

Function expansion module

For controllers from the grandis family

flex 400

Installation and operating instructions

English translation of the German original installation and operating instructions

Version: 2.2

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This manual is designed to help you use the controller properly, safely and economically.

Target group

This manual is addressed to all persons who carry out any of the following tasks:

- Installing the controller
- Connecting the controller
- Putting the controller into operation
- Setting the controller
- Maintaining the system
- Eliminating faults on the controller and the system
- Disposing of the controller

These persons must have the following knowledge and skills:

- Knowledge about establishing electrical connections
- Knowledge about the hydraulic operation of solar power systems
- Knowledge of the applicable regulations at the point of use and the ability to apply them

These persons must have read and understood the contents of this manual.

Availability

This manual is part of the controller. Always keep it in an easily accessible location. Include this manual with the controller should the controller change hands.

If this manual gets lost or becomes unusable, you can contact the manufacturer for a new copy.

Style conventions used in the text


Specific style conventions are assigned to different elements in the manual. This makes it easy to recognise the type of text concerned:

Standard text,

"Menu", "Menu item", "Button designations",

- lists and

➤ actions.

 Notes accompanied by this symbol contain information about how to operate the controller economically.

Style conventions for hazard warnings

This manual makes reference to the following categories of hazard warnings:



DANGER

Information or instructions accompanied by the word DANGER provide a warning about a hazardous situation that will lead to fatal or serious injuries.



WARNING

Information or instructions accompanied by the word WARNING provide a warning about a hazardous situation that may possibly lead to fatal or serious injuries.



CAUTION

Information or instructions accompanied by the word CAUTION provide a warning about a situation that can lead to minor or moderate injuries.

Style conventions for warnings of damage to property or the environment

ATTENTION

Information and instructions of this kind provide a warning about a situation that can lead to damage to property or the environment.

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1 Safety

This chapter contains information on:

- the proper use of the controller and
- the safe use of the controller.

Read this chapter through carefully before you install, connect or operate the controller.

1.1 Proper use

The flex 400 is designed to expand the functions of controllers from the grandis family by adding an additional heating circuit.

Appropriate use of the controller includes the following requirements:

- Use the controller exclusively in dry rooms in residential, commercial and/or industrial environments.
- Use the RS485 interface (ProBusX) only for networking further devices from the manufacturer Prozeda.

The definition of proper use also encompasses observing and complying with all of the information contained in this manual - in particular compliance with all safety information and instructions.

Any other use, or any use exceeding the specifications, will be deemed to be improper use and may lead to personal injury or damage to property and shall render the warranty void.

Use of the controller in the following situations in particular is considered to be improper use:

- If you modify the controller independently and without prior authorisation
- If you operate the controller in a humid or wet environment

The manufacturer shall not be liable for damages arising from inappropriate use.

1.2 Basic safety information

This section contains basic safety information relating to working with the controller. You will find additional safety information relating to specific actions and workflows at the beginning of the section concerned.

Preventing risks of explosion

- Never use the unit in areas where there is a risk of explosion.

Preventing risks of fatal injury from electric shocks

- Make sure that all regulations applicable at the point of use are complied with.
- Always make sure that the controller is disconnected from the power supply before carrying out any work on it.
- Make sure that the connections of the protective extra-low voltage areas do not get mixed up with the power supply connections.
- On completion of the installation work, refit the cover and tighten the screws using a screwdriver.
- Make sure that the electrical connection of the controller can be disconnected from the mains externally if required.
- Make sure that all cables are secured by strain relief devices.
- Use the device only if it is in a fault-free condition.

Preventing damage to property

- A damaged controller may cause malfunctions in the system as well as damage to its components. Use the controller only if it is in a fault-free condition.
- Install the controller with due observance of its protection class. Information about this can be found in the chapter *Technical Data* from page 18 onwards.
- Make sure that no moisture gets into the controller.
- If any moisture gets into the controller, disconnect the controller from the power supply.
- Make sure that the maximum permissible ambient temperature is not exceeded. Information about this can be found in the chapter *Technical Data* from page 18 onwards.
- Make sure that all components to be connected to the switching outputs are suitable for an operating voltage of 230 V/50 Hz.
- Install sensor lines separate from 230 V lines.

