Thermal Centers Monitoring

Offer of converters
TRM102, TRM202, TRM112, TRM212
and additional options.

Communication with ECL200/300 via
Ethernet / GSM / GPRS / MODBUS_TCP

TRM102, TRM112

TRM202, TRM212
(built-in GSM modem)

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1. Introduction

This documentation describes available versions of TRM converters (called hereinafter TRM), designed for monitoring of thermal centers, equipped with ECL200/300 controlled from Danfoss, and thermal energy meters with MBus interface.

Photographs of converters in version with Ethernet interface and additional GSM modem are presented on the first page of this documentation.

1.1. Versions with Ethernet interface – TRM1x2

Group of TRM102 and TRM112 converters is designed for monitoring through the Ethernet network. In order to do this, LAN networks or Internet/WAN network may be used.

1.2. Versions with Ethernet interface and GSM modem – TRM2x2

Converters TRM202 and TRM212 are additionally equipped with GSM modem. Besides standard Ethernet communication, it allows for communication of converters through the GPRS. For GPRS communication SIM card of any GSM operator is required, allowing for modem logging in public or private APN.

1.3. Expansion of TRM converters functionality

Exact list of technical parameters and functions of TRM converters, available as standard in the individual versions, are presented in table in section 3.1.2 on page 17.

Each TRM converter may be expanded with additional functions, built directly in it, or by connecting external expanding modules. They may be additional digital or analogue inputs or outputs, or additional communication ports.

List of internally expanding functions is presented in sections 1.1 and 3.3 on page 18, and possibilities of expanding the TRM converter with external modules are presented in section 3.4 on page 19.

1.4. Calculation of prices

In section 4 on page 20 there are prices of TRM converters and additional options. If the TRM converter in standard version is expanded with one or more options, then it is required to add prices of those options to its price.

For products priced in PLN there are available discounts for non-unitary orders according to the discount table in chapter 4.6 on page 22, and if the product price is shown in EUR, then there are no discounts.

2. Description of solution, block diagrams

As mentioned above, TRM converters are equipped according to version with Ethernet communication interface (models TRM1x2), or with GSM/GPRS modem (models TRM2x2). Block diagrams of each converter installation are presented below.

2.1. Block diagram of TRM112 converter installation

Communication with ECL200/300 in service protocol, and with meters in MBus protocol.

2.2. Block diagram of TRM102 converter installation

Communication with ECL300 and meters in MBus RTU protocol Meters connected to the controller and communication with them is realized indirectly through the controller also in Modbus RTU protocol.
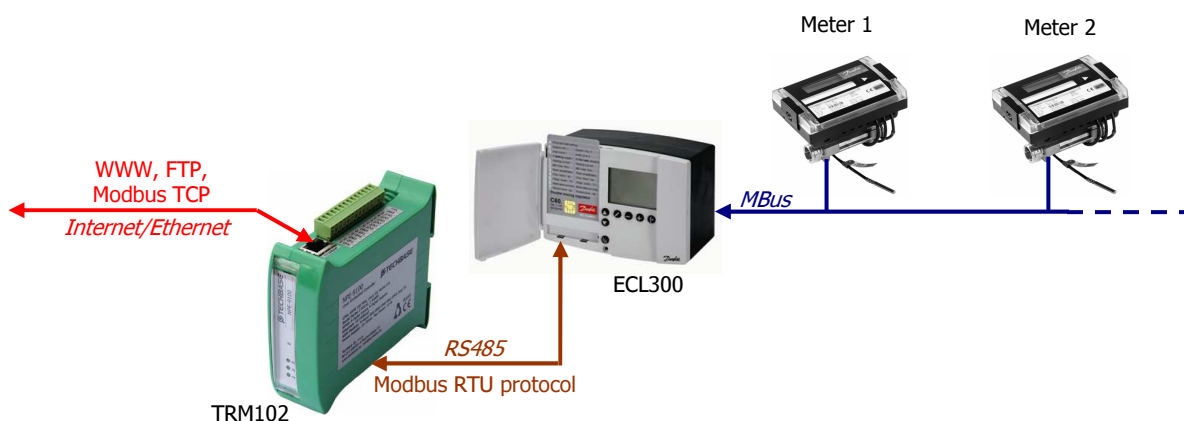
2.3. Block diagram of TRM212 converter installation

Communication with ECL200/300 in service protocol, and with meters in MBus protocol.
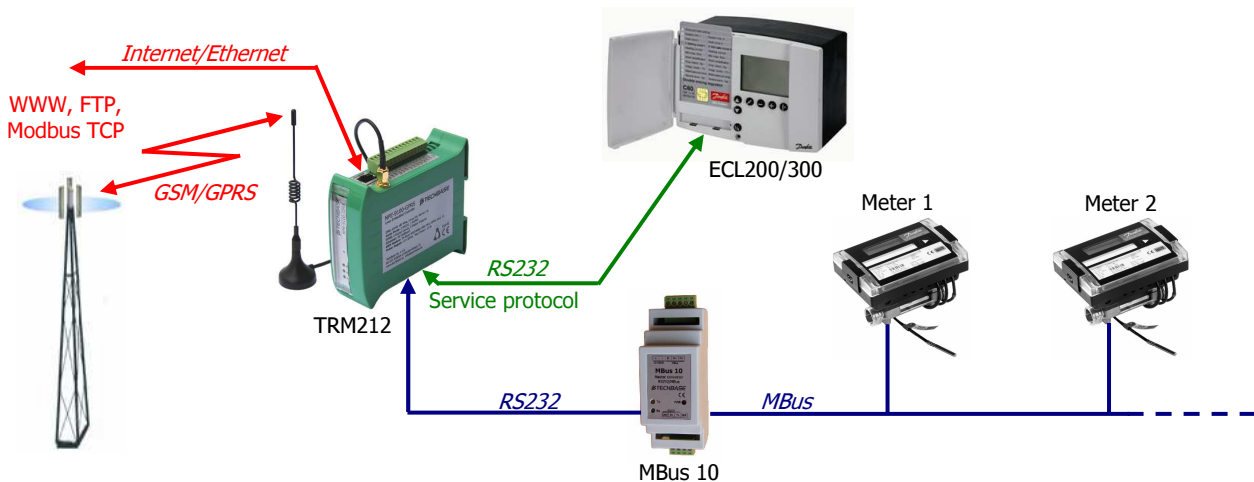
2.4. Block diagram of TRM202 converter installation

Communication with ECL300 and meters in MBus RTU protocol Meters connected to the controller through ECA73, which allows for communication with them indirectly through the controller also in Modbus RTU protocol.

In TRM2x2 both types of communication: through GPRS and Ethernet are realized independently, which allows user of telemetrical system to use freely offered communication methods, deciding to use one of those technologies or both of them at the same time. It is also possible to use one technology, e.g. Ethernet, as the basic communication channel, and GPRS is used as emergency channel.

