ZAPP

RECEIVER

EXCEL 5000 OPEN™ SYSTEM

SYSTEM ENGINEERING

CONTENTS

CE

INTRODUCTION

Description of Devices

The ZAPP receiver forwards commands from the ZAPP handheld(s) to devices on the LONWORKS® network. The ZAPP receiver is suitable for either wall mounting or unit mounting.

Organization of Manual

This manual is organized to guide you through the engineering of a project from start to finish. If you are adding to or changing an existing system, the Table of Contents guides you to the relevant information.

The Introduction and Application Steps 1 through 7 provide the information needed to make accurate ordering decisions. These steps are guidelines intended to aid understanding of the product I/O options, bus arrangement choices, configuration options, and ZAPP's role in the overall EXCEL 5000 System architecture.

Agency Listings

Table 1 provides information on agency listings for ZAPP products.

Table 1. Agency listings.

Device	Agency	Comments
ZAPP	CE	General Immunity per European Consortium standards EN50081-1 (CISPR 22 Class B) and EN 50082-1:1992 (based on Residential, Commercial, and Light Industrial). EN 61000-4-2 IEC 1000-4-2 (IEC 801-2) Electromagnetic Discharge. EN 50140, EN 50204 IEC 1000-4-3 (IEC 801-3) Radiated Electromagnetic Field. EN 61000-4-4 IEC 1000-4-4 (IEC 801-4) Electrical Fast Transient (Burst). Radiated Emissions and Conducted Emissions. EN 55022:1987 Class B. CISPR-22: 1985.
	FCC	Complies with requirements in FCC Part 15 rules for a Class B Computing Device.

Construction

ZAPP Receiver

The ZAPP receiver is available in one basic model. ZAPP is powered by 24 Vac. All wiring connections are made at screw terminal blocks accessible beneath a plastic cover. Mounting dimensions are shown in Fig. 1.

⚠ CAUTION

Turn off power prior to connecting to or removing connections from any terminals to avoid electrical shock or equipment damage.

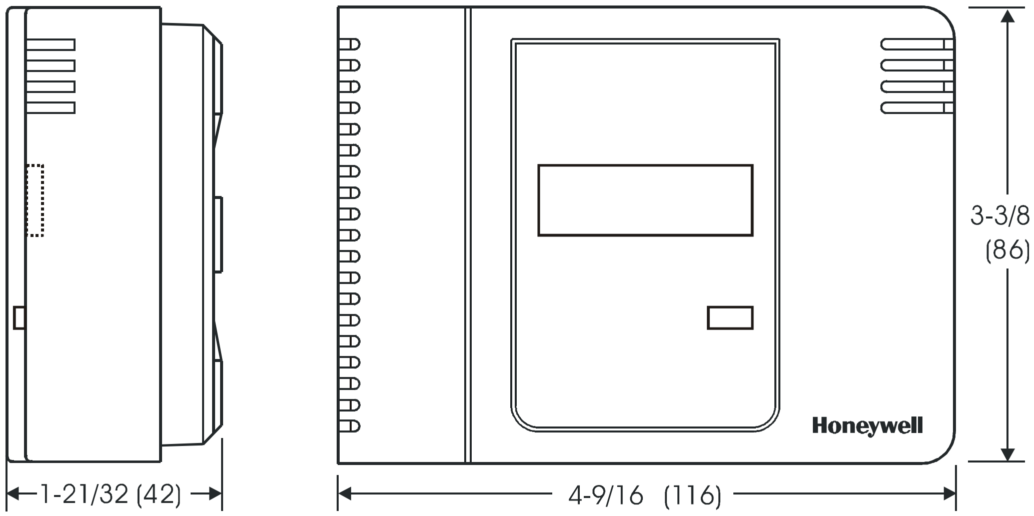


Fig. 1. ZAPP construction in inches (mm).

Performance Specifications

1. **Power Supply**

   24 Vac ± 20 %, 50/60 Hz, max. 2 VA.

2. **Operating Temperature**

   (0 ° to 40 °C).

3. **Shipping/Storage Temperature**

   (-35 ° to 65 °C).

4. **Relative Humidity**

   5 % to 95 % noncondensing

IMPORTANT!

> *When any device is energized by a Triac, the device must be able to sink a minimum of 15 mA. If non-Honeywell motors, actuators, or transducers are to be used with ZAPP, compatibility must be verified.*

5. **Interoperability**

ZAPP uses the Echelon® LonTalk® protocol.

Fig 2. shows the input and output variables of ZAPP.

