# TGW-100R / TGW-100

## TETRA Gateway
## for Packet Data and SDS Applications
## V 2.71 – June 2013


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# 1 Introduction

## 1.1 Overview

This document contains information about installation, settings, and operation of the TGW-100 TETRA Gateway. Additional information is also available over the Internet, at the website www.TetraModem.com, in the FAQ pages. This includes practical guidance relating to antenna selection and installation, operating range, extension modules, software support, etc.

## 1.2 Safety Precautions

This radio equipment should not be used in life support systems or in safety systems without our prior written permission.

## 1.3 Disclaimer

We have carefully checked the contents of this document, and the hardware and software described in it, for compatibility. We cannot however exclude possibilities of deviations and cannot guarantee complete conformity of the document with the equipment it describes. If any corrections or improvements are to be made, they will be taken into consideration in the next edition of this document.

Important instructions are marked by the expressions "Important", "Note" or “Caution!”. These should be carefully observed. Explanations regarding these precautions can be found in the website www.TetraModem.com, in the Login Area pages.

## 1.4 Functions and Features

The TGW-100 is a gateway for the connection between automation devices and servers (SCADA, PLC, PC), mainly used on the master side (i.e. control rooms, SCADA servers etc.) to make a connection between devices based on serial protocols and a TETRA network.

The TGW-100 supports nearly all standard and proprietary serial communication protocols. It has two serial data interfaces (RS-232 or RS-485/422) and an Ethernet (10/100 Mbits/sec) port. For the data transmission on the TETRA radio network, either of two modes can be selected: SDS based communication (on supported infrastructures) or packet data based transmission (working on any infrastructure which allows the connection of IP based equipment to the TETRA switch).

The main function of the TGW-100 is to connect serial based equipment to the TETRA network with a direct IP connection to the TETRA switch. This will save the air interface link on the master side, where normally the data to all outstations will be routed through. As IP based protocols can directly be connected to the TETRA switch, serial based protocols must use a gateway device for being connected to the infrastructure, featuring also a protocol address detection and translation into addresses which can be handled by the TETRA network (ISSI or IP addresses).

The use of a gateway instead of a radio link on the master side will dramatically decrease the load on the base station located to the master site and also reduce the latency by the half of time. It will eliminate the bottleneck of data communication which is sitting on the master side, where all data needs to pass, if a normal TETRA radio is used to connect the control room or master SCADA to the TETRA network.

The TGW-100 is delivered as a 19" rack version as "TGW-100R". The rack version allows the easy mounting in a server cabinet and includes two redundant power supplies. Up to 3 additional TGW-100 plug-in modules can be placed into the basic TGW-100R enclosure, giving a total of 4 TGW-100 modules with overall 8 independent serial ports.

The TGW-100 is also available in a rugged aluminum housing compatible with standard DIN rail mounting. The wide power input voltage range of 12-24 VDC [+/- 20%] makes it easy to integrate the unit into monitoring and control systems.

## 1.5 Software Options

Basically the TGW-100 can be used to connect serial equipment to any TETRA infrastructure if the data transmission is done by packet data (IP based) in the TETRA network.

For a SDS based data transmission, the protocol to send and receive SDS and Status messages is proprietary for each infrastructure manufacturer as there is no standardized interface.

Actually the TGW-100 supports SDS based messaging for infrastructures from Etelm. Other infrastructures may be implemented on project basis.

## 1.6 Software Versions

The software (firmware) versions and document editions history is listed below:

| Firmware Version | Document Version | Comments / Changes |
|---|---|---|
| 2.20 | 2.20 | Documentation Release |
| 2.60 | 2.60 | • TGW-100 supports SDS gateway mode for Cassidian infrastructures (TCS server needed)<br>• Support of TGW-100R rack mount version |
| 2.70 | 2.70 | • TGW-100 supports SDS gateway mode for Hytera infrastructures (native ACAPI interface support)<br>• Automatic redundancy switchover between two SwMi connections supported for Hytera and Cassidian SDS interface mode. |

# 2 Connections and Hardware Installation

## 2.1 TGW-100R: Rack version

### 2.1.1 Basic information

The TGW-100R (Tetra Gate Way) converts serial communication protocols to TETRA IP-Data and/or to TETRA SDS Messages. The device has two serial ports for interfacing to a SCADA Server or NMS Server and two IP (Ethernet) Ports. The TGW-100R has an embedded Web-Server and can be configured easily using a standard WEB browser on a Windows PC or MAC device. When beside Packet Switched Data also SDS messages shall be used, additional individual driver software is needed to interface the TGW-100R to the different TETRA infrastructure manufacturers.


### 2.1.2 Mode of operation

Each of the serial ports can be configured independent for a protocol such as Modbus RTU, DNP3, Sinaut and many others. And for each of these ports a Routing Table as well as an IP Reference Table will be used to rout the received serial data over the TETRA infrastructure either as an SDS message or as Packet Data stream to the outstation(s).
An optional trigger threshold can be used to operate the device in mixed mode and to send the data depending on its length as an SDS Message or as a Packet Data stream. If the messages will be send as an SDS, only individual ISSI addressing is used and the data will be com¬pressed to keep the network load as low as possible.

### 2.1.3 Mechanical Details

The TGW-100R is enclosed in a black 19" rack mount enclosure with 3 height units. The main rack has 2 independent power supplies with separated IEC power connectors on the back. Cables with a European power plug are delivered with the rack.

One TGW-100R rack can support up to 4 TGW-100R plug-in modules, each with two serial ports for connection to the SCADA equipment.

### 2.1.4 Interfaces

Both serial interfaces ("COM" and "AUX") use a standard 9-pin D-sub connector. Also available on the front panel are two Ethernet connectors which are connected by an internal Ethernet switch. This allows the chaining of the up to 4 plug-in TGW-100R-units in a rack to a single uplink cable or the easy connection of a PC for configuration.

In total, eight serial interfaces can be realized in one 19" enclosure.

LED lamps on the front panel provide information about the operating condition of the unit, the Rx and Tx status of all interfaces and the link status to the TETRA infrastructure in case that the gateway is used for SDS based data transfer.

### 2.1.5 Power supply inputs

The power inputs of the TGW-100R enclosure are located at the back. There is one IEC power input plug for each power supply, equipped with an on-off switch and two fuses (2A medium speed).

The IEC plugs are secured against unwanted removal by a lock. To remove the plug, the red lever on the plug must be pulled while the plug is drawn out.
Two cables with a European plug are included in the delivery, for other countries you may ask for cables fitting the needs. Also standard cables with IEC plug may be used, but please aware that you'll lose the removal lock with a standard plug.

IEC plug with removal lock

As each power supply has its own power input, a connection to redundant power trunks is possible. Even if one power supply fails, the TGW-100R with all plug-in modules will remain fully operational.

Beside the normal operational LED on each power supply which shows the availability of main source, each TGW-100R plug-in module also shows the status of both power supplies (named with "Pwr L" for the left module and "Pwr R" for the right module).

**The power supply modules can be hot-swapped, an exchange is possible during operation.**

## 2.2 TGW-100: DIN-Rail-Version

### 2.2.1 Mechanical Details

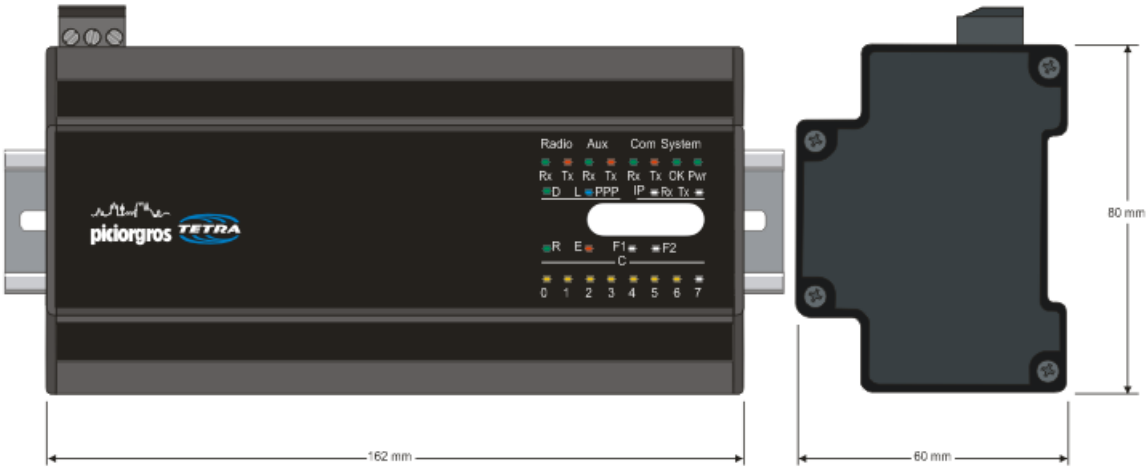
The dimensions of the TGW-100 housing conform to DIN 43880, and therefore it can be mounted on a standard 35mm DIN rail [DIN EN 50022]. Two serial interfaces are provided for connecting the TGW-100 to a PC/PLC or other local terminal equipment. The main serial interface ("COM") uses a standard 9-pin D-sub connector, while the secondary serial interface ("AUX") uses a standard RJ-11 socket. On the lower side of the housing an RJ-45 connector for the Ethernet port allows the TGW-100 to be hard-wire networked with the TETRA infrastructure.

On the left upper side of the unit is located the plug-in terminal connector for the power supply (12-24 VDC +/-20%) and a BNC socket for the antenna.

A 10-pole DIP-switch allows quick changes to the unit's settings: e.g., changeover to Programming Mode.
LED lamps on the front panel provide information about the operating condition of the unit: e.g., received TETRA RF signal strength, error conditions, etc.

### 2.2.2 Dimensions

The dimensions of the TGW-100 are as follows:
162mm (9T) wide x 80mm high x 62mm deep
All dimensions exclude connectors.

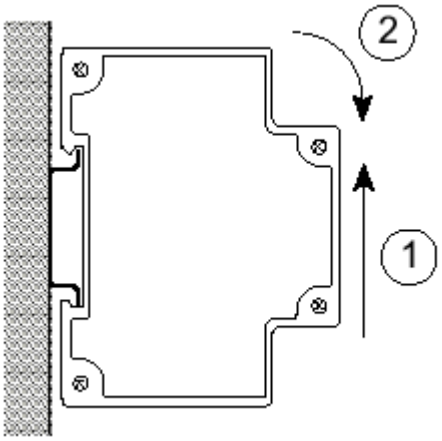


### 2.2.3 Mounting

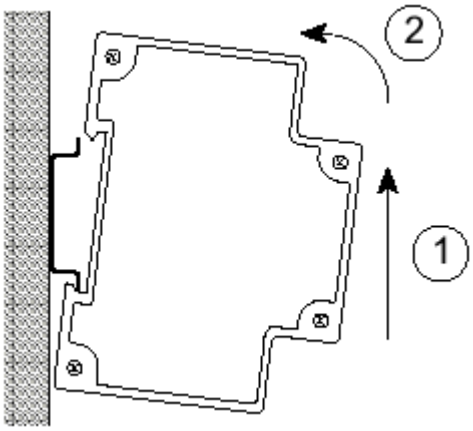
The DIN rail mounting clip is at the bottom of the Module. First the lower lip (spring-loaded) of the clip is engaged with the lower flange of the DIN rail, with the Module tilted downward slightly. The Module is then pushed upward (1) and rotated backward (2) until the upper lip of the clip snaps onto the upper flange of the DIN rail.

