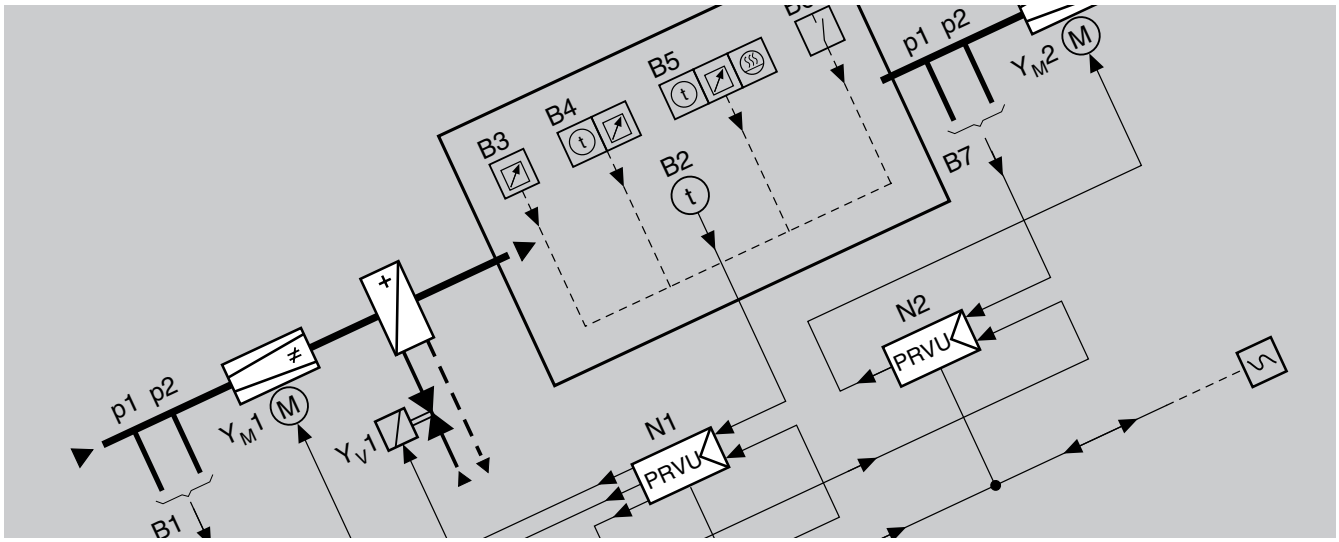
SIEMENS



PRONTO IRC

PRFB-A, PRFB-V – Communicating individual room controllers for fan-coil systems

Technical manual

Siemens Building Technologies
Landis & Staefa Divison

Contents

About this manual

The Landis & Staefa components and systems described in this manual are designed for control and interlock functions in heating, ventilation and air conditioning systems.

They should not be used in applications other than those described above except with the written approval of Landis & Staefa.

Contents

This manual, P20-07 provides the basic information required for the engineering, installation, and commissioning of the PRFB-A and PRFB-V fan-coil controllers.

For additional engineering support, refer to brochure P20-07/A, which contains application examples.

Further documentation

P20-07/A	Application examples	PRFB-A and PRFB-V

PRONTO IRC control system*:*

P20-01	System description	General range overview
P20-09	Technical manual	WSE10 communication module
P6	User manual	ZS1 service terminal

The peripheral devices (sensors, valves, room operating units etc.) are described in the relevant data sheets (and see Overview, Section 7.3, p. 59).

Target readership

This manual is intended for project engineers, system contractors, service engineers and other specialists in the field of HVAC and control engineering.

Validity

The validity of this manual is defined by the date printed on the back cover. Please quote these details in the event of queries to Landis & Staefa national subsidiaries and branch offices.

Conventions

- Responses in interactive mode are shown in single inverted commas.
- General quotations are shown in double inverted commas.
  Example: The term "initialisation" refers to .....

Note categories

In addition to the general notes in the margins of this manual, special attention is drawn to notes with the following headings:

Important *Failure to observe information under this heading could lead to malfunctioning.*

Caution *Failure to observe information under this heading could result in damage or serious program errors.*

1 Introduction

The PRFB-A and PRFB-V (**PR**ONTO **F**an-coil controllers, type **B**) are communicating individual room controllers[1)] for fan-coil systems.

The PRFB-A and PRFB-V are controlled and monitored via the communications bus. The bus data and the input signals required for the control and interlock algorithms are processed by a microprocesser built into the controller.

The controllers are suitable for a wide range of fan-coil applications, and for heated and chilled ceilings. They may also be used as input/output modules where required. The outputs of the two controller types differ as follows:

PRFB-A Two outputs, Y1 and Y2, which may be configured either as proportional (PWM)[2)] outputs, or as on/off outputs.
Used to drive type STE7... thermic valve actuators, 3-point damper actuators[3)] or for the control of contactors.

1 built-in relay (Y3) for various applications, such as lighting or single-speed fan control.

PRFB-V Outputs Y1 ... Y3 as for PRFB-A

3 built-in relays Y4, Y5 and Y6, for multi-speed fan control

1) also referred to as "IRC controllers" (IRC = Integrated Room Control)

2) PWM: pulse-width modulated (AC 24 V)

3) Landis & Staefa damper actuator or compatible product; AC 24 V and run-time of maximum 7 minutes.

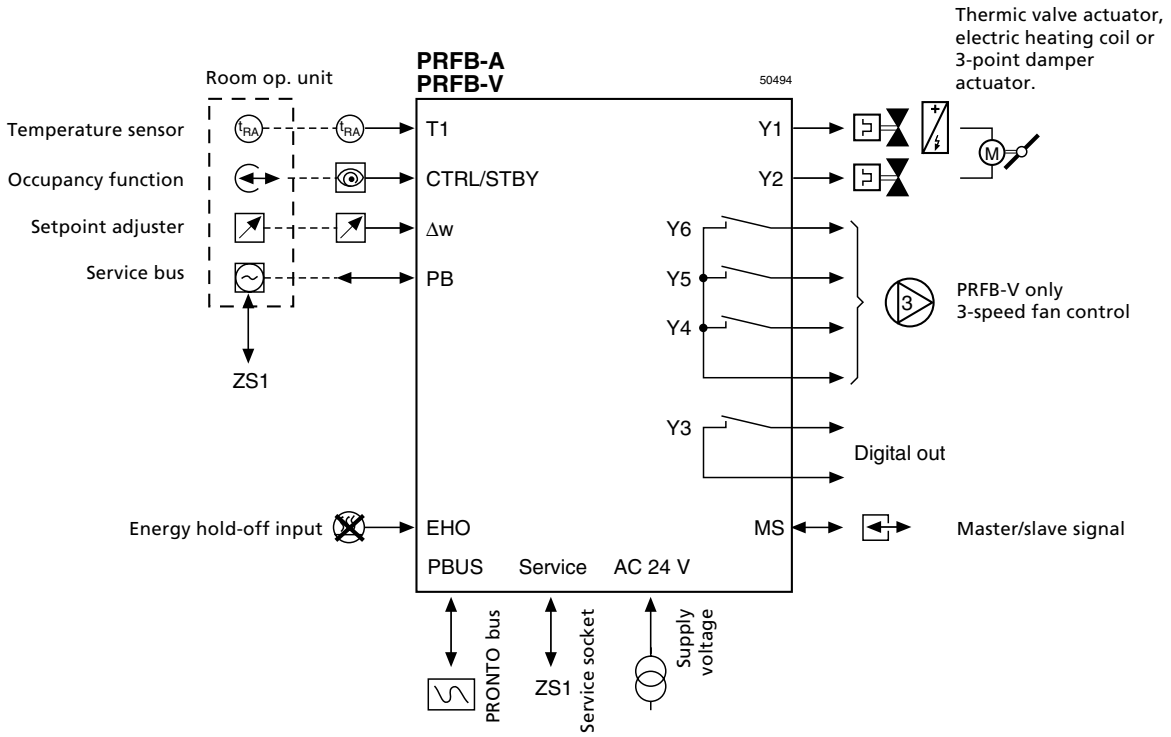
Features

- For use in fan-coil systems (2-pipe, 2-pipe change-over, 4-pipe and airside) and in chilled or heated ceiling applications
- May be used as stand-alone controllers or in conjunction with the systems KLIMO / MULTIREG, INTEGRAL AS1000, MS1000, TS1500 or MS2000
- Bus communication, compatible with all PRONTO IRC controllers
- Relay outputs for the control of fans, lighting, electric heating coils, and change-over from heating to cooling circuit in chilled / heated ceiling applications etc.
- Control signal for master/slave circuits
- Valve exercising feature
- Choice of various room operating units
- Socket for direct connection of the ZS1 service terminal and connection between service bus and operating unit
- May be used as universal I/O module

2 Description of functions

2.1 Inputs / Outputs

2.1.1 Overview



2.1.2 Input signals

T1	Temperature sensor	Any Landis & Staefa T1 temperature sensors may be connected.
CTRL/STBY	Occupancy function	For change of operating mode via the PBB room operating unit, PBIT/PBIR infrared remote control unit or occupancy sensor.
Δw	Setpoint adjuster	For temperature setpoint adjustment, via the PB... room operating units or BSG-U1 setpoint adjuster
PB	Service bus	Used to connect the ZS1 service terminal to the PB... room operating unit
EHO	Energy hold-off input	Switches to "Energy hold-off" operating mode, via window switch or dew point sensor.
PBUS	pronto bus	For communication with the control and interlock systems and management systems.
Service		Socket for ZS1 service terminal
AC 24 V		AC 24 V supply voltage

2.1.3 Output signals

Y1	Heating sequence AC 24 V PWM	For type STE7... thermic valve actuators For proportional control of electric heating coil or 3-point damper actuators
Y2	Cooling sequence AC 24 V PWM	For type STE7... thermic valve actuators or 3-point damper actuators
Y4 ... Y6	Relay outputs (PRFB-V only)	For 3-speed fan control To drive electric heating coils etc.
Y3	Relay output	For control of lighting, electric heating coils, fans etc.
MS	Master/slave	For parallel operation of a number of controllers.

2.1.4 Parallel operation of additional actuators

The PRFB-A and PRFB-V can each accommodate up to four STE7... actuators per output (Y1 or Y2). There are three options for parallel operation of additional actuators:

- **UA1T power amplifier**

Amplifier to allow connection of additional actuators (four per UA1T). The actuators are driven via output signals Y1 and Y2.

See data sheet N3591 or page 57 and connection diagram, page 39.

- **UA2T power amplifier**

Amplifier to allow connection of eight additional actuators (four each to outputs Y1 and Y2 of the UA2T) or six additional damper actuators. The devices are driven via the master/slave signal "MS".

See data sheet N3592 or page 58 and connection diagram, page 39.

- **PRFA-V controller**

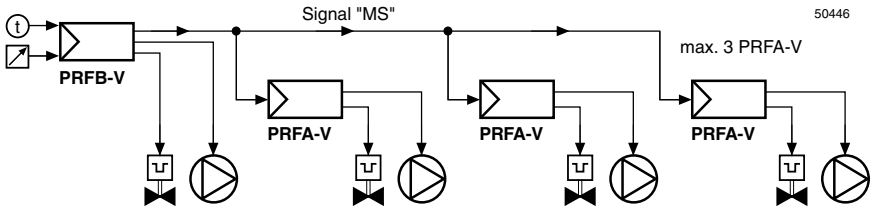
In addition to multiple control of valve or damper actuators, the use of the PRFA-V as a power controller also permits multiple use of the relay outputs.

Up to three PRFA-V controllers may be connected to one PRFB-V.

Output signals Y1, Y2 and Y4…Y6 are transmitted via the "MS" signal. Y3 has no effect, since there is no corresponding function in the PRFA-V. Apart from the master/slave signal, no other input signals are active.

The PRFA-V must be configured as a slave controller (see Manual P20-03, the PRFA technical manual).

Connection diagram: see page 40.

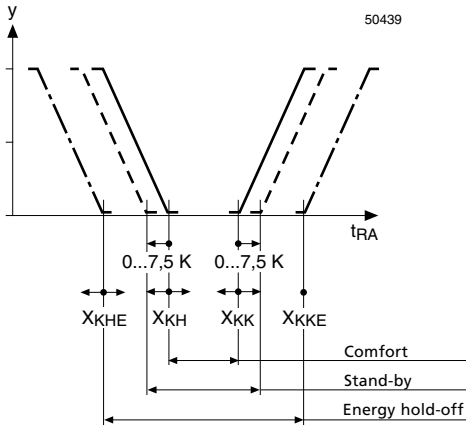


2.2 Setpoint calculation

2.2.1 Operating modes

The controller recognises the operating modes *Comfort, Stand-by* or *Energy hold-off.* The change from one operating mode to another can be effected either by use of the pushbuttons on the PBB room operating unit, or via the occupancy sensor or energy hold-off input (EHO), or through communication with higher-order systems.

The operating modes have differing setpoints, which can be adjusted separately for the heating and cooling sequences.



y *Output signal*
t_{RA} *Room temperature*
X_{KH} *Heating setpoint*
X_{KHE} *Heating setpoint in EHO mode*
X_{KK} *Cooling setpoint*
X_{KKE} *Cooling setpoint in EHO mode*

Command list

The bus communication functions are referred to as commands (CMD).
A complete command list for the functions described here will be found on pages 48 to 55.

For functions which can be invoked as *Read* and *Write* commands, both command numbers are shown.

Example: CMD 30/50
CMD 30 = Read heating setpoint
CMD 50 = Write heating setpoint

Comfort

Comfort is the normal operating mode for an occupied room. The controller operates at the basic comfort setpoints, X_{KH} for the heating sequence and X_{KK} for the cooling sequence.

Adjustment range:

Heating setpoint X_{KH}:	17 ... 24.5 °C in steps of 0.5 K	CMD 30/50
Cooling setpoint X_{KK}:	21 ... 28.5 °C in steps of 0.5 K	CMD 31/51

Stand-by

Stand-by is the operating mode for an unoccupied room. In this mode the controller operates in accordance with a setpoint a few degrees below the *Comfort* setpoint (for heating), and a few degrees above the *Comfort* setpoint (for cooling).

The amount by which the *Stand-by* temperature can be allowed to deviate from the *Comfort* temperature band depends on the type of building and the system response time. The *Stand-by* setpoints are entered as offset values, i.e. values representing the amount by which they deviate from the *Comfort* setpoint.

Adjustment range:

Heating setpoint: X_{KH}	0 ... – 7.5 K in steps of 0.5 K	CMD 32/52
Cooling setpoint: X_{KK}	0 ... + 7.5 K in steps of 0.5 K	CMD 33/53

Energy hold-off

In night mode (night setback), or during long periods of absence (e.g. weekends in offices, or in unoccupied rooms in hotels), or when windows have been left open or where there is a risk of condensation forming on chilled ceilings, the supply of heating or cooling energy to the space can be suspended.

In energy hold-off mode, the controller operates at the energy hold-off setpoints X_{KHE} for the heating sequence and X_{KKE} for the cooling sequence.

Adjustment range:

Heating setpoint X_{KHE}:	12 ... 19.5 °C in steps of 0.5 K	CMD 45/65
Cooling setpoint X_{KKE}:	Fixed at 40 °C	–

Types of communication

See page 27 for a definition of "individual" and "trunk" communication.

Initiation of the operating modes

- **Comfort** is initiated:

– via an occupancy sensor (room occupied)
– via the occupancy button on the PBB room operating unit or PBIT/PBIR remote control unit (room occupied)
– via individual communication (compulsory operating mode) CMD 125/25

- **Stand-by** is initiated by:

– via an occupancy sensor (room unoccupied)
– via the occupancy button on the PBB room operating unit or PBIT/PBIR remote control unit (room unoccupied)
– via individual communication (compulsory operating mode) CMD 125/25
– via trunk communication CMD 79

- **Energy hold-off** is initiated:

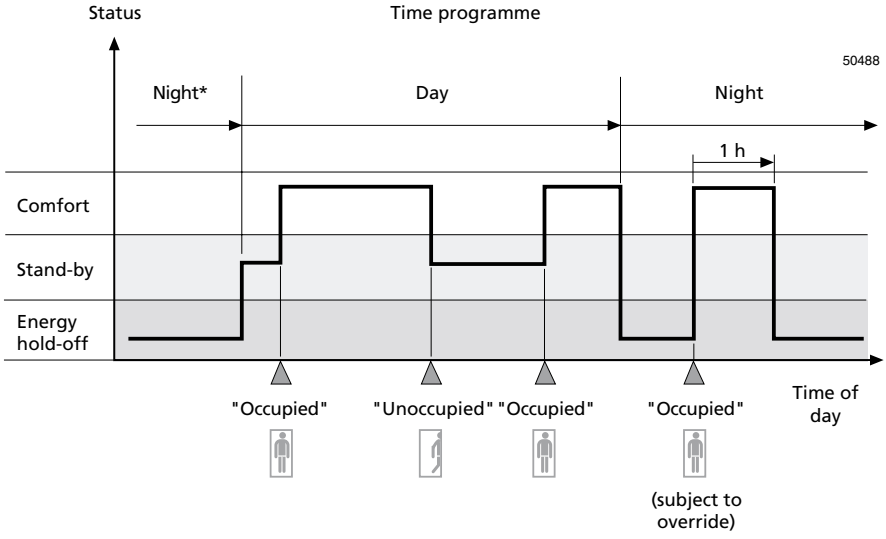
– locally, with the energy hold-off button on the PBB room operating unit
– locally, via the EHO input (energy hold-off) on the controller (e.g window contact)
– via individual communication (night mode in accordance with time programme) either with or without override CMD 125/25
– via trunk communication (night mode subject to override) CMD 78

- **Override function**

During night mode (energy hold-off) the override function can be activated via the occupancy button on the room operating unit (PBB or PBIT / PBIR). This will cause the controller to switch to *Comfort* mode for one hour. This override command can be repeated as often as required.

In systems where an occupancy sensor is used, *Comfort* mode will only override the EHO command for as long as the room is actually occupied.

- **Example:** Operating mode based on occupancy and time programme.



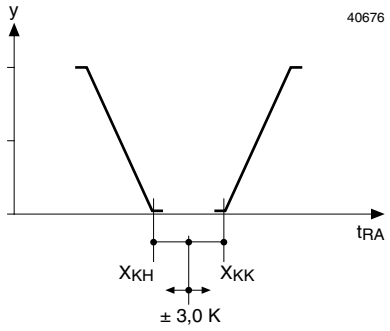
* At the end of the night mode, triggered with individual communication (CMD 125/25) or with trunk communication (CMD 78) the controller operating mode switches to "Stand by").

2.2.2 Setpoint adjustment

Local setpoint adjustment

The room occupant can adjust the programmed setpoints locally with the rotary knob on the PB... room operating units or BSG-U1 setpoint adjuster, or by use of the PBIT / PBIR infrared remote control unit. This causes the heating and cooling setpoints to be adjusted by the same amount and in the same direction.

This local adjustment has no effect on the energy hold-off setpoints.



y *Output signal*
t_{RA} *Room temperature*
X_{KHS} *Locally adjusted heating setpoint*
X_{KKS} *Locally adjusted cooling setpoint*

Remote control heating and cooling setpoint

This function is used for individual relative adjustments of the setpoints. Separate reset values can be programmed for the heating and cooling setpoints. The reset values are expressed in terms of a differential from the basic setpoint.

