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The Lonbox[®] PFG4000 Users Guide

*Fidelio Hotel Booking Gateway for
LonWorks Installations*

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Document No. 02-PFG4000-03

This manual is intended for use with the Lonbox® PFG4000 software version 1.0 release date February 2005

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The Lonbox[®] PFG4000 Users Guide

A Fidelio Hotel Booking gateway for LONWORKS control networks.

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Abstract

This document describes the function of the Prolon Lonbox[®] PFG4000 Fidelio Gateway. The PFG4000 is a device for LonWorks installations; it implements a protocol for the Fidelio Hotel booking systems. Through the interface to the Fidelio system, the gateway will monitor the room booking status and send occupancy status for each room to the individual room on the LonWorks[®] network.

Through the use of the PFG4000 gateway it is possible to save energy, by making the room controllers use different control algorithms and setpoints when a room is unoccupied.

The reader of this document should have technical knowledge about LonWorks installations.

Introduction

This chapter provides an introduction and overview for the Lonbox[®] PFG4000 Fidelio Hotel Booking Gateway.

The purpose of the Lonbox[®] PFG4000 gateway is to monitor the room occupancy status indicated from the Fidelio Hotel Booking system, and to inform the room HVAC controllers of the current room status.

The Lonbox[®] PFG4000 provides the following features.

- Embedded Fidelio Interface Protocol for interfacing the booking system
- Signaling of room occupancy status for each room using standard LonMark[®] network variables types
- Statistic and service information in network variables and on embedded web page

The Lonbox® PFG4000 is available in different models depending on installation size.

- Installation up to 100 rooms (model PFG4000-100)
- Installation up to 200 rooms (model PFG4000-100)
- Installation up to 400 rooms (model PFG4000-100)

If larger installation is required please contact Prolon Control Systems.

Connections

The interface to the Fidelio system is based on a serial RS232 communication port with a proprietary Fidelio protocol (FIAS). The Lonbox® PFG4000 gateway uses a standard DB-9 serial connector to the Fidelio Interface. The Fidelio Interface should be configured to run 9600 baud, no priority, 1 stop bit, and hardware handshake. (9600, N, 8, 1 + RTS/CTS)

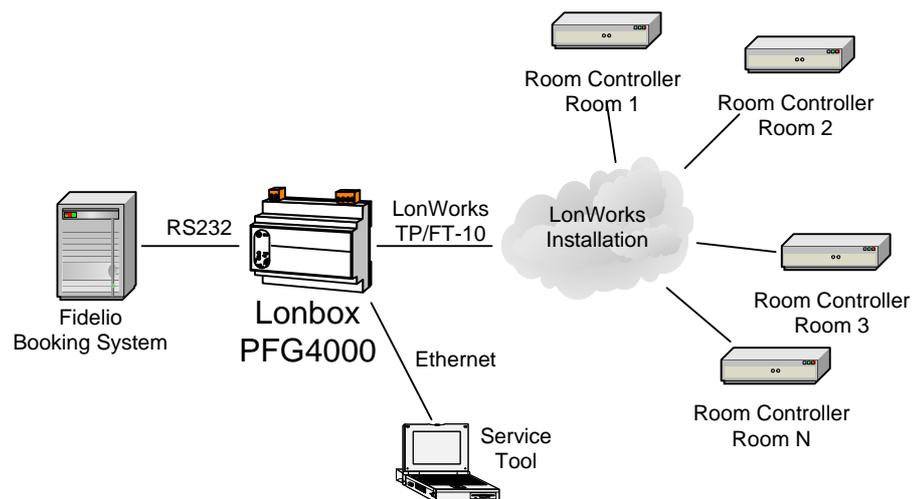


Figure 1 System Connection Overview

The communication with the building automation system is based on standard LonWorks communication. The interface on the PFG4000 is a free-topology FT/TP-10 interface implementing a LonMark functional block for each room in the system.

In addition the PFG4000 also includes an Ethernet 10/100 interface that optionally can be used to view status and diagnostics information.

