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User Manual

FG-200 HSE/FF Modbus

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If you are interested in our source modifications and sources used, please contact: info@softing.com

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1 About this guide

1.1 Read me first

Please read this guide carefully before using the device to ensure safe and proper use. Softing does not assume any liability for damages due to improper installation or operation of this product.

This document is not warranted to be error-free. The information contained in this document is subject to change without prior notice. To obtain the most current version of this guide, visit the product website.

1.2 Target audience

This guide is intended for experienced operation personnel and network specialists responsible for configuring and maintaining field devices in process automation networks. Any person using a FG-200 HSE/FF Modbus must have read and fully understood the safety requirements and working instructions in this guide.

1.3 Typographic conventions

The following conventions are used throughout Softing customer documentation:

Keys, buttons, menu items, commands and other elements involving user interaction are set in bold font and menu sequences are separated by an arrow	Open **Start → Control Panel → Programs**
Buttons from the user interface are enclosed in brackets and set to bold typeface	Press **[Start]** to start the application
Coding samples, file extracts and screen output is set in Courier font type	`MaxDlsapAddressSupported=23`
Filenames and directories are written in italic	Device description files are located in *C:\<Application name>\delivery\software\Device Description files*

WARNING
WARNING indicates a hazardous situation which, if not avoided, may result in major problems or injury.

CAUTION
CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate problems or injury.

Note
This symbol is used to call attention to notable information that should be followed during installation, use, or servicing of this device.

Hint
This symbol is used when providing you with helpful user hints.

1.4 Document history

Document version	Changes since last version
1.00	First version
1.01	▪ Installation in hazardous locations (11): - Introduction restructured and subsections implemented. - Preliminary information restrictions in hazardous locations deleted. - Certificate for cULus added (14). ▪ New section with certificate copy of UL certificate UL Certificate of Compliance (81).
1.02	New Corporate Identity implemented.
1.20	References to FF-CONF replaced with comConf. Instructions to Modbus mapping and related chapters removed.
1.30	New layout and structure of chapters. Simplified mounting, dismounting and configuration instructions. Additional trademark references. Software installation procedure updated.
1.30.1	New image of power supply pin assignment (16). Minor editorial changes.
1.30.2	RJ45 status LEDs (60) explained.
1.30.3	Description of Modus functionality (19) updated. Conformity of EX standards (14) updated.
1.30.4	CCCEx certificate added (14).
1.30.5	Description on Modbus functionality updated.
1.30.6	Modbus configuration (53) description updated.
1.31	Maintenance release.
1.32	Maintenance release.
1.33	Maintenance release.

1.5 Related documentation

The following documents provide additional product information:

- Communication Configuration Tool User Guide
- FG-200 HSE/FF Modbus datasheet

1.6 Document feedback

We would like to encourage you to provide feedback and comments to help us improve the documentation. You can write your comments and suggestions to the PDF file using the editing tool in Adobe Reader and email your feedback to support.automation@softing.com.

If you prefer to write your feedback directly as an email, please include the following information with your comments:

- document name
- document version (as shown on cover page)
- page number

2 About FG-200 HSE/FF Modbus

The Softing FG-200 HSE/FF Modbus is a gateway connecting Modbus TCP or FOUNDATION fieldbus High Speed Ethernet (HSE) to FOUNDATION fieldbus H1 field devices. It provides fast access to process data, while making use of FOUNDATION Fieldbus advantages such as reduced cabling, central field device parametrization, comprehensive diagnostics or intrinsically safe device segments.

2.1 Intended use

The FG-200 can be used for integrating up to four FF H1 links into a Modbus control system or for communication between FF H1 devices and FF HSE network. The gateway can be operated in both hazardous and non-hazardous areas. Any other use is not intended. Follow the instructions in this guide on how to use the FG-200.

2.2 Specifications

Power supply	18 VDC...32 VDC; SELV/PELV supply mandatory Typical input current is 200 mA; maximum is 1 A (considering the rush-in current at switch-on).
FF-H1	Four FF-H1 channels, compliant with type 114 of the FF physical layer profile. The Fieldbus voltage range is from 9 VDC...32 VDC. Preferred value is 24 VDC.
Ethernet	IEEE 802.3 100BASE-TX/10BASE-T
Minimum ambient operating temperature	-40 °C (see Installation positions 17 for the maximum ambient temperature depending on the mounting position)
Storage temperature	-40 °C...+85 °C
Relative humidity	10 %...95 % (non-condensing)
Altitude	Must not exceed 2000 m
Location	Indoor use only; no direct sunlight
Coating	Conformal Coating based on ANSI/ISA-S71.04 G3
Safety standard	IEC/EN/UL 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements IEC/EN/UL 61010-2-201 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-201: Particular requirements for control equipment (both with CB scheme).
Ingress protection	IP20

2.3 System requirements

- 24V power supply
- power conditioner
- PC with operating system Windows 7 or later (both 32 bit or 64 bit supported)
- Web browser (Chrome or Firefox)

2.4 Safety precautions

Use in hazardous areas

The FG-200 is an electrical equipment with degree of protection Ex ec, approved for use in Zone 2 hazardous areas or in the safe area. The four FF-H1 interfaces are designed according to the protection method Ex ic. Only certified circuits with an according protection method shall be connected to these FF-H1 interfaces.

Special hints for safe use

- Before setting the FG-200 into operation, the corresponding field has to be marked (e.g. if the device is used in an IC environment, mark the upper field on the type label).

  IECEx BVS 15.0055 X
  Ex ec [ic] IIC T4 Gc ☐
  Ex ec IIC T4 Gc ☐

- Use an appropriate permanent pen for signing, e.g. an etching pen.
- More than one marking is not allowed. If you need a second marking, you must replace the existing equipment with a new one.
- An equipment which has been operated under non-intrinsically safe conditions is no longer permitted to be used under intrinsically safe conditions.

The FG-200 HSE/FF Modbus is only approved for intended and appropriate use. In case of noncompliance, the warranty and manufacturer's liability do no longer apply!

CAUTION
During operation, the device's surface will be heated up. Avoid direct contact. When servicing, turn off the power supply and wait until surface has cooled down.

Note
Do not open the housing of the FG-200. It does not contain any parts that need to be maintained or repaired. In the event of a fault or defect, remove the device and return it to the vendor. Opening the device will void the warranty!

3 Installation

3.1 Hardware installation

Note

With an ambient temperature above 55 °C at the place of installation it is likely that the temperatures of connecting cables will increase if the cables are installed in an unfavourable position. In such cases, measure the temperature to ensure that the service temperature of the cables is not exceeded (i.e. 80 °C), or use cables sustaining high temperatures of at least 90 °C.

3.1.1 Installation in hazardous locations

The FG-200 may be used in hazardous locations and is certified according to ATEX, IEC and North America Approval cULus.

WARNING

Use only according to operating conditions from instructions! Use the FG-200 in accordance with its designated use only! Otherwise, the manufacturer's liability and warranty will expire. The device is only to be used according to the operating conditions described in these instructions..

WARNING

Do not connect or disconnect energized conductors! Be aware that energized conductors are not to be connected or disconnected! This can lead to danger of life if potentially explosive atmosphere is present there at that time!.

3.1.1.1 General requirements

Following general requirements must be observed while installing FG-200 on hazardous locations:

- The details of this document must be observed along with the conditions for use and the applicable details stated on the marking and type labels of each.
- Any selection and operation of the device must be done as per the technical rules.
- Adequate precautions must be taken to prevent unintended actuation or impairment of the device.
- Connectors must not be connected or disconnected when area is known to be hazardous. This can be life threatening in a potentially explosive atmosphere. Open or not securely closed sockets shall not be energized in the Ex-atmosphere!
- Ensure the installed equipment comply with the types of protection applicable to the corresponding zones.
- All connected electrical equipment must be suitable for the respective intended use.
- The operator must ensure protection against lightning in compliance with the locally applicable regulations.
- Electrostatic aspects must be considered when mounting the bus-modules. Electrostatic charges have to be prevented.

- In explosion group IIC and Zone 2 no protected plastic surfaces > 20 cm^2 are allowed; in IIB or dust-Ex, 100 cm^2 may be reached.
- The hazard of any objects falling onto the bus-module must be prevented.
- The FG-200 does not meet the requirements of impact protection and IP54 (according to IEC 60529). It must be installed in a protective enclosure which meets the requirements for resistance to impact and IP as stated in section 26.4 of IEC/EN 60079-0. This enclosure must be fully mounted and intact. If the enclosure is damaged, the operation is not permitted.
- Transient protection must be provided at a level not exceeding 140% of the peak rated voltage value at the supply terminals to the equipment.
- When removing the packaging ensure that no dirt can enter the enclosure or the plugs.
- If any vibration during the operation may cause parts of the plugs to loosen, then the plugs have to be provided with a light firm varnish used for securing screws. An extraction force of 0.5 Nm has to be achieved at an equivalent thread.
- To circuits of Zone 2 only such equipment may be connected that is suitable for operation in this zone and has been certified accordingly.
- Components may only be replaced by original spare parts which are also approved for the use in Ex-atmospheres. Spare parts are ordered as complete units giving the material number stated on the device (marking, type label).
- Only such auxiliary components may be used in potentially explosive atmospheres which meet all requirements of European and national directives and legislation.
- The environmental conditions specified in the manual have to be followed strictly.
- The FG-200 is not to be used in systems where cathodic systems for corrosion protection are in place. Although special precautions may allow the use in such systems (additional earthing bridges), the manufacturer has to be consulted in each case.
- The operator has to provide measures for protection against lightning.
- According to the local conditions and in compliance with the environmental rules, the operator is responsible to visually inspect the system and to remove dust settlements in a regularly interval (every 6 months). Use a damp cloth to clean the housing. Do not use abrasives or solvents.
- The company installing the device has to ensure that the transient characteristic is limited to 40% above the service voltage.
- Additional precautions have to be taken, if the presence of hydrosulfide, ethylene oxide and/or carbon monoxide is to be expected: those substances are of a vary low ignition energy.
- Icing is not permitted.

Pair of values for fieldbus voltage and current for Intrinsic Safety Fieldbus (ic):

	Pair 1	Pair 2	Pair 3
Fieldbus Voltage	Ui = 14 Volt DC	Ui = 17.5 Volt DC	Ui = 32 Volt DC
Fieldbus Current	Ii = 570 mA	Ii = 319 mA	Ii = 100 mA

CAUTION

Make sure that the sum of power supply voltage and fieldbus supply voltage does not exceed 60 VDC!

Explosion hazard

Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.

Observe relevant national regulations, standards and directives

This manual does not supersede the relevant national regulations, standards and directives. These must be observed and have to be applied according to the national conditions!

3.1.1.2 Hazardous Location - European and International Approval (ATEX, IECEx)

The equipment has been assessed as based on the following standards and editions:

a) EN IEC 60079-0:2018

b) IEC 60079-11:2011 Ed. 6 + Corr. 2012 / EN 60079-11:2012

c) EN IEC 60079-7:2015+A1:2018

If indicated on the device label or by technical documentation, the FG-200 is suitable for use in gas-Ex atmospheres of Zone 2 in the explosion groups IIA, IIB and IIC in temperature class T4, if accommodated in a tested enclosure.

- IECEx BVS 15.0055 x marking for explosion protection: Ex ec IIC T4 Gc, Ex ec [ic] IIC T4 Gc
- BVS 15 ATEX E 063 X marking for explosion protection: Ex II 3G

The Ex protection method [ic] corresponds only to the FF-H1 fieldbus interfaces.

The FG-200 HSE/FF Modbus complies with the applicable standards and regulations and meets the requirements of Directive 2014/35/EU. The requirements for erecting the device as part of the system in potentially explosive atmospheres (e.g. IEC / EN 60079-14) must be strictly adhered.

Certificates

ATEX The EC type examination number for ATEX is: **BVS 15 ATEX E 063 X**
A copy of the certificate is available in section ATEX Type Examination Certificate 78.

IECEx The type examination number for IECEx is: **IECEx BVS 15.0055X**
The certificate can be downloaded from the product website.

CCCEx The certificate can be downloaded from the product website.

3.1.1.3 Hazardous Location - North American Approval (cULus)

If indicated on the device label, the FG-200 is suitable for use in Class 1, Division 2, Groups A, B, C and D hazardous or non-hazardous locations.

The device must be installed in a protective enclosure which meets the requirements for resistance to impact and IP54 according to IEC 60529.

Marking for explosion protection: Class I Div.2 Groups A,B,C,D.

Certificate

cULus The cULus Certificate of Compliance number is: **20151215-E356500**
A copy of the certificate is available in section UL Certificate of Compliance 81.

3.1.2 Mounting and dismounting

Note

Make sure the FG-200 HSE/FF Modbus is mounted in such a way that the power supply can be easily disconnected.

Note

Depending on the installation position, the maximum ambient operating temperature may differ. See Section Installation positions 17 for details.

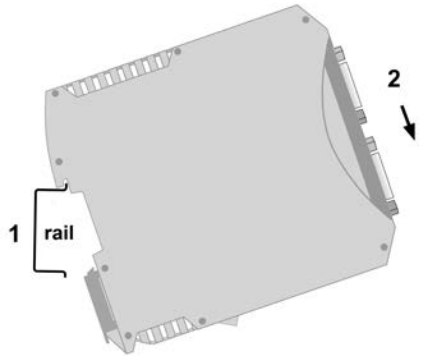
Installation and inspection

Installation and inspection must be carried out by qualified personnel only (personnel qualified according to the German standard TRBS 1203 - Technical Regulations for Operational Safety). The definition of terms can be found in IEC 60079-17.

Mounting

1. Hook the upper notch of the cut-out on the back of the FG-200 HSE/FF Modbus into a 35 mm DIN rail.

2. Press the FG-200 HSE/FF Modbus down towards the rail until it slides into place over the lip of the locking bar.



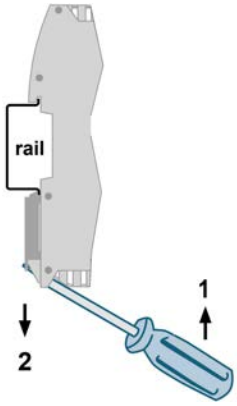
Note

Do not put stress on the system by bending or torsion.

Dismounting

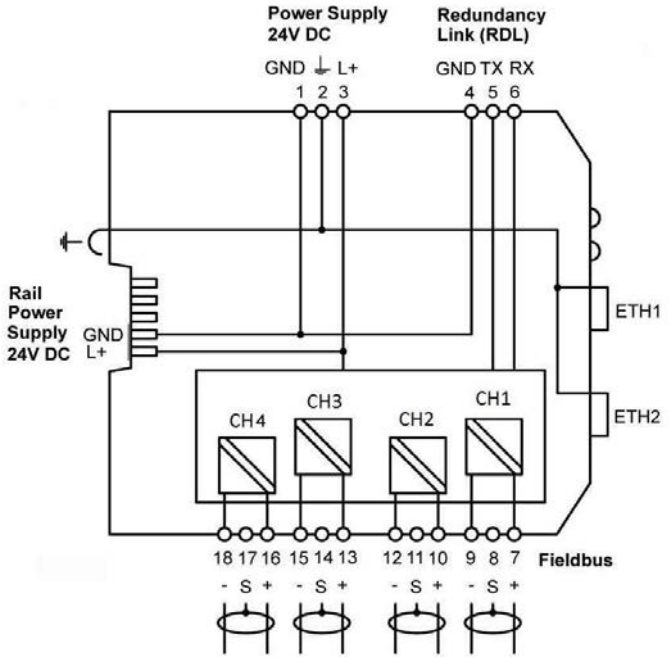
1. Slide a screwdriver diagonally under the housing into the locking bar.

2. Lever the screwdriver upwards, pull the locking bar downwards - without tilting the screwdriver - and move the gateway upwards off the rail.



3.1.3 Connection diagram

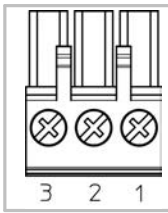
The following connection diagram shows the physical interfaces of the FG-200.



3.1.4 Connecting the power supply

1. Connect the FG-200 to a 24 V DC power supply.
2. Use different or redundant power supplies for redundant FG-200s.
3. Turn on the power supply. The boot process takes approx. 50 seconds. For indication of proper operation of a FG-200 acting in non-redundant mode or as primary device in redundant mode refer to LED status indicators 60.

The supply voltage (18 VDC .... 32 VDC) is connected by a 3-pole terminal block. The power supply is connected to the plug connector via flexible wires with a cross section of 0.75 to 1.5 mm². The ground connection wire must have a cross section of 1.5 mm².



Pin	Signal	Description
1	GND	Ground
2	⏚	Functional earth
3	L+	Positive supply voltage

CAUTION
The Functional Earth (FE) connection of the device has to be connected at low inductance with the Protective Earth (PE) of the system.

Note
As indicated in the connection diagram, the power can be applied alternatively by a special DIN rail connector (Rail Power Supply). For further information contact Softing Industrial Automation.

3.1.5 Installation positions

The FG-200 HSE/FF Modbus can be mounted horizontally and vertically. Depending on the installation position, different ambient operating temperatures (T_a) are allowed.

