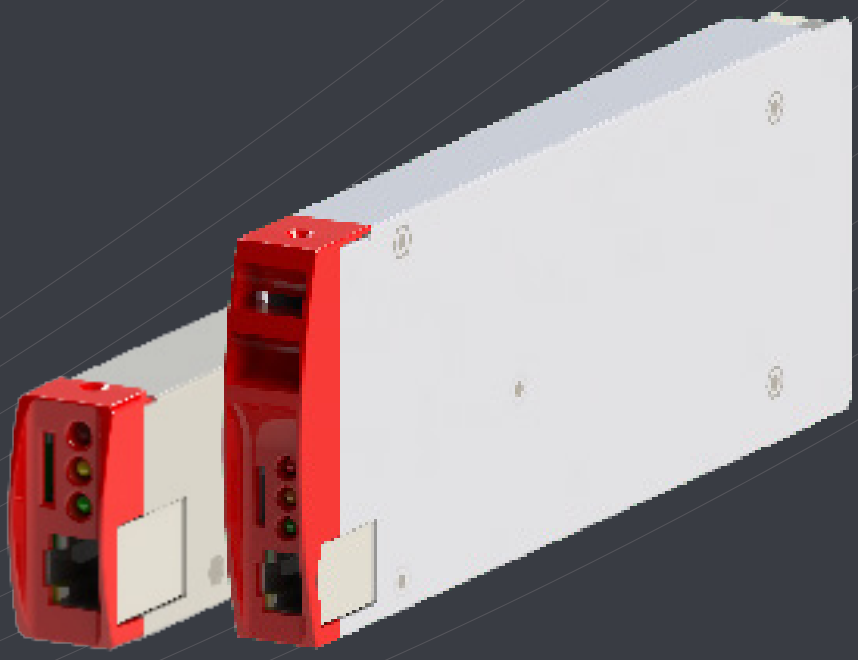
Leading AC Backup Technology

MONITORING T2S - ETH

ModBus User Guide V1.3

DRIVE YOU THROUGH

- ModBus RTU RS485



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Release Note:

Version	Release date (DD/MM/YYYY)	Modified page number	Modifications
1.0	16/01/2017	-	First release of the manual.
1.1	25/09/2017	21	Added Modbus testing procedure
1.2	25/09/2018	6, 17 & 22	Updated information
1.3	27/08/2021	26	Added display options

1. Introduction to CE+T

CE+T Power designs, manufactures and markets a range of products for industrial operators with mission critical applications, who are not satisfied with existing AC backup systems performances, and related maintenance costs.

Our product is an innovative AC backup solution that unlike most used UPS's

- Maximizes the operator's applications uptime;
- Operates with lowest OPEX;
- Provides best protection to disturbances;
- Optimizes footprint.

Our systems are:

- Modular
- Truly redundant
- Highly efficient
- Maintenance free
- Battery friendly

CE+T power puts 60+ years expertise in power conversion together with worldwide presence to provide customized solutions and extended service 24/7 - 365 days a year

2. Introduction

2.1 Scope of the document:

The aim of this paper is to describe information that can be retrieved from T2S ETH controller using the ModBus RTU protocol. This protocol is available since software version 6.2 of T2S ETH.

First section describes hardware requirements and configuration capabilities.

Second section is the exhaustive listing of all variables that can be retrieved and using the ModBus RTU protocol.

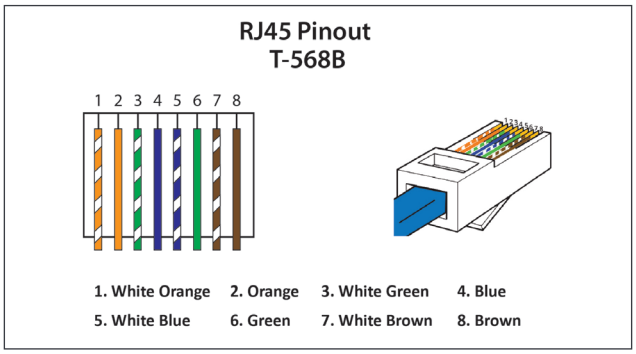
Section three is composed of examples and hints to properly operate with T2S ETH controller.

For more information related to the ModBus RTU protocol itself, please refer to http://www.modbus.org.

3. Hardware Requirements

3.1 Cabling:

ModBus RTU is available on the on RJ45 connector located on the back plane of the rack containing the T2S ETH controller. The pin out of this connector is the following:



Pin Number	Name	Description
1	CANH	CANH pin for Candis
2	CANL	CANL pin for Candis
3	GND_IAX	Digital Communication Ground
4	GND_IAX	Digital Communication Ground
5	12V_IAX	+12 V unregulated
6	COM_A	RS 485 A
7	GND_IAX	Digital Communication Ground
8	COM_B	RS 485 B

3.2 Baud rate, parity and mode:

Only RTU mode is supported.

Item	Value	Default
Slave address	From 1 to 247	1
Baud Rate	9600, 19200, 38400 or 115200	19200
Parity	Even, odd, none	Even
Stop bits	One, two	One
Mode	RTU	-
Electrical interface	RS485	-

4. Database Description

4.1 Typographic convention:

In this document the following naming convention will be used to represent the type of a variable:

The first letter will indicate if the variable is signed (S) or unsigned (U). Then the following digit(s) will indicate the number of bits needed to store the variable.

Thus:

- U8 will represent an unsigned variable stored in a 8-bit wide memory
- U16 will represent an unsigned variable stored in a 16-bit wide memory
- U32 will represent an unsigned variable stored in a 32-bit wide memory

And:

- S8 will represent a signed variable stored in a 8-bit wide memory
- S16 will represent a signed variable stored in a 16-bit wide memory
- S32 will represent a signed variable stored in a 32-bit wide memory

What is more, ModBus RTU register base type is a 16-bit wide variable. This means it is possible to store two 8-bit variables in a register. These two variables will be accessed using the same index in the structure. Thus in order to know if the variable is stored in the upper byte or in the lower byte, letter **H(High)** or **L(Low)** is added to the index.

