![Conel logo]

GPRS modem **CGU 04i**
USER´S GUIDE

**Declared system
ISO 9001:2009**

CE

Contents

Symbols used

Danger – important notice, which may have an influence on the user's safety or the function of the device.

Attention – notice on possible problems, which can arise to in specific cases.

Information, notice – information, which contains useful advices or special interest.

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1. Safety instructions

Please observe the following safety instructions:

- The communication module must be used in compliance with all applicable international and national laws and in compliance with any special restrictions regulating the utilization of the communication module in prescribed applications and environments.

- Use only the original Conel company accessories. Thus you will prevent possible health risks and damage to the devices and ensure compliance with all relevant provisions. Unauthorised adjustments or use of unapproved accessories may result in damage to the module and breach of applicable laws. Use of unapproved adjustments or accessories may lead to cancellation of guarantee, which has no effects on your legal rights.

- The communication module CGU 04i must not be opened. Only the replacement of the SIM card and expansion port is permitted.

- **Caution!** The SIM card could be swallowed by small children.

- Voltage at the feed connector of the communication module must not be exceeded.

- Do not expose the communication module to extreme conditions. Protect it from dust, moisture and heat.

- It is recommended not to use the communication module at petrol stations. We remind users to observe the limitations of radio devices use at pump stations, chemical plants or where explosives are being used.

- Switch the communication module off in a plane. Use of the communication module may endanger plane's functions, interfere with mobile network and be illegal. By not following these instructions the customer risks cancellation or termination of telephone services, prosecution or both.

- You have to be extremely careful when using the communication module in proximity to medical devices, such as pacemakers or hearing aids.

- Close to TV sets, radios and PCs the module may cause interference.

- It is recommended to create proper copy or backup of all the important settings saved in the device's memory, to database by help program Radwin, reference [3].

2. Description of the communication module CGU 04i

2.1. General

GSM/GPRS communication module CGU 04i is a wireless data transmission device. The communication module is one of the basic elements of AGNES GPRS system. The system AGNES characteristics are described in reference **[1]**. GSM-GPRS infrastructure is used for the wireless communication as a line layer. ARNEP protocol is implemented above the line layer. The protocol ARNEP is described in reference **[2]**. On its basis the modules create virtual private data network where data can be transferred between user devices via any protocols.

One may simply imagine the CGU 04i module as a protocol converter between the user device (PLC automatic, PC, data terminal, etc.) and GSM-GPRS infrastructure of a mobile network operator, it provides the user with possibility to communicate simply between all the systems. Apart from data transfers via GPRS the CGU 04i module enables SMS.

The radio component GSM-GPRS is built in the CGU 04i module, consisting module Cinterion.

GSM-GPRS module CGU 04i is controlled by communication 32-bit microprocessor. It ensures GSM-GPRS communication, data transfer on serial user interfaces and a number of diagnostic and service features. CGU 04i module in the basic version has one serial user interface (communication port) RS232, one interface for direct connection of inputs and outputs (CIO) for data collection and technological process management and one optional user interface (RS232, RS422, RS485, M-BUSD, CNT). It is possible to set transfer parameters and communication protocol for each user interface separately. As a result you may communicate with various user interfaces using different communication protocols on serial interface.

2.2. Examples of possible applications

- Security systems
- Telematics
- Telemetry
- Vending and dispenser machines

2.3. Compatibility with other Conel company modems

Regarding the communication and data transfers the CGU 04i module is compatible with the older CGU 04 type (or CGU 02). This means it is possible to combine both types in one network and simply extend an existing network of CGU 04 (CGU 02) modules with new communication points using CGU 04i modules. CGU 04i provides some features not included in the older CGU 04 type.

User and industrial communication protocol implemented on serial interfaces are compatible with the protocols used for Conel radio modems (e.g. CDA 70). Thus you may establish complex combined data networks consisting of both radio and GPRS modems.

2.4. Description of CGU 04i components

2.4.1 GSM module

Cinterion module is used for GSM network wireless communication. It is integrated into printed circuit board. FME antenna connector is accessible from the back panel. Release SIM card reader is located on the front panel.
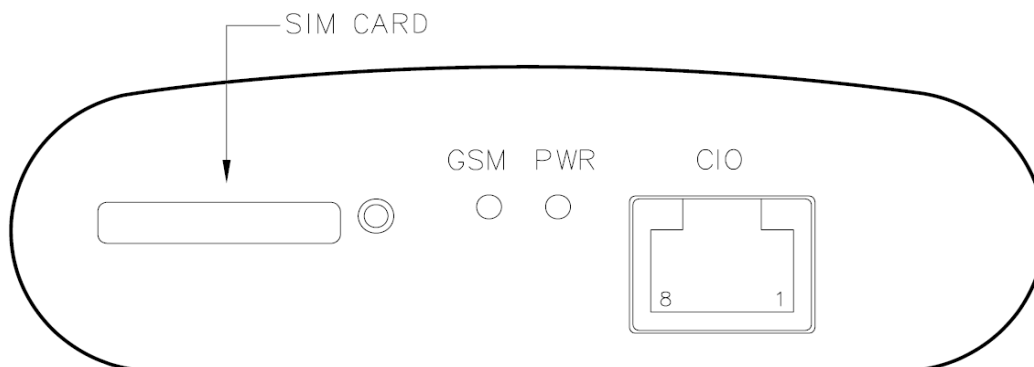
The MC39i module communicates in three GSM bands (900 MHz, 1800 MHz and 1900 MHz). It can transmit in two „Time Slots" and receive in four (GPRS multi-slot class 10 – maximum reception bit speed 85.6 kb/s). It supports CS-1, CS-2, CS-3 and CS-4 encryptions).

2.4.2 Control microprocessor

Thirty-two-bit microprocessor Freescale Coldfire with 64 kB SRAM backup memory, 512 kByte FLASH EEPROM memory and realtime circuit with reserve power supply makes for the basis of CGU 04i control microprocessor. Software is based on realtime operating system that processes simultaneous tasks. Thus parallel operation of all external interfaces of the communication module is maintained.

The microprocessor is connected through serial interface to MC39i OEM module and controls the communication via GSM-GPRS. Towards a user it is connected on serial interfaces RS 232 (PORT1), and direct I/O signal processing circuits. The microprocessor enables connection of up to two user devices through two interfaces. The second ports are linked to RJ45 connectors marked PORT2. This interface may be RS232, RS422, RS485, M-BUSD or CNT. All user interface signals are protected against overvoltage on the data cable.

A device with different communication protocol can be connected to each interface. The microprocessor may work as a protocol converter between separate serial user interfaces.

In case other than RS232 interface device needs to be connected, e.g. RS485/422, it is possible to connect level converter to the serial port according to particular application. The microprocessor can control such external converter.

The microprocessor further manages numerous functions of servicing, diagnostic and installation purposes. Data transfer statistics, separate port communications, power blackouts, voltage of the reserve supply, CGU 04i temperature and other important information – everything is recorded in the microprocessor's memory.

CGU 04i settings are saved in FLASH EEPROM memory. Service SW RADWIN is designed for CGU 04i module configuration. The description of programme RADWIN is in reference **[3]**.

2.4.3 Telemetric inputs and outputs

Apart from serial data interfaces there is CIO interface established in the module. These are 5 signals to be used as analogue or binary inputs or binary outputs with an open collector. The input is analogue 0 – 5 V. It may be as digital with control level adjustment. The output is an open collector able to switch up to 500 mA. Reading and control of I/O signals is possible from the remote CGU 04i module or any serial user interface. Simple technological interface can be created by configuration of two CGU 04i modules, where you may control remote outputs on the other module's connector based on the input signals of one module.

Interface between CIO connector and technology is supplied for general use and it is possible supplied this, providing voltage and current inputs of adjustable ranges, inputs for resistance measuring (thermometers and the like), optically separated binary inputs and relay outputs. With the equipment you may establish simple telemetry at low cost, without the using of industrial control automates.

2.4.4 Optional hardware interface PORT2

PORT2 on the CGU 04i back panel provides for direct use of other HW interface than the standard RS232. It is due to the design of the interface as a separate module built inside CGU 04i. Thus you may use CGU 04i module combined with RS422, RS485, M-BUSD or CNT. Such interface is physically linked to RJ45 PORT2 connector.

2.4.5 User interface protocols

There are numerous industrial protocols implemented on the user interface:

- ARNEP UI
- PROFIBUS
- MBUS
- MODBUS
- AT modem
- SAUTER
- IWKA
- SBUS
- RADOM
- RDS CONEL

New protocols, not supported by the communication module yet, can be implemented according to the customer's needs. CGU 04i module also enables the implementation of own user protocol directly by the customer.

In case of M-BUS expansion board installed and when chosen protocol is not M-BUS or M-BUS TCP then sent data will be returned back to the device! If e.g. LINE protocol is set-up on this port, then data will return back to the source.
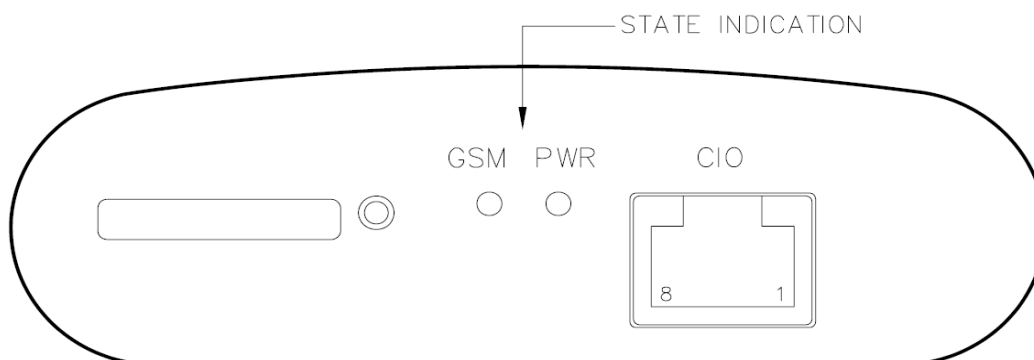
2.4.6 Sleep mode

On mounting module CNT – PORT2 the CGU 04i module contains voltage supply management. During idleness the module CGU 04i is switched to sleep mode, when energy demand is very slow (100 µA). Time of switch to sleep mode is programme adjustable. Module wake up it is possible of status change on port.

2.5. Technical parameters

GSM module		Cinterion
Complies with standards	Power safety EMC Radio parameters	ČSNEN 60 950:2000 ČSN ETSI EN 301 489-1:V1.2.1; -7:V1.1.1 ČSN EN 55022 3GPP TS51.010-1,V5.5.0 ČSN ETSI EN 301 511,V7.0.1
Frequency bands		EGSM900, GSM1800 and GSM1900 (GSM Phase 2/2+)
Transmit power		Class 4, 2 W for EGSM900 Class 1, 1 W for GSM1800
GPRS connection		GPRS multi-slot class 10 (4+2) GPRS mobile station class B
Communication speed	Transmission Reception	2 x Time slot (max. 42.8 kb/s) 4 x Time slot (max. 85.6 kb/s)
Temperature range	Function Storage	-20 ^{o}C to +55 ^{o}C -40 ^{o}C to +85 ^{o}C
Supply voltage		+10 to +30 V DC
Consumption	GPRS TX GPRS on-line GSM stand-by Sleep mode	3.5 W 1 W 350 mW 1 mW (on mounting module CNT – PORT2)
Dimensions		30 x 90 x 102 mm (moulding fixed to DIN 35 mm slat)
Weight		150 g
Antenna connector		FME – 50 Ohm
User interfaces	PORT1 PORT2 CIO	RS232 - connector RJ45 (300 b/s - 115 200 b/s) Optional - connector RJ45 (300 b/s - 115 200 b/s) RS232, RS422, RS485, M-BUSD, CNT – (2 counters, 2 binary inputs, 2 analogy inputs, 1 binary output - open collector) 5 SW adjustable inputs (analogue, binary) / outputs (open collector) – RJ45 connector

2.6. Module status indication

There are two LED indicators on the front panel informing on its status.

Colour	Description	Description
GREEN	PWR	Flashes once a sec……….……proper function Lights permanently…………...fault Off……………………….…….no DC supply or sleep mode
RED	GPRS	Lights permanently…………...neither serial established Flashes rapidly……………....serial connection being established, Flashes slowly……………….serial connection established Flashes together with PWR….station activation failed Inverse flashing to PWR……..no DNS connection Off…………………………......GSM GPRS communication established Flashes dimly………………...GPRS transmission or reception

- **Serial connection** – Establishment connection in face of GSM network at the level AT commands.

- **Station activation** – Modem authentication in global DNS, reference **[1]**.

- **DNS connection** – Establishment connection with distributed database for interface address translation to IP address.

- **GPRS** – General Packet Radio Services is transfer technology, which it work on co-called „transfer data packet", when the GPRS simply make use of free space (space=slot) in GSM network.

2.7. User interfaces (connectors)

There are RJ45 (PORT1 and PORT2), RJ12 (PWR) and FME (ANT) connectors located on the back panel. The two PORT1 and PORT2 (optional) connectors are for user interfaces. The fourth PWR connector is for supply adapter connection. Antenna is connected to the last, ANT connector.
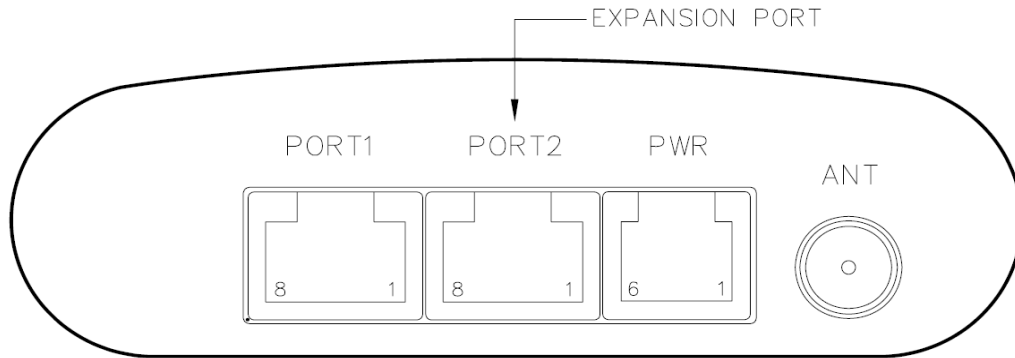
There is RJ45 (CIO) connector located on the front panel. The CIO connector is for direct input and output connections for data collection and technology control.