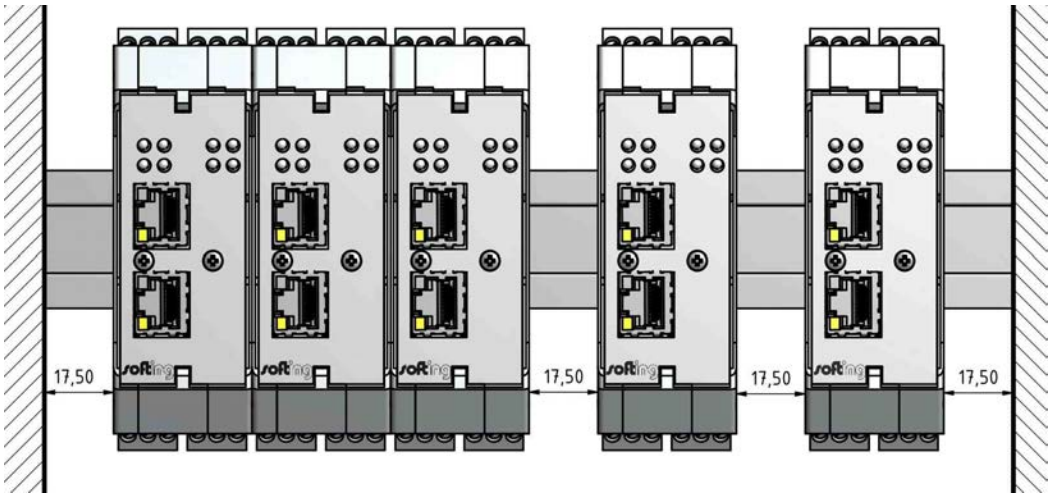
Minimum distance

Provide a minimum distance of 50 mm to the air inlet and air outlet to ensure natural convection.

Rotated installation position

The maximum permissible ambient temperature values also apply to a 180° rotated installation position.

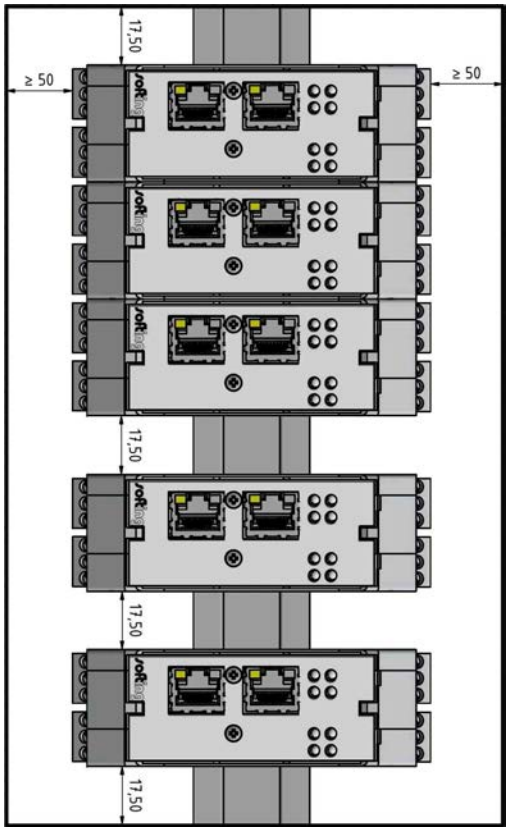
Horizontal installation position



Maximum ambient temperatures for the FG-200 HSE/FF Modbus

Number of FF H1 channels used	Maximum fieldbus voltage	Minimum distance	Maximum permissible ambient temperature T_a
4	32VDC	0 mm	55 °C
2	24VDC	0 mm	60 °C
4	32VDC	17.5 mm	65 °C
2	24VDC	17.5 mm	70 °C

Vertical installation position



Maximum ambient temperatures for the FG-200 HSE/FF Modbus

Number of FF H1 channels used	Maximum fieldbus voltage	Minimum distance	Maximum permissible ambient temperature T_a
4	32VDC	0 mm	40 °C
2	24VDC	0 mm	50 °C
4	32VDC	17.5 mm	55 °C
2	24VDC	17.5 mm	60 °C

3.1.6 Connecting to the network

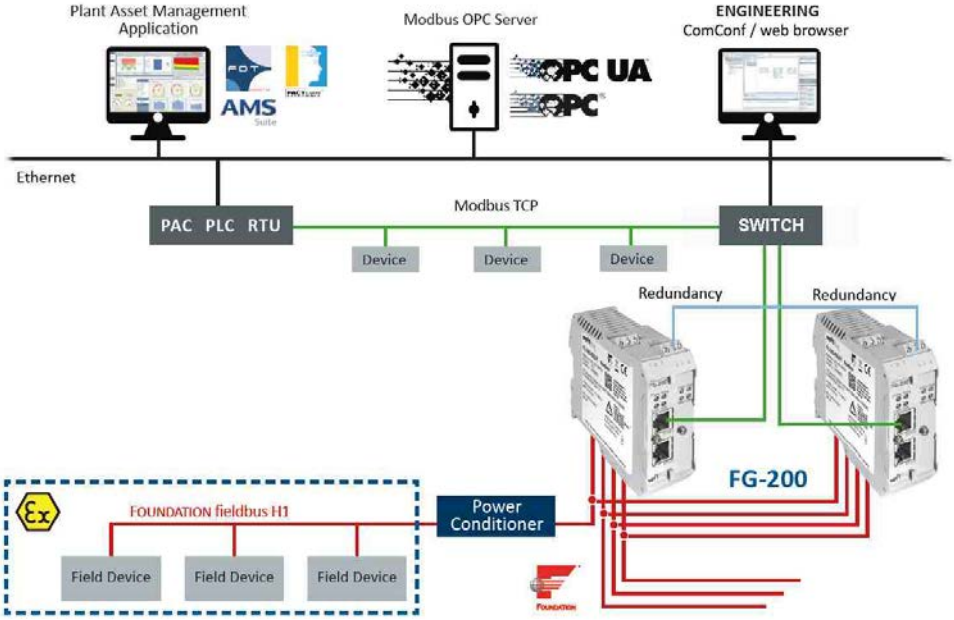
1. Connect the FG-200 to one of the two Ethernet ports (ETH1 or ETH2).

Note
FG-200 provides increases reliability: You can connect both ports (ETH1 and ETH2) to the network, while only one of the two Ethernet ports is used. If a connection failure is diagnosed between the active Ethernet port and the switch, the system automatically switches to the other Ethernet port.

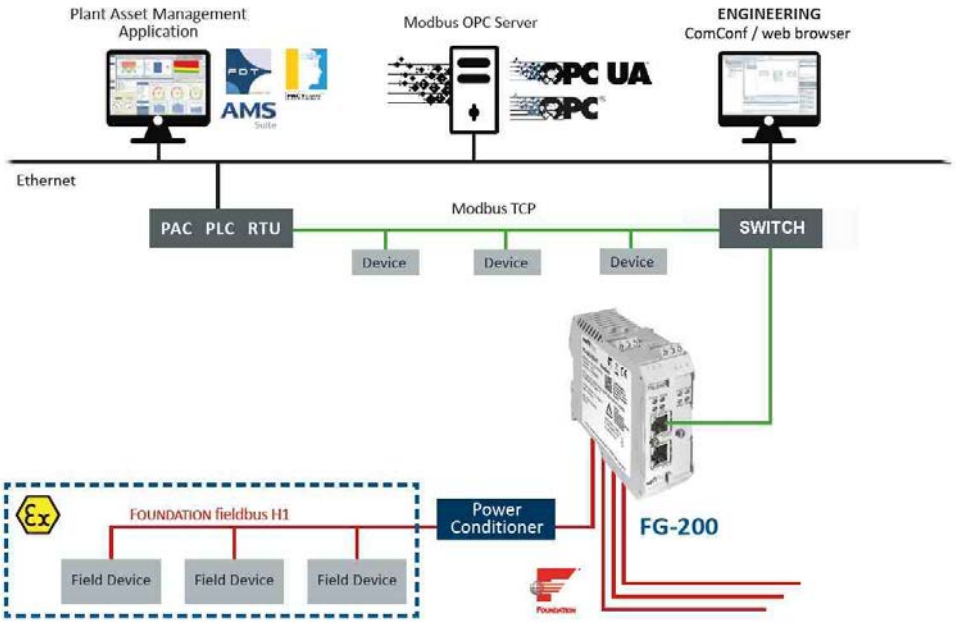
2. Connect your FOUNDATION fieldbus H1 network via a power conditioner to a Fieldbus Channel port of the FG-200 (CH0 to CH3).

Note
FG-200 is supporting High Speed Ethernet (HSE), Modbus TCP and the web server over the same Ethernet port.

FG-200 with redundancy connection

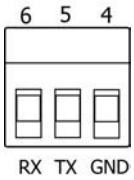


FG-200 without redundancy connection



3.1.7 Modbus serial connection

When connecting the FG-200 via serial connection use the connector from your delivery with the following pin assignment:



Pin No.	Signal	Connector symbol
6	RX	+
5	TX	S
4	GND	-

Note

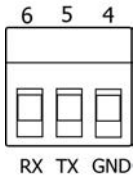
If you are working with two FG-200 in redundant mode, the serial connection cannot be used, refer to Use two FG-200s as a redundant set 21.

3.1.8 Using two FG-200

If you intend to use two FG-200 as a redundant set, connect the redundancy link interfaces (RDL) of both FG-200 (primary and secondary) by a cable before you power up the devices. If the redundancy link is not installed before start-up, the FG-200 will operate in non-redundant mode.

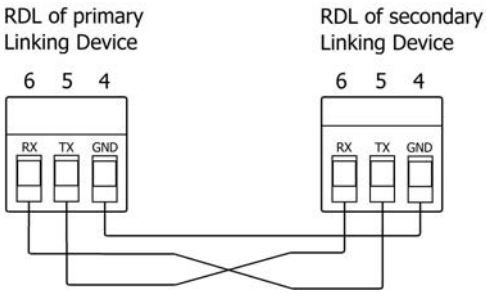
Note
As the interface is not galvanically isolated make sure that there is no potential difference between the two connected devices.

The maximum cable length is 0.5 m according to EMC requirements. The pin assignment is:



Pin	Signal	Description
6	RX	Receives data from redundant device
5	TX	Transmits data to redundant device
4	GND	Ground

Note
The receive (RX) and transmit (TX) signals must be cross-linked.



Do not power up devices when serial link is missing

If the two FG-200 forming a redundant set are powered while the serial link is missing, both devices will behave like independent, non-redundant Primary Devices. If they operated in redundant mode before and therefore have identical configuration information, both will use the same H1 node addresses, which will cause problems on the H1 links. The ERR (error) LED will blink. In this case, remove the power, install the serial link and apply the power again.

Primary device vs. secondary device

When using a redundant set of two FG-200, the device which is powered first will operate as primary device. If both devices are powered at the same time, the one with the lower IP address will operate as primary device.

Removing the power supply

Before you remove the power supply from the primary device make sure the secondary device is operational. In a redundant set of FG-200, removing the power supply, the Ethernet cable or the redundancy link interface cable from the primary device causes a redundancy change-over. Before doing so, make sure that the secondary device is operational (and not booting due to a prior change-over). Otherwise the system breaks down or the configuration information might get lost.

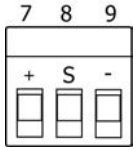
3.1.9 Connecting FF-H1 interfaces

Connect the H1 links to the terminal blocks of the H1 interfaces. Since the FG-200 does not provide power to the H1 links, a power conditioner and a bus termination is required for each H1 link. When using a redundant set of two devices, make sure to connect each H1 link to the same channel (CH 1 .. CH 4) on both FG-200s.

The FG-200 provides four Foundation Fieldbus H1 interfaces. These interfaces are named CH1 to CH4 and are used to connect an FF-H1 bus to the FG-200.

FF H1 bus line channel 1

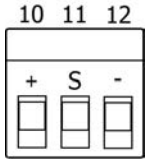
CH1



Pin	Signal	Description
7	+	Fieldbus +
8	S	Fieldbus shield
9	-	Fieldbus -

FF H1 bus line channel 2

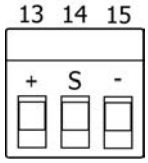
CH2



Pin	Signal	Description
10	+	Fieldbus +
11	S	Fieldbus shield
12	-	Fieldbus -

FF H1 bus line channel 3

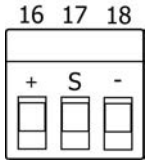
CH3



Pin	Signal	Description
13	+	Fieldbus +
14	S	Fieldbus shield
15	-	Fieldbus -

FF H1 bus line channel 4

CH4



Pin	Signal	Description
16	+	Fieldbus +
17	S	Fieldbus shield
18	-	Fieldbus -

Note
The fieldbus shield is not connected directly to functional earth. For EMC reasons, it is only connected via a capacitor. If a direct connection to functional earth or protective earth is required, you need to implement this separately.

3.1.10 Powering up the device

Turn on the power supply. The boot process takes a few seconds. For indication of proper operation of a FG-200 refer to LED status indicators [60].

3.1.11 Adding a second FG-200 for a redundant set of FG-200

For adding a second FG-200 to an already commissioned FG-200 that is operating in the role "Primary, no backup", the following steps are required:

1. Set the IP configuration (IP address and subnet mask) of the second FG-200 using the same IP subnet as the primary device (see Configuration).
2. Connect the H1 links to the terminal blocks of the H1 interfaces. Make sure to connect each H1 link to the same channel (CH 1 .. CH 4) on both FG-200s.
3. Connect the second FG-200 to the Ethernet switch or hub.
4. Connect both RDL interfaces as mentioned in Section FG-200 redundancy. [21]
5. Connect the second FG-200 to a 24 V DC power supply. Use different or redundant power supplies for redundant FG-200s.
6. After turning on the power supply the boot process takes approx. 50 seconds.
7. The second FG-200 will take over the configuration data from the primary device and will start operation in the role "secondary". For more details about proper operation as a secondary device see also the LED status indicators [60].

Hint
Refer to Section FG-200 redundancy [21] for more information on the redundancy concept.

3.2 Software installation

When you install a Softing product for the first time, you will be asked if you trust the publisher. Activate the option **Always trust software from Softing AG** if you do not want to be asked in subsequent installations and select **[Install]** to start the installation.

1. Go to the product page to download the latest product software.
2. Start by downloading and installing the **Search and Configure Discovery** tool.
3. Follow the on-screen installation instructions.
4. Read the license agreement carefully.
   If you have questions, you can **[Cancel]** the installation at this point and contact us. Click **[Print]** if you want to print the license agreement to a PDF or on a printer.
5. Select **I accept the terms in the license agreement** and click **[Next]**.
6. Click **[Install]** to install the selected software application on your PC.
   While the installation is in progress, the status bar of the installation wizard shows the different steps that are being executed. If you want to abort the installation, click **[Cancel]** button. The installation wizard will undo all modifications that have been made to your computer up to this point. Otherwise, wait until the installation is completed.
7. Press **[Finish]** to complete the installation and exit the wizard.

Note
Proceed with the installation of the other software packages.

Additional installations

Depending on your use case, install one of the following software packages:

- Install the FDT frame application **PACTware** if you are using FDT technology. The PACTware package includes the communication DTM **FFdtm**.
- Install FFdtm if you prefer using a different FDT frame application such as FieldCare, FieldMate or others to allow using a CommDTM in another FDT frame application.
- Install **Communication Configuration Tool** (comConf) for a complete network configuration.

4 Commissioning

This chapter describes how to prepare the FG-200 HSE/FF Modbus for operation, configure its network settings, and access the web-based user interface.

4.1 Prerequisites

Before commissioning the FG-200 HSE/FF Modbus, ensure that the following requirements are met:

- The FG-200 HSE/FF Modbus is connected to a PC via Ethernet.
- The PC is running a supported web browser (Google Chrome or Mozilla Firefox) with JavaScript enabled.
- The Search and Configure (SAC) Discovery Tool is installed on the PC.
  The latest version of the Search and Configure Discovery Tool can be downloaded from the product website.

4.2 Network configuration

The FG-200 HSE/FF Modbus is shipped with the following factory network settings:

Parameter	Factory Default
IP Address	192.168.0.10
Subnet Mask	255.255.255.0

Before connecting the FG-200 HSE/FF Modbus to an existing network, verify that the default IP address is not already assigned to another device. To communicate directly with the FG-200 HSE/FF Modbus using its factory settings, the PC must be connected to the same IP subnet (192.168.0.x).

Note

If you use the Search and Configure (SAC) Discovery Tool, it is generally not necessary to change the IP address of your PC. Administrator privileges may be required to modify the network settings of the PC.

