Data sheet

CCR3 Controller
- return temperature controller & temperature registration

Description

The CCR3 Controller is an electronic controller for return temperature control in risers in one-pipe heating system based on supply temperature signal.

CCR3 is dedicated to be used with AB-QM automatic balancing & control valve equipped with thermo actuators type TWA-Z (NO) and remote temperature sensors type ESMC.

CCR3 together with AB-QM and TWA-Z is complete one-pipe electronic solution: AB-QTE

Main data:
- Designed for AB-QM DN 10-32 mm
- Maximum number of controlled risers: 16 (individually) or 32 (parallel)
- No distance limitation between risers (control valves) and controller
- For any type of control valves (linear or logarithmic)
- Pulse Wide Modulation (PWM) algorithm
- Return temperature (curve) adjustable in 8 points
- Individual riser setting possible
- Possible to BMS system connection
- LCD display – temperature data indication
- All temperatures registered on SD card

Benefits

- Flow control in risers based on heat demand (risers load)
- One-pipe system operational as fully variable flow system in whole range of supply temperature
- Improved room temperature control
- Eliminate overheating of the building

- Reduce heating cost
- Full temperature monitoring: easy service and maintenance
- Remote control of all temperature setting (no need to get access to risers!)
- Pay back time around 4 years

Ordering

Inclusive in the box: CCR3 Controller, 1 pcs ESMC sensor

Type	Designation	Supply voltage	Actuator type/nos.	Code No.
CCR3 Controller	Return Temperature Controller & Temperature Registration	24 VAC	NO/16	**003Z0389**

Accessory

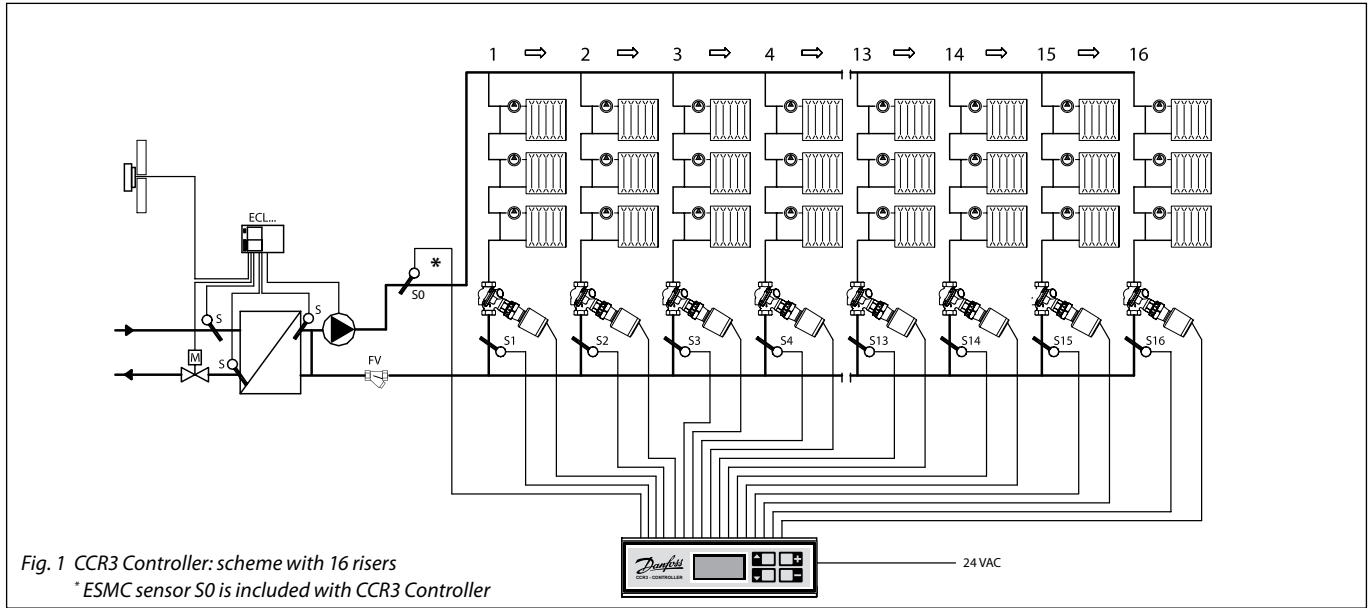| Type	Designation	Voltage	Comments	Data sheet	Code No.
TWA-Z (NO)	Thermal actuators	24 VAC	1.2 m cable	VD.JC.J' .02	**082F1220**
Set: TWA-Z (NO) with ESMC (PT 1000)	Thermal actuators with surface sensor	24 VAC			**003Z0388**
ESMC (PT 1000)	Surface sensor		2 m cable	VD.74.I7.02	**087N0011**

