ENGINEERING
TOMORROW

Operating Guide

ECL Comfort 310, application P318.21

1.0 Table of Contents

1.1 Important safety and product information

1.1.1 Important safety and product information

This Operating Guide is associated with the ECL Application Key P318 (code no. 087H3835) and is **only** focusing on subtype P318.21.

For detailed information about ECL Comfort 310, handling, setting etc., please see the P318 Operating Guide.

P318.21 runs an advanced Domestic Hot Water (DHW) temperature control. As option, a heating circuit can be controlled.
See the Installation Guide for application diagrams and electrical connections.
The application diagrams show mandatory temperature sensors with an underscore; example S3.

The described functions are realized in ECL Comfort 310 which also allows M-bus, Modbus and Ethernet (Internet) communication.
The Application Key P318 complies with ECL Comfort 310 controllers as of firmware version 1.11. The firmware (controller software) is visible at start-up of the controller and in 'Common controller settings' in 'System'.

Up to two Remote Control Units, ECA 30 or ECA 31, can be connected.

The application P318.21 works with the additional Internal I/O module ECA 35.

The extension module ECA 35 gives PWM (= Pulse Width Modulation) signal for control valves and ON-OFF signal for Flushing and Heating circuit.

Alternatively, ECA 35 gives 0 - 10 Volt signal for control valves.

The ECL Comfort 310 works with one ECA 35 which is placed in the base part of the ECL Comfort 310.

Together with the ECL Comfort 310 the additional Internal I/O modules can also be used for extra data communication to SCADA:

- Temperature, Pt 1000 (default)
- 0 - 10 volt signals
- Digital input

The set-up of input type can be done by means of the Danfoss Software "ECL Tool" or from the ECL Portal.
The ECL Portal (see *https://ecl.portal.danfoss.com*) is an Internet-based tool for monitoring and remote control of ECL controllers.

Documentation
Navigation: Danfoss.com > Products & Solutions > Products > District Heating and Cooling > Documentation > Tools & Software > ECL Tool.
The URL is:
https://www.danfoss.com/en/service-and-support/downloads

ECL Comfort 310 is available as:

- ECL Comfort 310, 230 volt a.c. (code no. 087H3040)
- ECL Comfort 310B, 230 volt a.c. (code no. 087H3050)
- ECL Comfort 310, 24 volt a.c. (code no. 087H3044)

The B-type has no display and dial.

The B-type is operated by means of the remote control unit ECA 30 / 31:

- ECA 30 (code no. 087H3200)
- ECA 31 (code no. 087H3201)

Internal I/O modules:

- ECA 35 (code no. 087H3205)

Base part for ECL Comfort 310, 230 volt and 24 volt: Code no. 087H3230.

Additional documentation for ECL Comfort 210 and 310, modules and accessories is available on *http://heating.danfoss.com/*.

Application keys might be released before all display texts are translated. In this case the text is in English.

Safety Note
To avoid injury of persons and damages to the device, it is absolutely necessary to read and observe these instructions carefully.

Necessary assembly, start-up, and maintenance work must be performed by qualified and authorized personnel only.

Local legislations must be respected. This comprises also cable dimensions and type of isolation (double isolated at 230 V).

A fuse for the ECL Comfort installation is max. 10 A typically.

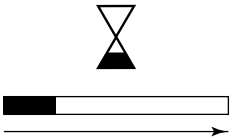
The ambient temperature ranges for ECL Comfort in operation are:
ECL Comfort 210 / 310: 0 - 55 °C
ECL Comfort 296: 0 - 45 °C.
Exceeding the temperature range can result in malfunctions.

Installation must be avoided if there is a risk for condensation (dew).

The warning sign is used to emphasize special conditions that should be taken into consideration.

This symbol indicates that this particular piece of information should be read with special attention.

Automatic update of controller software (firmware):
The software of the controller is updated automatically when the key is inserted (as of controller version 1.11 (ECL 210 / 310) and version 1.58 (ECL 296)). The following animation will be shown when the software is being updated:



Progress bar

During update:

- Do not remove the KEY
  If the key is removed before the hour-glass is shown, you have to start afresh.
- Do not disconnect the power
  If the power is interrupted when the hour-glass is shown, the controller will not work.
- Manual update of controller software (firmware):
  See the section "Automatic / manual update of firmware"

As this Operating Guide covers several system types, special system settings will be marked with a system type. All system types are shown in the chapter: 'Identifying your system type'.

°C (degrees Celsius) is a measured temperature value whereas K (Kelvin) often is used for temperature differences.

The ID no. is unique for the selected parameter.

Example	First digit	Second digit	Last three digits
11174	1	1	174
	-	Circuit 1	Parameter no.
12174	1	2	174
	-	Circuit 2	Parameter no.
If an ID description is mentioned more than once, it means that there are special settings for one or more system types. It will be marked with the system type in question (e.g. 12174 - A266.9).			

Parameters indicated with an ID no. like "1x607" mean a universal parameter.
x stands for circuit / parameter group.

Disposal Note
This product should be dismantled and its components sorted, if possible, in various groups before recycling or disposal.
Always follow the local disposal regulations.

