

COMPENSATING CONTROLLER FOR BOILER SEQUENCING

C ←BUS **C ←RING**

DTC 648 Eng C2



- **Controller for boiler sequencing with timed programming**
 - control temperature manifold boilers
 - control temperature DHW with control pump & diverting valve dedicated boilers
- **With ISC 648 relay modules controls :**
 - single- or two-stage burners
 - if used, boiler shut-off valves
- **Communication systems :**
 - **C-Bus** for telemanagement
 - **C-Ring** for exchange data of common interest between local controllers
- **Power supply 230 V~ ; DIN rail mounting**

1. APPLICATION

DTC 648, in combination with ISC 648 relay control modules, will sequence boilers as follows :

	Boilers with valves 1- stage burners	Boilers without valves 1- stage burners	Boilers with valves 2- stage burners	Boilers without valves 2- stage burners
with 1 ISC 648	up to 4	up to 8	up to 4	up to 4
with 2 ISC 648	up to 8	up to 16	up to 8	up to 8
with 3 ISC 648	up to 12	up to 24	up to 12	up to 12

2. FUNCTIONS

The main functions of DTC 648 are :

- Control of temperature manifold boilers at **fixed point** or at variable value in relation to **outside temperature** or temperature requested by user **plants** (if controllers are wired in C-Ring to DTC 648).
 - On-Off control single- or two-stage burners ;
 - On-Off control of shut-off valves with adjustable closure delay;
 - control of minimum and maximum limits of manifold temperature ;
 - self-adapting;
 - reduction of number of boilers in sequence in relation to outside temperature and/or by electrical contact (c2) and/or in summer period;
 - fixed sequence or timed automatic switching;
 - theoretical metering of operating hours of burners;
- Control of temperature of DHW storage tank with timed programming of:
 - control loading pump and (if used) diverting valve for dedicated boilers;
 - priority and antibacteria functions;
- Seven 24-hour programmes and two 7-day programmes;
- Programmes with dates for 25 holiday periods, 1 special period, heating season, summer time.
- Inputs for : – Remote On control (c1): switching on plant for special reasons;
 - 1 On-Off contact for signalling status or alarm;
 - 1 active detector 4 ... 20 mA for measurements with alarm options.
- Alarm for short or open detector circuits and for abnormal operation of plant and controller.
- Simulation of operation for testing wiring at commissioning stage.
- Option of connecting in C-Ring with other controllers and in C-Bus for telemanagement by central PC and/or local PCs.

3. DETECTORS & ACCESSORIES

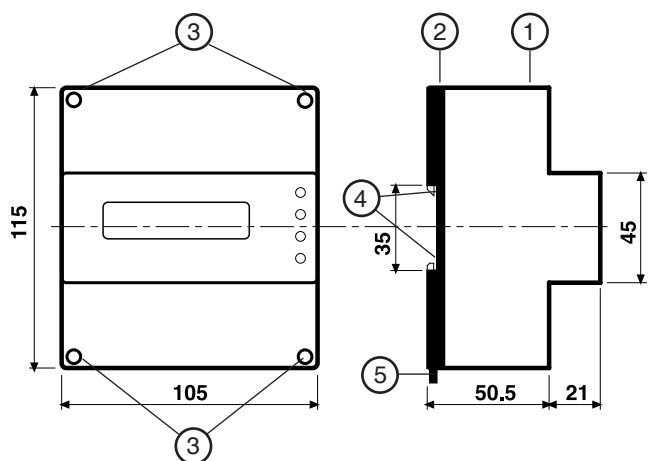
No.	Description	Type	Sensing element	Code	Data sheet
1, 2 or 3	Essential : Relay controls modules	ISC 648		–	A 450
1	Immersion temp. detector manifold (0 ... 99 °C) or Immersion temp. detector manifold (0 ... 200 °C)	SIH 010 STH 001	NTC 10 kΩ Pt 1 kΩ	B1 B3	– –
1	Optional : Outside temperature detector	SAE 001	NTC 1kΩ	B2	–
1	Immersion DHW temperature detector	SIH 010	NTC 10 kΩ	B6	–
1	Accessory for connecting active detector 4 ... 20 mA	ASA 420	–	B7	–

4. TECHNICAL DATA (factory settings 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. Comm. (CEI)
Storage data	5 years
• Mechanical	
Case	DIN 6E module
Mounting	on DIN 35 rail
Materials:	
base	NYLON
cover	ABS
Ambient temperature:	
operation	0 ... 45 °C
storage	- 25 ... + 60 °C
Ambient humidity :	Class F DIN 40040
Weight	1.0 kg
• Programmes & periods	
7-day programmes	0 ... 2
24-hour programmes	1 ... 7
24-hour periods	2 ... 6
Holiday periods	0 ... 25
Special period	1
• Measurement ranges	
Temperature manifold & boilers	0 ... 99 °C (B1) 0 ... 200 °C (B3)
Outside temperature	- 30 ... + 40 °C
DHW temperature	0 ... 99 °C

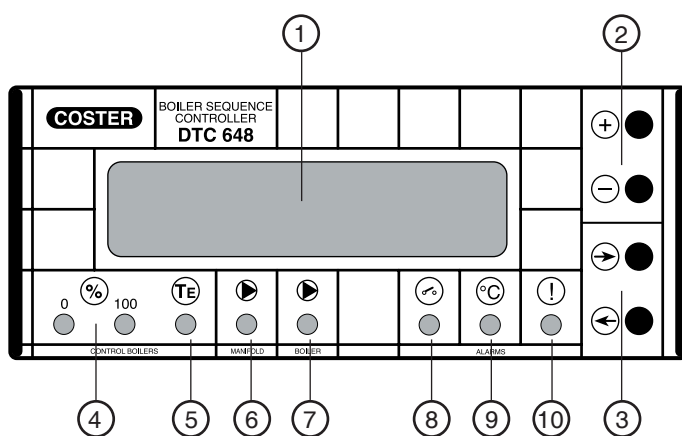
• Setting ranges sequencing control	
Fixed point temperature	20 ... 80 ... 99 °C (B1) 20 ... 160 ... 200 °C (B3)
Compensated control :	
design outside temperature	- 30 ... - 5 ... + 20 °C
design temperature boilers	20 ... 80 ... 99 °C
correction origin curve	20 ... 40 °C
Temperature limits boilers:	
minimum	1 ... 99 °C
maximum	1 ... 99 °C
Limit outside temperature	-30 ... 3 ... +20 °C
Correction desired temperature boilers	-10 ... 0 ... +10 °C
Boiler differential On	1 ... 4 ... 50 °C
Boiler differential Off	1 ... 4 ... 50 °C
Integral time	0 ... 20 ... 255 min.
Minimum time On boilers	1 ... 60 ... 180 s
Minimum time Off boilers	1 ... 60 ... 180 s
Delay closure valves	0 ... 360 ... 1,275 s
Days automatic change over	1 ... 15 ... 255 d
• Setting ranges control DHW	
Desired DHW temperature	0 ... 50 ... 99 °C
Differential temperature DHW	0.5 ... 10 ... 50 °C
• Setting ranges telemanagement (setting by PC)	
Telemanagement keynumber	0 ... 65535
Attempts alarm calls	1 ... 5 ... 255
Interval between alarm calls	2 ... 10 ... 255 min.
• Setting ranges alarms (setting by PC)	
Difference temperature boilers (B1)	0.5 ... 5 ... 99 °C
Difference temperature boilers (B3)	1 ... 10 ... 255 °C
Delay temperature boilers	2 ... 30 ... 255 min.
Difference temperature DHW (B6)	0.5 ... 5 ... 99 °C
Delay temperature DHW	2 ... 30 ... 255 min.
Minimum limit 4 ... 20 mA detector	4 ... 4 ... 20 mA.
Maximum limit 4 ... 20 mA detector	4 ... 20 ... 20 mA.