Applications

Fig. 1 CCR3 Controller: scheme with 16 risers
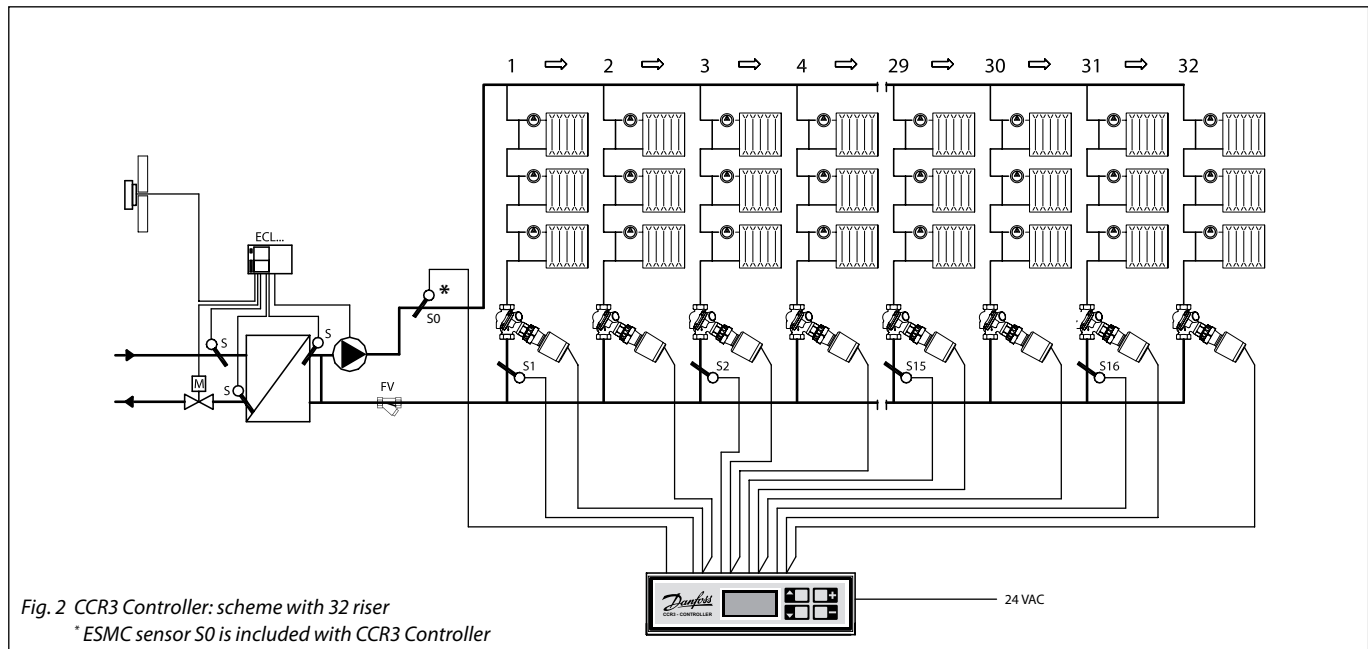 ** ESMC sensor S0 is included with CCR3 Controller*

Fig. 2 CCR3 Controller: scheme with 32 riser
  * ESMC sensor S0 is included with CCR3 Controller

AB-QTE solution converts one-pipe heating system - usually permanent flow system - into efficient variable flow system.
This innovative solution dynamically controls the flow in risers according to the load in risers by return temperature control. Wide range of return temperature setting (8 setting points) ensures high efficiency of the system in whole range of supply temperature from 40-90 °C.