2.0 Installation

2.1 Before you start

Description, in general

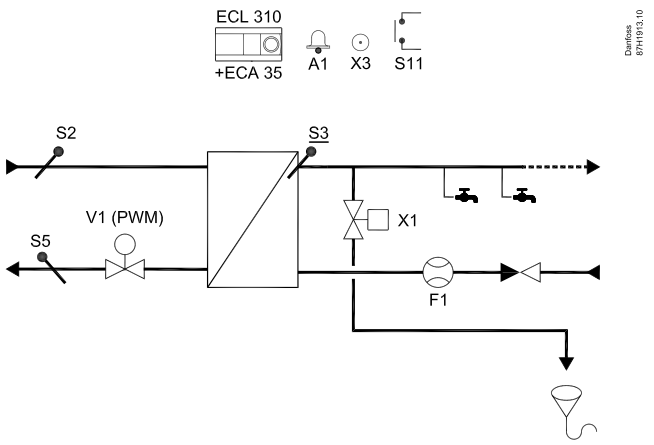
Subtype P318.21 ex. a

Control of the flow temperature in an indirectly heated DHW (Domestic Hot Water) system. The temperature sensor S3 must be connected and the temperature control is, among others, based on the flow signal from flow meter F1. This flow is present when DHW is taken from the tap. The control valve is operated by a stepper motor via the V1 output, which is a PWM signal. With control by means of a stepper motor (= quick operating), the control valve controls the flow for correct temperature at S3.

The measured temperature at S2 can change the Xp value (proportional band) for optimum DHW temperature control. Return temperature S5 is for monitoring only.
A Bypass function can maintain a desired temperature at S2. This helps to reduce the heat-up time for DHW if DHW has not been taken from the tap for a longer time.
Based on the measured temperature at S2, the control valve V1 can be opened periodically to a set position. ECL awaits the temperature to reach a set temperature and V1 closes again. A schedule ("Schedule, bypass") can be set for having Bypass active in set periods.

A flush function, activating an ON-OFF valve via output X1, can avoid the heat exchanger to be too warm when no DHW is taken from the tap.

P318.21, ex. a:



The shown diagram is a fundamental and simplified example and does not contain all components that are necessary in a system.

All named components are connected to the ECL Comfort controller.

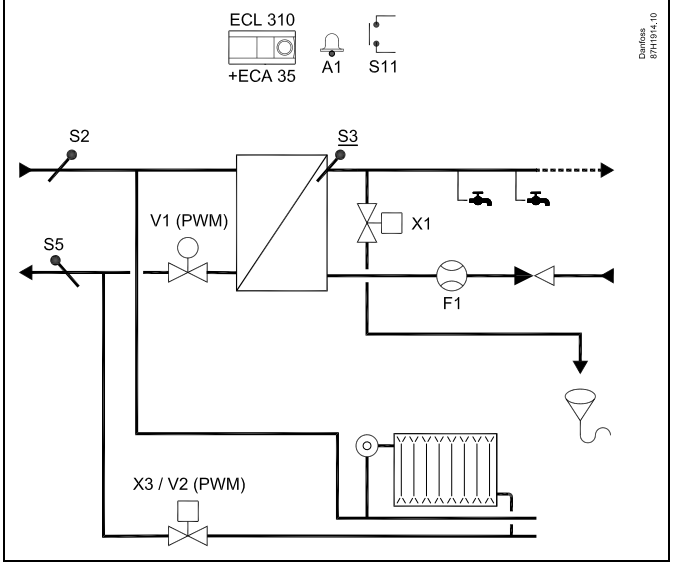
List of components:

ECL 310	*ECL Comfort 310 controller*
ECA 35	*Extension module, placed in the base part of ECL 310*
S2	*Supply temperature sensor (used for Bypass function and compensated Xp)*
S3	*(mandatory) DHW temperature sensor*
S5	*Return temperature sensor (monitoring purpose only)*
S11	*Input (potential free) for room thermostat, see ex. b*
F1	*Flow sensor (connected to S7)*
V1	*Actuator, PWM controlled, for control valve*
X1	*ON-OFF flush valve*
X3	*See example b*
A1	*Alarm*

Subtype P318.21 ex. b

In addition to the description of example a, the subtype can furthermore control a heating circuit.
The ON-OFF valve X3 (= solenoid valve = magnetic valve) is operated by **either** the X3 output **or** the V2 output, which is the PWM signal for control of a stepper motor. In this case the stepper motor either fully opens or closes the X3 valve.
The week schedule ("Schedule") determines the periods (Comfort) where the heating circuit is switched in.
A room thermostat, potential free (= volt free) connected at input S11, can also switch in the heating if "Schedule" is in Saving mode.
The heating circuit is switched off (= closed) during DHW heating.

P318.21, ex. b:



The shown diagram is a fundamental and simplified example and does not contain all components that are necessary in a system.

