LON bus

POL635 + POL906   POL635 + POL906

Climatix™
LON communication with POL906.00
Integration guide

IV PRODUKT
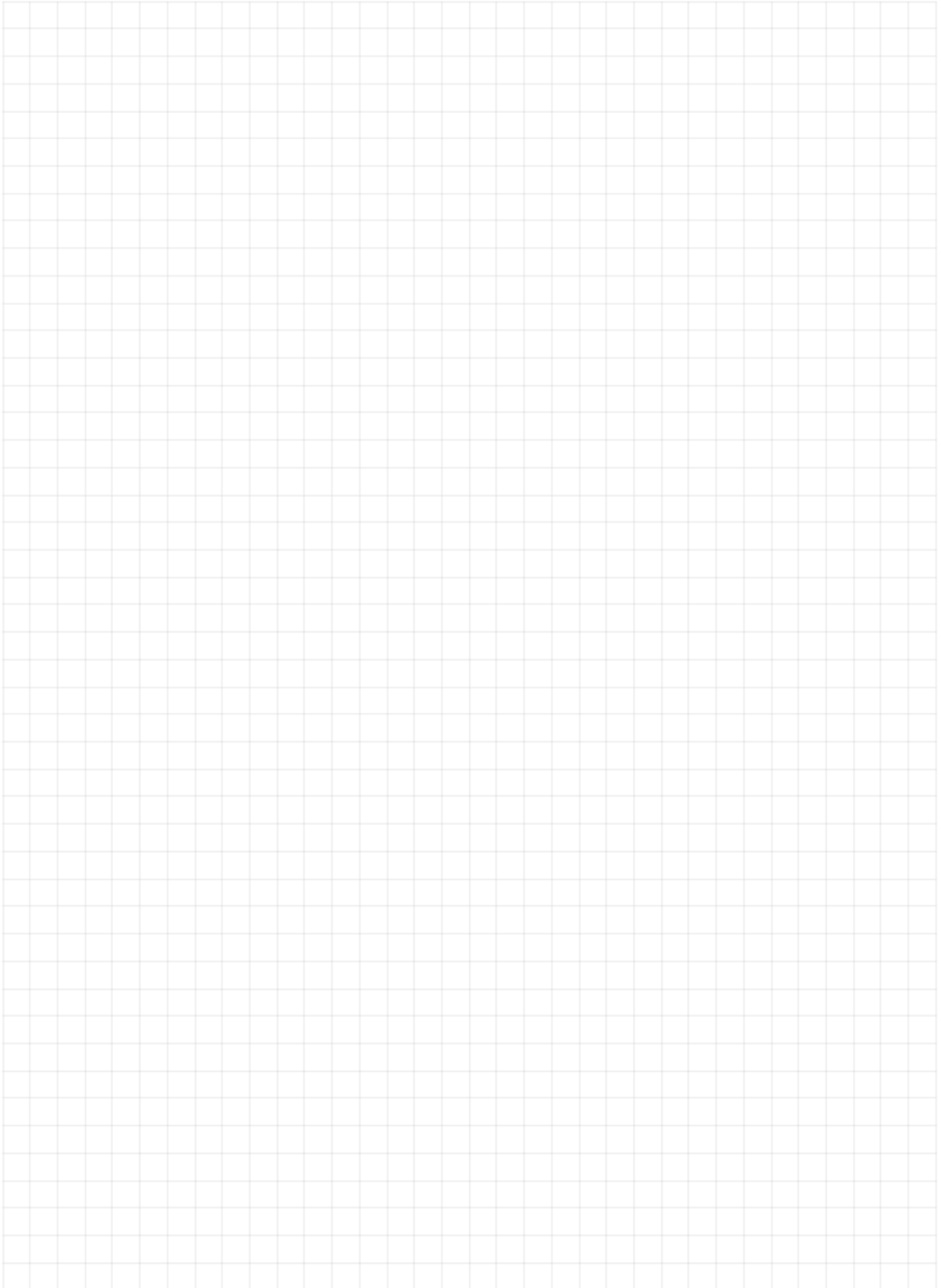
Air handling with the focus on LCC

LON communication with POL906.00 – Integration guide

Contents

LON communication with POL906.00 – Integration guide

1 About this document

1.1 Revision history

Version	Date	Changes	Section	Pages
	20.08.2010	First edition		
Validity	14.09.2010	Software service pin	3.2 / 4.2	15 / 17

1.2 Before you start

Product versions

This document applies to the following products:

Name	Type (ASN)	Short name
LON communication module	POL906.00/STD	LON module

Target audience

Description and functional scope of the products are based on the Climatix Valid Version Set 8.0 or higher and application based on Siemens standard.

Prerequisites

This document is intended for the following audience:
- LON system integrators
- Measuring and control engineering staff
- Sales and commissioning staff

The above target audience:
- Has general professional knowledge on planning and commissioning HVAC technology measuring and control solutions.
- Has basic knowledge of LON.

Further information
- Has the additional SNVTs documentation for the specific product.

1.3 Reference documents

The following documents contain additional information on the products described in this manual:

Document	Order no.
Data sheet "Communication module LON"	CB1Q3931en
Basic documentation "LON communication module"	CB1P3931en
SNVTs "LON communication with POL906.00" Note! Unique documentation for each application.	CB1Y3965en
Basic documentation "Standard Application AHU"	CB1P3977en

1.4   Document conventions

Symbols used

Below is an overview of all symbols used in this document denoting risks or important information:

⚠ This symbol draws your attention to special safety notes and warnings. Failing to observe these notes may result in injury and/or serious damages.