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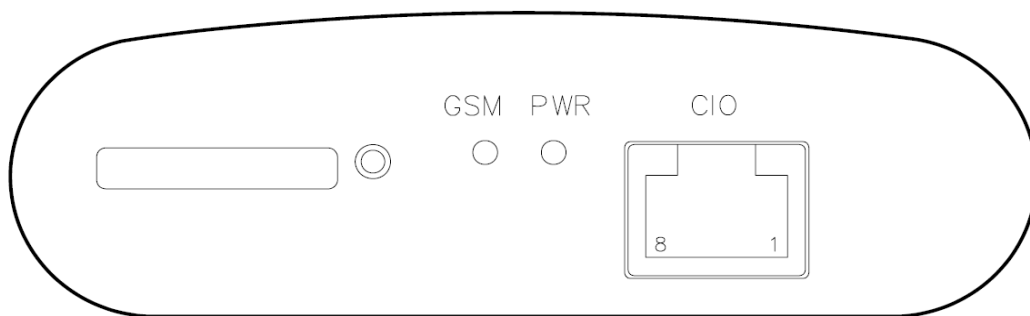
2.7.1 PORT1 (PORT2) connector - RS232
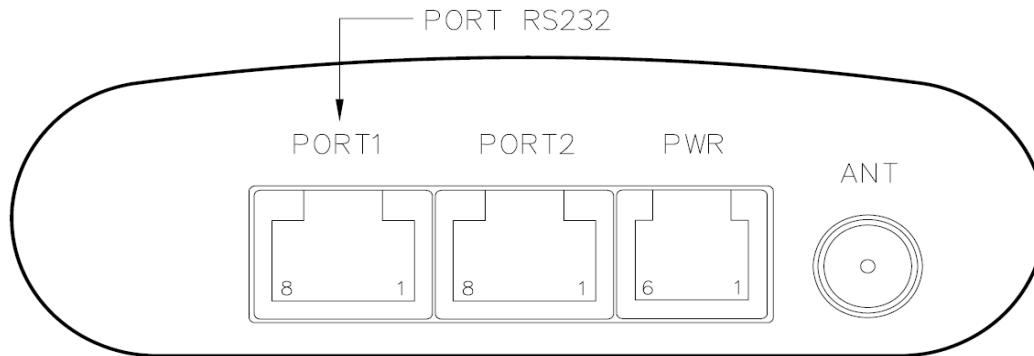
Panel socket RJ45 (RS232 – DCE - Data Communication Equipment).

Pin number	Signal mark	Description	Data flow direction
1	RTS	Request To Send	Input
2	CTS	Clear To Send	Output
3	DTR	Data Terminal Ready	Input
4	DSR	Data Set Ready – connected to +4 V through 330 Ohm	Output
5	GND	GROUND – signal ground	
6	RXD	Receive Data	Output
7	CD	Carrier Detect	Output
8	TXD	Transmit Data	Input

Example of the meter connection to the CGU 04i:
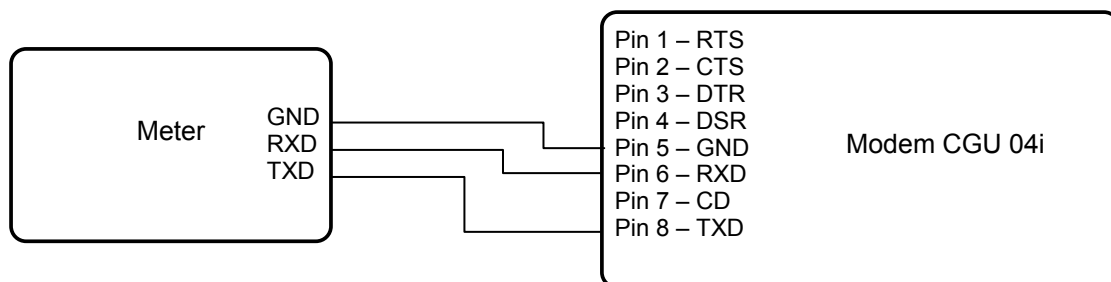
Example of the PC connection to the CGU 04i:

PORT1

Cable KD-2   PORT2   Modem CGU 04i

PWR
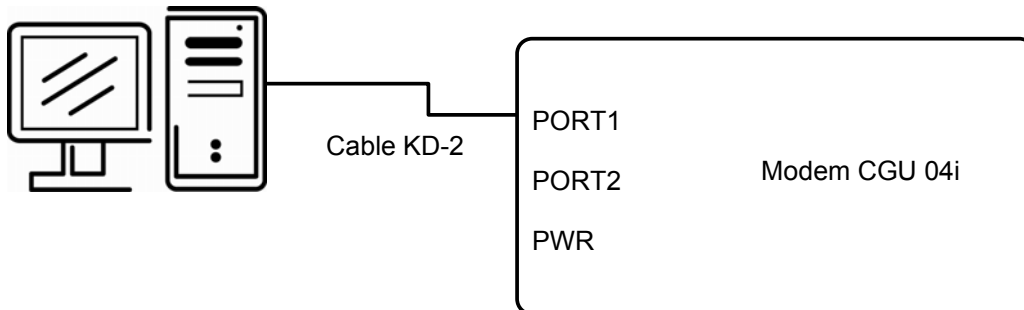
● Cable KD2 is connected to serial port PC (example COM1)

Example of the RS232 equipment connection to the CGU 04i (possibility to use all RS232 ports):

PORT1

Cable KD-2   PORT2   Modem CGU 04i

PWR
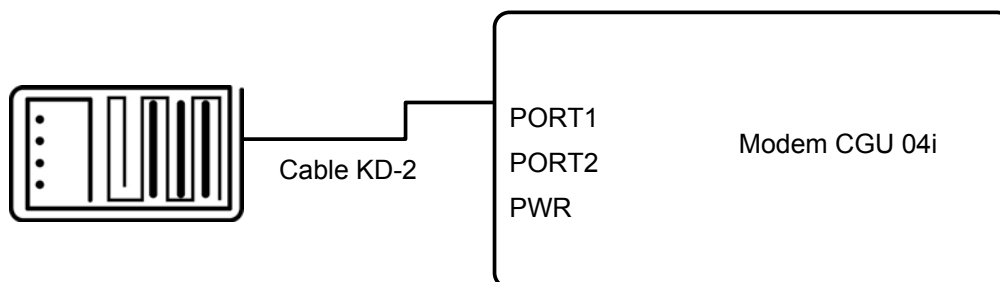
2.7.2 PORT2 connectors

On demand of the client it is possible mounting second interface. The second interface may be RS232, RS422, RS485, M-BUSD or CNT. If PORT2 isn't mounted, connector will not active.
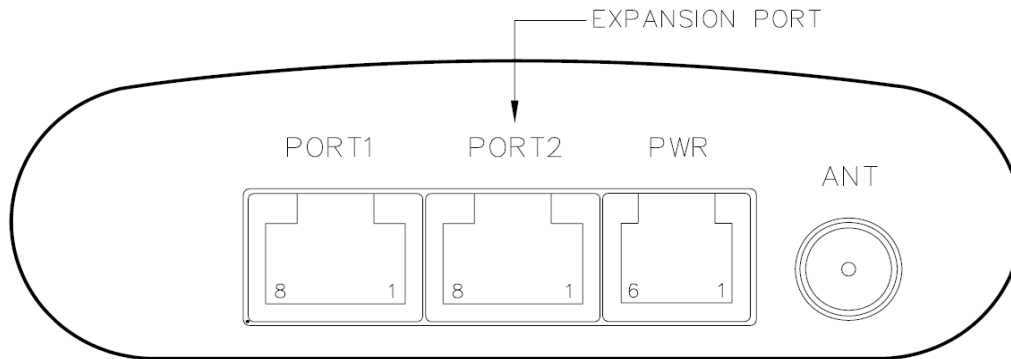
2.7.3 Connector PORT2 - RS485

Panel socket RJ45

Pin number	Signal mark	Description	Direction
1	GND	Signal and supply ground	
2	GND	Signal and supply ground	
3	TxRx-	RS485 B (-)	Input/Output
4	TxRx+	RS485 A (+)	Input/Output
5	TxRx-	RS485 B (-)	Input/Output
6	TxRx+	RS485 A (+)	Input/Output
7	+12V EXT	External supply	
8	+12V EXT	External supply	

BEWARE! Power supply is selected on module PORT2-RS485 by help jumper, ref. 2.9.

Circuit example of the equipment with a modem with data length less than 10 m:
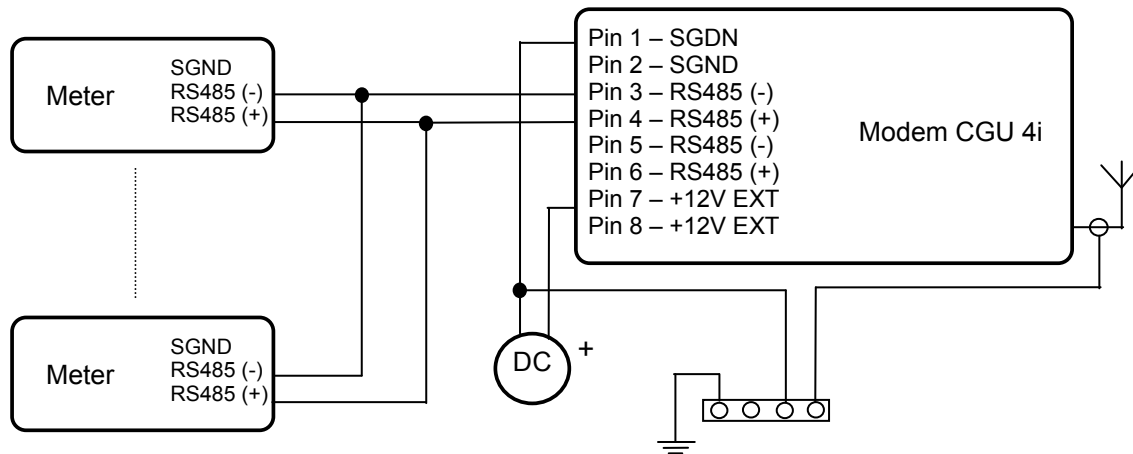
Circuit example of the equipment with a modem with data length more than 10 m:
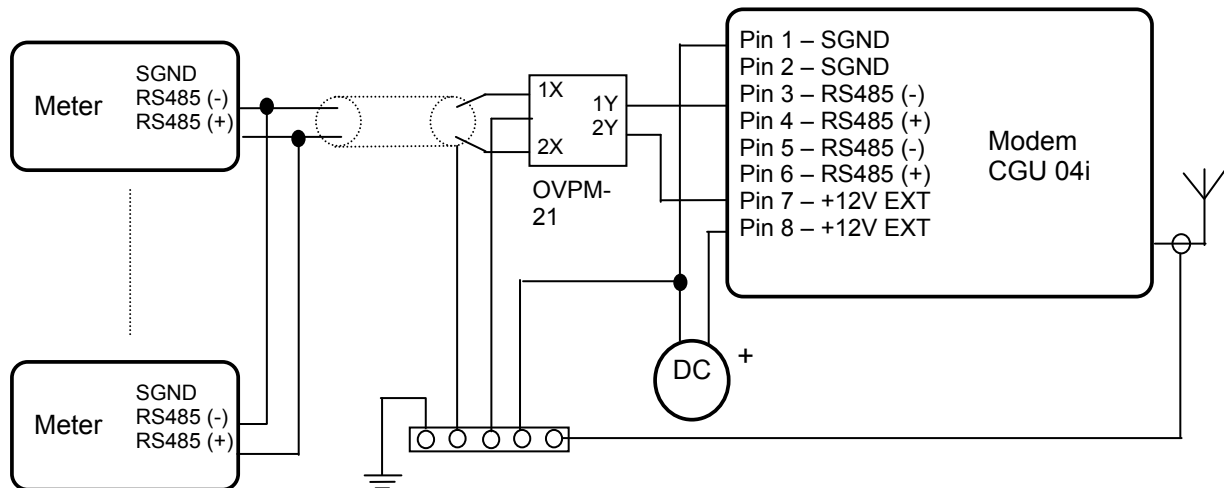
At RS485 data cable more than 10m it is need to use overvoltage protection on the modem side!

2.7.4 Connector PORT2 - RS422

Pin Number	Signal mark	Description	Data direction
1	GND	Signal and supply ground	
2	GND	Signal and supply ground	
3	RxD-	Receive Data (-)	Input/Output
4	RxD+	Receive Data (+)	Input/Output
5	TxD-	Transmit Data (-)	Input/Output
6	TxD+	Transmit Data (+)	Input/Output
7	+12V EXT	External supply	
8	+12V EXT	External supply	

ATTENTION! Power supply is selected on the expansion port RS422 by help of a jumper, ref. 2.9. If galvanic separation is required the converter must have an external power supply.

