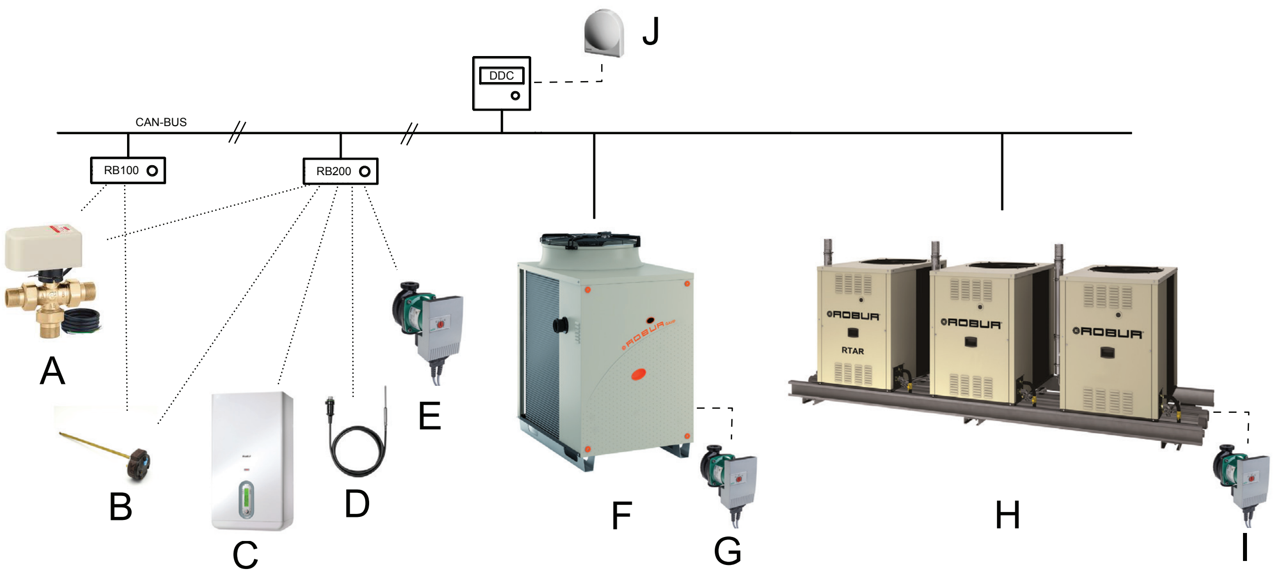
1 DDC CONTROL ARCHITECTURE

The diagram shown in Figure 1.1 *p. 1* sets out the elements of the control system Robur based on the DDC Panel and the types of available connections.

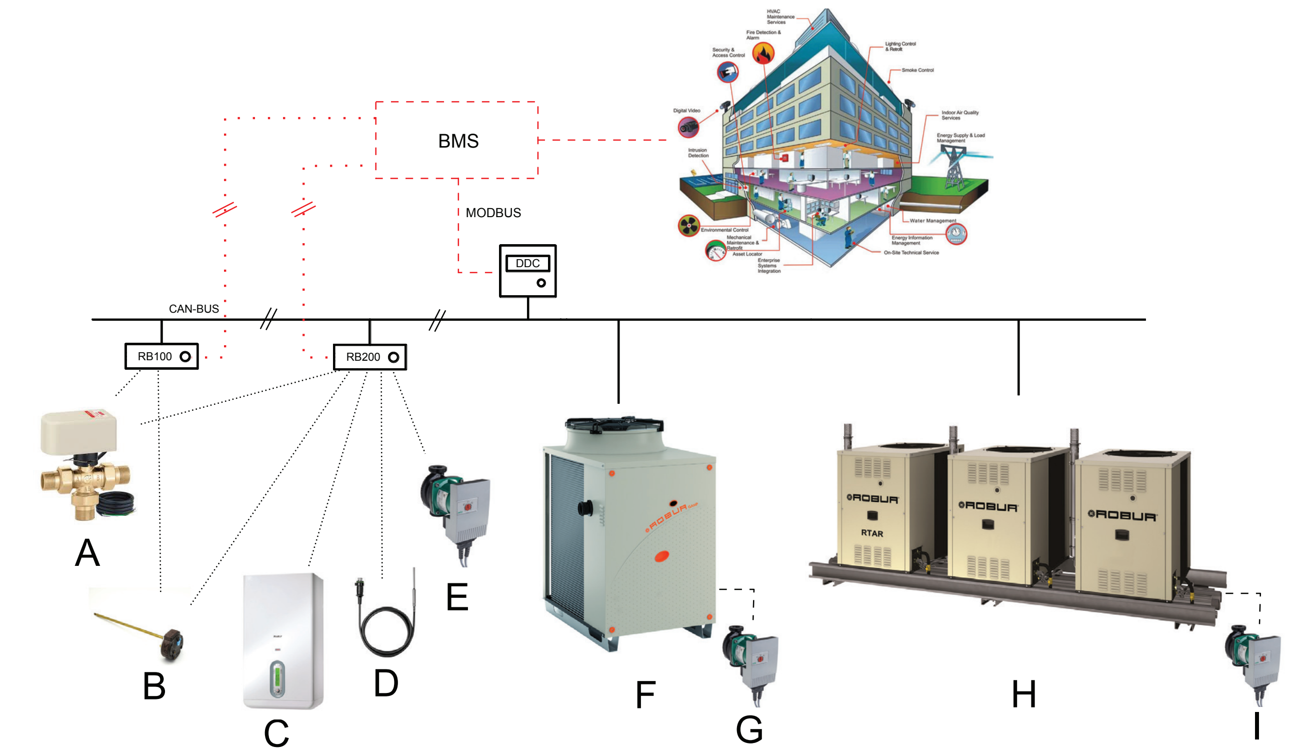
Figure 1.1 *DDC control architecture*



In solid line the CAN-BUS connection connecting control devices Robur
In dotted line the connection with analogue/digital signals connecting the RB100/RB200 devices with the objects that may be controlled by them
In dashed line the connections with analogue/digital signals between DDC and outdoor temperature probe and of unit Robur circulating pumps that must be controlled by the electronic boards inside the units
A ON/OFF type three-way diverting valves
B Thermostats
C Third party generators
D Temperature probes
E Secondary circulating pumps
F Single Robur units
G Single Robur units circulating pumps
H Robur preassembled groups
I Robur preassembled group circulating pumps (independent or common)
J Outdoor temperature probe

The Robur units and Robur control devices are always connected via CAN-BUS connections.
All connections towards other devices are effected via analogue signals (0-10 V or resistive probe readings) and digital signals.
The diagram shown in Figure 1.2 *p. 2* shows the elements of the control system and the types of available connections if the DDC Panel is installed and a users control system such as BMS, SCADA and similar.
Connection with the DDC Panel will always be via Modbus protocol, while any analogue/digital type signals from the BMS system (only useful if the BMS does not communicate via Modbus with the DDC Panel) will be connected to the RB100/RB200 devices.
Third party generators or other system components may be controlled by the DDC Panel (via the RB100/RB200 devices) or directly by the BMS.
Users control is always managed by the BMS.

Figure 1.2 *Control architecture with BMS*



In solid line the CAN-BUS connection connecting control devices Robur
In dotted line the connection with analogue/digital signals connecting the RB100/RB200 devices with the objects that may be controlled by them
In dashed line the connections with analogue/digital signals between DDC and outdoor temperature probe and of unit Robur circulating pumps that must be controlled by the electronic boards inside the units
In red dashed line the MODBUS connection between the DDC Panel and the fixture control system (BMS, SCADA, etc.)
In red dotted line the connection with analogue/digital signals connecting the fixture control system with the RB100/RB200 devices

A ON/OFF type three-way diverting valves
B Thermostats
C Third party generators
D Temperature probes
E Circulating pumps
F Single Robur units
G Single Robur units circulating pumps
H Robur preassembled groups
I Robur preassembled group circulating pumps (independent or common)

1.1 CAN-BUS COMMUNICATION NETWORK

The CAN-BUS communication network, implemented with the cable of the same name, makes it possible to connect and remotely control one or more Robur appliances with the DDC or CCP/CCI control devices.
It entails a certain number of serial nodes, distinguished in:
- intermediate nodes, in variable number;
- terminal nodes, always and only two (beginning and end).

Each component of the Robur system, appliance (GAHP, GA, AY, ...) or control device (DDC, RB100, RB200, CCI, ...), corresponds to a node, connected to two more elements (if it is an intermediate node) or to just one other element (if it is a terminal node) through two/one CAN-BUS cable section/s, forming an open linear communication network (never star or loop-shaped).

1.1.1 CAN-BUS signal cable

Robur control devices are connected between them and to their units via the CAN-BUS signal cable, shielded, compliant to Table 1.1 *p. 2* (admissible types and maximum distances).
For lengths ≤200 m and max 4 nodes (e.g. 1 DDC + 3 GAHP), a simple 3x0.75 mm shielded cable may even be used.

Table 1.1 *CAN BUS cables type*

CABLE NAME	SIGNALS / COLOR			MAX LENGTH	Note
Robur					Ordering Code OCVO008
ROBUR NETBUS	H= BLACK	L= WHITE	GND= BROWN	450 m	
Honeywell SDS 1620					In all cases the fourth conductor should not be used
BELDEN 3086A	H= BLACK	L= WHITE	GND= BROWN	450 m	
TURCK type 530					
DeviceNet Mid Cable					
TURCK type 5711	H= BLUE	L= WHITE	GND= BLACK	450 m	
Honeywell SDS 2022					
TURCK type 531	H= BLACK	L= WHITE	GND= BROWN	200 m	

2 DDC

The DDC controller is able to control the appliances, a single GAHP unit, or even several GAHP/GA/AY Robur units in cascade, only in ON/OFF mode (non modulating).
Each individual DDC Panel is able to manage up to 16 units
Up to 3 DDC panels may be coupled to control up to 48 units.

2.1 MAIN FUNCTIONS

The main functions of the DDC panel are:

1. regulation and control of one (or more) Robur units (GAHP, GA, AY) with ON/OFF unit control;
2. data display and parameters setting;
3. hourly programming;
4. climate curve control;
5. diagnostics;
6. errors reset;
7. possibility to interface with a BMS;

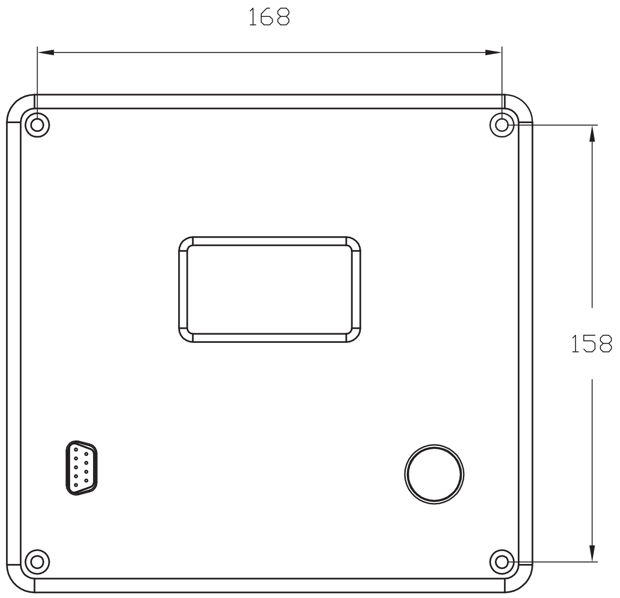
DDC functionality may be extended with auxiliary Robur devices RB100 and RB200 (e.g. service requests, DHW production, Third Party generator control, probe control, system valves or circulating pumps, ...).
Below is a synthetic description of the main DDC Panel functions:

1. Regulation and control of one (or more) unitsRobur makes it possible to manage cascade operation of the various types of appliance, using the more efficient ones with priority.
2. Values view and parameters setting allow you to optimize the adjustment parameters in order to best exploit the efficiency of the absorption technology, while safeguarding user comfort.
3. The hourly programming makes it possible to turn the generation system on only if an actual service request is expected, preventing fuel waste.
4. Weather curve management, both in winter and summer, makes it possible to only deliver the energy actually required in the specific environmental conditions. This on one hand prevents wasting energy when the conditioning system does not require it, and on the other it makes it possible to prevent appliances from stopping in conditions of limit thermostating due to the applied load being too low with respect to the temperature set on the DDC Panel.
5. Diagnostics lets you know at any time the operating status, warnings or errors of appliances and identify the possible causes of any malfunctions, as well as manage a log of recorded events.
6. The error reset lets you restore appliance availability following resolution of an error that involved shutdown by the control system.
7. The BMS interfacing option (or other external supervision and control system) makes it possible to manage the DDC Panel (and the appliances controlled by it) through an external device, within more complex and integrated domotics or integrated building/installation control systems. In practice, interfacing is carried out either via simple analogue/digital signals, or (more comprehensively) via the Modbus protocol, detailed in Paragraph 2.5 *p. 7*.

2.2 INSTALLATION

The DDC Panel is suitable for internal installation and must be fixed onto an electrical panel, into which a 155 x 151 mm rectangular opening must be made.
Figure 8.2 *p. 34* indicates the position of the fixing holes.

Figure 2.1 *DDC/CCI front view with fixing dimensions*

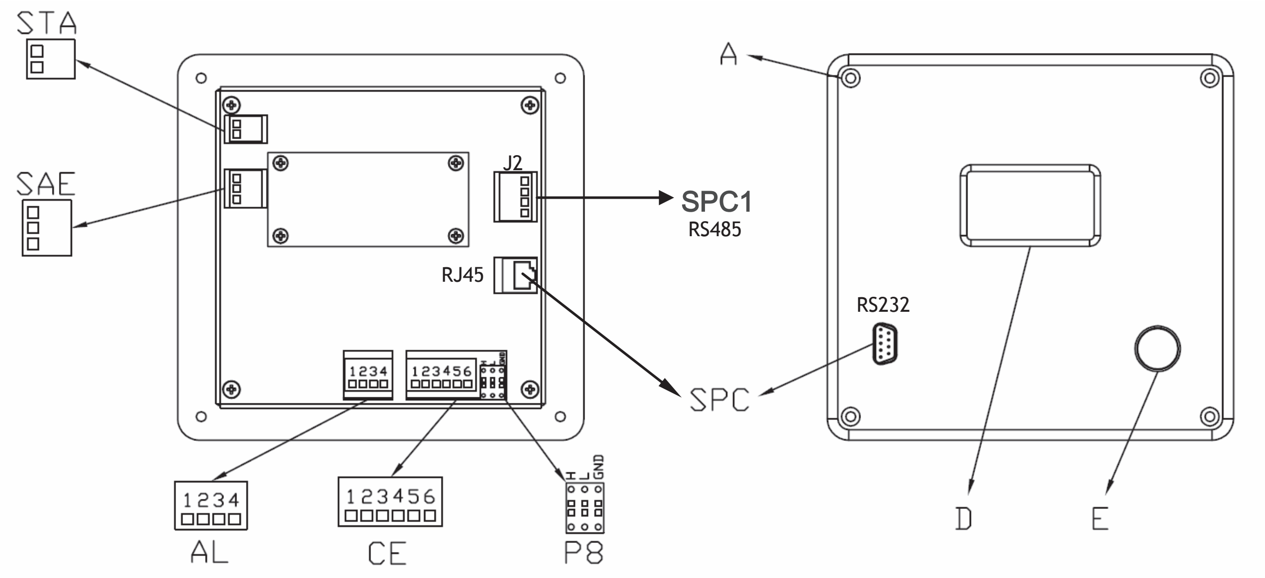


The DDC Panel has IP20 degree of protection, and must be installed in premises with ambient air temperature between 0°C and 50°C, away from direct sunlight exposure.

2.3 CONNECTIONS

The DDC Panel provides the connection terminals shown in Picture 2.2 *p. 4*.

Figure 2.2 *Detail of DDC connectors*



On the right the front view, on the left the rear view of the DDC Panel
STA = Outdoor temperature probe NTC 10k - 2-pole connector
SAE = Output for external alarm systems - 3-pole connector, max 24V voltage

- 1 = COM
- 2 = NO
- 3 = NC

AL = 24Vac electrical power supply - 4 pole connector

- 1 = 24Vac
- 2 = 0Vac
- 3 = earth

CE = External requests - 6-pole connector

- 1 = R (24Vac output)
- 2 = W (heating request)
- 3 = Y (conditioning request)
- 4 = 0 (0Vac)
- 5 = NA (not connected)
- 6 = R (24Vac output)

P8 = CAN-BUS network connector (orange)
SPC = RS232 serial port

- RJ45 (connection MODBUS / supervision system / monitoring)
- DB9 (connection MODBUS / supervision system / monitoring)

SPC1 = J2 port (MODBUS protocol RS485):

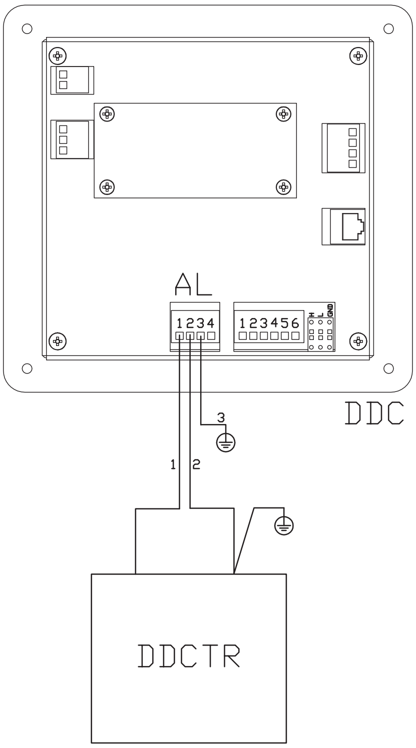
- 1 = A (TXD/RXD +)
- 2 = B (TXD/RXD -)
- 3 = Common (earth & GND)
- 4 = Cable shielding (earth & GND)

A = DDC fixing holes
E = Encoder
D = Display

2.3.1 Electrical power supply

The DDC Panel must be supplied by a 230/24 V AC - 50/60 Hz safety transformer with power no less than 20 VA (not supplied); in particular, this transformer must comply with standard EN 61558-2-6.
Use a 3 x 0.75 mm2 electrical connecting cable and make the connections on the terminals of the 4-pole connector located at the bottom left of the DDC rear, complying with the polarity as shown in Picture 2.3 *p. 5*.
The maximum specified length for this cable is 1m.

Figure 2.3 *DDC power supply*



AL = 24 Vac electrical power supply - 4 pole connector
- 1 = 24 Vac
- 2 = 0 Vac
- 3 = earth

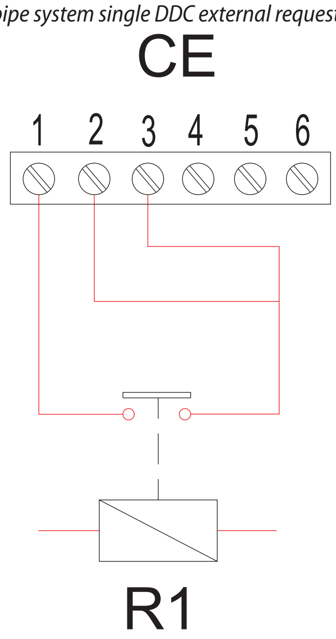
DDCTR = Safety transformer (240/24 Vac - 50/60 Hz - min 20 VA)

2.3.2 Inputs/Outputs

External requests

Switching on/off of the appliances controlled by the DDC Panel may be managed via a general external request.
To use this function it is required to appropriately configure the DDC Panel and set up the electrical connections as detailed in the following Pictures.
Figure 2.4 *p. 5* shows the case of connecting an external request for a two-pipe system (alternative hot/cold).
The operating mode to be configured on the DDC Panel is RWYm (see DDC Panel Booklet D-LBR246-257).

