SERVAL Controller

User Guide

CENTRALINE by Honeywell

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INTRODUCTION

Description of Devices

The SERVAL controllers **CLSE1L230**and **CLSE1L24** belong to the CentraLine group of products. SERVAL controllers control the space temperature in a given room by regulating the heating and/or cooling equipment. Fans (providing air flow) and reheat coils are often included when a fan coil unit is used. SERVAL controllers are capable of stand-alone operation; however, optimum functional benefits are achieved when the network communication capabilities are used.

A family of directly-wired wall modules with a temperature sensor for space temperature measurement, setpoint adjustment, bypass push-button, status LED, or LCD display can be used in conjunction with SERVAL controllers.

The wall modules are available in a variety of models incorporating various combinations of the following options:

- Setpoint adjustment
- Bypass pushbutton and LED
- Fan Switching

See table 8 for a complete list of wall modules.

SERVAL controllers connect to a LonWorks network and interoperate with other CentraLine products like PANTHER, COACH, and ARENA.

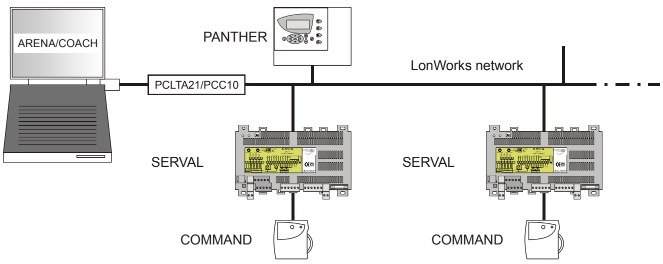


Fig. 1. Overview of typical system

Room Control Application

The following applications can be covered:

- **Radiator with heating valve**
- **Floor heating with heating valve**
- **Floor heating/cooling changeover valve**
- **Chilled ceiling with cooling valve**
- **Chilled ceiling with heating / cooling changeover valve**
- **Radiator with heating valve / chilled ceiling with cooling valve**
- **Fancoil unit with heating valve / cooling valve**
- **Fancoil unit with heating valve / cooling valve + electric reheat relay**
- **Fancoil unit with heating / cooling changeover valve**
- **Fancoil unit with heating / cooling changeover valve + electric reheat relay**

Individual room control systems in commercial buildings control room temperature through the control of heat and/or cold water valves. With fancoil systems also fan speed and electric reheat coils may be used. The SERVAL controller is located in the false ceiling or in the FCU and is typically connected to a CentraLine wall module incorporating a temperature sensor, setpoint and fan speed controls, and a bypass or override button. Fig. 2 shows a typical FCU control application.

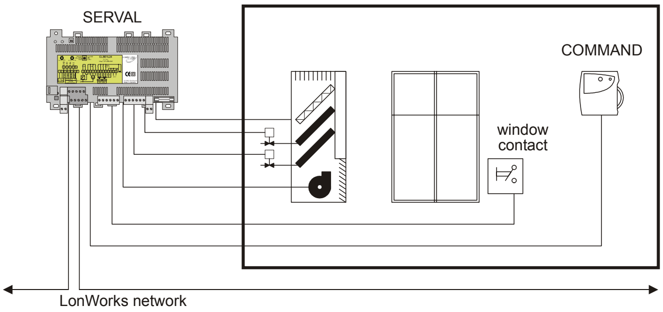


Fig. 2. Typical room control application (here: fancoil unit application)

Control Provided

SERVAL controllers provide room temperature control for two- and four-pipe systems with optional electric heating coil. The basic control sequence is shown in Fig. 3. As space temperature falls below the heating setpoint, the heating output is increased. As space temperature increases above the cooling setpoint, the cooling output is modulated to 100%. Switching levels for fan speeds are assigned to the output value. When the SERVAL is in the "occupied" mode, the fan will stop within the zero-energy band.

The third fan stage will start at an adjustable default of 75%.

SERVAL controllers use a PID control algorithm in which each of the three parameters can be configured. There is an additional boost function which specifies the temperature range to be added to the heating/ cooling setpoint, above which the heating/ cooling output is fully open to allow a faster response. The controllers are delivered with a fixed value of 1 K for this function.

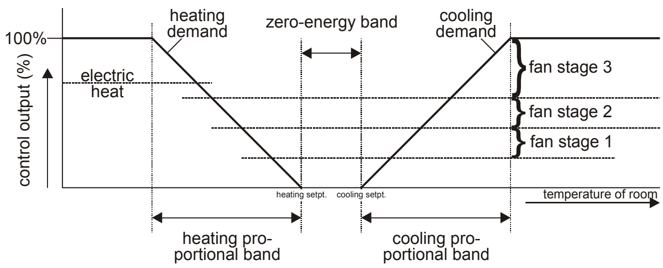


Fig. 3. Control sequence diagram

Setpoints

Setpoint Knob

SERVAL controllers must be hardwired to a CentraLine COMMAND wall module equipped with at least a room sensor. Other wall modules provide e.g. a setpoint knob, bypass button, LED, and fan switch. When the SERVAL has been configured (using COACH1.2 or higher) to read input from the wall module's setpoint knob, the value from the setpoint knob is used to calculate the "occupied" setpoint for the heating and the cooling modes. The setpoint used by the control algorithm is calculated as follows: the setpoint knob represents a number from -5...+5 K, which is added to the configured "occupied" and "standby" setpoints for the heating and the cooling modes. The range of the ZEB (zero-energy band) is found by taking the difference between the "occupied" or "standby" setpoints configured for the heating and the cooling modes.

When the SERVAL is in the "unoccupied" mode, the remote setpoint knob is ignored, and the configured setpoints for this mode are used instead.

Setpoint Limits

Setpoints are limited to the range of 10...35°C. The value of the setpoint knob is limited to the range provided by the configuration parameters Max. Limit Setpoint and Min. Limit Setpoint. The lowest actual "occupied" setpoint allowed is equal to "occupied" heating setpoint minus Min. Limit Setpoint, and the highest allowed is equal to "occupied" cooling setpoint plus Max. Limit Setpoint. The lowest and highest "standby" setpoints are found in an analogous way.

Table 1. Example setpoint values based upon default configuration - Relative setpoint knob (°C)

	occupancy mode		
	occupied	standby	unoccupied
configured cooling setpoint	23	25	28
configured heating setpoint	21	19	16
zero-energy band	2	6	12
setpoint knob[1]	-2	-2	X
effective cooling setpoint[2,3]	21	23	28
effective heating setpoint[2,4]	19	17	16
1) Sample value shown. Limited by default configuration settings to the range of -5...+5K.			
2) Limited to the range of 10...35°C.			
3) equal to configured cooling setpoint + setpoint knob			
4) equal to configured heating setpoint + setpoint knob			

Bypass

Bypass Mode

When the SERVAL controller is in the "unoccupied" mode, the CentraLine COMMAND wall module's bypass push-button may be used to force the SERVAL into the "occupied" mode. The SERVAL can also be forced into the "occupied" mode by means of a LONWORKS network command (when the assigned time schedule switches to "occupied"). The controller will then remain in "occupied" mode until:

- The bypass timer has timed out, ***or***
- The user again presses the CentraLine COMMAND wall module's bypass push-button, thus cancelling the "bypass" mode, ***or***
- The assigned time schedule switches the mode to "standby" or "unoccupied".

The CentraLine COMMAND wall module indicates the current bypass mode status (see CentraLine COMMAND wall module literature for further information).

Bypass Timer

When the "bypass" mode has been activated, the bypass timer is started (default of 180 minutes), at the end of which the mode will revert to its original state.

The bypass time is configurable in COACH and ARENA.

Continuous "Unoccupied" Mode

The continuous "unoccupied" mode is activated:

- In the case of the CLCM4T111 or CLCM5T111: If the bypass button is pressed for four to seven seconds (until the LED blinks).
- In the case of the CLCM6T21N: If the bypass button is pressed for more than five seconds (until the flashing moon appears).

