

## J. COMMUNICATION BETWEEN SIEMENS TC65 MODEM AND SVAN 95X INSTRUMENTS

### J.1. Introduction

The paper deals with the communication protocol between SIEMENS TC65 modem and SVAN 95x instruments. All functions are handled automatically by SVAN 95x firmware, but the user is expected to configure basic settings for the proper handling of the communication. The paper explains steps required to ensure the two devices to work successfully, as well as notes several points of interest that explains the nature of the communication system.

### J.2. Requirements

Described below are required parts for the use of the SIEMENS TC65 modem and SVAN 95x instrument outside the standard station box. For the proper configuration of a stand-alone instrument + modem station, the following components are required:

1. SVAN 95x instrument.
2. SIEMENS TC65 modem.
3. SV 55 cable.
4. SC 55 Female-to-female RS232 converter used for connection between SV 55 and TC65 modem.

The connection scheme is presented in chapter J.10.

Follow these steps to connect the instrument and the modem together:

1. Plug in SV 55 cable (USB connector) to the instrument's USB Host port.
2. Plug in SV 55 cable (RS232 connector) to SC 55 adaptor.
3. Plug in SC 55 to the modem's RS232 port.

### J.3. Getting started

This chapter explains in couple steps how activate internet connection in basic automatic configuration mode with SIEMENS GPRS modem. For more detailed information, please view next paragraphs. Let's start:

1. Insert SIM card into modem's SIM-card slot; the slot shape prevents the card from being inserted incorrectly.
2. Switch on the SVAN 95x instrument.
3. Configure modem basic settings; by *SETUP / WIRELESS TRANSFER / NETWORK*, select network to GPRS and tick **INTERNET CFG** option in **MODEM** window which appears on the **WIRELESS TRANSFER** list, other options in **MODEM** window should be selected depending on user needs, but it is advised to tick them all. Depending on the SIM card's requirements, **AUTH. MODE** option needs to be set accordingly.
4. Configure modem connection settings; by *SETUP / WIRELESS TRANSFER / MODEM CONNECTION*. It's important to set APN in accordance to the SIM card being used, and to enter **USER** (APN USER) and **PASSWORD** (APN PASSWORD); **DNS SERVER** field needs to hold either IP or DNS name of the server being used as monitoring server.
5. If required, configure SMS settings; by *SETUP / WIRELESS TRANSFER / SMS OPTIONS*, define **PHONE NUMBER** and **TEXT MESSAGE**.
6. If required, configure e-mail settings; by *SETUP / WIRELESS TRANSFER / E-MAIL SETTINGS*, defining **SMTP ADDRESS**, **USER LOGIN**, **USER PASSWORD** as well as **E-MAIL SENDER**, **E-MAIL RECIPIENT**, **E-MAIL SUBJECT** and **E-MAIL-MESSAGE**.
7. Turn off the SVAN 95x instrument.

8. Turn on the modem and wait until it completes initialization procedures; it is indicated by change of LED blinking speed.
9. Turn on the measurement device; modem's LED will start blinking with double pulses - indicating that connection is active.
10. Run SvanPC+ application to collect data and control stations.



**Notice:** If registration procedure is being used, it is important to run SvanPC+ software before turning on the measurement device.

## J.4 Connecting

The devices communicate through RS232 serial protocol. **The modem's default baud rate is 115200 bits per second and it is important to ensure that SVAN 95x device has the same baud rate defined in SETUP / RS232 / BAUD RATE setting tab.**

To activate successfully the system, it is important to turn on the modem first and wait until it will finish the initialization procedures (it is easy to notice as the modem's LED changes the frequency of blinking, from fast to slow). Once the modem is ready, the user may turn on SVAN 95x device and, provided proper options are set in **SETUP** tab, it will attempt to configure the modem and establish the connection capable of receiving and transmitting data.

Once the modem is configured and connection with the internet established, the modem's LED will start blinking with double pulses, denoting an active connection. Any additional steps, including station's registration will commence now and it is now possible to connect to the modem from remote host to exchange data through standard #1, #2, #3 and #4 commands.