2 Description of the controller

The flex 400 is designed to expand the functions of controllers from the grandis family by adding an additional heating circuit. Initialisation takes place automatically after the flex 400 is connected to the bus and is activated at the controller in the "Basic settings" menu. The actual control functions are performed by the connected main controller. If several flex 400 modules are connected to the bus, the DIP switch (addressing) in the flex 400 must be set by hand, see chapter 4.4.

- Compact design to enable installation in a heating station.
- Protection class IP 54 (e.g. for use in heating circuit stations).

3 Installing the flex 400



DANGER

Risk of fatal injuries due to explosions or fire.

- Never use the controller in areas where there is a risk of explosion.
 - Install the controller on a non-flammable subsurface.
-



DANGER

Risk of fatal electric shock when working on the opened controller.

- Make sure that the controller is disconnected from the mains voltage before removing the cover.
 - Make sure that the power supply has been secured to prevent it from being switched on again.
 - Check that the controller is free from voltage.
 - Screw the cover securely back in place when the work has been completed.
-

ATTENTION

Risk of damage and malfunctions due to improper storage before connection.

- Store the controller at room temperature for at least four hours before connecting it.
-

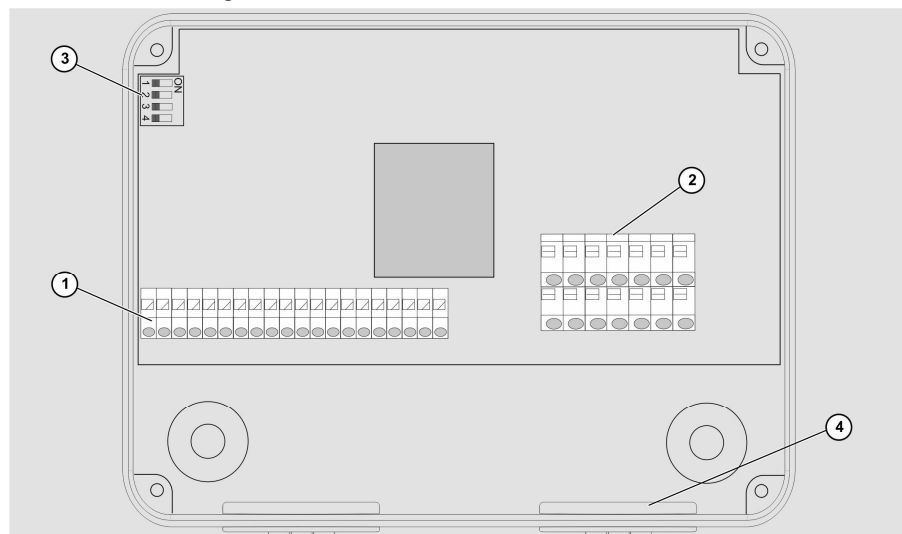
Select an installation location which meets the following requirements:

- It must have access to the power supply.
- There must be sufficient space in front of the controller to allow it to be operated.

3.1 Connecting cables to the controller

- Make sure that the cables and the controller are disconnected from the voltage.
- Remove the cover.

The following illustration shows the elements of the controller that are important for connection and configuration:



Item	Description
1	Terminals for extra-low voltage area
2	Terminals for 230 V area
3	DIP switch – flex 400 addressing. Relevant when several flex 400 modules are connected to the bus
4	Cut-out apertures for cable feedthrough on the underside

- Connect the cables to the corresponding terminals.

Information about connecting the system components to the corresponding terminals can be found in the section *Assignment of the terminals*.

- Screw the cover securely back in place.

3.2 Connecting the controller to the power supply

When making the mains connection, you must ensure that the mains supply can be disconnected at any time.