Fidelio Interface

The protocol described by Fidelio contains three layers, in the following referred to as the physical layer, link layer and application layer, the Lonbox® PFG4000 implementation of

these protocols are based on the protocol specification versions listed in the references section. The protocol between Fidelio and the interfaces system is bi-directional.

Physical Layer

The physical layer is based on a serial point-to-point communication line following the RS-232C electrical interface standard. The PFG4000 is configured with a fixed communication setting and the Fidelio Interface should be configured according to this. The communication settings used are:

| | |
|-------------|-----------|
| Baud rate: | 9600 baud |
| Parity | None |
| Data bits | 8 |
| Stop bit(s) | 1 |
| Handshake | Hardware |

The cable that should be used is a so called “null-modem” cable; the specification for this is listed under “mounting” and should implement connections for hardware handshake.

Link Layer

The link layer is a simple protocol with the purpose of ensuring that data is delivered as expected to both sides of the communication. The link layer is capable of signaling packet errors and retransmission of packets. This layer is fully implemented in the gateway application.

Application Layer

On startup the application runs a sequence that establishes a connection between the Fidelio system and the Lonbox® PFG4000 gateway. This startup sequence is handled using the application layer Link Control commands LS, LA, LE, LR and LD.

In the startup sequence the gateway will provide information about interface type and requested information from the booking system. The startup sequence is not available for configuration, but is made so that the Fidelio system will send the information required for the gateway functionality.

The room occupancy status is maintained in the gateway by monitoring for guest check-in and guest checkout records (GI / GO).

It is important the GO (guest out) message from the Fidelio system contains the GS (guest share) information. The message will not be considered valid if the information is transmitted from Fidelio.

After the startup the Fidelio interface will update the gateway with relevant information. When the gateway is restarted or if any other need for an updated room status is needed, the gateway will request a resynchronization from the Fidelio interface. This capability is provided by the Fidelio interface by the means of the DR, DS and DE application layer commands.

The Fidelio communication link is periodically monitored with Link Alive packets. If the communication link is not functional, the updates of occupancy status on the network will

stop. In case the individual controller's uses receive heartbeat, they will be able to fall back into default mode if communication with the Fidelio system is lost.

LonWorks® Interface

Each zone controller in the installation that should be interfaced needs to implement a network variable input for either a scheduler or an occupancy sensor. These network interfaces is described in several LonMark standard documents and is based on the standard network variable type SNVT_toc_event or SNVT_occupancy. This document has been based on the definitions described in the LonMark functional profile Unit Ventilator Controller 8080.

The interface provides means for sending both a current occupancy status for the room through the SNVT_occupancy variable, and for scheduling the next occupancy status through the SNVT_tod_event variable. We are not in the current implementation using the scheduling option; this is because the Fidelio interface does not provide the required information to schedule future occupancy changes.

The Lonbox® PFG4000 implements a LonMark Object (function block) for each room. Each of the function blocks contains two network variable outputs. Depending on the room controller implementation one of these should be bound to the room controller. Additionally each room has a location configuration property (nciRoomLocation). This location should be configured with the same room number as indicated by the Fidelio system. The room number received from Fidelio can be filtered for white spaces and for alphanumeric characters before trying to match a room number with a location of a node on the LonWorks® net.

Note that normally the **Lonbox Resource Files** should be installed on the computer used as network management tool. This is required because some user defined configuration types are required to configure the PFG4000. The LonMark resource files can be downloaded from the www.prolon.dk website.

Mounting

Mechanical

The PFG4000 is mounted in a plastic 9 module gray DIN-rail enclosure M36.



Figure 2 PFG4000 Picture

Connection

Cable entries and screw terminals are reached from outside the housing. The module can be power from either AC or DC as defined in the table below. Only one power source should be connected to the module.

Terminals

6 screw terminals are available for Power Supply and LonWorks connection, one DB9 male connector is available for serial interface to Fidelio, and one RJ-45 connector for the Ethernet connections.