The SERVAL can also be forced into the continuous "unoccupied" mode by means of a LONWORKS network command (issued when the assigned time schedule switches to "unoccupied"). The SERVAL will then remain in this mode until the next switching point, or until the bypass button is pressed to exit the mode or a network command is sent to change the mode again.

LED/LCD

LED Override

The wall module's LED indicates that the SERVAL is being overridden by either the bypass button or the LONWORKS network.

- LED ON ⇒ "override bypass"
- One flash per second ⇒ "override unoccupied"
- Two flashes per second ⇒ "override standby" or "occupied"
- LED OFF ⇒ no override
- Four flashes per second ⇒ The controller is responding to a LONWORKS network management wink command. (See commissioning of LONWORKS systems).

LCD Display

This mode is used only for CLCM6T21N Wall Modules. The occupancy mode is represented by the following symbols:

Table 2. Meaning of symbols

	effective "occupied" or effective "bypass"
	effective "standby"
	effective "unoccupied"
OFF	controller is OFF
OFF and 	Controller is OFF, frost protection is enabled
Flashing symbols indicate the "override" mode as follows:	
	override "occupied" or override "bypass"
	override "standby"
	override "unoccupied"
	The controller is responding to a LONWORKS network management wink command. (See commissioning of LONWORKS systems)

Energy-Saving Features

"Standby" Mode

The digital input for reading input from an occupancy sensor (usually a motion detector) provides the SERVAL with a means to enter an energy-saving standby mode whenever there are no people in the room. The "standby" mode occurs when the scheduled occupancy mode is "occupied" but the occupancy sensor indicates that the room is nevertheless currently unoccupied. The SERVAL can also be forced into the "standby" mode by means of a LONWORKS network command (issued when the assigned time schedule switches to “standby”). When in the "standby" mode, the SERVAL uses the "standby" setpoints configured for the heating and the cooling modes.

Synchronization

In the case of floating actuators, a synchronization function ensures that all connected actuators run in parallel. The synchronization drives the actuator to the 0% position. Synchronization is carried out whenever:

- the controller is connected to the supply voltage;
- the occupancy status changes to either "standby" or "unoccupied;"
- the actuator has not moved in the last 24 hours;
- the control signal is 0%.

After each synchronization, the controller will return to the normal control mode.

Window Sensor

The digital input for reading input from a window contact provides the SERVAL with a means to disable its temperature control activities if someone has opened a window or door in the room. Frost protection remains active. Normal temperature control resumes when the window closes.

Optimum Start Gradients

There are two parameters, Cool Rec Ramp and Heat Rec Ramp, which can be configured to cause the cooling and heating setpoints respectively to **ramp up** to their occupied settings from their unoccupied or standby settings **prior** to scheduled occupancy. The SERVAL uses the configured rates to determine the optimum time to start increasing the heating or cooling demand. See the following figures. The configuration parameters are in K/hour.

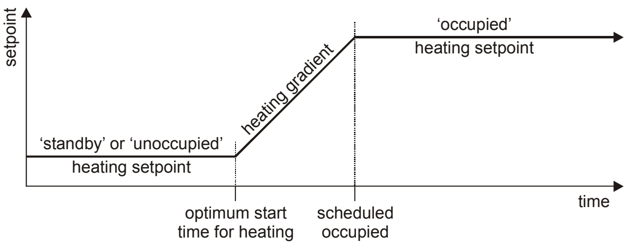


Fig. 4. Optimum start (heating)

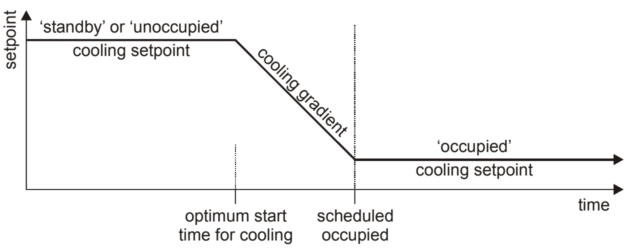


Fig. 5. Optimum start (cooling)

Occupancy Status

The occupancy status is arbitrated according to Table 3. Manual override may come from the bypass push-button.

Table 3. Effective occupancy mode arbitration

scheduled occupancy mode	occupancy sensor status	manual override status	effective operating mode
occupied	room occupied	n.a.	occupied
occupied	room unoccupied	n.a.	standby
"don't care"	"don't care"	occupied	occupied
"don't care"	"don't care"	unoccupied	unoccupied
standby	"don't care"	n.a.	standby
unoccupied	"don't care"	n.a.	unoccupied

Safety Features

Frost Protection

If the room temperature falls below 8 °C, the SERVAL enables the heating circuit to ensure frost protection and an alarm is issued (only if there is an ARENA workstation connected). When the temperature rises above 9 °C again, the heating circuit is turned OFF again.

Fan Failure Protection

When configured with an airflow detector (fan coil with electric heating), the SERVAL protects equipment by switching OFF heating / cooling outputs and issuing an alarm when the input is open. This airflow detector is mandatory when electric heating is chosen.

Condensation Protection

In the case of a chilled ceiling application, the configurable digital input 1 is automatically assigned to connect to a condensation switch, which has to be mounted to the cold water piping. Thus, the condensation switch will prevent condensation on the cold water pipes and cooling panels by changing the controller status to OFF. The switch is **H7018A1003**. This means that the cooling valve will close until the humidity drops below the condensation point.

Design

The SERVAL is available in two basic models:

The CLSE1L230 is used for 230 Vac supply and has 230 Vac triac outputs for heating and cooling valves.

The CLSE1L24 is used for 24 Vac supply and has 24 Vac triac outputs for heating and cooling valves.

Both models are equipped with a fourth, high-power relay for applications with electric reheat.

All wiring connections to the controllers are made at screw terminal blocks accessible beneath a plastic safety cover. Mounting dimensions are shown in Fig 6.

CAUTION

If SERVAL controllers are mounted vertically and thermal actuators are used, the transformer must not be located below the electronics; this is because of heating effects.

WARNING

Electrical Shock Hazard.
Mains power at terminal block can cause personal injury or death. To prevent access by unauthorized personnel, SERVAL controllers must be mounted in a suspended ceiling, electric cabinet or inside a fan coil unit. It is advisable to use the plastic cover on the terminals.
To reduce the risk of fire or electric shock, install in a controlled environment relatively free of contaminants.

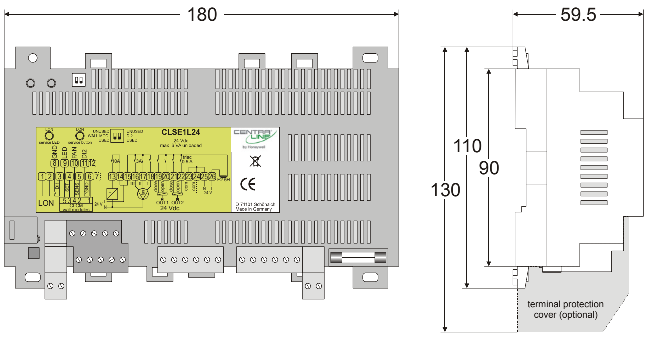


Fig. 6. SERVAL dimensions (in mm)

Performance Specifications

Power Supply

CLSE1L230: 230 Vac +10%, -15%, 50/60 Hz;
power consumption: < 6 VA (device unloaded)

CLSE1L24: 24 Vac ±20%, 50/60 Hz;
power consumption: < 3 VA (device unloaded)

Specified Sensing Temperature Range

0° to 40°C

Environmental Ratings

Operating temperature:	0...50°C
Shipping/storage temperature:	-40...+70°C
Relative humidity:	5% to 95% non-condensing

Inputs

CentraLine COMMAND wall module, with built-in:

- temperature sensor (20kΩ NTC)
- setpoint potentiometer (10kΩ)
- two digital inputs (closed ≤ 400 Ω; open ≥ 10 kΩ)

Relays 1, 2, and 3

Permanently configured to write output to a hardwired 3-speed fan.

