

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 **Błąd! Nie można odnaleźć źródła odwołania.** on page **Błąd! Nie zdefiniowano zakładki.** 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 **Błąd! Nie można odnaleźć źródła odwołania.** on page **Błąd! Nie zdefiniowano zakładki.**, 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.

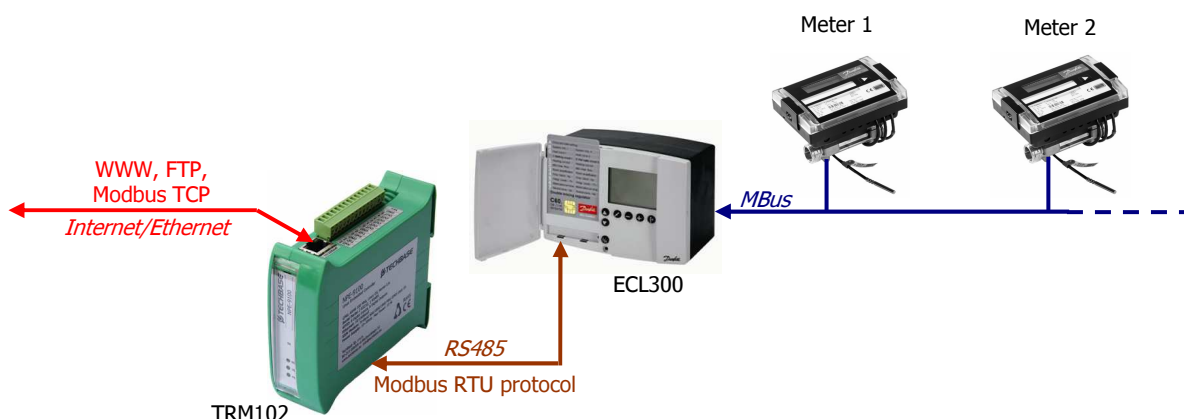
2.1. Block diagram of TRM112 converter installation

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



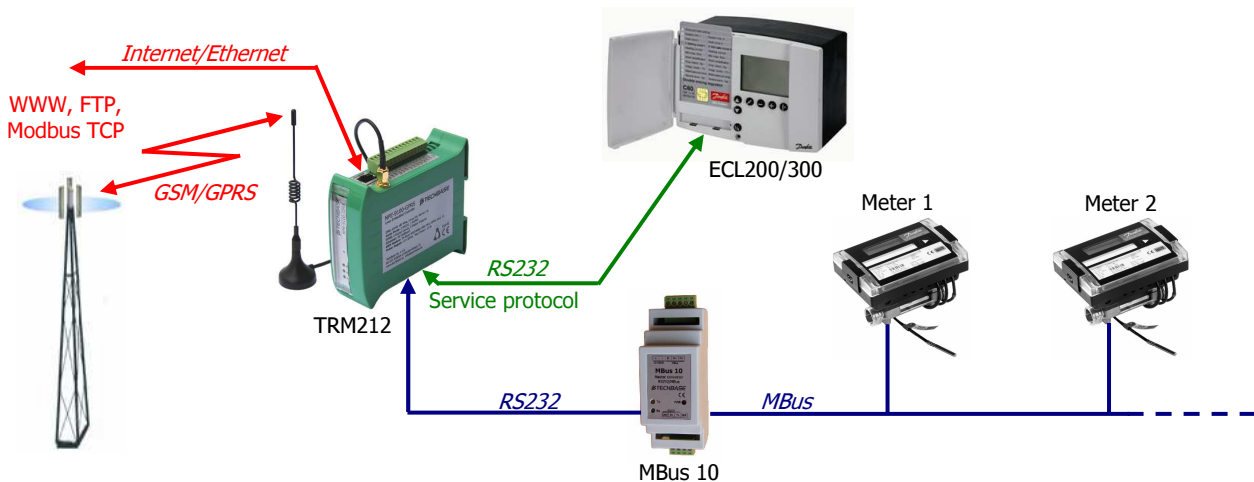
2.2. Block diagram of TRM102 converter installation

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

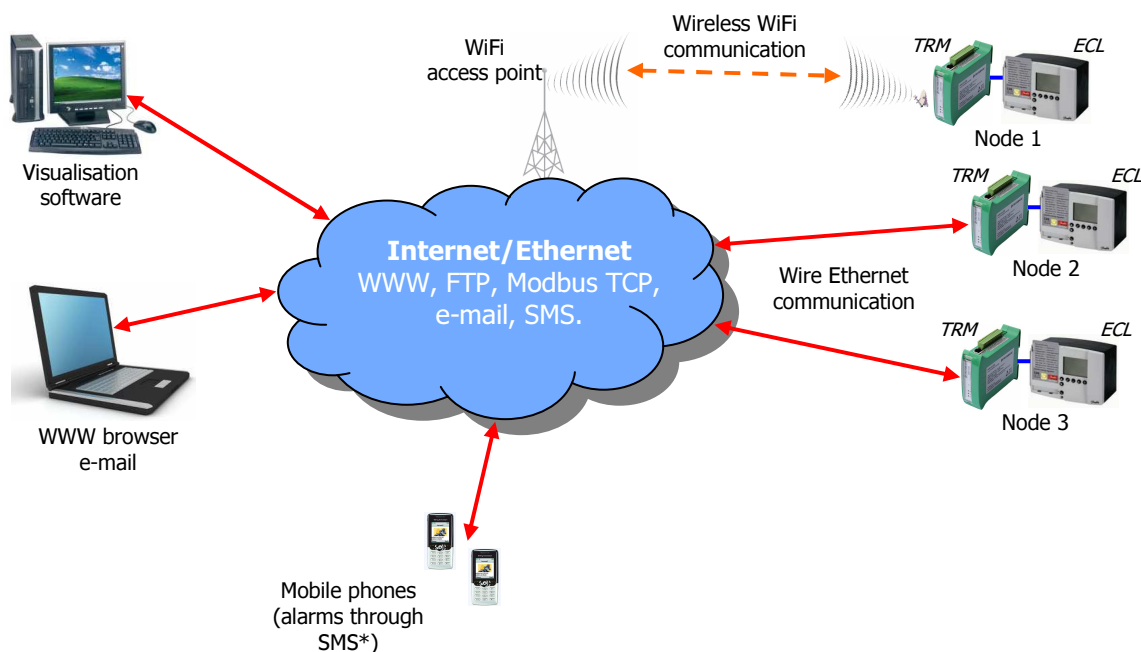
Communication with ECL300 and meters in MBus RTU protocol. Meters connected to the controller through ECA73, which allows for communication with them indirectly through the controller also in Modbus RTU protocol.