2.5. Internet/Ethernet communication architecture

The exemplary architecture of communication with thermal centres with use of Internet/Ethernet infrastructure is shown below. It may be any type of network, e.g. local internet network, realized in wire or wireless WiFi technology, cable TV network, Neostrada TPSA, Netia, light pipe network, etc.
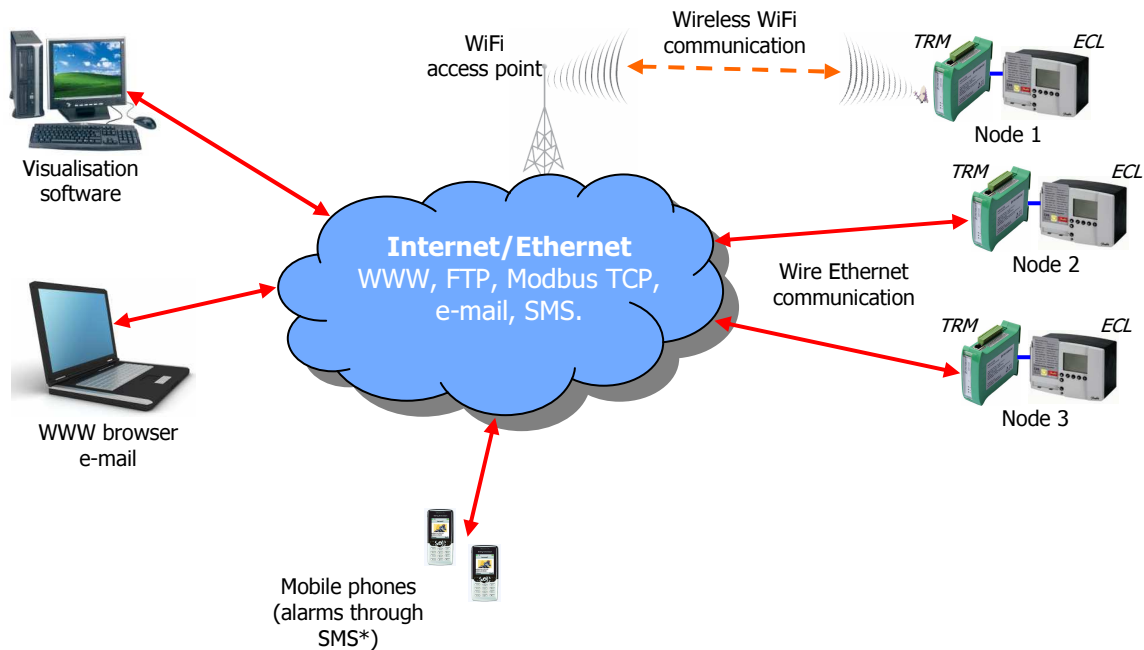
Internet/Ethernet communication architecture

* SMS messages are realized indirectly by sending messages to the e-mail account at mobile operator. It allows for sending the message to the defined mobile number as SMS.

System user may use TRM converters for integrating ECL controllers with any visualisation software thanks to open Modbus TCP protocol, or monitor centres operation from any computer, equipped with WWW browser, e.g. Internet Explorer, Firefox, Opera, etc.

2.6. GSM/GPRS communication architecture

The architecture of communication based upon GSM/GPRS technology is shown below.
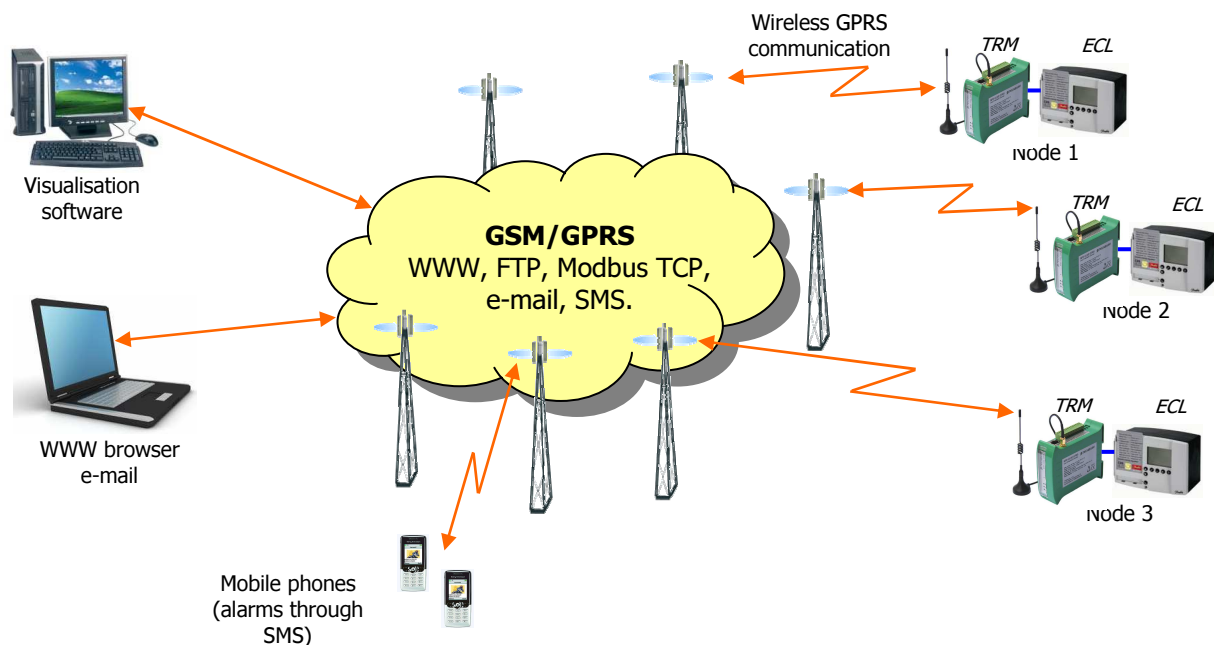
GSM/GPRS communication architecture

Thanks to GSM/GPRS modem, built in TRM2x2 converters, monitoring may also include centers, where accessibility of popular Internet/Ethernet networks is limited. In order to use this wireless technology it is required to have SIM card of any GSM operator with activated GPRS service, and GSM network access in place of antenna installation.

Moreover, it is possible to connect both communication technologies in one system, i.e. Internet/Ethernet and GSM/GPRS. The exemplary architecture of such solution is presented in the following section.

