IIoT Gateways FP S-OTGuard
Hardware manual

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Safety instructions

Target group Electricians

This manual is intended exclusively for qualified electricians who are familiar with the safety standards of electrical and automation engineering. Project planning, installation, start-up, maintenance and testing of the devices may only be carried out by a recognised qualified electrician.

Any interventions in the hardware and software of our products, unless they are described in this or other manuals, may only be carried out by our qualified personnel.

Intended use

The FP S-OTGuard models (subsequently referred to as FP gateways) are only intended for the applications described in this manual. Ensure that all specifications in the manual are observed. Unqualified interventions in the hardware or software, or a failure to observe the warnings in this manual can cause serious personal injury or damage to property. In this case, no liability is accepted and all warranty claims become invalid.

Safety-relevant regulations

When project planning, installing, starting up, maintaining and testing the devices, the safety and accident prevention regulations applicable for the specific application must be observed.

This manual provides instructions that are important for proper and safe use of the device. The individual instructions have the following meanings:

DANGER

Means that there is a risk to the user's life if the corresponding preventive measures are not taken.

CAUTION

Means that there is a risk of injury for the user if the corresponding preventive measures are not taken.

ATTENTION

Means that there is a risk of damage to the device, the software or other material assets if the corresponding preventive measures are not taken.

1 The functions at a glance

The FP IIoT gateways (subsequently referred to as FP gateways) have a large data memory, many functions, integrated clod technology and a 128 MB non-volatile memory (Flash memory). The devices can perform the following functions fully automatically:

- Sending alarm and status messages (e-mail, SMS, cloud)
- Receiving switching commands by e-mail, SMS or cloud and transmitting them to a PLC,
- Sending data to a controller/system that is connected and
- Exchanging data between controllers.
- The models also have an SD card slot (or USB slot for devices in the Hx65x range, which can also be used for a WiFi function), which can be used to transfer the configuration to the device and to read out log data.

1.1 Comprehensive connection options

The FP gateways can communicate directly with controllers from many manufacturers via their PLC protocol. Furthermore, different bus systems are supported. Convenient software programs based on XML files enable the required functions to be configured easily.

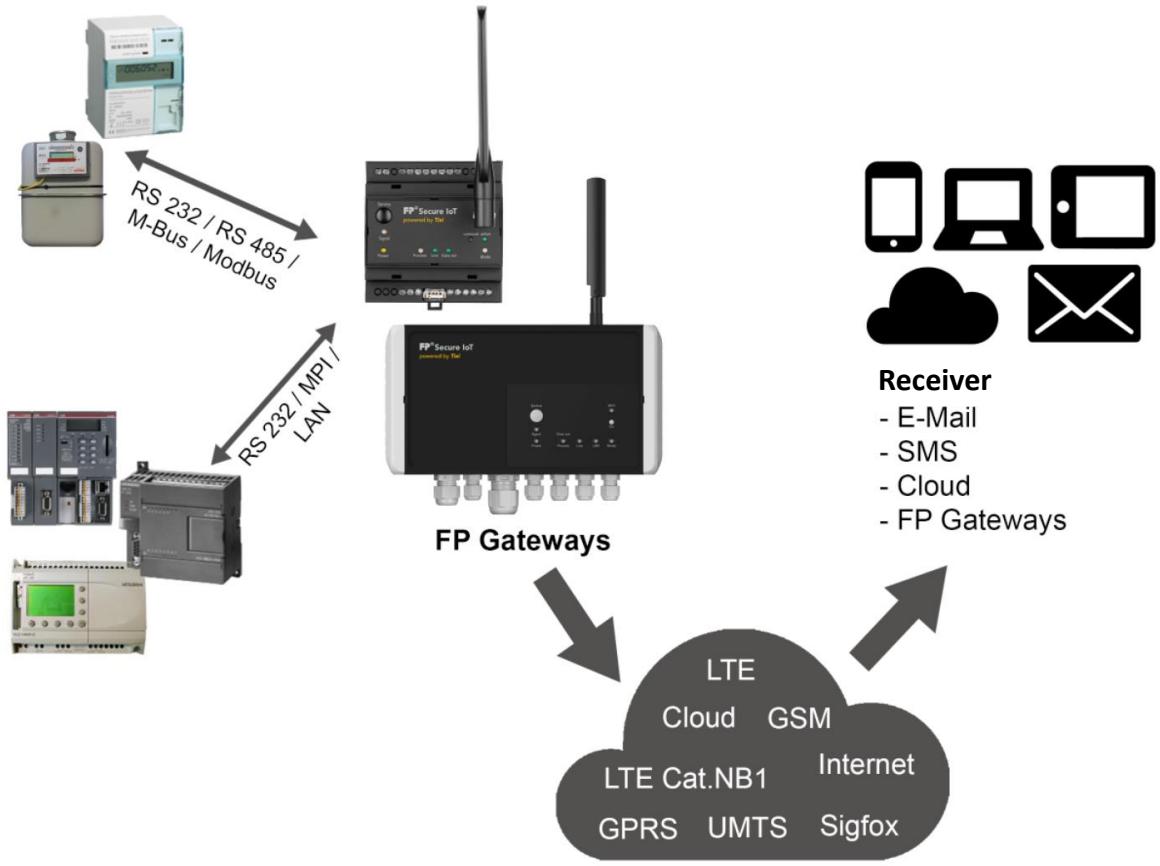


Illustration: Sample application

The device's versatile functions allow for numerous areas of application such as monitoring temperature, pressure and fill levels or activating motors, fans, pumps, sliders and cover flaps.

1.2 Easy to retrofit

FP gateways can be integrated into existing systems with minimum effort. No changes to the PLC program are generally required.

1.3 Integrated PLC protocols

FP gateways can communicate directly with the PLC protocol and use the PLC programming interface to access PLC variables, markers and ports immediately. To do this, the PLC protocol does not have to be adjusted and no additional function module has to be loaded.

The following PLC protocols are supported:

Mitsubishi	Moeller / Eaton	Siemens	ABB	Saia-Burgess
Alpha XL	Easy E4	S7-200	AC010	PCD1
FX1S	Easy400, 500	S7-300	AC31	PCD2
FX1N	Easy600, 700, 800	S7-400	AC500	PCD3
FX2N	MFD-Titan, XC/XVC0	S7-1200	AC800	PCS
FX2NC	PS4 range	S7-1500	CL	
FX3U	EasyControl	Logo! 8.X		**Allen-Bradley**
			Theben	Series A
Crouzet	**Schneider Electric**	**VIPA**	Pharao2	Series B
Millenium 2 + 3	Zelio, Twido MODICON	100V, 200V, 300V SPEED7		GFX

1.4 Integrated field bus protocols

FP gateways can communicate directly with controllers, consumption meters, etc. via various field bus protocols.

The following PLC protocols are supported:

Field bus protocol	Explanation
Modbus master	International standard. RTU, TCP, ASCII are supported
Modbus slave	Completely configurable Modbus TCP slave
M-Bus	For consumption meters in accordance with DIN EN 13757
Wireless M-Bus	Supported via additional, optional “FP wMBus Adapter” supplementary module (conforms to OMS)
IEC 62056-21 mode C	For consumption meters (mode C); also known as EN 61107
IEC 62056-21 mode D	For eHZ consumption meters (mode D); also known as D0 protocol
Aurora	Communication protocol for ABB inverters (subset implemented)
TixiBus	For smaller OEM controllers

1.5 Integrated cloud protocols

FP gateways support multiple widely-used cloud protocols as standard. All cloud protocols provide a feedback channel via which you have direct access to the gateway from the cloud (e.g. for configurations):

Cloud protocol	Explanation
MQTT	Universal MQTT client (e.g. usable with AWS, Mosquitto, etc.)
Telekom CoT	MQTT protocol for the Telekom “Cloud der Dinge” (cloud of things)
Software AG	MQTT protocol for the Software-AG cloud (Cumulocity)
Juconn	MQTT protocol for the Juconn cloud

1.6 Web server in the FP gateway

Thanks to the web server that is integrated into the FP gateways, a standard browser on any computer can be used to display system statuses, PLC data and log data and to change this with a click of the mouse.

To do this, only corresponding HTML pages have to be stored in the device. Access is provided via an IP connection. For more details, see the web server manual.

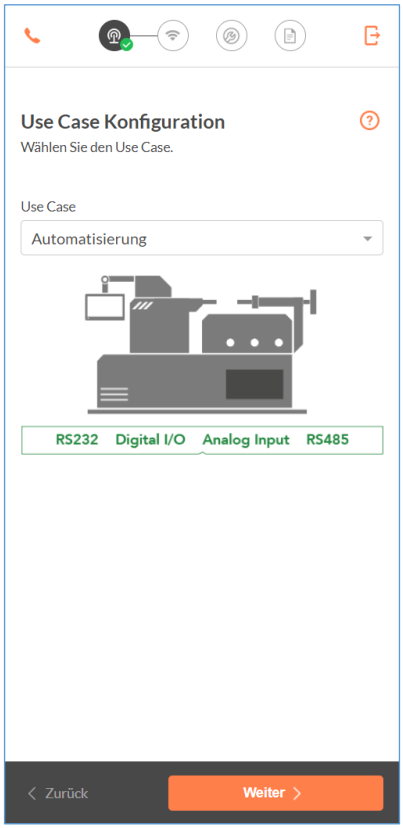
1.7 Web apps

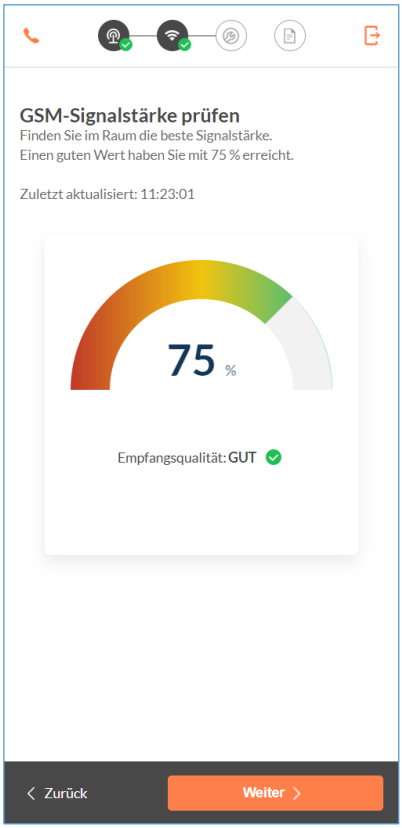
The web server for the FP gateways enables various applications that can be adjusted to the customer's requirements to be used.

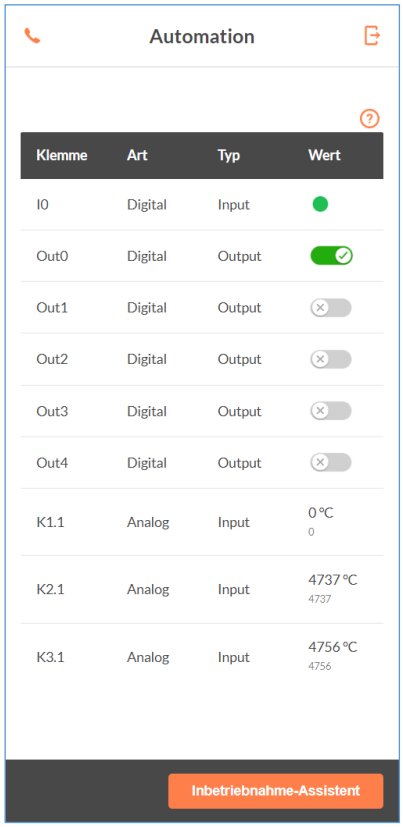
For example, initial commissioning can be automated. The installer can therefore set up the device with just a few clicks on their tablet or smartphone so that it is accessible externally or can already perform the basic functions.

We'd be happy to provide you with more information.

Sample screenshots from a real commissioning app:







1.8 Remote switching by e-mail, HTTP request, cloud

The FP gateways can switch the outputs of a connected PLC with a short command by e-mail, HTTP request or from the cloud. Other PLC variables can also be changed in this way.

Up to 100 switching commands with up to 10 parameters each can be freely defined. PLC variables can be queried quickly and easily by e-mail, HTTP request or from the cloud.

1.9 Remote switching by SMS, e-mail and cloud

FP gateways with GSM modems can switch the outputs of a connected PLC with a short command by SMS, e-mail or from the cloud. Other PLC variables can also be changed in this way. CallerID can also be used to transfer commands (not supported by all models).

An acknowledgement of the execution of the command is possible. Up to 100 SMS switching commands with up to 10 parameters each can be freely defined. PLC variables can be queried quickly and easily, without a computer by SMS command.

1.10 Logging data for the PLC

The FP gateways record any PLC data (variables, ports) and system data with a configurable time and date stamp in a non-volatile flash memory (standard: 128 MB, other sizes available optionally). The query cycle and scope of the data to be logged can be configured feely.

The recorded data is sent by e-mail cyclically or based on events in CSV format, which is compatible with Excel. Several log files with a freely definable size can be created simultaneously. The memory is designed as a ring memory.

	A	B	C	D
1	Zeit	Temp_1	Temp_2	AirCond
2	09:00	21,3	11,5	0
3	09:10	21,3	11,5	0
4	09:20	21,4	11,4	0
5	09:30	21,3	11,3	0
6	09:40	21,4	11,3	0
7	09:50	21,4	11,4	0
8	10:00	21,5	11,5	0
9	10:10	21,4	11,5	0
10	10:20	21,5	11,6	1
11	10:30	21,6	11,7	1
12	10:40	21,8	11,7	1
13	10:50	22,1	11,8	1
14	11:00	22,1	11,7	1

1.11 Cloud-based database and management

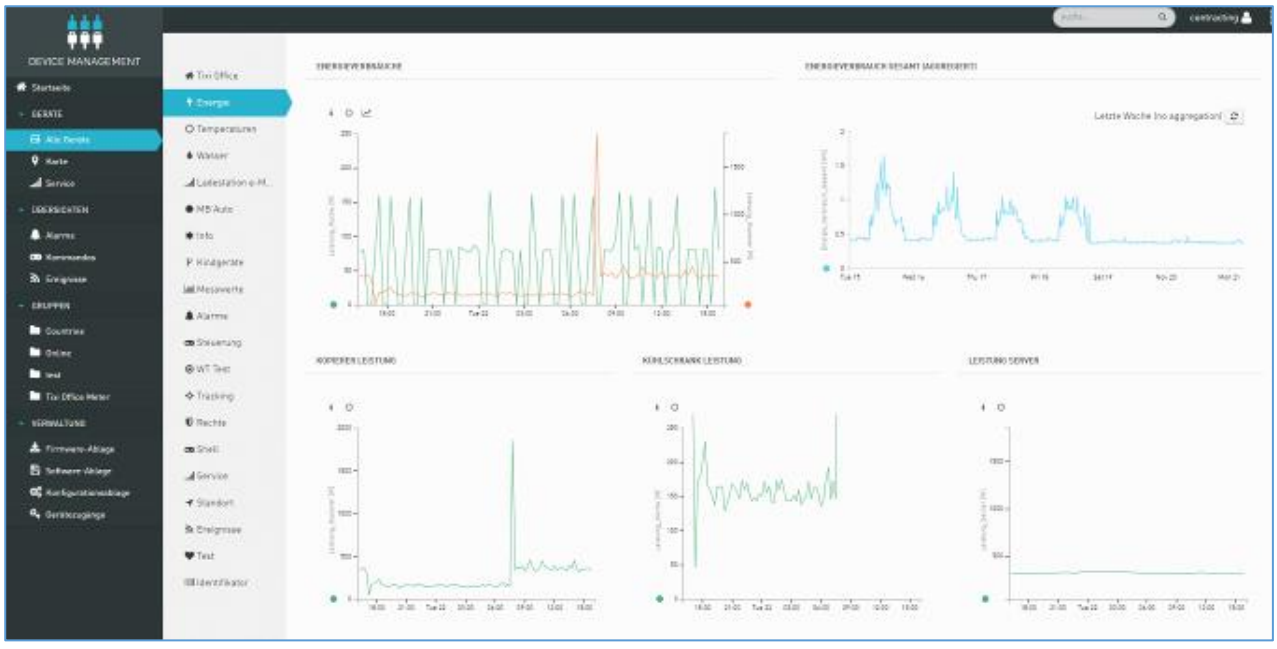
In a cloud-based database, numerous PLC systems and FP gateways can be managed. The data recorded when logging data can be saved, analysed and displayed here.

Only authorised users are permitted to access the data. The system can be adapted to the user requirements easily.

Only an active internet connection is required for the device to connect to the cloud automatically, logged in with the unique serial number.

As the user, you only have to enter the device’s serial number and connect to your account.

You then have access to the device data already. Encrypted communication ensures the required security.



2 Model and equipment variants

2.1 Interfaces, inputs and outputs

The FP gateways are available in several equipment variants. These are identical in basic functions but differ in the type and number of interfaces as well as inputs and outputs.

Built-in interfaces for the top-hat rail models							
Connection type	H651	H653-M100	H627	H632	H634	H647	H671
Ethernet	1	1	1	1	1	1	1
COM1	RS232 [1]	RS232 [1]	RS232 [2]	RS232 [2]	RS232 [2]	RS232 [2]	RS232 [2]
COM2	RS485	RS485	RS232 [1]	RS232 [1]	RS232 [1]	RS485	Siemens MPI
Digital inputs	1	1	2	8	4	2	-
Digital outputs	-	-	2	2	4	2	-
Analogue inputs	-	-	1	1	1	1	-
USB host	1	1	-	-	-	-	-
M-Bus (COM3)	-	1 (100 loads)	-	-	-	-	-
Relay	-	-	1	-	-	1	-

All specified models are of type “FP S-OTGuard”.

[1] DTE [2] DCE

The FP gateways are based on a modern Linux operating system and the software is compatible with the older Tixi Hx400 series.

2.2 FP I/O modules

FP I/O modules are available as accessories for the devices in the HE range and these can be used to add up to 128 additional input and output modules to the basic device. The FP I/O bus can be used to connect up to 8 I/O modules with up to 128 I/Os to the basic device. The FP I/O bus can also be used for customer-specific I/O modules.

Expansion modules for more I/Os		
Up to 8 I/O modules with up to 128 I/Os can be coupled to an FP Gateway via the I/O expansion bus.		
Module types	XP84D	8 digital inputs (switchable via potential-free contacts, max. 5 V) 4 digital outputs (potential-free, AC/DC 125 V, max. 130 mA)
	XP88D	8 digital inputs (switchable via potential-free contacts, max. 5 V) 8 digital outputs (potential-free, AC/DC 125 V, max. 130 mA)
	XP84DR	8 digital inputs (switchable via potential-free contacts, max. 5 V) 4 relays; (potential-free, 230 VAC 3 A, 110 VDC 0.3 A)
	XS00	2 free slots for S1 expansion modules (see “S1 expansion modules ...” table)

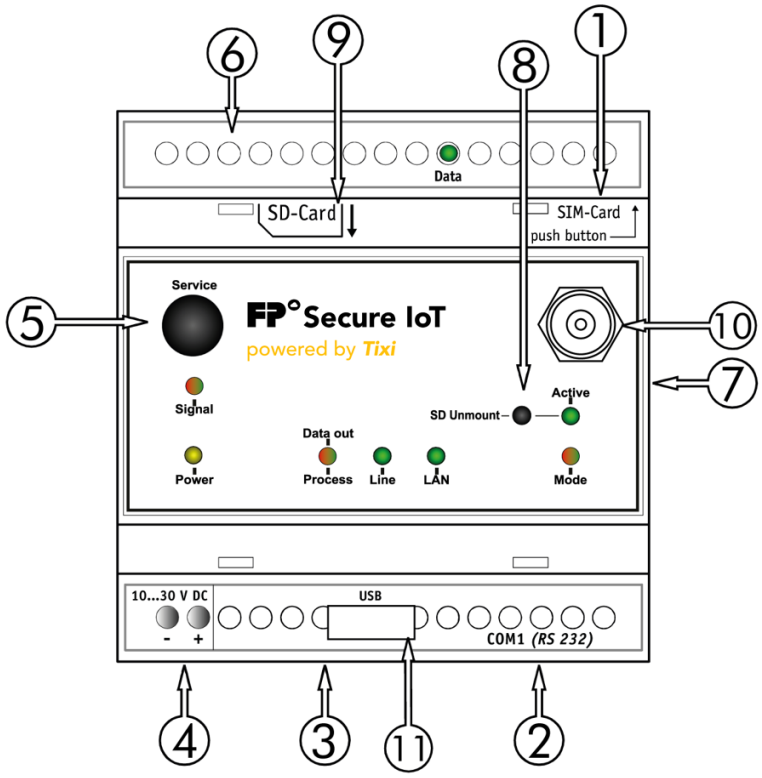
S1-expansion modules (requires optional Xs00-module expansion)			
Up to 2 S1 plug-in modules can be installed per XS00 module. Several XS00-module expansions are cascadable.			
Inputs	S1-D50	5x digital inputs, max. 24 V	-
	S1-D30G	3x digital inputs, independently and galvanically isolated (0 - +/- 60 V; input current 2.2 - 3.1 mA)	-
	S1-AE3	3x analogue inputs 0 - 10 V / 0 - 20 mA (can be adjusted using jumpers)	0.2 % +/- 5 mV
	S1-PT3	3x Pt-1000 inputs; resolution: 0.3K	+/- 1.2 K
	S1-PT3C	3x Pt-100 inputs; resolution: 0.3K	+/- 1.2 K
	S1-S03	3x pulse inputs S0 for read contacts; cable length max. 30 m; optional battery backup via button cells	-
Outputs	S1-D05	5x digital outputs, max. 48 V, 120 mA	-
	S1-D03G	3x digital outputs, galvanically isolated	-
	S1-AA2	2x analogue outputs 0 - 10 V / 0 - 20 mA (can be adjusted using jumpers) A separate 24 V power supply is required on the XS00 module	1 % +/- 6 mV
	S1-WL2	2x changeover relay, max. 230 V / 3 A	-

2.3 Analogue inputs

Some series of the FP gateways are equipped with an analogue input among other things. If you require more than one analogue input, the external XS00 FP supplementary module can be used with the S1-AE3 analogue module or a small controller (e.g. a Mitsubishi Alpha XL).

3 Installation and assembly

3.1 Connections and controls at a glance



No.	Designation	Meaning
1	Ethernet	Ethernet port (RJ45) with LEDs (see section 4.5)
2	COM1 (RS232)	9-pin D-sub port (DCE) or plug (DTE)
3	COM2 (RS232)	9-pin D-sub plug (DTE, not Hx647, Hx671)
3	COM1 (RS485/422)	5 screw terminals (configurable via DIP switches, only Hx 671)
3	COM2 (S7-MPI)	9-pin D-sub port (only Hx671)
4	10 - 30 V DC 18 - 30 V DC	Power supply (2 screw terminals) Power supply (2 screw terminals) for H653-M100
5	Service	Button (function can be programmed by the user)
6	I/Os, M-bus and LEDs	Depending on the device type
7	FP I/O bus	6-pin precision port for expansion modules
8	Unmount	Button to disconnect the SD card / USB stick Controls the WiFi function (model-dependent)
9	SD card	Slot for SD card (standard SD card, max. 32 GB)
10	Antenna port	Plug (FME) for antenna cable (model-dependent)
11	USB port	USB host port for WiFi stick / memory stick (model-dependent)

3.2 Meaning of the LEDs

The following table provides you with an overview of the operating statuses that are indicated by the LEDs on the device.