## J.5 Menu options

There are four tabs in *SETUP / WIRELESS TRANSFER* section (when in **NETWORK** window **GPRS** has been selected) that contain options for configuring SIEMENS connection:

- **MODEM** tab permits to configure basic modem options, such as modem type and connection types. It contains the following options:
  - **INTERNET CFG** – ticking this option makes that the device is set to automatically configure the modem to connect to the internet. When the device is turned off with this option set, it will attempt to configure the modem after next turn on. With this option ticked off, the modem will only be configured for handling SMSes. More about this option is written in J.5 (Configuration and Registration).
  - **AUTO REGISTER** – ticking this option makes that the device instantly attempts to register the station provided the modem is already configured. More about the registration is written in J.5 (Configuration and Registration).
  - **DATA PROTOCOL** – defines connection type for data exchange. Available types are TCP S (server mode), TCP C (client mode) and UDP.
  - **SIM AUTH MODE** – defines the way of user verification by SIM card. Depending on the SIM card, several options are possible, some of them are recognized by the modem:
    - **none** – no verification required.
    - **PAP**
    - **CHAP**
    - **MsChap1** – denotes MsChap in version 1.
  - **SEND SMS (SIEMENS only)** – ticking this option will enable SMS alarm notification.
  - **SEND E-MAIL (SIEMENS only)** – ticking this option will enable e-mail alarm notification.
  - **AUTO RECONN** – ticking this option will make the device attempt to reconnect the modem in the case of errors or sudden disconnection. More about this option is written in J.6 (Error handling).

- **RECONN. DELAY** – defines delay between each reconnection attempts. Also determines delay between each registration packets being sent.
- **TCP IRT** – Tcp Initial Retransmission Timeout – defines initial timeout for sending packets in TCP mode.
- **TCP MAX RET.** – defines maximum amount of packet retransmissions during TCP connection.
- **MODEM CONNECTION** tab – allows configuring several supporting options required to configure successfully SIEMENS modem to establish internet connection. It contains the following options:
  - **SERVER ADDRESS** – allows one to enter up to 32 characters of either IP or domain address, where the registration data will be sent during the registration process. More about this option is written in J.5 (Configuration and Registration).
  - **DATA PORT** – allows entering up to 5 characters of port number. This number denotes a port on which a communication socket will be configured for data exchange between remote host and the station.
  - **REGISTRATION PORT** – allows entering up to 5 characters of port number. This number denotes a port on which a communication socket will be configured to transmit registration packet.
  - **APN** – allows entering up to 20 characters of APN name of the SIM card used with the modem.
  - **APN USER** – allows entering up to 20 characters of user name used for verification by the SIM card used with the modem.
  - **APN PASSWORD** – allows entering up to 20 characters of password used for verification by the SIM card used with the modem.
  - **DNS SERVER** – allows one to enter up to 15 characters of IP address of DNS server used for establishing connection with the internet. In the most cases, leaving the default value of “0.0.0.0” will be sufficient, but some SIM cards may require a specific address to be entered.
- **SMS OPTIONS** – allows one to configure SMS service used for alarm notification. For more information about alarm notification see J.6 (Alarm notification). It contains the following options:
  - **PHONE NUMBER** – allows one to enter up to 20 characters of phone number where the text messages will be sent.
  - **TEXT MESSAGE** – allows one to enter up to 20 characters of additional text which will be appended into a standard alarm message template.
- **E-MAIL SETTINGS** tab – allows one to configure e-mail service used for alarm notification. For more information about alarm notification see J.6 (Alarm notification). It contains the following options:
  - **SMTP ADDRESS** – allows one to enter up to 32 characters of SMTP server address which will be used to send e-mail messages.
  - **USER LOGIN** – allows one to enter up to 20 characters of user login used to establish verified connection with SMTP server.
  - **USER PASSWORD** – allows one to enter up to 20 characters of user password used to establish verified connection with SMPT server.
  - **SENDER E-MAIL** – allows one to enter up to 48 characters of e-mail address from which the e-mail message will be sent.
  - **RECIPIENT E-MAIL** – allows one to enter up to 48 characters of e-mail address to which the e-mail message will be sent.
  - **E-MAIL SUBJECT** – allows one to enter up to 20 characters of the message's subject.
  - **E-MAIL MESSAGE** – allows one to enter up to 20 characters of additional text which will be appended to standard e-mail message template used for alarm notification.

You may see the current state of modem connection and GPRS connectivity by selecting *DISPLAY / MODEM STATUS*. Note that without GPRS option selected in *WIRELESS CONNECTION / NETWORK* tab modem status will always be OFF.