4.3 Changing the IP address of an FG-200 HSE/FF Modbus

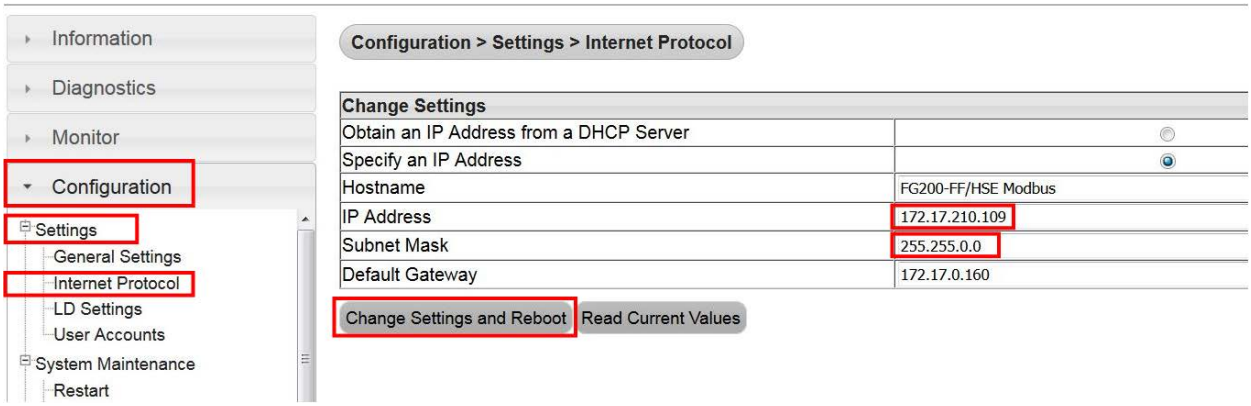
If the default IP address is not suitable for your network, change the gateway's IP configuration before commissioning.

1. Open a supported web browser.
2. Enter the factory default IP address: **192.168.0.10**
3. Login with the following data:
   login name: **administrator**
   login password: **fgadmin**

4. Navivate to **Configuration → Settings → Internet Protocol**.

5. Enter the required **IP Address** and **Subnet Mask**.

6. Click **[Change Settings and Reebot]**.



7. The FG-200 performs a reboot.
   Wait until the FG-200 has restarted before reconnecting using the new IP address.

4.4 Setting the IP address of your PC

If the FG-200 HSE/FF Modbus still uses its factory default IP address and you have not changed the IP address as described in the previous session, you will need to configure the IP address of your PC to access the device from your PC.

The following chapter describes how to set a static IP address in Windows 10.

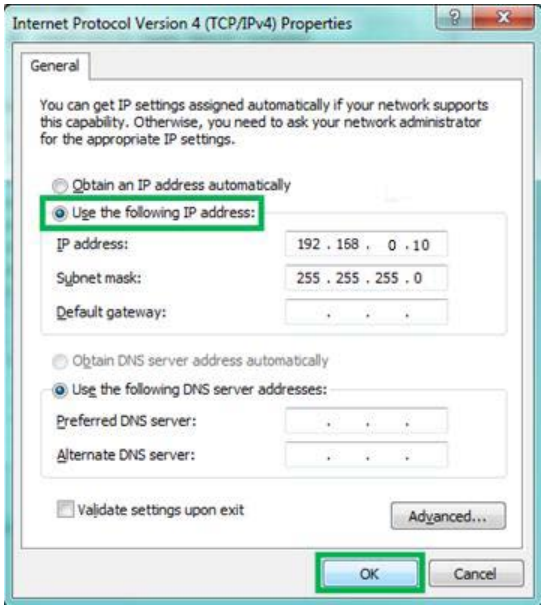
1. Open **the Control Panel**.

2. Select **Network and Internet → Network and Sharing Center**.
   A new window opens where you can view your basic network information.

3. Select the active Ethernet connection under **View your active networks**.
   A new window opens.

4. Click **[Properties].**

5. Select **Internet Protocol Version 4 (TCP/IPv4)**.
   The following window opens.



6. Select **Use the following IP address**.

7. Enter a specific IP address and Subnet mask.
   Example
   IP address: 192.168.0.20
   Subnet mask: 255.255.255.0

8. Click **[OK]** to confirm.

5 Security

The FG-200 HSE/FF Modbus is installed in level 0 of the Purdue reference model. The Ethernet ports are connected to a Modbus/TCP controller in level 1 or to asset management applications running in level 3.

FG-200 Ethernet (ETH) services

Service	Port	Description
HTTP	80 / TCP	Internal Web server
SNTP	123 / UDP	Time synchronization
HTTPS	443 / TCP	Internal Web server
Modbus/TCP	502 / TCP	Modbus/TCP Server
HSE	1089 / UDP	Sending of HSE annunciations
HSE	1090 / UDP + TCP	Reception port for opening Client/Server sessions, new port is created when session is opened starting at UDP port 1026
HSE	1091 / UDP	Reception port for receiving SM services
Softing SAC	2355 / UDP	Softing SAC (Search And Configure, configuration of IP address setting)
Redundancy	3622 / UDP	LAN redundancy, port could be overwritten by host by configuring the related MIB object
HSE		In addition, various UDP ports will be used depending on the configuration done by an HSE host. This is for connections of types

6 Working with the FG-200 HSE/FF Modbus

6.1 FG-200 as Modbus / FF-H1 Gateway

Main purpose: PLC with Modbus interface accesses IO parameters of FF-H1 field devices

FG-200 supports access to IO parameters of FF-H1 field devices via client/server connections [65] (CLT/SRV connections) and via publisher/subscriber links [64] (PUB/SUB links).

6.1.1 FG-200 as link active scheduler

If FG-200 acts as a link active scheduler [64], no other FF host system is connected to the H1 segment.

For accessing field device parameters, both CLT/SRV connections and PUB/SUB links can be used. PUB/SUB links are typically used for accessing IO parameters in FF installations. For more information see the Configuration Communication Tool User Guide (ComConf).

Before you go online with the ComConf, update your general settings in the FG-200's web interface. Go to:
Configuration → Settings → General Settings

If you have changed your settings, click **[Change Settings]** to apply the new values. For more configuration details, see the Configuration Communication Tool user guide.

6.1.2 FG-200 as visitor host

In this case the FG-200 is connected to an H1 segment that is controlled by another FF host system. The links between the FF field devices and the FF host system are working. The FG-200 is not allowed to disturb the operation by reconfiguring working communication paths.

The FG-200 is just allowed to use CLT/SRV connections for reading contained parameters [65] and function block output parameters. The parameters to be read have to be configured in the Softing Configuration Communication Tool (comConf). See the comConf User Guide for more details.

Important Note

If the FG-200 acts as a visitor host, no comConf project must be downloaded into the FG-200 and the field devices.

Parameter settings

- Make sure **Enable automatic VCR Creation** is activated.
- Activate or deactivate **Link Master Functionality** depending on the following presumptions:

  For this scenario we recommend configuring the Node Address within the range from 252 to 255 for the FG-200. If you want prevent the FG-200 to take an active role in the H1 segments, deactivate **Link Master Functionality**. Usually this is not required if the H1 bus parameters used in the control system are not too slow.

  If **Link Master Functionality** is deactivated, make sure that all activated H1 links of the FG-200 are connected to H1 segments with an active host system interface. Otherwise the FG-200 will wait for about 6 minutes for activity on the H1 segments and will then disable any segments without activity (all segments without an active host interface).

6.1.3 Configuring the Modbus mapping table

The FG-200 supports the mapping of a set of function block parameters to Modbus registers. The set of available parameters depends on the type of communication (PUB/SUB links or CLT/SRV connections) used for transferring IO data.

The FG-200 selects PUB/SUB links or CLT/SRV connections depending on the Modbus mapping created with the ComConf.

Mapping on the web server application

Prerequisite: You have downloaded the ComConf project.

1. Open the web browser and login.
2. Go to **Configuration → Fieldbus → Blocks** and click **[Reload Live List]**.
3. Select **Configuration → Fieldbus → Devices.**
4. Load the .csv file with the Modbus mapping. Select **Configuration Modbus Mapping Import/Export**. Click **[Import]** and load the file generated by comConf.

Mapped values are now accessible in the configured Modbus registers and can be accessed by a Modbus controller.

6.1.4 Modbus statistics counter

You can get additional statistic information concerning the Modbus communication state by reading the Modbus registers:

Modbus Holding Register (add. base 0)	Modbus Holding Register (add. base 1)	Meaning
9000	9001	Redundancy Role: 0: Primary 1: Secondary
9001	9002	Number of received Modbus TCP requests
9002	9003	Number of sent Modbus TCP responses
9003	9004	Number of received Modbus TCP requests with encoding errors
9007	9008	Number of current open Modbus TCP sessions
9008	9009	Total number of Modbus TCP sessions
9009	9010	Timestamp for starting Modbus TCP statistic collection
9010	9011	Time stamp for starting Modbus TCP statistic collections
9011	9012	Diagnostic for Modbus Mapping Import: 0: Current import Modbus Mapping is ok: 0x0100: Syntax error in Mapping file 0x0200: Invalid datatype used 0x0400: Mapping loaded but not yet all contained entries are used because not all referred blocks are found. 0x0800: Block tag is not unique. As the tag is a key to find the parameter, it is not possible to resolve the entry.
9012	9013	Reference to mapping entry that has the invalid data type. Only the first occurance is indicated here.

Note

Statistic values from Modbus registers 9001 – 9010 are identical to information available in the menu: **Diagnostics → Advanced → Modbus Statistics → TCP** and **Diagnostics → Advanced → Modbus Statistics → Serial**.

Statistic counter values can be reset in the web menu.

6.2 FG-200 as FF-HSE/ FF-H1 gateway

6.2.1 FG-200 as H1 interface used by Emerson AMS System

Emerson provides its AMS Device Manager for calibration, diagnostics and device configuration for various fieldbus technologies. Using the FG-200 enables AMS Device Manager to access FF-H1 devices. As a precondition it is necessary to enable FF-HSE interface in the AMS Device Manager and integrate the FF device descriptions of the FG-200 (CFH-File) and the H1 Devices that have to be accessed.

FG-200 alongside an H1 host system

The typical use case is to add the FG-200 and AMS to an existing H1 network with an H1 host and H1 devices. To use the FG-200 the following General Settings must be selected in the webserver interface:

General Settings	
Enable automatic VCR Creation	☑
Display Blocks	☐
Enable HSE Alarms	☑
Link Master Functionality	☐
Visitor Mode	☑
Enable Modbus	☐

Additional settings depend on the user scenario.

For this scenario we recommend configuring the Node Address within the range from 252 to 255 for the FG-200. If you want to prevent the FG-200 from taking an active role in the H1 segments, deactivate **Link Master Functionality**. Usually this is not required if the H1 bus parameters used in the control system are not too slow.

If **Link Master Functionality** is not activated make sure that all activated H1 links of the FG-200 are connected to H1 segments with an active host system interface. Otherwise the FG-200 will wait for a period of about 6 minutes to register any activity on the H1 segments and will then disable the inactive segments (meaning the segments without an active host interface).

Make sure **Enable automatic VCR Creation** is activated. Otherwise no access to H1 device parameters would be necessary.

H1 Device Alarms

AMS Device Manager supports monitoring a subset of H1 device alarms. To make use of this functionality you need to enable this feature in the AMS Device Manager and to configure the FG-200 and the attached H1 devices accordingly. Note that within AMS Device Manager alarms are designated as "Alerts". Activate this setting with **Enable HSE Alarms** in the General Settings web menu of the FG-200.

We recommend activating **Visitor Mode** in the **General settings** web page to prevent an impact on the existing device configuration.

AMS Device Manager is supporting standard Fieldbus Foundation alarm messaging using the UDP protocol, but it has an preconfigured UDP multicast address (239.255.0.33) and UDP port (45000) for the reception of the alarm messages. This is used as default in the FG-200 but could be altered if a future AMS Device Manager version would expect a different multicast address or UDP port by changing the settings in the following web menu.

Configuration > Fieldbus > Advanced > Network Parameters > HSE

Settings	
Alarm Distribution Address	239.255.0.33
Alarm Distribution Port	45000

FG-200 as standalone H1 host

Below you find the settings that need to be made if your are using the FG-200 as standalone H1 host

Configuration > Settings > LD Settings

Linking Device Settings	
PD Tag	FG200_For_AMS_Interface
Link ID 1 (Range 0,1000-FFFF)	1000
Link ID 2 (Range 0,1000-FFFF)	1001
Link ID 3 (Range 0,1000-FFFF)	1002
Link ID 4 (Range 0,1000-FFFF)	1003
Node Address (Range 16-247,252-255)	16

7 Using the web interface

After an IP connection between PC and FG-200 has been set up as described in Commissioning 25, you may access the FG-200 from your PC by means of a web browser that supports JavaScript (e.g. Microsoft Internet Explorer).

The internal web server of the FG-200 offers the possibilities to configure the device (such as IP address settings or Modbus mapping), to get diagnostic information on the fieldbus or Modbus as well as to monitor process values of the connected field devices.

7.1 Login to webserver

1. Start your web browser with the URL http://192.168.0.10.
   You are prompted to log in with username and password.
2. Enter any username described in Settings - User Accounts 41 in the field **Username**.
3. Enter **FG200$Admin** in the **Password** field (default setting - refer also to Settings - User Accounts 41).
   For firmware versions 1.20.03 and older enter password **fgadmin**.
   The start page is opened - in our example the Information page. Depending on the web browser you are using the information presentation may vary slightly:

In the sidebar you can choose left side offers three main menus and several submenus:

- Information menu 35
- Diagnostics menu 36
- Configuration menu 38

Note

If you erase the FG-200 configuration, the password is reset to its default value.

7.2 Information

The **Information** menu offers the following menu items:

Menu item	Functionality
Contact	Page shows the Softing contact information in case ▪ you require general information about the product or ▪ you need technical support or ▪ you like to provide feedback about the product. **Softing Industrial Automation GmbH** Richard-Reitzner-Allee 6 85540 Haar / Germany Phone: + 49 89 4 56 56-0 Internet: https://industrial.softing.com Email: info.automation@softing.com Support: https://industrial.softing.com/services/product-support/support-form.html
Version	Page provides detailed information about the device/system, the base module (mother board) and the H1 module (daughter bard) with the four H1 channels. Both modules as well as the entire device are identified by hardware version numbers and serial numbers. The firmware version and the system id, a manufacturer-specific identifier for the system, are also indicated.
Manual	Page provides a link to the FG-200 HSE/FF Modbus product web page. Here you can find and download the latest PDF version of the FG-200 HSE/FF Modbus User Guide-
Notices	Page informs you about the open Source Declaration and the open source software packages used in conjunction with FG-200 HSE/FF Modbus. **Open Source Declaration:** The FG-200 HSE/FF Modbus uses the following open source software packages: ▪ - eCosPro V3.1.41 ▪ - jQuery V1.7.2 The license declarations and links to source codes for these components are available on the following webpage: https://opensource.softing.com/IA/FG-200FF/V1/

7.3 Diagnostics

7.3.1 System

Click **System** to display system information about the operating system and the hardware status:

- Operating State: operational, good, ...
- System Uptime: Time elapsed since the FG-200 has been booted.
- Memory load: Percentage of memory used.

Diagnostics > System

Operating System	
Operating State	Good
System Uptime	8d 6h 27m 32s

Hardware State	
Memory Load	22
Flash Load	132

7.3.2 Internet Protocol

Click **Internet Protocol** to display detailed information about the addresses used:

Protocol parameters	Description
MAC Address	number that acts like a name for the network adapter
IP Address	IP address of the FG-200
IP Address (redundant device)	IP address of the redundant FG-200. Empty if the FG-200 operates in non-redundant mode.
Subnet Mask	IP subnet mask
Default Gateway	Address of the IP gateway to other subnets
Redundancy State	Current role in a redundant set of FG-200; the following values are possible ▪ Primary, no backup ▪ Primary ▪ Secondary

Diagnostics > Internet Protocol

Internet Protocol	
MAC	00:06:71:2d:00:86
IP Address	10.20.240.63
IP Address(redundant Device)	Not detected
Subnet Mask	255.255.252.0
Default Gateway	172.20.11.100
Redundancy State	Primary, no backup

7.3.3 Fieldbus

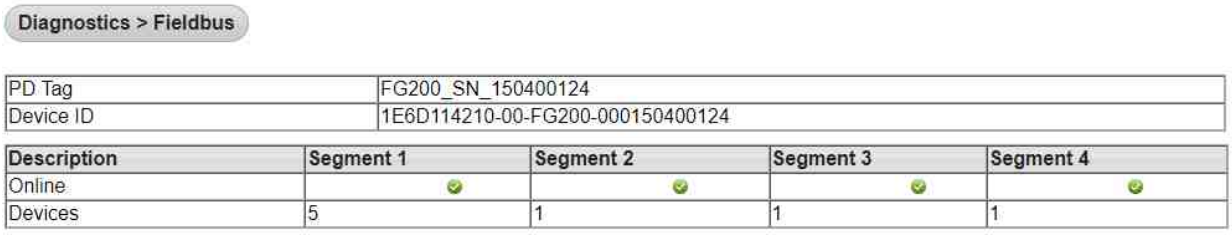
This page provides Fieldbus segment diagnostics that give you a quick view of the FG-200 connections. It shows how many segments are active. Two tables are displayed: The first table shows the information about the FG-200, the PD Tag as well as the Device ID. The PD Tag can be modified in the LD Settings submenu 41 page or with an HSE configurator The second table shows which segment (H1 Link) of the FG-200 is enabled and how many FF-H1 devices are connected to each segment. To update this list click the **Fieldbus** menu again.