If you make the mains connection complete with cable and earthing pin plug, proceed as follows:

- Make sure that the earthing pin plug is easily accessible.
- Plug the earthing pin plug in the plug socket.

3.3 Connecting temperature sensors

ATTENTION

Risk of damage and malfunctions on the controller due to improper connection of the temperature sensors.

- Use only sensor connection boxes supplied by the manufacturer.
- Use only shielded cables for line extensions.
- Connect the shield of the extension cable to a PE terminal.
- Install sensor lines separately from 230 V lines.

Use cables with the following cross-sections for line extensions:

- Up to 15 m: $2 \times 0.5 \text{ mm}^2$
- 15 to 50 m: $2 \times 0.75 \text{ mm}^2$



When connecting the temperature sensors, you do not need to observe polarity for the two wires.

3.4 Assignment of the terminals

P5	F1	T1	M	A	B	A	B	HE1	M	HE2	M	S1	S1	S2	S2	S3	S3	S4	S4
----	----	----	---	---	---	---	---	-----	---	-----	---	----	----	----	----	----	----	----	----

L	L	R1	R2	R3	PE	PE
N	N	N	N	N	PE	PE

Terminal	Use
F1 / T1 5V / M	VFS (vortex flow sensor) for the "Flow monitoring" function "Flow" on F1, "Temperature" on T1. Further details can be found in the VFS manufacturer's documentation.
T1 / 5V	DFG (impeller flow sensor) for the "Yield measurement" function
A + B	RS-485 interface (ProBusX) Make sure that the polarity of the bus connection is not mixed up (A-A, B-B). Use paired twisted-conductor cables for connection.
HE1 / M	PWM or analog output – configurable over grandis (FxHE1)
HE2 / M	PWM or analog output
S1 to S4	Connections for PT1000 temperature sensor

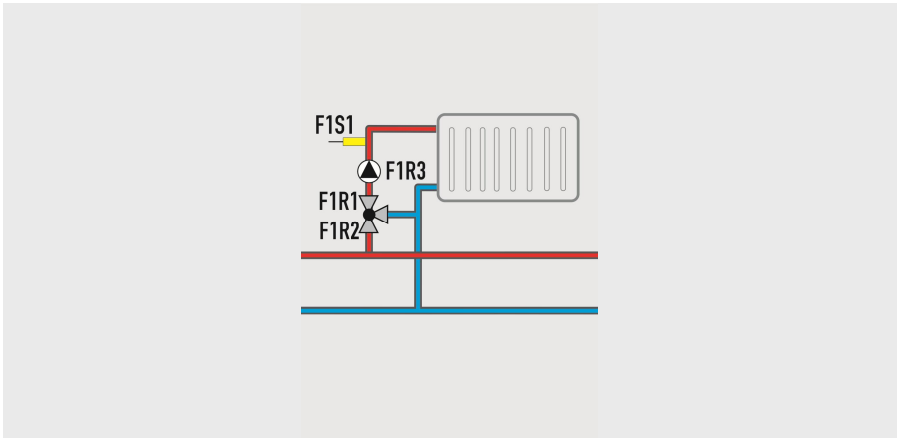
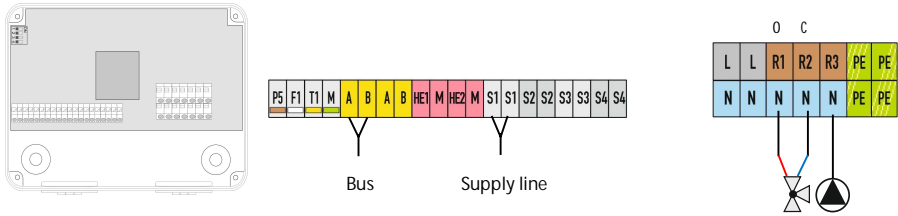
230V area

Terminal	Use
L / N / PE	Power supply 230V~
R1 / N / PE	230V~ switching output
R2 / N / PE	230V~ switching output
R3 / N / PE	230V~ switching output

As IO modules for grandis

The flex 400 is designed to expand the functions of controllers from the grandis family by adding an additional heating circuit. If several flex 400 modules are connected to the bus, the DIP switches (addressing) in the flex 400 must be set by hand.