🛑 This symbol denotes special information that, when failed to observe, may result in faulty functionality *or loss of data*.

ℹ️ Notes with this symbol provide important information that requires appropriate attention.

💡 This symbol marks passages containing tips and tricks.

Abbreviations

The following abbreviations are used in text and illustrations:

Abbreviation	Meaning
BACS	**B**uilding **A**utomation and **C**ontrol **S**ystem
BSP	**B**oard **S**upport **P**ackage (operating system)
Climatix	Controller family with common tools
CPT	**C**onfiguration **P**roperty **T**ype (LON)
FTT-10A	**F**ree **T**opology **T**ransceiver for channel type TP/FT-10 (LON)
HMI	**H**uman **M**achine **I**nterface, e.g. Operator unit
HMI-DM	Climatix **D**ot **M**atrix HMI, POL895.51
HVAC	**H**eating, **V**entilating, **A**ir **C**onditioning
LON	Local Operating Network
LNS	**L**onWorks **N**etwork **S**ervice (LON interface)
MS	**M**anagement **S**tation
NV	**N**etwork **V**ariable (LON)
SELV	**S**afety **E**xtra-**L**ow **V**oltage
SNVT	**S**tandard **N**etwork **V**ariable **T**ype (LON)
TP/FT-10	Physical channel to transmit data over **T**wisted **P**air to **F**ree **T**opology networks.

1.5   Important information on safety

Field of application

Use LON communication modules only for control and monitoring.

Intended use

Trouble-free and safe product operation of the above products presupposes transport, storage, mounting, installation, and commissioning as intended as well as careful operation.

Electrical installation ⚠

Fuses, switches, wiring and grounding must comply with local safety regulations for electrical installations.

Wiring ⚠

When wiring, strictly separate AC 230 V mains voltage from AC 24 V safety extra-low voltage (SELV) to protect against electrical shock!

Commissioning and maintenance

Only qualified staff trained accordingly may prepare for use, commission, and maintain LON communication modules.

Maintenance

Maintenance of Climatix controller and LON communication modules generally only means regular cleaning. We recommend removing dust and dirt from system components installed in the control panels during standard service.

Faults ⚠

Only authorized staff may diagnose and correct faults and recommission the plant. This applies to working within the panel as well (e.g. testing or changing fuses).

Storage and transport

Refer to the environmental conditions specified in the respective data sheets for storage and transport.
If in doubt, contact your supplier.

Disposal

Devices contain electrical and electronic components; do not dispose of them in household garbage.
Observe all local and applicable laws.

1.6 Trademarks and copyrights

Trademarks, legal owners

The table below lists the third-party trademarks used in this document and their legal owners. The use of trademarks is subject to international and domestic provisions of the law.

Trademarks	Legal owner
LonLink™ LON® / LonManager® LonMark® LonTalk® LonWorks®	Echelon Corporation
Microsoft …	Microsoft Corporation see http://www.microsoft.com/TRADEMARKS/t-mark/nopermit.htm
Neuron®	Echelon Corporation

All product names listed in the table are registered (®) or not registered (™) trademarks of the owner listed in the table. We forgo the labeling (e.g. using the symbols ® and ™) of trademarks for the purposes of legibility based on the reference in this section.

Copyright

This document may be duplicated and distributed only with the express permission of Customer!!, and may be passed on only to authorized persons or companies with the required technical knowledge.

1.7 Quality assurance

Document contents

These documents were prepared with great care.
- The contents of all documents are checked at regular intervals.
- All necessary corrections are included in subsequent versions.
- Documents are automatically amended as a consequence of modifications and corrections to the products described.

Please make sure that you are aware of the latest document revision date.

1.8 Document use/ request to the reader

Request to the reader

Before using our products, it is important that you read the documents supplied with or ordered at the same time as the products (equipment, applications, tools etc.) carefully and in full.
We assume that persons using our products and documents are authorized and trained appropriately and have the technical knowledge required to use our products as intended.
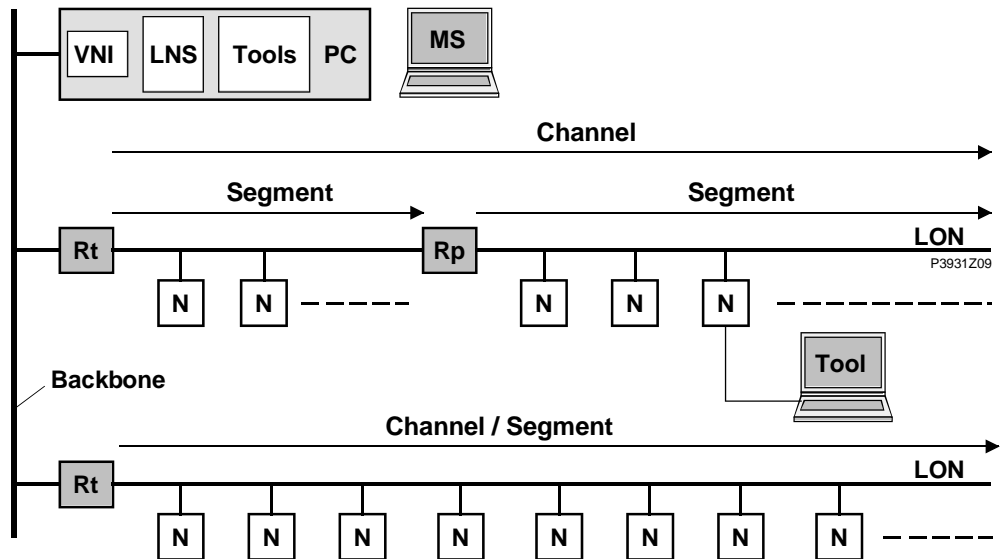
Exemption from liability

