MOULDPRO®

Operating Instructions
Controller

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Area of Application

The controller is developed specially intended for temperature controller. These operating instructions cover **all models** in the temperature controller series.

1. Structure/Function

The controller is based on a microprocessor and acts as one unit. It is not possible to service the controller. In case of a defect, the entire controller has to be replaced.

The controller monitors the temperature and level, and has a built-in alarm for these functions, as well as an alarm in case of a temperature sensor defect. A built-in clock makes it possible to start/stop the temperature controller. A PCB for transferring data to/from process can also be supplied. Likewise, a remote control module with all functions is also available.

2. Safety Instructions

The controller can be connected to both 10V and 24V. The device must therefore be disconnected before handling the controller.

It is important to follow all safety instructions in the user manual before connecting the mains voltage.

3. Connection

Status	Key 1	Key 2	Display						Function	Signal
			.					.	When the voltage is connected, the display will show two dots - the device is ready for start-up.	

4. Start/Stop of Temperature Controller

Status	Key 1	Key 2	Display						Function	Signal
On			1				2	0.	Press key 1 – start temperature controller. The current temperature will be shown on the display.	
Off			.					.	Press key 1 – stop temperature controller. Two dots will be displayed for standby mode.	

Temperature controller, water, will automatically refill the tank. The LED for the level is lit:

Status	Key 1	Key 2	Display	Function/Display	Signal
Level monitoring	----	--------	F I L L.	Oil devices are manually refilled with heat transfer oil. Once the tank is filled to the correct level, the LED for the level goes out and the temperature controller turns on.	

Status	Key 1	Key 2	Display	Function	Signal
On			I 25	If you press 1, the tank temperature will appear on the display.	

The temperature controller is now running and the desired temperature has to be entered.

5. Temperature Adjustment

Status	Key 1	Key 2	Display	Function	Signal
Changing a set point		 	I 20.	1. Press key 1 (the display shows the set point). Press ▲ to increase or ▼ to decrease the set point.	

Status	Key 1	Key 2	Display	Function	Signal
			I 25.	When you release the key, after about 5 seconds, the display will show the current tank temperature.	

The temperature entered above is now saved and the tank temperature is regulated according to it. The set temperature can be recalled on the display by pressing:

Status	Key 1	Key 2	Display	Function	Signal
			I 20.	Press key 1 – the display shows the set temperature.	

6. Decimal View

Activating/deactivating the decimal view (only temperature controller, water, with °C display.

Status	Key 1	Key 2	Display	Function	Signal
Off	0		. .	Press key 1 – stop temperature controller – two dots on the display	
Decimal selection			. 1 0.	Press key 1 for at least 3 seconds - activating the decimal view: 0 = No decimal (default) 1 = Decimal (99.9)	
Decimal selection	△	0	. 1 1.	Press key 1 = choice of display Press key 2 = confirm choice of display ▼ = no decimal	

7. Temperature Alarm

It is possible to set an alarm for temperature deviations.

The alarm function has one available terminal where a signal for activating an auxiliary relay can be selected. The auxiliary relay activates a sounder or any other alarm type (cf. the electric drawing in the user manual, the enclosed temperature control).

The voltage of the terminal is the same as the mains voltage and it may be loaded to up to 30VA. In case of alarm "**Off**", there is no voltage in the alarm output.

Alarm Setting

Status	Key 1	Key 2	Display	Function	Signal
Strip	🔔	△ ▽	A 2 0.	Press key 1 – alarm for temperature deviations. Setting 1⌧ 80 °C (176 °F) ▲ or ▼. Default 20 °C (68 °F). The first time it is active - for 45 min. with pump operation, pump "On".	----
Alarm On	🔔	1	A - 1 -.	Press key 1 then key 2 – alarm On. Alarm always active (On) after pump stop (Off)	Alarm LED on X1 - constant sounder
Alarm Off	🔔	0	A - 0 -.	Press key 1 then key 2 – alarm Off. In case of an alarm, no sound or voltage in X1.	Alarm LED not lit.