LED	Status	Meaning
Power	○	No power supply
	●	Device ready for operation
Process/Data Out	○	No process, no messages in the outbox
	●	Process execution
	●	Messages for sending in the device
Line	○	Modem is not logged into the GSM network
	●	GSM connection established
	● (flashes)	Connection setup (incoming or outgoing call)
	● (flashes 1x per second)	Modem is logged into the GSM network
	● (flashes 2x per second)	Modem is logged into the GPRS network
LAN	○	no connection
	●	Ethernet active
	● (flashes)	IP address conflict or no IP address received via DHCP
Signal	○	application specific, user-programmable
	●	
	●	
Mode	○	Transparent mode switched off
	●	Transparent mode (device has switched through transparent connection to a serial interface)
WiFi	○	WiFi not active/no USB memory stick loaded
	● (flashes briefly)	WiFi mode is active
	● (flashes for an extended period)	USB memory stick detected and loaded, WiFi active *
	●	USB memory stick detected and loaded
RJ45	●	Connection established
	○	No connection
	● (flashes)	Data transmission
	●	100MBit connection
	○	10Mbit connection
"Service" button		Button: application specific, user-programmable
"SD Unmount" button		Optional: Unmount a USB memory stick Optional: Turn the WiFi function on / off (requires a plug-in WiFi module)

* An external USB hub is required to operate the USB memory stick and the WiFi stick simultaneously

Only on Hx671 models for the Siemens Simatic S7 with MPI interface:

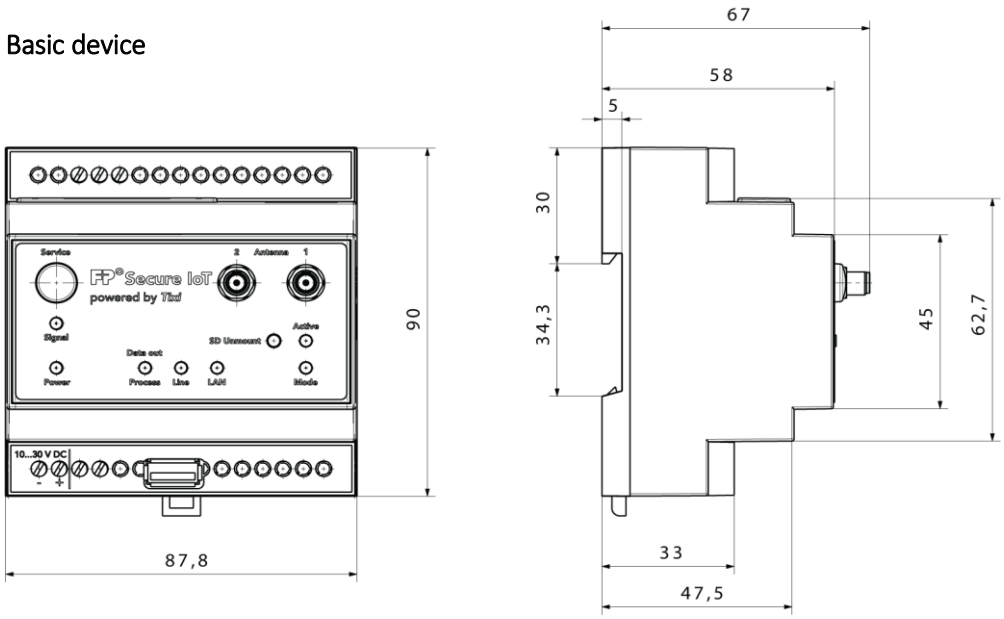
Data		Connection to the PLC established
	 (flashes)	Data being transferred from/to the PLC
Active Param.		is correctly parametrised and registered on the MPI net

Only on the Hx627 models:

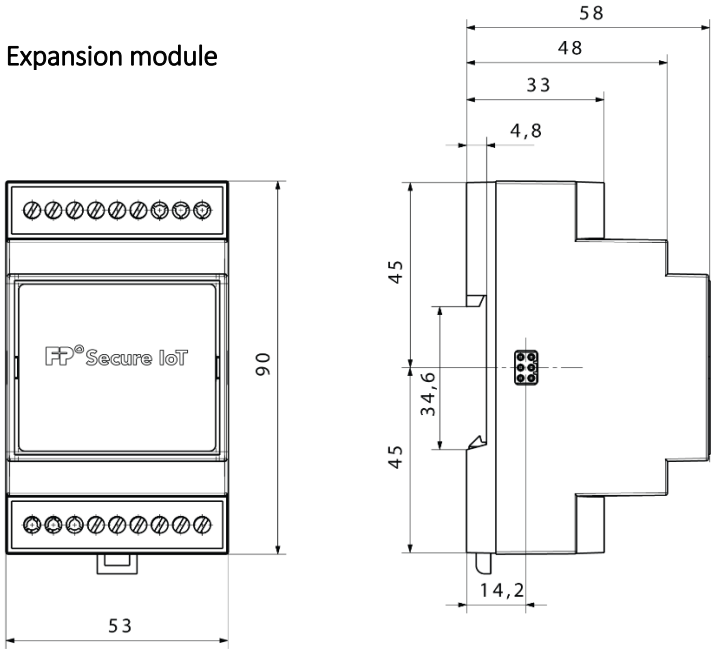
Data		No communication to COM2
		PLC or transmode data traffic from COM1 to COM2
		PLC or transmode data traffic from COM2 to COM1

3.3 Dimensions

Basic device



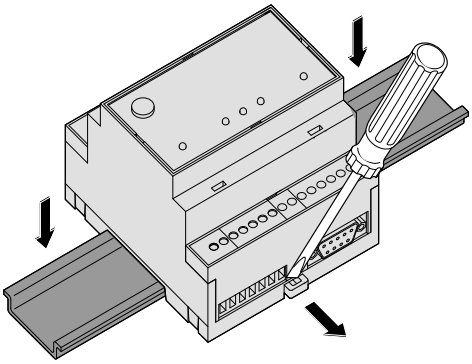
Expansion module

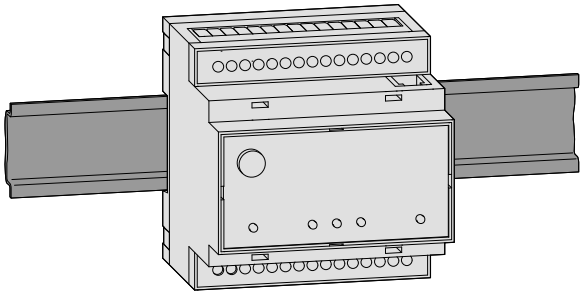


(all dimensions specified in mm)

3.4 Installation

Mount the device by sliding or snapping it onto a DIN rail (35 x 15 mm | 1.4" × 0.6" or 35 x 7.5 mm | 1.4" × 0.3" top-hat rail, in accordance with EN 50022).





ATTENTION

Damage to the device due to external influences!

Only use the device in dry and clean spaces. Protect the device from moisture, water spray, heat and direct sunlight.

Do not expose the device to strong shocks or vibrations.

DANGER

Explosion due to reactions between sparks and inflammable substances
Danger to life from explosion!

Keep the device away from inflammable gases, vapours, dust or conductive dusts.

3.5 Connecting the mobile communications antenna

First find a suitable location for the mobile communications antenna outside the electrical cabinet. To find a suitable location with good reception, the TILA operating software can be used to display the reception quality.

We recommend performing several measurements and finding an average value, as the signal strength at the intended reception location can vary greatly.

Use an antenna with high antenna gain if the signal strength at the receiving location is too low. Especially transferring data by e-mail places higher demands on the connection's quality and stability than short SMS connections.

In order to design data connections (for remote parametrisation, Internet dial-up) reliably, the signal strength should be at least -77 to -53 dBm. In the range from -95 to -79 dBm, SMS still works in most cases, but the connections often break down. No operation is possible below -97 dBm.

Screw the antenna or antenna cable into the antenna plug on the top of the FP gateway.

Standard mobile communications antenna can be used

You can use standard mobile communications antennas with an FME plug. The mobile communications antenna is not included with the FP gateway and can be ordered separately. A list of available antennas is provided in section 11.5 in this manual.

Buying the correct antenna

When buying the antenna, pay attention to the correct frequency range for your mobile communications provider.

Extending the antenna cable

If the antenna cable length is insufficient for your requirements, you can obtain suitable extension cables from mobile communications accessories suppliers. Note that these cables have a damping effect that reduces the antenna gain and also note the manufacturer specifications.

3.6 Inserting the SIM card

ATTENTION

Damage to the device due to using the SIM card incorrectly!

Only insert the SIM card when the device is de-energised.

Use a mobile phone to ensure that there are no SMS saved on the SIM card.

ATTENTION

SIM card damage or blocking due to improper use!

Do not touch the contacts on the SIM card.

If a different SIM card was used previously in the device, first load a project with the new SIM card's PIN into the device.

Unlock the receiving drawer for the SIM card by pressing the small button to the right of the drawer using a pen or a pointed object.

You can now pull the drawer out carefully and insert your SIM card (standard or mini SIM). Then slide the SIM card receiving drawer back into the device with the SIM contacts pointing downwards until the drawer clicks into place.

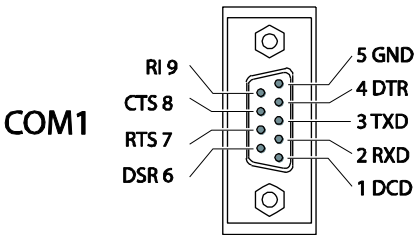
SIM cards are sometimes delivered with very different properties that must be noted and, if in doubt, queried with the corresponding provider:

- Old SIM cards (5V) do not work; replacements with a more modern SIM card (V3) is required and normally also possible.
- SIM cards may not be data-capable or may only be data-capable after requesting that this is activated.
- Prepaid cards often withhold their own phone number when making outgoing calls.
- When you call the FP gateway, no ringing tone is given by some SIM cards due to prepaid cards being supported. This does impair the functions.

4 Technical details regarding interfaces

The COM1 and COM2 serial interfaces are used to connect a PC, a programmable logic controller (PLC) or other devices.

4.1 COM1 - RS232 (DCE port or DTE plug)

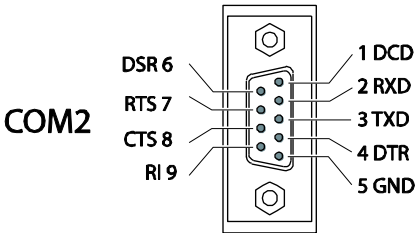


The RS232 interface COM1 (9-pin D-sub port) is present on most FP gateways.

On the H650 device series, COM1 is designed as an RS232 as a 9pin D-sub plug.

On the plug (DTE), the pins are arranged in the opposite order.

4.2 COM2 - RS232 (DTE plug)



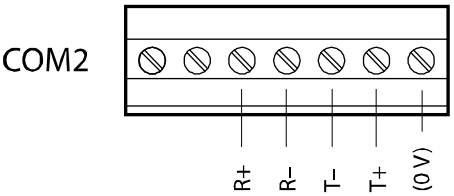
A controller can be connected directly to the 9-pin RS232 interface (plug) designated as COM2, as the COM2 corresponds to the standard RS232 interface on a PC.

FP InovoLabs provides various adapter types for the RS232 connection. For more information regarding these adapters, see section 9 in this manual.

Note
As the majority of controllers require special serial programming cables, you should always work with the programming cable from the controller manufacturer.
For more information regarding connecting the different controllers, see section 9 in this manual.

4.3 COM2 - RS485 / RS422

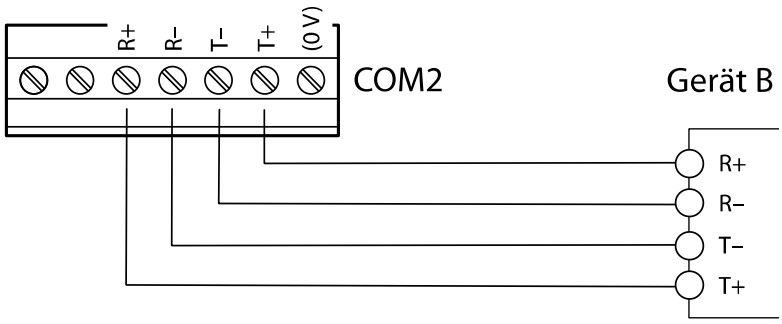
The devices in the Hx647 series have an RS485/422 interface in order to connect 2-wire or 4-wire bus systems. The interface on the device is designed as a 5-pin screw terminal strip. The interface is not galvanically decoupled.



RS485/422 assignment viewed from above

Note
Twisted, twin wire lines (“twisted pair”) are recommended. In RS422 operation and with a 4-wire RS485, 2 twin wire lines each must be used.

RS422 connection



*The **receiving lines** are connected to*

R+ (receiver T+) and
R- (receiver T-),

*the **transmission lines** are connected to*

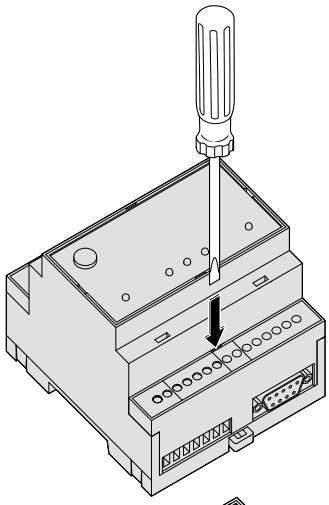
T+ (receiver R+) and
T- (receiver R-)

in accordance with the adjacent sketch.

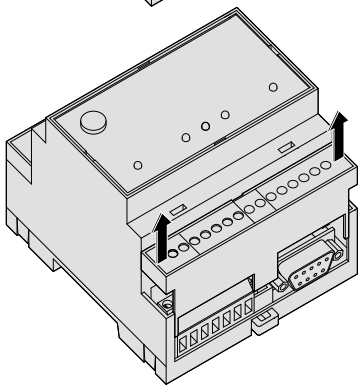
Access to the DIP switches

A DIP switch is used to set the operating mode on the RS485/422 interface. This is located on the right next to the COM2 connection terminal and can be accessed after removing the cover.

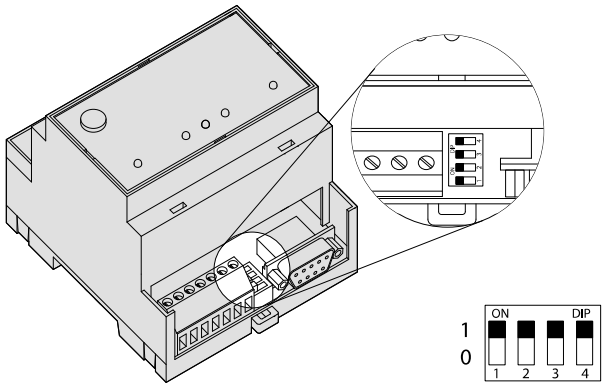
Insert a screwdriver (with a blade width of around 3mm | 0.12" into the slot and turn the screwdriver slightly.



The terminal cover pops out of the housing with an audible click and can be removed.



The DIP switches are located under this cover and their meanings are described in the following table.



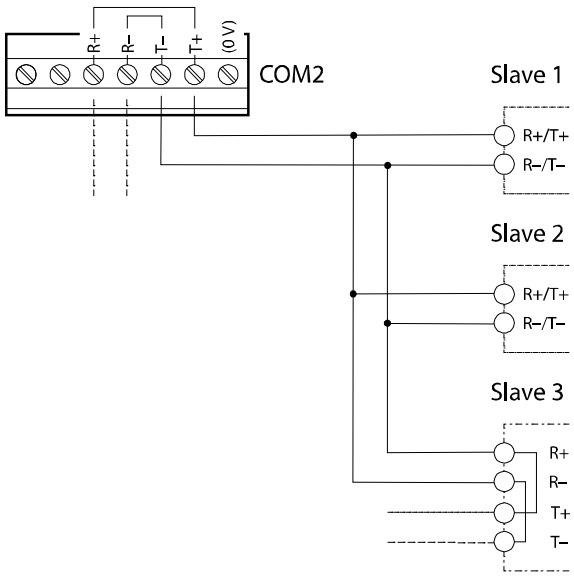
Setting the operating mode on the DIP switch

Operating mode	Switch 1	Switch 2	Switch 3	Switch 4	DIP
2-wire RS485 with termination	1	1	1	1	1111
2-wire RS485 without termination	0	0	1	1	0011
4-wire RS485 without termination	0	0	0	0	0000
4-wire RS485 with termination on the receiving line	1	1	0	0	1100
RS422	0	0	0	0	0000

Note
The RS485 requires that the lines be terminated at both ends of the transmission path. Termination prevents reflections in the lines and forces a defined idle state on the bus at times in which no data transmitter is active.
Termination can be external, e.g. via discrete resistors on the screw terminal. It can also be performed using the DIP switch on the FP gateway.

RS485 2-wire connection (2-wire bus system, half-duplex)

In this operating mode, the transmission line and receiving line are connected to each other. If the FP gateway is arranged at the start (start station) or the end (end station) on the bus system, the bus must be terminated via the DIP switches.



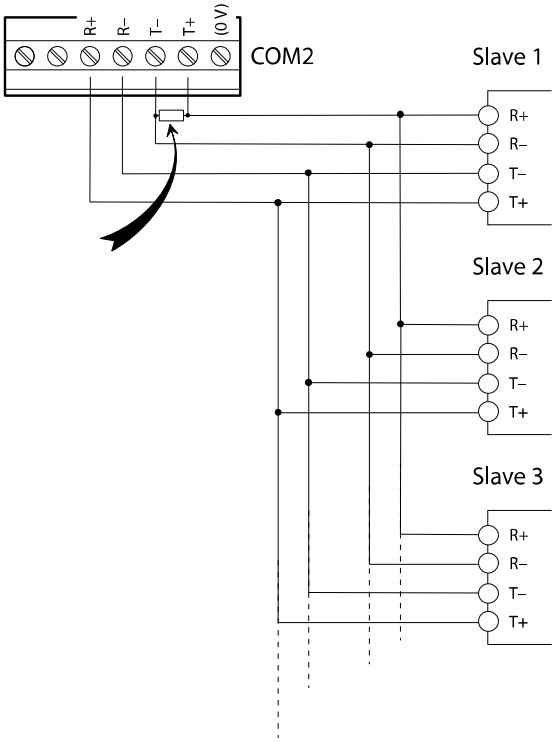
The twisted, twin wire line is for the

T+ to T+ or R+ and for the
T- to T- or R-

connection in accordance with the adjacent sketch.

RS485 4-wire connection (4-wire bus system, full-duplex)

The connections for the 2 twin wire lines must be wired in the same way as for the RS422 connection. Both twin wire lines must be terminated if the FP gateway is arranged at the start or end of the two bus lines.



Termination for the receiving lines is activated using the DIP switches. The transmission lines must be terminated externally (see illustration, arrow).

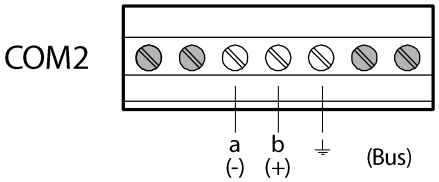
The twisted, twin wire lines must be connected in accordance with the adjacent sketch.

To terminate the transmission lines, connect a 120 Ohm/0.5W (arrow) resistor between screw terminals T+ and T-.

RS485 with 2-wire connection (2-wire bus system, half-duplex)

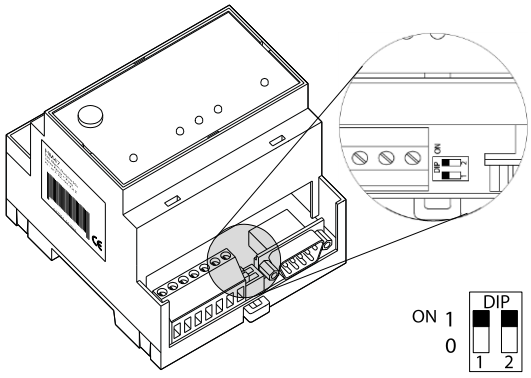
Some devices such as the Hx651 and Hx653, etc. have an RS485 interface in order to connect 2-wire bus systems.

The interface on the device is designed as a 3-pin screw terminal strip:



In the 2-wire variant, there are only 2 DIP switches.

Operating mode	Switch 1	Switch 2	DIP
2-wire RS485 with termination	1	1	11
2-wire RS485 without termination	0	0	00



The switch positions for both DIP switches must always be identical (either both 0 or both 1).

ATTENTION

Communication faults due to incorrect or missing termination!

Ensure that the end devices are terminated correctly.

4.4 COM2 - MPI (multi-point interface)

The MPI is a specific bus and is used to network devices that implement the S7-MPI interface. The MPI bus has the RS485 level and transmission rates of 19.2 or 187.5 kBaud.

The COM2 MPI is a 9-pin D-sub port with the following assignment:

Pin	D-sub port MPI
1	n.c.
2	n.c.
3	DATA.A
4	n.c.
5	0V (m5V)
6	+ 5V
7	n.c.
8	DATA.B
9	RTS PG

Note
The S7 PLC (S7-300/400) is connected via the Profibus plug that is not included.
We recommend using the Siemens Profibus plug (e.g. 6ES7-972-0BB12-0XA0) or a compatible plug.

For more information regarding operating the MPI interface, see section 10.5.

ATTENTION

Damage to the interface due to incorrect connection!

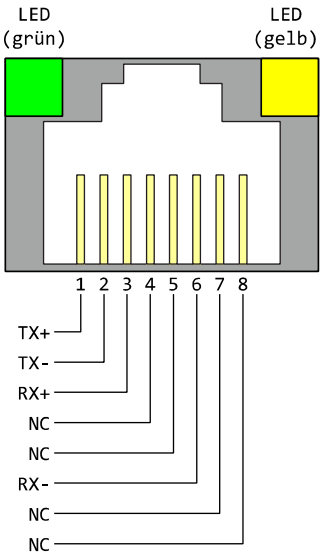
Ensure that the S7 PLC cable is connected correctly to COM2.

Ensure that you do not mix up the RS232 cable (COM1) and the MPI cable (COM2).

4.5 Ethernet connection

The Ethernet connection is designed in accordance with IEE 802.3. It is designed as a shielded 8P8C port (often known as an RJ45 port). The assignment is so that the connection to the HUB or switch can be established using a 1:1 wired and shielded patch cable. The LEDs that indicate the interface statuses are also located in the 8P8C port. The meaning of the LEDs is as follows:

green: illuminated	Ethernet connection established
green: flashing	Data is being transferred
yellow: off	10 Base-T
yellow: illuminated	100 Base-T



The connection works in Auto-Negotiation operating mode. The data transmission speed and full- or half-duplex are arranged automatically with the switch/HUB that is connected.

The connection's wiring is visible in the adjacent drawing.

