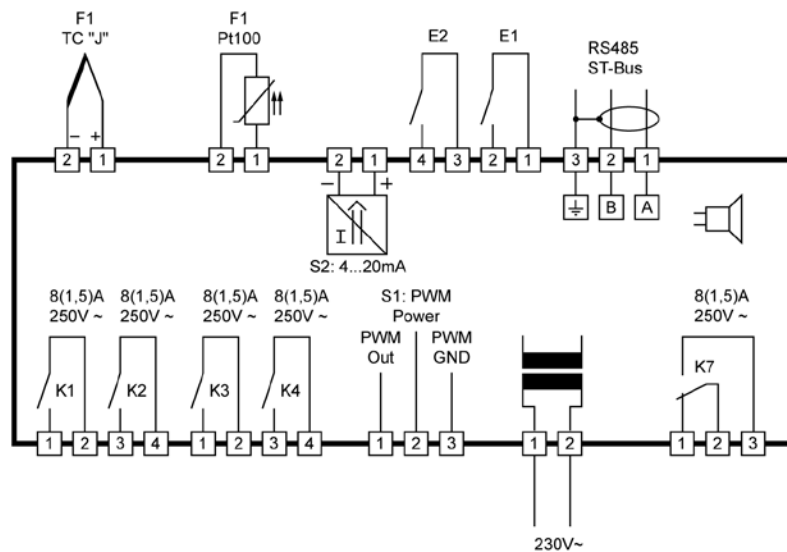## ST552 Glass

Deep-frying controller

Order number 900350.011

As of: 14.03.2018, Software V2.70

Wiring diagram

Product description
The deep-frying controller ST552 consists of a touch panel based on a mineral glass. It can easily be integrated into existing plants and its sturdy surface can replace our approved foil keyboards in environments with high mechanical or chemical loads. It features two displays, four relay exits and two digital switching inputs. The two sensor inputs can process a temperature sensor Pt100 or thermocouple.
Five LEDs arranged above each display indicate the selected temperature and time, respectively. A delayed key activation and multiple timers are optional.
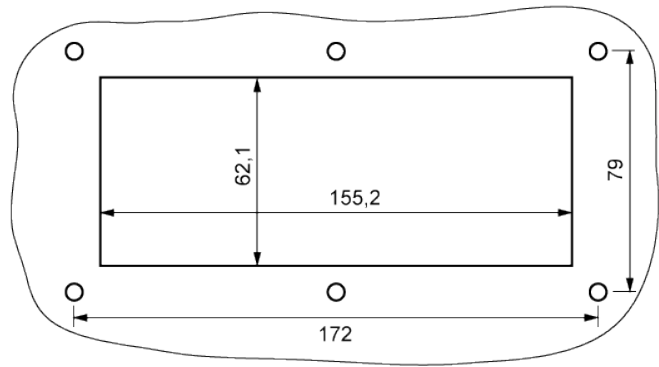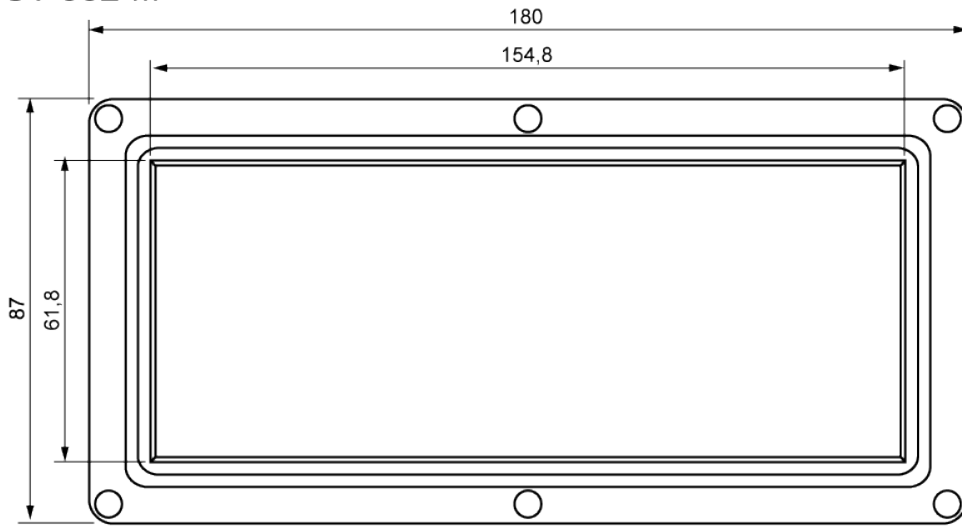Via a ST-Bus interface, the controller is connected to networks.

Sensor: Pt100 / Thermo couple Type ”J”
Range: -50...700 °C
Tightness: Front IP65
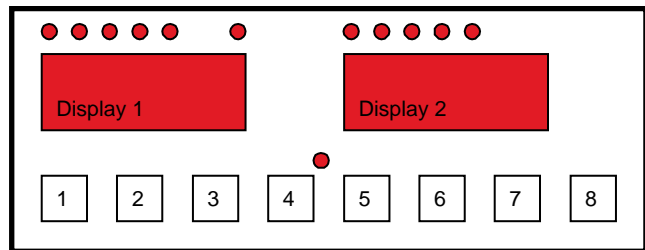**Connector:** screw terminals

STÖRK TRONIC

ST 552 ...

Software deep fryer

Displays

Display 1:	Temperature display
LEDs 1...5:	Selected temperature
LED Button 4:	Turbo heating

Display 2:	Time display
LEDs 1...5:	Selected time

Design, function and parameterisation

The device is designed as a complete built-in unit and for rear installation. The new capacity keypad enables a smooth glass front and makes the device particularly suitable for applications with a high degree of soiling. All inputs and outputs are connected from the rear side. The device is as a temperature controller with timer functions and is designed for use with deep fryers.

The front of the device is provided with a three-digit and a four-digit display, eight control buttons and twelve LEDs. Five LEDs indicate the reference temperature selected for the control operation ("TEMPERATURE 1, 2, 3, 4, 5"), five LEDs indicate the time selected for the timer ("TIME 1, 2, 3, 4, 5") and another one indicates the current status of the control output ("HEAT"). The LED at the Melt/Turbo button signals the selected operating status. If it is on, gentle heating is activated. This behaviour can be reversed with parameter P17.

For determination of the actual temperature, a temperature sensor type Pt100 or a thermocouple is connected. Two switching inputs enable external starting and stopping of the timer and connection of an overtemperature signal contact. In case of overtemperature "UEb" or "Hot" will flash on the display and the controller will be turned off. Function of the switching inputs can be deactivated via the parameterisation.

Four make-contacts and one change-over contact are provided as output relays. Via the parameterisation, you can select function Heat Thermostat 1 or Heat PID, you can also deactivate the output. Output K2 performs the basic function Cool Thermostat 2 and can be used for a release function. Output K3 controls lowering of the basket, output K4 controls raising of the basket. This also applies in the case of a temporary stop of the timer. Output K7 is assigned to the limit value alarm.

