

ASYNCHRONOUS SERIAL INTERFACE RS485

SERIAL COMMUNICATION MANUAL FOR E2002, E742002, E92002.

The Network Analyzers **Exx2002** can communicate with three protocols :

- MODBUS RTU
- ESAM
- METASYS N2BUS (see specific manual)

Serial characteristics :

- RS485 HALF DUPLEX
- BAUD RATE : are 1200,2400,4800,9600,19200
- The parameters "N" (no parity), "1" start bit "8" data bit and "1" stop bit are fixed.

Connection

	A	B	0
E2002	PIN 19	PIN 20	PIN21
E742002	PIN 11	PIN 12	PIN 13
E92002	PIN 20	PIN 21	PIN 22

ESAM PROTOCOL

Protocol characteristics

- All parameters are strings of ascii values.
- E.g. A value of **100.2V** is transmitted with characters "100.2V";

The functions implemented are the following:

- **Read/written Variables :**
- **String format for data TRANSMISSION to the device:**

<stx>	<nt>	<opt1>	<opt2>	<data>	<checksum>	<CR>
2	0...32	"0"... "9"	"0"... "9"	ASCII characters	128...255	13
2 1 BYTE	128...160 1 BYTE	48...57 1 BYTE	48...57 1 BYTE	32...127 n. BYTE	128...255 1 BYTE	13 1 BYTE

NOTES: **checksum** is sum of **stx+nt+opt1+opt2+data** where the bit 7 (MSB) is set 1.

opt1, opt2 are two number that identify the command TYPE.

nt is a 8 bit byte with a bit 7 forced to 1.

- **Error message :**

<stx>	<nt>	<data>	<checksum>	<CR>
1	0...32	"T01Rx0002" 02: Fault	128...255	13
1 1 BYTE	128...160 1 BYTE	9 BYTE	128...255 1 BYTE	13 1 BYTE

NOTES: **checksum** is the 8 bit sum of stx+nt+data with the bit 7 forced to 1.
fault is the error number
 01 value is too high
 02 value is too low
 03 The value can't be displayed (Over range)
 04 Invalid value
 05 Value is read only
 06 Unknown command
 07 invalid floating point number
 99 syntax error
nt is a 8 bit byte with a bit 7 forced to 1

EXAMPLE "T1Rx0099"

COMMAND 00 (Software version request)

- **Request**

<stx>	<nt>	<opt1opt2>	<checksum>	<CR>
2	0...32	"00"	128...255	13
2 1 BYTE	128...160 1 BYTE	2 BYTE	128...255 1 BYTE	13 1 BYTE

- **Reply**

<stx>	<nt>		<checksum>	<CR>
1	0...32	"T01Rx0000 Ver 3.4"	128...255	13
1 1 BYTE	128...160 1 BYTE		128...255 1 BYTE	13 1 BYTE
		18 BYTE		

COMMAND 09 (Request for a single measurement)

- **Request**

<stx>	<nt>	<opt1opt2><n° measure>	<checksum>	<CR>
2	0...32	"0901"	128...255	13
2 1 BYTE	128...160 1 BYTE	4 BYTE	128...255 1 BYTE	13 1 BYTE

Send this string to obtain a measured value in this example Phase 1 voltage, where 09 is <opt1opt2> and 1 is the number of the measurement. (see table 2)

- **Reply**

<stx>	<nt>		<checksum>	<CR>
1	0...32	"100V"	128...255	13
1 1 BYTE	128...160 1 BYTE		128...255 1 BYTE	13 1 BYTE

The reply is 100V, phase voltage 1 (see table 1).

COMMAND 94 (Configuration parameters writing)

- **Request**

<stx>	<nt>	<opt1opt2><n° par.> <val. par.>	<checksum>	<CR>
2	0...32	"940001 5"	128...255	13
2 1 BYTE	128...160 1 BYTE	8BYTE	128...255 1 BYTE	13 1 BYTE

Send this string to write the configuration parameters.

In this example we set CT primary current (parameter 1, see table 1); The set value is 5.