In one-pipe systems flow in the risers is always present even when all TRV's are closed; water flow through the by-pass which result in high operating costs (heat losses, pumping costs, overheating etc). TRV on the radiator controls room temperature by controlling flow through the radiator, while flow ratio between radiator and by-pass is varying; however total flow in risers remains permanent. At partial loads (some TRV's are closed) return water temperature in risers increases, which results in overheating of rooms due to very hot risers.
After the building is renovated heating system becomes oversized since the heat losses of the building decrease. As a result overheating issue increases even more.

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Applications	AB-QTE concept solution:

Applications

AB-QTE concept solution:

- AB-QM mounted in the risers provides right water balance in the risers at all system condition. Every riser get designed flow and each riser is independent from the rest of installation.
- CCR3 and actuators mounted on AB-QM with temperature sensors allow to control flow in risers through the return temperature control. When return temperature increases CCR3 automatically detects this change and reduces flow in risers according to set points (lower load in risers – lower flow needed). This results in improved room temperature control and greatly reduced overheating of the building. Compared to self- acting solution (QT thermostatic elements), AB-QTE solution covers very wide temperature setting. Setting range is presented Fig. 3. All 8 points of return temperature setting correspond to supply temperature what allows automatic adaptation to weather condition according the rules: lower outside temperature , higher supply temperature – except higher return temperature, but all time optimized at any supply parameter.

Thus one-pipe system becomes energy efficient variable flow system.

- AB-QTE solution is perfect from service, monitoring and maintenance point of view. All temperature resetting can be done in remote way, all temperature can be review on LCD display which allows detection of possible problems. SD card used in CCR3 allows to register temperature data which will simply system optimizations.

Danfoss AB-QTE solution for one-pipe renovation system is a top end solution where the first for system control double curve control is proposed. First one: on primary side , usually in sub-station where weather compensatory control supply temperature according out-door temperature (based on weather compensator curve). Second one: on secondary side where return temperature curve is adjusted based on supply water temperature.

Technical data

General data

Temperature sensor (S0, S1-S16)	Pt1000 , S0 – type ESMC, S1-S16 – type ESMC
Temperature range (registration)	−20 … 120 °C
Temperature accuracy	+/- 0,5 K
Inputs: B1 i B2	Free contact relay (5 V, 1 mA)
Number of control (risers)	16 basic, additional 16 with parallel connection (32 all together)
Output signal to actuators	24 VAC max. 1 A (Triac)
Alarm output signal	24 VAC max. 1 A (Triac)
Relay output	0-24 V AC/DC max. 1 A
Output °C	0-20 V DC NPN Open collector max. 200 mA (Transistor)
Type of memory card	SD, Included as standard – 2 GB
Maximum memory card	4 GB
Timer: actual time	Built in, hold up 10 years
Ambient temperature	0 … 50 °C
Transport temperature	−10 … 60 °C
IP rating	IP 20
Power supply	24 VAC
Power consumption	6 VA
Weight	0,9 kg
Installation	DIN 35 mm (DIN RAIL 35 mm)

The return temperature can be adjusted in eight points, each correspondent to one flow temperature.
The setting can be automatically applied for all risers or using from menu additional setting function return temperature can be modified individually to each riser by:
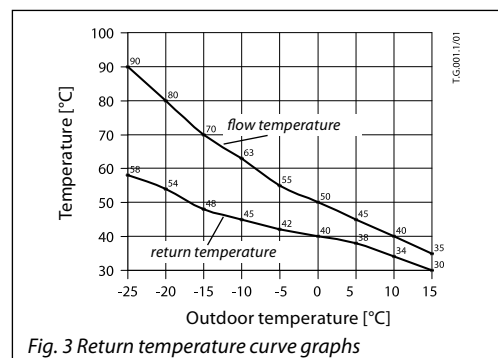Shift factor – allow to move up and down the curve in each point, setting range ±10 °C.

Fig. 3 Return temperature curve graphs

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Settings

Flow on AB-QM and temperature setting on CCR3 Controller need to be set to achieve best performance and efficiency of one-pipe heating system.

Recommended is a following 3 steps setting procedure:
1. AB-QM setting
2. CCR3 Controller setting
3. Follow up

There are two main reasons that influence one-pipe system efficiency and therefore AB-QM and CCR3 setting:
1. renovation status of the building since renovation is major reason for heating system to become oversized, generally, after building is renovated (wall & roof insulation, new windows) existing heating system becomes significantly oversized.
2. a dynamic nature of the heating load that is changing unpredictably in he building due to partial loads, internal gains and weather conditions.