5. OVERALL DIMENSIONS



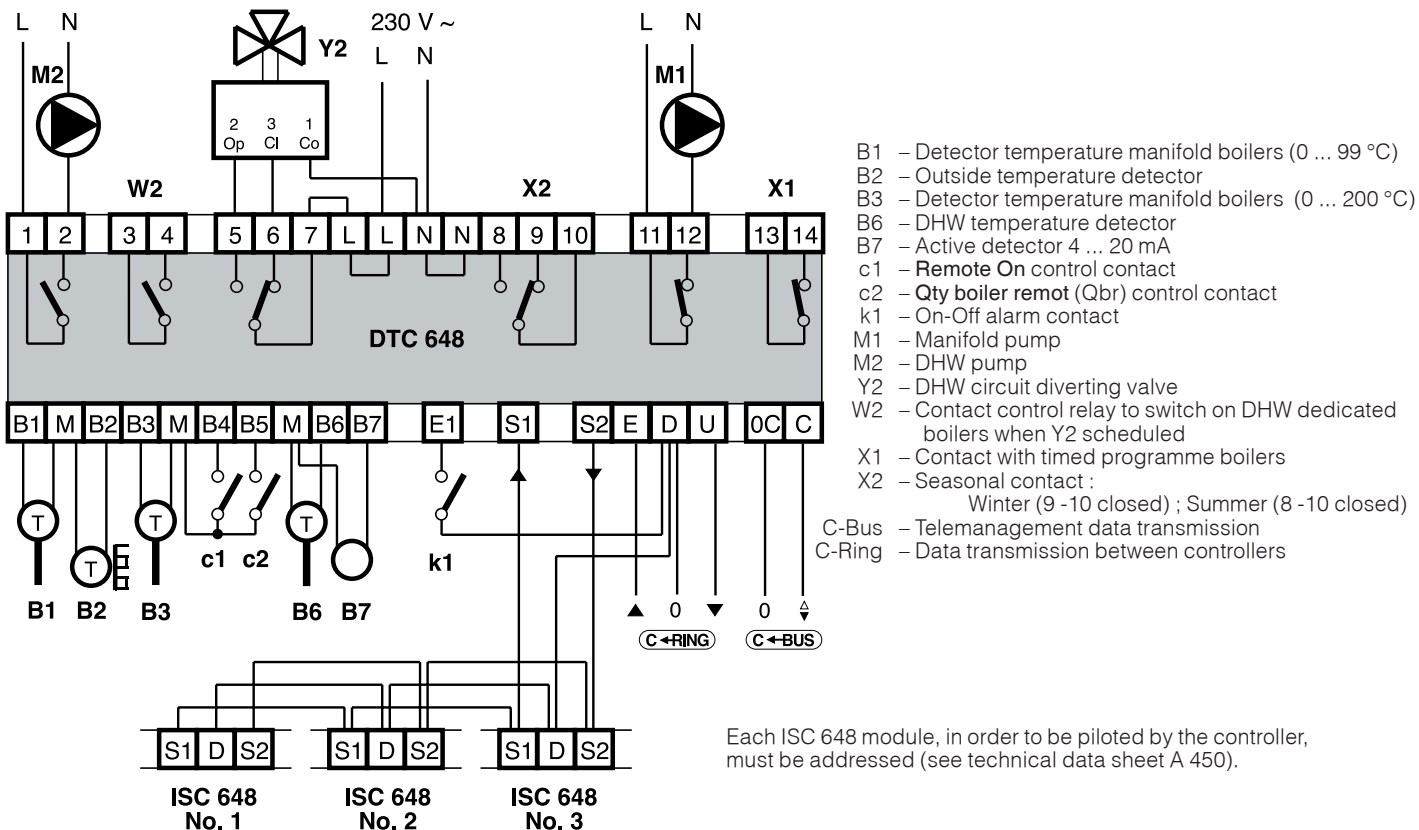
- 1 - Protective cover for electronic components
- 2 - Base with transformer, relay and terminal blocks
- 3 - Screws for securing cover and base
- 4 - DIN rail securing elements
- 5 - DIN rail release lever

6. FACIA



- 1 - Two-line backlighted alphanumeric display
- 2 - + and - operating keys
- 3 - ← and → operating keys
- LED indicators :
- 4 - Control
- 5 - On when outside limit temp. exceeded
- 6 - Manifold pump On
- 7 - DHW pump On
- 8 - Digital alarm (On-Off contact)
- 9 - Detector & functional alarms
- 10 - Controller fault alarm

7. WIRING DIAGRAM



8. SITING OF CONTROLLER, VALVES & DETECTORS

8.1 Controller

The controller must be sited in a dry ambience in accordance with the permitted ambiental limits in 4. TECHNICAL DATA. If positioned in an ambience classified as "Dangerous" it must be enclosed in an electrical cabinet constructed according to the current regulations for the class of danger involved. It can be installed on a DIN rail or in a DIN module.

8.2 Boiler shut-off valves

These can be installed indifferently on the flow or return pipework of the boilers. If the flows are used, care must be taken to install the valves downstream of all the safety devices.

8.3 Manifold detector B1 or B3

This must be installed so that it is always covered by the flow of water between the boilers and user plants.

8.4 Outside detector B2

It must be installed outside the building on the north or north-west side at least 3 metres from the ground, protected from direct sunlight and away from windows, doors, chimneys and other possible sources of thermal disturbance

9. WIRING

Proceed as follows :

- Separate the base and cover
- Mount the base on the DIN rail and check that the securing elements (5.4) hold it firmly in place.
- Carry out the wiring according to the diagram and in accordance with current regulations, and using cables of :
 - 1,5 mm² for power and relay control outputs
 - 1 mm² for the detectors and remote control
 - for C-Bus and C-Ring consult technical data sheets T 021 and T 022
- Switch on power (230 V ~) and check the voltage across terminals L and N
- Switch off power, replace cover on base/terminal block and secure it with the four screws supplied (5.3).

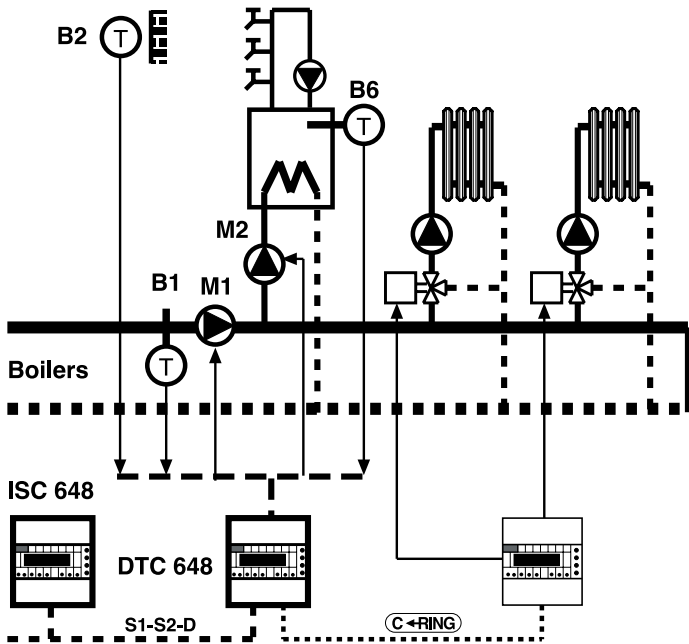
Notes

If the outside detector is used also by other controllers in C-Ring, it must be connected to DTC 648 and not to "Secondary" or "Slave" controllers.

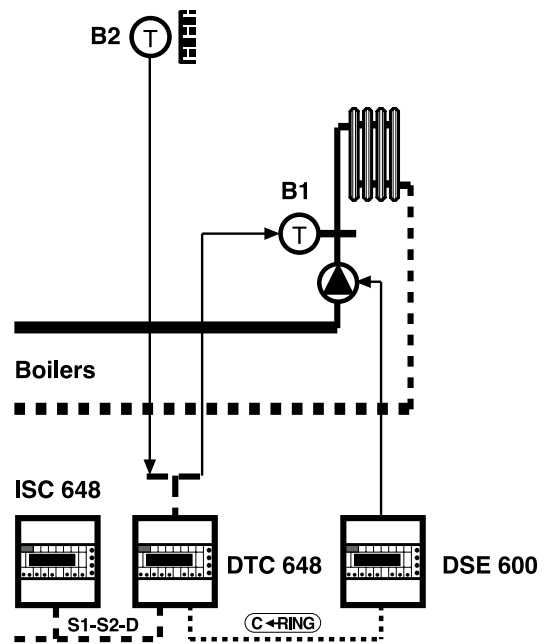
You are advised not to insert more than two cables in a single terminal of the controller and if necessary to use junction boxes.

10. EXAMPLES OF USE OF CONTROLLER

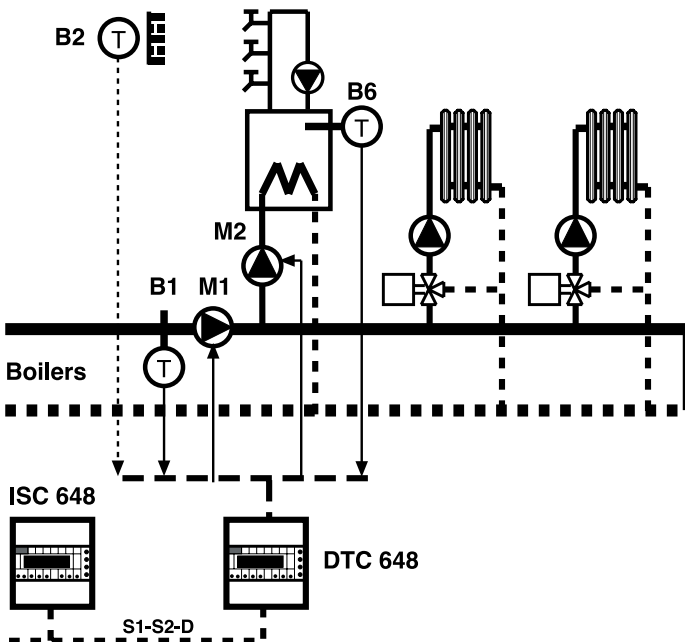
10.1 Variable-temperature boilers with heating controllers in C-Ring and DHW controlled by DTC 648.
 Configuration DTC 648 : Type of control = PLANTS



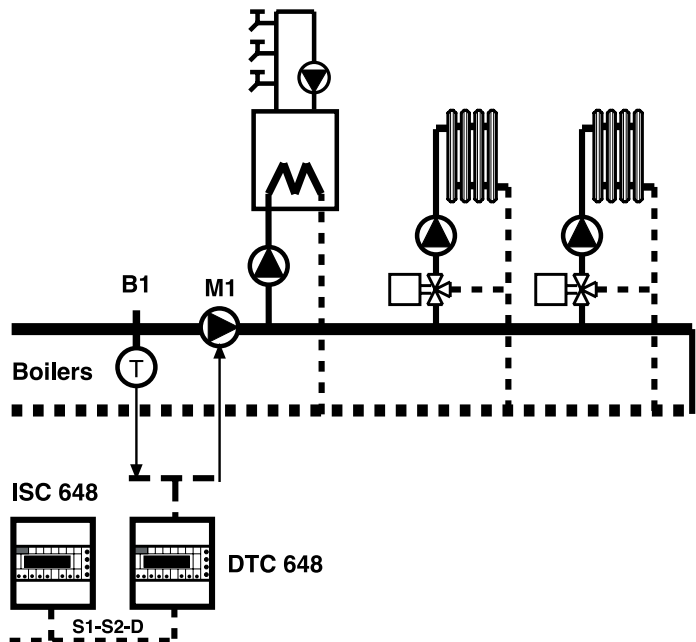
10.2 Variable-temperature boilers with heating controller in C-Ring without regulating valve.
 Configuration DTC 648 : Type of control = PLANTS