The controller features a gentle heating function which is activated as long as the frying fat is still congealed. This slow heating process (melt function) is active each time the system is turned on and will be deactivated as soon as an adjustable temperature threshold below the selected fat temperature is reached. Via the "TURBO" button, accelerated heating can be activated before the threshold is reached if the fat has melted visibly. After cooling, turbo mode will remain active at first. As soon as the temperature drops below 50 °C, it is assumed that unmelted fat is reloaded and the controller activates the melt function automatically.

You can also enter a variable frying time. Taking a parameterisable weighing factor into account, the time of the started timer is increased or reduced dynamically, depending on the control deviation.

A threshold couple which can be adjusted during parameterisation, enables a temperature alarm, referred to the actual value. Both relative and absolute thresholds can be selected. If these alarms are triggered, the control operation is continued. An internal buzzer enables an acknowledgeable warning signal.

Parameterisation mode can be activated by pressing the Temperature Up and Temperature Down buttons simultaneously for 3 seconds. Parameter "P1" appears in the display. Use the Up and Down buttons to scroll through the parameters. To access higher parameters quickly, scroll backwards using the Down button. Press the Melt-Turbo button to activate the value of the current parameter, the digit which can be changed will be flashing. Use the temperature selection button to select other digits. Once, you return to "P1",... the changed value is saved. Now, you can return to normal mode by pressing Up+Down. After 60 seconds, the controller returns to normal mode automatically without saving any changes.

Setting options

General operating notes:
If operated in an environment containing vapour the controller tends to undesired key activations.
In this case a delayed key activation can be set with parameter P47. If P47 is set to "1" the keys must be unlocked by a further keypress.

Button 1: UP Temperature
Use this button to increase a temperature value activated via the temperature selection. A delayed one-finger setup is implemented. After tapping the button the display gets dark for a short period (parameter P49) for unlocking. Once the display comes back, the value is increased without any further delay by tipping or keeping the button pressed to increase the increment and reach distant end values faster. The maximal increment can be parameterised.
For non-delayed key operation the timer side has the same behaviour, if the actual value is selected as the permanent display (P32 = 0). only the short darkening of the display doesn't take place.
Single-finger setup is implemented on the parameter level, too. Here, the UP button is used for switching to the following parameter and for adjustment, after the value was activated with the Melt/Turbo button and the digit to be adjusted was selected via the selection button. You can scroll through the digits.

Button 2: DOWN Temperature
Use this button to reduce a temperature value activated via the temperature selection. The procedure corresponds to increasing the value via the UP button. The same applies to the parameter level.
The down button is also used for acknowledgement of the buzzer. Since the timer remains active when parameterisation mode is activated, the buzzer can also be acknowledged there.

Button 3: Temperature selection
Use this button to select the setpoint to be used by the controller. Scroll to select, each push of the button switches the display further one step. The selected reference temperature remains active even after disconnection of mains supply. Special presets are also possible.
In delayed key operation the selection lamp goes off when initially pressed briefly, then the button must be released and from then on you can change instantaneously. In non-delayed key operation the change takes place immediately.

Button 4: MELT/TURBO
Use this button to toggle between slow heating and fast heating when the controller is switched on. This is only possible below an adjustable threshold below the limit value. "MELT" mode is always activated when the device is turned on. A key delay can be set with parameter P48.
The status LED is on during "slow heating" mode (MELT function). It is possible to select the reverse behaviour with parameter P17, i.e. the LED is on during fast heating (TURBO function).

Button 5: Time UP
Use this button to increase a time value activated via the time selection. One-finger setup is implemented. Keep the button pressed, after a short unlocking delay, the value is increased without delay. Now, you can also release the button and press it repeatedly briefly. In this case, the increment increases so that you can set higher end values more quickly. Changing the time is possible while the timer is running down. The new value will be saved and used immediately for the active timer operation.
The procedure in relation to the selected key operation mode (parameter P47) corresponds to the temperature side. In non-delayed key operation mode however, there is no additional keypress on this side.

Button 6: DOWN Time
Use this button to decrease a time value activated via the temperature selection. The procedure corresponds to increasing the value via the UP button.

Button 7: Time selection
Use this button to select the time to be used by the timer. Scroll to select, each push of the button switches the display further one step. The selected time value remains active even after disconnection of mains supply.
Special presets are also possible.
The procedure in relation to the selected key operation mode (parameter P47) corresponds to the temperature side.

Button 8: START/STOP
As soon as this button is pressed and released again, the selected timer is started. The remaining time appears in the display. The timer can be stopped at any time. When the timer has elapsed, the acoustic signal will be active for 3 seconds. It can be acknowledged by pressing the DOWN button. The timers have no influence on the control operation. If you press the button for at least 2 seconds, the timer will be stopped again.
In addition, you can turn the controller to standby by pressing the button for at least 5 seconds. In the right display, "OFF" will appear. Press the button again, to turn the controller on again. Via the parameterisation, you can also set up a button delay for the restar (P43). In addition, you can change the message displayed to "OFF" (parameter P36). Via the parameterisation, you can also deactivate the standby function completely (parameter P41). In this case, the controller will always be on after Mains ON.

Buttons 4+8: Reset of fat time registration
Press these buttons simultaneously for at least 2 seconds to reset the time registration. The warning message "OIL" disappears, the control block will be cancelled, if applicable. The operating time so far will be deleted. The message "rES" will appear briefly in the display. Please note that the reset is possible only during a warning status or a block and only if the temperature is below an adjustable temperature threshold. This is to ensure that the user cannot use the fryer without replacing the fat. However, you can also set up the system such that reset is possible without any restrictions.

Parameter table

1. Setpoint level

Parameter	Description of function	Setting range	Default value	Customer value
Reference temperatures				
S1	Temperature setpoint 1:	P4...P5	110 °C	
S2	Temperature setpoint 2:	P4…P5	120 °C	
S3	Temperature setpoint 3:	P4...P5	130 °C	
S4	Temperature setpoint 4:	P4...P5	140 °C	
S5	Temperature setpoint 5:	P4...P5	150 °C	
Timer values				
T1	Time 1:	0:00 to 59:59 min.	1:11 min.	
T2	Time 2:	0:00 to 59:59 min.	2:12 min.	
T3	Time 3:	0:00 to 59:59 min.	3:13 min.	
T4	Time 4:	0:00 to 59:59 min.	4:14 min.	
T5	Time 5:	0:00 to 59:59 min.	5:15 min.	