Switching voltage = 24...230 Vac.

Switching current = 0.05...3 A (max. 3 A for all three relays together).

Relay 4

Permanently configured to write output to a hardwired electrical reheat coil.

Switching voltage = 24...230 Vac.

Switching current = 0.05...10 A.

Triacs

Permanently configured to write output to OUT1/2.

Switching voltage = 230 Vac (CLSE1L230) or 24 Vac (CLSE1L24).

Max. switching current = 0.5 A.

Max. peak (10 sec) current = 1 A.

Maximum allowable continuous current for all of the triac outputs together: 1 A. cos φ > 0.8.

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 SERVAL controllers, compatibility must be verified.

Configurations

General

The following sections provide an overview of the SERVAL controller options related to applications.

Room Control Application

The following room applications can be chosen with the engineering tool COACH:

- Hydronic heating/ cooling control
- Chilled ceiling control
- Fancoil control (FCU)

FCU Fan Type

Each fan coil unit controlled by a SERVAL can have a fan with up to three different speeds or no fan at all. Multi-speed fans are switched at switching levels defined in the controller (see Fig. 7). For example, a three-speed fan will switch ON its first speed at the control level of 5% fixed heating or cooling output. The second stage will switch on at 50% fixed heating or cooling output. A two-stage fan will switch with the first two stages of a 3-stage fan. Likewise, a single-speed fan will turn ON at the first stage of any multi-staged fan. The third stage will switch at an editable default of 75%.

Hysteresis

The hysteresis (fixed to 10%) for fan speed extends to the next lower switching level (or a control level of 0) as is shown in Fig. 7. For example, the second fan speed will remain ON until the control level falls below the switching point for the first fan speed. Minimum ON/OFF times can be configured and will apply to all fan switching points.

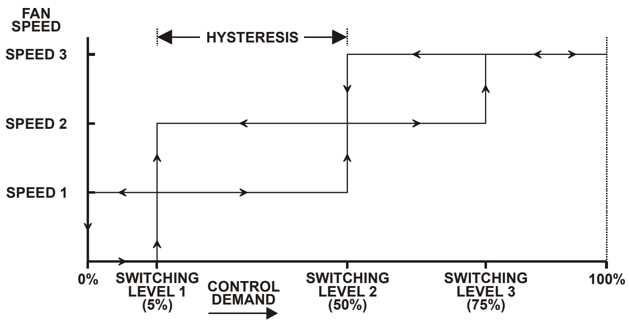


Fig. 7. Three-speed fan switching and hysteresis, cooling mode (defaults for switching levels shown)

Type of Heating and Cooling Equipment

SERVAL controllers can operate with either two-pipe or four-pipe systems. A two-pipe system requires a changeover input to the pre control circuit.

SERVAL controllers can operate with a variety of actuators for heating and cooling equipment. Floating actuators can be used which will require specifying the valve run time during configuration of the controller with COACH. Valve action can be configured as either direct or reverse.

Thermal actuators can also be connected and can be configured as either direct or reverse action. The cycle time must be specified during configuration.

Reheat Output

Both SERVAL controllers have an additional high-current (10 A max.) output relay to control an electric reheater. The reheat output has its own switching level and hysteresis settings (see Fig. 8). It can be used and configured with fan coil applications, only.

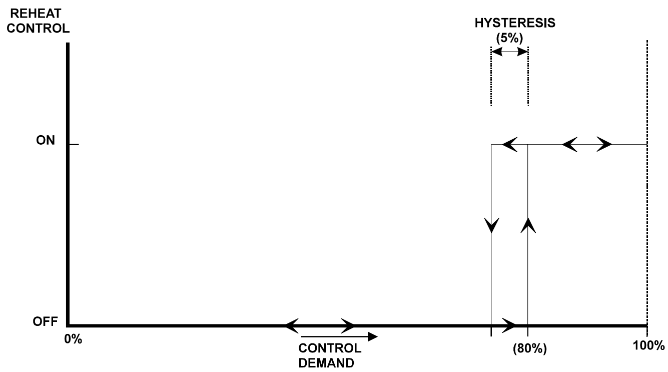


Fig. 8. Reheat switching and hysteresis (defaults shown)

Digital Inputs

The SERVAL controllers are equipped with **two** digital inputs; input 1 may be configured to accommodate an occupancy sensor, a window open/closed contact, or a movement sensor. It is possible to configure this input for either normally-open or normally-closed contacts for any of the switches.

The second digital input is fixed assigned to window function and is a normally open contact. (window open= contact closed) This input can be deactivated by means of a dip switch if it is not used.

The SERVAL's control algorithm uses the occupancy sensor (if configured) to determine the effective occupancy mode (see Table 1). If the controller schedule indicates an occupied state and if the occupancy sensor contact is closed, the effective occupancy mode will be "occupied". However, if the schedule indicates an occupied state and if the occupancy sensor contact is open, then the effective occupancy mode will be "standby". The control algorithm will then control according to the "standby" setpoints configured for the heating and the cooling modes.

Configuring the digital input for movement or no movement (dependent upon normally-open or normally-closed contacts) adds a delay of 15 minutes to the occupancy sensor such that the space is considered occupied until 15 minutes has elapsed since the last movement was detected.

If the digital input is configured to read input from a window open/closed contact, heating, cooling, and fan control will be disabled while the window is detected open. Frost protection will be enabled. A set of contacts may be wired in series for multiple windows.

The digital input is automatically configured to read input from an **air flow detector** in case of **electric reheat**, heating control (including electric heating) will be disabled for a fan failure (fan ON and no air flow detected).

The digital input is automatically configured to read input from a **dew point switch** in case of **chilled ceiling application**.

The controller will switch to unoccupied if this contact is active.

Wall Module Options

A typical individual room control installation will include a CentraLine COMMAND wall module containing a 20kΩ NTC room temperature sensor and additional features depending on the wall module type (see CentraLine COMMAND wall module literature for further information).

SERVAL controllers can read input from either just a sensor (not equipped with a manual override) or from a complete wall module (equipped with a sensor). Setpoint adjustments are always relative, and upper and lower limits can be set. A configuration option for the complete wall module allows an easy and comfortable selection with COACH. The bypass button can be used to override the control mode to "occupied" for a configurable bypass time and to override the control mode to "unoccupied" for an indefinite time. The button may also be used to cancel the override.

APPLICATION STEPS

Overview

Steps one through seven (see Table 4) address considerations for engineering a SERVAL system. These steps are guidelines intended to aid understanding the product I/O options, bus arrangement choices, configuration options, and the SERVAL controllers' role in the overall CentraLine System architecture.

Table 4. Application steps

step	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 Controllers
7	Troubleshooting

Step 1: Planning the System

Plan the use of the SERVAL controllers according to the job requirements. Determine the location, functionality, and sensor or actuator usage. Verify the sales estimate of the number of SERVAL controllers and wall modules required for each model type. 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 controllers in future projects.

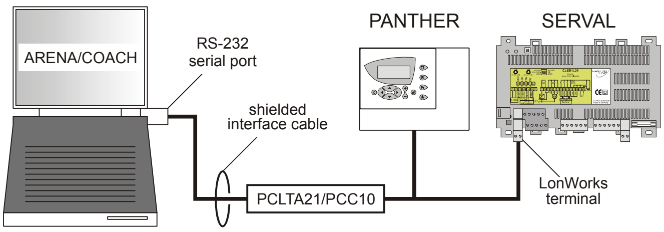


Fig. 9. Connecting the COACH engineering tool to the LonWorks network

The LonWorks communication loop between controllers must be engineered according to the guidelines for the chosen topology. SERVAL and PANTHER Controllers use FTT (Free Topology Twisted Pair Transceiver) technology which allows daisy chain, star, loop or combinations of these bus configurations. See section "Step 3: Laying Out Communications and Power Wiring" for more information on bus wiring layout, and see Fig. 10 through Fig. 16 in section "Step 4: Preparing Wiring Diagrams" for wiring details.