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.



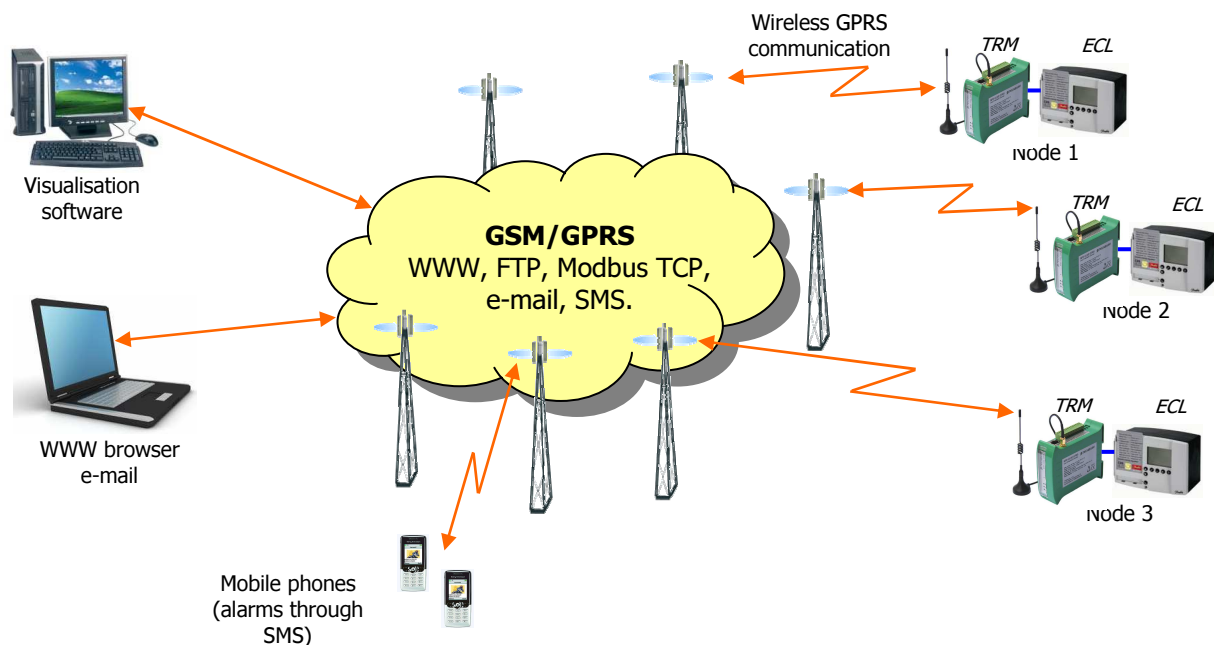
Internet/Ethernet communication architecture

* 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.