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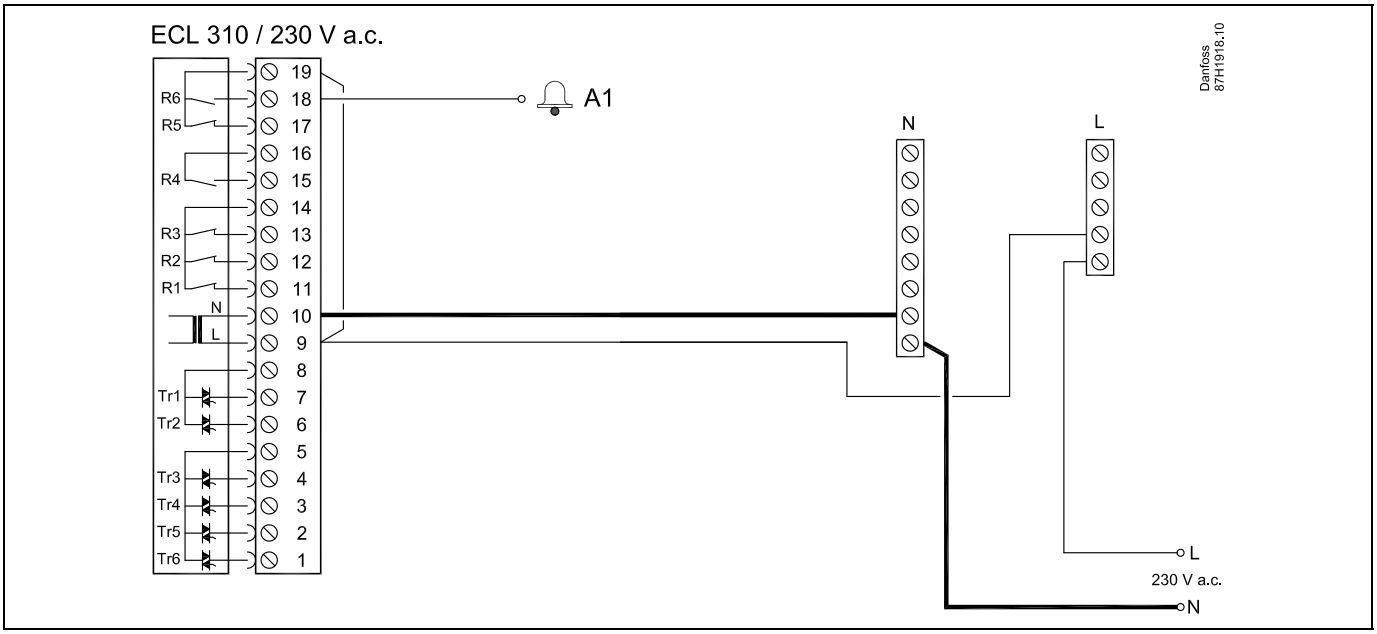
S3	*(mandatory) DHW temperature sensor*
S5	*Return temperature sensor (monitoring purpose only)*
S11	*Input (potential free) for room thermostat*
F1	*Flow sensor (connected to S7)*
V1	*Actuator, PWM controlled, for control valve*
V2	*Actuator, PWM controlled, for heating ON-OFF*
X1	*ON-OFF flush valve*
X3	*Output for heating ON-OFF. Alternative to V2*
A1	*Alarm*

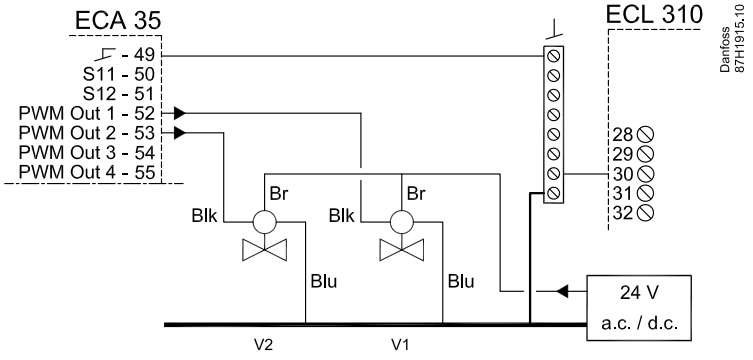
The controller is pre-programmed with factory settings that are shown in the 'Parameter ID overview' appendix.