Additional heating circuit



F1S1: Temperature sensor for supply line

F1R1: Mixer OPEN

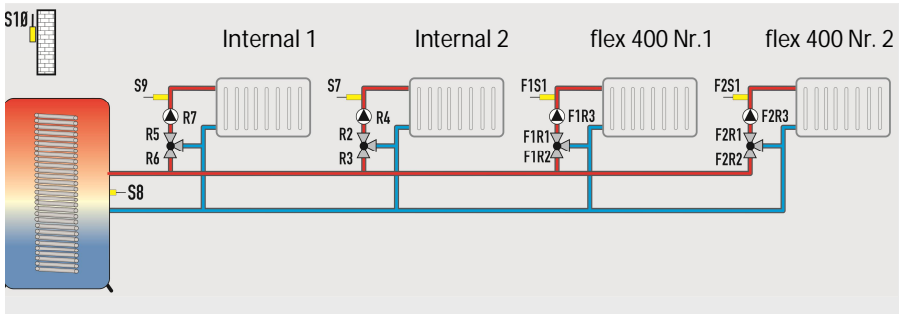
F1R2: Mixer CLOSED

F1R3: Heating pump

Four mixed heating circuits – internal and external assignment

All the heating circuits (up to 4) can be assigned externally either partly or completely. A flex 400 module can be assigned with a mixed or an unmixed heating circuit.

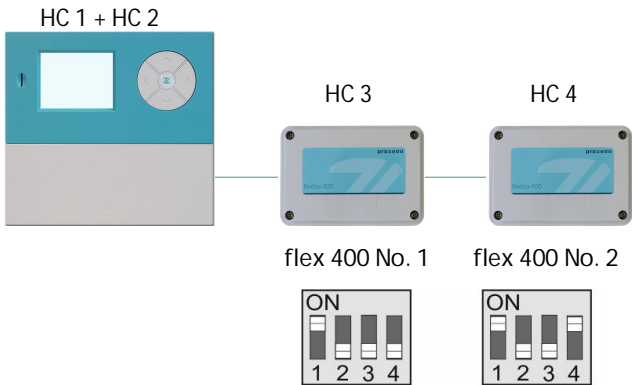
Example of a hydraulic layout with 2 flex 400-modules:



Four mixed heating circuits. Assignment: 2x internal, 2x flex 400

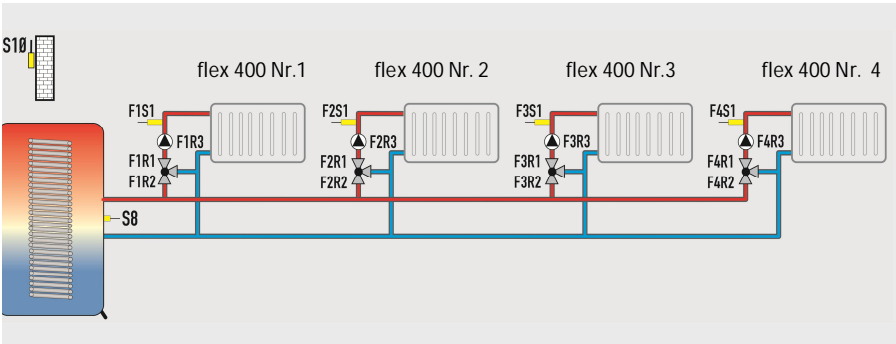
HC1: internal 1	HC1: internal 1	HC1: internal 1	HC1: internal 1
S9 sensor for supply line to HC 1	S9 sensor for supply line to HC 1	S9 sensor for supply line to HC 1	S9 sensor for supply line to HC 1
R5 mixer open R6 mixer close R7 pump for HC 1	R5 mixer open R6 mixer close R7 pump for HC 1	R5 mixer open R6 mixer close R7 pump for HC 1	R5 mixer open R6 mixer close R7 pump for HC 1
Common sensors and outputs for all heating circuits: S8 sensor for middle of storage tank S10 sensor for outdoor temperature R0 boiler request			