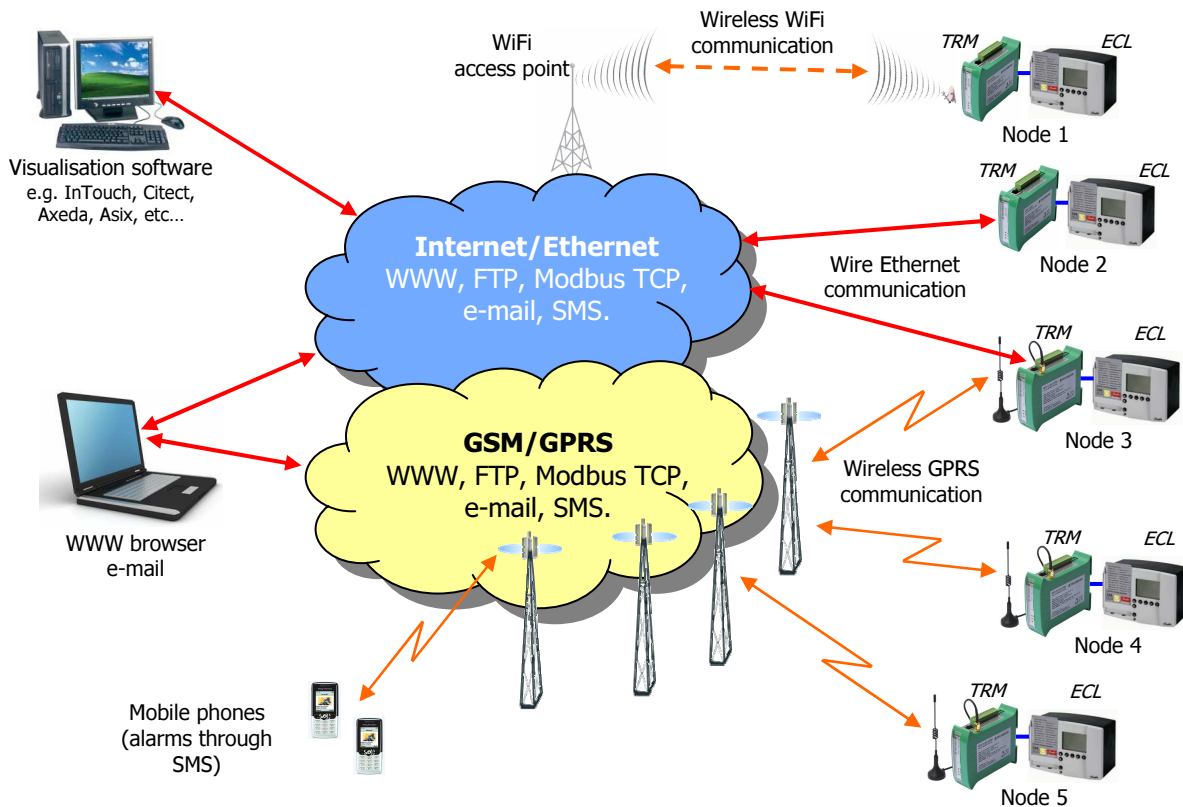
GSM/GPRS communication architecture

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

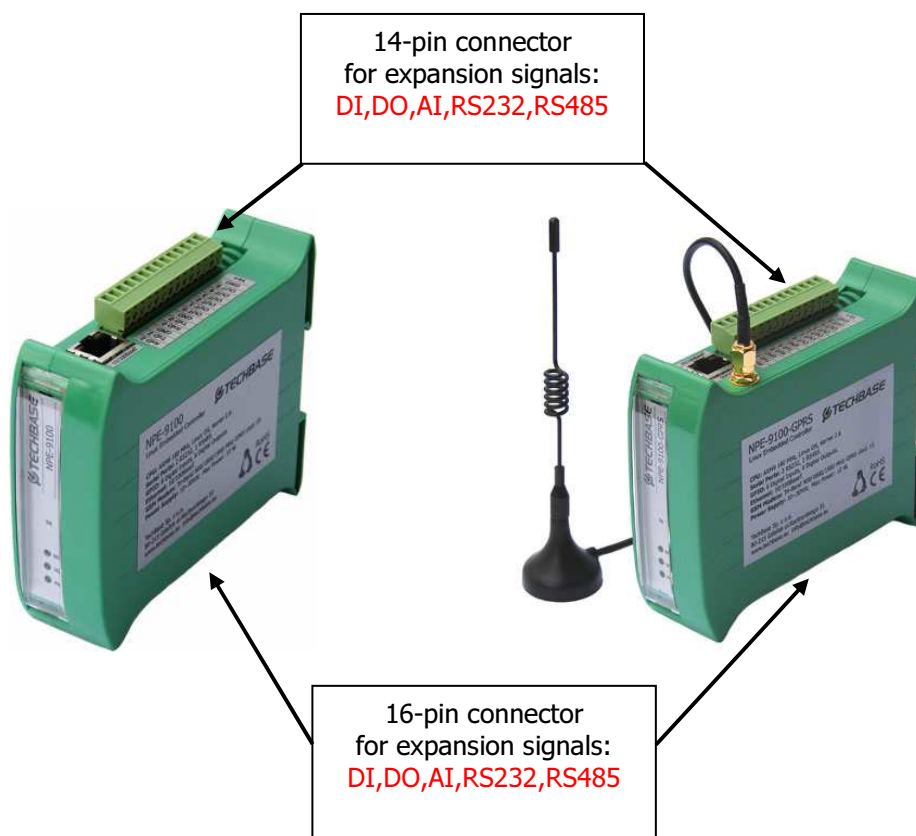
TRM converters resources may be expanded in two ways:

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 telemetry 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.