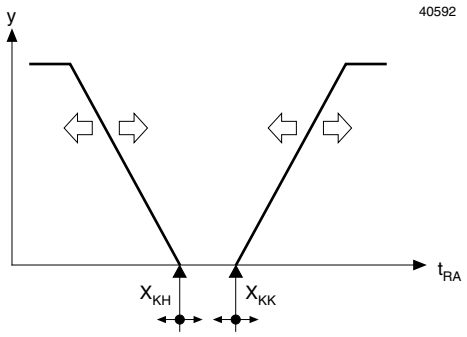
The cooling setpoint can be adjusted downwards until it is equal to the heating setpoint, but no lower. If the heating setpoint is reset to a value above the cooling setpoint, the cooling setpoint is automatically reset to the same value.

Adjustment ranges:

Heating sequence	X_{KH} – 8 K ... + 7.5 K
Cooling setpoint	X_{KK} – 8 K ... + 7.5 K

Read/write remote control reset

Heating setpoint	CMD 128/28
Cooling setpoint	CMD 129/29
Receipt of commands enabled	CMD 34/54



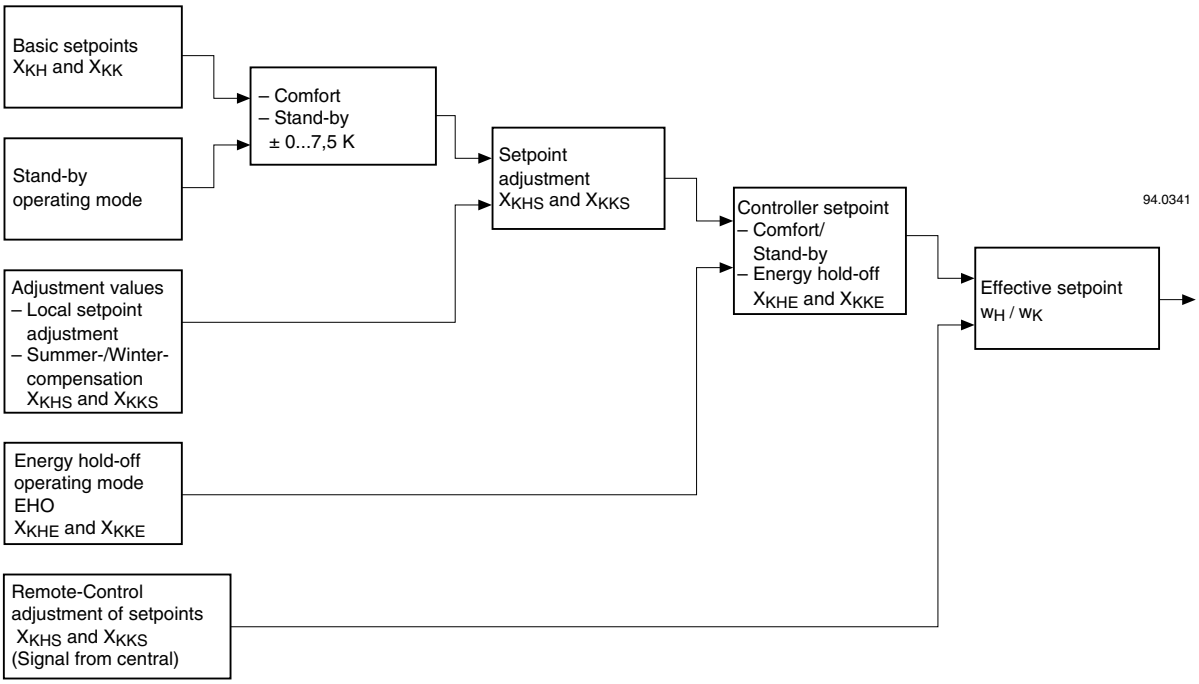
y *Output signal*
X_{KH} *Heating setpoint reset – 8 ... + 7.5 K*
X_{KK} *Cooling setpoint reset – 8 ... + 7.5 K*
t_{RA} *Room temperature*

2.2.3 Effective setpoint

The effective setpoints for heating and cooling are calculated separately as shown in the diagram below.

If setpoints w_H und w_K are programmed so that they overlap, the controller resets the cooling setpoint so that it is equal to the heating setpoint.

When the parameters are interrogated via a central (remote control) command, only the controller setpoints X_{KHE} and X_{KKE} will be transmitted.



Setpoint calculation

X_{KH}	*Heating setpoint*
X_{KK}	*Cooling setpoint*
X_{KHE}	*Energy hold-off heating setpoint*
X_{KKE}	*Energy hold-off cooling setpoint*
X_{KHS}	*Heating setpoint adjustment*
X_{KKS}	*Cooling setpoint adjustment*
w_H	*Effective heating setpoint (CMD 2)*
w_K	*Effective cooling setpoint (CMD 3)*

2.2.4 Summer / winter compensation

The summer/winter compensation function is designed to enhance thermal comfort. It causes a gradual increase in the controller setpoint as a function of the outside temperature. In summer, this prevents exposure to too great a difference in temperature when entering or leaving the building, and in winter it improves overall thermal comfort by counteracting the effects of the cold radiated from the walls in perimeter zones.

To prevent unintentional reheating, summer compensation acts only on the cooling setpoint.

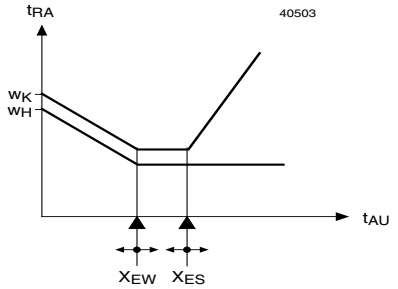
Winter compensation affects both the cooling and the heating setpoints.

The start points for summer and winter compensation are programmed centrally and transmitted to the controllers by a trunk communication command.

In order to receive the summer/winter compensation signals, the controllers must be enabled accordingly (Enable receipt).

Enable receipt: CMD 35/55

Read data: CMD 76 and 77



w_H	*Effective heating setpoint*
w_K	*Effective cooling setpoint*
X_{EW}	*Start point for winter compensation*
X_{ES}	*Start point for summer compensation*
t_{AU}	*Outside air temperature*

2.3 Sequence diagrams / Type of control

The diagrams illustrate the operation of the control signals as a function of the (measured) room temperature.

There are 16 codes for the various types of control (0…15); these are activated during initialisation.

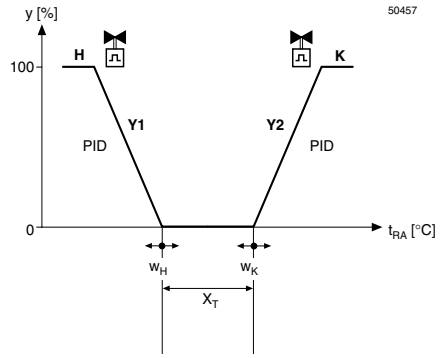
Select the "Control Type" code with CMD 46/66 and 47/67 (refer to the table on page 53)

The types of control are described in detail below.

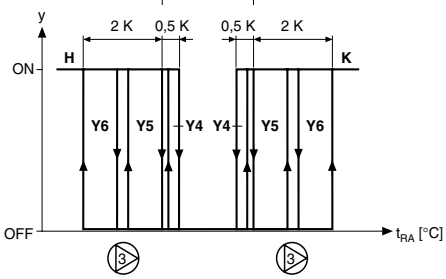
2.3.1 4-pipe systems

- **Control Type 0: – Proportional heating with thermic valve**
  – Proportional cooling with thermic valve

Outputs Y1, Y2



Relays Y4 ... Y6, with PRFB-V only (3-speed fan control)



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
X_T *Zero-energy band*

Note:

In conjunction with this type of control, a zero-energy zone X_T of 0 K is to be avoided, as it can result in partial overlapping of the valves in the low opening range (partial heating and cooling, simultaneously).

If required, the direction of operation of this control sequence can be reversed by a centrally issued change-over command (via trunk communication). Output Y1 is then driven by the cooling sequence instead of the heating sequence, and output Y2 by the heating sequence instead of the cooling sequence.

Enable receipt of change-over command:	CMD 34/54
Read change-over command:	CMD 78
Select type of control:	CMD 46/66

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

2.3.2 2-pipe system with change-over

- **Control Type 2: – Proportional heating, with thermic valve or**
  – On/off heating with switching differential x_D = 1.5 K
- **Control Type 3: – Proportional heating, with thermic valve or**
  – On/off heating with switching differential x_D = 1.0 K

These types of control are used in two-pipe systems for heating or cooling with the same heat exchanger (change-over). The change-over from heating to cooling is a function of the outside temperature. The change-over command is transmitted via a trunk communication signal from the primary plant. Output Y1 is then driven by the cooling sequence instead of the heating sequence, and output Y2 by the heating sequence instead of the cooling sequence. The fan runs only when heating or cooling are operative.

This option has a further application in combination systems involving LTHW and an on/off electric heating coil or chilled water and a chiller. The downstream on/off output, Y2, does not switch on until output Y1 reaches its maximum value (valve fully open).

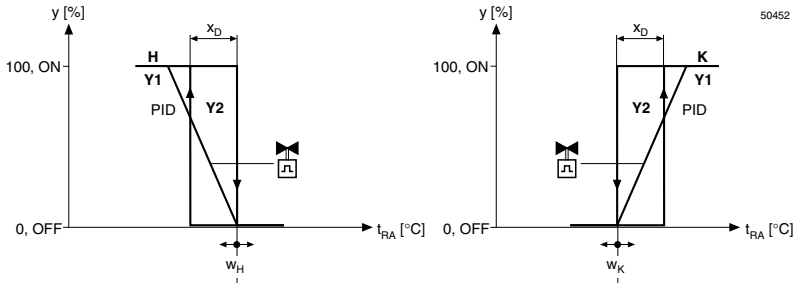
Direction of operation normal

Y1 = Proportional heating
Y2 = On/off heating

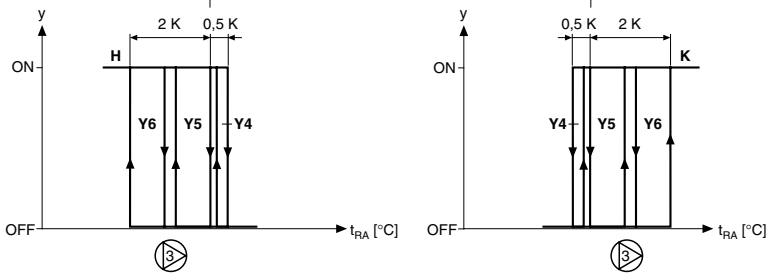
Direction of operation reversed (change-over)

Y1 = Proportional cooling
Y2 = On/off cooling

Outputs Y1, Y2



Relays Y4...Y6, with PRFB-V only (3-speed fan control)



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential*

Representation of PID function

The proportional characteristic (Y1: PID) is often shown only as a P function. However, output Y2 (offset by x_D) does not come into operation until the output signal Y1 has reached its maximum value.

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

When the direction of operation is reversed (change-over), both outputs (Y1 and Y2) are switched from the heating sequence to the cooling sequence.

Important:

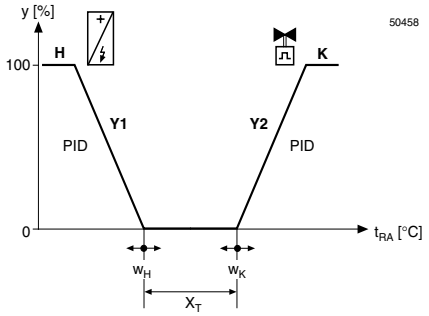
With Control Types 2 and 3, the maximum rating for outputs Y1 and Y2 is limited to a total of 12 VA for both outputs together. This allows the connection of two valve actuators and two contactors for example.

Enable receipt of change-over command:	CMD 34/54
Read change-over signal:	CMD 78
Select type of control:	CMD 46/66

2.3.3 2-pipe system with proportional control of electric heating coil

• Control Type 11: – Proportional heating, with electric heating coil
– Proportional cooling, with thermic valve

With Control Type 11, the control parameters are optimised to allow quasi-proportional control of an electric heating coil with the PWM signal, Y1, via a solid-state relay.



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
X_T *Zero-energy band*

The direction of operation cannot be reversed.

3-speed fan control with the PRFB-V operates with the same relay sequence as for Control Type 0.

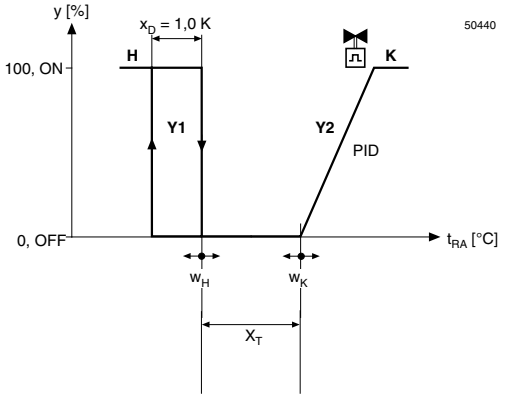
For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

Select type of control: CMD 46/66

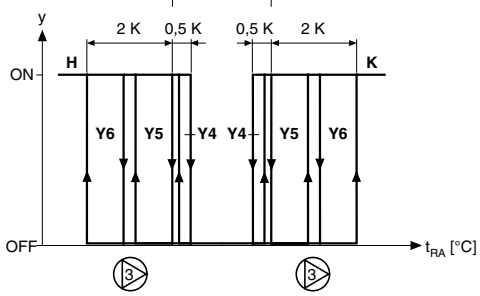
2.3.4 2-pipe system with on/off control of electric heating coil

• Control Type 1: – On/off heating
– Proportional cooling

Outputs Y1, Y2



Relays Y4...Y6, with PRFB-V only (3-speed fan control)



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential 1.0 K (fixed)*
X_T *Zero-energy band*

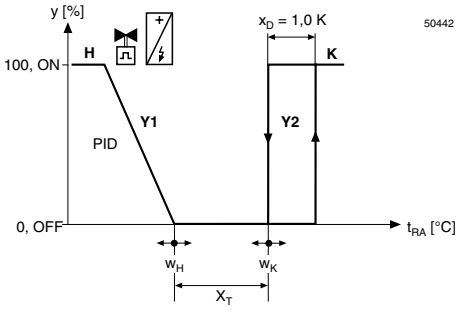
The change-over function cannot be used with this type of control.
To invert the functions (proportional heating and on/off cooling), select Control Type 10.

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21

Select type of control: CMD 46/66

2.3.5 On/off control of cooling and proportional control of electric heating coil or heating valve

- **Control Type 10: – Proportional heating with thermic valve**
  – On/off cooling
- **Control Type 13: – Proportional heating with electric heating coil**
  – On/off cooling



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential 1.0 K (fixed)*
X_T *Zero-energy band*

With Control Type 13, the control parameters are optimised to allow quasi-proportional control of an electric heating coil with the PWM signal Y1 via a solid-state relay.

Neither of the above types of control allow selection of the direction of operation. Use Control Type 1 to invert the functions (i.e. on/off heating and proportional cooling).

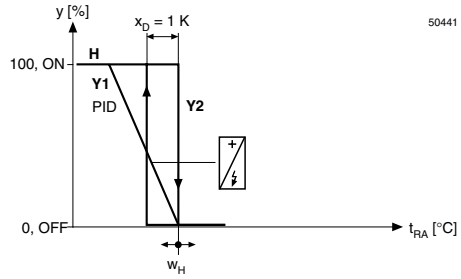
3-speed fan control with the PRFB-V operates with the same relay sequence as for Control Type 0.

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

Select type of control: CMD 46/66

2.3.6 System with proportional control of electric heating coil

- **Control Type 12: – Proportional heating with electric heating coil**
  – On/off heating with switching diff. x_D = 1.0 K



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
x_D *Switching differential 1.0 K (fixed)*

With Control Type12, the control parameters are optimised to allow quasi-proportional control of an electric heating coil with the PWM signal Y1 via a solid-state relay.

The direction of operation cannot be selected.

3-speed fan control with the PRFB-V operates with the same relay sequence as for Control Types 2 and 3 (heating sequence only).

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

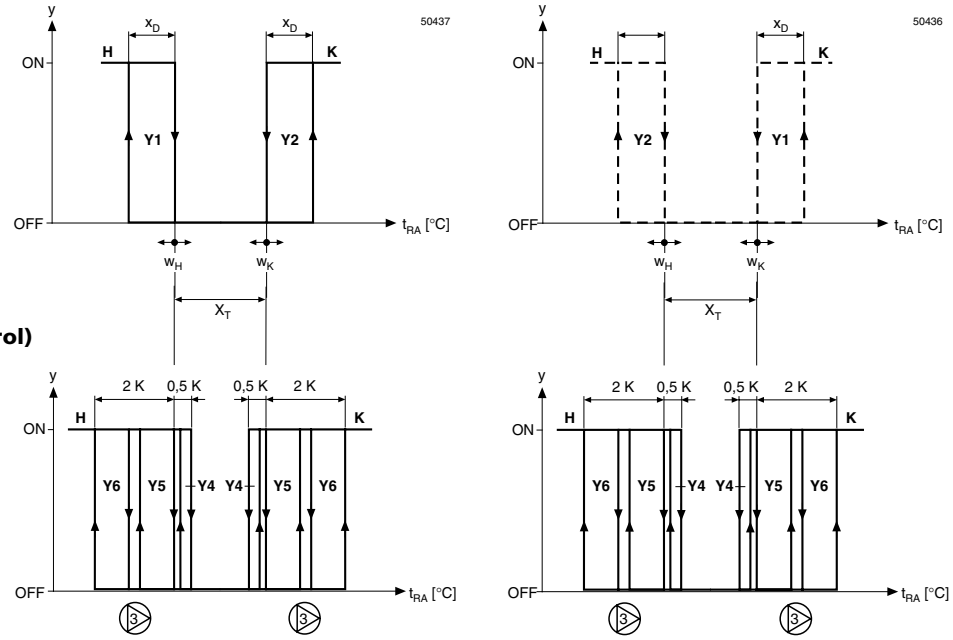
Select type of control: CMD 46/66

2.3.7 On/off control

- **Control Type 4: – Switching differential x_D = 1.0 K**
- **Control Type 5: – Switching differential x_D = 1.5 K**

Direction of operation normal	**Direction of operation reversed (change-over)**
Y1 = On/off heating	Y1 = On/off cooling
Y2 = On/off cooling	Y2 = On/off heating

Outputs Y1, Y2



Relays Y4 ... Y6, with PRFB-V only (3-speed fan control)

H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential*
X_T *Zero-energy band*

If required, the direction of operation of these control sequences can be reversed by a control signal from the communications master (change-over via trunk communication). Output Y1 is then driven by the cooling sequence instead of the heating sequence, and output Y2 by the heating sequence instead of the cooling sequence.