2.2 Electrical connections

ECL 310, power supply and alarm connections

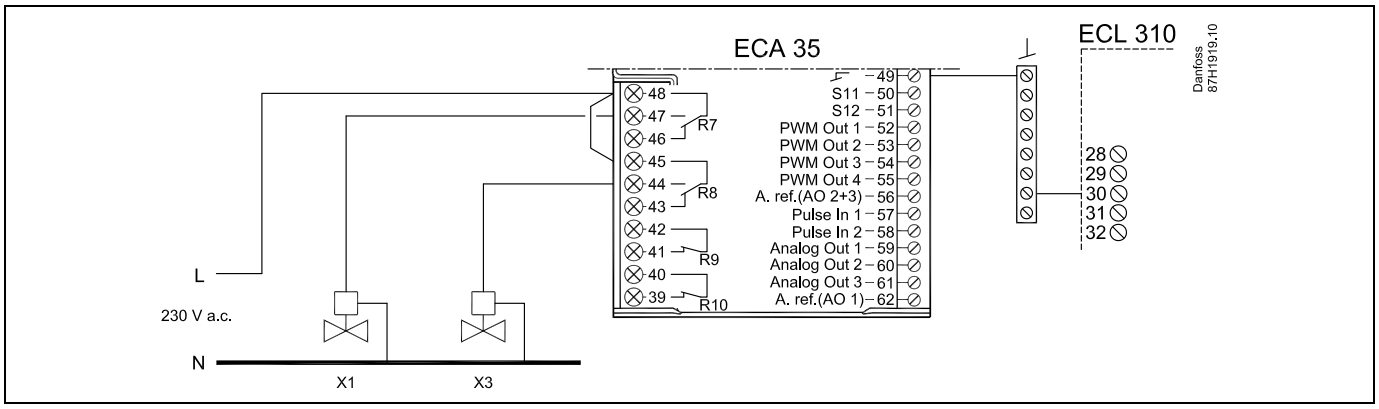


ECA 35, output connections
V1, V2



Blk = Black, Blu = Blue, Br = Brown

ECA 35, output connections
X1, X3

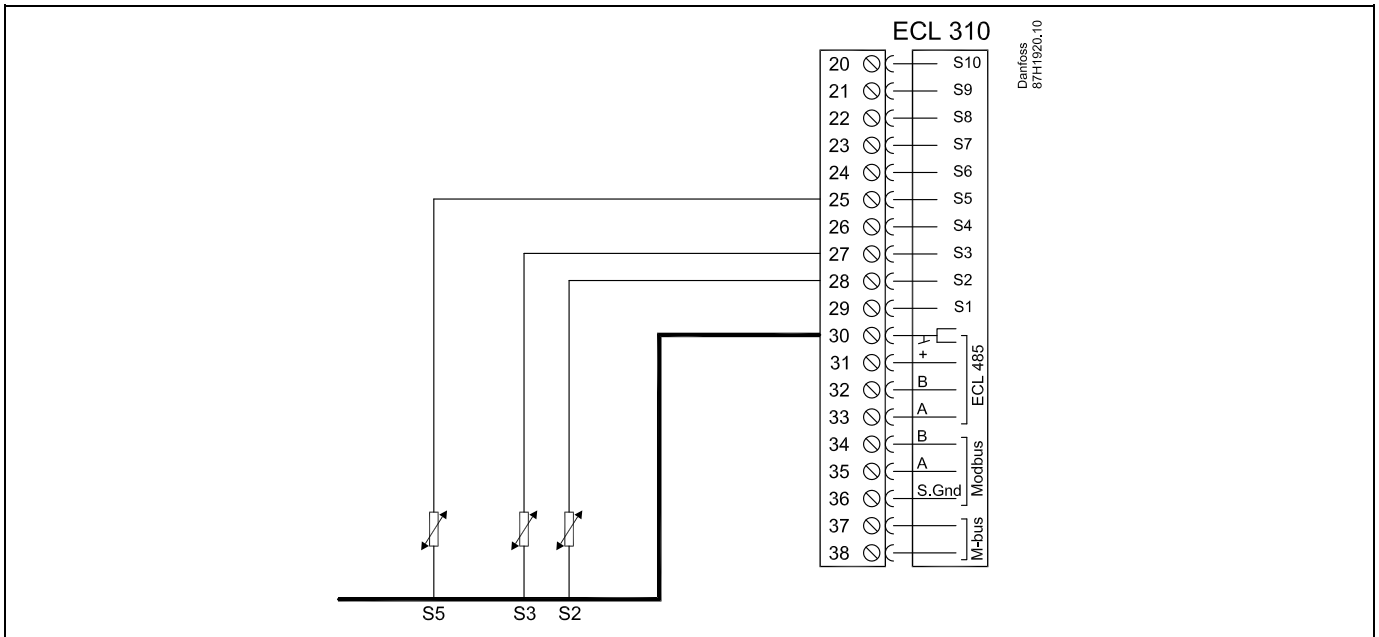


Sensor	Description	Recommended type
S2	Supply temperature sensor **	ESM-11, ESMB, ESMC, ESMU (all Pt 1000 types)
S3	Flow temperature sensor *	ESMU (Pt 1000 type)
S5	Return temperature sensor	ESM-11, ESMB, ESMC, ESMU (all Pt 1000 types)

*)
The flow temperature sensor must always be connected in order to have the desired functionality.
If the sensor is not connected or the cable is short-circuited, the motorized control valve closes (safety function).

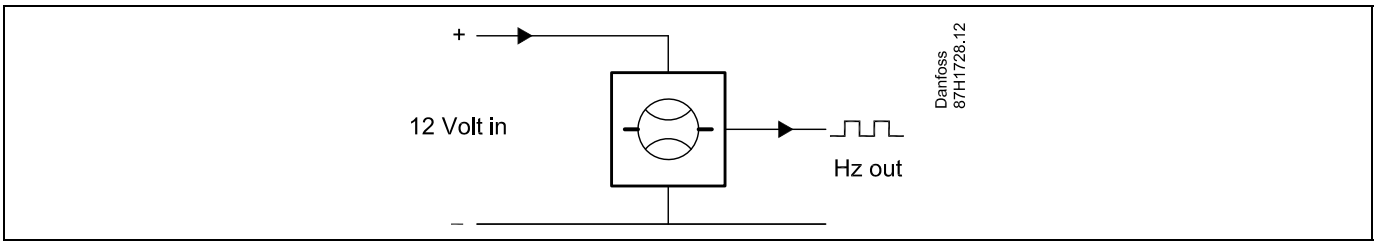
**)
The supply temperature sensor must be connected for enabling the Bypass function.