It is important to understand the interrelationships between SERVAL and PANTHER Controllers on the LonWorks network early in the job engineering process to ensure their implementation when configuring the controllers. (See section "Step 6: Configuring Controllers" for information on the various SERVAL controller parameters.)

Step 2: Determining Other Required Bus Devices

A max. of 60 CentraLine controllers can communicate on a single LonWorks segment. If more controllers are required, a repeater is necessary. Using a repeater allows up to 120 controllers, divided between two LonWorks segments. The repeater accounts for two of these nodes (one node on each side of the repeater). Table 5 summarizes the LonWorks segment configuration rules.

Table 5. LonWorks configuration rules

one LonWorks segment (example)	max. no. of nodes = 60
max. no. of CentraLine controllers	60 nodes (wall modules do *not* count as LonWorks nodes!)
total	**60 nodes**
two LonWorks segments (example)	max. no. of nodes = 120
max. no. of CentraLine controllers in segment no. 1	60 nodes (wall modules do *not* count as LonWorks nodes!)
max. no. of CentraLine controllers in segment no. 2	60 nodes (wall modules do *not* count as LonWorks nodes!)
total	**120 nodes**

The max. length of an FTT LonWorks segment is 1400 m (double termination with Level IV cable) for a daisy chain configuration or 500 m total wire length(single termination and free bus configuration, standard cable) and 400 m node-to-node for any other type of configuration.

NOTE: In the case of FTT LonWorks segments, the distance from each transceiver to all other transceivers and to the termination must not exceed the max. node-to-node distance. If multiple paths exist, the longest one should be used for the calculation.

If longer runs are required, add a repeater in order to partition the system into two segments.

In addition, all LonWorks segments require the installation of a Bus Termination Module. For an FTT LonWorks segment, one or two Termination Modules may be required depending upon the bus configuration. See section "Step 3: Laying Out Communications and Power Wiring" and the LonWorks Termination Module subsection in section "Step 4: Preparing Wiring Diagrams" for more details.

Step 3: Laying Out Communications and Power Wiring

Laying Out the LonWorks Wiring

The communications bus, LonWorks, is a 78-kilobit serial link that uses transformer isolation and differential Manchester encoding. Wire the LonWorks using the cables specified in Table 4. An FTT LonWorks can be wired in daisy chain, star, loop or any combination thereof as long as the max. wire length requirements given in Step 2 are met.

NOTE: Due to the transformer isolation, the bus wiring does not have a polarity; that is, it is not important which of the two LonWorks terminals are connected to each wire of the twisted pair.

LONWORKS networks can be configured in a variety of ways, but the rules listed in Table 5 always apply. Fig. 10 and Fig. 11 depict two typical daisy chain LONWORKS network layouts; one as a single bus segment with 60 nodes or less, and one showing two segments. Fig. 12 through Fig. 15 show examples of free topology bus layouts. The bus configuration is set up using COACH.

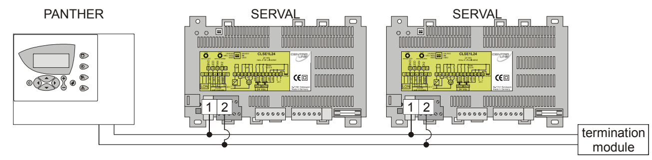


Fig. 10. LONWORKS wiring layout for PANTHER, SERVAL, and repeater

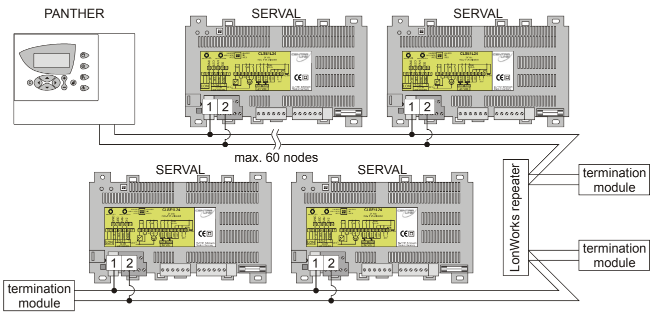


Fig. 11. LONWORKS wiring layout for two daisy-chain networks

LONWORKS Wiring Layout for Two Daisy-Chain Network Segments

As a general rule, the TP/FT-10 channel communication cables should be separated from high-voltage power cables. Follow local electrical codes with regards to cable placement.

The **recommended** configuration is a daisy chain with **double terminations**. This layout allows for maximum length of the LONWORKS bus, and its simple structure presents the least number of possible problems, particularly when adding on to an existing bus.

Table 6. Specifications of doubly-terminated buses

cable type	max. bus length for segments with FTT-10 / FTT-10A transceivers, only
Belden 85102	2,700 m
Belden 8471	2,700 m
Level IV, 22AWG	1,400 m
JY (St) Y 2x2x0.8, twisted pair	900 m
TIA568A Category 5 24AWG, twisted pair	900 m

Free topology requires only one termination and allows a variety of bus configurations.

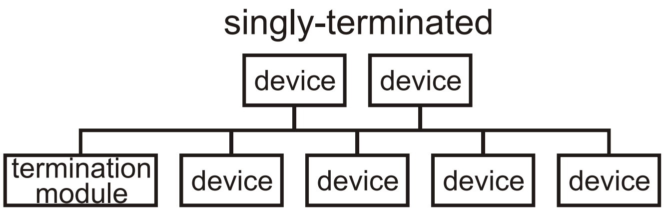


Fig. 12. Configuration with single termination

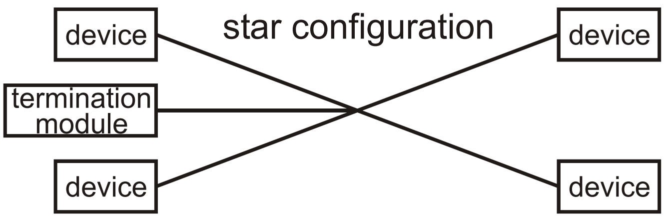


Fig. 13. Star configuration

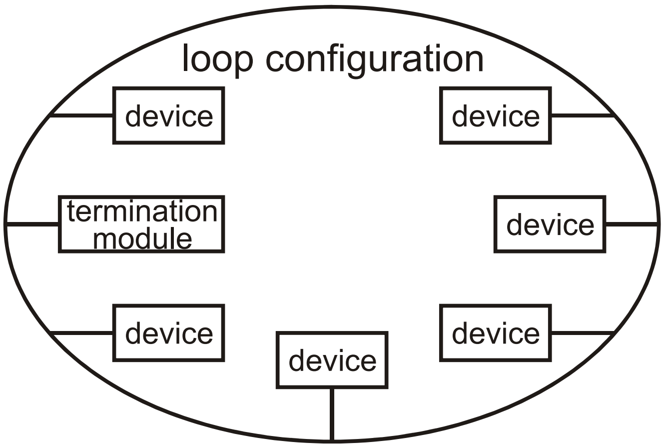


Fig. 14. Loop configuration

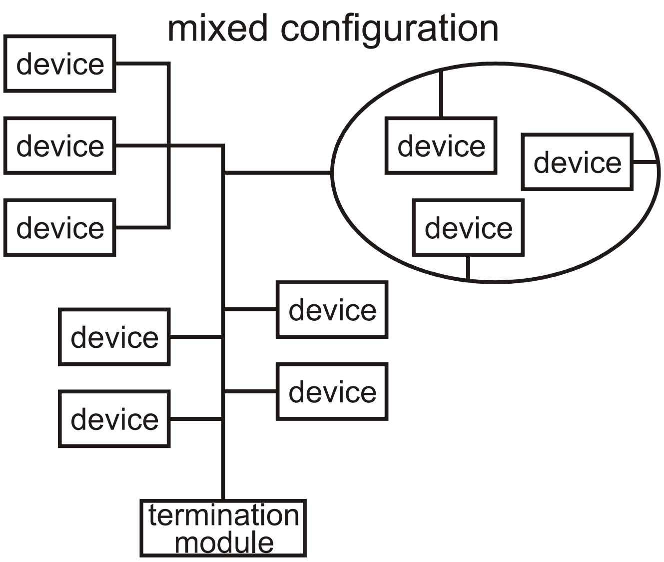


Fig. 15. Mixed configuration

In the event that the limits on the number of transceivers or total wire distance are exceeded, then one FTT physical layer repeater can be added to interconnect two segments, thus doubling the overall system capabilities.