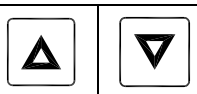
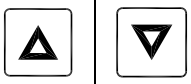
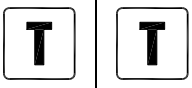
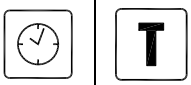
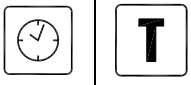
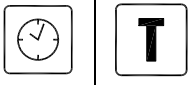
Note:
Regardless of the setting above, the alarm for deviating temperature
will be activated for the first time after **45 min.** pump operation "**pump On**".
The factory setting of the alarm is active, "**On**".

8. Setting the Clock

Encoding of Start/Stop Time
The unit must be in operation during the encoding.
The control has a clock with hours, minutes and weekdays:

1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday
7 = Sunday

Setting of the clock, including start/stop times. When encoding, the LED lamp, the hours symbol, must be active.

Status	Key 1	Key 2	Display	Function/Display	Signal
Access to the clock			. 0 1 2 5.	Press key 1 – shows for how long the temperature controller has had voltage supply, e.g. 1 hour and 25 minutes	
Setting the clock			. 2 0 0 0.	Press key 1, then ▲ or ▼ for the desired hour – e.g. 20.00	
Setting the day of the week			. 1 .	Press key 1 twice – the weekday is displayed. Select the weekday using ▼ or ▲. The time and the weekday will be reset if the power supply is interrupted.	
Setting the start time			. 0 0 0 0.	Press key 1, then key 2 – set the start time using ▲ or ▼. If the keys are not pressed within about 5 seconds, the current temperature will be shown on the display.	
Setting the stop time			. .	Press key 1 and then key 2 twice - set the stop time using ▲ or ▼. If the keys are not pressed within about 5 seconds, the current temperature will be shown on the display.	
Auto start/stop			. 1 . .	Press key 1 twice, then press key 2 – automatic start/stop selection. 2 dots on the right side = no auto start. Two dots with a segment's distance = auto start. The example = no auto start.	
Auto start/stop			. 1 . .	To move dots, press 	
Auto start/stop			. 2 . .	Press key 1 twice, then press key 2 – choice of weekday for auto start using ▲ or ▼.	

Stop timer	T		1			2	0.	3	Press key 1 once during normal operation and the timer will be temporarily disconnected. The example shows: Timer on – dot on the right side.	
Start timer	T		1				2	0	Timer disconnected - no dot on the right side. Press 1 once to activate the timer again.	
									The temporary disconnection of timer will be reset after a power cut. The timer can be permanently disconnecting by deselecting the day in question.	

Automatic Start/Stop:

The control can have a start and a stop time.
Days for which start/stop is not required can be deselected.
In case of a power cut, the control will reset the clock and day, but will remember all other data.

9. Automatic Restart

Status	Key 1	Key 2		Display						Function/Display	Signal
On	I							2	0.	Press key 1 – start temperature controller. The current temperature will be shown on the display.	
Auto restart			T	.		1		.	.	Press key 1 twice, then press key 2 – automatic start/stop selection. 2 dots on the right side = no auto start. 2 dots with a segment's distance = auto start. In the example = no auto start.	
Auto restart			T	.		1		.	.	To move a dot, press I	
										This programming shall only be done for day 1. The unit will restart after a power cut. **Note!** The machine also starts when the main switch is activated.	

Note!

In case of any repairs, the power supply must be disconnected. The cabinet and the cover plates must be re-installed before starting up the facility again.

10. Working Hour Counter

The working hour counter registers only integer hours of pump operation - up to 9999 hours.

Status	Key 1	Key 2	Key 3	Display	Function/Display	Signal
Working hours timer		I		0 0 0 I.	Press key 1, then key 2 – the working hour counter registers integer hours during pump operation.	
Reset		I	0	0 0 0 0.	Press key 1, press key 2 and then key 3. Resets the working hours timer	

11. Entering a Password

The temperature controller makes it possible to enter a blocking code that prevents the change of temperature and alarm temperature values.