Receipt of change-over enabled:	CMD 34/54
Read change-over signal:	CMD 78
Select type of control:	CMD 46/66

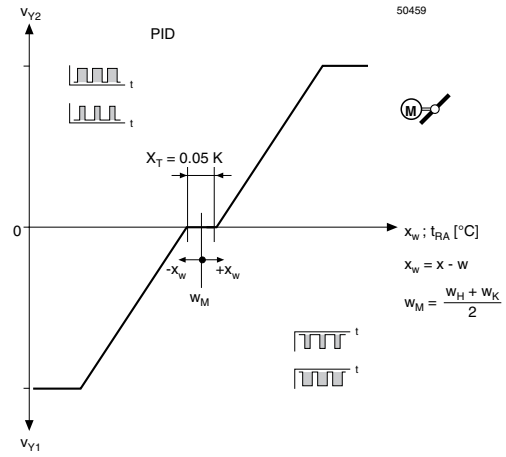
For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

2.3.8 Airside control

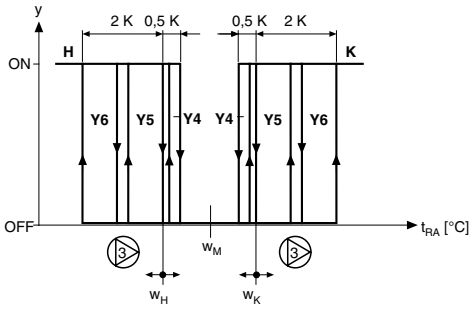
- **Control Type 6: – without synchronisation**
- **Control Type 7: – with synchronisation**

With Control Types 6 and 7, outputs Y1 and Y2 can be used to drive damper actuators.

Outputs Y1, Y2



Relays Y4...Y6, with PRFB-V only (3-speed fan control)



H	*Heating sequence*
K	*Cooling sequence*
y	*Control signal*
$v_{Y1,2}$	*Positioning speed of damper actuator*
t_{RA}	*Room temperature*
x_W	*Control deviation*
w_M	*Setpoint*
w_H	*Heating setpoint*
w_K	*Cooling setpoint*
X_T	*Zero-energy band ≙ resolution t_{RA} : 0.05 K*

Setpoint w_M for damper control is the mid-point between the heating and cooling setpoints.
$w_M = (w_H - w_K)/2$

The relay sequences operate in accordance with setpoints w_H and w_K.

For other uses of relays Y4 ... Y6 and Y3, see Sections 2.4 and 2.5 on pages 19 and 21.

With the above types of control, the direction of operation is not reversible.

Select type of control: CMD 46/66

Synchronisation of damper actuators connected in parallel

When a number of damper actuators are connected in parallel, they need to be synchronised. This is the purpose of Control Type 7.

Important:

The run-time of the damper actuators must not exceed 7 minutes.

For synchronisation purposes, the damper actuators are run to the end-position over a 7-minute period at least once every 24 hours via output Y2 (Y2 = ON). The resulting synchronised operation ensures that all fan-coil units in the same space all operate at the same discharge temperature.

The synchronisation routine is initiated at the end of night mode (transition from *Energy hold-off ∅ Stand-by / Comfort*) or every 24 hours. The 24-hour counter is reset after each synchronisation routine.

No synchronisation takes place during energy hold-off mode (night setback).

During the synchronisation routine, the fan always operates at stage 1 (relay Y4: ON; Y5 and Y6: OFF). For fan control using Y3, refer to page 19.

Since no synchronisation is required when only one actuator is connected, this function can be disabled by selection of Control Type 6.

2.3.9 Control of chilled and heated ceilings

• Control Type 8: – Change-over valve for separation of water circuits
– PRFB-A controller

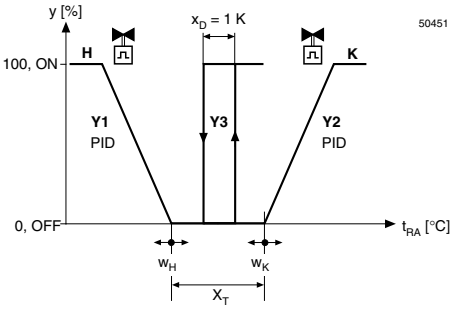
See P20-07/A70 for application example.

Outputs Y1 and Y2 are used to control the thermic valves in the chilled and LPHW water circuits.

In this application, relay Y3 is used to open and close a change-over valve. This separates the chilled water circuit from the LPHW circuit, to prevent LPHW from flowing through the refrigeration system, for example. This is a fixed function of relay Y3, which cannot be used for other purposes.

To prevent any possibility of the LPHW and CHW circuits being mixed in the transition from the heating to the cooling sequence and vice versa, valves Y1 and Y2 are closed for a few minutes during this period.

Y1 = Proportional heating
Y2 = Proportional cooling
Y3 = OPEN/CLOSE control of change-over valve(s)



H	*Heating sequence*
K	*Cooling sequence*
y	*Control signal*
t_{RA}	*Room temperature*
w_H	*Heating setpoint*
w_K	*Cooling setpoint*
x_D	*Switching differential 1 K (fixed)*
X_T	*Zero-energy band*

The switching points of relay Y3 are always mid-way between setpoints w_H and w_K.

The switching differential x_D is fixed at 1 K.

The zero-energy band X_T (w_K – w_H) must be at least 2 K.

The direction of operation cannot be reversed.

CMD 36/56, (Select function of relay Y3) has no effect in this application.

For test purposes, relay Y3 can be driven directly via the ZS1 service terminal or by a command from the communications master.

Forced control of relays:	CMD 126/26, 127/27
Select type of control:	CMD 46/66

- **Control Type 9: – Separation of water circuits with 2 thermic shut-off valves**

  – PRFB-V controller

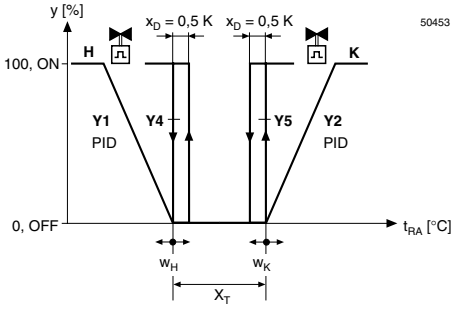
See P20-07/A71 for application example.

Outputs Y1 and Y2 are used to control the thermic valves in the chilled and LPHW water circuits.

Relays Y4 and Y5 are used to open and close two shut-off valves. These separate the chilled water circuit from the LPHW circuit, to prevent LPHW from flowing through the refrigeration system, for example.

To prevent any possibility of the LPHW and CHW circuits being mixed in the transition from the heating to the cooling sequence and vice versa, valves Y1 and Y2 are closed for a few minutes during this period.

Y1 = Proportional heating
Y2 = Proportional cooling
Y4, Y5 = OPEN/CLOSE control of shut-off valves



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential 0.5 K (fixed)*
X_T *Zero-energy band*

The switching differentials (x_D) are fixed at 0.5 K.

The zero-energy band, X_T (w_K – w_H) must be at least 2 K.

The direction of operation cannot be selected.

Relay Y3 may be used as required.

Relay Y6 is not controlled by the control algorithm. It remains de-energised unless overridden by forced control. For test purposes, forced control of relays Y4 and Y5 is possible via the ZS1 service terminal or by a command from the communications master.

Forced control of relays:	CMD 126/26, 127/27
Select type of control:	CMD 46/66

2.4 Function of relay Y3 (PRFB-A and PRFB-V)

Except with Control Type 8 (for control of chilled/heated ceilings), relay Y3 can be used for various purposes.

- **Function K1** CMD 36/56 X|0|0|0

– Relay Y3 ON in *Comfort* operating mode
– Relay Y3 OFF in *Stand-by* or *Energy hold-off* mode.
– Can be overridden by forced control (CMD 126/26, 127/27).

- **Function K2** CMD 36/56 X|0|0|1

– Relay Y3 ON in *Comfort* or *Stand-by* operating mode
– Relay Y3 OFF in *Energy hold-off* mode.
– Can be overridden by forced control (CMD 126/26, 127/27).

- **Function K3, ON/OFF via bus communication** CMD 36/56 X|0|1|0

Relay Y3 can be enabled and disabled via individual, group or trunk communication.

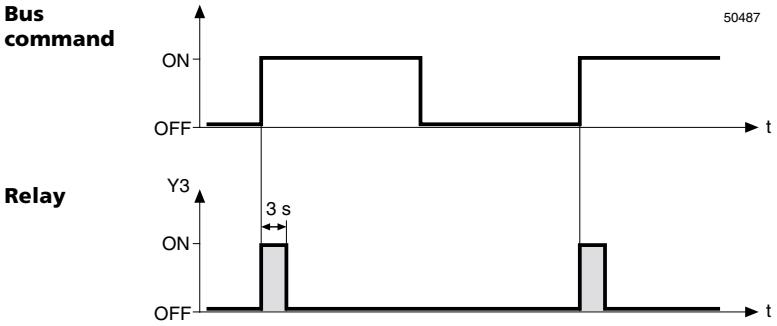
Forced control (CMD 126/26, 127/27) has priority over trunk communication.

The receipt of the trunk signal must be enabled in the controller. (CMD 37/57). Use CMD 79 to read the trunk signal.

- **Relay function K3 with pulse control** CMD 36/56 X|0|1|1

Function K3, described above, can also be used for pulse control (e.g. for control of lighting).

Output Y3 must be set to OFF before each pulse. The next 'ON' command triggers a pulse, activating relay Y3 for approximately 3 seconds.



- **Response of relay Y3 after a power failure (CMD 37/57):**

– CMD 37/57 0|X|X|X

Relay Y3 responds immediately depending on operating mode (K1, K2) or in response to trunk command or forced control (K3).

– CMD 37/57 1|X|X|X

Relay Y3 remains de-energised until next forced control command (trunk command has no effect).

- **Single speed fan control with PRFB-A (Control Types 0 ... 7 and 10 ... 13)** CMD 36/56 X|1|0|0

With this function, relay Y3 is used to control a single-speed fan in the same way as with relay Y4 of the PRFB-V.

For single-speed fan control, additive switching must be enabled (see page 22).

The fan control function has a switch-off delay (run-on).

Additive switching CMD 47/67 X|X|1|X

Run-on, fan stage 1 CMD 42/62 0 ... 255 s

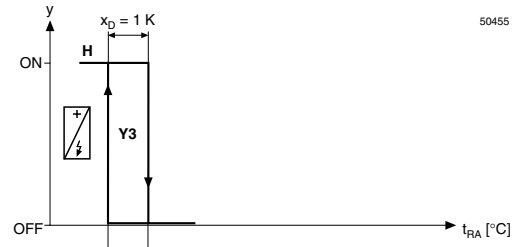
Refer to Section 2.5, page 21 for a description of the functioning of relay Y4.

- **On/off control of electric reheater (with Control Types 0 ... 7 and 10 ... 13)** CMD 36/56 X|1|0|1

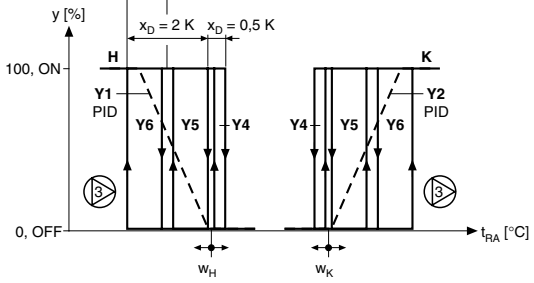
Both controllers allow the use of relay Y3 for on/off control of an electric heating coil.

This makes it possible to maintain 3-speed control in the PRFB-V (using relays Y4 ... Y6).

Relay Y3



Relays Y4 ... Y6



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*
x_D *Switching differential*

Switching sequence for relay Y3 in relation to relays Y4…Y6 in the PRFB-V:

In the cooling sequence, relay Y3 remains de-energised.

For test purposes, forced control of relays Y3 ... Y6 is possible using CMD 126/26, 127/27 (see page 50).

2.5 Relay functions Y4 ... Y6 (PRFB-V only)

- **3-speed fan control (Control Types 0 ... 7 and 10 ... 13)**

The difference between the PRFB-A and the PRFB-V is that the latter has three additional built-in relays (Y4, Y5, Y6), which can be used for automatic multi-speed control of a fan.

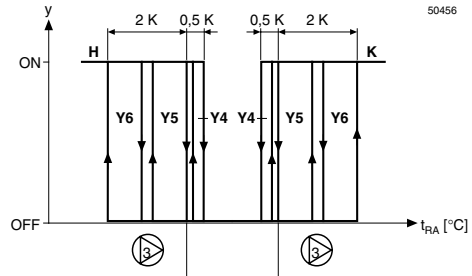
Except in the case of Control Types 2 and 3, selecting the direction of operation (change-over command) has no effect on the relay sequences.

See sequence diagrams on pages 11 to 16.

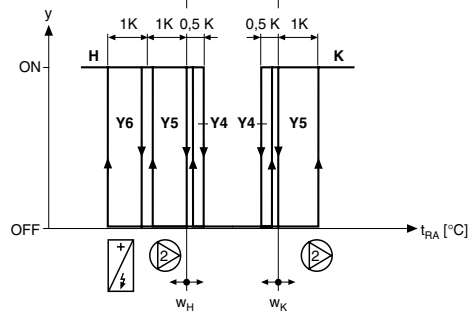
- **2-speed fan control and control of an electric reheater (Control Types 0 ... 7 and 10)** CMD 47/67 X|1|X|X

Instead of controlling fan-speed 3, relay Y6 may be used to control an electric heating coil (heating sequence only).

3-speed fan control



2-speed fan control and electric reheater



H	*Heating sequence*
K	*Cooling sequence*
y	*Control signal*
t_{RA}	*Room temperature*
w_H	*Heating setpoint*
w_K	*Cooling setpoint*

Irrespective of the direction of operation selected (change-over command), the electric heating coil is only ever driven by the heating sequence, and is always disabled in the cooling sequence.

With Control Types 2 and 3, the electric heating coil is only operated in the "normal" direction of operation. If the direction of operation is reversed (cooling sequence only), it remains off.

- **Switch-off delay - Relay Y4** CMD 42/62 0 ... 255 s

In the heating sequence, with Control Types 0…7 and 10, relay Y4 (or Y3[1)]) has a switch-off delay. This ensures that the heat exchanger is cooled by the fan after the heating output has been disabled. CMD 42/62 is used to enter the run-on time in seconds.

A run-on time of four minutes is recommended (e.g. CMD 42/62 = 240).

1) when used for fan control

- **Switch-on delay - Relays Y5, Y6** CMD 43/63 0 ... 255 s

With control types 0 ... 7 and 10 ...13, a minimum run-time can beassigned to relays Y4 (Y3[1)]) and Y5.

With an increasing control deviation, relay Y5 switches on after a delay defined by the minimum run-time of relay Y4 (Y3[1)]). Similarly, Y6 switches on after a delay defined by the minimum run-time of relay Y5.

The minimum run-time is enterd in seconds via CMD 43/63.

1) when used for fan control

- **Alternating and additive switching - Relays Y4 ... Y6**

To permit the connection of fans with different types of winding, the relays in the PRFB-V controller have two different switching sequences:

– Alternating switching CMD 47/67 X X 0 X

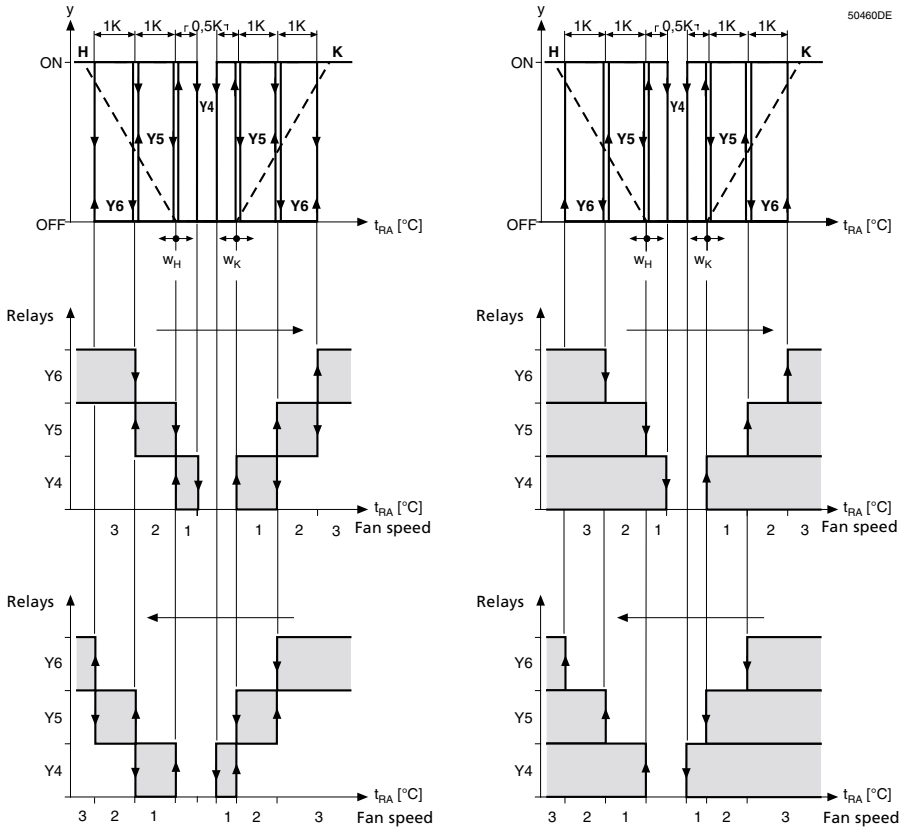
As the control deviation increases, the relays are energised in succession, each relay being de-energised as the next is energised, so that only one relay is ever ON at any one time. A switch-on delay of 100 ms is incorporated to ensure an interrupt at each change-over.

– Additive switching CMD 47/67 X X 1 X

As the control deviation increases, the relays are energised in succession, but in this case they all remain ON.

Alternating switching **Additive switching**

Relays Y4 ... Y6



Increasing room temperature

Decreasing room temperature

Note:

Where relay Y6 is used to control an electric heating coil, Y6 is only active in the heating sequence (CMD 36/56 = X 1 0 1).

H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*

- **Return air sensor and room sensor - Relay Y4**

– Return air sensor CMD 47/67 | X | X | X | 1 |

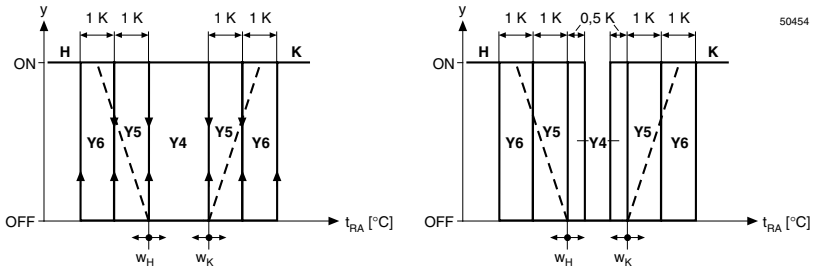
– Room sensor CMD 47/67 | X | X | X | 0 |

To ensure an accurate reading when using a return-air sensor (unit-mounted temperature sensor), the fan in *Comfort* or *Stand-by* operating mode is run continuously at the lowest speed via relay Y4 around the zero energy band ($w_H < t_{RA} < w_K$). This ensures a measurement in moving return air.

In *Energy hold-off* mode, the fan remains off while the room temperature is within the zero-energy band. If the room temperature falls below w_H or rises above w_K, relay Y4 switches the fan on again.

When a room sensor is used, relay Y4 is energised only as a function of the control deviation, regardless of the operating mode.