Customer!! assumes no liability to the extent allowed under the law for any losses resulting from a failure to comply with the aforementioned points or for the improper compliance of the same.

2 LON networks

2.1 General design

Physical design

The figure shows the physical design for a general LON network:

P3931Z09

Elements

Displayed elements:

Element	Explanation
MS	Management station, PC with: VNI (Virtual Network Interface) LNS (LonWorks Network Services) Tools: BAC software, engineering tool (e.g. LonMaker and possibly SCOPE).
Backbone	E.g. Ethernet TCP/IP, interconnects building networks.
Channel	Physical LON transmission channel, e.g. TP/FT-10.
Router (Rt)	Interconnect subnets.
Segment	Physical segment of a channel.
Repeater (Rp)	Interconnect segments. No processing function.
Nodes (N)	LON node: Device with Neuron Chip (controller, interface etc.).
Tool	PC with LON tool (NL220, LonMaker): – Load LON application. – Create bindings.

Logical organization

A LON network is divided into domain, subnet, and node. A logical, unique address (ID) is assigned to each LON node accordingly:

Term	Explanation	ID
Domain	Comprises max. 255 subnets.	$1 \ldots 2^{48}$
Subnet	Comprises max. 127 nodes.	$1 \ldots 255$
Node	Smallest, addressable unit.	$1 \ldots 127$

The address is comprised of: Domain-ID → Subnet-ID → Node-ID.

Assignment in general occurs when the system integrator configures and commissions the network using the LON tool (e.g. LN220, LonMaker).

More information on LON

See www.echelon.com and www.lonmark.org

2.2 Interface and transmission

FTT-10A transceiver

The LON communication module comes with a FTT-10A bus coupling unit.
This "Free Topology Transceiver" for Neuron Chip-based devices was developed by Echelon as a successor to the FTT-10 for simple creation and extension of LonWorks networks with channel type TP/FT-10.

Allowed topologies

The following topologies are possible for devices with FTT-10A transceiver:
- Free topology (including star and ring topologies).
- Line topology (bus topology).

TP/FT-10 channel type

TP/FT-10 stands for "Twisted Pair / Free Topology".
It specifies a physical channel for data transmission to free topology networks using twisted pair at a transfer rate of 78 kbps.
Channel type TP/FT-10 is LonMark®-certified.

Cable types

Echelon allows three cable types for channel type TP/FT-10, including the Category 5 network cable used commonly in building automation and control (TIA 568A Cat-5).

Cat-5 specifications

Unshielded cable, twisted pair with at least 18 beats per meter:

Cross-sectional area	Min. $\varnothing$ 0.5mm, AWG24, 0.22mm²
Impedance	100 Ω +/- 15 % @ f > 1 MHz
Operating capacity between two wires of a pair.	< 46 nF/km
Capacity pair to ground, asymmetric.	< 3.3 nF/km
DC loop resistance	< 168 Ω
Cable length	See section 2.3 "Topologies specifications"

Repeater and router

Repeaters and router are used in the following cases:
- The entire cable length in a physical segment exceeds 450 m (in a free topology) or 900 m (in a line topology).
- The max. possible number of nodes per physical segment is exceeded: 64 nodes with FTT-10A transceivers.

- Each trunk can have max. one physical repeater.
- Repeaters or routers may not be used in a ring topology. They must be placed **before** the network's ring port.

2.3 Topologies specifications

Primary data

Below are the lists of all primary data for individual elements regarding:

- Free topology
- Line topology

The max. distance and length apply to network cables Category 5 (TIA Cat-5) as per section 2.2 "Interface and transmission":

Free topology

Element	Value
Max. distance between the two nodes farthest apart in a given physical segment.	250 m
Max. cable length in a segment. (Total of all lines including lines to room units).	450 m
Max. number of nodes per physical segment. The following formula applies to mixed configurations of FTT-10A and LPT-10 transceivers: (1 x number of LPT-10) + (2 x number of FTT-10A) ≤ 128	64 FTT-10A 128 LPT-10 [*)]
Bus terminator at the busiest point of the physical segment, i.e. the area with the highest network data traffic (e.g. at master).	52.3 Ω (RXZ01.1)

Line topology

Element	Value
Max. cable length per physical segment.	900 m
Maximum stub line length. The same also applies to connections to room units.	3 m
Max. number of nodes per physical segment. The following formula applies to mixed configurations of devices with FTT-10A and LPT-10 transceivers: (1 x number of LPT-10) + (2 x number of FTT-10A) ≤ 128	64 FTT-10A 128 LPT-10 [*)]
Bus terminators at each end of the physical segment.	105 Ω (RXZ02.1) both ends

*) LPT-10: "Link Power Transceiver" by Echelon.
Compatible to FTT-10A. Offers the advantage that voltage supply for nodes can also be run via the bus line. Requires special link-power power supplies.