Status	Key 1	Display	Function/Display	Signal
Off	0	. .	Press key 1 – stop temperature controller	
Access Password	C	. C 0.	Press key 1 until "C" appears on the display.	
Enter Password		. C I.	Enter 4 characters using the A B C keys The temperature controller "counts" the number of characters, i.e. 4 on the display = 4 characters entered.	
Off	0	. .	Press key 1 to confirm the password.	
On	I	I 2 0. 3	Press key 1 – start temperature controller. The temperature can now be changed only after the correct password is entered.	
Off	0	. .	Press key 1 – stop temperature controller	
Access password	C	. C 0.	Press key 1 until "C" appears on the display.	
Delete password	0	. .	Press key 1 – the password is now deleted.	
On	I	I 2 0. 3	Press key 1 – temperature controller is running without a password.	

The code cannot be deleted as a result of a power cut.

12. The VAC Function

Temperature controllers, water with VAC function, can automatically cool down to 40°C (104°F) and temperature controller can cool down oil to 50°C (122°F). The display shows "**E**" and the current temperature.

When 40/50°C (104/122°F) is reached, the alarm sounder will send a signal that the temperature controller is ready for mould emptying.

Status	Key 1	Key 2	Display	Function	Signal
			I -. / E 50.	Press key 1 then key 2 – mould-emptying active, "On". The display shows the current temperature.	Water unit: 40°C (104°F) Oil unit: 50°C (122°F)
On			I. -.	Press key 1 then key 2 – mould emptying inactive, "Off".	

See also the separate section in the user manual on the temperature control unit itself.

13. Cooling prior to Stop

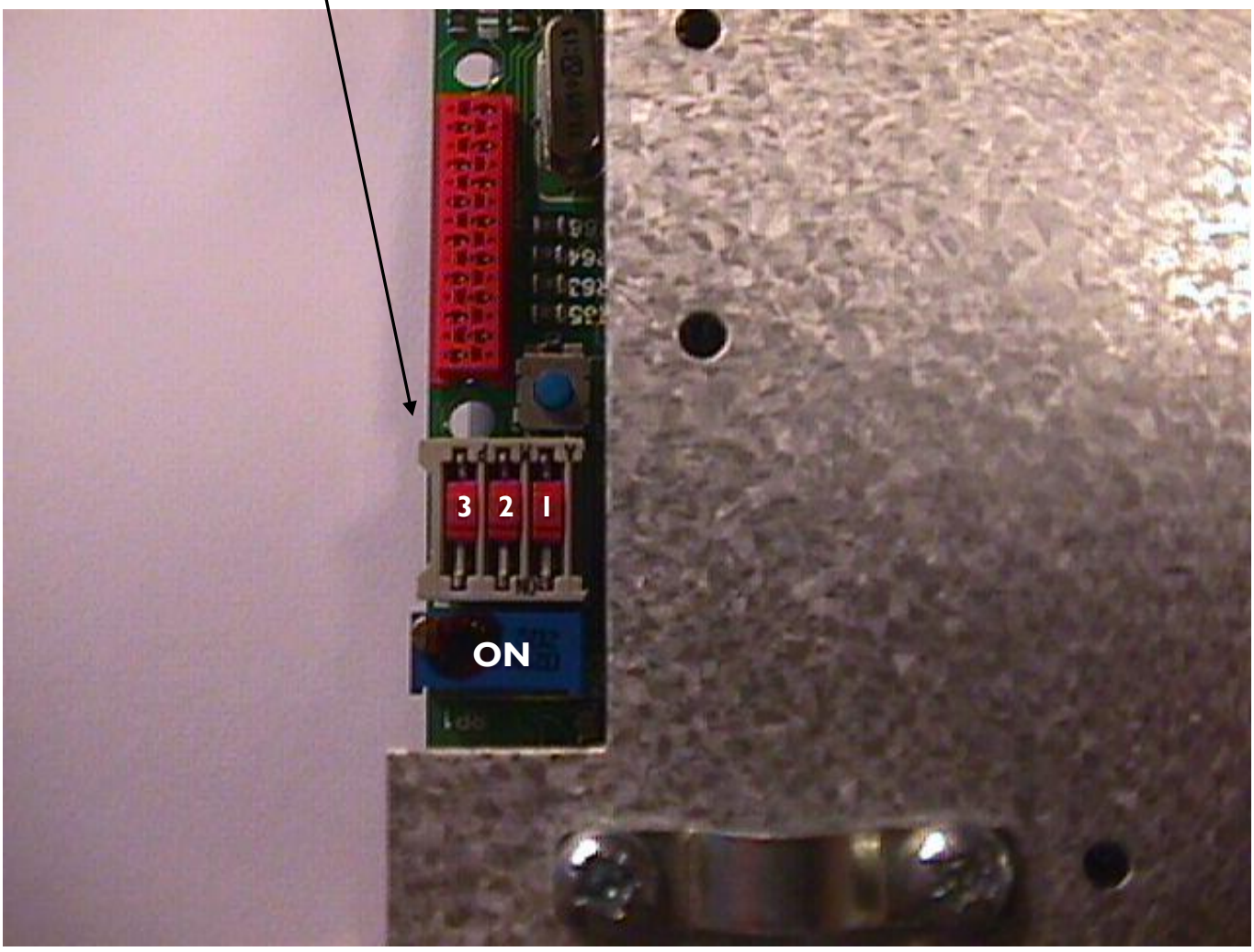
Automatic cooling 40°C (104°F) for water devices and 50°C (122°F) for oil devices. This option is also included in order to avoid that the unit stops at "high" temperature, e.g. at the end of the work hours.