With return air sensor **With room air sensor**



H *Heating sequence*
K *Cooling sequence*
y *Control signal*
t_{RA} *Room temperature*
w_H *Heating setpoint*
w_K *Cooling setpoint*

- **Forced control of relays Y3, Y4, Y5 and Y6**

Forced control via remote control CMD 126/26, 127/27

Relays Y3, Y4, Y5 and Y6 can be overridden centrally with a forced control command via remote control (active in all types of control). Forced control has the highest priority (see page 50).

The forced control commands can be used to define the states ON, OFF and AUTO. In automatic mode, the relays are energised in accordance with the control sequence (Y4 ... Y6) or the operating mode (Y3 with relay functions K1 and K2).

Response of relays after a power failure:

When the power is restored after a power failure, up to five minutes may elapse before a remote control command is received. During this period, the relays switch in accordance with the control sequence.

If CMD 37/57 was used for forced control of all relays, these will remain de-energised until the next remote control command is received. This function can be assigned separately to output Y3 or outputs Y4, Y5 and Y6.

2.6 Master / slave circuit

Operation as slave controller CMD 46/66 Control Type 15

The master/slave circuit is used when a number of fan-coil units (max. 4) are operated in parallel, in circumstances where flexibility is required to allow for future repartitioning of the space.

For this purpose, the controllers are interconnected via the MS terminals. The change-over from individual operation to master/slave operation is initiated by communication from the management system or from the ZS1 service terminal.

Important:

At no point must more than one master controller (a controller programmed with Control Type 0 ...13) be connected via the MS terminal to a slave controller (controller programmed with Control Type 15). For this reason, when changing from master/slave to individual operation and vice versa, it is essential that the procedure described here is followed.

Changing from individual to master/slave operation:

– First switch all controllers connected via the MS terminals to "Neutral" control, except the master controller
  Neutral control: CMD 46/66 = 14
– Switch each of the controllers to be designated as slave controllers from "Neutral" to "Slave" control.
  Slave control: CMD 46/66 = 15

Changing from master/slave to individual operation:

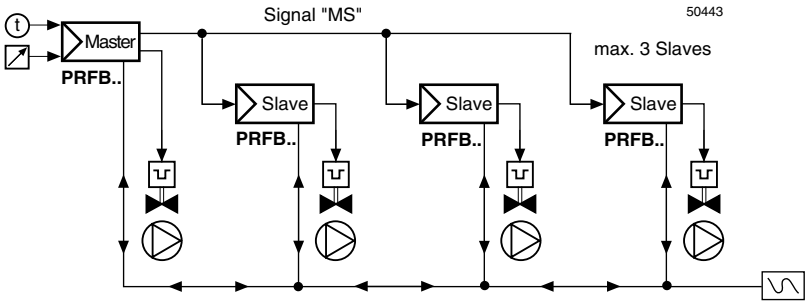
– First switch all slave controllers connected via the MS terminals, to "Neutral" control. Then switch the master to "Neutral".
  Neutral control: CMD 46/66 = 14
– Switch all controllers in succession from "Neutral" to the desired type of control.
  Control Type (0 ...13): CMD 46/66 = (0 ...13)

Note:

Where a controller is to operate exclusively as a slave controller, and where no communication direct to the slave controller is required or envisaged, the PRFA.. stand-alone controller may be used (see page 6).

Apart from the MS signal, the slave controllers do not process any other input signals (parameter setting, change-over etc.).

Forced control of relays Y3 ... Y6 using CMD 126/26, 127/27 is, however still possible, via communication on the bus, and represents the one exception to the above.



Important:

Master controllers have no effect on each other. However, slave controllers must not be controlled by more than one master.

2.7 Valve exercising feature

To prevent the valves (e.g. the cooling valve in winter) from sticking after long periods of non-use, the valves are "exercised" every 100 hours. Depending on the type of control (selected via CMD 46/66) they are either fully opened or fully closed for a few minutes.

At the same, the lowest fan-speed is enabled, or the fan is switched back to the lowest speed.

With Control Types 8 and 9 (chilled/heated ceilings) the valves are alternated open and closed, to ensure that neither the cooling nor the heating water circuits are short-circuited.

3 Communication

3.1 Control and management systems

The PRFB-A and PRFB-V are communicating controllers; in other words, they are able to exchange data with control and management systems and the associated user interfaces.

The exchange of data takes place on the PRONTO bus. The next page shows how the controllers are linked with the control and management systems. The range of functions and the operator facilities available depend on the system configuration:

• KLIMO/MULTIREG – Analogue control & interlock system

Interface: WSE10 communication module

Operation: From a PC running DISPLAY1 (software for service and operation). Alphanumeric display. Functions similar to those available with the ZS1 service terminal.

• INTEGRAL AS1000 – Digital control and interlock system

Interface: To the RS bus of the control and interlock system via the NAPC adapter and the NIPRO interface; optionally from RS bus to PC with the NITEL communications module.

Operation: With portable NBRN operator terminal. Alphanumeric display. Functions similar to those available with ZS1 service terminal, with additional information from the NIPRO (e.g. individual time programmes).

From a PC running INTEGRAL DIALOG (software for service and operation). Alphanumeric display. Functions similar to those available with the NBRN, but with a more comprehensive display.

• INTEGRAL MS1000 – In-house management system
INTEGRAL TS1500 – Remote buildings management system

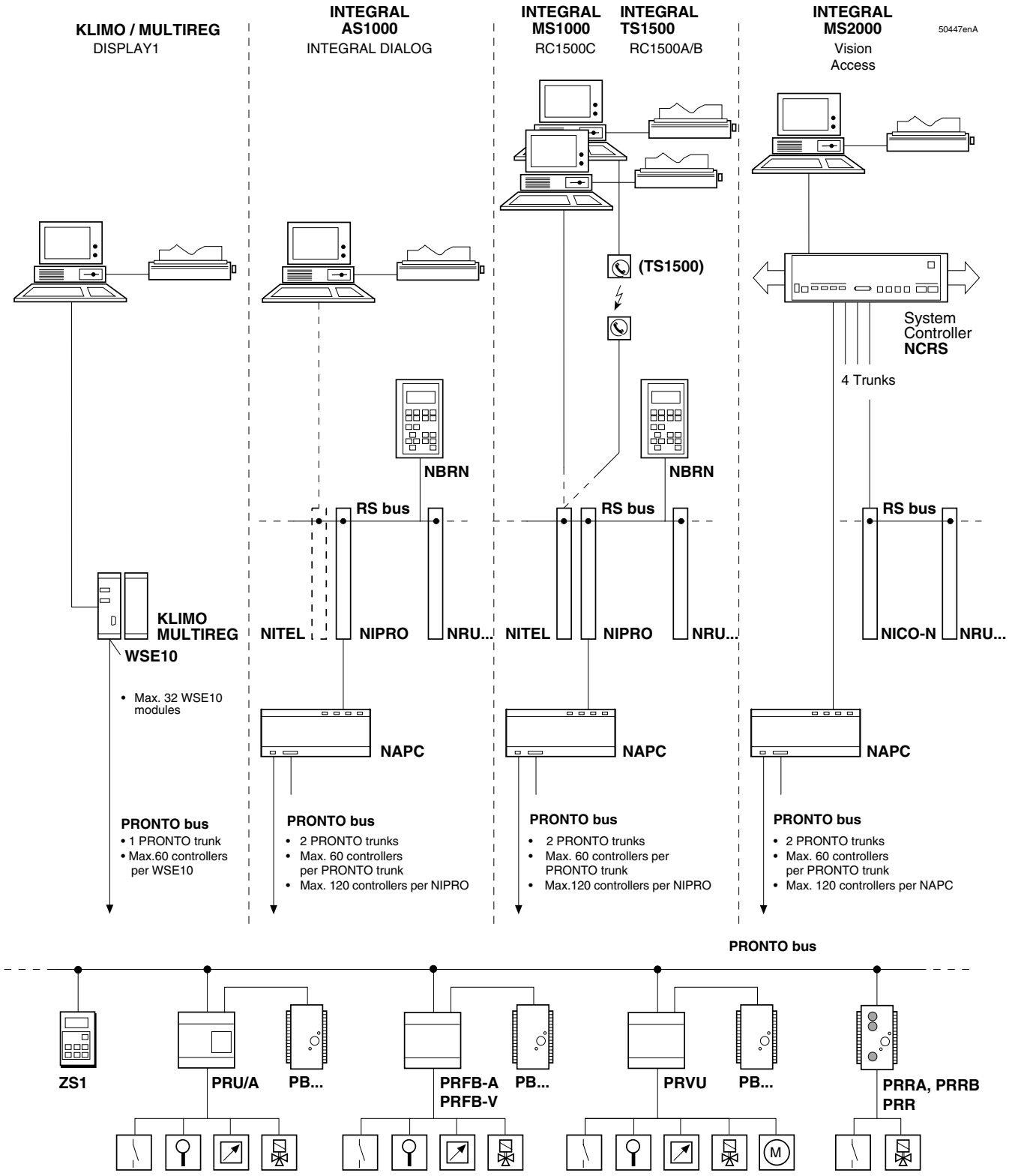
Interface: To RS bus of the control and interlock system via NAPC adapter and NIPRO interface. From RS bus to management station (PC) via the NITEL.

Operation: With the NBRN operator terminal on the RS bus (see AS1000). From the management station, the controllers can be operated individually in graphics mode using one of the RC1500 software variants (RC1500C for MS1000 and RC1500A/B for TS1500). Data points can be imported into plant schematics. Various access levels, time and exception programmes plus an extensive range of operator facilities and automated engineering functions.

• INTEGRAL MS2000 – Management system

Interface: To the management station PC via the NAPC adapter and system controller(s), and to the RS bus of the control and interlock system via the NICO-N interface.

Operation: Convenient graphics-based operation from the management station using the two programs, Vision (for operation) and Access (for service). Data points can be imported into plant schematics. Various access levels, exception and time programmes. Wide-ranging engineering options for individual or user-zone communication and data analysis.


KLIMO / MULTIREG
DISPLAY1
INTEGRAL
AS1000
INTEGRAL DIALOG
INTEGRAL
MS1000
RC1500C
INTEGRAL
TS1500
RC1500A/B
INTEGRAL
MS2000
Vision
Access
50447enA
(TS1500)
System
Controller
NCRS
4 Trunks
NBRN
NBRN
RS bus
RS bus
RS bus
KLIMO
MULTIREG
WSE10
NITEL
NIPRO
NRU...
NITEL
NIPRO
NRU...
NICO-N
NRU...
• Max. 32 WSE10 modules
NAPC
NAPC
NAPC
PRONTO bus
• 1 PRONTO trunk
• Max.60 controllers per WSE10
PRONTO bus
• 2 PRONTO trunks
• Max. 60 controllers per PRONTO trunk
• Max. 120 controllers per NIPRO
PRONTO bus
• 2 PRONTO trunks
• Max. 60 controllers per PRONTO trunk
• Max.120 controllers per NIPRO
PRONTO bus
• 2 PRONTO trunks
• Max. 60 controllers per PRONTO trunk
• Max. 120 controllers per NAPC
PRONTO bus
ZS1
PRU/A
PB...
PRFB-A
PRFB-V
PB...
PRVU
PB...
PRRA, PRRB
PRR
M

3.2 Communication modes

There are three ways of exchanging data:

- **Individual communication**

In this mode, data is exchanged between the user interface and the individual controller via the communications interface. Individual communication takes place only at the request of the user and, at any one time, will relate only to one of the following data groups:

– Controller address (Write command, with ZS1 only)
– Control data (Read only)
– Remote control data (forced control commands relating to type of control, setpoint adjustment and forced control of relays Y3 ... Y6)
– Control parameters

For more detailed information refer to Section 5.5 "Command lists".

- **Trunk communication**

This refers to the periodic exchange of data between the primary system, the communications interface and all controllers connected to the same trunk (the PRONTO bus). For example, all controllers relating to one temperature control zone in the building could be connected to one and the same trunk. Trunk communication signals are transmitted automatically, under control of the interface. They can be classified according to the "direction" in which they flow:

Signals from the interface to the controllers:

– Summer / winter compensation
– Change-over
– Energy hold-off
– Stand-by
– Relay Y3 (where used for relay function K3)

Signals from the controllers to the interface:[1)]

– Heating and cooling energy demand signals
– Maximum control deviation and address of the associated controller.

[1)] These signals represent selected data. Only the signal from the controller with the highest control deviation or the highest demand signal will be transmitted.

For more detailed information, refer to Section 5.5 "Command lists" and the notes in Section 3.3 ff.

- **User zone communication**

In this mode, data is exchanged with groups of controllers which may be connected to different trunks, but which are assigned to selected "user zones". User zone communication covers the same data as described under individual communication (with the exception of the facility to write the controller address). A wide range of engineering options relating to the selection and analysis of data can be made available, depending on the system configuration.

Note: The WSE10 interface cannot be used for user zone communication.

3.3 Centrally controlled functions

In addition to the functions detailed in this section, some of the functions already described in Section 2 are also controlled centrally:

– Central setpoint adjustment	Section 2.2.2	Page 9
– Summer / winter compensation	Section 2.2.4	Page 10
– Change-over	Section 2.3.2	Page 12
– Forced control of relay outputs	Section 2.5	Page 23

3.3.1 Operating mode

For more information on the operating modes, see page 7.

- **Forced control via remote control command (Individual and user zone communication)**

A "compulsory operating mode" signal from the central plant overwrites the operating mode defined by the room operating unit, occupancy sensor or energy hold-off input. The controllers then switch to the centrally defined operating mode, *Comfort, Stand-by* or *Energy hold-off.* The occupancy function and the energy hold-off input have no effect. This function is used primarily for commissioning purposes.

The controller must be enabled for the receipt of the remote control command.

Commands:

Remote control command: Read / Write operating mode	CMD 125/25
Enable receipt	CMD 34/54

- **Night mode with option of override**

At night, the controllers can be switched to energy hold-off from the central communications device via a time programme. The command can be transmitted via trunk communication or individual communication (remote control). *Night mode* is thus a form of energy hold-off which is subject to an override command (see page 8).

When the system changes from night to day mode, the controller reverts to stand-by operation.

The controllers must be enabled for receipt of the Night mode command.

Commands:

Enable receipt of trunk communication commands	CMD 35/55
Read Night mode command (trunk signal)	CMD 78
Enable remote control	CMD 34/54
Read/write Night mode command	CMD 125/25

- **Stand-by via trunk communication**

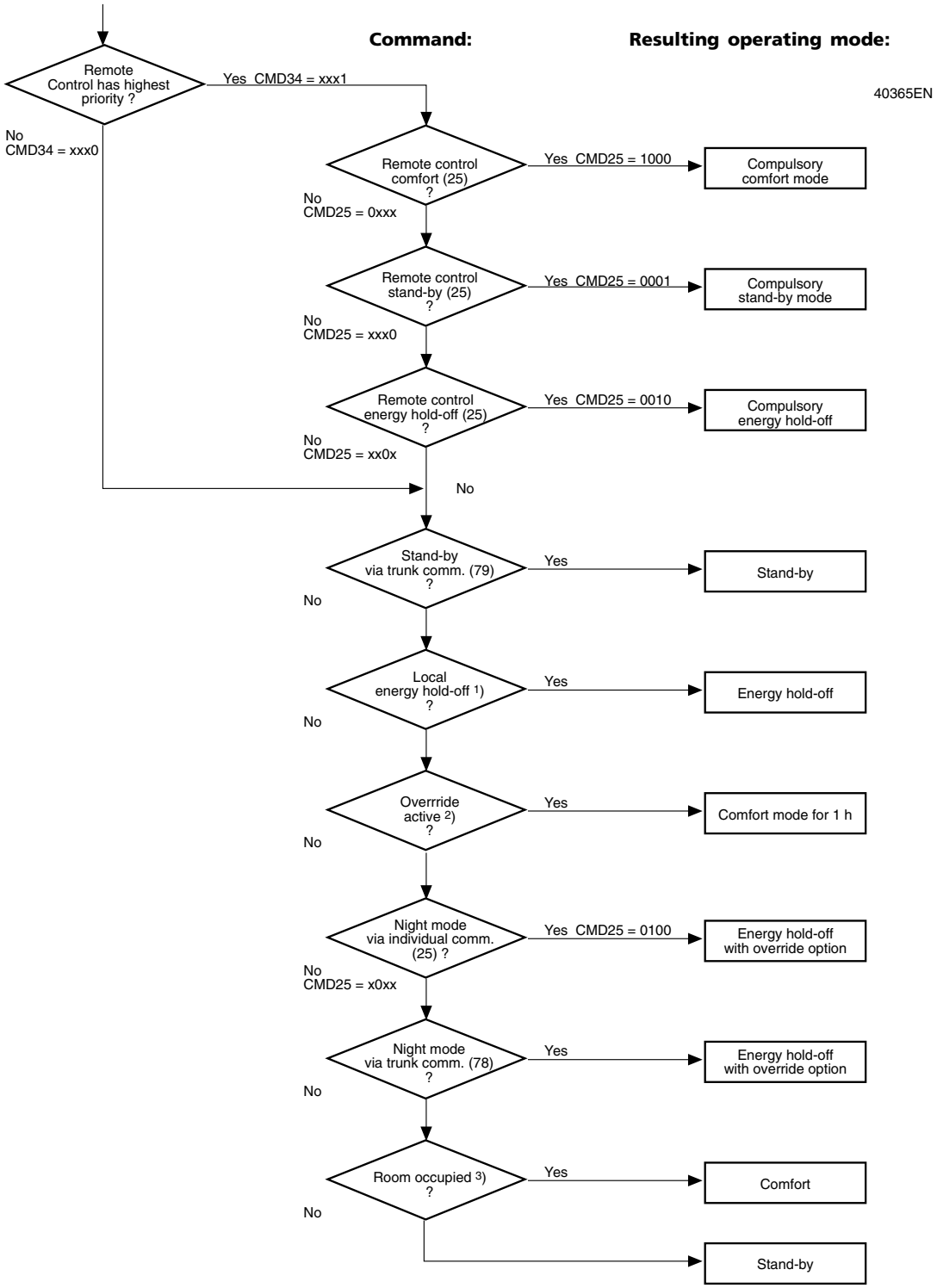
All controllers connected to the same trunk can be switched to *Stand-by* with a command which takes priority over the room operating unit and night-mode commands and over the energy hold-off input.

Commands:

Enable receipt of trunk communication	CMD 35/55
Read *Stand-by* command	CMD 79

- **Command hierarchy**

The flow diagram below shows the order of precedence of the signals determining operating mode:



1) Signal via energy hold-off input (EHO) or "OFF" button on PBB room operating unit.

2) "Occupied" button on PBB room operating unit, or "HVAC on" on PBIT / PBIR remote control unit.

3) FR-A.. occupancy sensor activated with priority over night mode CMD 37/57

4) – "Occupied" and "Unoccupied" buttons on PBB room operating units
– "HVAC on", "HVAC off" on PBIT/PBIR infrared remote control unit.
– Occupancy sensor activated

3.3.2 Energy demand signals

The controllers transmit energy demand signals HBI (Heating demand I) and KBI (Cooling demand I) as a percentage of the control deviation. The signals are transmitted to the central plant via trunk communication. Signals HBI and KBI correspond to a proportional band of 4 K (0 ... 100 % energy demand). When the measured value is equal to the setpoint (control deviation = 0), the controller transmits an energy demand signal of 50 %.

Based on the highest heating and highest cooling demand signal received from the controllers connected to the same trunk, the central operator station calculates the current flow temperatures and the load switching points for the primary plant (e.g. circulating pumps).