Circuit example of the equipment with modem with data length less than 10 m:

Circuit example of the equipment with a modem with data length more than 10 m:
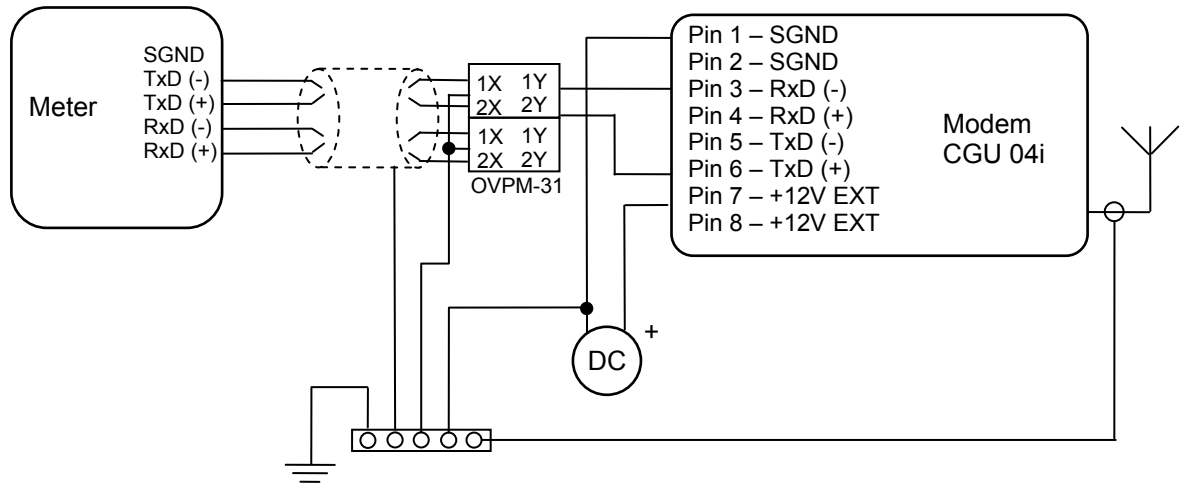
At RS422 data cable more than 10m it is need to use overvoltage protection on the modem side!

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2.7.4.1 Connector PORT2 – MBUSD

Panel socket RJ45

Pin number	Signal mark	Description	Direction
1	SGND	Signal and supply ground	
2	SGND	Signal and supply ground	
3	TxRx-	MBUS B (-)	Input/Output
4	TxRx+	MBUS A (+)	Input/Output
5	TxRx-	MBUS B (-)	Input/Output
6	TxRx+	MBUS A (+)	Input/Output
7	+12V EXT	External supply	
8	+12V EXT	External supply	

BEWARE! External supply is for converter MBUSD!
If galvanic separation is required the converter must have external power supply.

Circuit example of the equipment with a modem with data length less than 10 m:
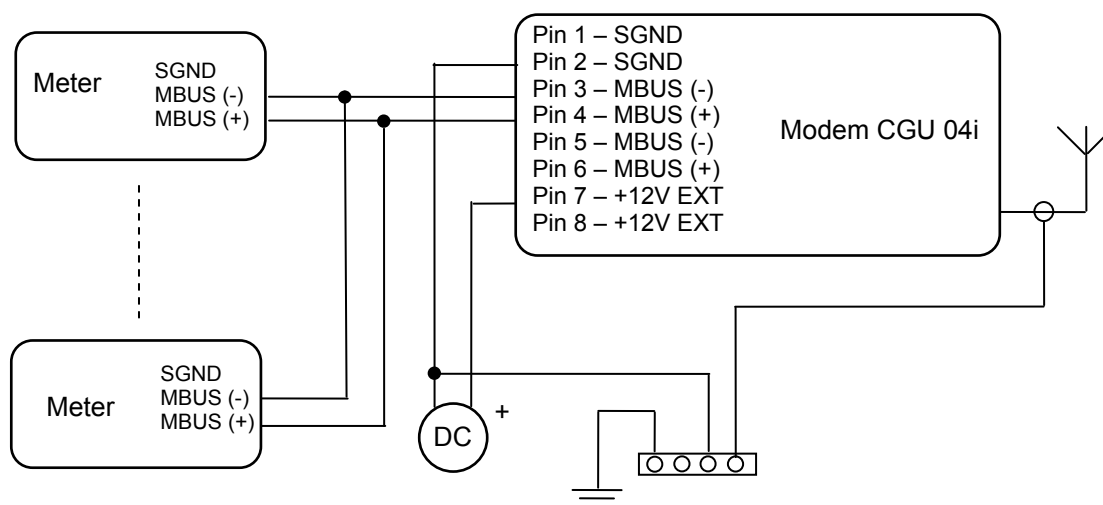
Circuit example of the equipment with a modem with data length more than 10 m:
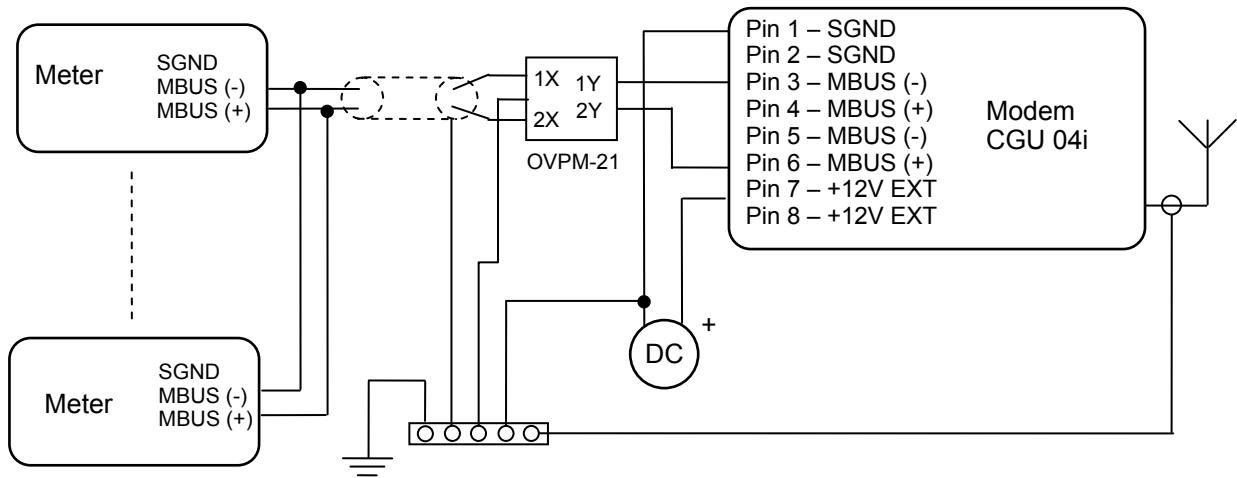
If an M-BUS data cable more than 10m it is need to use overvoltage protection on the router side!
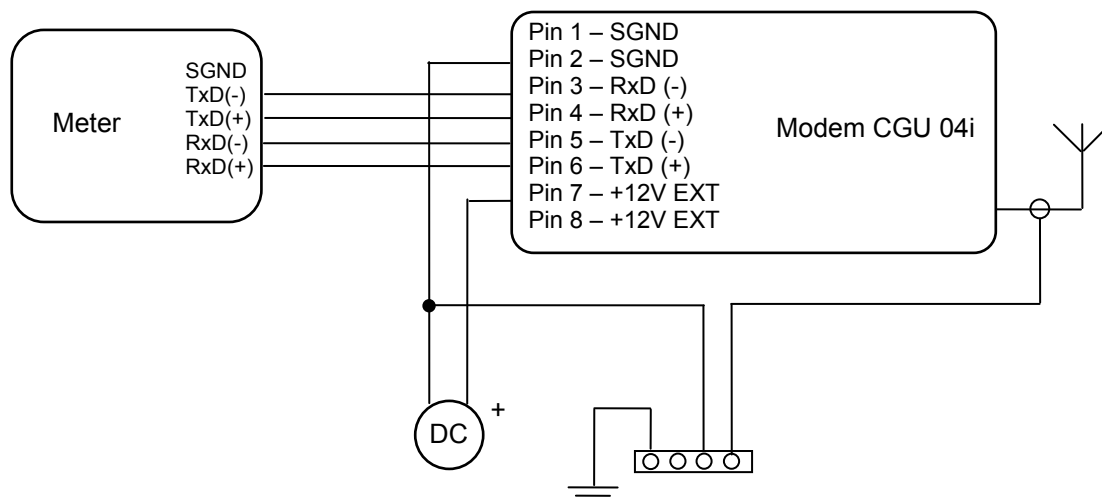
2.7.4.2 Connector PORT2 – CNT

Panel socket RJ45

Pin number	Signal mark	Description	Direction
1	BIN0/CNT0	Binary input/counter input	Input
2	BIN1/CNT1	Binary input/counter input	Input
3	BIN2	Binary input	Input
4	BIN3	Binary input	Input
5	GND	Signal ground	
6	OUT0	Binary output	Output
7	AN0	Analogy input	Input
8	AN1	Analogy input	Input

Typical connection of CGU 04i measuring circuits
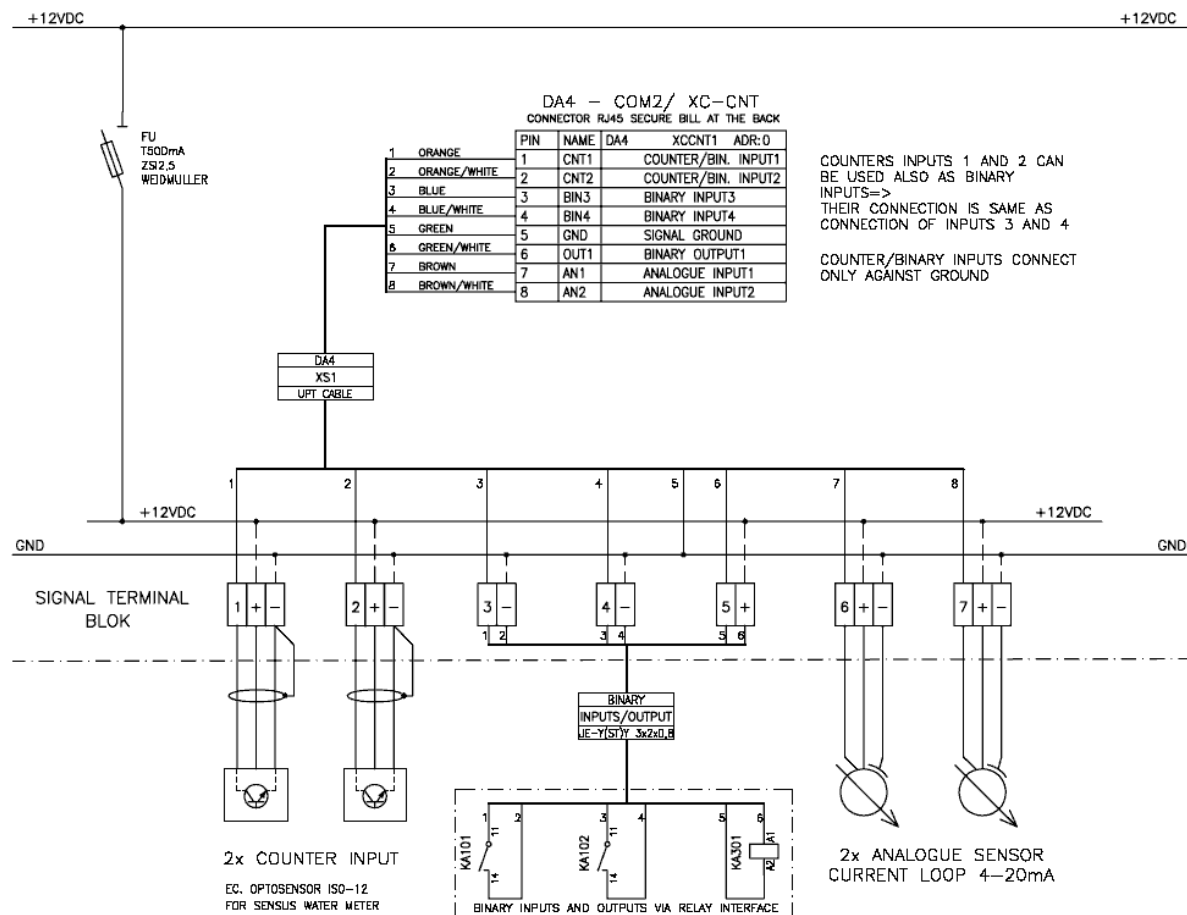
2.7.5 CIO connector
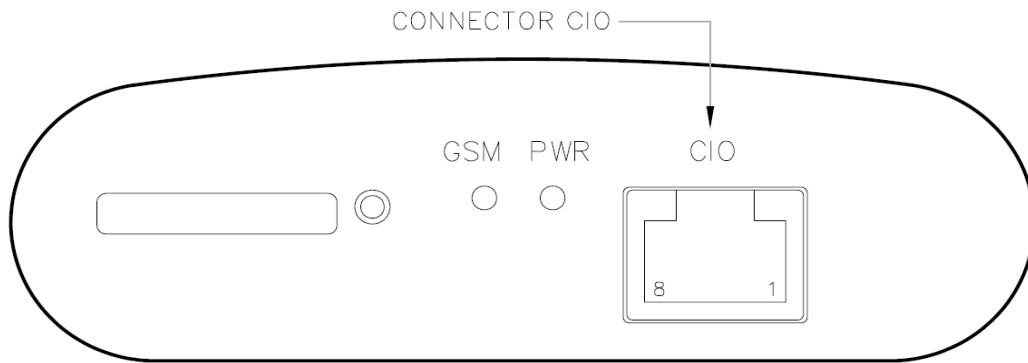
Panel socket RJ45

Pin number	Signal mark	Description	Direction
1	I/O 5	Input/Output – analogue or binary input or binary output (open collector)	Input/Output
2	I/O 4	Input/Output – analogue or binary input or binary output (open collector)	Input/Output
3	I/O 3	Input/Output – analogue or binary input or binary output (open collector)	Input/Output
4	+12V	Output + 12V supply of other circuits (connected directly to modem supply)	Output
5	GND	Signal and supply ground	
6	I/O 2	Input/Output – analogue or binary input or binary output (open collector)	Input/Output
7	I/O 1	Input/Output – analogue or binary input or binary output (open collector)	Input/Output
8	Service	For servicing purposes only	Input/Output

Circuit example:

The CIO 2 modules are connected by the help of KD-51 cable (cable 1:1). The connector K1 is input, K2 output to other CIO 2 module. By serial modems connection the addresses are automatically assigned. In the direction from modem the addresses raises uplink: 1,2,3,4 and 5. Maximal module number in series is five. See reference **[4]**.
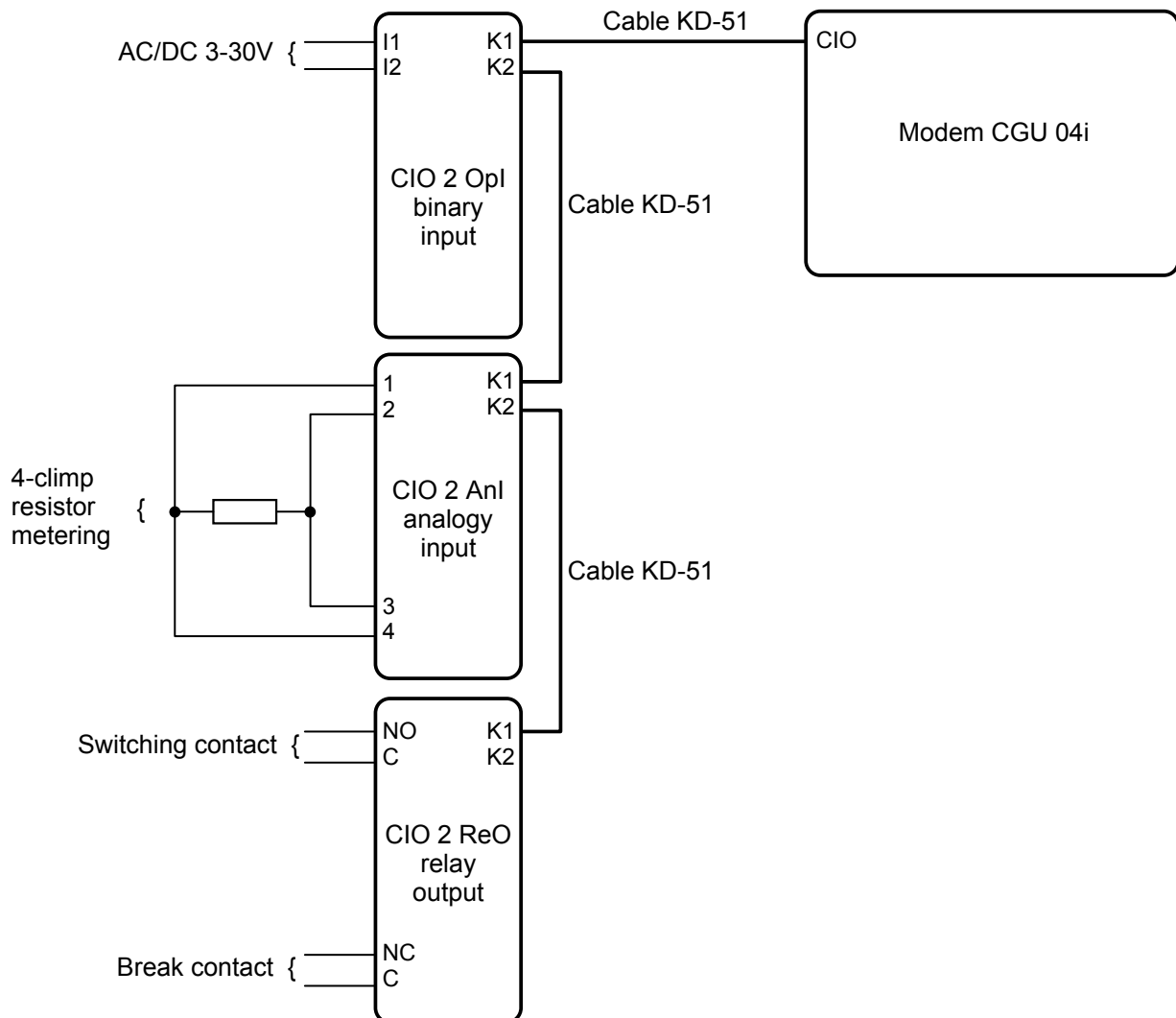
2.7.6 PWR supply connector

Panel socket RJ12
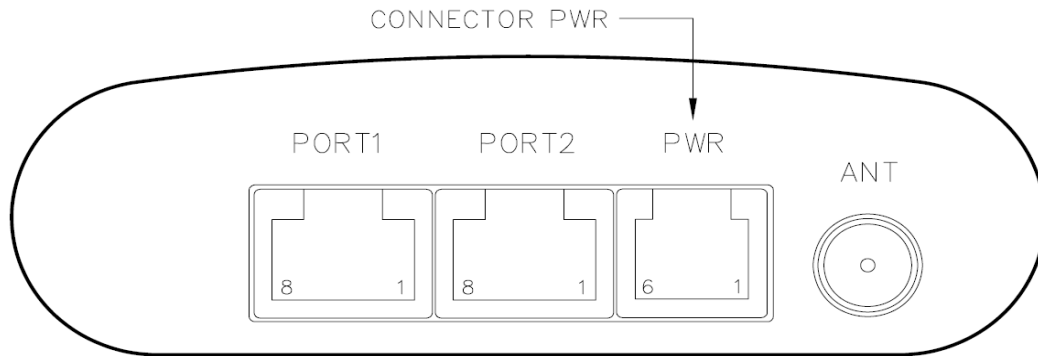
Pin number	Signal mark	Description	Direction
1	+UN	Positive pole of DC supply voltage (10 to 30 V)	
2	PWRSV	Output open collector (Power Save) See CIO description	Output
3	INAC	Network supply presence check. Range 0 – 16 V	Input
4	+UN	Positive pole of DC supply voltage (10 to 30 V)	
5	GND	Negative pole of DC supply voltage	
6	GND	Negative pole of DC supply voltage	

Note: Clamps 1-4 (+UN) and 5-6 (GND) are in the modem connect for bigger current overload.

On the power supply connector it is possible to use the signal INAC (NAP230) for present AC voltage monitoring for power supply (it can be functional only in case of supply accumulator backup).

Beware, on INAC (NAP230) input it isn't possible direct connect link voltage 230 V!

Circuit example:

DC supply

Pin 1 – +UN
Pin 2 – NC
Pin 3 – INAC
Pin 4 – +UN
Pin 5 – GND
Pin 6 – GND

Modem CGU 04i
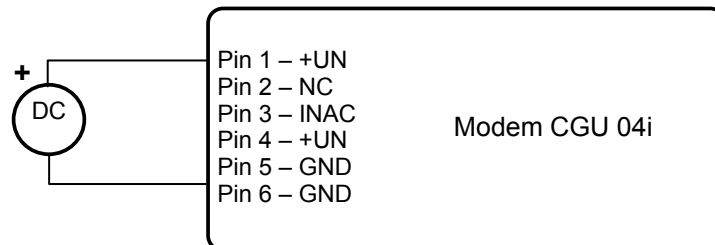
DC supply with backup battery with present supply monitoring

```
                          ┌──────────────────────────────────┐
                          │ Pin 1 – +UN                      │
                          │ Pin 2 – NC                       │
                          │ Pin 3 – INAC       Modem CGU 04i │
                          │ Pin 4 – +UN                      │
                          │ Pin 5 – GND                      │
                          │ Pin 6 – GND                      │
                          └──────────────────────────────────┘
```
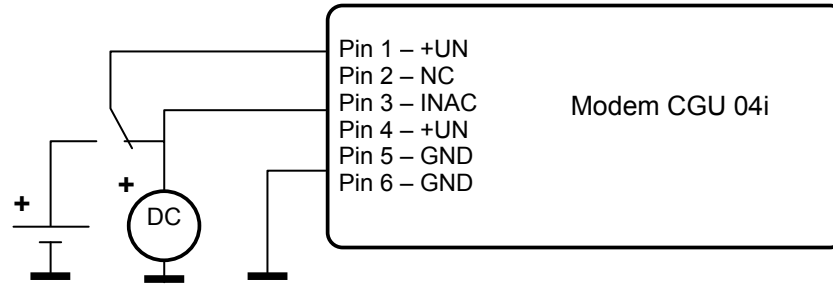
DC supply with backup battery without present supply monitoring

```
                          ┌──────────────────────────────────┐
                          │ Pin 1 – +UN                      │
                          │ Pin 2 – NC                       │
                          │ Pin 3 – INAC       Modem CGU 04i │
                          │ Pin 4 – +UN                      │
                          │ Pin 5 – GND                      │
                          │ Pin 6 – GND                      │
                          └──────────────────────────────────┘
```
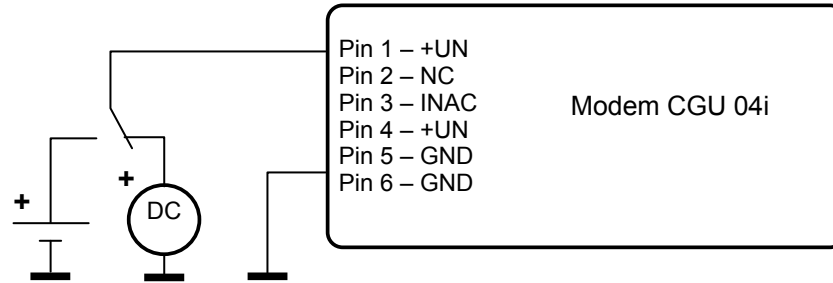
2.8. Antenna connection

Antenna is connected to CGU 04i by FME connector on the back panel.
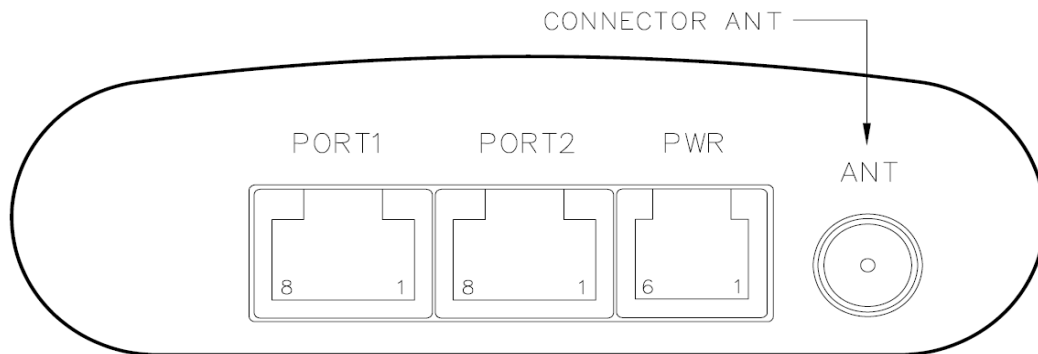
2.9. Technical specifications of port 2

- for product Expansion port M-BUSD

Expansion port M-BUSD		
Power supply	Voltage	+10 .. +30 V
	Supply power	Max. 4 W
Environment	Operating temperature	-20 .. +55 °C
	Storage temperature	-20 .. +85 °C
Standards	Emission	EN 55022/B
	Immunity	ETS 300 342
	Safety	EN 60950
M-BUS specifications (ČSN EN 1434)	Max. devices (each 1,5 mA)	30
	Max. operating bus current	60 mA
	Overload protection	100 mA
	Short circuit strength	permanent
	Bus voltage mark	36 .. 43 V
	Bus voltage space	24 .. 31 V
	Max. Total cable length (300 Bd, 200 nF/km)	1000 m

Information about short-circuit on wiring of M-BUS it is possible found out in VF statistics for port COM2 wickedly state of signal DTR. Level 1 indicates correct activity of the bus, level 0 informs about a short-circuit on the bus.

- for product Expansion port RS485 – RS422

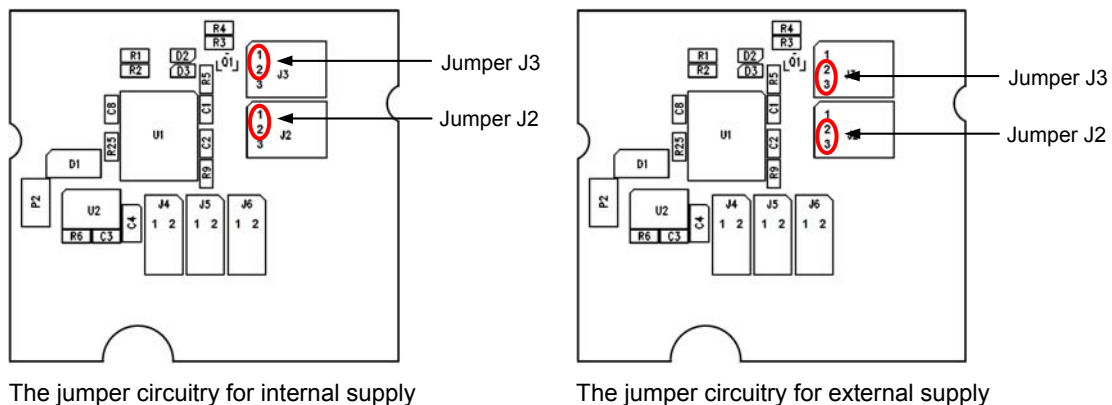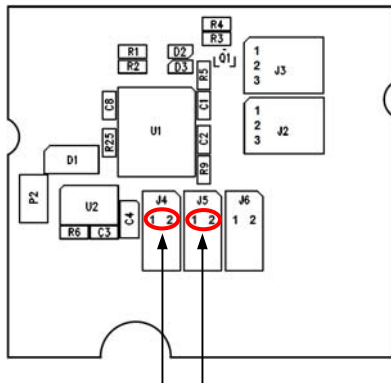| Expansion port RS485-422		RS485	RS422
Power supply	External	+10 .. +30 V	
	Internal	....	
	Supply power	Max. 1 W	
	Supply current	Max. 4 mA	
Environment	Operating temperature	-20 .. +55 C	
	Storage temperature	-20 .. +85 C	
Standards	Emission	EN 55022/B	
	Immunity	ETS 300 342	
	Safety	EN 60950	
RS485 specifications (EN 1434)	Max. devices (each 1,5 mA)	256	
	Max. bit rate	38400 bps	
	Short circuit strength	Permanent	
	Max. total cable length (300Bd, 200nF/km)	1200 m	

External or internal power supply of module Expansion port RS485/RS422 can be made by wiring jumpers J2 and J3 on this module. If external power supply of the module is required, jumpers J2 and J3 must be connected to pins 2 - 3. Internal power supply is made by connecting pins 1 - 2 with jumpers J2 and J3.

Interface behavior of module Expansion port RS485/RS422 can be made by wiring jumpers J4, J5 and J6 on this module. If RS485 is required, jumpers J4 and J5 must be connected and jumper J6 disconnected. If RS422 is required, jumpers J4 and J5 must be disconnected and jumper J6 connected.