Table 2 provides you with an overview of the ZAPP network variables. For a more-detailed description, see the Appendix.

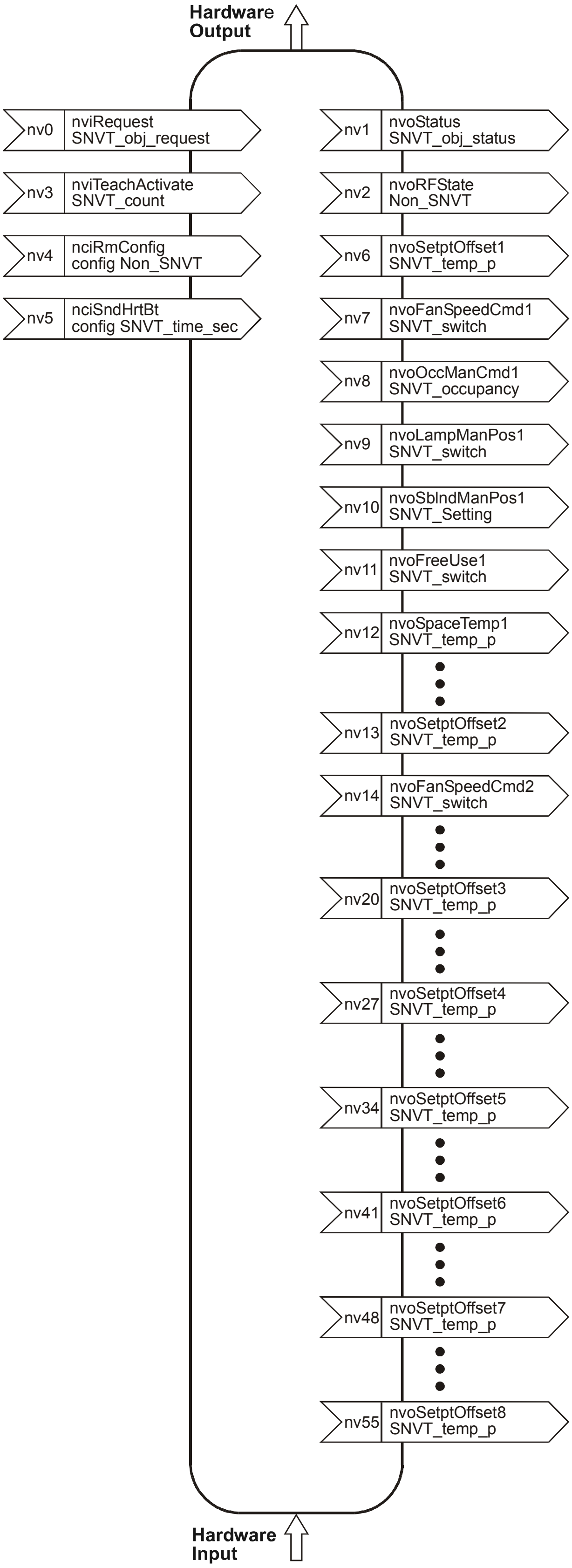


Fig. 2. Input and output variables

Abbreviations and Definitions

LONWORKS® network
Network for communication among different ZAPPs.

Echelon®
The company that developed the LONWORKS® network and the Neuron Chips used to communicate on the LONWORKS® network.

EMI Electromagnetic Interference. Electrical noise that can cause problems with communication signals.

FTT Free Topology Technology

ID Identification

I/O Input/Output. The physical sensors and actuators connected to a ZAPP.

K Kelvin.

NEC National Electrical Code. The body of standards for safe field-wiring practices.

NEMA National Electrical Manufacturers Association. An organization of companies which has developed safe field-wiring practices and standards.

NV Network Variable. A ZAPP parameter that can be viewed or modified over the LONWORKS® network.

NVI Network input variable

NVO Network output variable

PC Personal Computer.

RF Radio frequency

VA Volt-Amperes. A measure of electrical power output or consumption as applicable to an ac device.

Vac Voltage alternating current. ac voltage as opposed to dc voltage.

APPLICATION STEPS

Overview

Steps one through seven describe ZAPP's engineering. These steps are guidelines intended to aid understanding of the product I/O options, bus arrangement choices, configuration options and ZAPP's role in the overall EXCEL 5000® System architecture.

Step No.	Description
1	Planning the System
2	Determining Other Bus Devices Required
3	Laying out Communication and Power Wiring
4	Preparing Wiring Diagrams
5	Ordering Equipment
6	Configuring ZAPP
7	Teaching-in

Step 1. System Planning

Plan the use of ZAPP according to the job requirements. Determine the location, functionality, and sensor or actuator usage. Also check the number and type of output actuators and other accessories required.