10.3 High-temperature boilers with independent heating controllers; DHW controlled by DTC 648.
 Configuration DTC 648 : Type of control = FIXED POINT or COMPENSATED



10.4 High-temperature boilers with heating controllers and independent DHW
 Configuration DTC 648 : Type of control = FIXED POINT



B1 – Detector boilers
 B2 – Outside detector
 B6 – DHW detector

M1 – Manifold pump
 M2 – DHW pump

11. EXAMPLES OF CONTROL BOILERS

11.1 – Control of 2 ... 12 single-stage boilers with shut-off valves

DTC 648 configuration : Boilers = 1 STAGE WITH VALVES

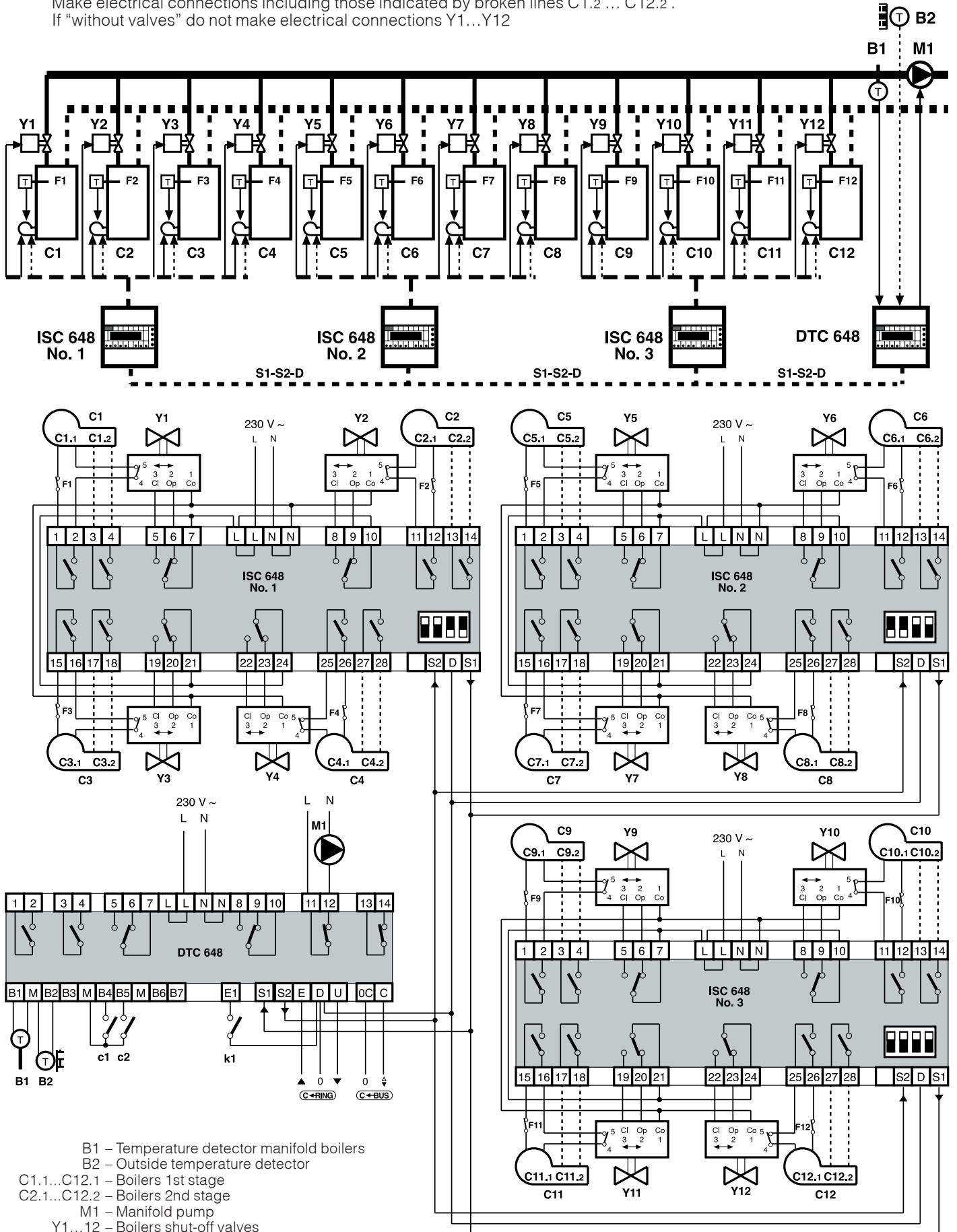
Do not make electrical connections indicated by broken lines

– Control of 2 ... 12 two-stage boilers with or without shut-off valves

DTC 648 configuration : Boilers = 2 STAGES WITH VALVES or 2 STAGES WITHOUT VALVES

Make electrical connections including those indicated by broken lines C1.2 ... C12.2 .

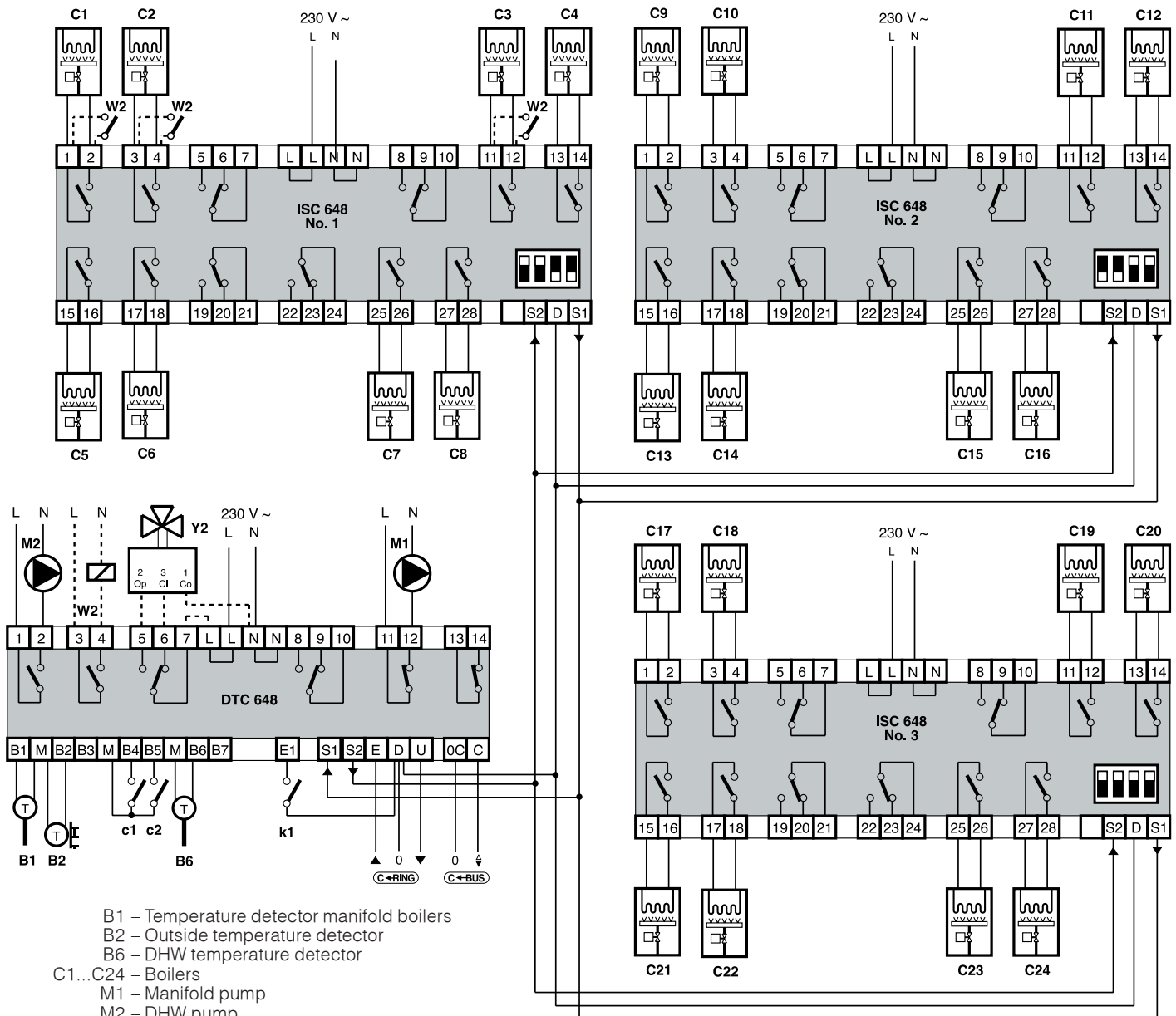
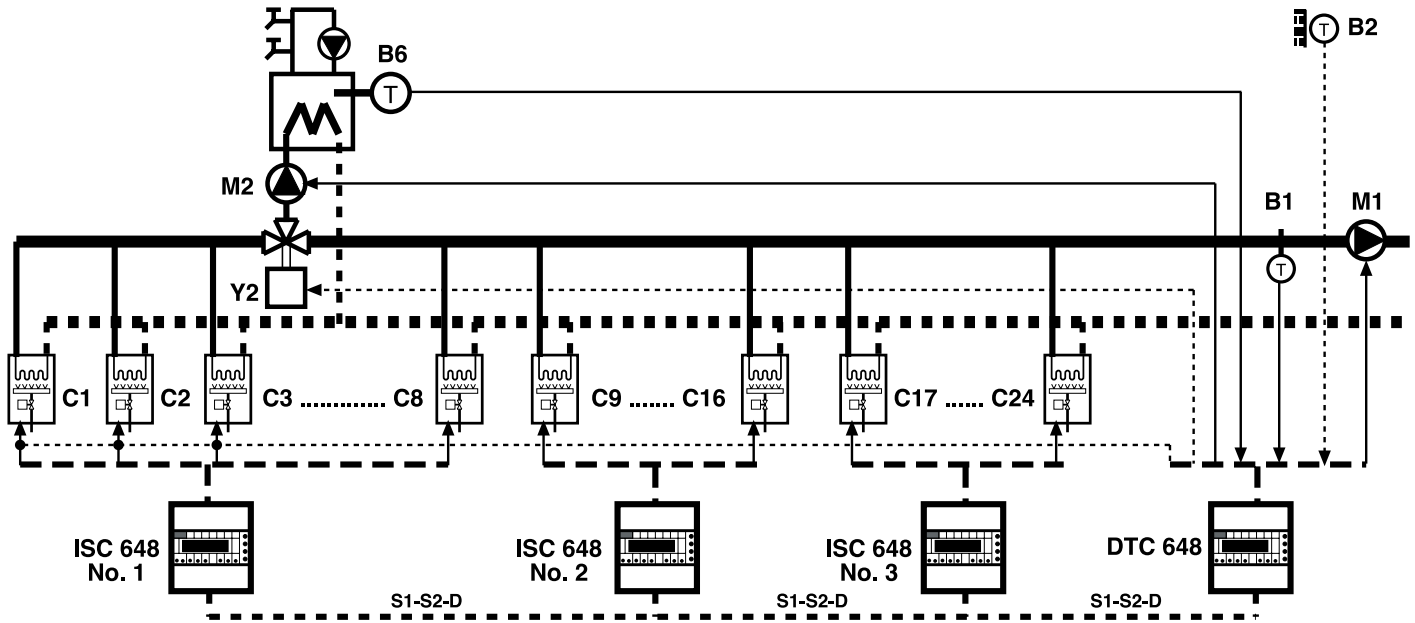
If “without valves” do not make electrical connections Y1...Y12