Jumper placement can be seen in the picture below (module Expansion port RS485/RS422 from TOP layer). We recommend that internal power supply is only chosen in the event that it is not possible to ensure external power supply. If internal power supply is chosen, converter RS485/RS422 is not galvanic separated.

The jumper circuitry for internal supply

The jumper circuitry for external supply

Jumpery J4 a J5

The jumper circuitry for RS485
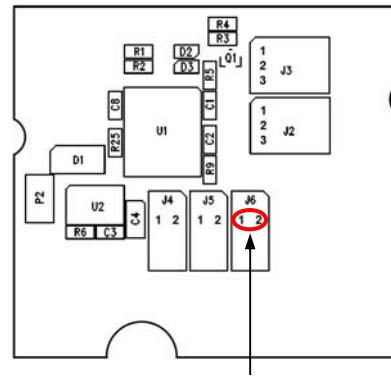
Jumper J6

The jumper circuitry for RS422

- for product Expansion port RS232

Expansion port RS232		
Power supply	Internal	....
Environment	Operating temperature	-20 .. +55 C
	Storage temperature	-20 .. +85 C
Standards	Emission	EN 55022/B
	Immunity	ETS 300 342
	Safety	EN 60950
RS232 specifications (EN 1434)	Max. operating bus current	15 mA
	Max. bit rate	230400 bps
	Max. overvoltage	±30 V
	Max. total cable length (300Bd, 200nF/km)	20 m

- for product Expansion port CNT

Expansion port CNT		
Power supply	Internal	...
	Sleep	100 µA (counter is functional)
	Operation	2 mA
Environment	Operating temperature	-20 .. +55 °C
	Storage temperature	-20 .. +85 °C
Standards	Emission	EN 55022/B
	Immunity	ETS 300 342
	Safety	EN 60950
	Isolation	EN 60747
Inputs/outputs	2x counter	Max. 100 Hz
	2x analogy inputs	0 .. 20 mA
	2x binary inputs	-
	1x output (open collector)	100 mA
Others	Voltage resistance	Permanent
	Sleeping mode	Controlled

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2.10. CGU 04i settings

Configuration and service SW RADWIN is designed for the module setup (reference **[3]**). The software is created for MS WINDOWS 95/98/ME/2000/XP platforms. Service cable is designed for CGU 04i connection. After service cable (data cable KD-2 and jump service SEPRO) is connected to any serial user interface RS232 and service SW runs on a connected PC it is possible to execute not just all the needed CGU settings, but service interventions
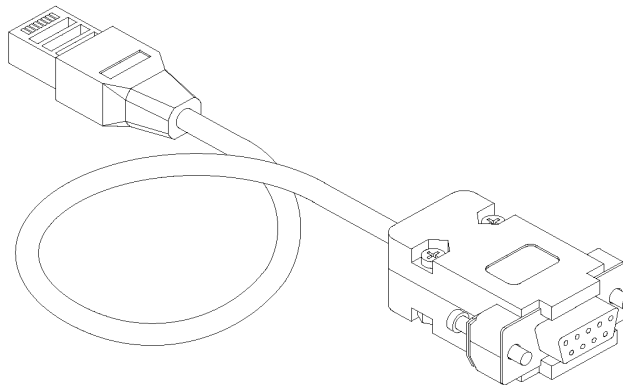
in the data network as well. The basic setting of the radio modem is in **[5]**.

Data cable KD-2

CGU 04i module settings can be done remotely via GPRS. Remote configuration access is protected by password. The enter password it is possible only after straight connect by service cable.

2.11. Service cable

CGU 04i – PC connection cable with DCR and GND signals connected at 100 Ohm. It is made from normal data cable KD-2 by adding service interconnection SEPRO. It is necessary to interconnect all eight signals between CGU 04i and PC. See RJ45 connectors' description in chapter 2.7.
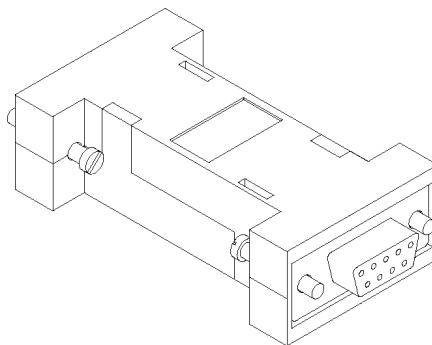
Service interconnection SEPRO to the data cable

2.12. Standard accessories

1. RJ12 supply connector for supply voltage cable.
2. Three RJ45 connectors for data cables and CIO connection.
3. Compliance certificate.
4. Complaint procedure.
5. Warranty.
6. User manual

2.13. Additional accessories
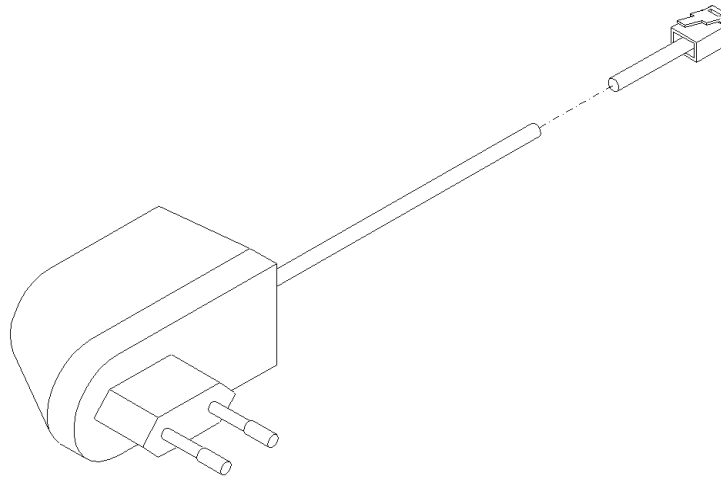
1. Supply adapter
2. AO-AGSM-FME-V antenna
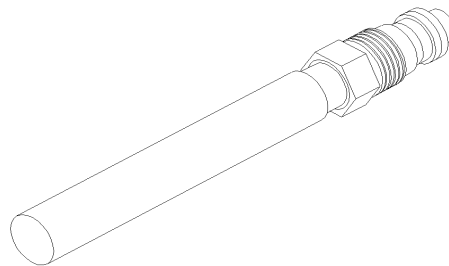
3. Modules of PORT2
   ● Expansion port RS232
   ● Expansion port RS485-422
   ● Expansion port MBUSD
   ● Expansion port CNT

2.14. Assembly procedure

CGU 04i module is designed as a standard for:

1. Assembly to a panel using the through holes.

Through hole for assembly
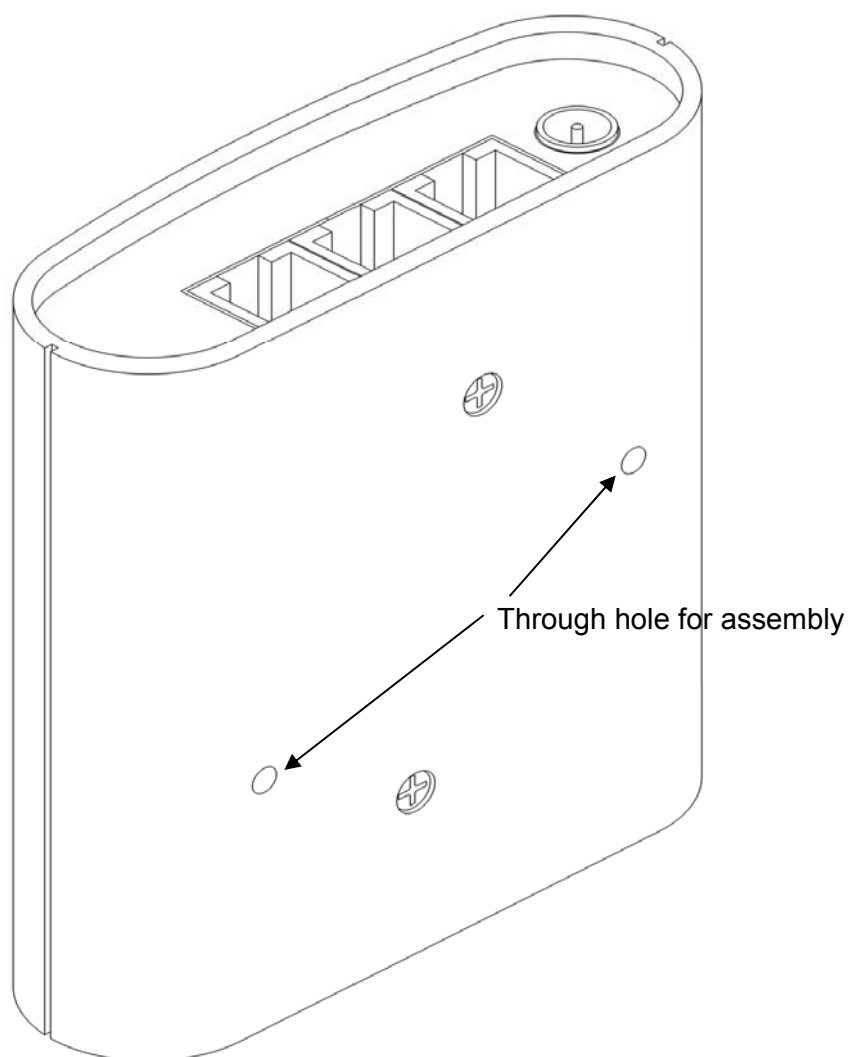
2. DIN 35 mm rail assembly using plastic grips.
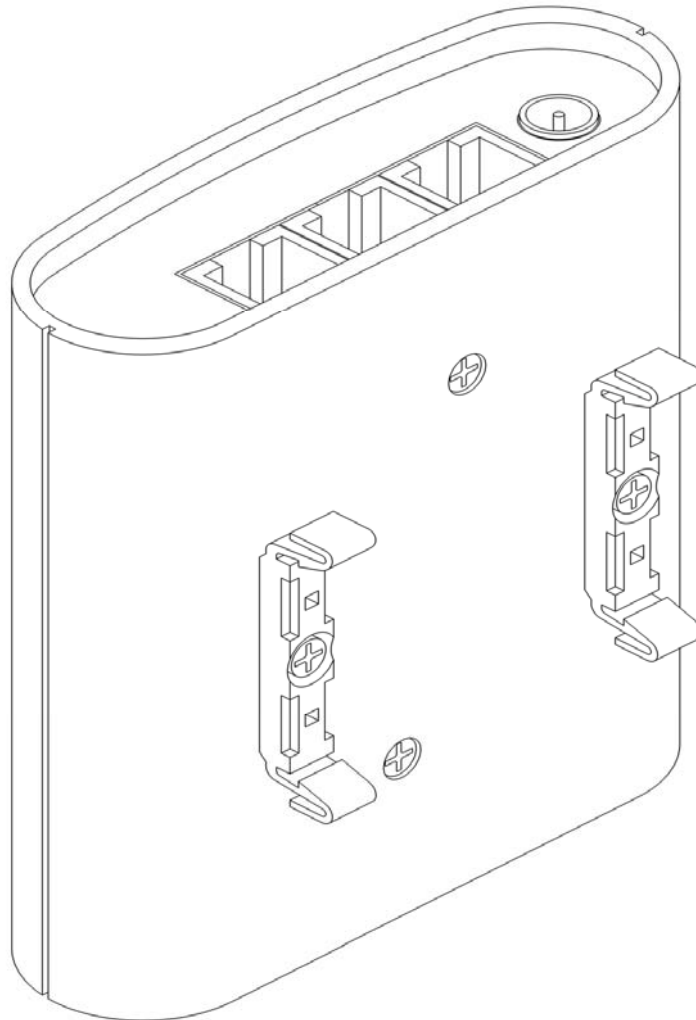
3. To be put on a worktop

2.15. Mechanical external dimensions and mounting recommendations
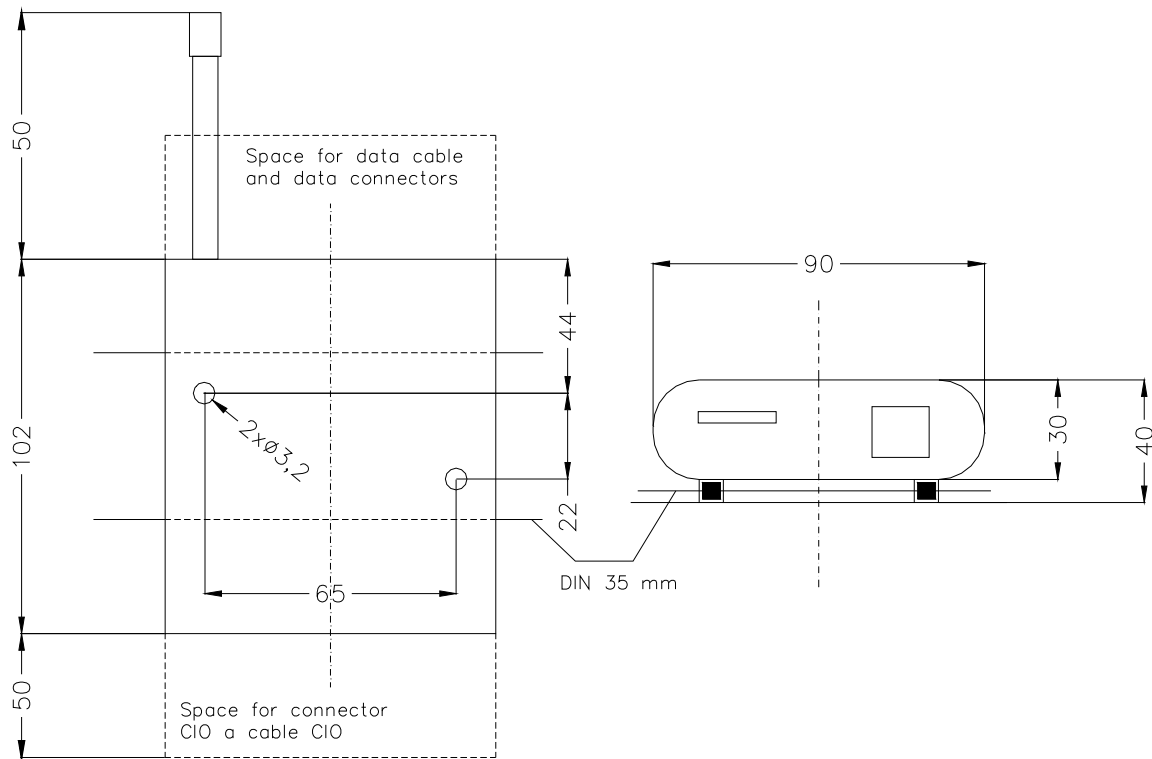
For the majority of applications with a built-in modem in a switch board it is possible to recognize two sorts of environments :
- nopublic and industry environment of low voltage with high interference,
- public environment of low voltage without high interference.