As specified by the protocol, variables longer than 8-bit are always represented in big-Endian format (MSB first).

4.2 Data types:

ModBus RTU protocol defines four types of variables class described in the following table

Name	Type	Access	Supported by T2S ETH
Discrete input	1-bit wide	Read-only	No
Coil	1-bit wide	Read-write	No
Input register	16-bit wide	Read-only	Yes
Holding register	16-bit wide	Read-write	No

Data address mapping and signification are described in the following sections

4.3 Supported function:

Accordingly to ModBus RTU specification, supported functions by the T2S ETH controler are the following:

- Read Input registers (0x04)

4.3.1 INPUT REGISTERS ELEMENTS (Read-Only 16-bit wide)

4.3.1.1 Module table (0x0000)

The table described below represents the information that can be retrieved regarding a particular module. Maximum amount of module is set to 32. Each of them is identified by an address ranging from 1 to 32.

BASE ADDRESS: 0(0x0000) + 31*(Module address – 1).

Index	Name	Description	Type
0H	eStatusACOut	AC output status number (see 5.1.1, page 14)	U8
0L	eStatusACIn	AC input status number (see 5.1.2, page 14)	U8
1H	eStatusDCIn	DC Input status number (see 5.1.3, page 14)	U8
1L	bAddress	Configured address	U8
2H	bLoadPosition	Position of the load regarding input power sources (0:AC, 100:DC, 50:mixed, 101:unknown)	U8
2L	bLoadRatioW	Loading ratio regarding power in watts (%)	U8
3H	bLoadRatioVA	Loading ratio regarding power in VA (%)	U8
3L	bPhaseNumber	Number of the phase module is belonging to	U8
4	wVout	Output voltage value (0.1V)	U16
5	wIout	Output current value (0.1A)	U16
6	wPoutW	Output power value (W)	U16
7	wPoutVA	Output power value (VA)	U16
8	wVinAC	AC input voltage value (0.1V)	U16
9	wIinAC	AC input current value (0.1A)	U16
10	wPinACW	AC input power value (W)	U16
11	wPinACVA	AC input power value (VA)	U16
12	wACInFreq	AC input frequency value (0.1Hz)	U16
13	wVinDC	DC input voltage value (0.1V)	U16
14	wIinDC	DC input current value (0.1A)	U16
15	wPinDC	DC input power value (W)	U16
16	wTemperature	Temperature value (K)	U16
17	wSoftVersion	Software version number	U16
18	lSerialNumber	Serial number	U32
22H	bStatusMod	Event number of the status related to the output stage and the module internal status	U8
22L	bStatusAC	Event number of the status related to the AC input stage	U8
23H	bStatusDC	Event number of the status related to the DC input stage	U8
23L	bPresent	Flag (true or false) that indicates if module is seen by T2S ETH or not	U8
24H	bGroupAC	AC input group number module is belonging to	U8
24L	bGroupDC	DC input group number module is belonging to	U8
25H	bRestrained	Flag (true or false)that indicates if module cannot cope with more than five other module or not	U8

Index	Name	Description	Type
25L	bNoEPC	Flag (true or false) that indicates if module has an AC input (EPC) or not	U8
26	wPoutNominalW	Nominal output power (W)	U16
27	wPoutNominalVA	Nominal output power (VA)	U16
28	wVinNominalAC	Nominal AC input voltage (0.1V)	U16
29	wVinNominalDC	Nominal DC input voltage (0.1V)	U16
30	wVinNominalFreqAC	Nominal AC frequency (0.1Hz)	U16

4.3.1.2 Phase table (0x0640)

The following table described represents the information that can be retrieved regarding a particular phase. Maximum amount of phase is set to 8. Each of them is identified by a label ranging from 1 to 8.

BASE ADDRESS: 600(0x0640) + 27*(Phase label – 1).

Index	Name	Description	Type
0H	bRatioAvailableW	Ratio between output load and available power in watts (%)	U8
0L	bRatioAvailableVA	Ratio between output load and available power in VA (%)	U8
1H	bRatioInstalledW	Ratio between output load and installed power (Nb modules – redundancy) in watts (%)	U8
1L	bRatioInstalledVA	Ratio between output load and installed power (Nb modules – redundancy) in VA (%)	U8
2	wVout	Output voltage value (0.1V)	U16
3	wIout	Output current value (0.1A)	U16
4H	bNbOndCfg	Number of modules configured in the phase	U8
4L	bRedundancy	Amount of redundancy configured in the phase	U8
5	wACOutFreq	AC output frequency value (0.1Hz)	U16
6	lPinDC	DC input power value (W)	U32
8	lPinACW	AC input power value (W)	U32
10	lPinACVA	AC input power value (VA)	U32
12	lCurrentPowerInVA	Output power value (VA)	U32
14	lCurrentPowerInW	Output power value (W)	U32
16	lInstalledPowerInW	Installed power value (W)	U32
18	lInstalledPowerInVA	Installed power value (VA)	U32
20	lAvailablePowerInW	Available power value (W)	U32
22	lAvailablePowerInVA	Available power value (VA)	U32
24H	bNbInvSeen	Number of module seen by T2S ETH in that phase	U8
24L	bNbInvOK	Number of modules that are delivering output in the phase	U8
25H	bNbInvMO	Number of modules manually off in the phase	U8
25L	bNbInvKO	Number of modules that are not delivering output due to a failure in the phase	U8

Index	Name	Description	Type
26H	bNbInvNT	Number of modules not seen by T2S ETH in the phase (accordingly to bNbOndCfg)	U8

4.3.1.3 AC group table (0x0730)

The table described below represents the information that can be retrieved regarding a particular AC group. Maximum amount of AC group is set to 4. Each of them is identified by a label ranging from 1 to 4.

BASE ADDRESS: 1840(0x0730) + 10*(AC group label – 1).