4.6 COM3 - M-bus

The M-bus is a 2-wire bus system that is used to read out resource meters for heat, water, gas and electricity automatically.

The M-bus is designed in accordance with DIN EN 13757-2 and DIN EN 13757-3 and is the master for up to 100 slaves (end devices).

The M-bus voltage is 36 voltage and is symmetrical to the protective earth.

Data communication is performed in both directions with 8 data bits, 1 start bit, 1 stop bit and 1 parity bit (even parity).

Baud rates of 300, 2400, 4800, 9600 and 19200 can be used.

The bus length depends on the baud rate and should be a maximum of one kilometre.

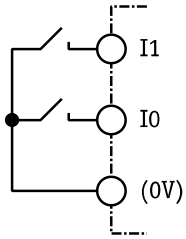
Twisted standard telephone cables (unshielded) with a diameter of 0.8 mm (0.03") must be used.

4.7 Digital and analogue inputs/outputs in the basic device

The inputs in the basic device can be used to detect and evaluate digital and analogue signals. Switching processes are performed via the outputs and relays.

Note
The number and design of the inputs and outputs depends on the device type used. For more detailed overviews of the device types and their equipment, see section 2 in this manual.

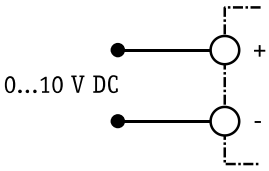
Digital input



The digital inputs can be switched *potential-free* using switches or relay contacts. Digital signals can also be connected (max. 5V).

The lines should be kept as short as possible.

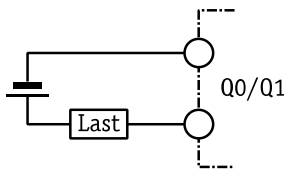
Analogue input



A voltage of 0 to 10 V DC can be applied to analogue inputs. The typical input current at 10 V is around 100 µA.

Input resistance: approx. 100 kOhm.

Digital output



The digital outputs are potential-free and can switch DC or AC voltages of up to 48 V. The capacity per output is 0.12 A.

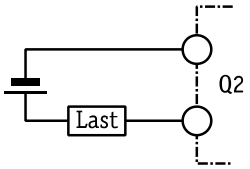
ATTENTION

Output destruction due to too high an output load!

I_{max} = 0.12 A; U_{max} = 48 V AC/DC

The maximum output load for the digital outputs must not be exceeded.

Relay output



Ohmic or inductive loads can be connected directly to the relay outputs. The capacity per output is 3 A / 230 V AC or 0.3 A / 110 V DC.

ATTENTION

Output destruction due to too high an output load!

I_{max} = 3 A at 230 V AC or 0.3 A at 110 V DC

The maximum output load for the relay outputs must not be exceeded.

5 Power supply

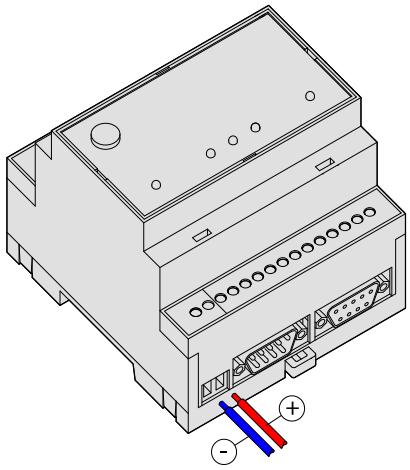
After performing all other installation work, establish the power supply connection to the device.

ATTENTION

Faults on the device due to incorrect voltage connection!

U = 10-30 V DC (for M-bus models: U = 18-30 V DC)

Ensure that the voltage connections have the correct polarity.



Note
DC cable and AC cables
In order to avoid interference from mains adapters or other sources of interference, do not lay the DC cables in the immediate vicinity of AC cables.

ATTENTION

Inadequate power supply due to insufficient cable cross section!

Only use cables with sufficient wire cross-section for connection.

ATTENTION

Damage to the device due to incorrect torque!

Tighten the clamping screws to a torque of 0.5 Nm (0.37 ft lb).

CAUTION

Electrical voltage
Risk of electric shock!

Ensure that the device is de-energised when wiring.

6 Start-up

When all installation steps are completed, the device can be put into operation. Simply establish the power supply to do this.

Self-test after turning on
After applying the operating voltage, the device carries out an extensive self-test. All LEDs are switched on once for checking and all three memory types are checked. The memory test is also performed automatically each time the device is turned on.

LEDs during the self-test

Power	Data out/Process	Line	LAN	Mode	Remarks
					Load firmware, check checksum
	 (flashes)				Unpacking of the firmware
					Launching the Kernel
					Launching the Linux application
					All LEDs off for approx. 5s
	 (flashes)	 (flashes)	 (flashes)		Multiple simultaneous flashing of Data Out/Line/LAN

As soon as the device is ready for operation, an acoustic signal is emitted.
Duration of the start procedure (depending on the project): approx. 1 minute.

Memory test
The internal memory with RAM, the program memory (flash ROM) and the file system in the user memory (flash) are tested. This test takes around 60 seconds.

The FP gateway is ready for operation
Once the self-test is complete, the device is now electrically usable.

6.1 Using the gateway as a WiFi access point (only devices with USB)

A mini formal WiFi stick can be used to also operate FP gateways with a USB interface as an access point and therefore to perform configuration wirelessly.

Insert the WiFi stick into the USB connection and wait a few seconds.

Now press the “SD Unmount” button for around 4 seconds. The WiFi LED should now flash quickly. After around 15 - 20 seconds, the LED flashes cyclically every second. The access point is now active.

Default values after factory reset:

SSID: `Tixi-Devtype-serial`
Authentication: `WPA2`
Password: `berlin2000`
Host name: `Tixi-Devtype-serial`
Number of client connections: `1`
IP address via WiFi: `192.168.100.1`

The WiFi configuration can be adjusted using the “WLAN_AP” ISP database.

All following database entries are optional. If individual entries are omitted, the respective default values apply.

```
[<SetConfig _="ISP" ver="v">
<WLAN_AP>
  <SSID _="HT651_Test" />
  <EnableOnStartup _="0" />
  <AllowedConnections _="1" />
  <Authentication _="WPA2_TKIP|WPA2_CCMP" />
  <Password _="Secret Password" />
  <HostName _="HT651_Test" />
</WLAN_AP>
</SetConfig>]
```

`SSID`

Name of the access point (ASCII characters, no special characters).

Default: `Tixi-`**`Devtype`**`-`**`serial`**

`EnableOnStartup`

This parameter determines whether the WiFi access point is automatically activated when the system starts. 0=do not activate automatically; 1=activate automatically; default: 0

`AllowedConnections`

Defines how many concurrent client connections are allowed (max. 5). Default: 1

`Authentication`

Specifies the encryption method. WPA2_TKIP (default) and WPA2_CCMP are supported.

`Password`

WiFi password (ASCII characters, no special characters).

Default value: `berlin2000`

`Host name`

Host name via which the FP gateway can be reached (alternative to the IP address). Default: see SSID

WiFi IP address for the FP gateway: `192.168.100.1`

Automatic connection to the WiFi access point via WPS (WiFi Protected Setup)

The USB devices support the WiFi Protected Setup (WPS) option in access point mode.

WPS allows automatic connection to an access point without entering a password.

To switch to WPS mode, access point mode must already be active on the FP gateway.

How to switch WPS mode on:

Press the “SD Unmount” button on the FP gateway for around 1 second, hold the button and then press the “Service” button at the same time.

The "WiFi On" LED should now flash rapidly. WPS mode is activated.

You can now use your end device (laptop, smartphone etc.) to establish a connection to the FP gateway. Many end devices detect WPS mode automatically (e.g. Windows 10) and can connect directly to the FP gateway.

WPS mode is active for about 2 minutes. The FP gateway then switches back to normal access point mode. WPS mode can be reactivated at any time.

6.2 Using the gateway as a WiFi client (only devices with USB)

A mini formal WiFi stick can be used to also use FP gateways with a USB interface as a WiFi client. In this mode, the FP gateway connects to a WiFi router and can therefore be integrated into a network wirelessly.

“WiFi client” mode must be configured. After a factory reset, “Access point” mode (see section 6.1) is active initially. For the FP gateway to work as a WiFi client, the ISP/WLAN database must be configured.

```
[<SetConfig _="ISP" ver="y">
<WLAN>
  <Profile_0 SSID="acer">
    <Authentication _="WPA_TKIP"/>
    <Password _="87654321"/>
    <Ethernet>
      <IP _="DHCP"/>
      <HostName _="myDeviceName"/>
    </Ethernet>
  </Profile_0>
</WLAN>
</SetConfig>]
```

`SSID`

Name of the access point to which the FP gateway should connect (only ASCII characters allowed)

`Authentication`

Specifies the encryption method. Currently only WPA_TKIP is supported.

`Password`

Router WiFi password (only ASCII characters, no special characters).

`IP`

IP configuration. Only DHCP mode is supported currently (automatic assignment of IP address, gateway and DNS by the router)

`Host name`

Host name via which the FP gateway can be reached on the network (if supported by the router).

After configuring the `ISP/WLAN` database, plug the WiFi stick into the USB connection and wait a few seconds. The WiFi LED should now flash briefly every second.
The FP gateway is now logged on to the router. If the WiFi LED is not flashing, check the settings (especially the password).

> **Please note:**
>
> Simultaneous use of the LAN interface and WiFi client mode on the same network (i.e. connecting the FP gateway to the WiFi router both wirelessly and via LAN cable) is currently not supported.
> If the FP gateways are to be used as WiFi clients, the configuration for the WiFi access point is not permitted to be active.

Scanning the WiFi network

You can use the `[<ScanWLAN ver="y">]` command to scan the WiFi network for access points.

Result (example):

```
<ScanWLAN>
  <AP0 _="" RSSI="-67">
      <BSSID _="cc:32:e5:85:7b:3b" />
      <SSID _="MyWLAN_1" />
      <Channel _="1" />
      <Security _="WPA2" />
  </AP0>
  <AP1 _="" RSSI="-47">
      <BSSID _="dc:39:6f:53:0e:4e" />
      <SSID _="WiFi-network_2" />
      <Channel _="6" />
      <Security _="WPA2" />
  </AP1>
<ScanWLAN>
```

7 FP configuration software

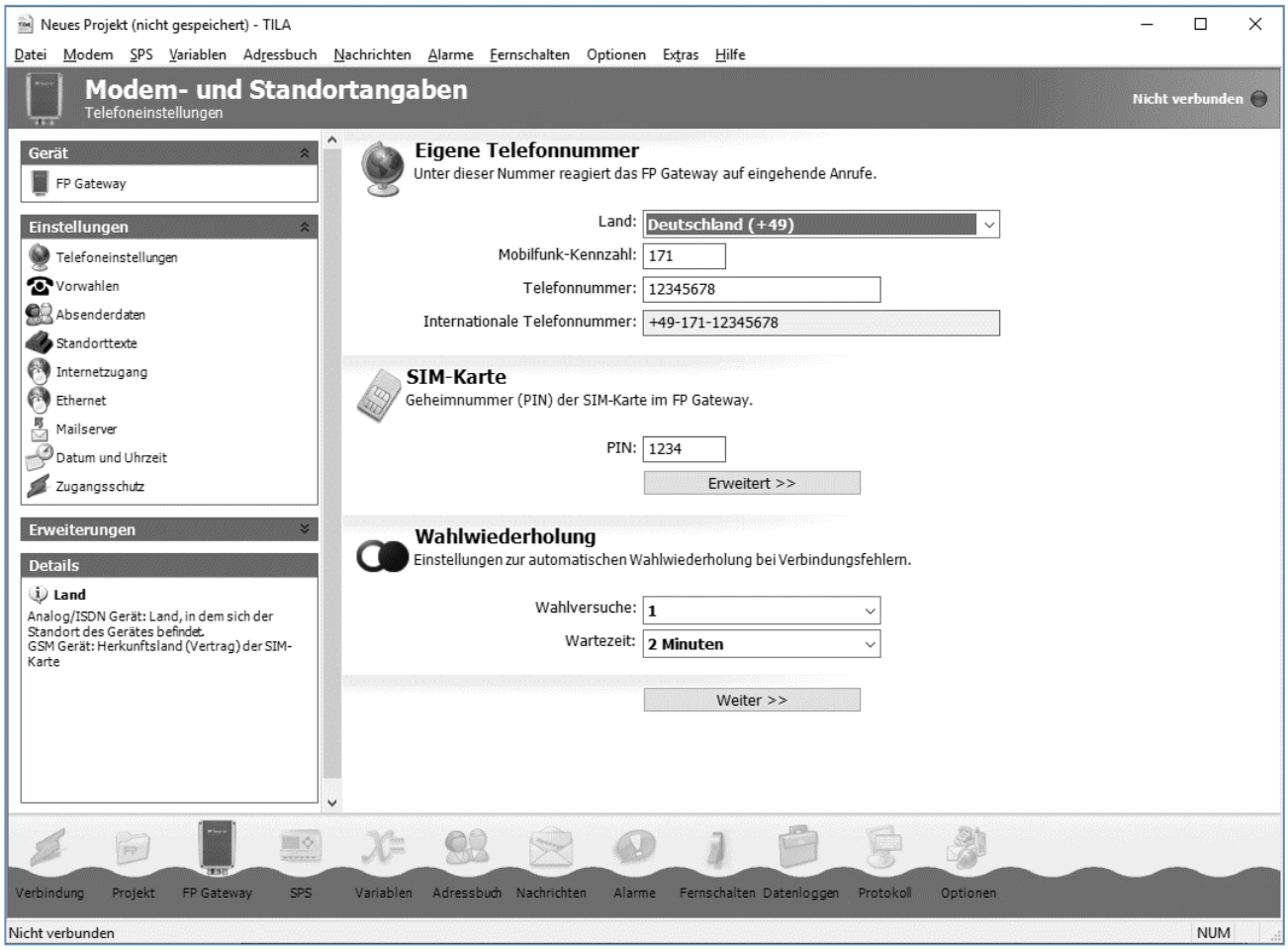
FP InovoLabs supplies various software tools to configure the FP gateway, which are tailored to the different requirements of the various user groups.

TILA	FP configuration software for technicians and experienced end users
TICO	TiXML console for developers and experienced technicians
WebTILA	Web-based configuration tool for M-bus, 1-wire, I/Os, data communication

7.1 TILA – easy installation for technicians

TILA is Windows software that can be used to conveniently configure the FP gateway's functions such as alarms and messages, message receipt and sending, and reading out logged data.

With a click of the mouse, you can merge recipients, messages and PLC variables or I/O ports into alarm messages. For more details, see the TILA manual.



TILA also enable you to access a remove FP gateway from the PC using an IP connection (via mobile communications or LAN) and to configure it remotely: You can use TILA to access a remote device in exactly the same way as a local device and to use the same range of functions.

The FP gateways in the H600 range require TILA Version 2.6 or higher.

Note
Adapted versions of TILA can be created for OEM customers, which only allow certain entries. Please contact FP InovoLabs GmbH for more information.

7.2 Secure login: Protects against unauthorised access

FP gateways can be protected against unauthorised access. To do this, specify the authorised users in TILA and TICO during configuration. Only authorised users can then change and read out the FP gateway's configuration and access it locally and remotely.

If the secure login data has been "forgotten", the device must be reset to factory defaults using Factory Reset (see section 11.4.4). This is the only way to delete the entire configuration, which also includes the project that was created. The FP gateway must then be re-configured with the project and the secure login.

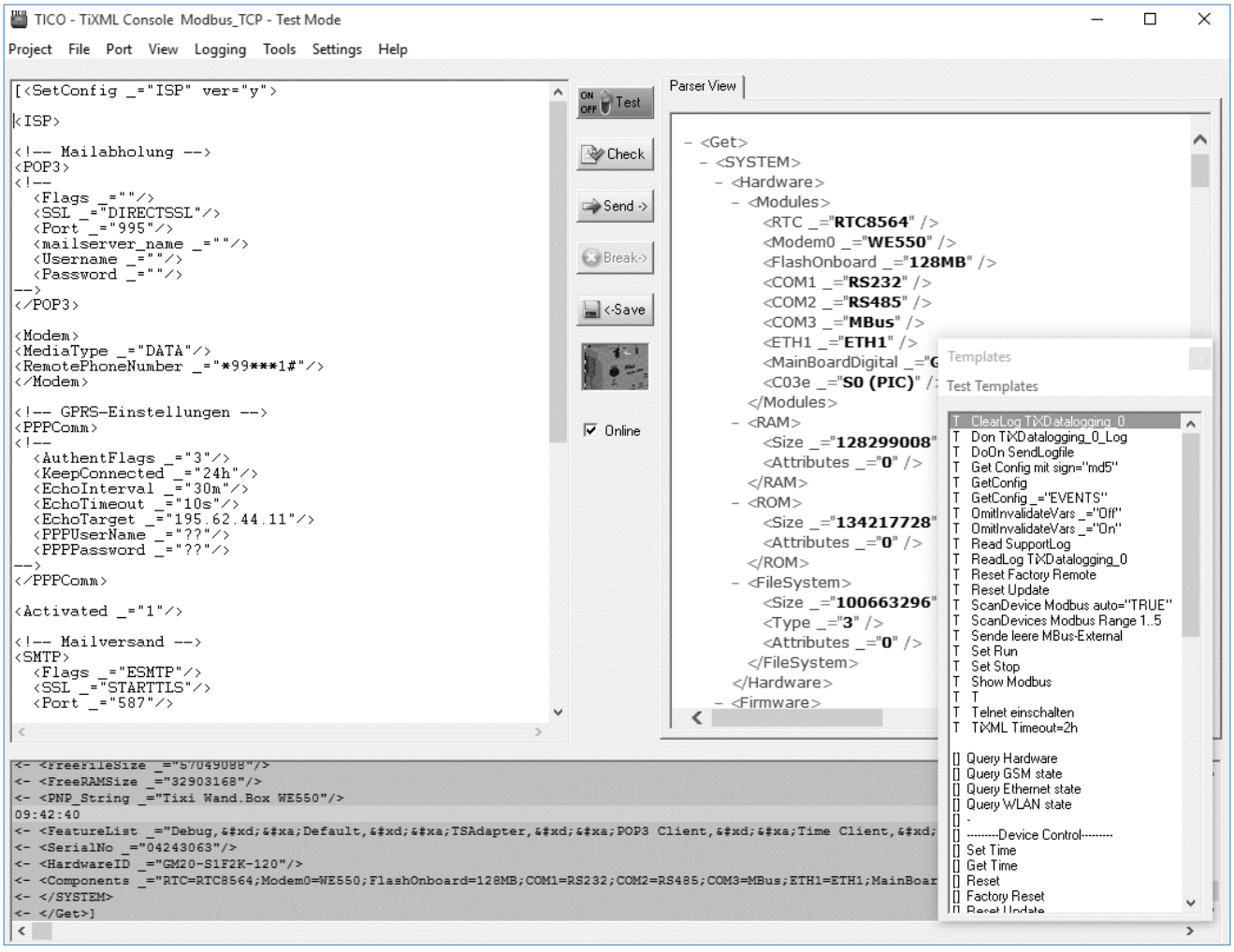
The only exception is the SIM PIN for the FP gateway's internal mobile communications modem, which is also retained after this type of reset in order to prevent logging in with an empty and therefore incorrect PIN.

7.3 TiXML console TICO for developers

The TICO Windows program is available to create TiXML project for complex tasks. Experience with XML programming is helpful but not essential.

Demo projects with tutorials and a comprehensive command reference are supplied as standard with TICO.

For more details, see the TILA manual.



Note

We recommend a one to two day training session to get to know TiXML and TICO. Please contact FP InovoLabs GmbH for more information.
Furthermore, FP InovoLabs offers project creation as a service.

8 Configuration and projects

8.1 Initial configuration

You can imagine an FP gateway as a PC with an operating system and many communication programs. After turning on for the first time, the task memory is empty and the device does not "know" what to do. It must first be configured and be assigned a task. Task setting for the device with all relevant specifications is known as a project and is saved in a TiXML project file. These points are explained in the following paragraphs.

8.2 IP address for the FP gateway

The FP gateway can be configured via the LAN connection using the TICO or TILA parametrisation software. When delivered from the factory or after a factory reset, the FP gateway has a fixed IP address or can be addressed via a defined host name in a network with a DHCP server.

A WiFi stick can also be used for wireless access (only H650 models).

Network without DHCP server / direct connection to PC

The device attempts to obtain an IP address from a DHCP server for about 30 seconds after turning on. If it has not received an answer after 30 seconds, the device's LAN LED flashes and the default IP address is set as follows:

In this case, the IP address for the FP gateway on the LAN connection is as follows: *192.168.0.1*

The IP address for the FP gateway via WiFi is: *192.168.100.1*

Network with DHCP server

In a network with DHCP server, the host name is formed in accordance with the following scheme:

`Tixicom-`**`Devtype`**`-`**`serial`** (applies to LAN and WiFi)

Devtype = device type (see serial number plate): HT651, HT623-M100, etc.

serial = serial number for the FP gateway, see the test label on the bottom of the housing (SN: always 8 characters)

Example Default host name for model **HG621**, serial number **04240361**

`Tixicom-`**`HG621`**`-`**`04240361`**

If you have integrated the FP gateway into a domain network with a DHCP server, it is usually necessary to add the local address of your domain network to the device host name, e.g. in the FP InovoLabs company network: `Tixicom-`**`HG621`**`-`**`04240361`**`.tixicom.local`

8.2.1 Access to the web server

As delivered and after a factory reset, a default website is installed on the FP gateway.

To access the default website, enter the IP address or host name of your FP gateway in the address line of your browser, e.g.:

Illustration: Access via host name

Illustration: Access via WiFi with fixed IP address

FP S-OTGuard BB + 2xRS485 + USB

Hardware	
Device type	LA852-N BB
Serial number	[redacted]
Filesystem size	85.377.024 Bytes
Free Memory	82.796.544 Bytes
Software	
Firmware	6.00.00.150
Firmware Date	2020-07-31 20:25:43
Linux Kernel	Linux buildroot 4.13.16-684713c #1 PREEMPT Fri Jul 31 20:24:13 CEST 2020 armv7l GNU/Linux
UBoot	2017.03-linux4sam_5.7 Tixi 1.2 (Aug 09 2018 - 17:02:55 +0200)
Webserver	
HTTP port	80
Connection timeout	300s
GSM	
Signal strength (0-31)	30
Operator	Telekom.de
Local IP address	10.157.241.216
GPRS APN	internet.t-mobile
GPRS Connection time	24h
IMEI	[redacted]
IMSI	[redacted]

LAN	
Hostname	n/a
IP address	192.168.178.71
Subnet mask	255.255.255.0
Gateway	192.168.178.1
DNS	192.168.178.1
Link speed	100 MBit/s
MAC address	00:11:E8:8A:24:06
WLAN	
Role	Access Point
SSID	LA852-N-04905319
Active connections	1
Signal strength (dBm)	-45
Rate (Mbit/s)	5.5
Hostname	mytixi
IP address	192.168.100.1
Subnet mask	255.255.255.0
Gateway	192.168.100.1
DNS	192.168.100.1
Times	
System time	Fri, 07 Aug 20 08:10:06 +0000
Timezone	+0000
Last power-on time	2020/08/06,10:04:31
Last power-off time	2020/08/06,10:00:00

System links

System config | System properties

Local User Data Bus Config | Local User Data Tree

Upload a custom website

Choose file (.txt): Datei auswählen Keine ausgewählt Upload

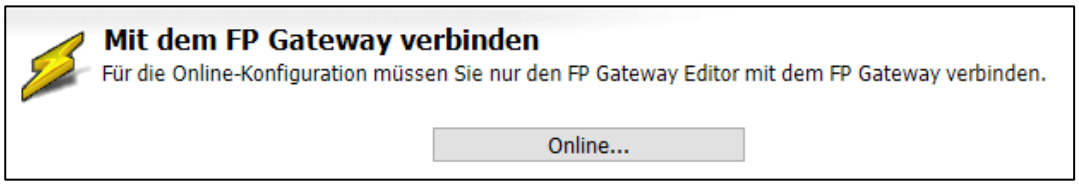
The default website displays a variety of information regarding the hardware and configuration of the device clearly.