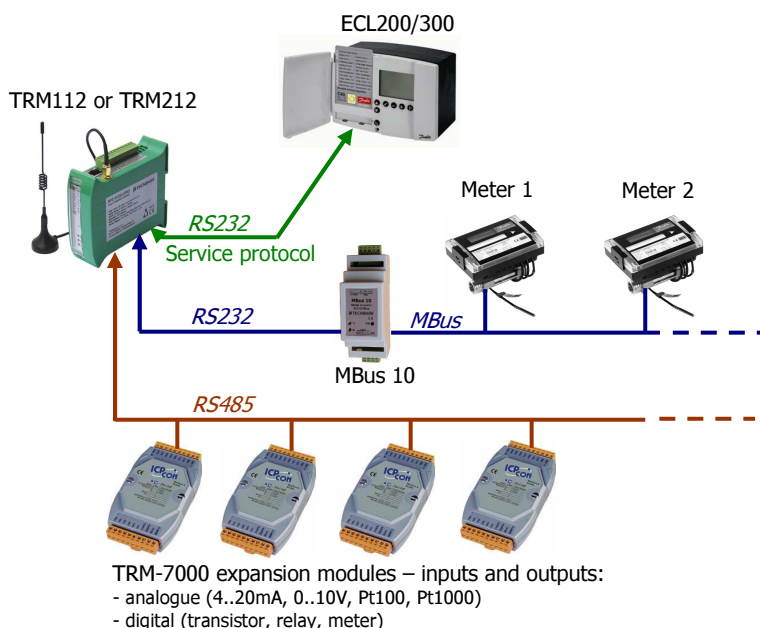


Connectors for signals expanding built-in resources of TRM converters

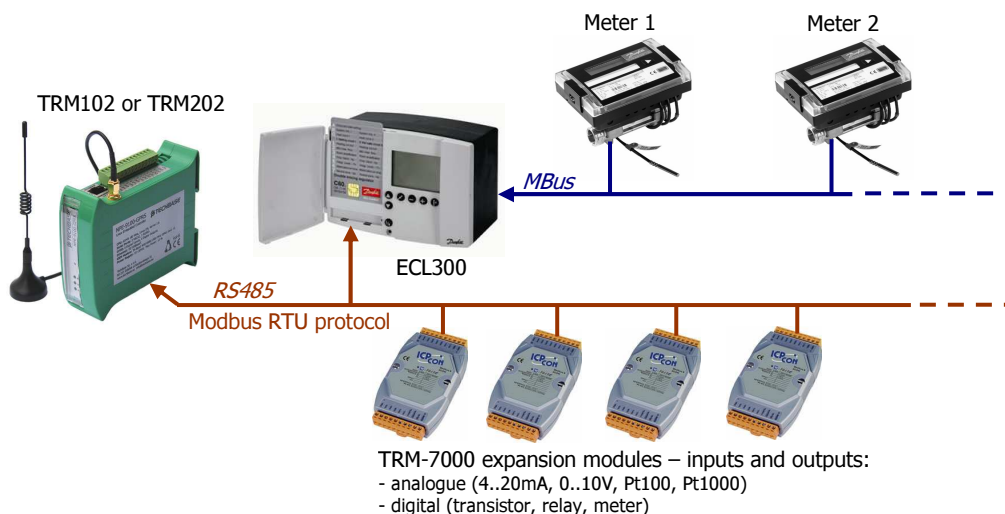
2.8.2 External expansions – TRM-7000 modules series

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:

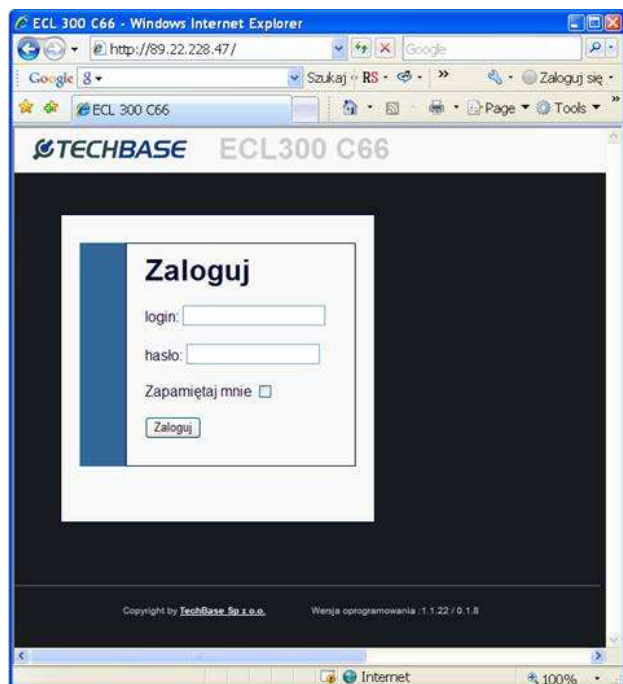


Connecting modules TRM-7000 to TRM102 and TRM202 converters:



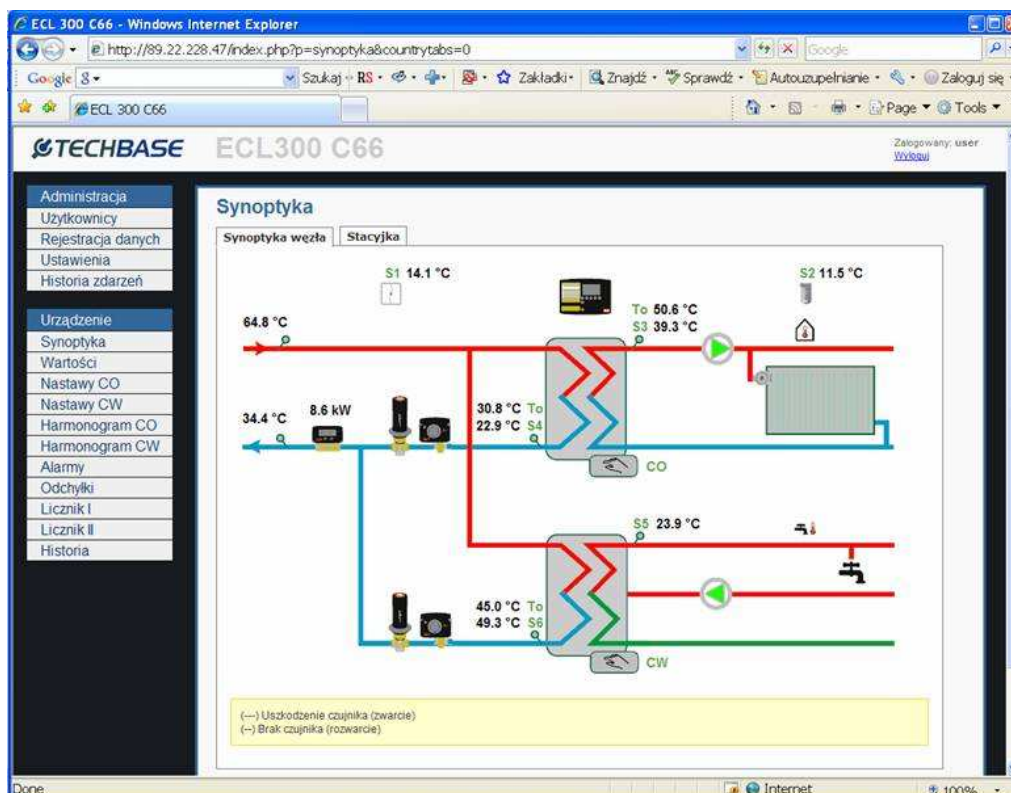
2.9. Examples of visualisation screens – WWW option