Index	Name	Description	Type
0H	bNbInvOK	Number of modules that are delivering output in the group	U8
0L	bNbInvMO	Number of modules manually off in the group	U8
1H	bNbInvKO	Number of modules that are not delivering output due to a failure in the group	U8
1L	bNbInvSeen	Number of module seen by T2S ETH in that group	U8
2	lPinACW	AC input power value (W)	U32
4	lPinACVA	AC input power value (VA)	U32
6	wVinAC	AC input voltage value (0.1V)	U16
7	wIinAC	AC input current value (0.1A)	U16
8	wACInFreq	AC input frequency value (0.1Hz)	U16
9H	bACInOk	Number of modules stating that their AC input stage is fully functional	U8

4.3.1.4 DC group table (0x076C)

The table described below represents the information that can be retrieved regarding a particular DC group. Maximum amount of DC group is set to 8. Each of them is identified by a label ranging from 1 to 8.

BASE ADDRESS: 1900(0x076C) + 7*(DC group label – 1).

Index	Name	Description	Type
0H	bNbInvOK	Number of modules that are delivering output in the group	U8
0L	bNbInvMO	Number of modules manually off in the group	U8
1H	bNbInvKO	Number of modules that are not delivering output due to a failure in the group	U8
1L	bNbInvSeen	Number of module seen by T2S ETH in that group	U8
2	lPinDC	DC input power value (W)	U32
4	wVinDC	DC input voltage value (0.1V)	U16
5	wIinDC	DC input current value (0.1A)	U16
6H	bDCInOk	Number of modules stating that their DC input stage is fully functional	U8

4.3.1.5 Miscellaneous information table (0x07BC)

The table described below represents the miscellaneous information that can be retrieved regarding T2S ETH and system.

BASE ADDRESS: 1980(0x07BC)

Index	Name	Description	Type
0H	bOldVersionNumber	Deprecated. Always 0x00	U8
0L	ePhaseNumber	Number of phase configured in the system	U8
1	lSerialNumber	T2S ETH serial number	U32
3	wTempoMajorAl	Temporization of major alarm relay	U16
4	wTempoMinorAl	Temporization of minor alarm relay	U16
5H	bNbMajor	Number of major alarm in the system	U8
5L	bNbMinor	Number of minor alarm in the system	U8
6H	bNbTotalAlarmNumber	Total number of alarm in the system	U8
6L	bACInputPresent	Flag (true or false) that indicates if AC input should be considered as present or not	U8
7H	bSaturationThresh	Value of the ratio over which the saturation alarm will be raised (%)	U8
7L	bNbGroupsDC	Number of DC groups configured in the system	U8
8H	bNbGroupsAC	Number of AC groups configured in the system	U8
8L	bProgRelay	Always 0xFF	U8
9	wSoftMainRevision	Main revision software number of T2S ETH	U16
10	wSoftSubRevision	Sub revision software number of T2S ETH	U16
11H	bSystemLoadPosition	Position of the load at the system level (0:AC, 100:DC, 50:mixed, 101:unknown)	U8
11L	bT2S ETHMaxKnownParameters	Version number of TSI modules configuration parameters	U8
13H	bNbrModConf	Total number of module configured on the installation	U8
13L	bNbrModSeen	Total number of module configured on the installation	U8

4.3.1.6 Date and time table (0x07D0)

The table described below represents the information that can be retrieved regarding date and time.

BASE ADDRESS: 2000(0x07D0)

Index	Name	Description	Type
0	lTime	Time in epoch	U32
2H	bSeconds	Seconds number	U8
2L	bMinutes	Minutes number	U8
3H	bHours	Hours number	U8
3L	bDay	Day of the month	U8

Index	Name	Description	Type
4H	bMonth	Month number	U8
4L	bDaylightSaving	Flag (true or false) that specify if daylight saving is enable or not	U8
5	wYear	Year number	U16

4.3.1.7 Alarm table (0x07DA)

The table described below represents the information that can be retrieved regarding alarms. Maximum amount of entries is set to 50. A valid entry represents an alarm present in the system. An invalid entry is an entry where all bits of each field are set. All entries following an invalid entry will be invalid.

BASE ADDRESS: 2010(0x07DA) + 2*(Entry number – 1)

Index	Name	Description	Type
0H	bDeviceNumber	Identifier that specifies which device is responsible of this alarm (see 5.1, page 14)	U8
0L	bEventType	Type of the alarm (Major or minor) (see 5.1, page 14)	U8
1	wEventNumber	Alarm number identifier	U16

Rem: See alarm types in the annexes for *bEventType* description.

4.3.1.8 Configuration table (0x1040)

The table described below represents the information that can be retrieved regarding parameters that can be configured in the T2S ETH controller. Maximum amount of entries is set to 500. Not all entries are valid. An invalid entry is an entry where all bits of each field are set. Invalid entries might be interleaved with valid entries.

BASE ADDRESS: 4160(0x1040) + 20*(Entry number – 1)

Index	Name	Description	Type
0	swParameter	Configured value of the parameter	S16
1	wValidity	Value indicating if last configured parameter value is valid (see 5.4, page 15)	U16
2	wIdentifier	Unique value identifying the parameter	U16
3	wUnit	Value indicating in which units the parameter is expressed (see 5.4, page 15)	U16
4	strParamDescription	Textual description of the parameter	32*U8

4.3.1.9 Event string table (0x4114)

The table described below represents the information that can be retrieved regarding event textual description. Maximum amount of entries is set to 300. Each event is identified by an unique number (Event 0 exists!).

