V800
- Serial Communication Protocol - Electronic Expansion Driver V800

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CONTENTS

1 MODBUS FUNCTIONS AND RESOURCES

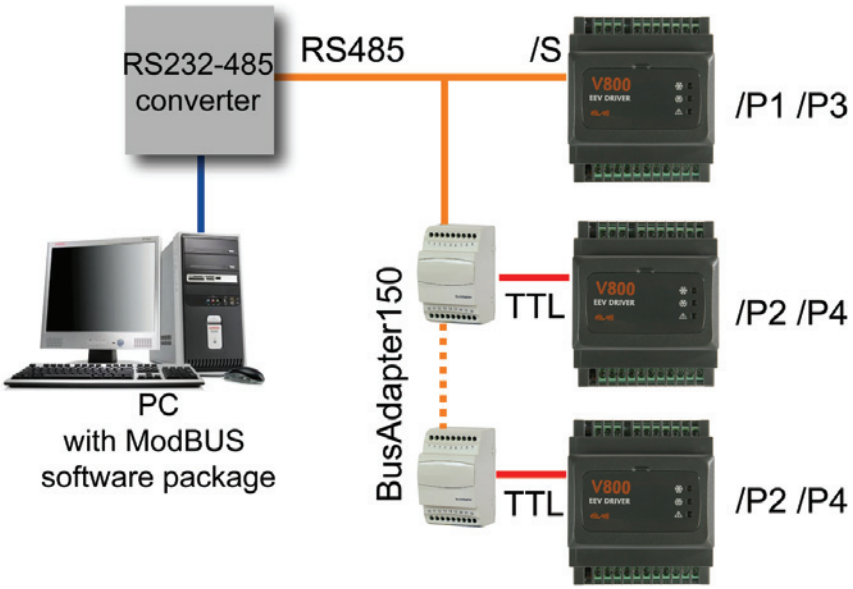
Modbus is a client/server communication protocol between devices connected on a *network*.
Modbus instruments communicate using a master/slave technique in which only one device (master) can send messages. The other devices on the *network* (slave) respond by returning the data requested by the master or performing the action indicated in the message sent. A slave is a device connected to the *network* that processes information and sends the results to the master using the Modbus protocol.
The master can send messages to individual slaves, or send messages to the whole *network* (broadcast), whereas the slave instruments respond to the messages only individually and to the master device.
The Modbus standard used by Eliwell provides for the use of RTU coding for data transmission.

1.1 Data format (RTU)

The coding model used defines the structure of messages transmitted on the *network* and the way in which this information is decoded. The type of coding is normally selected according to specific parameters (baud rate, parity, etc.), also, certain devices only support certain coding models, however it must be the same for all the instruments connected to a Modbus *network*.
The protocol uses the binary RTU method with the byte made up as follows:
8 bits for data, even parity configurable, 1 stop bit.

NOTE: the transmission speed could be set to 9600 baud.
Setting the parameters allows the *instrument* to be fully configurable
They can be modified by means of:

- instrument keyboard
- copy Card
- sending the data using the ModBus protocol, directly to an individual instrument, or by broadcast, using *address* 0 (broadcast)



1.2 Network

ModBus to multiple device connection diagram

PC / Interface connection	RS232 cable
Device / Bus Adapter connection	5-way TTL connector cable (30cm) (other sizes/lengths available)
Bus Adapter	BA150
Bus Adapter / Interface connection	RS485 cable screened and twisted (e.g. Belden cable model 8762)

1.3 Modbus functions available and data areas

Function Code	*Command description*
3	Read 16 consecutive registers for Client side Read 1 single register for parameters.
16	Write 15 consecutive registers for Client side Write 1 register for parameters

Product identification

43	Reading instrument ID. The following fields can be read:

Field code	*Field description*
0	Manufacturer ID(=”Invensys”)
1	Instrument policarbonate ID
2	Instrument family(msk)/version ID

IMPORTANT! Send a write request not less than 60 seconda. In case not V800 will indicate a E7 error (link error)

IMPORTANT! The reading of 2 registers (WORD) must be requested to obtain 1 in response. If reading of only one register is requested a reading of the highest byte will be obtained.

IMPORTANT! To write values to WORD it is necessary to send a write request with 2 registers, and a dimension 2 response will be obtained.

