Roth BW/H

Mounting

Connection

Operation

Troubleshooting

Application examples



49004211

Thank you for buying this product. Read this manual carefully to get the best perfomance from this unit. Please keep this manual carefully.





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Subject to technical change. Errors excepted.

Safety advice:

Please read the following information carefully before installing and operating the controller. In this way damage to the solar system caused by wrong installation will be avoided. Please make sure that the mounting is adapted to the characteristics of the building, that the local regulations are respected and is conform with the technical rules.

Please pay attention to the following safety advice in order to avoid danger and damage to people and property.

Instructions:

Equipment to be installed and used in accordance with the rules of the National Electrical Code (NEC) or with Canadian Electrical Code (CEC), Part I.

Attention should be paid to

- valid local regulations
- respective valid standards and directives

These instructions are exclusively addressed to authorized skilled personnel.

- Only qualified electricians should carry out installation and maintenance work.
- Initial installation should be carried out by qualified personnel

Description of symbols

WARNING!	Warnings are indicated with a
	 warning triangle! → They contain information on how to avoid the danger described.

Signal words describe the danger that may occur, when it is not avoided.

Warning means that injury, possibly life-threatening injury, can occur.

Attention means that damage to the appliance can occur.



Note

Notes are indicated with an information symbol.

Information about the product

Proper usage

This product is to be used in solar thermal and heating systems in compliance with the technical data specified in these instructions.

Improper use excludes all liability claims.



Note

Strong electromagnetic fields can impair the function of the controller.

➔ Make sure the controller as well as the system are not exposed to strong electromagnetic fields.



- System-monitoring-display
- Up to 4 Pt1000 temperature sensors
- 9 basic systems to choose from
- Heat quantity balancing
- VBus[®]
- Function control
- Thermostat function (time controlled)
- Parametrization and control of the system by Service Center Software is possible
- User-friendly operation
- Housing with outstanding design



Included with the BS Plus:

$1 \times BW/H$

- 1 x accessory bag
 - 1 x spare fuse T4A
 - $2\ x$ screws and dowels
 - 4 x strain relief and screws
 - 1 x capacitor 4,7 nF

Additionally enclosed in the full kit:

- 2 x sensor FKP6
- 2 x sensor FRP6





Technical data

Housing:

plastic, PC-ABS and PMMA

Protection type: IP 20 / DIN 40050

Ambient temp.: 32 ... 104 °F **Size:** 172 x 110 x 46 mm

Mounting: wall mounting, mounting into patch-panels is possible

Display: System screen for system visualization, 16-segment display, 7-segment display, 8 symbols for system status and operating control lamp

Operation: by 3 pushbuttons in the front of the housing

Functions: Differential temperature controller with optional add-on system functions. Function control according to BAW-standards, operating hours counter for solar pump, tube collector function, thermostat function and heat quantity balancing.

Inputs:

for 4 temperature sensors Pt1000

Outputs: 2 electromechanical relays Bus: VBus[®] Power supply: 115V~ Total power supply: 4 (2) A 115V~



1. Installation 1.1 Mounting cover use of the strain of

lower fastening

1.2 Electrical connection



power supply terminals



Please note:

The relays are semiconductor relays for pump speed control - a minimum load of 20 W (power consumption of the load) is required for faultless function. The capacitor from the accessory bag must be connected in parallel to the respective relay output if it feeds auxiliary relays, motor valves, etc to prevent interference.

The minimum pump speed must be set to 100% when auxiliary relays or valves are connected.

ATTENTION! ESD damage!



WARNING! Electric shock!



Opening the housing will expose live parts! → Switch off power supply and disconnect the device from mains

before opening the housing!

The unit must only be located in dry interior locations. It is not suitable for installation in hazardous locations and should not be placed close to any electromagnetic fields. The controller must additionally be supplied from a doublepole switch with contact gap of at least 3 mm. Please pay attention to separate routing of sensor cables and power supply cables.

- 1. Unscrew the cross-head screw from the cover and remove it along with the cover from the housing.
- 2. Mark the upper fastening point on the wall and drill and fasten the enclosed wall plug and screw leaving the head protruding.
- 3. Hang the housing from the upper fastening point and mark the lower fastening point through the hole in the terminal box (centres 130 mm). Drill and insert the lower wall plug
- 4. Fasten the housing to the wall with lower fastening screw and tighten.