BASE ADDRESS: 16660(0x4114) + 8*Event number

Index	Name	Description	Type
0	strEventTxt	Textual description of event	16*U8

5. Annexes: Status and constants description

5.1 Module status explanation (A1):

5.1.1 eStatusACOut:

Name	Description	Value
SBR	Standby running. This means that the module is delivering output	0
SB	Standby. This mean that the module is manually OFF	1
SBWE	Standby with error. This means that the module is not delivering output due to an unrecoverable error	2
SBWRE	Standby with recoverable error. This means that the module is not delivering output due to a recoverable error.	3
UNKNOWN	Unknown. This means status is unknown	4

5.1.2 eStatusACIn:

Name	Description	Value
OK	OK. This means the AC input is OK for the module	0
SAFE	Safe. This means the AC input is not considered as “good” but some power can still be drawn from it.	1
NOT_SYNC	Not synchronized. This means that the AC input and output are not synchronized together thus invalidating AC input.	2
OFF	Off. This means that the AC input stage of the module has been turned off due to an invalid AC input (maybe not safe).	3
UNKNOWN	Unknown. This means the status is unknown	4

5.1.3 eStatusDCIn:

Name	Description	Value
OK	OK. This means the AC input is OK for the module	0
FAIL	Fail. This means the DC input voltage is out of valid range.	1
UNKNOWN	Unknown. This means the status is unknown	2

5.2 Alarm types:

Name	Description	Value
NO_ALARM	Defines an event that is not considered as an alarm	0
MINOR	Defines an event that is to be considered as a minor alarm	1
MAJOR	Defines an event that is to be considered as a major alarm	2

5.3 Alarm sources:

Name	Description	Value
T2S ETH	Device responsible of the alarm is the T2S ETH controller.	0
MOD XX	Device responsible of the alarm is the module number XX where XX is the value	1-32
SYSTEM	Source of the alarm is the whole system (e.g. if all module are sharing the same alarm).	33

5.4 Validity and Unit description (A2):

wValidity should be interpreted as follow:

Name	Description	Value
PARAM_OK	Parameter value is valid	0
PARAM_TOO_LOW	Parameter value is too low	1
HYST_TOO_LOW	Parameter value is in an acceptable range but is too close from another related parameter value	2
PARAM_TOO_HIGH	Parameter value is too high	3
TSI_MUST_BE_OFF	Parameter value can only be changed if TSI modules are not delivering output	4
BAD_VALUE	Parameter value is not acceptable	5
INV_MISMATCH	Parameter cannot be configured for that type of module	6

wUnit is divided in two part:

- High byte is exponent value for parameter conversion (e.g. 2 means to be divided by $10^2 = 100$).
- Low byte represents the unit in which the parameter is expressed. This unit can be one of the one represented in the array below.

Name	Description	Value
NO_UNIT	No unit. Represented by a blank character	0
VOLT	Volt. Represented by the “V” character	1
AMPERE	Ampere. Represented by the “A” character	2
HERTZ	Hertz. Represented by the “Hz” characters	3

Name	Description	Value
SECOND	Second. Represented by the “s” character	4
ANGLE	Angle. Represented by the “deg” or “°” characters	5
WATT	Watt. Represented by the “W” character	6
VA	VA. Represented by the “VA” character	7
PERCENT	Percent. Represented by the “%” character	8
DEGREE	Degree. Represented by the “deg” or “°” characters	9
OHM	Ohm. Represented by the “Ohm” character	10

Example: if wUnit value is 0x0201 the parameter is expressed in centiVolts.

6. How to and examples

6.1 Introduction:

In all the following examples, assumption will be made that T2S ETH controller ModBus RTU slave address is 1 (0x01).

6.1.1 Reading simple variables:

Ex 1: Reading output voltage of module #5

Field	Value	Description
Function	4 (0x04)	Read input register
Address	128 (0x0080)	31*(5-1) + 4 = 128 (see module table, page 8)
Number of registers	1 (0x01)	Vout value is 16-bit wide

Master frame: 0x01 0x04 0x00 0x80 0x00 0x01 0x71 0xE3

T2S ETH frame: 0x01 0x04 0x02 0x09 0x1B 0xFF 0x6B

Received value: 0x091B = 2331 ➔ Output voltage is 233.1V (see module table, page 8)

Ex 2: Reading T2S ETH serial number

Field	Value	Description
Function	4 (0x04)	Read input register
Address	128 (0x0080)	31*(5-1) + 4 = 128 (see module table, page 8)
Number of registers	1 (0x01)	Vout value is 16-bit wide

Master frame: 0x01 0x04 0x07 0xC5 0x00 0x02 0x60 0x82

T2S ETH frame: 0x01 0x04 0x04 0x00 0x01 0x00 0x07 0xEB 0x86

Received value: 0x0001 and 0x0007 ➔ T2S ETH revision is Vs1.7

6.1.2 Reading alarm and history log:

Reading entry #1

Field	Value	Description
Function	4 (0x04)	Read input register
Address	2010 (0x07D4)	2010 + 2*(1-1) = 2010 (see alarm table, page 12)
Number of registers	2 (0x02)	Alarm entry is 2 registers wide

Master frame: 0x01 0x04 0x07 0xDA 0x00 0x02 0x51 0x44

T2S ETH frame: 0x01 0x04 0x04 0x21 0x01 0x00 0xB3 0xE1 0xCD

Alarm entry #1 is a minor (0x01) alarm generated by the system (0x21) and this alarm has the ID 179 (0x00B3)

Reading an invalid entry

Let's assume that there are only 2 alarms present in the system. Then reading alarm entry #3 should return an invalid entry

Field	Value	Description
Function	4 (0x04)	Read input register
Address	2014 (0x07DE)	2010 + 2*(3-1) = 2014 (see alarm table, page 12)
Number of registers	2 (0x02)	Alarm entry is 2 registers wide

Master frame: 0x01 0x04 0x07 0xDE 0x00 0x02 0x10 0x85

T2S ETH frame: 0x01 0x04 0x04 0xFF 0xFF 0xFF 0xFF 0xFA 0x10

Conclusion, there is no alarm entry #3 and nor are there further entries. This leads to the conclusion that only 2 alarms are present at the time in the system.

Linking alarm ID to alarm description text:

If we consider the alarm ID #179 of example above, we can get description text for this alarm by reading related entry in the "Event string table".