2. Parameter level

Para-meter	Description of function	Setting range	Default value	Cust. value
General control parameters				
P1	Delta W control circuit 2	-99...+99.0 K	10.0 K	
P2	Hysteresis control circuit 1	0,1...99.0 K	1.0 K	
P3	Hysteresis control circuit 2	0,1...99.0 K	1.0 K	
P4	Bottom setpoint limitation	0...999 °C	0 °C	
P5	Top setpoint limitation	0...999 °C	999 °C	
P6	Correction actual value 1	-20.0...+20.0 K	0.0 K	
P7	Display actual value 1	-----	-----	
P8	Initial temperature selection after Mains On	0: Selection as before 1...5: Selection of setpoint 1...5	0	
P9	Initial time selection after Mains On	0: Selection as before 1...5: Selection of time value 1...5	0	
Pid parameter				
P11	Control circuit 1: Proportional range in PID control	0.1…999 K	20.0 K	
P12	Control circuit 1: Integral time in PID control (I portion)	0...999 sec. (0 sec. = inactive)	500 sec.	
P13	Control c. 1: Derivative action time in PID control (D portion)	0...999 sec. (0 sec. = inactive)	50 sec.	
P14	Control circuit 1: Cycle time in PID control	2...100 sec.	10 sec.	
P17	Behaviour of the MELT/TURBO LED	0: on during MELT 1: on during TURBO	0	
Relay delay				
P18	Switch-off delay for heating relay	0.0...99.0 sec.	0.0 sec.	

Para-meter	Description of function	Setting range	Default value	Cust. value
Button lock				
P19	Button lock (Setpoint adjustment disabled)	0: Not locked 1: Locked	0	
Alarm parameters				
P21	Lower threshold for alarm	-99...999 °C/K	-99 K	
P22	Upper threshold for alarm	-99...999 °C/K	200 K	
P23	Hysteresis alarm, one side	0.1...99.9 K	1.0 K	
P24	Alarm function	0: Threshold alarm relative 1: Threshold alarm absolute	1	
P25	Special function in case of alarm	0: Not active 1: Display flashing, buzzer active	0	
P26	Alarm suppr. after Mains On	0...60 min.	0	
P27	Buzzer duration when timer elapsed	0...60 sec. (0 sec. = inactive)	5 sec.	
P28	Buzzer type	0: continous 1: pulsating	0	
P29	Blinking after timer expiry	0...180 sec. (0 sec. = inactive)	0 sec.	
Display parameters				
P31	Display mode basic level	0: Integral numbers 1: Resolution 0.5 K 2: Resolution 0.1 K	2	
P32	Type of temperature display	0: Actual value display 1: Setpoint display	0	
P33	Type of time display	0: Remaining time display 1: Operating time display	0	
P34	Temperature scale	0: Fahrenheit 1: Celsius	1	
P35	Message in case of overtemperature	0: UEb 1: Hot	0	
P36	Display in case of standby off	0: AUS 1: OFF	0	
P37	Blinking mode during timer (when the timer has elapsed, P29 is effective)	0: blinking during buzzer 1: blinking during buzzer and after timer has elapsed 2: different blinking intervals during/after the timer and during activated buzzer	0	
Button parameters				
P41	Standby function	0: Not active 1: Standby with button click 2: Standby via ST-Bus 3: Standby with button and ST-Bus	1	
P42	Internal buzzer mode	0 ... 15 (0 = buzzer inactive) **Bit mask** (add values): 1: Button klick 2: Baking end 4: Error, high temp./sensor error 8: Errors like an alarm relay	15	
P43	Delay of Start/Stop key at Standby-On	0.1…5.0 sec.	1.0 sec.	
P44	Delay before start of Turbo setup	0.0...2.0 sec.	0.5 sec.	

Para-meter	Description of function	Setting range	Default value	Cust. value
P45	Maximum increment / decrement in turbo setup, temperature setting	1...20 K	5 K	
P46	Maximum increment / decrement in turbo setup, time setting	1...20 sec.	5 sec.	
P47	Key operating mode	0: standard mode (no delay) 1: delayed key operation	1	
P48	Key delay for MELT/TURBO key	0.1 ... 5.0 sec.	0.5 sec.	
P49	Key delay for setup (if P47=1)	0.5 ... 3.0 sec.	1.0 sec.	
Input and output parameters				
P51	Function of external input E1	0: No function 1: External start/stop 2: Access to parameter level	0	
P52	Function of external input E2	0: No function 1: Message overtemperature 2: Feedback in case of "Gas" and "Gas+fan" heating mode	0	
P53	Switching mode input E2	0: Active when open 1: Active when closed	1	
P54	Assignment output K1	0: Not active 1: Thermostat control circuit 1 (not with P56=2 and P56=3) 2: PID control circuit 1	2	
P55	Assignment output K2	0: Not active 1: Thermostat 2 2: on together with controller on	1	

P56	Type of heating	0: Gas heating with feedback
		1: Electrical (or gas heating without feedback)
		2: Gas+fan, gentle
		   heating realised via fan
		3: Gas+fan, gentle
		   heating realised via burner
			2	

P57	Type of PWM / analogue signal (fan selection)	0: Active when high (230V~) 1: Active when low (24V=)	0	
P58	Tolerance time for burner start and restart chance	1...20 sec.	10 sec.	
P59	Min. on/off time during burner clocking	1.0...5.0 sec.	5.0 sec.	
Fan parameters				
P61	Minimum speed at fan	0...100 %(PWM/analogue signal)	30 %	
P62	Maximum speed at fan	0...100 %(PWM/analogue signal)	100 %	
P63	Maximum speed increase per 0.1 sec.	1...250 stages	4 stages	
P64	Correcting variable in case of clocked operation	0...100 % (PWM / analogue signal)	50 %	
P65	Lead/delay time of fan	1...60 sec.	5 sec.	
P66	Time for start increase	1...60 sec.	5 sec.	
P67	Starting boost (for P61/P62)	0 ... 100% (PWM/analogue signal)	100%	
Deep fryer parameters				
P71	On time of heating clocking	1...255 sec.	60 sec.	
P72	Off time of heating clocking	1...255 sec.	90 sec.	
P73	Clock end below threshold	-99...0,0 K	-30 K	