The power supply to the controller must be carried out via an external power switch (last step!) and the supply voltage must be $115 V \sim (50 \dots 60 \text{ Hz})$. Flexible cables must be attached to the housing with the enclosed strain relief and the corresponding screws.

The controller is equipped with 2 semiconductor relays, to which **loads** such as pumps, valves etc. can be connected:

- Relay 1 18 = conductor R1
- 17 = neutral conductor N13 = grounding conductor
- Relay 2
- 16 = conductor R2
- 15 = neutral conductor N
- 14 = grounding conductor

The **temperature sensors** (S1 up to S4) will be connected to the following terminals independently of the

polarity:

1 / 2 = Sensor 1 (e.g. Sensor collector 1)

- 3 / 4 = Sensor 2 (e.g. Sensor store 1)
- 5 / 6 = Sensor 3 (e.g. Sensor collector 2)
- 7 / 8 = Sensor 4 (e.g. Sensor store 2)

The **power supply** is effected to the clamps:

- 19 = neutral conductor N
- $\begin{array}{l} 20 = \text{conductor L} \\ 12 = \text{ground clamp} \end{array}$



1.2.1 Data communication/ Bus



The controller comes with a **VBus**[®] for data transfer with and energy supply to external modules. The connection is carried out at the terminals marked "VBus" (either polarity). One or more VBus[®] modules can be connected via this data bus, e.g.:

- \bullet calorimeter module WMZ
- large display GA3, smart display SD3
- data logger DL2

Additionaly, the controller can be connected to a PC with a RS-COM adapter. With the ServiceCenter Software (RSC) the controller parameters can be changed, measurements can be read out, processed and visualized. The software allows easy function control and adjustment of the system.





1.2.3 Terminal allocation - system 2

Solar system and heat exchange with an existing tank with 1 tank, 4 sensors and 2 pumps.





Solar system and after-heating with 1 tank, 3 sensors and after-heating. Sensor S4 / TRF can optionally be used for heat quantity balancing.

Symbol	Specification
S1	Collector sensor
S2	Tank sensor bottom
S3	Tank sensor at the top
S4 / TRF	Sensor for heat quantity balancing (optional)
R1	Solar pump
R2	Pump for heat exchange





1.2.6 Terminal allocation - system 5



2-tank-solar system with valve logic with 2 tanks, 3 sensors, 1 solar pump and 1 3-way-valve. Sensor S4 / TRF can optionally be used for heat quantity balancing.

Symbol	Specification
S1	Collector sensor
S2	Tank sensor 1
S3	Tank sensor 2
S4 / TRF	Sensor for heat quantity
	balancing (optionally)
R1	Solar pump
R2	3-way-valve



1.2.6 Terminal allocation - system 6

2-tank solar system with pump logic with 2 tanks, 3 sensors and 2 solar pumps.



1.2.7 Terminal allocation - system 7

Solar system with east-west collectors, 1 tank, 3 sensors and 2 solar pumps.







Solar system with solid fuel boiler after-heating
with 1 tank, 4 sensors, 1 solar pump and 1 pump for after-
heating.

Symbol	Specification
S1	Collector sensor
S2	Tank sensor bottom
S3	Tank sensor at the top
S4	Tank - solid fuel boiler
R1	Solar pump
R2	Solid fuel boiler pump

1.2.9 Terminal allocation - system 9

5

Solar system and heating circuit return preheating

with 1 tank, 4 sensors, 1 solar pump and 1 3-way-valve for heating circuit return preheating





2. Operation and function

2.1 Pushbuttons for adjustment



(selection / adjustment mode)

2.2 System monitoring display



2.2.1 Channel display



2.2.2 Tool bar



The controller is operated by 3 pushbuttons below the display. The forward-key (1) is used for scrolling forward through the indication menu or to increase the adjustment values. The backwards-key (2) is accordingly used for the reverse function.

For adjustment of last indication channel, keep button 1 pressed for 3 seconds. If an **adjustment value** is shown on the display, **SET** is indicated. In this case you can press the key "Set" (3) in order to change into input mode.