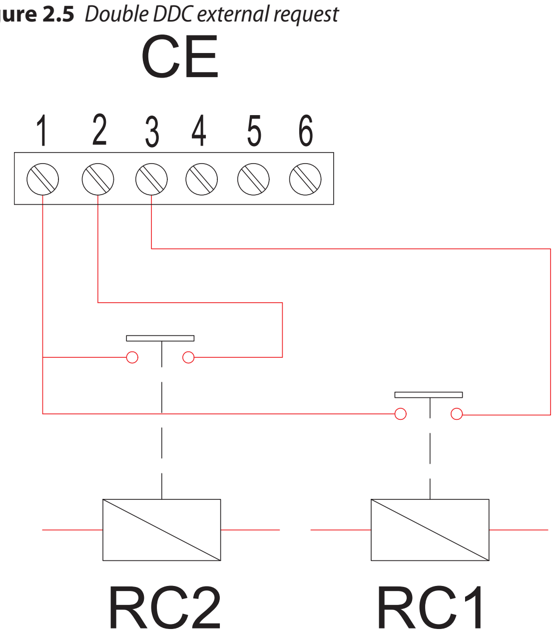
Figure 2.4 *2-pipe system single DDC external request*



Details of CE connector (see Figure 2.2 *p. 4*)
R1 relay for system switch-on external request (not supplied)

Figure 2.5 *p. 5* shows the case of connecting two external requests for a two/four-pipe system (alternative or simultaneous hot/cold).
The operating mode to be configured on the DDC Panel is RWYa (see DDC Panel Booklet D-LBR246-257).

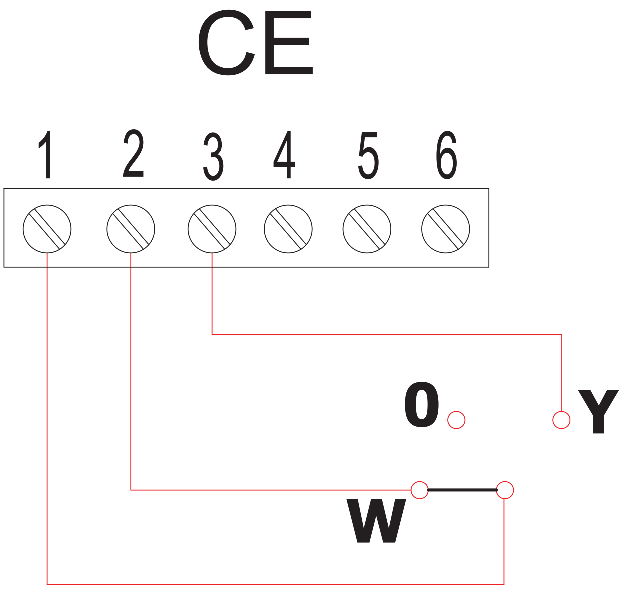
Figure 2.5 *Double DDC external request*



Details of CE connector (see Figure 2.2 *p. 4*)
RC1 relay for cooling system switch-on external request (not supplied)
RC2 relay for heating system switch-on external request (not supplied)

Figure 2.6 *p. 6* shows the case of connecting a three-position external selector for a two-pipe system (alternative hot/cold).
The operating mode to be configured on the DDC Panel is RWYa (see DDC Panel Booklet D-LBR246-257).

Figure 2.6 *DDC 2 pipe external request selector*



Details of CE connector (see Figure 2.2 *p. 4*)
Operating mode external selector (not supplied)

- Position W to turn on heating
- Position Y to turn on cooling
- Position 0 for system off

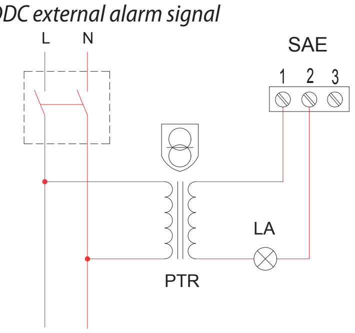
External alarm signal output

The DDC Panel provides a digital type SELV output for turning on an external alarm signal (such as a warning light, siren or other) NO/NC type in the event of an alarm condition (on the units or on the water temperature):

- ► NO is closed if an alarm condition occurs
- ► NC is opened if an alarm condition occurs

Maximum applicable voltage 24 Vac.
Maximum applicable current 1 A.
Figure 2.7 *p. 6* below shows a connection diagram for SELV type external alarm connected to the NO terminal.
If the connected alarm device is not SELV type, a control relay must be installed.

Figure 2.7 *DDC external alarm signal*



L-N phase/neutral 230V 1N - 50Hz
PTR Safety transformer (240/24 Vac - 50Hz)
LA External alarm signalling device (lamp, siren, etc.)
SAE terminals (SELV, maximum 24 Vac voltage, maximum 1 A current):
1 Common
2 NO
3 NC

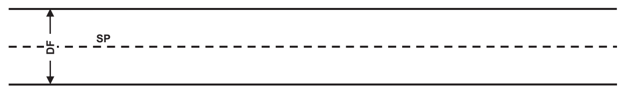
2.3.3 CAN-BUS connections

For CAN-BUS connection of the DDC Panel to the individual appliances refer to Section B concerning the specific appliance, and to Section C1.02 for preassembled groups.

2.4 CONTROL AND SETUP

The DDC Panel regulates the water temperature with the aim of keeping it within a range centred around the set-point.
The width of said range is defined by a parameter (called differential) whose default is 2 °C (i.e. ± 1 K with respect to the set-point).
The purpose of the differential is to define the maximum acceptable deviation of water temperature from the set-point, before the control system intervenes.

Figure 2.8 *DDC setpoint and differential*



SP water setpoint
DF water differential

To make the regulation, the DDC manages switch-on and switch-off in cascade mode of the different types of machines available, adapting the power supplied to the system thermal or cooling load.
It is possible to choose whether to regulate the delivery or the return temperature.
Up to four daily time bands may be set, possibly using different values for the set-point.

2.4.1 Regulation of the cascade

On the basis of their type, the units are assigned to **categories** which have different properties, so as to allow the control panel to manage the various types of units with differentiated logic and parameters.
However, the units within a category have equivalent features.
The **power** of the individual third party unit that belongs to it must be set for each category.
Each category must be associated to a **switching on priority**, defined by the user, that determines the priority of utilisation of the units in that category.
The **number of stages** used by the control system must be defined for each category, settable in the range from 1 to 10.
Four additional parameters must be defined for each category, in order to adapt as much as possible the regulation to the specific features of the category:

- ► **inhibition time**, which makes it possible to wait for stable operation of a stage before allowing the energy lack to be calculated (and therefore turn on the next);
- ► **enabling integral**, that represents the energy lack beyond which the next stage of the category is unlocked;
- ► **inhibition integral**, which represents the excess energy over which the previous stage of the category is turned off and the one previously unlocked is locked;
- ► **minimum switching on time**, which allows preventing a stage from being kept on too briefly.

The regulation algorithm may be synthesised with the following rules:

- ► At a given time, the controller works with a certain number of stages unlocked and the remaining ones locked;
- ► The first stage of the category with the highest priority is never locked;
- ► All locked stages are always turned off; all unlocked stages, except the last one, are always turned on; the last unlocked stage is turned on or off when the water temperature, respectively dropping or rising, leaves the differential range;
- ► A locked stage is unlocked (and turned on) if the area that

- represents the energy shortage, calculated starting from expiry of the inhibition time, reaches the value of the enable integral;
- An unlocked stage is locked (and the previous stage is switched off) if the excess energy reaches the inhibition integral setting.

2.4.2 Mixed systems

If there are mixed conditioning systems, i.e. consisting of Robur units and third party units (boilers and/or chillers), the need arises for an interface device that makes it possible to control in a coordinated manner the various appliances, which otherwise are unable to communicate, as well as the set of sensors (manifold temperature probes) and any auxiliary plumbing components (circulation pumps and diverter valves).
The optional RB200 interface device is available to this end which, coupled to the DDC Panel, performs the following functions:

- Controlling third party boilers and/or chillers in addition to Robur units;
- Managing the circulating pumps of controlled third party units and primary and secondary circuits;
- Managing the delivered power and temperature according to the set-points, optimising the efficiency obtained from the system (priority assigned to the generator with the highest efficiency);
- Managing the domestic hot water function (possibility to change the set-point if there is a request for this service);
- Managing the switching of any three-way diverter valves to feed DHW tanks for production of domestic hot water or for seasonal summer/winter switching;
- Managing any heating, conditioning and domestic hot water requests by external control devices.

For additional information on the RB200 device refer to Paragraph 4 *p. 13*.
For additional information on the control methods of mixed conditioning systems refer to Paragraph 6 *p. 23*.

2.5 MODBUS

The DDC Panel supports interfacing with external devices also via Modbus RTU protocol in slave mode.
With the Modbus protocol it is possible to acquire information concerning the operation data of the units and systems managed by the DDC (temperatures, statuses, meters, etc.).
It can also acquire information regarding alarms, both current and registered in the alarms log.
It can also act on the plant to set a variety of operational parameters such as unit On/Off, hot/cold inversion, setpoints, differentials, power steps, and operating time bands.
Paragraph 9.2 *p. 38* sets out the Modbus mapping implemented in the current version of the DDC Panel.

3 RB100

3.1 MAIN FUNCTIONS

The RB100 device has the purpose of:

- ► interfacing requests from external control systems (heating, cooling service, DHW0 and DHW1);
- ► actuate switching valves (for DHW or hot/cold inversion).

The requests from external control systems may be:

- ► 0-10 V analogue input signals;
- ► digital signals (voltage free contacts).

The requests from external control systems are only effective if the relevant service is active on the DDC.

The outputs for driving the valves are digital signals (voltage free contacts) with the following features:

- ► maximum voltage 250 Vac;
- ► maximum current for resistive loads 4 A;
- ► maximum current for inductive loads 3 A.

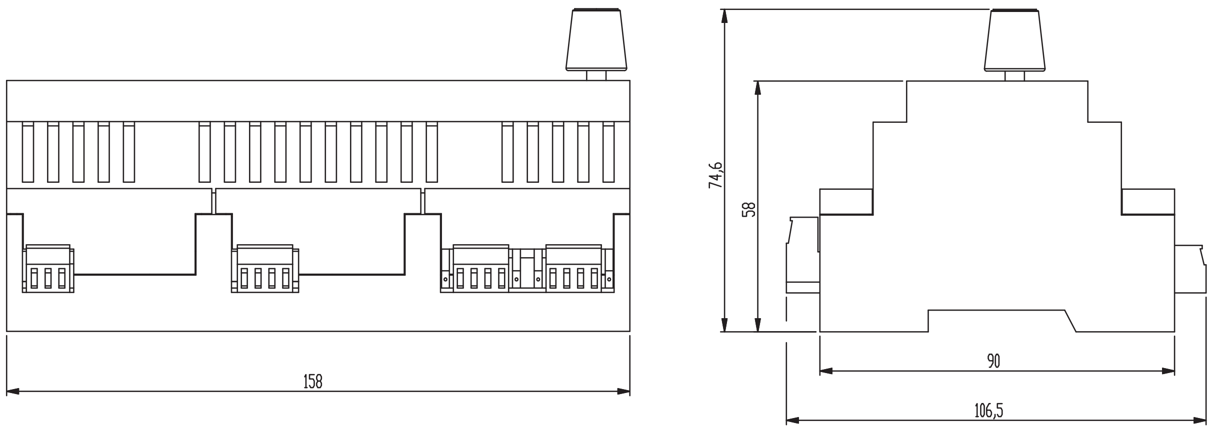
The RB100 device may only be used jointly with the DDC Panel.

3.2 INSTALLATION

The RB100 device is suited to internal installation and must be fitted on 35 mm DIN rail in an electrical panel (EN 60715).

The space requirement is equal to 9 modules, as shown in Figure 3.1 *p. 8*.

Figure 3.1 *RB100 device dimensions*

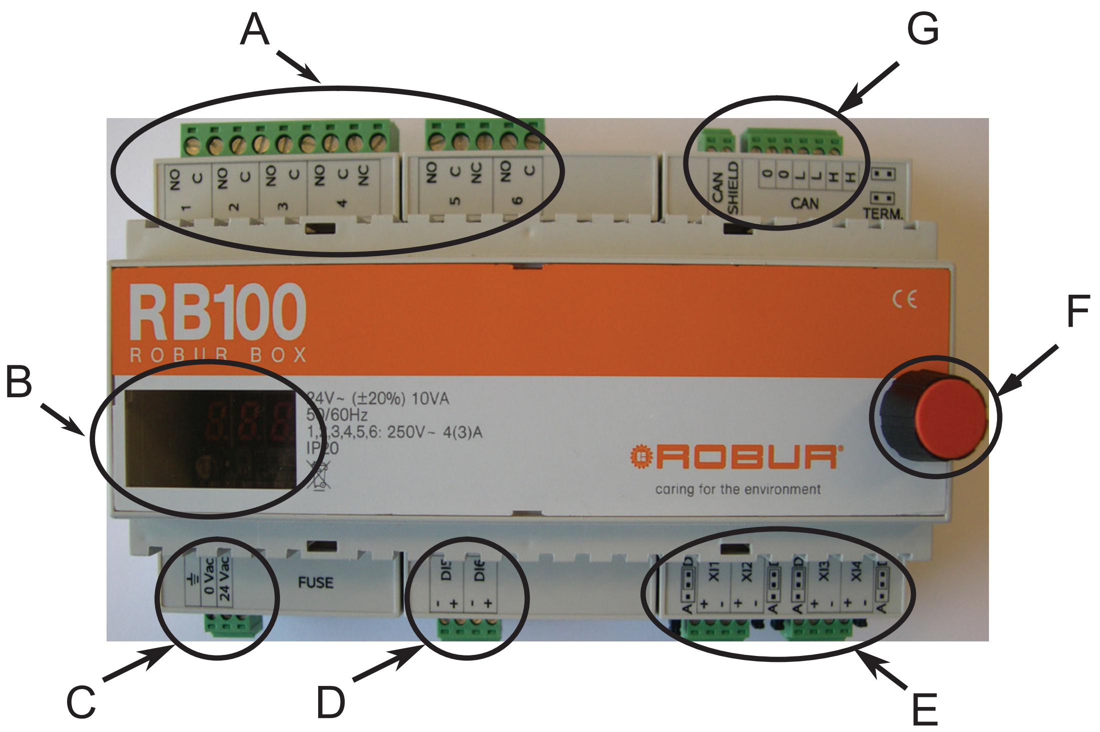


The RB100 device has protection rating IP20, and must be installed in premises with ambient air temperature between 0°C and 50°C.

3.3 CONNECTIONS

The RB100 device provides the connection terminals shown in 3.2 *p. 9*.

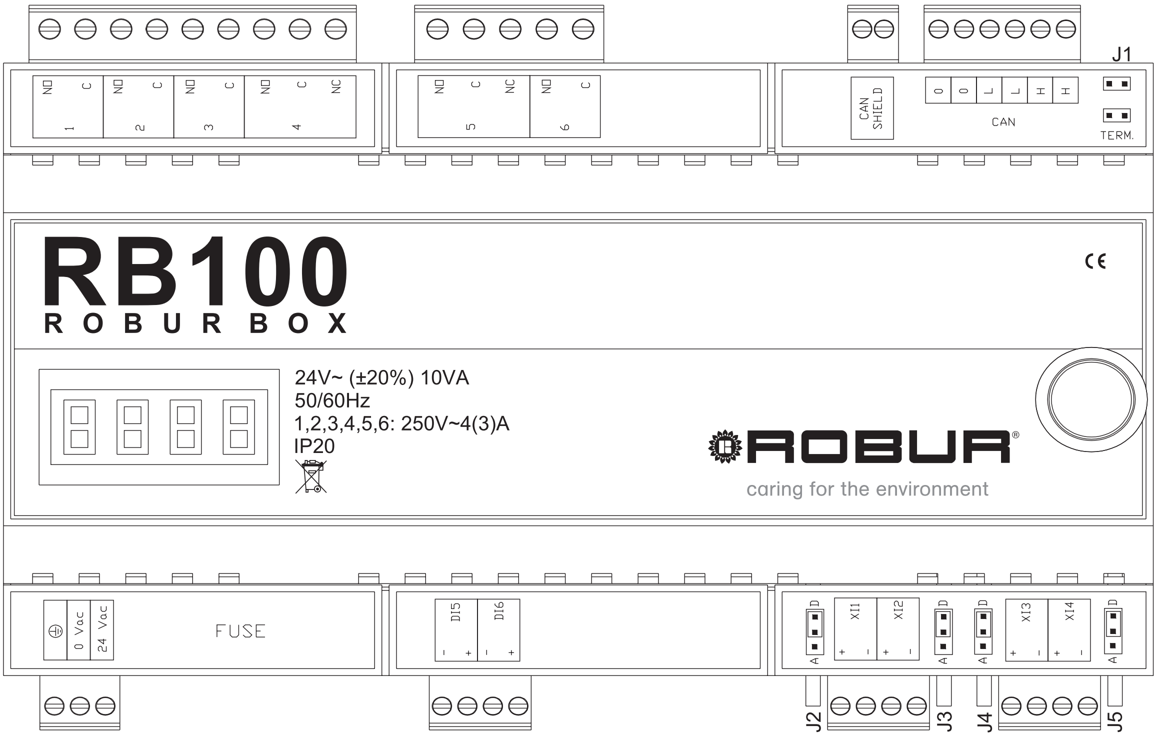
Figure 3.2 *RB100 device connections*



A Output relay
B Display
C 24 V AC power supply
D Limit switch auxiliary contacts input
E Service requests analogue/digital inputs
F Knob (encoder)
G CAN-BUS connection

Figure 3.3 *p. 10* shows the detail of connection terminals.

Figure 3.3 *Detail of RB100 device connections*



A Terminals:
4 = Valve service NO/NC contact
C Terminals:
Device power supply connector
E terminals:
XI1 = Cooling service request analogue/digital input
XI2 = Heating service request analogue/digital input
XI3 = DHW0 service request analogue/digital input
XI4 = DHW1 service request analogue/digital input
J2 = Jumper to select input type (analogue/digital) for cooling service request
J3 = Jumper to select input type (analogue/digital) for heating service request
J4 = Jumper to select input type (analogue/digital) for DHW0 service request
J5 = Jumper to select input type (analogue/digital) for DHW1 service request
G terminals:
CAN SHIELD = CAN-BUS cable shielding connector
CAN = CAN-BUS cable connector
J1 = CAN-BUS Jumpers

Each of the four inputs XI1...XI4 may be configured either as analogue or digital. Configuration must be carried out by correctly positioning the jumpers on the board as well as by correctly setting the configuration parameters.

