D 315
06.09.05 LB

TEMPERATURE CONTROLLER FOR SOLAR PANEL INSTALLATIONS

C◄RING

RPS 638 C3 Eng.

- **Temperature control for solar panel installations**
- **Communication systems:**
  – C-Ring for sharing data of common interest between local controllers
- **Power supply 230 V~; DIN rail mounting**

CE

1. APPLICATION

RPS 638 temperature controller is designed for the automation of solar panel installations.

2. FUNCTIONS

The principal functions of RPS 638 are:

- Management of the thermal exchange between solar panels and storage tanks (max 3) according to the pre-set temperature differential and the desired exchange temperature in the main storage tank with:
  – control of pump in panels circuit;
  – automatic exchange between a maximum of three tanks.
- Control of integration circuit temperature by On-Off signals according to 24hour or 7day timed programs.
- Temperature control by modulating 3-wire control (e.g. minimum temperature solar panels, DHW distribution temperature).
- Three On-Off inputs for signalling status or alarm.
- Alarms for malfunctioning components.
- C-Ring connection for local exchange of data with other controllers (integration priority, desired temperature boilers).

3. DETECTORS

No.	Description		Type	Sensing element	Range	Code	Data sheet
	Essential :						
1…3	Storage tank temp. detector	immersion	**SIH 010**	NTC 10 kΩ	0....99 °C	B1-2-3	N 140
	or	cable-type	**SAF 010**	NTC 10 kΩ	0....99 °C	B1-2-3	N 145
1	Panels temperature detector	immersion	**SIH 010**	NTC 10 kΩ	0....99 °C	B4	N 140
	or	cable-type	**SHF 001**	Pt 1 kΩ	0...180 °C	B7	N 145
	Optional						
1	Integration temp. detector	immersion	**SIH 010**	NTC 10 kΩ	0....99 °C	B5	N 140
	or	cable-type	**SAF 010**	NTC 10 kΩ	0....99 °C	B5	N 145
1	Modulating control temp. detector		**SIH 010**	NTC 10 kΩ	0....99 °C	B6	N 140

4. TECHNICAL DATA(default values in bold type)

• Electrical

Power supply	230 V~ ± 10%
Frequency	50 … 60 Hz
Consumption	5 VA
Protection	IP40
Radio disturbances	VDE0875/0871
Vibration test	with 2g (DIN 40 046)
Voltage-free output contacts:	
Maximum switched voltage	250 V~
Maximum switched current	5 (1) A
Construction standards	Italian Electrotech. Committee CEI
Data storage in memory	5 years
Software	Class A

• Mechanical

Case	DIN 6E module
Mounting	on DIN 35 rail
Materials:	
Base	NYLON
Cover	ABS
Ambient temperature:	
Operating	0 … 45°C
Storage	– 25 … + 60°C
Ambient humidity	Class F DIN 40040
Dimensions	105 x 115 x 71.5
Weight	0.6 kg

• Programmes and periods

24-hour programmes	**1** … 7
24-hour events	**2** … 6
7-day programmes	**0** … 2

• Measurement ranges

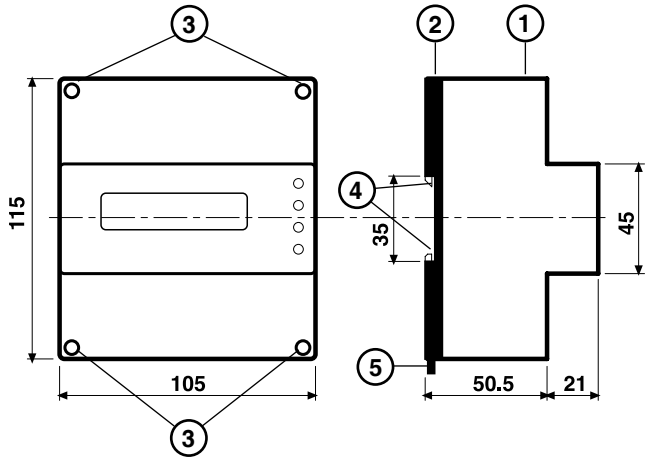
Temperature of solar panels	
detector B4	0 … 99 °C
detector B7	0...200 °C
Temperature of storage tanks (B1 - B2 - B3)	0 … 99 °C
Integration temperature (B5)	0 … 99 °C
Modulating control temperature (B6)	0 … 99 °C

• Control setting ranges

Control thermal exchange panels-storage tanks:	
Off differential	0 … **5** … 99 °C
On differential	0 … **10** … 99 °C
Exchange temperature storage tank 1	0 … **60** … 99 °C
Differential exchange storage tank 1	0 … **5** … 99 °C
Integration temperature	0 … **50** … 99 °C
On-Off integration differential	1 … **5** … 30 °C
Modulating control:	
Desired temperature	0 … **50** … 99 °C
Valve run time	30 … **60** … 3,600 s
Proportional Band	± 0.5 … **10** … 99 °C
Integral Time	0 … **30** … 1,275 s

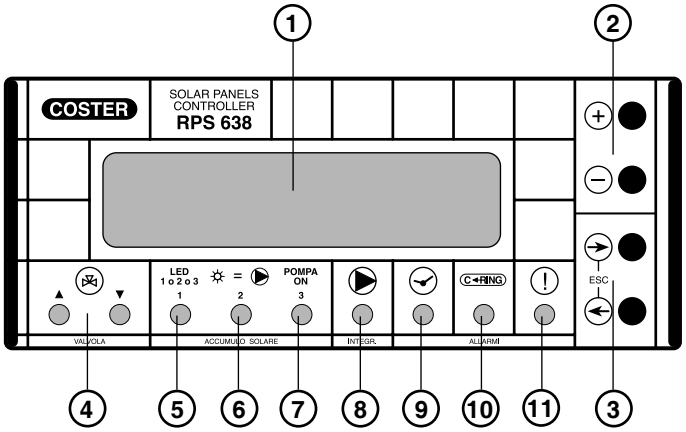
In the presence of electrical disturbances the output controls of the controller may change status but this will automatically return to normal.

5. OVERALL DIMENSIONS



1 – Protective cover for electronic components
2 – Base with transformer, relay and terminal blocks
3 – Screws for securing base and cover
4 – DIN rail securing elements
5 – DIN rail release lever

6. FRONT PANEL



1 – Backlighted alphanumeric display
2 – + and – keys
3 – ← and → keys
LEDs:
4 – Control valve modulating control
5 – Storage tank 1
6 – Storage tank 2
7 – Storage tank 3
8 – Integration circuit
9 – On-Off alarms
10 – Measurement alarms
11 – Controller fault alarm

7. SITING OF CONTROLLER & DETECTORS

7.1 Controller

The controller must be sited in a dry space that meets the relevant ambiental conditions shown under “Technical Data”. If placed in a space classified as “Hazardous” it must be installed in an electrical enclosure constructed according to the regulations in force for the degree of danger involved.
It can be mounted on a DIN rail and housed in a standard DIN enclosure.

7.2 Temperature detector for solar panels B4 or B7

This must be installed on the outlet pipe of the solar panels (upper part) and as near as possible to the panels themselves so that it can measure the temperature of the panels even when the solar circuit pump is idle.

7.3 Temperature detectors for storage tanks B1 – B2 – B3

Must be installed in the storage tank just above (5...10 cm) the internal heat exchanger or on the upper pipework coming from the external heat exchanger

7.4 Integration temperature detector B5

Must be installed in storage tank 1 just above (5…10 cm) the internal integration exchanger or on the upper pipework coming from the external integration exchanger.

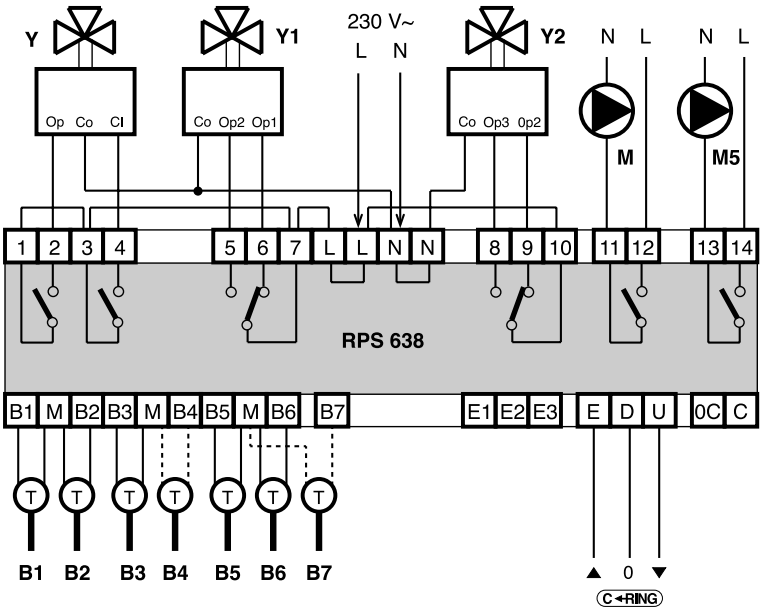
7.5 Temperature detector for DHW distribution B6 (as alternative to minimum temp. solar panels)

Must be installed on DHW distribution on pipe at least 1 metre after mixing valve Y.