Para-meter	Description of function	Setting range	Default value	Cust. value
P74	Activation of burner clocking	0: Not active 1: Burner clocking below setpoint	1	
P75	Duration of basket lowering at K3 at start of timer	0...30 sec. (0 sec. = inactive)	5 sec.	
P76	Duration of basket raising at K4 at start of timer	0...30 sec. (0 sec. = inactive)	5 sec.	
P77	Selection of post-frying time	0: Fixed time 1...20: Elastic time	0	
P78	Activation of heating clocking	0: Not active, always turbo heating 1: Gentle heating	1	
P79	Threshold for return to heating clocking mode	0.0...99.0 °C	50.0 °C	
Operating time parameters				
P81	Temperature limit for fat operating time elapsed	0.0...999 °C	999 °C	
P82	Fat operating time until warning message	0...99 hrs. (0 hrs. = inactive)	0 hrs.	
P83	Fat operating time until controller block	0...99 hrs. (0 hrs. = inactive)	0 hrs.	
P84	Display of fat operating time	-----	-----	
P85	Temperature limit for reset of fat operating time (only effective if P86 = 2)	-99...999 °C	100 °C	
P86	Reset option of fat operating time	0: No restrictions 1: After warning message or blocking 2: After warning message or blocking plus cool-down	2	
Sensor and hardware parameters (if changed, Mains Off required)				
P91	Selection of sensor type	0: Pt100 2-wire 1: Thermocouple type J (Fe-CuNi) 2: Thermocouple type K (NiCr-Ni)	1	
P92	Display compensation	-----	-----	
P93	Software filter depth	1...64	8	
P94	Mains frequency	0: 50 Hz 1: 60 Hz	0	
P95	Type of analogue output	0: 0-10 V 1: 4-20 mA	1	
LowFat- and NoContact settings				
H1	Temperature increase for test heating „LowFat"	0.1…99.0 K	1.0 K	
H2	Minimum duration for test heating „LowFat"	0…240 sec. (0 sec. = inactive)	0 sec.	
H3	Maximum duration for test heating „NoContact"	0…240 sec. (0 sec. = inactive)	0 sec.	
H4	Temperature increase for test heating „NoContact"	0.1…99.0 K	1.0 K	
H5	Maximum temperature for LowFat- and NoContact settings	1…990 °C	60 °C	

Para-meter	Description of function	Setting range	Default value	Cust. value
Timer characteristic				
tic	Timer function	0: without multiple starts 1: with multiple timer starts	0	
Address + version				
L0	Controller address	1...255	5	
Pro	Program version	-----		

LowFat- and NoContact controll settings

General
Temperature monitoring a fryer can show whether enough oil is available. The LowFat and NoContact control settings provided by the controller cary out this task. Low Fat and No Contact operate independently, each have their own parameters and can be deselected separately.
At the moment of turning on the burner the control settings start running both at once and a test heating starts.

**Heating dynamics at various amounts of oil**
Rule of thumb: The more oil, the slower the heating rate at a given heat output.
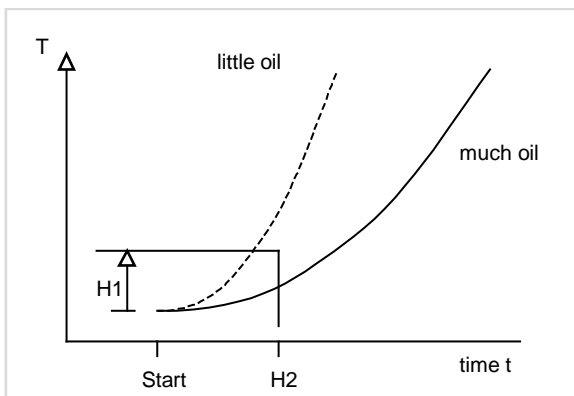
The illustration shows the heating up with small or large quantities in the deep fryer tank.

Fryer design features

The special features in the design of the deep-fryer must be taken into account. The temperature measurement value depends on the thermal coupling of the sensor to the oil or heating system. If the thermal coupling disappears with little oil, then the temperature also increases slowly or not at all.
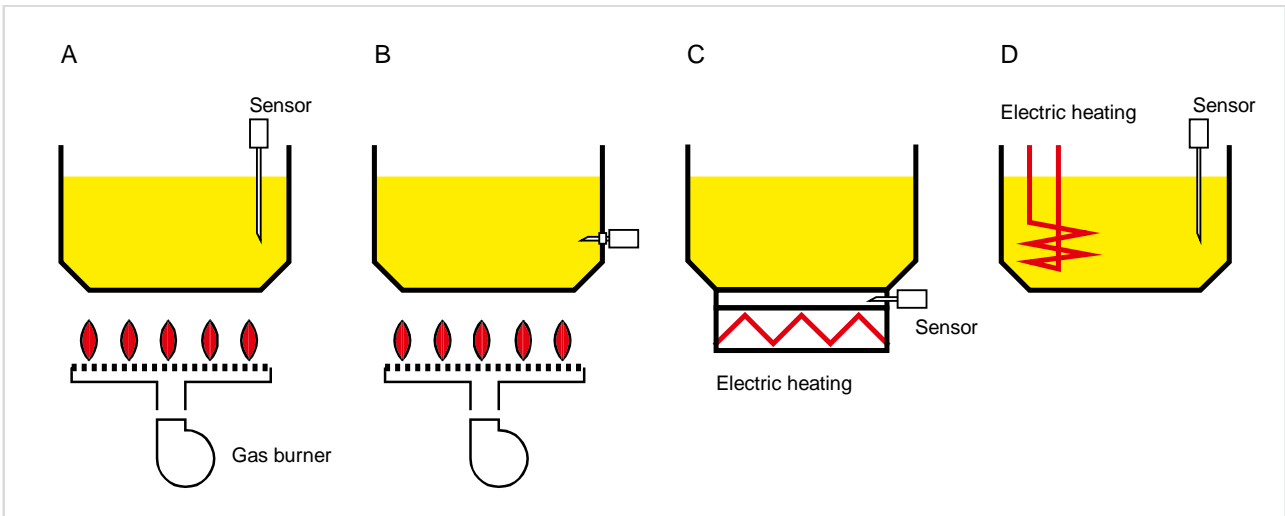
The illustrations show different constructions and thermal coupling to the sensor

Oil shortage or missing oil
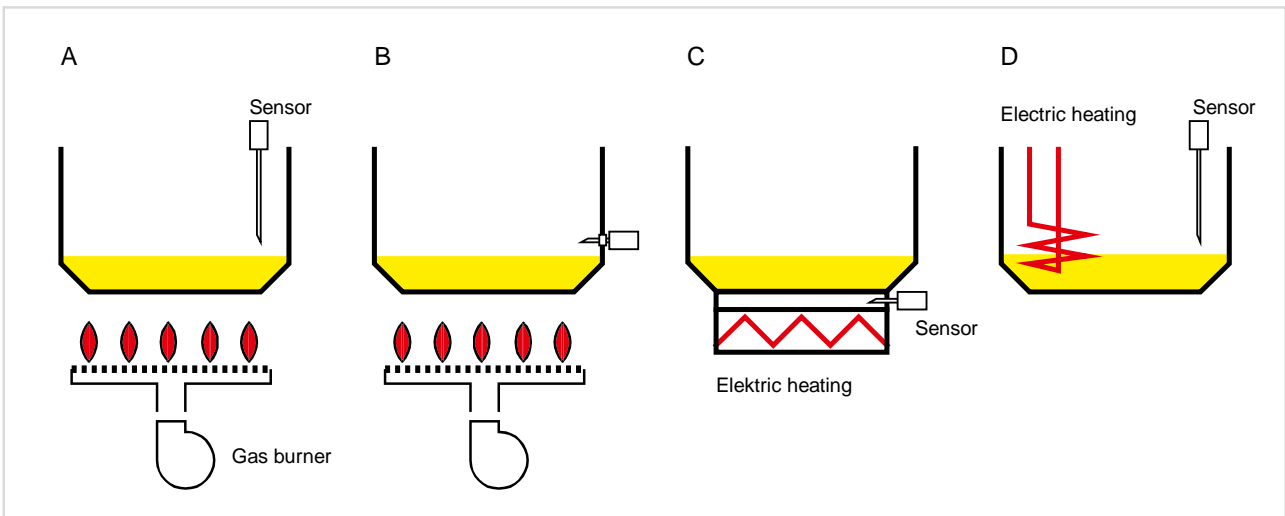
The illustrations show the conditions in case of lack of oil or missing oil.