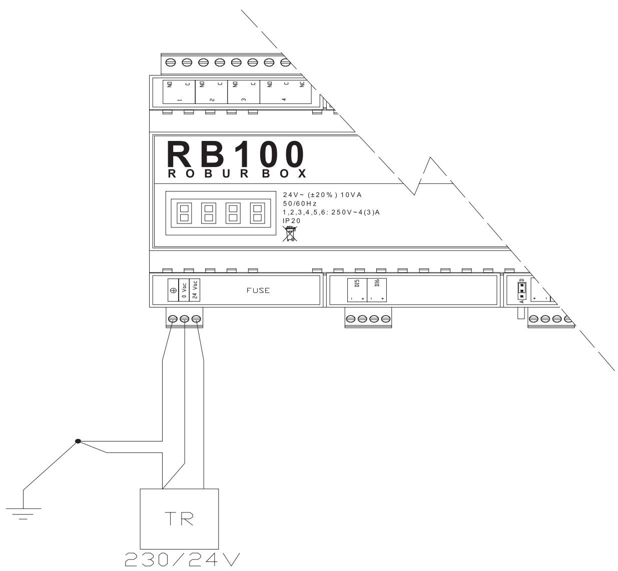
3.3.1 Electrical power supply

The RB100 device must be supplied by a 230/24 V AC - 50/60 Hz safety transformer with power no less than 10 VA (not supplied); in particular, this transformer must comply with standard EN 61558-2-6.

Use a connecting 3 x 0.75 mm² electrical cable and perform connections on C terminals (see Figure 3.2 *p. 9*) complying with the polarity indicated in Figure 3.4 *p. 10.*

The maximum specified length for this cable is 1m.

Figure 3.4 *RB100 power supply connection*



TR Safety transformer 230 Vac/24 Vac min 10 VA (not supplied)

3.3.2 Inputs/Outputs

Service requests analogue inputs

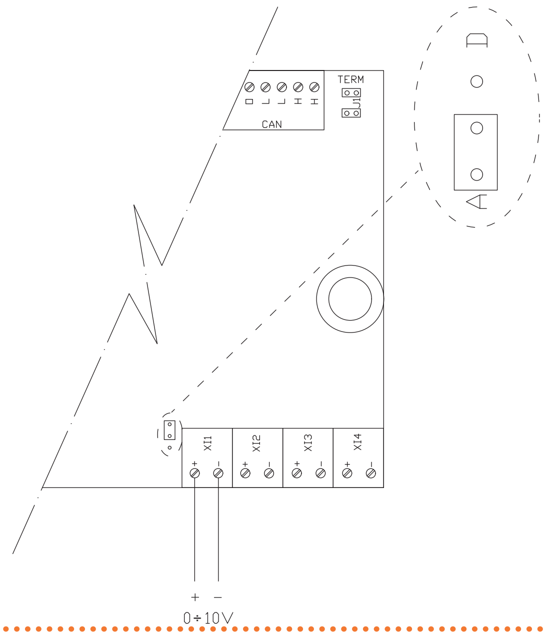
For service request analogue inputs the input voltage must be between 0 and 10 Vdc.
The maximum length of the connecting cables and their section are detailed in Table 3.1 *p. 11* below.
The cable must be shielded and with shield earthed at one end.

Table 3.1 *RB100/RB200 analogue input cables*

Maximum cable length (m)	Wire cross section (mm^2)
300	1,5
100	0,5

Figure 3.5 *p. 11* details the connecting diagram for input XI1, valid for any analogue input XI1...XI4.

Figure 3.5 *RB100 services requests analogue inputs*



Service requests digital inputs

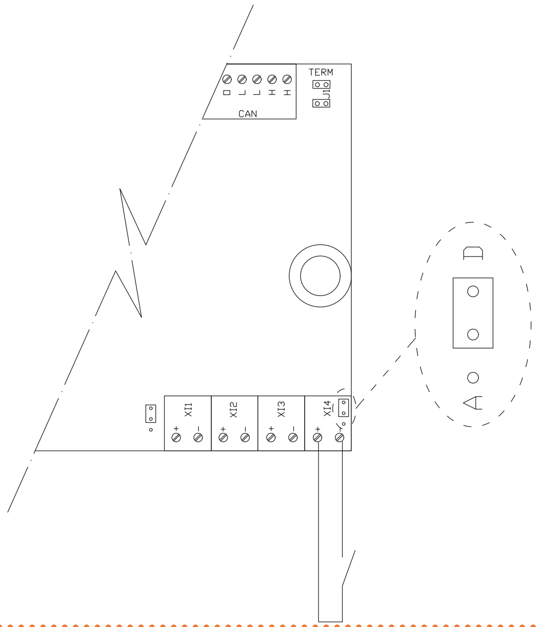
For service requests digital inputs the external contact must have operating voltage of at least 12 Vdc and must assure closing with minimum current of 5 mA.
The maximum length of the connecting cables and their resistance are detailed in Table 3.2 *p. 11* below.
The cable must be shielded and with shield earthed at one end.

Table 3.2 *RB100/RB200 digital input cables*

Max resistance for On (Ω)	Min resistance for Off (Ω)	Maximum cable length (m)
200	50	300

Figure 3.6 *p. 11* details the connecting diagram for input XI4, valid for any digital input XI1...XI4.

Figure 3.6 *RB100 services requests digital inputs*



Diverter valves output

The digital output to control the diverter valves is a NO/NC diverter voltage free contact:

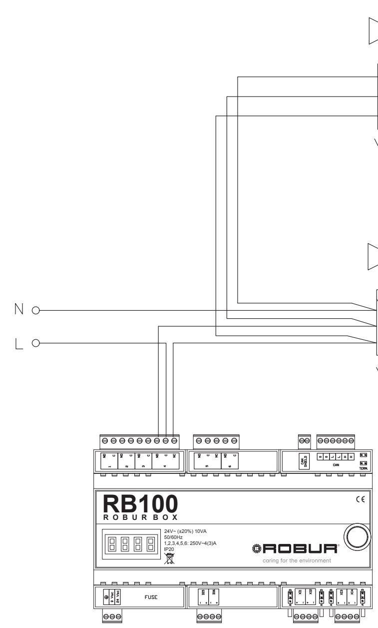
- NO is closed when the valves are towards the heating circuit or towards the separable group;
- NC is closed when the valves are towards the conditioning circuit or towards the base group.

The relay retains its position even in the event of power supply interruption.
Maximum applicable voltage 250 Vac.
Maximum applicable current:

- Resistive loads 4 A;
- Inductive loads 3 A.

Maximum cable length 300 m.
Figure 3.7 *p. 12* details the connection diagram for diverter valves.

Figure 3.7 *RB100 diverter valves output*



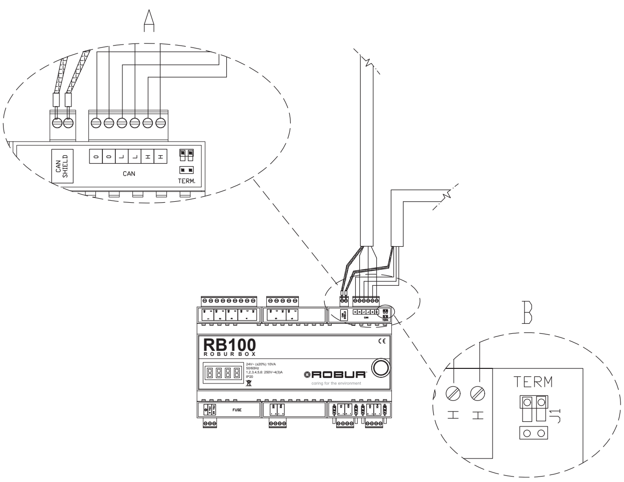
VD1 system delivery pipes 3-way motorised valve
VD2 system return pipes 3-way motorised valve

3.3.3 CAN-BUS connections

For general concepts on the CAN-BUS communication network, see Paragraph 1.1 *p. 2*.
For the features of the CAN-BUS cable see Paragraph 1.1.1 *p. 2*.
The RB100 device may be an intermediate or terminal node of the CAN-BUS network.
If the RB100 device is an **intermediate node**, make the connection as shown in the Figure 3.8 *p. 12*.

If the RB100 device is an intermediate node, the J1 jumpers (position B in Figure 3.8 *p. 12*) must be **open**.

Figure 3.8 *CAN-BUS RB100 intermediate node connection*

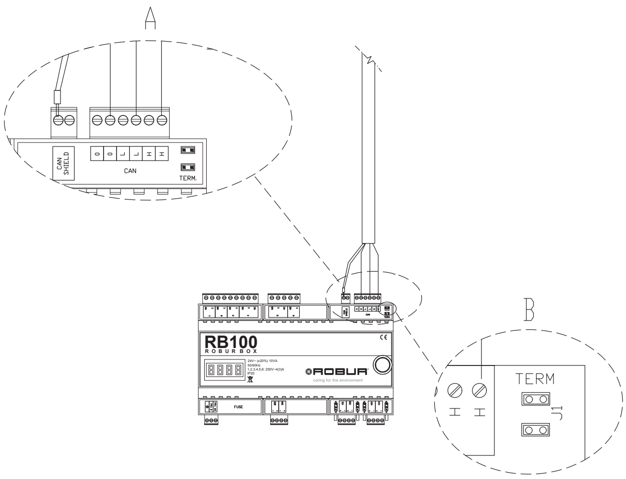


A CAN-BUS screen connection detail
B Detail of J1 jumpers position

If the RB100 device is a **terminal node**, make the connection as shown in the Figure 3.9 *p. 12*.

If the RB100 device is a terminal node, the J1 jumpers (position B in Figure 3.9 *p. 12*) must be **closed**.

Figure 3.9 *CAN-BUS RB100 terminal node connection*



A CAN-BUS screen connection detail
B Detail of J1 jumpers position

4 RB200

4.1 MAIN FUNCTIONS

The RB200 device has the purpose of:

- interfacing requests from external control systems (heating, cooling service, DHW0 and DHW1);
- actuate switching valves (for DHW and/or hot/cold inversion);
- interface third party generators;
- interface system temperature probes;
- interface common circulating pumps.

The requests from external control systems may be:

- 0-10 V analogue input signals;
- digital signals (voltage free contacts).

The requests from external control systems are only effective if the relevant service is active on the DDC.

The inputs/outputs to control third party generators may be:

- a digital output (voltage free contact) to switch on the generator;
- a digital output (voltage free contact) to control the generator circulating pump;
- an analogue 0-10 V output for the generator water temperature set-point;
- a digital input (voltage free contact) for the generator alarm signal.

The system temperature probes must be resistive type NTC 10 kΩ, and may concern four types of service:

- manifold delivery and return probes conditioning only or conditioning/heating 2 pipes;
- manifold delivery and return probes heating only;
- manifold delivery and return probes separable DHW;
- GAHP return manifold probe.

The common water circulating pumps are controlled through digital outputs (voltage free contacts) and there may be 5 types:

- secondary circulating pump conditioning only or conditioning/heating 2 pipes;
- primary circulating pump heating only;
- separable primary circulating pump;
- secondary circulating pump conditioning only or conditioning/heating 2 pipes;
- secondary circulating pump heating only.

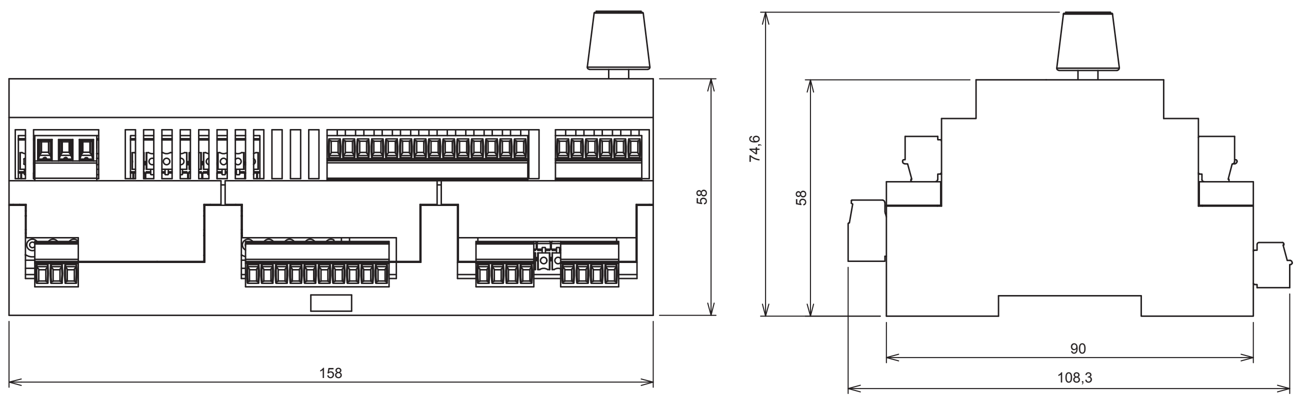
The RB200 device may only be used jointly with the DDC Panel.

4.2 INSTALLATION

The RB200 device is suited to internal installation and must be fitted on 35 mm DIN rail in an electrical panel (EN 60715).

The space requirement is equal to 9 modules, as shown in Figure 4.1 *p. 13*.

Figure 4.1 *RB200 device dimension drawing*

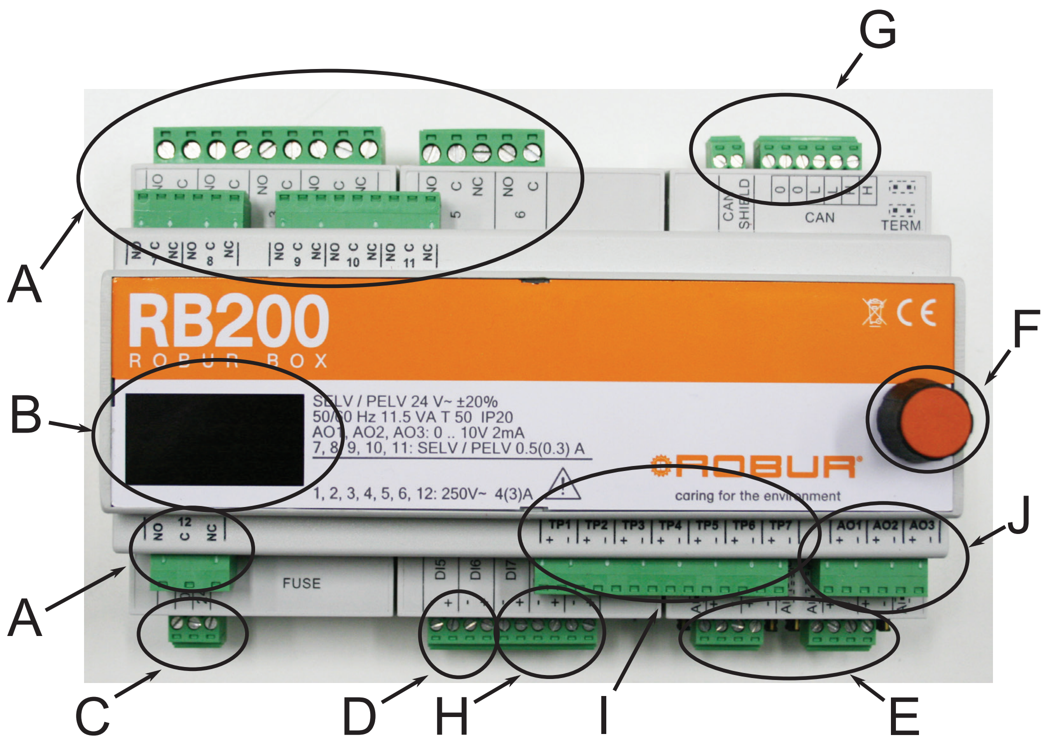


The RB200 device has protection rating IP20, and must be installed in premises with ambient air temperature between 0°C and 50°C.

4.3 CONNECTIONS

The RB200 device provides the connection terminals shown in Figure 4.2 *p. 14*.

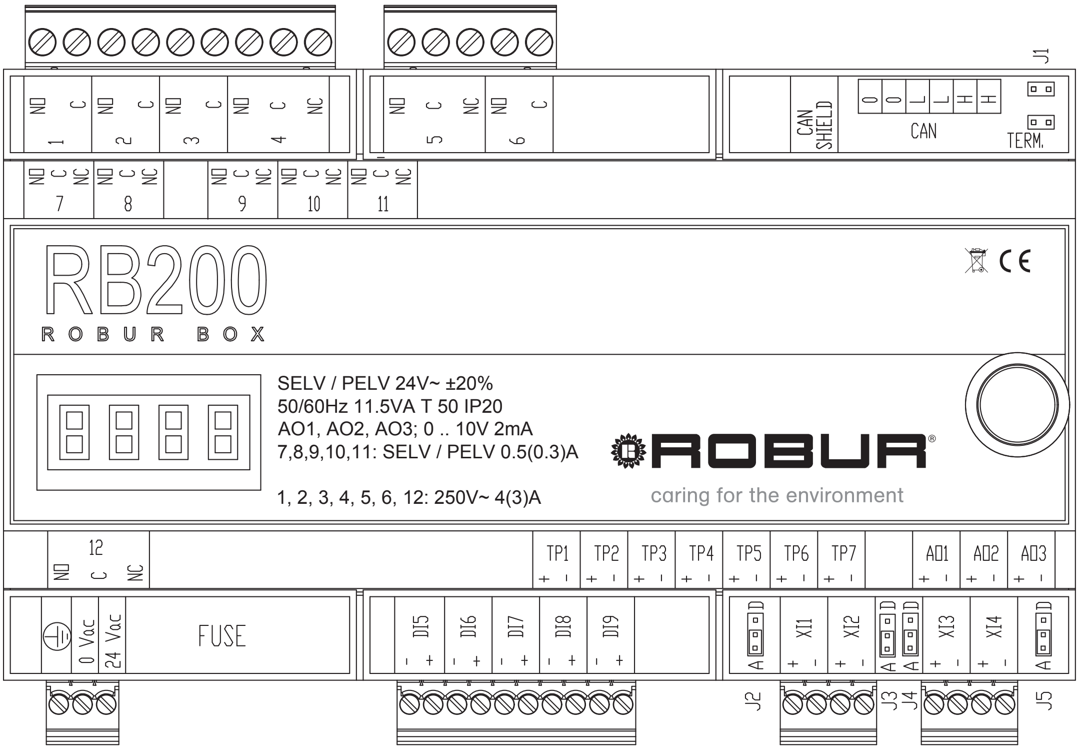
Figure 4.2 *RB200 device connections*



A	Output relay	F	Knob (encoder)
B	Display	G	CAN-BUS connection
C	24 V AC power supply	H	Digital inputs for signalling third party generators unavailability
D	Limit switch auxiliary contacts input	I	Inputs of temperature probes
E	Service requests analogue/digital inputs	J	Third party generator set-point analogue outputs

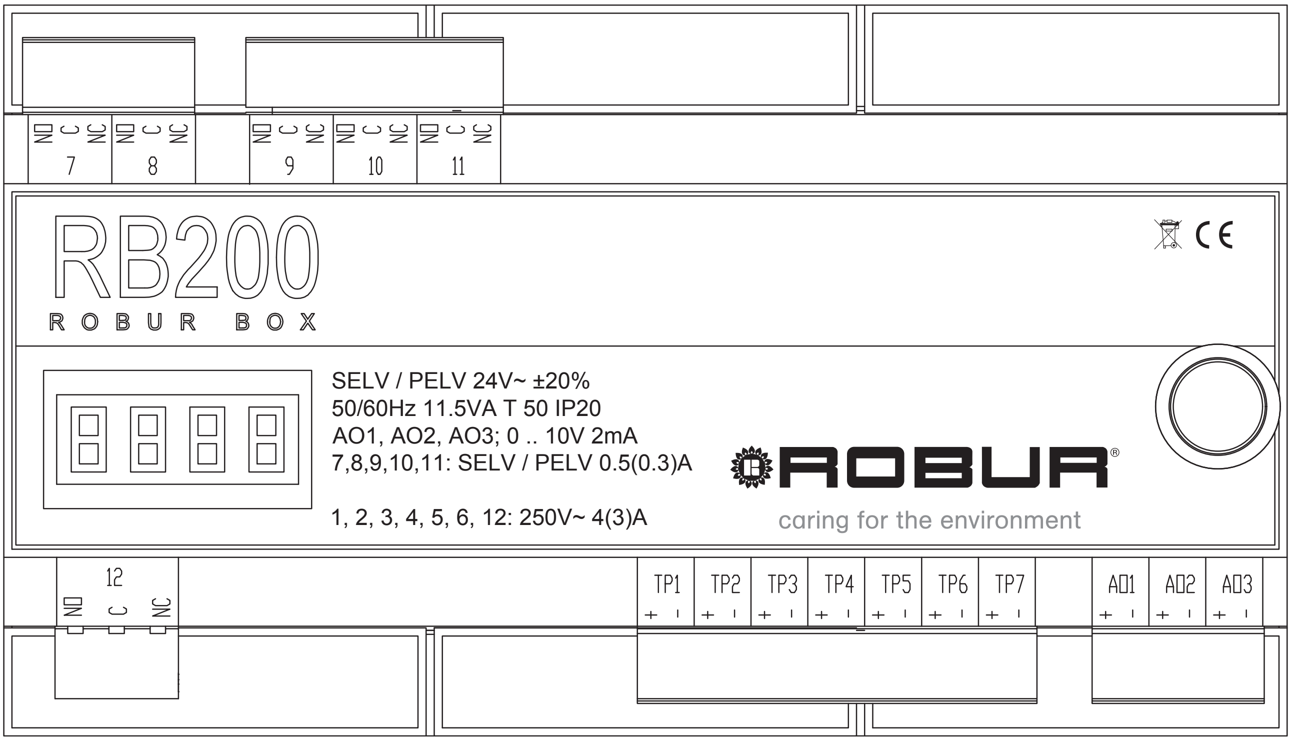
The following Figures show in detail the connection terminals, divided by lower level (Figure 4.3 *p. 15*) and upper level (Figure 4.4 *p. 16*).