7.6 Minimum temperature detector for solar panels B6 (as alternative to DHW distributiontemperature)

This must be installed between the solar panels and the mixing valve Y.

7. WIRING DIAGRAM



B1 – Solar storage tank 1 temp. detector (NTC 10 kΩ; 0...99 °C)
B2 – Solar storage tank 2 temp. detector (NTC 10 kΩ; 0...99 °C)
B3 – Solar storage tank 3 temp. detector (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – DHW integration temp. detector
B6 – Distribution DHW temp. detector
or minimum temp. solar panels
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M – Panels pump
M 5 – Integration pump
Y – Control valve for DHW distribution
or minimum temp. solar panels
Y1 – Changeover valve storage tanks 1 and 2-3
Y2 – Changeover valve storage tanks 2 and 3

9. ELECTRICAL CONNECTIONS

Proceed as follows:
- Separate the base from the cover
- Mount the base on the DIN rail and check that it is firmly anchored by the securing elements (5.4).
- Carry out the wiring according to the diagram and in compliance with the relevant regulations and using:
  – 1.5 mm² cables for power supply and relay control outputs.
  – 1 mm² for the detectors.
  – 1 mm² for C-Bus and for C-Ring. For length limits see data sheets T 021 and T 022.
- Apply power (230 V~) and check its presence across terminals L and N.
- Remove power, replace cover on base/terminal block and secure it with the four screws supplied (5.3).

You are advised not to insert more than two cables in a single terminal of the controller and, if necessary, to use an external junction box.

10. COMMUNICATION

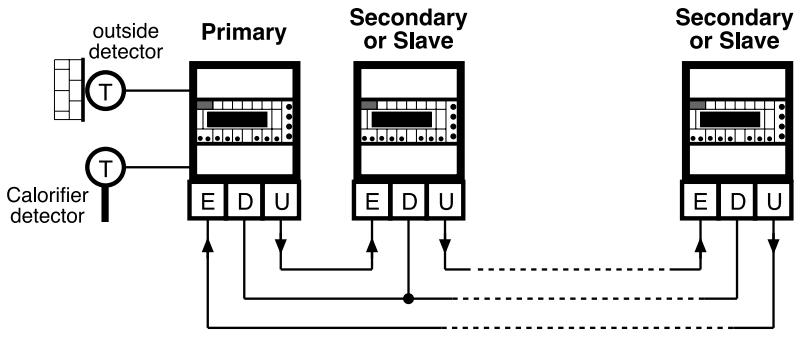
10.1 C-Ring for communication between controllers (for details see data sheet T 022)

21.5
CRing:
NO

RPS 638 controller can be **"Primary"** or **"Secondar**y".
In the C-Ring the following signals are transmitted:
– permission to operate as **Slave** controllers.
– value of **ow temperature** requested by DHW/heating circuit controllers, used by "PRIMARY" controller for temperature regulation of boilers (if scheduled).
– modulating control of valves closure of heating circuits.

NO = *connection to C-Ring not scheduled.*
PRIMARY = *connected to C-Ring and is configured as "Primary".*
SECONDARY = *connected to C-Ring and is configured as "Secondary".*

10.2 C-Ring electrical connections

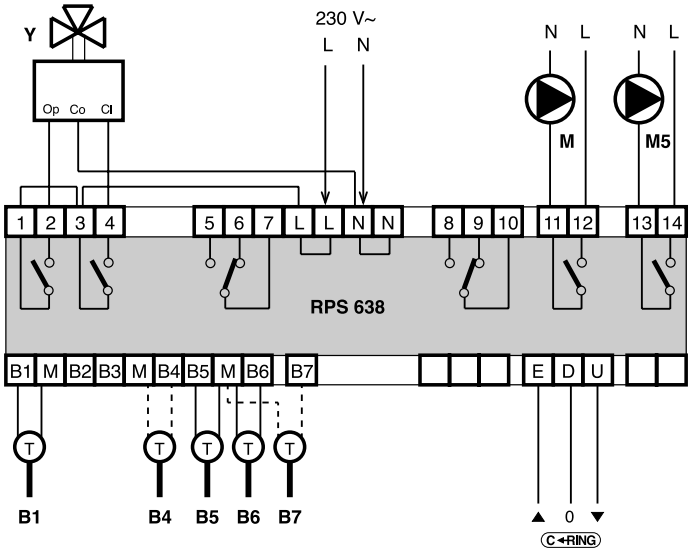


11.1 EXAMPLES OF PLANTS WITH ONE STORAGE TANK

Setting solar plants :

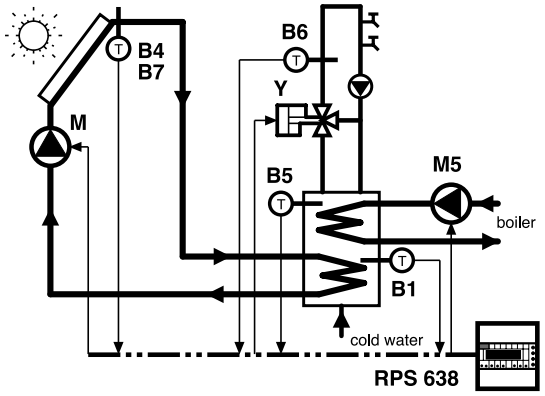
21.1	18.2
Config detectors 1 – – 4 5 6 7	Integration temp Des:50c Act:xxc
20.1	**20.3**
Solar Different On :10c Off: 5c	Integ Diff :05c Priority :NO

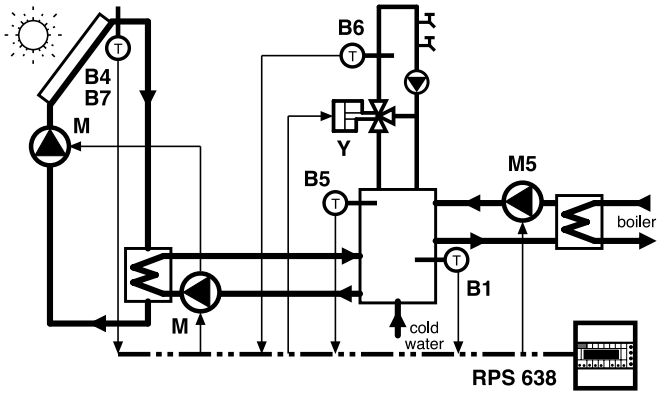
B1 – Storage tank temp. detector (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – Integration temp. detector
B6 – Distribution DHW temp. detector
or minimum temp. solar panels.
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M – Solar circuit pump
M5 – Integration circuit pump
Y – DHW distribution control valve
or minimum temp. solar panels
ΔOn – Solar plant switching on differential
ΔOff – Solar plant switching off differential



Thermal exchange between solar panels and storage tank:
• Pump M: On (11–12 closed) with B4 – B1 ≥ ΔOn
Off (11–12 open) with : B4 – B1 ≤ ΔOff

Plants with modulating control of DHW distribution temperature

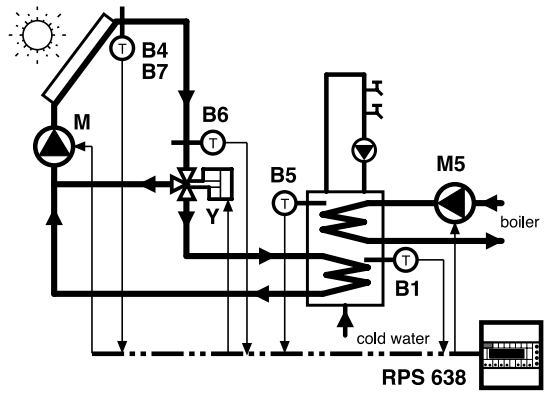


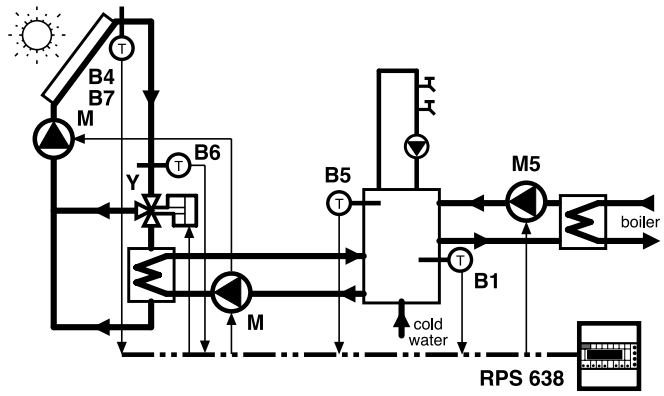


Setting temperature control distribution of DHW :