11.2 – Control of 2 ... 24 single-stage boilers without shut-off valves with dedicated DHW boilers (variation)

DTC 648 configuration : Boilers = 1 STAGE WITHOUT VALVES

For plants without dedicated DHW boilers do not make electrical connections indicated by broken lines.



- B1 – Temperature detector manifold boilers
- B2 – Outside temperature detector
- B6 – DHW temperature detector
- C1...C24 – Boilers
- M1 – Manifold pump
- M2 – DHW pump
- Y2 – DHW circuit diverting valve

12. COMMUNICATION

12.1 C-Ring communication between controllers (for detailed information consult technical data sheet T 022)

DTC 648 controller is **always the "Primary"** which transmits to the controllers connected in the C-Ring and configured as **"Secondary" and/or "Slave"**, the following signals :

- permission to operate as **Slave** controllers
- value of **outside temperature** (use of a single detector for several controllers)
- **DHW priority** = modulating control in closing valves of heating circuits.

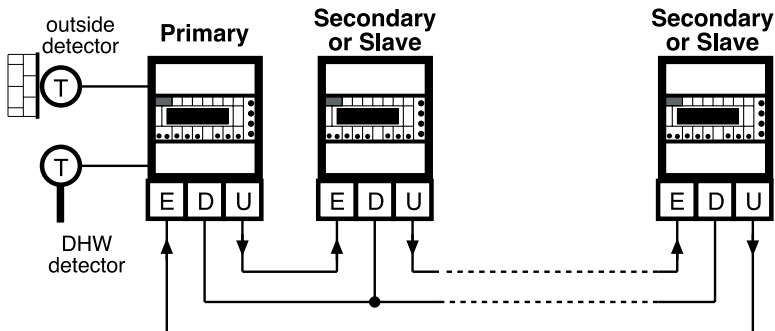
Receives from controllers connected the value of the desired **flow temperature**.

C-Ring : NO = connection to C-Ring not scheduled
 YES = connection to C-Ring scheduled

26.4

CRing connection :
NO

12.2 C-Ring wiring diagram



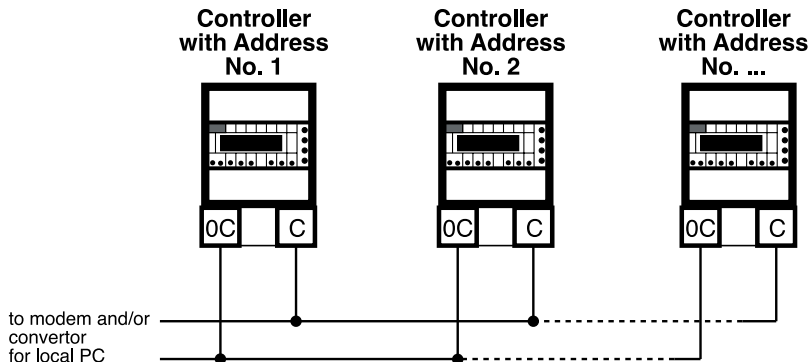
12.3 C-Bus communication for telemanagement (for detailed information consult technical data sheet T 021)

By means of C-Bus output DTC 648 can be telemanaged : two-way communication of data using one or more local PCs and/or remote central PC via telephone network.

From PC or PCs it is possible to display and/or change :

- the data and values entered on display pages of controller and those of configuration dedicated exclusively to telemanagement (see 4. TECHNICAL DATA)
- operational status of components of plant (pumps, auxiliaries in general)
- acquire alarms coming from plant
- read the measurements of the detectors (outside, flow, boiler, etc)

12.4 C-Bus wiring diagram



12.5 Address for telemanagement

26.3

Address : -
Group : -

In telemanagement, so that the controllers can be identified by the central PC and/or the local PCs, they **must have** a progressive address number.

If required, it is also possible to subdivide the controllers in groups.

Notes

When telemanagement is not scheduled leave a dash (-).

To cancel the values keep the + and - keys pressed at the same time.

12.6 Sending alarms

26.2

Send alarms :NO
PassWTeleman :NO

- Sending alarms: NO = alarms not sent
 YES = alarms are sent to central PC and indicated by "ALARM" on display.
- PassWTeleman : NO = keynumber not entered
 YES = keynumber enabled : prevents access of non-authorized persons to telemanagement programme.

12.7 Recording data

The controller can memorise 32 series of all the operational data of the plants controlled. The last recording brings about the cancellation of the oldest one.

The recordings take place automatically at the change of mode both by the timed programme and by the intervention of the operator.

13. OPERATION

DTC 648 is a digital controller with microprocessor for the PI control of the manifold temperature of boilers in sequence. For control of the burners and of the shut-off valves the controller has to be combined with ISC 648 relay control modules according to the number and type of boilers connected, as indicated under 1. APPLICATION.

26.1
Config detectors
 1 - - - - -

It is indispensable to configure the controller in relation to the detectors and the controls connected.

13.1 Type and number of boilers

25.1
Boilers: 1 STAGE WITH VALVES

In order to adapt the controller and the control modules to the conditions of the plant, enter the type of burners fitted to the boilers and if shut-off valves are present :

- Boilers : 1 STAGE = boilers with single-stage burners
- 2 STAGES = boilers with two-stage burners
- WITH VALVES = boilers with shut-off valves
- WITHOUT VALVES = boilers without shut-off valves

25.2
Total boilers in sequence: 4

Selection of number of boilers connected in sequence.

13.2 Minimum On and Off times of burners

25.3
Minimum time On boilers: 60sec

25.4
Minimum time Off boilers: 60sec

To avoid too short On and Off times of the burners causing lockouts enter minimum On and Off times.

13.3 Delay closure shut-off valves

25.5
Delay closure valves : 360sec

To avoid overheating of the boiler because of residual heat in the combustion chamber, the shut-off valves must be closed with a certain delay after switching off the burners

13.4 Sequencing

22.7
Differential On boiler 4c

The sequencing of the boilers (opening valve and switching on burners) depends on the **differential** between the actual manifold temperature (detector B1 or B3) and that desired.

22.8
Differential Off boiler 4c

- Differential On : - - - c = lowering of temperature for switching on a single boiler or a single stage. The **sequence differential (Band of Proportional control action)** is the boiler differential for the number of boilers or stages.
- Differential Off : - - - c = increase in temperature for switching off a single boiler or a single stage.

25.1
Boilers: 2 STAGES

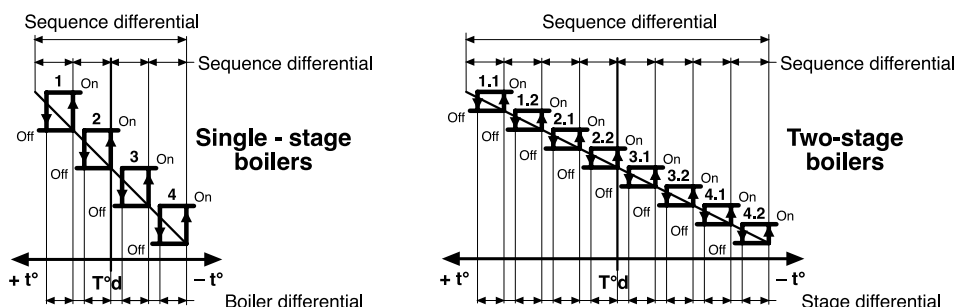
When **Stage Appears Instead of Boiler**

22.9
Integral Time 20min

- Integral time : - - m = permits controller to take into account not only temperature differential but also time for which that differential remains. If actual temperature does not tend to rise the controller nevertheless sequences the boilers which have not been switched on by the Proportional control action.
 - Short times = boilers sequenced rapidly and the time necessary for those already in operation to re-establish the desired temperature, not allowed.
 - Long times = boilers sequenced slowly and the temperature remains below that desired for too long.