Field	Value	Description
Function	4 (0x04)	Read input register
Address	18092 (0x46AC)	16660 + 8*179 = 18092
Number of registers	8 (0x08)	Event description string is 16 characters long

Master frame: 0x01 0x04 0x46 0xAC 0x00 0x08 0x24 0xA5

T2S ETH frame: 0x01 0x04 0x10 0x56 0x61 0x63 0x5F 0x69 0x6E 0x20
0x54 0x4F 0x4F 0x20 0x4C 0x4F 0x57 0x20 0x20 0x36 0x7C

String description: Vac_in TOO LOW

6.1.3 Reading configuration:

Reading entry #1

Field	Value	Description
Function	4 (0x04)	Read input register
Address	4160 (0x1040)	4160 + 20*(1-1) = 4160
Number of registers	20 (0x14)	Alarm entry is 20 registers wide

Master frame: 0x01 0x04 0x10 0x40 0x00 0x14 0xF5 0x11

T2S ETH frame: 0x01 0x04 0x28 0x01 0xB8 0x00 0x00 0x01 0x04 0x01
0x01 0x44 0x43 0x20 0x31 0x20 0x3A 0x20 0x56 0x64
0x63 0x5F 0x69 0x6E 0x20 0x4C 0x6F 0x77 0x20 0x53
0x74 0x61 0x72 0x74 0x20 0x20 0x20 0x20 0x20 0x20
0x20 0x20 0x20 0x64 0x36

Configured Value:	0x01B8 ➔ 440
Validity:	0x0000 ➔ PARAM_OK (see 5.4, page 15)
Parameter ID:	0x0104 ➔ 260
Units:	0x0101 ➔ unit is dV (0.1V) (see 5.4, page 15)
String description:	DC 1 : Vdc_in Low Start

Reading an invalid entry

Let's assume that entry #189 is invalid

Field	Value	Description
Function	4 (0x04)	Read input register
Address	7920 (0x1EF0)	4160 + 20*(189-1) = 7920
Number of registers	20 (0x14)	Alarm entry is 20 registers wide

Master frame:	0x01 0x04 0x1E 0xF0 0x00 0x14 0xF6 0x1E
T2S ETH frame:	0x01 0x04 0x28 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
	0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
	0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
	0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
	0xFF 0xFF 0xFF 0xF0 0x04

Due to internal memory organization, the configuration might have valid entries interleaved with invalid ones. Thus, in order to read all configurations, one should read all entries to determine which ones are valid and which ones are not.

Exceptions: Textual parameter

As one can see, the configured value field is 16 bit wide. Consequently, only integer values can be read (or further configured) using this way. There are 3 parameters that are not integer values but strings. Thus, the values returned in the "Configured value" field of the configuration table for those 3 IDs are dummy values that have no meaning.

Those IDs are the following

ID	Description	Remark
901	Digital input 1 label	Can be read in the digital inputs table in the holding registers (0x0686)
902	Digital input 2 label	Can be read in the digital inputs table in the holding registers (0x0686)

Note 1:

Caution should be taken while changing module address because it will affect the addresses where to retrieve information regarding this module. What is more there can be a delay between the moment where the change address order is received and the moment where the module address has been physically changed. Moreover, a module address can be changed to a new address that is already assigned to another module! In this case, the modules will swap their addresses.

For all those reasons, the best and secure way to change a module address is the following one:

1. Get module serial number using “Module information table” using the current address to calculate the index.
2. Send to the new address for this module using the “Module action table” using the current address to calculate the index.
3. Poll the serial number using “Module information table” using the new address as index until there is a match with the serial number collected at point 1.

7. Modbus Testing

In order to test the Modbus communication functionalities, please install the program "**Radzio ! Master Modbus Simulator**" on your computer.

- **Website**: http://en.radzio.dxp.pl/modbus-master-simulator/
- **Direct download**: http://en.radzio.dxp.pl/modbus-master-simulator/RMMS.zip

7.1 Requirement:

- USB to RS485 interface cable (For example USB-RS485-WE cable, FTDI chip), Fig 1

Fig 1: FTDI cable

- RJ45-TERM (Gravitech.us) Fig 2

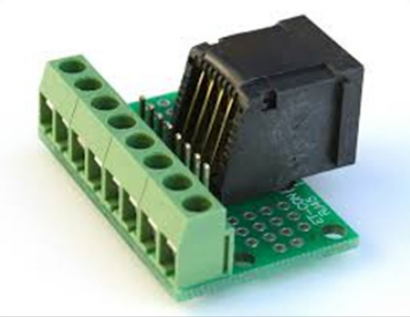


Fig 2: Adapter for RJ45

7.2 Modbus Testing procedure

Perform the following steps to test the Modbus

1. Connect FTDI cable on the **RJ45 port** at the back plane of the T2S-ETH with
    - Yellow on pin 8.
    - Orange on pin 6.
    - Black on pin 7.
2. Use RJ45-TERM to help you.
3. Read the COM port number in your computer settings (In the device manager), Fig 3.