21.2	18.4	20.4	20.5	20.6
Control Y: DHW	T DHW Des:50c Act:50c	DHW Run time : 60s	DHW Proport Band:20c	DHW Integral T 30s

Plants with modulating control of minimum temperature solar panels





Setting control minimum temperature solar panels :

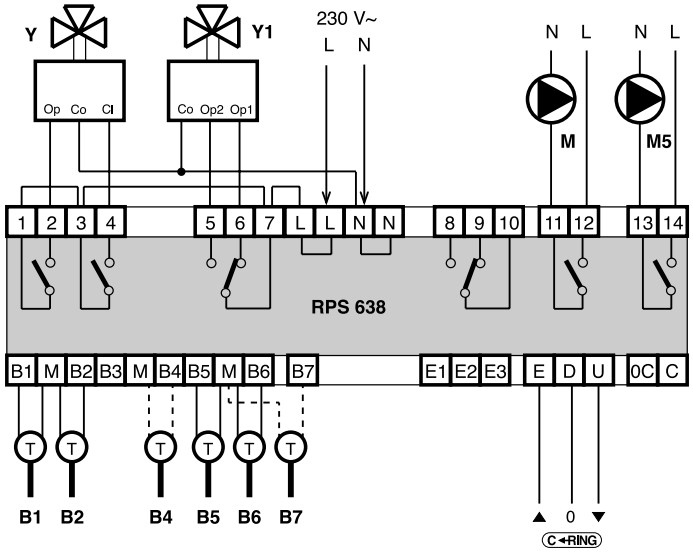
21.2	19.4	20.4	20.5	20.6
Control Y: SOLAR PANELS	T Solar panels Des:60c Act:50c	Solar panels Run Time :120s	Solar panels Propor.Band : 5c	DHW Integral T. 600s

11.2 EXAMPLES OF PLANTS WITH TWO STORAGE TANKS & ONE DIVERTING VALVE

Setting solar plant:

21.1	18.5	18.2
Config detectors 1 2 – 4 5 6 7	Storage 1 T :xxc Des Switch T:60c	Integration temp Des:50c Act:xxc
20.1	**20.2**	**20.3**
Solar Different. On :10c Off: 5c	Switch Different Storage 1 : 5c	Integ Diff :05c Priority :NO

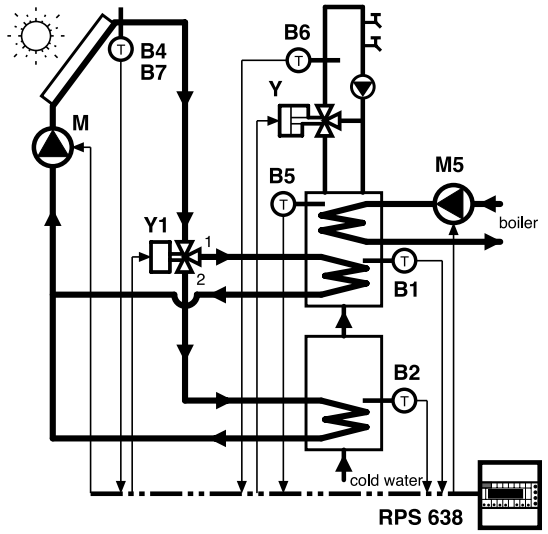
B 1-2 – Storage tanks temp. detectors (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – DHW integration temp. detector
B6 – Distribution DHW temp. detector
or minimum temp. solar panels.
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M – Solar circuit pump
M5 – Integration circuit pump
Y – DHW distribution control valve
or minimum temp. solar panels
Y1 – Valve for switching storage tanks 1 and 2
ΔOn – Solar plant switching on differential
ΔOff – Solar plant switching off differential
Tex – Storage tank 1 exchange temperature
ΔTex – Storage tank 1 exchange differential

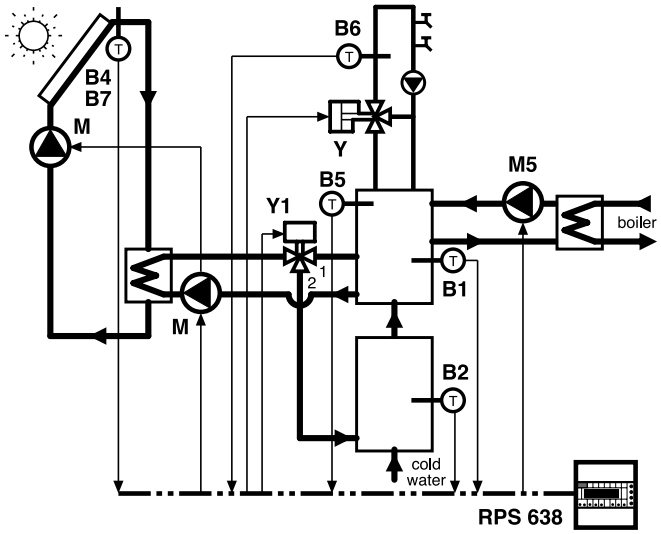


Thermal exchange between solar panels and storage tanks:

- Pump M : On (11-12 closed) with : $B4 - B1 \geq \Delta On$ or $B4 - B2 \geq \Delta On$
  Off (11-12 open) with : $B4 - B1 \leq \Delta Off$ and $B4 - B2 \leq \Delta Off$
- Valve Y1 : Opens storage tank 1 (7-6 closed ; 7-5 open) Off : $B4 - B1 \geq \Delta On$ and $B1 \leq Tex - \Delta Tex$
  or
  $B4 - B1 \geq \Delta Off$ and $B4 - B2 \leq \Delta Off$
  Opens storage tanks 2 (7-6 open ; 7-5 closed) with: $B4 - B1 \leq \Delta Off$ or $B1 \geq Tex$

Plants with modulating control of DHW distribution temperature

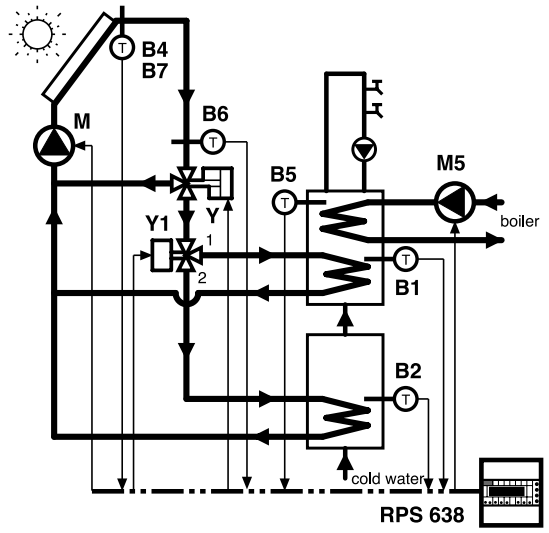


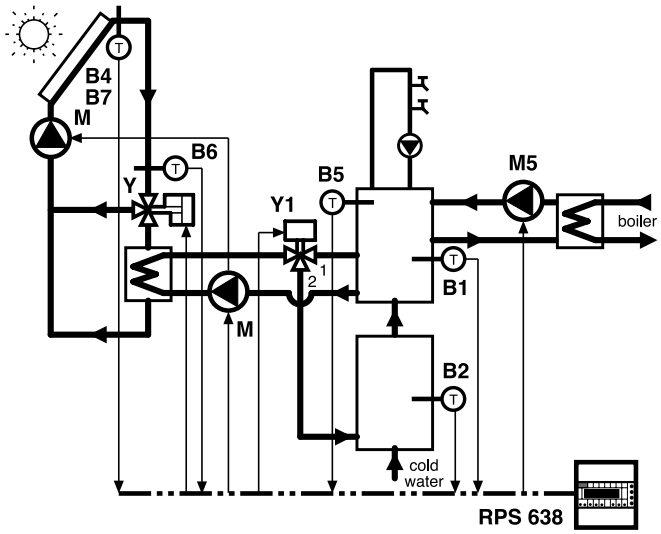


Setting control DHW distribution temperature:

21.2	18.4	20.4	20.5	20.6
Control Y: DHW	T DHW Des:50c Act:50c	DHW Run time : 60s	DHW Proport Band :20	DHW Integral T 30s

Plants with modulating control of minimum temperature solar panels

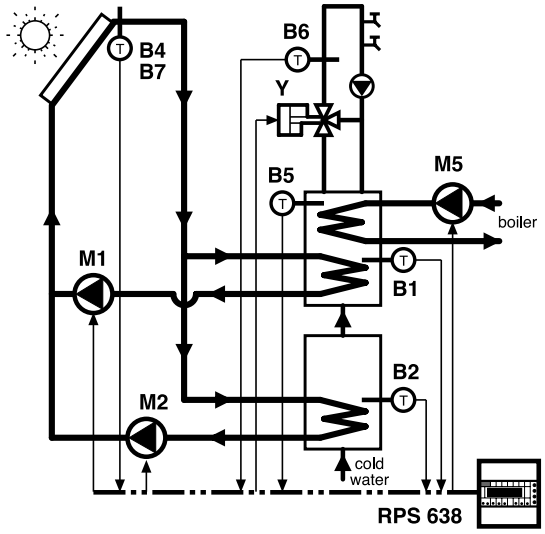


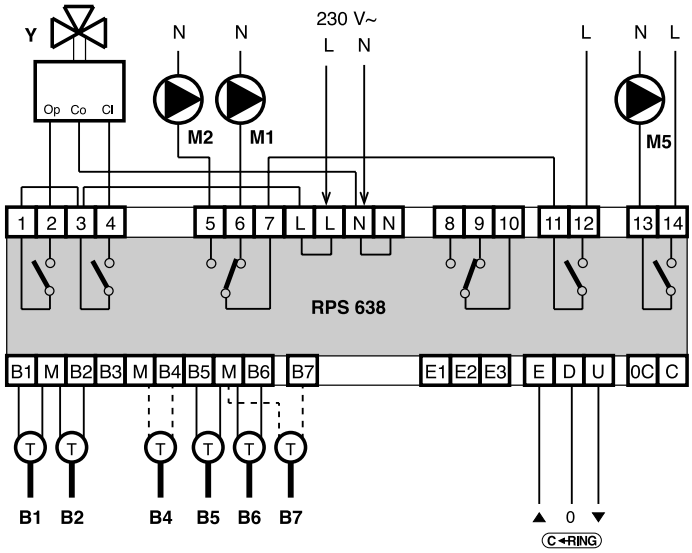


Setting control minimum temperature solar panels:

21.2	18.4	20.4	20.5	20.6
Control Y: SOLAR PANELS	T Solar panels Des:60c Act:50c	Solar panels Run time :120s	Solar panels Proport Band: 5c	Solar panels Integral T 600s

11.3 EXAMPLES OF PLANTS WITH TWO STORAGE TANKS & TWO PUMPS





B 1-2 – Storage tanks temp. detectors (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – DHW integration temp. detector
B6 – DHW distribution temp. detector
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M1 – Storage tank 1 pump
M2 – Storage tank 2 pump
M5 – Integration circuit pump
Y – DHW temperature control valve
ΔOn – Solar plant switching on differential
ΔOff – Solar plant switching off differential
Tex – Storage tank 1 exchange temperature
ΔTex – Storage tank 1 exchange differential

Setting solar plant :

21.1	18.5	18.2
Config Detectors 1 2 – 4 5 6 7	Storage 1 T :xxc Des switch T:60c	Integration temp Des:50c Act:xxc

20.1	20.2	20.3
Solar Different On :10c Off: 5c	Switch Different Storage 1 : 5c	Integ Diff : 5c Priority :NO

Thermal exchange between solar panels and storage tanks:
• Pump M1On and M2 Off (11–12 closed; 7-6 closed; 7-5 open)) with : B4 – B1 ≥ ΔOn and B1 ≤ Tex – ΔTex
or
B4 – B1 ≥ ΔOff and B4 – B2 ≤ ΔOff
• Pump M1Off and M2 On (11-12 closed; 7-6 open; 7-5 closed) with : B4 – B1 ≤ ΔOff or B1 ≥ Tex
• Pump M1 and M2 Off (11-12 On) with : B4 – B1 ≤ ΔOff and B4 – B2 ≤ ΔOff

Setting control temperature DHW distribution:

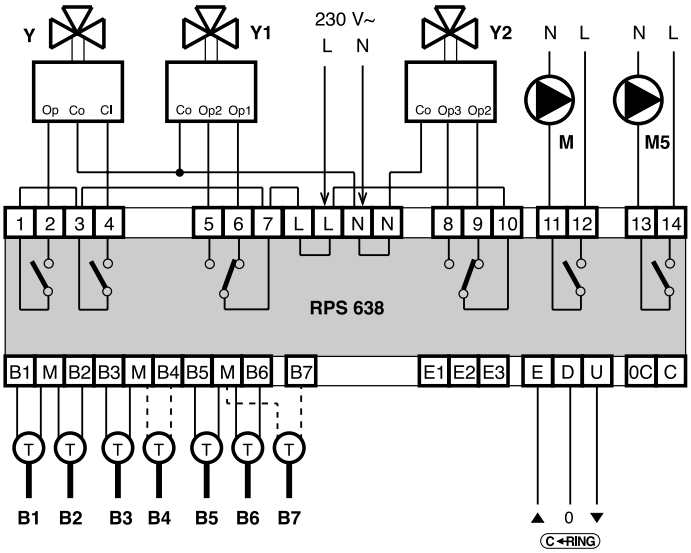
21.2	18.4	20.4	20.5	20.6
Control Y: DHW	T DHW Des:50c Act:50c	DHW Run time : 60s	DHW Proport Band:20c	DHW Integral T 30s

11.4 EXAMPLES OF PLANTS WITH THREE STORAGE TANKS AND THREE PUMPS

Setting solar plant:

21.1	18.5	18.2
Config detectors 1 2 3 4 5 6 7	Storage 1 T :xxc Des switch T:60c	Integration temp Des:50c Act:xxc
20.1	**20.2**	**20.3**
Solar Different On :10c Off: 5c	Switch Different Storage 1 : 5c	Integ Diff : 5c Priority :NO

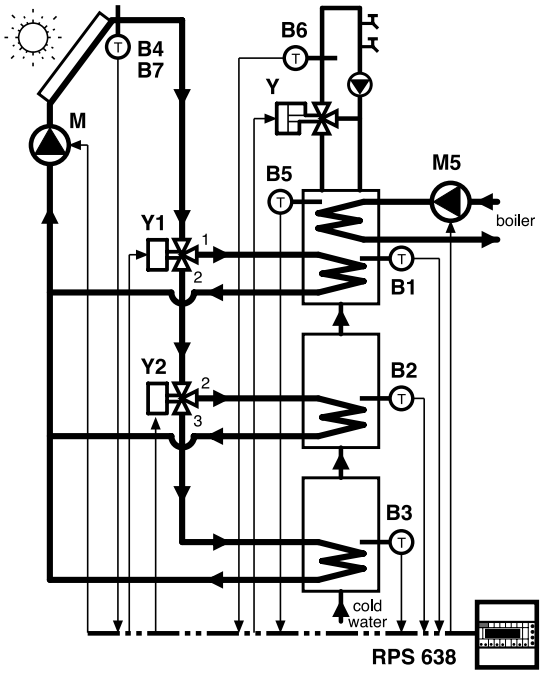
B 1-2-3 – Storage tanks temp. detector (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – DHW integration temp. detector
B6 – Distribution DHW temp. detector
or minimum temp. solar panels.
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M – Solar circuit pump
M5 – Integration circuit pump
Y – DHW distribution control valve
or minimum temp. solar panels
Y1 – Valve for switching storage tanks 1 and 2
Y2 – Valve for switching storage tanks 2 and 3
ΔOn – Solar plant switching on differential
ΔOff – Solar plant switching off differential
Tex – Storage tank 1 exchange temperature
ΔTex – Storage tank 1 exchange differential