ECL 310, input connections
S2, S3, S5

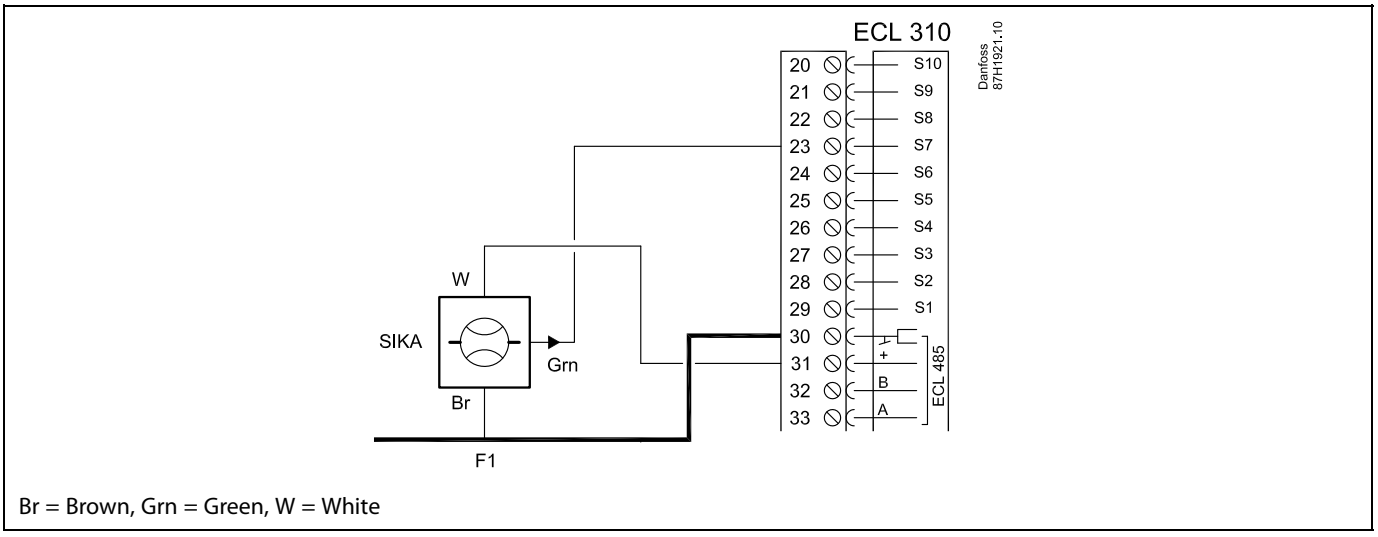


Note: S3 must be connected

Flow sensor, F1

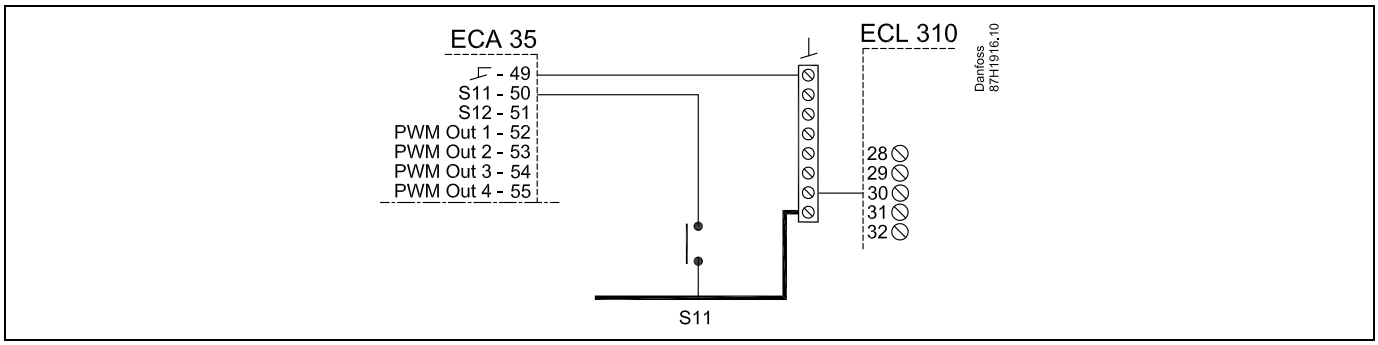


ECL 310, input connections
Flow sensor connection to S7

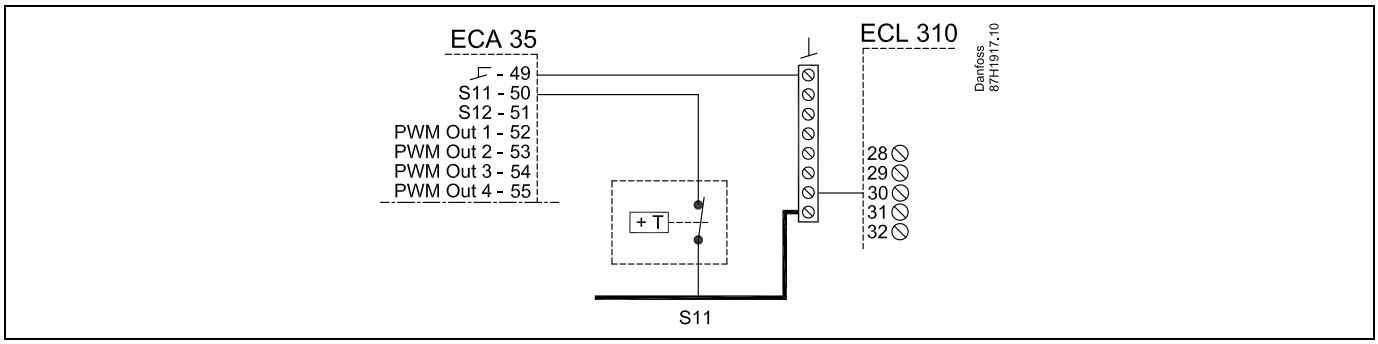


Br = Brown, Grn = Green, W = White

ECA 35, Input connections
S11



Input connections, ECA 35
S11 (Room thermostat)



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Safety Note
Necessary assembly, start-up, and maintenance work must be performed by qualified and authorized personnel only.

Local legislations must be respected. This comprises also cable size and isolation (reinforced type).

A fuse for the ECL Comfort installation is max. 10 A typically.

The ambient temperature range for the ECL Comfort in operation is 0 - 55 °C. Exceeding this temperature range can result in malfunctions.

Installation must be avoided if there is a risk for condensation (dew).

See also the Installation Guide (delivered with the application key) for application specific connections.

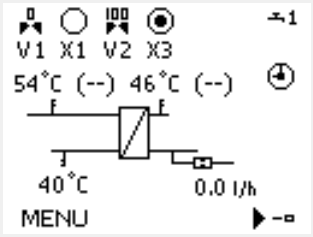
3.0 Daily use

3.1 Understanding the controller display

Favorite display 1:

20.10.2020:	Date
46.3:	Actual DHW temp. at S3
16.51	Actual time
50 °C:	Desired DHW temp.

Favorite display 2:



V1:	Opening in % of V1
X1:	Flush activity; shown OFF
V2:	Heating valve ON-OFF control (0 % = closed, 100 % = open)
X3:	Heating valve ON-OFF control; shown ON
54 °C:	Supply temp. S2
(- -):	Desired bypass temp.
46 °C:	DHW temp. S3 (heat exchanger temp.)
(- -):	Desired DHW temp.
40 °C:	Return temp. S5
0.0 l/h	Actual water flow
	The indication (- -) shows that the related function is not active.

The display is updated every 5th second.
When operating the ECL with the dial, the display is immediately updated.

Settings and navigation in menus:
See sections **Navigation** and **Settings**

3.2 Description of functions

DHW temperature control

Desired DHW temperature is set in the Favorite display 1, for example 50 °C.
The cold-water flow signal from F1 is used to optimize the DHW temperature control.
This pro-active functionality compensates for the delay before the flow temperature sensor S3 measures a change in temperature.