For both of these environments it is possible to mount modems to switch board, the following it is not need have no examination immunity or issues in connection with EMC according to EN 60439-1+A1.

For compliance of EN 60439 - 1 + A1 specification it is necessary observe next assembly of the modem to the switch - board :
- round antenna we recommend to observe a distance of 6 cm from cables and metal surfaces on every side according to the next picture due to the elimination of interference, while using an external antenna except for the switch-board it is necessary to fit a lightening conductor,
- before mounting a modem on sheet-steel we recommend using an external antenna,
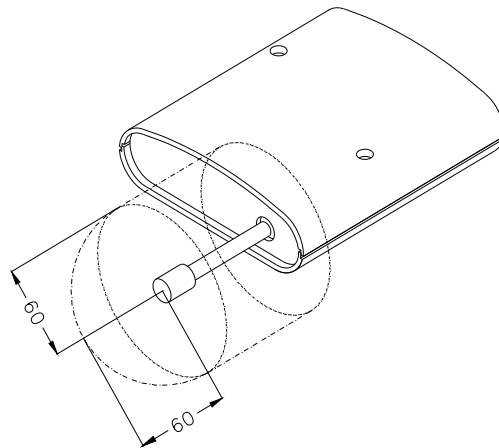
⚠ ● for single cables we recommend to bind the bunch according to the following picture, for this use we recommend:
- length of the bunch (combination of power supply and data cables) can be maximum 1,5 m, if length of data cables exceeds 1,5 m or in the event of, the cable leads towards the switch - board, we recommend to use fit over - voltage protectors (surge suppressors),
- with data cables they mustn't carry cables with reticular tension ~ 230 V/50 Hz,
- all signals to sensors must be twisted pairs.
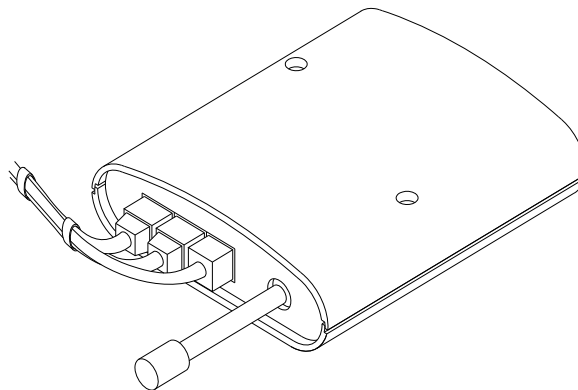
⚠ ● sufficient space must be left before individual connectors for handling of cables,
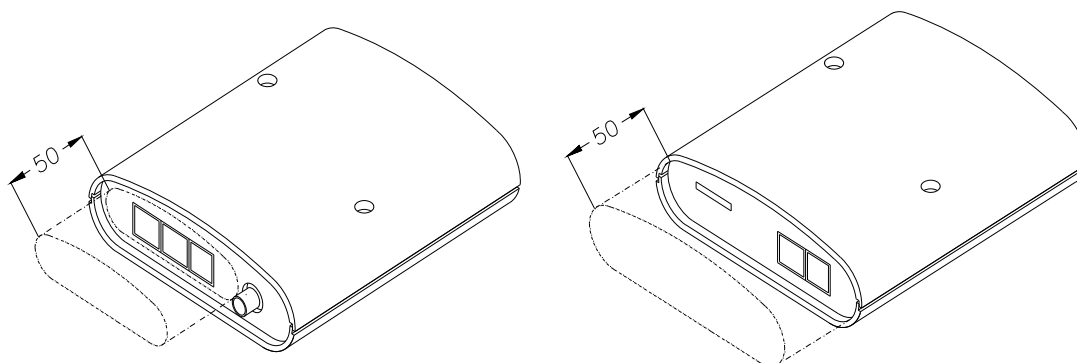
● for correct function of the modem we recommend to use in switch - board earth-bonding distribution frame for grounding of power supply of modem, data cables and antenna,

● the circuit diagram of the modem is on the following pictures.
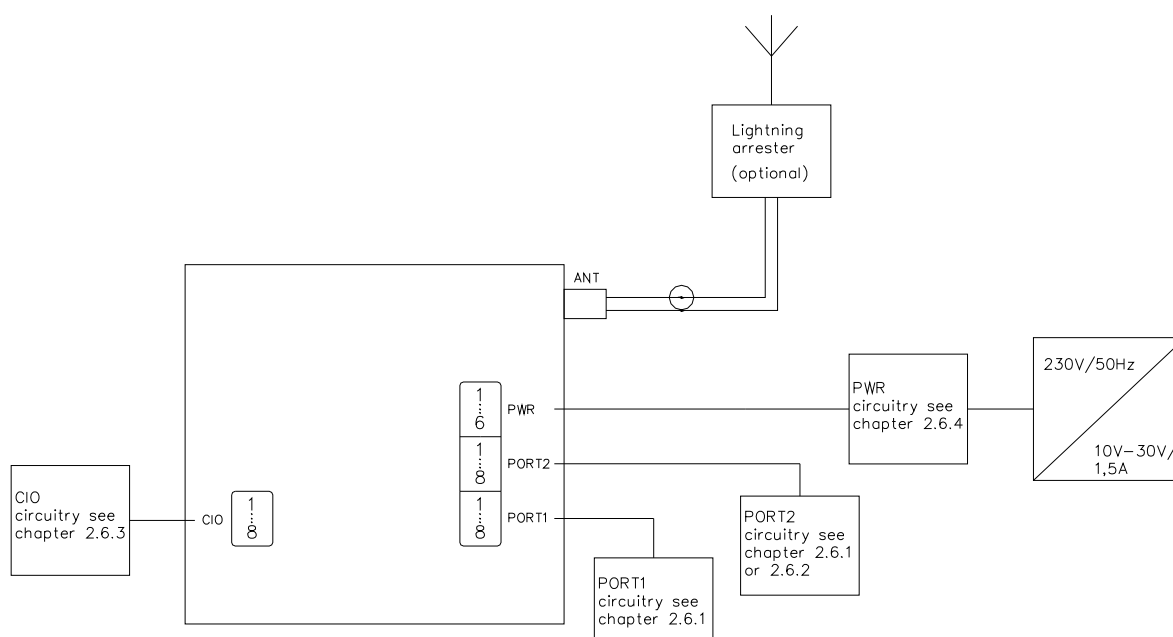
2.16. Product marking

Trade name	Type name	Antenna connector	Supply	Interfaces	Other
CGU 04i	CGU-04i	FME	10 – 30 V	1x RS232	CIO, class 10

2.17. PORT2 marking

Trade name	Type name	Supply	Other
Expansion port RS232	XC-232	Internal from module CGU 04i	
Expansion port RS485-RS422	XC-485-422	External or internal	Round variation RS-485-422 it is possible choose internal/external power supply
Expansion port M-BUSD	XC-MBUSD	External	
Expansion port CNT	XC-CNT	Internal from module CGU 04i	Supply management

2.18. CGU 04i production label
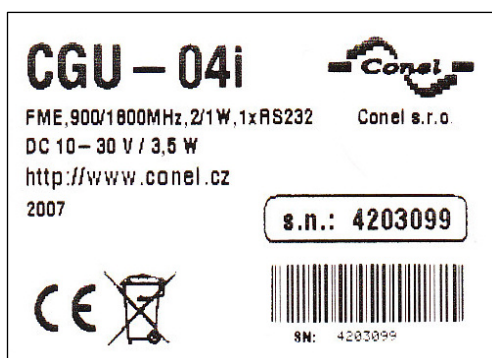
2.19. Expansion ports labels

XC - 232
Expansion port RS232
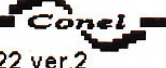
Pin description   s.n.: 22646

Pin 1	RTS	Request To Send
Pin 2	CTS	Clear To Send
Pin 3	DTR	Data Terminal Ready
Pin 4	DSR	Data Set Ready
Pin 5	GND	GROUND
Pin 6	RXD	Receive Data
Pin 7	CD	Carrier Detect
Pin 8	TXD	Transmit Data

22646

XC-485-422
Expansion port RS485-RS422 ver.2

Pin description   s.n.: 69465

Interface	RS485	RS422
Pin 1	Ground	
Pin 2	Ground	
Pin 3	B (-)	RXD (-)
Pin 4	A (+)	RXD (+)
Pin 5	B (-)	TXD (-)
Pin 6	A (+)	TXD (+)
Pin 7	External +12 V	
Pin 8	External +12 V	

69465
www.conel.cz

XC-MBUSD
Expansion port M-BUSD rev.1
Conel s.r.o.

Pin descritpion   s.n.: 91681

Pin 1	SGND	Ground
Pin 2	SGND	Ground
Pin 3	TxRx-	M-BUS B (-)
Pin 4	TxRx+	M-BUS A (+)
Pin 5	TxRx-	M-BUS B (-)
Pin 6	TxRx+	M-BUS A (+)
Pin 7	+12V	Ext. power 12V
Pin 8	+12V	Ext. power 12V

91681
⚠ 40V
www.conel.cz

XC - CNT
Expansion port CNT
www.conel.cz

Pin description   s.n.: 27098

Pin 1	CNT1	Counter input 1
Pin 2	CNT2	Counter input 2
Pin 3	BIN1	Binary input 1
Pin 4	BIN2	Binary input 2
Pin 5	GND	GROUND
Pin 6	OUT1	Binary output 1
Pin 7	AN1	Analog input 1
Pin 8	AN2	Analog input 2

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2.20. Basic parameters description

For monitoring of status, configuration and administration of the modem is RADWIN program **[3]**. In right under main menu is function list where is possible choice Configuration (Ctrl + F1). Next table describes parameters of the tap Basic. Ports description is depend on used protocol. Protocols description is possible to get from Conel Company.

Parameter name	Set value range	Parameter description
Module serial number	---	Modem serial number information.
GPRS – access point name	text	Defines network domain, which is accessible from individuals modems. Every SIM card in modem is set on the APN of the mobile operator. In the case of private APN (network domain) is by this parameter ensure privacy and secured communication against jam and system break. APN (domain) assign mobile operator or Conel company.
GPRS – own IP address	x.x.x.x	This parameter set own IP address of the SIM card. By this is faster registration to the network, some operators not support this function.
Direct IP address	x.x.x.x	Parameter sets direct IP address on which will be send all data when the parameter **GPRS – all direct** is set .
Direct IP port	0 up to 65535	Parameter sets direct IP port on which will be send all data when the parameter **GPRS – all direct** is set.
GPRS – all direct	YES/NO	If this parameter is set to **YES** than all data will be send to the direct station. The direct station is defined by parameters **Direct IP address** and **Direct IP port**. In this case in network isn't any routing.
GPRS – global DNS IP address	x.x.x.x	It is need to configure in case when in the network is Global DNS server. It monitors network failure and stations operation. The IP address of global DNS server would has been accessible and static. GDNS stores informations about route tables from all networks under one domain. GDNS got informations from LDNS, eventually from modems. GDNS has to be only one in all APN (domain).
Network address x	---	Network address information on particular port.

Parameter name	*Set value range*	Parameter description
Interface address x	---	Interface address information on particular port.
GPRS – network x address range	Auto/256 up to 8182	By this parameter is possible to set maximal usable interface addresses range in particular network.
GPRS – local DNS x IP address	x.x.x.x	Local DNS server creates network route table on the base of modems informations. On modem demand LDNS returns informations about target modem. Thanks to this the modems can communicates directly among itself without LDNS. The IP address of local DNS server would has been accessible and static.
GPRS – activation	YES/NO	If parameter **GPRS – access point name** contains *agnep*, or if parameter **GPRS – activation** is set on *YES*, the modem will do activation compared with Global DNS server. Modem, which isn't right activated, isn't accessible from any other modem in network and isn't able send any data to other modem itself. In this case the modem isn't able communicate.
GPRS – connected mobile phone	---	Used GSM-GPRS module information.
GPRS – Send PIN 0000	YES/NO	If the PIN number is impossible to switch off than it is necessary to set PIN 0000 on the SIM card and set this parameter to **YES**.
GPRS – update of IP table addresses	YES/NO	If the modem is local DNS than the modem updates information in the IP address table according to received packets after set this parameter.
GPRS – roaming allowed	YES/NO	Parameter enables roaming on the GPRS.
GPRS – source address check	YES/NO	If this parameter is **YES** the modem checks received packet source IP address against to own IP addresses table. By this check the modem doesn't work packets from foreign modems.
GPRS – Global DNS forwarding	YES/NO	If the modem is local DNS than is possible retranslation via global DNS.

Parameter name	Set value range	Parameter description
GPRS – enable duplicate registration	YES/NO	When the station is Local DNS server, then this parameter enable logging of the modem with dynamical IP address to network. The modem changes own IP address after some time and then tries log on to network with the same interface address. In this case the Local DNS server thinks that the next modem log on to the network with the same interface address and decline it.
GPRS – communication speed	---	Communication speed between modem CPU and GSM/GPRS module information.
GPRS – registration period	0 up to 999999 s	Registration period is time how often the modem repeats first log in to the local DNS.
GPRS – Heart Beat period	0 up to 255 min	Heart beat period is time when the modem repeats log in to the local DNS after successful log in. By this the modem checks active connection with local DNS.
GPRS – timeout for disconnection	0 up to 255 s	The modem checks CTS control signal from module. If the CTS signal is inactive after this timeout the GPRS connection is inactive and will be new log in to the GPRS.
Acknowledge time out	100 up to 25500 msec	After this timeout the modem wait to sent message acknowledge.
Transmit attempts	1 up to 5	Parameter sets the maximal number of data transmission repetition.
Packet maximum length	128 up to 1000	Parameter set maximal possible length of sending data message, the maximal adjustable message length is 1000 bytes.
Attempts for PPP init connection	1 up to 16	Parameter set attempts number of the transmitted control LCP/IPCP frames behind PPP connection establishment.
Firmware version	---	Parameter shows modem firmware number, only for information.
Automatic reset interval	0 up to 999999 min	Parameter set period after which the modem will be reset.
Transferred data limit	0 up to 65535 kB	If this data limit is proceed it will send size data information to the global DNS. The data communication is next allowed and possible.
GPRS – firmware version	---	IGSM/GPRS module firmware version information.