Figure 4.3 *Detail of RB200 device connections lower level*



A Terminals:
1 = NO contact 1 generator circulating pump or 1 circulating pump service
2 = NO contact generator 2 circulating pump or circulating pump 2 service
3 = NO contact circulating pump 3 service
4 = NO/NC contact valve 1 service or circulating pump 4 service
5 = NO/NC contact generator 1 start up
6 = NO/NC contact generator 2 start up
C Terminals:
Device power supply connector
E terminals:
XI1 = Cooling service request analogue/digital input
XI2 = Heating service request analogue/digital input
XI3 = DHW0 service request analogue/digital input
XI4 = DHW1 service request analogue/digital input
J2 = Jumper to select input type (analogue/digital) for cooling service request
J3 = Jumper to select input type (analogue/digital) for heating service request
J4 = Jumper to select input type (analogue/digital) for DHW0 service request
J5 = Jumper to select input type (analogue/digital) for DHW1 service request
G terminals:
CAN SHIELD = CAN-BUS cable shielding connector
CAN = CAN-BUS cable connector
J1 = CAN-BUS Jumpers
H terminals:
DI7 = generator 1 alarm input
DI8 = Generator 2 alarm input

Figure 4.4 *Detail of RB200 device connections upper level*



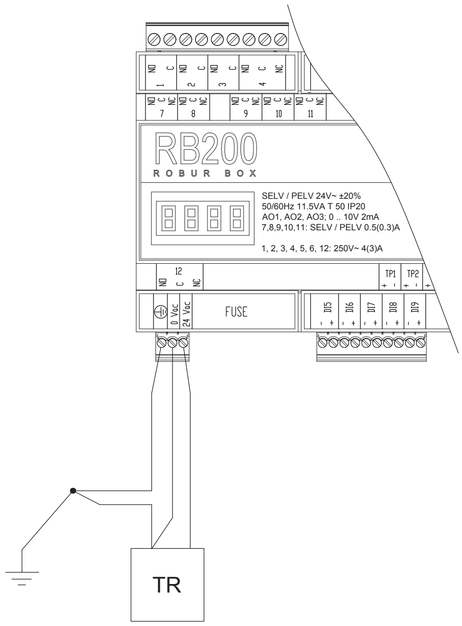
A Terminals:
12 = NO/NC contact valve 2 service or circulating pump 5 service
I terminals:
TP1 = Conditioning return temperature probe input
TP2 = Conditioning delivery temperature probe input
TP3 = Heating return temperature probe input
TP4 = Heating delivery temperature probe input
TP5 = Separable DHW return temperature probe input
TP6 = Separable DHW delivery temperature probe input
TP7 = GAHP return temperature probe input
J terminals:
AO1 = 1 generator set-point 0-10 V output
AO2 = 2 generator set-point 0-10 V output

Each of the four inputs XI1...XI4 may be configured either as analogue or digital. Configuration must be carried out by correctly positioning the jumpers on the board as well as by correctly setting the configuration parameters.

4.3.1 Electrical power supply

The RB200 device must be supplied by a 230/24 V AC - 50/60 Hz safety transformer with power no less than 12 VA (not supplied); in particular, this transformer must comply with standard EN 61558-2-6.
Use a connecting 3 x 0.75 mm^2 electrical cable and perform connections on C terminals (see Figure 4.2 *p. 14*) complying with the polarity indicated in Figure 4.5 *p. 16*.
The maximum specified length for this cable is 1m.

Figure 4.5 *RB200 power supply connection*



TR Safety transformer 230 Vac/24 Vac min 12 VA (not supplied)

4.3.2 Inputs/Outputs

The digital outputs (voltage free contacts) have these features:
- maximum voltage 250 Vac;
- maximum current for resistive loads 4 A;
- maximum current for inductive loads 3 A.

Service requests analogue inputs

For service request analogue inputs the input voltage must be between 0 and 10 Vdc.

The maximum length of the connecting cables and their section are detailed in Table 3.1 *p. 11* below.

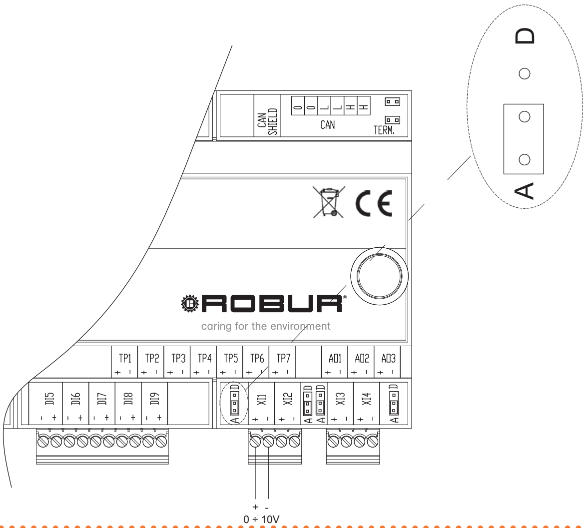
The cable must be shielded and with shield earthed at one end.

Table 4.1 *RB100/RB200 analogue input cables*

Maximum cable length (m)	Wire cross section (mm²)
300	1,5
100	0,5

Figure 4.6 *p. 17* details the connecting diagram for input XI1, valid for any analogue input XI1...XI4.

Figure 4.6 *RB200 services requests analogue inputs*



Service requests digital inputs

For service requests digital inputs the external contact must have operating voltage of at least 12 Vdc and must assure closing with minimum current of 5 mA.

The maximum length of the connecting cables and their resistance are detailed in Table 3.2 *p. 11* below.

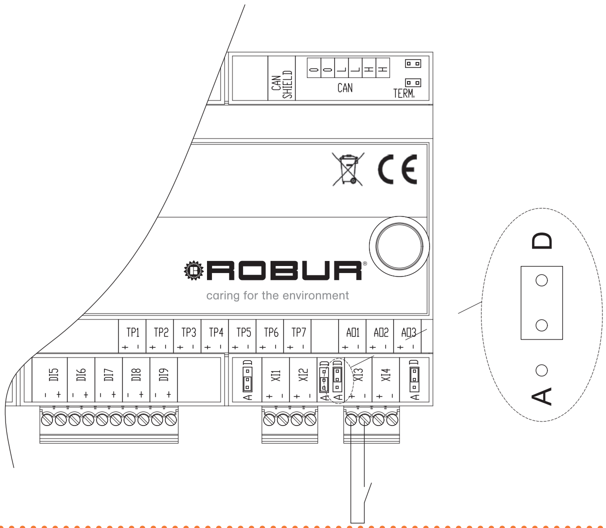
The cable must be shielded and with shield earthed at one end.

Table 4.2 *RB100/RB200 digital input cables*

Max resistance for On (Ω)	Min resistance for Off (Ω)	Maximum cable length (m)
200	50	300

Figure 4.7 *p. 17* details the connecting diagram for input XI4, valid for any digital input XI1...XI4.

Figure 4.7 *RB200 services requests digital inputs*



Diverter valve outputs

The digital outputs (contact 4 in Figure 4.3 *p. 15* and contact 12 in Figure 4.4 *p. 16*) to control the diverter valves are NO/NC diverter voltage free contacts:

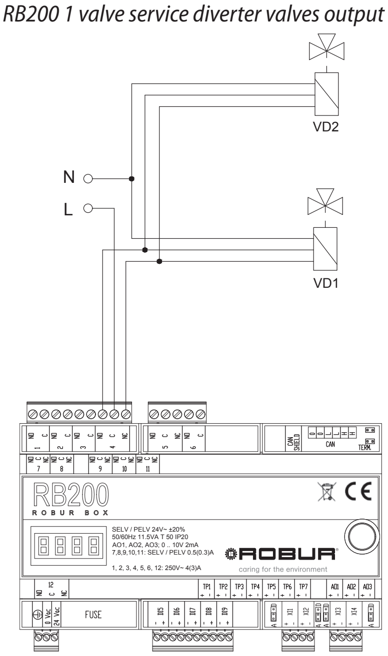
- NO is closed when the valves are towards the heating circuit or towards the separable group;
- NC is closed when the valves are towards the conditioning circuit or towards the base group.

The relay retains its position even in the event of power supply interruption.

Maximum cable length 300 m.

Figures 4.8 *p. 17* and 4.9 *p. 18* show in detail the connection diagram of the diverter valves to each of the two available digital outputs.

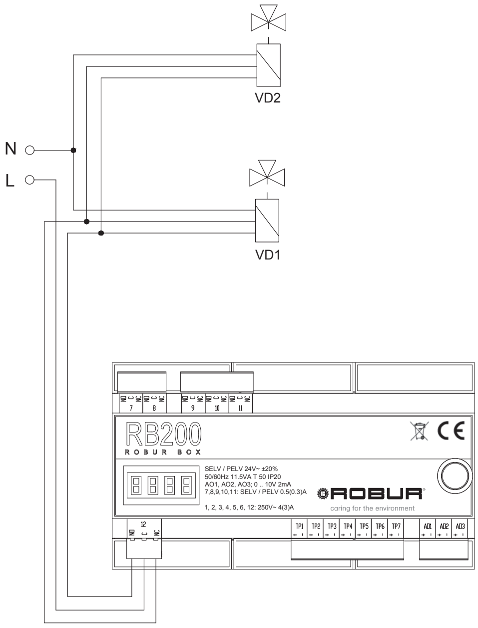
Figure 4.8 *RB200 1 valve service diverter valves output*



VD1 system delivery pipes 3-way motorised valve

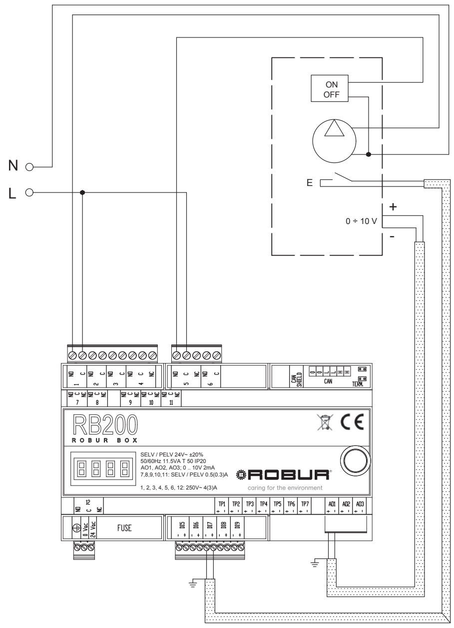
VD2 system return pipes 3-way motorised valve

Figure 4.9 *RB200 2 valve service diverter valves output*



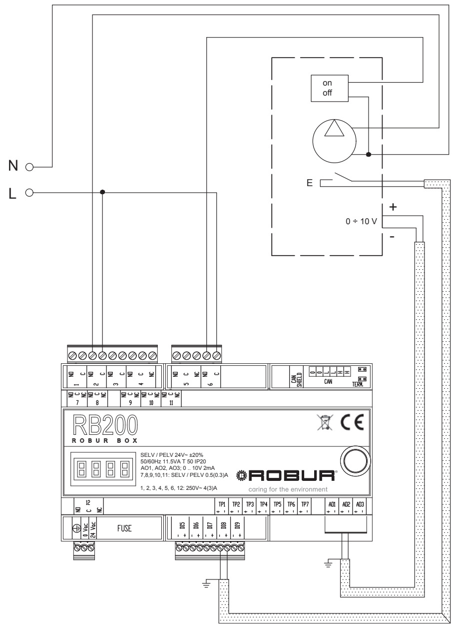
VD1 system delivery pipes 3-way motorised valve
VD2 system return pipes 3-way motorised valve

Figure 4.10 *RB200 1 generator service connection*



E Third party generator alarm output

Figure 4.11 *RB200 2 generator service connection*



E Third party generator alarm output

Third party generators services

To control third party generators, the following outputs are available for each generator:

- One NO voltage free contact for ON/OFF generator command (contact 5 for generator 1, contact 6 for generator 2, see Figure 4.3 *p. 15*);
- One NO voltage free contact for ON/OFF generator circulating pump command (contact 1 for generator 1, contact 2 for generator 2, see Figure 4.3 *p. 15*);
- One analogue 0-10 V output for the generator temperature set-point (output AO1 for generator 1, output AO2 for generator 2, see Figure 4.4 *p. 16*).

NO contacts are closed when the system requires switching on (ON) the generator or circulating pump.

For the analogue output the features of the cable to be used are set out in Table 4.1 *p. 17*.

The cable of the analogue output must be shielded with shield earthed at one end.

The following are available for signalling the alarm status of each generator:

- one digital input (voltage free contact) (contact DI7 for generator 1, contact DI8 for generator 2, see 4.3 *p. 15*).

The alarm signal is on with closed contact.

The cable of the digital input must be shielded with shield earthed at one end.

For the digital input the features of the cable to be used are set out in Table 4.2 *p. 17*.

Maximum input/ouput cable length 300 m.

Figure 4.10 *p. 18* shows the connection diagram for the signals relating to generator 1, whereas Figure 4.11 *p. 18* shows the connection diagram for the signals relating to generator 2.

Circulating pumps service outputs

The circulating pump command outputs are NO voltage free contacts (contacts 1, 2, 3, 4, 12 for circulating pump services 1, 2, 3, 4, 5, see Figure 4.3 *p. 15*)

NO contacts are closed when the system requires switching on (ON) the circulating pump.

Maximum cable length 300 m.

Some contacts are common for two types of services, which therefore cannot be configured simultaneously on the RB200 device.

Figure 4.12 *p. 19* shows the connection diagram for the circulating pump 3 service.

For the other circulating pump services, only the contact to be connected changes.

Figure 4.12 *RB200 3 circulating pump service connection*

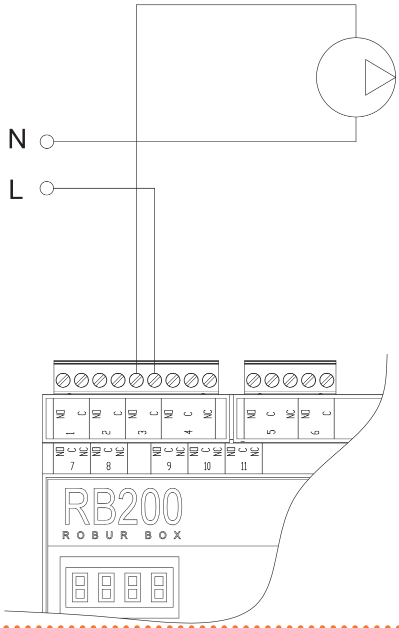
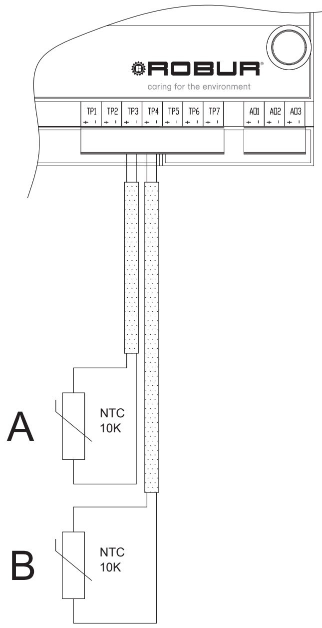


Figure 4.13 *RB200 heating temperature probes connection*



A Heating return probe
B Heating delivery probe

Temperature probes inputs

The analogue inputs TP1 - TP7 (see Figure 4.4 *p. 16*) are intended for resistive type temperature probes NTC 10 kΩ:

- TP1-TP2: manifold probes conditioning only or conditioning/heating 2 pipes;
- TP3-TP4: manifold probes heating only;
- TP5-TP6: separable DHW manifold probes;
- TP7: GAHP return manifold probe.

Table 4.1 *p. 17* sets out the features of the connecting cables for the temperature probes.

Figure 4.13 *p. 19* shows an example connection for the heating manifold probes.

For the other temperature probes, only the contact to be connected changes.

4.3.3 CAN-BUS connections

For general concepts on the CAN-BUS communication network, see Paragraph 1.1 *p. 2*.