System and Segment status in detail:

- PD Tag (Physical Device Tag): a unique, configurable and system-dependent name for the device.
- Device ID is set to a unique value for each individual device by the device manufacturer.
- Online: indicates whether a segment is enabled (green icon) or disabled (red icon).
- Devices: shows number of devices online (including the FG-200).

For each FG-200 up to four H1 Links (segments) are available. And under each H1 Link up to 16 H1 devices are possible.

The following example shows that in segment 1 the FG-200 plus four field devices are online and in segment 3 the FG-200 plus five field devices are online. In the segments 2 and 4 only the FG-200 is online.



7.3.4 Advanced

The Advanced submenu contains additional statistics information. Refer to Diagnostics - Advanced submenus 72 in the Appendix for a detailed description of the different web menus.

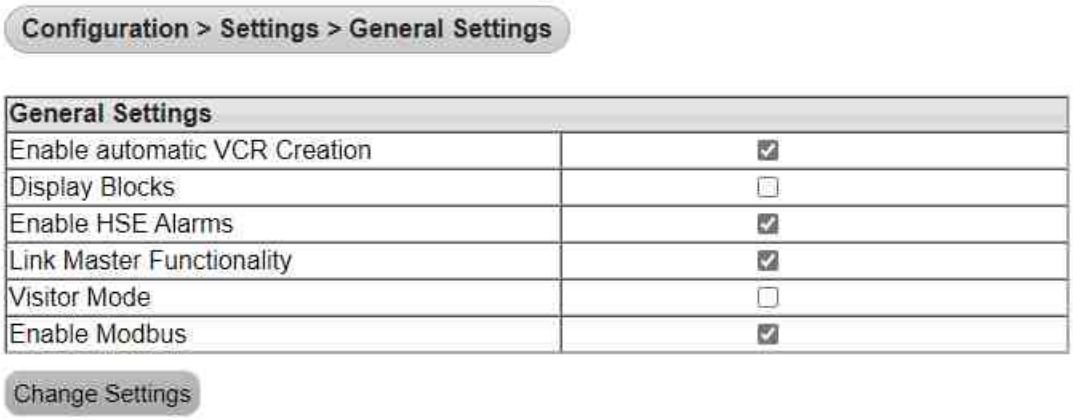
7.4 Configuration

Note

Settings performed on the web interface are not automatically transferred from the primary to the secondary FG-200. The secondary FG-200 must also be configured separately.

7.4.1 Settings

7.4.1.1 General Settings



Enable automatic VCR Creation

If this feature is activated, the FG-200 creates the necessary Client/Server VCRs in its H1 link and in an H1 device. 40 VCRs are reserved for this purpose within the H1 link if this option is selected.

Examples:

- Softing Communication Configuration Tool ComConf: activate
- Emerson AMS™ Software: activate
- NI-FBUS Configuration Tool: deactivate

Note

The feature **Enable automatic VCR Creation** has to be activated when the tool comConf is to be used for the Foundation fieldbus configuration.

Display Blocks

This feature enables or disables the display of H1 device blocks in the **Configuration → Fieldbus** page.

Enable HSE Alarms

The FG-200 is able to use configured alarm VCRs in the FF-H1 devices. Alternatively, it can establish new ones or configure a VCR and link the FF-H1 devices accordingly. The behavior depends whether the Visitor Mode is enabled or not.

Link Master Functionality

Using the Visitor Mode it is recommended to disable the Link Master functionality. When no Link Master is available on a segment connected to an activated H1 Link of the FG-200, a timeout will occur after about 6 minutes. The FG-200 will not be visible in the HSE live list during this period. To avoid this ensure that a Link Master is present for all activated H1 Links or deactivate H1 Links of the FG-200.

Visitor Mode

When the FG-200 is in visitor mode it can be connected to a running FF-H1 network with the FF-Host system without affecting the established communication.

Enable Modbus

This button enables or disables Modbus TCP.

7.4.1.2 Internet Protocol

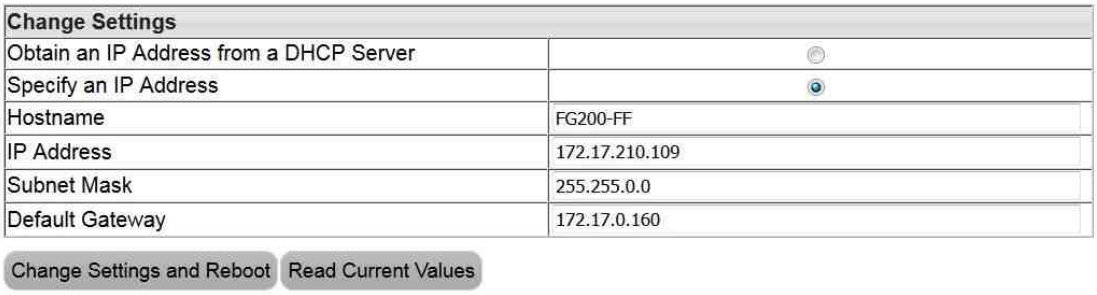
The FG-200 is delivered in a default configuration. To change the default internet protocol settings to assigned values of the chosen subnet in which the installation is running, select **Configuration**, then **Internet Protocol**.

A table enabling you to change settings appears.

1. Click **Obtain an IP Address from a DHCP server** for an address chosen from the DHCP server.
   To find out the IP address of the FG-200 you can use the function **Network Livelist** in the ComConf tool (available from the Softing download area).

2. Alternatively, specify an IP address to activate the fields in the table below:

   - Host name: configurable name for the host
   - IP Address: must be compatible with the subnet you choose for the PC setting, must be present in any case.
   - Subnet mask: 255.255.0.0
   - Default Gateway: host and FG-200 must share the same network.



3. Click **[Change Settings and Reboot]**
   The web site shuts down and the system reboots. The input values are checked for consistency. In case of problems the following error may be displayed:
   Failure: Wrong IP Settings.
   The FG-200 reboots after a few seconds and the new values are accepted.
   If you change the IP address of the FG-200, the IP connection between PC and FG-200 is lost. You have to use the new IP address to re-establish web access to the FG-200.
   If all parameters are correct, the new values are accepted and displayed.

4. **[Read Current Values]**
   If you changed some of the parameters and you are not sure of your changes, click the button **[Read Current Values]**. Input fields which are already filled are shown again.

7.4.1.3 LD Settings

Note

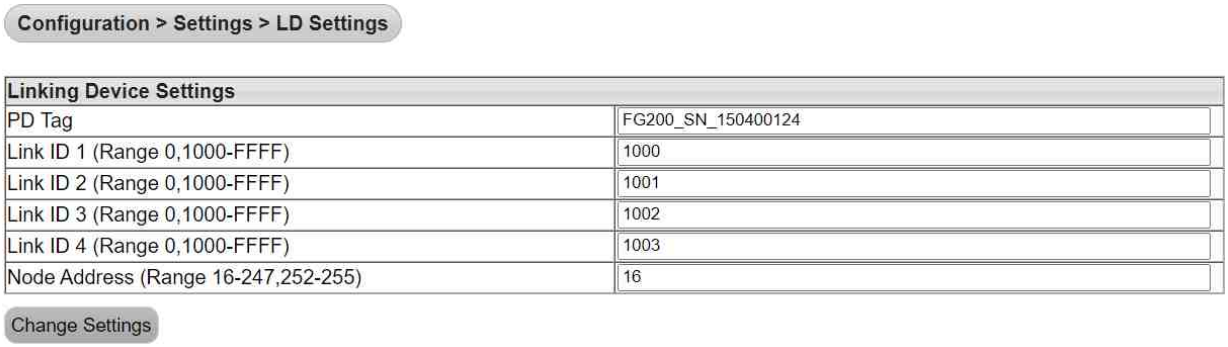
The LD Settings page should only be used in a stand-alone system without no configurator. If the FG-200 is used in a system with an HSE configurator (such as Softings ComConf) the configurator will configure these settings.

On this page you can change these settings

- PD-Tag of the FG-200
- Link ID
- Node Address of the H1 links

Each FG-200 uses a default PD tag that includes the serial number. The default PD Tag is also used if the configuration is erased via the web server interface or during firmware download.

By clicking **[Change Settings]**, the new value is added to the configuration data of the FG-200 and the device is rebooted to apply these value.



Note

In a redundant system the settings information is forwarded after a reboot from the primary to secondary device. It therefore makes no sense to change the setting on a secondary FG-200, as the primary would otherwise overwrite the secondary with the old values.
Link ID = 0: H1 Link is disabled.
Link ID >= 1000: H1 Link is enabled. Within a Linking Device the Link ID has to be unique. In the complete HSE network it is recommended to have unique LInk IDs for all Linking Devices but it is not required

7.4.1.4 User Accounts

In this menu you can change and confirm account passwords depending on their role. For firmware V1.20.30 and **older** the following usernames and passwords are available.

Username	Password	Role
administrator	fgadmin	Administrator
maintenance	keepitgoing	Service or maintenance engineer
operator	runit	User or operator
executive	showme	Executive

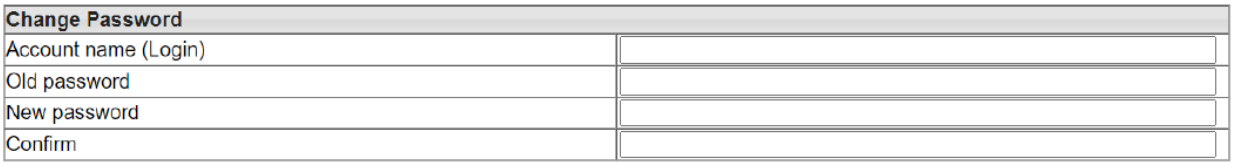
For firmware versions V1.20.31 and **newer** use the the following usernames and passwords are available.

Username	Password	Role
administrator	FG200$Admin	Administrator
maintenance	KeepItGoing3!	Service or maintenance engineer
operator	RunIt?42	User or operator
executive	Show2Me!	Executive

The following tasks can be executed by the specified role:

Task	Administrator	Maintenance	Operator	Executive
Configure network settings	☑			
Set passwords	☑			
Set time settings and home page options	☑			
Restart applications	☑			
Monitor process values	☑	☑	☑	☑
Monitor diagnostic values	☑	☑	☑	☑

These passwords can be configured with administrator rights in the following window:



Enter the password into the corresponding field(s), confirm your entry and click **[Change Password]** to confirm the modified password(s).

Note

It is recommended to store your changed passwords in a password manager (Keepass). If you lose a modified administrator password, you will no longer be able to change any settings.

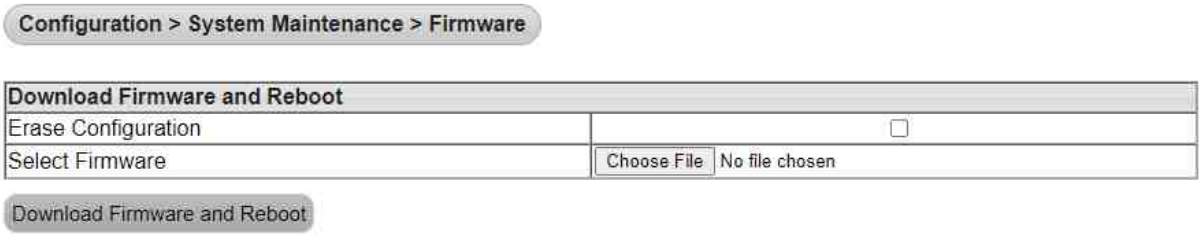
7.4.2 System Maintenance

7.4.2.1 Restart

- Click **[Restart Now]** to restart the system.

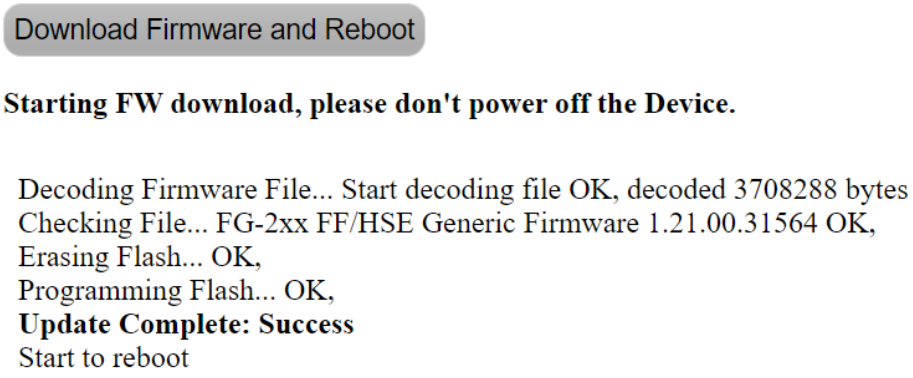
7.4.2.2 Firmware

- Select new firmware file(s).
- Erase an existing firmware configuration.



Do not activate the check box **Erase Configuration** unless you want to set up the complete plant configuration using the ComConf tool. When activating, the PD tag is set to the default value (FG_200_<serial number>) and all passwords are reset to standard passwords (refer to Login to webserver 34 for more information).

1. Download the latest firmware from the product website.
2. Click **[Choose File]** in the **Select Firmware** field.
   The File Explorer opens.
3. Select the downloaded firmware file and click **[Open]**.
4. Click **[Download Firmware and Reboot]** to load the firmware file and to reboot the system.
   The system performs a firmware file check. The download is started. Messages indicate the current download status. A complete download is indicated as successful and the FG-200 reboots.
5. Wait until the message shows **Start to reboot**.

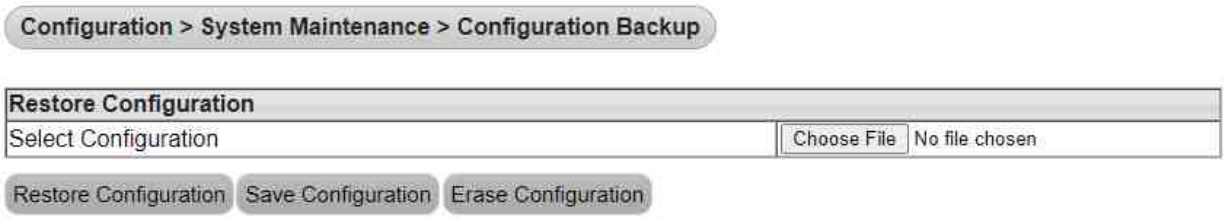


Note
Do not access the web server of the FG-200 before the "Success" message is displayed in the browser window. If you do so, you will have to clear the cache of your web browser after the boot process has finished, and then re-establish a connection to the web server of the FG-200.

The end of the boot process is indicated by a continuously lit RUN LED for a FG-200 acting in non-redundant mode or for a primary device in redundant mode. For a secondary device it is indicated by a flashing (2.5 Hz) RUN LED.

7.4.2.3 Configuration Backup

- Restore a selected system configuration
- Save a selected configuration
- Erase the current configuration



Restore Configuration

To restore a previously saved configuration click **[Browse]**, select the desired configuration file and confirm with **[Open]**.

Save Configuration

1. To save your current configuration, click **[Save Configuration]**. An additional window is opened asking you to save the file.
2. Click **Save file** and confirm with **[OK]**. The configuration file is saved to your standard download directory.

Erase Configuration

Click **[Erase Configuration]** to erase an existing configuration and to reset the FG-200 to factory default settings.

Note

When clicking **[Erase Configuration]** this causes the current configuration (without IP configuration) to be deleted. All passwords will be deleted and will be reset to their default value.

7.4.2.4 CA Download

To establish a secure HTTPS connection to the FG-200 HSE/FF Modbus , the device must use a trusted digital certificate issued by a Certificate Authority (CA). A CA certificate enables the FG-200 HSE/FF Modbus to verify the authenticity of certificates presented during secure communication. By importing a trusted CA certificate, the FG-200 HSE/FF Modbus can validate certificates issued by that authority, ensuring encrypted communication and authentication of the communicating parties.

To import CA certificates:

1. Navigate to Configuration → System Maintenance → CA Download.
2. Upload the required CA certificate file.
3. Upload the corresponding private key file.
4. If your certificate chain includes one or more intermediate Certificate Authorities, upload the intermediate CA certificates as well.
5. Apply the configuration to store the certificates on the device.