2.9.1 System logging

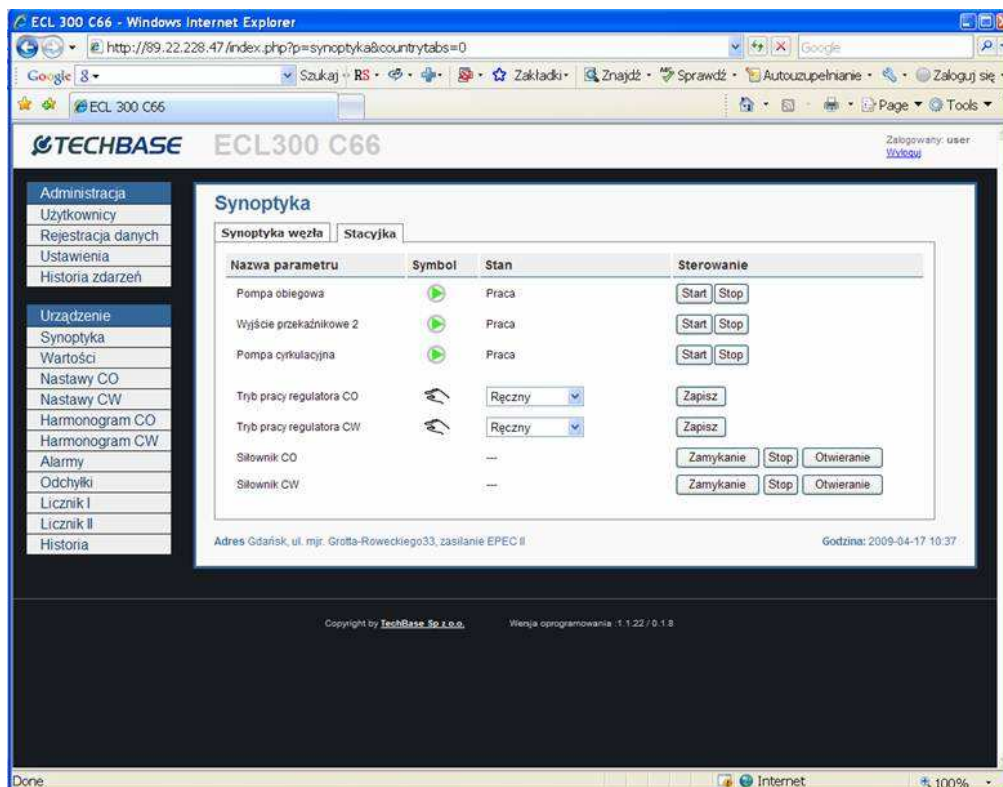


- After TRM system installation centres monitoring without installation of additional software
- Standard Internet browser is enough
- For systems with SCADA software, e.g. Intouch, Axeda, Citect, Asix, iFix, etc., easy communication in open Modbus TCP protocol