Status	Key 1	Key 2	Display	Function/Display	Signal
Set			C 58.	Press key 1, then key 2 – the current tank temperature is displayed, automatic cooling to 40°C (104°F), then pump Off	Temp >40°C (104°F): cooling
Off		----	. .	Press key 1 – "Cooling prior to Stop" can only be disabled by "Off".	
On	----	--------		The current tank temperature is blinking on the display. If the temperature has not been >80°C (122°F), set On, alarm <40°C (104°F)	cooling alarm

14. Thermostat Reset

This function makes it possible to reset the control (factory settings).
The temperature controller must be stopped during resetting the thermostat.

Status	Key 1		Key 2	Display	Function/Display	Signal
Reset	0	Switch 3 in ON	C	C.	Press key 1 – DIP switch 3 set in "On". Display shows "C". Press key 2 – the thermostat is reset to factory settings. Resets the start/stop times. Open days still open ↓ clock LED lit. Does <u>not</u> remove the code.	Brief alarm
Reset	0	Switch 3 in ON	🌡	F.	Press key 1 – DIP switch 3 set in "On". Display shows "F". Press key 2 – the thermostat is reset to the factory setting. Resets the start/stop times. Open days remain open ↓ clock LED lit. Does not delete the code.	Brief alarm



C = Celsius ° and F = Fahrenheit °

15. Sensor 2 – External Sensor

Only temperature controller with sensor 2

Status	Key 1	Key 2	Display	Function/Display	Signal
On	I		I 2 0.	Press key 1 – start temperature controller. The current temperature will be shown on the display.	
Read sensor 2	△		2 2 0.	Press key 1 once – external temperature reading on the display	
Read sensor 1	▽		I 2 0.	Press key 1 once – tank temperature reading on the display	
Off	0		. .	Press key 1 – stop temperature controller	
Sensor status	A		. 2 0.	Press and hold key 1 for at least 3 seconds. The sensor status will be shown on the display.	
Tank sensor	△	0	. 2 0.	Press key 1 and then key 2 – the temperature controller regulates the temperature only after the tank sensor. Press key 2 to confirm the status	
External PT 100	△	0	. 2 1.	Press key 1 and then key 2 – the temperature controller regulates only the temperature after the external PT 100 Press key 2 to confirm	
External FeCuNi	△	0	. 2 2.	Press key 1 and then key 2 – the temperature controller regulates only the temperature after the external FeCuNi Press key 2 to confirm.	
On	I		I 2 0.	Press key 1 – start temperature controller. The current temperature will be shown on the display.	

16. "Weighting" (Internal Sensor/External Sensor)

When an external sensor is used, the tank temperature can vary (unintended) as compared to the desired mould temperature in part due to the location of the external sensor with regard to the cooling pipes, and in part due to the mass of the tool.