## J.6 Configuration and Registration

In order to configure and establish the internet connection the SVAN 95x device, in the configuration process, sends the series of commands recognized by the modem. Right after ticking **AUTO CONFIG** option (or turning on the device with this option on), the system will perform the following steps:

The steps taken by the SVAN 95x device for configuring SIEMENS modem are as follows:

- Configure handshake lines
- Configure SMS service
- Configure internet connection
- Configure data exchange service
- Configure e-mail service
- Configure registration service (if **AUTO REGISTER** is ticked and **DATA PROTOCOL** is either **TCP S** or **UDP**)
- Attempt to establish connection (if **DATA PROTOCOL** is set to **TCP C**)
- Send registration packet (if **AUTO REGISTER** is ticked and **DATA PROTOCOL** is either **TCP S** or **UDP**)

It is important to configure the most options from **MODEM CONNECTION** tab for successful establishment of the connection for data exchange. **REGISTRATION** port is optional if registration is not demanded (**AUTO REGISTER** option). Steps 5 and 6 are optional if corresponding options are ticked off as well.

The system configures connection depending on **DATA PROTOCOL** and **DATA PORT** settings. In TCP S mode, it establishes a listening socket, ready to accept any incoming connection and establish transmit/receive connection with a remote host. In TCP C mode, it attempts to connect to remote address defined in **SERVER ADDRESS** using TCP/IP connection to exchange data. In UDP mode, it establishes a listening socket and transmitting socket, which is capable of sending data to remote address defined in **SERVER ADDRESS**. All sockets are bound to port defined in **DATA PORT** setting.

Upon configuring main connection and data exchange service, the system attempts to establish connection with the internet (it takes place when first service is being opened). If successful, the modem's LED will start blinking in double pulses, acknowledging active internet connection.

After configuring main connection and configuring data exchange service, the device will configure SMS and e-mail services for future use.

If **AUTO REGISTER** option is ticked, the device will attempt to register the station by configuring another service and sending a registration packets to address defined in **SERVER ADDRESS**. During this process, the service will be configured depending on the **REGISTRATION PORT** option.



**Notice:** *In TCP/IP mode, the service will require the remote host to accept the connection. If there is no such response or the connection fails, the system will attempt to reconfigure and start the process again.*

After the configuration and successful starting of the service, the device will send the following registration packet:

```
#1,Uaaaa,Nbbbb,CTccc,PTdddd;
```

where:

aaaa –	device type
bbbb –	device serial number
ccc –	station's data exchange connection type
dddd –	data port number

The device will continue on sending these packages in regular intervals determined by **RECONN. TIME** until a remote peer connects to the station (if **DATA PROTOCOL** is set to **TCP S**) or the station receives data first time after being configured (if **DATA PROTOCOL** is set to **UDP**). Please

note that in **TCP S** mode, the device will resume sending registration packets as soon as remote peer disconnects from the device. In **UDP** mode, however, the packets will not be sent again until the station is reconfigured.



**Notice:** at any given time you may restart the modem to force the device to reconfigure the station from start.

## J.7 Alarm notification

Using SIEMENS modem and SVAN 95x device allows one to utilise SMS messages and e-mail to send out the alarm notification. Such service is accessible by ticking the corresponding options – setting options **SEND SMS** and/or **SEND E-MAIL** in **EXTERNAL I/O SETUP** tab for **DIGITAL OUT** mode with **ALARM PULSE FUNCTION**. These options are also accessible in **WIRELESS TRANSFER / MODEM** tab.

Setting these options will, upon an occurring alarm, send messages through selected service(s) using the following template:

```
UNIT SVANaaaaa #bbbb: ccccccccc dddd(1)=eeeeedB(>=ffffdB)
```

where:

- aaaaa – device type
- bbbb – device serial number
- cccccccc – text message defined in **TEXT MESSAGE** in **SETUP / SMS OPTIONS** tab or **SETUP / WIRELESS TRANSFER / E-MAIL SETTINGS** tab
- ddd – name of the parameter / result which triggers the alarm (**SPL**, **PEAK** or **LEQ**)
- eeee – parameter's level in decibels when alarm occurs
- ffff – parameter's level defined for the alarm



**Notice:** to send an SMS for alarm notification, the instrument does not need to have a ready internet connection. To use SMS feature only, the modem needs only to be turned on, without the need of any additional configuration.