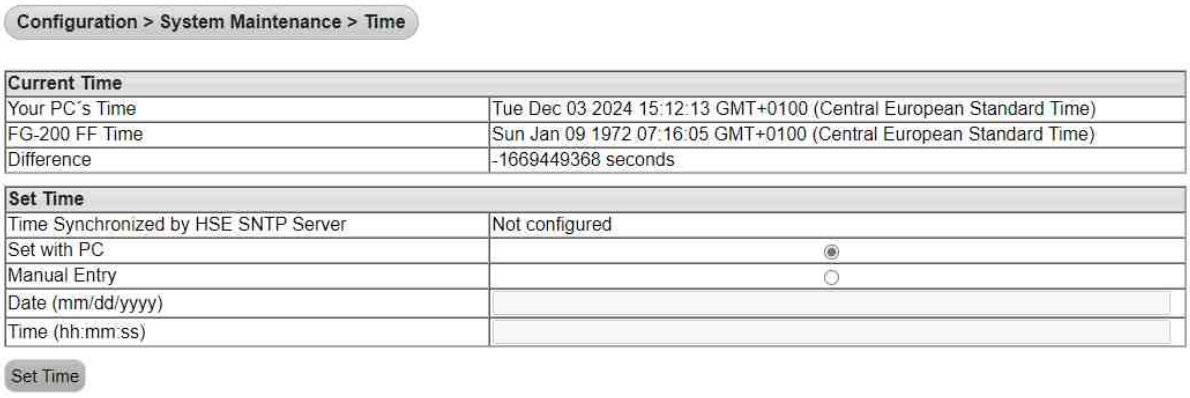
Note
The private key must correspond to the uploaded certificate. If intermediate CA certificates are required, they must be uploaded in the correct certificate chain to ensure successful certificate validation.

After the certificates have been successfully imported, the FG-200 HSE/FF Modbus uses them to establish trusted HTTPS connections.

7.4.2.5 Time

In this submenu you can:

- Synchronize date and time between PC and device(s).
- Set a specific date and time for your device.



Note
If an HSE SNTP server is configured, you cannot modify date and time due to automatic time synchronization.

The **Current Time** window frame shows the

- current time on your PC

- time on the Softing FG-200 and
- difference between the current PC time and the time on the FG-200.

In the **Set Time** window frame you can synchronize the current PC time and the time of the FG-200.

1. Select the radio button **Set with PC**.
2. Click **[Set Time]**.
   The synchronized time will appear in the table.
   If the FG-200 is connected to a network and if you want to use this feature, you can select a timeserver at your facility or one near you geographically to ensure accurate time adjustments. The device will function properly with this feature disabled but data time stamps are less accurate and time updates must be entered for each FG-200
3. Alternatively, select the radio button **Manual Entry**.
4. Click in the corresponding field **Date** and **Time** and enter the desired values.
5. Confirm your changes by clicking **[Set Time]**.
   Your entries are now activated.

7.4.3 Fieldbus

7.4.3.1 Devices

The devices submenu opens a table displaying the devices that are connected to the FG-200. The table shows which segment from the FG-200 is connected to how many devices. The devices are displayed with their H1 Node Address, their Device ID and their PD Tag.

Precondition: You have activated **Enable HSE Alarms** in **Configuration → Settings → General Settings**.

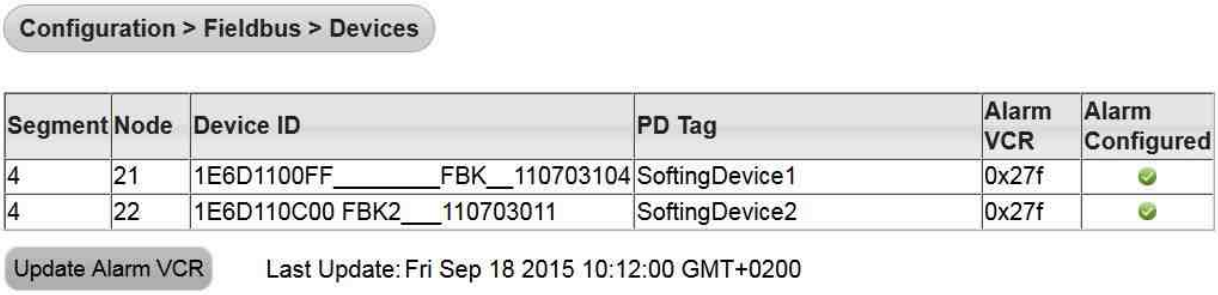
Additionally there is information about the alarm VCR (VCR address) and the status of the alarm (alarm sending in the H1 device and transferring the alarm from the FG-200 to HSE).

The column Alarm VCR displays the configured H1 endpoint address used to receive alarms.

- indicates that alarm sending is configured.
- indicates that no alarm can be configured or - in Visitor mode only - a different endpoint is configured for the device which must not be overwritten.

Note

When Enable HSE Alarms is not set, Alarm VCR will be set to 0x0 and Alarm Configured will show the red icon.



The fields **Node** and **PD Tag** are display fields and cannot be modified.

Click **[Update Alarm VCR]** to update the list, e.g. after a configuration download from a configuration host on H1 or HSE. The modified node addresses, PD tags or the communication configuration list will therefore reflect the current H1 segment configuration status. Alternatively, you can restart the FG-200 to update settings.

7.4.3.2 Blocks

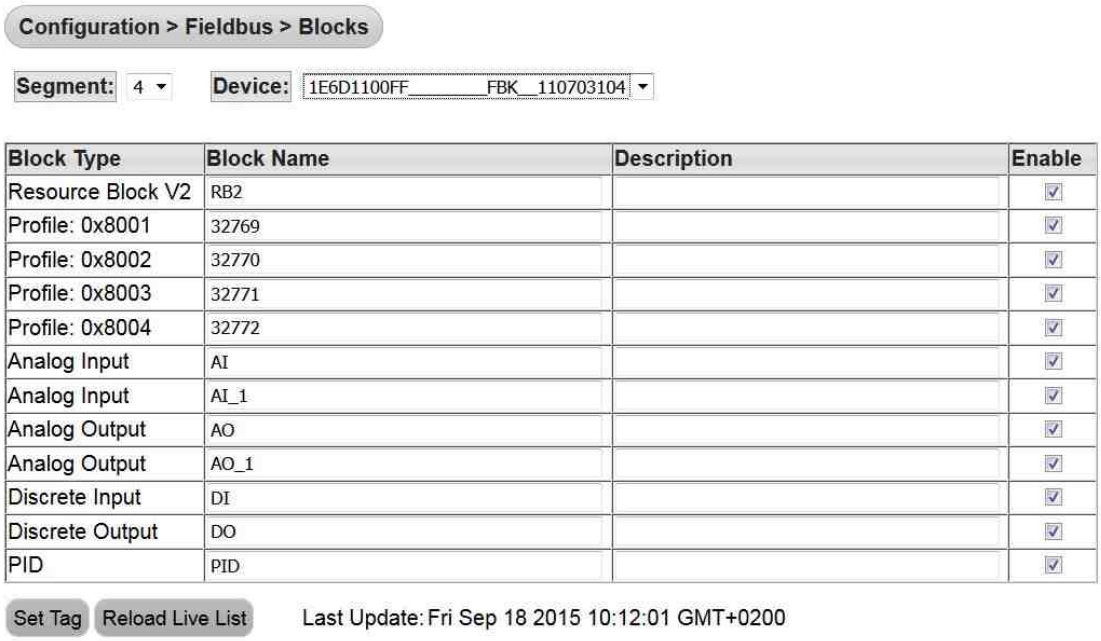
The Block submenu displays the block information of all FF-H1 field devices that are connected to the FG-200. Two filters allow for selecting

Segment the list of configured segments.

Device list of devices connected.

The table shows the corresponding Block Type, Block Name, Description and whether it is enabled or not. By default only those blocks are enabled that have a block name. For vendor-specific blocks the profile number is displayed instead of the name.

When naming blocks (up to 32 ASCII-characters) we recommend assigning self-explanatory names that contain information about the location or type (e.g. analog output, digital input).



[Set Tag] changes the block tag in the device according to the modifications performed.

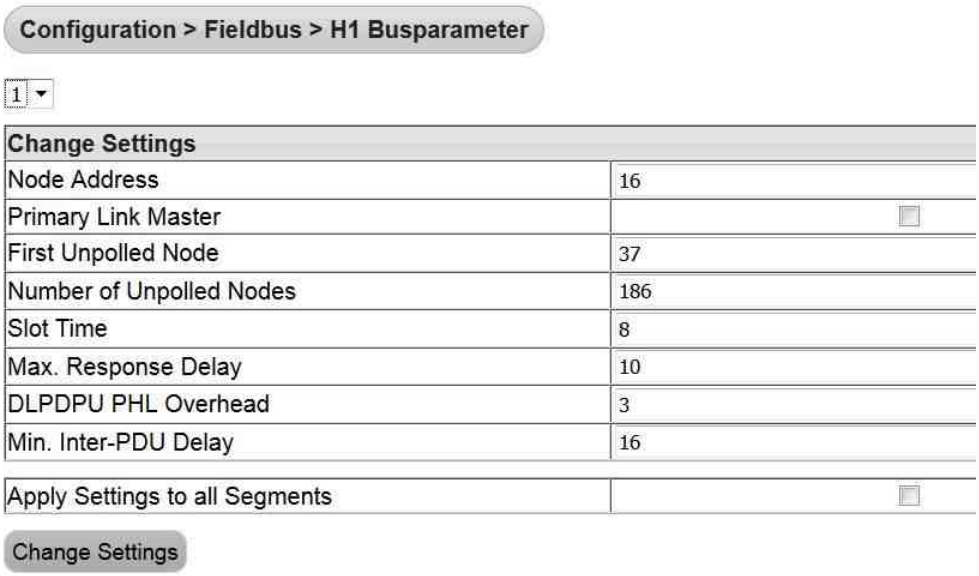
Note

If you are working with the Communication Configuration tool (ComConf) or any other host system we recommend that you do **not** modify any the block names (block tags) as they are set via the configuration system. As the FG-200 checks the current values of the block tags only when an H1 device enters the live list a change of the block tag would not be discovered automatically. It would be necessary to use the 'Reload Live List' button. This is also necessary if PD tags or node addresses of H1 devices are changed by a configurator.

[Reload Live List] updates information on the blocks and reloads the live list in the comConf with updated information, e.g. after a configuration download. Thus, modified block tags will reflect the current configuration status. Alternatively you can restart the FG-200 to update information on the blocks.

7.4.3.3 H1 Busparameter

The H1 Busparameter submenu allows to define parameters for the chosen segment (H1 Link). Click **[Change Settings]** to apply your modifications and download it to the FG-200. If the selected H1 segment is active, the settings would also be downloaded to a secondary FG-200 if the FG-200 is acting as primary in a redundant set.



Parameters	Description	Range	Default
Node Address	Addresses used by FOUNDATION fieldbus are as follows: ▪ 0-15 are reserved ▪ 16–247 are available for permanent devices. Some DCSs (Distributed Control System/Digital Control System) may further subdivide this range. This range is typically shortened for efficiency. ▪ 248–251 are available for devices with no permanent address such as new devices or decommissioned devices. This must not be used as address for a host. ▪ 252–255 are available for temporary devices, such as visitor hosts or handhelds.	see description	16
Primrary Link Master	Determines the H1 interface as active Linkmaster (Link Active Schedule = LAS)	checkbox selection only	N/A
First Unpolled Node	The parameters First Unpolled Node (FUN) and Number of Unpolled Nodes(NUN) determine the range of the node address to be used in the node address range for permanent devices (16-247).	20 - 248	37

Parameters	Description	Range	Default
	The usable node address are: 16 - (FUN-1) and (FUN+NUN)-247 Reducing the range will speed up the time until a device added to a H1 network is detected. But if a device is using a node address that is not in the range it will not be able to join the network.		
Number of Unpolled Nodes	Range of consecutive node addresses that are not polled by the LAS of the link.	0 - 227	186
Slot Time	Device capability how fast the device can reply upon receipt of a PDU. This capability is measured in MaxResponseDelay SlotTimes, V(MRD) V(ST). Both parameters are specified in octet durations. The attributes SlotTime and MaxResponseDelay should be set such that the device represents the maximum response delay in octets of the device. The capability can be obtained from the devices CFF file. When configuring a H1 Link, the maximum value of the product SlotTime MaxResponseDelay of all devices residing on that link should be the minimum value for the Link configuration. This is to assure that all devices participate on the bus.	1 - 4095	8
Max. Response Delay	Device capability how fast the device can reply upon receipt of a PDU. This capability is measured in Maximum Response Delay Slot Times, V(MRD) V(ST). Both parameters are specified in octet durations. The attributes Maximum Response Delay and Slot Time should be set such that the device represents the maximum response delay in octets of the device. The capability can be obtained from the devices CFF file. When configuring a H1 Link the maximum value of the product Slot Time and Maximum Response Delay of all devices residing on that link should be the minimum value for the Link configuration. This is to assure that all devices participate on the bus.	1 - 11	10

Parameters	Description	Range	Default
DLPDPU PHL Overhead	Device capability how fast the device can reply upon receipt of a PDU. This capability is measured in MaxResponseDelay SlotTimes, V(MRD) V(ST). Both parameters are specified in octet durations. The attributes SlotTime and MaxResponseDelay should be set such that the device represents the maximum response delay in octets of the device. The capability can be obtained from the devices CFF file. When configuring a H1 Link, the maximum value of the product SlotTime * MaxResponseDelay of all devices residing on that link should be the minimum value for the Link configuration. This is to assure that all devices participate on the bus.	2 - 63	3
Min. Inter-PDU Delay	This parameter specifies the minimum interval between two frames on the H1 link. The minimum value of Minimum Inter Pdu Delay which a device is able to support is described in the CFF file of a device. When configuring the H1 link, the minimum value that can be used for Minimum Inter Pdu Delay is the maximum of the values from the CFF files of the used devices.	-	16

Note
If a configuration system like ComConf is used, these parameters are also set by the configurator. This page should be used only if no configurator or host system is available.

7.4.3.4 HSE

The HSE submenu allows to specify the **Alarm Distribution Address** and the **Alarm Distribution Port**. These parameters are the Multicast Address and the UDP Port that are used by the FG-200 to forward alarms from H1 devices.

Note

The default settings "Address = 239.255.0.33" and "Port = 45000" are required for interoperability with Emerson AMS tool.

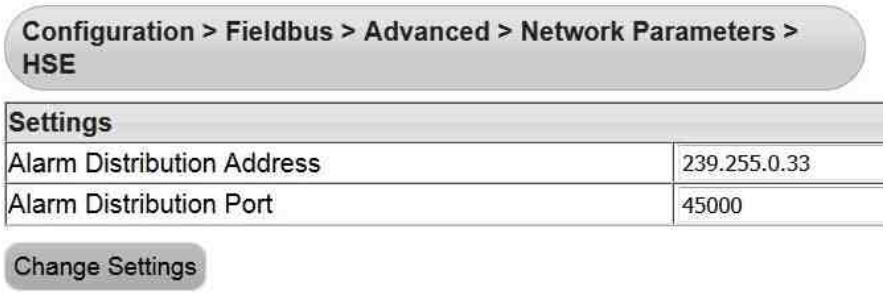
Changing these parameters may disable the display of alarm conditions in AMS alert monitoring.

If a different HSE host tool is used, the parameter could be adapted to the values required by that tool.

Click **[Change Settings]** to apply your modifications.

Note

A configuration system can also set up the alarm configuration. In this case the settings configured here will not be used. However, ComConf does not configure the alarms.



7.4.4 Modbus

The FG-200 allows traditional control systems access to H1 fieldbus devices over Modbus TCP.

7.4.4.1 Communication

The Communication submenu allows to configure the Modbus Communication settings.

Hint

Before you modify settings make sure that the Modbus function is enabled and all parameters are set to a valid value. Therefore consult the manual of your particular Modbus client and adjust the Modbus configuration accordingly.

For Modbus TCP the communication settings (baud rate, parity, stop bits) can be ignored.

Click **[Change Settings]** to apply your modifications.

Configuration > Modbus > Communication

Settings	
One Modbus Address	◉
Single Address	1
Multiple Modbus Address	○
Modbus TCP Port	502
Baud Rate	19200
Parity None	Even
Stop Bits	1
Response Delay Time	0
Unmapped Register Read Response	Illegal Data Address
Unmapped Register Write Response	Illegal Data Address
Write Behaviour	Queued
Floating Point Representation	Float
Low word first in two word values (Float/Usign32)	No
Incorporate Values Associated Status As Error	Yes
Value Reported For Error (Floating Point)	NaN
	0
Value Reported For Error (Rounded and Native Integer)	0
Stale count limit	4
Scaled Floating Point Maximum Integer Value	65534
Gain value used for scaled representation	1
Offset value used for scaled representation	0

Change Settings

7.4.4.2 Import/Export

In this submenu you can import a Modbus mapping created by comConf.

Note
You are currently importing a Modbus mapping created by the Softing ComConf.

[Export] Saves the imported Modbus Mapping table.

[Import] Imports an existing Modbus Mapping table in csv format.