Status	Key 1	Key 2	Display	Function	Signal
Scope	⌗		– – 8.	The permissible temperature deviation between the internal and the external sensor.	
Change Scope	△	▽		Press key 1 or key 2 - which broaden or narrow the scope respectively.	

In practice, the limitation means that the temperature is regulated after the external sensor, but if the temperature in the tank varies beyond the set temperature, the internal sensor will take over the regulation until the temperature is restored within the set values. This way the temperature of the tool can be regulated without major fluctuations even in case of unfavourable positioning of the external sensor.

17. Flow

Flow reading (only water devices to up to 95°C (203°F) with flow measuring – option

Status	Key 1	Key 2	Display	Function	Signal
On	I		I 2 0.	Press key 1 – start temperature controller. The current temperature will be shown on the display.	
Read flow	△		F 5 0.	Press key 1 until "F" appears on the display. By default, the reading unit is l/min.	
Read temp.	▽		I 2 0.	Press key 1 – temperature reading. After that, Press key ▼ until the temperature is shown on the display. For sensor 2, press ▲ once or ▼ twice.	

The flow meter used is a turbine flow meter that makes it possible to read the current flow on the return flow of the temperature controller.

18. Autotune and Manual PI Function Settings

By default, the microprocessor control is supplied with a PI function. It can be set manually or using the autotune function. The PI parameters are preset. They can be changed as described below.

Access to manual PI regulation:

Status	Key 1	Key 2	Display						Function/Display	Signal
Standby			.					.	Temperature controller "OFF" status	OFF
PI access	Δ		.		a			i.	Press key 1 – hold until "A 1" appears on the display.	
Confirm	0							.	Press key 1 to confirm.	
ON	I		i				2	0.	Press key 1 – start temperature controller. The current temperature will be shown on the display. Access to PI (C) parameters is granted.	
P factor	A		a.				x	x.	Proportional band, also referred to as Gain	
I factor	B		b.				x	x.	Integral action factor - a time factor that determines the increase of the gain in proportion to the P factor.	
C factor	C		c.				x	x.	Cooling factor – a factor for the cooling signal, which is a PWM signal. PWM = Pulse Width Modulating signal.	

Note:

P factor: high value = big gain
I factor: high value = small growth
C factor: high value = Long cooling pulse (min. 10)

After the parameters have been changed, the controller must have enough time to adapt to the process. When changing these parameters it is important to wait until the regulator has adapted to the process. General rule for setting P and I factors:

1. P factor – use the factory setting in the first run, 40 – (max. value = 100)
2. I factor – set to max. value 100 - (factory setting = 50).
3. Start the temperature controller and select the desired process temperature.
4. Once the temperature is stable, there will be a difference between the set and the actual temperature if the P factor is not high enough. This means that the PI function is not high enough as a result of which the desired temperature cannot be reached.
5. Increase the PI factor gradually. Wait a while between settings.
6. When the temperature is fluctuating around the set point, decrease the P factor by about 50%
7. Reduce the I factor now.
8. Check whether the set temperature has been reached - continue with the steps above until the process temperature is stable. You can always restore the factory settings of the controller, and the setting of the PI function can start from the beginning. If autotune is used, the PI function will

automatically find the optimal P and I factor. When changing the process (e.g. bigger process or higher temperature), the controller will pulse 2-5° around the set point until the set point is reached.

Autotune Routine:

1. The process must be stable around the set point – i.e. heating/cooling requirements must be recognised by the controller.
2. The routine for manual setting of the PI function must be carried out - makes it possible to read and optimise the parameters.

Status	Key 1	Key 2	Display						Function/Display	Signal
ON	I		i				2	0.	Press key 1 – start temperature control unit. The current temperature will be shown on the display.	
Autotune		A				-	a	-	Press key 1 and then key 2 to activate the autotune routine. "A" appears briefly on the display.	
			i				2	0.	The controller shows the current temperature during the execution of the routine. The routine ends with a beeping sound.	Alarm signal
P factor	A		a.				x	x.	Check and, where applicable, record the P factor	
I factor	B		b.				x	x.	Check and, where applicable, record the I factor	
C factor	C		c.				x	x.	Check and where applicable record C factor standard = 10 max. = 180	

Note!