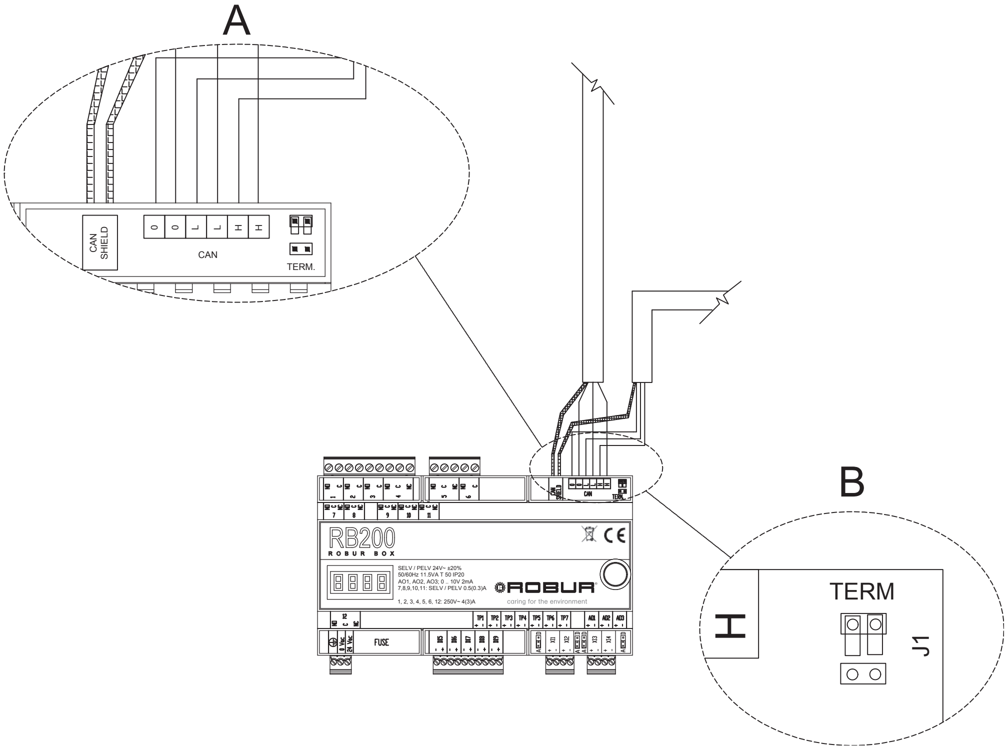
For the features of the CAN-BUS cable see Paragraph 1.1.1 *p. 2*.

The RB200 device may be an intermediate or terminal node of the CAN-BUS network.

If the RB200 device is an **intermediate node**, make the connection as shown in the Figure 4.14 *p. 20*.

If the RB200 device is an intermediate node, the J1 jumpers (position B in Figure 4.14 *p. 20*) must be **open**.

Figure 4.14 *CAN-BUS RB200 intermediate node connection*

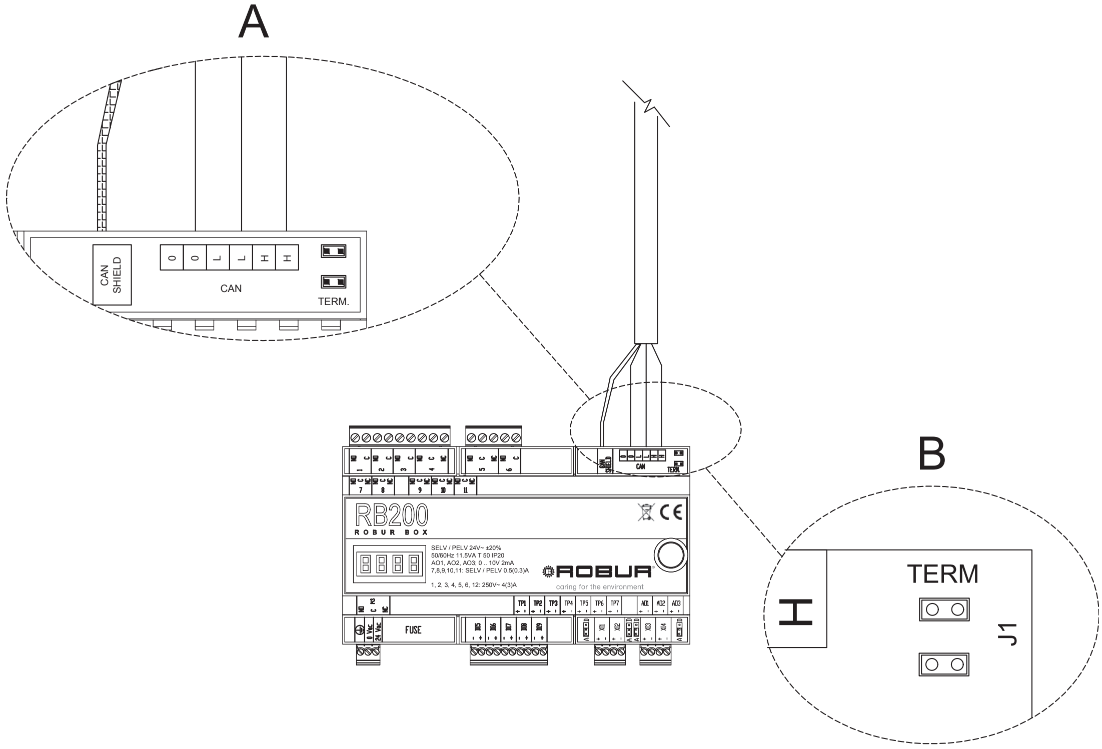


A CAN-BUS screen connection detail
B Detail of J1 jumpers position

If the RB200 device is a **terminal node**, make the connection as shown in the Figure 4.15 *p. 20*.

If the RB200 device is a terminal node, the J1 jumpers (position B in Figure 4.15 *p. 20*) must be **closed**.

Figure 4.15 *CAN-BUS RB200 terminal node connection*



A CAN-BUS screen connection detail
B Detail of J1 jumpers position

5 ENGINEERING APPLICATIONS

A number of installation configurations can be supported with the DDC panel, if required jointly with the RB100 and RB200 devices.
The control logic resides in the DDC Panel, while the RB100 and RB200 devices act as interface for the inputs and outputs towards the system's components.

5.1 MANAGEMENT OF SERVICE REQUESTS

The service requests make it possible to interface devices fitted on the system (e.g. thermostats) as well as external control devices (BMS).
These requests may be:

- digital signals (voltage free contact);
- analogue signals (0-10 V);
- via Modbus RTU protocol.

The following services may be managed through these requests:

- heating service;
- conditioning service;
- base DHW service;
- servizio ACS separabile.

The service set-points may be set either on the DDC or on the RB100/RB200 devices.

5.1.1 DDC

The DDC panel provides two digital inputs for service request:

- Conditioning service request (RY contact);
- Heating service request (RW contact).

For positioning the digital inputs see Figure 2.2 *p. 4*, whereas for details on connecting methods see Paragraph *p. 5*.

The same inputs may be used to switch operating mode in 2-pipe hot/cold systems.

The DDC panel also supports interfacing via Modbus protocol to receive service requests from BMS devices. For further information see Paragraph 9.2 *p. 38*.

5.1.2 RB100/RB200

The RB100/RB200 devices provide four service request inputs, independently configurable as analogue (0-10 V) or digital:

- heating service;
- conditioning service;
- DHW service (0);
- DHW service (1).

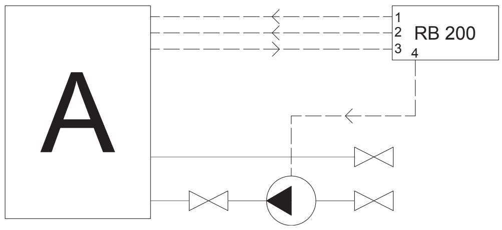
DHW services are independently configurable as base DHW or separable DHW.
Digital type requests consist of voltage-free contacts, whereas analogue type requests are 0-10 V signals corresponding to the set-point for the service.
In the case of digital type requests the service set-point is set on the DDC Panel or on the RB100/RB200 device.

The service requests to RB100/RB200 devices do not involve switching the operating mode.

5.2 THIRD PARTY GENERATORS CONTROL

For each RB200 it is possible to configure up to two third party generators, and up to eight RB200 devices may be set up for each installation.
Figure 5.1 *p. 21* shows the signals that RB200 is able to exchange with each third party generator.

Figure 5.1 *Third party generators control*



A third party generators
1 generator ON/OFF digital output
2 analogue 0-10 V output for temperature set-point (where the generator is arranged to receive it)
3 digital input for generator error/unavailability (where the generator makes it available)
4 digital output for controlling independent generator circulating pump (if installed and if not driven by the generator)

All the combinations of the aforementioned signals are possible to control the generator, according to its features.

Refer to the third party generator manufacturer for the features of the signals required to control it.

Manifold temperature probes

When third party generators are involved, the manifold temperature probes must be installed and configured for the part of the system in which the generators are present.

Third party generator errors and settings

If the third party generator error/unavailability signal is available, the event is recorded in the DDC Panel event log as generic error, whereas the details on the type of error are only available on the generator (if provided by the manufacturer).
Any customisations of the generator settings in terms of regulation dynamics and any temperature lags compared to the system set point must be set directly on the generator regulator.

Controller for control in cascade of several third party generators

If there are several third party generators fitted with their own controller for control in cascade, it is possible to interface directly with the cascade controller via RB200 through the signals described in Figure 5.1 *p. 21*. In this case the control system manages the cascade as if it were a single third party generator. However, this is not an optimal situation because the cascade controller might generate undesirable and not easily foreseeable behaviour.

5.3 SYSTEM CIRCULATING PUMPS CONTROL

Up to five common circulating pumps (i.e. serving a group of units) may be controlled via RB200, driven in ON/OFF mode. Any modulation must be managed independently by the circulating pumps (e.g. constant Δt or Δp).
The following types of circulating pumps may be controlled:

- 2-pipe primary cold or hot/cold common circulating pump;
- Primary hot common circulating pump;
- Separable primary common circulating pump;
- 2-pipe secondary cold or hot/cold common circulating pump;
- Secondary hot common circulating pump.

In general, it is not obligatory to have a circulating pump on the secondary circuit and it is not obligatory to control it with RB200. If there are probes installed on the secondary circuit, however, it is *recommended* to install a secondary circulating pump and configure it on RB200, to correctly control flushing of the probes, as they must be constantly flushed when the system is active.

If the third party units are fitted with directly controlled circulating pump (i.e. not connected to RB200), then the antifreeze protection must be assured by the third party units, or the appropriate precautions must be taken to protect the system from icing.

5.4 TEMPERATURE PROBES CONTROL

The following temperature probes may be configured on the RB200 device, all resistive type NTC 10 kΩ:

- hot delivery and return;
- cold delivery and return;
- separable DHW delivery and return;
- GAHP return (only used for "integration and progressive replacement" control mode).

Manifold temperature probes are required:

- if third party generators are installed;
- for plumbing systems with generators hydraulically in series;
- should one wish to perform system control on the secondary circuit.

Water flow on the manifold probes must always be assured when the relevant system (hot/cold/DHW) is on.

5.5 VALVE SERVICES

Two types of valve driving services may be configured on the RB100 and RB200 devices:

- hot/cold commutation valves;
- basic/separable commutation valves.

These services are alternative on the RB100 device, whereas both may be used independently on the RB200 device.
The output to control the valves consists of a diverter voltage free contact (NO/NC), with the following logic:

- NO closed: valve on heating system or on separable group;
- NC closed: valve on cooling system or on base group.

The diverter valves must be such as to assure to Robur generators the flow rates set out in Table 5.1 *p. 22* under all operating conditions (including the switching stage).

Table 5.1 *Diverter valves water flow*

			GAHP GS/WS		GAHP A	AY00-120	GA ACF		GAHP-AR
			GAHP WS	GAHP GS HT				ACF 60-00 LB	
Heating mode									
Heating water flow	minimum	l/h	1400		1400	1500			2500
	maximum	l/h	4000		4000	3200			3500
Operation in conditioning mode									
Water flow rate	minimum	l/h					2500	2300	2500
	maximum	l/h					3500	2900	3500
Renewable source operating conditions									
Renewable source water flow rate	minimum	l/h	2300						
	maximum	l/h	4700						
Renewable source water flow rate (with 25% glycol)	minimum	l/h		2000					
	maximum	l/h		4000					

6 INTEGRATION METHODS

The methods for controlling mixed conditioning systems, i.e. consisting of Robur units and third party appliances (boilers and/or chiller) are detailed below.
Three different methods are available for the space heating service (integration between heat pumps and boilers):

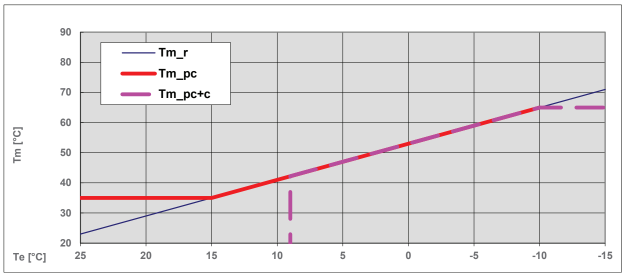
- Integration method (either parallel or series plumbing configuration);
- Integration and replacement method (either parallel or series plumbing configuration);
- Integration and progressive replacement method (series plumbing configuration only).

Only the integration mode is available for the conditioning service (either parallel or series plumbing configuration), and it is possible to set the priority between Robur systems and third party chillers.

6.1 HEATING: INTEGRATION

This operating mode makes it possible to manage heating systems consisting either of GAHP units or boilers where, in all operative conditions, the required set-point (fixed or variable) is compatible with the operating range of all generators.
Therefore, in this mode it is not expected to have operative conditions requiring such a high set-point that GAHP units must be excluded.
The power contribution of each generator is therefore controlled by the DDC Panel simply according to the efficiency of each type of generator in view of the system load.
The integration mode is possible either in parallel or series plumbing configurations, even at different operative temperatures by type of generator, as long as remaining within the permitted operating range of the individual generators.
In this operating mode it is therefore assumed that the total installed power (GAHP + boilers) is equal to the building maximum thermal load.
Figure 6.1 *p. 23* shows an example of weather curve set-up to illustrate this operating mode.
For higher outdoor temperatures, the GAHP units cover on their own the low load required by the system, at low delivery temperature. When the outdoor temperature decreases, the load increases and higher delivery temperatures are required.
GAHP units and boilers therefore operate in parallel at the same temperature, with GAHP units active at full power and boilers integrating the power according to the load.

Figure 6.1 *Integration heating weather curve*



Tm_r Delivery temperature required by the system (linear weather curve)
Tm_pc Delivery temperature required for GAHP units alone
Tm_pc+c Delivery temperature required for GAHP units + integration boilers

Table 6.1 *Integration heating weather curve*

	Te	Tm
1st point	-10	65
2nd point	15	35
T max p.c.	-10	65
T min	15	35
T max boiler	-10	65

Te = Outdoor temperature
Tm = Heating flow temperature

This operating mode is set out by the European regulation 811/2013 and illustrated in Section C1.01.

In addition to the delivery set-point, it is very important to ensure the return temperature from the building is compatible with the GAHP operative range: if the delta between delivery and return is low (lower than the nominal 10 °C), the GAHP units stop due to the return temperature being too high and no longer contribute to covering the total load, contrary to the intended sizing.

Refer to Table 6.2 *p. 23* which sets out the maximum delivery and return temperatures for GAHP units in heating mode.

Table 6.2 *GAHP heating temperature limits*

			GAHP A	GAHP-AR	GAHP GS/WS	AY00-120
Heating mode						
Hot water delivery temperature	maximum for heating	°C	65	-	65	-
	maximum	°C	-	60	-	80
Hot water return temperature	maximum for heating	°C	55	-	55	-
	maximum	°C	-	50	-	70

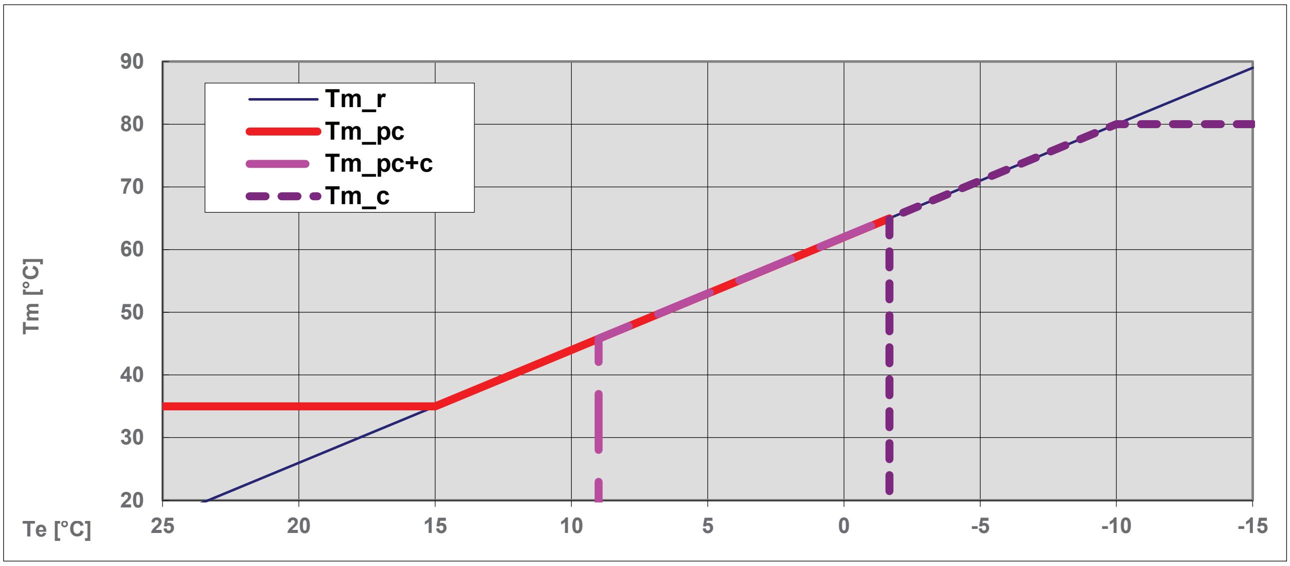
6.2 HEATING: INTEGRATION AND REPLACEMENT

This operating mode makes it possible to control heating systems consisting of both GAHP units and boilers where the operative conditions entail the possibility of the set-point required by the weather curve exceeding the maximum temperatures that may be reached by the GAHP units (see Table 6.2 *p. 23*).
Therefore the DDC Panel manages situations where the entire building thermal load (peak load) is covered by the boilers alone, whereas the GAHP units contribute to covering the base load only for as long as permitted by the required temperatures.
Clearly, in these systems the total installed power (GAHP units + boilers) is higher than the maximum power required by the building (peak load).
The Figure shows an example of weather curve set-up to illustrate this operating mode.
For high outdoor temperatures the system will work at low load and low temperature with the GAHP units only (Tm_pc section).
When the outdoor temperature decreases, the system load

increases: GAHP units and boilers will work together at the same temperature, with GAHP units at full power and boilers following the load (Tm_pc+c section).

When the outdoor temperature decreases further, under a certain level the required delivery temperature will be higher than that reached by the GAHP units, which therefore will be off: heating will then only be supplied by the boilers (Tm_c section).