## J.8 Extra features

As mentioned before, the modem's current state can be viewed from **DISPLAY / MODEM STATUS** tab. In this tab, the following information is displayed:

- Signal quality – described GPRS signal quality measured in dBm.
- GPRS availability – can be either Detached, Attached or Not available.
- Connection state – describes whether the modem is connected to host application. Note that for UDP the connection state is always NOT CONNECTED as UDP protocol never establishes a firm connection between host and client.
- Service IP – the current IP of the modem. Note that for SIM cards with dynamic IP this value might be different with each start up.

The station can be reset remotely through SMS. The reset will turn off and turn on the modem shortly after, forcing the station to reset whatever connection configuration it currently employing or whatever modem state it is in.

To do this, a simple sending of SMS with text „Reset” is required. Note that it is case sensitive, therefore the SMS may only contain this single word with exact spelling as described here.

## J.9 Error handling

The firmware has several error handlers, allowing the system to operate despite connection or transmission errors that might occur during its use. All reactions are independent from other measurement device's activities – all measurements will continue proceeding, only the communication system will be affected. Particular behaviour depends on the nature of the error occurring:

- Configuration error – if an error occurs during the configuration process (SIEMENS modem transmits “ERROR” string in such case), the system will attempt to reset all configuration made so far and configure it again. In the case of such error is occurring during the attempt to establish internet connection, the system will wait a number of seconds defined by **RECONN. TIME** option and attempt to connect again, provided the **AUTO RECONN** option is ticked.
- Random disconnect – if an error occurs and modem will report internet connection failing, the system will reset all configuration settings, wait a number of seconds defined by **RECONN. TIME** option and attempt to connect again, provided the **AUTO RECONN** option is ticked.
- Unexpected disconnect from remote host – such error will be handled by closing the particular connection and clearing configuration in regard to it. Other system activities will be resumed.
- Broken transmission or interrupted configuration procedure – such error usually results in device waiting for reaction from the modem (during, for example data exchange) and not receiving any data that would progress its functions further regardless of reasons. In such circumstances, the communication system will wait 5 minutes before resetting the modem. Reset of the modem is done by turning it off and turning it on automatically. After a fixed period of 20 seconds, the modem will be configured again.
- TCP inactivity timeout – while using GPRS connection for TCP communication, a connection between the instrument and the server may break after a period of inactivity (as in no messages being exchanged). To counter this problem, a small packet of data (a single '#' character) is being sent to the server by the instrument every one minute if during this time no messages are being exchanged.
- To handle incorrect configuration, the modem will be automatically reset whenever any option from *MODEM*, *MODEM CONNECTION* or *E-MAIL OPTIONS* is changed.

## J.10 Communication diagrams

Data transmission process between server and configured station (EXAMPLE)

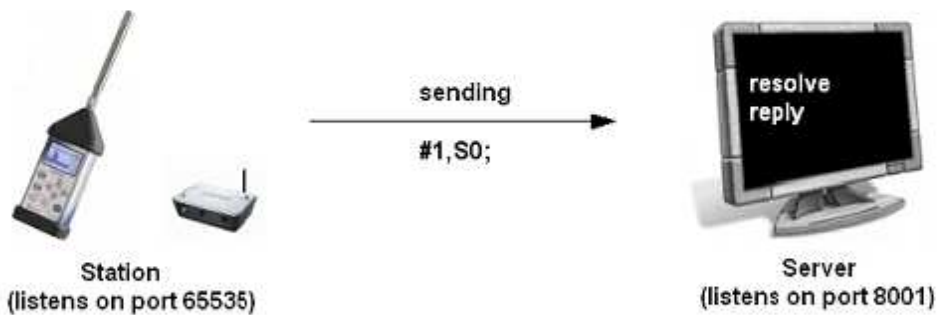
### 1. Connecting (TCP connection type)



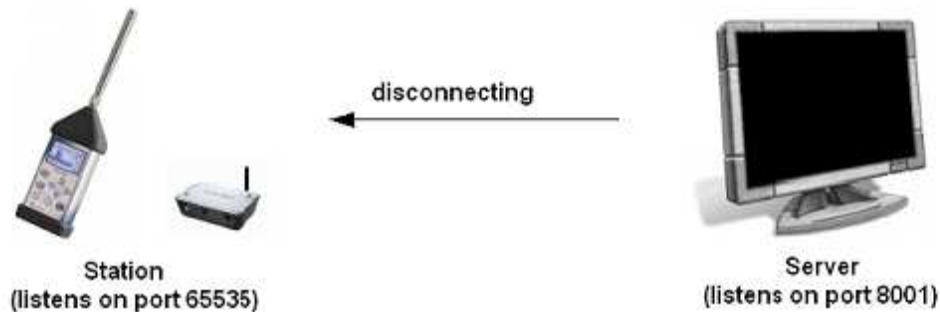
### 2. Send command (TCP or UDP connection types)