2.7. Ethernet/Internet/GSM/GPRS combined communication architecture

The architecture of communication based upon Internet/Ethernet and GSM/GPRS technology is shown below.
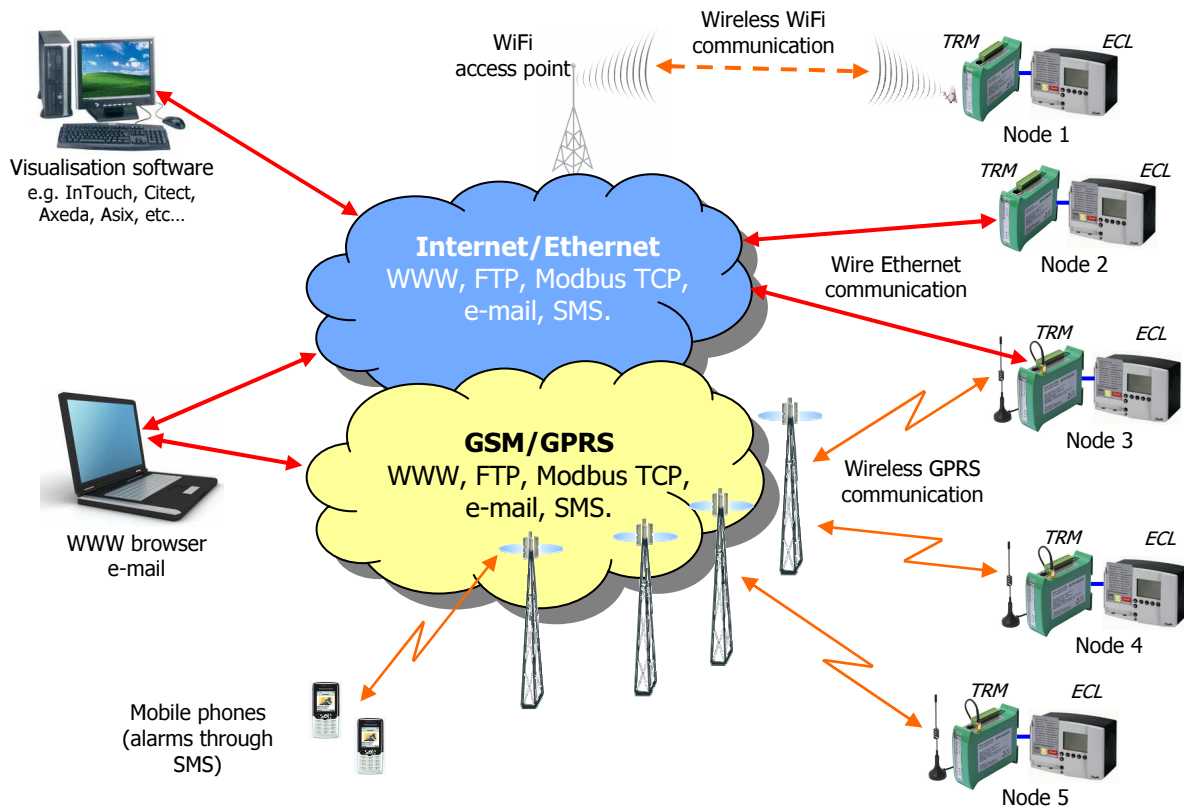
Ethernet/Internet/GSM/GPRS combined communication architecture

As shown below, it is possible to use in one system centres using standard Internet/Ethernet and GSM/GPRS networks.

Moreover, when it is required to increase the communication reliability, it is possible to use both communication technologies in one centre at the same time. In such case the Internet/Ethernet communication may be the basic communication channel, and GSM/GPRS – the emergency channel, activated in case of no basic communication. Example of such centre monitoring is presented above in centre 3.

2.8. Expansion of TRM converters functionality

TRM converters resources may be expanded in two ways:
1. By additional inputs-outputs or communication ports, built in TRM converter
2. By additional external input-output modules (TRM-7000 series), connected to TRM converter through RS485 communication port.

Both possibilities are described below.

2.8.1 Extensions built in TRM

Standard equipment of converters is presented in section 3.1.2 on page 17. When the telemetrical system requires connecting additional signals, not available in any of standard versions, it is possible to equip it with additional interfaces. It is possible to add directly to TRM converter **8 digital inputs (DI), 6 digital outputs (DO), 4 analogue inputs (AI)**, and according to TRM version: **RS485 or RS232 port**. Exact list of available options is presented in sections 1.1 and 3.3 from page 18.

14-pin connector
for expansion signals:
DI,DO,AI,RS232,RS485

16-pin connector
for expansion signals:
DI,DO,AI,RS232,RS485
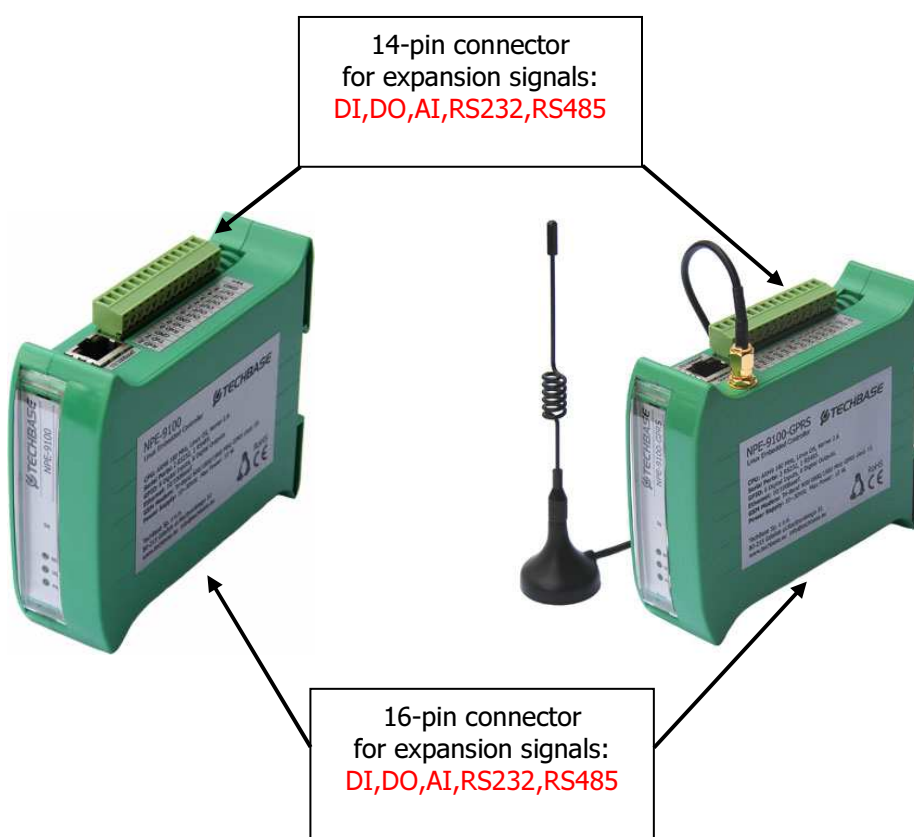
Connectors for signals expanding built-in resources of TRM converters