### 2.2.4 Dismounting

To dismount the Module, force it upwards (1), and then rotate its upper end outward (2) until the upper lip of the Module's clip disengages from the upper flange of the rail. Then move the Module down slightly to disengage its lower lip from the rail flange.




**Mounting**




**Dismounting**

### 2.2.5 Power Supply Input

The required supply voltage (12-24 VDC +/-20%) is connected through 3-way screw terminal connector located on the upper side of the enclosure.

The terminals are assigned as follows (viewed from the front of the module, facing the front panel):

Outer (left): Enclosure Ground (electrical earth)
Middle: + 12 Volt to + 24 Volt (+/- 20%)
Inner (right): GND, 0 Volt from Power Supply

## 2.3 Electrical Connections

### 2.3.1 Serial Interfaces

The TGW-100 has two serial data interfaces. The primary interface (COM) can be either RS-232 or user-selectable RS-422/485. The AUX interface can be RS-232 or RS-485 (only).

The following parameters are user adjustable: baud rate in the range 300 - 57600 bps, data word length 7 or 8 bits, odd / even / no parity, and 1 or 2 stop bits. The factory setting is 9600 bps, 8 data bits, no parity, 1 stop bit.

If a frame error is detected, or if the parity bit does not conform to the setting, the received data block is rejected.

Both serial interfaces are supplied as RS-232, unless ordered otherwise. The primary interface is optionally available as a user-selectable RS-485 / RS-422 port, while the AUX interface is optionally available as an RS-485 port. Note that the RS-485 / RS-422 interface does not have the CTS/RTS lines.

| **Pin No.** | **Pin Assignment: DB9, RS-232** | |
|---|---|---|
| 2 | TxD | Send data TGW-100 → peripheral |
| 3 | RxD | Receive data TGW-110 ← peripheral |
| 4 | DTR | Shorted to Pin 6 |
| 5 | GND | |
| 6 | DSR | Shorted to Pin 4 |
| 7 | RTS | Handshake TGW-100 ← peripheral |
| 8 | CTS | Handshake TGW-100 → peripheral |

| **Pin No.** | **Pin Assignment: DB9, RS-422** | |
|---|---|---|
| 2 | A | Receiver + (input) |
| 3 | Z | Transmitter – (output) |
| 5 | GND | |
| 7 | B | Receiver – (input) |
| 8 | Y | Transmitter + (output) |

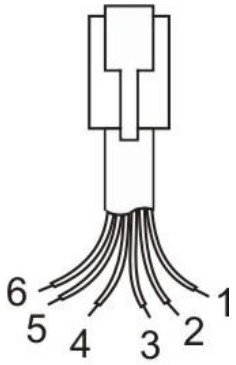
| **Pin No.** | **Pin Assignment: DB9, RS-485** | |
|---|---|---|
| 3 | B | Transceiver – |
| 5 | GND | |
| 8 | A | Transceiver + |

For the connection of the COM interface to a PC or PLC, use a standard 1:1 connector-terminated cable (9-pin D-sub male to 9-pin D-sub female).

### 2.3.2 Secondary Serial Interface (AUX Interface) on TGW-100 DIN-Rail

On the TGW-100 DIN-Rail-version, the AUX interface socket is located on the lower side of the unit. This interface allows the implementation of special applications, e.g., switching of the data-flow through this interface by a command, or feeding data from a predefined ISSI to this port rather that to COM.

This secondary interface is provided through a 6-pin RJ-12 connector and equipped default with an RS-232 interface. The unit can be ordered optional with an RS-485 interface (RS-422 is not possible on the AUX port).




AUX Port

| Pin No. | Pin Assignment: Auxiliary Interface, RS-232 | |
|---|---|---|
| 1 | GPS Supply voltage | |
| 2 | RTS | Handshake TGW-100 ← peripheral |
| 3 | RxD | Receive data TGW-100 ← peripheral |
| 4 | TxD | Send data TGW-100 → peripheral |
| 5 | CTS | Handshake TGW-100 → peripheral |
| 6 | GND | |

| Pin No. | Pin Assignment: Auxiliary Interface, RS-485 | |
|---|---|---|
| 1 | GND | |
| 3 | B | Transceiver – |
| 4 | A | Transceiver + |
| 6 | GND | |

**On the TGW-100R rack version, also the AUX port is realized with a standard DB9 connector!**

### 2.3.3 Ethernet Interface(s)

The Ethernet interface is provided via an RJ-45 socket on the underside the unit. This is a standard 10/100 Mbit/s interface. Two LEDs indicate the operating condition of this interface:

- Green LED: Lights up when an Ethernet network is connected (LINK)
- Yellow LED: Blinks when data transfer is taking place (DATA)

Network parameters such as IP address, netmask, and gateway address can be assigned as a static address.

A TGW-100R plug-in-module is equipped with two Ethernet plugs. Both Ethernet plugs are internally connected by an Ethernet switch. Any interface can be used for the Ethernet connection, but due to the availability of the second port, the IP network can be chained to the next TGW-100R module in a very easy way.

## 2.4 LED Functions

Groups of LED lamps on the front panel of the TGW-100 indicate the operating condition of the modem, the link to the TETRA infrastructure, and error conditions if any. Specific LED functions are described below.

### 2.4.1 TGW-100R rack version

| LED | Function |
|---|---|
| System Pwr | Power supply input |
| System OK | Indicates the "Ready" status of the modem (continuously lit). Also indicates error conditions (coded blink sequences). |
| COM Tx | Lights up while the TGW-100 sends data via the COM interface |
| COM Rx | Lights up while the TGW-100 receives data via the COM interface |
| Aux Tx | Lights up while the TGW-100 sends data via the AUX interface |
| Aux Tx | Lights up while the TGW-100 receives data via the AUX interface |
| IP Tx | Lights up while the TGW-100 sends data to the infrastructure for packet data transmission |
| IP Rx | Lights up while the TGW-100 receives data from the infrastructure from packet data transmission |
| SDS Tx | Lights up while SDS or Status data is being sent to the infrastructure |
| SDS Rx | Lights up while SDS or Status data is being received from the infrastructure |
| Link (blue) | Off: No link to TETRA SwMi or TGW-100 is operating as packet data gateway<br>Flashing: Trying to connect to the TETRA SwMi in SDS mode<br>Permanent on: Shows active link to the TETRA infrastructure in SDS gateway mode |

### 2.4.2 DIN-Rail version

| LED | Function |
|---|---|
| System Pwr | Power supply input |
| System OK | Indicates the "Ready" status of the modem (continuously lit). Also indicates error conditions (coded blink sequences). |
| COM Tx | Lights up while the TGW-100 sends data via the COM interface |
| COM Rx | Lights up while the TGW-100 receives data via the COM interface |
| Aux Tx | Lights up while the TGW-100 sends data via the AUX interface |
| Aux Tx | Lights up while the TGW-100 receives data via the AUX interface |
| IP Tx | Lights up while the TGW-100 sends data via the Ethernet interface |
| IP Rx | Lights up while the TGW-100 receives data via the Ethernet interface |
| Radio Tx | Lights up while SDS or Status data is being sent to the infrastructure |
| Radio Rx | Lights up while SDS or Status data is being received from the infrastructure |
| RF | These Led bar indicates the correct registration to the TETRA infrastructure if the TGW-100 is in SDS gateway mode. During startup, a yellow LED point runs from the right side to the left side. As soon as the TGW-100 is registered to the infrastructure, all 8 LED will light up (this gives the same picture like the TGW-100 when it's attached to the network with full field strength).<br><br>In case of a connection problem, LED 4 flashes continuously. This indicates that the IP connection to the TETRA infrastructure is lost or the infrastructure is not responding properly to the communications from the TGW-100. |
| PPP Data | not used |
| PPP Link (blue) | Shows active link to the TETRA infrastructure in SDS gateway mode |
| R,E,F1,F2 | not used |

### 2.4.3 OK LED: Blink Pattern Error Indication

When the TGW-100 is powered up, the OK LED should be constantly “on” to indicate the proper device operation.
If this LED is flashing or off, it indicates an exception. Different “blinking codes” can indicate different problems as shown in the table below:

| **Blink Pattern** | **Meaning** |
|---|---|
| LED off | Controller (CPU sub-module) fault or the modem is not in "Ready" state. |
| Continuously lit | Device in "Ready" state, no fault/error conditions |
| Slow blinking,<br>1:1 tempo | The device is in programming mode. |

## 2.5 Reset to factory default (DIN-Rail version)

The TGW-100 can be reset to the factory default configuration. Also the Ethernet parameter can be reset independently, if the IP address is not known any more.

### 2.5.1 General Reset of the Device to Factory Default

Using the following procedure, the TGW will be reset to factory default. All parameter will be cleared, the IP address will be set to 192.168.0.199.

- Disconnect the device from power supply
- Set DIP-switch 10,9,6,5 and 1 to "on" all other to “off”

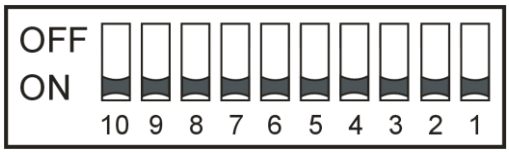

- Apply power to the device
- If the LED’s in the RF-display Stepp from left to right (single LED), set DIP 10 to „off“


- Now two pairs of 4 LED each flash indicating that the unit is resetting. Now wait until the device reset is ready, and the unit will restart again.
- After the restart, all DIP-switches should be reset to „off“

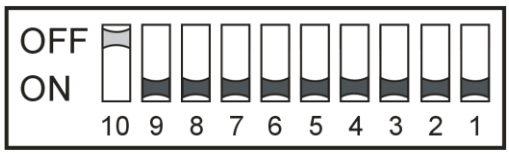
### 2.5.2 Resetting the Ethernet Parameter

Using the following procedure, the Ethernet parameter of the TGW will be reset to factory default and the IP address will be set to 192.168.0.199, subnet mask 255.255.255.0. All other parameter will be unaltered.