Distance Rules

The free topology transmission (FTT) specification includes two further requirements which must be met for proper system operation. The distance from each transceiver to all other transceivers and to the termination must not exceed the *max. node-to-node distance*. If multiple paths exist, the *max. total wire length* is the total amount of wire used (see Table 7).

Table 7. Specifications of free topology (singly-terminated) buses

cable type	max. node-to-node distance	max. total wire length
Belden 85102	500 m	500 m
Belden 8471	400 m	500 m
Level IV, 22AWG	400 m	500 m
JY (St) Y 2x2x0.8, twisted pair	320 m	500 m
TIA568A Category 5 24AWG, twisted pair	250 m	450 m

IMPORTANT

Do not use different wire types or gauges on the same segment of the LONWORKS bus. The step change in line impedance characteristics would cause unpredictable reflections on the bus.

Examples of allowed and not-allowed free topology layouts for cable JY (St) Y 2x2x0.8 are shown in Fig. 16 through Fig. 18.

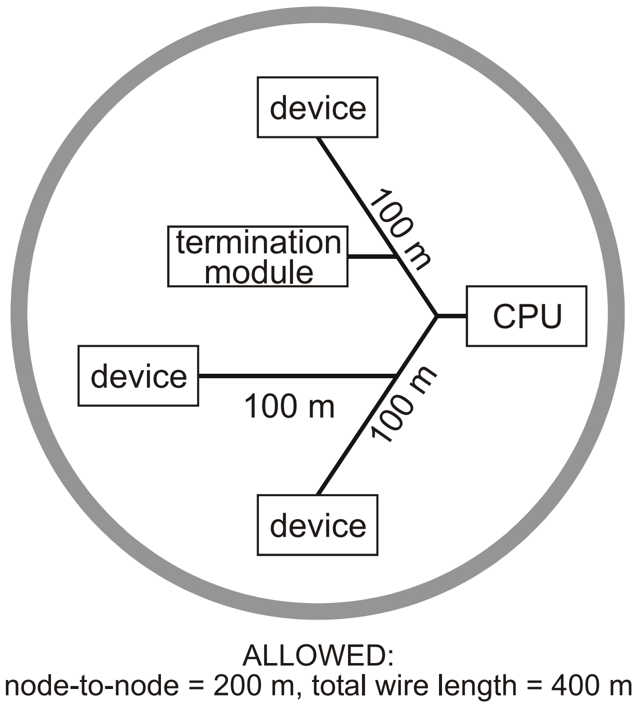


Fig. 16. Allowed free topology layout (example)

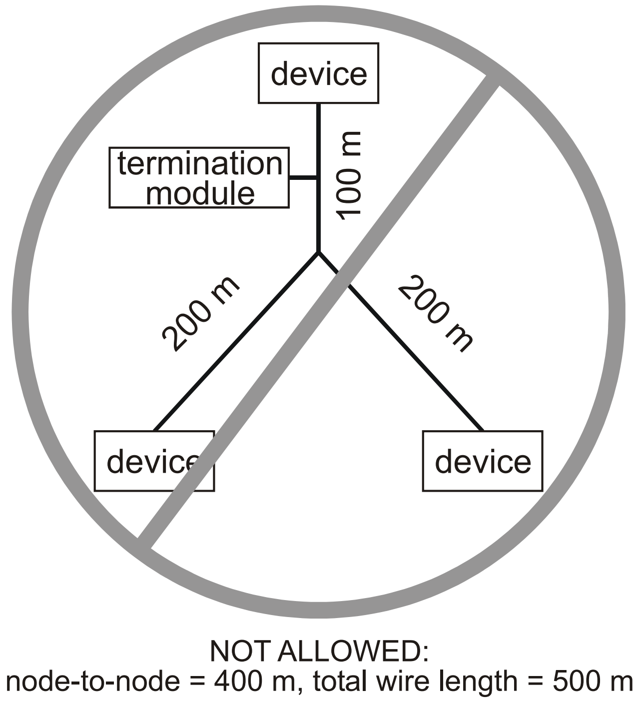


Fig. 17. Not-allowed free topology layout (example 1)

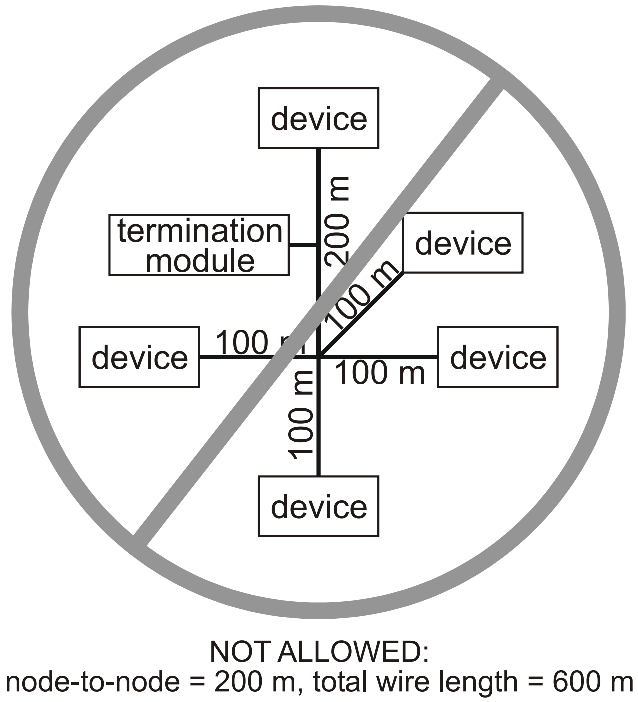


Fig. 18. Not-allowed free topology layout (example 2)

NOTE: In the event that the limit on the total wire length is exceeded, then FTT physical layer repeaters (FTT 10A) can be added to interconnect segments and increase the overall length by an amount equal to the original specification for that cable type and bus type for each repeater used. For example, adding repeaters for a doubly-terminated bus using JY (St) Y 2x2x0.8 cable increases the maximum length by 900 m for each repeater.

IMPORTANT

The LONWORKS transceiver can be affected by electromagnetic fields generated by frequency converters. If possible, position frequency converters in a different cabinet, or allow a minimum distance of 50 cm between frequency converters and their respective cabling.

NOTE: See section "LONWORKS Termination" on page 11 for additional details.

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 segment. The step change in line impedance characteristics would cause unpredictable reflections on the LONWORKS network.

*Do **not** use shielded cable for LONWORKS 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 80 mm of separation between noisy lines and the LONWORKS cable.*

Make sure that neither of the LONWORKS wires is grounded.

Power Wiring

IMPORTANT

Notes on power wiring:

All field wiring must conform to local codes and ordinances.

Use the heaviest gauge wire available, up to 2.0 mm^2 with a minimum of 1.0 mm^2 for all power and earth ground connections.

To minimize EMI noise, do not run triac and/or relay output wires in the same conduit as the input wires or the LONWORKS communications loop.

To comply with CE requirements, in the case of devices having a voltage range of 50 to 1000 Vac or 75 and 1500 Vdc which are not provided with a supply cord and a plug or with other means for disconnection from the supply having a contact separation of at least 3 mm in all poles, the means for disconnection must be incorporated in the fixed wiring.