1.4 Address Configuration

The *address* of a device inside a ModBus message is made up of one byte and is formed of the family code and the instrument code, made up of parameters dEA and FAA respectively.
The *address* (Device *Address*) is thus formed of two nibbles:

- **dEA:** low nibble
- **FAA:** high nibble

INSTRUMENT CONFIGURATION PARAMETERS			
Par.	Description	*Range*	Value
dEA	Family serial *address*	0...14	0
FAA	Device serial *address*	0...14	0

To calculate the *address* ***address*** = **dEA** x 16 + **FAA**
Example: *address* (HEX) 16 (dEA=01; FAA=00)

Address 0 is used for broadcast messages, which are recognised by all slaves. Slaves do not respond to a broadcast type request.

1.5 Address tables

1.5.1 Description of parameters

The ***address tables*** contain the information required to read, write and decode each individual resource accessible in the instrument.
There are two tables:

- the ***parameters*** *table* contains all the device configuration parameters stored in the instrument's non-volatile memory.
- the ***client*** *table* includes all the I/O and alarm status resources available in the instrument's volatile memory.

Description of columns:

INDEX For the ***parameters*** *table* this value represents the order in which the parameter is displayed in the instrument's menu.
For the ***client*** *table* this value is not significant.

FOLDER This indicates the *label* of the *folder* containing the parameter in question

LABEL This indicates the *label* used to display the **parameters** in the instrument's menu.

ADDRESS The whole part represents the *address* of the MODBUS register containing the value of the resource to be read or written in the

instrument. The value after the point indicates the position of the most significant data bit inside the register; if not indicated it is taken as zero. This information is always provided when the register contains more than one information item, and it is necessary to distinguish which bits actually represent the data (the working size of the data indicated in the column *DATA SIZE* is also taken into consideration). Given that the modbus registers have the size of one WORD (16 bit), the *index* number after the point can vary from 0 (least significant bit –LSb–) to 15 (most significant bit –MSb–).
Examples (in binary form the least significant bit is the first on the right):

ADDRESS	Contents of register	*DATA SIZE*	Value
8806	1350 (0000010101000110)	WORD	1350
8806	1350 (00000101**01000110**)	Byte	70
8806,8	1350 (**00000101**01000110)	Byte	5
8806,14	1350 (**00**000101010000110)	1 bit	0
8806,7	1350 (00000**1010**1000110)	4 bit	10

Important: when the register contains more than one data item, during the write operation proceed as follows:

- read current register value
- modify the bits that represent the resource concerned
- write the register

R/W Indicates the option of reading or writing the resource:

R	the resource is read-only
W	the resource is write-only
RW	the resource can be both read and written

DATA SIZE Indicates the size of the data in bits.

WORD	=	16 bits
Byte	=	8 bits
“n” bit	=	0...15 bits based on the value of “n”

CPL When the field indicates “Y”, the value read by the register requires conversion, because the value represents a number with a sign. In the other cases the value is always positive or null.
To carry out conversion, proceed as follows:
if the value in the register is between 0 and 32.767, the result is the value itself (zero and positive values)
if the value in the register is between 32.768 and 65.535, the result is the value of the register – 65.536 (negative values)

RANGE Describes the interval of values that can be assigned to the parameter. It can be correlated with other parameters in the instrument (indicated with the parameter *label*).

DEFAULT Indicates the factory-set value for the standard model of the instrument.

EXP This is the multiplier *index* to be applied for converting the value read from the register to the values indicated in the *RANGE* and *DEFAULT* column to convert them into the final values according to the measurement unit indicated in the column ***M.U.***
The multiplier is calculated with the base 10 exponential function and with the exponent indicated in the ***EXP*** column. When not indicated the value is 0. The following values are valid:

Value		Corresponding multiplier	
-2	=	10^{-2}	(0.01)
-1	=	10^{-1}	(0.1)
0	=	10^{0}	(1)
1	=	10^{1}	(10)
2	=	10^{2}	(100)

M.U. Measurement unit for values converted according to the rules indicated in the *CPL* and *EXP* columns.