8 Redundancy mode

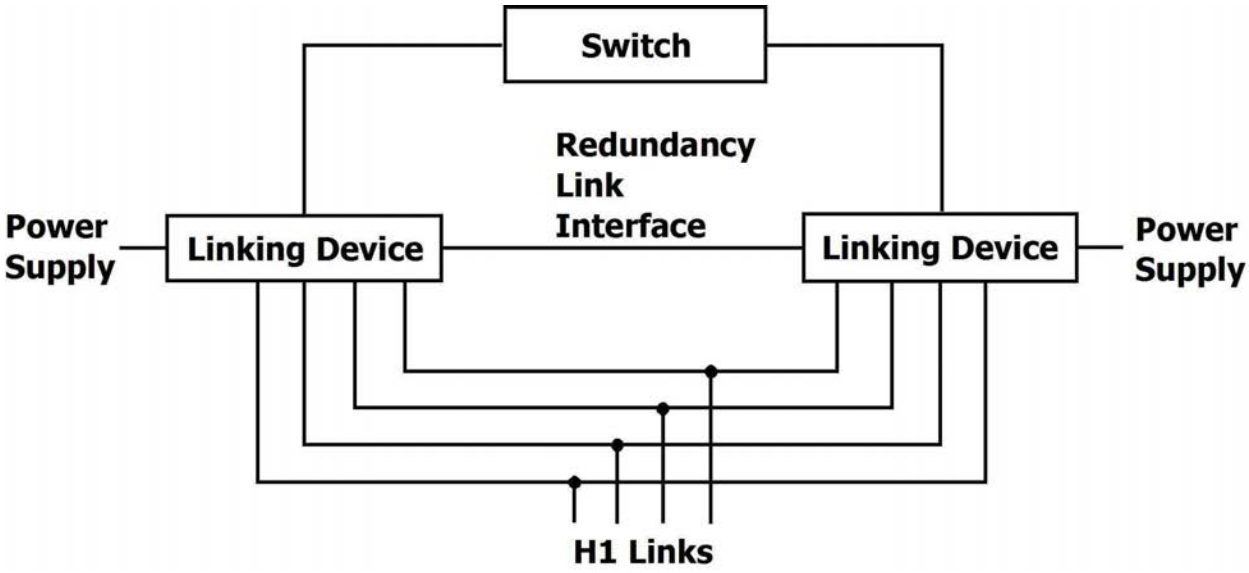
Redundancy mode is possible in all environments/use cases where the FG-200 acts as link active scheduler.

Redundancy mode is not possible when FG-200 acts as a visitor host or when the serial RS232 interface of the FG-200 is used for Modbus communication.

8.1 Redundancy concept

FOUNDATION fieldbus is a distributed control architecture that provides increased availability compared to centralized control architectures.

To improve the availability of the FG-200 HSE/FF Modbus, it is possible to combine two FG-200 which then form a redundant Linking Device:



A redundant Linking Device (also called "a redundant set of devices") consists of two physical Linking Devices that are connected to the same HSE subnet and to the same H1 links. The redundant set of devices behaves like one logical Linking Device. By duplicating the physical Linking Device, it is possible to tolerate one fault in one of the two devices.

In a redundant set of devices one Linking Device acts as primary device and performs actively all communication functions, including the Link Active Scheduler (LAS) function on the H1 links. In a redundant set it is the primary device that has to be addressed by Hosts and configuration tools.

The second Linking Device, named secondary device, acts as backup device. It receives automatically the same configuration as the primary device, but uses different node addresses on the H1 links and a different IP address on HSE.

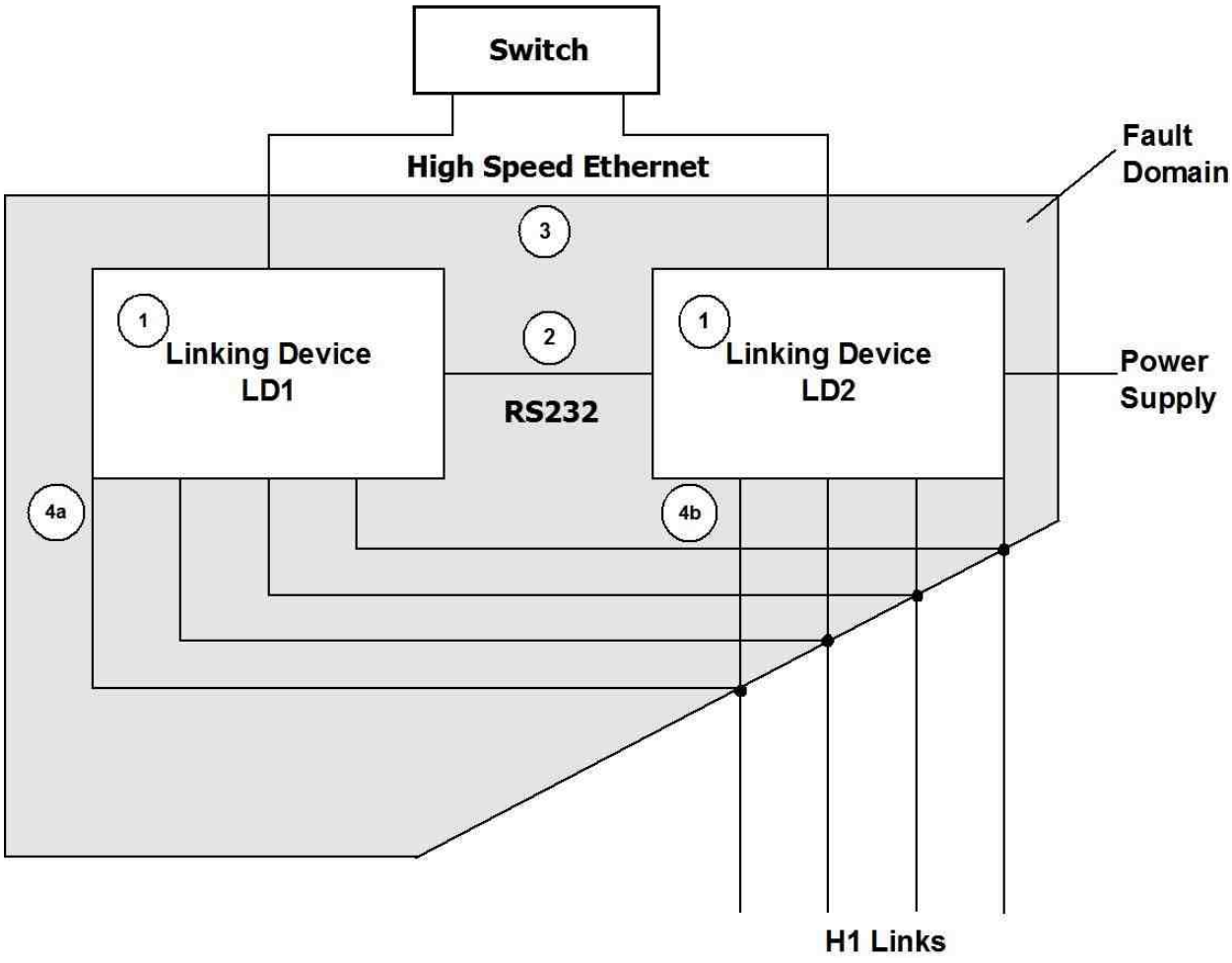
The secondary device is able to take over the function of the primary device if the primary device fails. In that case the Linking Device is reduced to a non-redundant system that is not able to tolerate any further failure. Therefore it is necessary to replace the defective device as soon as possible to recover redundancy.

The secondary device acts as Backup Link Master on each H1 link attempting to take over the LAS role if required. Additional Link Master Devices may be configured to act as Backup Link Master on the H1 links.

The two devices forming a redundant set communicate via a redundancy link interface. The serial line is used to establish a redundant set of devices, to exchange signs of life, to control redundancy switch-over and to transfer configuration information. Therefore an operational serial communication path between both devices are required for proper operation.

The two physical Linking Devices forming a redundant set of devices are determined by the serial link between them. Without that serial link, both devices operate like independent, non-redundant Primary Devices.

8.2 Fault domain



The shaded area in the figure above shows the fault domain. Faults within the fault domain can be detected and covered by the redundancy features. Those are:

- Permanent faults within the Linking Device - (1)
- Transient faults within a Linking Device that lead to loss of functions - (1)
- Loss of the serial connection between the two Linking Devices - (2)
- Surveillance of the connection to the switch to detect the Ethernet port health - (3)

- Loss of an H1 connection between the primary device and the entire H1 link; this may be caused by disconnecting an H1 cable from the primary device - (4a) if LD1 acts as primary device; (4b) if LD2 acts as primary device).

Detecting a loss of an H1 connection between the primary device and the entire H1 link requires that at least two H1 devices have been connected to that H1 channel of the Linking Device and have appeared in the H1 Live List before the loss of the connection occurs.

Only one of the listed faults may be present at a time. Another fault cannot be tolerated until the redundant set has been repaired and a fully operational secondary device is available.

The following fault conditions cannot be detected and covered:

- Loss of an H1 connection between the primary device and a subset of devices on an H1 link
- Loss of an H1 connection between the secondary device and the entire H1 link or a subset of devices on an H1 link.

The conditions for a switch-over from the primary device to the secondary device are listed below.

Transfer from primary device to secondary device

The primary device transfers its role to the secondary device

if Host system or configuration tool request to transfer the role

or the primary device detects a failure of its own Ethernet port

or the primary device detects a failure on at least one H1 interface

or the primary device detects a loss of the connection to all devices on an H1 link.[1]

[1] This requires that at least two devices have been connected to that H1 channel of the Linking Device and have appeared in the H1 Live List before the loss of the connection occurs.

The secondary device accepts the transfer

if its H1 interfaces are operational and faultless

and its Ethernet port is operational

and it has a valid configuration.

Take over of primary role

The secondary device takes over the primary role

if the serial connection to the primary device is lost

and it acts as Link Active Scheduler on all configured H1 links

and its Ethernet port is operational.

Restoring redundancy

Only one of the listed faults may be present at a time. Another fault cannot be tolerated until the redundant set has been repaired and a fully operational secondary device is available.

The required measures for repairing the redundant set of devices depend on the present fault. For an overview refer to Table 15.

Fault	Measure of repair
Permanent fault within the FG-200	Replacement of the detective FG-200.
Transient fault within the FG-200	Restart of the FG-200 (performed automatically).
Loss of the serial connection between the two FG-200s	Re-establishment of the serial connection.
Ethernet port is not operational.	Typically not caused by a hardware fault within the FG200 but by a bad connection to the switch. Replace the cable. It is also possible to connect both Ethernet ports of the FG200 to the switch. Only one is used actively, but when the connection fails, the FG200 automatically tries to switch to the 2nd port
Loss of an H1 connection between the Primary Devices and the entire H1 link	Re-establishment of the H1 connection.

8.3 Configuration of a redundant FG-200 pair

Webserver interface

Make sure that both FG-200s have a different IP address. Refer to Chapter Configuration for a detailed description.

After modifying the configuration settings click **[Change Settings]** to apply the new settings and to reboot the FG-200. Make sure to apply these configuration settings on **both** FG-200s.

Detect primary and secondary FG-200

To detect primary and secondary FG-200 go to **Diagnostics** → Internet Protocol [36]. In the respective entry in line **Redundancy State** you will see **Primary, no backup** for the primary device and **Secondary** for the secondary device.

Then go to **Diagnostics** → Fieldbus [37] and note down the **Device ID** for the respective FG-200.

comConf

1. To configure a redundant FG-200 with the comConf select the FG-200 within the project manager or topology and open the Properties View.
2. Enter the IP address in the corresponding fields of the secondary FG-200.
3. Save the values with Ctrl+S.
4. From the **Build** menu select the command **Build All** (or press **Alt+F8**).
5. Generate Code for the current segment.
6. Select **Download** → **Download Project**.

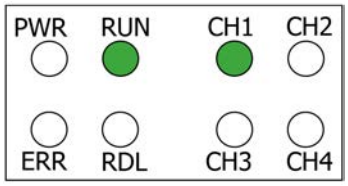
Synchronize Modbus mapping tables

To synchronize Modbus mapping tables of primary and secondary device, import the mapping tables generated with comConf in both the primary and secondary FG-200.

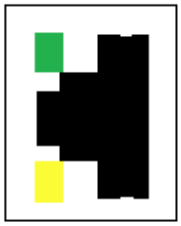
9 LED status indicators

The FG-200 displays eight device status LEDs and two RJ45 connection status LEDs on the front side:

Device status LEDs



RJ45 status LEDs



PWR = power supply - refer to PWR - power supply 61

RUN = running - refer to Device LED statuses 61

ERR = error- refer to Device LED statuses 61

RDL = redundancy link - refer to LED statuses in redundant mode 62

CH1 to **CH4** = H1 channel 1 to H1 channel 4 - refer to Status indications of the four H1 channels 63

The device status LEDs are permanently on or flash in different colors and frequencies as indicated below:

Symbol	Color	Lighting
	none	off
	red	permanent
	green	permanent
	red	flashing (2.5 Hz)
	green	flashing (2.5 Hz)
	green	flashing slowly (0.5 Hz)
	green	flashing fast (5 Hz)

The RJ45 status LEDs indicate the following behaviour:

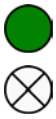
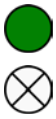
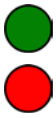
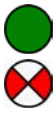
Symbol	Color	Lighting
	green	permanent when Ethernet connection is on
	yellow	flashing when Ethernet connection is active

9.1 PWR - power supply

	permanent green	24V DC power supply is ok
	off	no power supply

9.2 Device LED statuses in stand-alone mode

The following table shows possible LED combinations in stand-alone mode. The redundancy link LED (RDL) is always OFF.

LEDs				Meaning
PWR	green	**RUN**		**Start–up phase (approximately 7 seconds)** During this phase redundancy role is determined. **Note**: The RUN LED briefly turns red.
ERR		**RDL**		
PWR	green	**RUN**	green	**Non redundant device, ready.** The device is operational; it is not part of a redundant set.
				
ERR		**RDL**		
PWR	green	**RUN**	green	**Permanent hardware fault detection.** A fatal error has been detected.
	red			
ERR		**RDL**		
PWR	green	**RUN**	off	**Configuration error** The loaded configuration conflicts with the existing network configuration. For example, the assigned node address is already in use by another station on the H1 link. Load a corrected configuration or remove the conflicting station from the H1 link.
	flashing red		off	
ERR		**RDL**		

9.3 Device LED statuses in redundant mode

The redundancy link LED (RDL) is used to indicate if traffic via the serial line is performed. It will flash GREEN if a valid message is received. It will switch to RED if serial communication is lost and it will be OFF if no serial response is received after startup.

	flashing green	redundancy link communication is OK (triggered by redundancy link packets)
	red	link communication interrupted or aborted (broken down)
	off	no link communication

LEDs	Meaning
PWR green / **RUN** off **ERR** off / **RDL** off	**Start–up phase (approx. 7 seconds)** During this phase redundancy role is determined. Primary and secondary. **Note**: The RUN LED is flashing briefly
PWR green / **RUN** green **ERR** off / **RDL** off	**Non redundant device, ready (primary, no secondary).** The device is operational; it is not part of a redundant set. Primary Device is redundant set. The device is operational, acting as Primary Device in a redundant set. The secondary device is ready
PWR green / **RUN** green **ERR** green / **RDL** off	**Primary with secondary device**
PWR green / **RUN** green **ERR** green / **RDL** off	**Secondary device, startup**
PWR green / **RUN** flashing green **ERR** off / **RDL** off	**Secondary device, operational** The device is operational as secondary device in a redundant set. The configuration information has been successfully transferred from the Primary Device and the redundancy link is operational.
PWR green / **RUN** flashing green **ERR** red / **RDL** off	**Primary device failure** The device is acting as a primary device in a redundant set, but a failure has been detected.

LEDs	Meaning
PWR green / flashing red; RUN green / off; ERR; RDL	**Primary device with H1 failure**
PWR green / flashing red; RUN green / off; ERR; RDL	**Secondary device, hardware failure** The device is acting as secondary device in a redundant set, but a hardware failure has been detected. Details are available on the web page Diagnostics [36] of the device.

9.4 Status indications of the four H1 channels

The following table shows the channel LEDs and their meaning for all four channels (CH1 - CH4):

Symbol	Color / frequency	Meaning
	green	Visitor address
	flashing slowly (0.5 Hz)	not in LAS role
	flashing fast (5 Hz)	LAS role
	red	no carrier or H1 link is disconnected
	flashing red	no token received
	off	H1 link unused

10 Appendix

10.1 FOUNDATION Fieldbus basics

10.1.1 Link active scheduler

The link active scheduler (LAS) is a deterministic, centralized bus scheduler that controls the communication in the H1 segment. It is responsible to maintain the live list.

10.1.2 Visitor host

A visitor host is a secondary on-process host typically used for asset management and device maintenance. The visitor host uses CLT/SRV connections only. It usually should be assigned to node addresses in the range from 252 to 255.

10.1.3 Live list

The Live list is a list of all currently active devices.

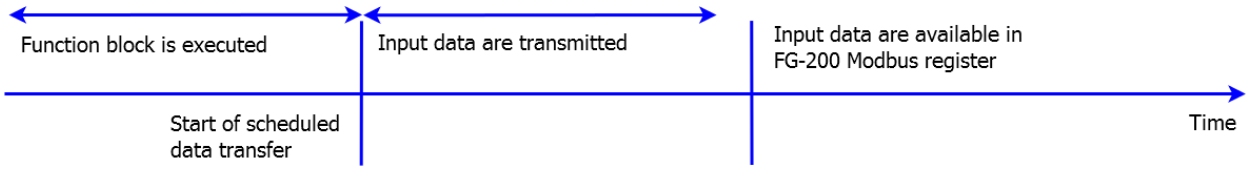
10.1.4 Publisher/subscriber links (PUB/SUB links)

Publisher/subscriber links is used for cyclic transfer of process values (input data and output data). The process value is send by a publisher. Multiple subscribers linked to the publisher are able to receive the process value.