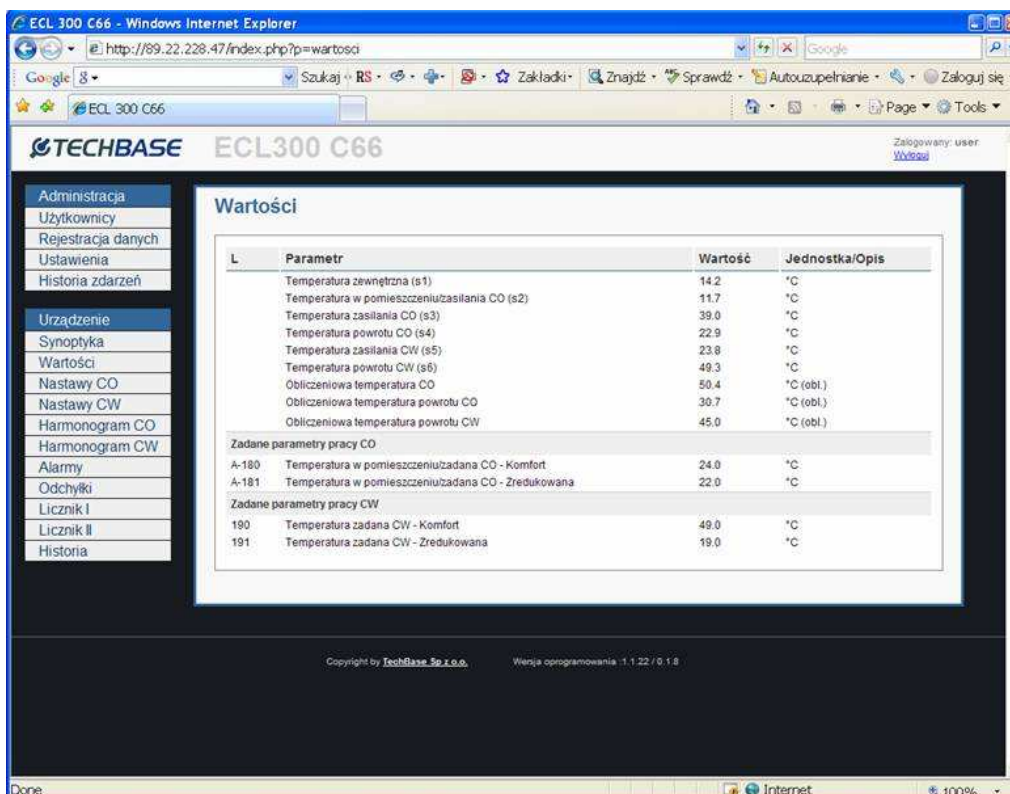
2.9.2 Centre diagnostics



2.9.3 Controller keylock



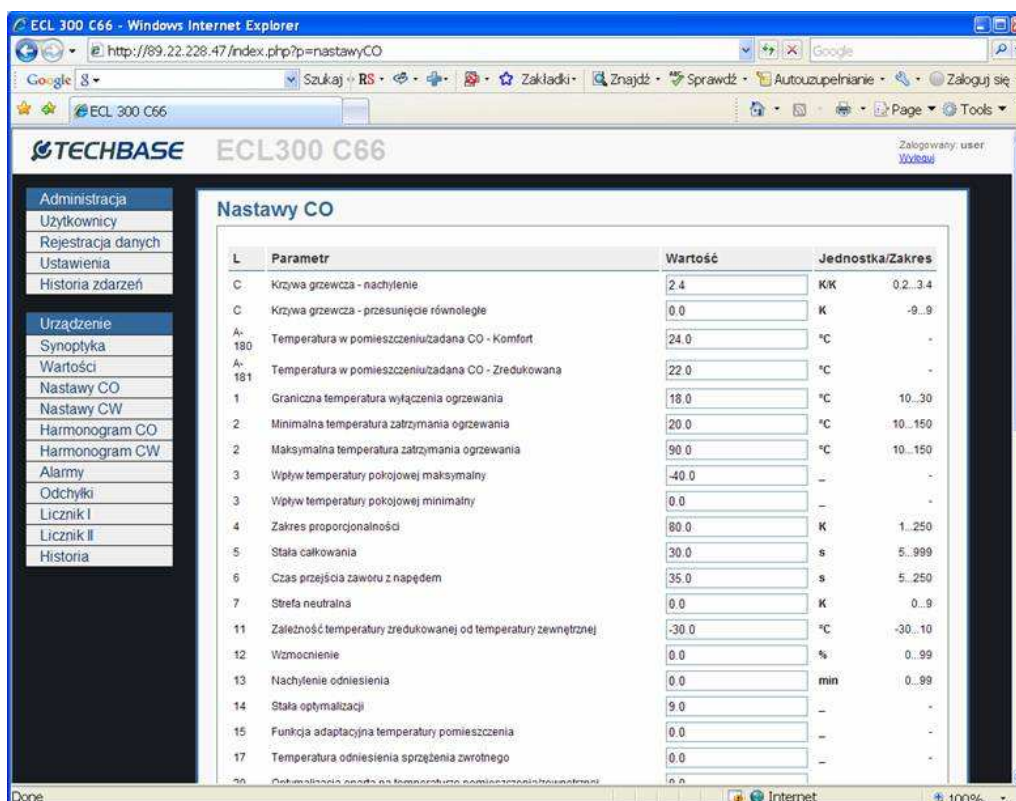
2.9.4 Table of parameters values



Wartości

| L | Parametr | Wartość | Jednostka/Opis |
|----------------------------------|---|---------|----------------|
| | Temperatura zewnętrzna (s1) | 14.2 | °C |
| | Temperatura w pomieszczeniu/zasilania CO (s2) | 11.7 | °C |
| | Temperatura zasilania CO (s3) | 39.0 | °C |
| | Temperatura powrotu CO (s4) | 22.9 | °C |
| | Temperatura zasilania CW (s5) | 23.8 | °C |
| | Temperatura powrotu CW (s6) | 49.3 | °C |
| | Obliczeniowa temperatura CO | 50.4 | °C (obl.) |
| | Obliczeniowa temperatura powrotu CO | 30.7 | °C (obl.) |
| | Obliczeniowa temperatura powrotu CW | 45.0 | °C (obl.) |
| Zadane parametry pracy CO | | | |
| A-180 | Temperatura w pomieszczeniu/zadana CO - Komfort | 24.0 | °C |
| A-181 | Temperatura w pomieszczeniu/zadana CO - Zredukowana | 22.0 | °C |
| Zadane parametry pracy CW | | | |
| 190 | Temperatura zadana CW - Komfort | 49.0 | °C |
| 191 | Temperatura zadana CW - Zredukowana | 19.0 | °C |