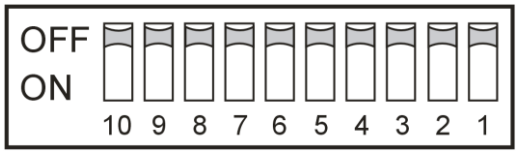
- Disconnect the device from power supply
- Set all DIP-switches to “on”




- Apply power to the device
- If the LED’s in the RF-display steps from left to right (single LED), set DIP 10 to „off“

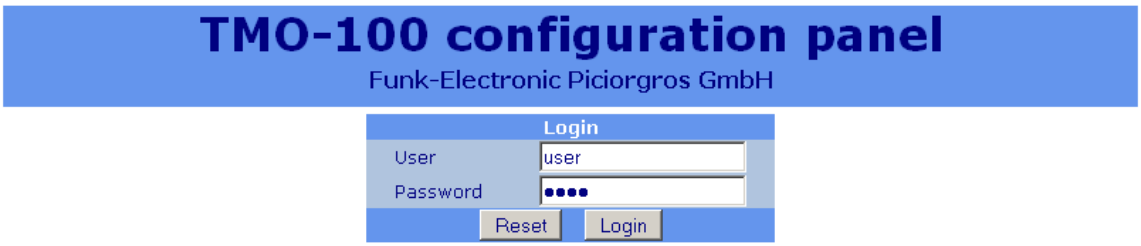



- Now two pairs of 4 LED each flash indicating that the unit is resetting. Now wait until the device reset is ready, and the unit will restart again.
- After the restart, all DIP-switches should be reset to „off“



## 2.6 Configuration of the TGW using the embedded web server

The TGW can easily be configured using the embedded web server.
Connect the device to your Laptop / PC using a standard Ethernet cable. Then start your web browser (all our tests have been successfully made using the Firefox browser)
Enter the IP address 192.168.0.199 into the input box of your browser (that is the default IP address of the TGW).
The following screen will then be displayed:

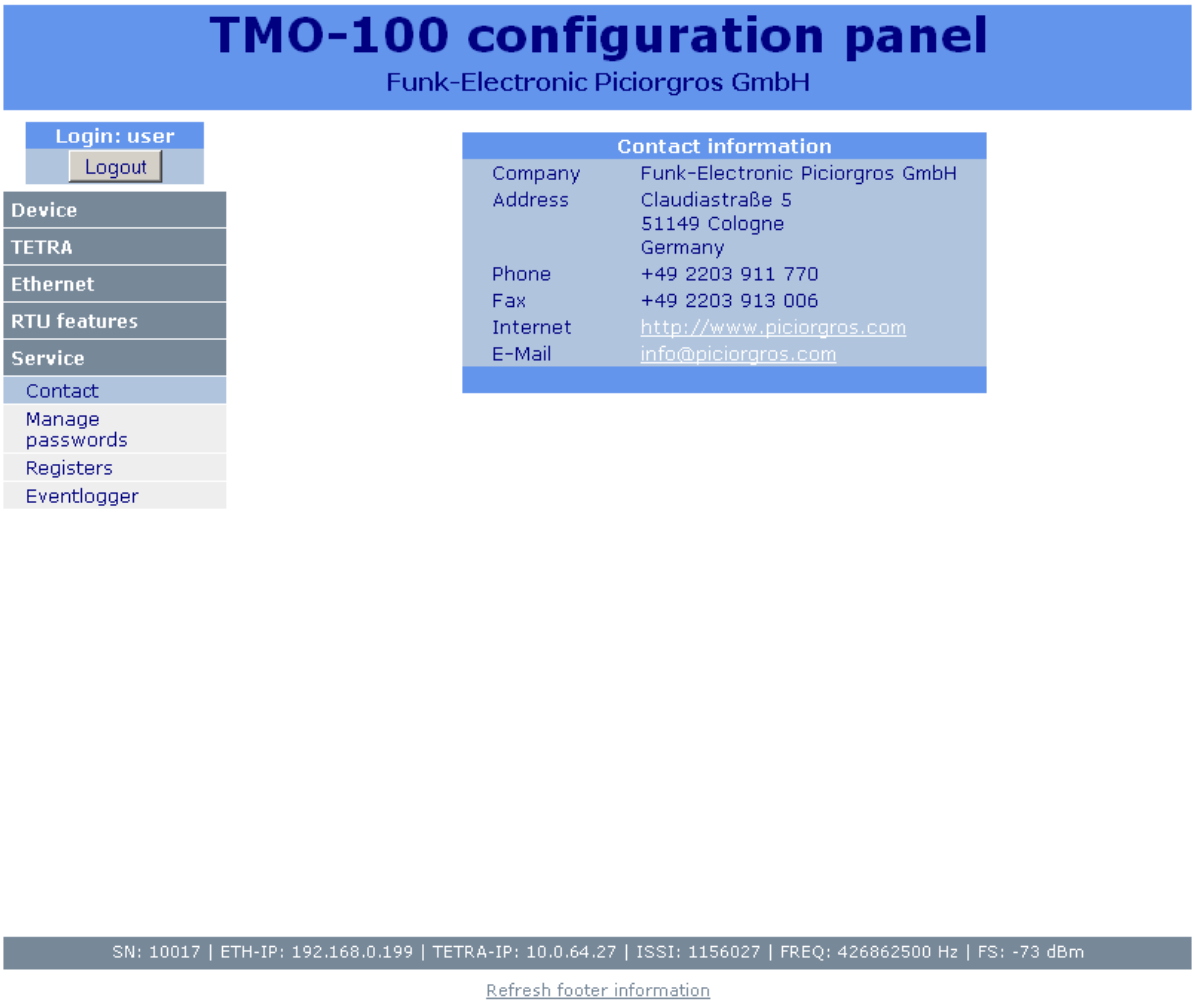



The login will be done using the default username and password
(take care, as both are case sensitive):

Username: “user”
Password: “user“

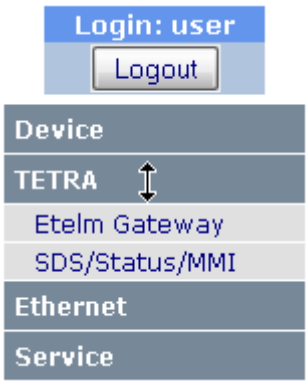
These passwords can be changed any time using the menu “Service / Manage Passwords”.
After a successful login, the configuration menu of the TGW will be displayed. On the left part of the screen the menu is listed, on the right part the parameters can be changed. A separate footer displays the most important device parameters.

Please note that the menu and footer line are only loaded once at the beginning from the device to reduce traffic load. On demand the Menu and Footer Line can be reloaded.



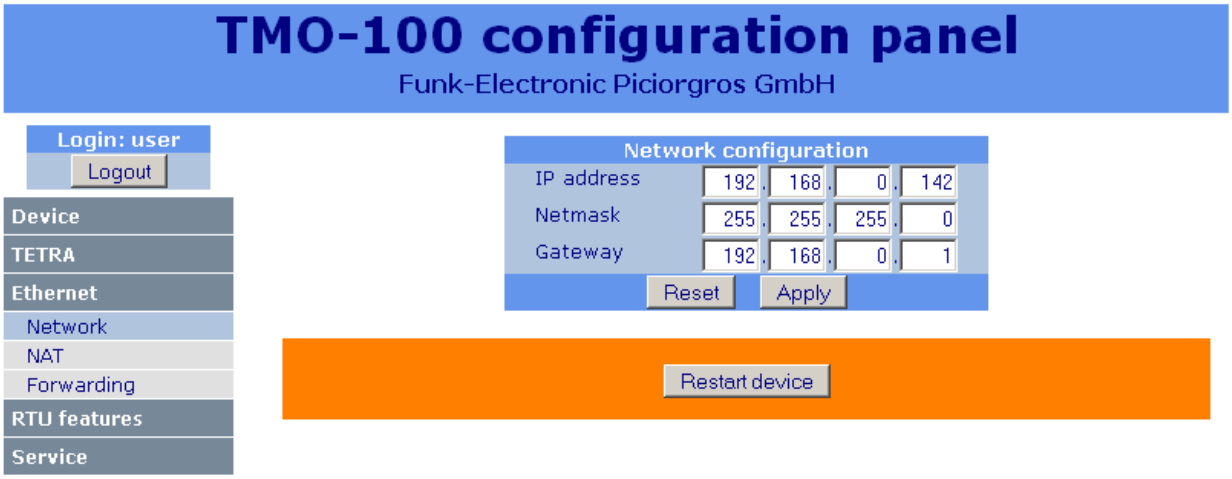

### 2.6.1 Navigation using the Menu

To select a menu, move the cursor over the desired headword and click it. Then the menu will open displaying the next options



### 2.6.2 Requesting Restart of the Device

Some configuration changes (change of Ethernet or Tetra parameter) need a restart of the device before they will take effect.
If these changes have been done by the user, an orange button with the text “Restart Device” is displayed.
The button has not to be pressed until all changes have been made, even if it is necessary to change to another menu page.



# 3 Data Communication over TETRA Networks

The TGW-100 can transfer data between any of its wired data interfaces (serial and Ethernet ports) on one side, and the TETRA infrastructure on the other. The TGW-100 can handle any of the common industrial automation and instrumentation protocols (MODBUS, MODBUS/TIP, IEC-60870-5-101, IEC-60870-5-104, PakBus, DNP3 etc.…), custom protocols, and configuration data.

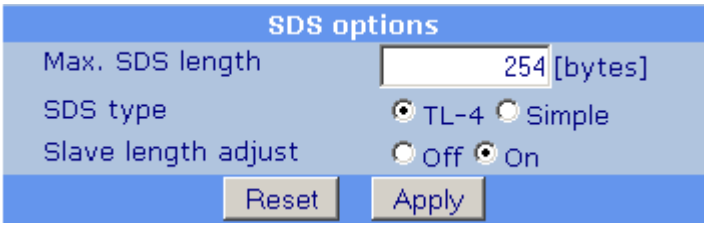
Data communication is possible in two modes (of which two are supported presently):

**SDS based data transfer:**

With SDS based data communication, the TGW-100 can transfer data in serial data packets of up to 1460 bytes each. The final maximum length of a serial data packet is determined by the maximum length of a single SDS, which can be limited by the infrastructure. As a maximum of 7 single SDS can be used for one data packet, the size limitation will be 980 bytes in networks with a limitation of 140 bytes per SDS, going up to full 1460 bytes in networks which supports the full specified length of 254 bytes per SDS.

The packets are broken down if necessary (transparent to the user) into smaller SDS data blocks. Serial data communication protocols such as MODBUS, DNP3 or IEC-60870-5-101 are smart routed to the slave modems. To do this, the TGW-100 extracts the logical addresses, looks up a routing table, and sends the data onward to the slave/receiving station modem with corresponding ISSI address.

The maximum length of an SDS data block is configurable up to 254 characters. Restriction of SDS data block length is necessary because not all TETRA infrastructures support the full length of 2047 bit. If the data block to be transferred is longer than the maximum SDS length supported form the Tetra infrastructure, it is split into several SDS data blocks by the transmitting TGW-100 and automatically re-assembled by the receiving TMO-100 and vice versa.