1.5.2 Parameters table

(see next page)

FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	CPL	RANGE	DEFAULT	EXP	M.U.
At1	**U01**	**49232**	RW	PWM period	BYTE		3 ... 10	6		sec
At1	**U02**	**49233**	RW	Maximum valve opening percentage	BYTE		0 ... 100	100		num
At1	**U03**	**49234**	RW	Valve actuation percentage after blackout	BYTE		0 ... 100	0		num
At1	**U04**	**49235**	RW	Valve actuation percentage after defrost	BYTE		0 ... 100	0		num
At1	**U05**	**49236**	RW	Operating time at max opening for alarm signal	BYTE		0 ... 255	180		sec
At1	**U06**	**49237**	RW	Minimum valve useful opening percentage	BYTE		0 ... P07	0		num
At1	**U07**	**49238**	RW	Maximum valve useful opening percentage	BYTE		P06 ... P02	100		num
CnF	**H00**	**49216**	RW	Selection of analogue input type 1	BYTE		0 ... 2	1		num
CnF	**H01**	**49217**	RW	Selection of analogue input type 2	BYTE		0 ... 4	1		num
CnF	**H03**	**16432**	RW	Minimum limit for current input	WORD	Y	-145 ... 10000	0	-1	bar/PSI
CnF	**H04**	**16434**	RW	Maximum limit for current input	WORD	Y	-145 ... 10000	1000	-1	bar/PSI
CnF	**H05**	**49218**	RW	Unit of pressure measurement	BYTE		0 ... 1	0		flag
CnF	**H06**	**49219**	RW	°C/°F selection	BYTE		0 ... 1	0		flag
CnF	**H10**	**49220**	RW	Select type of gas	BYTE		0 ... 6	0		num
CnF	**H11**	**16436**	RW	Configurability and polarity of digital input 1	WORD	Y	-3 ... 3	0		num
CnF	**H12**	**16438**	RW	Configurability and polarity of digital input 2	WORD	Y	-3 ... 3	0		num
CnF	**H15**	**49221**	RW	Valve opening percentage during probe error	BYTE		0 ... 100	0		num
CnF	**H21**	**49222**	RW	Configurability of digital output 1	BYTE		0 ... 2	1		num
CnF	**H22**	**49223**	RW	Configurability of digital output 2	BYTE		0 ... 2	2		num
CnF	**H30**	**49224**	RW	Control from digital inputs or serial port	BYTE		0 ... 2	1		num
CnF	**H60**	**49239**	RW	Type of plant	BYTE		0 ... 16	0		num
Add	**PtS**	**49159**	RW	Protocol selection on COM1	BYTE		0 ... 1	0		flag
Add	**dEA**	**49172**	RW	Device *address*	BYTE		0 ... 14	0		num
Add	**FAA**	**49173**	RW	Family *address*	BYTE		0 ... 14	0		num
Add	**PtY**	**49176**	RW	Modbus parity bit	BYTE		0 ... 2	1		num
Add	**Ptb**	**49174**	RW	Baud selection on COM1	BYTE		0 ... 5	3		num
OP	**HOE**	**49270**	RW	Enable MOP	BYTE		0 ... 1	1		flag
OP	**HdP**	**16478**	RW	MOP disable time at start-up	WORD		0 ... 999	180		sec
OP	**HOt**	**16472**	RW	Evaporator temperature upper threshold	WORD	Y	-600 ... 1000	0	-1	°C/°F
OP	**tAP**	**49271**	RW	Min time that temp upper threshold is exceeded for alarm activation	BYTE		0 ... 255	120		sec
OH	**OLt**	**16510**	RW	Overheating lower threshold	WORD		0 ... 1000	60	-1	°C/°F
OH	**OtF**	**16462**	RW	Valve opening freezing timer after OFF->ON	WORD		0 ... 1999	0		sec
diS	**PA1**	**16440**	RW	Value of password	WORD		0 ... 65535	0		num
diS	**ndt**	**49313**	RW	Display with decimal point	BYTE		0 ... 1	1		flag
diS	**CA1**	**16458**	RW	Probe calibration 1	WORD	Y	-120 ... 120	0	-1	°C/°F
diS	**CA2**	**16460**	RW	Probe calibration 2	WORD	Y	-120 ... 120	0	-1	°C/°F