The terminals have a rated cross section of 2.5 mm² single wired or 1.5 mm² fine wired.

Table 1 Screw terminals

| Name | N o. | Type | Function |
|-----------|------|--------------------|-------------------------------------|
| TP/FT-10 | 1 | Communication line | Network port polarity insensitive |
| TP/FT-10 | 2 | Communication line | Network port polarity insensitive |
| 0V | 3 | Power | DC input, ground |
| AC | 4 | Power | AC input, 8-24V |
| +VDC / AC | 5 | Power | DC input, 12-30V or AC input, 8-24V |
| Ground | 6 | Power | Ground |

The DB9 connector is a standard RS232 serial connector. The cable connected between a PC and the PFG4000 should be a so called null modem cable including hardware handshake lines.

The pin layout on the following figure is seen from the outside of the Lonbox® PFG4000 node.

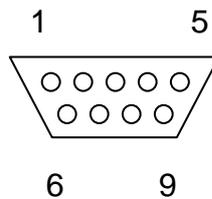


Figure 3 Serial DB9 RS232 Connector

Table 2 Pin layout for RS232 connection

| Name | Pin | Direction | Full name | Remark |
|------|-----|-----------|---------------------|-----------------|
| TxD | 3 | Output | Transmit data | Data |
| RxD | 2 | Input | Receive data | Data |
| RTS | 7 | Output | Request to send | Handshaking |
| CTS | 8 | Input | Clear to send | Handshaking |
| DTR | 4 | Output | Data terminal ready | Status |
| DSR | 6 | Input | Data set ready | Status |
| RI | 9 | Input | Ring indicator | Status |
| DCD | 1 | Input | Data Carrier Detect | Status |
| GND | 5 | NA | Signal ground | Reference level |

Network Interface

The module contains eight LonMark® Objects or Functional Blocks. The standard node object used for generic control and status information from the node. A gateway status object allows for configuration and monitoring of the gateway status.

The device contains the following function blocks (LonMark objects)

- Node Object
- Booking Interfaces (one for each room)

Node Object

This is the generic node object required by the LonMark® standard. The only function in addition to the required status functions available through the node is the alarm status bit signal.

The configuration and functionality of the interface to Fidelio and the Ethernet is configured through the node object.

Object Request

network input SNVT_obj_request nviRequest;

The input network variable provides the mechanism to request a particular mode for a particular object within the node. The only supported request codes are RQ_REPORT_MASK and RQ_UPDATE_STATUS.

Object Status

network output SNVT_obj_status nvoStatus;

The output network variable reports the status for any other object on the node. In the PFG4000 no status except for the minimum required are reported through the status variable.

Data are transmitted whenever a value is received on the Object Request input.

Alarm Flags

network output SNVT_state nvoAlarmFlags;

The following bit flags are signaled for different alarm conditions in the unit.

Table 3 Alarm Signals

| Field | Name | Description |
|-------|----------------------|--|
| Bit 2 | Fidelio link failure | The communication link to Fidelio is in fault state. The last error number from the protocol driver, can be read from the nvoFidelioError network variable. The bit will automatically be reset when communication is reestablished. |

Data is transmitted whenever an alarm flag changes state. The initial state of all the alarm flags is OFF/FALSE.

Version Information

SCPTdevMajVer configuration implemented through network variable nciDevMajVer contains the major version number of the device.

SCPTdevMinVer configuration implemented through network variable nciDevMinVer contains the minor version number of the device.

SCPTobjMajVer configuration implemented through network variable nciObjMajVer contains the major version number of the function block.

SCPTobjMinVer configuration implemented through network variable nciObjMinVer contains the major version number of the function block.

Ethernet Configuration

UCPTipAddress configuration implemented through network variable nciIpAddress contains the IP address of the ethernet interface.

UCPTipGateway configuration implemented through network variable nciIpGateway contains the default gateway for the IP network of the Ethernet interface.

UCPTipMask configuration implemented through network variable nciIpMask contains the mask for the IP interface defining the IP subnet size.