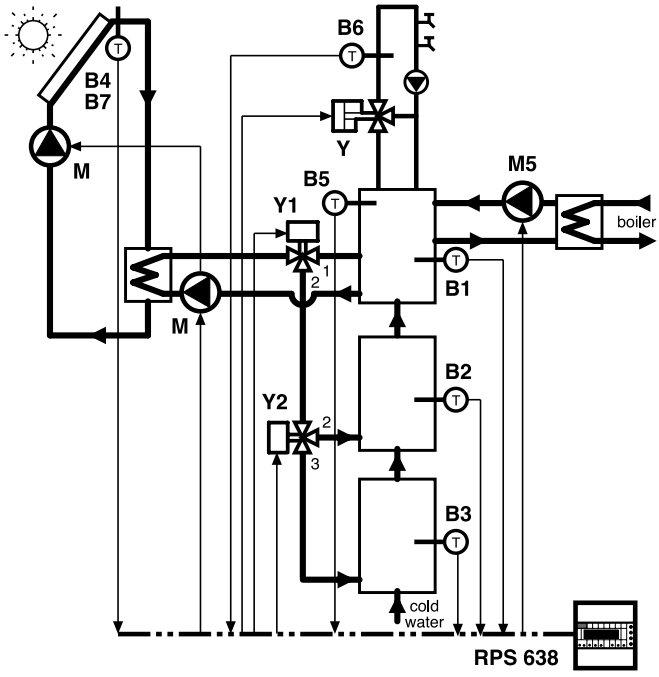


Thermal exchange between solar panels and storage tanks:

- Pump M : On (11-12 closed)with : B4 – B1 ≥ ΔOn or B4 – B2 ≥ ΔOn or B4 – B3 ≥ ΔOn
  Off (11-12 open) with : B4 – B1 ≤ ΔOff and B4 – B2 ≤ ΔOff and B4 – B3 ≤ ΔOff
- Valve Y1 : Opens storage tank 1 (7-6 closed ; 7-5 open) with : B4 – B1 ≥ ΔOn and B1 ≤ Tex – ΔTsc
  or
  B4 – B1 ≥ ΔOff and B4 – B2 ≤ ΔOff and B4 – B3 ≤ ΔOff
  Opens storage tanks 2 and 3 (7-6 open ; 7-5 closed) with : B4 – B1 ≤ ΔOff or B1 ≥ Tex
- Valve Y2 : Opens storage tank 2 (10-9 closed ; 10-8 open)with : B4 – B2 ≥ ΔOn
  Opens storage tank 3 (10-9 open ; 10-8 closed) with : B4 – B3 ΔOn and B4 – B2 ≤ ΔOff

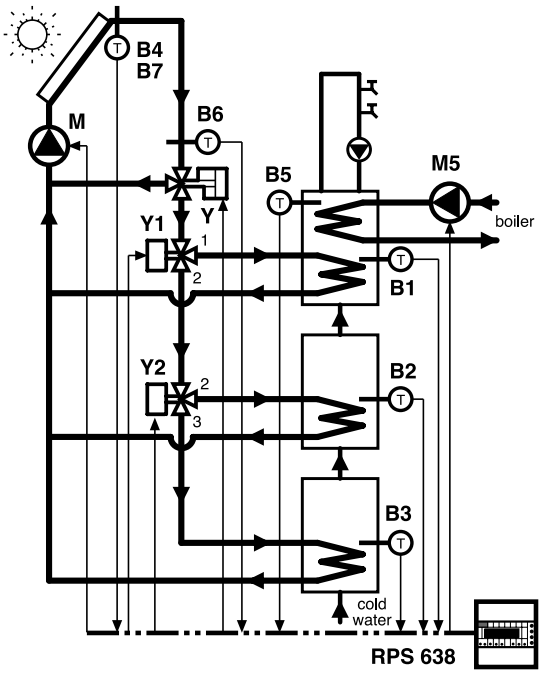
Plants with modulating control of DHW distribution temperature

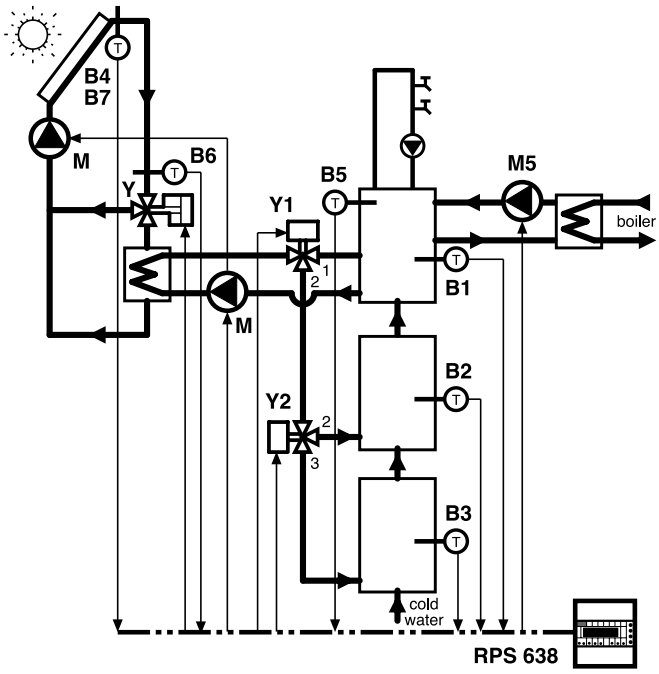




21.2	18.4	20.4	20.5	20.6
Control Y: DHW	T DHW Des:50c Act:50c	DHW Run time : 60s	DHW Proport Band:20c	DHW Integral T 30s

Plants with modulating control of minimum temperature solar panels





Setting control minimum temperature solar panels:

21.2
Control Y:
SOLAR PA NELS

18.4
T Solar panels
Des:60c Act:50c

20.4
Solar panels
Run time :120s

20.5
Solar panels
Proport Band :5c

20.6
Solar panels
Integral T 600s

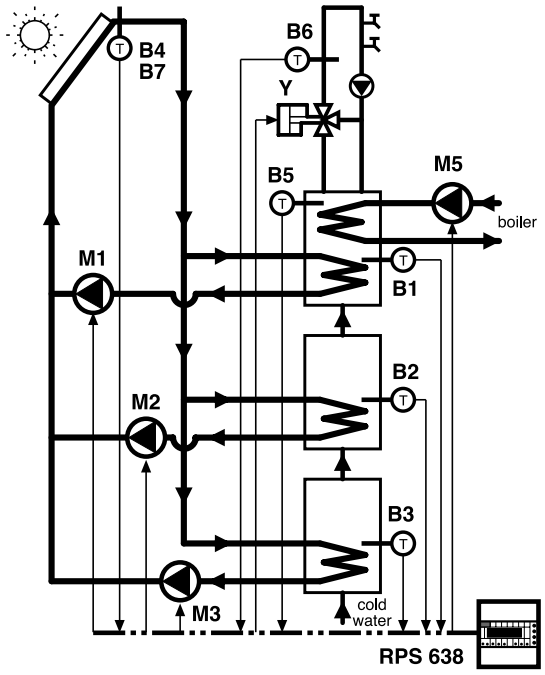
11.5 EXAMPLES OF PLANTS WITH THREE STORAGE TANKS AND THREE PUMPS

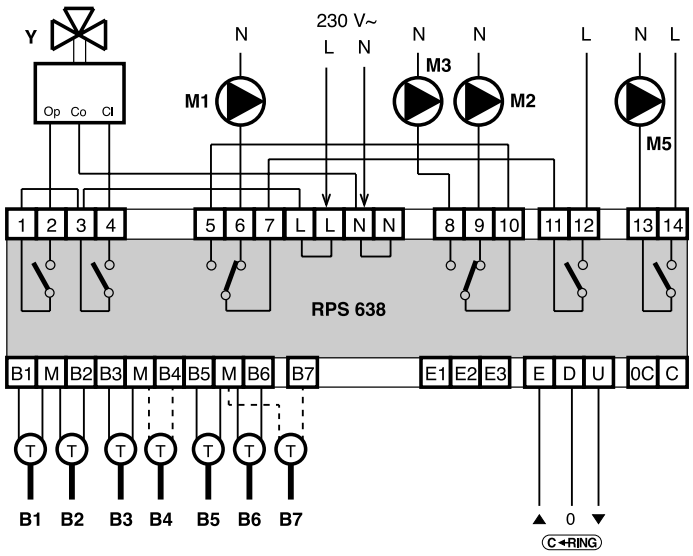
Setting solar plant:

21.1	18.5	18.2
Config detectors 1 2 3 4 5 6 7	Storage 1 T :xxc Des switch T:60c	Integration temp Des:50c Act:xxc
20.1	**20.2**	**20.3**
Solar Different On :10c Off: 5c	Switch Different Storage 1 : 5c	Integ Diff : 5c Priority : NO

B 1-2-3 – Storage tanks temp. detector (NTC 10 kΩ; 0...99 °C)
B4 – Solar panels temp. detector (NTC 10 kΩ; 0...99 °C)
As alternative to B7
B5 – DHW integration temp. detector
B6 – Distribution DHW temp. detector
B7 – Solar panel temp. detector (Pt 1kΩ; 0...200 °C)
As alternative to B4
M1 – Storage tank 1 pump
M2 – Storage tank 2 pump
M3 – Storage tank 3 pump
M5 – Integration circuit pump
Y – DHW temperature control valve
ΔOn – Solar plant switching on differential
ΔOff – Solar plant switching off differential
Tex – Storage tank 1 exchange temperature
ΔTex – Storage tank 1 exchange differential