Setting the SDS parameter

**SDS based transmission will require that the proprietary protocol of the TETRA infrastructure manufacturer must be supported by the TGW-100. Please contact Piciorgros for a list of supported infrastructures.**

**Packet-data based data transfer:**

The use of data transmission which uses the packet data transmission in the TETRA network **is possible with all infrastructures which allow the connection of IP based devices to the TETRA switch** for communication with TETRA radio modems using packet data.

In contrast to SDS based transmission, there is no need of a special support of the used infrastructure by the TGW-100, as IP packets are standardized and no proprietary protocol is needed.

## 3.1 Data Communication by SDS

Data communication by SDS does not necessarily require an IP switch within the TETRA network: therefore it is compatible even with smaller installations. SDS Data communication takes place only through the Control Channel (MCCH). Therefore no additional timeslots or RF-Carriers are required for data communication.

The TGW-100 supports a maximum SDS length of 2047 bits (254 bytes) in accordance with the ETSI specification. However, since not all TETRA infrastructures support this length, users can set a lower maximum length for SDS data blocks. If the data block to be transferred is longer than the maximum SDS length, it is split into several SDS data blocks by the transmitting TGW-100 and automatically re-assembled by the receiving TGW-100. This fragmentation/de fragmentation of data blocks is transparent to the terminal equipment connected to the TGW-100 at either end, and makes the TGW-100 compatible even with older TETRA networks. In this respect, radio data communication through TGW-100 modems behaves like wire communication, with minimum transmission delay. If a TGW-100 receiving data detects a checksum error, the entire data block is discarded.

SDS data communication supports data communication only via the serial interfaces: RS-232 or RS-422/485. Transfer and routing of IP packets is not possible

The serial interface settings of TGW-100 modems on the same TETRA network do not have to be the same. Therefore it is no problem if the master modem is set for 38400 bps, 8N1, - while the slave is set for 9600 bps, 8E1. For performance-critical applications the serial interface should be set for the highest possible baud rate compatible with the terminal equipment, as this naturally minimizes data communication delay time.

As every TETRA infrastructure manufacturer uses an own proprietary protocol to send and receive SDS and Status message with a direct connection to the switch, the used infrastructure must be supported by the TGW-100. Please contact Piciorgros for a list of supported infrastructures.

### 3.1.1 Selection of the TETRA infrastructure manufacturer

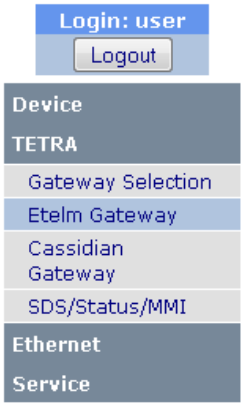
As the use of SDS for data transmission is depending on the implementation of the used infrastructure in the TGW-100, the infrastructure manufacturer must be selected in the TGW-100 for the use of SDS based transmission. This selection is done in "TETRA → Gateway" selection:

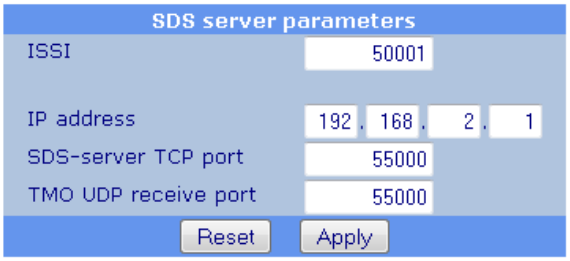

Some infrastructure manufacturers may be subject to a license for the TGW-100, so not all options may be available for activation. The active options in the TGW-100 can be reviewed in "Service → Configuration", where also additional services can be activated by activation keys.

Each manufacturer has a different configuration page in the TGW-100 where the service can be configured according to the data which should be used.

### 3.1.2 SDS services for Etelm infrastructures

In TETRA → Etelm Gateway all needed parameters can be configured:




- ISSI: The ISSI of the TGW-100. SDS data from the outstations needs to be sent to this ISSI to be received by the TGW-100. Each TGW-100 needs a different, unique ISSI. This will be provided by the network operator.

- IP address: IP address of the Etelm infrastructure. This will be provided by the network operator.

- SDS-Server TCP and UDP ports: The ports which are configured for the dispatcher connection of the infrastructure. Normally both port numbers are the same. These will be provided by the network operator.

As soon as all parameters are configured, the TGW-100 will indicate a needed restart. After the reboot, the TGW-100 will start to connect to the infrastructure. As soon as the connection is established, all RF LED's will be lit (on the TGW-100 DIN-Rail version) and the blue LED (named "PPP" on the TGW-100 DIN-RAIL, and "Link" on the TGW-100R rack version) will be lit. This blue LED will indicate a proper connection between TGW-100 and TETRA infrastructure.

### 3.1.3 SDS services for Cassidian infrasturctures

The Cassidian infrastructures are handling the SDS transfer by the TCS server, which is an optional part of the infrastructure. A TCS server is needed for the use of the TGW-100 for SDS based transmission.

As the TCS server does not offer a direct open IP based protocol for the data transmission, the COM / RCOM connection which is provided by the TCS API must be used by any application which wants to send and receive SDS and Status messages. Due to this limitation, a gateway software for Windows based computers is needed to provide the connection between the TGW-100 and the TCS server.

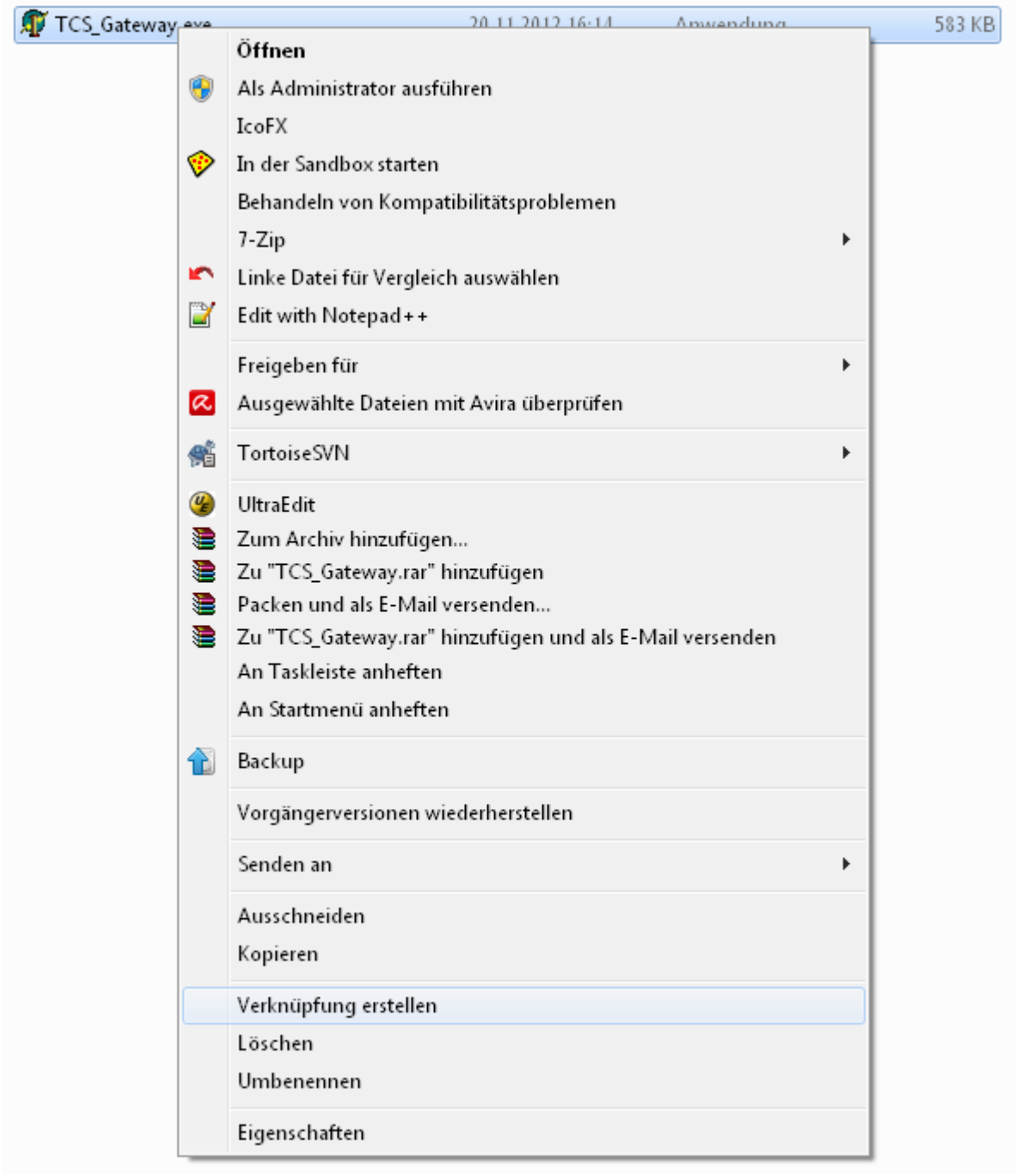
This software is a single executable called "TCS_Gateway" which does not need an installation on the PC. Also this application can be started in multiple instances on a single PC, so that the PC can handle the connection of several TGW-100 to the Cassidian TCS server.

#### 3.1.3.1 TCS-Gateway installation

To install the TCS-Gateway, copy the file "TCS_Gateway.exe" on a PC running Windows operating system (Windows XP or higher needed, also a Windows Server OS starting from Windows Server 2003 can be used). You can use any directory (i.e. C:\Program Files\Piciorgros\TCS Gateway). Please take care that the application must have the rights to write into this directory!

You can run multiple instances of the program on the same machine, each interfacing one TGW-100. The application will open a TCP port to wait for a connection of the TGW-100. This port must be specified, also one port can only be used by one application on a PC. If you want to run 5 instances of the TCS_Gateway.exe, each one must listen on a different port.