2.8.2 External expansions – TRM-7000 modules series

Input-output interfaces of TRM converters may also be expanded by connecting external expansion modules of TRM-7000 series 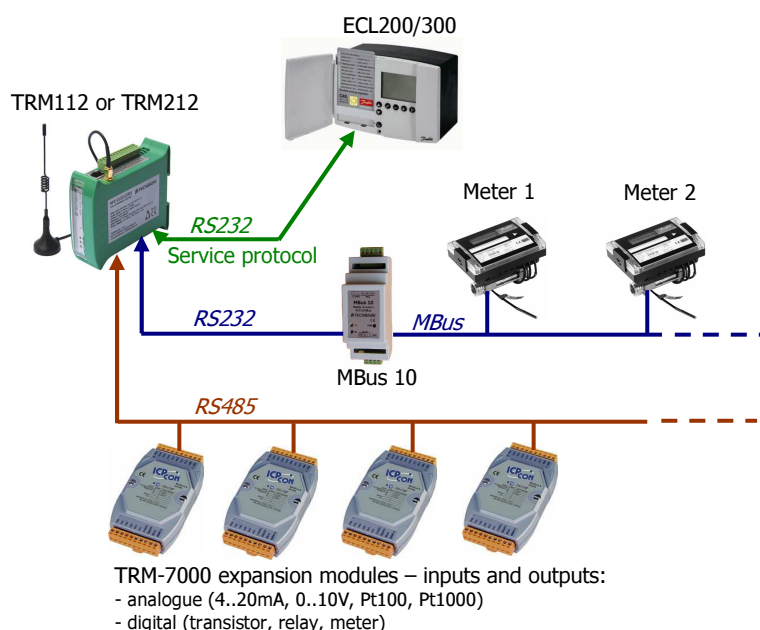through RS485 port. There are modules of temperature inputs Pt100, Pt1000, analogue inputs 0..10V, 0..20mA, 4..20mA, analogue outputs 0..10V, 0..20mA, 4..20mA, digital inputs and digital outputs available. Complete list of available external expansion modules is presented in section 3.4 on page 19. Connecting method for external expansion modules is presented below.

Connecting modules TRM-7000 to TRM112 and TRM212 converters:

ECL200/300

TRM112 or TRM212

Meter 1   Meter 2

RS232
Service protocol

RS232   *MBus*

MBus 10

RS485

TRM-7000 expansion modules – inputs and outputs:
- analogue (4..20mA, 0..10V, Pt100, Pt1000)
- digital (transistor, relay, meter)

Connecting modules TRM-7000 to TRM102 and TRM202 converters:

Meter 1   Meter 2

TRM102 or TRM202

MBus

ECL300

RS485
Modbus RTU protocol

TRM-7000 expansion modules – inputs and outputs:
- analogue (4..20mA, 0..10V, Pt100, Pt1000)
- digital (transistor, relay, meter)
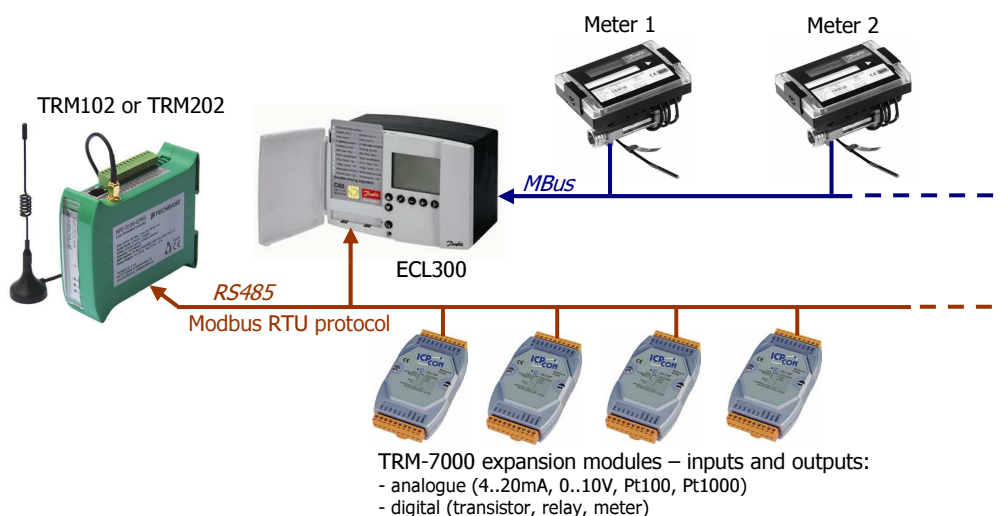
2.9. Examples of visualisation screens – WWW option

2.9.1 System logging
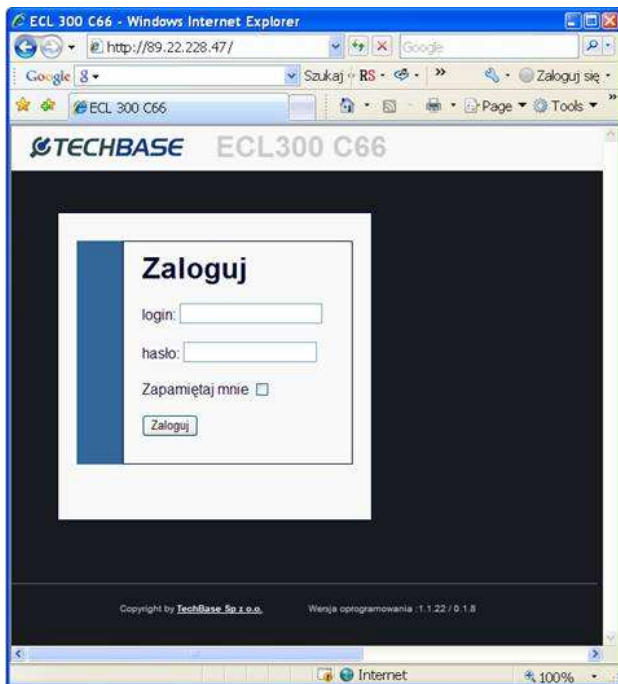
- After TRM system installation centres monitoring without installation of additional software

- Standard Internet browser is enough

- For systems with SCADA software, e.g. Intouch, Axeda, Citect, Asix, iFix, etc., easy communication in open Modbus TCP protocol