There are no mixer and supply line sensor when unmixed



Four heating circuits with external assignment

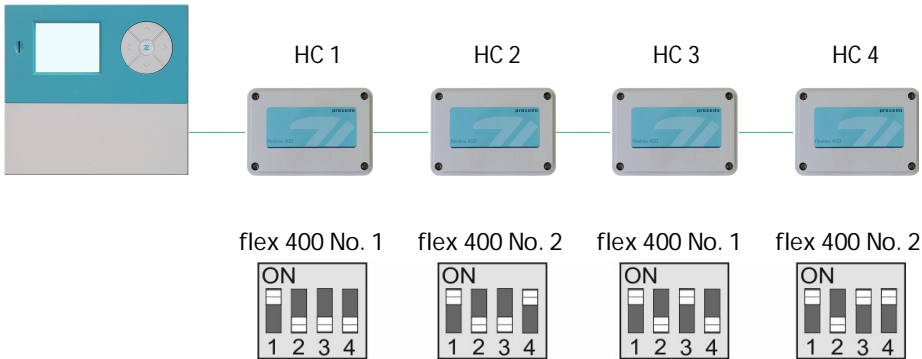
Example of hydraulic layout with 4 flex 400-modules:



Four mixed heating circuits. Assignment: 4x flex 400

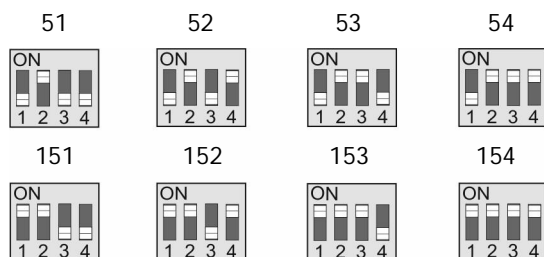
HC1: flex 400 Nr. 1	HC1: flex 400 Nr. 1	HC1: flex 400 Nr. 1	HC1: flex 400 Nr. 1
F1S1 sensor for supply line to HC 1	F1S1 sensor for supply line to HC 1	F1S1 sensor for supply line to HC 1	F1S1 sensor for supply line to HC 1
F1R1 mixer open F1R2 mixer close F1R3 pump for HC 1	F1R1 mixer open F1R2 mixer close F1R3 pump for HC 1	F1R1 mixer open F1R2 mixer close F1R3 pump for HC 1	F1R1 mixer open F1R2 mixer close F1R3 pump for HC 1
Common sensors and outputs for all heating circuits: S8 sensor for middle of storage tank S10 sensor for outdoor temperature R0 boiler request			

There are no mixer and supply line sensor when unmixed



As an I/O Module for Modbus

Modbus Addresses:



Input Registers (0x04):

No.	Description	Range	Einheit
0	Version	'V' / 'P'	
1	Version	0...255	
2	Version	0...255	
3	Version	0...255	
4	Addresses	51/52/53/54/151...	
5	RESET-cause	0...255	
6			
7			
8	Adj. S1	-128...127	K/10
9	Adj. S2	-128...127	K/10
10	Error	0-255	Binary
11	Supply line (S1)	-300 ... 2500	°C/10
12	Return line (S2)	-300 ... 2500	°C/10
13	Flow (Huba type 235)	ca. 0...60000	l/h
14	Power (Huba 235)	0...60000	W
15	Yield H (Huba 235)	commulating	Wh
16	Yield L (Huba 235)	commulating	Wh
17	S3	-300 ... 2500	°C/10
18	S4	-300 ... 2500	°C/10
19			
20	VFST (2)		mV

21	VFS F (2)		mV
22	DFG (1)		Imp/min/100
23	DFG (2)		Litre/min/10
over 40	Address-error		

Errors:

S1	Interruption: 0x80	Short circuit: 0x08
S2	Interruption: 0x40	Short circuit: 0x04
S3	Interruption: 0x20	Short circuit: 0x02
S4	Interruption: 0x10	Short circuit: 0x01

Holding Registers (0x06):

Nr.	Bezeichnung	Bereich	Einheit
8	Adjustment S1	-128...127	K/10
9	Adjustment S2	-128...127	K/10
10	RESET counter	43605	
11	DFG-type	1...3	-
12	Pulse/Litre	1-100	-
13	HE-type	12...14	
14	HE-type 2	12...14	
...			
20	R 1	0/100	%
21	R 2	0/100	%
22	R 3	0/100	%
23	HE	0...100	%
24	HE2	0...100	%
over 40	Address-error		

HE-type (HE1): 12= PWM 13=PWM invers 14= 0-10V
HE-type 2 (HE2): 12= PWM 13=PWM invers 14= 0-10V
DFG-type (AI2): 1= 1 Imp/I 2=VFS 3= 10 Imp/I
Huba type 235: terminal: Ain1

Modbus protocol	Slave RTU, 8 data bits, 1 stop bit, no parity
Baud rates	9600, 19200, 57600

Faults

ATTENTION

Risk of damage to the system if faults are remedied incorrectly.

- Make sure that faults are only ever remedied by specialist personnel.

Störung	Mögliche Ursache	Maßnahme
No LED indication.	There is no mains voltage.	Switch on the controller or connect the controller to the mains voltage.
		Make sure that the main fuse for the mains connection is switched on.
		Check the 230 V components for a short circuit. In the event of a short circuit, contact the manufacturer.
	The controller is faulty.	Contact the manufacturer.
The pump fails to switch on.	The connection to the pump has been interrupted.	Make sure that the cable connection to the pump is intact.
	The preconditions for the pump to be switched on have not been met.	Wait until the preconditions for the pump to be switched on have been met.
	The pump has seized up.	Make sure that the pump is running.
	There is no voltage at the pump output.	Contact the manufacturer.

4 Technical data

Autonomous electronic temperature difference controller, continuous operation	
Housing material	100% recyclable ABS housing
Dimensions L x W x D in mm	128 × 88 × 59
Protection class	IP54 according to DIN 40050, EN 60529
Operating voltage	AC 230 voltage, 50 Hz, –10 to +15%
Power consumption	< 2 W
Max. line cross-section for 230 V connections	2.5 mm ² finely stranded/single core
Inputs S1–S4 (protected by varistors)	For temperature sensors PT 1000 (1 kΩ at 0 °C)
Other inputs	VFS (vortex flow sensor) DFG (impeller flow sensor) Minimum measurable flow: 20 litres/hour Maximum measurable flow: 72,000 litres/hour
Measuring range (temperature)	–30 °C to +250 °C
Interfaces	RS 485 for ProBusX
Output R1–R3	Electronic semiconductor relay (Triac) with zero-cross switch, opto-decoupled, 230 V AC, 50 Hz, min. 10 mA, max. 150 W, with $\cos \varphi \geq 0.9$
Total output of all outputs	Max. 300 W
Control output for HE pump	PWM signal: 1 kHz, $V_{iL} < 0.5$ V DC, $V_{iH} > 9$ V DC, 10 mA max. Analog signal: 0 - +10 V DC +/- 3%, 10 mA max.
Type 1 action	Type 1.B and type 1.Y
Software class	A
Protection	Microfuse TR 5 type 372, 2 A/T (2 ampere, slow)
Ambient temperature	0 to +40 °C
Storage temperature	–10 to +60 °C

5 Disposing of the controller

The environment-friendly disposal of electronic assemblies, recyclable materials and other unit components is regulated by national and regional laws.

- Contact the competent local authority for detailed information on disposal.
- Dispose of lithium batteries in accordance with the statutory regulations.
- Dispose of all components in accordance with statutory regulations.