When planning the system layout, consider potential expansion possibilities to allow for future growth. Planning is very important to be prepared for adding HVAC systems and ZAPPs in future projects.

NOTE: The ZAPP handheld unit and the ZAPP receiver to which it has been allocated should not be blocked by more than one intervening wall and one intervening story, nor should be they be separated by a distance of more than 30 meters. The possible effects of massive metal structures (steel beams, metal panels, etc.) located between the ZAPP handheld and the ZAPP receiver should be taken into consideration. Further, no two ZAPP receivers should be stationed nearer than 0.5 meter to each other.

The LONWORKS® network communication loop between ZAPP receivers and handhelds must be laid out according to the guidelines applicable for that topology.

ZAPP uses FTT technology, which allows daisy chain, star, loop or combinations of these bus configurations.

It is important to understand the interrelationships between ZAPP and other LONWORKS® devices in the network early in the job engineering process to ensure their implementation when configuring the ZAPP receiver.

Step 2. Determining What Other Bus Devices Are Required

A maximum of 62 nodes can communicate on a single LONWORKS® network segment. If more nodes are required, a router is necessary.

Using a router allows up to 125 nodes, divided between two LONWORKS® network segments. The router accounts for two of these nodes (one node on each side of the router).

The maximum length of an FTT LONWORKS® network segment is 1,400 m for a daisy chain configuration or 500 m total wire length and 400 m node-to-node for any other type of configuration.

NOTE: For FTT LONWORKS® network segments, the distance from each transceiver to all other transceivers and to the termination module must not exceed the maximum node-to-node distance. If multiple paths exist, the longest one should be used for the calculation.

If longer runs are required, add a router to partition the system into two segments. In addition, all LONWORKS® network segments require the installation of a Bus Termination Module.

For an FTT LONWORKS® network segment, one or two Termination Modules may be required, depending upon the bus configuration.

Step 3. Laying Out Communications and Power Wiring

LONWORKS® network Layout

The communications bus, LONWORKS® network, is a 78-Kbaud serial link that uses transformer isolation and differential Manchester encoding.

Wire the LONWORKS® network using level IV 22 AWG or plenum rated level IV 22 AWG nonshielded, twisted pair, solid conductor wire as the recommended wire size.

An FTT LONWORKS® network can be wired in daisy chain, star, loop, or any combination thereof as long as the maximum wire length requirements given in Step 2 are met.

NOTE: Due to the transformer isolation, the bus wiring does not have a polarity. It is not important which of the two LONWORKS® network terminals are connected to each wire of the twisted pair.

Fig. 3. and Fig. 4. depict two typical daisy chain LONWORKS® network layouts; one as a single bus segment that has 60 nodes or less, and one showing two segments.

Fig. 5. shows examples of free topology bus layouts.

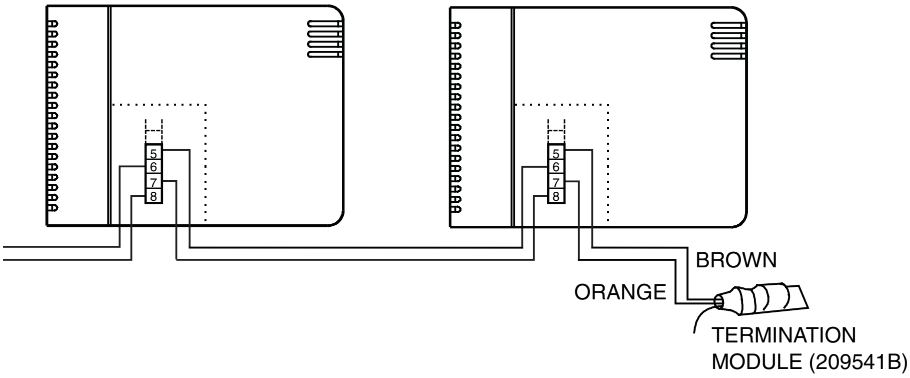


Fig. 3. Termination module connection (daisy-chain network configuration).

