available Function / engaged
CRC - LOW	Calculated between 0 and 65535 (0-0xFFFF)	
CRC - HIGH		
TOTAL: 5 Bytes		

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6. Writing of registers

Writing is permitted on RW and WO registers only.

Single Register (06) writing function only is available

Response will be made by the instrument with the same node number of the request ONLY, which must be the SOLE on the net.

- Writing of registers in binary mode (RTU)**

Conversation happens in binary Bytes.

Writing Function RTU			
Binary request Frame		Binary response Frame	
	Range		Description
Node	1 – 255	Node	The same of the request frame
Function	6	Function	
Address -HIGH	1 – 65535 (1-	Address -HIGH	
Address - LOW	0xFFFF)	Address - LOW	
Datum - HIGH	0 – 65535 (0-	Datum - HIGH	
Datum - LOW	0xFFFF)	Datum - LOW	
CRC - LOW	Calculated between	CRC - LOW	
CRC - HIGH	0 and 65535 (0-0xFFFF)	CRC - HIGH	
TOTAL: 8 Bytes		TOTAL: 8 Bytes	

The associated response in case of error is the following:

Error framing Writing Function RTU		
	Range	Description
Node	The same of the request	
Function	The same of the request + 128 (0x80)	Request = 6, function = 134 (86 Hex)
Exception Code	1 - 4	1 = Function not supported 2 = Registers address not valid 3 = Value not valid 4 = Not available Function / engaged
CRC - LOW	Calculated between 0 and 65535 (0-0xFFFF)	
CRC - HIGH		
TOTAL: 5 Bytes		

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7. List of available registers

WORDS KEY:

ADDRESS = Number of Modbus register [.Bit register].

When the register includes a numerical value, its address is ENTIRE.

When on the contrary it includes a BOOLEAN value of specific bit (flag), this bit is individualized by the dot followed by its position value (0-15) starting from the right.
(example: 258.10 means the eleventh bit of register 258).

TYPE = BBBB - BB - Bb -bB. Identification of composite management register (32bit), 16 bit entire register or half-register (8 bit).

BBBB means a value to obtain from 2 consecutive registers, on which the H side is on the mentioned register, immediately followed by the L side on the address+1.

BB means a value to obtain from the entire register (16bit).

Bb means an 8 bit value included in the High half part of the register.

bB means an 8 bit value included in the Low half part of the register.

FORMAT = DEC - DECS - BOL - HEX - BCD.

The 32, 16 or 8 bit binary value must be converted into:

DEC = Decimal value without sign

DECS = Decimal value with sign

BOL = True or False value of specified bit in the address matter

HEX = Value

BCD = One character (0-9) every 4 bit

PERMISSIONS = RO - RW - WO permissions from remote

With RO it is not permitted to change the register value.

With RW it is permitted to change the register value, using write command

With WO it is permitted to write the register value, using write command but not to read it
(send command mode – fisically the register doesn't exist).

FACTOR = DM - D - C - M - N comma position. It has a sense on Decimals formats only (DEC or DECS).

With N, the decimal number remains entire.

With D, the value must be intended multiplied by 0,1.

With C, the value must be intended multiplied by 0,01.

With M, the value must be intended multiplied by 0,001

With DM, the value must be intended multiplied by 0,0001.

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BASIC REGISTERS GROUP "WRITE ONLY", 1 - 255

ADDRESS	TYPE	DESCRIPTION	FORMAT	U.M.	PERMISSIONS	FACTOR
1	BB	PASSWORD	DEC		WO	N

BASIC REGISTERS GROUP "READ/WRITE", 256 - 511

ADDRESS	TYPE	DESCRIPTION	FORMAT	U.M.	PERMISSIONS	FACTOR
256.1	BB	SYS CMD: 1=Factory Settings of parameters only	BOL		RW	N
256.3	BB	SYS CMD: 1=Save Energies and hourcounter in EEprom	BOL		RW	N
256.4	BB	SYS CMD: 1=Reset of consumed Energy	BOL		RW	N
256.5	BB	SYS CMD: 1=Reset of produced Energy	BOL		RW	N
256.6	BB	SYS CMD: 1=Reset of Reactive Energy	BOL		RW	N
256.7	BB	SYS CMD: 1=Reset of Partial hour counter	BOL		RW	N
256.8	BB	SYS CMD: 1=RELE 1 ON (only if TH1=OFF)	BOL		RW	N
257	bB	Medium of analogue measurements (V - I and P)	DEC		RW	N
259	BB	CT Value	DEC	Amp	RW	D
260	BB	VT Value	DEC	Volt	RW	N
261	bB	Default page when device is powered	DEC		RW	N
262	bB	Threshold type 1 (0=Off - 1= max - 2= min)	DEC		RW	N
263	bB	Delay direction of threshold 1 (0=Excit. - 1=Disexc.)	DEC		RW	N
264	BB	Delay time of threshold 1	DEC	Sec	RW	D
265	bB	Source threshold 1	DEC		RW	N
266	BB	Percentage value threshold 1	DEC	%	RW	D

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BASIC REGISTERS GROUP “READ ONLY”, 512 – 767