UCPTuseDHCP configuration implemented through network variable nciIpUseDHCP configures if the Ethernet connection should obtain the IP network configuration from a DHCP server. It is not recommended to use DHCP because there is no means for determining the IP address assigned to the PFG4000.

Note that changing the IP settings through the LonWorks interface requires a manual hardware reset after the new configuration has been set.

Send Heartbeat Configuration

config network input SNVT_time_sec nciSntHrtBt

This configuration property defines the maximum period of time that expires before the occupancy state of a room is automatically updated. The status defines the period for a single room and performance considerations should be made. As an example in a 500 room installation, setting the send heartbeat to 2 minutes will generate 4 messages send out on the network every second (500 rooms in 120 seconds).

Remove Whitespace Configuration Input

UCPTrmvWhitesp configuration property SNVT_lev_disc nciRmvWhitesp

When the value is different from ST_OFF the gateway will remove any white space characters from the location received from Fidelio before processing the location.

Remove Alphanumeric Characters Configuration Input

UCPTrmvAlphaChar configuration property SNVT_lev_disc nciRmvAlphaChar

When the value is different from ST_OFF the gateway will remove any alphanumeric characters from the location received from Fidelio before processing.

Room Update Values

These configuration variables define what values will be send to the room controllers on guest check-in and check out.

UCPTcheckInVal implemented in the network variable nciCheckInVal defines the occupancy signal value transmitted to the room controller when a guest check in signal is received. Default value is OC_OCCUPIED.

UCPTcheckOutVal implemented in the network variable nciCheckOutVal defines the occupancy signal value transmitted to the room controller when a guest check out with no guest share signal is received. Default value is OC_UNOCCUPIED.

Room Update Heartbeat

SCPTmaxSendTime configuration property implemented in nciMaxSendTime defines the heartbeat rate used to update the room status of each room. The rate defines the update rate between each update the rooms will be updated in a round robin manner.

That the total number of rooms in combination with this configured rate will influence the minimum receive heartbeat of the room controller.

Synchronization with Fidelio

These configuration properties will define when a complete synchronization off room status with be requested from the Fidelio system.

UCPTsynqAfterFail; if true a synchronization will be requested after a protocol failure has occurred.

UCPTsynqOnAlive; if true synchronization will be requested after a link alive signal is received from Fidelio.

UCPTsynqOnReset; if true synchronization will be requested after a reset of the PFG4000 gateway.

UCPTsynqOnStart; if true a synchronization will be requested after a link start signal is received from Fidelio.

Booking interface

Each booking interface can be enabled and disabled through the use of the RQ_ENABLE and RQ_DISABLED commands available through the node object nviRequest variable.

Occupancy Sensor Signal

network output SNVT_occupancy nvoOccup;

The values send when a guest check-in or check-out occurs is configured in the UCPTcheckInVal and UCPTcheckOutVal configuration properties of the node object.

Updated when status is changed based on signals received from the Fidelio system and updated with the rate defined by the SCPTmaxSendTime configuration property on the node object.

Occupancy Scheduler Signal

network output SNVT_tod_event nvoTodEvent;

The value send in the current_state and next_state fields are always the same as and the time_to_next_state is always zero.

The values send when a guest check-in or check-out occurs is configured in the UCPTcheckInVal and UCPTcheckOutVal configuration properties of the node object.

Updated when status is changed based on signals received from the Fidelio system and updated with the rate defined by the SCPTmaxSendTime configuration property on the node object.

Room Location

UCPTroomLocation configuration property should be configured with room number matching the room number send by the Fidelio system.

HTTP Web Server

The PFG4000 has a build-in web server. This server and the embedded web page can be used for service monitor and troubleshooting purpose.

To access the information page, open a internet browser and type in the address of the PFG4000. The default IP address is 192.168.1.100 but the address can be changed through the LonWorks interface Node Object function block. If you cannot get access on the default address, use you LonWorks tools to find the current address. Note that changing the IP settings through the LonWorks interface requires a manual hardware reset after the new configuration has been commissioned.