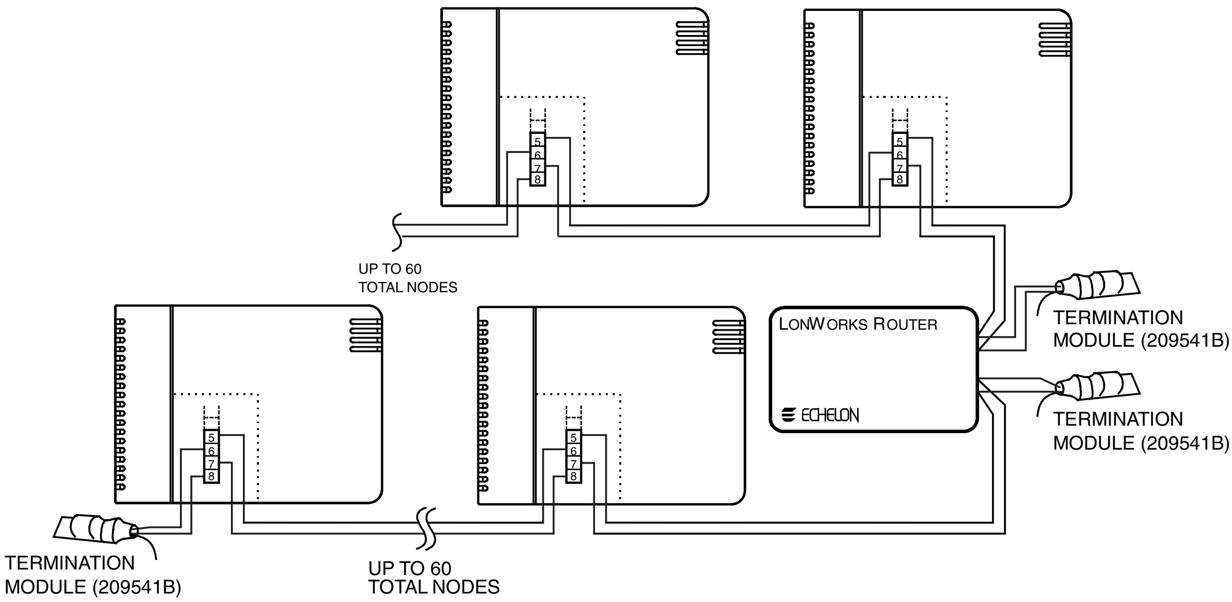


Fig. 4. LONWORKS® network wiring layout for two daisy-chain network segments.

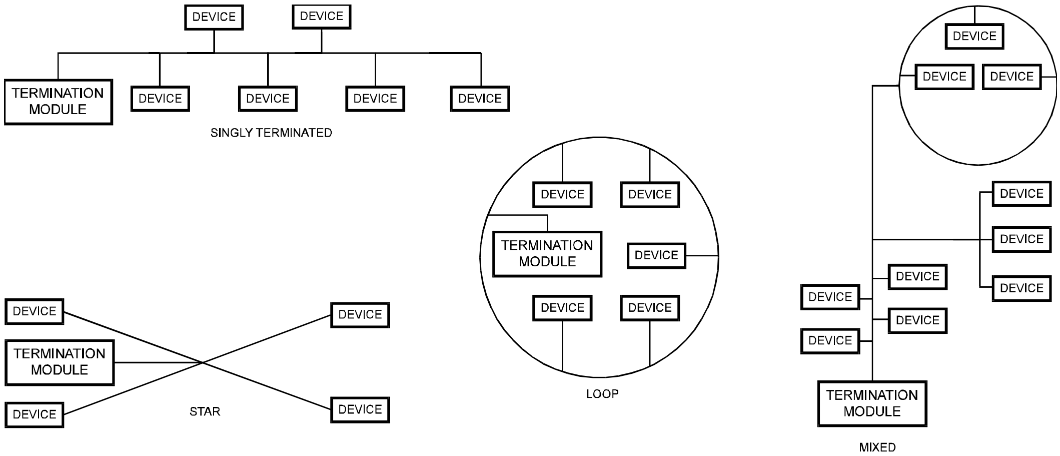


Fig. 5. Free topology LONWORKS® layout examples.

IMPORTANT!

Notes on Communications Wiring:

All field wiring must conform to local codes and ordinances.

Do not use different wire types or gauges on the same LonWorks® network segment. The step change in line impedance characteristics would cause unpredictable reflections on the bus. When using different types is unavoidable, use a router at the junction.

Do not use shielded cable for LonWorks® network wiring runs. The higher capacitance of the shielded cable will cause degradation of communications throughput. In noisy (high EMI) environments, avoid wire runs parallel to noisy power cables, or lines containing lighting dimmer switches, and keep at least 3 in. (76 mm) of separation between noisy lines and the LonWorks® network cable.