Additionally, the configuration (“System config” button) and the process data (“System properties” button) of the connected sensors (meters, PLCs etc., if configured) can be displayed in separate windows.

8.2.2 Access with the TILA software

1. Start TILA

2. Click the “Online” button on the home page:



3. Double-click the appropriate entry in the list of possible connections:

- GPRS/Internet/LAN for connections via the FP gateway’s LAN port
- FP WLAN Stick for connections via WiFi using the FP WiFi stick

4. Enter the FP gateway’ s IP address or host name in the “IP Einstellungen” (IP Settings) section.

If the “FP WLAN Stick” (FP Wi-Fi stick) option has been selected, the IP address is already preset and does not have to be adjusted. The default address for WiFi access is: `192.168.100.1`

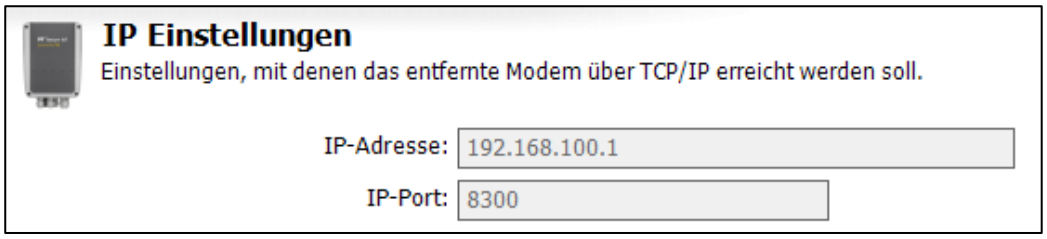
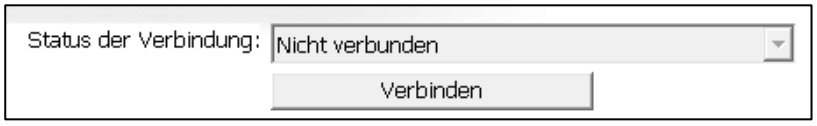


Illustration: Entering the IP address or the host name

5. Now click the “Verbinden” (Connect) button:

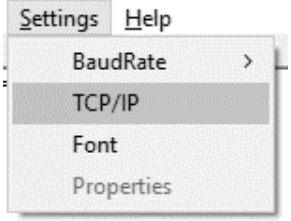


➔ Once the connection to the FP gateway has been established successfully, this is signalled at the upper right edge of TILA:

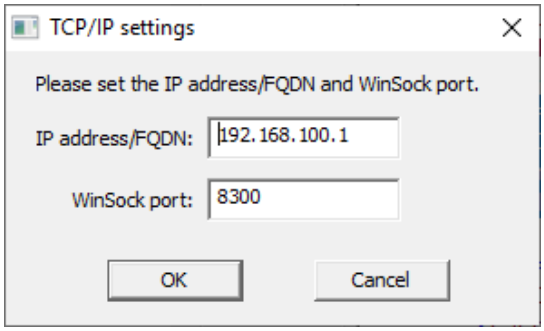
8.2.3 Access with the TICO software

1. Start TICO.

2. Click the “Settings” menu item and select “TCP/IP”.



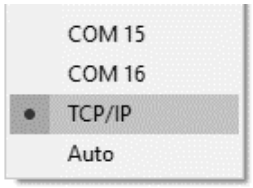
3. Enter the IP address or the host name in the dialogue and click “OK”:



Example: Connection via WiFi stick

If the “Online” option in the middle of the TICO window is activated, deactivate the option with a single mouse click:

4. Click the “Port” menu item and select “TCP/IP”.



➔ After the connection to the FP gateway has been established successfully, the “Online” option is activated.

8.3 Loading projects into the FP gateway

The TILA software is available to you to create projects (see section 7.1, FP software). You can enter the required parameters conveniently on the PC and save them as a TiXML project file on the PC’s hard disk. The SIM card’s PIN is also entered in the software and saved in the project data. An IP connection is used to transfer the project to the FP gateway (LAN or optionally WiFi).

The device is now autonomously functional without a PC and can monitor a PLC for example.

8.4 Loading projects remotely into the FP gateway

After a functional configuration was loaded into the FP gateway, this can also be changed or transferred via remote access (IP connection). Each reconfiguration (remote or local) can be protected against unauthorised access via a login with password.

8.5 Putting the mobile communications modem into operation

In order to configure the FP gateway correctly for mobile communication operation, the SIM card PIN must be entered as for a mobile phone. The FP gateway can only log in automatically and be ready for operation with a correct PIN. The PIN is specified in the documents from your mobile communications provider. The PIN can be changed by inserting the SIM card into a mobile phone.

8.5.1 Entering the PIN using the TILA software

If you are using the TILA software, you can enter the PIN when creating the project.

8.5.2 PIN OK, network present, FP gateway logged in

If the PIN entered into the project is correct for the SIM card inserted into the mobile communications modem and there is network reception for the relevant provider, the FP gateway logs in like a mobile phone. The Line LED then flashes at regular intervals.

8.5.3 PIN OK, no network, FP gateway not logged in

If the PIN entered into the project is correct for the SIM card inserted but there is no network reception for the relevant provider, the FP gateway cannot log in, the Line LED does not flash and remains off.

Once the reception is again sufficient, e.g. because a stronger antenna is used, the Line LED flashes again.

8.5.4 PIN incorrect, FP gateway not logged in

If the PIN entered into the project is incorrect for the SIM card inserted, the FP gateway cannot log in and the Process, Line and Data out LEDs flash.

The same happens if there is no project and therefore no PIN present in the FP gateway, for example, after initial commissioning.

Ensure that a valid SIM card was inserted. Check that it is in the correct position and check the PIN used.

8.5.5 SIM card blocked, entering the SUPER PIN

If the FP gateway is started with an incorrectly configured PIN three times, the SIM card is then blocked and can be unblocked using the PUK. The card can be unblocked by entering the SUPER PIN. To do so, insert the blocked SIM into a mobile phone and enter the SUPER PIN and the PIN in accordance with the operating manual. If the mobile phone logs in properly using the SIM card, you can re-insert the now unblocked SIM card into the FP gateway again.

8.5.6 Service Centre on the SIM card

Also use a mobile phone to check whether the phone number for the SMSC (Short Message Service Centre) is entered on the SIM card. If this is not the case, short messages (SMS) will not be able to be sent using the FP gateway. In this case, contact your mobile communications service provider to find out what this number is and how to save it on the SIM card.

8.5.7 Caution in border areas: Logging in abroad

As with a mobile phone, the FP gateway searches for the strongest mobile communications provider in the location. In an area of up to 10 km from the country border, this may be a foreign mobile communications provider. If the FP gateway logs in there, this may cause significantly higher costs (roaming). Furthermore, problems may occur when sensing SMS and e-mails.

You can prevent logging in to “foreign” networks by assigning a “home network” for the SIM card.

8.5.8 Call acceptance, mailbox and ringing tone

Due to a special initialisation of the mobile communications module, which also enables data to be transferred with prepaid cards, no ringing tones are output on some SIM cards when the modem is rung. In “Telecontrol via CallerID”, wait for around 5 seconds after dialling instead of the first ringing tone in this case. The mailbox should be deactivated if possible.

9 Communication with an PLC

FP gateways can communicate with a controller in two ways:

- The FP gateway speaks the language of your PLC.
  Technically: The **PLC driver** is integrated into the FP gateway.
- The PLC speaks the language of the FP gateway.
  Technically: The **FP driver** is loaded into the PLC.
- The FP gateway and the PLC speak a common language.
  Technically: The FP gateway and PLC use the **same protocol**, e.g. Modbus or text.

The following sections explain what you must pay attention to when connecting the various controller to the FP gateway.

9.1 PLC driver in the FP gateway

In order to enable communication between the corresponding programmable logic controller and the FP gateway, select the suitable driver or drivers for your PLC. Other PLC drivers are provided by FP InovoLabs as required and developed specifically for the customer.

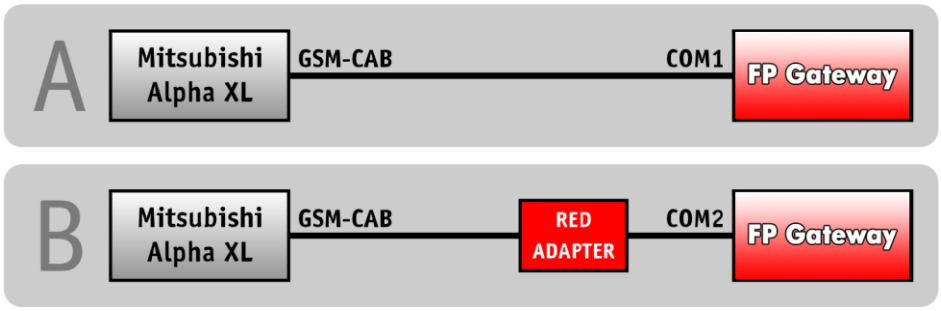
PLC manufacturers	Series
Mitsubishi Electric	Alpha XL MELSEC FX1S/FX1N, FX2N/FX2NC, FX3U
Moeller / Eaton	EASY 400-800, MFD-Titan PS4 series, XC/XVC, Easy Control Easy E4 via Modbus TCP
Siemens	Simatic S7-200 Simatic S7-300/400 via MPI interface Simatic S7-300/400, 1200, 1500 via LAN Logo! 8.X via Modbus TCP
VIPA	100V, 200V, 300V via GreenCable 100V, 200V, 300V via MPI
Berthel	ModuCon via GreenCable ModuCon via MPI
ABB	AC010, CL range AC31
Saia Burgess	PCD1, PCD2, PCD3, PCS
Allen Bradley	PICO (series A + B, GFX)
Theben	Pharao2
Field bus standards	
Modbus (master & slave)	RTU (many controllers have a Modbus RTU option, e.g. ABB AC500) ASCII TCP (many controllers have a Modbus TCP option, e.g. Logo 8.X, Easy E4)

9.2 Mitsubishi Alpha XL

The FP gateway must be connected to the Alpha XL via a Mitsubishi GSM-CAB. Note the following information:

- In the Alpha XL, a program with activated “serial communication” must be present on 9600/8N1 (see the Alpha Programming Software online help). After activation, the Alpha must be restarted.
- The GSM-CAB can be connected directly to the FP gateway’s RS232 interface (COM1).
- If you connect the GSM-CAB to the FP gateway’s COM2, you must use a RED adapter between the device and the GSM-CAB.

The following illustration shows the connection options:



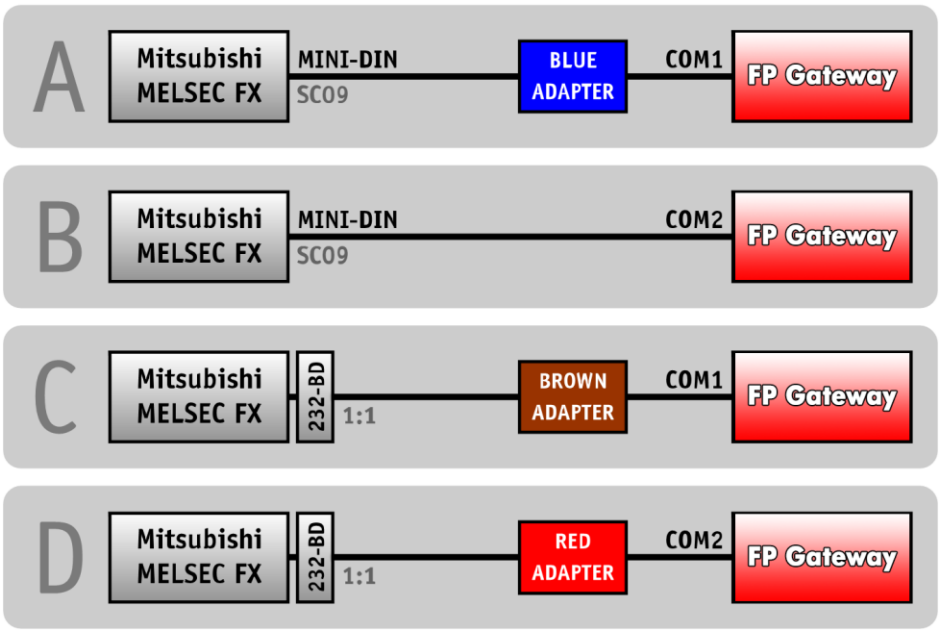
For information regarding the RED adapter, see section 11.5 in this manual.

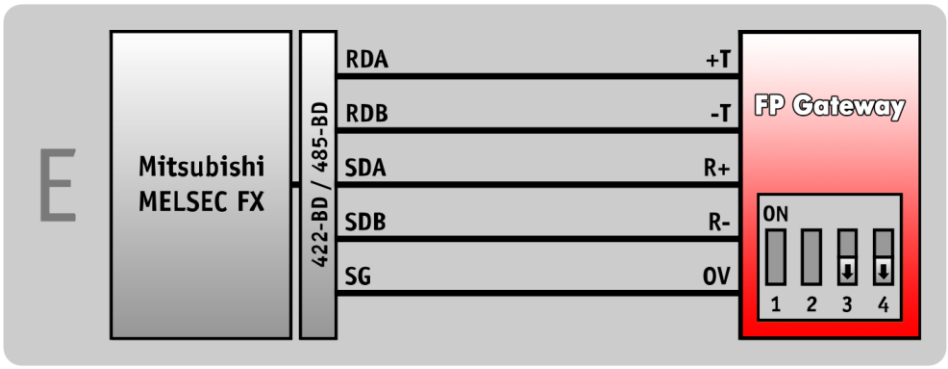
9.3 Mitsubishi MELSEC FX

The FP gateway can be connected to the FX internal RS422 interface or via an additional RS232-BD / RS422-BD / RS485-BD interface expansion.

If you use a BD expansion, this interface must be activated using the GX Developer Software with the parameters 9600/7E1. Both interfaces can be used simultaneously, e.g. to connect an FP gateway and a display to the FX simultaneously.

The following illustration shows the connection options:



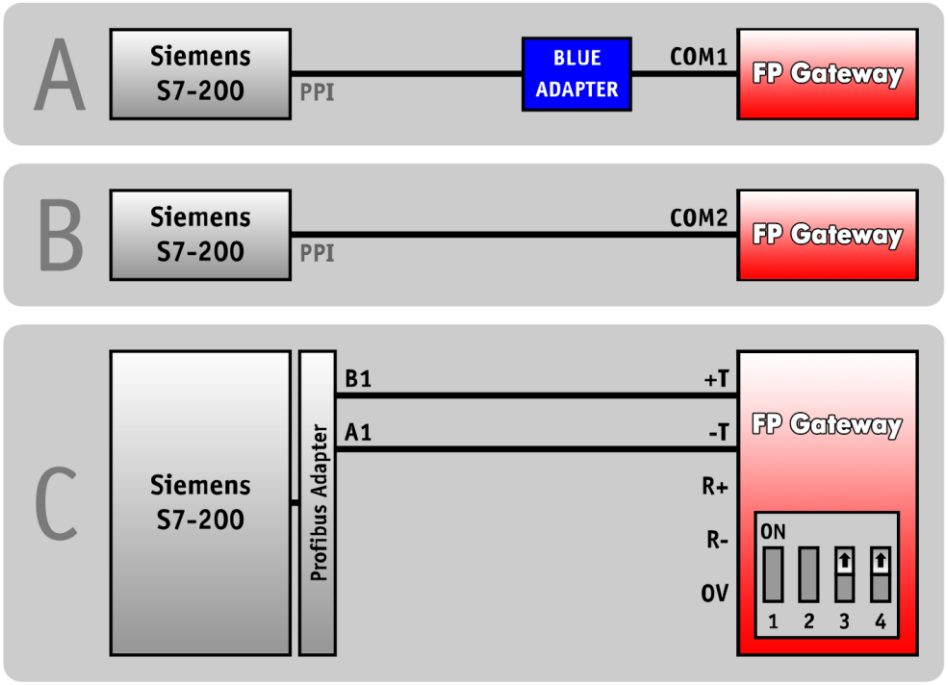


For information regarding the FP adapter, see section 11.5 in this manual.

9.4 Siemens Simatic S7-200 to RS485

The S7-200 can be connected to the RS422/485 interface via a PPI cable (RS232) or via a Profibus adapter.

The following illustration shows the connection options:

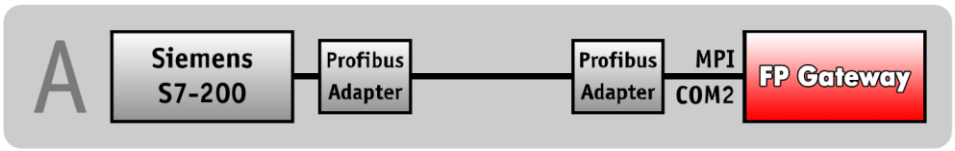


For information regarding the blue adapter, see section 11.5 in this manual.

9.5 Siemens Simatic S7-300/400 to MPI

The S7-300/400 can be connected to the MPI interface on an Hx671 via a Profibus adapter.

The following illustration shows the connection:



9.6 Siemens Simatic S7-300/400/1200 via LAN

The S7-300/400/1200 can be connected via the LAN connection on an Hx6xx. From the software side, communication is performed via the AGLink protocol.

TILA2 as of Version 2.6.0.26 is required for configuration.

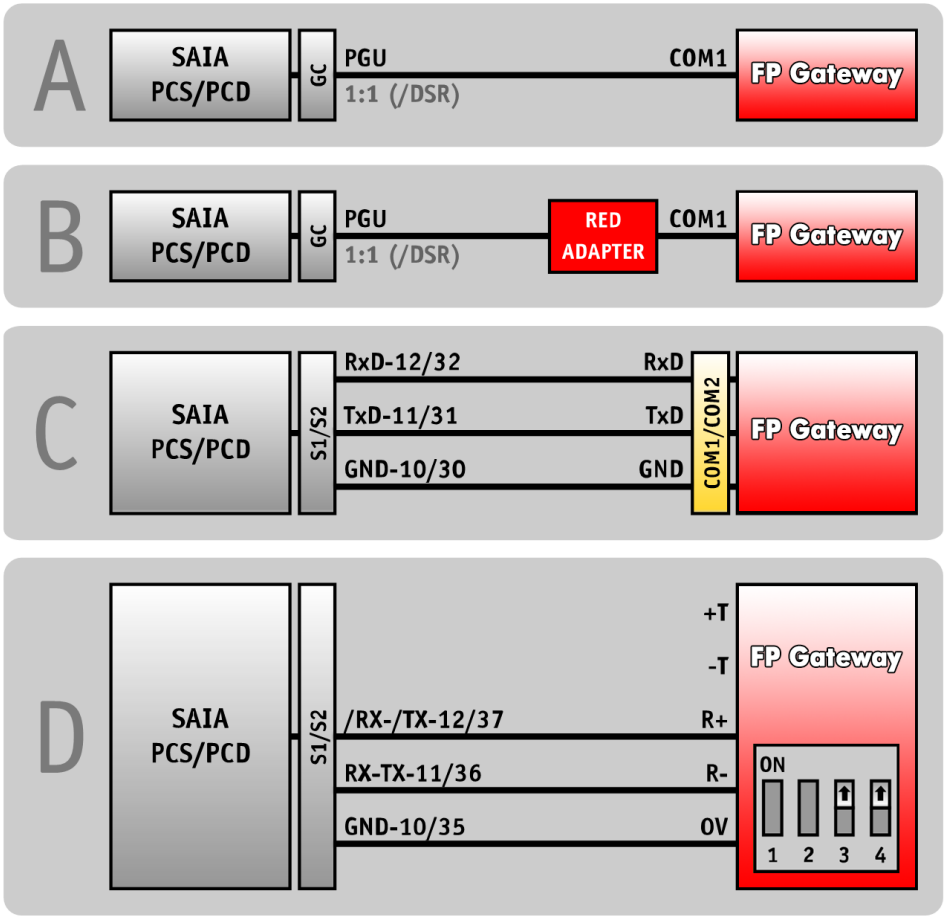
9.7 SAIA Burgess S-bus

The FP gateway can be connected to the PCD2 on all three serial interfaces S0-S2. Only a 3-wire line (RX,TX,GND) is required.

Note the following information:

- If you connect the FP gateway to the PGU port (S0) on the PCD2, the DSR line is not permitted to be carried along, as the PCD2 would otherwise deactivate the S-BUS.
- If the FP gateway is connected to the RS232 (COM1) on the PCD2, the DTR line is not permitted to be carried along, as the S-BUS would otherwise be deactivated.

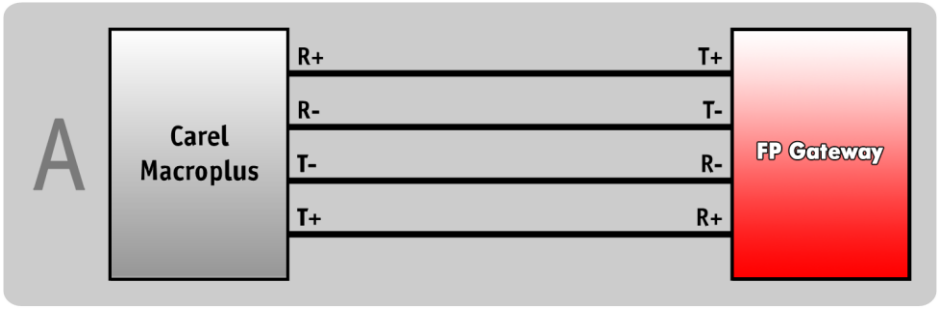
The following illustration shows the connection options:



For information regarding the red adapter, see section 11.5 in this manual.