### 3. Send reply (TCP or UDP connection types)

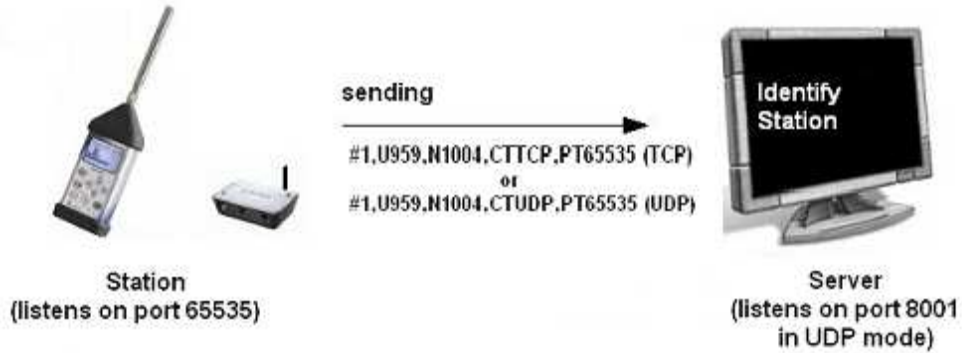


### 4. Disconnecting (TCP connection type)

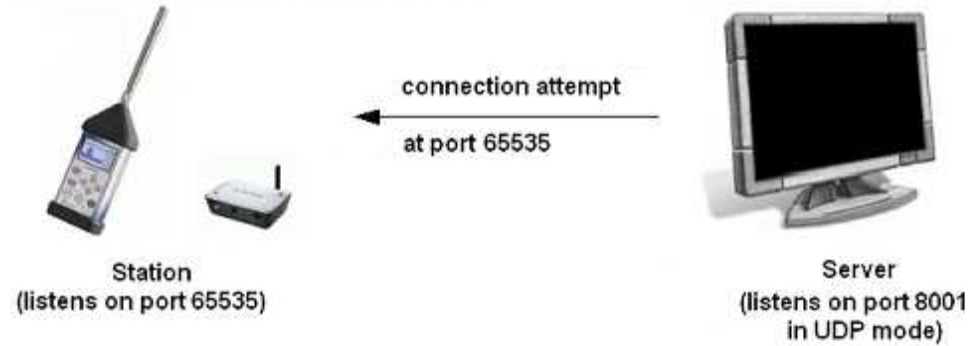


Registration process of configured station (EXAMPLE)

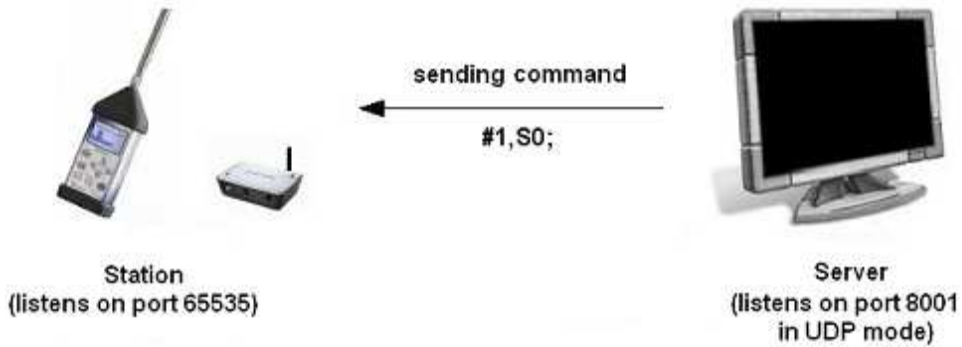
1. Sending registration packet



2a. Connecting (for TCP connection type)



2b. Sending command (for UDP connection type)