2.4 Bus termination

Bus terminators

Bus terminators are used for properly terminating a network based on twisted pair-technology with regard to impedance. Use the following terminators in dependence of the topology:

- Free topology:
  1 bus terminator 52.3 Ω (Siemens RXZ01.1) at busiest point of network.
- Line topology:
  2 bus terminators 105 Ω (Siemens RXZ02.1) at both network ends.

Terminators often are integrated in system devices and can be activated via switches or jumpers.
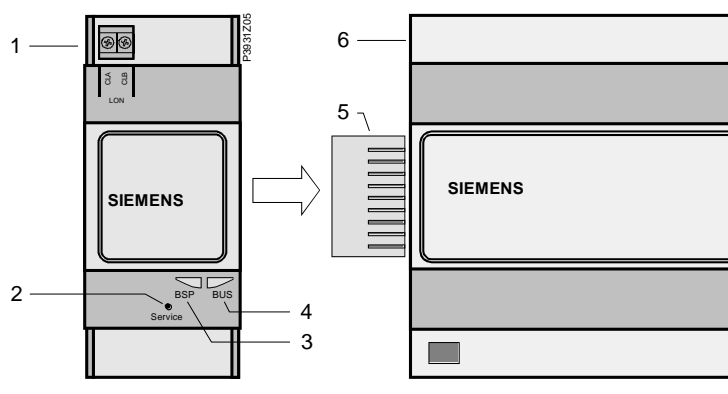
LON communication with POL906.00 – Integration guide
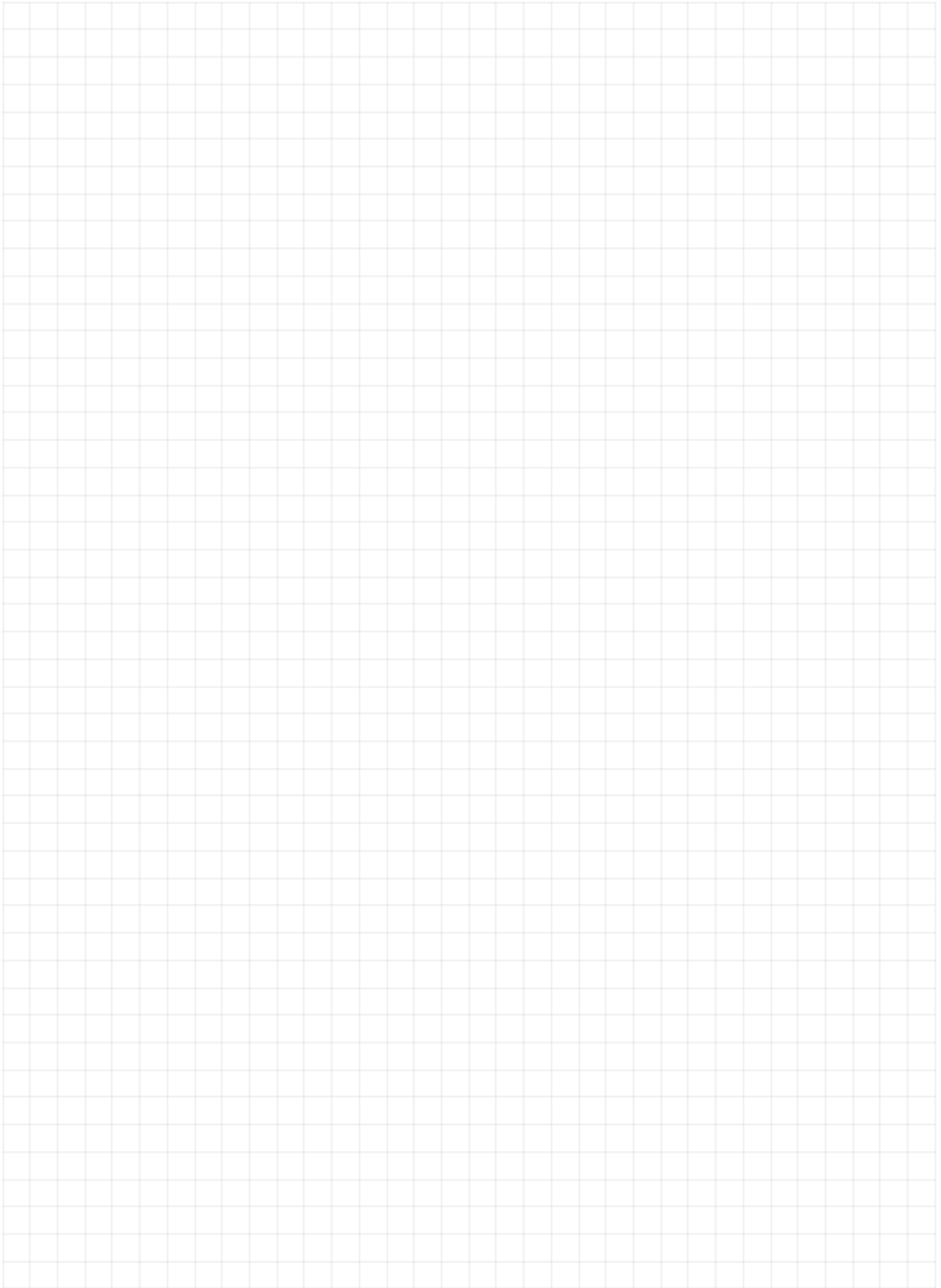
3 Commissioning instructions

3.1 The LON module

Design

The figure shows the LON module. It is connected to the Climatix controller via the internal communication extension bus. This is done via plug connection on the left side of the controller.