9.8 Carel Macroplus

The Macroplus can be connected via an RS422-RS232 adapter or directly to an RS422 interface (only HM4x):

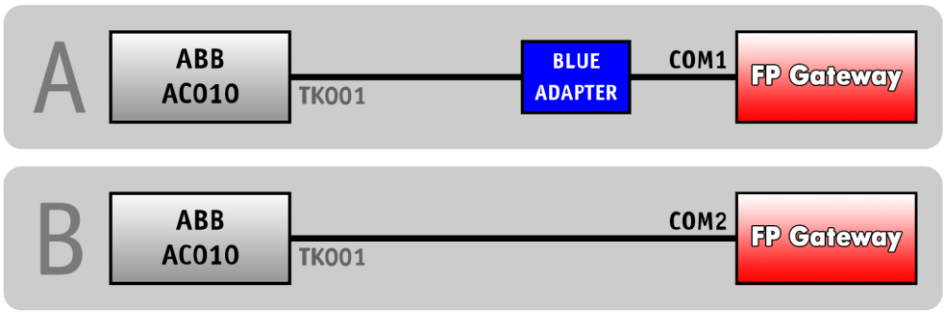


9.9 ABB AC010

The ABB AC010 is connected to the FP gateway's COM1 interface via programming line "TK001" and a "blue adapter".

When connecting the ABB AC010 to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:



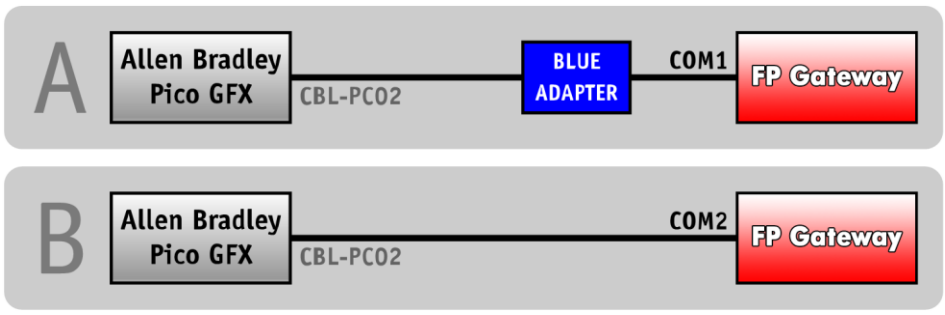
For information regarding the blue adapter, see section 11.5 in this manual.

9.10 Allen Bradley Pico GFX

The Allen Bradley Pico GFX is connected to the FP gateway's COM1 interface via programming line "CBL-PC02" and a "blue adapter".

When connecting the Allen Bradley Pico GFX to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:



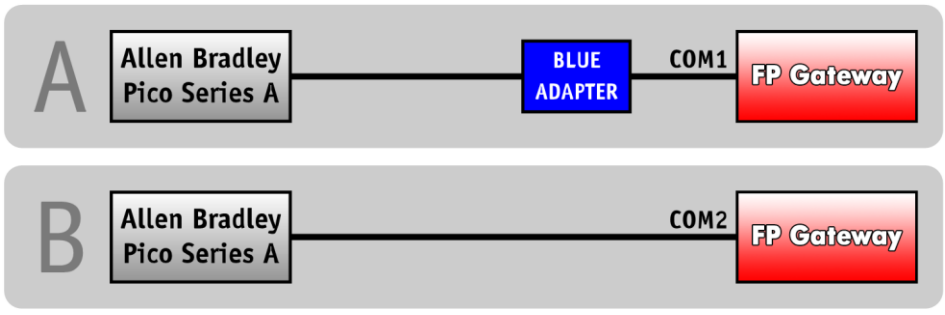
For information regarding the blue adapter, see section 11.5 in this manual.

9.11 Allen Bradley Pico Series A + B

The Allen Bradley Pico Series A + B is connected to the FP gateway's COM1 interface via a serial cable and a "blue adapter".

When connecting the Allen Bradley Pico Series A + B to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:



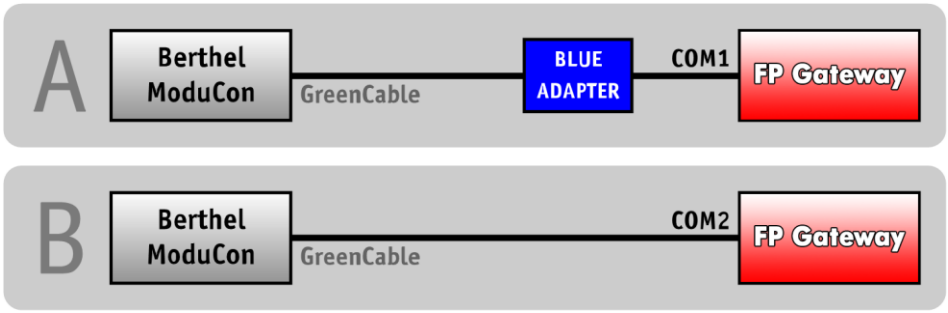
For information regarding the blue adapter, see section 11.5 in this manual.

9.12 Berthel ModuCon

The Berthel ModuCon is connected to the FP gateway's COM1 interface via the "GreenCable" programming line and a "blue adapter".

When connecting the Berthel ModuCon to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:

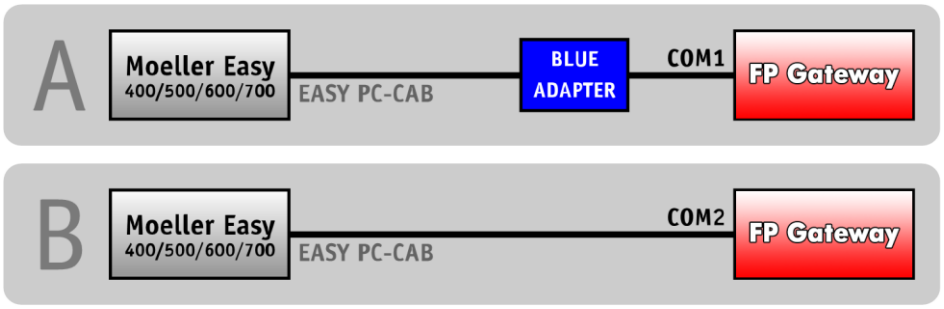


For information regarding the blue adapter, see section 11.5 in this manual.

9.13 Moeller Easy 400/500/600/700

The Moeller Easy 400/500/600/700 is connected to the FP gateway's COM1 interface via the "EASY-PC-CAB" programming line and a "blue adapter".

When connecting the Moeller Easy 400/500/600/700 to the FP gateway's COM2, the "blue adapter" is not required. The following illustration shows the connection options:

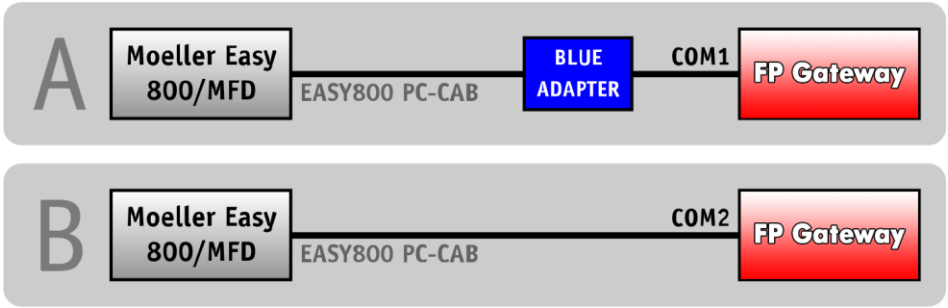


For information regarding the blue adapter, see section 11.5 in this manual.

9.14 Moeller Easy 800/MFD

The Moeller Easy 800/MFD is connected to the FP gateway's COM1 interface via the "EASY800-PC-CAB" programming line and a "blue adapter".

When connecting the Moeller Easy 800/MFD to the FP gateway's COM2, the "blue adapter" is not required. The following illustration shows the connection options:



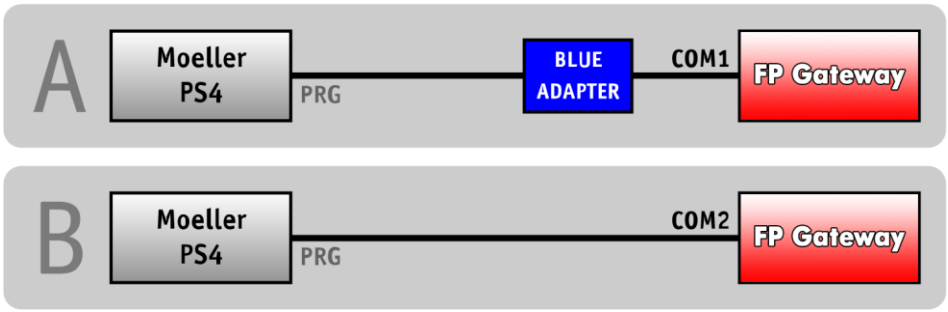
For information regarding the blue adapter, see section 11.5 in this manual.

9.15 Moeller PS306/316, PS4-200 and PS4-300

The Moeller PS4 is connected to the FP gateway's COM1 interface via the PRG port with programming cable "ZB4-303-KB1" and a "blue adapter".

When connecting the Moeller PS4 to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:



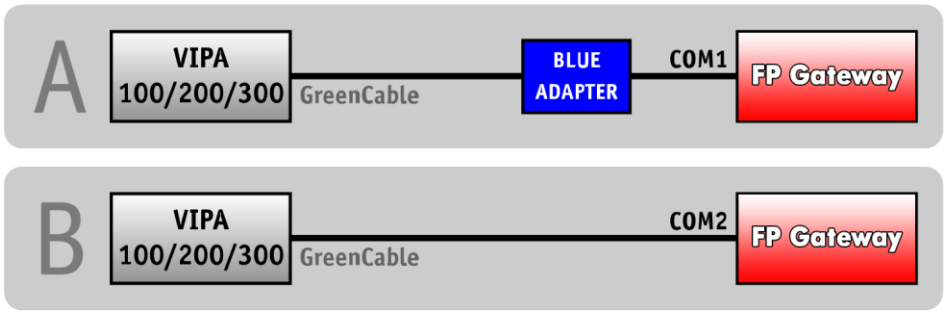
For information regarding the blue adapter, see section 11.5 in this manual.

9.16 VIPA

The VIPA is connected to the FP gateway's COM1 interface via the "GreenCable" programming line and a "blue adapter".

When connecting the VIPA to the FP gateway's COM2, the "blue adapter" is not required.

The following illustration shows the connection options:



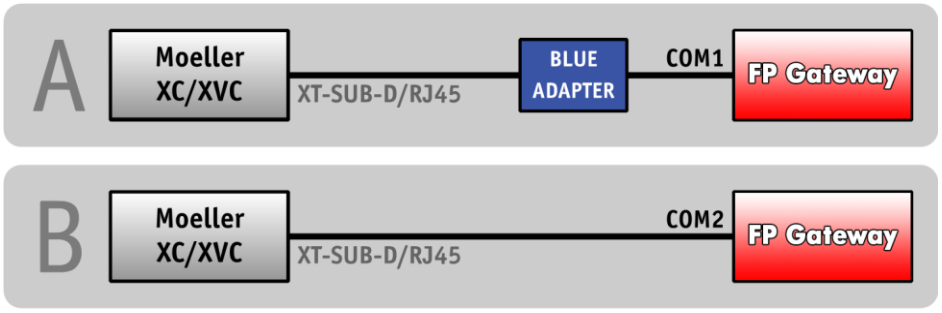
For information regarding the blue adapter, see section 11.5 in this manual.

The S7-compatible VIPA can also be connected to the MPI interface on an Hx671. For more information regarding this, see section 9.5 in this manual.

9.17 Moeller XC/XVC

The Moeller XC/XVC is connected to the FP gateway's COM1 interface via the "ZB4-303-KB1" programming line and a "blue adapter".

When connecting the Moeller XC/XVC to the FP gateway's COM2 interface, the "blue adapter" is not required.



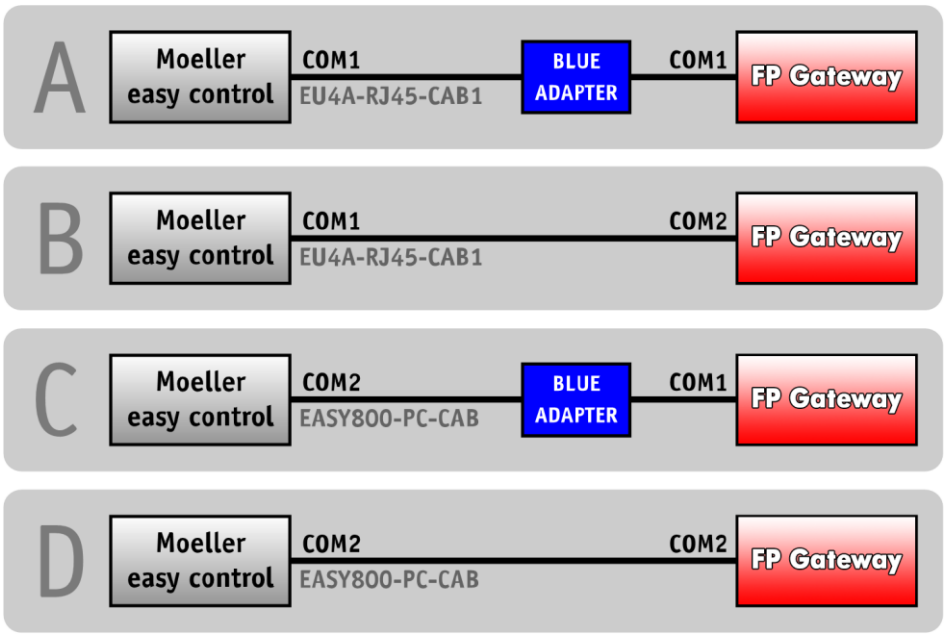
9.18 Moeller easy control

The Moeller easy control COM1 interface is connected to the FP gateway's COM1 interface via the "EU4A-RJ45-CAB1" programming cable and a "blue adapter".

When connecting the Moeller easy control COM1 interface with the "EU4A-RJ45-CAB1" programming cable to the FP gateway's COM2 interface, the "blue adapter" is not required.

Alternatively, the Moeller easy control COM2 interface can be connected to the FP gateway's COM1 interface via the "EASY800-PC-CAB" programming cable and a "blue adapter".

When connecting the Moeller easy control COM2 interface with the "EASY800-PC-CAB" programming cable to the FP gateway's COM2 interface, the "blue adapter" is not required.



10 Serial IP

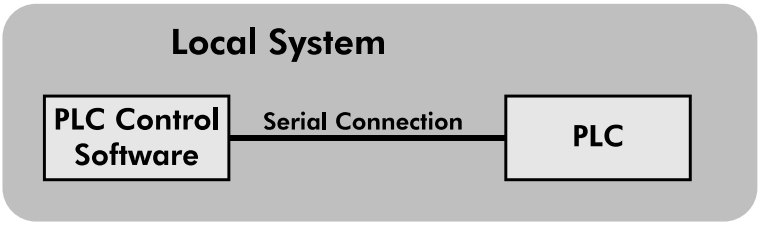
10.1 Overview and description

The serial IP interface is implemented in all current FP gateways.

It enables IP data (sent via an Ethernet connection) to be translated into serial data. This translation enables devices that only have a serial interface to be controlled via any IP connection even if this device does not have its own IP interface.

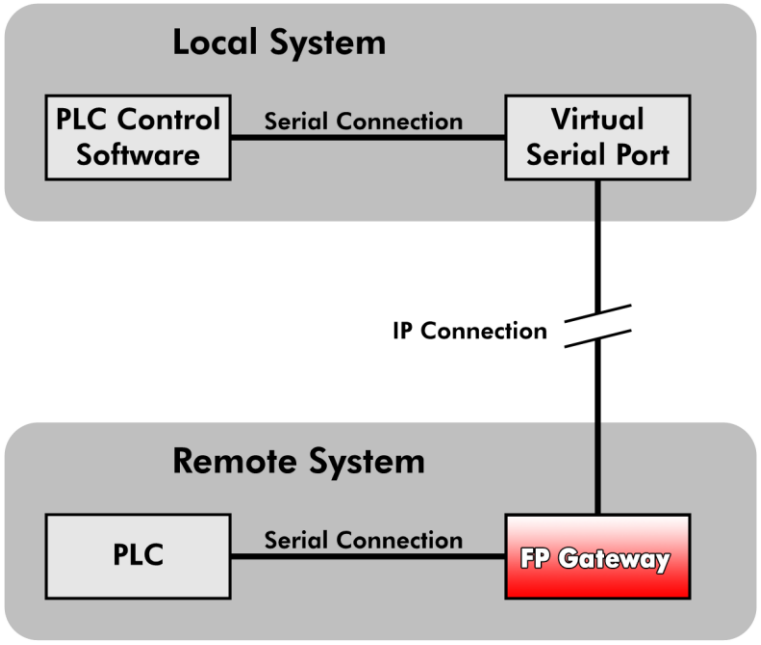
10.1.1 Conventional serial connection

A serial connection (e.g. between a PLC and the configuration software) is basically simpler but does not enable remote access:



10.1.2 Connection via serial IP

If the FP gateway is used for this, there is a physical connection to a PLC in order to implement its configuration software via an IP connection, the layout is as follows:



This function is very easy to use but requires certain prerequisites:

- The FP gateway must be reachable via an IP connection, e.g. there must be an Ethernet connection and the device must have an IP.
- The FP gateway must be connected via a serial interface to the device that is to be reached remotely.
- The FP gateway must have a special configuration in the ISP database.

This section describes this configuration within the ISP database.

10.2 Serial IP configuration

We highly recommend acquiring basic knowledge regarding configuring an FP gateway before configuring the serial IP interface, as this section of the manual only covers the parameters that are directly related to the serial IP interface.

Detailed information regarding configuring an FP gateway is provided in the TiXML reference that can be downloaded from the downloads area on the FP InovoLabs website.

The serial IP interface is configured within the following database:

/ISP/SerialGateway

Serial gateway	
Syntax	[<SetConfig _="ISP" ver="y"> <SerialGateway> <VirtualCOMServer_1> <Port _="**Port**"/> <MinSendBlockSize _="**MinSendBlockSize**"/> <MinReceiveBlockSize _="**MinReceiveBlockSize**"/> <CharTimeout _="**CharTimeout**"/> <ReceiveTimeout _="**ReceiveTimeout**"/> <ControlMode _="**ControlMode**"/> <InactivityTimeout _="**InactivityTimeout**"/> <COMPort _="**COMPort**"/> <Behaviour _="**Behaviour**"/> <ConnectTimeout _="**ConnectTimeout**"/> <COMSettings _="**COMSettings**"> <Baudrate _="**Baudrate**"/> <Format _="**Format**"/> <Handshake _="**Handshake**"/> </COMSettings> </VirtualCOMServer_1> </SerialGateway> </SetConfig>]
Description	Attribute group that defines the properties of the serial-to-IP gateway from the G6 range.

Elements	*Port:*	IP port on the FP gateway that receives the data to be converted. Note that the port must not be the same as that used to send commands to the FP gateway. (default: 23, range: 0-65535, no unit)
	MinSendBlockSize:	This optional parameter defines the minimum number of characters that the serial interface must receive before an IP data package is sent out. Note that this behaviour can be interrupted by the effects of the setting *CharTimeout*. This is described below. (default: 1500, range: 0-1500, no unit)
	MinReceiveBlockSize:	This optional parameter defines the minimum number of characters that the IP interface must receive before they are transferred to the serial interface. Note that this behaviour can be interrupted by the effects of the setting *ReceiveTimeout*. This is described below. (default: 1500, range: 0-1500, no unit)
	CharTimeout:	This optional parameter defines the time that may elapse between two successive characters that come from the serial interface. If this time is exceeded, the previously collected characters are sent as IP packages without considering whether MinSendBlockSize was met or not. (default: 100ms, range: 0ms-1073741823ms 0s-1073740s 0m-17894m 0h-297h)
	ReceiveTimeout:	This parameter defines how long the device will wait for the quantity of characters that was defined in the *MinReceiveBlockSize* parameter. (default: 100ms, range: 0ms-1073741823ms 0s-1073740s 0m-17894m 0h-297h)
	COMPort:	This defines which COM port is used for the FP gateway's serial connection. The quantity and selection of COM ports depends on the interfaces of the FP gateway that is used.
	Behaviour:	This setting controls the behaviour of the VirtualSerialCOMPortServer. It comprises a list of options that are separated by commas and that are described below:
	MessageConnect	If activated, a CONNECT messages is sent to the IP port as soon as the serial port is available. If deactivated (default setting), no message is sent as soon as the COM port is available.

NoNVTNeg If activated, transmission of the Telnet options is suppressed; however, transmissions are accepted from the serial port but this depends on the circumstances. If deactivated, even Telnet connections are transmitted. This option is only active if *ControlMode* is set to "NVT" as described below.

ConnectTimeout: This function sets the time for which the IP port waits until the serial port opens before the session is closed. (default: 100ms, range:
0ms-1073741823ms
0s-1073740s
0m-17894m
0h-297h)

ControlMode: This parameter sets the operating mode for the VirtualCOMServer:

NVT The VirtualCOMServer works as a virtual network terminal and the COM port settings can be set dynamically by the serial port. Furthermore, modem and line changes can be transmitted.

none The COM port settings ate used as configured and TELNET commands that apply to the settings are ignored.

InactivityTimeout: Defines the time that must elapse between transmission of two successive characters before the VirtualCOMServer closes the connection to the virtual serial port.

COMSettings: This (optional) parameter defines the COM port's configuration mode.

dynamic This default value starts the COM port with the default settings within this group. The virtual serial port can overwrite these settings with other settings.

fix The COM port is started with the default settings within this group. The virtual serial port cannot overwrite these settings with other settings.

Baudrate: This setting only sets the baud rate that is used on the FP gateway's COM port in bits per second (bps or baud). (default: 115200, range:
300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 115200)

Format: Defines the data format on the COM port. The syntax is the same as for each COM port configuration and is divided into three parts:

DatabitsParitybitStopbits that are explained as follows:
Data bits: **8** (8 data bits), **7** (7 data bits)
Parity bit: **N** (none), **E** (even), **O** (odd)
Stop bits: **1** (one stop bit), **2** (two stop bits)
The default is **8N1**.

Handshake: This optional parameter defines the handshake type, which is "none" by default:

None	No handshake (default)
XONXOFF	Software handshake
XONXOFFPASS	Software handshake, XONXOFF forwarded to the application

	RTSCTS	Hardware handshake with RTS/CTS
	DTRDSR	Hardware handshake with DTR/DSR
	HALF	Half-duplex RS485 communication
	FULL	Full-duplex RS485 communication
	HALFX	Half-duplex RS485 communication with XON/XOFF
	FULLX	Full-duplex RS485 communication with XON/XOFF
	noDTR	Deactivates DTR
	RTSDTRPower	Reciprocal activation of RTS and DTR for the bus power supply

Example

```
[<SetConfig _="ISP" ver="y">
   <SerialGateway>
      <VirtualCOMServer_1>
         <Port _="23" />
         <MinSendBlockSize _="100" />
         <CharTimeout _="10ms" />
         <MinReceiveBlockSize _="100" />
         <ReceiveTimeout _="100ms" />
         <ControlMode _="none"/>
         <InactivityTimeout _="1m"/>
         <COMPort _="COM2" />
         <Behaviour _="" />
         <ConnectTimeout _="5s" />
         <COMSettings _="fix">
            <Baudrate _="115200"/>
            <Format _="8E1"/>
            <Handshake _="RTSCTS"/>
         </COMSettings>
      </VirtualCOMServer_1>
   </SerialGateway>
</SetConfig>]
```

10.3 Configuring Ethernet

In order to act as an interface between the serial and IP port, an IP address must be assigned to the FP gateway. This is done in the ISP database in the Ethernet section:

/ISP/Ethernet

Ethernet configuration	

Syntax	`<Ethernet _="keep">`
	`<IP _="IP-address"/>`
	`<Mask _="Subnetmask"/>`
	`<Gateway _="GW-address"/>`
	`<FirstDNSAddr _="DNS-address"/>`
	`<SecondDNSAddr _="DNS-address"/>`
	`<HostName _="Host"/>`
	`</Ethernet>`

Description	Defines the FP gateway's TCP/IP settings.
Elements	***keep*** Setting to activate a fixed IP configuration that is written to EEProm. **persistent:** Keep the configuration in EEProm **empty:** Forget the configuration ***IP address*** Either the static IP address in dotted quadruple format or the “DHCP” string to activate the Dynamic Host Configuration Protocol. ***Subnetmask*** Subnet mask for the FP gateway. Can be omitted if DHCP is activated.