Temperature behavior of the different designs

Example A:
If there is so little oil present that the sensor is no longer immersed in oil, it measures approximately the air temperature instead of the oil temperature and hardly changes the measured value during heating.
The lack of oil then becomes noticeable as too little temperature rise.

Example B:
In design B, a mixing temperature can occur because the sensor has thermal contact with the oil and the tank wall.
The temperature at the sensor rises when the oil heats up, or when heat is transferred to the sensor via the tank wall through heat conduction.

Example C:
In design C, the sensor is always in thermal contact with the medium.
In this case, the lower the amount of oil present, the higher the temperature rise.

Example D:
Design D has the same characteristics as design A.

Parameters involved
H1: Temperature rise for sample heating "LowFat".
H2: Minimum duration for sample heating "LowFat".
H3: Maximum duration for "NoContact" test heating
H4: Temperature rise for "NoContact" sample heating
H5: Maximum temperature for LowFat and NoContact facial expressions

Test heating procedure and alarm conditions

Once after start
After switching on the controller, it once executes a test heating. This is to avoid that the fryer is started, if there is no or insufficient oil.

To fast temperature rise with insufficient oil
Parameter H2 defines a minimum required time for the temperature rise according to parameters H1.
In case of a faster temperature rise the heating is switched off and an alarm with "lack of oil" message is triggered.

To slow temperature rise without oil
Parameter H4 defines a minimum required temperature rise for the duration according to parameter H3.
A slower temperature rise may indicate that no oil is present and the sensor is no longer in the oil. The heating is switched off and an alarm with "lack of oil" message is triggered.

In baking mode
In baking mode, i. e. above the temperature of parameter H5, the process is no longer reliable.
  - Monitoring of the minimum temperature increase is not possible when cold goods are thrown into the deep fryer.
  - The monitoring of the maximum temperature increase is not possible because this would require an unallowed deviation from the setpoint.

Please note:
A medium other than oil and changing the heating output will result in other parameter values.

Temperature range for LowFat- and NoContact settings
Parameter H5 sets a limit, up to which the test heating is started after switching on the controller.
Please note that the test heating is aborted if this limit is exceeded.

Alarm and Reset
If the test heating causes an alarm, the display flashes with "FAt" and the buzzer sounds. The test heating is stopped and the heater (i.e. burner and fan) is switched off.
The buzzer can be acknowledged immediately with the DOWN key. To reset the alarm fill up oil and switch off and back on the controller with the OFF key.

Selection parameter post-frying time

With parameter P77, you can define if the frying time is exactly the programmed time or if the frying time is to be extended if the fried material causes a temperature decrease.
Extension of the frying time, also referred to as elastic time or post-frying time, depends on the deviation from the setpoint. If the setpoint is exceeded, the time is reduced.
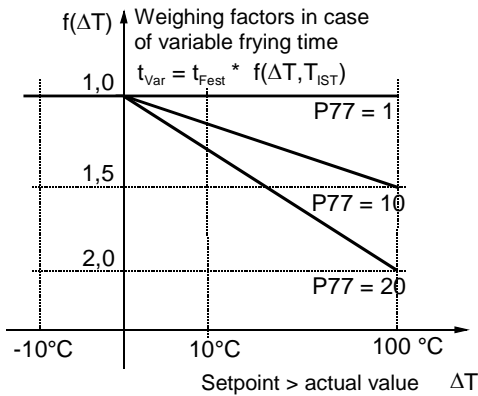
Actual value	P77	Effective frying time
180 °C	0	100 sec.
150 °C	0	100 sec.
180 °C	1	100 sec.
150 °C	1	120 sec.
180 °C	10	100 sec.
150 °C	10	135 sec.
180 °C	20	100 sec.
150 °C	20	150 sec.
125 °C	20	210 sec.
100 °C	20	300 sec.

Table: Setpoint 180 °C, selected frying time 100 sec.

Weighing factors in case of variable frying time

$$t_{Var} = t_{Fest} * f(\Delta T, T_{IST})$$

P77 = 1

P77 = 10

P77 = 20

Setpoint > actual value ΔT

Feedback in case of heating modes "Gas" and "Gas+fan"

In the case of heating modes "Gas" and "Gas + Fan", a feedback signal detected via switching input E2 can be used. The feedback confirms that the burner has started properly. Otherwise, the control is stopped. The feedback signal is considered in different ways in the case of these heating modes.

Heating mode "Gas"
Control at the heating output is effected only if the feedback is present on switching input E2. Without the feedback, the heating relay is not switched on. If the feedback is missing during the heating process, the relay is switched off. In this heating mode, no error message is triggered nor is it necessary to acknowledge an error.

Heating mode "Gas+Fan"
Restart with controller switched off:
Control at the heating input will be activated upon request by the controller part. After that, the system waits for receipt of the feedback (for the time set in parameter"P58"). If the feedback is received at switching input E2 of if it is already present at the time of the request, the control operation is continued. If not, the control operation is switched off. The "HEAT" lamp flashes slowly signalling the start error. To acknowledge and restart the control operation, press the "OFF" button, i.e. switch to Standby Off and on again.
Burner failure with restart chance:
If the feedback fails during the control operation, the fan is switched back to minimum speed according to parameter "P61" immediately. The system waits for the restart of the burner and the return of the feedback signal (for the time set in parameter "P58"). The "HEAT" lamp flashes quickly signalling the restart chance. If the feedback signal is received again, the control operation is continued. If the feedback is not received within this time, the control operation is switched off. The "HEAT" lamp flashes slowly signalling the burner failure. To acknowledge and restart the control operation, press the "OFF" button, i.e. switch to Standby Off and on again.

Deactivation of feedback
Via parameter "P53", you can deactivate the feedback function by reversing the switching mode of switching input E2. In this case, the controller will interpret the open switching input, to which nothing may be connected, as a feedback signal. Independent of this, the feedback will also be deactivated if you assign other functions to the switching input via "P52".