ADDRESS	TYPE	DESCRIPTION	FORMAT	U.M.	PERMISSIONS	FACTOR
512	Bb	Family instrument	DEC		RO	N
512	bB	Type instrument	DEC		RO	N
513	Bb	Version	DEC		RO	N
513	bB	Review	DEC		RO	N
514	BB	K_RMS_FACTOR Value	DEC		RO	N
515	BB	End scale calibration value I1 (*K_RMS_FACTOR)	DEC		RO	N
516	BB	End scale calibration value I2 (*K_RMS_FACTOR)	DEC		RO	N
517	BB	End scale calibration value I3 (*K_RMS_FACTOR)	DEC		RO	N
518	BB	End scale calibration value V1 (*K_RMS_FACTOR)	DEC		RO	N
519	BB	End scale calibration value V2 (*K_RMS_FACTOR)	DEC		RO	N
520	BB	End scale calibration value V3 (*K_RMS_FACTOR)	DEC		RO	N
521	BB	Frequencymeter calibration value (=KAPPA_F/100)	DEC		RO	N
523	BB	Medium measurement frequencymeter (constant)	DEC		RO	N
526	BB	Voltage V1	DEC	Volt	RO	N
527	BB	Voltage V2	DEC	Volt	RO	N
528	BB	Voltage V3	DEC	Volt	RO	N
529	BB	Voltage V12	DEC	Volt	RO	N
530	BB	Voltage V23	DEC	Volt	RO	N
531	BB	Voltage V31	DEC	Volt	RO	N
534	BB	Current I1	DEC	Amp	RO	D
535	BB	Current I2	DEC	Amp	RO	D
536	BB	Current I3	DEC	Amp	RO	D
538	BB	Current on Neutral	DEC	Amp	RO	D
539.8	BB	1 = Overflow Current I1	BOL		RO	N
539.9	BB	1 = Overflow Current I2	BOL		RO	N
539.10	BB	1 = Overflow Current I3	BOL		RO	N
539.11	BB	1 = Overflow Voltage V1	BOL		RO	N
539.12	BB	1 = Overflow Voltage V2	BOL		RO	N
539.13	BB	1 = Overflow Voltage V3	BOL		RO	N
539.0	BB	1 = Overflow Current on Neutral	BOL		RO	N
539.1	BB	1 = Overflow Frequency measurement	BOL		RO	N
540	BB	Frequency measurement	DEC	Hz	RO	C
541	bB	Power factor phase 1	DEC	Cos	RO	C
542	bB	Power factor phase 2	DEC	Cos	RO	C
543	bB	Power factor phase 3	DEC	Cos	RO	C
544	bB	Total Power factor	DEC	Cos	RO	C
545.0	BB	Sign Total Cosphi (1=Cap / 0=Ind)			RO	N
545.1	BB	Sign phase 1 Cosphi (1=Cap / 0=Ind)			RO	N
545.2	BB	Sign phase 2 Cosphi (1=Cap / 0=Ind)			RO	N
545.3	BB	Sign phase 3 Cosphi (1=Cap / 0=Ind)			RO	N
546	BBBB	Active Power phase 1	DECS	W	RO	N
548	BBBB	Active Power phase 2	DECS	W	RO	N
550	BBBB	Active Power phase 3	DECS	W	RO	N
552	BBBB	Total Active Power	DECS	W	RO	N
554	BBBB	Reactive Power phase 1	DECS	var	RO	N
556	BBBB	Reactive Power phase 2	DECS	var	RO	N
558	BBBB	Reactive Power phase 3	DECS	var	RO	N
560	BBBB	Total Reactive Power	DECS	var	RO	N
562	BBBB	Apparent Power phase 1	DEC	VA	RO	N
564	BBBB	Apparent Power phase 2	DEC	VA	RO	N
566	BBBB	Apparent Power phase 3	DEC	VA	RO	N
568	BBBB	Total Apparent Power	DEC	VA	RO	N

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BASIC REGISTERS GROUP "READ ONLY", 512 - 767 (NEXT)

ADDRESS	TYPE	DESCRIPTION	FORMAT	U.M.	PERMISSIONS	FACTORE
570	BBBB	Consumed Active Energy	DEC	kWh	RO	N
572	BBBB	Produced Active Energy	DEC	kWh	RO	N
574	BBBB	Total Reactive Energy	DEC	kvarh	RO	N
576	BBBB	Hours of Hour-counter TOTAL	DEC	h	RO	N
578	bB	Minutes of Hour-counter TOTAL	DEC	min	RO	N
579	BBBB	Hours of Hour-counter PARTIAL	DEC	h	RO	N
581	bB	Minutes of Hour-counter PARTIAL	DEC	min	RO	N
582	bB	Seconds of Hour-counter	DEC	sec	RO	N
583.0	bB	1 = Voltage phases in correct sequence	BOL		RO	N
583.1	bB	1 = Adjustment of parameter from keyboard at this moment	BOL		RO	N
583.2	bB	1 = Write parameters and commands from remote permitted	BOL		RO	N
583.3	bB	1 = Remark of activation status threshold 1	BOL		RO	N
583.4	bB	1 = Activation delay time threshold 1 at the moment	BOL		RO	N
583.5	bB	Status of output relay 1 (0=Open - 1=Close)	BOL		RO	N
583.6	bB	1 = Write parameters and commands from remote permitted	BOL		RO	N
584	BB	Timer delay of activation threshold 1	DEC		RO	N
586	bB	Display: 0=Nor - 1=Cover - 2 = ProgMode	DEC		RO	N
587	bB	Display: Number of displayed page	DEC		RO	N
588.0	bB	Keyboard: 1= Right key pressed	BOL		RO	N
588.1	bB	Keyboard: 1= Left key pressed	BOL		RO	N
588.6	bB	Keyboard: 1= Left key pressed	BOL		RO	N
588.7	bB	Keyboard: 1= Long time stable keys	BOL		RO	N

8. Solution of problems

The system doesn't give response in 3 cases only:

1. Hardware Failure (wrong connections, turn-off card,.....)
2. Node Address is not the same of the card
3. CRC or LRC of telegram is wrong.