Figure 6.2 *Integration and replacement heating weather curve*



Tm_r Delivery temperature required by the system (linear weather curve)
Tm_pc Delivery temperature required for GAHP units alone
Tm_pc+c Delivery temperature required for GAHP units + integration boilers
Tm_c Delivery temperature required for boilers alone

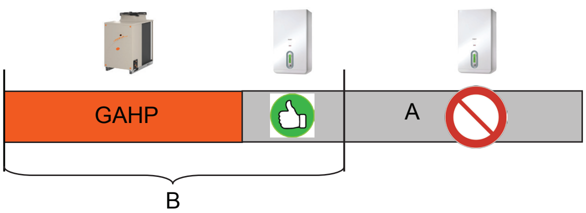
Table 6.3 *Integration and replacement heating weather curve*

	Te	Tm
1st point	-10	80
2nd point	15	35
T max p.c.	-2	65
T min	15	35
T max boiler	-10	80

Te = Outdoor temperature
Tm = Heating flow temperature

For as long as the required temperature remains within the operating range of the GAHP units, the DDC Panel only makes a part of the boilers available for start-up, so the total power (GAHP units + active boilers) does not exceed the design power; the other boilers remain inhibited (Figure 6.3 *p. 24*).

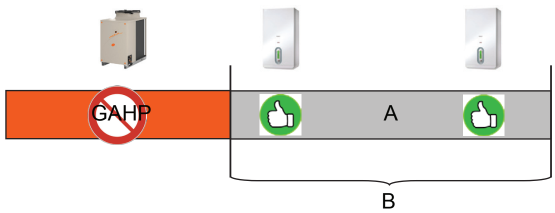
Figure 6.3 *Low temperature operation (integration)*



A Integration boilers B Design power

As the temperature rises above the admissible limits for the GAHP units, their operation is inhibited and the boilers alone meet the entire thermal requirement (Figuure 6.4 *p. 24*).

Figure 6.4 *High temperature operation (replacement)*



A Integration boilers B Design power

Switching from operating mode at low temperature ("integration" part) to that at high temperature ("replacement" part) takes place as soon as the actual delivery or return temperature of one of the GAHP units reaches its operative limit (see Table 6.2 *p. 23*). The GAHP units are automatically restored as soon as permitted by the conditions.

The "integration and replacement" operating mode makes it possible to simply "upgrade" the energy efficiency of a building, by installing GAHP alongside existing boilers without intervening in any way on the existing boilers, which are left to cover the higher loads.

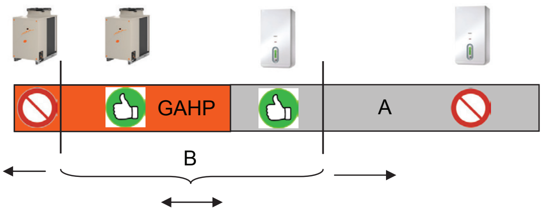
6.3 HEATING: INTEGRATION AND PROGRESSIVE REPLACEMENT

This operating mode requires plumbing configuration in series between GAHP units and boilers, complying with the indicative diagrams in Paragraphs 7.1.3 *p. 27* and 7.1.4 *p. 27*.

This operating mode makes it possible to achieve a temperature

"staging" , i.e. to obtain overall delivery temperatures higher than the operative limits of the GAHP units yet without inhibiting them (for as long as possible), integrating in temperature with the boilers.
Unlike the "integration and replacement" mode, this mode seeks to use the GAHP units as much as possible before definitely switching over to the boilers alone, which occurs when the return temperature from the system (and not the required delivery) becomes incompatible for the operative limits of the GAHP units.
In the "integration and replacement" mode, in fact, as soon as one of the GAHP units reaches the operative limit condition, all the GAHP units are inhibited until the temperatures fall back within the operative limits.
To ensure that the regulation is effective, it is therefore necessary for the building to develop a high thermal gradient (at least greater than 10°C) when the requested delivery temperature exceed the operating limits of the GAHP.

Figure 6.5 *Progressive replacement operation*



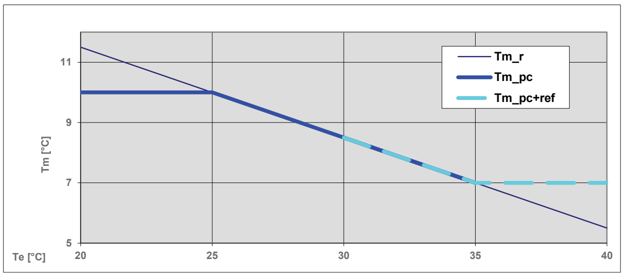
A Integration boilers
B Design power

The DDC Panel identifies the maximum number of GAHP units that may be activated according to the operative conditions.
To do so, the temperature probes of the delivery and return manifolds are required, as well as the designated return temperature probe for the GAHP units alone.
Furthermore, certain additional parameters must be set in the DDC Panel, specific for this operating mode; in particular, the building design thermal load must be set (which is correlated to the mobile "band" B in Figure 6.5 *p. 25*).

6.4 CONDITIONING: INTEGRATION

This operating mode makes it possible to manage conditioning systems featuring both GAHP heat pumps and GA ACF chillers, and third party chillers.
The required set-point (fixed or variable) must be compatible with the temperature limits of all generators installed in the system.
For this operating mode, a parameter is available on the DDC to define the priority between Robur units and third party chillers, in order to assure maximum flexibility in the choice of the generators in charge of the base load, according to the system specific features.
In the case of conditioning, the third party chillers might cover the base load (hence active in the Tm_pc section of the weather curve in Figure 6.6 *p. 25*), whereas Robur chillers are only active to cover peak loads (Tm_pc+ref section), or vice versa.
Figure 6.6 *p. 25* shows an example of weather curve set-up to illustrate this operating mode.
In this case, the minimum temperature that may be reached by the third party chiller and by the Robur units is the same, and corresponds to the minimum temperature request of the system.
For the first operation section (section Tm_pc), the chillers chosen to cover the base load are able to cover the requirement on their own.
As the outdoor temperature rises, so does the system load and lower temperatures are required; the base chillers and the peak ones are therefore working in parallel at the same temperature (section Tm_pc+ref), with base chillers at full power and peak ones keeping up with the load.

Figure 6.6 *Integration conditioning weather curve*



Tm_r Delivery temperature required by the system (linear weather curve)
Tm_pc Required delivery temperature for active chillers on base load
Tm_pc+ref Required delivery temperature for active chillers on base load and active chillers on peak load

Table 6.4 *Integration conditioning weather curve*

	Te	Tm
1st point	25	10
2nd point	35	7
T max p.c.	25	10
T min	35	7

6.5 PLUMBING CONFIGURATIONS AND INTEGRATION METHODS

The integration methods described above may be used either with series or parallel plumbing configurations, with the exception of the integration and progressive replacement mode, which requires mandatory series configuration.
The series configuration is advantageous when the system, faced with a high thermal load, requires a temperature exceeding the GAHP operative limits and at the same time, under these conditions, a thermal gradient exceeding 10°C might develop on the system.

7 SYSTEM BLOCK DIAGRAMS FOR THIRD PARTY UNIT CONTROL

In order to illustrate in a more general manner the control options of third party generators and other system components (temperature probes, circulating pumps, diverter valves) supported by Robur control systems, block diagrams are set out below, divided by:

- primary circuit (see Paragraph 7.1 *p. 26*);
- secondary circuit (see Paragraph 7.2 *p. 27*);
- separable circuit (see Paragraph 7.3 *p. 29*);

Table 7.1 *p. 26* sets out the permitted combinations between system blocks.

Table 7.1 *System block combinations*

	Plumbing configuration		Separable	
			A1	A2
Primary	Parallel circuit	P1	S1	X
		P2	X	S1
	Series	P3	S2	X
		P4	S1	X

X Combination not managed by the control systems Robur

The control of third party generators and system components such as temperature probes and circulating pumps is only possible by using the DDC Panel together with the RB200 device, as described in Paragraph 2.4.2 *p. 7*.

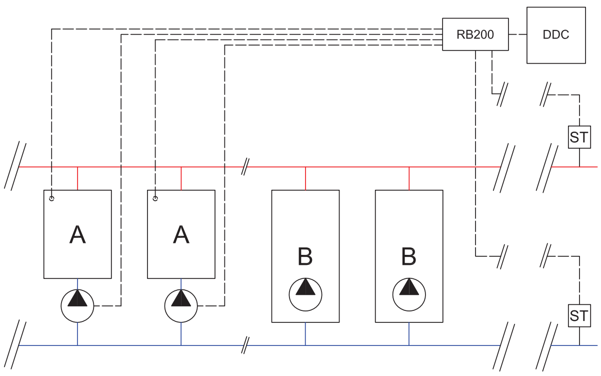
Table 7.1 *p. 26* intentionally refers to the generic secondary S1 (see Paragraph 7.2.1 *p. 27*), without specifying one of the three possible versions, as the combination is possible with any of the three versions. However, the "X" means that the combination cannot be managed by Robur control systems.
Paragraph 7.4 *p. 29* sets out some example diagrams of possible combinations.

7.1 PRIMARY CIRCUIT BLOCKS

Below is a series of system configurations of possible primary circuits supported by Robur control systems.

7.1.1 Primary P1

Figure 7.1 *Primary P1*



A Third party generators
B Generators Robur
ST Temperature probes on secondary circuit

Figure 7.1 *p. 26* shows type P1 primary block, with the following features:

- Robur Generators with circulating pumps controlled by the unit electronics;
- Third party generators with circulating pumps controlled by RB200;
- A pair of temperature probes on the secondary circuit connected to RB200.

The temperature probes connected to RB200 are mandatory if third party generators are installed.

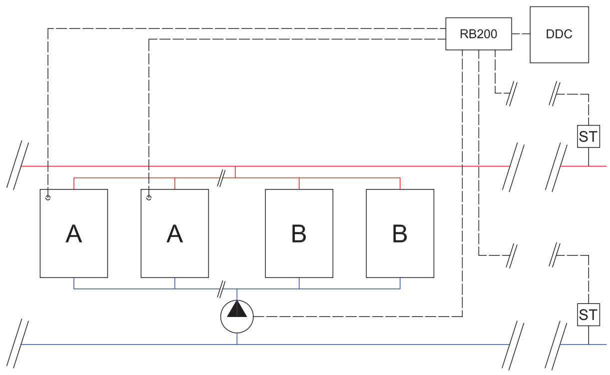
The circulating pumps of third party units are exclusively controlled in ON/OFF mode.

Any water flow modulation must be controlled directly by the circulating pumps.

This plumbing layout supports the "integration" mode (see Paragraph 6.1 *p. 23*) and "integration and replacement" mode (see Paragraph 6.2 *p. 23*) for the heating and DHW function with base system.
For the conditioning function, only the "integration" mode described in Paragraph 6.4 *p. 25* is available.

7.1.2 Primary P2

Figure 7.2 *Primary P2*



A Third party generators
B Generators Robur
ST Temperature probes on secondary circuit

Figure 7.2 *p. 26* shows type P2 primary block, with the following features:

- Robur generators and third party generators with common circulating pump controlled by RB200;
- A pair of temperature probes on the secondary circuit connected to RB200.

The temperature probes connected to RB200 are mandatory if third party generators are installed.

The common circulating pump does not allow the water flow to bypass generators that are temporarily turned off from normal cascade control.

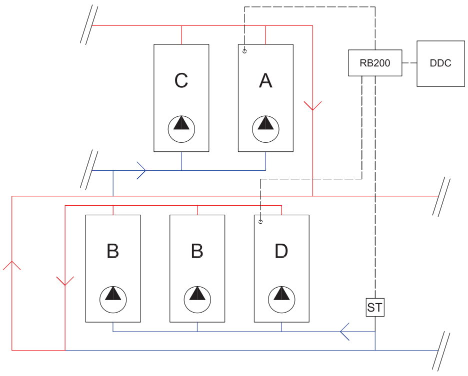
It is not therefore possible to ensure the general setpoint is reached and maintained under any conditions.
With high delivery setpoint, GAHP units may exceed their operative limits to offset the mixing that is brought about with inactive units.

The common circulating pump is exclusively controlled in ON/OFF mode.

This plumbing layout supports the "integration" mode (see Paragraph 6.1 *p. 23*) and "integration and replacement" mode (see Paragraph 6.2 *p. 23*) for the heating and DHW function with base system.
For the conditioning function, only the "integration" mode described in Paragraph 6.4 *p. 25* is available.

7.1.3 Primary P3

Figure 7.3 *Primary P3*



A Third party generators
B Generators Robur
C AY00-120 Robur boilers
D Third party chillers
ST GAHP return temperature probe

Figure 7.3 *p. 27* shows type P3 primary block, with the following features:

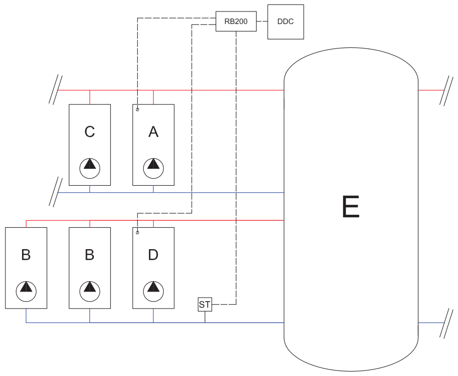
- Robur Generators with circulating pumps controlled by the unit electronics;
- Third party generators with circulating pumps controlled by their own electronics;
- Series plumbing configuration;
- Probe on the return manifold for "integration and progressive replacement" function (see Paragraph 6.3 *p. 24*).

The temperature probe on return connected to RB200 is mandatory for the "integration and progressive replacement" function.

This plumbing layout supports the "integration" mode (see Paragraph 6.1 *p. 23*) and "integration and replacement" mode (see Paragraph 6.2 *p. 23*) and "integration and progressive replacement" mode (see Paragraph 6.3 *p. 24*) for the heating and DHW function with base system.
For the conditioning function, only the "integration" mode described in Paragraph 6.4 *p. 25* is available.

7.1.4 Primary P4

Figure 7.4 *Primary P4*



A Third party generators
B Generators Robur
C AY00-120 Robur boilers
D Third party chillers
E Buffer tank
ST GAHP return temperature probe

Figure 7.4 *p. 27* shows type P4 primary block, with the following features:

- Robur Generators with circulating pumps controlled by the unit electronics;
- Third party generators with circulating pumps controlled by their own electronics;
- Series plumbing configuration serving a buffer tank;
- Probe on the return manifold for "integration and progressive replacement" function (see Paragraph 6.3 *p. 24*).

The temperature probe on return connected to RB200 is mandatory for the "integration and progressive replacement" function.

This plumbing layout supports the "integration" mode (see Paragraph 6.1 *p. 23*) and "integration and replacement" mode (see Paragraph 6.2 *p. 23*) and "integration and progressive replacement" mode (see Paragraph 6.3 *p. 24*) for the heating and DHW function with base system.
For the conditioning function, only the "integration" mode described in Paragraph 6.4 *p. 25* is available.

7.2 SECONDARY CIRCUIT BLOCKS

Below is a series of system configurations of possible secondary circuits supported by Robur control systems.
It should be noted that the diagrams show always include a hydraulic separator as the residual head of the circulators installed on the machine (if any) is often not sufficient for distribution to the services.
Please also note that the functions of the control systems do not include controlling tapping towards fixtures.

It is important for the DDC panel to receive a secondary circuit disabling signal, in order to maintain generation active only if there is an actual request.

This simple measure makes it possible to further optimise overall efficiency.

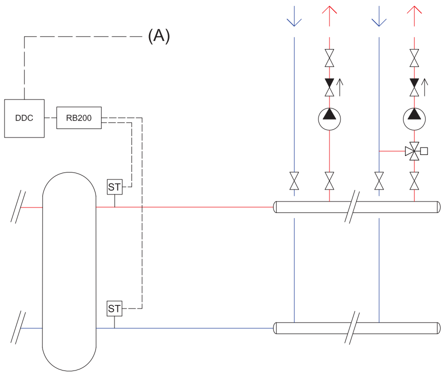
7.2.1 Secondary S1

This type of secondary circuit is divided into three versions: S1A, S1B and S1C.

In all three variants, the temperature probes are required in the following cases:

► Presence of third party generators controlled by Robur control systems;
► Primary system in series configuration.

Figure 7.5 *Secondary S1A*

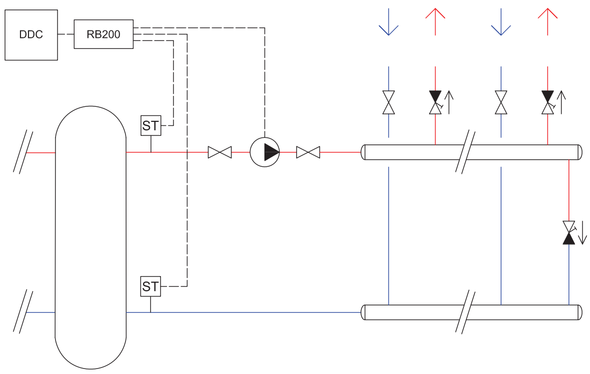


(A) Service request signal from secondary circuits control system (not supplied)
ST Temperature probes on secondary circuit

Figure 7.5 *p. 28* shows type S1A secondary block, with the following features:
► Common manifold with tapping and check valves;
► Circulating pumps designated for each tap, not controlled by Robur control systems;
► Pair of temperature probes on secondary circuit.

As set out in Paragraph 7.2 *p. 27*, it is recommended for the DDC Panel to receive from the fixture management system a digital signal for enabling/disabling them, in order to optimise operation of the generation system.

Figure 7.6 *Secondary S1B*



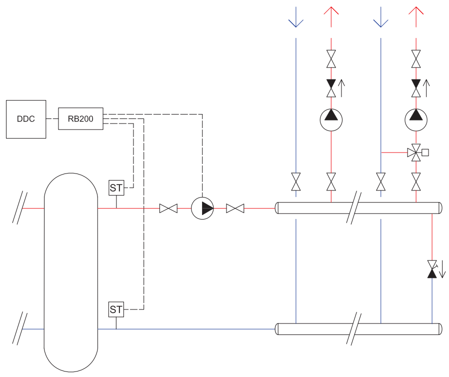
ST Temperature probes on secondary circuit

Figure 7.6 *p. 28* shows type S1B secondary block, with the following features:
► Common manifold with tapping and balancing valves;
► Common circulating pump controlled by RB200;
► Plumbing bypass with balancing valve;
► Pair of temperature probes on secondary circuit.

The common circulating pump is exclusively controlled in ON/OFF mode.

Any water flow modulation must be controlled directly by the circulating pump.

Figure 7.7 *Secondary S1C*



ST Temperature probes on secondary circuit

Figure 7.7 *p. 28* shows type S1C secondary block, with the following features:
► Common manifold with tapping and check valves;
► Circulating pumps designated for each tap, not controlled by Robur control systems;
► Common circulating pump controlled by RB200;
► Plumbing bypass with balancing valve;
► Pair of temperature probes on secondary circuit.

The common circulating pump is exclusively controlled in ON/OFF mode.

Any water flow modulation must be controlled directly by the circulating pump.

7.2.2 Secondary S2

Type S2 secondary circuit includes an additional common circulation pump upstream of any hydraulic separator (called secondary pump); for this reason, if the separator is actually included, the downstream circulating pump is called tertiary. The type S2 secondary circuit must be used in combination with type P3 primary circuit (described in Paragraph 7.1.3 *p. 27*).