Make sure that neither of the LONWORKS® network wires is grounded.

Power Wiring

A power budget must be calculated for each ZAPP receiver to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled by ZAPP. This includes the ZAPP receiver itself, the equipment and various contactors and transducers, as appropriate, for the configuration. For contactors and similar devices, the in-rush power ratings should be used as the worst-case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly. The worst case that uses the largest possible VA load should be determined when sizing the transformer.

IMPORTANT!

The installation must be designed to allow for a line loss of no greater than two volts, thus guaranteeing nominal

Line Loss

The ZAPP receiver must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohm's Law (I x R) line loss must be considered. This line loss can result in a significant increase in total power required and thereby affect transformer sizing. This means that some volts will be lost between the transformer and the ZAPP receiver. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load. Fig. 6 shows this voltage load dependence.

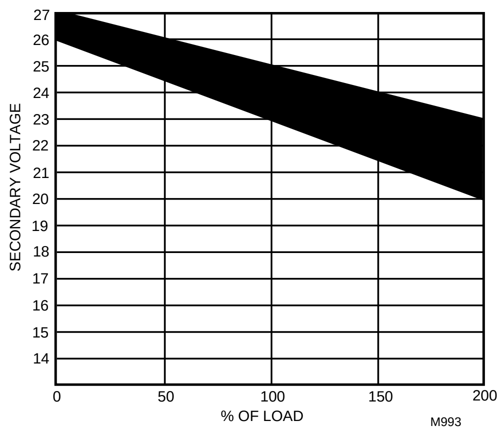


Fig. 6 NEMA class 2 transformer voltage output limits.

There are three ways to adjust the output level:

1. Use a larger transformer.

2. Use heavier gauge wire for the power run.

3. Locate the transformer closer to the ZAPP receiver.

The issue of line loss is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. The rule to remember is to keep all power and output wire runs as short as practical.

Use the heaviest gauge wire available, up to 14 AWG (2.0 mm^2), with a minimum of 18 AWG (1.0 mm^2) for all power wiring.

operation if the primary voltage drops to 102 Vac (120 Vac minus 15 %) or 193 Vac (230 minus 15 %).

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. Fig. 6 shows this voltage load dependence. With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage-regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary. The following Honeywell transformers meet this NEMA standard:

Transformer Type	VA Rating
AT20A	20
AT40A	40
AT72D	40
AT87A	50
AK3310 Assembly	100

IMPORTANT!

Notes on power wiring:

All field wiring must conform to local codes and ordinances or as specified on installation wiring diagrams.

To maintain NEC Class 2 and UL ratings, the installation must use transformers of 100 VA or less capacity.

In the case of multiple ZAPP receivers operating from a single transformer, the same side of the transformer secondary must be connected to the same input terminal on each ZAPP receiver.

The ZAPP receiver has Triac outputs; all output devices must therefore be powered from the same transformer as the one powering the ZAPP receiver.

Unswitched 24 Vac power wiring can be run in the same conduit as the LONWORKS® network cable.

To minimize EMI noise, do not run Triac and/or relay output wires in the same conduit as the input wires of the LONWORKS® network communications wiring.

Step 4. Preparing Wiring Diagrams

General Considerations

The purpose of this step is to assist the application engineer in developing job drawings to meet job specifications. Wiring details for the ZAPP receiver are shown in Fig. 7. Table 3 lists wiring types, sizes, and length restrictions for ZAPP products.

LONWORKS® Termination Module

One or two LONWORKS® network Termination Modules, part no. 209541B, are required for a LONWORKS® network with FTT devices on it, depending upon the configuration. Double termination is required only when the network is a daisy-chain configuration and the total wire length is greater than 1640 ft (500 m). The maximum lengths described in Step 2 must be adhered to for either a daisy chain or free topology LONWORKS® network layout.