Note

The valve of the Lead boiler always remains open in order to ensure the flow of water in the manifold.



21.8

**Choice sequence
AUTO CHANGE OVER**

The sequence can be :

- Choice sequence : LEAD ... = fixed sequence with choice of Lead boiler.
AUTO CHANGE OVER = sequence with automatic change of Lead boiler each period of time programmed in number of days in :

25.6

**Auto change over
sequence: 15d**

It is possible to change, at any time, the Lead boiler set by the **auto change over** without changing the Choice Sequence.

In the event of a change, the new sequence operates for the days still remaining before **auto change over**.

21.9

**Current sequence
LEAD 1**

Example :

Choice sequence : AUTO CHANGE OVER ; Automatic Sequence Change : 15 days Current sequence : LEAD 1 .

- For 15 days : Lead 1 & Sequence = 1 - 2 - 3 - 4
- After 15 days : Lead 2 & Sequence = 2 - 3 - 4 - 1
- After 30 days : Lead 3 & Sequence = 3 - 4 - 1 - 2
- After 45 days : Lead 4 & Sequence = 4 - 1 - 2 - 3

If after 5 days Current sequence : Lead 1 is changed to current sequence : Lead 3

- For following 10 days : Lead 3 & Sequence = 3 - 4 - 1 - 2
- After 15 days : Lead 4 & Sequence = 4 - 1 - 2 - 3
- After 30 days : Lead 1 & Sequence = 1 - 2 - 3 - 4
- After 45 days : Lead 2 & Sequence = 2 - 3 - 4 - 1

13.5 Partial use of the boilers in sequence

It is possible to exclude automatically a certain number of boilers to be sequenced or the 2nd stage of all the boilers, when the **outside temperature** exceeds a programmed value (Eco Off).

- Value of outside limit temperature

22.10

**Eco Off
Limit T: 3.0c**

- Eco Off limit T : NO = Eco Off function disabled
YES = Eco Off function enabled
- On : 1st STAGE = boilers use only 1st stage
xx BOILERS = only xx boilers in sequence

25.7

**Eco Off : NO
On : 1st STAGE**

25.8

**Qty boiler remot
On: 2 BOILERS**

By using contact c2 **Qty boiler remot** it is possible to reduce the number of boilers to be sequenced when the user plants operate at a reduced thermal load.

When DTC 648 is connected in C-Ring with the controllers of the user plants it is possible to establish the type of operation which must be adopted when the user plants are "Off".

- With heating Off : BOILERS OFF = All boilers Off
MIN LIMIT T = Boilers controlled in sequence at minimum temperature

25.9

**With heating Off
BOILERS OFF**

22.6

**Limits T boilers
Min: 1c Max: 99c**

25.10

**Summerseason
On: 0 BOILERS**

It is possible to limit automatically the number of boilers sequenced during the **summer period**. If during the summer season a Special Period is used the limit, during this period, is automatically cancelled.

14. PROGRAMMES & PERIODS WITH DATES

14.1 24-hour programmes

23.1

How many 24hour programmes ? 1

Enter number of programmes you wish to use so as to avoid viewing unused display pages.

They can be used both for control of boilers and of DHW.

23.2

P1 Event 1 06.00
ON

In each 24-hour programme (**P1... P7**) you can set a maximum of 6 event start times (**Event 1... Event 6**) assigning to each one of following modes :

22.1

Type of control
FIXED POINT

- ON : - control boilers according to choice made in

21.5

Des DHW T : 50.0c
Diff : 10.0c

- control DHW with temperature set in

23.7

P1 Event 6 22.00
OFF

- OFF : - boilers off
- DHW excluded

22.6

Limits T boilers
Min: 1c Max:99c

- MINIMUM : - control boilers with minimum limit temperature
- DHW excluded

Notes

The times of start event must be entered in increasing order.

The times not used must be excluded by pressing at the same time the + and - keys until --- appears on the display.

You must not leave unused times (---) between programmed times.

14.2 7-day programmes

23.8

How many 7day programmes ? 0

Enter number of programmes you wish to use so as to avoid viewing unused display pages.

They can be used both for control of boilers and of DHW.

23.9

7day 1: MONDAY
24 HOUR 1

The pages of the days of the week appear only when 1 or 2 is entered.

In each 7-day programme you can assign to each day of the week one of the programmes

- 24 HOUR 1 ... 7 ;

- ON ;

- MINIMUM ;

- OFF.

23.15

7day 1: SUNDAY
24 HOUR 1

14.3 Holiday periods

These set an operating programme, the same for all periods, which replaces that in use. At the end of each holiday period the controller returns to normal operation.

Applies also to DHW control if the programme chosen is

21.4

DHW programme
FOLLOWS HEATING

Enter the number of holiday periods or of bank holidays you wish to use in order to reduce the number of display pages dedicated to the setting of the dates.

If left at "0" the programming pages do not appear.

23.16

How many holiday periods ? 0

Choose the programme to be used during **all the holiday periods** and the programme to be used on the **last day** of holiday so as to prepare the building for the return to occupancy.

- 24HOUR 1 ... 7 ;

- 7DAY1 or 2 ;

- ON;

- MINIMUM ;

- OFF.

23.17

Holiday program
OFF

23.18

Last day holiday
ON

23.16

How many holiday periods ? 0

Enter the data of the period :

• Hol 01 = choice of periods made available by

• Start : - NO = holiday period not used

- 00 = start period at 00.00

- 12 = start period at 12.00 noon

• Fr - - - - to - - - - = day and month of start & end of holiday period

23.19

Hol 01 Start NO
Fr - - - - to - - - -

For a single day of holiday enter the same date for start and end.

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

14.4 Special period

21.6

Special program
24HOUR 1

Period in which you enter an operating programme which temporarily replaces the current one in order to meet special requirements, chosen from :

- 24HOUR 1 ... 7 ;
- 7DAY 1 or 2 ;
- ON;
- MINIMUM ;
- OFF.

21.7

Special period
Fr --.--to --.--

Enter the day and month of start and end of special programme period.

21.4

Applies also for control of DHW if chosen programme is

DHW programme
FOLLOWS HEATING

The use of a Special Period during the Summer Season automatically cancels the limit on the number of boilers in use set in

25.10

Summer Season
On: 0BOILERS

14.5 Heating season

23.20

Heating season
Fr 15.10to 15.04

Specifies the heating period according to that laid down in the regulations for the climatic region in question.

Enter the day and month of the start and end of the heating season.
To cancel the period keep pressed the + and – keys at the same time.

22.13

Applies also to DHW if is

DHW summer :NO

14.6 Summer time

21.21

Summer Time
Fr 29.03to 26.10

The controller is able to change automatically the current time in relation to the summer time period.

- From --.-- = the night of the last Saturday of the month of March the timeswitch is automatically put forward an hour.
- to --.-- = the night of the last Saturday of the month of October the timeswitch is automatically put back one hour.

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

15. CONTROL TEMPERATURE BOILERS

22.1

Type of control
FIXED POINT

The temperature of the manifold (boilers) can be controlled in three ways :

- FIXED POINT ;
- COMPENSATED ;
- PLANTS (VIA C-RING).

15.1 Fixed point

22.2

Temperature
FixedPoint: **80c**

To be used when compensated or plants control is not possible because the controller is not able to know the temperature requested by the plants or the controls of the plants are not only of the compensated type.

Necessary to establish desired temp. for Remote On (c1) and to set the desired boiler temp. on request of DHW.

Keeps the temperature constant at the programmed value.

15.2 Compensated

22.1

Type of control
COMPENSATED

Variable control of temperature in relation to outside temperature according to the **heating curve** set by means of values :

22.3

Design outside
temp : **- 5.0c**

- design outside minimum temperature

22.4

Design boilers
temp : **80.0c**

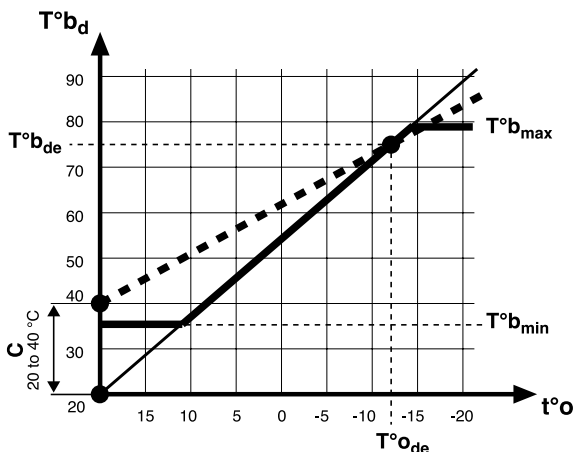
- design boilers temperature

22.5

CurveOrigin TO20
T boilers: **20.0c**

The point of **origin of the heating curve** (+ 20 °C boilers with + 20 °C outside) can be adjusted by an increase in the temperature of the boilers (0 ... 40 °C). It may be necessary to do this in order to avoid difficulties due to possible imbalances in the output of heat emitters with mild outside temperatures and to reduced period of heating during intermediate seasons.

Heating curve



- C = correction curve origin
- Tb_d = desired compensated temperature boilers
- Tb_{de} = design boilers temperature
- To_{de} = design outside temperature
- Tm_{max} = maximum limit manifold
- Tm_{min} = minimum limit manifold
- t°o = actual outside temperature

15.3 Plants

22.1

Type of control
PLANTS

Setting to be used when DTC 648 is connected in C-Ring with the plant controllers so that the temperature of the boilers is always that of the maximum flow requested by the plant controllers. N.B. the choice PLANTS appear only if 26.4 is "YES"

21.2

Site
PLANTS

In this case the controller is able to manage the boilers automatically according to the requirements of the plant users, without the need of a timed programme.