GW address
Gateway IP address for the next router. Can be omitted if the DHCP server provides this information.

DNS address
IP address for the DNS server. Can be omitted if the DHCP server provides this information.

Host
DHCP option 12 that is used for DDNS registration.

Example

Permanent IP configuration for a private CLASS-C /24 network with a WAN router on the IP 192.168.0.1.

```
<Ethernet _="persistent">
    <IP _="192.168.0.20"/>
    <Mask _="255.255.255.0"/>
    <Gateway _="192.168.0.1"/>
    <FirstDNSAddr _="192.168.0.2"/>
</Ethernet>
```

Automatic IP configuration via a DHCP server.

```
<Ethernet>
    <IP _="DHCP"/>
    <HostName _="FPDevice"/>
</Ethernet>
```

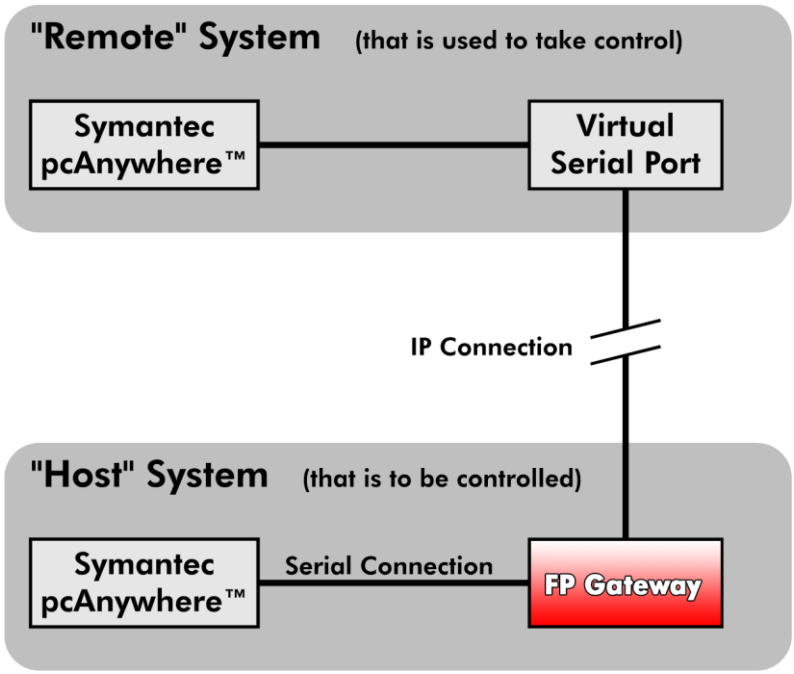
10.4 Application examples

Some applications may require special configurations. These special cases and the corresponding database configuration are documented in this section for your benefit.

10.4.1 Connection with pcAnywhere™ via virtual serial port

This function comprises two components: a virtual serial interface (VSP = virtual serial port) on the remote system and a serial gateway on the host system, which provides a virtual COM port IP service on the remote FP gateway.

Basic approach:



A virtual serial interface (VSP) is provided on the remote side. This is used by pcAnywhere to access a remote PC via a direct serial connection.

The remote PC (host system) is connected to the FP gateway's COM1 interface.

The local virtual interface (VSP) packs the serial data into IP data and sends these to the FP gateway. The FP gateway's serial IP service unpacks the IP data into serial data.

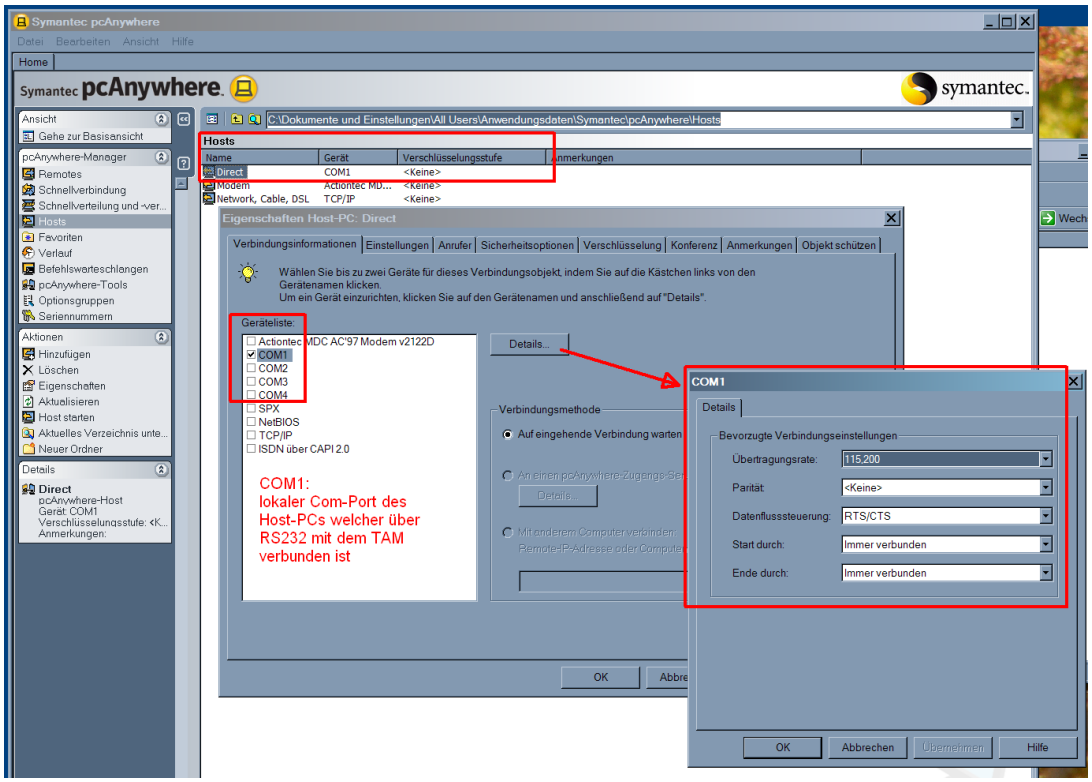
The exact settings for the serial gateway database look as follows:

```
[<SetConfig _="ISP" ver="y">
       <SerialGateway>
           <VirtualCOMServer_1>
               <Port _="23"/>
              <MinSendBlockSize _="1500"/>
               <CharTimeout _="0ms"/>
               <MinReceiveBlockSize _="1500"/>
               <ReceiveTimeout _="0ms"/>
               <ControlMode _="none"/>
               <COMPort _="COM1"/>
               <Behaviour _="MessageConnect"/>
               <ConnectTimeout _="5s"/>
               <COMSettings _="fix">
                   <Baudrate _="115200"/>
                   <Format _="8N1"/>
                   <Handshake _="RTSCTS"/>
               </COMSettings>
           </VirtualCOMServer_1>
       </SerialGateway>
</SetConfig>]
```

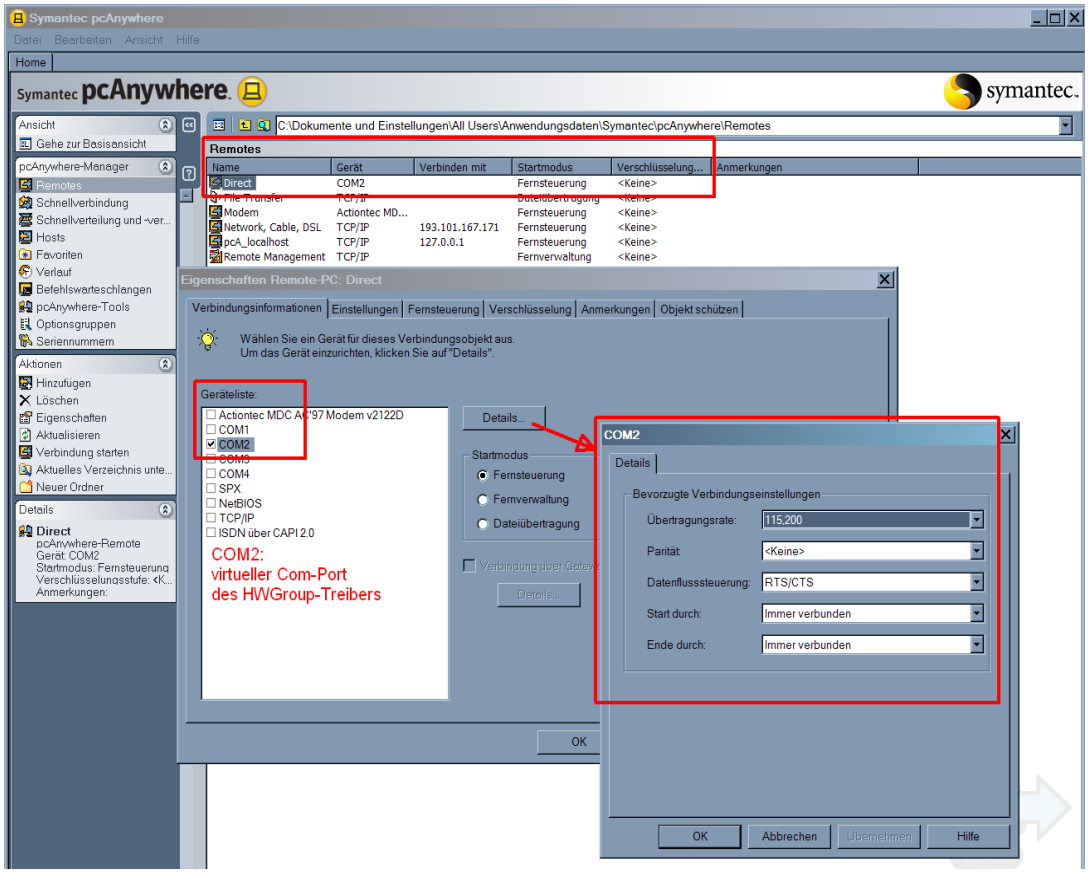
10.4.1.1 pcAnywhere ™- settings

The following settings must be made on the host side and on the pcAnywhere remote station.

Hosts:

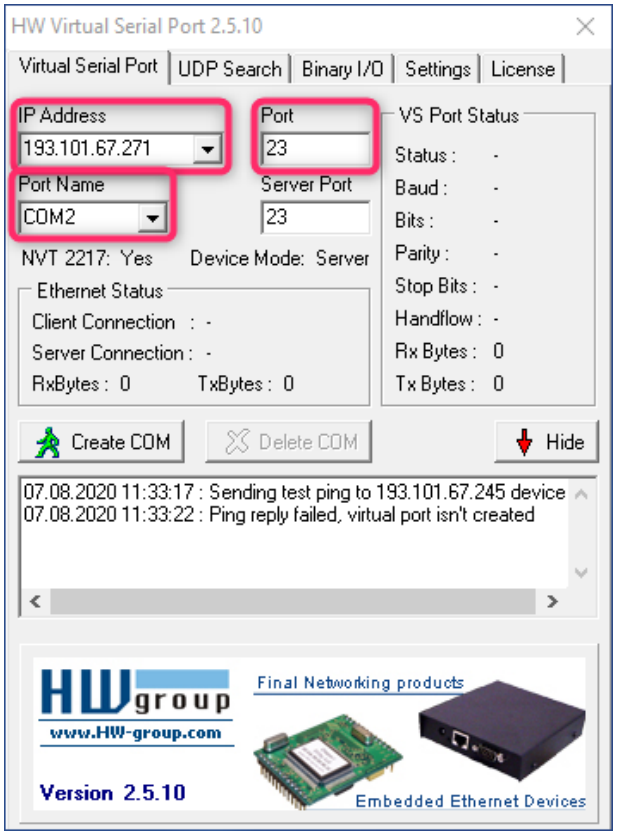


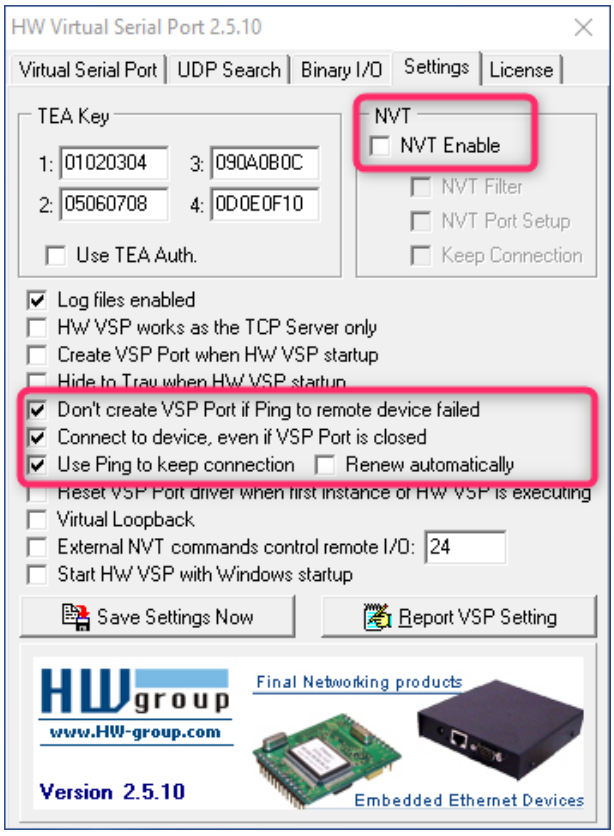
Remote stations:



10.4.1.2 Virtual serial port settings for pcAnywhere™

The following settings must be made in the VSP (HW-Group).





IP address:
IP address for the FP gateway

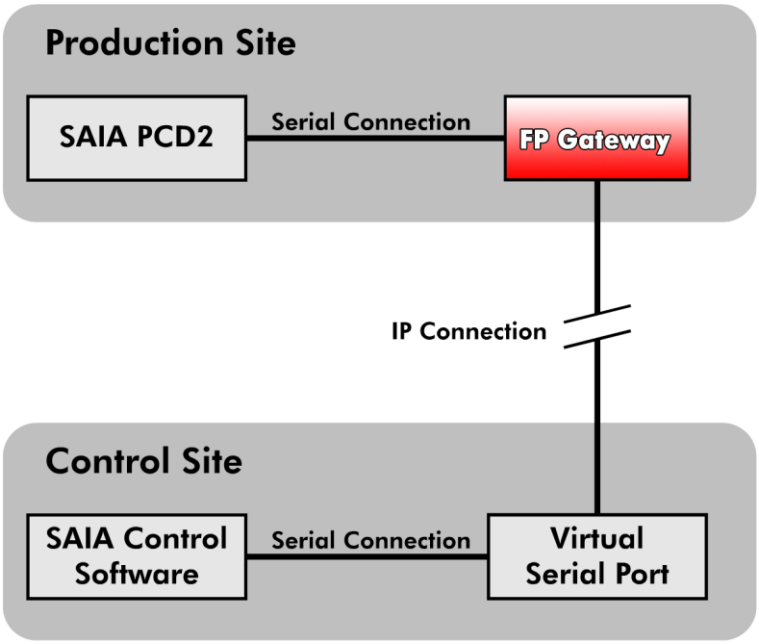
Port:
Port for the FP gateway

Port name:
Virtual port that is used by the pcAnywhere remote stations.

10.4.2 Connection to a SAIA PCD2™

One of the excellent functions of serial IP is the ability to “drill out” the conventional serial connection between a PLC and its control software by adding an IP component. It can do this for virtually unlimited cable lengths as long as they match the physical limitations of a classic RS232 cable.

In the system, the SAIA™ PLC is only connected serially to the FP gateway so that a complete computer system no longer has to be on-site. The FP gateway connects via IP to the virtual serial port (third-party PC software) in the control station that is then connected to the PLC's control software:



The hardware connection between the SAIA™ PCD2 and the FP gateway's COM2 port is established via a standard serial cable (1:1) in conjunction with an FP red adapter (between the cable and the FP gateway).

Alternatively, you can also connect the controller to the FP gateway using the SAIA programming cable (available from SAIA), whereby no adapter is required. For the connection between the FP gateway and the SAIA controller, either use PGU mode or S-bus.

The SAIA programming cable can be ordered from SAIA, while the red adapter is available from FP InovoLabs.

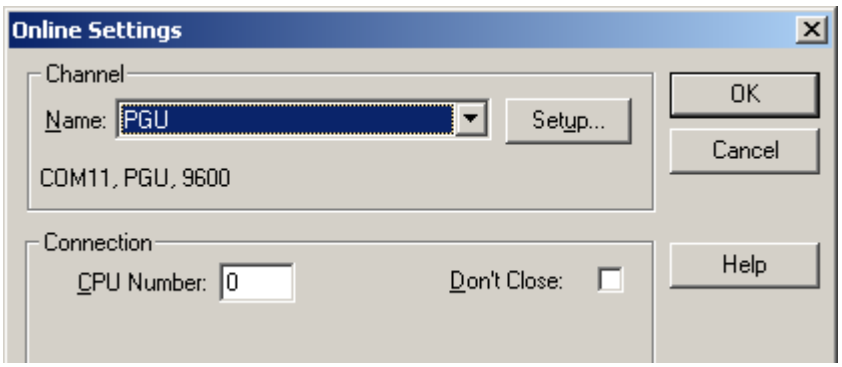
10.4.2.1 Virtual serial port settings

There are various software solutions that enable Pc-controlled translation between serial and IP data. You can of course use the product of your choice, but we recommend the *HW-Group VSP.* This was tested by us, works and can be downloaded for free from:
http://www.hw-group.com

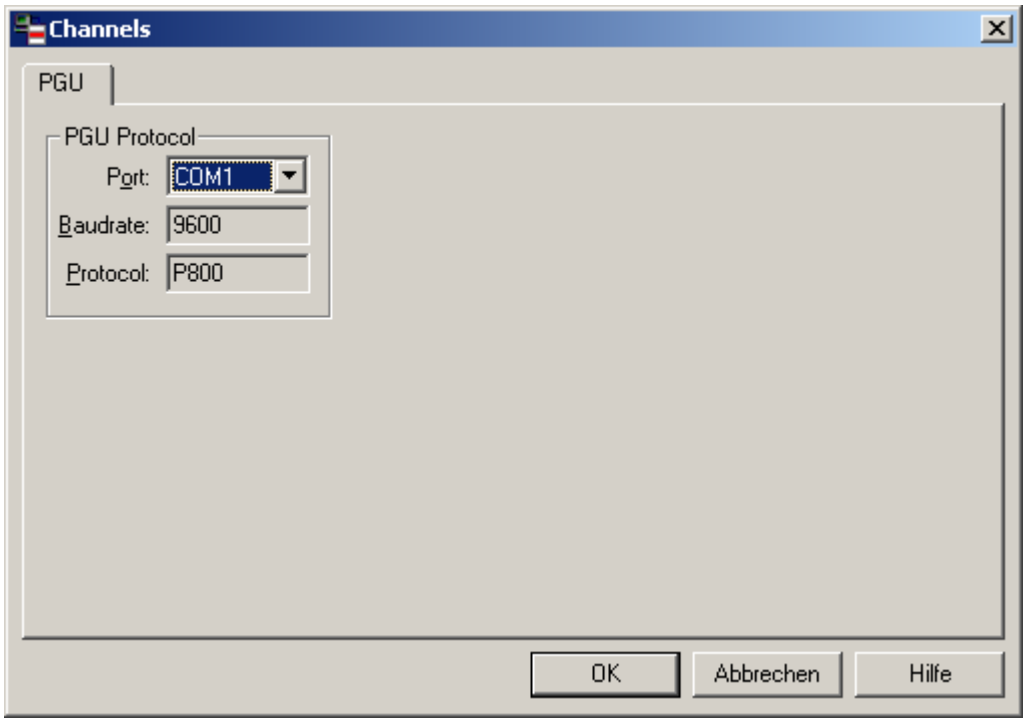
In addition to the number of virtual COM ports and IPs, as well as port numbers, no special settings are required.

10.4.2.2 SAIA control software settings: PGU mode

Not many parameters have to be set in the SAIA control software. If the FP gateway is connected to the SAIA™ PGU interface, the "Online Settings" screen should look as follows:



Furthermore, click the Setup button on the screen to open the Channels screen that looks as shown below:

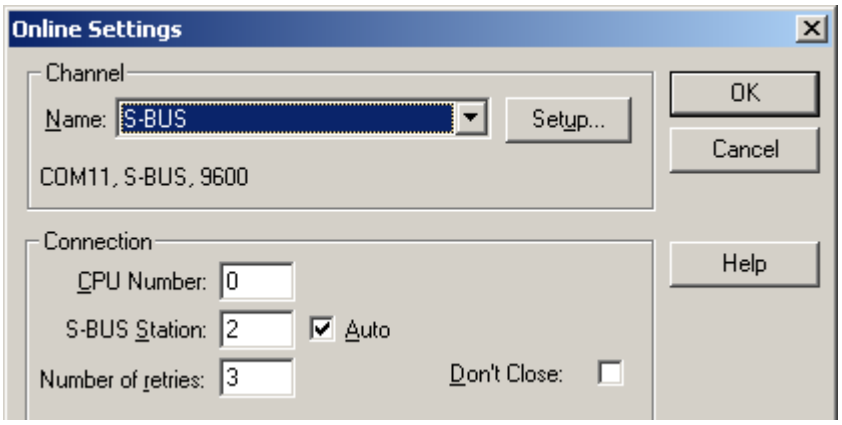


Note
You must set the “Port” to the port number that is provided by the virtual serial port.