Manual subsequent adjustment might be necessary after autotune because in some cases autotune cannot find the optimal controller setting.

19. Alarms and Display Overview

Status	Key 1	Key 2	Display						Function/Display	Signal
Temperature deviation	----	--------	A				2	0.	If the pump is On >**45 min.** The current tank temperature is blinking on the display.	Alarm On: X1 – constantly
Pump reset	----	--------	A				2	0.	The current tank temperature is blinking on the display.	Alarm On: X1 – constantly Reset-diode On
Sensor error	----	--------	A		1			.	Sensor short-circuited. The display is blinking.	Alarm On: X1 – constantly
Sensor error	----	--------	A		2			.	The sensor is interrupted. The display is blinking.	Alarm On: X1 – constantly
Water Shortage	----	--------			F	I	L	L.	First filling, lasts up to 4 min. Refilling – up to 20 seconds	Alarm <u>always</u> X1 – constantly

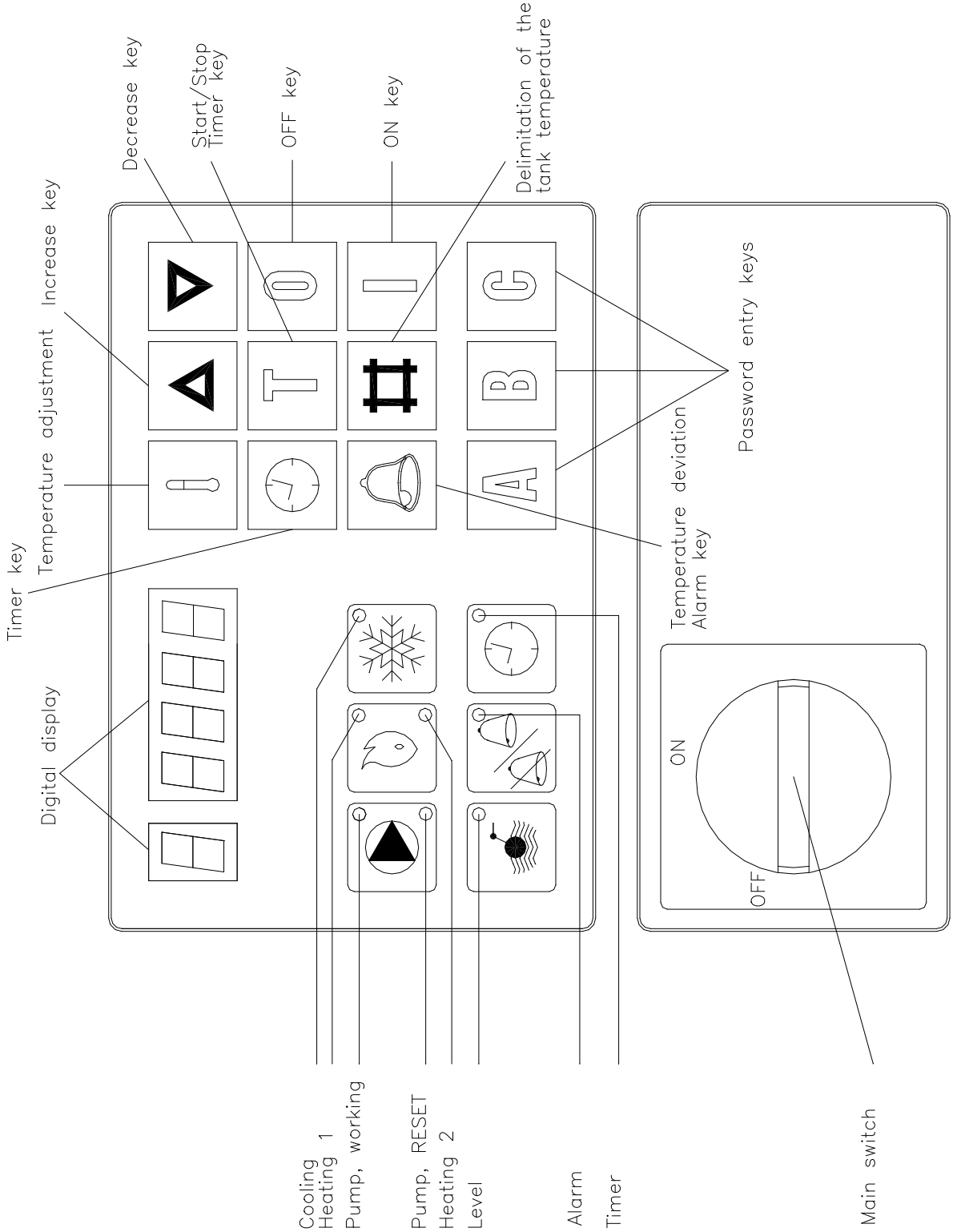
Display View - Overview

Display						Function
.					.	Temperature controller connected (4)
		I		x	x.	Temperature controller in operation (5)
I.			x	x.	x.	Temperature setting, internal sensor (6)
I.				x	x.	Actual temperature, internal sensor (6)
		I	2	3.	4.	Decimal view (7)
A				x	x	Permissible deviation from the set temperature °C (8)