The controllers must be enabled for the transmission of the energy demand signals on the trunk (Enable trunk signal). This also makes it possible to prevent transmission of signals from non-relevant controllers.

Commands:

Enable trunk signal	CMD 34/54
Max. heating demand I (Read trunk signal)	CMD 70
Max. cooling demand I (Read trunk signal)	CMD 71
Enable display under control data	CMD 48/68
Read heating demand I	CMD 10
Read cooling demand I	CMD 11

3.3.3 Control deviation

While evaluating the energy demand signals, the controller also calculates the control deviation as the differential between the measured value (room temperature t_{RA}) and the effective heating and cooling setpoints w_H and w_K.

The control deviation, expressed as a temperature differential, can be retrieved as part of the control data via individual communication. The direction of the deviation can be determined from the measured value and the two controller setpoints.

In the context of trunk communication, only the controller with the highest control deviation transmits its value on the trunk to the central operator station. The maximum control deviation and the address of the associated controller can be displayed with the commands shown below.

Commands:

Control deviation	CMD 6
Measured value	CMD 1
Controller setpoints	CMD 2, CMD 3
Max. control deviation (trunk signal)	CMD 74
Address of the associated controller	CMD 75

3.4 Use as universal I/O module

Configuration as I/O module CMD 90 Application Code 30

The PRFB-A and PRFB-V controllers may also be used as universal input/ output modules, in which case they cease to have any control functions. For use as an I/O module, the controllers must be assigned with Application Code 30 when initialising with CMD 90 (see Section 5.5, page 55).

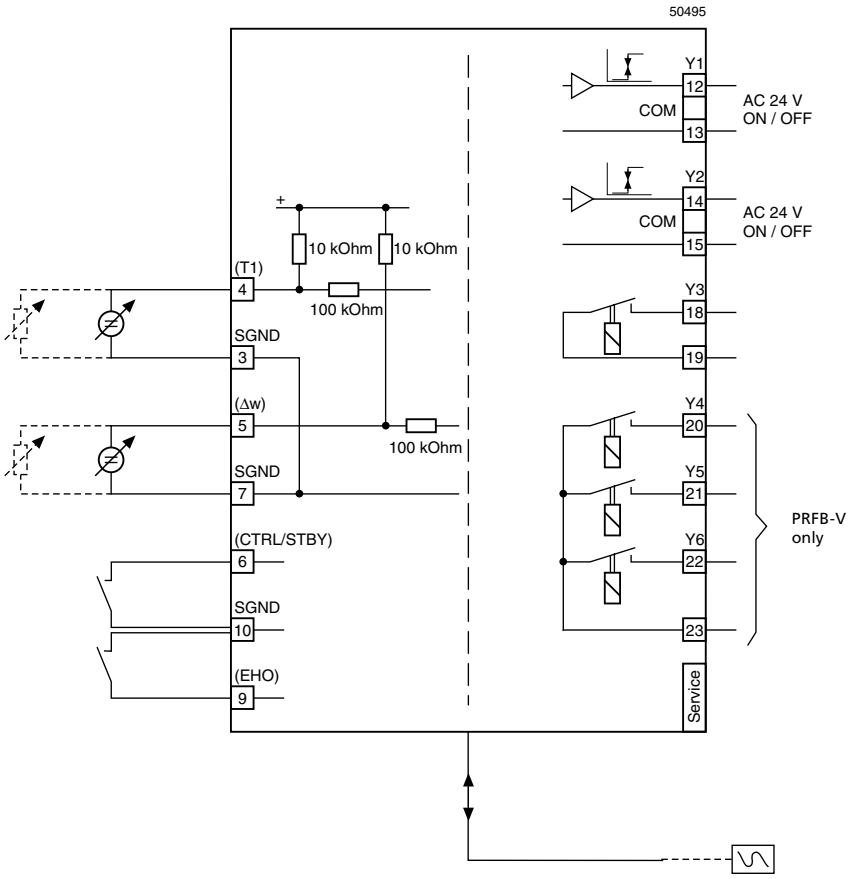
The I/O module is used to transmit input and output signals to a management station via the communications bus.

The signals can be transmitted either by individual or user zone communication, but not by trunk communication, which has no effect.

Two analogue and two digital inputs are available, together with six digital outputs. The input signals can be used to display measured values at the management station or as input variables for application programs used by the central control and interlock system.

The outputs can be operated manually or driven via output variables from application programs.

Terminal layout in I/O module application



Terminals 20 ... 23 are not available with the PRFB-A

Inputs

There are two analogue and two digital inputs available. The table below gives a summary of the input signal ranges and the commands used to read the values.

CMD	Terminal	Signal	Display on ZS1 terminal	Decimal	Resolution / Range Binary
1	4 (T1)	U = 2.821 ... 3.141 V [1]	9 ... 40.8 °C	0 ... 255	2^7 ... 2^0 0 0 0 0 0 0 0 0 ... 1 1 1 1 1 1 1 1
7	5 (Đw)	U = 2.531 ... 3.431 V [1]	– 3.5 ... 3.5 K	0 ... 28	2^7 ... 2^0 0 0 0 0 0 0 0 0 ... 0 0 0 1 1 1 0 0
8	6 (CTRL / STBY)	Contact (< 1 / > 9 V)	0 / 1	–	X X X ☐ x = Not relevant 1 = Contact open 0 = Contact closed
9	9 (EHO)	Contact (< 1 / > 9 V)	0 / 1 [2]	–	☐ X X X x = Not relevant 1 = Contact closed 0 = Contact open [2]

[1] – Measured against SGND
– See data sheet N1713 for detailed information on analogue outputs

[2] CMD 36/56 = 0 X X X (inverted sense of operation: CMD 56 = 1 X X X)

Outputs

Outputs Y1 and Y2 switch an AC 24 V signal ON/OFF. Outputs Y3 ... Y6 are volt-free relay contacts. These are driven by forced control, using a remote control command.

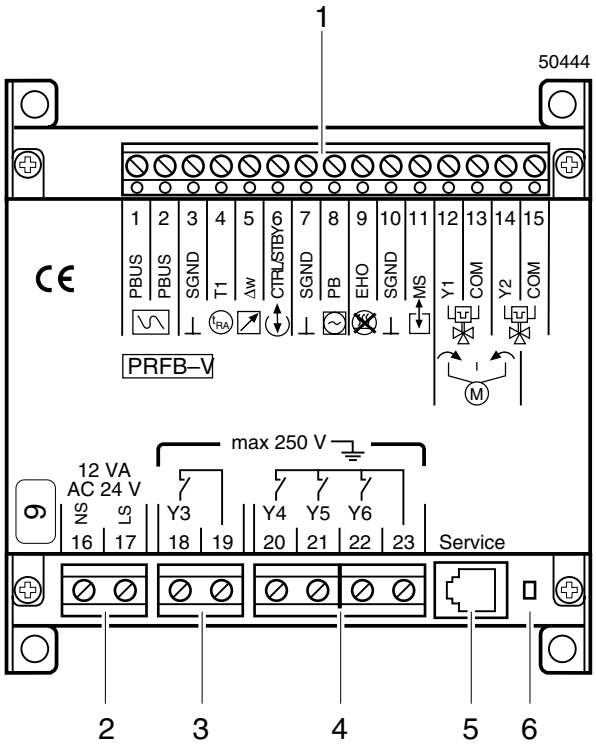
CMD	Terminal	Signal	Binary place
127/27	12, 13 (Y1)	AC 24 V, ON / OFF	X X ☐ ☐ x = Not relevant 1 = Y1 ON 0 = Y1 OFF
	14, 15 (Y2)	AC 24 V, ON / OFF	1 = Y2 ON 0 = Y2 OFF
126/26	18, 19 (Y3)	Relay contact ON / OFF	☐ ☐ ☐ ☐ 1 = Y3 ON 0 = Y3 OFF
	20, 23 (Y4)	Relay contact ON / OFF	1 = Y4 ON 0 = Y4 OFF
	21, 23 (Y5)	Relay contact ON / OFF	1 = Y5 ON 0 = Y5 OFF
	22, 23 (Y6)	Relay contact ON / OFF	1 = Y6 ON 0 = Y6 OFF

Important:

This table applies only when the controller is configured as an I/O module. In controller applications (Application code 16) the table on page 50 applies.

4 Installation

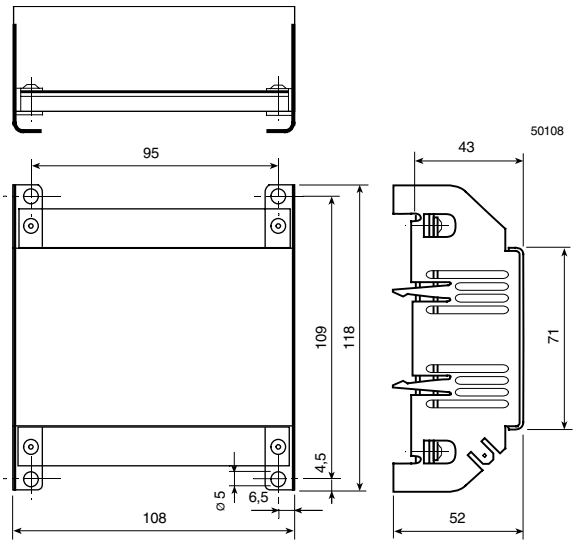
4.1 Construction and mounting

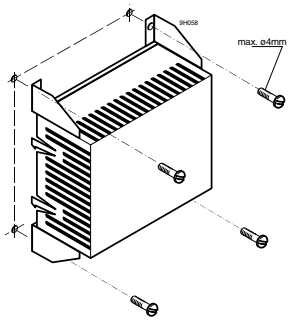


1 Connection terminals 1...15
2 AC 24 V supply
3 Relay contact Y3
4 Relay contacts Y4, Y5 and Y6 (PRFB-V only)
5 Service socket
6 LED

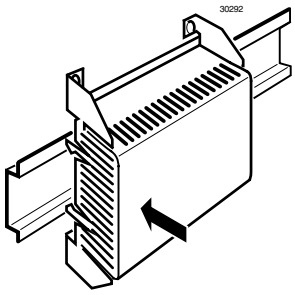
⚠ Observe the technical data for the relay outputs (Section 6, page 56)

Dimensions [mm] PRFB-A, PRFB-V and UA2T





Surface mounting
Four clear holes are provided for surface mounting with screws.



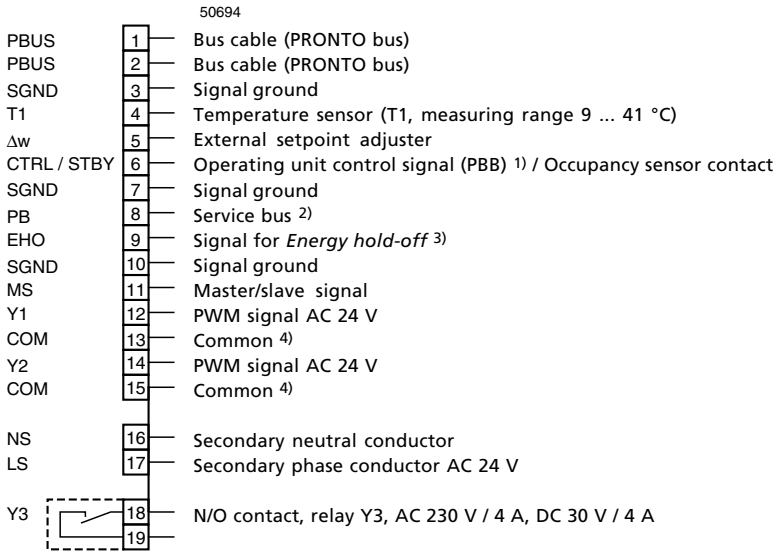
Rail mounting
The housing base is designed for snap-mounting on DIN/EN rails.
Rail type: EN50022-35 x 7.5

Important notes on mounting

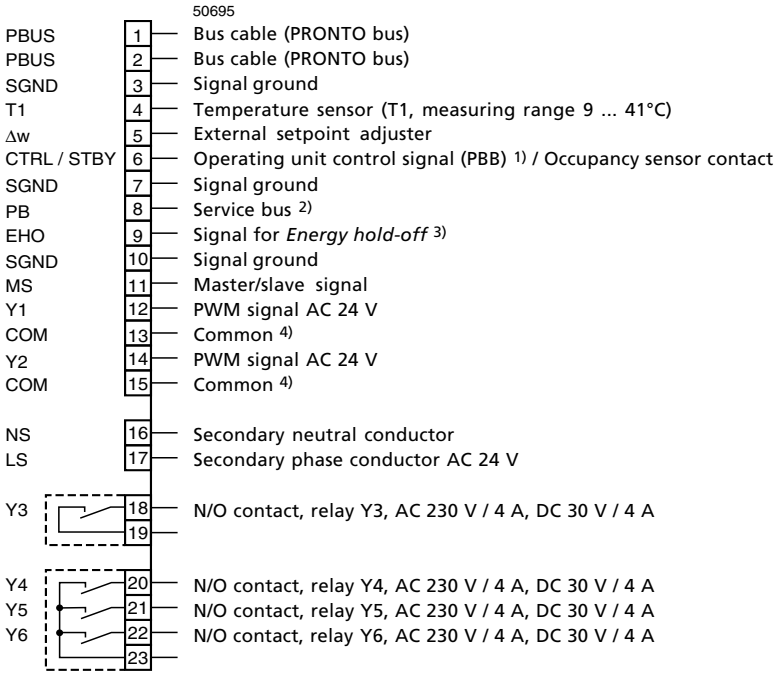
- Install only in a protected environment (e.g. in control panel, behind cover, above suspended ceiling).
- Adequate air circulation must be allowed for to dissipate heat generated during operation.
- Ensure easy accessibility for servicing and maintenance.
- The controller may be mounted in any orientation.
- Local installation regulations must be observed.

4.2 Electrical installation

PRFB-A terminal layout



PRFB-V terminal layout

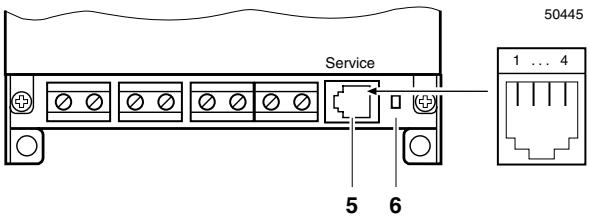


1) Bidirectional "Operating mode" control signal

2) Service bus to operating unit for diagnostics and parameter-setting. Not for initialisation.

3) Window contact or dewpoint sensor. Type of operation (N/O or N/C) can be selected with CMD 56

4) Common and SGND have reverse polarity and must NOT be connected!



5 Service socket connections (FCC telephone socket)

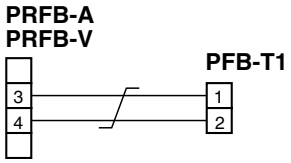
PIN	*Signal*	*Designation*
1	Initialisation	PB-I (INIT)
2	Signal Ground	PB-A (SGND)
3	Parameter setting	PB-B (PB-Service)
4	Not used	—

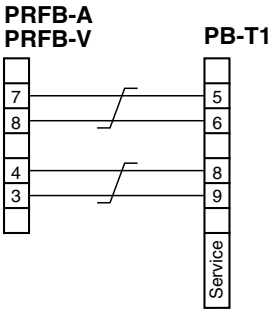
6 LED indication

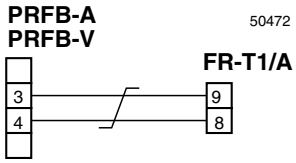
– Switch on controller	LED lights up after 10 s
– Normal operation without communication	LED on steadily
– Normal operation with communication	LED flashing
– Faulty controller	LED off

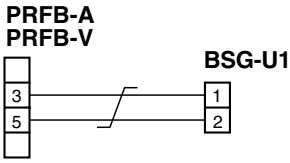
4.3 Connection diagrams

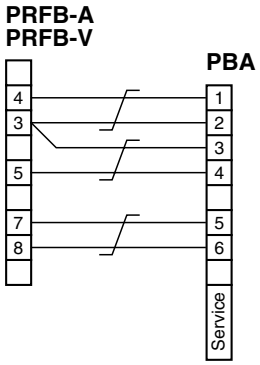
Connection of sensors, setpoint adjusters and room operating units

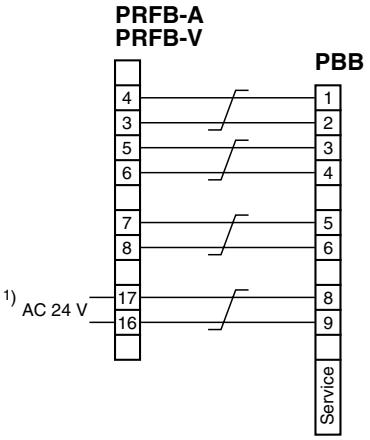


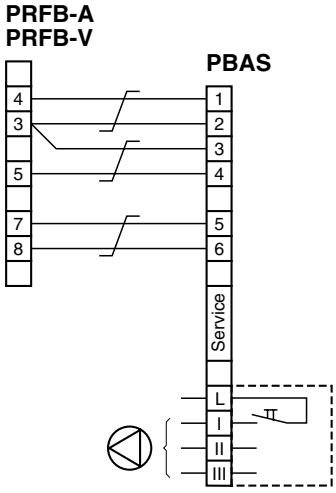


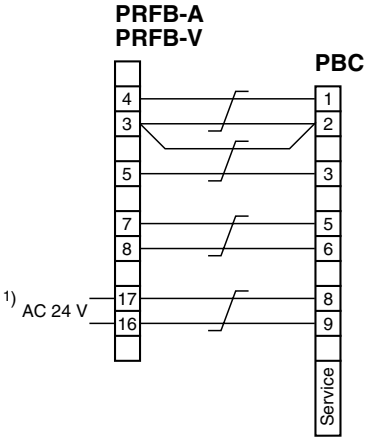


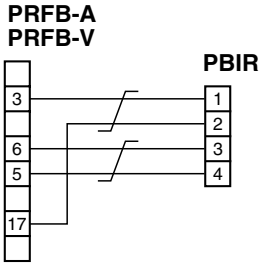








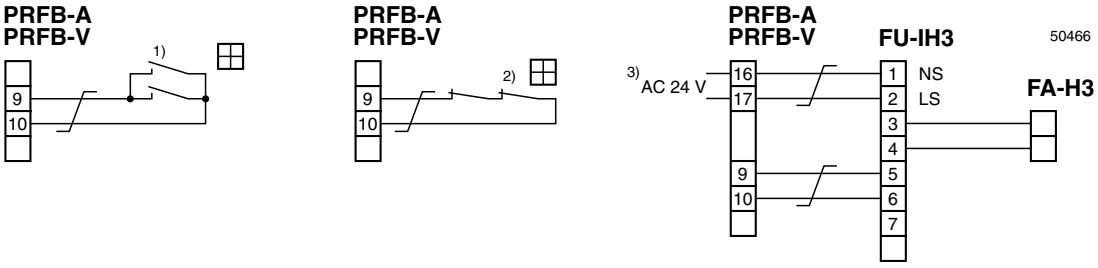




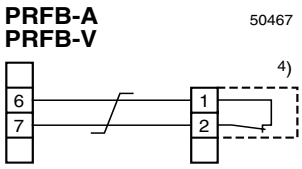
Twisted pairs

1) NS and LS conductors are not interchangeable

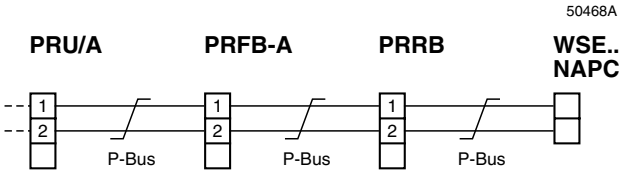
Connection of energy hold-off input



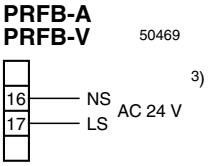
Connection of occupancy sensor



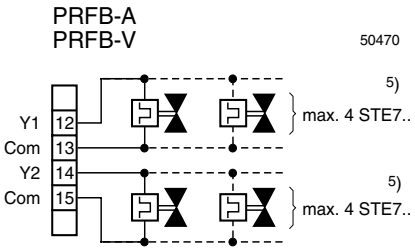
Bus cable connection



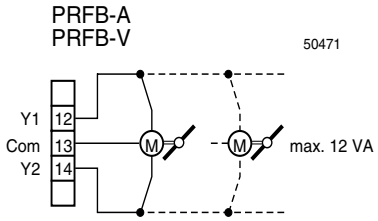
Connection of power supply



Connection of STE7.. valve actuators



Connection of damper actuators



1) Window switch: Window open = Contact closed

2) Window switch: Window open = Contact open

1), 2) Type of operation (N/O or N/C) selected with CMD 56

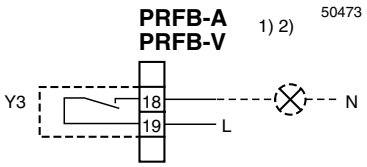
3) NS and LS conductors are not interchangeable