Bypass function

For having an acceptable temperature (supply temperature) present at the installation, the Bypass function is useful for minimizing the DHW heat-up time.
The supply temperature sensor S2 is used for the Bypass function.
A desired temperature for the Bypass function can be set.
Furthermore, a week schedule ("Schedule, bypass") can be set to activate the Bypass in set periods.
(Navigation: MENU > Schedule, bypass)

Flush function

This function is active only if no DHW is taken from the tap.
If the temperature at S3 gets higher than "DHW max. T", the Flush is activated (= X1 opens) in periods, set by "Delay".
The ECL awaits the S3 temperature to drop, and Flush is de-activated when the S3 temperature is "DHW max. diff" below "DHW max. T".
The Flush function can be disabled by setting "DHW max. T" to OFF.

Alarm

An alarm function is only implemented for sensor connections.
See the P318 Operating Guide for details.

Flow sensor

SIKA VTY20 flow sensor in the CW line has a pulse rate of 119 pulses / liter. The flow range is 1 . . . 60 l / min. The flow signal (pulses) is sent to the ECL for controlling the DHW temperature at S3.

Stepper motor indications from closed to open position

- red triangle = fully closed (0 %)
- red triangle + blue rectangle
- blue rectangle
- blue rectangle + yellow circle
- yellow circle = fully opened (100 %)

Settings for daily use

Normally, the set value for DHW temperature is set once.

3.3 A general overview: What do the symbols mean?

Symbol	Description	
	Outdoor temp.	Temperature
	Relative humidity indoor	
	Room temp.	
	DHW temp.	
	Position indicator	
	Scheduled mode	Mode
	Comfort mode	
	Saving mode	
	Frost protection mode	
	Manual mode	
	Standby	
	Cooling mode	
	Active output override	
	Optimized start or stop time	
	Heating	Circuit
	Cooling	
	DHW	
	Common controller settings	
	Pump ON	Controlled component
	Pump OFF	
	Fan ON	
	Fan OFF	
	Actuator opens	
	Actuator closes	
42	Actuator, analogue control signal	
45	Pump / fan speed	
	Damper ON	
	Damper OFF	

Symbol	Description
	Alarm
	Letter
	Event
	Monitoring temperature sensor connection
	Display selector
	Max. and min. value
	Trend in outdoor temperature
	Wind speed sensor
--	Sensor not connected or not used
---	Sensor connection short-circuited
7-23	Fixed comfort day (holiday)
	Active influence
	Heating active (+) Cooling active (-)
1 2	Number of heat exchangers

Additional symbols, ECA 30 / 31:

Symbol	Description
	ECA Remote Control Unit
15	Connection address (master: 15, slaves: 1 - 9)
	Day off
	Holiday
	Relaxing (extended comfort period)
	Going out (extended saving period)

In ECA 30 / 31 only the symbols that are relevant to the application in the controller are displayed.

3.4 Navigation, ECL Application Key P318.21

Navigation (1)

Menu	Schedule	Week schedule for Heating circuit
	Schedule, bypass	Week schedule for Bypass function
	Settings	
	Influence overview	Info if Bypass is active

4.0 Settings overview

For factory settings and setting range, see appendix “Parameter ID overview”.
Parameters indicated with an ID no. like "1x607" mean a universal parameter. x stands for circuit / parameter group.

Setting	ID	Page	Factory settings in circuit(s) 1
Xp actual		19	
"Empty line”		20	
BYPASS		20	
Await time		21	
Actual		22	
DHW deact. time	11045	18	
Delay	11080	18	
Supply T (idle)	11097	20	
Pulse	11114	22	
Units	11115	22	
V out max.	11165	19	
Reverse out	11171	20	
Tn	11185	19	
Nz	11187	19	
Td	11197	19	
Wake up level	11330	21	
Level	11353	20	
CW influence	11354	20	
Control delay	11364	21	
Send desired T	11500	23	
DHW max. T	11580	18	
DHW max. diff.	11581	18	

5.0 Settings

5.1 Introduction to Settings

Settings

Flow temperature	Flush function related settings
Control par. 1	Parameters for DHW temp. control and Bypass function
Flow meter	Parameters related to flow sensor
Application	Used if the ECL is a sub-controller in an ECL system

5.2 Flow temperature

(Flush function related settings)

MENU > Settings > Flow temperature

DHW max. T	**11580**

See Appendix "Parameter ID overview"

OFF: Flush function is disabled

Value: Flush function is enabled if DHW temp. at S3 is above set value.

MENU > Settings > Flow temperature

DHW max. diff.	**11581**
Flush function is stopped when DHW temp. at S3 gets below "DHW max. T" + set value.	

See Appendix "Parameter ID overview"

Example: DHW max. T = 40 °C, DHW max. diff = -4 K.
Result: Flush stops when DHW temp. at S3 gets below 36 °C.

MENU > Settings > Flow temperature

Delay	**11080**
Flush starts in intervals with set value when DHW temp. at S3 is above "DHW max. T"	

See Appendix "Parameter ID overview"

MENU > Settings > Flow temperature

DHW deact. time	**11045**
DHW deactivation time	

See Appendix "Parameter ID overview"

OFF: Deactivation disabled.
Flushing is according to "DHW max. diff." and "Delay".
If the DHW temp. at S3 does not get below "DHW max. T", flush is automatically stopped after 100 sec.

Value: Flushing time. DHW heating is deactivated after flush has started according to "DHW max. T" and set time.

5.3 Control parameters (1)

MENU > Settings > Control parameters (1)

Xp actual
Read-out *of the actual Xp (proportional band) based on the supply temperature S2.*

See Appendix "Parameter ID overview"

Xp is determined by settings related to the supply temperature. Typically, the higher the supply temperature, the higher the Xp must be to get a stable temperature control.
Click the menu and see the scale for Xp at 50 and 90 °C.
Change settings if required.
If the supply temperature sensor S2 is not connected, the Xp value is the value set at 50 °C.