The control function of the deep fryer controller is explained in the following and will always be valid while the controller is switched on.

Control function

Heating phase without manual intervention

Heating phase after activation (refer to Figure 1):
After activation and start of the controller, a slow heating phase will always follow when the fat is cold. This phase is finished when the setpoint is reached, at the latest. In this slow heating phase, the heating relay clocks, i.e. with the on time set in parameter "P71" being followed by the off time set in parameter "P72" and vice versa. Slow heating is to ensure that congealed fat is heated up gently at the start of operation. Via parameter "P73", you can stop the slow heating phase before the setpoint is reached. If this is not desired, set P73=0.0 K.
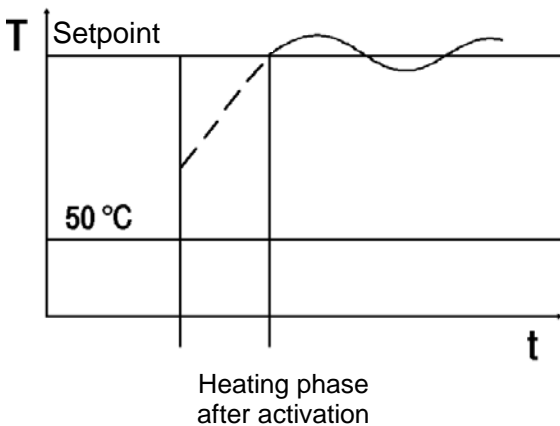

Heating phase
after activation

Figure 1

Heating phase after slight cooling (refer to Figure 2):
After minor cooling to temperatures above 50 °C, e.g. loading of small quantities of cold fat, the normal heating function of the controller is maintained. The new heating phase will not be slowed down, the heating relay will not be clocked with a thermostat function defined via the parameterisation. If PID function is specified, the heating relay will only clock within this range. The clock end defined via parameter "P73" does not have any influence.
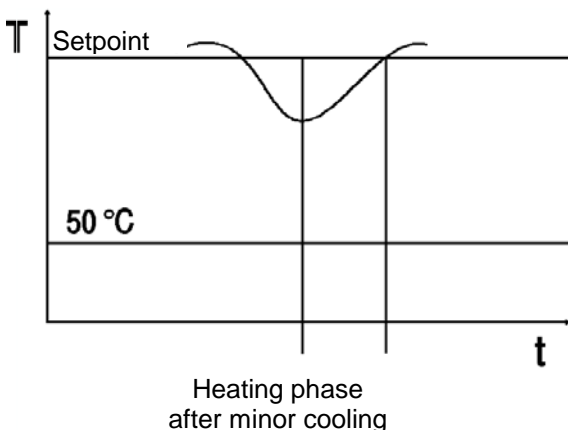

Heating phase
after minor cooling

Figure 2

Heating phase after significant cooling (refer to Figure 3):
After significant cooling to temperatures below 50 °C, e.g. loading of large quantities of cold fat, the slow heating function is activated again. The heating relay clocks again like in the initial heating phase, until the setpoint or the clock end below the setpoint defined in parameter "P73" is reached again. This is to ensure gentle heating of the reloaded fat.
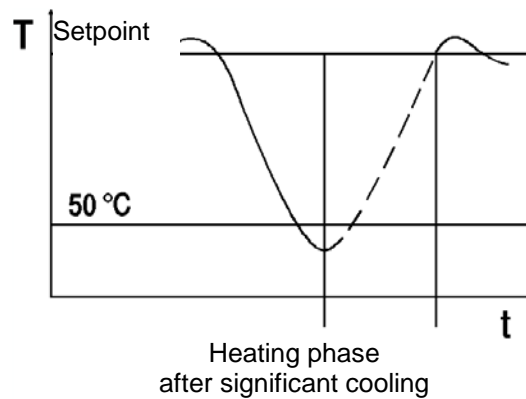

Heating phase
after significant cooling

Figure 3

Control after heating
After the heating phase, the controller works with the PID function based on parameter group "P11" to "P14".

Heating phase with manual intervention

Heating phase after activation (refer to Figure 4):
After activation and start, the slow heating phase will start without manual intervention. By pressing the quick heating button MELT/TURBO, you can switch over to the normal heating function. Now, the fat will be heated more quickly. The heating relay will no longer clock based on the times set in parameters "P71" and "P72" but based on the PID function set via the PID parameters. The clock end defined via parameter "P73" does not have any influence after the manual intervention.
To undo the change-over, press the MELT/TURBO button again. Now, the heating relay will clock like before the manual change-over again.

The manual change-over function can be used for reducing the heating phase if the fat has melted visibly and can be heated at a higher rate without any damage. Manual change-over between slow heating and turbo heating is possible only if the controller actually is in the heating phase, i.e. below the threshold set via parameter "P73". Above this threshold, the turbo button has no function.
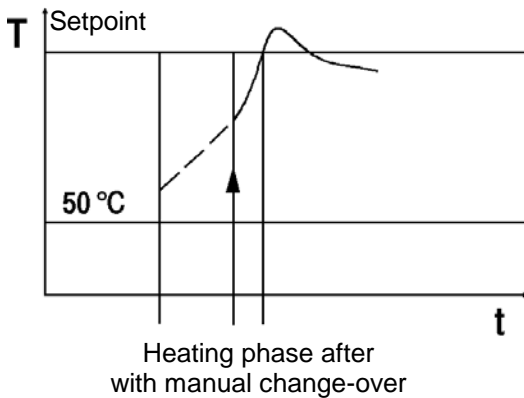
Setpoint

50 °C

T

t

Heating phase after
with manual change-over

Figure 4

Heating phase after significant cooling (refer to Figure 3, top):
After significant cooling to temperatures below 50 °C, e.g. loading of large quantities of cold fat, a slow heating phase will start, although the change-over to normal heating mode is effected earlier; the heating relay clocks like in the initial heating phase.
Thus, manual change-over to normal heating function is only effective for the current heating phase and will become ineffective as soon as the setpoint is reached, at the latest. After that, as well as after mains failure and restart, the controller is in normal operation mode with slow heating phase when the controller is switched on and started or restarted later or in the case of cool-down to temperatures below 50 °C. The switch-back threshold is can be set via parameter "P79".