Parameter name	*Set value range*	Parameter description
Received SMS sent to	COM1/COM2/ COM3/Nowhere	If the modem receive new SMS message than this SMS message will be send to defined modem port by this parameter.
SMS format	7-bit/ 8-bit	By this parameter is possible to set format (7-bit/8-bit) of the transmitted SMS messages. For Nokia mobiles is used 7-bit format generally.
New SMS reading period	0 up to 255 s	The modem checks a new SMS messages after this time.
GPRS – username	---	Parameter set username to the APN.
GPRS – password	---	Parameter set password to the APN.
Roaming GPRS connect delay	0 up to 5760 min	Three connections after defined by parameter **Minimal successful GPRS connect time**, it waits this set time before the modem try establish next GPRS connection.
Tolerated GSM registration drop	0 up to 4294 s	When the GSM registration drop is longer than set this parameter, the modem try establish new connection.
Minimal successful GPRS connect time	0 up to 65535 s	When three successful GPRS connect time are smaller than this set parameter then the next GPRS connection will establish parameter **Roaming GPRS connect delay**.
CSD – enabled	YES/NO	This parameter enables using CSD connection like as back up when GPRS connection failed.
CSD – DCD signalling	YES/NO	By this parameter setting it signalised using the GPRS or the CSD connection on the serial DCD signal on the all serial modem ports.
CSD – phone number x	Telephone number with international preselection without + sign	By this parameter is possible to set up to three telephone numbers on which will be try CSD dial-up connection.
CSD – disconnect when idle (0=disabled)	0 up to 1800 s	After set this time is terminate CSD connection when inactive.
Packet lifetime	1 up to 120 s	Parameter sets time after which the modem will try send message via GPRS. Parameter after the modem drop out message.

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Parameter name	Set value range	Parameter description
Preferred GSM operator x	0 up to 9999	By this parameter it is possible define the GSM operator on which the modem will try record.
Send M-BUS short status	YES/NO	When M-BUS short start and end is send information to the global DNS.
Clock synchronization network address	0 up to 9999 HEX	This parameter sets network address by which it is possible synchronizes modem time.
Clock synchronization interface address	0 up to 254	This parameter sets interface address by which it is possible synchronizes modem time.
Log resets	YES/NO	When this parameter is set to **YES**, than reset information are stored to the journal.
Log RF channel	YES/NO	when this parameter is set to **YES**, than radio channel information are stored to the journal.
Log COM ports	YES/NO	When this parameter is set to **YES**, than COM information are stored to the journal.
Log PPP protocol	YES/NO	When this parameter is set to **YES**, than PPP information are stored to the journal.
Log DNS service	YES/NO	If Agnep protocol is set on the Ethernet port and this parameter is set to **YES** than DNS information is stored to the journal. For modem this parameter is unimportant
Log CIO	YES/NO	When this parameter is set to **YES**, than CIO information is stored to the journal.
Log service events	YES/NO	When this parameter is set to **YES**, than service events are stored to the journal.
Log ARET events	YES/NO	When this parameter is set to **YES**, than automated tables information are stored to the journal.
Log ETH interface	YES/NO	When this parameter is set to YES, than Ethernet information is stored to the journal. For modem this parameter is unimportant
Port 2 type	RS-232/RS422/ RS485/MBUSD/CNT	Information about interface type on particular port.

3. Quality of the GPRS signal

The AGNES system works with the aid of the GSM network. The AGNES stations contain GSM-GPRS modules, which are on the radio channel connected to a certain GSM cell. Its signal can be evaluated with the aid of this function.

The function is used first of all when installing the station and checking its function. From the obtained information, the following can be read: On which channel the station operates, what is its signal strength, what neighbour channels are available and what their signal is strength. These data are often indispensable for the correct installation of the antenna.

3.1. Antenna installation for modems

Good placement of antenna is required for good function. Important factors are GSM cell signal strength and signal quality. Signal strength could me measured by function „GPRS receive signal strength measuring" in program Radwin.

Second part is quality of signal. There is no exact measurement. Good point of view is from data transfer statistic. If number of lost packet is low, signal quality is good.

3.2. Good quality GPRS requirements:

- serving cell signal better than –90dBm,
- adjacent cell signal below 12dB to serving cell, otherwise risk of interference,
- if many cell with close signal levels (<3 dB), be in danger of reselection (switching between cells, that caused bad time response or communication interruption). In this case is needed to extend difference between signals.

3.3. Example, station received these signals:

```
Serving Cell                                             I Dedicated channel
chann  rs  dBm  PLMN  LAC   cell NCC  BCC  PWR  RXLev  C1  I chann TS timAdv PWR  dBm Q ChMod
 107   18  -77  23001 352A 6E91   5    6    33   -106   29  I No connection


chann rs  dBm  PLMN BCC  C1  C2
  76  18  -78  23001   1  28  28
 106  17  -79  23001   3  27  27
  33  17  -80  23001   7  26  26
  77  14  -85  23001   3  21  21
  30  14  -85  23001   1  21  21
```

What does it means:

- module received cell 6E91 on channel 107 with level –77dB,
- there is possible to interference from channel 106, with level –79dBm,
- there is possible to reselection between channels 76, 106, 107 and 33, its level is so close.

Way to fix

Change type (from unidirectional to directional – e.g. yagi), direction or place of antenna. After changing you must do measurements again.

3.4. Method of signal measurements

Run Radwin, function "GPRS receive signal strength measuring". Answer is information about serving and remaining cells. Output is from AT commands AT^MONI and AT^MONP from GPRS module.

3.5. AT^MONI command meaning

Serving Cell:

Item	Description
chann	ARFCN (Absolute Frequency Channel Number) of the BCCH carrier
rs	RSSI value 0 . 63 (RSSI = Received signal strength indication)
dBm	receiving level of the BCCH carrier in dBm
PLMN	PLMN ID code
LAC	location area code
cell	cell ID
NCC	PLMN colour code
BCC	base station colour code
PWR	maximal power level used on RACH channel in dBm
RXLev	minimal receiving level (in dBm) to allow registration
C1	coefficient for base station selection

Dedicated channel:

Item	Description
chann	ARFCN (Absolute Frequency Channel Number) of the TCH carrier Note: **<chann> = h** indicates frequency hopping.
TS	timeslot number
timAdv	timing advance in bits
PWR	current power level
dBm	receiving level of the traffic channel carrier in dBm
Q	receiving quality (0.7)
ChMod	channel mode (S_HR: Half rate, S_FR: Full rate, S_EFR: Enhanced Full Rate)

3.6. AT^MONP command meaning

Item	Description
Chann	ARFCN (Absolute Frequency Channel Number) of the BCCH carrier
rs	RSSI value 0 . 63 (RSSI = Received signal strength indication)
dBm	Receiving level in dBm
PLMN	PLMN ID code
BCC	Base Station colour code
C1	coefficient for base station selection
C2	coefficient for base station reselection
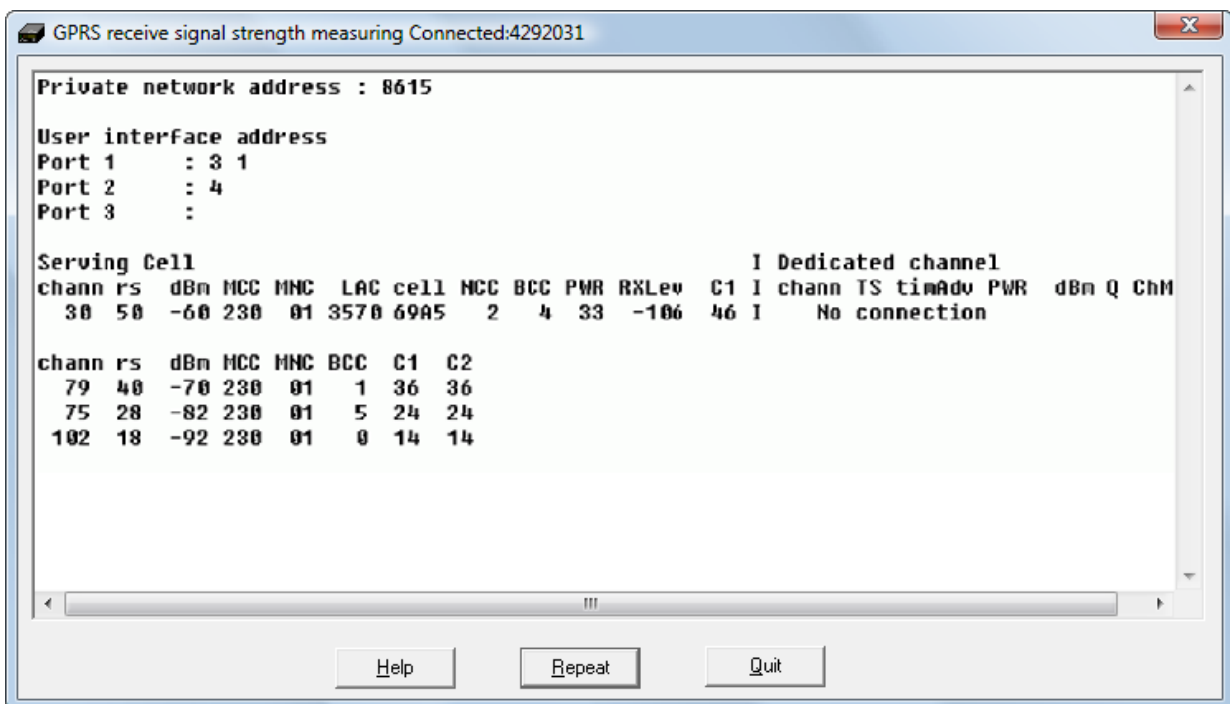
4. Expansion port mounting

Attention! Expansion port include when the modem CGU 04i is switch off.

After unscrewed two screws (position 8) on box bottom part (position 3) and carried out box top part (position 2) the expansion port PORT2 (position 6) connect to connector J3 (see below) of the router B-CGU-04i motherboard (position 1) from TOP side. Expansion port is mounted to motherboard by the help of three distant columns (position 7). After expansion port mounting the box is screwed by the help three screws (position 8).
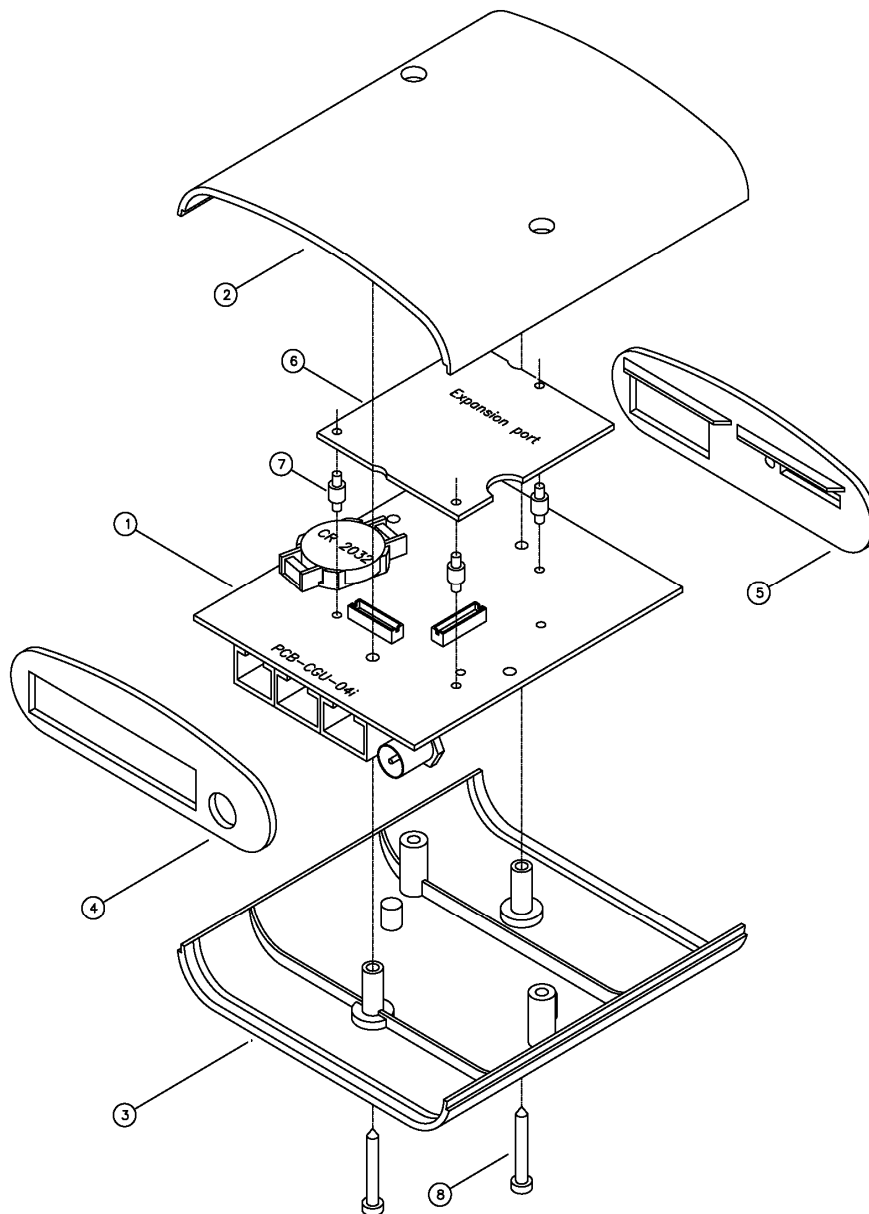
Parts list and description

Part	Description	Number
1	Modem CGU 04i motherboard	1
2	CGU 04i box top part	1
3	CGU 04i box bottom part	1
4	CGU 04i rear head	1
5	CGU 04i front head	1
6	Expansion port	1
7	Distant columns for expansion port PORT2 mounting to motherboard	3
8	Screw for box completion	2

5. CIO – analogue inputs and binary outputs

CGU 04i module is equipped with user interface CIO for analogue signal reception and processing and control (settings) of binary signals. User is provided with 5 adjustable inputs/outputs located on CIO connector at the front panel. More about CIO 2 modules see [4].