Note: After renovation, one possible step to improve efficiency of the one-pipe heating system is also optimization (reduction) of the supply water temperature. This procedure should consider the worst riser condition (big load, bad isolation etc) that means that the rest of the risers will stay with over-heated parameters. AB-QTE solution in allows adopting individual parameters for each riser what increases efficiency of the system.

1. AB-QM setting
First it is necessary to set the AB-QM for required flow before the actuators is mounted. As AB-QM setting not influence for return temperature setting, flow can be adjust according standard AB-QM setting recommendation from 20 % to 100 %.

2. CCR3 controller setting
Return temperature setting should be done centrally on CCR3 for all risers.
To simplify setting procedure it is required to adjust only 8 return temperature points which correspondent to supply temperature, e.g: supply temp. 40 °C (required return temp. 38 °C), supply temp. 45 °C (required return temp. 40 °C), etc.
These settings will apply for risers. Later, if needed from menu we can choose option to change setting individually for each riser. Setting point can be moved up and down – according to request. This option allows in easy way adapting risers to individual demands.

For additional information about temperature choosing for nominal condition including Dynamic factor method please look in data sheet:
VD.C6.U1.02 Danfoss 08/2010 – Thermostatic actuators QT, page 6.

For simplification CCR3 Controller offers default setting (factory setting curve) that fits to typical renovated system based on EN 15316 and ISO 13790.

3. Follow up
Achieved energy efficiency of AB-QTE solution depends on CCR3 Controller setting. For maximum results it is strongly recommended to perform follow up on the installation during first weeks of system operating. Easy access to setting from one central place (where CCR3 Controller is installed) allows making any changes without extra cost and efforts!

Mounting

Actuators:
according data sheet:
VD.JC.J3.02 Danfoss 01/2007

Sensors:
according data sheet:
VD.74.I7.02 Danfoss 01/2007

Note: to compensate long distance from sensor to CCR3 controller (additional cable resistance can influence accuracy of temperature measuring), please use correction factors according CCR3 instruction VI.D3.A1.02 page 7, points 32. Cables shorter than 10 m (0,75 mm²) and 15 (1,00 mm²) do not require any correction.

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Recording data (storing data)

The CCR3 Controller can measure temperature with accuracy: ±0,5 °C.
Temperature indicated resolution: accuracy:
± 0, °C
All data is stored in .txt file and can be transferred to .xls file.

An example of temperature indication:

SN: {072833} {066458} {008930}				
Data	S0	S1	S2	S3
2006-11-10 09:13:38	48.6	52.6	50.3	53.2
2006-11-10 09:13:48	48.6	52.6	50.3	53.2
2006-11-10 09:17:15	48.6	52.6	50.3	53.2

Fig. 4 The example of temperature storage on SD card

Each CCR3 Controller has an individual identification code number. This SN code is generated by the producer and contains two series of six numbers {072833} {066458}. The third number is the control sum which is used by the producer and service engineer for code verification. This sum control allows controlling if the system was edited manually. The CCR3 Controller can be used to record temperatures in one-pipe heating system. Temperatures are measured by PT 1000 temperature sensors installed on the risers. If the CCR3 Controller is used solely for recording temperatures, it is not necessary to install any actuators on AB-QM.

Sampling time (data collection) intervals can be adjusted using the controller's keypad from 10 seconds to 4 hours.

Data is stored on an SD memory card. The period of collecting data depends strongly on the card's capacity and the sampling interval. Several examples of data collection periods are provided in the table below. The SD card is included with the CCR3 Controller. 2 GB SD cards allow storing data during 6 years with sampling rate every 5 minutes in 16 risers.