Elements and connections

The elements and connections in the figure are:

Pos.	Element / Connection
1	LON interface. Plug connection: Screw/terminal connection.
2	"Service" pin; see section 3.2 "Connect and configure LON module".
3	Status display "BSP" (Board Support Package).
4	Status display "BUS" (bus connections o.k. / bus traffic).
5	Plug connection "Communication extension bus".
6	Climatix controller POL6XX.

Status displays

The status LEDs "BSP" and "BUS" can light red, green and yellow in operation.

"BSP" LED

This LED informs on the status of the "Board Support Package" (BSP). Color and flashing frequency of the LED:

Color	Flashing frequency	Meaning / Mode
Red / Green	1 s "on" / 1 s "off"	BSP upgrade mode.
Green	Steady "on"	BSP operating and communication with controller working.
Yellow	Steady "on"	BSP operating, but no communication with controller.
Red	Flashing at 2Hz	BSP error (software error).
Red	Steady "on"	Hardware fault.

"BUS" LED

This LED shows the status of external communication with the bus, not to the controller. Color and flashing frequency of the LED:

Color	Flashing frequency	Meaning / Mode
Green	Steady "on"	Ready for communication (all parameters loaded, Neuron configured). Does not indicate communication with other devices.
Red	Steady "on"	No communication to Neuron (internal error, could be solved by downloading a new LON application).
Yellow	Steady "on"	Startup
Yellow	Flashing	Communication not possible to the Neuron. The Neuron must be configured and set online over the LON Tool.

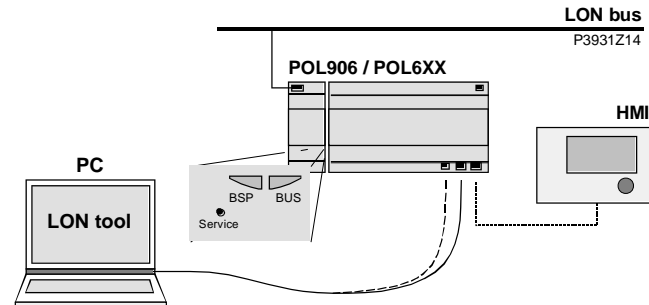Power supply is outside the allowed range if both LEDs are dark.

3.2 Connect and configure LON module

	Prerequisites for connecting and configuring: Working application loaded and started in the Climatix controller.

Devices involved

The Climatix POL6XX controller and the LON module POL906 are involved in this action:

P3931Z14

Tools

Tools used:
– Operator unit (HMI)
– PC with LON tool (NL220, LonMaker).

Connect LON module

Proceed as follows to connect the LON module to the bus:
(see also description and picture in the previous section)

Step	Action Type
1	Controller **OFF**
2	Connect LON module to controller using plug connection.
3	Connect LON bus cable to the module.
4	Controller **ON**: → The module starts / initialization begins. → As soon as the two LEDs "BSP" and "BUS" are steady green, communication with the controller and bus (LON) is active.
5	Carry out a further restart: Switch the power supply **OFF** / **ON**. *Caution!* The controller must be reset a second time to update HMI; prior to parameterization.

Configuration via operator unit

Proceed as follows to configure the LON module:

1	Log in to HMI-DM using the password for level 4 (Service), default 2000.
2	Go to: **Main Index** > **System overview** > **Communication** > **Comm module overview** > **Module[x] LON** > *Note!* [x] is the position of the connected communication module. This is only information used when more than one module is connected.
3	Go to **Settings** > Set up Heart beat and Min send interval if needed. See parameter list on next page.
4	Select **Reset required !!**: When done, restart controller using this command by first going back two pages, with **ESC**, to **Comm module overview**.

After restart, the LON module is configured and ready to use.

Connect and configure LON module, *continued*

Parameter list

The following table lists all LON module parameters which are displayed by the HMI. Menu item:

Main Index > **System overview** > **Communication** > **Comm module overview** > **Module[x] LON**

Parameter	Function
Service pin*	Executes a software trig for the service pin
State	Current status of the communication module
Comm failure	Communications error between module and processor (e.g. no LON application loaded on the Neuron chip).
Location	Displays an information, which may be set at commissioning the bus via LON Chip.
Application	Name of loaded LON image/application (list of LON variable) on the Neuron chip.
Neuron-ID	Displays ID number for the Neuron chips.
Send heart beat	Displays current interval for sending values.
Receive heart beat	Displays current interval for receiving values.
Min send interval	Displays current minimum interval for sending values. A value may only be sent a maximum of one time during this interval.
Settings	Go to settings page to parameterize LON module.
Software version	Module BSP version.
Device ID	Module hardware ID.
Module	Displays module type (e.g. POL906LON).