2.9.2 Centre diagnostics

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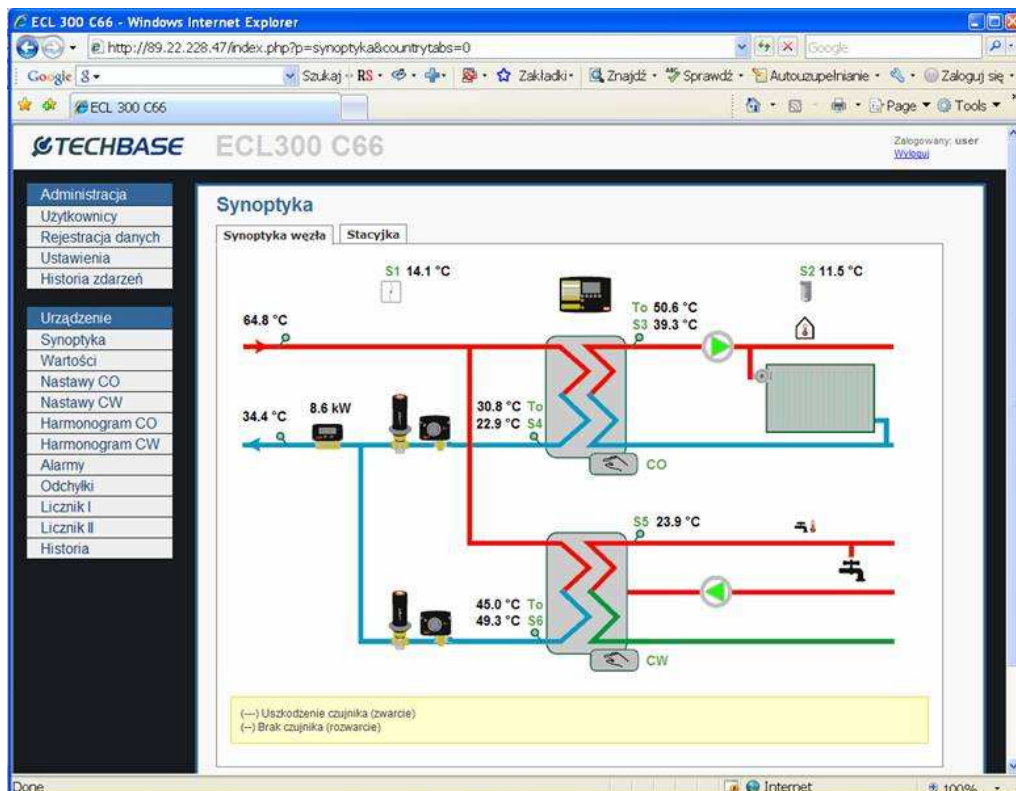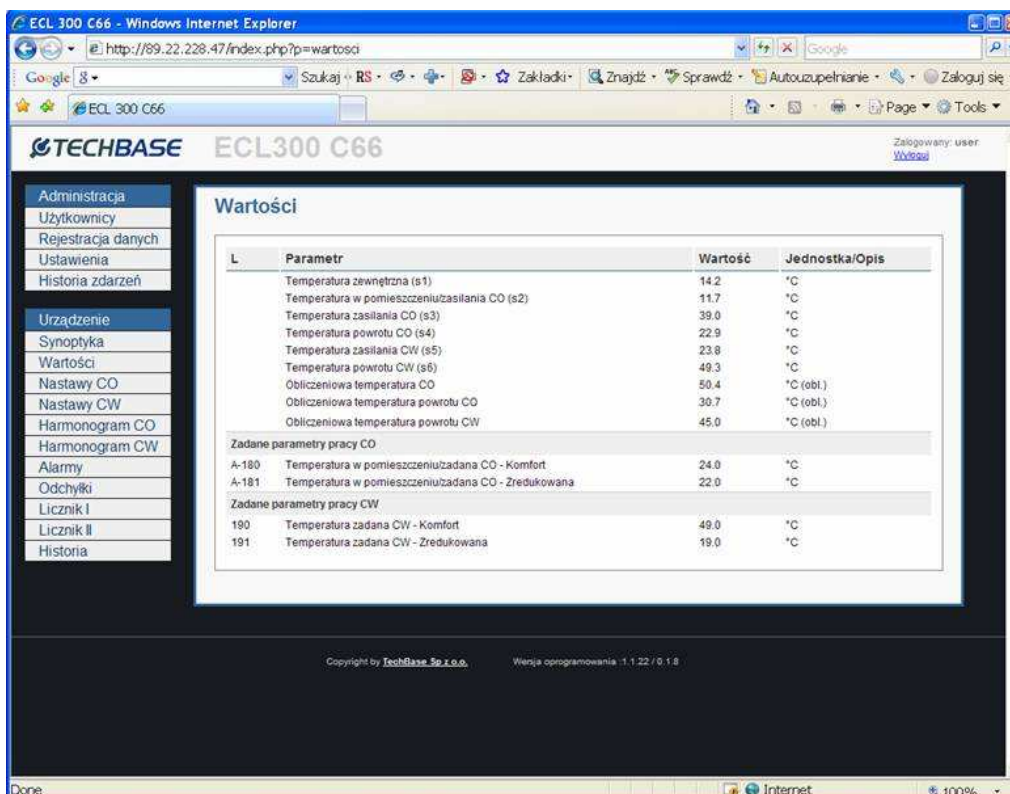
2.9.3 Controller keylock
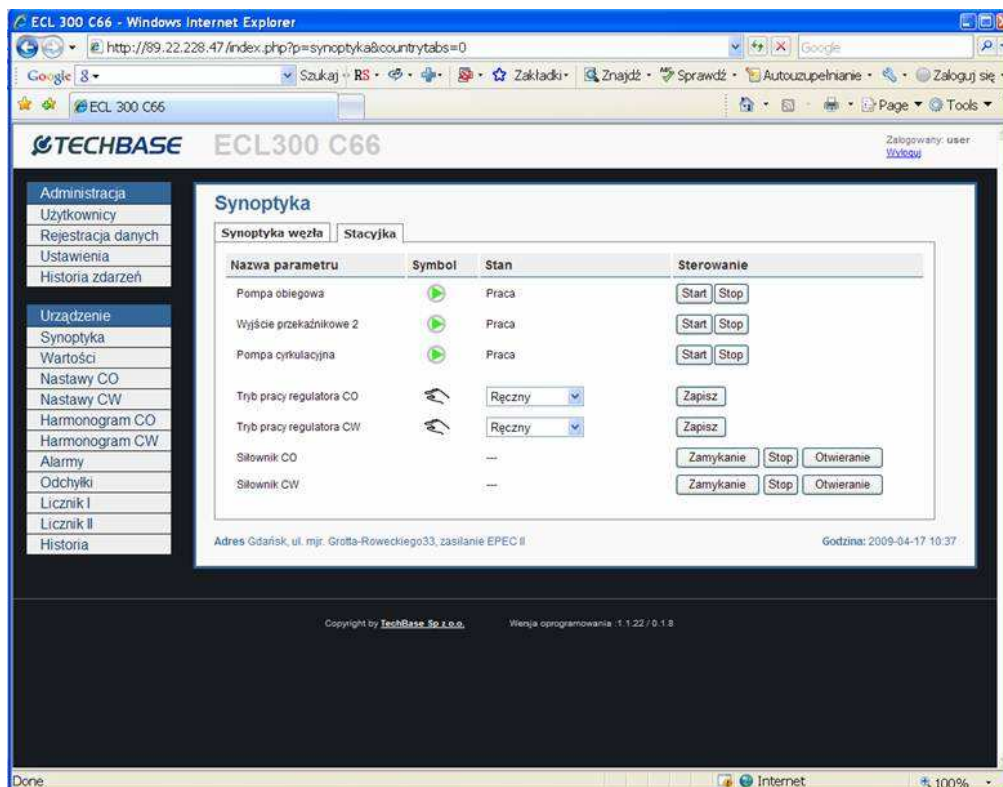
2.9.4 Table of parameters values