4) Occupancy sensor: Room occupied = Contact open

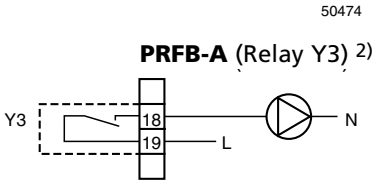
5) With control types 2, 3 and 12, total of both outputs: max. 12 VA

Twisted pairs

Connection for lighting control etc., relay Y3

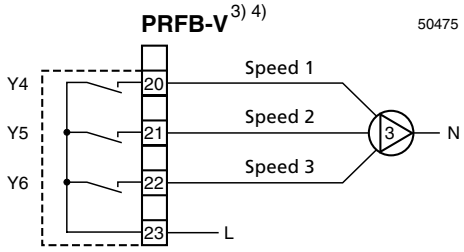


Connection for fan control

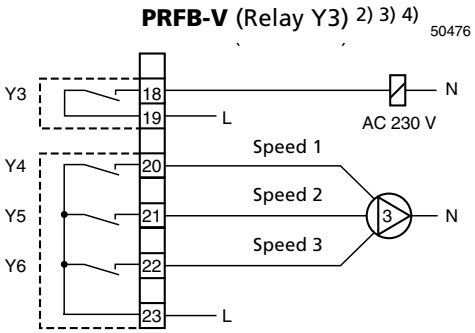


Connection for fan control with relays Y4 ... Y6

- **3-speed**



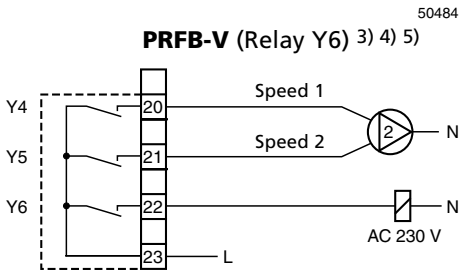
- **3-speed fan and electric heating coil with relay Y3**



Important:

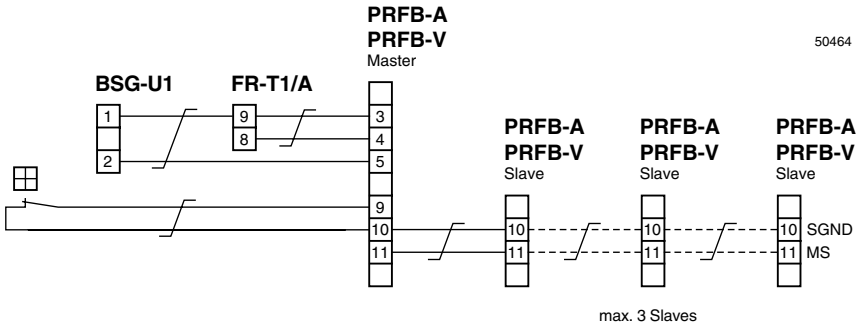
Refer to "Alternating and additive switching of relays Y4 ... Y6", page 22.

- **2-speed fan and electric heating coil with relay Y6**



1) Continuous or pulsed signal: CMD 36/56, see Section 2.4, page 19
2) Function of relay Y3: CMD 36/56, see Section 2.4, page 19
3) Room or return air sensor (Relay Y4): CMD 47/67, see Section 2.5, page 23
4) Alternating or additive switching of relays Y4 ... Y6: CMD 47/67, see Section 2.5, page 22
5) Relay Y6 for electric heating coil: CMD 47/67, see Section 2.5, page 21

Example of connections for master/slave circuit

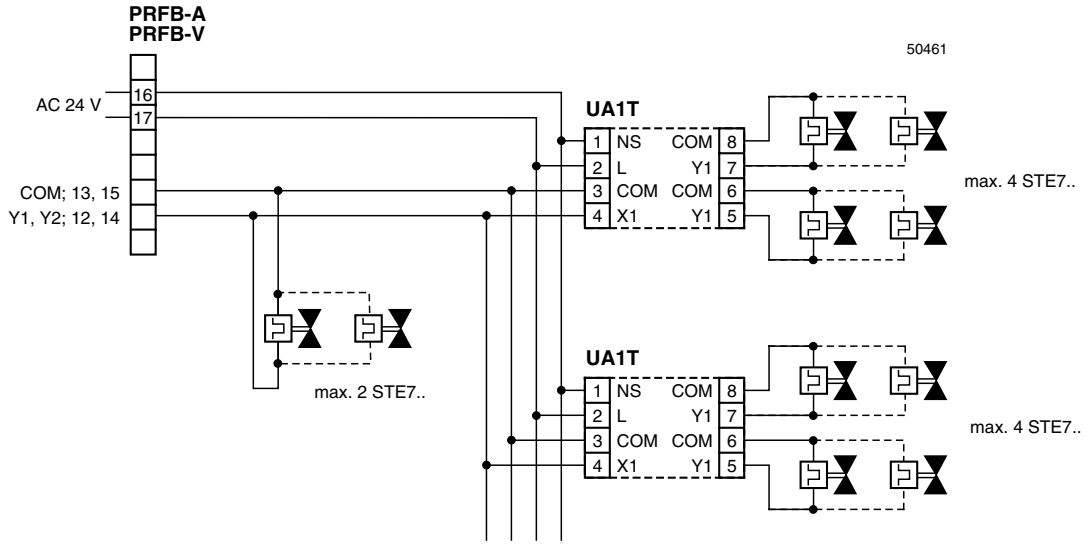


Note:

The signals at Terminals 4, 5 and 6 are not multiple-use signals (i.e. they cannot be used for more than one PRFB-A or PRFB-V).

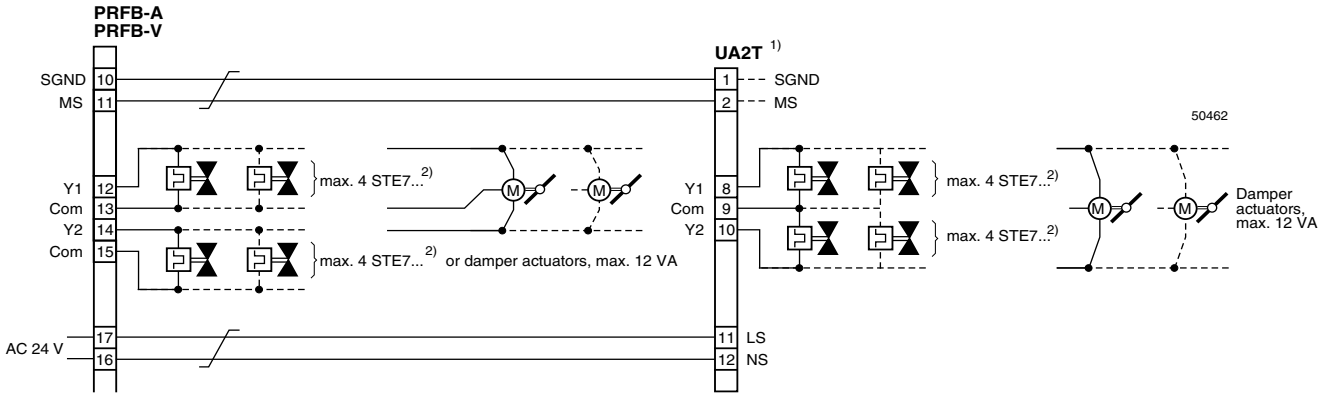
Sensors, setpoint adjusters etc. are connected only to the master.
The only input to the slave controllers is the "MS" master/slave signal.

Connection of UA1T power amplifier



Each PRFB-A or PRFB-V can accommodate a maximum of 6 UA1T amplifiers and 2 STE7... actuators per output Y1 and Y2. (With Control Types 2, 3 and 12, this maximum applies to both outputs together.)

Connection of UA2T power amplifier

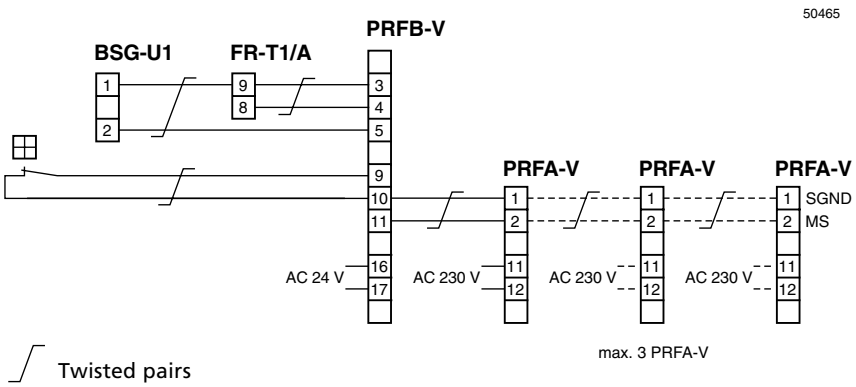


1) Maximum of 3 UA2T amplifiers per PRFB-A or PRFB-V

2) With Control Types 2, 3 and 12, max. 12 VA for both outputs together

Twisted pairs

Connection diagram using PRFA-V as power amplifier



PRFA-V supply voltage: AC 230 V
PRFA-V technical manual: P20-03

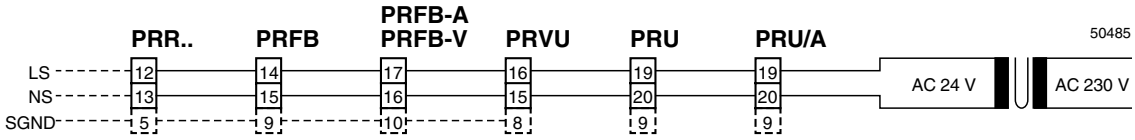
4.4 Controllers with a shared power supply

Where several PRONTO IRC controllers of different types are supplied from the same transformer, it is important to note the following:

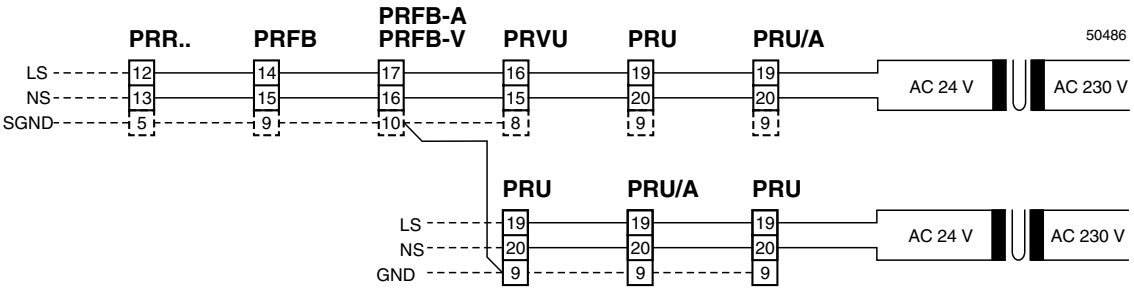
- The controllers must be connected in phase (the NS and LS conductors must not be interchanged). Except for the PRU and PRU/A controllers, the NS and SGND conductors are connected internally.
- SGND may be connected between all controllers (e.g. for shared window contacts) except the PRU and PRU/A (Fig. a).

If SGND is connected between the PRU or PRU/A and other controllers, a separate transformer is required for the PRU and PRU/A (Fig. b).

a) Various PRONTO IRC controllers with a shared power supply **without** connection to SGND of the PRU or PRU/A:



b) Various PRONTO IRC controllers with a shared power supply **with** SGND connection to PRU or PRU/A:



Important:

A separate transformer is required where SGND is connected from the PRU or PRU/A to other controllers.

4.5 Transformer sizing

The required transformer power is calculated by adding together the power consumption of all connected devices, after first multiplying the power consumption of any valve actuators by 1.5. Since it is not possible for both the heating and cooling valve of one controller to be open simultane-ously, only the higher of the two power consumption values need be used. The transformer must comply with the requirements of EN60742 for safety transformers for general use.

Fuses on the primary side must be rated in accordance with the rating of the installed transformer. No fuse is required on the transformer secondary side when connecting controllers, as these are fused internally.

4.6 EMC strategy

To ensure that complex, communicating systems operate without error from the outset, careful planning in respect of the electromagnetic compatibility (EMC) of the system is essential.

Particular attention should be paid to the following:

- Routing of cables
- Prevention of power transients
- Use of suitable cables (twisted pairs)
- Prevention of interference from relay contacts (e.g. by use of decoupling diodes)

Compliance with the cable specifications in this section is an essential requirement for the prevention of electromagnetic interference.

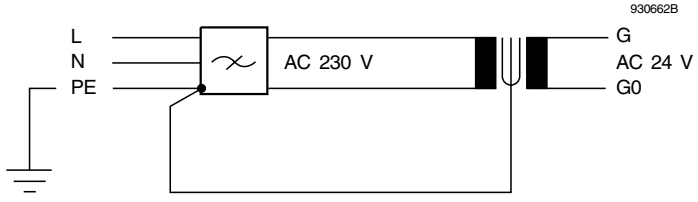
Should EMC problems occur during operation despite compliance with these specifications, consult your Staefa service department.

4.7 Cable selection and routing

4.7.1 Primary power supply cables (AC 230 V)

Transformers receive their mains voltage from the power supply cables on the primary side. The dimensions of these cables are determined by the total load and by local regulations. The primary power supply cables are frequently the cause of system interference and must therefore be connected to the transformers by as direct a route as possible. To avoid the risk of inductive and capacitive coupling, power supply cables should never be routed parallel to other cables, particularly to bus communication and signal cables.

Wide fluctuations in voltage can occur in shared power supply cables. Power transients are a particular risk (e.g. when switching contactors on and off). Not only do these affect the transformers on the primary side, but they may also damage components connected on the secondary side. If there is a possibility of such transients, a mains filter must be connected to the transformer primary side, and, where an earth connection is provided, the transformer must be earthed.



Connecting a mains filter

4.7.2 Secondary power supply cables AC 24 V

The power supply cables on the secondary side provide the AC 24 V supply voltage for the controllers, communication modules and power amplifiers.

Attention should be paid to the following:

– Do not route these cables in the vicinity of primary power supply cables and do not run them parallel to communication cables (to avoid inductive and capacitive coupling)
– Use twisted pair cable with at least 10 twists per metre (recommended type, see table).

Cable description		A	d	R	Cable length L_{max} [m]							
VDE / DIN	AWG	[mm²]	[mm]	[Ohm/km]	8.5 VA	13 VA	20 VA	40 VA	60 VA	80 VA	100 VA	120 VA
	10	5.26	2.59	3.8	420	280	180	90	60	45	36	30
YSLY		4.00	2.26	5.0	320	210	138	69	46	34	28	23
	12	3.10	2.05	6.3	250	165	108	52	36	26	21	18
YSLY		2.50	1.80	8.0	200	130	86	43	29	22	17	14
	14	1.95	1.62	11	160	100	68	34	22	17	13	11
LiYYP		1.50	1.40	14	120	80	52	26	17	13	10	8.5
	16	1.23	1.30	16	100	65	42	21	14	10	8.5	7.0
LiYYP		1.00	1.15	20	80	53	34	17	11.5	8.6	6.9	5.5
	18	0.96	1.02	21	78	51	33	16	11.0	8.3	6.6	5.5
LiYYP		0.75	0.98	26	61	40	26	13	8.6	6.5	5.2	4.3
	20	0.56	0.81	33	45	30	20	10	6.4	4.8	3.8	–
LiYYP		0.50	0.80	39	40	26	17	8.5	5.8	4.3	–	–
	22	0.34	0.64	56	28	18	12	5.8	3.9	–	–	–
LiYYP (G51 / G87)		0.28	0.60	64	22	15	9.7	4.8	–	–	–	–
LiYYP		0.25	0.57	77	20	13	8.6	–	–	–	–	–
	24	0.22	0.51	85	18	11.5	7.6	–	–	–	–	–
	26	0.15	0.40	130	12	8.0	5.2	–	–	–	–	–
LiYYP		0.14	0.39	138	11	7.5	–	–	–	–	–	–

Table of secondary power supply cables

– The cable length L_{max} represents the maximum distance between connected devices
– The maximum permitted voltage drop over L_{max} at an ambient temperature t_A of 40 °C is 4 %.
– Parallel connection of a maximum of 2 pairs is permissible. This doubles the maximum cable length L_{max}.

4.7.3 Signal and bus cables

Signal cables are lower-power control cables, including the cables for temperature sensors, window switches, setpoint adjusters etc.

The bus cable connects the individual room controllers to the communications interface.

Attention should be paid to the following:

Important:

The PRONTO bus cable does not need to be screened (twisted-pair cable must be used). An incorrectly connected screen can cause problems. If in doubt, contact your local Landis & Staefa office.

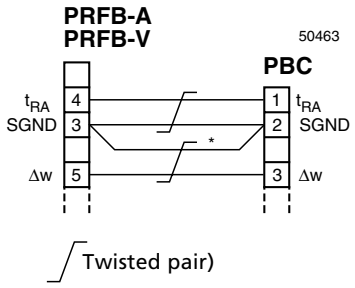
– Avoid routing signal cables in the vicinity of primary power supply cables.
– Use twisted pair or concentrically stranded cables with at least 10 twists per metre (recommended type: LiYYP to VDE/DIN).
– Avoid combining signal and power supply cables.
– The pronto bus must not be combined with other cables.