The screenshot shows the 'Lonbox® Series Web Server' interface. At the top, there is a status section with the following information:

| Status | Resync Status |
|--------------------|---|
| Fidelio Link | OK - Fidelio link is active |
| LonWorks Interface | OK - LonWorks interface is Configured, Online |
| Application | OK - 2 rooms are enabled |

Below the status section is a 'Summary' section:

| | |
|------------------------|---------------------|
| Last Link Alive signal | 2005-02-23T16:36:23 |
| Last Link Start signal | 2005-02-23T16:36:23 |

The main part of the page is a log table with the following columns: Timestamp, Type, Category, Event, and Detail.

| Timestamp | Type | Category | Event | Detail |
|---------------------|-------------|-------------|-----------------|---------------------------------|
| 2005-02-23T16:36:02 | Information | Datalink | Received | LE DA050223 TI163603 |
| 2005-02-23T16:36:03 | Warning | Application | Link stopped | |
| 2005-02-23T16:36:22 | Information | Datalink | Received | LS DA050223 TI163623 |
| 2005-02-23T16:36:23 | Information | Datalink | Transmitted | LD DA050223 TI163623 V#1.0 IFEM |
| 2005-02-23T16:36:23 | Information | Datalink | Transmitted | LR RIGI FLRNG#GS |
| 2005-02-23T16:36:23 | Information | Datalink | Transmitted | LR RIGI FLRNG#GS |
| 2005-02-23T16:36:24 | Information | Datalink | Transmitted | LA DA050223 TI163623 |
| 2005-02-23T16:36:24 | Information | Datalink | Received | LA DA050223 TI163623 |
| 2005-02-23T16:36:23 | Information | Datalink | Received | GI RN201 G#22 GSN |
| 2005-02-23T16:36:23 | Information | Application | Room occupied | 201 |
| 2005-02-23T16:36:24 | Information | Datalink | Received | GI RN201 G#21 GSY |
| 2005-02-23T16:36:24 | Information | Application | Room occupied | 201 |
| 2005-02-23T16:36:28 | Information | Datalink | Received | GI RN202 G#22 GSN |
| 2005-02-23T16:36:28 | Information | Application | Room occupied | 202 |
| 2005-02-23T16:36:29 | Information | Datalink | Received | GO RN201 G#22 GSY |
| 2005-02-23T16:36:30 | Information | Datalink | Received | GO RN202 G#22 GSN |
| 2005-02-23T16:36:30 | Information | Application | Room unoccupied | |
| 2005-02-23T16:36:44 | Information | Datalink | Transmitted | DR DA050223 TI163644 |
| 2005-02-23T16:36:44 | Information | Datalink | Received | DS DA050223 TI163646 |
| 2005-02-23T16:36:45 | Information | Datalink | Received | GI RN201 G#21 GSN |
| 2005-02-23T16:36:45 | Information | Application | Room occupied | 201 |
| 2005-02-23T16:36:46 | Information | Datalink | Received | GO RN202 GSN |
| 2005-02-23T16:36:46 | Information | Application | Room unoccupied | 202 |
| 2005-02-23T16:36:46 | Information | Datalink | Received | DE DA050223 TI163648 |

At the bottom of the page, it says: 'Lonbox PFG4000 Version 1.00 Copyright (c) 2005 Prolon Control Systems'.

Figure 4 Information Web Page

In the top of the screen status and summary information are shown. Below this is a trace of messages from the different parts of the PFG4000 application.

The tree lines of status should all show “OK” if the gateway is operational.

Link alive and link start information is showing the time that these two message types were last received from the Fidelio Interface. It is possible that the gateway is operational

even if these messages were never received. Especially the link start is not received if the PFG4000 was the last device that was reset.

When troubleshooting the operation, look for trace messages with type “Error” or “Warning”. As an example an “Error” type message will be traced if the Fidelio Interface is sending guest check in information for a room where the room number cannot be found in any of the configured booking interface function blocks.