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2.9.5 Controller setpoints
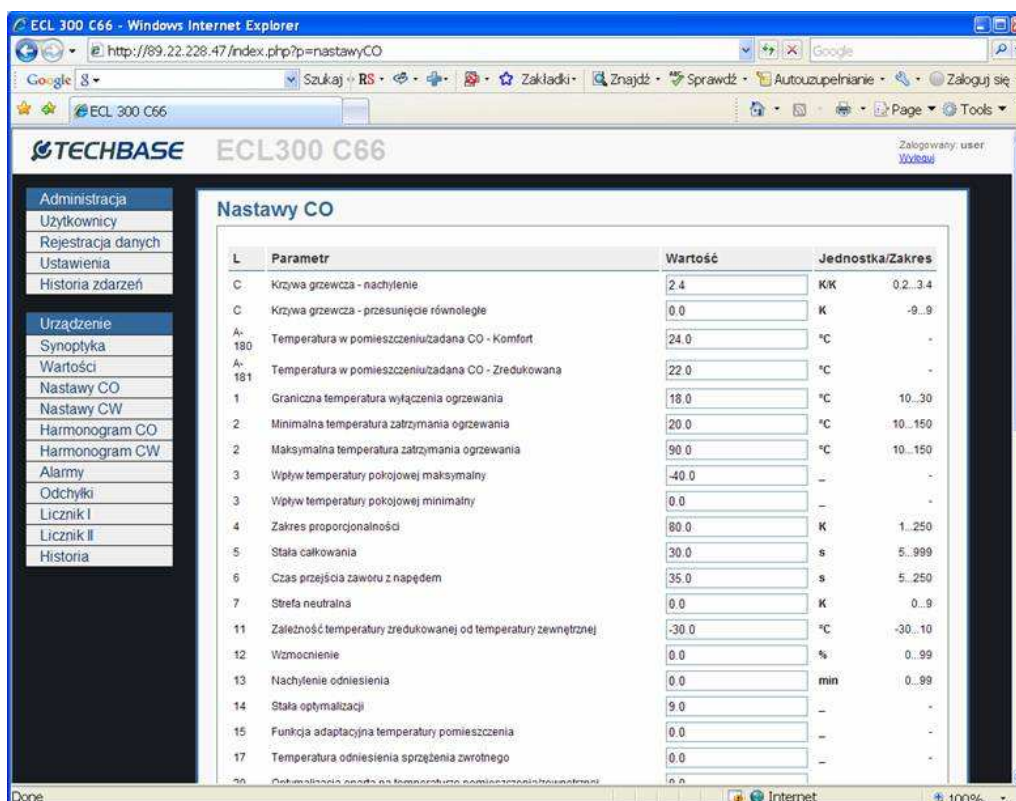
2.9.6 Data registering

- *.csv files ready for analysis in MS Excel spreadsheet

- *.txt files ready for analysis in other programs
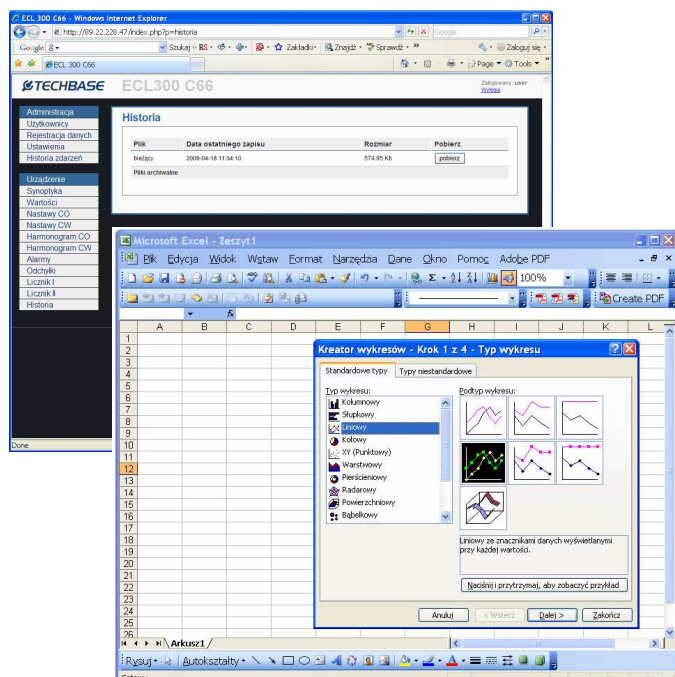
- Flexible data presentation as graphical charts in MS Excel spreadsheet.

- Quick data integration with settlement systems
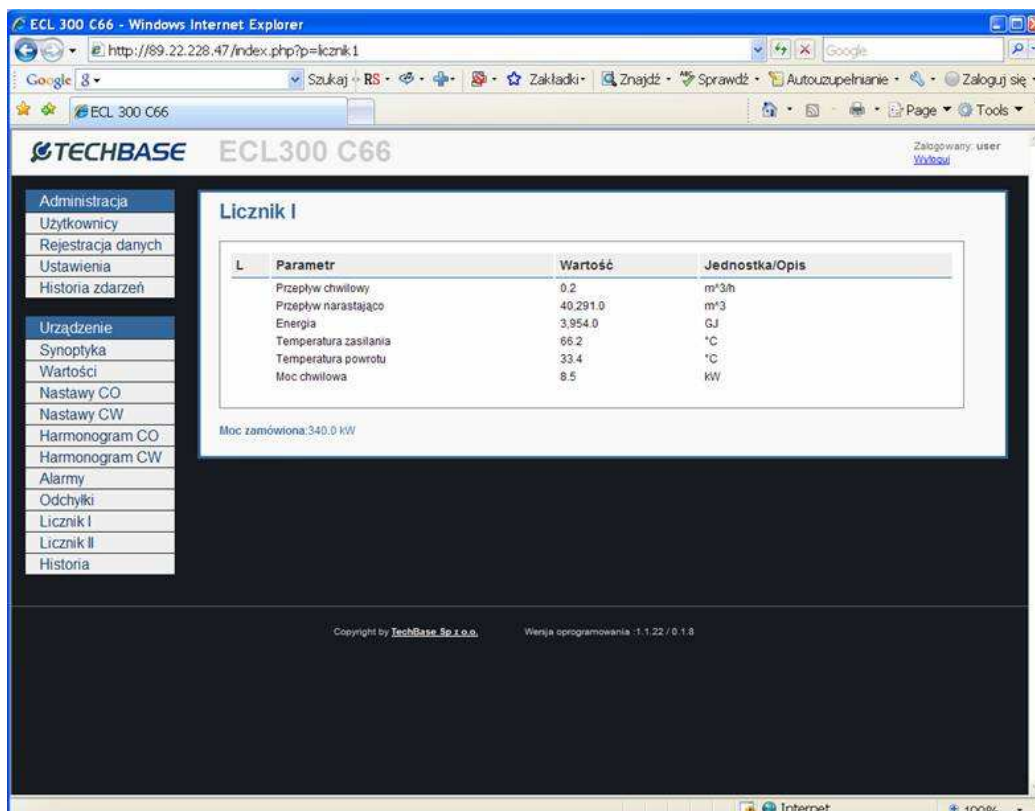
- Registering of logging users