*New parameter, not included in all versions

LON module parameterization

The following parameters can be set via the HMI. Menu item:

Main Index > **System overview** > **Communication** > **Comm module overview** > **Module[x] LON > Settings**

Parameter	Range	Function
Send heart beat	0…65535 [s]	Set interval for sending values.
Receive heart beat	0…65535 [s]	Set interval for receiving values.
Min send interval	0…65535 [s]	Set minimum interval for sending values.
Use default	– Passive – Active	Reset communication module para-meterization to default setting.

STOP As a matter of principle, the controller must be restarted with "Reset required !!" or power off/on the controller after changing any settings to assume the data.

Connect to the LON bus

Proceed as follows to connect the LON module to the LON bus:

Step	Action Type
1	Generate a new node in the LON tool (preparation).
2	Press the "Service" pin on the LON module or execute the software service pin from the HMI: → The module is recognized and displayed in the LON tool. → All network variables are available.
3	Assign the logical address.

ℹ️ See further instructions how to update the LON module if the application needs another LON application/image than the default ClimatixAHU v1.x.

LON communication with POL906.00 – Integration guide
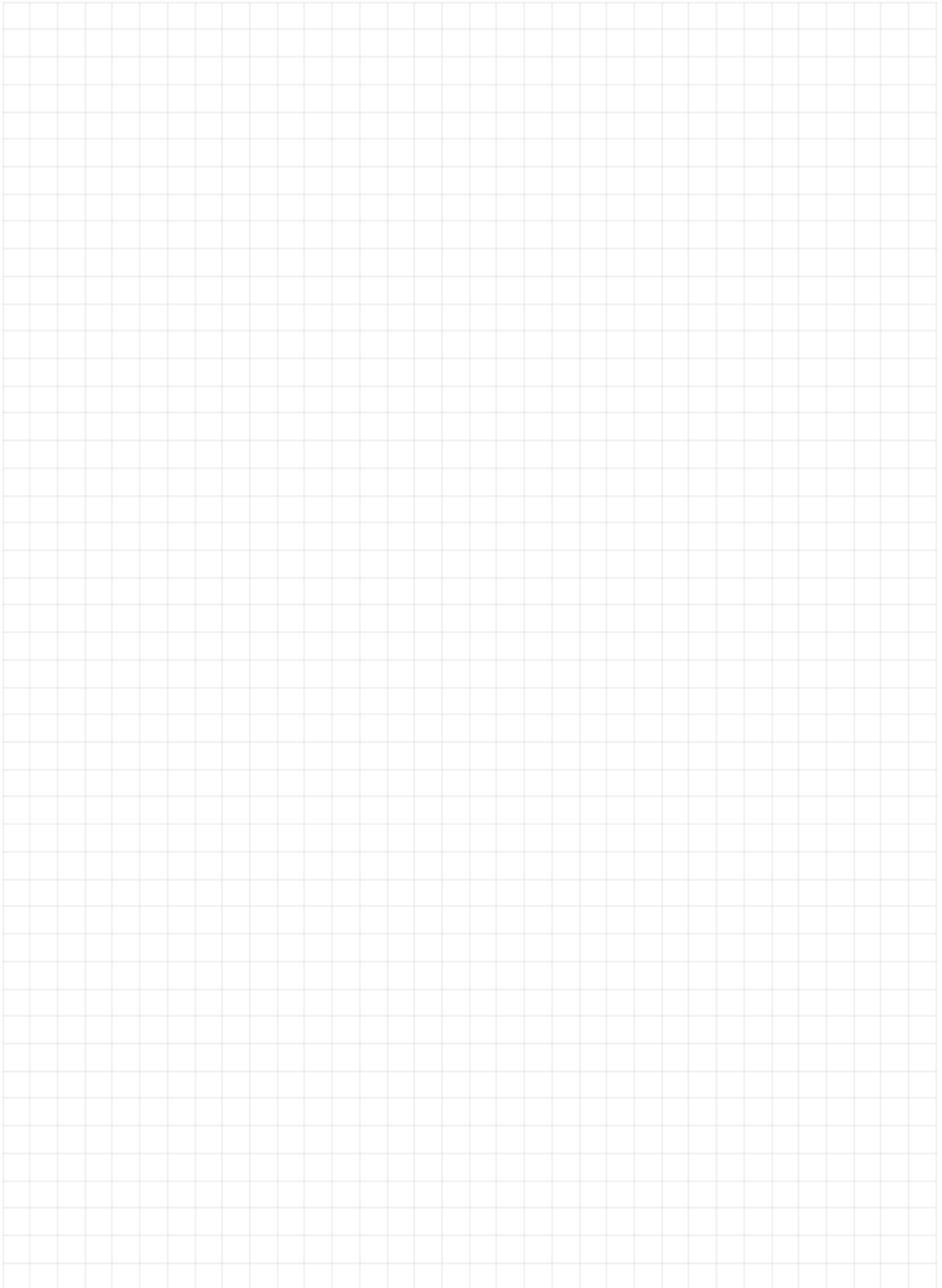
4 Integration

4.1 General

LON image/application XIF file

The LON module's Neuron application supports 62 network variables to integrate controllers in a management station, and allow controllers to exchange data over LON. The LON module is per default loaded with LON image/application set (XIF file) ClimatixAHU V1.x.

Software

A special LON tool (for ex. LN220, LON Maker) must be used to configure the network, bind the variables and to observe the SNVTs. The tool can also be used to download new updated LON images (XIF files) if necessary. To communicate with the LON device the PC must have an LON interface (card) installed as well.