- **Reply**

<stx>	<nt>		<checksum>	<CR>
1	0...32	"T01Rx0000"	128...255	13
1 1 BYTE	128...160 1 BYTE	9 BYTE	128...255 1 BYTE	13 1 BYTE

COMMAND 95 (Configuration parameters reading)

- **Request**

<stx>	<nt>	<opt1opt2><n° par.>	<checksum>	<CR>
2	0...32	"950001"	128...255	13
2 1 BYTE	128...160 1 BYTE	6BYTE	128...255 1 BYTE	13 1 BYTE

Send this string to read the configuration parameters.

In this example we read CT primary current (parameter 1, see table 1).

- **Reply**

<stx>	<nt>		<checksum>	<CR>
1	0...32	"CTP (1-99999) 5"	128...255	13
1 1 BYTE	128...160 1 BYTE		128...255 1 BYTE	13 1 BYTE

00005 is the CT primary set current (5A) the number can be set in the range 1-99999A.

COMMAND 97 (Saving configurations parameters)

- **Request**

<stx>	<nt>	<opt1opt2><numpar>	<checksum>	<CR>
2	0...32	"97STORE"	128...255	13
2 1 BYTE	128...160 1 BYTE	7BYTE	128...255 1 BYTE	13 1 BYTE

- **Reply**

<stx>	<nt>		<checksum>	<CR>
1	0...32	"T01Rx0000"	128...255	13
1 1 BYTE	128...160 1 BYTE	9 BYTE	128...255 1 BYTE	13 1 BYTE

From sw version 3.0 this command has no effect.
Parameters are written immediately after a write command ("94...").
It has been kept only for compatibility with previous sw releases.

- **Table 1**

CODE	PARAMETER	DESCRIPTION	RANGE
0001	CTP	CT primary current value	1...99999
0002	CTS	CT secondary current value	1...6.00
0003	VTP	VT primary voltage value	1...999999
0004	VTS	VT secondary voltage value	57.7...300
0005	PAG1	First Page displayed	1...34
0006	PAG2	Second Page displayed	0...34
0007	PAG3	Third Page displayed	0...34
0008	PAG4	Fourth Page displayed	0...34
0009	TPAG	Page time	0..99
0010	AVG	Averaging time interval	1...5
0011	PASS	Password	00000 ...99999
0012	ChP01	Peak 1	29...32
0013	ChP02	Peak 2	29...32
0014	TPO1	Timing of pulse 1	10 255
0015	TPO2 10-255mS	Timing of pulse 2	10 255
0016	WPO1 0000=off	Weight of pulse 1	
0017	WPO2 0000=off	Weight of pulse 2	
0018	ChPk1	Peak 1 channel	0-28,33-36,40
0019	ChPk2	Peak 2 channel	0-28,33-36,40
0020	ChAl1	Alarm channel 1	1-28,33-36,40,41
0021	ChAl2	Alarm channel 2	1-28,33-36,40,41
0022	TYAl1	Alarm 1 type (see table 5)	1...7
0023	TYAl2	Alarm 2 type (see table 5)	1...7
0024	HyAl1	Isteresi allarme 1	0...99 S
0025	HyAl2	Isteresi allarme 2	0...99 S
0026	TdAL1	Delay time for alarm 1	0...99 S
0027	TdAL2	Delay time for alarm 2	0...99 S
0028	TrAl11	Auto-reset time for alarm 1	0...9999 S
0029	TrAl12	Auto-reset time for alarm 2	0...9999 S
0030	AL1 0=Off	Alarm 1 threshold	
0031	AL2 0=Off	Alarm 2 threshold	
0032	NUMT 01-32	Station address	1...32
0033	BAUD 1 5 (note 4)	Baud rate (see table 6)	1 4
0034	XDEL 0-255mS	Min. delay before reply	0...255
0035	InCfg	2 = Aaron 3 =3 phase	2...3
0036	TPm	Calculation time for medium power	1...99 min
0037	ResEn 0-1	Reset energy	0...1
0038	ResPk 0-1	Reset peak	0...1
0039	ResPm 0-1	Reset average power	0...1
0040	ResH	Reset hour meter	0 1
0041	LDEF	Load default	0 1
0042	SynPm	Reset peak average power	0 1
0043	Out1	Type of output 1	0-2
0044	Out2	Type of output 2	0-2
0045	ChPk3	Peak 3 channel	0-28,33-36,40
0046	ChPk4	Peak 4 channel	0-28,33-36,40
0048	CTR	Nominal ratio of TA (Read only)	
0049	VTR	Nominal ratio of TV (Read only)	