Note that the trace information is not stored in persistent memory and will be lost when the PFG4000 is reset.

The “Resync Status” button can be used to request an update of room status from the Fidelio system. When the button is pressed, the PFG4000 will send a data request message to the Fidelio Interface.

The embedded web server is supporting standard HTTP 1.1 protocol and is configured to use port 80.

FTP Functions

The PFG4000 has a build-in FTP server. This server is used to up-date the firmware.

Connection to the FTP server

To connect to the FTP server you can to use the build-in FTP client in the MS Windows operating systems, as WIN98, Windows 2000 and Windows XP. You need to be connected either via the Ethernet connector or have a PPP connection on a dial- up connection, PSTN, GSM or GPRS.

The PFG4000 FTP Server do not support passive mode and advanced list commands.

```

C:\>ftp
ftp> open 192.168.1.3
Connected to 192.168.1.3.
220 NET+ARM FTP Server 1.0 ready.
User <192.168.1.3:<none>>: Admin
331 User Admin OK, send password.
Password:
230 Password OK.
ftp>

```

Figure 5 FTP client prompt

The MS FTP client is used in the command prompt window and started using the following command:

FTP

Hereafter you need to connect to a specific data logger using the IP address, with the following FTP client command:

OPEN xxx.xxx.xxx.xxx

The *xxx.xxx.xxx.xxx*. represent an IP Address for a data logger. Hereafter the server request a username and a password. These account parameter can be changed from the PFG4000 WEB pages.

The default user is:

Admin

And the password is:

admin

For more details about the FTP client in Windows, please consult the MS Windows manuals or help files.

Firmware update

To update the firmware in the PFG4000 data logger you use the following FTP client commands

When first connected with the FTP client you are located in the FLASH0 partition. The firmware binary image file *image.bin* shall be put into the partition named RAM0. To change the partition, use the *CD* command with the following option:

```
“cd \RAM0”
```

With the *PUT* command you transfer a file from your local disk to the PID4000 WEB Server unit.

```
“put image.bin”
```

When this command completes, write “bye” to disconnect and wait for the PID4000 WEB Server to restart.

Electrical Specifications

| Tekniske data: | PFG4000 |
|-----------------------|---|
| LonWorks® topology: | TP/FT-10 |
| Transceiver: | FT-X1 |
| Neuron-Chip: | FT3120E4, 10MHz |
| Main processor: | ARM 32-bit RISC |
| Prog. Memory: | 4 Mbyte Flash |
| Memory: | 8Mbyte SDRAM |
| Data Memory: | 2 Mbyte Flash |
| Ethernet: | RJ45 10/100 Mbit TCP/IP protocol |
| Serial Port: | RS232C |
| Control Indicators: | Neuron state function, modem status, I/O status, Link and 100Mb in Yellow. Green Supply |
| Service Switch: | Neuron service Pin |
| Supply: | 12 - 30Vdc 8 - 24Vac |
| Consumption | Max. with modem, 350 mA @ 24Vdc 300 mA @ 24Vac |
| EMC immunity: | IEC 61000-6-2 |
| EMC emission: | EN 50081-2 |
| Safety: | EN 60950 |
| Operating temp.: | 0 til 45°C |
| Storage temp.: | -20 til 70°C |
| Size: | L x H x W 157 x 58 x 90+con. mm |
| Weight | 261g |

References

- *LonMark™ Functional Profile: 8080 Unit Ventilator Controller 8080 Version 1.0*
- *Micros Fidelio: Interface Protocol Specification V1.12 February 1998*
- *Micros Fidelio: Interface Application Specification V1.11 January 1998*
- *LonMark™ Application Layer Interoperability Guidelines*
- *LonWorks™ Custom Node Development engineering bulletin*
- *Motorola LonWorks technology device data*
- *EN 50081-1, Electromagnetic emission*
- *EN 50082-1, Electromagnetic immunity*
- *LonWorks® FTT-10A Free Topology Transceiver User's Guide*