Select a channel by keys 1 and 2 Shortly press key 3, so that **SET** is blinking. Adjust the value by keys 1 and 2 Shortly press key 3, so that **SET** permanently appears, the adjusted value is now saved.

The system monitoring display consists of 3 blocks: **channel display, tool bar** and **system screen** (active system scheme).

The **channel display** consists of two lines. The upper line is an alpha-numeric 16-segment display (text display) for displaying channel names and menu items. In the lower 7-segment display, the channel values and the adjustment parameters are displayed. Temperatures and temperature.

Temperatures are either indicated in °F or °C, whereas temperature differences are indicated in K or °Ra respectively.

The additional symbols of the **tool bar** indicate the current system status.

Symbol	standard	blinking
	relay 1 active	
	relay 2 active	
*	maximum tank limitation active / maximum tank temperature exceeded	collector cooling function or reccoling function active
₩	antifreeze function activated	collector minimum limitation or antifreeze function active
⚠		collector emergency shutdown or tank emergency shutdown active
+ ≁		sensor defective
⚠ + 🖉		manual operation active
SET		an adjustment channel is being changed SET-mode



2.2.3 System screen



2.3 Flashing codes

2.3.2 LED flashing codes

2.3.1 System screen flashing codes

- Pumps are flashing during initialization phase
- Sensor symbols are flashing if the corresponding sensor display channel is selected.
- Sensors are flashing in the case of a sensor fault.
- Burner symbol is flashing if the after-heating is active

green:	everything OK
red/green flashing	initialization phase
	manual operation
red flashing:	sensor fault
	(sensor symbol is flashing quickly)



3. Commissioning

When the controller is commissioned for the first time, the arrangement has to be selected first



1. Switch on power supply. During the initialization phase, the operating control lamp flashes red and green. After initialization, the controller is in the automatic mode with typical settings. The pre-programmed system scheme is Arr 1.

2. Adjust the clock time in the TIME channel. Pressing the **SET** button once for adjusting the hours, and press it once again for adjusting the minutes. The time can be adjusted using buttons 1 and 2 and saved by pressing the SET button.

- 3. Select the adjustment channel Arr
 - Change to the SET-mode (see 2.1)
 - Select the arrangement via the Arr-index number
 - Save the adjustment by pressing the SET button

Now the controller is ready for operation with typical settings to suit that system and normally the factory settings will give close to optimum operation.















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Arr 2

Arr 4

Arr 6

Arr 1: standard solar system

System survey:

- Arr 2: solar system with heat exchange
- Arr 3: solar system with after-heating
- Arr 4: solar system with vertical tank charging
- Arr 5 : 2-tank solar system with valve logic
- Arr 6: 2-tank solar system with pump logic
- Arr 7: solar system with 2 collectors and 1 tank
- Arr 8: solar system with after-heating by solid fuel boiler
- Arr 9: solar system with heating circuit return preheating



4. Control parameters and display channels

4.1 Overview of channels

Legend:



Corresponding channel is available.

Please note:

S3 and S4 be displayed.



Corresponding channel is available if the appropriate option is activated.

Only if temperature sensors are connected, will



Corresponding channel is only available if the option heat quantity measurement is **activated** (OHQM).



Corresponding channel is only available if the option heat quantity measurement is **deactivated** (OHQM).



The channel antifreeze content (MED%) is only shown if **the antifreeze is not water or Tyfocor LS / G-LS (MEDT 0 or 3).** Adjustments concerning the antifreeze content will only make sense if the antifreeze is used in the solar circuit.