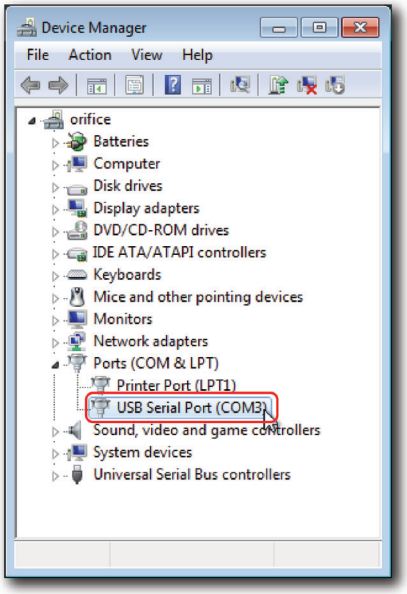


Fig 3: COM port number

4. Open the downloaded **Radzio!**, Fig 4

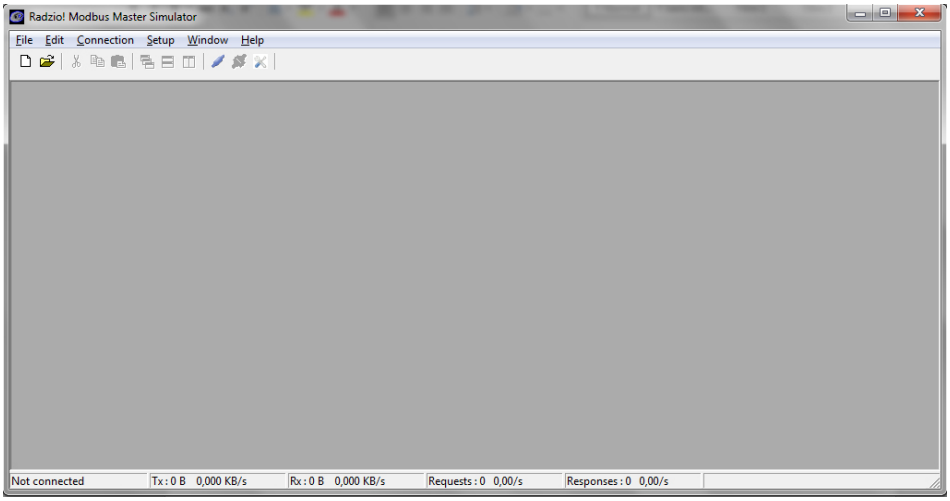


Fig 4: Radzio! Home Screen

5. Click on the **Connection settings** icon in the tool bar.

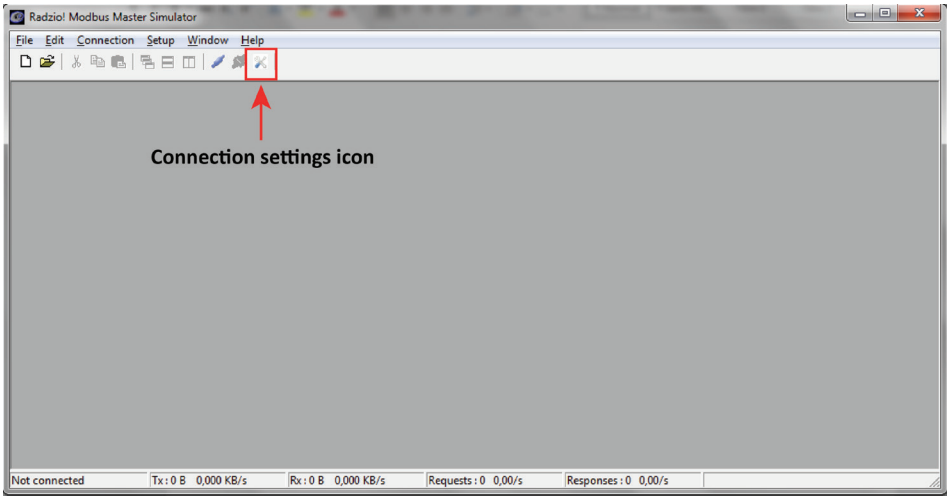


Fig 5: Connection settings icon

6. Select **Modbus RTU** in the Connections settings window

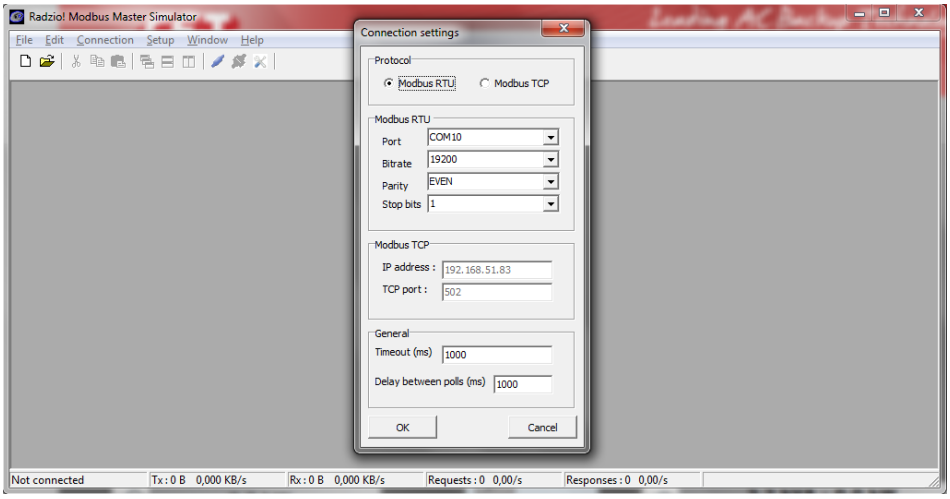


Fig 6: Connection settings window

7. Verify the **Modbus RTU** parameters are matching with the **T2S-ETH** in the Modbus section (Fig 7).

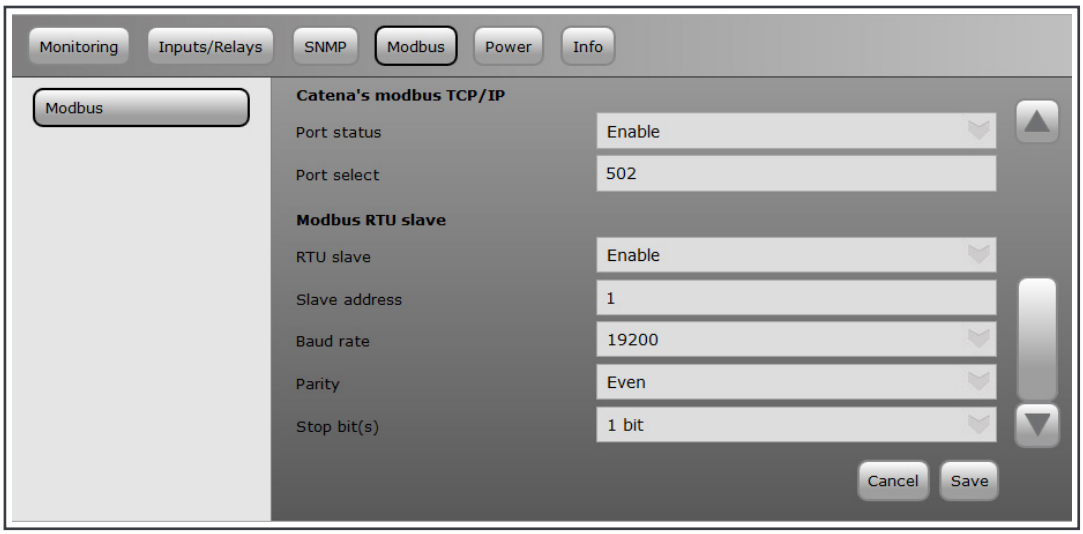


Fig 7: Modbus settings in T2S ETH

8. Close the **Connection settings window** in Radzio!.

9. Click on the **Connect** icon in the Radzio tool bar in order to establish the connections. (Fig 8)

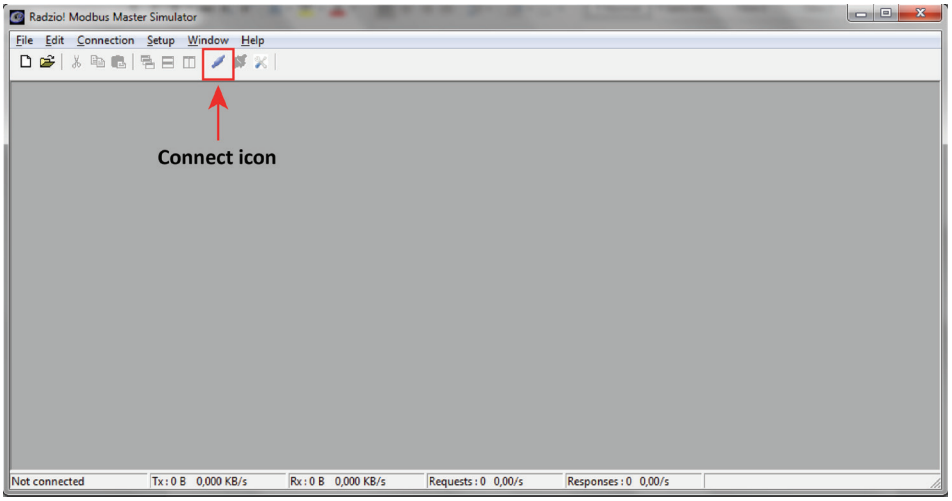


Fig 8: Connect icon

10. Click **New Modbus sheet** icon, to open the new Modbus sheet. (Fig 9)