2.9.5 Controller setpoints



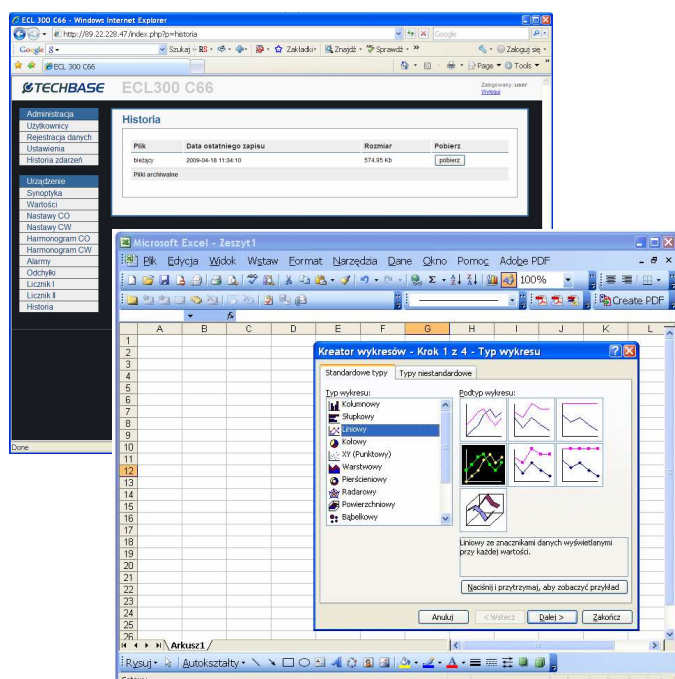
2.9.6 Data registering



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



- *.txt files ready for analysis in other programs



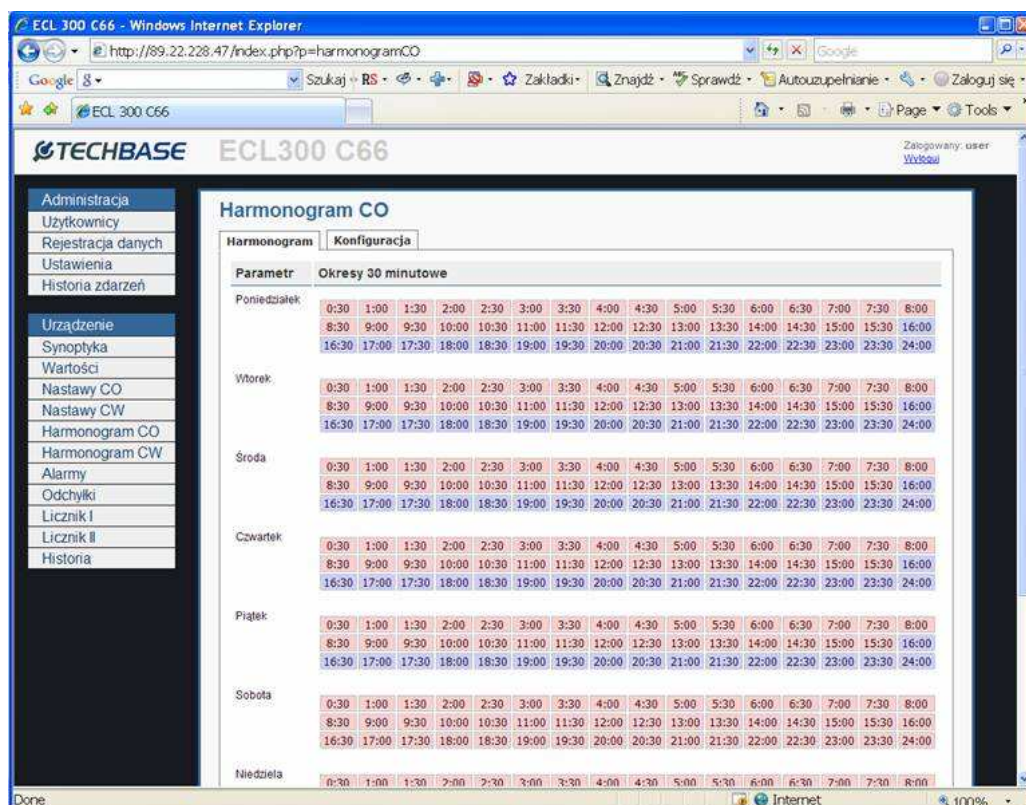
- Flexible data presentation as graphical charts in MS Excel spreadsheet.