Channel					Description	Page					
Channel	1	2	3	4	5	6	7	8	9	Description	Tage
COL	x	×	x	x	x	×		×	x	Temperature collector 1	15
COL 1							x			Temperature collector 1	15
TST	x						х			Temperature tank 1	15
TSTL			x	x				x	х	Temperature tank 1 bottom	15
TST1		×			x	x				Temperature tank 1 bottom	15
TSTU		×	x	x				x	х	Temperature tank 1 at the top	15
TST2		×			x	x				Temperature tank 2 bottom	15
TFSB								×		Temperature solid fuel boiler	15
TRET									x	Temperature heating circuit	15
COL2							x			Temperature collector 2	15
S3	x									Temperature sensor 3	15
TRF	1		0		1					Temperature return sensor	15
S4	2		2	2	2	x	x			Temperature sensor 4	15
hP	x			x	x				x	Operating hours relay 1	16
h P1		×	x			x	x	x		Operating hours relay 1	16
h P2		×	x			x	x	x		Operating hours relay 2	16
kWh	1		1	0	1					Heat quantity kWh	16
MWh	1		1	0	1					Heat quantity MWh	16
time					x					Time	15
Arr					1-9					System	12
DT O	x	×	x				x	×	x	Switch-on temperature diff	17
DT1O				x	x	x				Switch-on temperature diff 1	17
DT F	x	×	x		1		x	×	x	Switch-off temperature diff 1	17
DT1F				x	x	×				Switch-off temperature difference	17
S MX	x	x	x				x	x	x	Maximum temperature tank 1	17
S1 MX				x	x	x				Maximum temperature tank 1	17
DT2O				x	x	x				Switch-on temperature difference 2	17
DT2F				x	x	x				Switch-off temperature difference 2	17
S2MX				x	x	x				Maximum temperature tank 2	17
EM	x	x	x	x	x	x		x	x	Emergency temperature collector 1	18
EM1							x			Emergency temperature collector 1	18



					Description						
Channel	1	2	3	4	5	6	7	8	9	Description	Fage
OCX	x	x	x	x	x	x		x	x	Option collector cooling collector 1	18
OCX1	1		1	1			x			Option collector cooling collector 1	18
CMX	x*	x*	x*	x*	x*	x*		x*	x*	Maximum temperature collector 1	18
CMX1		1		1	İ	i – – –	x*	1		Maximum temperature collector 1	18
OCN	x	x	x	x	x	x		×	x	Option minimum limitation collector 1	18
OCN1						1	x			Option minimum limitation collector 1	18
CMN	x*	x*	x*	x*	x*	x*	İ	x*	x*	Minimun temperature collector 1	18
CMN1	1		1	1			x*			Minimun temperature collector 1	18
OCF	x	x	x	x	x	x		×	×	Option antifreeze collector 1	18
OCF1	1			i – –			x	i – – i		Option antifreeze collector 1	18
CFR	x*	x*	x*	x*	x*	x*	1	x*	x*	Antifreeze temperature collector 1	18
CFR1							×*			Antifreeze temperature collector 1	18
FM2							x	<u> </u>		Emergency temperature collector 2	18
OCX2							x			Option collector cooling collector 2	18
CMX2							×*	<u> </u>		Maximum temperature collector 2	18
							×	<u> </u>		Option minimum limitation collector 2	18
CMN2							×*	<u> </u>		Minium temperature collector 2	18
OCF2										Option antifraeze collector 2	18
CER2							^ *			Antifração temporaturo collector 2	10
										Priority	10
+ST						~				Proof time	10
					×	×				Cinclation nuntime	17
		~			×	×					17
OREC	X	X	X	×	X	X	X	×	X	Option reccoling	17
	X	X	X		X	X	X	×	X	Suritable on terms stratume differences 2	17
		X						X	×	Switch-on temperature difference 3	17
DT3F		X						X	×	Switch-off temperature difference 3	17
MX25		×						×		Switch-on treshold for maximum temp.	17
MNIDO		×				ļ		×		Switch-off treshold for maximum temp.	17
MIN3O		×		<u> </u>				×		Switch-on treshold for minimum temp.	17
MN3F		×						×		Switch-off treshold for minimum temp.	1/
			X							Switch-on temp. for thermostat 1	20
			X					<u> </u>		Switch-off temp. for thermostat 1	20
	X		X								16
MEDT	0		0	0	0		<u> </u>	<u> </u>		Antifreeze type	16
MED%	MEDT	Ì	MEDT	MEDT	MEDT	ĺ	İ	i		Antifreeze concentration	16
t1 on			x							Switch on time 1 thermostat	20
t1 off			x							Switch off time 1 thermostat	20
t2 on			x							Switch on time 2 thermostat	20
t2 off			x							Switch off time 2 thermostat	20
t3 on			x							Switch on time 3 thermostat	20
t3 off			x							Switch off time 3 thermostat	20
HND1	x	×	x	x	x	×	x	×	×	Manual operation relay 1	20
HND2	x	x	x	x	x	x	x	×	x	Manual operation relay 2	20
LANG	x	x	x	x	x	x	x	×	x	Language	20
UNIT	x	x	x	x	x	x	x	×	x	Selection: °FAH / °CEL	20
PROG				-	XX.XX					Program number	1
VERS	X.XX									Version number	İ