Cable description VDE / DIN	AWG	A [mm²]	d [mm]	R [Ohm/km]	Cable length L_{max} [m] Signal cable	Cable length L_{max} [m] pronto bus
LiYYP		1.50	1.40	14	240	1200
	16	1.23	1.30	16	200	1000
LiYYP		1.00	1.15	20	150	800
	18	0.96	1.02	21	140	700
LiYYP		0.75	0.98	26	120	600
	20	0.56	0.81	33	80	400
LiYYP		0.50	0.80	39	75	400
LiYYP	22	0.34	0.64	56	55	250
LiYYP (G51 / G87)		0.28	0.60	64	50	200
LiYYP		0.25	0.57	77	40	180
	24	0.22	0.51	85	35	160
	26	0.15	0.40	130	22	100
LiYYP		0.14	0.39	138	20	100

Table of signal and bus cables

- Cable length L_{max} represents the maximum distance between connected devices, i.e. between the communications interface and the furthest controller. The total length of all bus connections must not exceed 1200 m. Signal cables must not exceed 240 m in length.
- Parallel connection of a maximum of 2 pairs is permissible. This doubles the maximum cable length L_{max}.
- Surplus cable pairs or conductors must be connected at one end at least, e.g. to SGND.

Example:



* In this case the surplus wire is connected to the SGND terminals

5 Commissioning

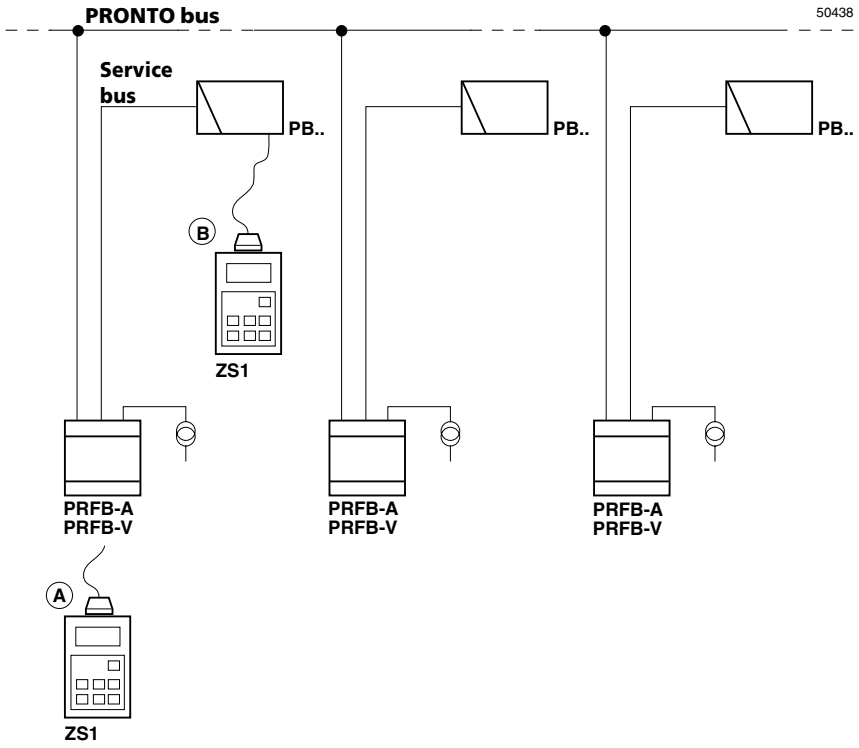
5.1 General

Commissioning with the ZS1 service terminal involves defining and entering the controller address, application code and parameters.

The ZS1 service terminal can be used for communication between any controllers or PB... room operating units connected to the same trunk (the PRONTO bus). However, for initialisation purposes (entry of the address and application code), the ZS1 must be connected directly to the controller (via the service socket).

There is no need to disconnect the bus cable for this purpose.

Cable type 22845 is required for the connection between the ZS1 and the controller or room operating unit.



Communication options using the ZS1 service terminal	Position in diagram
– Initialisation (Write address and application code), with ZS1 plugged directly into controller	A
– Read address and application code	A or B
– Read and write parameters	A or B
– Read and write remote control data	A or B
– Read control and trunk data	A or B

Refer to User manual P6 for detailed information on the ZS1 service terminal.

5.2 Initialisation

When commissioning the controller, it must be initialised by assigning it an application code (to determine whether it will be used as a controller or an I/O module) and a bus communication address (1 ... 60).

Command:

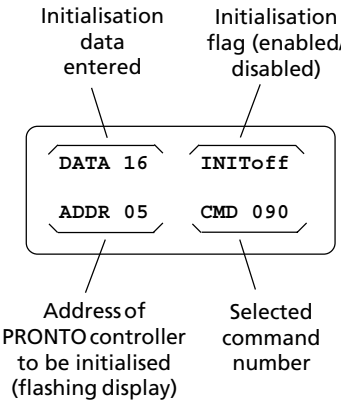
Enter application code and address CMD 90/91

- Application code 16: All fan-coil and chilled/heated ceiling applications (Default setting)
- Application code 30: Use of the controller as an I/O module (see Section 3.4, page 31)

Initialisation is only possible with the ZS1 service terminal plugged directly into the controller to be initialised. There is no need to disconnect the bus cable. The address, application code and parameters are stored in the controller EEPROM, so that this data is retained even in the event of a power failure.

This also enables initialisation and parameter-setting to be carried out prior to delivery; (in this case, ensure that the controllers are labelled accordingly.)

The address, application code and parameters are recorded in a configuration directory. The addresses are also allocated a position (room number and room-related name), trunk number, user zone and adapter or interface reference.



Initialising the first controller with the ZS1 service terminal

Step		Keys	Display
1	Switch on ZS1	on / off	– `'PRONTO PRU'` flashes
2	Select **PRONTO PRU**	enter	– `'PRU'` flashes
3	Select **PRUservice**	select	– `'PRUservice'` flashes
4	Select **COMMUNICATION**	enter	– `'COMMUNICATION'` flashes
5	Select **ADDR**	enter	– 'Address number' flashes
6	Select **CMD** field	select	– 'Command number' flashes
7	Select **Command 91**	Δ ∇	– `CMD '91'` flashes
8	Read controller data	enter	– Controller data displayed: `'INITOff' DATA 16, ADDR 60`
9	Select **Command 90**	Δ ∇	– `CMD '90'` flashes
10	Select **INIT**	select	– `'INITOff'` flashes
11	Enable initialisation	Δ	– `'INITon'` flashes
12	Select **DATA**	select	– `DATA '16'` flashes
13	Select application code (Appl. code **16** or **30**)	Δ ∇	– `DATA '16'` flashes
14	Select **ADDR**	select	– `ADDR '60'` flashes
15	Select address required e.g. select **ADDR 05**	Δ ∇	– `ADDR '05'` flashes
16	Initialise controller	enter	– Controller data displayed: `INITon, DATA 16, ADDR 05`

Initialising subsequent controllers:

– with same application code

Select the address to be assigned to the controller	Δ ∇	– 'Address number' flashes
Initialise controller	enter	– 'Address number' flashes

– with a different application code

Repeat steps 1 ... 16 in this case.

Important:

Do not switch off the ZS1 when transferring the connection from one controller to another.

5.3 Parameter setting

After initialisation, the controller parameters are set in accordance with the proposed application. The parameters can be set using the ZS1 service terminal or via the management system using the DISPLAY1 service software. The check-list below shows the steps required to set the parameters for a given application. This involves a basic setting which can be supplemented with additional functions. The command list in Section 5.5, page 51 gives details and indicates the factory settings.

Check list for parameter setting

- Select type of control required CMD 46/66
- Select room sensor or return air sensor CMD 47/67
- Select additive or alternating fan-speed switching CMD 47/67
- Enable receipt of remote control data CMD 34/54

If the controller was initialised for use as an I/O module (Application code 30), no parameter setting is required, apart from CMD 36/56.

5.4 Equipment tests

Equipment tests must be carried out before the system is commissioned or in the event that problems occur. The output signals can be tested with a voltmeter.

Communication

After successful initialisation, communications can be checked by reading and writing control data from the ZS1, WSE10 or management system.

Outputs Y1 and Y2

1. Use the ZS1 to set a heating setpoint (cooling setpoint) which is at least 2 K above (below) the current room temperature.
2. Briefly disconnect the controller from the power supply and reconnect it.
3. There should now be a pulsed signal (AC 24 V) at output Y1 (Y2).

A useful aid when checking the outputs is a small 24 V bulb connected parallel to the output to be tested.

Outputs Y3 ... Y6

1. To test the functioning of the relay outputs, use the forced control commands, CMD 126/26 and 127/27.

5.5 Command lists

The commands transmitted on the bus are used to invoke control data and parameters, and to adapt the controllers to the conditions prevailing in the plant.

The lists which follow show all commands used for controllers in the PRONTO IRC range. Hence, not all the commands shown are relevant to the PRFB-A and PRFB-V.

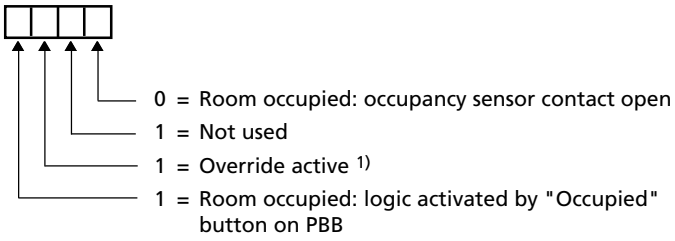
Non-relevant commands
Commands which are not applicable to the PRFB-A and PRFB-V are shown against a grey background. The default values for these commands should not be modified.

5.5.1 Control data (CMD 1 ... 20)

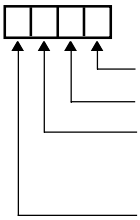
The control data consists of values or logic states which can change continuously as a function of the control and interlock process (e.g. measured room temperature).

The control data is 'read-only' data and cannot be modified.

Read** control data with ZS1 service terminal:* ***Commands 1 ... 20

Command	Description	Range / Unit	Details
1	Room temperature t_{RA}	9 ... 40.8 °C	Measured room temperature sensor reading
2	Controller heating setpoint	12 ... 40.0 °C	Result of setpoint calculation (including compensation)
3	Controller cooling setpoint	21 ... 41 °C	Result of setpoint calculation (including compensation)
4	Remote control reset (heating)	– 8 ... 7.5 K	Superimposed remote control reset. Value to be added to current setpoint (Command 2 or 3). – Enter desired value with Command 28 or 29 – Enable remote control reset with Command 54 – Display in energy hold-off mode reads: 0 K
5	Remote control reset (cooling)	– 8 ... 7.5 K	
6	Control deviation	0 ... 30 K	Measured value is below controller heating setpoint (Command 2) or above controller cooling setpoint (Command 3) by the amount displayed.
7	Local setpoint adjustment	± 3.5 K	Local setpoint reset (affects controller setpoints, Commands 2 and 3)
8	Occupancy logic	Binary	

1) "Occupied" button depressed on PBB room operating unit; the signal remains active for one hour.

9	Operating mode	Binary	
10 11	Heating demand I Cooling demand I	0 ... 100 % 0 ... 100 %	Demand signals for temperature control in primary systems.
12 13	Heating demand II Cooling demand II	0 ... 100 % 0 ... 100 %	Demand signals corresponding to the damper. positions for the heating and cooling signals. Enable – Display: Command 48/68 – Transmission via trunk communication: Command 34/54.
14	Air volume sensor	0 ... 100 %	Actual reading of pressure or air flow sensor
15	Air volume sensor 2 (V2)	0 ... 100 %	Actual reading of pressure or air velocity sensor 2 (Terminal 11)
16	Temperature sensor t_2	0 ... 49.5 °C	Actual sensor reading t_2 (T1 sensor, Terminal 7).
17	Command position, motor 1	0 ... 255 steps of 1 or 2 s	Calculated value for the command position of motor 1 (see Commands 36/56) (motor run-time)
18	Measured position, motor 1	0 ... 255 steps	Measured position of damper 1 (see Commands 36/56)
19	Command position, Motor 2	0 ... 255 steps of 1 or 2 s	Calculated value for the command position of motor 2 (see Commands 36/56) (motor run-time)
20	Measured position, motor 2	0 ... 255 steps of 1 or 2 s	Measured position of damper 2 (see Commands 36/56)

Important:

The remote control data is stored in the communications module in table form. When inputs are made with the ZS1 service terminal, the data is modified in the controller but not in the communications module.

5.5.2 Remote control data (CMD 24/124 ... 29/129)

The remote control data consists of the commands sent from the central plant to the controller including, for example, operating mode *(Comfort, Stand-by, Energy hold-off)* and setpoint adjustments.

In normal operation, the communications module periodically overwrites the data in the controller with the programmed values at regular intervals (approximately every 5 minutes). For service purposes, this *Write* routine can be suppressed as described in the documentation for the relevant communications interfaces or system controller.

Enabling remote control

To allow the controller to accept remote control commands 25 (forced control only), 28 and 29, it must be enabled for receipt, with CMD 34/54.

Read remote control data: ***Commands 124 ... 129***
Write *remote control data:* ***Commands 24 ... 29***

Command Read	Write	Description	Range / Unit	Details	Default
124	24	Not used			
125	25	Operating mode (does not need to be enabled via CMD 34)	Binary 0 0 0 0	No remote control. The controller determines its mode independently.	(0 0 0 0)
			0 1 0 0	Energy hold-off (night mode); (with option of local override)	
		Compulsory operating mode (does not need to be enabled via CMD 34)	1 0 0 0	Comfort	
			0 0 0 1	Stand-by	
			0 0 1 0	Energy hold-off (no local override option)	
128	28	RC reset (heating)	– 8 ... 7.5 K	Resets the controller setpoints for heating and cooling (CMD 2 and 3)	(0)
129	29	RC reset (cooling)	– 8 ... 7.5 K		

* For write commands set "PRUService" in Menu 2.

Forced control of relay outputs

Command Read	Write*	Description	Range / Unit	Details				Default
126/127	26/27	Forced control of relays Y3 ... Y6	Binary					
				Relay:				
			CMD 127 / 27	CMD 126 / 26	Y3	Y6	Y5	Y4 (0 0 0 0 0 0 0 0)
			X 0 0 0	0 0 0 0	AUT	AUT	AUT	AUT
			X 1 0 1	X X X X	AUT	–	–	–
			X 0 0 1	X X X 0	OFF	–	–	–
			X 0 0 1	X X X 1	ON	–	–	–
			X 1 0 0	0 0 0 0	–	AUT	AUT	AUT
			X 0 0 0	0 0 1 0	–	AUT	AUT	OFF
			X 0 0 0	0 0 1 1	–	AUT	AUT	ON
			X 0 0 0	1 0 0 0	–	AUT	OFF	AUT
			X 0 0 0	1 0 1 0	–	AUT	OFF	OFF
			X 0 0 0	1 0 1 1	–	AUT	OFF	ON
			X 0 0 0	1 1 0 0	–	AUT	ON	AUT
			X 0 0 0	1 1 1 0	–	AUT	ON	OFF
			X 0 0 0	1 1 1 1	–	AUT	ON	ON
			X 0 1 0	0 0 0 0	–	OFF	AUT	AUT
			X 0 1 0	0 0 1 0	–	OFF	AUT	OFF
			X 0 1 0	0 0 1 1	–	OFF	AUT	ON
			X 0 1 0	1 0 0 0	–	OFF	OFF	AUT
			X 0 1 0	1 0 1 0	–	OFF	OFF	OFF
			X 0 1 0	1 0 1 1	–	OFF	OFF	ON
			X 0 1 0	1 1 0 0	–	OFF	ON	AUT
			X 0 1 0	1 1 1 0	–	OFF	ON	OFF
			X 0 1 0	1 1 1 1	–	OFF	ON	ON
			X 0 1 1	0 0 0 0	–	ON	AUT	AUT
			X 0 1 1	0 0 1 0	–	ON	AUT	OFF
			X 0 1 1	0 0 1 1	–	ON	AUT	ON
			X 0 1 1	1 0 0 0	–	ON	OFF	AUT
			X 0 1 1	1 0 1 0	–	ON	OFF	OFF
			X 0 1 1	1 0 1 1	–	ON	OFF	ON
			X 0 1 1	1 1 0 0	–	ON	ON	AUT
			X 0 1 1	1 1 1 0	–	ON	ON	OFF
			X 0 1 1	1 1 1 1	–	ON	ON	ON

Caution:

Where fans are controlled by alternating switching (see p.22), an incorrect remote control command can cause short-circuiting (if more than one stage is ON).

x *Not relevant*
– *Relay remains in last state*
ON *Relay ON, taking priority over control sequence or trunk communication (K3)*
OFF *Relay OFF, taking priority over control sequence or trunk communication (K3)*
AUT *Relay controlled by control sequence (except with Control Types 8 and 9) or trunk communication (K3)*

* For write commands, set "PRUService" in Menu 2.

Note:

To avoid switching the relays unintentionally, both commands must be activated simultaneously. – Press **<enter>** only after entry of both commands (CMD 26 and 27).

Important:
Before each *Write* routine, select Command 30 once and press <Enter>. This causes the data of the whole group to be loaded into the communications module or service terminal.

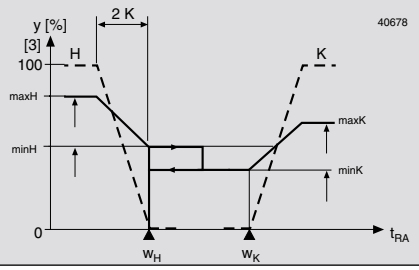
5.5.3 Control parameters

The "Control parameters' data group is used to set the controller parameters in accordance with the system specification. The factory-set default values are shown below in brackets.