Integration types

The integration can me made using either pooling or binding. A bound system is COV based and the communication is only active at changes.

4.2 Update LON image/application

Update version or SNVT set

The LON image/application can be updated to another version or another SNVT set via the LON tool connected to the LON network. Normally only the XIF file is selected but the whole image/application contains more needed files.

The procedure can be different depending on LON tool so this can not be fully described here.

Update the LON image

Proceed as follows to load the LON module with the needed LON image/application:

Step	Action Type
1	Generate a new node in the LON tool (preparation).
2	Press the "Service" pin on the LON module or execute the software service pin from the HMI: → The module is recognized and displayed in the LON tool. → All network variables are available.
3	Load the individual LON application (file "XY.XIF"). Standard application ClimatixAHU V1.x is loaded by default.
4	Restart the controller with "Reset required !!" or power off/on.

4.3   LON SNVTs

ℹ️ You can find current general descriptions of SNVTs (Standard Network Variable Types) used in LON image on the homepage of "LonMark International" at:

http://types.lonmark.org/index.html
"LONMARK Resource Files, version XX.XX"

Use the right document for actual application

All available SNVT's are found in a separate document and are specific for the actual application. All different applications, and in some cases also application versions, have different SNVT's mapping. The specific document for the actual application must be used to see what SNVT's that are used.

ℹ️ The actual application name and version can be found using the HMI-DM. In some cases it is also good to check the controller BSP version.

Check actual application

Proceed as follows to see the actual application name and version:

1. Log in to HMI-DM using the password for level 4 (Service), default 2000.
2. Select **Main Index** > **System overview** > **Application info** >

Parameter	Explanation / Example
Application manufacturer	e.g. Customer!!
Application name and version	e.g. STD_AHU_vX.XX
Date	Application creation date; can be changed by application manufacturer
Name	e.g. plant name.
Street	e.g. plant address.
City	e.g. plant address.

Check actual controller BSP version

Proceed as follows to see the actual controller BSP version:

1. Log in to HMI-DM using the password for level 4 (Service), default 2000.
2. Select **Main Index** > **System overview** > **Target** >

Parameter	Explanation / Example
BSP version	Controller operating system.

5 Other information

5.1 Troubleshooting, tips

General

General things to check:
- Check the actual application version, controller BSP and communication module BSP version before call any support.
- As a matter of principle, the controller must be restarted with "Reset required !!" or power off/on after changing any settings to assume the data.
- Use the "Use default" parameter to go back to default setting of the communication module, reset the controller, and do the parameterization again.

Bus termination error states

Errors from bus termination may result in the following states:
- Signal level too low.
- Signal level (too) high.

Signal level too low

Possible causes:
- Wrong bus terminator (e.g. RXZ01.1 rather than RXZ02.1).
- Too many bus terminators (e.g. integrated bus terminator in repeater or bus supply not considered).

Signal level (too) high

Possible causes:
- A high-level signal or signal reflections point to a missing or wrong bus terminator.
- Bus terminator placed incorrectly:
  → Find the busiest point in the network through trial and error.

Min Send time

Some output (nvo) SNVTs use the "Min send time". Means that this SNVTs have fastest send interval of x seconds.

SNVT_state

Climatix are using SNVT_state binary counted from left to right and due to that some LON devices counts from right. In this case it is necessary to invert the bits, Bit0=Bit15, Bit1=Bit14....

SNVT_switch

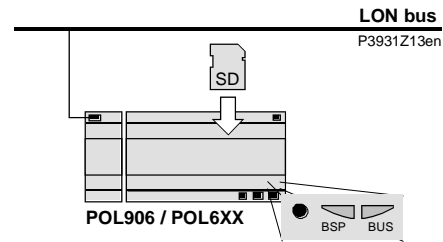The state part for SNVT_switch must be set to 1 (Active) to use the value part.

XIF file

The XIF file can be opened and read with a text editor like Notepad.

5.2 Upgrade application or BSP via SD card

Situation

The Climatix POL6XX controller and/or the LON module POL906 can in special cases be updated with new software.

Prerequisite

To upgrade the following items are needed:

- SD card
- Application- and/or BSP files from the actual manufacturer:

File	Used for…
POL8193.hex	LON Communication module, POL906, BSP
POL63x.hex	Controller, POL63x, BSP*
MBRTCode.bin	Controller, POL63x, Application*
OBH.bin	Controller, POL63x, Communication mappings
HMI/HMI4Web.bin	Controller, HMI structure

⚠ * These files may set all settings in the controller to default!

ℹ All settings can be saved to the SD card before the upgrade and then loaded again after the upgrade.

Upgrade procedure

The upgrade procedure and how to save/load all settings are not described in this manual. See basic documentation for the specific product depending of what upgrade is needed.