4.1.1 Indication of collector temperatures

COL, COL1, COL2:

Collector temperature display range: -40 ... +480°F

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1115

Shows the current collector temperature.

- COL : collector temperature (1-collector system)
- COL1: collector temperature 1
- COL2: collector temperature 2

4.1.2 Indication of tank temperatures

TST, TSTL, TSTU,

TST1,TST2: Tank temperatures Display range: -40 ... +480 °F Shows the current tank temperature.

- TST : tank temperature (1-tank system)
- TSTL : tank temperature bottom
- TSTU: tank temperature top
- TST1 : temperature tank 1
- TST2 : temperature tank 2

4.1.3 Indication of sensors 3 and 4

S3, S4:
S3, S4:
Sensor temperatures
Display range: -40+480 °F

Shows the current temperature of the corresponding additional sensor (without control function).

- S3 : temperature sensor 3
 - S4 : temperature sensor 4

Note:

S3 and S4 will only be indicated if the temperature sensors are connected.

4.1.4 Indication of other temperatures

TFSB, TRET, TRF:

Other measured temperatures	ŢĔĠŊ
Display range: -40+480 °F	

Shows the current temperature of the corresponding sensor.

- TFSB : temperature solid fuel boiler
- TRET : temperature heating return preheating
- TRF : temperature return

4.1.5 Time



Indicates the actual time.

Press the SEE button for 2 seconds in order to adjust the hours and press it again in order to adjust the minutes (flashing). The time can be set using buttons 1 and 2 and saved by pressing the SET button.



4.1.6 Operating hours counter

h P / h P1 / h P2: Operating hours counter Display channel

ŀı	p	/ / 591
	30	5

The operating hours counter accumulates the solar operating hours of the respective relay (h P / h P1 / h P2). Full hours are displayed.

The accumulated operating hours can be set back to zero. As soon as one operating hours channel is selected, the symbol **SET** is displayed. Press the SET (3) button for approx. 2 seconds in order to access the RESET-mode of the counter. The display symbol **SET** will flash and the operating hours will be set to 0. Confirm the reset with the SET button in order to finish the reset.

In order to interrupt the RESET-process, do not press a button for about 5 seconds. The display returns to the display mode.

4.1.7 Heat quantity balancing

OHQM :Heat quantity measu- rement Adjustment range: OFFON Factory setting: OFF	DHQM DF I
FMAX: Flow rate in l/min Adjustment range 0 20 in steps 0,1-steps Factory setting 6,0	FMAX 6. 1
MEDT: antifreeze Adjustment range 03 Factory setting 1	MELDI
MED%: Concentration of antifreeze in Vol-% MED% is hidden when MEDT 0 or 3 is used.	ME]] T
Adjustement range 2070 Factory setting 45	
kWh/MWh :Heat quantity	

in kWh / MWh

Display channel



Heat quantity measurement is possible in Arr 1, 3, 4, and 5 if a flowmeter is used. For this purpose, the heat quantity measurement option (OHQM) has to be enabled.

The flow rate should be read from the flowmeter (I/min) and has to be adjusted in the channel **FMAX**. Antifreeze type and concentration of the heat transfer fluid have to be adjusted in the channels MEDT and MED%.

Antifreeze type:

SET

SET !

SET

- 0 : water
- 1 : propylene glycol 2 : ethylene glycol
- 3 : Tyfocor® LS / G-LS

The flow rate as well as the reference sensors S1 (flow) and S4 (return) are used for calculating the heat quantity supplied. It is shown in kWh in the channel kWh and in MWh in the channel **MWh**. The overall heat quantity results from the sum of both values.