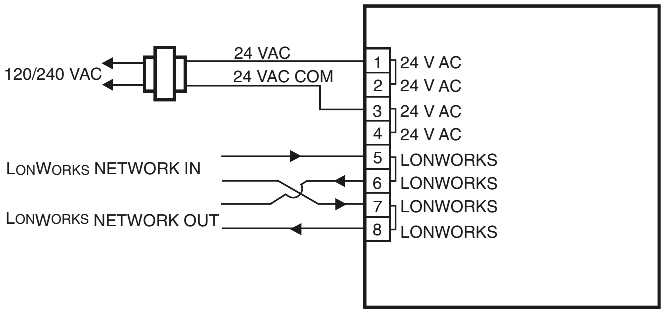


Fig. 7. ZAPP wiring example

Table 3. Field wiring references

Wire Function	Recommended Minimum Wire Size AWG (mm^2)	Construction	Specification or Requirement	Vendor Wire Type	Maximum Length ft (m)
LONWORKS® **network (Plenum)**	22 AWG	Twisted pair solid conductor, nonshielded	Level IV 60 °C rating	Europe: Belden 9H2201504	
LONWORKS® **network (Nonplenum)***	22 AWG	Twisted pair solid conductor, nonshielded	Level IV 60 °C rating	Europe: Belden 9D220150	
Power Wiring	14 AWG (2.5 mm^2)	Any pair nonshielded (use heavier wire for longer runs)	NEC Class 2 60 °C rating		Limited by line loss effects on power consumption.

NOTE: PVC wire must not be used where prohibited by local fire regulations.

Step 5. Ordering Equipment

Order equipment after compiling a bill of materials through completion of the previous application steps.

Table 4. ZAPP Ordering Information

Part Number	Product Description	Comments
ZAPP receiver		
W7070 A 1000		
ZAPP handhelds		
RT 7070A 1008		
Echelon®-Based Components and Parts		
209541B	FTT Termination Module	Two required per LONWORKS® network segment.
Cabling		
—	Serial Interface Cable, male DB-9 to female DB-9 or female DB-25	Obtain locally from any computer hardware vendor.
Belden 9H2201504 (Europe)	LONWORKS® network (plenum): 22 AWG twisted pair solid conductor, nonshielded	Level IV 60 °C rating.
Belden 9D220150 (Europe)	LONWORKS® network (non-plenum): 22 AWG twisted pair solid conductor, nonshielded	Level IV 60 °C rating.
CD-ROM		
CARE-CD	Contains all of the DRF's (Data Resource Files) which you will need to adjust the configuration of the network variables.	At present, no plug-ins are available.

Step 6. Configuring the ZAPP Receiver

General

The configuration process involves providing the ZAPP receiver with information using the LonMaker™ tool (or other LNS-based tool).

Commissioning

Commissioning refers to the activities performed to install the ZAPP receiver on the LONWORKS Network. The ZAPP receiver is preconfigured at the Factory; a LonMaker Plug-In for configuration is therefore not required.

ID Number

Each ZAPP receiver is shipped with a unique internal Identification Number from the factory called the Neuron© ID.

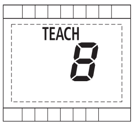
Step 7. Teach-in Procedure

Teach-in is a procedure required to allocate ZAPP handhelds to the ZAPP receiver. Up to eight handhelds can be allocated to a single ZAPP receiver. After successful completion of the teach-in procedure, the ZAPP receiver will recognize commands from the given handheld(s). The following procedure must be performed for each individual handheld:

1. Enable teach-in mode of the ZAPP receiver

a) Press the button on the ZAPP receiver for at least two seconds.

"TEACH" is displayed, thus indicating that the ZAPP receiver is now in the teach-in mode.



NOTE: If you enter no input within 3 minutes, the ZAPP receiver will revert back to the normal mode.

2. Choose a unique number for the handheld

Because you can allocate up to eight handhelds to the ZAPP receiver, you must give each handheld a unique number.

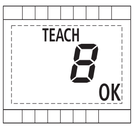
a) Select a unique number (1 through 8) for the given handheld by pressing the button on the ZAPP receiver as many times as is necessary.

The ZAPP receiver is now ready to receive signals from the handheld.

3. Enable the teach-in mode of the handheld

a) While holding down the handheld's **UP** and **B** keys, press also its **ok** key.

If the teach-in procedure has been successfully completed, the ZAPP receiver will now recognize commands from the handheld. Successful completion is indicated by the ZAPP receiver displaying "OK".



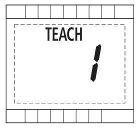
If teach-in has failed, no change is visible in the display of the ZAPP receiver. After three minutes, the ZAPP receiver returns to the normal mode. For a retry of teach-in, repeat steps one to three as described above.

Teaching-in Additional Handhelds

It is possible to allocate up to eight handhelds to a single ZAPP receiver. To do this, proceed as follows:

NOTE: Make sure that each handheld is associated with a unique number.

- If the ZAPP receiver is still in the teach-in mode ("TEACH“ is displayed), repeat steps two and three, each time entering a different number (1 through 8) for the respective handheld.
- If the ZAPP receiver has reverted back to the normal mode, repeat the entire procedure (steps 1 through 3), each time entering a different number (1 through 8) for the respective handheld unit.