5.1. Description of I/O signal evaluation and reception

There are five signals linked to CIO that are possible to process and control by setting up CGU 04i module. These signals can be controlled remotely, or their values can be sent in data form to a remote point of data network.

5.1.1 Analogue input

Voltage is checked every 100 ms from the analogue input, transferred to digital ten-bit value and adjusted by calibration constant. The value is further average-computed according to user interface and saved in the computer memory. Basic input voltage range is 0- 5 V.

5.1.2 Binary output

Binary output is implemented by a transistor with open collector connected to I/O signal. When inactive (log 0) the transistor does not conduct and acts like open switch. When active (log 1) the transistor acts like switch connecting I/O signal to the ground (GND). In both cases the I/O value is measured as an analogue input. The status of switched circuit is being checked.

Maximum switched output current is 500mA. Maximum voltage at transistor collector equals the supply voltage of CGU 04i module.

5.1.3 I/O signals inside CGU 04i
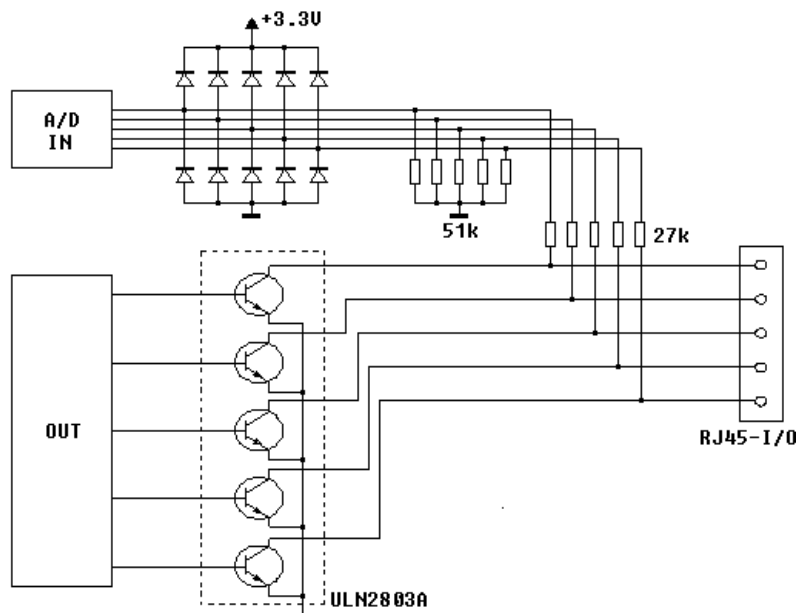
Scheme of connection I/O signals

5.1.4 I/O signals parameters

Signal name	Measuring range [V]	Resolution [bit]	Sampling [ms]	Average from samples	Hysteresis	Control level
I/O1-5	0 to 5	10	100	Optional 1 – 128	Optional 0 – 255	Optional

5.2. Measuring other CGU 04i signals

5.2.1 Measuring the supply voltage

Another two signals are measured in CGU 04i. The first is called +UN (DC SUPLY), it is an internal one and describes supply voltage on CGU 04i brackets. The measuring range is 0 to 30 V. The supply voltage value has an effect over CGU 04i function – in case it falls below the set value the GSM module is disconnected, because its proper function is not safeguarded, and discharge current of reserve accumulator is reduced.

The second one is INAC (AC SUPLY) linked to the supply connector (see the supply connector description). The measuring range is 0 to 30 V. The signal is protected against overvoltage by a protection element that blocks voltage in excess of 16 V. INAC is designed for measuring of network supply voltage presence. The change of the value is recorded in CGU 04i statistics as a failure and rise of supply voltage 230 V.

Beware – it is impossible to link 230 v supply voltage directly to the input!

Signal name	Measuring range [V]	Resolution [bit]	Sampling [ms]	Average from samples	Hysteresis	Control level
UN+	0 to 30	10	5000	4	2 V	Optional
INAC	0 to 30	10	5000	4	2 V	Optional

5.2.2 Measuring internal CGU 04i temperature

To ascertain proper GSM module function, temperature is measured inside CGU 04i. In case the temperature exceeds the set control value, the GSM module is disconnected from the supply voltage, as proper function is not guaranteed over this temperature and at the same time it is protected against heat damage.

Signal name	Measuring range [^{o}C]	Resolution [bit]	Sampling	Average from samples	Hysteresis	Control level
TEP	-40 to +100	10	5000	16	2 ^{o}C	Optional

5.2.3 Measuring DSR output signal level

DSR signals on separate user interfaces are output signals from CGU 04i viewpoint. They are not controlled form the inside. Individual signals are linked through 330 Ohm resistors.

By placing 100 Ohm ground resistor on DSR output the voltage will fall to 1 V. Following this fall CGU 04i will recognize the connection of the service cable and will start to communicate on this user interface via ARNEP protocol with defined communication parameters. It is not allowed to load the output to a level when voltage falls below 3 V.

As well as the other signals, DSR values are accessible within CIO communication reports (see ARNEP protocol description).

Signal name	Measuring range [V]	Resolution [bit]	Sampling [ms]	Average from samples	Hysteresis	Control level
DSR1	0 to 20	10	100	Optional	Optional	Optional
DSR2	0 to 20	10	100	Optional	Optional	Optional

5.3. Output signal for disconnection of supply voltage

The only single-output signal is PWRSV (Power Save). The signal is linked to the supply connector (see the supply connector description). It is connected as universal I/O signal outputs. This is an open collector that switches PWRSV signal to the ground (GND). The output is controlled by a report similar to I/O outputs.

5.4. Technical parameters

Number of I/O signals on I/O connector	5
Basic range of the analogue input supply voltage	0 to 5 V
Maximum switching current of the binary output	500 mA
Maximum switched voltage of the binary output	30 V

5.5. Connecting CIO signals to user device

It is not appropriate and often even possible to connect I/O interface signals directly to the user device. In order to measure currents, resistance and large voltage it is necessary to mount series of circuits before I/O signals that will adjust the values measured to a voltage within 0 to 5 V range and at the same time protect the inputs from interference and overvoltage. Similarly serial electric circuits should be mounted to control power parts of the user device, as the transistor with open collector is able to switch current up to 500 mA and voltage up to the value of CGU 04i supply voltage.

Supplementary CIO modules are designed for practical I/O signal use, establishing an interface between the user device and I/O signals.

Name	Type	Description
CIO ANI	Analogue input	Analogue differential input for small voltage, current and resistance measuring It includes differential amplifier with adjustable power 1 to 10000. Exact current source 0.1 to 3 mA can be used to measure resistance. Configuration of the input signals, amplification and current source is carried out through resistance net. Presence of the input signal relevant to A/D converter working range is signalled by LED on the front panel. Input circuits are protected against short-time overvoltage by suppressors and against the long-time one by reverse fuse. Ranges of the measured values: U 1V, U 2V, U 5V, U 10V, U 20V I 5mA, I 10mA, I 20mA Pt100 100°C, Pt100 200°C, Pt100 500°C Resistance 100 to 50000 Ohm (METRA transmitter)
CIO OPI	Binary input	One galvanically-separated digital input for AC/DC signals up to 30 V, on high voltage brackets up to 350 V. It includes bipolar optoelement that enables processing both input signal polarities. For AC signal it includes integration circuit that provides for direct processing of 50 Hz signal. Output logical value of the measured signal is LED signalled on the front panel. Input circuits are protected against short-time overvoltage by suppressors and against the long-time one by a reverse fuse. Insulation capacity of the galvanic part is 5000 V. Input DC voltage – 30 V Input AC voltage 3 – 30 V rms Input AC voltage, high voltage input 150 – 350 V
CIO REO	Binary output	One relay output. It includes a relay with one switch contact. Switch on/off contact is linked separately, common contact twice (C marking). The presence of a control signal is LED signalled. Insulation capacity of the galvanic part is 5000 V. Maximum permanent voltage 400 V rms Maximum permanent current 5 A rms

6. References

[1]   Conel s.r.o.: *Application CGU Server*, 2004

[2]   Conel s.r.o.: *ARNEP Protocol description*, 2007

[3]   Conel s.r.o.: *RADWIN Programme for control AGNES,* 2008

[4]   Conel s.r.o.: *CIO 2 Users guide*, 2008

[5]   Conel s.r.o.: *GPRS modems – application guide*, 2008

7. Links to related products of the manufacturer

Related products and materials with a reference can be found on the manufacturer's website – Conel company:

www.conel.cz

There are another links on Cinterion company website:

www.cinterion.com

7.1. Systems

AGNES – Advanced GPRS Network System – represents a solution for private data network structures for industrial applications and technological systems.

7.2. Protocols

AGNEP – Advanced GPRS Network Protocol – one of the AGNES system protocols.

7.3. Software

RADWIN – the software provides for creation, installation and administration of AGNES system GPRS data networks.

7.4. Products

CGU 04 – GPRS modem, the predecessor of CGU 04i.

CGU Server – hardware and software equipment connecting AGNES system and company LAN with the possibility of GPRS network control and diagnostics.

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8. Product disposal information

The WEEE (Waste Electrical and Electronic Equipment: 2002/96/EC) directive has been introduced to ensure that electrical/electronic products are recycled using the best available recovery techniques to minimise the impact on the environment. This product contains high quality materials and components which can be recycled. At the end of it's life this product MUST NOT be mixed with other commercial waste for disposal. Check with the terms and conditions of your supplier for disposal information.

9. Complaints procedure

Dear customer,

The product you have purchased had passed manufacturer's tests and its functions had been checked by our technician before sale. In case any defect shows up during the guarantee period that prevents normal use we ask you to follow the Complaints procedure when registering your claim.

To make a possible complaint procedure easier please make sure when taking over the product your vendor has duly filled in all the relevant parts of the warranty, including date, seal and signature.

This complaints procedure relates to the purchased products. This complaints procedure does not relate to the services provided.

Guarantee period of the products

Guarantee period of 24 months from the date of purchase is provided for the device, source, antenna, data cable and possible accessories. The date of purchase is at the same time date of takeover.

Registering a claim

It is necessary to register your claim at the vendor where the subject of the complaint has been purchased. The customer shall present duly filled warranty and the complete subject of the complaint. Subject of the complaint shall be presented in a condition adequate to that at the moment of purchase.

Caution!

The vendor is not responsible for keeping default settings or data saved in the subject of the complaint.

The customer is obliged to clarify the defect or how it is displayed and what claim he intends to register.

Processing the complaint

The vendor shall provide a free remedy depending on particular conditions, or replace the subject of the complaint for a new product, or settle the matter in another manner in compliance with the Civil Code and the Act on consumer's protection.

As of the moment the claim is registered by the customer and the subject of the complaint is taken over by the vendor the guarantee period stops running. The guarantee period continues on the date of takeover of the repaired subject of the complaint or replaced faultless product by the customer, or should it not be taken over on the date the customer is obliged to take over the repaired or replaced product. In case the vendor replaces the subject of the complaint for a new product (including IMEI replacement) the original subject of the complaint becomes property of the vendor and the new product becomes property of the purchaser. Since takeover of the new product a new guarantee period starts. In the cases when the vendor settles the matter after agreement with the customer by replacement of the subject of the complaint for a faultless product the new guarantee expires.

1. After 12 months since the replaced product was taken over by the customer.
2. On the date when the original guarantee period (subject of the complaint) would have expired should it not have been replaced, whichever comes first.
3. The claim is deemed unsubstantiated when the defect is not found by the vendor processing the complaint or the defect is not covered by the guarantee under Article 3 of the procedure.
4. In case the claimed defect is not found and functionality is proven to the customer, the customer is obliged to pay demonstrable cost related to expert assessment of the claimed defect.
5. In case defect is found when processing the complaint that is not covered by the guarantee (extra-warranty repair), the vendor shall inform the customer and the customer shall inform the vendor whether he/she wishes to have the defect repaired for the price set. A protocol shall be made on exact conditions of the extra-warranty repair and signed by both the customer and the vendor. Should the customer not require remedy through an extra-warranty repair under the conditions, the device shall be returned to him/her after he/she pays the demonstrable cost of expert assessment.

The guarantee does not cover defects incurred due to
1. Mechanical damage (fall and the like).
2. Use of inadequate, or not recommended sources and other accessories.
3. Connection of the product with non-standard accessories.
4. Installation or use of the product conflicting with the Manual or use for other purposes than usual for this type.
5. Improper manipulation, or an intervention of unauthorised person or other service than authorised by the manufacturer.
6. Effects of natural forces (flood, fire etc.) or other local phenomena (storm, overvoltage and the like).
7. Storage under unauthorised temperatures.
8. Operation in a chemically aggressive environment.

Other conditions

The fact that the subject of the complaint does not conform to parameters set for other similar product types shall not be considered a fault. To assess whether it is a case of covered fault the parameters stated in the technical documentation for the product are decisive.

The guarantee expires in any case of changes to the subject of the complaint, or damaged or otherwise unreadable serial number.

10. Warranty

Device type	
Serial number	
Guarantee period (months)	
Vendor	
Date of purchase	
Seal of the vendor	

	1	2	3	4	5
Date of complaint registration					
Complaint protocol number					
Date of reception of the device in repair shop					
Date of finished repair					
Number of repair sheet					
Warranty repair	YES – NO	YES – NO	YES – NO	YES – NO	YES – NO
New serial number of the device (IMEI)					
Notes					
Seal of the repair shop					