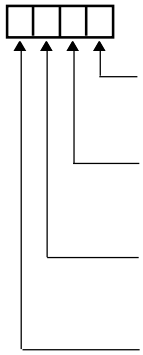
Read** control parameters:* ***Commands 30 ... 49
Write** control parameters:* ***Commands 50 ... 68

Command Read	Write	Description	Range / Unit	Details	
30	50	Heating setpoint X_{KH}	17 ... 24.5 °C	Basic heating setpoint (*Comfort* setpoint without resets)	(21.0 °C)
31	51	Cooling setpoint X_{KK}	21 ... 28.5 °C	Basic cooling setpoint (*Comfort* setpoint without resets)	(24.0 °C)
32	52	ÐT Stand-by, heating	0 ... 7.5 K	Difference from *Comfort* setpoint (heating) X_{KH}	(2.0 K)
33	53	ÐT Stand-by, cooling	0 ... 7.5 K	Difference from *Comfort* setpoint (cooling) X_{KK}	(3.0 K)
34	54	Function block 1: Enable/disable trunk communication functions	Binary	(1 1 1 1) 1 = Receipt of remote control commands 25 (forced control only), 28 and 29 enabled 1 = Heating demand signal I + II enabled * 1 = Cooling demand signal I + II enabled * 1 = Receipt of change-over command disabled * via trunk communication (See Commands 10…13 to display values)	
35	55	Function block 2: Enable/disable trunk communication functions	Binary	(1 1 1 1) 1 = Summer / winter compensation (Commands 76 and 77) enabled 1 = Energy hold-off / Night mode (Command 78) enabled 1 = Morning boost (Command 78) enabled 1 = Purge (Command 78) / Free Cooling (79) enabled	
36	56	Function block 3: Functions of relay Y3	Binary	X 0 0 0 = Relay Y3 has function K1 (0 0 1 0) X 0 0 1 = Relay Y3 has function K2 X 0 1 0 = Relay Y3 has function K3 X 0 1 1 = Relay Y3 has function K3, but operates as pulse switch (pulse duration: ca. 3 s) X 1 0 0 = Relay Y3 for fan control (like relay Y4 of PRFB-V) X 1 0 1 = Relay Y3 for electric heating coil (like relay Y6 of PRFB-V) X X X Local energy hold-off (terminal 9) Inversion of type of operation 0 = Energy hold-off when contact closed 1 = Energy hold-off when contact open	
37	57	Function block 4	Binary	(0 0 0 0) 1 = Occupancy sensor has priority over night mode via trunk or individual communication (CMD 78 or 25) (see flow chart, p. 29) Response of Y4, Y5, Y6 after power-up 0 = Status depends on operating mode 1 = De-energised until next forced control command 1 = Output signals for heating coil disabled when $\dot{V}$ < selected $\dot{V}_{min}$ Response of Y3 after power-up 0 = Status depends on Control Type, forced control cmd, or trunk communication (selected under CMD 36/56) 1 = De-energised until next forced control command	

38	58	Max. volume (heating)	0 ... 100 %	(100 %)
39	59	Min. volume (heating)	0 ... 100 %	(0 %)
40	60	Min. volume (cooling)	0 ... 100 %	(0 %)
41	61	Max. volume (cooling)	0 ... 100 %	(100 %)



42	62	Run-on Fan speed 1	0 ... 255 s	Fan-speed 1 switch-off delay (Relay Y3 or Y4) Not applicable to control types 8 and 9	(5 s)
43	63	Minimum run-times fan speeds 1 and 2	0 ... 255 s	Minimum run-time of relays Y4 and Y5 (or switch-on delay of Y5, Y6) Not applicable to control types 8 and 9	(5 s)
44	64	Cascade factor	0 ... 100 %	Differential or ratio for cascade via factor K – (Differential control): a constant differential between the supply and extract air volume – (Ratio control): a relationship between the supply and extract air volume, expressed as a percentage	(100 %)
45	65	EHO setpoint (heating)	12 ... 19.5 °C	Cooling setpoint fixed at 40 °C	(12.0 °C)
46	66	Select Control Type see table on page 53	0 ... 15		(0)
47	67	Function block 5	Binary	(0 0 0 0)	



Temperature sensor
1 = Return air sensor (unit-mounted sensor)
0 = Room air sensor

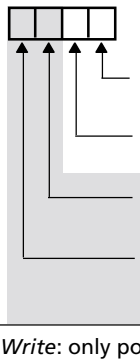
Fan control Y4, Y5 and Y6[1)]
1 = Additive
0 = Alternating

Relay Y6[1)]
1 = Relay Y6 for electric heating coil
0 = Relay Y6 for fan control

CRTL/STBY input (occupancy sensor)
1 = Occupancy sensor function is displayed only (CMD 8), but does not affect the operating mode. If activated (contact closed), the PBB remains in its last operating mode.
0 = Operation from PBB room operating unit and/or occupancy sensor. Both have an influence on the operating mode.

[1)] If relay Y6 is used for on/off control of the electric heating coil, the fan operates at two speeds only, controlled by Y4 and Y5.

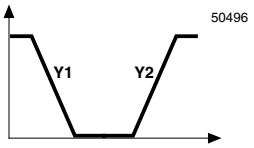
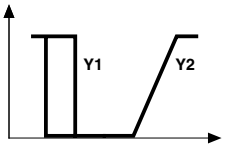
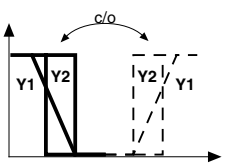
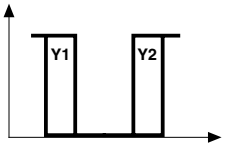
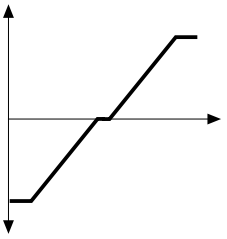
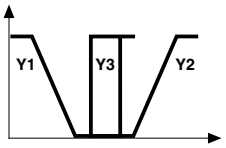
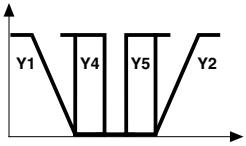
48	68	Function block 6: Energy demand display	Binary	(0 0 0 0)	

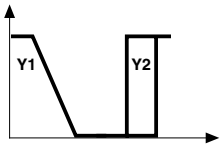
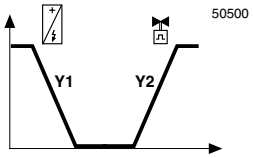
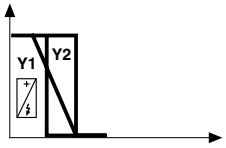
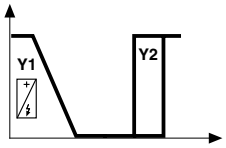


1 = Heating demand I (control deviation in heating sequence) displayed under Command 10
1 = Cooling demand I (control deviation in cooling sequence) displayed under Command 11
1 = Heating demand II (heating demand due to air volume) displayed under Command 12
1 = Cooling demand II (cooling demand due to air volume) displayed under Command 13
0 = Value displayed: 0

49/100		Application code	16, 30	*Write*: only possible with direct connection to controller (CMD 90). 16 = Operation as fan-coil controller 30 = Operation as I/O module	(16)
	69	Write default data with ZS1			

Setting the type of control (Enter Control Type via CMD 46/66)

Sequence diagram	Output Y1	Output Y2	Control type
	PID (Fan-coil)	PID (Fan-coil)	0
	On/off x_D = 1.5 K	PID (Fan-coil)	1
	PID (Fan-coil)	On/off x_D = 1.5 K	2
	PID (Fan-coil)	On/off x_D = 1.0 K	3
	On/off x_D = 1.0 K	On/off x_D = 1.0 K	4
	On/off x_D = 1.5 K	On/off x_D = 1.5 K	5
	3-point without synchronisation		6
	3-point with synchronisation		7
	PID (chilled/heating ceiling)	PID (chilled/heating ceiling)	8
	Y3: On/off x_D = 1.0 K		
	Transition from heating to cooling sequence: 8 mins		
	PID (chilled/heating ceiling)	PID (chilled/heating ceiling)	9
	Y4: On/off Y5: On/off x_D = 0.5 K		
	Min. duration of transition from Y4 - Y5: 8 mins		

Sequence diagram	Output Y1	Output Y2	Control Type
	PID (Fan coil)	On/off x_D = 1.0 K	10
	PID (Electric heating coil)	PID (Fan coil)	11
	PID (Electric heating coil)	On/off x_D = 1.0 K	12
	PID (Electric heating coil)	On/off x_D = 1.0 K	13
Neutral	Controller outputs Y1, Y2, Y3, Y4, Y5, Y6 all disabled		14
Slave	Operation as slave controller		15

5.5.4 Trunk data

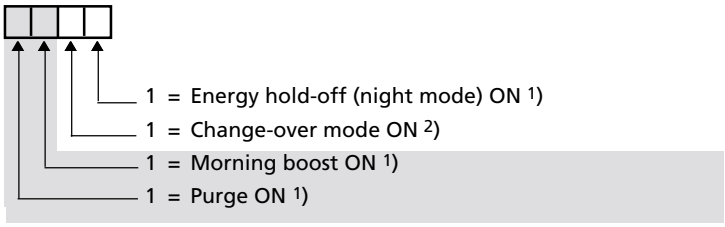
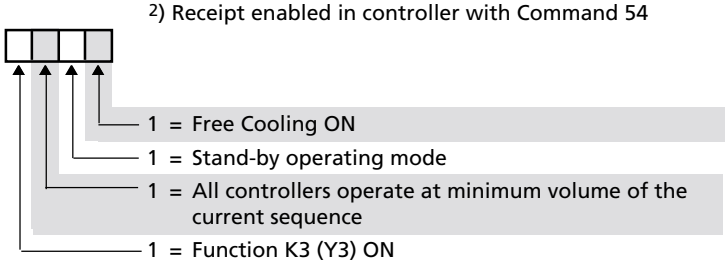
Trunk data is transmitted from the central plant simultaneously to all controllers connected to the same trunk. The trunk data is therefore *Read only* data.

Read** trunk communication data:* ***Commands 70 ... 81

Signals from the controller to the primary plant

Command	Description	Range / Unit	Details
70	Max. heating demand I	0 ... 100 %	
71	Max. cooling demand I	0 ... 100 %	The highest demand signals on the trunk (See Commands 10 ...13 for individual signals)
72	Max. heating demand II	0 ... 100 %	
73	Max. cooling demand II	0 ... 100 %	
74	Max. control deviation	0 ... 30 K	Max. control deviation transmitted on the trunk
75	Controller address	0 ... 60	Address of controller transmitting the maximum control deviation under CMD 74

Signals from the primary plant to the controller

76	Winter compensation	0 ... 31.7 K	Receipt enabled in controller with CMD 55
77	Summer compensation	0 ... 31.7 K	Receipt enabled in controller with CMD 55
78	Control commands – Purge – Morning boost – Change-over – Energy hold-off	Binary	 1) Receipt enabled in controller with Command 55 2) Receipt enabled in controller with Command 54
79	Control commands* – Output Y3 – Minimum volume – Stand-by – Free Cooling (night cooling) * Not available in conjunction with the WSE10.	Binary	
80	Outside temperature	– 42.5 ... 42.5 °C	
81	Not used		

5.5.5 Address and application code (initialisation, CMD 91/90)

Command	Description	Range / Unit	Details	Default
90	Controller address Application code	1 ... 60 16 or 30	(Over)write address Write application code	(60) (16)
91	Controller address Application code	1 ... 60 16 or 30	Read address Read application code	(60) (16)

6 Technical data

Power supply	Low voltage (SELV)
Nominal voltage	AC 24 V, 50/60 Hz
– Admissible voltage tolerance	+15 / –10 %
Power consumption	
– Without peripheral devices	4 VA
– With peripheral devices	Max. 17 VA
Fuse	0.9 A, with automatic reset
Signal inputs	
Temperature sensor	T1, effective measuring range 9 ... 41 °C
External setpoint adjustment	Max. ± 3.0 K
Occupancy function	Occupancy sensor or PBB operating unit
Energy hold-off	Window switch or dewpoint sensor (N/C or N/O operation as selected)
Master/slave	Specific signal for parallel operation of up to 4 controllers
Signal outputs	
Outputs Y1, Y2	
– For thermic valve actuators	AC 24 V, modulating (PWM), max. 4 STE7.. actuators, or 12 VA per Y1; Y2 [1]
– For damper actuators	AC 24 V, 3-position (PWM), max. 12 VA, max. run-time 7 mins.
– For contactors	AC 24 V, on/off, max. 12 VA per Y1; Y2 [1]
– For electric heating coils (Y1 only)	AC 24 V, modulating (PWM), max. 12 VA [1]
Relay outputs Y3 ... Y6	Volt-free relay contacts, AC 230 V
– Contact rating	Max. AC 250 V / 4 A / $\cos\varphi$ = 0.6 max. DC 30 V / 4 A
– Min. admissible load	10 mA at DC 5 V
– Switch capacity	Max. AC 1000 VA, DC 120 W
– Voltage against earth	Max. 250 V
Controller data	
Control algorithm	PID
Operating modes	Comfort, Stand-by, Energy hold-off
Connections	
Connection terminals	4 mm^2 screw terminals with test socket
Max. cable length	See "Installation", pp. 42 and 43
Communication	
pronto bus	2-wire cable
Service socket	For ZS1 service terminal
Weight including packaging	0.42 kg
Dimensions (w x h x d)	108 x 52 x 118 mm
Mounting	Snap-mounting on DIN rails (EN50022-35 x 7.5) or screwed to a flat surface
Safety	
Product safety	EN 61010-1: 1993
– Overvoltage category (for circuits at relay outputs Y3...Y6)	II (with transient overvoltages up to 2500 V)
– Contamination level	2 (normal, non-conductive contamination)
Electrical safety	PELV
General ambient conditions	
Usage	For indoor use, inside control panel
Temperature range	
– Operation	5 ... 45 °C
– Storage	– 25 ... 70 °C
Ambient humidity	10 ... 90 %rh, non-condensing
Conformity	This product meets the requirements for **CE** marking

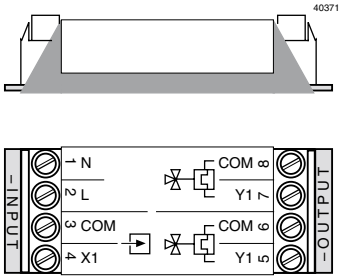
[1] With Control Types 2, 3 and 12: Total for both outputs: max. 12 VA.

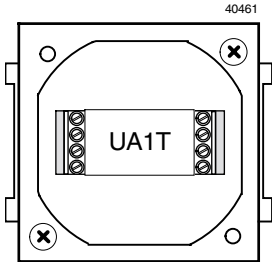
7 Peripheral devices

7.1 UA1T power amplifier

The UA1T power amplifier is used for the connection of additional STE7... thermic valve actuators.

Four valve actuators may be connected to each UA1T. For example, two valve actuators and six UA1T power amplifiers may be connected to each of the controller outputs Y1 and Y2 (up to a maximum of 10 VA). See page 39 for connection diagram.





Technical data

Power supply	Low voltage (SELV)
Nominal voltage	AC 24 V, 50/60 Hz
– Admissible voltage tolerance	+15 / –10 %
Power consumption	
– From PRFB-A, PRFB-V controller	0.5 VA
– From external transformer	Max. 15 VA
Fuse	0.9 A, automatic reset
Signal inputs	
Input X1	AC 24 V (PWM)
Signal outputs	
Y1 outputs	AC 24 V (PWM) For 2 x 2 STE7... thermic valve actuators Max. 5 VA per Y1
Connections:	
Connection terminals	4 mm² screw terminals
Weight including packaging	0.03 kg
Dimensions (w x h x d)	22 x 18 x 56 mm
Mounting	Flush- or surface-mounting
Safety:	
Product safety	EN 61010-1
Electrical safety	SELV
General ambient conditions:	
Usage	For indoor use (installed in control panel, or on flush or surface mounting box)
Temperature range	
– Operation	5 ... 45 °C
– Storage	–25 ... 70 °C
Ambient humidity	10 ... 90 %rh, non condensing
Conformity	This product meets the requirements for **CE** marking

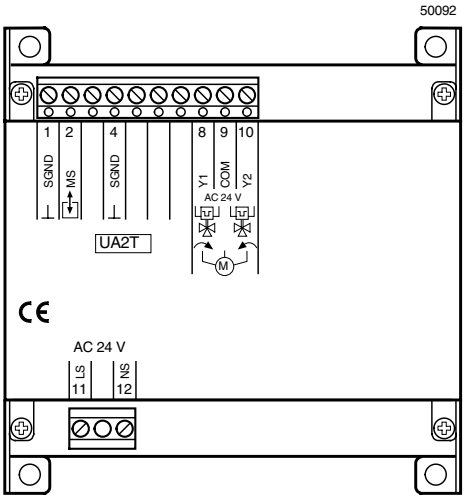
Connection diagram

See Section 4.3, page 39

7.2 UA2T power amplifier

The UA2T power amplifier is used for the connection of additional thermic valve actuators or additional damper actuators. Each UA2T allows direct connection of up to eight STE7... thermic valve actuators (four to each output) or up to six GHD131.2E damper actuators.

A maximum of three UA2T power amplifiers may be connected to the PRFB-A or PRFB-V controller. The power amplifiers are controlled by the digitally encoded master/slave signal (MS).



Technical data

Supply voltage:	Low voltage (SELV)
Nominal voltage	AC 24 V, 50/60 Hz
– Admissible voltage tolerance	+15 / –10 %
Power consumption	
– Without output peripheral devices	Max. 3 VA
– With output peripheral devices	Max. 15 VA
Fuse	0.9 A, automatic reset
Signal input:	
Master/slave	Specific master/slave signal
Signal outputs:	
Outputs Y1 and Y2	
– For thermic valve actuators	AC 24 V, modulating (PWM), max. STE7... actuators or 12 VA per Y1; Y2 [1]
– For damper actuators	AC 24 V, 3-position (PWM), max. 12 VA, max. run-time 7 mins.
– For contactors	AC 24 V, on/off, max. 12 VA per Y1; Y2 [1]
Connections:	
Connection terminals	Screw terminals, 1 x 4 mm^2
Weight including packaging	0.44 kg
Dimensions (w x h x d)	108 x 52 x 118 mm
Mounting	Snap-mounted on DIN rails (EN50022-35 x 7.5) or screwed to a flat surface
Safety:	
Product safety	EN 61010-1
– Contamination level	2 (normal non-conductive contamination)
Electrical safety	SELV
General ambient conditions:	
Usage	For indoor use, installed in control panel
Temperature range	
– Operation	5 ... 45 °C
– Storage	–25 ... 70 °C
Ambient humidity	10 ... 90 %rh, non-condensing
Conformity	This product meets the requirements for **CE** marking

[1] With Control Types 2, 3 and 12: Total for both outputs max. 12 VA.

Connection diagram

See Section 4.3, page 39

7.3 Summary of peripheral devices for use with PRFB-A, PRFB-V

PFB-T1 Unit-mounted temperature sensor
See data sheet N1836

PB-T1 Room temperature sensor with service socket
See data sheet N1656

FR-T1/A Room temperature sensor
See data sheet N1736

BSG-U1 Universal setpoint adjuster
For a setpoint adjustment of ± 3.0 K
See data sheet N1987

FA-H3 / FU-IH3 Dewpoint sensor with interface
See data sheet N1879

For connection to PRFB-A and PRFB-V, see connection diagrams, Section 4.3

PBA Room operating unit

With ± 3 K setpoint adjuster and T1 temperature sensor.

See data sheet N1651

PBAS, PBAS/C1 Room operating unit

Like PBA, but with additional switch for three-speed fan (PBAS) or other switching function (PBAS/C1)

See data sheets N1652 and N1653

PBB Room operating unit

Like PBA, but with three pushbuttons for control of operating mode *(Comfort, Stand-by* and *Energy hold-off)*

LEDs to indicate operating mode

See data sheet N1654

PBC Room operating unit

Like PBA, but with LCD temperature display.

See data sheet N1655

PBIT / PBIR Infrared remote control unit

With ± 3 K setpoint adjuster and control of operating mode *(Comfort* and *Stand-by*). Option of lighting control.

See data sheet N1658

For connection to PRFB-A and PRFB-V, see connection diagrams, Section 4.3

3-point damper actuators for secondary air handling units

Rotary actuators:

SQE85.1, SQE85.12 See data sheet N4622

GDB13...1E, GLB13...1E See data sheet N4624

GHD131.2E Linear actuator

See data sheet N4689

Linear actuators:

SQE85.2 See data sheet N4652

GDB13...2E, GLB13...2E See data sheet N4654

STE71 Thermic actuator for valve type 2T.../A
with AC 24 V PWM control signal

STE71: See data sheet N4874

2T.../A: See data sheet N4848

T3W...,
T4W... Valves with thermic actuators
with AC 24 V PWM control signal, comprising STE72 actuator and type ...W... valve body

See data sheet N4829

For connection to PRFB-A and PRFB-V, see connection diagrams, Section 4.3

Siemens Building Technologies Ltd.
Landis & Staefa Division
Gubelstrasse 22
CH-6301 Zug
Tel. +41 41-724 24 24
Fax +41 41-724 35 22

http://www.landisstaefa.com

P20-07 en / Sept. 1999