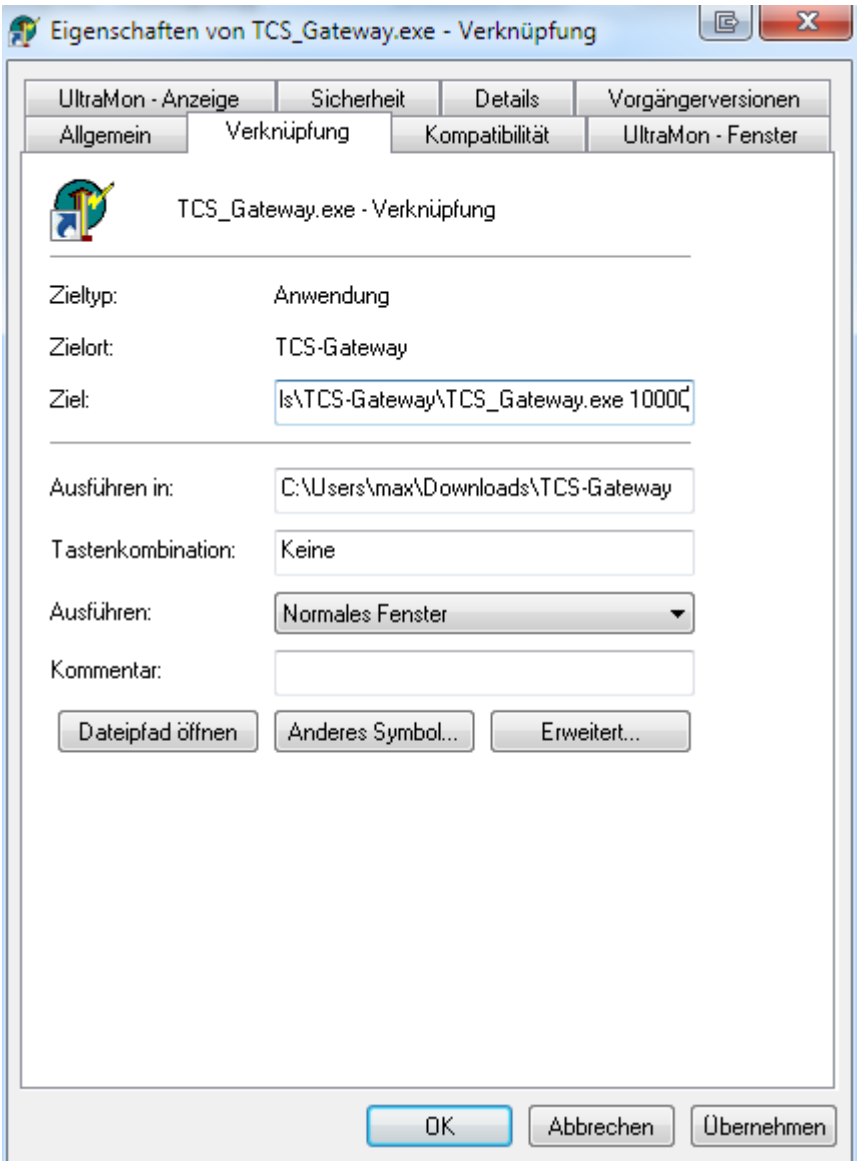
To specify the IP port, you need to create a link in the same directory. Make a right-click on the "TCS_Gateway.exe" and select "Create Link".



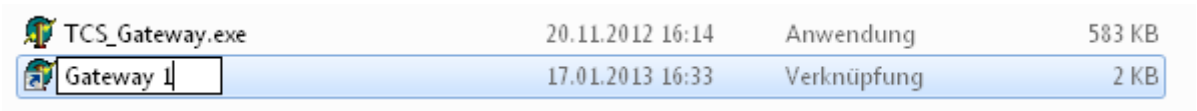

You will get the link created in the same directory:

Right-Click on the link and select "Properties":

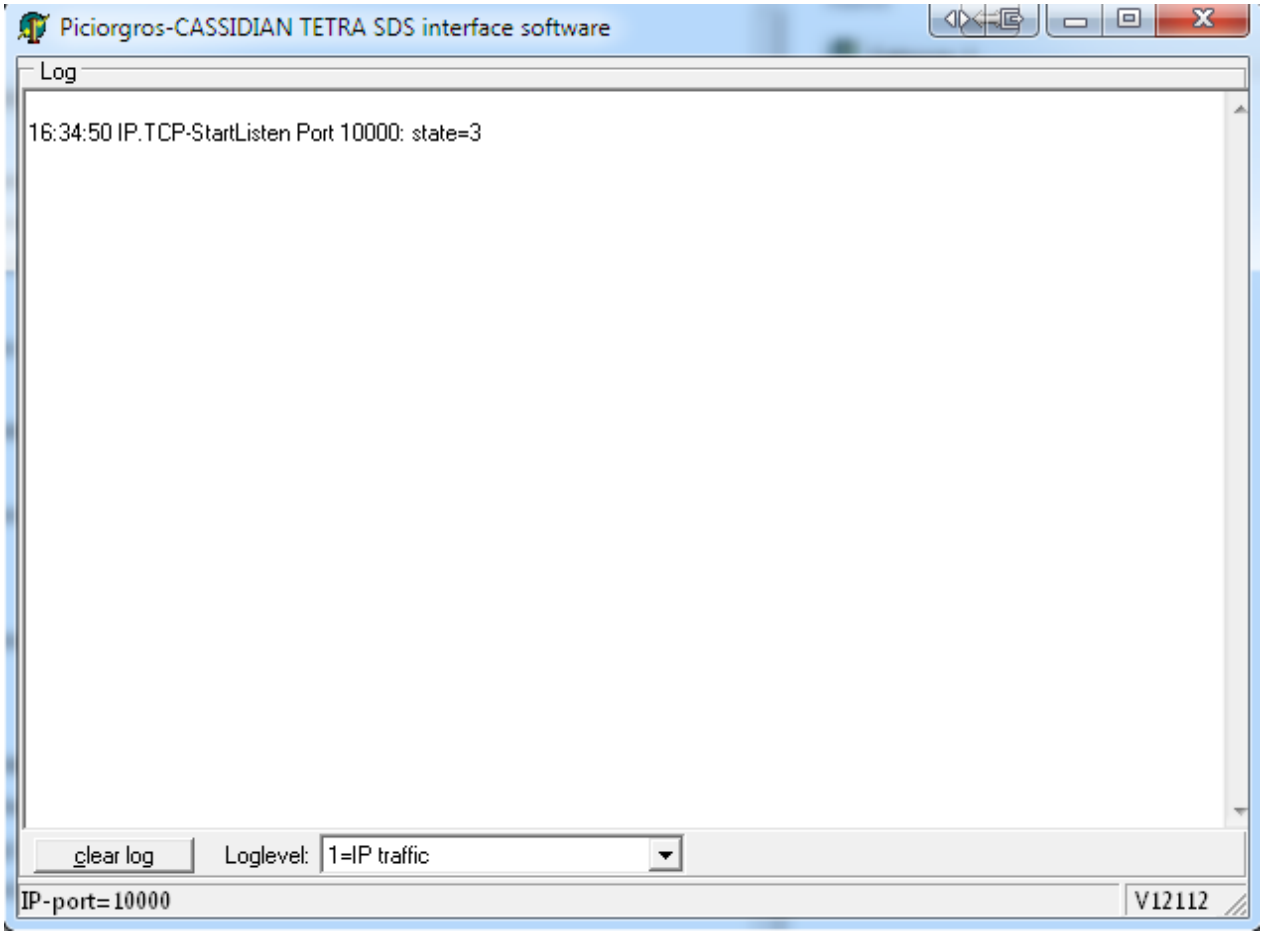
In the "Target" line, add the port number behind the "TCS_Gateway.exe". We'll use 10000 in this example:




Click "OK". If you like, you can also rename the Link (i.e. to: "Gateway 1").



By performing a double-click on the link, the application will be started:



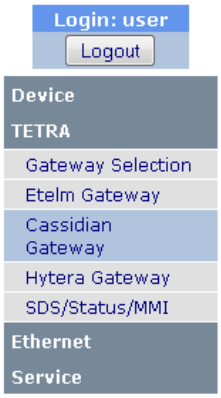

Please doublecheck the "IP-port" on the left side of the status bar: It should show the port number you've specified in the link to the application.

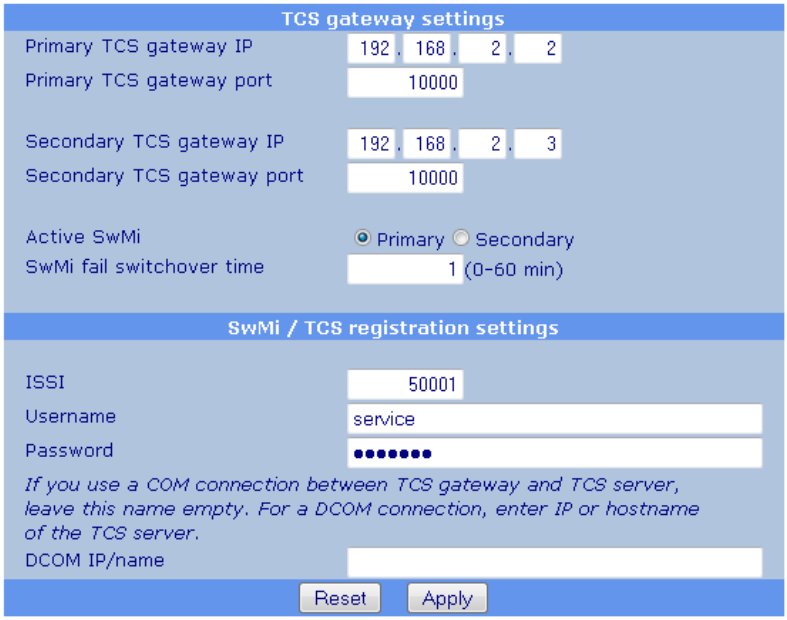
**Note:**
**Please use always the link(s) to start the application(s). Do not start the .exe-file itself as in this case it will not listen on a port for incoming connections from a TGW-100.**
**Use always different port numbers for each instance of the TCS_Gateway application!**
**Don't forget to include the links in the AUTOSTART, so the applications will automatically restart after a reboot of the PC.**

**The PC running the TCS_Gateway applications must be in the same IP subnet as the TCS server and all TGW-100 gateways! Also the firewall must allow connections between the PC and the TCS server and also between the PC and all TGW-100.**

### 3.1.3.2 TGW-100 configuration

On the TGW-100, "TETRA → Cassidian gateway" must be configured according to the installation of the TCS_Gateway application and the infrastructure settings:




- TCS gateway IP: This is the IP address of your server running the TCS_Gateway application

- TCS gateway port: This is the port number of the TCS_Gateway instance which is responsible for this TGW-100 (10000 in our example). Each TGW-100 needs a unique instance and port number on the gateway server.

Two independent TCS gateway addresses can be configured: A primary TCS gateway connection and a secondary TCS gateway connection. Below these settings, the use of the primary or the secondary gateway connection can be selected. In addition to this, a switchover time between 0 and 60 minutes can be configured for a redundancy switching.

If the switchover time is configured, the TGW-100 will automatically switch to the other TCS gateway address if the selected interface fails (i.e. if the SwMi is down). If this setting is set to 0 minutes, no automatic switching will occur.

Please note that the TGW-100 will stay connected to the SwMi after the switching, it will not automatically switch back to the previous used connection. If the TGW-100 should use again the old connection, it must be switched back manually. Of course, if the second connection also fails, the TGW-100 will go back and try the first connection after the switchover time has passed without a valid connection to the SwMi.