Please be aware that it is not possible to use different handhelds allocated to the same ZAPP receiver to operate the exact same devices (i.e. the same lights, fans, sunblinds, etc.) unless "many-to-one" bindings have been performed for the respective NVs

Revoking a Taught-In Handheld

If you wish, you may revoke an already taught-in handheld.

1. Repeat step one.

2. Repeat step two, pressing the button on the ZAPP receiver as many times as necessary until the number of the given handheld appears in the display.

3. Press the button on the ZAPP receiver continuously for at least five seconds until the word "PRESENT" in the display disappears.

APPENDIX. COMPLETE LIST OF ZAPP NETWORK VARIABLES

The following tables list all network variables associated with the ZAPP receiver.

Table A1. Configuration Variables for ZAPP.

NV Name	Field Name	Engineering Units: English (Metric) or States plus Range	Default	SH[1]	HB[2]	Comments
nciRmConfig	.low_setpt	SNVT_temp_p: 0..-5 Kelvin	-5			Low-temperature setpoint offset limit
	.high_setpt	SNVT_temp_p: 0..+5 Kelvin	+5			High-temperature setpoint offset limit
	.fanstages	enum 0..3 0 = NO FAN 1 = ONE_SPEED 2 = TWO_SPEED 3 = THREE_SPEED	THREE_SPEED			Number of possible fanspeeds: 0=no fan / 1..3 = 1..3 speeds (plus Auto, off). If this variable is set to 0 (= no fan), the button on handheld can be used as a simple on/off switch. Up = on, down = off, ok = no function.
	.bypass	Bit 0 = NOT_ALLOWED 1 = ALLOWED	ALLOWED			Bypass allowed to be commanded over handheld.
	.unocc	Bit 0 = NOT_ALLOWED 1 = ALLOWED	ALLOWED			Unoccupied allowed.
	.occ	Bit 0 = NOT_ALLOWED 1 = ALLOWED	ALLOWED			Occupied allowed.
	.sblnd_runtime	SNVT_time_sec: 1..240s	60			maximum movement time fur sunblinds
	.lamp_runtime	SNVT_time_sec: 1..60s	10			Button 5 (bright): Maximum time for dimming dark -> bright
	.lamp_start	1=100% 0= last level	0			Button 5 (bright): Start dimming brightness at 100% or at last light level
	.lamp_increment	SNVT_lev_percent: 0..100%	100			Button 5 (bright): Step height for dimming
	.free_runtime	SNVT_time_sec: 1..60s	10			Button 6 (free): Maximum time for dimming dark -> light
	.free_start	1=100% 0= last level	0			Button 6 (free): Start dimming brightness at 100% or at last light level
	.free_increment	SNVT_lev_percent: 0..100%	100			Button 6 (free): Step height for dimming
nciSndHrtBt		SNVT_time_sec	60			After this timeout, the ZAPP receiver sends nvoSetptOffset and nvoSpaceTemp to the network.

[1] SH: Sharable (bindable) points can be set up for data sharing either a data source or as a destination.

[2] HBT: These points are either sent out on the network (outputs) or received from the network (inputs) at a certain fixed interval (heartbeat).

Table A2. Input Variables for ZAPP.

NV Name	Field Name	Engineering Units: English (Metric) or States plus Range	Digital State / Value	Default	SH[1]	HB[2]	Comments
nviTeachActivate		SNVT_Count 1..16 0, FFFF		FFFFh			The number with this variable starts teach-in process of ZAPP handheld, e.g. nviTeachActivate = 2 starts teach of handheld 2 nviTeachActive = 0 or FFFFh: no activity / stop process possible range:1..16, FFFFh Device numbering is: 1..8 = handheld 1..8 9..16 = wall module 1..8 Visual (LCD) Behavior of ZAPP receiver is equal to teach-in without tools The result of teach-in can be read out of nvoRfState.teached.
nviRequest	object_id	SNVT_obj_request 0 = NODE_OBJECT 1 = ROOM1 2 = ROOM2 .. 8 = ROOM8					This input variable belongs to the Node Object and provides the mechanism to request a particular mode for a particular object within a node.
	object_request	object_request_t RQ_NORMAL RQ_UPDATE_STATUS	 0 2				See above. Commanding any modes other the ones listed will result in an "invalid_request" when reading nvoStatus.

[1] SH: Sharable (bindable) points can be set up for data sharing either a data source or as a destination.