.					.	Weekly timer, connected (9) – please note the timer symbol
.						Weekly timer, connected (9) – please note the timer symbol
		I	4	3	0.	Time: Hours/min., for example : 14.30 (9)
		2.				Weekday, for example: Tuesday (9)
		0	6	3	0.	Start time, for example : 06.30 (9)
		I	6	3	0.	Stop time, for example : 16.30 (9)
		2.	.		.	Automatic start/stop, active on Tuesdays (9).
		2.		.	.	Automatic start/stop, inactive on Tuesdays (9).
I.			.		.	Automatic restart (10)
E				5	0.	Mould emptying – VAC function (13) 50 = current temperature
C				5	8.	Cooling prior to Stop (14) 58 = current temperature
2			x	x.	x.	Actual temperature, external sensor (16)
2.				x	x.	Temperature setting, external sensor (16)
– _					8.	Scope of the tank temperature (17)
F				5	0.	Flow (only Temp 95) 50 = litre/min. (18)

20. Keyboard

Symbol	Explanation
	Temperature adjustment
	Clock and setting of on/off timer/operating time reading
	Encoding of alarm for temperature deviation
	Higher values
	Lower values
	Temporary interruption of on/off timer
	Scope of tank temperature
	Temperature controller, start
	Temperature controller, stop
	Password input
	Password input
	Password input
	Device number encoding (controller no.) only devices with communication capabilities
	Baud rate display; only devices with communication capabilities