- **Table 2**

LABEL	DESCRIPTION	CODE
V1N	Voltage Phase 1	01
V2N	Voltage Phase 2	02
V3N	Voltage Phase 3	03
I1	Current Phase 1	04
I2	Current Phase 2	05
I3	Current Phase 3	06
P1	Active Power Phase 1	07
P2	Active Power Phase 2	08
P3	Active Power Phase 3	09
Frequency	Frequency (misured on Phase 1)	10
V12	Linked Voltage Phase 1-2	11
V23	Linked Voltage Phase 2-3	12
V31	Linked Voltage Phase 3-1	13
Vtm	Average Voltage $(V12+V23+V31)/3$	14
I _{tm}	Average Current $(I1+I2+I3)/3$	15
P	Total active power $(P1+P2+P3)$	16
S1	Apparent Power Phase 1	17
S2	Apparent Power Phase 2	18
S3	Apparent Power Phase 3	19
Stot	Total apparent power $(\sqrt{P^2+Q^2})$	20
PF1	Phase 1 power Factor	21
PF2	Phase 2 power factor	22
PF3	Phase 3 power factor	23
PF	The three-Phase power factor	24
Q1	Reactive power phase 1	25
Q2	Reactive Power Phase 2	26
Q3	Reactive power phase 3	27
Qtot	Total reactive power $(Q1+Q2+Q3)$	28
Wh(+)	Total positive active energy	29
Wh(-)	Total negative active energy	30
VARh(+)	Total positive reactive energy	31
VARh(-)	Total negative reactive energy	32
Pm(+) last/max	Average positive active power in 15 minutes	33
Pm(-) last/max	Average negative active power in 15 minutes	34
Qm(+)/last	Average positive reactive power in 15 minutes	35
Qm(-)/last	Average negative reactive power in 15 minutes	36
Peak1	Peak value 1	37
Peak2	Peak value 2	38
Hour Meter	Hour meter	39
Temperature	Temperature	40
V Phase Sequence	Phase sequence	41
Alarms	Output state 1 (see table 3)	42
Alarms	Output state 2 (see table 3)	43
Peak 3	Peak value 3	44
Peak 4	Peak value 4	45
Pm(+) last/max	Max positive active power in 15 minutes	46
Pm(-) last/max	Max negative active power in 15 minutes	47
Qm(+) last/max	Max positive reactive power in 15 minutes	48
Qm(-) last/max	Max negative reactive power in 15 minutes	49
THD V1	Total harmonic distortion V1 (%)	50
THD I1	Total harmonic distortion I1 (%)	51
THD V2	Total harmonic distortion V2 (%)	52
THD I2	Total harmonic distortion I2 (%)	53
THD V3	Total harmonic distortion V3 (%)	54
THD I3	Total harmonic distortion I3 (%)	55

- **Table 3**

VALUE	Alarm state	Output state
0 (00)	OFF	OFF
1 (01)	ON	OFF
2 (10)	OFF	ON
3 (11)	ON	ON

- **Table 4**

VALUE	Voltage Phase Sequence
123	Sequence ok
132	Incorrect sequence
0	All Phase off
1	Phase T
10	Phase S
100	Phase R
11	Phase T+S
101	Phase R+T
110	Phase R+S
111	3 Phase, sequence error

- **Table 5**

VALUE	ALARM
1	Min
2	Max
3	Window
4	min on 3 phase
5	max on 3 phase
6	Window on 3 phase
7	Phase sequence

- **Table 6**

VALUE	BAUD RATE
1	1200
2	2400
3	4800
4	9600
5	19200