MENU > Settings > Control parameters (1)

Tn	**11185**
Integration time	

See Appendix "Parameter ID overview"

Set a high integration time constant (in seconds) to obtain a slow, but stable reaction to temperature deviations.
A low integration time constant will make the controller react fast, but with less stability.

MENU > Settings > Control parameters (1)

Td	**11197**
Time derivative (Differentiation time). *The Td related function can avoid a too aggressive reaction in the temperature control.*	

See Appendix "Parameter ID overview"

0: No influence
Low values will cause minor influence, whereas high values will cause major influence.

MENU > Settings > Control parameters (1)

Nz	**11187**
Neutral zone. *Symmetrically temperature band around desired S3 temperature.* *When the S3 temperature is inside the Neutral zone the regulation makes no change of the V1 position.*	

See Appendix "Parameter ID overview"

MENU > Settings > Control parameters (1)

V out max.	**11165**
Setting the maximum opening of the control valve.	

See Appendix “Parameter ID overview”

MENU > Settings > Control parameters (1)

Reverse out	**11171**

See Appendix “Parameter ID overview”

NO: Control signal (%) rises for more opening of the control valve.

YES: Control signal (%) falls for more opening of the control valve.

MENU > Settings > Control parameters (1)

CW influence	**11354**
Cold-Water influence. *The cold-water flow signal from F1 optimizes the DHW temperature control.* *The value expresses how many % of 100 liters / hour will do an influence on the motorized control valve.* *Low values will cause minor influence, whereas high values will cause major influence.*	

See Appendix “Parameter ID overview”

MENU > Settings > Control parameters (1)

Level	**11353**
Change in water flow more than set value will make further activation of the control valve.	

See Appendix “Parameter ID overview”

MENU > Settings > Control parameters (1)

"Empty line”

MENU > Settings > Control parameters (1)

BYPASS
(group headline only)

MENU > Settings > Control parameters (1)

Supply T (idle)	11097

See Appendix “Parameter ID overview”

OFF: Bypass function is disabled.

Value: Desired temperature to be maintained at S2.

MENU > Settings > Control parameters (1)

Wake up level	11330
The %-value reflects how much V1 opens the control valve at Bypass. The control valve must be opened properly to ensure an acceptable water flow in the supply pipe; readjust the setting, if needed.	

See Appendix “Parameter ID overview”

MENU > Settings > Control parameters (1)

Control delay	11364

See Appendix “Parameter ID overview”

OFF: V1 opens the control valve when the temperature gets more than 5 K below "Supply T (idle)".
V1 closes the control valve when the temperature gets above "Supply T (idle)".

ON: Adaptive adjustment.
An adaptive function detects the progress of the supply temperature and makes change of the period (Await time) between two Bypass activities.

MENU > Settings > Control parameters (1)

Await time
Read-out value *Valid only when "Control delay" is set to ON. It indicates the number of minutes the control valve is closed between two Bypass-based openings.*

See Appendix “Parameter ID overview”

Initial time at power-up is 15 minutes. If time gets higher, the setting of "Wake up level" should be increased or the setting of "Supply T (idle)" should be decreased.
Calculated Await time cannot be reset to 15 minutes without re-powering the ECL.

5.4 Flow meter

MENU > Settings > Flow meter

Actual
Read-out *of actual flow in the Cold Water flow sensor.* *The value is based on applied pulse signal and the settings "Pulse" and "Units".*

See Appendix “Parameter ID overview”

MENU > Settings > Flow meter

Pulse	**11114**
Number of pulses for 1 milli-liter or 1 liter of water flow through flow sensor F1.	

See Appendix “Parameter ID overview”

MENU > Settings > Flow meter

Units	**11115**

See Appendix “Parameter ID overview”

ml, l / h: Number of pulses ("Pulse") represents one ml; flow read-out in l / h

l, l / h: Number of pulses ("Pulse") represents one l; flow read-out in l / h

ml, m3 / h: Number of pulses ("Pulse") represents one ml; flow read-out in m3 / h

l, m3 / h: Number of pulses ("Pulse") represents one l; read-out in m3 / h

5.5 Application

MENU > Settings > Application

Send desired T	**11500**
When the ECL acts as a slave controller in a master / slave system, information about the desired flow temperature can be sent to the master controller via the ECL 485 bus.	

See Appendix “Parameter ID overview”

OFF: Information about the desired flow temperature is not sent to the master controller.

ON: Information about the desired flow temperature is sent to the master controller.

6.0 Common controller settings

6.1 Introduction to 'Common controller settings'

Navigation to "Common controller settings":
MENU (1) > Circuit 1 > Common controller.
See the Operating Guide for P318 for description in general.

Common Controller

Time & Date	Setting Time and date
Input overview	Actual values for: DHW flow temp. Primary return temp. Supply temp.
Log	Log features for: DHW flow temp. Primary return temp. Supply temp.
Output override	Override possibility for selected outputs: V1, X1, V2, X3, A1
Key functions	Info about applications. Copy functions
System	Further system related info and communication settings

7.0 Appendix

7.1 Application upload

The application upload procedure is the following after having powered up the ECL Comfort controller:

1. Insert the application key P318
2. Select language. Info: See section 7.4, Language
3. Select subtype P318.21
4. Set Time and Date

The ECL Comfort controller installs the application, initializes and restarts. Output relays are activated / de-activated (click-sounds from this can be heard). This also means that, for example, Flush and Heating valve can be switched ON and OFF shortly.