On the page for choice of programmes appears the word **PLANTS** and it is not possible to change it.

15.4 Minimum & maximum limits

22.6

Limits T boilers
Min: **1c** Max: **99c**

When the temperature of the boilers reaches one of the limit values it is kept constant at that value (the controller no longer takes into account the heating curve or the request for the maximum temperature coming from the plants via C-Ring).

Warning !

The maximum temperature limit does not replace any safety limits imposed by the relevant regulations.

15.5 Operating programmes

21.2

Site-----
24HOUR 1

If the Type of Control is **Compensated** or **Fixed Point** it is possible to programme the operation of the boilers according to the plant user requirements :
 - 24HOUR 1 ... 7 ; - 7DAY 1 or 2 ; - ON ; - MINIMUM ; - OFF.

When in place of the programme appears :

- REMOTE ON = contact c1 is closed and the desired temperature is
- SPECIAL = special period is current
- SUMMER = summer period is current established by Heating Season
- HOLIDAY = one of Holiday periods is current

22.2

Temperature
FixedPoint: 80.0c

15.6 Operating mode & variation temperature boilers

The current operating mode depends on the programme set in shown on the display :

21.2

Site-----
24HOUR 1

21.3

Mode:ON Qbr
Td80.0cVar+ 0.0c

- Mode : ON ; MINIMUM ; OFF ; PLANTS.
- Qbr = appears when contact c2 Qty boiler remot is closed.
- Td 80.0 = temperature desired by current mode.
- Var + 0.0 = increase in temperature requested by current mode so that it is always sufficient to satisfy the request of the plant users when the controller is in **Compensated** or **Plants** .

16. CONTROL DHW TEMPERATURE

21.5

Des DHW T : 50.0c
Diff : 10.0c

When detector B6 is connected and configured in the controller regulates the DHW pump M2 according to the **desired temperature** and the **temperature differential** set.
 If the detector B6 is not connected and configured the output can be used for a **timed control**.

26.1

Config detectors
6

If the type of manifold temperature control is **Compensated** or **Plants**, when the DHW control switches on the M2 pump, the controller compares the desired **Compensated** or **Plants** temperature with the desired **Fixed Point** temperature and uses the higher as the desired manifold temperature. The desired **Fixed Point** temperature must always have a value sufficient to meet DHW requirements..

16.1 Operating programmes

21.4

DHW programme
ALWAYS ON

The choice of operating programmes for DHW control is independent of the control of the boilers :
 - 24HOUR 1...7;
 - 7DAY 1 or 2;
 - ALWAYS ON;
 - ALWAYS OFF;
 - FOLLOWS HEATING : follows the same programme used for controlling the boilers including the Holiday periods , Special period and Heating season .

16.2 Antibacteria & summer operation

22.13

Antibacteria : NO
DHW summer : NO

The antibacteria function prevents the formation of bacterial colonies in the storage tank.

- Antibacteria : NO = function not enabled
 YES = every Wednesday at 2,00 AM the DHW temp is raised to 70 °C for 90 minutes.

It is possible to programme the summer operation of DHW.

- DHW summer : NO = DHW Off
 YES = DHW On & controlled according to setting in

21.4

DHW programme
ALWAYS ON

21.5

Des DHW T : 50.0c
Diff : 10.0c

16.3 Dedicated DHW boilers (see diagram 11.2)

22.12

Dedicated DHW
boilers : YES

In plants where a certain number of boilers are dedicated to supplying DHW primary circuit, the controller, at the request of DHW control, does not bring the temperature requested by the boiler control to "Fixed Point".

The dedicated boilers are temporarily excluded from the sequence and controlled by their own thermostats.

N.B. Indispensable the use of contact W2 (see diagram 11.2, page 6)

17. COMPLEMENTARY FUNCTIONS

17.1 Control manifold pump

22.11

Manifold Pump: AUT
Delay Off : 60min

The manifold pump can be controlled in two ways :

- Manifold Pump : MAN = pump always in operation
AUT = pump controlled by current timed programme
- Delay Off : - - min = period of switching off delay to allow pump to dissipate heat accumulated in boilers.

17.2 Summer plant exercise

22.14

Summer plant exercise : YES

The function prevents the lockout of the pumps during prolonged shutdown of plants.

- Manifold pump : every Sunday at 12 noon the pump is switched on for 5 minutes.
- DHW pump : if it is excluded in summer, every Sunday at 12 noon the pump is switched on for 5 minutes.

17.2 Input B7

24.5

B7 : 12.0mA
Min : 02.0Max : 24.0

The input B7-M can be used to connect an active detector for various measurements such as :
- level, - pressure, - flow.

It can be used only to display the measurement or to send an alarm to the telemanagement PC in the event that the minimum and/or maximum threshold set by the PC is exceeded for at least one minute.

17.3 Access keynumber

26.8

Choice keynumber
- - - -

Choice and enabling of the access keynumber prevents the use of the + and - keys thereby preventing any alteration of the data. Enter the number (1900 ... 1999) using the + and - keys. To cancel the keynumber press the + and - keys at the same time until the dashes re-appear.

Access keynumber
- - - -

When the keynumber is enabled, if you press the + or - keys there will appear on the display the request to enter the keynumber. Only after having entered the correct keynumber can you use the + and - keys.

If no key is pressed for 15 minutes the keynumber is automatically re-enabled.

17.4 Site name

26.9

Site name
- - - - -

Entering plant site name which appears on the first page of display.

Each dash can be replaced, using the + and - keys, by a letter of the alphabet (A ... Z) or by a digit (0 ... 9). The → key serves to position the cursor.

17.5 Display measurements

24.1

Des T boil : 80.0c
Act T boil : 80.0c

The controller displays all the values measured by the detectors and the data which serves to monitor the operational status of the plant :

- temperature boilers (manifold) desired and actual.

24.2

Output control
boilers : 50%

- value of control output : this is the value (0 ... 100 %) which identifies the potential requested by the controller.

24.3

Outside temp
Actual :- 2.0c

- outside temperature Actual 2.0 = value of detector connected to controller.
C-Ring 2.0 = value via C-Ring.

24.4

Des DHW T : 50.0c
Act DHW T : 50.0c

- desired or actual DHW temperature : without detector dashes will appear.

24.5

B7 : 12.0mA
Min : 4.0Max : 20.0

- actual value in mA, measured by active detector B7, and the minimum and maximum limit values set by telemanagement PC for triggering alarms.

24.6

Boiler 1 : 0000hrs
Boiler 2 : 0000hrs

- metering of operating hours of boilers if is

25.1

Boilers : 1 STAGE

25.1

Boilers : 2 STAGE

- metering of operating hours of single stages if is

18. ALARMS

The alarms processed by the controller are of three types :

- alarms for abnormal functioning of the controller (LED 6.10)
- alarms for short or open circuits of the detectors connected and break in C-Ring (LED 6.9)
- alarm by external contact (LED 6.8)

The alarm state is indicated by the LEDs situated on the facia of the controller and by the word ALARM appearing on the display when the alarm is sent to the PC and is identified, on the configuration page, by the letter "A" alternating with the number of the alarm in question.

With the C-Bus setup the alarms can be sent to a local PC and /or to the telemanagement central PC.

18.1 Functional alarms

26.5

Functional Alarms
- - - - 8

The functional alarms are triggered in the presence, over long periods of time, of differences between actual and desired measurements.

They do not affect the normal operation of the controller with the exception of the real time clock alarm (8).

Factory setting : all functional alarms are disabled except for timeswitch alarm (8)

To enable the alarms use + key to replace the dashes with the appropriate numbers.

When the number blinks = alarm triggered

The limit values and the delay times in sending the alarms can be changed only by PC

Type of alarm :

1 = difference of temperature boilers (B1) :

- triggered if pump M1 is in operation
- and actual temperature lower than that desired by controller.

3 = difference temperature boilers (B3) :

- triggered if pump M1 is in operation
- and actual temperature lower than that desired by controller

6 = temperature DHW (B6) :

- triggered if pump M2 is in operation
- and actual temperature lower than that desired by controller

7 = measurement active detector 4 ... 20 mA (B7) :

- triggered if actual measurement 4 ... 20 mA exceeds for at least one minute

24.5
B7 : 12.0mA
Min: 4.0Max: 20.0

8 = internal real time clock; cannot be disabled.

- triggered if real time clock assumes meaningless values.

18.2 Detector alarms

26.6

Detector alarms
- - - - -

The detector alarms are triggered in the event of **short** or **open detector circuits**.

The alarms are triggered after a delay of one minute and only if the relative alarms are enabled.

Factory setting : all detector alarms are disabled .

To enable the alarms use + key to replace the dashes with numbers.

Number of alarm and consequent controller action :

1 = detector boilers (B1) :

- boilers in operation controlled by thermostats

2 = outside detector (B2) :

- if **Compensated** control, this changes to **Fixed Point** and the function of limiting number of boilers by outside T is disabled.

3 = detector boilers (B3) :

- boilers in operation controlled by thermostats.

6 = detector DHW (B6) :

- pump M2 idle

8 = C-Ring : short or open electrical connection or faulty controller in ring (alarm after 10 minutes).

18.3 Alarm or status

26.7

K alarms
-

Alarm triggered by closure of voltage-free contact **k1** of components of plant (pumps, burners, etc).

The alarm is triggered after about 60 seconds.

Factory setting : disabled.

To enable the alarm use + key to replace the dash with number.

If not used as alarm can be used for signalling status (displayed only on telemanagement PC).

19. TESTING ON COMMISSIONING PLANT

Testing to be carried out at the conclusion of installation and when wiring and configuration have been completed and checked.

19.1 Testing C-Ring

The page of C-Ring testing appears only if "YES" has been entered in

26.4
CRing connect ion:
YES

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

27.1

CRing : ??