The LAS coordinates the cyclic data transfer on base of a synchronized system time. The cyclic data transfer is synchronized with the execution of the function blocks in the field devices. The schedules for cyclic data transfer as well as for the execution of the function blocks are generated by the comConf tool.

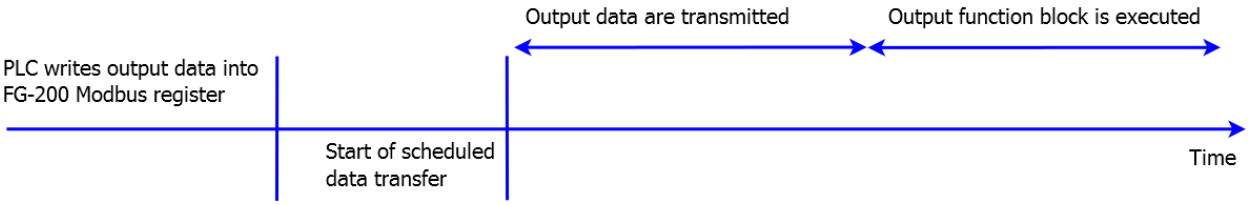
Input data

In case of input data the input function block executed and immediately after the function block execution the new data are transmitted over the line.



Output data

In case of output data the output function block is executed immediately after the transmission of the output data.



Output function blocks detect the absence of fresh PLC output data. If the PLC does not provide fresh output data then output function blocks will switch into a fault state mode. As the PLC write accesses to the FG-200 Modbus registers are not synchronized with the cyclic data transfer in the H1 segment it is necessary that the PLC writes "oversample" the H1 macrocycle. If, for example, the macrocycle time in the H1 link is one second then it is assumed that the PLC writes fresh output data every 500 milliseconds.

10.1.5 Client/server connections (CTL/SRV connections)

Client/server connections are used for acyclic transfer between FG-200 and field devices. Acyclic data transfer is performed in the gaps between cyclic data transfer. For client/server connections the client (FG-200) establishes and server (H1 field device) is established. Once the connection is established the FG-200 can send read and write requests to the field device. After processing the request the field device sends a read or write response to the FG-200.

In case of client/server communication the FG-200 build internal read lists with all parameters configured in the Modbus mapping table or in the point pages. The FG-200 executes this read lists periodically. The time for executing the read lists depends on various factors. As a rule of thumb you can assume that a read request and the corresponding read response will take about 100 millisecond. Thus, if you have, for example, 25 parameters in your Modbus mapping and/or in your point pages each Modbus register and point page parameter will be updated every two and a half second.

The main time consuming factors in read request handling are the low baud rate in an H1 segment (31.25 kbit/sec) and the processing time of the read request in the H1 field device. The processing time within the FG-200 is negligible. The FG-200 supports four H1 segments. If, enhancing the example above, 25 parameters are configured in each segment the update time of the 4 * 25 parameters will still be two and a half second.

Please consider that the execution of the FG-200 read lists is not synchronized with the periodic execution of the function blocks. Assuming the function blocks are executed one time per second and the execution of the read list takes two and a half seconds then you will get only each second or third value produced by the function block.

10.1.6 Macrocycle

Macro cycle is the period of the function block schedule and the cyclic data transfer schedule. Typical macrocycle times are 500 milliseconds, one second, two seconds and four seconds.

10.1.7 Input/output parameters (I/O parameters)

Input and output parameters are used for accessing process values (input data and output data). They are structured parameters composed of a status and a value.

IO parameters are typically transmitted via publisher/subscriber links. If no publisher/subscriber links are configured IO parameter can be read and written via client/server connection.

10.1.8 Contained parameters

Contained parameters are used for data that are not process values. Contained parameters contain status information and configuration data.

Contained parameters are read or written via client/server connections. It is not possible to transmit contained parameters via publisher/subscriber links.

10.2 Redundancy

10.2.1 Redundancy behavior

This chapter consists of several sections. Each section describes a specific redundancy fault scenario and the corresponding system behavior. The number shown in parentheses in each section heading (for example, *Primary device failure (1)* or *Ethernet cable broken (2)*) identifies the corresponding fault state. These fault state numbers are referenced later in the table in Section *State indication associated*. The table summarizes the corresponding LED and Web interface indications for each fault state.

The following information may be useful to obtain a correct understanding of which fault conditions are covered and how the system recovers from these fault conditions.

In any case, the fully redundant state is restored when the secondary device indicates "operational" (RUN LED flashing) and its H1 live lists are complete. In highly populated, tightly configured H1 links, it may take several minutes to acquire the live lists. Before the live lists are complete, redundancy switching is possible, but client/server connections can only be established to H1 devices that are already included in the live lists.

Any further fault that occurs before the fully redundant state is restored may cause the system to fail.

10.2.1.1 Primary device failure - fault state 1

Primary device failure due to permanent or transient hardware or software fault.

Fault detection	Device fails completely or software watchdog expires or hardware watchdog expires or exception occurs or failure in H1 interface detected.
Fault treatment	Primary role actively transferred to or taken by redundant system
Effect	Redundancy switch-over. System degrades to non–redundant system.
Repair measure	Transient fault: Automatic reboot Permanent fault: replace device Secondary service will reboot and receive configuration data from primary device.

10.2.1.2 Ethernet cable broken - fault state 2

Ethernet cable broken between primary device and Ethernet hub/switch.

Fault detection	Bad link status of Ethernet port detected. Detection time less than 500 ms.
Fault treatment	Primary role actively transferred to redundant device.
Effect	Redundancy switch-over. System degrades to non-redundant system.
Repair measure	Repair or reconnect Ethernet cable. Secondary device will reboot and receive configuration data from primary device.

10.2.1.3 H1 cable broken - fault state 3

H1 cable broken between primary device and H1 network.

Fault detection	Empty live list detected on one H1 port or primary device while secondary device still has non-empty live list. Due to the H1 protocol it may take some seconds. Until the live list becomes empty. Detection occurs only if in primary device and secondary device the number of active H1 devices in the live list has exceeded the threshold of one.

Fault treatment	Primary role actively transferred to redundant device, so that access to H1 is possible again.
Effect	Redundancy switch-over. No redundancy concerning the affected H1 link.
Repair measure	Repair or reconnect H1 cable.

10.2.1.4 Secondary device failure - fault state 4

Secondary device fails due to permanent or transient hardware or software fault.

Fault detection	Device fails completely or software watchdog expires or hardware watchdog expires or exception occurs or failure in H1 interface detected.
Fault treatment	Secondary device assumes and indicates non-operational state.
Effect	System degrades to non-redundant system.
Repair measure	Transient fault: Automatic reboot Permanent fault: replace device Secondary device will reboot and receive configuration data from primary device.

10.2.1.5 Ethernet cable broken - fault state 5

Ethernet cable broken between secondary device and Ethernet hub/switch.

Fault detection	Bad link status of Ethernet port detected. Detection time less than 500 ms.
Fault treatment	Secondary device assumes and indicates non-operational state.
Effect	System degrades to non-redundant system.
Repair measure	Repair or reconnect Ethernet cable. Secondary device will reboot and receive configuration data from primary device.

10.2.1.6 H1 cable broken - fault state 6

H1 cable broken between secondary device and H1 network.

Fault detection	No fault detection in secondary device. Empty live list has to be detected by any HSE client (e. g. asset monitor).
Fault treatment	None.
Effect	No redundancy concerning the affected H1 link.
Repair measure	Repair or reconnect H1 cable.

10.2.1.7 TCP connection lost - fault state 7

TCP connection lost between primary device and secondary device.

Fault detection	Time-out on TCP connection. Detection time less than 2 sec during activity and less than 7 sec during idle times.
Fault treatment	Secondary device assumes and indicates non operational state[1)].
Effect	System degrades to non-redundant system. Secondary device clears configuration.
Repair measure	Repair Ethernet connection.

	Secondary device may reboot in some cases depending on prior state and will receive configuration data from primary device.

[1] If the secondary device reboots cyclically in this state, set the TCP acknowledge timeout (object 22223) to a smaller value.

10.2.1.8 Redundancy link broken or removed - fault state 8

Redundancy link broken or removed between primary device and secondary device.

Fault detection	Loss of serial communication. Detection time less than 800 ms.
Fault treatment	Secondary device assumes and indicates non operational state.
Effect	System degrades to non-redundant system.
Repair measure	Repair or reconnect redundancy link. Secondary device will reboot and receive configuration data from primary device.

10.2.1.9 State indication associated

The following table summarizes the LED and Web interface indications for each fault state described in the preceding sections. The **Fault State** numbers (**FS**) in the first column correspond to the numbers shown in the section headings of this chapter. **Fault State 0** represents the normal operating state with no fault present. The terms **primary device** and **secondary device** refer to the device roles after any redundancy switch-over has occurred. The H1 LED indication codes (F, S, O, M) are described below.

FS	Primary device			Secondary device		
	Run LED	**H1 LED**	**Web Info**	**Run LED**	**H1 LED**	**Web Info**
0	On	F	**Ok** - Primary	Flashing	S	**Ok** - Secondary
1	On	F	**Failure** - no serial communication Primary, no backup	Off	O	(no connection to web server)
2	On	F	**Failure** - TCP link to redundant device is lost Primary, no backup	Flashing	S	(no connection to web server)
3	On	F	**Ok** - Primary	Flashing	M	**Ok** - Secondary
4	On	F	**Failure** - no serial communication Primary, no backup	Off	O	(no connection to web server)
5	On	F	**Failure** - TCP link to redundant device is lost Primary, no backup	Flashing	S	(no connection to web server)
6	On	F	**Ok** - Primary	Flashing	M	**Ok** - Secondary
7	On	F	**Failure** - TCP link to redundant device is lost Primary, no backup (if connection to web server possible)	Off	O	**Failure** - TCP link to redundant device is lost Primary, no backup (if connection to web server possible)
8	On	F	**Failure** - no serial communication Primary, no backup	Off	S	**Failure** - no serial communication Primary, no backup

H1 LED indication code

F	Fast on configured links; Off on unconfigured links
S	Slow on configured links; Off on unconfigured links
M	Fast on missing links; Slow on configured links; Off on unconfigured links
O	Off

10.2.2 Duration of redundancy switch-over

Switch-over duration PUB/SUB links

During redundancy switch-over, the activity on H1 links is interrupted. From the perspective of a single H1 device, PUB/SUB links [64] are interrupted for a period of time that is composed of the following times:

- fault detection time t_{fd}
- redundancy switching time t_{rs}
- macro cycle duration t_{mc}

The time of inactivity due to redundancy switch-over for a single process value is therefore:

- time of inactivity <= $t_{fd} + t_{rs} + t_{mc}$
- compared to t_{mc} during regular operation.

The fault detection time is:

- t fd = 800 ms if the primary device fails.
- t fd = 1500 ms if the Ethernet connection on the primary device is removed.

The redundancy switching time is:

- t rs = 500 ms.

The macrocycle duration depends on the configuration and is usually in the range of 500 ms to 2 seconds.

Switch-over duration for CLT/SRV connections

In case of CLT/SRV connections [65] the switch will take about one minute.

If contained parameters [65] such as BLOCK_ERR or channel are accessed, it will take about one minute until the registers in the secondary FG-200 show the current parameter values.

10.2.3 Replace a defective FG-200 in a redundant set

For replacing a defective FG-200 in a redundant set of FG-200s, perform the following steps:

1. Identify the defective FG-200. Refer to Status indicators - LEDs 60.
2. Remove the power terminal block from the FG-200.
3. Remove the redundancy link interface cable and the Ethernet cable.
4. If not indicated on the cable, make a note to which channel each H1 link is connected. Then remove the H1 terminal blocks.
5. Make sure that the new FG-200 has the same IP configuration (IP address and subnet mask) as the replaced defective device. See Internet Protocol submenu 40 for more information.
6. Replace the defective FG-200.
7. Plug in the H1 terminal blocks. Make sure to use the same allocation as before.
8. Connect the Ethernet cable and the redundancy link interface cable.
9. Make sure that the redundancy link interface cable is connected before plugging in the power terminal block.

   If the replaced FG-200 is powered while the serial link is missing, it will behave like an independent, non-redundant primary device. If in this case the FG-200 has a valid (possibly unknown) configuration, it might use H1 node addresses which are already in use on the H1 links. This will disturb or interrupt communication and application processing on the H1 links.
10. Plug in the power terminal block. The boot process and the download of the configuration information take about 1 minute. For indication of proper operation as a secondary device refer to Status indicators - LEDs 60.

10.3 Diagnostics - Advanced submenus

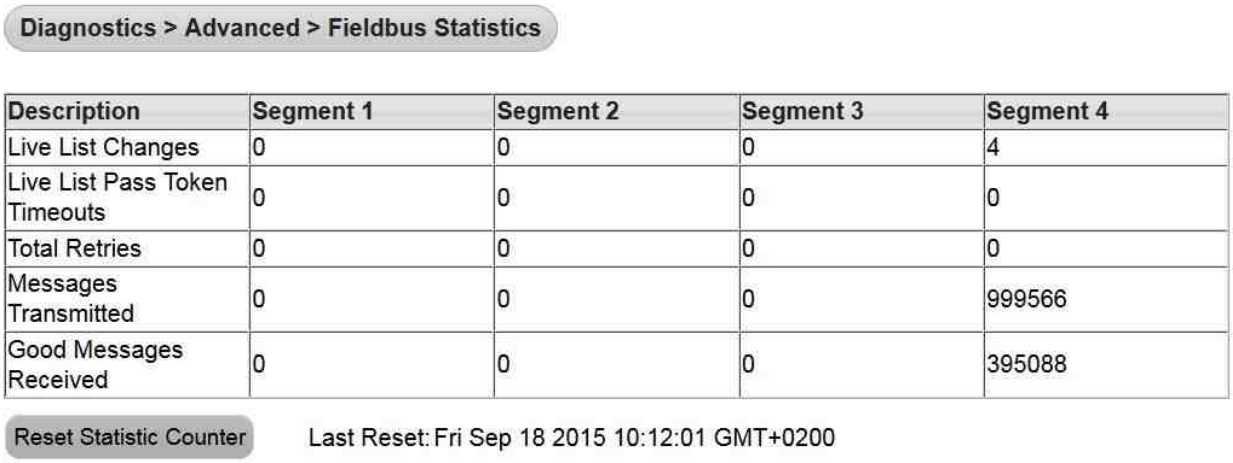
Click **Advanced** to open the following submenus:

10.3.1 Fieldbus Statistics submenu

This table shows you information about all four segments concerning

- Live List Changes - number of total live list changes
- Live List Pass Token Timeouts - number of pass token timeouts; under good conditions it should be "0"
- Total Retries - number of total retries for acyclic H1 requests. This could be an indication of noise on the H! segment or a H1 device problem.
- Messages Transmitted - number of messages transmitted by the FG-200.
- Good Messages Received - number of messages received from FG-200.

The button **[Reset Statistic Counter]** allows you to reset all segment values to zero and to restart counting. To see the new results, click **Fieldbus Statistics** again.



10.3.2 HSE Statistics submenu

This table shows you the total number and number per second of HSE frames grouped into:

- Publisher / Subscriber
- Report Distribution
- Client / Server
- System Management
- Redundancy Synchronization

(This functionality is not supported by AssetMonitor Linking Devices.)

The button **[Reset Statistic Counter]** allows you to reset all segment values to zero and to restart counting. To see the new results, click **[Fieldbus Statistics]** again.

Diagnostics > Advanced > HSE Statistics

Description	Total	Per Second
Publisher / Subscriber	186837	3
Report Distribution	0	0
Client / Server	295	0
System Management	215	0
Redundancy Synchronization	0	0

Reset Statistic Counter Last Reset: Thu Sep 17 2015 15:38:49 GMT+0200

10.3.3 FPGA Error Statistics submenu

This table shows the values of the framing error counters per channel and checksum errors in received packets. High counter values may indicate a bad signal quality in the H1 channel and/or a device that is not operating properly.

In addition, the following information is displayed:

- Framing Errors (i.e. incomplete frames, might be an indication of noise on the H1 segment)
- Checksum Errors (might be an indication of noise on the H1 segment)
- Carrier Not Seen Errors
- Buffer Not Empty (might indicate that the H1 network is not connected or not powered)
- Receive Overrun
- Transmit Overrun
- Transmit Readback Error
- Collision Timeout Errors (might indicate that the H1 network is not connected or not powered).