Thermal exchange between solar panels and storage tanks:
• Pumps M1 On, M2 and M3 Off (11-12 closed; 7-6 closed) with : $B4 - B1 \geq \Delta On$ and $B1 \leq Tex - \Delta Tex$
or
$B4 - B1 \geq \Delta Off$ and $B4 - B2 \leq \Delta Off$ and $B4 - B3 \leq \Delta Off$
• Pumps M2 On, M1 and M3 Off (11-12 closed; 7-5 closed; 10-9 closed) with : $B4 - B2 \geq \Delta On$ and $B4 - B1 \leq \Delta Off$
or
$B4 - B2 \geq \Delta On$ and $B1 \geq Tex$
• Pumps M3 On, M1 and M2 Off (1-12 closed; 7-5 closed; 10-8 closed) with : $B4 - B3 \geq \Delta On$ and $B4 - B2 \leq \Delta Off$
• Pumps M1, M2 and M3 Off (11-12 open) with : $B4 - B1 \leq \Delta Off$ and $B4 - B2 \leq \Delta Off$ and $B4 - B3 \leq \Delta Off$





Setting control temperature distribution DHW:

21.2	18.4	20.4	20.5	20.6
Control Y: DHW	T DHW Des:50c Act:50c	DHW Run time : 60s	DHW Proport Band:20c	DHW Integral T 30s

12. OPERATION

RPS 638 is a microprocessor-based digital controller for:
- Control of thermal exchange panels-storage tanks with On-Off control of solar circuit pump and automatic switching of three (max.) storage tanks by control of diverting valves.
- Control at fixed point of integration temperature with On-Off control.
- Control of temperature at fixed point with three-wire modulating control (e.g. minimum temp. solar panels, DHW distribution temperature).

It is essential to configure the controller according to the detectors connected.

21.1
```
Config detectors
1 – – 4 – – –
```

12.1 On-Off control of thermal exchange between solar panels and storage tanks

With three storage tanks (detectors B4, B1, B2 and B3)
The controller compares the difference between the panels temperature B4 and the temperatures of storage tank B1, storage tank B2 and storage tank B3, with the differentials Solar ΔOn and ΔOff :

20.1
```
Solar Diffent
On :10c  Off: 5c
```
18.5
```
Storage 1 T :xxc
Des switch T:60c
```
20.2
```
Switch Different
Storage  1  : 5c
```

- Pump M :
  switches on when : B4 – B1 ≥ ΔOn or B4 – B2 ≥ ΔOn or B4 – B3 ≥ ΔOn
  switches off when : B4 – B1 ≤ ΔOff and B4 – B2 ≤ ΔOff and B4 – B3 ≤ ΔOff
- Valve Y1 :
  opens Storage 1 when : B4 – B1 ≥ ΔOn and B1 ≤ Tex – ΔTex
  or
  B4 – B1 ≥ ΔOff and B4 – B2 ≤ ΔOff and B4 – B3 ≤ ΔOff
  opens Storage 2 and 3 when : B4 – B1 ≤ ΔOff or B1 ≥ Tex
- Valve Y2 :
  opens Storage 2 when : B4 – B2 ≥ ΔOn
  opens Storge 3 when : B4 – B3 ≥ ΔOn and B4 – B2 ≤ ΔOff

With two storage tanks (detectors B4, B1 and B2)
The controller compares the difference between the panels temperature B4 and the temperatures of storage tank B1and storage tank B2 with the differentials Solar ΔOn and ΔOff :

- Pump M :
  switches on when : B4 – B1 ≥ ΔOn or B4 – B2 ≥ ΔOn
  switches off when : B4 – B1 ≤ ΔOff and B4 – B2 ≤ ΔOff
- Valve Y1 :
  opens Storage 1 when : B4 – B1 ≥ ΔOn and B1 ≤ Tex – ΔTex
  or
  B4 – B1 ≥ ΔOff and B4 – B2 ≤ ΔOff
  opens Storage 2 when : B4 – B1 ≤ ΔOff or B1 ≥ Tex

With one storage tank (detectors B4 and B1)
The controller compares the difference between the panels B4 temperature and the storage tank B1 temperature with the differentials Solar ΔOn e ΔOff :

- Pump M :
  switches on when : B4 – B1 ≥ ΔOn and B1 ≤ Tex – ΔTex
  switches off when : B4 – B1 ≤ ΔOff or B1 ≥ Tex

Legend :
- **B1** = storage tank 1 temperature
- **B2** = storage tank 2 temperature
- **B3** = storage tank 3 temperature
- **B4** = solar panels temperature
- **ΔOn** = solar On differential
- **ΔOff** = solar Off differential
- **Tex** = storage tank 1 exchange temperature
- **ΔTex** = storage tank 1 exchange temp. differential

The plants with two or three storage tanks can be constructed without diverting valves, and using a circulation pump for each tank (see EXAMPLES PLANTS 11.3 and 11.5)

12.2 On-Off control integration circuit (detector B5)

It is possible to program the operation of the integration circuit according to the consumer requirements:

18.3
```
Integration :ON
24 HOUR      1
```

- 7 DAY 1-2 = timed operation with 7 day program 1 or 2.
- 24 HOUR 1…7 = timed operation with one of seven 24 hour programs.
- ALWAYS ON = continuous operation with desired temperature.
- ALWAYS OFF = always off.

The current operating mode (-On - Off) depends on the program set.

18.2
```
Integration temp
Des:50c  Act:50c
```

The controller compares the desired integration temperature with the value measured by detector B5 according to the differential set:

20.3
```
Integ Diff : 5c
Priority   : NO
```

- When B5 ≤ Ti – Δ :
  – Pump M5 = On ;
- When B5 ≥ Ti :
  – Pump M5 = Off ;

When RPS 638 is connected in C-Ring with other controllers, the Priority function is enabled and the pump M5 is switched on, sends in C-Ring the differential between the desired and actual integration temperature (B5). The controllers in C-Ring, with the Anticondensing function enabled, reduce their own desired ow temperature by 4°C for each C° of differential in order to give precedence to the RPS 638 integration circuit.

12.3 Three-wire modulating control (detector B6)

21.2
```
Control      Y:
SOLAR PANELS
```
```
Control Y:
DHW
```
```
Control   Y:
 ______________
```

This can be used for:

- Control of minimum temperature of the solar panels so as to exploit better the thermal exchange with the storage tanks (valve Y and detector B6 installed on the panels circuit).

or

- Control of temperature of DHW distribution (valve Y and detector B6 installed on the DHW distribution circuit).

or

- Control of the temperature of a generic plant not in relation to the solar panels installation.

The controller compares the value measured by detector B6 with desired temp. and produces the command Y according to the difference measured

17.4
```
T. DHW
Des:50c  Act:50c
```

and the PI parameters set:

19.4
```
DHW
Run time   : 60s
```
19.5
```
DHW
Proport Band:10c
```
19.6
```
DHW
Integral T : 30s
```

12.4 Antibacteria function

Prevents the formation of bacterial colonies in the DHW circuit by bringing the Integration circuit to a high temperature for a certain period of time.

19.8
```
Antibacteria
Temp:70c for090m
```

– NO : function not enabled.
– STORAGE ONLY : function enabled only for storage tank; DHW control continues to maintain the distribution circuit at low temperature.
– STORAGE + DISTRIB. : function enabled both for storage tank and for distribution circuit: the DHW control valve is completely opened.

20.7
```
Antibacteria
NO
```

The function is enabled at the time and on the days of the week (1 or 2) set

19.9
```
Antibacteria
02.00  MONandTHU
```

13. PROGRAMS & PERIODS WITH DATES

*The timed programs can be used only for control of the **integration circuit.***

13.1 24 hour programs

19.1
```
How many 24hour
programs ?  1
```

Set the number of 24 hour programs (1… 7) you wish to use in order to eliminate unnecessary display pages.

19.2
```
P1 Event 1  6.00
ON
```
⇓
19.7
```
P1 Event 6 22.00
OFF
```

In each 24 hour programs you can set a maximum of six event start times (**Ev1…Ev6**) assigning to each one of the following modes:

18.2
```
Integration temp
Des:50c
```

– ON : control with desired integration temperature set in
– OFF : plant off

The times of each start event must be entered in increasing order.
Unused times must be excluded by pressing + and – keys at the same time.
You must not leave unused times(– – –) between programmed times.