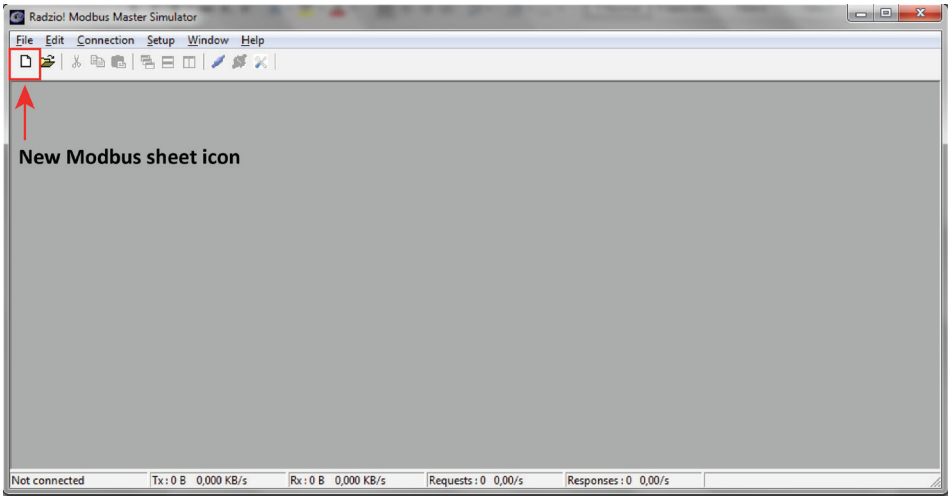


Fig 9: New Modbus sheet icon

11. Modify the **Device Settings** in the new modbus sheet. (Fig 10)

- Set the **Device ID** (Default value is 1)
- Set the **entity** of Device ID as **Input Register** (Default value is Coil status)

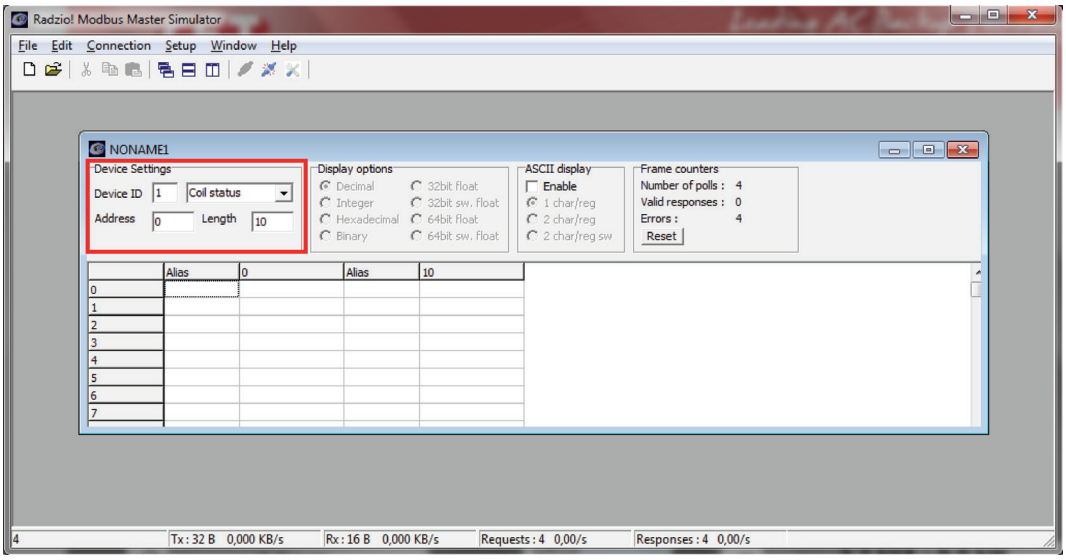


Fig 10: Default Radzio settings to Modify

12. Modify the Display options to Decimal, Integer, Hexadecimal or Binary based on how you want to read the register value in the Modbus tool
    - The display option is Decimal; the value read would display register value in Integer with decimals.
    - The display option is Integer; the value read would display register value in Integer without decimals.
    - The display option is Hex; the value read would display register value in Hexadecimal.
    - The display option is Binary; the value read would display register value in Binary.