– correctly powered by 230 V ~

– Slave controllers or configured as SECONDARY in

CRing connect ion:
YES

– selected on testing page

CRing ??

DTC 648 sends via C-Ring a signal every 5 seconds: on all the displays "??" appears. If the wiring is correct the word "YES" replaces the "??" on all the displays. If on one or more displays "YES" does not appear, this means that there is an open 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" : Wiring OK
- Cont.1 "???" – Cont.2 "YES" – Cont.3 "YES" – Cont.4 "YES" : Open between 4 and 1
- Cont.1 "???" – Cont.2 "YES" – Cont.3 "???" – Cont.4 "???" : Open between 2 and 3
- Cont.1 "???" – Cont.2 "???" – Cont.3 "???" – Cont.4 "???" : Open between 1 and 2

19.2 Testing DTC 648 control outputs

27.2

Output : DHW
Status : OFF

With + and – keys choose :

- Output : DHW = DHW pump
 - W2 = contact control relay to switch on dedicated DHW boilers
 - Y2 = DHW circuit diverting valve
 - X2 = contact with DHW timed programme
 - MAN = manifold pump
 - X1 = contact with timed programme boilers
- Status : OFF
 - ON

Check the result.

19.3 Testing connections with ISC 648 modules

27.3

Testing ISC648
1 : YES 2 : NO 3 : NO

Displaying the page, the controller checks every two seconds the electrical connections with the ISC 648 modules.

- YES = module connected correctly
- NO = module not connected, connected incorrectly or faulty.

19.4 Testing ISC 648 control outputs

27.4

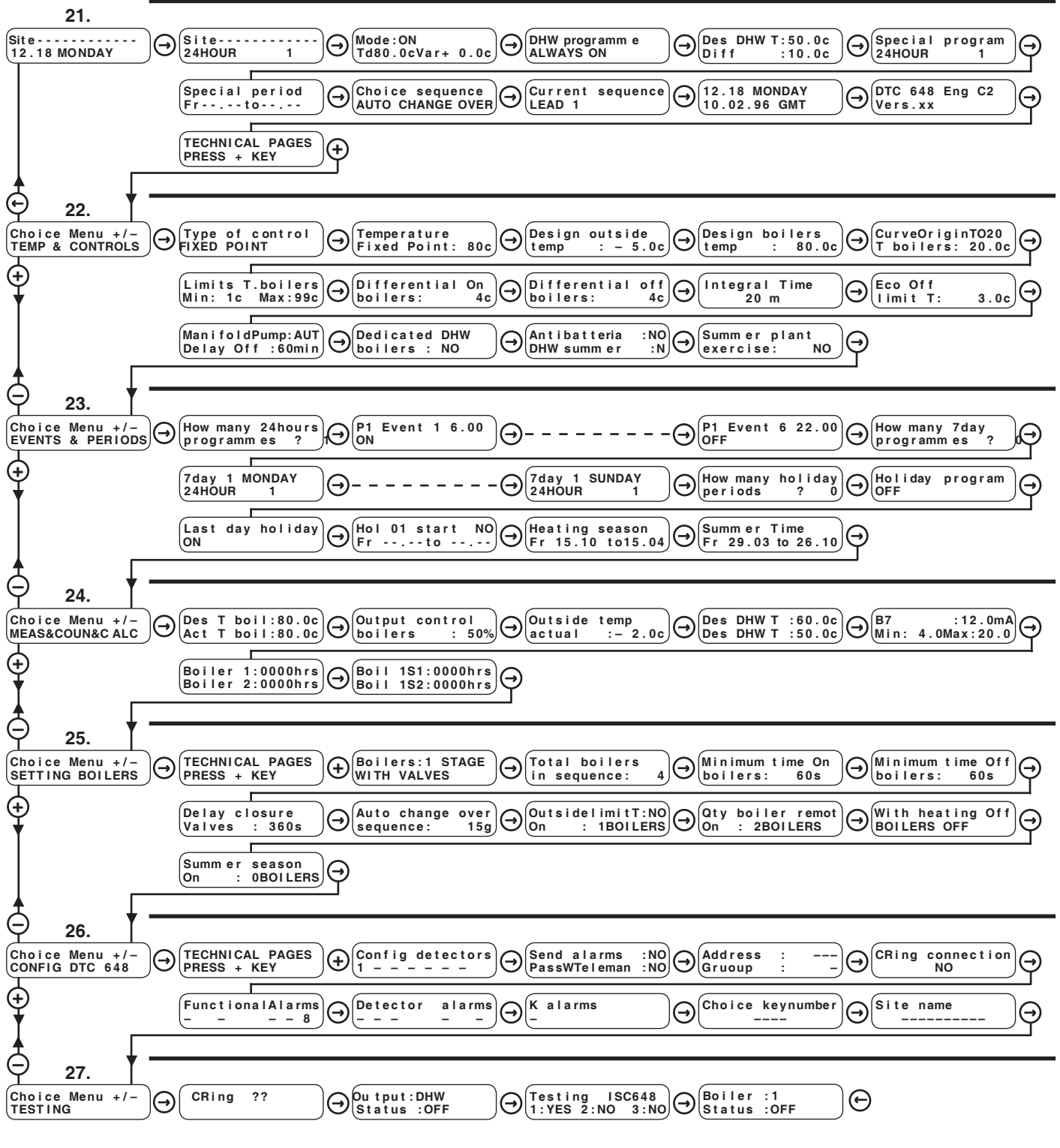
Boiler : 1
Status : OFF

With + and – keys choose :

- Boiler ... = number of the boiler to be tested
- Status : OFF = boiler Off and valve open
 - ON S1 = 1st stage On and valve open
 - ON S2 = 2nd stage On and valve open

Check the result.

20. SEQUENCE OF DISPLAY PAGES (the data and functions are those set by factory)



⬅ ➡ Keys for scrolling the display pages and positioning the cursor ■ on data which can be adjusted on the pages.

In the following descriptive list of display pages the data which can be adjusted are highlighted thus ■

By pressing them at the same time for a few seconds, or in any case after 15 minutes, the first page is displayed Site-----
12.18 MONDAY

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

- displaying the possibility of configuring a function, eg: Control boiler
FIXED POINT or Control boiler
COMPENSATED

- passing directly from a menu (sequence of pages) to another

21. NORMAL USE

Ref.	Display	Description	Notes	Sect.
21.1	Site----- 12.18 MONDAY	Site name Current time & day.	Entered in 26.9 Entered in 21.10	
21.2	Site----- 24HOUR 1	Choice programme boilers : 24HOUR 1 ... 7 ; 7DAY 1 or 2 ; ON ; MINIMUM ; OFF.	Instead of programme may appear : PLANTS ; RE- MOTE ON ; SPECIAL ; SUMMER ; HOLIDAY .	15.5
21.3	Boil:ON Qbr Tv80.0cVar+ 0.0c	Current mode operation boilers. Temperature desired by mode and Variation	Modes : ON ; MINIMUM ; OFF ; PLANTS. With c2 closed (Qty boiler remot) Qbr appears.	15.6
21.4	DHW programme ALWAYS ON	Choice programme for control DHW : 24HOUR 1 ... 7 ; 7DAY 1 or 2 ; ALWAYS ON ; ALWAYS OFF ; FOLLOWS HEATING.		16.1
21.5	Des DHW T : 50.0c Diff : 10.0c	Desired temperature for control DHW. Temp. differential for control DHW.	Appears only if B6 is configured in 26.1	16.1
21.6	Special program 24HOUR 1	Choice programme for Special period: 24HOUR 1 ... 7 ; 7DAY 1 or 2 ; ON ; MINIMUM ; OFF.		14.4
21.7	Special period Fr -- -- to -- --	Entering dates of start & end of Special period.	Press + and - together to cancel.	14.4
21.8	Choice sequence AUTO CHANGE OVER	Choice type of sequence : - AUTO CHANGE OVER LEAD - - .	LEAD - - : You can choose between 1 and the number "Total boilers in sequence" entered in 25.2	13.4
21.9	Current sequence LEAD 1	Current type of sequence	Appears only if in 21.8 choice is AUTO CHANGE OVER You can change number of Lead boilers.	13.4
21.10	12.18 MONDAY 10.02.96 GMT	Setting : Time, day of week and date Current timed period : Summer or GMT	Accordinging dates summer time set in 23.21	
21.11	DTC 648Eng C2 Vers.xx	Identity data of controller		

22. TEMPERATURES & CONTROLS

Ref.	Display	Description	Notes	Sect.
22.1	Type Control FIXED POINT	Type of temperature control : FIXED POINT ; COMPENSATED ; PLANTS	PLANTS : appears only if choice in 26.4 is "YES"	15.
22.2	Temperature Fixed Point : 80c	Value of desired temp. at FIXED POINT	Appears always, even if in 22.1 choice is not FIXED POINT	15.1
22.3	Design outside temp : - 5.0c	Value of design outside temp. for compensated control.	Appears only if in 22.1 choice is COMPENSATED	15.2
22.4	Design boilers temp : 80.0c	Value of design temp. boilers for compensated control.	Appears only if in 22.1 choice is COMPENSATED	15.2
22.5	CurveOrigin TO20 T boilers: 20.0c	Correction of heating curve origin.	Appears only if in 22.1 choice is COMPENSATED	15.2
22.6	Limits T boilers Min: 1c Max: 99c	Values of minimum & maximum limits of temp. boilers.	Always appears.	15.4
22.7	Differential On boiler : 4c	Value of drop in temperature for switching on each single boiler or stage.	Appears: Boiler : if in 25.1 choice is 1 STAGE Stage : if in 25.1 choice is 2 STAGES	13.4
22.8	Differential Off boiler : 4c	Value of temperature differential for switching off each single boiler or stage	Appears: Boiler : if in 25.1 choice is 1 STAGE Stage : if in 25.1 choice is 2 STAGES	13.4
22.9	Integral Time 20m	Integral time of sequencing control.		13.4
22.10	Outside limit temp : 3.0c	Value of outside temp. limit.	Appears only if detector (B2) is configured Enabled if choice in 25.7 is "YES". When outside temp. is higher, follows setting in 25.7	13.5
22.11	ManifoldPump: AUT Delay Off : 60min	Control of manifold pump : MAN ; AUT. Delay in switching off manifold pump.	MAN : always On ; AUT : On with current time timed programme	17.1
22.12	Dedicated DHW boilers : NO	YES : if some boilers have been diverted on primary DHW circuit (see diagram 11.2).	With YES, to calculate temp. boilers, controller does not take into account desired DHW temp.	16.3
22.13	Antibacteria : NO DHW summer : NO	Enabling of DHW antibacteria function. Establishes if in summer DHW used or not.		16.2
22.14	Summer plant exercise: NO	Enabling of summer exercise function		17.2