5.3 Override I/Os via communication

Preamble

Some inputs can be overridden via LON, see SNVTs list. However these inputs must first be setup for this before it works. Inputs can work only via hardware, only via communication or as a combination.
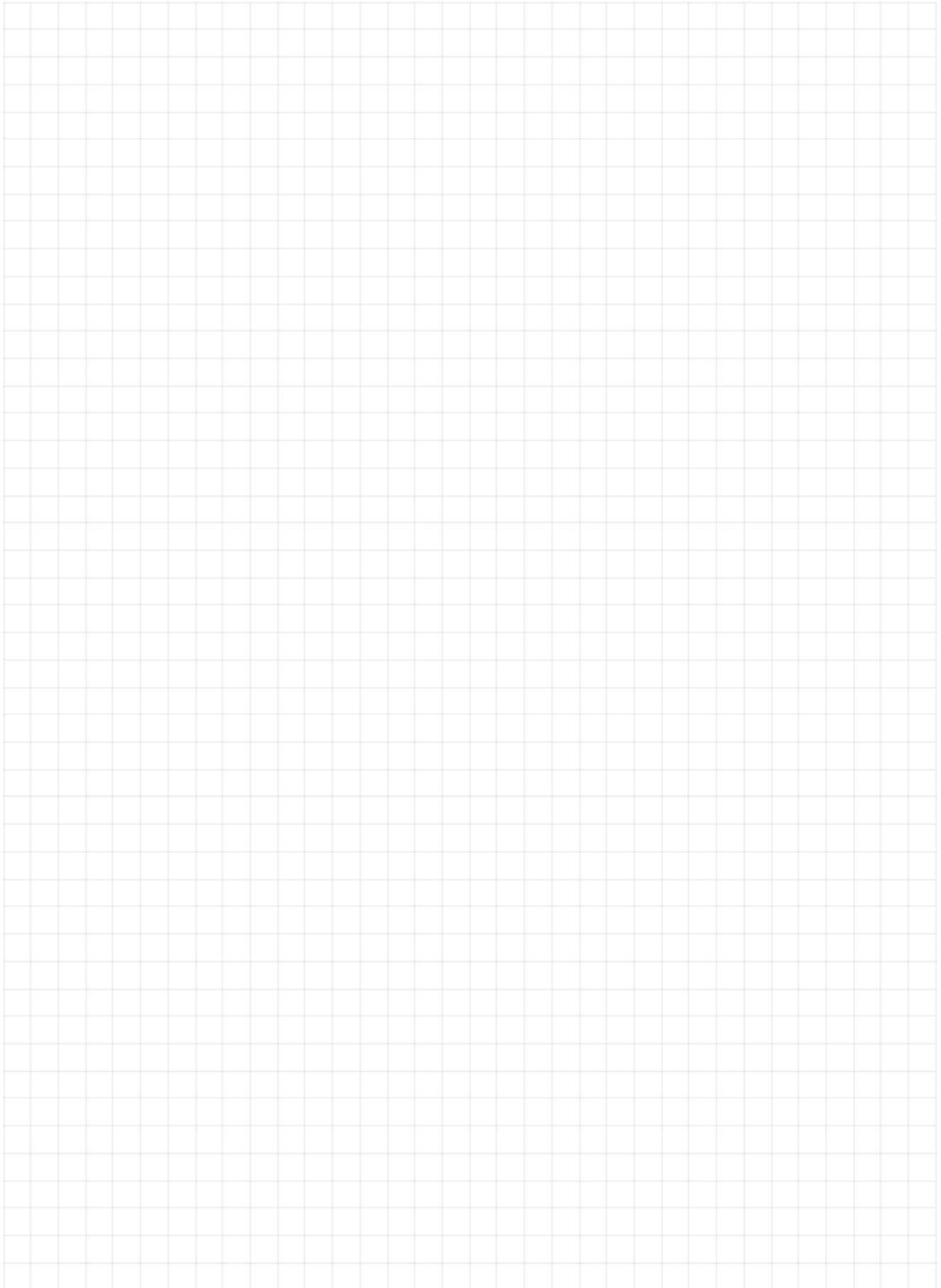
Prerequisite

Input must first be enabled and hardware place selected in configuration.

Configuration via operator unit

Proceed as follows to select input handling:

Step	Action
1	Log in to HMI using the password for level 4 (Service), default 2000.
2	Select **Main Index** > **Unit** > **Inputs** > **Element group** > **Element** > *Example: Main Index > Unit > Inputs > Temperatures > Outside temp >*
3	Select **Special settings > Value selector,** see selections below

Parameter	Range	Function
Value selector (Digital inputs)	– Hardware – Comm – And – Or – PreferedHW – PrefComm	Select valid input value for the application: – Value on hardware input. – Value from communications. – The input is 1, if the value on the hardware input and the value from communications = 1. Alarm triggers, if one of the two values is invalid. – The input is 1, if the value on the hardware input or the value from communications = 1. Alarm triggers, if one of the two values is invalid. – Value on hardware input has priority. The value from communications assumed if invalid. Alarm triggers, if both values are invalid. – Value from communications has priority. The value from hardware input assumed if invalid. Alarm triggers, if both values are invalid.
Value selector (Analog inputs)	– Hardware – Comm – Average – Minimum – Maximum – PreferedHW – PrefComm	Select valid input value for the application: – Value on hardware input. – Value from communications. – Average from the values on hardware input and from communications. Alarm triggers, if one of the two values is invalid. – Lowest value from the values on hardware input and from communications. Alarm triggers, if one of the two values is invalid. – Highest value from the values on hardware input and from communications. Alarm triggers, if one of the two values is invalid. – Value on hardware input has priority. The value from communications assumed if invalid. Alarm triggers, if both values are invalid. – Value from communications has priority. The value from hardware input assumed if invalid. Alarm triggers, if both values are invalid.

LON communication with POL906.00 – Integration guide

Index