Step 4: Preparing Wiring Diagrams

General Considerations, Wiring Documents from COACH

The purpose of this step is to assist the application engineer in developing job drawings to meet job specifications.

All terminal assignments will be listed in the COACH generated project documentation. Please refer to this automatically created document.

NOTE: For field wiring, when two or more wires are to be attached to the same connector block terminal, be sure to twist them together. Deviation from this rule can result in improper electrical contact.

SERVAL Terminal Block Assignment and Wiring

Table 8 lists the terminals and their functions of the SERVAL controller. Table 9 lists wiring information for all possible actuator types.

LONWORKS Termination

One or two LONWORKS terminations are required, depending on the given LonWorks bus layout.

Double termination is required only when the network is a daisy-chain configuration and the total wire length is greater than 500 m. The max. lengths described in Step 2 must be adhered to for either a daisy-chain or free-topology LONWORKS layout.

Two different LONWORKS termination modules are available:

- LONWORKS termination module, order no.: **209541B**

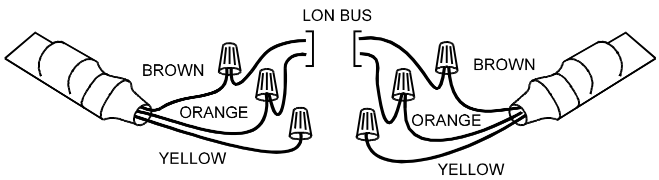


Fig. 19. Termination Module connections for doubly-terminated FTT network

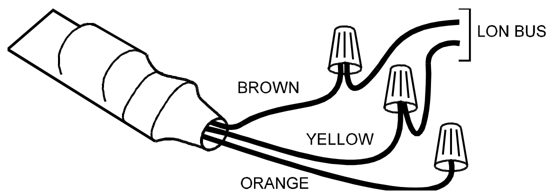


Fig. 20. Termination Module connections for a singly-terminated FTT network

- LONWORKS connection / termination module (mountable on DIN rails and in fuse boxes), order no.: **XAL-Term**

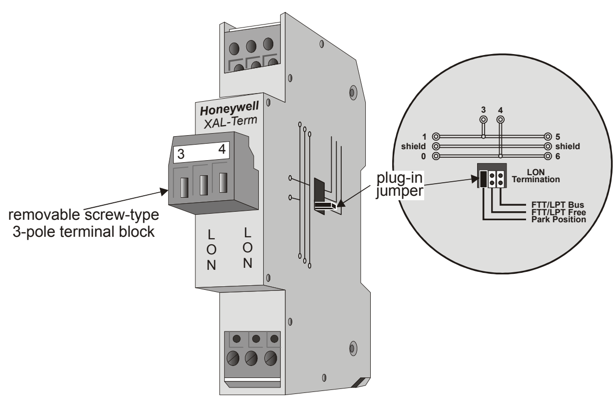


Fig. 21. LONWORKS connection and termination module

Table 8. Overview of SERVAL terminals and functions

term. #	Function	CLSE1L230	CLSE1L24
1+2	receiving/sending data on the LONWORKS network; removable plug	✓	✓
3	a digital input, configurable (using the LNS plug-in) to read input e.g. from a window contact, an occupancy sensor, etc.	✓	✓
4	an analog input, permanently configured to read input from a wall module's temperature setpoint adjustment knob	✓	✓
5	an analog input, permanently configured to read input from a room temperature sensor	✓	✓
6	GND serving terminals 4, 5, 9, 10, and 11	✓	✓
7	not used	--	--
8	GND serving terminal 3	✓	✓
9	a digital output, permanently configured to write output switching the wall module's LED ON/OFF	✓	✓
10	an analog input, permanently configured to read input on whether the wall module's 3-speed fan control knob has been set to AUTO, OFF, LOW, MEDIUM, or HIGH and whether the wall module's "occupancy override" button has been pressed	✓	✓
11 (1)	a digital input, permanently configured to read input on whether a window contact is "open" or "closed"	✓	✓
12	not used	--	--
13+14	relay 4, permanently configured to write output to a hardwired electrical reheat coil, switching it ON/OFF	✓	✓
15	a common terminal for terminals 16, 17, and 18	✓	✓
16 (2)	relay 3, permanently configured to write output to a three-speed fan, setting it to HIGH	✓	✓
17 (2)	relay 2, permanently configured to write output to a three-speed fan, setting it to MEDIUM	✓	✓
18 (2)	relay 1, permanently configured to write output to a three-speed fan, setting it to LOW	✓	✓
19	a triac output, permanently configured to write output to OUT1, closing it	✓	✓
20	a triac output, permanently configured to write output to OUT1, opening it	✓	✓
21	a triac output, permanently configured to write output to OUT2, closing it	✓	✓
22	a triac output, permanently configured to write output to OUT2, opening it	✓	✓
23	a common terminal for terminals 19 and 20	✓	✓
24	a common terminal for terminals 21 and 22	✓	✓
25	"N" terminal of power supply (24 Vac or 230 Vac, respectively); removable plug	230	24
26	"L" terminal of power supply (24 Vac or 230 Vac, respectively); removable plug	230	24

Using CentraLine COACH 1.2 or higher, you can configure the controller's triac outputs and relay outputs for a variety of different functions. E.g. the triac outputs can be configured for connection to either a floating drive or to a thermal actuator. Once the outputs have been configured, the corresponding devices can be directly connected to them.

Table 9. SERVAL output assignments for various actuator types

output type	OUT1		OUT2	
	terminal 19	terminal 20	terminal 21	terminal 22
floating	close	open	close	open
PWM	--	PWM	--	PWM
thermal	--	ON/OFF	--	ON/OFF

XAL-Term is a LONWORKS connection and termination module which can be mounted on DIN rails and in fuse boxes. See Fig. 21 for details. Advantages compared to other LONWORKS terminations, e.g. 209541B:

- Removable terminal to connect your tool, e.g. COACH, ARENA, to the LONWORKS network without disturbing LONWORKS communication.
- Easy mechanical mounting – just clip it onto a DIN rail.
- Easy termination configuration via jumper (three possible settings: no termination; free-topology wiring; daisy-chain wiring) which is accessible from outside the housing – no re-wiring necessary if the termination is changed.
- Easy wiring – not necessary to check polarity or color coding.
- The device has input / output terminals for the LONWORKS network as well as a removable plug for the LONWORKS tool.

Step 5: Ordering Equipment

After compiling a bill of materials through completion of the previous application steps, refer to Table 10 for ordering information.

Table 10. SERVAL ordering information

part no.	description / comments
SERVAL	
CLSE1L230	230 Vac version
CLSE1L24	24 Vac version
COMMAND	
CLCM1T11N, CLCM2T11N, CLCM4T111, CLCM5T111, CLCM6T111, CLCM6T21N	See CentraLine COMMAND wall module literature for details.
PANTHER	
CLPA21LC11	24 Vac controller with user interface
CLPA21LC01	24 Vac controller without user interface
Honeywell components and parts	
209541B	FTT termination module
XALTHERM	FTT termination and connection module
H7018A1003	early-warning dew point sensor (switch for CHC applications)
CRT6	6 A, 24 Vac transformer
CRT12	12 A, 24 Vac transformer
third-party parts	
PCLTA21	PCI LONWORKS interface card (Echelon)
PCC10	PCMCIA LONWORKS interface card (Echelon)
third-party material (cable for LONWORKS wiring)	
Belden 85102	
Belden 8471	
Level IV, 22AWG	
JY (St) Y 2x2x0.8, twisted pair	
TIA568A Category 5 24AWG, twisted pair	

Step 6: Configuring Controllers with COACH

This section will provide details on the COACH configuration options for SERVAL controllers.