Clocking of automatic burner device in the case of heating mode "Gas+Fan"

Control to setpoint with "burner clocking"
To obtain a better control to the setpoint in the case of heating mode "Gas+Fan", clocking of the automatic burner device can be activated. If the correcting variable percentage determined by the control part is smaller than the lower speed limit of the fan defined in parameter "P61", the fan remains at this minimum speed and the automatic burner device is clocked until the setpoint is reached.
In this case, the control part calculates the on phases from 0...100 % based on the correcting variable values, with a minimum on time / minimum off time being enforced by parameter "P59". The feedback is handled such that the time between the activation of the heating output and the receipt of the feedback signal is not considered as effective on time. Thus, the effective on time will start only upon receipt of the feedback signal.
Below the burner clocking range, the automatic burner device will always be on at first. Above the burner clocking range, i.e. after the setpoint was reached, the automatic burner device and the fan are switched off if the correcting variable becomes zero. For the fan, lead and delay times as well as a start-up boost are always effective.
If burner clocking is deactivated, the automatic burner device will always be switched on below the setpoint, and the control is affected by defining the fan speed based on the correcting variable, within the limits specified via parameters P61 and P62, across the whole proportional range. Above the setpoint, the automatic burner device and the fan will be switched off.

Gentle heating with "heating clocking"
Two operation modes are available for gentle heating of cold fat, with the effective correcting variable always being defined via the ratio of the on and off times in "P71" and "P72".
Heat clocking with fan:
If P56=2 the so-called heating clocking is affected only via the fan, the burner will be on permanently. The speed value of the on phase is defined by "P64", in the of-period, the minimum value defined by „P61" is valid. Note that the percentage value specified in "P64" is relative to the area of "P61 ... P62". Further the final value of the "on-period" is not reached in case of very short turn-on times in "P71" because the fan speed increase is reduced with parameter "P63".

If P56=3, the heating clocking is affected by switching the automatic burner device on and off at the time values defined in "P71" and "P72", with the fan always maintaining its minimum speed according to "P61". Parameter "P64" has no function in this operation mode.

Heating with "Superturbo"

To obtain always instant heat output in case of need, you can change and activate the switch option to "Superturbo" with P16. Now the Melt/Turbo button activates the thermostatic control, provided that the limit of "P73" is exceeded. This mode is called "Superturbo" and applies to all operating modes until reaching the one time switch-off limit that was established with "P15". Thereafter, switch again to "Superturbo", if necessary. So you can toggle with the button above the limit from "P73" between the PID control and the thermostat behaviour, in which the hysteresis of "P2" is effective. If you switch within this hysteresis to "Superturbo", the heating is switched on immediately and only from then on, the hysteresis will be activated. Once "Super Turbo" is active, there are no burner cycles.

Above the cut-off line, which was established with "P15", the Melt/Turbo button is blocked because an active "Superturbo" was already deactivated and should remain also inactive. You can only switch back to slower heating (melt function) below the limit from "P73".

Please note that the switch option to "Superturbo" remains in those named limits if the controller was configured as a pure thermostat with "P54". In this case, the switch does not create a change in the control behavior, and it is recommended to disable the "Superturbo" in "P16". On the other hand, you can activate "Superturbo" if you waive in special cases the gentle heating phase with "P78".
The status of "Superturbo" is always displayed with a flashing buttons light, it doesn't matter how "P17" is configured.

Switch-off delay for heating relay

With parameter P18, you can define a switch-off delay for the heating relay which is effective in all operation modes. The parameter is provided for cases, where the ignition of the gas heating is always delayed.

Caution: The setting P18 must be done taking utmost care, as it is active independent of the control part. For this reason, short cycle times might result in unintended permanent heating.

Operation of the timer group

Version without multiple start (tic=0):
Single start
After the start of a timer it is <u>not</u> possible to select or start another timer. At the end of a timer the buzzer sounds and the LED of the concerning timer flashes while the buzzer is on.
With parameter "P28" the buzzer can be specified for continuous or pulsating operation.

Basket activity:
If the basket operation is activated (P75>0 and P76>0) the basket is lowered at start of the timer and is raised at every stop of the timer.
By keeping pressed the Stop key the timer is cancelled and the basket is raised.
If the basket operation is deactivated (P75=0 and P76=0) the basket is not lowered or raised. The timer works as above.
Please note that it is mandatory to always adjust both parameters P75 and P76 either to "0" or to a time value!

Version with multiple start (tic=1):
Multiple start
After the start of a timer it is possible to select another time and start the timer. In the display you always see the time of the selected timer and the LED of this timer is on.
At the end of a timer the buzzer sounds and the LED of the concerning timer flashes while the buzzer is on.
The display shows the time of the selected timer and the LED of this timer is on.
It is possible to start all 5 timers simultaneously, however a multiple start of a single timer is not possible!
With parameter "P28" the buzzer can be specified for continuous or pulsating operation.

Basket activity:
If the basket operation is activated (P75>0 and P76>0) the basket is lowered at every start of a timer and is raised at every stop or end of a timer.
If the basket is raised or the Start/Stop key is pressed, the lapse of all timers is interrupted and can be continued by restarting.
It is possible to finally stop all timers by pressing the Start/Stop key for more than 4 seconds.
If the basket operation is deactivated (P75=0 and P76=0) every timer works independently and only the currently selected timer is started, stopped or cancelled. By pressing the Start/Stop key for more than 4 seconds all timers are cancelled.
Please note that it is mandatory to always adjust both parameters P75 and P76 either to "0" or to a time value!

Longer blinking of the timer lamps.
It is possible to let the timer lights flash at timer end for up to 3 minutes. This results in a longer signalling of expired timers, if only a short buzzer period. With parameter "P29" the flashing duration is specified, at P29 = 0 is no further flashing.
The flashing can, like the buzzer, be acknowledged with the down button. If a multi-start occurred, the flashing of all timers is always acknowledged together.

Error and warning messages

Display	Cause	Remedy
E1	Sensor error (Heating relay and analogue output are switched off!)	Check sensor
Ptc	Sensor error on compensation element for thermocouple measurement (P91=1,2)	Repair of controller
UEb	Overtemperature at E2 (P35=0, P52=1)	-----
Hot	Overtemperature at E2 (P35=1, P52=1)	-----
FAt	Alarm of the LowFat or NoContact control settings	Check oil level and/or switch on/off by pressing OFF button
EP	Error in parameter memory	Repair of controller
OIL control active	Warning message, fat operating time is exceeded (see P82)	Acknowledge with the temperature DOWN key
OIL control blocked	Control is blocked,, fat operating time is exceeded (see P82)	Acknowledge with the MELT and START key
rES	Reset of fat operating time (see P86)	-----
Display flashing	Threshold alarm (P25=1)	-----
Timer lamp flashing	Timer has elapsed (see P27 and P29)	Acknowledge with the DOWN key
Lamp "HEAT" flashing slowly	Burner fault (see P58)	Switch on/off by pressing OFF button
Lamp "HEAT" flashing quickly	Burner restart chance (see P58)	Switch on/off by pressing OFF button
„- - -" flashing during setup	Button lock (P19=1)	-----

Technical data of ST552

Analog inputs
F1: Temperature sensor Pt100 or thermocouple TC
       Measuring range: Pt100   -80...+400 °C
                            TC   -50...+400 °C
       Measuring accuracy referred to controller at 25 C: +/-0.5 K and +/-0.5 % of measuring range