The accumulated heat quantity can be reset. As soon as one of the display channels of the heat quantity is selected, the **SET** symbol is permanently shown on the display. Press button SET (3) for about 2 seconds in order to access the RESET mode of the counter. The display symbol SET will flash and the heat quantity value will be set to 0. In order to finish this process, press the SEE button to confirm.

In order to interrupt the RESET process, no button should be pressed for about 5 seconds. The controller automatically returns to the display mode.



4.1.8 **AT-regulation**

DT O/DT1O/DT2O/ DT3O:

Switch on temperature diff. Adjustment range 2,0 ... 40,0°Ra Factory setting 12,0°Ra

DT F/DT1F/DT2F/DT3F: Switch-off temperature diff. Adjustment range 1,0 ... 39,0°Ra Factory setting 8,0°Ra



RIS / RIS1 / RIS2 / RIS3: Rise Adjustment range 2 ... 40 °Ra Factory setting 4 °Ra



S MX / S1MX / S2MX:

Maximum tank temp. Adjustment range 40...205°F Factory setting 140°F



120

]]T 5mm

RIS

20

SET

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First the controller works as a standard differential controller. If the switch-on difference (**DT O / DT1O / DT2O**) is reached, the pump is activated at full speed for 10 seconds. The speed is then reduced to the minimum pump speed value (nMN / nMN1 / nMN2 = 30 %). If the temperature difference reaches the adjusted set value (**DT S / DT1S / DT2S / DT3S**), the pump speed increases by one step (10%). If the difference increases by 4°Ra (**RIS / RIS1 / RIS2 / RIS3**), the pump speed increases by 10 % respectively until the maximum pump speed of 100 % is reached. The response of the controller can be adapted via the parameter "Rise". If the temperature difference (**DT F / DT1F / DT2F**), the controller switches off.

DT O and **DT S** are locked against each other. **DT S** must be at least 1°Ra higher than **DT O**.

Please note:

The switch-on temperature difference must be at least 2 °Ra higher than the switch-off temperature difference.

Once the adjusted maximum temperature is exceeded, the solar pump is switched off and further loading of the tank is prevented to reduce scald risk or system damage. The # symbol is shown on the display.



Please note: The controller is also equipped with a non-adjustable emergency switch-off if the tank reaches 205°F.

4.1.10 Δ **T-control** (solid fuel boiler and heat exchange)

Maximum temperature limitation MX30 / MX3F:

Maximum temperature limitation Adjustment range 30...205°F Factory setting MX3O 140°F MX3F 136°F

^ X <u>:</u>][] saa \\0.0
MX∃F ₅ ∎

Minimum temperature limitation

MN3O / MN3F:

Minimum temperature limitation Adjustment range 30...195°F Factory setting: Arr = 2 MN3O 40°F MN3F 50F Arr = 8 MN3O 140°F MN3F 150°F



In arrangements 2 and 8, the controller is equipped with an additional differential control for heat exchange between two tanks or from a solid fuel back boiler (e.g. woodstove). Minimum and maximum temperature limits can be set. The basic differential function is adjusted using the switch on (**DT3 O**) and switch off (**DT3 F**) temperature differences.

The **MX30** / **MX3F** function provides a maximum temperature setting, usually to reduce scald risk in a storage tank. If **MX30** is exceeded, relay 2 is switched off until the sensor falls below **MX3F.** This function uses sensor 3 in Arr. 8 and sensor 4 in Arr.2.

The **MN3O** / **MN3F** function provides a minimum temperature setting and aims to provide frost protection in Arr.2, and back boiler protection in Arr.8. If the sensor temperature falls below **MN3O**, relay 2 is switched off until the temperature exceeds **MN3F**. This function uses sensor 4 in Arr.8 and sensor 3 in Arr.2.

Both switch-on and switch-off temperature differences **DT3O** and **DT3F** are valid for the maximum and minimum temperature limitation.