The configuration process is primarily performed in a series of screens seen as file tabs under the menu option **Application Selection** and is easily followed using the tables included in this section.

1. model type (see Table 11)
2. room control configuration (see Table 12)
3. manual override (see Table 13)
4. precontrol assignment (see Table 14)

Table 11. System settings for SERVAL with COACH (function: model type)

selection	settings
230V	CLSE1L230
24V	CLSE1L24

Table 12. System settings for SERVAL with COACH (function: room control configuration)

selection	settings	range	default value	unit
radiator with heating valve	heating occupied setpoint	10 to 34°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	4	K
	heating integral time	10..3200 s, 0=disable	300	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
floor heating with heating valve	heating occupied setpoint	10 to 34°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	4	K
	heating integral time	10..3200 s, 0=disable	300	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
floor heating / cooling changeover valve	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	4	K
	heating integral time	10..3200 s, 0=disable	300	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	4	K
	cooling integral time	10..3200s, 0=disable	300	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h
chilled ceiling with cooling valve	cooling occupied setpoint	11 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	4	K
	cooling integral time	10..3200 s, 0=disable	300	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h
chilled ceiling with heating / cooling changeover valve	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	4	K
	heating integral time	10..3200 s, 0=disable	300	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	4	K
	cooling integral time	10..3200 s, 0=disable	300	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h

System settings for SERVAL with COACH (function: room control configuration) (continued)

selection	settings	range	default value	unit
radiator with heating valve / chilled ceiling with cooling valve	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	4	K
	heating integral time	10..3200 s, 0=disable	300	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	4	K
	cooling integral time	10..3200 s, 0=disable	300	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h
fancoil unit with heating valve / cooling valve	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	20	K
	heating integral time	10..3200 s, 0=disable	250s	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	20	K
	cooling integral time	10..3200 s, 0=disable	250	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h
fancoil unit with heating valve / cooling valve + electric reheat relay	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	20	K
	heating integral time	10..3200 s, 0=disable	250	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	20	K
	cooling integral time	10..3200 s, 0=disable	250	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 K/h to 0	0	K/h
fancoil unit with heating / cooling changeover valve	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	20	K
	heating integral time	10..3200 s, 0=disable	250	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	20	K
	cooling integral time	10..3200 s, 0=disable	250	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h

System settings for SERVAL with COACH (function: room control configuration) (continued)

fancoil unit with heating / cooling changeover valve + reheat relay	heating occupied setpoint	10 to 35°C	21	°C
	heating standby setpoint		19	
	heating unocc. setpoint		16	
	heating proportional band	2..100 K, 0=disable	20	K
	heating integral time	10..3200 s, 0=disable	250	seconds
	heating derivative time		0	
	Heat rec ramp (heating optimum start gradient)	0 to +20 K/h	4	K/h
	cooling occupied setpoint	10 to 35°C	23	°C
	cooling standby setpoint		25	
	cooling unocc. setpoint		28	
	cooling proportional band	2..100 K, 0=disable	20	K
	cooling integral time	10..3200 s, 0=disable	250	seconds
	cooling derivative time		0	
	Cool rec ramp (cooling optimum start gradient)	-20 to 0 K/h	0	K/h

Table 13. System settings for SERVAL with COACH (function: manual override)

selection	activated devices
no (= default)	room sensor, only
yes	See Table 15

Table 14. System settings for SERVAL with COACH (function: precontrol assignment)

selection
precontrol circuit 1
precontrol circuit 2
precontrol circuit 3
precontrol circuit 4

Table 15. Equipment settings for SERVAL with COACH

equipment	type	settings	range	default value	unit
output 1	floating actuator	output 1 valve direction	direct / reverse	direct	--
		output 1 valve run time	20…600 s	150	seconds
	thermal actuator	valve direction	direct / reverse	direct	--
	PWM	PWM cycle time	20…600 s	150	seconds
output 2	floating actuator	output 2 valve direction	direct / reverse	direct	--
		output 2 valve run time	20…600 s	150	seconds
	thermal actuator	valve direction	direct / reverse	direct	--
wall module	CLCM2T11N	min. limit setpoint potentiometer	-5 to 5 K	-5	K
		max. limit setpoint potentiometer	-5 to 5 K	5	
	CLCM4T111	min. limit setpoint potentiometer	-5 to 5 K	-5	
		max. limit setpoint potentiometer	-5 to 5 K	5	
		bypass time	0…1080 min	180	minutes
	CLCM5T111	min. limit setpoint potentiometer	-5 to 5 K	-5	K
		max. limit setpoint potentiometer	-5 to 5 K	5	
		bypass time	0…1080 min	180	minutes
	CLCM6T111	min. limit setpoint potentiometer	-5 to 5 K	-5	K
		max. limit setpoint potentiometer	-5 to 5 K	5	
		bypass time	0…1080 min	180	minutes
	CLCM6T21N	min. limit setpoint potentiometer	-5 to 5 K	-5	K
		max. limit setpoint potentiometer	-5 to 5 K	5	
		bypass time	0…1080 min	180	minutes
fan (appears only with fancoil applications)	fan stages	fan stages	no fan	3-speed	--
			ONE_SPEED		
			TWO_SPEED		
			THREE_SPEED		
		heating stage switching level 3	0…100%	75	%
		cooling stage switching level 3			
		fan operation	continuous / automatic	automatic	--
electric reheat (appears only with fancoil application)	electric reheat	reheat hysteresis	0…100%	5	%
		reheat switching level	0…100%	100	%
digital input NOTE: The airflow contact is automatically assigned when any electric reheat application is selected. The dew-point switch is automatically selected when any chilled ceiling application is selected.	presence	contact closed = room occupied	--		
		contact open = room occupied			
	window	contact closed = window open			
		contact open = window open			
	movement	contact closed = movement			
		contact open = movement			
	monitoring input	contact open=active			
		contact closed =active			
	airflow contact	contact open=no airflow			
		contact closed=no airflow			
	dew-point switch	contact open=dew-point exceeded			
		contact closed= dew-point exceeded			

Commissioning

Commissioning is the process of writing the LonWorks® addresses, the binding information and the configuration to all CentraLine controllers in the system. This has to be done with COACH after the offline configuration of all controllers, including SERVAL.

ID Number

Each CentraLine Controller is shipped with an internal Identification Number from the factory called the Neuron ID®. The Neuron ID®. can either be manually entered into COACH or it can be received from the network. Pressing the service pin on the SERVAL controllers (and all other CentraLine controllers) causes them to broadcast a service message containing their Neuron ID®. This Neuron ID®. is also on a removable sticker on the controller housing.

Step 7: Troubleshooting CentraLine SERVAL Controllers and Wall Modules

Alarms

Alarms for SERVAL controllers are identified only by the ARENA workstation. See SERVAL alarms in ARENA.

Schedules

Because SERVAL controllers do not have their own schedules, PANTHER controllers in the same system will provide up to ten independent time programs for the assigned room control groups.

The assignment will be defined in COACH during the engineering process. See COACH literature for details.

A maximum of **60 room controllers** can be assigned to one schedule.

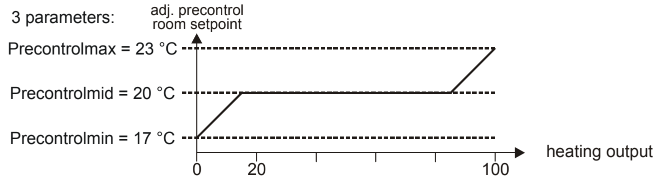
Heating Precontrol

In order to deliver precontrolled heating water to the room controllers, the PANTHER controller AH03 will provide up to four independent OTC precontrol circuits, which will receive heating demands from the individual room controllers. This function will ensure that whenever the demand is higher than the supply, the heating precontrol will open its valve and will also transmit increased heating demand to the heat generators (boilers).