13.2 7day programs

19.8
```
How many 7day
programs ?  1
```

Set the number of 7 day programs (0…2) to be used so as to eliminate unused display pages.

19.9
```
7day 1:MONDAY
24 HOUR      1
```
⇓
19.15
```
7day 1:SUNDAY
DAILY        1
```

In each 7day program you can assign to each day of the week one of the programs:

– 24 HOUR 1 …7; – ON ; – OFF.

13.3 British Summer Time (BST)

19.16
```
BST          AUT
Fr:xx.xxto:xx.xx
```

The controller changes the time automatically according to BST period.

- BST : – MAN = Changes the time at the dates set.
  – AUT = Changes the time automatically:
  - at 02.00 on the last Sunday in March the clock is put forward an hour;
  - at 02.00 on the last Sunday in October the clock is put back an hour.
- Fr - - . - - to - - . - - = day and month of start and end of BST (only if MAN).

To cancel the period keep pressed + and – keys at the same time.

14. COMPLEMENTARY FUNCTIONS

14.1 Access key number

21.4

```
Choice keynumber
      ----
```

Choice and enabling of access key number which prevents the use of + and – keys and consequently any modification of the data. Enter the number (1900…1999) using + and – keys.
To cancel the key number press + and – at the same time until the dashes re-appear.

```
Access keynumber
      ----
```

When the key number is enabled, if you press + or – keys there will appear on the display the request to enter the key number.
Only after having entered the correct number is it possible to use the + and – keys.
If for 15 minutes no key is pressed the key number is automatically re-enabled.

14.2 Name of plant site

21.5

```
Site Name
   ----------
```

Entering name of plant site. This appears on first page of display.
Each dash can be replaced, using + and – keys, by a letter of the alphabet (A … Z) or by a number (0…9). The → keys serves to position the cursor

14.3 Display of measurements

The controller displays all the measurements monitored by the detectors and the data which serves to understand the operational status of the plant:

18.7

```
Panels
Temperature :xxc
```

- *Solar panels* temperature measured by detector **B4**.

18.5

```
Storage  1 T:xxc
Des switch T:60c
```

- *Actual* temperature measured by detector **B1**.
- *Desired storage tank 1 exchange* temperature.

18.2

```
Integration temp
Des:50c  Act:xxc
```

- Desired *integration* temperature.
- *Actual* temperature measured by detector **B5**.

18.4

```
T DHW
Des:50c  Act:xxc
```

- *DHW or solar panels* or ---------- *desired* temperature.
- *Actual* temperature measured by detector **B6**.

18.6

```
Storage 2 T: xxc
Storage 3 T: xxc
```

- *Actual storage tanks* temperature measured by detectors **B2** and **B3**.

15. ALARMS

The controller is able to signal certain operating faults by means of three LEDs situated on the facia:

– fault internal real time clock (led 6.8)
– fault in C-Ring (led 6.9)
– fault in microprocessor (led 6.10)

16. TESTING AT COMMISSIONING

Testing to be carried out when installation has been completed and electric wiring and configuration carried out and tested.

16.1 Testing C-Ring

The C-Ring testing page appears only if it is configured in

21.5

CRing: PRIMARY

CRing: SECONDARY

Ensure that all the other controllers connected in C-Ring are:

22.1

CRing:??

– correctly powered at mains voltage (230 V~).

– Slave controllers or configured as SECONDARIES in CRing: SECONDARY

– selected on testing page CRing:??

The PRIMARY controller sends via C-Ring a signal every10 seconds. On all the displays appears "??". If the connection if satisfactory the word "YES" replaces "??" on all the displays. If on one or more displays "YES" does not appear this means that there is a break in the connection between the last controller with "YES" and the first with "??".
Examples of testing a C-Ring with four controllers:
– Cont.1 "YES" – Cont.2 "YES" – Cont.3 "YES" – Cont.4 "YES" : *Connection OK*
– Cont.1 "??" – Cont.2 "YES" – Cont.3 "YES" – Cont.4 "YES" : *Break between 4 &1*
– Cont.1 "??" – Cont.2 "YES" – Cont.3 "??" – Cont.4 "??" : *Break between 2 &3*
– Cont.1 "??" – Cont.2 "??" – Cont.3 "??" – Cont.4 "??" : *Break between 1 &2*

16.2 Testing outputs

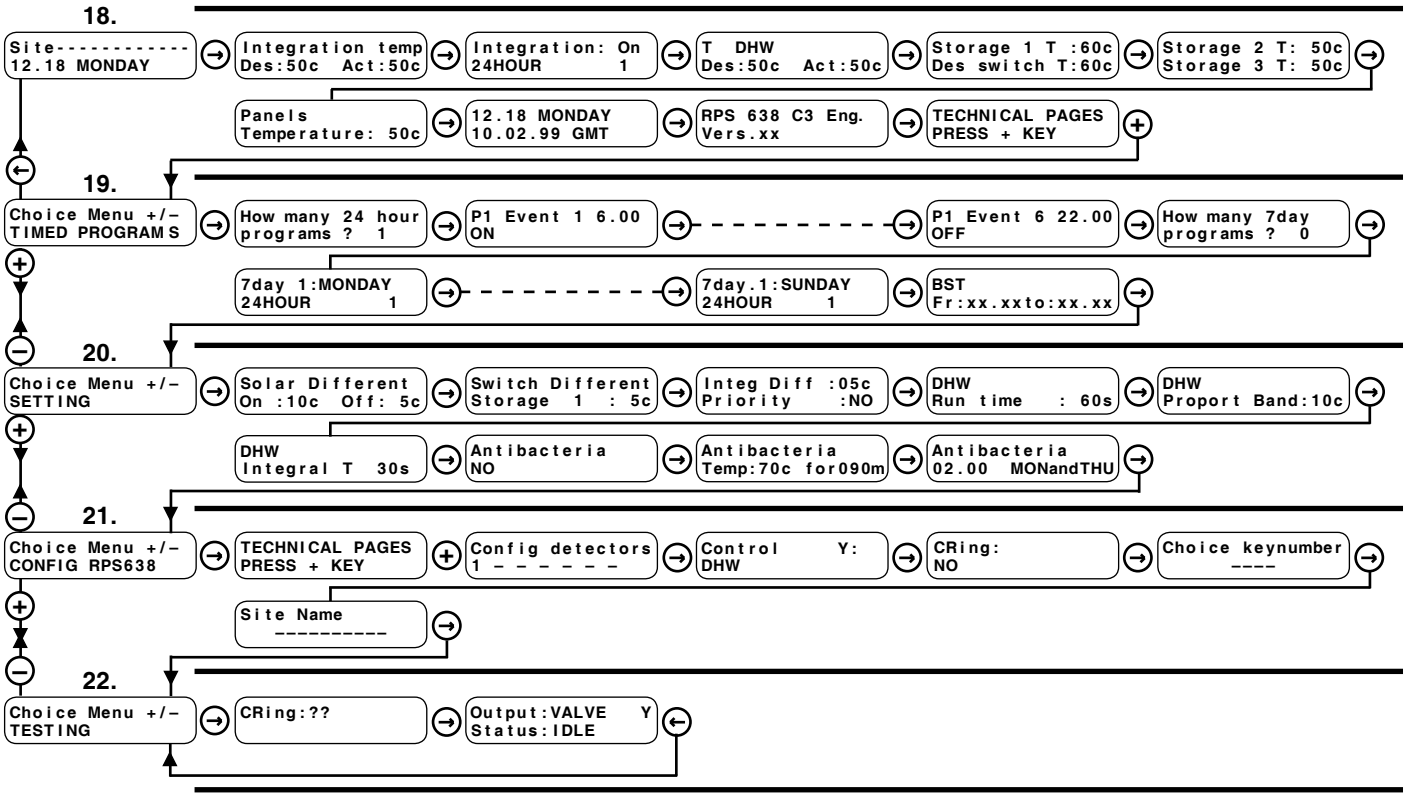
22.2

Output:VALVE Y
Status:CLOSED

Using + and – keys choose:
• output to be tested:
– VALVE Y ;
– INTEGRAT. ;
– STORAGES ;
•status :
– with VALVE : IDLE ;
CLOSES;
OPENS
– with INTEGRAT. : ON = switch 13-14 closed;
OFF = switch 13-14 open.
– with STORAGES: ON 1 = switch : 11-12 closed, 7-6 closed, 10-9 closed.
ON 2 = switch : 11-12 closed, 7-5 closed, 10-9 closed.
ON 3 = switch : 11-12 closed, 7-5 closed, 10-8 closed.
OFF = switch : 11-12 closed, 7-6 closed, 10-9 closed.

Check the result.