Figure 7.8 *Secondary S2*

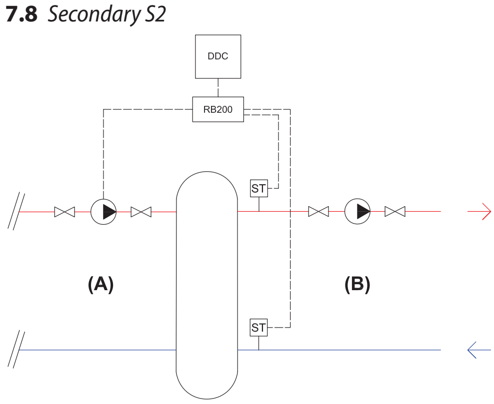


Diagram only applicable for series plumbing configuration, if type P3 primary circuit is installed (see 7.1.3 *p. 27*)
(A) Secondary circuit
(B) Tertiary circuit
ST Temperature probes on tertiary circuit

Figure 7.8 *p. 28* shows type S2 secondary block, with the following features:
► Secondary circulating pump controlled by RB200;
► Tertiary circulating pump (only if hydraulic separator is included);
► Hydraulic separator (optional);

► Pair of secondary circuit temperature probes (or tertiary, if the hydraulic separator is included).

The tertiary circuit circulator can be controlled via RB200, controlled in parallel to the secondary circulator.

The common circulating pump is exclusively controlled in ON/OFF mode.

Any water flow modulation must be controlled directly by the circulating pump.

7.3 SEPARABLE CIRCUIT BLOCKS

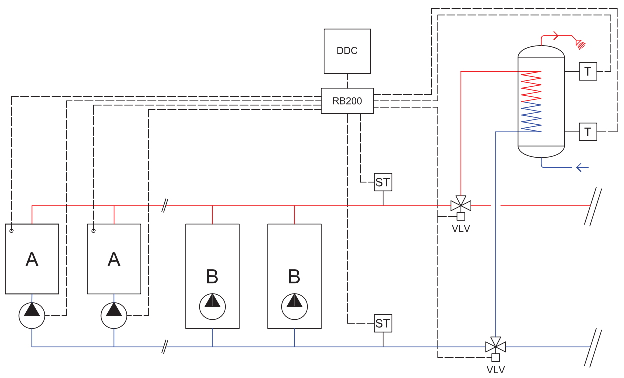
Below is a series of system configurations for possible separable circuits for production of domestic hot water and space heating alternatively, supported by Robur control systems.

Only the "integration" mode described in Paragraph 6.1 *p. 23* is available for separable systems.

In no case may reversible or 4-pipe Robur generators be used on the separable system.

7.3.1 Separable A1

Figure 7.9 *Separable A1*



A Third party generators
B GAHP A or AY00-120
ST Temperature probes on separable circuit
T DHW tank thermostats
VLV ON/OFF type diverting valves

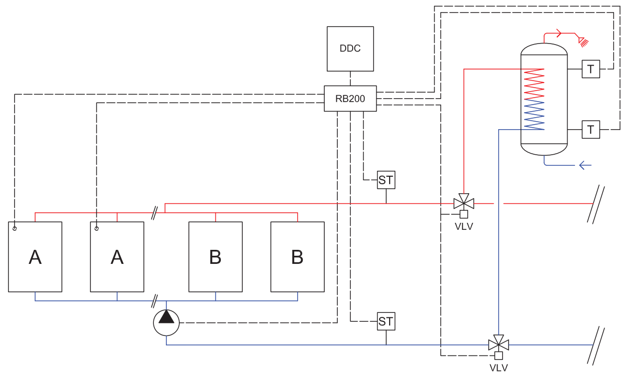
Figure 7.9 *p. 29* shows type A1 separable block, with the following features:

- ► Robur Generators with circulating pumps controlled by the unit electronics;
- ► Third party generators with circulating pumps controlled by RB200;
- ► Pair of 3-way diverter valves controlled by RB200;
- ► Thermostat(s) in the DHW tank for DHW service request;
- ► Pair of temperature probes on the separable circuit connected to RB200.

The temperature probes connected to RB200 are mandatory if third party generators are installed.

7.3.2 Separable A2

Figure 7.10 *Separable A2*



A Third party generators
B GAHP A or AY00-120
ST Temperature probes on separable circuit
T DHW tank thermostats
VLV ON/OFF type diverting valves

Figure 7.10 *p. 29* shows type A2 separable block, with the following features:

- ► Robur generators and third party generators with common circulating pump controlled by RB200;
- ► Pair of 3-way diverter valves controlled by RB200;
- ► Thermostat(s) in the DHW tank for DHW service request;
- ► Pair of temperature probes on the separable circuit connected to RB200.

The temperature probes connected to RB200 are mandatory if third party generators are installed.

The common circulating pump does not allow the water flow to bypass generators that are temporarily turned off from normal cascade control.

It is not therefore possible to ensure the general setpoint is reached and maintained under any conditions.

With high delivery setpoint, GAHP units may exceed their operative limits to offset the mixing that is brought about with inactive units.

The common circulating pump is exclusively controlled in ON/OFF mode.

Any water flow modulation must be controlled directly by the circulating pump.

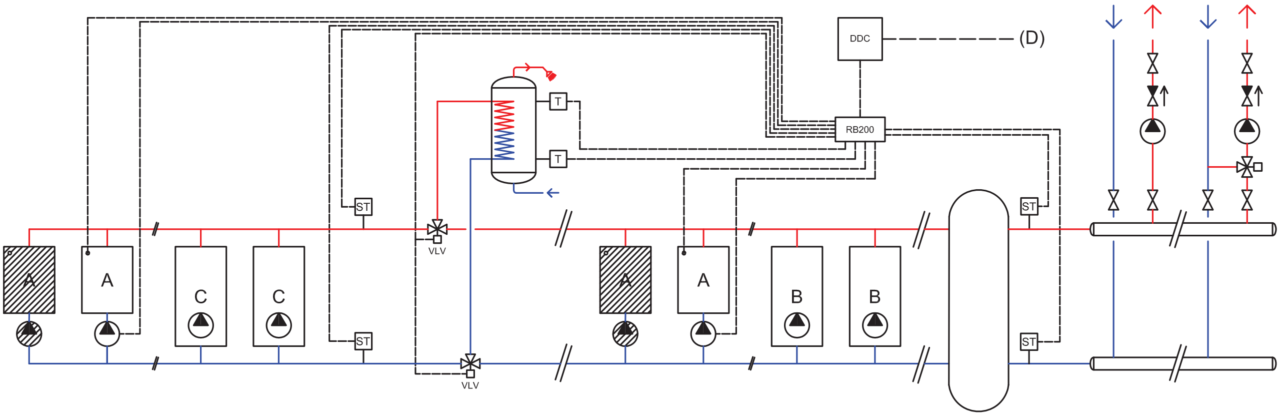
7.4 INDICATIVE BLOCK DIAGRAMS

For type S1 secondary circuit, it is possible to use any of the three versions S1A, S1B or S1C (see Paragraph 7.2.1 *p. 27*). For the sake of simplicity, the pictures show one version only.

The shaded generators are shown to comply with the original block structure described in the relevant chapters, but cannot be controlled with a single RB200, because (as illustrated in Paragraph 4 *p. 13*) each RB200 makes it possible to control up to two third party units.

7.4.1 Primary P1 with separable A1 and secondary S1

Figure 7.11 *P1+A1+S1 system*

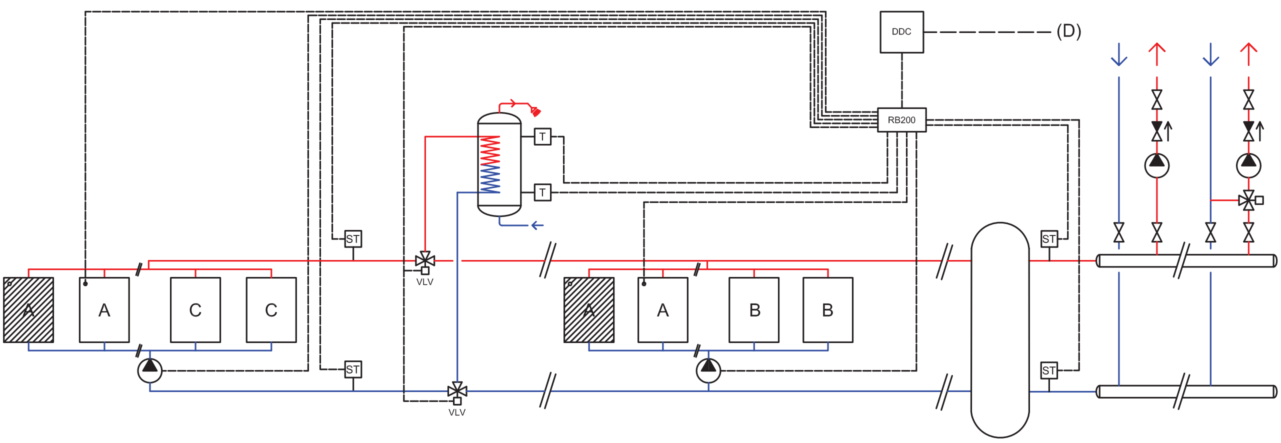


A Third party generators
B Generators Robur
C GAHP A or AY00-120
(D) Service request signal from secondary circuits control system (not supplied)
ST Temperature probes of secondary and/or separable circuits
T DHW tank thermostats
VLV ON/OFF type diverting valves

Figure 7.11 *p. 30* shows a general diagram for a system arising from the combination, according to the rules set out in Paragraph 7 *p. 26*, of type P1 primary (see Paragraph 7.1.1 *p. 26*) with secondary type S1A (see Paragraph 7.2.1 *p. 27*), with the addition (if required) of separable type A1 (see Paragraph 7.3.1 *p. 29*).
The probes are located both on the separable and on the secondary circuit, and the secondary control system (not supplied) is intended to provide an operation request to the DDC Panel.

7.4.2 Primary P2 with separable A2 and secondary S1

Figure 7.12 *P2+A2+S1 system*

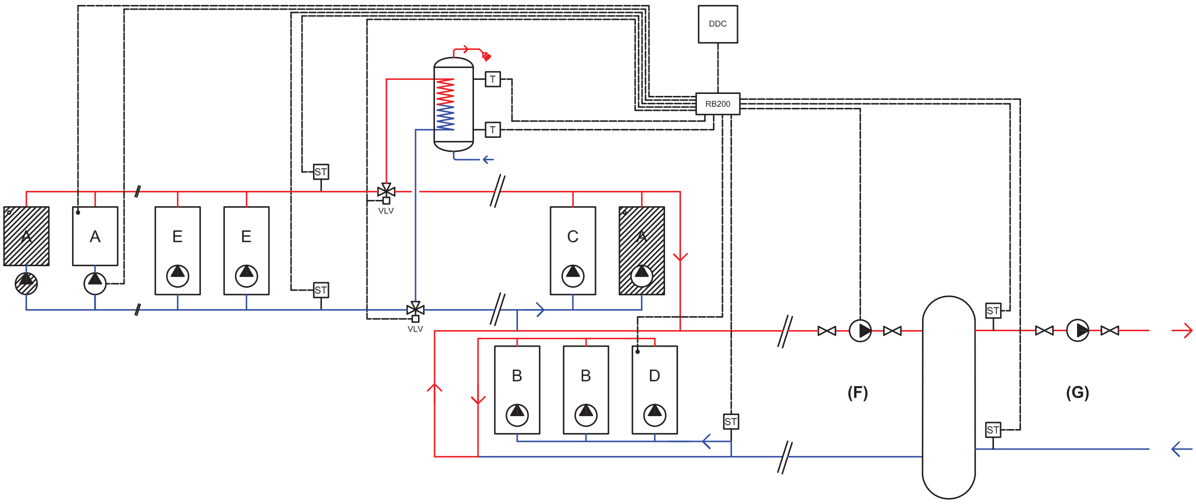


A Third party generators
B Generators Robur
C GAHP A or AY00-120
(D) Service request signal from secondary circuits control system (not supplied)
ST Temperature probes of secondary and/or separable circuits
T DHW tank thermostats
VLV ON/OFF type diverting valves

Figure 7.12 *p. 30* shows a general diagram for a system arising from the combination, according to the rules set out in Paragraph 7 *p. 26*, of type P2 primary (see Paragraph 7.1.2 *p. 26*) with secondary type S1A (see Paragraph 7.2.1 *p. 27*), with the addition (if required) of separable type A2 (see Paragraph 7.3.2 *p. 29*).
The probes are located both on the separable and on the secondary circuit, and the secondary control system (not supplied) is intended to provide an operation request to the DDC Panel.

7.4.3 Primary P3 with separable A1 and secondary S2

Figure 7.13 *P3+A1+S2 system*

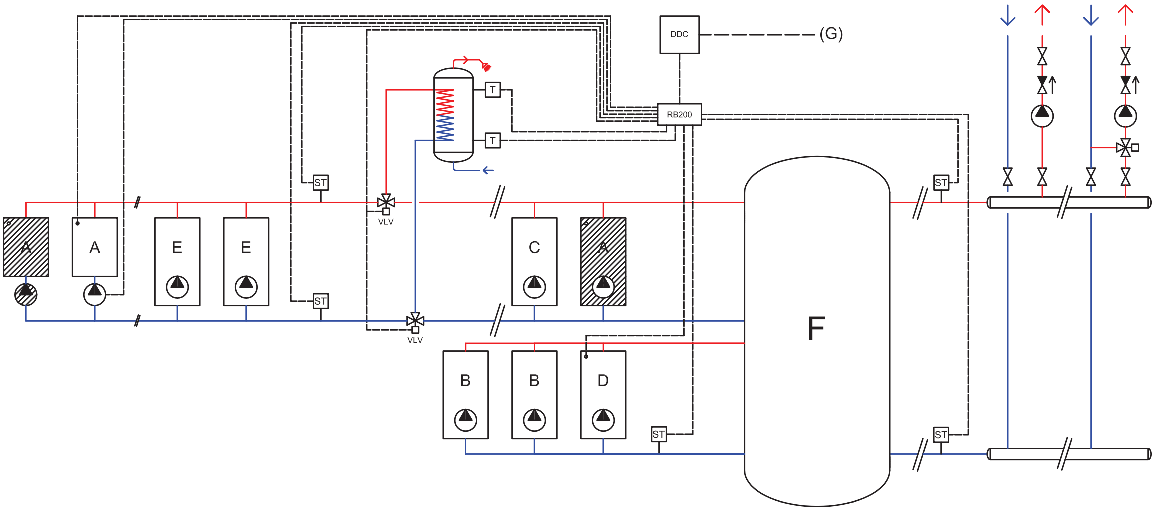


A Third party generators
B Generators Robur
C AY00-120 boilers
D Third party chillers
E GAHP A or AY00-120
(F) Secondary circuit
(G) Tertiary circuit
ST GAHP return temperature probe and/or tertiary and/or separable circuit temperature probes
T DHW tank thermostats
VLV ON/OFF type diverting valves

Figure 7.13 *p. 31* shows a general diagram for a system arising from the combination, according to the rules set out in Paragraph 7 *p. 26*, of type P3 primary (see Paragraph 7.1.3 *p. 27*) with secondary type S2 (see Paragraph 7.2.2 *p. 28*), with the addition (if required) of separable type A1 (see Paragraph 7.3.1 *p. 29*).
The probes are located both on the separable and on the secondary circuit (or tertiary if the buffer tank is installed), as well as on the GAHP inlet branch (the latter is only required if one should wish to use the integration and progressive replacement mode, described in Paragraph 6.3 *p. 24*).
The common circulating pump of the secondary circuit is controlled by RB200.

7.4.4 Primary P4 with separable A1 and secondary S1

Figure 7.14 *P4+A1+S1 system*



A Third party generators
B Generators Robur
C AY00-120 boilers
D Third party chillers
E GAHP A or AY00-120
F Buffer tank
(G) Service request signal from secondary circuits control system (not supplied)
ST GAHP return temperature probe and/or secondary and/or separable circuit temperature probes
T DHW tank thermostats
VLV ON/OFF type diverting valves

Figure 7.14 *p. 31* shows a general diagram for a system arising from the combination, according to the rules set out in Paragraph7 *p. 26*, of type P4 primary (see Paragraph 7.1.4 *p. 27*) with secondary type S1A (see Paragraph

7.2.1 *p. 27*), with the addition (if required) of separable type A1 (see Paragraph 7.3.1 *p. 29*).
The probes are located both on the separable and on the secondary circuit, as well as on the GAHP inlet branch (the latter is only required if one should wish to use the integration and progressive replacement mode, described in Paragraph 6.3 *p. 24*) and the control system of the secondary circuit (not supplied) is intended to provide an operation request to the DDC Panel.

8 CCI

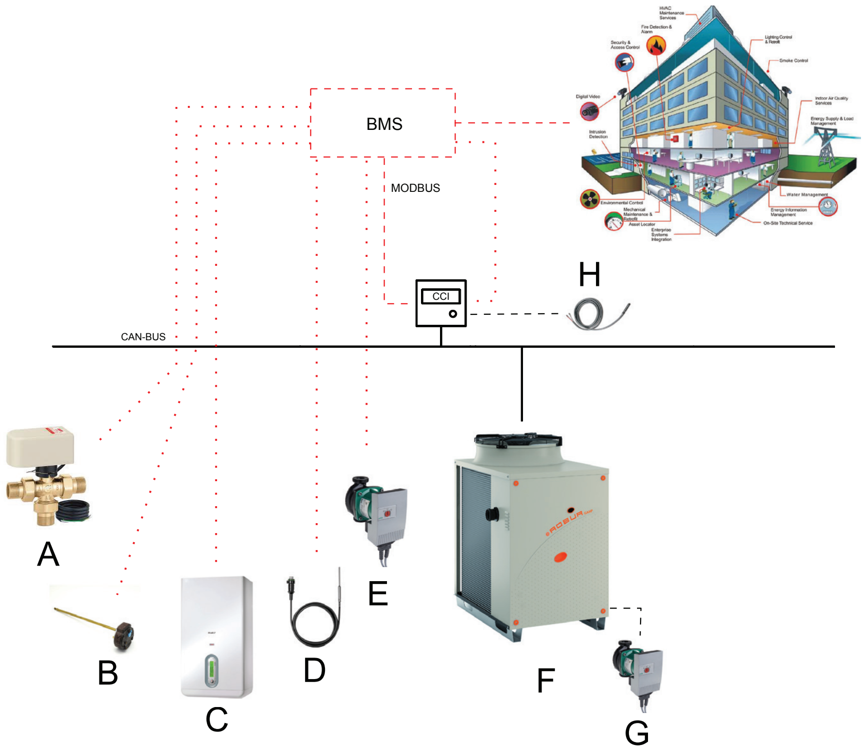
8.1 CCI CONTROL ARCHITECTURE

The CCI control is able to control the appliances, from a single unit up to three consistent GAHP A or GAHP GS/WS units, in modulating mode (for heating and DHW production) and any free-cooling (GAHP GS/WS units only).

The CCI Panel requires to receive the appropriate request signals from an external system as it is designed for operation in combination with a system control.

The diagram shown in Figure 8.1 *p. 33* shows the elements of the control system and the types of available connections if the CCI Panel is installed and a fixture control system such as BMS, SCADA and similar.