Temperature Overview – Temp



Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit
1	33,8	66	150,8	131	267,8	196	384,8	261	501,8	326	618,8
2	35,6	67	152,6	132	269,6	197	386,6	262	503,6	327	620,6
3	37,4	68	154,4	133	271,4	198	388,4	263	505,4	328	622,4
4	39,2	69	156,2	134	273,2	199	390,2	264	507,2	329	624,2
5	41	70	158	135	275	200	392	265	509	330	626
6	42,8	71	159,8	136	276,8	201	393,8	266	510,8	331	627,8
7	44,6	72	161,6	137	278,6	202	395,6	267	512,6	332	629,6
8	46,4	73	163,4	138	280,4	203	397,4	268	514,4	333	631,4
9	48,2	74	165,2	139	282,2	204	399,2	269	516,2	334	633,2
10	50	75	167	140	284	205	401	270	518	335	635
11	51,8	76	168,8	141	285,8	206	402,8	271	519,8	336	636,8
12	53,6	77	170,6	142	287,6	207	404,6	272	521,6	337	638,6
13	55,4	78	172,4	143	289,4	208	406,4	273	523,4	338	640,4
14	57,2	79	174,2	144	291,2	209	408,2	274	525,2	339	642,2
15	59	80	176	145	293	210	410	275	527	340	644
16	60,8	81	177,8	146	294,8	211	411,8	276	528,8	341	645,8
17	62,6	82	179,6	147	296,6	212	413,6	277	530,6	342	647,6
18	64,4	83	181,4	148	298,4	213	415,4	278	532,4	343	649,4
19	66,2	84	183,2	149	300,2	214	417,2	279	534,2	344	651,2
20	68	85	185	150	302	215	419	280	536	345	653
21	69,8	86	186,8	151	303,8	216	420,8	281	537,8	346	654,8
22	71,6	87	188,6	152	305,6	217	422,6	282	539,6	347	656,6
23	73,4	88	190,4	153	307,4	218	424,4	283	541,4	348	658,4
24	75,2	89	192,2	154	309,2	219	426,2	284	543,2	349	660,2
25	77	90	194	155	311	220	428	285	545	350	662
26	78,8	91	195,8	156	312,8	221	429,8	286	546,8	351	663,8
27	80,6	92	197,6	157	314,6	222	431,6	287	548,6	352	665,6
28	82,4	93	199,4	158	316,4	223	433,4	288	550,4	353	667,4
29	84,2	94	201,2	159	318,2	224	435,2	289	552,2	354	669,2
30	86	95	203	160	320	225	437	290	554	355	671
31	87,8	96	204,8	161	321,8	226	438,8	291	555,8	356	672,8
32	89,6	97	206,6	162	323,6	227	440,6	292	557,6	357	674,6
33	91,4	98	208,4	163	325,4	228	442,4	293	559,4	358	676,4
34	93,2	99	210,2	164	327,2	229	444,2	294	561,2	359	678,2
35	95	100	212	165	329	230	446	295	563	360	680
36	96,8	101	213,8	166	330,8	231	447,8	296	564,8	361	681,8
37	98,6	102	215,6	167	332,6	232	449,6	297	566,6	362	683,6
38	100,4	103	217,4	168	334,4	233	451,4	298	568,4	363	685,4
39	102,2	104	219,2	169	336,2	234	453,2	299	570,2	364	687,2
40	104	105	221	170	338	235	455	300	572	365	689
41	105,8	106	222,8	171	339,8	236	456,8	301	573,8	366	690,8
42	107,6	107	224,6	172	341,6	237	458,6	302	575,6	367	692,6
43	109,4	108	226,4	173	343,4	238	460,4	303	577,4	368	694,4
44	111,2	109	228,2	174	345,2	239	462,2	304	579,2	369	696,2
45	113	110	230	175	347	240	464	305	581	370	698
46	114,8	111	231,8	176	348,8	241	465,8	306	582,8	371	699,8
47	116,6	112	233,6	177	350,6	242	467,6	307	584,6	372	701,6
48	118,4	113	235,4	178	352,4	243	469,4	308	586,4	373	703,4
49	120,2	114	237,2	179	354,2	244	471,2	309	588,2	374	705,2
50	122	115	239	180	356	245	473	310	590	375	707
51	123,8	116	240,8	181	357,8	246	474,8	311	591,8	376	708,8
52	125,6	117	242,6	182	359,6	247	476,6	312	593,6	377	710,6
53	127,4	118	244,4	183	361,4	248	478,4	313	595,4	378	712,4
54	129,2	119	246,2	184	363,2	249	480,2	314	597,2	379	714,2
55	131	120	248	185	365	250	482	315	599	380	716
56	132,8	121	249,8	186	366,8	251	483,8	316	600,8	381	717,8
57	134,6	122	251,6	187	368,6	252	485,6	317	602,6	382	719,6
58	136,4	123	253,4	188	370,4	253	487,4	318	604,4	383	721,4
59	138,2	124	255,2	189	372,2	254	489,2	319	606,2	384	723,2
60	140	125	257	190	374	255	491	320	608	385	725
61	141,8	126	258,8	191	375,8	256	492,8	321	609,8	386	726,8
62	143,6	127	260,6	192	377,6	257	494,6	322	611,6	387	728,6
63	145,4	128	262,4	193	379,4	258	496,4	323	613,4	388	730,4
64	147,2	129	264,2	194	381,2	259	498,2	324	615,2	389	732,2
65	149	130	266	195	383	260	500	325	617	390	734

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