- Quick data integration with settlement systems

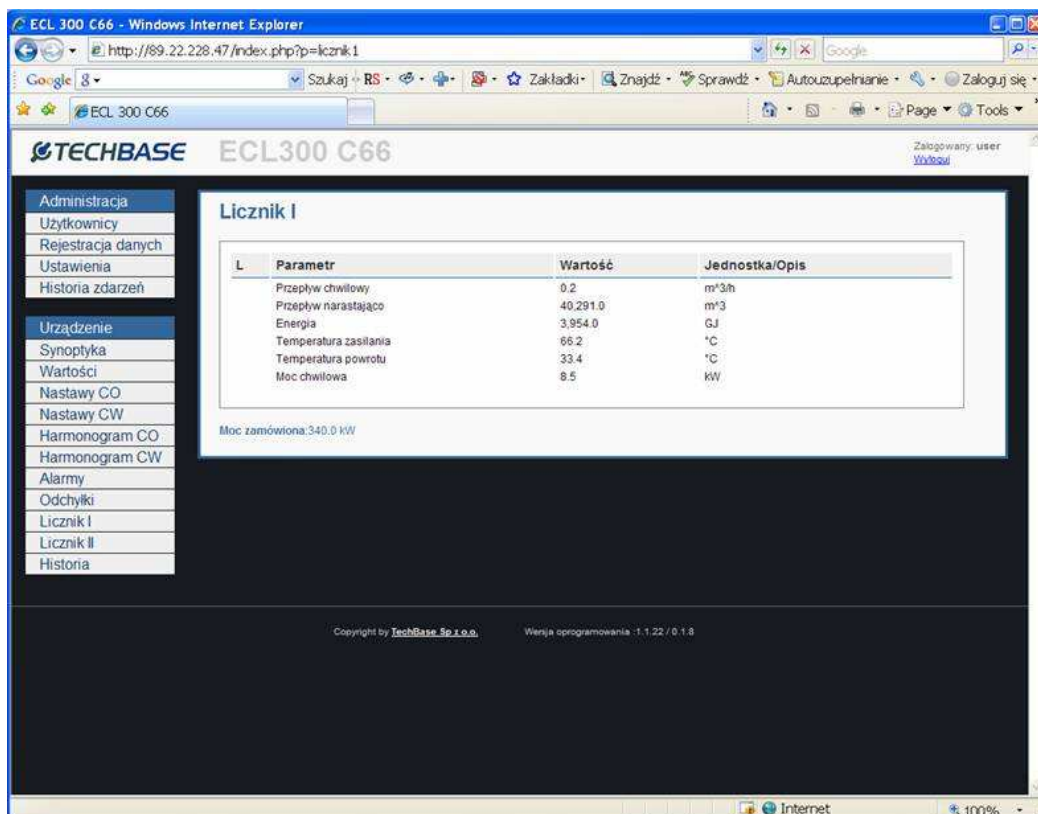
- Registering of logging users

-

2.9.7 Time schedule



2.9.8 Data from energy meters

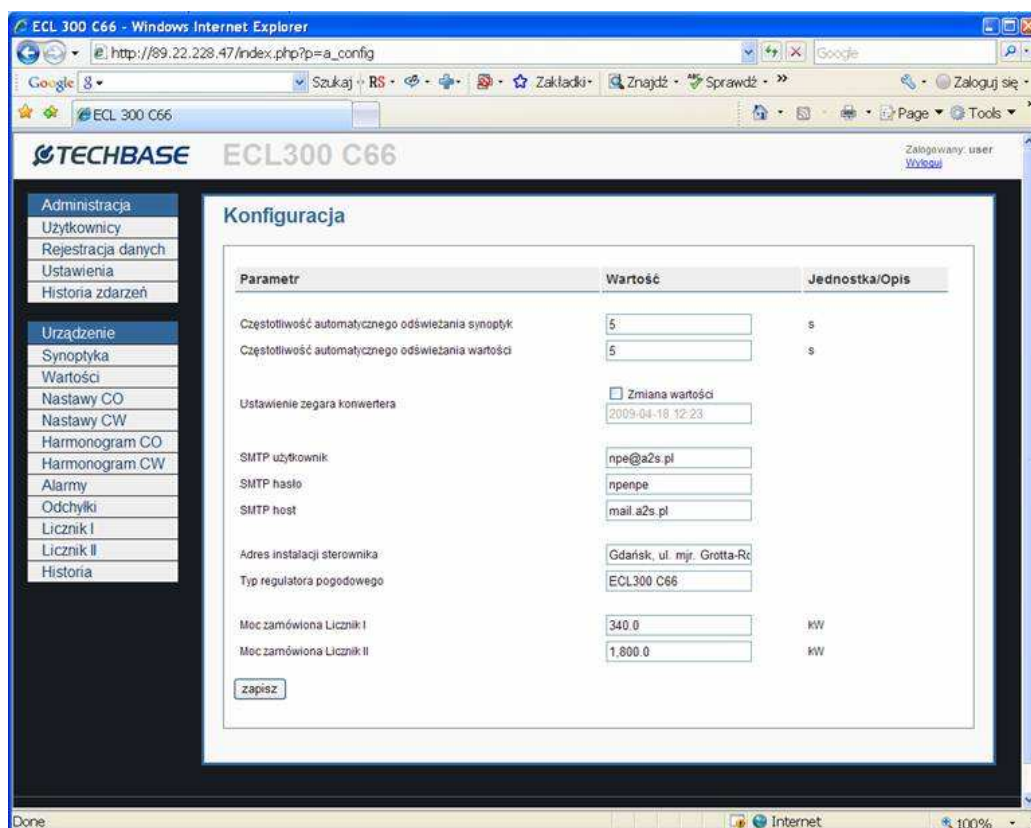


Licznik I

| L | Parametr | Wartość | Jednostka/Opis |
|---|-----------------------|----------|----------------|
| | Przepływ chwilowy | 0.2 | m³/s |
| | Przepływ narastająco | 40.291.0 | m³ |
| | Energia | 3.954.0 | GJ |
| | Temperatura zasilania | 66.2 | °C |
| | Temperatura powrotu | 33.4 | °C |
| | Moc chwilowa | 8.5 | kW |

Moc zamówiona: 340.0 kW

2.9.9 Configuration



| Parametr | Wartość | Jednostka/Opis |
|---|--|----------------|
| Częstotliwość automatycznego odświeżania synoptyk | 5 | s |
| Częstotliwość automatycznego odświeżania wartości | 5 | s |
| Ustawienie zegara konwertera | <input type="checkbox"/> Zmiana wartości 2009-04-18 12:23 | |
| SMTP użytkownik | npe@a2s.pl | |
| SMTP hasło | npenpe | |
| SMTP host | mail.a2s.pl | |
| Adres instalacji sterownika | Gdańsk, ul. mjr. Grotta-Ro | |
| Typ regulatora pogodowego | ECL300 C66 | |
| Moc zamówiona Licznik I | 340.0 | KW |
| Moc zamówiona Licznik II | 1,800.0 | KW |

zapisz

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 RTU¹ 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 through 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 | TRM112 + built-in WWW mini-server, allowing for viewing and controlling of controller parameters through 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:

| N o. | Type | Description | inputs-outputs ⁸ | | | |
|------|-------|--|-----------------------------|-----|-----|-----|
| | | | D I | DOT | DOR | A I |
| 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:

| N o. | 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.