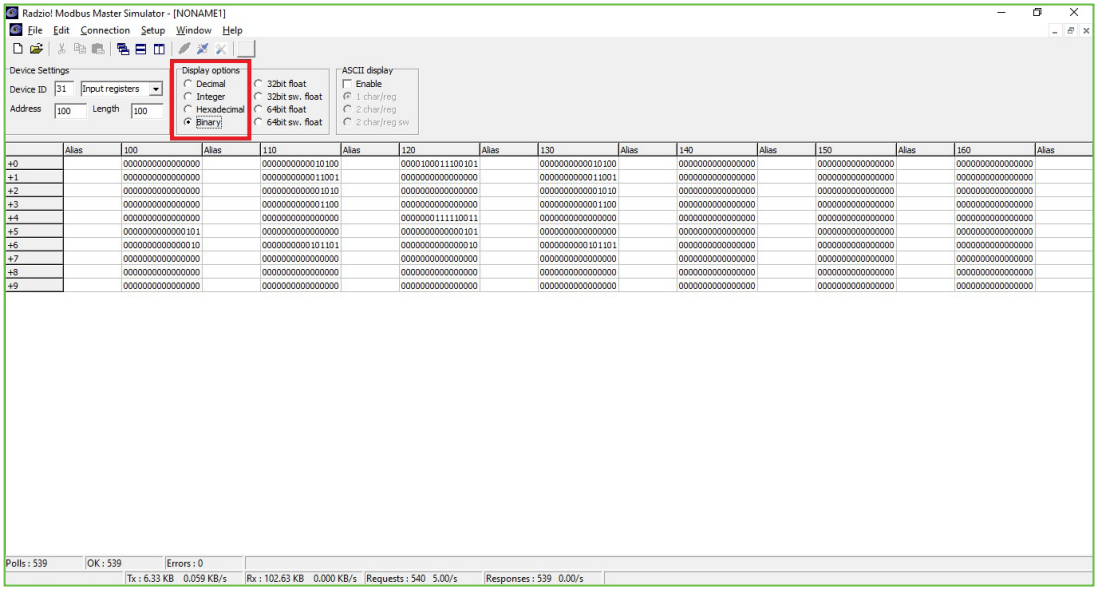


Fig 12: Display options

13. Access the desired addresses at the Modbus sheet in Radzio (Fig 12) as described in the Modbus document (Fig 13).

    If you only see zeros or bad values, check the Frame counter (Fig 12) to be sure that you receive “Valid responses”.
    If not, the settings may be wrong.

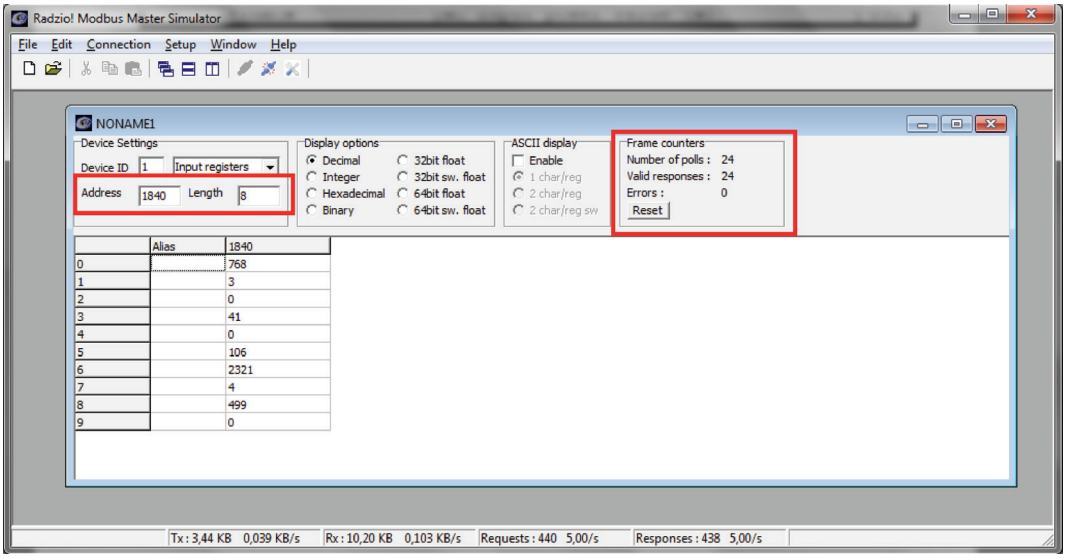


Fig 12: Modbus Example

4	lPinACVA	AC input power value (VA)	U32
6	wVinAC	AC input voltage value (0.1V)	U16
7	wIinAC	AC input current value (0.1A)	U16
8	wACInFreq	AC input frequency value (0.1Hz)	U16

Fig 13: MODBUS_protocol_for_T2S_Vs4.pdf

For example, you can read from base address 1840 (AC input L1)

AC input power value (U32 so address 4 will be MSB and address 5 LSB) = 106 [VA]

- Input voltage (U16) at address 6 = 2321 [0.1 V] = 232.1 [V]
- Input current (U16) at address 7 = 4 [0.1 A] = 0.4 [A]
- Input frequency (U16) at address 8 = 499 [0.1 HZ] = 49.9 [Hz]