17. SEQUENCE OF DISPLAY PAGES (data and functions are those in memory at time of delivery)



⊖ ⊕ Keys for scrolling the display pages and positioning the cursor □ on adjustable data on the pages.

The adjustable data, in the following descriptive list of display pages, are highlighted thus

By pressing these keys at the same time, or in any event after 15 minutes, the first page appears

```
Site------------
12.18 MONDAY
```

⊖ ⊕ Keys for : - adjusting the values indicated by the cursor □

– seeing the possibility of configuring a function, e.g.

```
Control Y:
DHW
```

or

```
Control Y:
Solar Panels
```

– passing directly from one menu (series of pages) to another.

18. NORMAL USE

Ref.	Display	Description	Notes	Sect.
18.1	Site---------- 12.18 MONDAY	Name plant site Current time and day	Set in **21.10**	.
18.2	Integration temp Des:50c Act:50c	Integration temperature desired by storage tank 1 in ON period	Appears only if in **21.1** B5 configured	12.2
18.3	Integration: ON 24 HOUR 1	Integration circuit current mode. Choice programme of integration plant: 7DAY 1-2 ; 24HOUR 1…7 ; ALWAYS ON; ALWAYS OFF.	Appears only if in **21.1** B5 configured – On; – Off: depends on program – Antib. :Antibacteria function running	12.2
18.4	T DHW Des:50c Act:50c	Desired DHW distribution temperature	Appears only if in **21.1** B6 configured If **21.2** is CONTROL Y: DHW	12.3
	T Solar Panels Des:50c Act:50c	Desired solar panels temperature	If **21.2** is CONTROL Y: SOLAR PANELS	
	T ---------- Des:50c Act:50c	Desired temperature – – – – – – – – – –	If **21.2** is CONTROL Y: – – – – – – – – – –	
18.5	Storage 1 T:60c Des.switch T:60c	When B1 exceeds the exchange value it switches the solar to storage tank 2.	Appears only if in **21.1** B2 is configured. Appears if in **21.1** B2 is not configured.	12.1
	Storage 1 T:60c			
18.6	Storage 2 T:50c Storage 3 T:50c	Temp. storage tanks 2 & 3 measured by B2 & B3.	2: appears only if in**21.1** B2 configured. 3: appears only if in **21.1** B3 configured.	14.3
18.7	Panels Temperature :50c	Temp. solar panels measured by B4.	.	14.3
18.8	12.18 MONDAY 10.02.99 GMT	Setting : Time, day of week and date Current time period: GMT or BST	According dates BST set in **19.16**	
18.9	RPS 638 C3 Eng. Vers.xx	Identitying data of controller		

19. TIMED PROGRAMS

Ref.	Display	Description	Notes	Sect.
19.1	How many 24 hour programs ? 1	Choice of number of 24 hour (1…7) and 7 day programs to use	Cancel unused display pages.	13.1
19.2 ⇓ ⇓ 19.7	P1 Event 1 6.00 ON P1 Event 6 22.00 OFF	Number of prog., number of event & start time of period programmed. Choice of mode to assign to period: ON ; OFF **Further pages according figure in 19.1**	Max. 6 periods. To cancel an unused period press + and – together **- - . - -** will appear Times must be in increasing order.. Do not leave - - . - - between program times. Times set are winter ones.	13.1
19.8	How many 7 day programs ? 0	Choice of number of 24 hour (1…7) and 7 day (0…2) programs to be used.	Cancel unused display pages.	13.2
19.9 ⇓ ⇓ 19.15	7day 1:MONDAY 24HOUR 1 7 Day 1:SUNDAY 24HOUR 1	Choice program for each day of week: 24 HOUR 1…7 ; ON ; OFF. **Further 7 pages if in 19.8 is 2**	Appears only if in **19.8** number > 0.	13.2
19.16	BST Fr:26.03to:28.10	Dates of start and end of BST.		13.3

20. SETTING

Ref.	Display	Description	Notes	Sect.
20.1	Solar Different On :10c Off: 5c	Differential between temp. panels B4 & any of temperatures of storage tanks B1, B2, B3 for: – Switching on solar circuit pump – Switching storage tanks.		12.1
20.2	Switch Different Storage 1 : 5c	Differential exchange temp. storage tank 1.	Appears only if in **21.1** B2 configured.	12.1
20.3	Integ Diff : 5c Priority : NO	Temp. differential for control integration DHW. Priority: : – YES ; – NO.	Appears only if in **21.1** B5 configured.	12.2
20.4	DHW Run time : 60s	Mode: DHW or solar panels or ---------- Actuator run time in seconds.	Appears only if in **21.1** B6 configured. DHW if in **21.2** is DHW Solar panels if **21.2** is SOLAR PANELS ---------- se **21.2** è ----------	12.3
20.5	DHW Proport Band:10c	Mode: DHW or solar panels or ---------- Proportional Band	Appears only if in **21.1** B6 configured.. DHW if in **21.2** is DHW Solar panels if **21.2** is SOLAR PANELS ---------- if **21.2** is ----------	12.3

20. SETTING

Ref.	Display	Description	Notes	Sect.
20.6	**DHW** **Integral T 30s**	Mode: DHW or solar panels or ---------- Integral Time	Appears only if in **21.1** B6 configured.. DHW if in **21.2** is DHW Solar panels if **21.2** is SOLAR PANELS ---------- if **21.2** is ----------	**12.3**
20.7	**Antibacteria** **NO**	Choice use Antibacteria function:NO ; ONLY STORAGE; STORAGE + DISTRIB.	Appears only if in **21.1** B5 configured.. STORAG + DISTRIB.: appears only if **21.2** is SOLAR PANELS	**12.4**
20.8	**Antibacteria** **Temp:70c for090m**	Temp. & duration of Antibacteria function.	Does not appear **20.7** is NO.	**12.4**
20.9	**Antibacteria** **02.00 MONandTHU**	Time & days of week (1 or 2) Antibacteria function operates:– MON; – TUE; – WED; – THU; – FRI; – SAT; – SUN; - - - ;	Does not appear if **20.7** is NO.	**12.4**
20.10	**Solar pump** **Delay Off: 0min**	Delay in switching off panels pump.	Useful when output Y is used to control minimum temp. of solar panels.	

21. CONFIGURATION RPS 638

Ref.	Display	Description	Notes	Sect.
21.1	**Config detectors** **1 – – 4 – – –**	Configuration detectors connected (inputs B-M). – = detector not connected; Number = detector connected. Factory setting: B1 & B4 configured (cannot be disabled).	1 : Storage tank 1 detector **B1**. 2 : Storage tank 2 detector **B2**. 3 : Storage tank 3 detector **B3**. 4 : Solar panels detector **B4** (0...99 °C). As alternative to **B7** 5 : Integration detector **B5**. 6 : Distribution circuit detector **B6**. 7 : Solar panels detector **B7** (0...200 °C). As alternative to **B4**	**12.**
21.2	**Control Y:** **DHW**	Use of control output Y: DHW = control of temp. of DHW distribution SOLAR PANELS = control of minimum temp. of solar panels. – – – – – – – – – – – – – – – = name of control.	Appears only if in **21.1** B6 is configured.	**12.3**
21.3	**CRing:** **NO**	NO : Not connected in C-Ring. PRIMARY : Connected as Primary. SECONDARY : Connected as Secondary.		**10.1**
21.4	**Choice keynumber** **----**	Choice key number for preventing use – 1901 ... 1999	To cancel key number, press + and – keys together.	**14.1**
21.5	**Site name** **----------**	Entering plant site name.	Use + and – to enter letters or numbers. Use ← and → to position cursor.	**14.2**

22. TESTING

Ref.	Display	Description	Notes	Sect.
22.1	**CRing:??**	Page of testing C-Ring connections. ?? = C-Ring test in progress or test failed. YES = test positive.	Appears only if **21.5** is PRIMARY or SECONDARY.	**16.1**
22.2	**Output:VALVE Y** **Status:IDLE**	Choice outputs to be tested. Choice output status.	Choice output: VALVE Y ; INTEGRAT ; STORAGES. Choice status: With VALVE Y : IDLE ; CLOSES ; OPENS. With INTEGRAT : ON ; OFF. With STORAGES : ON 1 ; ON 2 ; ON 3 ; OFF.	**16.2**

Modifiche da versione RPS 638 C2 09.01.01

Page	Section	Changes description
various	various	Add solar panel detector B7 Pt 1 kΩ (0…200 °C) as alternative to B4 NTC 10 kΩ (0…99 °C).

LB 01.03.00 ; Rev. : LB 26.05.00 ; LB 09.01.01 ; LB 25.05.04; LB 06.09.05

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