Figure 8.1 *BMS control architecture with CCI*



In solid line the CAN-BUS connection connecting Robur control devices to the units
In dashed line the connections with analogue/digital signals between CCI Panel and manifold water temperature probe and of unit Robur circulating pumps that must be controlled by the electronic boards inside the units
In red dashed line the MODBUS connection between the CCI Panel and the fixture control system (BMS, SCADA, etc.)
In red dotted line the connection with analogue/digital signals connecting the fixture control system with the CCI Panel and with the other devices in the system

A ON/OFF type three-way diverting valves
B Thermostats
C Third party generators
D Temperature probes
E Circulating pumps
F Single Robur units (only GAHP A and GAHP GS/WS and maximum three, mutually consistent)
G Single Robur units circulating pumps
H Manifold water temperature probe

Connection with the CCI Panel will always be via Modbus protocol, while any analogue/digital type signals from the BMS system (only useful if the BMS does not communicate via Modbus with the CCI Panel) will be connected to the CCI directly. With the CCI Panel, the possibility of using the DDC Panel or the RB100/RB200 devices is not provided.

8.1.1 CAN-BUS communication network

See Paragraph 1.1 *p. 2*.

8.2 MAIN FUNCTIONS

The main functions of the CCI Panel are:

1. Setup and control of up to three homogeneous Robur units (GAHP A or GAHP GS/WS) with control in modulation of the units;
2. data display and parameters setting;
3. manifold water temperature probe interface;
4. diagnostics;
5. errors reset;
6. possibility to interface with a BMS;

The CCI Panel in combination with an external system control supports the following functions:

- heating;
- DHW production;
- free cooling (GAHP GS/WS units only).

Below is a synthetic description of the main CCI Panel functions:

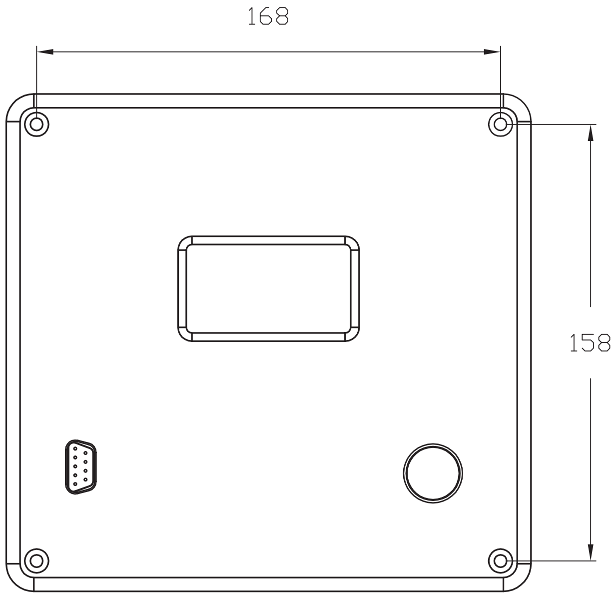
1. Set-up and control of up to three unitsRobur makes it possible to control operation in modulation of the supported types of appliance.
2. Values view and parameters setting allow you to optimize the adjustment parameters in order to best exploit the efficiency of the absorption technology, while safeguarding user comfort.
3. Interfacing for the manifold water temperature probe makes it possible to know exactly the actual temperature on the manifold feeding the fixtures, and to use this reading as feedback to optimise control.
4. Diagnostics lets you know at any time the operating status, warnings or errors of the appliances and identify the possible causes of any malfunctions, as well as manage a log of recorded events.
5. The error reset lets you restore appliance availability following resolution of an error that involved shutdown by the control system.
6. The BMS interfacing option (or other external supervision and control system) makes it possible to manage the CCI Panel (and the appliances controlled by it) through an external device, within more complex and integrated domotics or integrated building/installation control systems. In practice, interfacing is carried out either via simple analogue/digital signals, or (more comprehensively) via the Modbus protocol, detailed in Paragraph 8.6 *p. 37*.

8.3 INSTALLATION

The CCI Panel is suitable for internal installation and must be fixed onto an electrical panel, into which a 155 x 151 mm rectangular opening must be made.

Figure 8.2 *p. 34* indicates the position of the fixing holes.

Figure 8.2 *DDC/CCI front view with fixing dimensions*

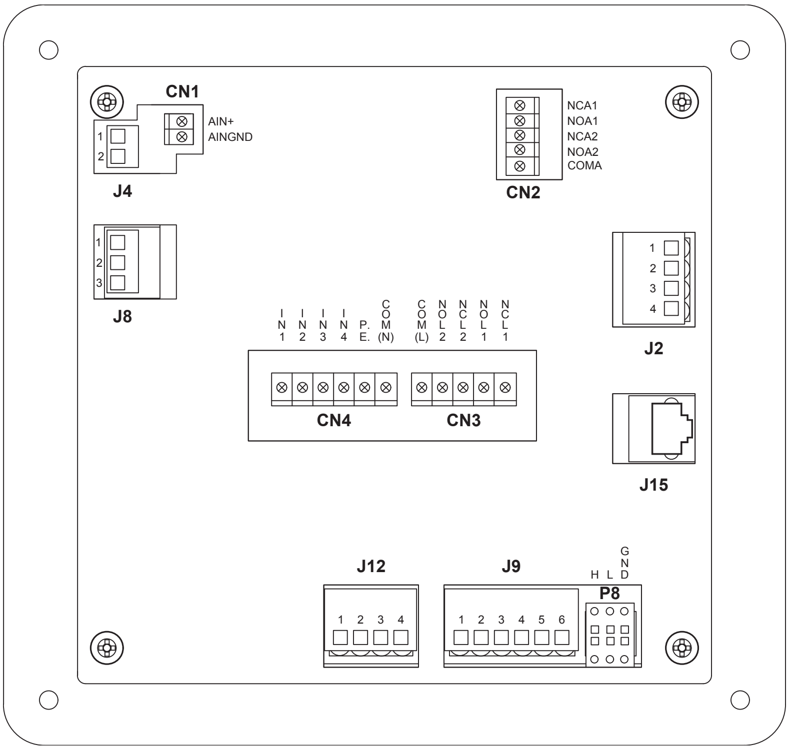


The CCI Panel has protection rating IP20, and must be installed in premises with ambient air temperature between 0°C and 50°C, away from direct sunlight exposure.

8.4 CONNECTIONS

The CCI Panel provides the connection terminals shown in Figure 8.3 *p. 35*.

Figure 8.3 *CCI panel connections*



CN12 = Set-point request connections
- AIN+ = 0-10 V input for set-point request
- AINGND = ground reference for AIN+

J4 = Delivery or return manifold temperature probe input

CN4 = Service request inputs
- IN1 = Input (phase 230 V) for GAHP start up request
- IN2 = Input (phase 230 V) for DHW service request
- IN3 = Not used
- IN4 = Input (phase 230 V) for free cooling request
- P.E. = Safety earthing
- COM(N) = Reference (neutral 230 V) IN1-IN4 inputs

J9 = Auxiliary generator turning on signal
- 1 = Reference for contact 2
- 2 = Auxiliary generator active signal input

CN3 = service alarms signal outputs
- COM(L) = Common contact
- NOL2 = NO contact impossibility to continue DHW service with GAHP
- NCL2 = NC contact impossibility to continue DHW service with GAHP
- NOL1 = NO contact general alarm
- NCL1 = NC contact general alarm

J8 = First GAHP unit alarm signal outputs
- 1 = Common contact
- 2 = NC first GAHP alarm contact
- 3 = NO first GAHP alarm contact

CN2 = Second and third GAHP unit alarm signal outputs
- COMA = Common contact
- NOA2 = NO third GAHP alarm contact
- NCA2 = NC third GAHP alarm contact
- NOA1 = NO second GAHP alarm contact
- NCA1 = NC second GAHP alarm contact

J12 = CCI panel power supply contacts
- 1 = 24 VAC, 20 VA SELV power supply
- 2 = 0 Vac
- 3 = Safety earthing

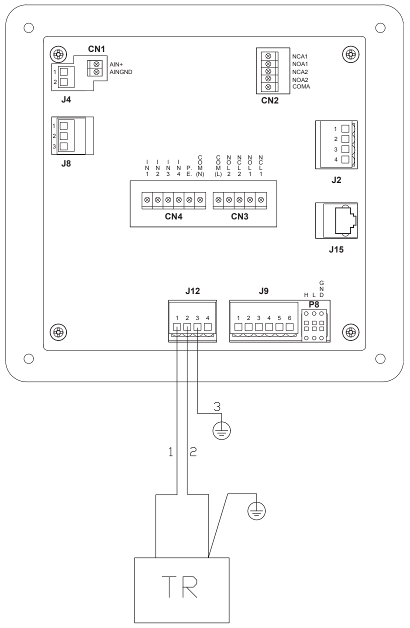
P8 = CAN-BUS network connector (orange)

J2 = Serial Modbus RS485 connection
- 1 = A (TXD/RXD +)
- 2 = B (TXD/RXD -)
- 3 = Common (earth & GND)
- 4 = Cable shielding (earth & GND)

8.4.1 Electrical power supply

The CCI Panel must be supplied by a 230/24 V AC - 50/60 Hz safety transformer with power no less than 20 VA (not supplied); in particular, this transformer must comply with standard EN 61558-2-6.
Use a connecting 3 x 0.75 mm² electrical cable and perform connections on the J12 connector terminals (see Figure 8.3 *p. 35*) complying with the polarity indicated in Figure 8.4 *p. 36*.
The maximum specified length for this cable is 1m.

Figure 8.4 *CCI power supply connection*



J12 24 Vac electrical power supply - 4 pole connector
- 1 = 24 Vac
- 2 = 0 Vac
- 3 = earth

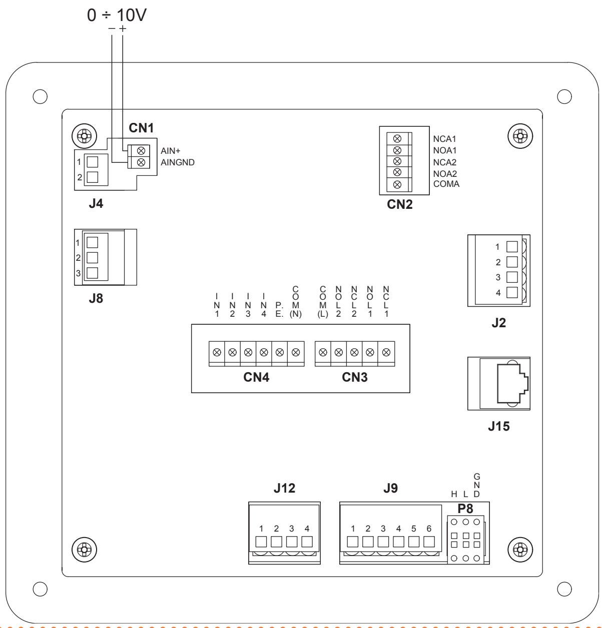
TR Safety transformer (240/24 Vac - 50/60 Hz - min 20 VA)

8.4.2 Inputs/Outputs

Set-point request analogue input

Connector CN12 (see Figure 8.3 *p. 35*) is used for connecting the set-point request 0-10 Vdc analogue signal from the external control system.
Maximum length of the connecting cables is 10 m.
Figure 8.5 *p. 36* shows the connection diagram.

Figure 8.5 *CCI set-point request connection*

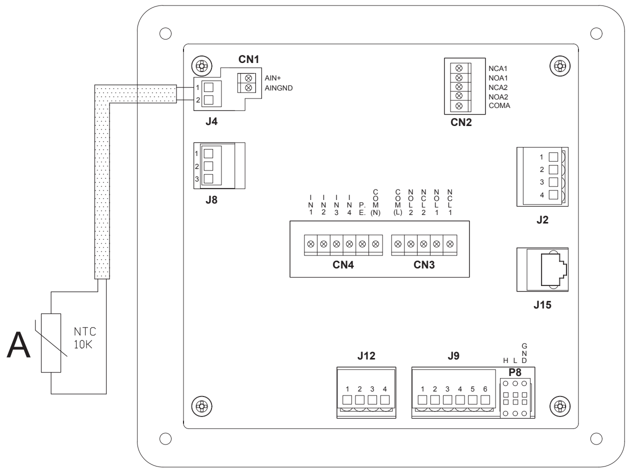


Manifold temperature probe input

The J4 analogue input (see Figure 8.3 *p. 35*) is used for the delivery (or return) manifold temperature probe, resistive type NTC 10 kΩ.

Maximum length of the connecting cable is 100 m.
Figure 8.6 *p. 36* shows the connection diagram.

Figure 8.6 *CCI manifold probe connection*



A Heating manifold delivery or return probe

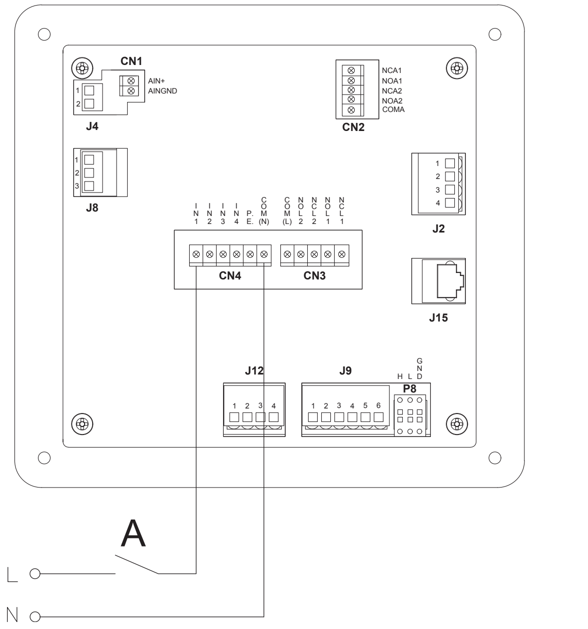
External request digital inputs

Connector CN4 (see Figure 8.3 *p. 35*) is used for connecting the service request digital signal from the external control system.
The inputs have the following features:

- ► IN1: phase 230 Vac, value 0 V if GAHP OFF, value 230 V if GAHP ON;
- ► IN2: phase 230 Vac, value 0 V if heating service, value 230 V if DHW service;
- ► IN3: not used;
- ► IN4: phase 230 Vac, value 0 V if free cooling OFF, value 230 V if free cooling ON;
- ► P.E.: safety earth connection;
- ► COM(N): neutral 230 Vac from mains.

Maximum length of the connecting cables is 10 m.
Figure 8.7 *p. 37* shows an example connection for the GAHP start-up contact IN1.
For the other start-up requests, only the contact to be connected changes.

Figure 8.7 *CCI services digital input connections*

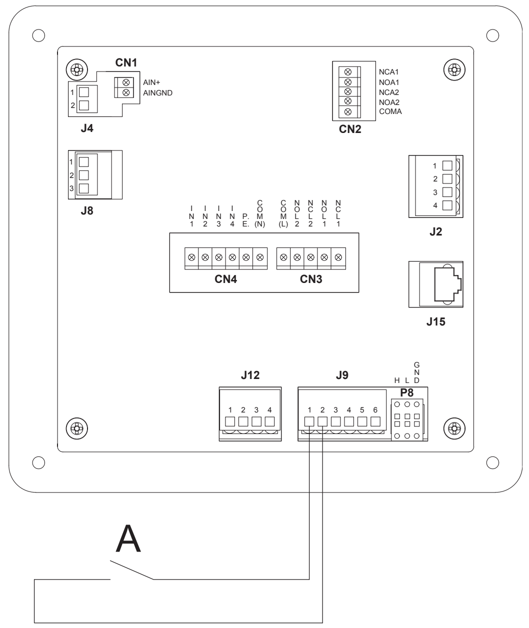


A Enable turning on request from external controller

Auxiliary generator start-up digital input

Connector J9 (see Figure 8.3 *p. 35*) is used for connecting the auxiliary generator start-up digital signal from the external control system.
This contact has the purpose of overriding the GAHP units at maximum power when the external control system starts up an auxiliary generator (typically a boiler).
Maximum length of the connecting cables is 10 m.
Figure 8.8 *p. 37* shows the connection diagram.

Figure 8.8 *CCI auxiliary generator digital input connection*



A Auxiliary generator turning on signal from external controller

8.4.3 CAN-BUS connections

For CAN-BUS connection of the CCI Panel to the individual appliances refer to Section B concerning the specific appliance.

The CCI Panel cannot be connected:

- To GAHP units other than GAHP A and GAHP GS/WS;
- To the RB100/RB200 devices;
- To the DDC Panel.

8.5 CONTROL AND SETUP

To start up the GAHP units controlled by the CC Panel, an external system control must enable the request signal on IN1 input of connector CN4 (see Paragraph *p. 36*).
The water set-point may be fixed or variable.
Should one wish a variable set-point, this must be relayed by the external system control through the 0-10 V signal connected to connector CN1 (see Paragraph *p. 36*), or received by the CCI via Modbus (see Paragraph 8.6 *p. 37*).
The CCI Panel enables GAHP units control with the purpose of controlling water temperature (measured by the manifold probe connected to connector J4, see Paragraph *p. 36*) at the set-point.
For the space heating service, the CCI panel is able to modulate power as follows:

- up to 50% for a single GAHP;
- up to 30% of the overall power with two or three GAHP units.

Under the minimum modulation threshold the CCI Panel controls the units in ON/OFF mode, either directly or through the external controller.
If there is DHW request (request signals IN1 and IN2 simultaneously on, see Paragraph *p. 36*), the DHW set-point may also in this case be either fixed or variable.
If the set-point needs to be variable, the same rules that apply for the space heating set-point also apply when relaying it to the CCI.
No modulation control is provided for the DHW service, but ON/OFF only, being able to specify the number of GAHP units that may be used for the DHW service, which will be started up at maximum power.

The CCI does not directly control an auxiliary generator (such as a boiler) which must be controlled by the external system control.

For the free cooling service (request signal IN4 active, see Paragraph *p. 36*) the CCI only starts up the circulating pumps on the cold side of GAHP GS/WS units.

8.6 MODBUS

The CCI Panel supports interfacing with external devices also via Modbus RTU protocol in slave mode.
With the Modbus protocol it is possible to acquire information concerning the operation data of the units and systems managed by the CCI (temperatures, statuses, meters, etc.).
It can also acquire information regarding alarms, both current and registered in the alarms log.
Finally, it is possible to act on the system to set a number of operating parameters such as unit On/Off, set-point, differential.
Paragraph 9.3 *p. 38* sets out the Modbus mapping implemented in the current version of the CCI Panel.

9 MODBUS MAPPING

The documents of reference for Modbus interface with the DDC and CCI controls are listed below.
Interface with the RB100 and RB200 devices is not provided. The relevant data, where available, are accessible via Modbus from the DDC Panel.

9.1 MAIN FUNCTIONS

The following main functions are obtained via Modbus protocol interface:

- Reading the system delivery and return temperatures;
- Reading the active set-point on the system;
- Reading the general alarm;
- Reading the digital statuses of each individual machine (On/Off, alarm, flame status etc.);
- Reset alarms, excluding the flame lock-out (only resettable directly from the control panel);
- Reading machine temperatures and analogues;
- Service switch on/off setting (Heating, conditioning, DHW);
- Summer/winter switching setting;
- System sliding temperature setting.

9.2 DDC

The document with Modbus Mapping may be obtained from the Robur Pre-Sale Service.

The FW version of the DDC Panel must be specified, as Modbus Mapping depends on the FW version.

9.3 CCI

The document with Modbus Mapping may be obtained from the Robur Pre-Sale Service.

The FW version of the CCI Panel must be specified, as Modbus Mapping depends on the FW version.