4.1.11 Collector temperature limitation Emergency shutdown of the collector

EM / EM1 / EM2:

Collector temperature limitation Adjustment range 230...400°F Factory setting 285°F



If the adjusted collector emergency shutdown temperature (**EM / EM1 / EM2**) is exceeded, the controller switches off the solar pump (R1 / R2) in order to protect the system against overheating (collector emergency shutdown). The factory setting is 285° F but it can be changed within the adjustment range of $230...400^{\circ}$ F. \triangle (flashing) is shown.

4.1.12 System cooling

OCX / OCX1 / OCX2: Option System cooling Adjustment range OFF...ON Factory setting ON

CMX / CMX1 / CMX2:

Maximum collector temp. Adjustment range 210...380°F Factory setting 250°F



0n

When the adjusted maximum tank temperature is reached, the system stagnates. If the collector temperature increases to the adjusted maximum collector temperature (**CMX** / **CMX1** / **CMX2**), the solar pump is activated until the collector temperature falls below the maximum collector temperature. The tank temperature may increase (subordinate active maximum tank temperature), but only up to 400°F (emergency shutdown of the tank). If the tank temperature is higher than the maximum tank temperature (**S MX** / **S1MX** / **S2MX**) and if the collector temperature is at least 10°Ra below the tank temperature, the solar system remains activated until the tank is cooled down below the adjusted maximum temperature (**S MX** / **S1MX** / **S2MX**) via the collector and the pipework.

If the system cooling function is enabled, # (flashing) is shown on the display. Due to the cooling function, the system will have a longer operation time on hot summer days and guarantees thermal relief of the collector field and the heat transfer fluid.

4.1.13 Collector minimum limitation option

OCN / OCN1 / OCN2:

Collector minimum limitation OFF / ON Factory setting OFF



CMN / CMN1 / CMN2:

Collector minimum temp. Adjustment range 50...195°F Factory setting 50°F



The minimum collector temperature is the minimum temperature which must be exceeded for the solar pump (R1 / R2) to switch on. The minimum temperature prevents the pump from being switched on too often at low collector temperatures. If the temperature falls below the minimum temperature, \Re (flashing) is shown on the display.

The antifreeze function activates the loading circuit between

the collector and the tank when the temperature falls below

the adjusted antifreeze temperature. This will protect the

fluid against freezing or coagulating. If the adjusted antifreeze temperature is exceeded by 2 °F, the loading circuit will be

4.1.14 Antifreeze option

OCF / OCF1 / OCF2: Antifreeze function Adjustment range OFF / O

Adjustment range OFF / ON Factory setting OFF

CFR / CFR1 / CFR2:

Antifreeze temperature Adjustment range 15...50°F Factory setting 40°F



NFF

[][⁻F

SET

Note:

deactivated.

Since this function uses the limited heat quantity of the tank, the antifreeze function should be used in regions with few days of temperatures around the freezing point.



4.1.15 Tank sequence control

Corresponding adjustment values:

priority [PRIO]

break-time [tST] loading runtime [tRUN]

The **BW/H** priority logic

Priority:



 Factory setting
 Adjustment range

 (1 / Arr 5,6) (2 / Arr 4)
 0-2

 2 min.
 1-30 min.

 15 min.
 1-30 min.

The above-mentioned options and parameters are used in multi-tank systems only (system Arr = 4, 5, 6). If **priority 0** is adjusted, the tanks with a temperature difference to the collector are loaded in numerical order (tank 1 or tank 2). Usually the tanks are loaded one after the other. **Parallel loading** is also possible in Arr = 5, 6..

Oscillating break time / oscillating loading time / collector rise temperature



This function aims to extract the maximum solar gain in 2 tank systems. If the first priority tank cannot be loaded, the second priority is checked. If useful heat can be added, it will be loaded for the "oscillating loading time" ("**t-run**" - factory default 15 min.) After this, the loading process stops and the controller monitors the increase in collector temperature during the break time "**t-st**". If it increases by 4°Ra, the break time timer starts again to allow the collector to gain more heat. If it does not, but useful heat can be added to the second priority tank, the second tank will be loaded again for the "t-run" time as before.

As soon as the switch-on condition of the priority tank is fulfilled, it will be loaded. If the switch-on condition of the priority tank is not fulfilled, loading of the second tank will be continued. If the priority tank reaches its maximum temperature, oscillating loading will not be carried out.