- ISSI: The ISSI of the TGW-100. SDS data from the outstations needs to be sent to this ISSI to be received by the TGW-100. Each TGW-100 needs a different, unique ISSI. This will be provided by the network operator.

- Username: Username on the TCS server to register this TGW-100. This will be provided by the network operator. Each TGW-100 may need a different username / password.

- Password: Password for the username above.

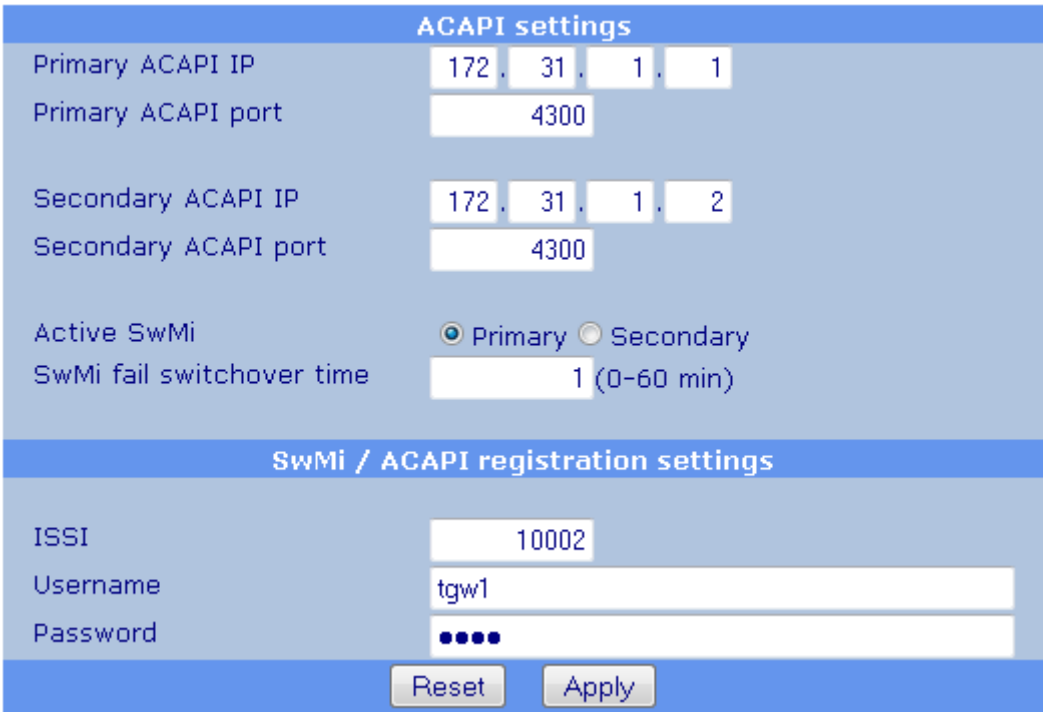
- DCOM IP/name: If a "COM" connection (common in most installations) is used for the TCS server connection, leave this field blank. If "DCOM" is used, you need to specify the IP address or host name of the TCS server. here.

As soon as all parameters are configured, the TGW-100 will start to connect to the infrastructure. As soon as the connection is established, all RF LED's will be lit (on the TGW-100 DIN-Rail version) and the blue LED (named "PPP" on the TGW-100 DIN-RAIL, and "Link" on the TGW-100R rack version) will be lit. This blue LED will indicate a proper connection between TGW-100 and TETRA infrastructure.

### 3.1.4 SDS services for Hytera infrastructures

The Hytera infrastructure is using the so called "ACAPI"-Interface to send and receive SDS data and status messages by a direct IP connection to the TETRA infrastructure. The TGW-100 supports the Hytera ACAPI interface from firmware 2.70.

If the Hytera infrastructure option is enabled in the TGW-100, the service can be configured in the webserver at TETRA→Hytera Gateway:

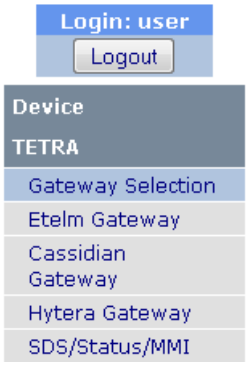


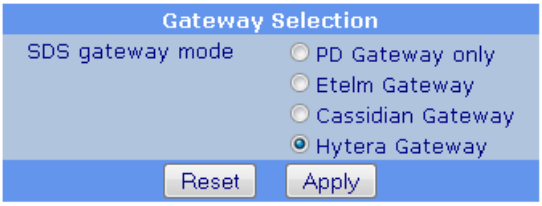

Two independent ACAPI addresses can be configured: A primary ACAPI connection and a secondary ACAPI connection. Below these settings, the use of the primary or the secondary ACAPI connection can be selected. In addition to this, a switchover time between 0 and 60 minutes can be configured for a redundancy switching.

If the switchover time is configured, the TGW-100 will automatically switch to the other ACAPI address if the selected interface fails (i.e. if the SwMi is down). If this setting is set to 0 minutes, no automatic switching will occur.

Please note that the TGW-100 will stay connected to the SwMi after the switching, it will not automatically switch back to the previous used connection. If the TGW-100 should use again the old connection, it must be switched back manually. Of course, if the second connection also fails, the TGW-100 will go back and try the first connection after the switchover time has passed without a valid connection to the SwMi.

To select the use of the Hytera ACAPI gateway, if must be selected on the page TETRA→Gateway Selection.

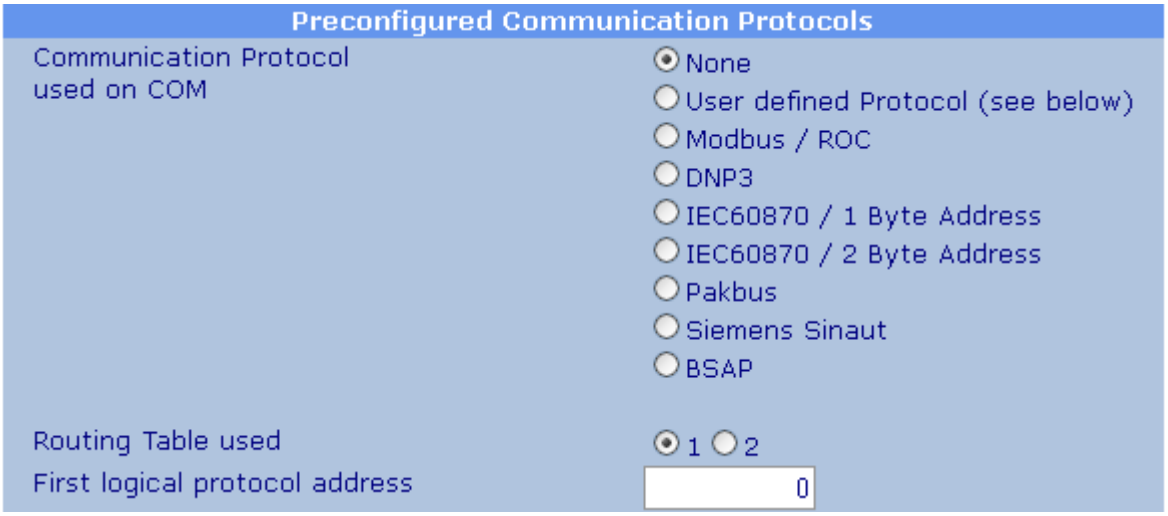


### 3.1.5 Use of the TGW-100 as master gateway

A Routing Table must be loaded into the TGW-100 when it is designated as a master device. Up to 1024 ISSI and IP addresses can be registered. Each of the ISSI or IP address in the Routing Table is assigned to a logical address in sequential order, corresponding to the addresses used by the serial data communication protocol.
The Routing table can be set up using the embedded web server.

The TGW-100 is configured (user setting) for the specific serial data communication protocol to be used. Any of the commonly used protocols can be selected, e.g., MODBUS, IEC-60870, Pakbus, ROC, BSAP or DNP3. Customized (non-standard) protocols may also be used because the position of the address byte and its length (1 or 2 bytes) are also user-programmable.




Protocol Configuration

When a data block is received at the serial interface of the TGW-100, it waits for the complete data block to be received. The data block end criterion is that no further data byte is received after a lapse of a user-programmed time (default: 10 milliseconds). The protocol-dependent logical address of the destination terminal equipment is extracted from the data received via the serial interface. Using this, the ISSI or IP address of the target modem is looked up from the Routing Table, added to the data block, and transmitted over the TETRA network.

If a broadcast address is reserved in the serial data communication protocol (e.g., MODBUS-RTU), a corresponding GISSI (Group ISSI address) included in the routing table. Therefore broadcast can be supported, whereby a data block can be sent simultaneously to several modems on the same TETRA network. Broadcast is only supported with SDS based communication, as most TETRA networks do not support IP broadcasting in their networks.

If multiple-address routing is not possible or desired, then the TGW-100 can be configured to use a single ISSI or IP, to which all transmitted data is addressed. The slave modems would be part of a group: all modems of this group receive the same data. Each terminal equipment connected to the slave modems is then responsible for determining whether a data block is intended for it or not.

It should be noted that when SDS is broadcast to a group, the SDS is sent from all base stations on the same TETRA network. This obviously generates a higher network load because when transmitting to an individual ISSI, the base station sends the SDS intended only for the specific base station to which the target terminal equipment is connected.

### 3.1.6 Using the TGW-100 as Slave Device

A TGW-100 used as slave modem need not be configured for handling a specific serial data communication protocol. Basically, the modem passes on each data record that it receives from a master modem out through its serial interface. When this happens, it tags the ISSI of the master modem from which data is received, so that when it gets a response to this data record from its local terminal equipment, it sends that response data back to the ISSI of the master modem. Because of this procedure, a slave modem can receive data from several master modems provided that such communications from multiple masters does not occur at the same time.

The return address refers the slave modem to the data record of the master modem. The response data record from the local terminal equipment is always sent back to the ISSI of the master modem from which the last communication was received. Alternatively, the ISSI of a specific master modem can be set in the slave modem, so that all data received from local terminal equipment is sent only to this ISSI.

#### 3.1.6.1 Routing SDS Data to the Primary (COM) or Secondary (AUX) Interface

The TGW-100 is equipped with two serial ports, “COM” and “AUX”. For each of these ports, a destination port can be configured and so it can be determined whether the data is feed from the source COM or AUX to the destination COM or AUX

If the COM routing is set to AUX, data received at the COM port will be sent to the AUX port of the destination device.
Also if the AUX routing is set to COM, data received at the AUX port will be sent to the COM port of the destination device.
As factory default, COM is routed to COM and AUX is routed to AUX. This feature of using two different serial ports at the same time provides the ability to use one port for data communication and the second port for configuration or for a second protocol if different devices (PLC and Meter or Filed bus device) are connected to the Outstation. Another application can use two different ports of the same device from different master units placed also on different location.