-

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2.9.7 Time schedule
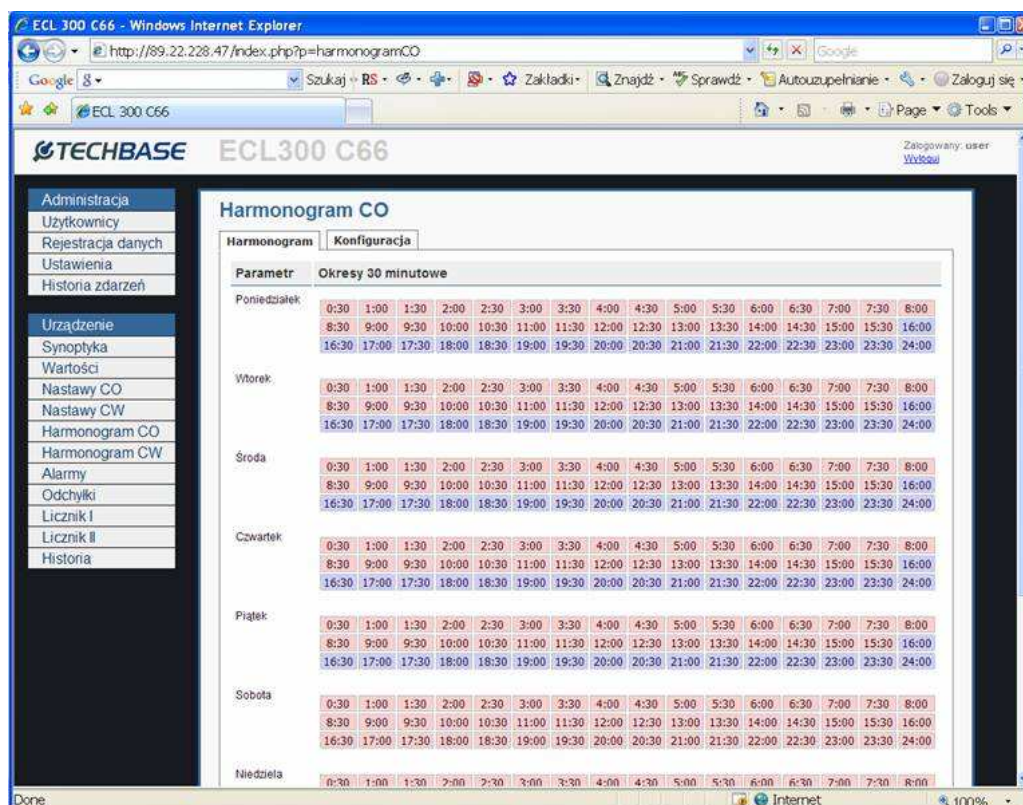
2.9.8 Data from energy meters

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2.9.9 Configuration

3. Technical parameters specification

3.1. Available versions of TRM converters

3.1.1 Functions description

No.	Type	Description
1	TRM102	ECL300 controller operation – bi-directional data exchange (write/read) with controller **in Modbus RTU[1] protocol**. Modbus TCP protocol available from Ethernet side. Energy meters with MBus protocol connected to controller through ECA73 card.
2	TRM102-W	TRM102 + built-in WWW mini-server, allowing for viewing and controlling of controller parameters though Internet browser.
3	TRM102-D	TRM102 + built-in memory for data recording. Registered data are available as *.csv* files through WWW server.
4	TRM102-DW	TRM102-W + TRM102-D
5	TRM202	TRM102 + **GSM/GPRS** modem.
6	TRM202-W	TRM102-W + **GSM/GPRS** modem.
7	TRM202-D	TRM102-D + **GSM/GPRS** modem.
8	TRM202-DW	TRM102-DW + **GSM/GPRS** modem.
9	TRM112	ECL200/300[3] controller operation – bi-directional data exchange (write/read) with controller **in service protocol**. Modbus TCP protocol available from Ethernet side. Energy meters with MBus protocol connected to TRM converter through separate serial port[2].
10	TRM112-W	TRM122 + built-in WWW mini-server, allowing for viewing and controlling of controller parameters though Internet browser.
11	TRM112-D	TRM112 + built-in memory for data recording. Registered data are available as *.csv* files through WWW server.
12	TRM112-DW	TRM112-W + TRM112-D
13	TRM212	TRM112 + **GSM/GPRS** modem.
14	TRM212-W	TRM112-W + **GSM/GPRS** modem.
15	TRM212-D	TRM112-D + **GSM/GPRS** modem.
16	TRM212-DW	TRM112-DW + **GSM/GPRS** modem.

1. *ECL300 controller equipped with ECA71 communication card*
2. *Required external MBus10 converter (RS232 standard into MBus)*
3. *ECL300 controller has built-in RS232 serial port, and ECL200 requires equipping with RS232 communication card of ECA81 type*

3.1.2 Technical parameters list

Table below presents available communication functions and software versions for the individual TRM converters versions:

No.	Type	Communication with ECL200/300		Communication with energy meters		Software options		Supply 9-36Vdc	Telemetrical communication	
		Service protocol	Modbus RTU[1]	MBus[2]	through ECL	Data recording	WWW visualisation		Ethernet 10/100BaseT	GSM GPRS
1	TRM102	-	RS485[1]	-	YES	-	-	YES	YES	-
2	TRM102-W					-	YES			
3	TRM102-D					YES	-			
4	TRM102-DW					YES	YES			
5	TRM202	-	RS485[1]	-	YES	-	-	YES	YES	YES
6	TRM202-W					-	YES			
7	TRM202-D					YES	-			
8	TRM202-DW					YES	YES			
9	TRM112	RS232[3]	-	RS232[2]	-	-	-	YES	YES	-
10	TRM112-W					-	YES			
11	TRM112-D					YES	-			
12	TRM112-DW					YES	YES			
13	TRM212	RS232[3]	-	RS232[2]	-	-	-	YES	YES	YES
14	TRM212-W					-	YES			
15	TRM212-D					YES	-			
16	TRM212-DW					YES	YES			

1. *ECL300 controller equipped with ECA71 communication card*
2. *Required external MBus10 converter (RS232 standard into MBus)*
3. *ECL300 controller has built-in RS232 serial port, and ECL200 requires equipping with RS232 communication card of ECA81 type*

3.2. Additional inputs-outputs in TRM

Selection of one of options below expands resources built in TRM converter in range of digital or analogue inputs-outputs according to table below:

No.	Type	Description	inputs-outputs[8]			
			DI	DOT	DOR	AI
1	8DI	eight digital inputs 0-30Vdc	8	0	0	0
2	6DOT	six digital transistor inputs	0	6	0	0
3	2DOTR	two digital transistor outputs and two digital relay outputs	0	2	2	0
4	4AI	four analogue inputs 0..10V	0	0	0	4

DI – digital inputs
DOT – digital transistor outputs 30Vdc 100mA max
DOR – digital relay outputs 30Vdc 1A max
AI – analogue inputs 0..10V(dc)

Notes:
Above options may be freely connected with any TRM model except 6DOT and 2DOTR, where in one converter only one may be selected.
Valid configurations:
    8DI+6DOT+4AI
    8DI+2DOTR+4AI
Invalid specification:
    8DI+6DOT+2DOTR+4AI

3.3. Additional communication ports in TRM

Selection of one of options below expands resources built in TRM converter in range of additional communication ports according to table below:

No.	Type	Description	Maximum ports no.	Options availability in main modules
1	R5R	Additional **RS485** port Modbus RTU Master protocol	1	any version of TRM102 or TRM202
2	R5P	Additional **RS485** port transparent communication	1	any version of TRM102 or TRM202
3	R2R	Additional **RS232** port Modbus RTU Master protocol	2	any version of TRM112 or TRM212
4	R2P	Additional **RS232** port transparent communication	2	any version of TRM112 or TRM212
5	R2M	Additional **RS232** port MBus Master protocol for communication with energy meters	2	any version of TRM112 or TRM212

3.4. External expansion modules TRM-7000

Tables below present options of additional external inputs-outputs, connected to TRM converter through RS485 interface with Modbus RTU protocol:

Temperature analogue inputs		
No.	Type	Description
1	TRM-7033	module of three inputs for temperature sensors Pt100, Pt1000, Ni120, Cu100, Cu1000
2	TRM-7015	module of six inputs for temperature sensors Pt100, Pt1000, Ni120, Cu100, Cu1000

Universal analogue inputs		
No.	Type	Description
1	TRM-7017	module of eight voltage inputs 0~10V
2	TRM-7017C	module of eight current inputs 0~20mA or 4~20mA

Universal analogue outputs		
No.	Type	Description
1	TRM-7024	module of four analogue inputs 0~20mA, 4~20mA, 0~10V

Insulated digital inputs		
No.	Type	Description
1	TRM-7041	module of fourteen digital inputs with galvanic separation

Insulated digital inputs		
No.	Type	Description
1	TRM-7045	module of sixteen digital inputs with galvanic separation

Notes:
1. In any TRMx12 version option R5R is required for connecting additional modules (additional RS485 port with Modbus RTU protocol).
2. In any TRMx02 version modules must be connected through RS485 port together with ECL controller.
3. It is possible to connect up to 250 external modules, but in one segment of RS485 network no more than 32 modules may operate. Therefore for each 32 connected modules it is necessary to use minimum one RS485 bus amplifier of TRI-7510 type.

4. Price list

4.1. TRM converters

No.	Type	Description	Net price in PLN
1	TRM102	ECL300 controller operation – bi-directional data exchange (write/read) with controller **in Modbus RTU[1] protocol**. Modbus TCP protocol available from Ethernet side. Energy meters with MBus protocol connected to controller through ECA73 card.	970,00
2	TRM102-W	TRM102 + built-in WWW mini-server, allowing for viewing and controlling of controller parameters though Internet browser.	1370,00
3	TRM102-D	TRM102 + built-in memory for data recording. Registered data are available as *.csv* files through WWW server.	1370,00
4	TRM102-DW	TRM102-W + TRM102-D	1500,00
5	TRM202	TRM102 + **GSM/GPRS**.	1590,00
6	TRM202-W	TRM102-W + **GSM/GPRS**.	1990,00
7	TRM202-D	TRM102-D + **GSM/GPRS**.	1990,00
8	TRM202-DW	TRM102-DW + **GSM/GPRS**.	2120,00
9	TRM112	ECL200/300 controller operation – bi-directional data exchange (write/read) with controller **in service protocol**. Modbus TCP protocol available from Ethernet side. Energy meters with MBus protocol connected to converter through separate serial port[2].	970,00
10	TRM112-W	TRM122 + built-in WWW mini-server, allowing for viewing and controlling of controller parameters though Internet browser.	1370,00
11	TRM112-D	TRM112 + built-in memory for data recording. Registered data are available as *.csv* files through WWW server.	1370,00
12	TRM112-DW	TRM112-W + TRM112-D	1500,00
13	TRM212	TRM112 + **GSM/GPRS**.	1590,00
14	TRM212-W	TRM112-W + **GSM/GPRS**.	1990,00
15	TRM212-D	TRM112-D + **GSM/GPRS**.	1990,00
16	TRM212-DW	TRM112-DW + **GSM/GPRS**.	2120,00

1. ECL300 controller equipped with ECA71 communication card
2. Required external MBus10 converter (RS232 standard into MBus)

4.2. Accessories

No.	Type	Description	Net price in PLN
1	MBus10	Converter RS232-MBUS	327,00
2	GSM-ANT01S	Straight GSM antenna, male SMA	35,00
3	GSM-ANT01R	Angular GSM antenna, male SMA	35,00
4	99	Magnetic antenna, male SMA, 3 m antenna cable	48,00

4.3. Additional inputs-outputs in TRM

No.	Type	Description	Net price in PLN
1	8DI	eight digital inputs 0-30Vdc	110,00
2	6DOT	six digital transistor outputs 30Vdc 100mA max	115,00
3	2DOTR	two digital transistor outputs 30Vdc max and two digital relay outputs 230Vac 1A max	135,00
4	4AI	four analogue inputs 0..10V	360,00

4.4. Additional communication ports in TRM

No.	Type	Description	Net price in PLN
1	R5R	Additional **RS485** port Modbus RTU Master protocol	95,00
2	R5P	Additional **RS485** port transparent communication	55,00
3	R2R	Additional **RS232** port Modbus RTU Master protocol	85,00
4	R2P	Additional **RS232** port transparent communication	45,00
5	R2M	Additional **RS232** port MBus Master protocol for communication with energy meters	85,00

4.5. External expansion modules TRM-7000

Temperature analogue inputs			
No.	Type	Description	Net price in EUR*
1	TRM-7033	module of three inputs for temperature sensors Pt100, Pt1000, Ni120, Cu100, Cu1000	156,00
2	TRM-7015	module of six inputs for temperature sensors Pt100, Pt1000, Ni120, Cu100, Cu1000	190,40

Universal analogue inputs			
No.	Type	Description	Net price in EUR*
1	TRM-7017	module of eight voltage inputs 0~10V	152,00
2	TRM-7017C	module of eight current inputs 0~20mA or 4~20mA	152,00

Universal analogue outputs			
No.	Type	Description	Net price in EUR*
1	TRM-7024	module of four analogue inputs 0~20mA, 4~20mA, 0~10V	171,20

Insulated digital inputs			
No.	Type	Description	Net price in EUR*
1	TRM-7041	module of fourteen digital inputs with galvanic separation	67,20

Insulated digital inputs			
No.	Type	Description	Net price in EUR*
1	TRM-7045	module of sixteen digital inputs with galvanic separation	80,80

Accessories			
No.	Type	Description	Net price in EUR*
1	TRI-7510	RS485 bus amplifier	45,60

*Recalculation from EUR to PLN will be realized according to sale rate of BZ WBK bank from the invoice issue date.

Notes:
List of external expansion modules is continuously expanded. If you cannot find the module with required configuration in the list above, contact our company.

4.6. Discounts, notes

Discounts for above catalogue prices in PLN depend on ordered quantity:
- 10-19 pcs. - 4%
- 20-49 pcs. - 8%
- 50-99 pcs. - 11%
- 100+ pcs. - 15%

Notes:
1. Discounts may be calculated only for prices in PLN.
2. Prices in EUR are fixed, and are not subjected to discount according to above principles.
3. Prices in this price list do not include VAT 22%.
4. Recalculation from EUR to PLN will be realized according to sale rate of BZ WBK bank from the invoice issue date.