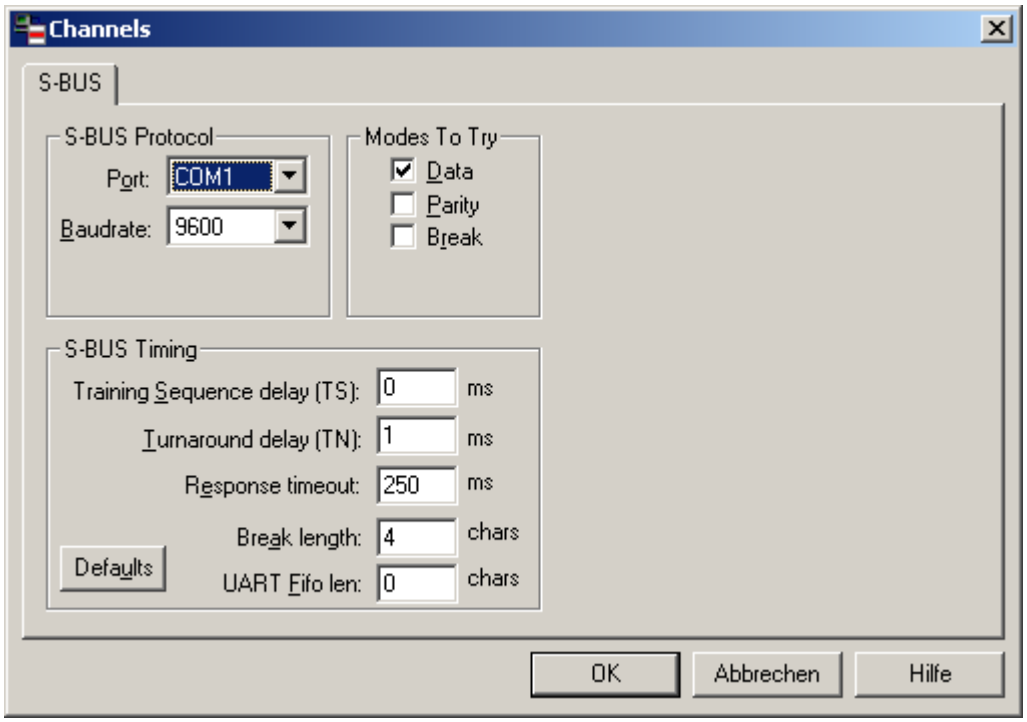
10.4.2.3 SAIA control software settings: S-bus mode

If you connect the SAIA PCD2 to the FP gateway via the S-bus, the only important setting has to be made in the SAIA control software.

The “Online Settings” screen should look as follows:



Furthermore, click the Setup button on the screen to open the Channels screen that must be set up as shown below:



Note
You must set the “Port” to the port number that is provided by the virtual serial port.

10.4.2.4 Serial IP settings

Within the FP gateway, the SerialGateway database should look as follows regardless of whether a PGU or S-bus connection is used:

```
[<SetConfig _="ISP" ver="y">
    <SerialGateway>
        <VirtualCOMServer_1>
            <Port _="8402" />
            <MinSendBlockSize _="1280"/>
            <CharTimeout _="1ms"/>
            <MinReceiveBlockSize _="1280"/>
            <ReceiveTimeout _="1ms" />
            <COMPort _="COM2"/>
            <Behaviour _=""/>
            <ConnectTimeout _="5s"/>
            <ControlMode _="NVT"/>
            <InactivityTimeout _="1m"/>
            <COMSettings _="dynamic">
                <Baudrate _="9600"/>
                <Format _="8N1"/>
                <Handshake _="none"/>
            </COMSettings>
        </VirtualCOMServer_1>
    </SerialGateway>
</SetConfig>]
```

As with the *pcAnywhere™* example, the relevant parameters are the following:

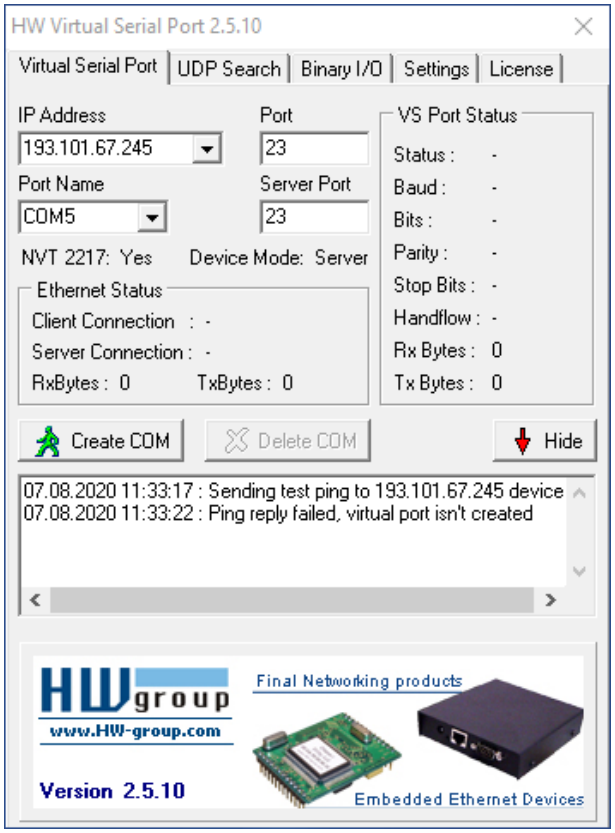
<Port _="8402"/>

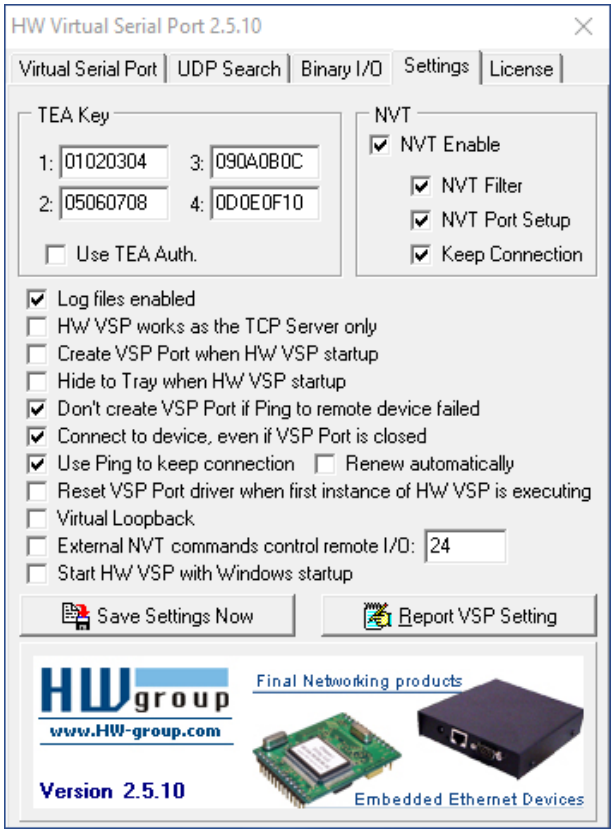
This is the IP port to which the virtual serial port must connect. You can fill this with any permitted number as long as you do not use the TiXML control port 8300.

<COMPort _="COM2"/>
This designates the FP gateway COM port to which the SAIA PCD2 is connected.

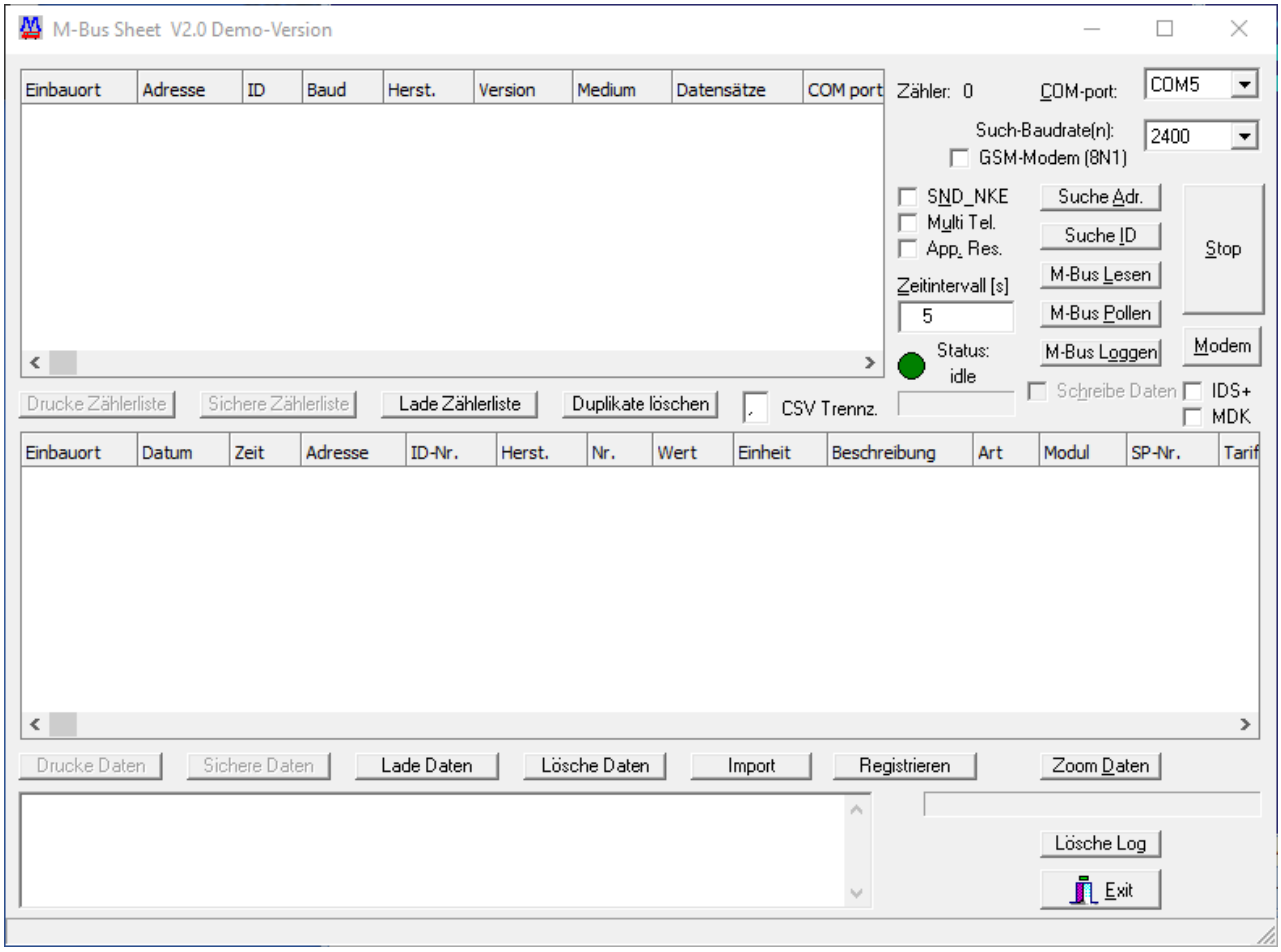
10.4.3 Connection to M-bus

10.4.3.1 Virtual serial port settings





10.4.3.2 M-bus software settings



10.4.3.3 Serial IP settings

```
[<SetConfig _="ISP" ver="y">
     <SerialGateway>
         <VirtualCOMServer_1>
            <Port _="23" />
            <RestrictionStartIP _="0" />
            <RestrictionEndIP _="0" />
            <MinSendBlockSize _="1500" />
            <CharTimeout _="1ms" />
            <MinReceiveBlockSize _="1500" />
            <ReceiveTimeout _="1ms" />
            <ControlMode _="NVT"/>
            <InactivityTimeout _="1m"/>
            <COMPort _="COM3" />
            <Behaviour _="" />
            <ConnectTimeout _="5s" />
            <COMSettings _="dynamic">
               <Baudrate _="2400"/>
               <Format _="8E1"/>
               <Handshake _="None"/>
            </COMSettings>
         </VirtualCOMServer_1>
      </SerialGateway>
</SetConfig>]
```

10.4.4 Connection to the Modbus RTU

10.4.4.1 Virtual serial port settings

Please configure the HW-Group driver as follows (IP address / port may differ from your configuration).

Ensure that NVT is definitely deactivated!

IP address:
IP address for the FP gateway

Port:
FP gateway port as set in VirtualCOMServer_1/Port

Port name:
Virtual port that is used by the Modbus RTU software (e.g. COM3)

10.4.4.2 Serial IP settings

Within the FP gateway, the SerialGateway database should look as follows (baud rate, format and handshake settings may differ from your configuration):

```
[<SetConfig _="ISP" ver="y">
<SerialGateway>

    <VirtualCOMServer_1>
       <Port _="8402" />
       <MinSendBlockSize _="1500"/>
       <CharTimeout _="1ms"/>
       <MinReceiveBlockSize _="1500"/>
       <ReceiveTimeout _="1ms" />
       <COMPort _="COM2"/>
       <Behaviour _=""/>
       <ConnectTimeout _="5s"/>
       <ControlMode _="none"/>
       <InactivityTimeout _="1m"/>
       <COMSettings _="fix">
          <Baudrate _="19200"/>
          <Format _="8N1"/>
          <Handshake _="HALF"/>
       </COMSettings>
    </VirtualCOMServer_1>

</SerialGateway>
</SetConfig>]
```

10.5 Additional remarks

If you have any problems with FP gateway connections, please inform us of these. Please send an e-mail to: tixi-support@inovolabs.com

In this way, we can rectify problems quickly and adjust our device to improve your user experience.

11 Appendix

11.1 Technical data for the FP S-OTGuard series

11.1.1 Main functions

Main functions	
Alarm and fault indicator	Automatic generation and sending of fault messages from message templates and current values (from PLC or Gateway). Actions can trigger up to 100 definable events depending on the time requirements. Address book: max. 100 addresses. 100 message texts, 100 alarms
Acknowledgement	Acknowledgement option for alarms and triggering of alarm chains if the acknowledgement does not arrive within a set time. Acknowledgement via SMS or e-mail possible.
Alarm chain	Multiple levels of alarm actions and receivers if alarm messages are not acknowledged in time. Alarm actions can be sending an SMS, e-mails or switching actions for example.
Event	Event, e.g.: Error, PLC communication interrupted, acknowledgement of an alarm. All actions in the gateway are triggered by events.
SMS	Sending and receiving of SMS
E-mail	Sending and receiving of e-mail (SMTP)
Remote switching	Remote switching of the variable values of the connected controller by sending switching commands as SMS or e-mail to the Gateway. Password protection
Remote maintenance	Configuration of the Gateway and the connected PLC via an existing IP connection.
Security	Local and remote configuration can be protected using access rights.
Web server	Integrated web server for local access to web applications (e.g. for commissioning)
PLC protocols	More than 30 integrated PLC and field bus protocols; direct access to PLC data points (read/write), e.g. Siemens, ABB, Mitsubishi, Moeller/Eaton, Allen-Bradley, Schneider, VIPA, etc.
Counter protocols	Many integrated field bus protocols, e.g. Modbus, M-Bus, EN 61107, 1-Wire, Aurora, wMBus via optional FP wMBus adapter, …
EDGE functions	Extensive data handling functions (EGDE computing) integrated by users in a freely programmable way, e.g. logical links, thresholding
Data logging	Large integrated log memory (power failure fail-safe due to flash memory) Up to 100 MB of log memory available for user data; up to 100 log files definable
Cloud protocols	Cloud protocols integrated from notable Cloud providers incl. Cloud command channel -> Gateway e.g. Deutsche Telekom CoT, Cumulocity, AWS, Juconn, generic MQTT
Security Protocols	TLS 1.2, VPN, your own certificates and keys can be configured FTP, SFTP, SMTP, POP3, SMS, MQTT, http, https, telnet and more

11.1.2 System architecture

System architecture	
CPU	400 MHz, ARM9, ATMEL SAM9-G25
RAM / Flash	128 MB DDR2-RAM / 128 MB on-board
System clock (Battery-backed)	For logging of events, e.g.: Error, incoming call, PLC or cloud communication interrupted, acknowledgement of an alarm

11.1.3 Interfaces

Serial interfaces	
COM1 RS232	D-Sub 9, DCE socket / H651 + H653: D-Sub 9, plug, DTE max. 230,400 bps, ITU-T V.24, V.28, hardware handshake. Signals: DTR, DSR, RTS, CTS, DCD, GND, RI, RxD, TxD Transmission distance: 12 m
COM2 RS232	D-Sub 9, plug, DTE, FIFO 16550, otherwise like COM1
COM2 RS485	In accordance with EIA/TIA-485, 3- or 5-pin screw connection max 230 kbit/s, not galvanically isolated integrated termination, switchable via DIP switches transmission distance max. 1200 m depending on transmission rate, bus and cable type
COM3 M-Bus	Conformity: DIN EN 13757-2, DIN EN 13757-3 M-bus master for up to 100 end devices (meters) short-circuit proof, galvanically isolated 1500 V M-bus voltage: 36 V, bus length: max. 1000 m (3 281 ft) 3 screw terminals, grid dimension 3.81 mm (0.15"), cross-section max. 1.5 mm^2 (AWG 16), Data rate: 300 Baud - 19200 Baud data formats: 8 data bits, 1 start bit, 1 stop bit and 1 parity bit (even parity)

USB 2.0 Host	
1x USB Host	For USB devices such as USB memory sticks, WiFi sticks, etc.

Digital inputs	
Digital inputs	Can be switched via potential-free contacts or digital signals, not galvanically isolated All models: max. 5 V; H651 / H653: max. 24V

Digital outputs	
All models:	Max. voltage: 48 V, 120 mA

Relay	
All models:	Potential free, 230 V AC 3A or 110 V DC 0.3 A
Analogue inputs	
All models:	0 - 10 V DC, resolution: 12 Bit

11.1.4 Ethernet connection

Ethernet connection		
Connection	10/100 Base-T IEEE 802.3, RJ45 port (8P8C with 2 LEDs), shielded	
Operating mode	Auto negotiation, Auto MDI-X (crossover cable not required)	
Status LEDs	Flashing green Yellow off Yellow on	Data is being transferred 10 Base-T 100 Base-T
Galvanic isolation	1500 V (V_{rms} min.)	

11.1.5 WiFi stick (optional)

WiFi stick (only for models H651, H653)	
WiFi	USB stick model “90.0072.8100.00”
Wireless type	IEEE 802.11b/g/n WPS (WiFi Protected Setup)
Frequency	1T1R 2.4 GHz
Data rates	IEEE 802.11b: 11 MBit/s max. IEEE 802.11g: 54 MBit/s max. IEEE 802.11n: 150 MBit/s max.
Network modes	Ad-hoc, infrastructure
Encryption	WEP-64, WEP-128, TKIP, WPA2
Antenna connection	Internal
Temperature range	0 - 40 °C (32 - 104 °F)

11.1.6 Operating elements

Operating elements	
Service buttons	Can be freely configured by the user via TiXML programming
Signal LED	Can be configured via TiXML (red/green flashing function, 32 patterns), e.g. “red = error” and “green = functioning properly”
Speakers	Mini speakers for audio signals; can be controlled using TiXML, e.g. continuous sound for alarm
System LEDs	Power, Process/Data out, LAN, Line, Mode, Active
Unmount button	For switching the WiFi subsystem on and off or for unloading (unmounting) an SD memory card

11.1.7 SD memory cards

SD memory cards	
All FP top-hat rail gateways have a card reader for SD memory cards with a capacity of up to max. 32 GB.	
Active LED	green: SD card active red: read or write process active
Unmount button	Before removing the SD card, ALWAYS press the unmount button first for <= 1 second and wait until the “Active LED” extinguishes
Batch mode	A TiXML configuration can be brought into the device via the SD card and system diagnostic data can be saved on the SD card (e.g. configuration, log data, etc.)
Memory card type	All SD memory cards up to max. 32 GB (SD and SDHC)

11.1.8 Mobile communications modem (model-dependent)

GSM/GPRS/LTE Cat.NB1/LTE Cat.M1: (2G, 4G IoT) NBP model (only available as HN651-P)	
Frequencies	2G: Quad Band 850/900/1800/1900 MHz LTE: B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B26, B28, B39
EDGE features	Multi-Slot Class 33, Coding Schemes MCS 1-9
GPRS features	Multi-Slot Class 33, Coding Schemes CS 1-4
GSM features	Call Forwarding, Call Barring, Multiparty, Call Waiting, Call Hold, Calling Line Identity, Advice Of Charge, USSD, Closed User Group
Antenna	SMA socket (female), coaxial, impedance 50 Ω Output: 2 W at 850/900 MHz, 1 W at 1800/1900 MHz
Data transmission	GPRS: Downlink: 107 kbps, Uplink: 85.6 kbps EDGE: Downlink: 296 kbps, Uplink: 236.8 kbps Transmission power: max. 2 W
GNSS	Positioning. 2nd antenna required. Protocols: GPS, Baidou, GLONASS, Galileo

UMTS/HSPA+: (2G, 3G) NB model	
Frequencies	Dual-mode UMTS (WCDMA) / HSDPA / EDGE / GPRS operation Dual Band 900 / 1800 MHz; UMTS Band 1 (2100 MHz), Band 8 (900 MHz)
EDGE features	Multi-Slot Class 12, E-GPRS Mobile Station Class B, Coding Schemes MCS 1-9; up to 236.8 kbps DL
GPRS features	Multi-Slot Class 12, GPRS Mobile Station Class B, Coding Schemes CS 1-4; up to 85.6 kbps DL/UL
UMTS features	UMTS Terrestrial Radio Access (UTRA) HSDPA category 8
GSM features	Call Forwarding, Call Barring, Multiparty, Call Waiting, Call Hold, Calling Line Identity, Advice Of Charge, USSD, Closed User Group
Antenna	FME socket (male), coaxial, impedance 50 Ω
Data transmission	GSM: CSD up to 9.6 kbps DL/UL GPRS: max. Downlink: 85.6 kbps, max. Uplink: 85.6 kbps EDGE: max. Downlink: 236.8 kbps, max. Uplink: 70.4 kbps UMTS: max. Downlink: 384 kbps, max. Uplink: 384 kbps HSDPA: category 8: max. 7.2 Mbps DL (peak rate) HSUPA category 6: 5.76 Mbps UL Transmission power: 2 W GPRS/GSM/E-GSM @ 900 MHz 1 W GPRS/GSM/E-GSM @ 1800 MHz 0.5 W EDGE/GSM/E-GSM @ 900 MHz 0.4 W EDGE/GSM/E-GSM @ 900 MHz 0.25 W WCDMA/HSDPA/HSUPA @ 800/850/1900/2100 MHz

LTE: (4G) BB model	
Frequencies	8-Band LTE (B1, B2, B3, B5, B7, B8, B20; all bands with diversity) Quad Band 3G (850, 900 1800, 1900 MHz) Quad Band 2G (850, 900 1800, 1900 MHz)
Antenna	FME socket (male), coaxial, impedance 50 Ω
Data transmission	WCDMA CS: Downlink: 64 kbps, Uplink: 64 kbps GPRS: Downlink: 85.6 kbps, Uplink: 85.6 kbps EDGE: Downlink: 236.8 kbps, Uplink: 236.8 kbps WCDMA PS: Downlink: 384 kbps, Uplink: 384 kbps HSPA+: Downlink: 21.6 Mbps, Uplink: 5.76 Mbps DC-HSPA+: Downlink: 43.2 Mbps, Uplink: 5.76 Mbps LTE FDD: Downlink: 150 Mbps, Uplink: 50 Mbps @ 20M BW cat4 Transmission power: 2 W GSM-GPRS @ 850/900 MHz 1 W GSM-GPRS @ 1800/1900 MHz 0.5 W EGPRS @ 850/900 MHz 0.4 W EGPRS @ 1800/1900 MHz 0.25 W UMTS @ 850/900/1900/1950 MHz 0.2 W LTE @ 800/850/900/1700/1800/1900/1950/2100 MHz

11.1.9 Firmware

Firmware	
TECom	**T**ixi **E**mbedded **Com**munication System **TECom** TECom provides all basic functions which are required for close communication with controllers and remote communication in telephone networks, mobile wireless networks, LAN, Wi-Fi and IP based networks.
Operating system	Embedded Linux
File system	UBIFS: Log data and process variables remain in the event of a power failure (flash memory)
OEM functions	The firmware can be expanded for OEM customers, e.g. for: New control protocols, calculating or processing functions or web server functions.
Data security	Use of the industry standard libraries Open SSL (TLS 1.2) and OpenVPN

11.1.10 General data

Power supply	
Standard device	All devices: 10 - 30 V DC; max. 0.7 A Model H653: 18 - 30 V DC; max. 0.7 A 2 screw terminals; conductor cross section max. 2.5 mm^2 (AWG 14)
Backup battery	CR2032 backup battery for RTC (real time clock), service life >= 10 years, replacement by the user not intended

Housing	
Installation	On standard 35 mm x 7.5 mm (1.4" x 0.3") top-hat rails in accordance with EN 50022, horizontal or vertical
Type	FP H5-top-hat rail housing
OEM housing	Standard OEM H5-top-hat rail housing
Dimensions W x H x D	87.8 mm x 90 mm x 58 mm (3.46" × 3.54" × 2.28")
Weight	approx. 225 g (0.5 lb)

Conformity and use	
Conformity	CE 2014/53/EU Radio Equipment Directive RED 2011/65/EU RoHS 2012/19/EU WEEE
Temperature range	Operation: -25 °C - +65 °C / -13 °F - 149 °F (except H653: -25 °C - +60 °C / -13 °F - 140 °F) Storage: -25 °C - +85 °C / -13 °F .. 185 °F
Permitted humidity	5 - 95 % relative humidity, non-condensing
Protection class	IP20
Degree of contamination	2
Mechanical strength	Vibration (Sinus) in accordance with IEC 60068-2-6, vibration (broadband) in accordance with IEC 60068-2-64 Shock in accordance with IEC 60068-2-27
Electromagnetic compatibility	Class A Warning: In a residential environment this equipment may cause radio interference.