The AUX interface is restricted, as it can not be used for RS-422, only RS-232 or RS-485.

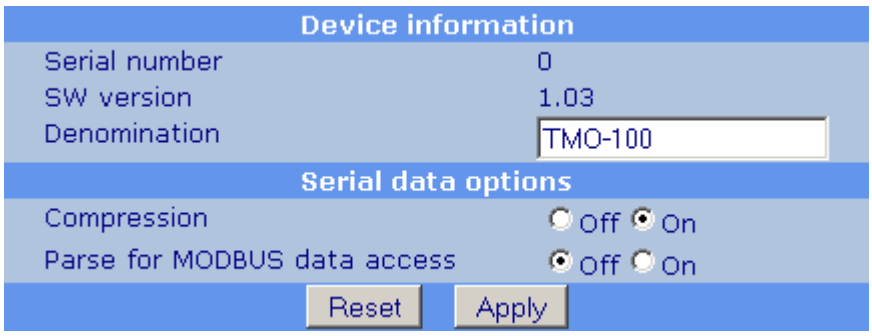
### 3.1.7 Data Compression using the LZ77 algorithm

The TGW-100 has data compression capability and all data records received over the serial interface are compressed before sending as SDS. At the receiving station, the data is decompressed before moving it out. Detailed information regarding the LZ77 can be found at:

http://de.wikipedia.org/wiki/LZ77

Data compression can improve performance when large data blocks are involved, by reducing the data that is conveyed over the TETRA network, even if additional SDS blocks are created (in cases where the original data block does not fit within an SDS).

If using the TGW-100 in conjunction with the discontinued TRM-, RTU-, or MDP-Type Tetra units, (these ones do not have the compression feature) compression can be disabled.




Enabling the Data Compression feature

## 3.2 Sending and receiving SDS- and Status Messages using the Hash (#) Command Sequence

SDS- and Status messages can be sent over the TGW-100s serial ports using the #-command (Hash Command)

The idea behind the #-commands is to have a simple method of sending and receiving SDS and Status messages for machine to machine, for human to machine or for human to Voice-Terminal applications.

The Hash-Command is defined as a header control sequence within two #-characters, followed by a SDS or status information in the following way:

# Control+SSI # Text, Data or Status

| Control character | ISSI / GSSI | Text or Status | Remark |
|---|---|---|---|
| T | Yes | Text | Sends a Text SDS |
| S | Yes | Numeric Status: 0-65535 | Sends a Status Message |
| D | Yes | Text or Data | Sends Text or Data including specific header information |
| C | Yes/No | MMI Command | Sends a MMI command to a different TGW-100 or to the own device |

**Rules:**
The transmitting TGW serial interface (COM or AUX) has to be in Hash Command Mode

The first character inside the # signs is the control character T, S or D
Followed by an ISSI or GSSI

The characters outside the # signs are: Text Information, Data or Status Information

On manual (human) input:
Choose the CR LF on "COM Port Serial Parameter Settings" and use a terminal software (e.g. HyperTerminal on your computer)

On PLC or PC communication:
Choose Timeout or 3964R (CR LF will work also)

The following example will explain what happens on the receiver side, if the following #-commands will be sent to a TGW-100 with an ISSI=4711 that is configured for #-command mode:

**Example 1:**

```
#T12345#This is a test message
```

Will be stored as an SDS in a Tetra Terminal with the ISSI (GSSI) 12345 as:
This is a test message

Will be sent out on the TGW-100s (ISSI: 12345) serial port that is configured for #-commands as:
#T4711# This is a test message
Remark: 4711 is the sender ISSI

**Example 2:**

```
#S12345#52000
```

Will be sent as a status message to a Tetra Terminal with the ISSI (GSSI) 12345

Will be sent out on the TGW-100s (ISSI: 12345) serial port that is configured for #-commands as:
#S4711# 52000
Remark: 4711 is the sender ISSI

**Example 3:**

```
#D12345# This is a test message
```

Can not be displayed correctly on a Tetra Terminal with the ISSI (GSSI) 12345

Will be sent out on the TGW-100s (ISSI: 12345) serial port that is configured as **slave** as:
This is a test message
Remark: No sender ISSI will be included in the output

## 3.3 Packet Data (IP) Communication

Packet data (PD) communication essentially differs from SDS data communication in that the TETRA infrastructure must support the use of packet data. Data communication takes place not through the Control Channel (as in the case of SDS data communication) but through normal traffic channels. Thus an active PD connection over which data is to be transferred, affects the availability of the voice channels: this must be taken into account at the time of network planning. Also the TETRA radios are not addressed by their ISSI but by the IP address which was assigned to them by the TETRA network.

The main advantage of packet-data based communication in Tetra infrastructures is that it supports protocols using IP data packets.

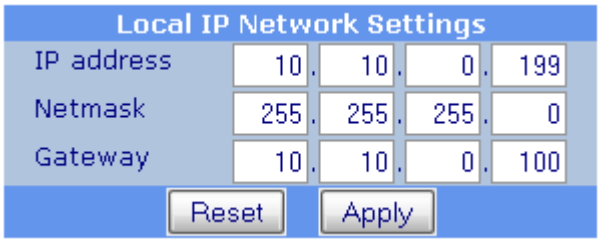
Any network which allows the connection of IP based equipment to the TETRA switch can be used for the TGW-100 if packet data based transmission is used to the TMO-100 outstations.

### 3.3.1 IP Assignment for the Ethernet Interface

The IP address of the Ethernet interface of the TGW-100 is preconfigured before delivery as 192.168.0.199 with the net mask 255.255.255.0. These settings can be changed by the users whenever necessary.

The Ethernet IP of the TGW-100 must allow the communication with the data router (IP gateway) of the TETRA network. Therefore, the TGW-100 must be in the same subnet than the IP gateway of the TETRA infrastructure. The IP gateway in the TETRA network must be entered as the gateway address in the TGW-100 Ethernet setup.

Example: If the IP gateway in the TETRA network has the address 10.10.0.100, the TGW-100 must be in the same subnet and the IP gateway in the TETRA network must be entered as the IP gateway in the TGW-100:



# 4 Protocols

## 4.1 Layer one Protocols between TGW-100 and the external device, connected via serial interface

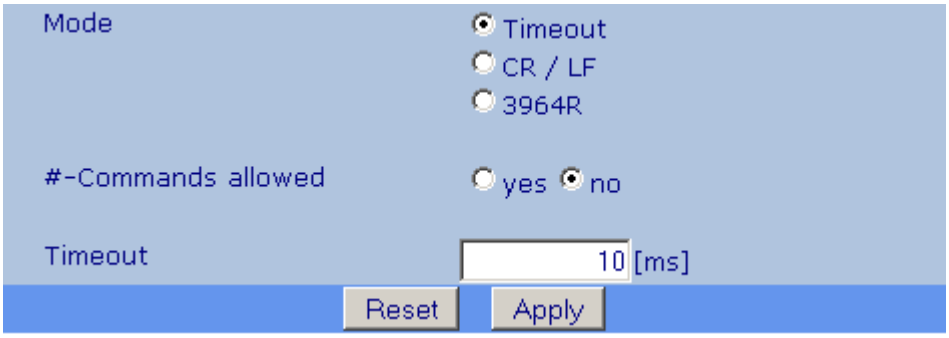
### 4.1.1 Timeout Protocol

Using the "Timeout Protocol", the TGW-100 will accept any data received via its serial interface(s) accepting the whole character range from hex 00 to hex FF. The "Data End" criteria in that case are just the facts, that there is no more data received over a predefined period of time. (Factory default is set to 10 ms for 9600 bps. That reflects 10 characters in sequence).
Basically if used other baud rates, a timeout period of 10 character-times is suggested.

Using the COM interface, a timeout period between 3-1000 ms, using the AUX interface 10-1000 ms is programmable.

### 4.1.2 3964R Protocol

The 3964R often is used in the „Siemens World", connecting PLC's to PLS's or PLS's to SCADA systems. That "Layer One" protocol is fully supported by the TGW-100.
If possible, the priority settings of the device connected to the TGW-100 should be set to "low priority".
Character delay and handshaking can be set up using the TGW's embedded Web Server




Settings for the Serial Port(s)

## 4.2 Serial Protocols (RS-232 or RS-485/RS-422)

When setting the TGW as a master unit, it is useful to know what communication protocol is used. Regarding that, the TGW-100 knows, where inside the data stream the address byte(s) is (are) located. With that knowledge, the TGW extracts this “logical address byte” and using the predefined address translation (or routing) table, it can convert the protocol address into the destination ISSI of the Tetra target device.
Using that technology, in comparison to GISSI (group transmission) the load of the Tetra network can be reduced enormously.

The outstation devices do not need any routing or address translation table. As these units usually are used as “polled devices”, they just answer to the polling request ISSI.

The following protocols are supported by the TGW-100

### 4.2.1 Modbus RTU

As the Modbus RTU protocol can be used either for internal device access or for communication with an external device, care should be taken when sharing out the Modbus addresses. Under no circumstances, an external device should have the same Modbus address as the TGW-100.

### 4.2.2 ROC protocol

The ROC protocol has the same basic data structure for the address byte location and data packet detection than MODBUS, so MODBUS and ROC protocol shares the same protocol setting in the configuration.

### 4.2.3 DNP3

Using the Link Address out of the DNP3 protocol, the routing to the outstation can be calculated. In case of transmitting multiple DMP3-Data Segments while the timeout period is not considered, each data segment will be transmitted individually. Outstations can send data at any time to the master device (unsolicited messaging)

Serial DNP3 was tested with the TGW-100 simultaneously with the HART protocol. The DNP3 was communicating over the COM port while HART was transferred via AUX. In that application the TGW-100G Serial-to-Tetra Gateway was used with an ETELM switch and Infrastructure.

### 4.2.4 IEC 60870-5-101

The routing for this protocol is similar to the DMP3. Also in this case it may be that multiple data segments are sent, to complete one message.

### 4.2.5 PakBus

Pak bus is a much unknown protocol, but it is fully supported by the TGW-100

### 4.2.6 BSAP

The TGW-100 detects the difference between the normal and the extended messages in BSAP protocol and extracts the address information accordingly. The node address contains 7 bit, so the address range which can be used for routing here is 0-127.

As any device can also act itself as a router, you may enable a master-to-master communication for the used serial port.


Any node can then itself contain a routing table for a retransmission of information to other nodes (which is not possible when acting in slave mode)

### 4.2.7 User-Protocol

Using user-defined protocols, the exact position of the address bytes and the address length can be pre defined.
If these parameters are unknown, the “Transparent Data Communication” can be used (see below).

### 4.2.8 Transparent Data Communication without Protocol Filter (User Defined)

Protocols, where the address byte can not be extracted, or where the „Address Range“ exceeds the TGW-100 storage spectrum, (1024 entries, e.g.: sometimes that can happen using the HART protocol) can be transmitted using the Group ISSI or a fixed, predefined ISSI.