[2] HBT: These points are either sent out on the network (outputs) or received from the network (inputs) at a certain fixed interval (heartbeat).

The fixed values of the variables are described in the ZAPP Handheld User Manual (EN2B-0205GE51 R1100).

Table A3. Output Variables for ZAPP.

NV Name	Field Name	Engineering Units: English (Metric) or States plus Range	Default	SH[1]	HB[2]	Comments
nvoOccManCmd*		SNVT_occupancy 0 = OC_OCCUPIED 1 = OC_UNOCCUPIED 2 = OC_BYPASS	0xFF = no override	X		User occupancy override.
nvoSetPtOffset*		SNVT_temp_p: -5..+5 K due to nciRmConfig	0	x	x	User setpoint temperature offset.
nvoFanSpeedCmd*	.value	SNVT_switch.value: 0..100%	O%	x		Manual user override of fanspeed.
	.state	SNVT_switch.state: 0 = OFF 1 = ON 255 = NUL	NUL	x		
nvoSblndManPos*		SNVT_setting 3 = SET_UP 2 = SET_DOWN 4 = SET_STOP 255 = SET_NUL	SET_NUL= no action	x		Allows user to command sunblinds.
nvoLampManPos*		SNVT_switch.value: 0..100%	0	x		Allows user to switch a light on/off or to dim it.
		SNVT_switch.state: 0 = OFF 1 = ON 255 = NUL	NUL	x		Allows user to switch a light on/off or to dim it.
nvoFreeUse*	.value	SNVT_switch.value: 0..100%	0	x		Same as above.
	.state	SNVT_switch.state: 0 = OFF 1 = ON 255 = NUL	NUL	x		Same as above.
nvoSpaceTemp*		SNVT_temp_p 0..40° C	invalid	x	x	Shows wall module temperature of taught ZAPP receiver.
nvoRfState	.BatteryState1 ... .BatteryState16	Bit: 0 = battery ok 1 = battery low	0 = ok			Battery condition for handheld in room 1..8 (=state 1..8) and optionally from receiver in room 1..8 (=state 9..16)
	.teached1 ... .teached16	Bit: 1 = taught 0 = no device taught	0, but saves value over power down			1..8 = handheld in room 1..8 9..16 = wall module in room 1..8
	.lastRfDevice	Byte: 0..16				Where did the last ZAPP message come from? 1..8 = handheld in room 1..8 9..16 = receiver in room 1..8

[1] SH: Sharable (bindable) points can be set up for data sharing either a data source or as a destination.

[2] HBT: These points are either sent out on the network (outputs) or received from the network (inputs) at a certain fixed interval (heartbeat).

*Each of these variables exists for room1 to 8 with a single-digit index 1..8.

Table A3 (continued). Output Variables for ZAPP.

NV Name	Field Name	Engineering Units: English (Metric) or States plus Range	Default	SH[1]	HB[2]	Comments
nvoRfState	.lastCommand	Enum: 0 = OFFS_HIGHER 1 = OFFS_LOWER 2 = OFFS_ZERO 3 = OFFS_MIN 4 = OFFS_MAX 5 = FAN_HIGHER 6 = FAN_LOWER 7 = FAN_AUTO 8 = FAN_MAX 9 = FAN_OFF 10 = OCC_BYP 11 = OCC_UNOCC 12 = OCC_NUL 13 = OCC_OCC 14 = LIGHT_MAX 15 = LIGHT_MIN 16 = LIGHT_START_DIM 17 = LIGHT_STOP_DIM 18 = SBL_UP 19 = SBL_DOWN 20 = SBL_STOP 21 = OFFICE_STYLE_1 22 = OFFICE_STYLE_2 23 = FREE_MAX 24 = FREE_MIN 25 = FREE_START_DIM 26 = FREE_STOP_DIM 27 = DIRECT_SETPT 28 = ROOM_TEMP 255 = CMD_NUL				Shows last ZAPP message received.
nvoRfState	.TeachActive	SNVT_count: 0..16				Shows the ZAPP device number currently in the teach-in mode. 0 = no teach-in process. 1..8 = handheld in room 1..8. 9..16 = receiver in room 1..8
nroSwVersion	.major					Current software version of LONWORKS chip
	.minor					
	.bug					
nvoStatus	.object_id	0 = NODE_OBJECT 1 = ROOM1 2 = ROOM2 3 = ROOM3 ... 8 = ROOM8				
	.invalid_id	0 = VALID_ID, 1 = INVALID_ID				
	.disabled	0 = ENABLED, 1 = DISABLED				

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