1.5.3 Visibility table

FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	CPL	RANGE	DEFAULT	EXP	M.U.
	At1	**49424**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	CnF	**49424,2**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	Add	**49424,4**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	OP	**49424,6**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	OH	**49425**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	diS	**49425,2**	RW	*Folder* visibility	2 bit		0 ... 3	3		num
	U01	**49425,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U02	**49425,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U03	**49426**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U04	**49426,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U05	**49426,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U06	**49426,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	U07	**49427**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H00	**49427,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H01	**49427,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H03	**49427,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H04	**49428**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H05	**49428,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H06	**49428,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H10	**49428,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H11	**49429**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H12	**49429,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H15	**49429,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H21	**49429,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H22	**49430**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H30	**49430,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	H60	**49446,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	PtS	**49430,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	dEA	**49430,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	FAA	**49431**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	PtY	**49431,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	Ptb	**49431,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	OPE	**49431,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num

FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	CPL	RANGE	DEFAULT	EXP	M.U.
	HdP	**49432**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	HOt	**49432,2**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	tAP	**49433**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	OLt	**49437,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	OtF	**49447**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	PA1	**49442,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	ndt	**49442,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	CA1	**49445,4**	RW	Parameter visibility	2 bit		0 ... 3	3		num
	CA2	**49445,6**	RW	Parameter visibility	2 bit		0 ... 3	3		num
diS	**rEL**	**49443**	R	Parameter visibility	2 bit		0 ... 3	3		num

NOTE: Each parameter can be assigned a “visibility value” as described below:

Value	Meaning
3	The parameter or *label* is always visible
0	The parameter is only visible using a PC

1.5.4 Client table

FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	CPL	RANGE	DEFAULT	EXP	M.U.
	m_ValAnalogVis[0]	309	R	Analogue input (display) 1	WORD	Y	-1000 ... 10000	0	-1	°C/°F
	m_ValAnalogVis[1]	311	R	Analogue input (display) 2	WORD	Y	-1000 ... 10000	0	-1	°C/°F
	di0	33041	R	Digital input 1	1 bit		0 ... 1	0		flag
	di1	33041,1	R	Digital input 2	1 bit		0 ... 1	0		flag
	Dip1	33034	R	DIP switch 1 status	1 bit		0 ... 1	0		flag
	Dip2	33034,1	R	DIP switch 2 status	1 bit		0 ... 1	0		flag
	Dip3	33034,2	R	DIP switch 3 status	1 bit		0 ... 1	0		flag
	Dip4	33034,3	R	DIP switch 4 status	1 bit		0 ... 1	0		flag
	Dip5	33034,4	R	DIP switch 5 status	1 bit		0 ... 1	0		flag
	Dip6	33034,5	R	DIP switch 6 status	1 bit		0 ... 1	0		flag
	Dip7	33034,6	R	DIP switch 7 status	1 bit		0 ... 1	0		flag
	Dip8	33034,7	R	DIP switch 8 status	1 bit		0 ... 1	0		flag
	Dip9	33035	R	DIP switch 9 status	1 bit		0 ... 1	0		flag
	Dip10	33035,1	R	DIP switch 10 status	1 bit		0 ... 1	0		flag
	relè	33042,7	R	Out 1	1 bit		0 ... 1	0		flag
	open collector	33042,1	R	Out 2	1 bit		0 ... 1	0		flag