Digital inputs
E1: External start-stop button
E2: Overtemperature signal contact from temperature limiter

Signal outputs
K1: Relay, 8(1.5) A / 250 V~, normally-open contact (heating contact)
K2: Relay, 8(1.5) A / 250 V~, normally-open (control contact 2)
K3: Relay, 8(1.5) A / 250 V~, normally-open (raise basket)
K4: Relay, 8(1.5) A / 250 V~, normally-open (lower basket)
K7: Relay, 8(1.5) A / 250 V~, change-over contact (alarm contact)
Linear analog output with 0 to 20 mA output range

PWM output
S1: PWM output 3.6 KHz, output of PID correcting variable for control via a fan

Power supply
230 V~ 50/60 Hz, Power consumption max. 6 VA

Connections
Screw terminals, grid 5.00 mm, for cables up to 2.5 mm²

Ambient conditions
Storage temperature   -20...+70 °C
Operating temperature   0...55 °C
Relative humidity   max. 75 % r.H., no condensation

Weight
approx. 600 g

Enclosure type
IP65 front, IP00 rear

Protection class
Protection class II, rated voltage 250 V~

Standards
CE Low Voltage Directive 73/23/EEC
EN 60335-1:2002   Household and similar electrical appliances - Safety -
EN 60730-1:2002   Automatic electrical controls for household and similar use
EN 61010-1:2001   Safety requirements for electrical equipment for measurement, control and
                               laboratory use
CE EMC Directive 89/336/EEC, degree of severity 3

ST-Bus at RS485
Shielded 2-wire cable, twisted pair, maximum cable length 1000 m
Interface driver: RS485, galvanically not isolated.
The network must be designed in line topology with termination resistor of 120 Ohm on both sides.

Installation specifications
The display unit is designed for installation in a switching panel (note dimensioned drawing).
Front size: 154.8mm x 61.8mm
Assembly size: 180 x 87mm
Assembly depth: approx. 25mm

Annex ST-Bus

A. Actual values
(read via ST-Bus-Token ReadRam)

	Index	Name	Text
	0	F 0	Sensor F1: Pt100
	1	F 2	Sensor F2: PTC compensation
	2	F 3	Sensor F3: TC
	3	TST	only internal use
	4	-S1	Setpoint
	5	P	PID: P portion
	6	I	PID: I portion
	7	D	PID: D portion
	8	PID	PID: result
	9	OUT	Relay output
	10	Fan	Fan output
	11	T1	Timer 1 (Start or remaining time)
	12	T2	Timer 2 (Start or remaining time)
	13	T3	Timer 3 (Start or remaining time)
	14	T4	Timer 4 (Start or remaining time)
max=	15	T5	Timer 5 (Start or remaining time)
=max+1	16	S-0	Status 0
=max+2	17	S-1	Status 1 (Error)
=max+3	18	S-2	Status 2 (Intern)
=max+4	14	S-3	Status 3 (mainFlags.i16[1])

All values are sent with "MSB first"!
For a description of the individual status bits, see separate table.

B. Status64
(read via ST-Bus-Token ReadStatus64)

Index	Data [0]	Data [1]	Data [2]	Data [3]
0	Status 0	0	0	Status 2
1	Status 1	0	0	0
2	MainFlags[0]	MainFlags[1]	MainFlags[2]	MainFlags[3]

The individual status words are sent with "MSB first"!
For a description of the individual bits, see separate table.

C. Status16 Words

(read via ST-Bus-Token ReadRam as actual values)

Description

Bit	Function	Message

Status 0 (S-0)

Bit	Function	Message
0	Controller on	if 0: „OFF" in the display, **this bit is writable**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10	internal EEProm error	„EP" in the display
11		
12	Check mode on	„Pr" in the display
13		
14		Buzzer on
15		Error -> if 1 see Status1

Status 1 (S-1): Error

Bit	Function	Message
0	„E1" in the display (Sensor error F1/F3)	
1	„FAt" in the display	
2	„UEb" in the display	
3		
4		
5	„Hot" in the display	
6	„Ptc" in the display	
7	„OIL" in the display	
8		
9		
10		
11		
12		
13		
14		
15		

Status 2 (S-2): internal signals

Bit	Function
0	Relay K1
1	Relay K2
2	Relay K3
3	Relay K4
4	Relay K5
5	Relay K6
6	Relay K7
7	Relay K8
8	Switching input E1
9	Switching input E2
10	

11
12
13
14
15

0	Warning message „Oil", without blocking
1	Warning message „Oil",without blocking
2	Warning message „Oil" acknowledged
3	Acknowledgement for "Oil" enabled (cold fat)
4	Warning „FAt"
5	LowFat- or NoContact mode is checking
6	LowFat mode active (only once after switching on)
7	NoContact mode active (only once after switching on)
8	Feedback signal given to input E2 (switching direction taken into account)
9	Burner start phase
10	burner start-up phase
11	Burner restart
12	Burner error
13	Burner is switched on
14	Burner clocking under setpoint value active
15	Burner clocking was active

D. MainFlags (corresponds Status64 Index 3)

Description

Bit	**Function**	Message

MainFlags[0]

0	Panel On
1	Timer running!
2	Buzzer on because end of baking
3	Intern: button beep
4	Intern: buzzer on for alarm
5	Intern: buzzer on for error
6	Intern: buzzer acknowledged
7	Intern: Parameterization (via buttons) active
8	Intern: Display Temperatures
9	Setpoint display
10	Time adjustment active
11	Heating cycles active
12	Heating cycles ready
13	"Superturbo" free, i. e. can be activated
14	„Superturbo" activated
15	Hot fat, registration is released

MainFlags[1]

0	Warning message "Oil", without blocking
1	Warning message "Oil", without blocking
2	Warning message "Oil" acknowledged
3	Acknowledgement for "Oil" enabled (cold fat)
4	Warning „FAt"

5	LowFat- or NoContact mode is checking
6	LowFat mode active (only once after switching on)
7	NoContact mode active (only once after switching on)
8	Burner feedback at input E2
9	Burner start phase
10	burner start-up phase
11	Burner restart
12	Burner error
13	Burner is switched on
14	Burner clocking under setpoint value active
15	Burner clocking was active

MainFlags[2]

0	Relay switch-off delay active
1	Alarm signal with flashing and buzzer
2	Alarm relay is switched on
3	Internal: Controller is in test mode
4	Internal: ST-Bus test mode
5	Internal: Manual test mode
6	Internal: Display
7	Basket is up
8	Basket is down
9	Overtemperature alarm at input E2
10	Internal: unauthorized setpoint access
11	Internal: unauthorized time access
12	Multiple timer starts possible
13	Internal: EP error
14	Internal: Test
15	Internal: Display

MainFlags[3]

0	Internal: Display
1	Internal: Display
2	Internal: Display
3	Internal: Display
4	Internal: Display
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	