Data is saved in text format (*.txt) and can be read using an ordinary PC. To read data from the card, you need to have a standard SD card reader installed on your PC or use an SD/USB adapter. The data can be imported into a spreadsheet and processed graphically e.g. visualised in the form of graphs. The saved data is not scrambled in any way, however a control sum is written with every save to authenticate the data.
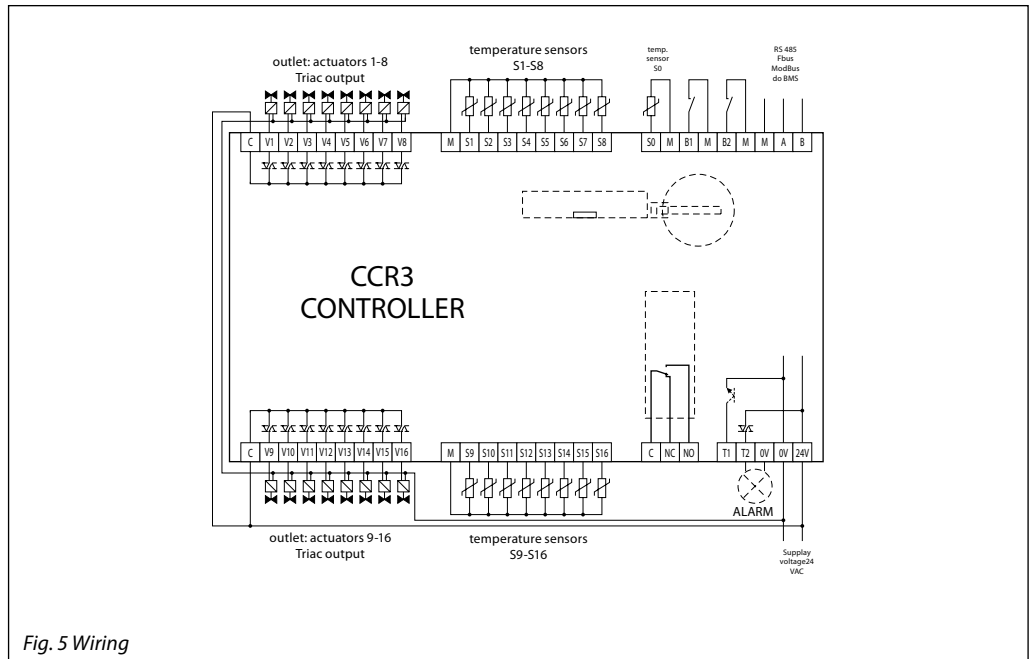
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Wiring

Fig. 5 Wiring

Dimensions and Installation
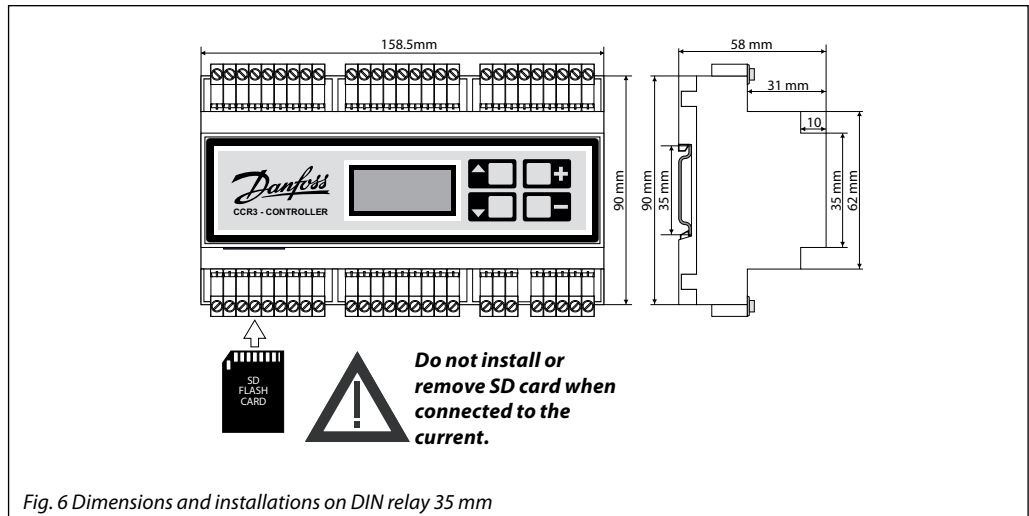
Do not install or remove SD card when connected to the current.

Fig. 6 Dimensions and installations on DIN relay 35 mm