If the adjusted maximum tank temperature (**S MX** / **S1MX** / **S2MX**) is reached, the controller keeps the solar pump running in order to prevent the collector from being overheated. The tank temperature may increase but only up to 205 °F (emergency shutdown of the tank).

In the evening, the solar thermal system remains switched on until the tank is cooled down to the adjusted maximum temperature via the collector and the pipework.

If the controller detects an increase in collector temperature by 4 °Ra compared to the previously stored collector temperature, the solar pump will be switched-on at 100 % for about 30 seconds in order to detect the fluid temperature. The current collector temperature will be saved as a new reference value. If the measured temperature (new reference value) is exceeded by 4 °Ra, the solar pump will run for 30 seconds. If the switch-on difference between the collector and the tank is exceeded during the runtime of the solar pump or the standstill of the system, the controller will automatically switch to solar loading.

If the collector temperature decreases by 4 °Ra during standstill, the switch-on value for the evacuated tube collector function will be recalculated.

4.1.16 Recooling function

OREC: Option recooling adjustment rangeOFF...ON Factory setting: OFF



4.1.17 Evacuated tube collector function

OTC: Evacuated tube collector function Adjustment range: OFF ... ON Factory setting: OFF





4.1.18 Thermostat function (Arr = 3)





AH F:

AH O: Thermostat switch-on temp. Adjustment range 30...205°F

Factory setting 105°F



00:00 t1 F, t2 F, t3 F:

Thermostat switch-off temp.

Adjustment range 30...205°F

Factory setting 115°F

Use of surplus energy

ารก

t1 O, t2 O, t3 O: Thermostat switch-on time Adjustment range: 00:00 ... 23:45 Factory setting: 00:00

4.1.19 **Operating mode** HND1/HND2:

Operating mode Adjustment range: OFF, Auto, ON Factory setting: Auto



Ruto

Thermostat switch-off time Adjustment range: 00:00 ... 23:45 Factory setting: 00:00

The thermostat function works independently from the solar operation and can be used for using surplus energy or for after-heating.



thermostat function for after-heating AHO > AHF

thermostat function for using surplus energy

Symbol will be shown on the display if the second relay output is activated.



Note:

Reference sensor for the thermostat function is S3.

In order to block the thermostat function for a certain period, there are 3 time frames t1 ... t3. If the function should be active between 6:00 and 9:00, set t1 O to 6:00 and **t1 F** to 9:00. The thermostat function is factory set to continuous operation.

If all time frames stop at 00:00 o'clock, the thermostat function is continuously activated (factory setting).

For control and service work, the operating mode of the
controller can be manually adjusted. For this purpose, select
the adjustment value HND1, HND2 in which the following
adjustments can be made:

• HND1 / HND2

Operating mode

relay off 🛆 (flashing) + 🖉 OFF :

- relay in automatic operation Auto
- ON
 - relay on \triangle (flashing) + \heartsuit

4.1.20 Language

LANG:

Language choice Adjustment range: dE,En, It, Fr Factory setting: En



The menu language can be adjusted in this channel.

- dE : German
- En : English
- It : Italiano
- Fr : French

4.1.21 Unit **UNIT:** Unit choice Adjustment range: FAH, °C Factory setting: FAH



The menu unit can be adjusted:

 °FAH °CEL



5. Troubleshooting



In the case of an error, a message is shown on the display of the controller:



Operating control lamp off

Operating control lamp flashes red. On the display the symbols \checkmark and \bigtriangleup appear.



Check the power supply	s it disconnected?
The fuse of the controller	Check the supply line and
could be blown. It can be	reconnect it.
replaced after the front	
(spare fuse is enclosed in	
the fuse holder).	

°F	Ω		°F	Ω
14	961		131	1213
23	980		140	1232
32	1000		149	1252
41	1019		158	1271
50	1039		167	1290
59	1058		176	1309
68	1078		185	1328
77	1097		194	1347
86	1117		203	1366
95	1136		212	1385
104	1155		221	1404
113	1175		230	1423
122	1194		239	1442
resistance of the Pt1000 sensors				



5.1 Various:



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BW/H





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