23. EVENTS & PERIODS

Ref.	Display	Description	Notes	Sect.
23.1	How many 24hour programmes ? 1	Choice of number of 24-hour programmes to be used (1 ... 7).	Cancel unrequired display pages	14.1
23.2	P1 Event 1 06.00 ON	Number of programme, number of event & start time.	Max. 6 periods. To cancel an unused event press + and - together: there will appear - - - -	14.1
23.7	P1 Event 6 22.00 OFF	Choice type of mode to be assigned to event: ON ; OFF ; MINIMUM. Further groups of 6 pages in relation to choice made in 23.1	The events must be in increasing order. You must not leave - - - - between events.	

23. EVENTS & PERIODS				
Ref.	Display	Description	Notes	Sept.
23.8	How many 7day programmes ? 0	Choice of number of 7-day programmes to be used (0 ... 2).	Cancel unused display pages	14.2
23.9	7day 1: MONDAY 24HOUR 1	Programme for each day of the week: 24HOUR 1...7; ON; OFF; MINIMUM. Further group of 7 pages if choice in 23.8 is 2.	Appears only if choice in 23.8 is 1 or 2.	14.2
23.15	7day 1: SUNDAY 24HOUR 1			
23.16	How many holiday periods ? 0			
23.17	Holiday program OFF	Holiday programme : 24HOUR 1...7; 7DAY 1 or 2; ON; OK; OFF.	Appears only if choice in 23.16 is superior to 0.	14.3
23.18	Last day holiday ON	Progr. last day of holiday: 24HOUR1...7; 7DAY 1 or 2; ON; MINIMUM; OFF.	Appears only if choice in 23.16 is superior to 0.	14.3
23.19	Hol 01 Start NO Fr --- to ---	NO=period not used; 00=start at 00; 12=start at 12 noon; Dates of start & end of holiday period. Further pages according to choice made in 23.16	Appears only if choice in 23.16 is superior to 0.	14.3
23.20	Heating season Fr 15.10 to 15.04	Dates of start and end of period of heating season.		14.5
23.21	Summer Time Fr 29.03 to 26.10	Dates of start and end of period of summer time period.		14.6

24. MEAS & COUNT & CALC				
Ref.	Display	Description	Notes	Sept.
24.1	Des T boil: 80.0c Act T boil: 80.0c	Des: Desired temp. boilers. Act: Actual temp. boilers (B1 or B3).		17.5
24.2	Output control boilers : 50%	Value of control output of ISC 648 modules	General situation boilers: 0 = all Off; 50% = half On; 100% = all On	17.5
24.3	Outside temp CRing : -02.0c	Actual: Outside temp. measured by B2 C-Ring: Outside temp. via C-Ring	Actual : only if detector B2 connected and configured in 26.1.	17.5
24.4	Des DHW T : 50.0c Act DHW T : 50.0c	Des : Desired DHW temp. Act : Actual DHW temp (B6).	Appears only if detector B6 connected and configured in 26.1.	17.5
24.5	B7 : 12.0mA Min: 4.0Max: 20.0	Value measured by active detector B7 Alarm limits programmable by PC	Appears only if detector B7 connected and configured in 26.1.	17.5
24.6	Boiler1 : 0000hrs Boiler2 : 0000hrs Boil 1F1: 0000hrs Boil 1F2: 0000hrs	Metering hours boilers 1 & 2 On Metering hours stages 1 & 2 boiler 1 On. Further pages according to number boilers in 25.2	Appears if in 25.1 choice is 1 STAGE Appears if in 25.1 choice is 2 STAGES	17.5

25. SETTING BOILERS				
Ref.	Display	Description	Notes	Sept.
25.1	Boilers: 1 STAGE WITH VALVES	Type of boiler : 1 STAGE; 2 STAGES. WITH VALVES ; WITHOUT VALVES.		13.1
25.2	Total boilers in sequence: 4	Number of boilers connected : 2 ... 24.		13.1
25.3	Minimum time On boilers: 60s	Minimum On time boilers		13.2
25.4	Minimum time Off boilers: 60s	Minimum Off time boilers		13.2
25.5	Delay closure valves : 360s	Delay time closure valves		13.3
25.6	Auto change over sequence: 15d	Number of days for automatic sequencing		13.4
25.7	Eco Off : NO On : 1stSTAGE	NO = limit not enabled ; YES= limit enabled. 1stSTAGE = in operation only 1st stages ; -- BOILERS = in operation only number of boilers.	Appears if choice in 21.8 is AUTO CHANGE OVER.	13.5
25.8	Qty boiler remot On : 2BOILERS	Maximum number of boilers in operation with contact c2 closed (Qty boiler remot)	Appears only if in 26.1 input 5 is configured.	13.5
25.9	With heating Off BOILERS OFF	Operation with temp. plants C- Ring = 0. BOILERS OFF ; MINIMUM LIMIT T		13.5
25.10	Summer season On : 0BOILERS	Number of boilers in operation in summer period.		13.5

26. CONFIGURATION

Ref.	Display	Description	Notes	Sect.
26.1	Config detectors 1 - - - - -	Configuration detectors connected (inputs B-M). - = detector not connected; Number = detector connected. Factory setting : only B1 configured. B1 and B3 are alternatives.	1 :Detector temp. manifold boilers B1 (0...99 °C). 2 : Outside temp. detector B2 . 3: Detector temp. manifold boilers B3 (0...200 °C). 4 : Contact control Remote On c1 . 5 : Contact control Qty boiler remot c2 . 6 : DHW temp. detector B6 . 7 : Active detector 4 ... 20 mA B7 . Necessary only if connected in C-Bus	13.
26.2	Send alarms :NO PassWTeleman :NO	Enabling alarms to send to telemanagement PC. Enabling telemanagement keynumber.		12.6
26.3	Address : - - - - Group : -	Telemanagement address of controller. Group to which controller belongs.	Necessary only if connected in C- Bus.	12.5
26.4	CRing connection NO	NO : Not connected in C- Ring; YES : connected.		12.1
26.5	Functional Alarms - - - - 8	Enabling functional alarms. Factory setting : only 8 enabled (cannot be disabled).	1 : Diff temp. boilers B1 (0...99 °C). 3 : Diff temp.boilers B3 (0...200 °C). 6 : Temp. DHW B6 . 7 : Value active detector B7 . 8 : Internal real time clock alarm	18.1
26.6	Detector alarms - - - - -	Enabling alarms short or open detector circuits. Factory setting : all disabled. B1 and B3 are alternatives.	1 :Detector temp. manifold boilers B1 (0...99 °C). 2 :Outside temp. detector B2 . 3: Detector temp. manifold boilers B3 (0...200 °C). 6 : DHW temp. detector B6 . 8 : C-Ring alarm	18.2
26.7	K alarms -	Enabling On-Off alarm. Factory setting : disabled.	1 : Input E1, alarm with k1 closed.	18.3
26.8	Choice keynumber - - - -	Choice keynumber to prevent use + and - : 1901 ... 1999	To eliminate keynumber press + and - together	17.3
26.9	Site name - - - - -	Entering site name.	Use + and - to enter letters or digits Use ← and → to position cursor	17.4

27. TESTING

Ref.	Display	Description	Notes	Sect.
27.1	CRing : ??	?? = C- Ring test in progress or test negative YES = test positive	Appears only if in 26.4 choice is YES.	19.1
27.2	Output : DHW Status : OFF	Choice of DTC 648 outputs to test. Choice status of output	Output : DHW; W2; Y2; X2; MANIFOLD; X1 Status : OFF; ON	19.2
27.3	Testing ISC648 1: YES 2: NO 3: NO	Test connections with ISC modules. YES = ISC connected; NO = ISC not connected	Every two seconds controller checks connections of ISC modules	19.3
27.4	Boiler : 1 Status : OFF	Choice outputs of ISC 648 to be tested. Choice status of output.	Boiler: 1 ... n(depends on number of boilers in 25.2). Status :OFF ; ON S1 = On boiler or 1st stage ON S1+2= On 1 st & 2 nd stage (appears only if choice in 25.1 is 2 Stages).	19.4

Amendments to data sheet

from version	to version	Page	Section	Details of amendments
17.09.98 LB	09.12.05 LB	9 11 13	13.5 Partial use of the boiler in seq. 14.4 Special period 6. CONTROL DHW TEMPERATURE	The limit to the number of boilers used in the summer period is cancelled by a Special Period. A Special Period during the summer period cancels the limit to the number of boilers in use. Before : At the request for DHW the desired manifold temperature is the Fixed Point temperature Now : At the request for DHW the desired manifold temperature is the greater between Fixed Point and that in use by Compensation or Plants.



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