7.2 Commissioning

When the P318.21 application has been uploaded the ECL Comfort controller starts in Manual mode. This can be used to verify correct connections of temperature and flow sensors. Also verifying the controlled components (valve actuators) for correct functionality can be done.
The application key is delivered with factory settings.
Depending on system type, it might be necessary to change some factory settings individually in order to optimize the functionality.
The application key must be inserted in order to change settings.

7.3 Power down / power-up

When the power supply to the ECL Comfort controller is disconnected (power down), the output relays go to de-activated position.
This means that, for example, valve actuators can be switched ON.

See the electrical connection diagrams in the Installation Guide. All relay contacts are shown in de-activated situation. Some relay contacts are closed, some relay contacts are open.

When the power supply to the ECL Comfort controller is re-established (power-up), the output relays are activated / de-activated (click-sounds from this can be heard). This also means that, for example, valve actuators can be switched ON and OFF shortly.

7.4 Language

Language

At application upload, a language must be selected.*
If another language than English is selected, the selected language **AND** English will be uploaded into the ECL controller.
This makes service easy for English speaking service people, just because the English language menus can be visible by changing the actual set language into English.
(Navigation: MENU > Common controller > System > Language)

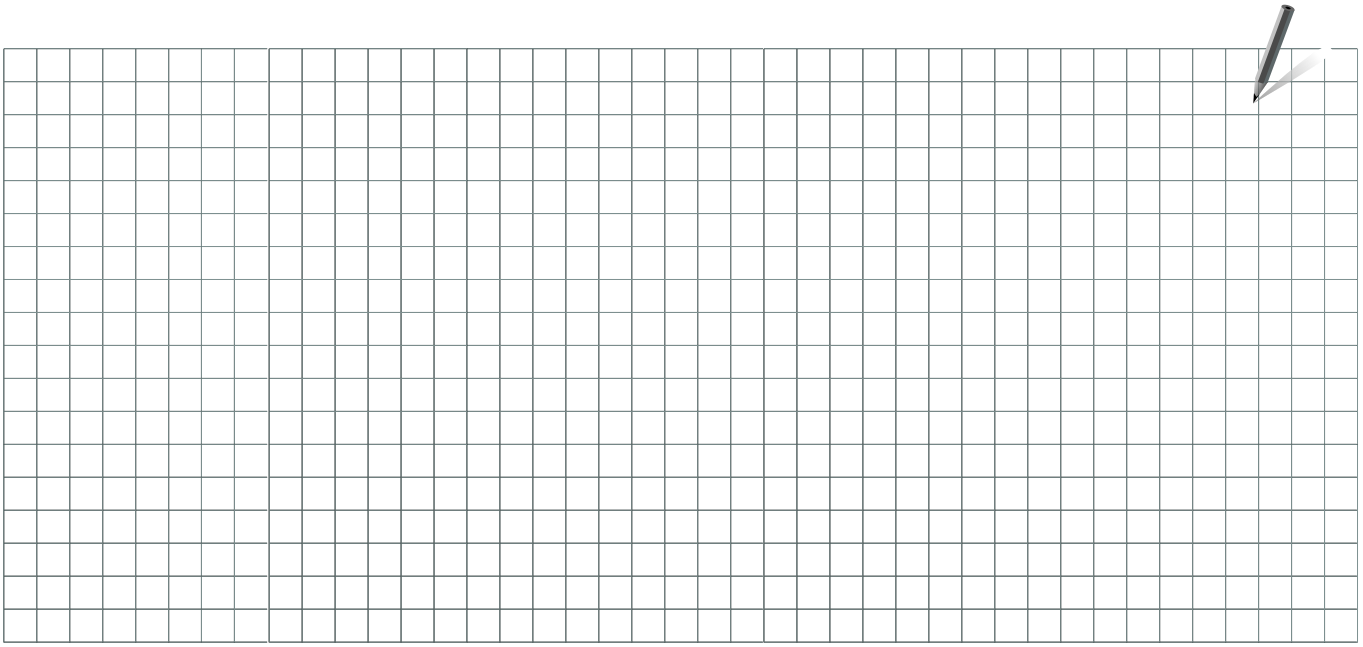
If the uploaded language is not suitable, the application must be erased. User and System settings can be saved on the application key before erasing.
After new upload with preferred language, the existing User and System settings can be uploaded.

*)
(ECL Comfort 310, 24 Volt) If language cannot be selected, the power supply is not a.c. (alternating current).

7.5 Parameter ID overview

P318.x — **x** refers to the subtypes listed in the column.

ID	Parameter Name	P318.x	Setting range	Factory	Unit	Own settings	
11045	DHW deact. time	21	OFF, 1 ... 250	OFF	Sec		
11080	Delay	21	2 ... 200	45	Min		
11097	Supply T (idle)	21	OFF, 10 ... 100	OFF	°C		
11114	Pulse	21	1 ... 9999	119			
11115	Units	21	ml, l/h ; l, l/h ; ml, m3/h ; l, m3/h	l, l/h			
11165	V out max.	1, 2, 5, 10, 11, 21	0 ... 100	100	%		
11171	Reverse out	1, 2, 5, 10, 11, 21	NO ; YES	NO			
	Xp	21	5 ... 250	45 / 45	K		
11185	Tn	21	OFF, 1 ... 999	10	Sec		
11187	Nz	10, 11, 21	0 ... 9	1	K		
11197	Td	21	0.0 ... 25.0	0.0	Sec		
11330	Wake up level	21	0 ... 100	0	%		
11353	Level	21	0 ... 250	20	l/h		
11354	CW influence	21	OFF, 0.1 ... 100.0	7.0	%		
11364	Control, delay	21	OFF ; ON	ON			
11500	Send desired T	1, 2, 5, 10, 11, 21	OFF ; ON	ON			
11580	DHW max. T	21	OFF, 10 ... 110	40	°C		
11581	DHW max. diff.	21	-20 ... -1	-4	K		



Installer: By: Date:

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