FOLDER	LABEL	ADDRESS	R/W	DESCRIPTION	DATA SIZE	CPL	RANGE	DEFAULT	EXP	M.U.
	OutPWM[0]	315	R	Analogue output 1	WORD		0 ... 1000	0	-1	num
	OutPWM[1]	317	R	Analogue output 2	WORD		0 ... 1000	0	-1	num
	Allarme E1	33214	R	Valve overheating probe alarm	1 bit		0 ... 1	0		flag
	Allarme E2	33214,1	R	Valve saturation probe alarm	1 bit		0 ... 1	0		flag
	Allarme HP	33214,2	R	Valve MOP alarm	1 bit		0 ... 1	0		flag
	Allarme HO	33214,3	R	Valve output max alarm	1 bit		0 ... 1	0		flag
	Allarme EA	33214,4	R	Valve external alarm	1 bit		0 ... 1	0		flag
	Allarme E7	33214,5	R	No link	1 bit		0 ... 1	0		flag
	EEV_STTS_ON	390	R	Enable valve control	1 bit		0 ... 1	0		flag
	EEV_STTS_ALM	390,1	R	Alarm	1 bit		0 ... 1	0		flag
	EEV_STTS_DEFR	390,2	R	Defrost	1 bit		0 ... 1	0		flag
	EEV_STTS_NOLINK	390,3	R	control status in no-link	1 bit		0 ... 1	0		flag
	EEVSuperHeatingTemp	420	R	valve overheating temperature	WORD	Y	-1000 ... 10000	0	-1	°C/°F
	EEVSuperHeatingSetp	422	R	valve overheating setpoint	WORD	Y	-1000 ... 10000	0	-1	°C/°F
	EEVEvaporatorPress	424	R	valve evaporator pressure	WORD	Y	-145 ... 10000	0	-1	Kpa*10
	evaporatorPress	430	RW	remote valve evaporator pressure	WORD	Y	-145 ... 10000	0	-1	Kpa*10
	EEV_STTS_ON	390	W	Enable valve control	1 bit		0 ... 1	1		flag
	EEV_STTS_DEFR	390,2	W	Defrost	1 bit		0 ... 1	1		flag

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3 ANALITIC INDEX

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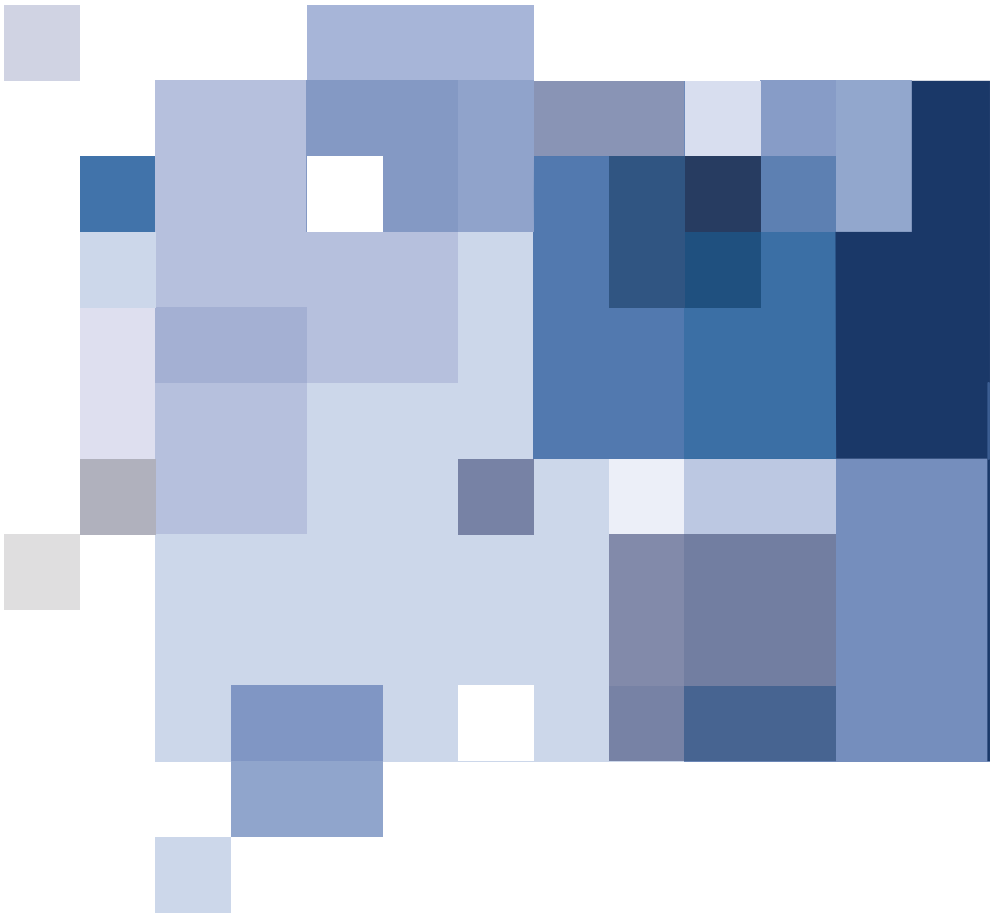

V800 Modbus
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