## J.10 Monitoring station/instrument side - GPRS/INTERNET remote communication modes

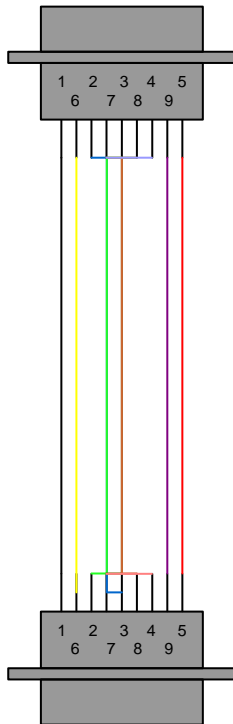
Connection mode	Description	Usage
<b>UDP</b>	<p><b>User Datagram Protocol.</b> UDP does not guarantee reliability or ordering of transmitted packets in the way as the <b>TCP</b> does. Datagrams may arrived out of order, appear duplicated, or went missing without notice. Avoiding the overhead of checking whether every packet actually arrived makes UDP faster and more efficient. SvanPC+_RC application has a built-in mechanism which behaves speed and efficiency of the UDP protocol and improves its functionality: ensures delivering and order of transmitted packets.</p> <p>In this connection mode station/instrument is ready to receive commands from a computer just after making a connection to the internet. A registration packet is sent to the computer at the beginning of the internet session. Registration packet contains: serial number of the station/instrument, IP address, UDP port etc.</p>	<p>Use it when IP address of your modem is <b>public</b> (depend on your SIM card).</p> <p>In case of <b>private</b> IP address:</p> <ul style="list-style-type: none"> <li>- one way communication "Receive Only" mode is available – from station/instrument to the computer,</li> <li>- system cannot work in "Transmit-Receive" mode and it's not possible to setup station/instrument remotely.</li> </ul>
<b>TCP S</b> (TCP/IP Server )	<p><b>Transmission Control Protocol.</b> TCP is a reliable stream delivery service that guarantees to deliver a stream of data sent from one host to another without duplication or losing data. However, because TCP is optimized for accurate delivery rather than timely delivery, TCP sometimes incurs long delays while waiting for out-of-order messages or retransmissions of lost messages, that it is why it is slower than UDP. TCP/IP connection is a peer-to-peer system, with client-server architecture. TCP server listens for incoming connection(s) and TCP client initiates this connection (s).</p>	<p>Use it when IP address of your modem is <b>public</b> (depend on your SIM card).</p> <p>This connection type is the most preferred because of its reliability and small amount of data needed to make a connection with the computer.</p> <p><b>This mode is not suitable for private IP addresses – system will not transmit any data!</b></p>
<b>TCP C</b> (TCP/IP Client)		<p>In this connection mode station/instrument does not send any registration packets but tries to establish a TCP connection to the computer directly. This time computer is a TCP server. Station/instrument is ready to receive commands from the computer just after establishing a TCP connection.</p> <p>There are no limitations on using this mode of communication. The modem's IP can be <b>private, public, static</b> or <b>dynamic</b>.</p>

### Computer side - GPRS/INTERNET remote communication modes

Internet IP address of the computer	System configuration
<b>public &amp; static</b>	Configuration of the system is very simple – just write your computer's IP as a "Server Address" in every station/instrument of the system (e.g. 192.168.1.100).
<b>public &amp; dynamic</b>	Use one of the Dynamic DNS services such as DynDNS and correlate dynamic

	IP of your computer with a name e.g. "svantek.dyndns.org" (see <a href="http://www.dyndns.com">www.dyndns.com</a> for more details). Write your computer's internet name e.g. "svantek.dydns.org" instead of IP address as a "Server Address" in every station/instrument of the system.
<b>private static or dynamic</b>	Use the same configuration as for public & dynamic IP address. Pay attention to proper configuration of your internet gateway (router and firewall) to retransmit packets from the stations/instruments to your computer in the Local Area Network.

### J.10. Scheme of RS232 modem-to-SV 55 converter



The picture to the left represents the scheme of the RS232 gender converter required for correct connection between the SV 55 cable and the SIEMENS modem. For maximum performance of the system it is required that all connections match and the converter is plugged accordingly with the picture's instructions.



**Notice for advanced users:** the scheme represents the standard crossed gender changer. The only difference are the crossed 4 and 7 pins on the to-modem connector, while the other has no 4th pin wire. This is essential mechanism for automatic modem restart feature that is part of the software