11.2 Operation with an SD card

The FP Gateways have an SD card slot. Use this with an SD or MMC card with a maximum of 32 GB of memory, which must first be formatted using Windows (FAT or FAT32).

In order to insert an SD card into the device, push it into the designated slot with the contacts at the front and the label pointing upwards. In order to remove it, press the card located in the device in slightly further; this releases it and pushes it out of the slot.

If a memory card is inserted into the device when it has been started, this is detected automatically.

Before removing the card, press the “Unmount” button for a maximum of 1 seconds and wait until all read and write processes are complete. This is the case as soon as the Active LED extinguishes.

11.3 GNSS localization function (only available in some models)

Some FP gateways like the FP S-OTGuard HN651-P support a GNSS localization function (satellite based) which is often called “GPS function”.

The datasheet shows a list of all supported GNSS protocols (e.g. GPS, GLONASS, Galileo, Baidou).

In order to use the GNSS location function the following requirements must be met:

1. Use of a secondary GNSS antenna in order to receive the satellite data
2. The GNSS-antenna must have a clear view of the sky so that the satellite signals can be received.

Note
GNSS localization is usually not possible in buildings and basements !

The GNSS localization function is switched on at the factory and after a factory reset. It can be configured via TiXML parameters in the `USER/USER` database.

The following parameters are available:

`GNSSInterval`	specifies the refresh rate (default = 60s)
`GNSSOff`	switches GNSS on or off (default= ON)
`GNSSConf`	controls which GNSS satellite data should be used (default = all)

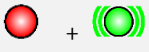
Example USER database:

```
[<SetConfig _="USER" ver="y">
  <USER>
    <InitString0 _="ATX3M1L1"/>
    <TimeZone _="+0000"/>
    <RedialDelay _="120s"/>
    <DialTimeout _="90s"/>
    <MaxDialAttempts _="4"/>
    <RingCounter _="1"/>
    <Pin1 _=""/>
    <GPRS _="On"/>

    <!-- GNSSInterval: GNSS refresh rate in seconds
         default = 60; min value: 1; max value: 3600 (1 hour) -->
    <GNSSInterval _="10"/>

    <!-- GNSSOff: switches GNSS on and off
         default = Off; switch GNSS off: On  -->
    <GNSSOff _="Off"/>

    <!-- GNSSConf: select which GNSS satellite data should be used
         deafult = 1 (all data)
         0 = GLONASS OFF / BeiDou OFF / Galileo OFF
         1 = GLONASS ON  / BeiDou ON  / Galileo ON  (default)
         2 = GLONASS ON  / BeiDou ON  / Galileo OFF
         3 = GLONASS ON  / BeiDou OFF / Galileo ON
         4 = GLONASS ON  / BeiDou OFF / Galileo OFF
         5 = GLONASS OFF / BeiDou ON  / Galileo ON
         6 = GLONASS OFF / BeiDou OFF / Galileo ON
         Note: GPS is always switched on !  -->
    <GNSSConf _="1"/>
  </USER>
</SetConfig>]
```

11.4 LEDs, reset, update, error diagnostics

11.4.1 LEDs during a restart

A restart on the FP gateway with a memory test runs after turning the power supply on, after a factory reset and after loading new firmware.

Power (Yellow)	Data Out/ Process (Red/green)	Line (Green)	LAN (Yellow)	Mode (Red)	Remarks
					Load firmware, check checksum
	 (flashes)				Unpacking of the firmware
					Launching the kernel
					Launching the Linux application
					All LEDs off for approx. 5s
	 (flashes)	 (flashes)	 (flashes)		Multiple simultaneous flashing of Data Out/Line/LAN

As soon as the device is ready for operation, an acoustic signal is emitted.
Duration of the start procedure (depending on the project): approx. 1 - 2 minutes.

11.4.2 LEDs in the event of errors

Data Out/ Process (Red)	Line (Green)	LAN (Yellow)	Remarks
 (flashes)	 (flashes)		**Error accessing the GSM module** SIM card missing, wrong PIN, missing project, GSM module faulty.
	(remains off)		**No coverage, low signal quality** Modem is not logged in if no mobile communications network is available or the reception strength is too low. Check connection and placement of the antenna.
		 (flashes)	**Error in IP configuration** IP address conflict or no IP address via DHCP

11.4.3 The signal LED

The devices in the HG600 series are equipped with an addition LED marked “Signal”, which can be controlled freely by the user. To do this, the variable

```
Process/MB/SignalLED
```

must be set to a value between 0 and 27; these numeric values and the resulting LED behaviour are described in the following table:

Value	Status
0	off
Periodic flashing: red	
1	on
2	Flashing (200ms on, 200ms off)
3	Flashing (50ms on, 50ms off)
4	Flashing (200ms on, 600ms off)
5	Flashing (600ms on, 200ms off)
6	Double flashing (50ms on, 50ms off, 50ms on, 50ms off, 600ms off)
7	Flashing every 3 seconds
8	Double flash every 3 seconds
Periodic flashing: green	
9	on
10	Flashing (200ms on, 200ms off)
11	Flashing (50ms on, 50ms off)
12	Flashing (200ms on, 600ms off)
13	Flashing (600ms on, 200ms off)
14	Double flashing (50ms on, 50ms off, 50ms on, 50ms off, 600ms off)
15	Flashing every 3 seconds
16	Double flash every 3 seconds

Periodic flashing: red and green	
17	Double flashing (50ms green, 50ms off, 50ms red, 50ms off, 600ms off)
18	Flashing (200ms green, 600ms red)
19	Flashing (200ms red, 600ms green)
20	Flashing (50ms green, 50ms off, 50ms red, 50ms off)
Single flash: red	
21	Flashing
22	Flashing for 4 seconds (200ms on, 200ms off)
23	Flashing twice (50ms on, 50ms off)
Single flash: green	
24	Flashing
25	Flashing for 4 seconds (200ms on, 200ms off)
26	Flashing twice (50ms on, 50ms off)
Single flash: red and green	
27	Single flash

11.4.4 Factory reset

During a factory reset, all data saved on the FP gateway is deleted and overwritten with factory settings (DHCP=ON).

Procedure:

(1) Turn the device off.
(2) Press the Service button and **hold it down**.
(3) Turn the device on and wait until the Power LED flashes.
(4) Release the Service button for a **short** time and
(5) press again until the Power LED flashes visibly faster.
(6) Release the Service button.

Note
Note that the device configuration is deleted during a factory reset. The FP gateway restarts with the basic factory settings. The SIM PIN is retained during a factory reset. The IP address for the Ethernet connection can also be retained after the factory reset by using a “persistent configuration” (optional feature).

LEDs during a factory reset and a restart

Power (Yellow)	Data Out/ Process (Red/green)	Line (Green)	LAN (Yellow)	Mode (Red)	Remarks	Duration
(flashes)					Service button was pressed when turning on	1-2 s
(flashes rapidly)					Press the Service button again until the Power LED flashes faster, release	1-2 s
					Test all LEDs	
					Load firmware, check checksum	25 s
	+ (flashes)				Unpacking of the firmware	
	+				Launching the kernel	
					Launching the Linux application	
					All LEDs off for approx. 5s	
	(flashes)	(flashes)	(flashes)		Multiple simultaneous flashing of Data Out / Line / LAN	
					Total duration: approx. 60 s	

11.4.5 Firmware update

New firmware can be loaded into the FP gateway using an upload tool. The LEDs behave as follows when doing so:

Power (Yellow)	Data Out/ Process (Red/yellow)	Connect/ Line (Green)	LAN (Green)	Mode (Red)	Remarks	Duration
(flashes)					Unpack update, check checksum	60 s
		(flashes)	(flashes)		Linux application being updated	5 s
	(flashes)		(flashes)		Kernel being updated (optional)	20 s
	+ (flashes / illuminates)				Restart the system	45 s
					Total duration: approx. 2 min. (with kernel) or 1 min. (without kernel)	

The duration of the firmware update may vary. A firmware update including a Linux kernel takes around 2 minutes, an update without a Linux kernel takes around 1 minute.

For firmware updates, please contact FP InovoLabs GmbH.

ATTENTION

Damage to the peripheral devices or the device due to switched outputs!

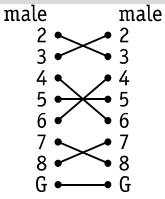
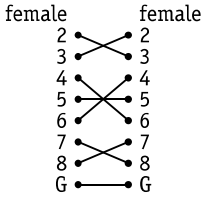
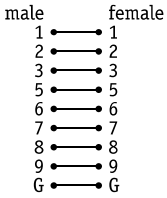
Do not perform an update if peripheral devices are connected.

11.5 Accessories

To equip your FP gateway completely, you can obtain the following accessories directly from FP InovoLabs GmbH or your distributor:

Accessories	Description
ZP-DC24-2A	Power supply unit for installation on a 35mm top-hat rail (24 V DC, 2 A)
ZK-R9M9F180	Serial RS232 cable (D-sub-9 plug on D-sub-9 port, length: 180 cm)
ZK-BA	Blue adapter (zero modem gender changer RS232 D-sub-9 plug/plug)
ZK-RA	Red adapter (zero modem gender changer RS232 D-sub-9 port/port)
ZK-BRA	Brown adapter (for MELSEC FX/BD board on the FP gateway's COM1)
ZA-DE-MINI-LUG	Mini antenna LTE 3G UMTS GSM
ZA-DE-LUG	Rod antenna LTE 3G UMTS GSM
ZA-K-FME1000	FME cable extension, 10m
ZW-R1-SR 10	FP WiFi stick for USB for wireless configuration

Assignment of the FP adapter

Blue adapter	Red adapter	Brown adapter
		

11.6 Mobile communications networks in Europe – USA – worldwide

Europe: GSM networks with 900 MHz and 1800 MHz

Only GSM mobile communications are provided in Europe and therefore, all networks are compatible.

The corresponding network standard only depends on the contract with your mobile communications provider.

USA: GSM networks with 850 MHz and 1900 MHz

In the USA, there are other mobile communications standards (e.g. CDMA) that are not compatible with GSM.

However, GSM is starting to also become ever more established in the USA. For example, T-Mobile uses the GSM mobile communications standard in the USA.

Worldwide: GSM is used in most countries around the world. However, CDMA or both mobile communications standards are used in some.

New LTE narrowband standards LTE Cat.NB1 and LTE Cat.M1
In addition to the 2G (GSM), 3G (UMTS) and 4G (LTE) standards, the standard known as LTE narrowband is offered increasingly. This includes LTE Cat.NB1 and LTE Cat.M1. LTE narrowband is being rolled out in more and more countries around the world. Depending on the country, either LTE Cat.NB1 or LTE Cat.M1, or even both categories is or are offered. Coverage is increasing continuously but is not yet comparable with the established 2G / 3G / 4G standards. Roaming is also often not yet possible.

Some mobile communications modems (option NB) for the FP gateways support LTE narrowband.

11.7 Models

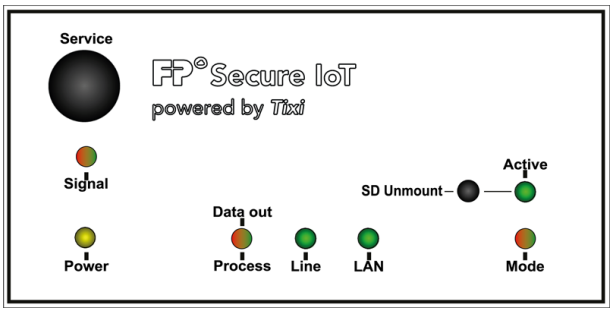
The FP gateways in the Hutline range differ by the type and number of interfaces.

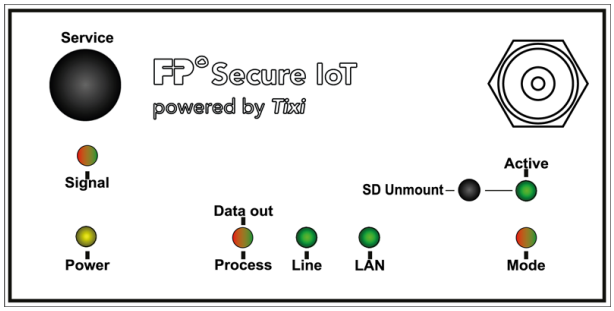
The different variants are shown on the following pages.

11.7.1 Cover plates

The cover plates for the different ranges differ slightly. The devices in the LAN range (FP S-OTGuard Hx6xx LAN, left illustration) do not have an antenna socket.

The Line LED has no function in the LAN range.

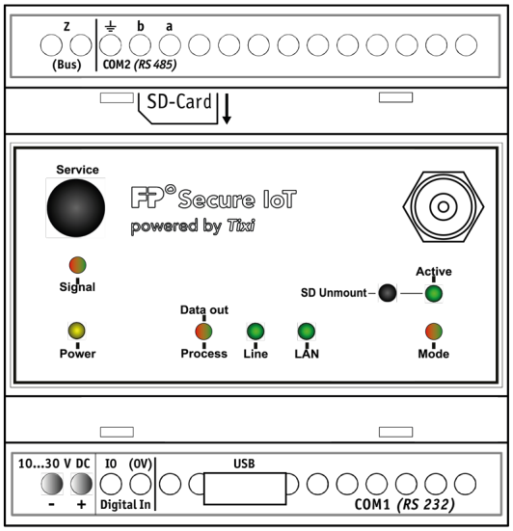




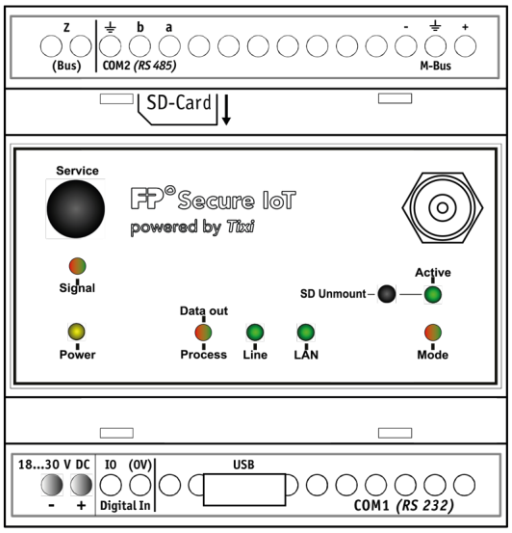
11.7.2 Variants

The following shows a top-down view of the mobile communications versions (FP S-OTGuard Hx6xx NB or FP S-OTGuard Hx6xx BB models) with their interfaces.

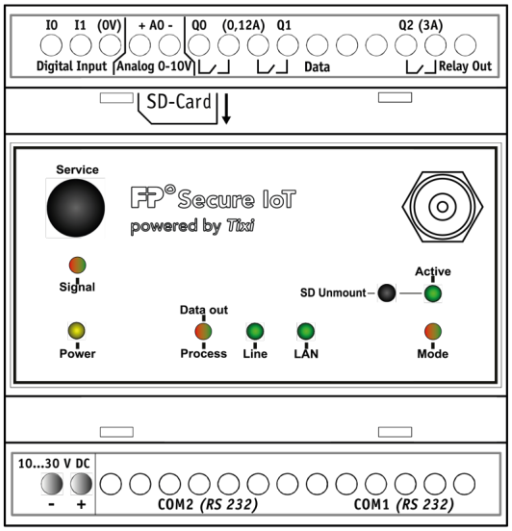
Hx651



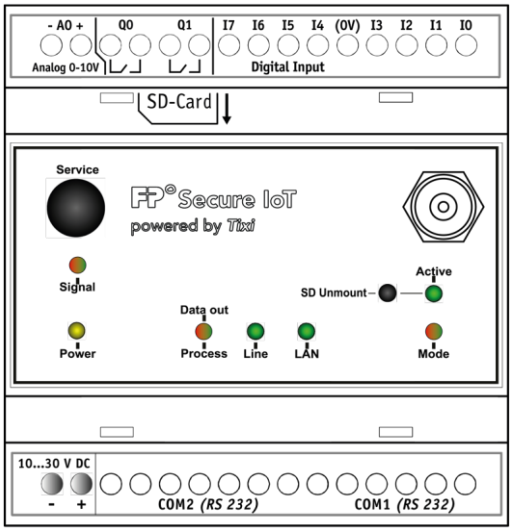
Hx653-Mx



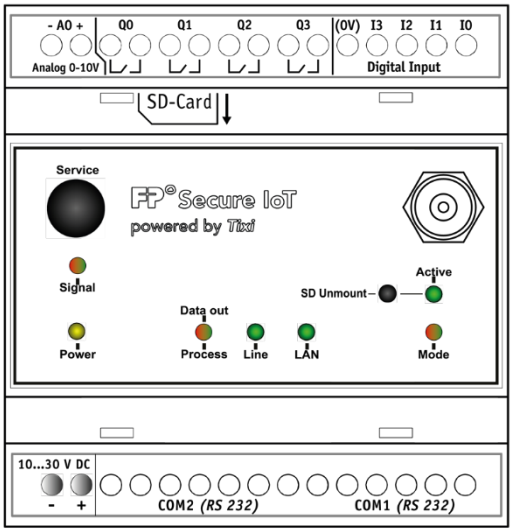
Hx627



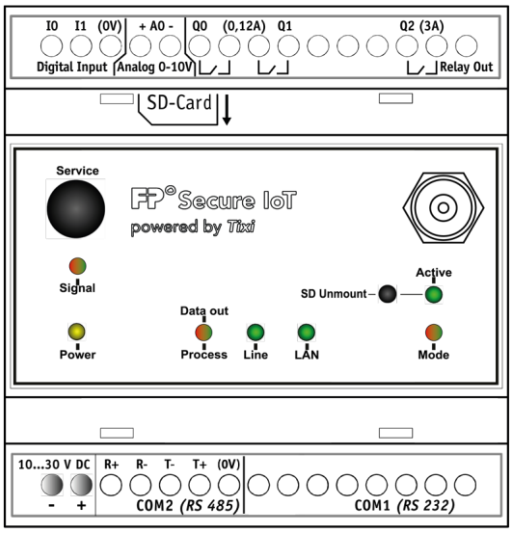
Hx632



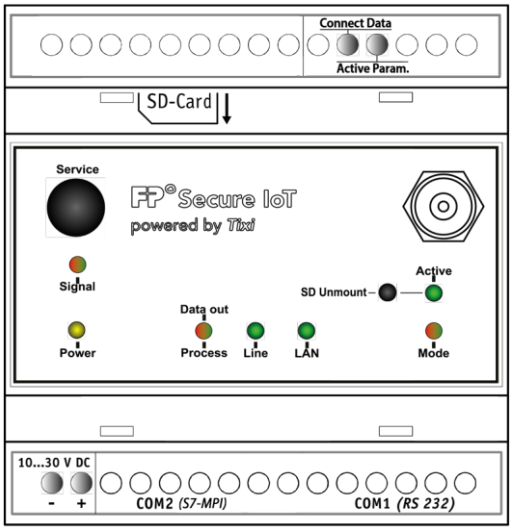
Hx634



Hx647



Hx671



11.8 Further literature

The following manuals and documentation are available for the FP gateways:

Name of the manual / documentation	Content
510058920001_xx_FP-TiXML-Reference	Reference guide for programming the FP gateways
510058920101_xx_FP-SPS-TiXML manual	Setting parameters for the PLC and meter protocols
510058920201_xx_FP-IIoT-Communication protocols	Overview of the WAN communication protocols
510058920401_xx_FP-Firmware_Update_Overview	Overview of the options for a firmware update
510058920501_xx_FP-Remote Firmware Update	Remote firmware update configuration
510058920601_xx_FP-SCADA-GLT	Integration of the gateways in SCADA / GLT systems
510058920701_xx_FP-Webserver-TiXML-manual	Webserver manual
510058920801_xx_FP-Universal_MQTT_Client	Universal MQTT client
510058920901_xx_FP-C8y_Client	MQTT client for Cumulocity / Software AG
510058921001_xx_FP-CoT_Client	MQTTclient for Telekom Cloud of Things
510058921101_xx_FP-Juconn_MQTT_Client	MQTT-Client for Juconn cloud
510058921201_xx_FP-OpenVPN-Toolkit_Doku	Setting up the OpenVPN client
510071900701_xx_FP_S-OTGuard_H600_TechData	Technical data for the FP HutLine gateways series H600
510070900501_xx_FP_S-ENGuard_W550_TechData	Technical data for the FP S-ENGuard gateways series 550
510070900601_xx_FP_S-ENGuard_W600_TechData	Technical data for the FP S-ENGuard gateways series 600
510058921301_xx_FP-TICO manual	Manual for software TICO
510058921401_xx_FP-TILA2 manual	Manual for software TILA2 / TILANET
510072900101_xx_FP-MAN-XP	Hardware manual for the expansion modules
510058921501_xx_FP-ModbusRTU_AutoConfig	Manual for Modbus RTU auto configuration feature
510077000401_xx_FP-wMBus adapter	Hardware manual for the wMBus adapter
510077900101_xx_FP-wMBusConf manual	Configuration of the wMBus adapter

xx = Revision of the document, starting with 00

For more information and to download documents, see www.inovolabs.com.