Care should be taken when using the GISSI communication, as this method increases the over all load of Tetra networks.

In case the ISSI parameter is set to not equal zero for COM or AUX, all data will be transmitted to that particular ISSI. In this particular case, the routing is ignored.

When a packet data passed transmission is used, broadcasting may not be possible by the TETRA network, so individual addressing should be used here.

### 4.2.9 Hart-Protocol

Serial HART was tested with the TGW-100 simultaneously with the DNP3 protocol. The DNP3 was communicating over the COM port while HART was transferred data via AUX. In that application the TGW-100 was used with an ETELM switch and Infrastructure.

# 5 Configuring the TGW-100

## 5.1 Configuring the TGW-100 through the Integrated Web Server

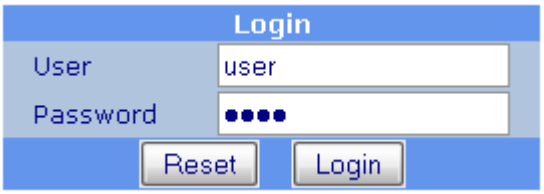
The adjustable parameters of the TGW-100 can be configured through the integrated Web server from a conventional browser. This can be done over its Ethernet interface. The Web server responds to queries through Port 80.

**Example:**

The TGW-100 is delivered with a factory-installed IP address 192.168.0.199 for the Ethernet interface. A PC connected to this interface has the (for example) the IP address 192.168.0.26. To configure the TGW-100, type http//192.168.0.199 in the address window of the browser and hit "Enter". If necessary, a fixed IP address in the range 192.168.0.xxx may need to be assigned to the connected PC.

The TGW-100 can be connected using a 1:1 patch cable if connecting to the PC via a switch or hub. If connecting to a PC directly, use a crossed cable.

The TGW-100 will respond with a login window.




The default login is "user" / "user".

# 6 Maitenance

## 6.1 TGW-100 Firmware update procedure

The update mechanism of the TGW-100 was introduced with firmware version 1.16. Previous versions can not be updated by this method, for such devices please contact your Piciorgros partner who will be able to upgrade the devices to at least this version.

To perform the update, just a TFTP client is needed. A simple command-line client is built directly into Windows operating system.

### 6.1.1 Preparation and setup

For updating the TGW-100 you will need the following equipment:

- PC with Ethernet connection
- TFTP client software (Windows command line or i.e. "PumpKIN" software)
- Firmware files for the TGW-100

### 6.1.2 Update procedure

For the update, two firmware files are needed. The file with the extension ".pfw" is the firmware file, the one with the extension ".pch" is the keyfile to activate the loaded firmware.

To perform the update, the ".pfw" file must be sent first to the TGW-100. Unless the ".pch" file is sent to the TGW-100, the device will just store the new firmware file.

As soon as the matching ".pch" file is also transferred to the TGW-100, the device will restart and reprogram itself to the new firmware.

**Important!**
This reprogramming after sending the ".pch"-file to the device will take about 15-20 seconds. During this action, DO NOT INTERRUPT THE POWER TO THE TGW-100. Otherwise the update fails and the device must be restored by a Piciorgros partner.

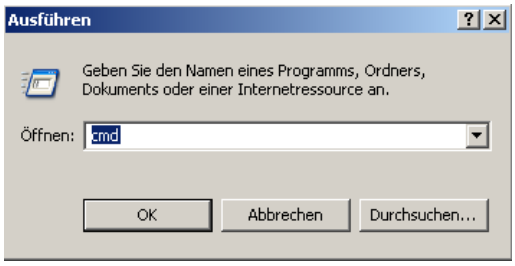
After the update process has ended, the device will start immediately with the new firmware.

### 6.1.3 Connecting the TGW-100

Connect the Ethernet port of the TGW-100 to the PC. The IP-settings of the PC must allow it to access the TGW-100 (default IP: 192.168.0.199).

### 6.1.4 Update using the Windows command line client

Start the Windows command line by using "Start" / "Execute" and then type "cmd"



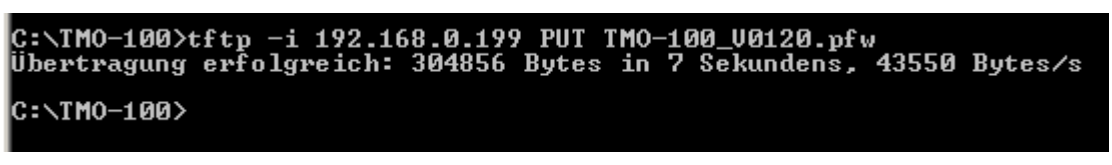

Change to the directory where you've put the firmware files


Transfer the .pfw file to the device, using the command

```
tftp -i 192.168.0.199 PUT filename.pfw
```

The IP here is the default IP of the TGW-100, if this IP is changed you have to give the correct IP address instead. Also "filename.pfw" must be replaced by the real firmware file name.

The transfer will take some seconds, unfortunately the software won't give you any feedback of the progress. After some seconds you should see the success output like this:



Now you'll perform the same action again, but now for the ".pch" file.

```
C:\TMO-100>tftp -i 192.168.0.199 PUT TMO-100_V0120.pch
Übertragung erfolgreich: 14 Bytes in 1 Sekunden, 14 Bytes/s

C:\TMO-100>
```

The device should restart now, doing the internal update process.

**Important!**
Do not disconnect the TGW-100 from its power until the update process has finished (the TGW will not show any action on it's LED for about 15-20 seconds, then it will restart). After the TGW has restarted and is alive, the power can be disconnected.

The .pch file must always match to the corresponding firmware. Otherwise an error message will be displayed and the update operation will not be started:

```
C:\TMO-100>tftp -i 192.168.0.199 PUT TMO-100_V0120.pch
Fehler auf Server : .pch file does not match firmware

C:\TMO-100>_
```

**The firmware for TGW-100 and TGW-100R is different! It will not be possible to update a TGW-100 DIN-Rail with a TGW-100R firmware and vice versa!**

## 6.2 Saving and restoring the configuration

### 6.2.1 Save a configuration

To back up the configuration of a TGW-100, the file "config.tmo" can be downloaded from the device by TFTP using the methods described before. The file can be renamed afterwards for proper identification or archiving.

### 6.2.2 Restore a configuration

To restore a previously saved configuration, the "config.tmo"-file (which may have renamed, but the extension ".tmo" must remain untouched), must be transferred to the TGW-100.

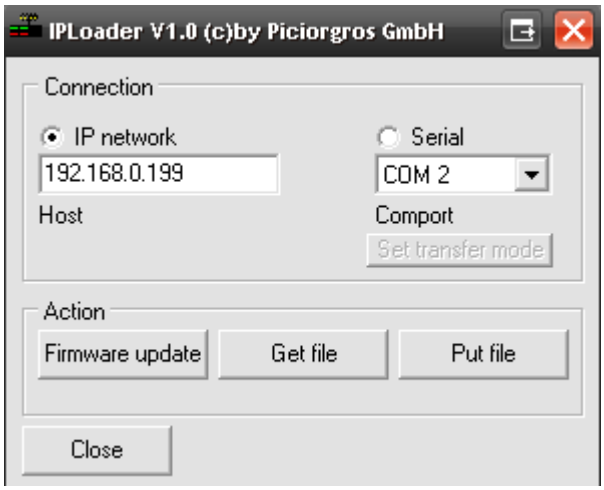
The complete configuration will be changed according the saved one, however the device properties as serial number and enabled features will remain unchanged.

You can also clone TGW-100 configurations by this method to other TGW-100 devices.

## 6.3 Using the IPLoader application

The IPLoader application is a small windows software to upload and download files from and to the TGW-100. Also firmware updates can basically be performed with just a few clicks.

The software can be downloaded for free and can replace the TFTP-software or the command line procedure for firmware updates and backing up and restoring the device configuration.



# 7 Specifications TGW-100R

| | |
|---|---|
| Function: | • Gateway for connecting serial based equipment directly to a TETRA infrastructure for communication with TMO-100 outstations |
| Interfaces: | |
| COM: | • RS-232 or RS-485/422, DB9 (F) |
| AUX: | • RS-232 or RS-485, RJ12, DB9 (F) |
| Ethernet: | • Two 10/100 Mbit/s Ports |
| Operating modes: | • SDS-based data communication (on supported infrastructures)<br>• Packet data based communication |
| Protocols: | • MODBUS-RTU, ROC<br>• IEC-60870-5-101<br>• DNP3, PakBus, BSAP<br>• Custom protocols |
| Indicators: | Front panel LED indication for all interfaces and connection status to the TETRA infrastructure |
| EMC Conformance | EN 301 489-1 und -18 |
| ESD Conformance | 61000-4-2 von 1998 |
| Power supply voltage: | 90 – 240V AC, 50-60Hz |
| Enclosure: | Cassette for mounting in 19” Rack |
| Enclosure Width: | 19” |
| Operating Temperature: | -20°C to +65°C |

## 7.1 Specifications TGW-Rack (19” Rack)

| | |
|---|---|
| Function: | • 19” Rack for TGW-100R with redundant power supply |
| Power Supply: | • Two separate mains connector plugs |
| Input Power Range: | • 90 – 240 VAC |
| Indicators: | Front panel LED indication “Power” |
| Output Voltage: | 24 VDC +/- 20% (12 VDC +/- 20%) |
| Output Power: | 18 Watt (each device) |
| Enclosure: | 19” Rack |
| Rack Height: | 4 HE |
| Operating Temperature: | -20°C to +65°C |

## 7.2 Specifications TGW-100 (DIN-Rail)

| | |
|---|---|
| Functions: | • Gateway for connecting serial based equipment directly to a TETRA infrastructure for communication with TMO-100 outstations |
| Interfaces: | |
| COM: | • RS-232 or RS-485/422, Sub-D (F) |
| AUX: | • RS-232 or RS-485, RJ12 |
| Ethernet: | • 10/100 Mbit/s |
| Operating modes: | • SDS-based data communication (on supported infrastructures)<br>• Packet data based communication |
| Protocols: | • MODBUS-RTU, ROC<br>• IEC-60870-5-101<br>• DNP3, PakBus, BSAP<br>• Custom protocols |
| Indicators: | Front panel LED indication for all interfaces and connection status to the TETRA infrastructure |
| EMC Conformance | EN 301 489-1 und -18 |
| ESD Conformance | 61000-4-2 von 1998 |
| Power supply voltage: | 12-24 VDC +/- 20% |
| Power consumption (av.) | 12V power supply: Approx. 210mA<br>24V power supply: Approx. 110mA |
| Enclosure: | Extruded aluminum body; plastic end caps |
| Operating Temperature: | -20°C to +65°C |
| Mounting: | 35 mm DIN rail, symmetrical |
| Dimensions: | 80mm x 162mm x 62 mm (excluding connectors) |