Diagnostics > Advanced > FPGA Error Statistics

Description	Segment 1	Segment 2	Segment 3	Segment 4
Framing Errors	0	0	0	0
Checksum Errors	0	0	0	0
Carrier Not Seen Errors	0	0	0	0
Buffer Not Empty	0	0	0	0
Receive Overrun	0	0	0	0
Transmit Overrun	0	0	0	0
Transmit Readback Error	0	0	0	0
Collision Timeout Errors	0	0	0	0

10.3.4 FPGA Register Contents submenu

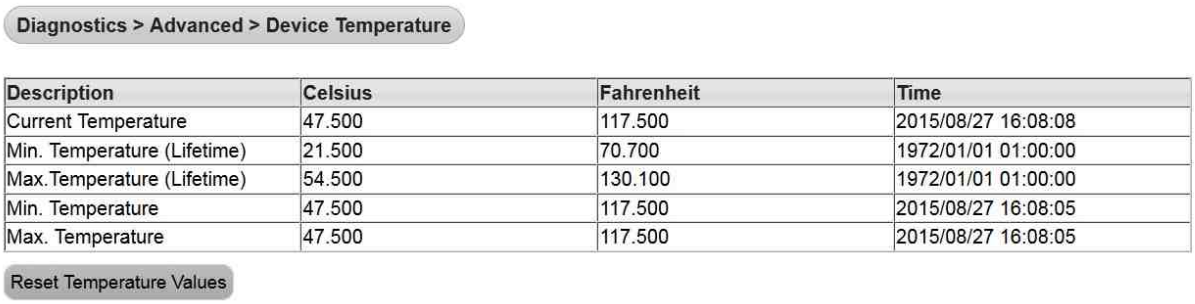
The content of the FPGA register contains data which is only relevant if you contact Softing's customer support for error analysis and troubleshooting.

If requested by Softing's support, take a screen shot and send your problem description together with the screen shot to support.automation@softing.com.

10.3.5 Device Temperature submenu

This table shows you information about current temperature values in degrees Celsius and Fahrenheit.

The button **[Reset Temperature Values]** allows you to reset all values to zero and to restart measuring. To see the new results, click **[Device Temperature]** again.



10.3.6 Modbus Statistics submenu

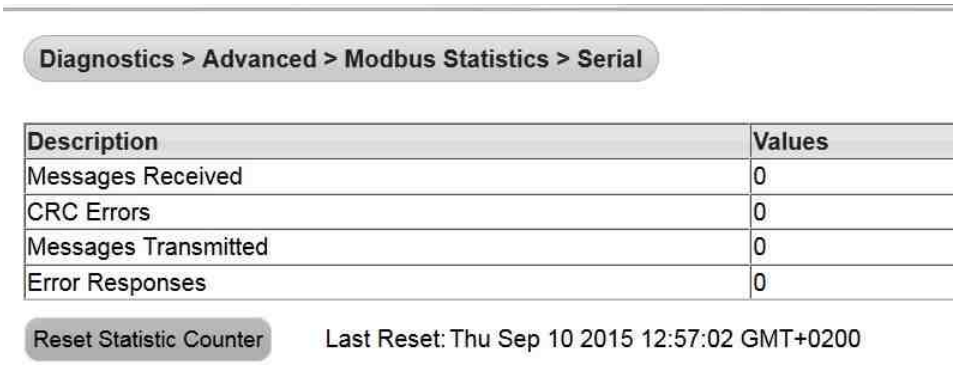
The Modbus communications statistics provide information on the data and packets received and transmitted by the Modbus slave interface.

- **[Serial]** for monitoring the Modbus link
- **[TCP]** for monitoring the Modbus TCP/IP communications

Serial

The menu item **Serial** shows statistical data of a Modbus connected on a serial interface. First messages and CRC errors from received data are listed. Then messages and error responses from the transmitted data are listed.

The values specified apply to the time since the program has been started or the latest **[Reset Statistic Counter]**.

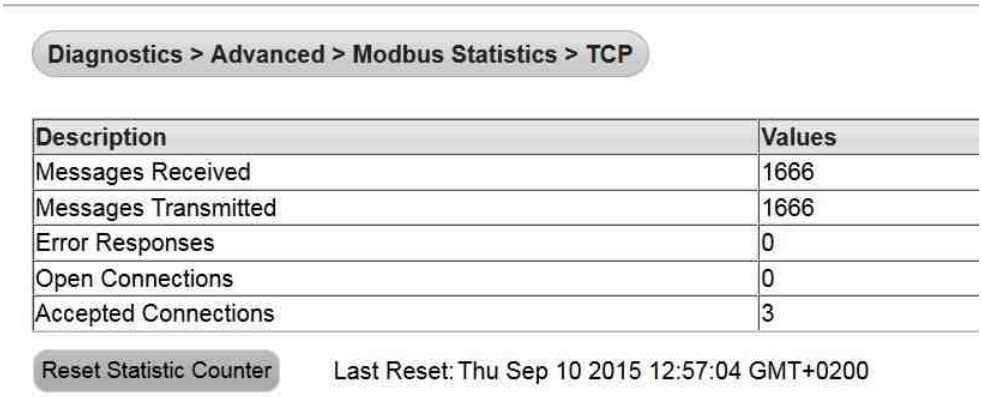


The button **[Reset Statistic Counter]** allows you to reset all values to zero and to restart counting. To see the new results, click **[Serial]** again.

TCP

The menu item **TCP** shows statistical data of a Modbus connected using TCP. First received and transmitted messages are listed. Then the error responses are counted. Finally open and accepted connections are listed.

The button **[Reset Counts]** allows you to reset all values to zero and to restart counting. To see the new results, click **[TCP]** again.



10.4 Coding of bit fields

Parameter BLOCK_ERR

No error	0x0000
Out Of Service	0x0001
Power up	0x0002
Device needs maintenance	0x0004
Readback check failed	0x0008
Lost nv data	0x0010
Lost static data	0x0020
Memory failure	0x0040
Output failure	0x0080
Input failure	0x0100
Dev needs maint soon	0x0200
Dev fault state set	0x0400
Local override	0x0800
Simulate active	0x1000
Link config err	0x2000
Block config err	0x4000
Other	0x8000

Parameter MODE_BLK:

Out Of Service	0x01
Initialization Manual	0x02
Local Override	0x04
Manual	0x08
Auto	0x10
Cascade	0x20
Remote-Cascade	0x40
Remote-Output	0x80

Modbus Register 16 Bit register contains target mode in High Byte, actual mode in low byte.

Example: Modbus value 0x1001 means: target mode = Auto, actual mode = Out Of Service

Field Diagnostics (Parameter FD_FAIL, FD_OFFSPEC, FD_CHECK, FD_MAINT)

The bit fields are vendor specific and not specified by FIELDBUS Foundation except the least significant bit (LSB). The LSB indicates the check function to be active. The check function is typically mapped to the FD_CHECK parameter but may also be mapped to any of the other FD_xxx parameters.

The value for LSB is 0x80000000, the value for the most significant bit (MSB) is 0x00000001.

10.5 Modbus exception responses

ExceptionCode = 02

The FG-200 will send an exception response with [ExceptionCode = 02] if [start address] or [start address + quantity of registers] is not OK.

ExceptionCode = 04

The FG-200 will send an exception response with [ExceptionCode = 04] if one of the requested registers does not contain valid data. Please note that after power-on the FG-200 responds with [ExceptionCode = 04] until all requested data are read from the connected H1 field devices.

10.6 Assign a second (local) IP address under Windows 8.1

1. Open the **Desktop**.
2. Press the **Windows start key** and select **Control Panel**.
3. Select **Network and Internet**.
4. Open **Network and Sharing Center**.
5. Click **Connections**.
6. In the Connection Status window click **Properties**.
7. In the item connection list select **Internet Protocol Version 4 (TCP/IPv4)**.
8. Click **Properties**. In the **General** dialog, the regular (first) IP address, the subnet mask and the standard gateway are shown.
9. Click **Advanced** to add a second IP address. Then click **[Add]** in the IP Addresses dialog.
10. Enter the IP address and the subnet mask.
11. Click **[Add]**.
12. Then confirm all open dialogs with **[OK]**.

11 ATEX Type Examination Certificate

Translation

1 **Type Examination Certificate Supplement 1**

Change to Directive 2014/34/EU

2 Equipment intended for use in potentially explosive atmospheres Directive 2014/34/EU

3 Type Examination Certificate Number: **BVS 15 ATEX E 063 X**

4 Product: **Linking Device type FG-200 HSE/FF**

5 Manufacturer: **Softing Industrial Automation GmbH**

6 Address: **Richard-Reitzner-Allee 6, 85540 Haar, Germany**

7 This supplementary certificate extends Type Examination Certificate No. BVS 15 ATEX E 063 X to apply to products designed and constructed in accordance with the specification set out in the appendix of the said certificate but having any variations specified in the appendix attached to this certificate and the documents referred to therein.

8 DEKRA Testing and Certification GmbH certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in the confidential Report No. PP 15.2105 EU.

9 The Essential Health and Safety Requirements are assured in consideration of:

EN IEC 60079-0:2018	**General requirements**
EN IEC 60079-7:2015+A1:2018	**Increased Safety "e"**
EN 60079-11:2012	**Intrinsic Safety "i"**

10 If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Special Conditions for Use specified in the appendix to this certificate.

11 This Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

12 The marking of the product shall include the following:

II 3G Ex ec IIC T4 Gc
II 3G Ex ec [ic] IIC T4 Gc

DEKRA Testing and Certification GmbH
Bochum, 2021-08-11

Signed: Jörg-Timm Kilisch

Managing Director

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DEKRA Testing and Certification GmbH, Handwerkstr. 15, 70565 Stuttgart, Germany
Certification body: Dinnendahlstr. 9, 44809 Bochum, Germany
Phone +49.234.3696-400, Fax +49.234.3696-401, e-mail DTC-Certification-body@dekra.com

13 **Appendix**

14 **Type Examination Certificate**

BVS 15 ATEX E 063 X
Supplement 1

15 **Product description**

15.1 **Subject and type**

Linking Device type FG-200 HSE/FF

15.2 **Description**

With this supplement the certificate is changed to Directive 2014/34/EU.
(Annotation: In accordance with Article 41 of Directive 2014/34/EU, EC-Type Examination Certificates referring to 94/9/EC that were in existence prior to the date of application of 2014/34/EU (20 April 2016) may be referenced as if they were issued in accordance with Directive 2014/34/EU. Supplementary Certificates to such EC-Type Examination Certificates, and new issues of such certificates, may continue to bear the original certificate number issued prior to 20 April 2016.)

The linking device acts as a gateway between Ethernet-based host systems with foundation field-bus HSE and the foundation field-bus H1 bus system. It is suited for network configuration, device parametrization and the recording of production data. The data circuits are galvanically isolated.
The Fieldbus circuits may operate as intrinsically safe circuits (level of protection Ex ic) or as non-intrinsically safe circuits; details see manual.

Reason for this supplement:

- Change to Directive 2014/34/EU
- Updating of the standards and the resulting change in the marking

15.3 **Parameters**

15.3.1 Electrical parameters

15.3.1.1 Power supply circuit (terminals 1 – 3 or Rail Power Supply L+ and GND)

Nominal voltage		DC	18...32	V
Power consumption			< 5.6	W
Max. voltage	U_m	DC	40	V

15.3.1.2 Redundancy Link circuit (terminals 4,5,6)

Nominal voltage		DC	up to 32	V
Max. voltage	U_m	DC	40	V

15.3.1.3 Ethernet Ports (connectors ETH1, ETH2)

Nominal voltage		DC	up to 32	V
Max. voltage	U_m	DC	40	V

15.3.1.4 Fieldbus circuits (terminals 7,8,9 and 10,11,12 and 13,14,15 and 16,17,18)
(if operated as non-intrinsically safe circuits)

Nominal voltage		DC	24/32	V
(if operated as intrinsically safe circuits, each channel)				
Voltage	U_i	DC	32	V
Current	I_i		570	mA

15.3.2 Ambient temperature range

-40 °C ≤ T_a ≤ see manufacturer´s instructions

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15.3.2.1 Horizontal installation position

Minimum distance	Maximum number of fieldbus channels used per device	Maximum voltage of fieldbus circuits	Maximum permissible ambient temperature T_a
0 mm	4	32 VDC	55 °C
0 mm	2	24 VDC	60 °C
17.5 mm	4	32 VDC	65 °C
17.5 mm	2	24 VDC	70 °C

15.3.2.2 Vertical installation position

Minimum distance	Maximum number of fieldbus channels used per device	Maximum voltage of fieldbus circuits	Maximum permissible ambient temperature T_a
0 mm	4	32 VDC	40 °C
0 mm	2	24 VDC	50 °C
17.5 mm	4	32 VDC	55 °C
17.5 mm	2	24 VDC	60 °C

16 **Report Number**

BVS PP 15.2105 EU, as of 2021-08-11

17 **Special Conditions for Use**

17.1 Transient protection shall be provided that is set at a level not exceeding 140 % of the peak rated voltage value at the supply terminals to the equipment.

17.2 The equipment has to be installed in a protective enclosure which meets the requirements for resistance to impact and IP54 defined in EN 60079-0 clause 26.4.

17.3 Before the first use of the device one marking field (Ex ec IIC T4 Gc or Ex ec [ic] IIC T4 Gc) has to be selected and marked; once the device has operated at non-intrinsically safe fieldbus circuits it may not operate at intrinsically safe fieldbus circuits without reconsideration by the manufacturer.

17.4 The ambient temperature range depends on various installation conditions of the devices; see manufacturer's instructions.

17.5 The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1.

18 **Essential Health and Safety Requirements**

The Essential Health and Safety Requirements are covered by the standards listed under item 9.

19 **Drawings and Documents**

Drawings and documents are listed in the confidential report.

We confirm the correctness of the translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

DEKRA Testing and Certification GmbH
Bochum, 2021-08-11
BVS-Pe/Mu A20210732

Managing Director

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12 UL Certificate of Compliance

CERTIFICATE OF COMPLIANCE

Certificate Number	20151215-E356500
Report Reference	E356500-20151214
Issue Date	2015-DECEMBER-15
Issued to:	SOFTING AG RICHARD-REITZNER-ALLEE 6 85540 HAAR GERMANY
This is to certify that representative samples of	PROGRAMMABLE CONTROLLERS FOR USE IN HAZARDOUS LOCATIONS Class I, Division 2 Groups A,B,C and D. Enclosed Type Fieldbus Gateways Model – FG-200 HSE/FF Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	ANSI/ISA 12.12.01, Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations CAN/CSA C22.2 No. 213-15, Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

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13 Declarations of conformity

This device is compliant with EC directive 2014/30/EG, "Electromagnetic Compatibility" (EMC directive) and meets the following requirements:

- EN 55011 Industrial, scientific and medical (ISM) devices - radio disturbance - limits and methods of measurement
- EN 55032 Electromagnetic compatibility of multimedia equipment (MME) and interference emission
- EN 61000-6-4 Electromagnetic compatibility (EMC); Part 6-4: generic standard – emission for industrial environments
- EN 61000-6-2 Electromagnetic compatibility (EMC); Part 6-2: generic standard - immunity for industrial environments

Note
To fulfill the EMC requirements, the other components of your installation (DC adapter, Industrial Ethernet devices, etc.) also have to meet the EMC requirements. A shielded cable must be used. In addition, the cable shield must be grounded properly.

CAUTION
This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures!

CE
A Declaration of Conformity in compliance with the above standards has been made and can be requested from Softing Industrial Automation.

RoHS
This product is RoHS compliant.

FCC
This equipment has been tested and found to comply with the limits for a Class A digital device, under part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

VCCI
This Class A product conforms to the regulations of Voluntary Control Council for Interference (VCCI) by Information Technology Equipment.

WEEE
Electrical and electronic equipment must be disposed of separately from normal waste at the end of its operational lifetime. Packaging material and worn components shall be disposed of according to the regulations applicable in the country of installation.

EU-Konformitätserklärung
EU Declaration of Conformity

softing

Wir
We

Softing Industrial Automation GmbH
Richard-Reitzner-Allee 6
D-85540 Haar

erklären hiermit in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product

Modell / Typ
Model / Type

FG-200 HSE/FF (GLA-EK-024102) V1.01 / V1.02 / V1.04
FG-200 HSE/FF (GLA-EK-024103) V1.01 / V1.02 / V1.04

mit den Anforderungen der folgenden Richtlinien übereinstimmt
complies with the requirements of the following directives:

ATEX-Richtlinie 2014/34/EU
ATEX directive 2014/34/EU
EMV Richtlinie 2014/30/EU
EMC directive 2014/30/EU
ROHS-Richtlinie 2011/65/EU, ergänzt um Delegierte Richtlinie (EU) 2015/863
ROHS directive 2011/65/EU, amended by commission delegated directive (EU) 2015/863

Angewandte harmonisierte Normen
Applied harmonised standards:

EN IEC 60079-0:2018
EN 60079-11:2012
EN IEC 60079-7:2015/A1:2018
EN 55011:2016, Class A
EN 55032:2015
EN IEC 61000-6-2:2019
EN IEC 61000-6-4:2019
EN IEC 63000:2018

Haar, 3.11.2025
Ort, Datum
Place, Date

Geschäftsführer
Managing Director

Template: V1.11

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Version: 1.07

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