The **heating demand signal** for the heating precontrol circuits depends on the actual heating output of each individual room controller. It is defined as follows:

If one or more controllers have a heating output signal between 20% and 80%, then the default precontrol room setpoint (20°C) will be applied. If one or more room controllers have an output higher than 80%, then the room setpoint will be increased by the maximum amount of 3 K (at 100%). If all of the room controllers have an output lower than 20%, then the room setpoint will be decreased by an adjustable Delta t.

SERVAL Heating Precontrol Demand Diagram



CONDITIONS:
If one SERVAL heating output is > 80%, the virtual room setpoint is shifted to Precontrolmax.
If all SERVAL heating outputs are < 20%, the virtual room setpoint is shifted to Precontrolmin.

Fig. 22. Room demand signal from SERVAL to precontrol circuit in PANTHER controllers (AH03)

The heating precontrol will therefore need the heating output signal of each room controller. This signal is automatically sent from all assigned room controllers and defines the demand according to the above diagram.

The heating precontrol will also have the **changeover** signal as physical input. This signal will be automatically sent to all connected room controllers in order to make the two pipe systems work properly. A maximum of **60 room controllers** can be assigned to one precontrol circuit.

Cooling Precontrol

Every room controller with cooling output will sent his cooling demand to the AH03 cooling precontrol.

This is a simple digital output, which will close, whenever the cooling signal of at least one of the assigned room controllers exceeds 10% output. This output is responsible to enable or disable a cooling generator system with its own control.

The cooling precontrol will therefore need the cooling output signal of each room controller.

This signal is automatically sent from all assigned room controllers.

There will be a switch-off delay as PANTHER parameter, default = 0 min, range 0…60 min.

A maximum of **60 room controllers** can be assigned to one precontrol circuit.

In the case of two-pipe systems, the assigned cooling valves in the precontrol circuit will be 100% open during "cooling."

Precontrol and Schedule Assignment

The following overview shows the possible schedules and precontrols for one PANTHER controller. As indicated, a maximum of ten room groups can be covered by one PANTHER.

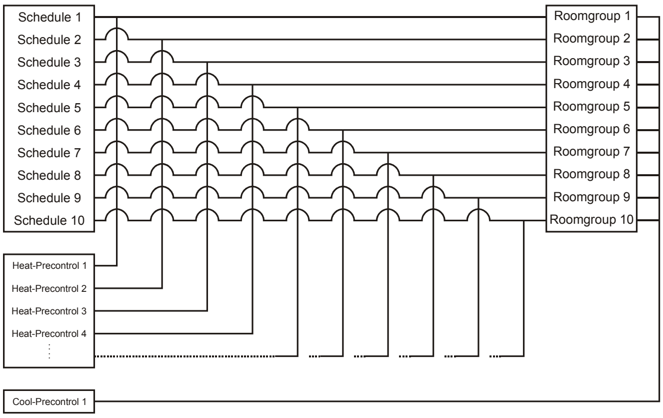


Fig. 23. Overview of precontrols and schedules

By default, all room groups are assigned to heating precontrol 1. Different assignments can be made during the setup process with COACH.

DISPLAY AND OPERATION USING AN ARENA WORKSTATION

Controller Recognition

All connected controllers of a commissioned CentraLine system can be recognized automatically by the ARENA workstation.

During the setup with COACH, the system parameters were defined and downloaded into the controllers.

Scanning and Displaying All Settings

When starting ARENA on a commissioned system, it will scan all relevant controllers with their datapoints, schedules and parameters. If required, controllers which shall not be displayed in ARENA can remain invisible to the end-user.

Operation of Schedules in ARENA

Schedules of SERVAL controllers will be easily accessible through the graphic controller application page. There will be a button with a direct link to the schedule. Physically, this schedule will be located in the connected PANTHER controller and can also be reached through the PANTHER controller time program setting.

Adjustment of Room Control Parameters in ARENA

All SERVAL controller settings (done in COACH) will be visible in ARENA, as well. However, only a few settings can still be edited (see Table 16).

Table 16. Editable wall module and room control configuration settings

parameter / setting	range	default
min. limit setpoint	-5…5 K	-5 K
max. limit setpoint	-5…5 K	-5 K
bypass time	0…1080 min	180 min
heating stage 3 switching level	0…100%	75%
cooling stage 3 switching level	0…100%	75%
heating occupied setpoint	10…35 °C	21 °C
heating standby setpoint	10…35 °C	19 °C
heating unoccupied setpoint	10…35 °C	16 °C
heating proportional band	2…100 K, 0 = disable	20 K
heating integral time	10…3200 s, 0 = disable	250 s
heating derivative time	10…3200 s, 0 = disable	0 s
Heat rec ramp (heating optimum start gradient)	0…+20 K/h	4 K/h
cooling occupied setpoint	10…35 °C	23 °C
cooling standby setpoint	10…35 °C	25 °C
cooling unoccupied setpoint	10…35 °C	28 °C
cooling proportional band	2…100 K, 0 = disable	20 K
cooling integral time	10…3200 s, 0 = disable	250 s
cooling derivative time	10…3200 s, 0 = disable	0 s
Cooling rec ramp (cooling optimum start gradient)	-20…0 K/h	0 K/h

SERVAL Alarms in ARENA

SERVAL alarms depend on alarm conditions defined in ARENA.

This means that ARENA is necessary in order to issue alarms for SERVAL controllers.

Table 17. Defined alarm conditions

condition	alarm
room temperature< 8°C	frost alarm
room temperature>40°C	room overheat / sensor break
room temperature, room setpoint, heating output, or cooling output are undefined	communication alarm
control deviation > 5 K and H/C output = 100% for 1 h	actuator fault / fan fault / pump fault / heating, cooling generation fault / system undersized
input is inactive although SERVAL configured with an airflow detector (FCU with electric heating)	airflow alarm

SERVAL alarms will be stored in ARENA, only. The historic alarms can be found in daily files on the ARENA hard-disk.

SERVAL Application Pictures in COACH and ARENA

During the application definition in COACH there will be pictures appearing which represent the SERVAL function for this room. Identical pictures will be created from the downloaded controller information in ARENA.

In ARENA and COACH online there will also be buttons for schedule links and setting links. Icons will show the actual status of digital inputs, fan stages and heating / cooling outputs. The actual temperature, actual setpoint and zero-energy band will also be displayed in this picture.

Fig. 24. Example application picture (actual picture may differ)

Table 18. Glossary of terms

PANTHER	CentraLine plant controller.
COACH 1.2	CentraLine engineering software.
ARENA 1.2	A CentraLine HVAC, Windows ® based software package providing a simple-to-use graphical interface to enable the status of HVAC systems to be monitored and data logged.
ARENA Editor	Graphic editor for the ARENA workstation.
LONWORKS	Bus system with LonTalk protocol.
workstation	PC-based central.
chilled ceiling	Static room cooling device, usually mounted at the ceiling.
commissioning	Download of application software into a control system consisting of one or more CentraLine controllers, at the same time managing and defining bus addresses for every controller.
2-pipe system	Hydraulic system which contains hot water for heating (usually in winter) and cold water for cooling (usually in summer).
4-pipe system	Two independent hydraulic systems: one (containing hot water) for heating and one (containing cold water) for cooling.
changeover signal	Binary signal defining when the change from heating to cooling and vice versa takes place. Input here for the precontrol circuits.
heating output	Controller heating output; represents the % opening of the heating valve.
cooling output	Controller cooling output; represents the % opening of the cooling valve.
effective setpoint	Setpoint as result from actual heating or cooling setpoint plus or minus setpoint correction from the wall module + influence of manual override.
actual room temperature	Temperature at the room sensor.
zero-energy band	Neutral zone where neither heating nor cooling takes place.
repeater	Device which extends the length of the LONWORKS network.
dew-point switch	Sensor for mounting to the "cold" pipe of a chilled ceiling system.
air flow switch	Sensor which detects air flow in conjunction with electric heating in order to avoid overheating in case the fan fails.

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