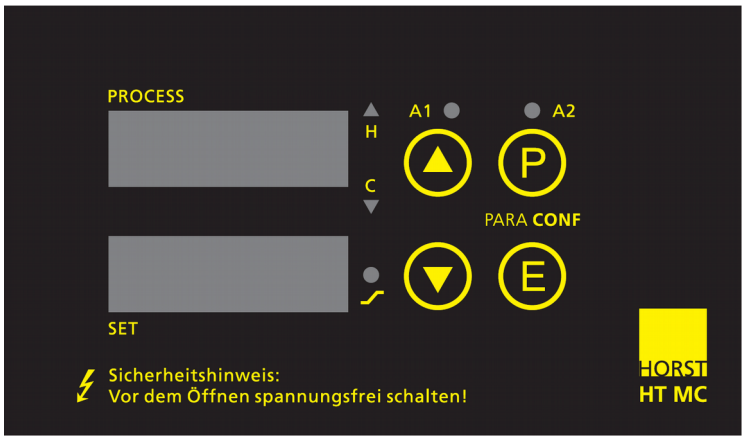

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Models

Models vary in switching power rates, connections to the heating and various housing types with different sizes.

 # 06 20 60 HT MC11 **10 A, KV**
Nominal current max. 10 A
Connection via cable glands
Switching power at 230 V AC: 2300 W

 # 06 20 61 HT MC11 **10 A, plug socket, 1 sensor**
Nominal current max. 10 A
Switching power at 230 V AC: 2300 W

 # 06 20 62 HT MC11 **10 A, plug socket, 2 sensors**
Nominal current max. 10 A
Switching power at 230 V AC: 2300 W

 # 06 20 65 HT MC11 **15 A, KV**
Nominal current max. 15 A
Connection via cable glands
Switching power at 230 V AC: 3450 W

 # 06 20 66 HT MC11 **15 A, plug socket, 2 sensors**
Nominal current max. 15 A
Switching power at 230 V AC: 3450 W

 # 06 20 67 HT MC11 **3x 15 A**
Nominal current 230 V / 400 V 3P+N+PE
Connection via cable glands
Switching power at 400 V AC: 11 kW AC-1

Options

06 21 50 • Serial interface RS485 / MODBUS-RTU

06 21 51 • Heating current monitoring

06 21 52 • Analog input/output 0..10 V DC

Options should be ordered together with the temperature regulator, they cannot be retrofitted by the customer.

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Important Advice

Please read this instruction manual carefully before putting the device into operation.

For safety reasons, this device may only be used for purposes described in this manual.

The regulator applies to the EMV Directive and the Low-Voltage Directive and has the CE mark. The regulator is a component of a heating appliance. Even if all components have the CE mark, the heating appliance as a whole must correspond to the legal regulations!

In case of a regulator fault, a danger of overheating of the heating elements or the medium to be heated arises, a safety arrangement for the limiting of the temperature is required according to DIN EN 60519-2 (DIN VDE 0721 part 2 / Safety in electroheat installations - Part 2: Particular requirements for resistance heating equipment).

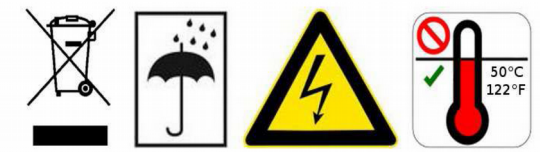
1 Description

Due to high configurability, an optional communication interface and particularly design, the self-optimizing microprocessor temperature regulator HT MC11 is a universal regulator for mechanical, plant and apparatus engineering.

Various HT MC11 models and options are listed on page 3.

For details of your regulator please refer to its type plate.

The regulator is pre-configured. Preset parameters are shown on the configuration sheet in the side of the housing. Inappropriate configuration can cause damage to regulator and heating. The user is responsible for the regulator configuration.



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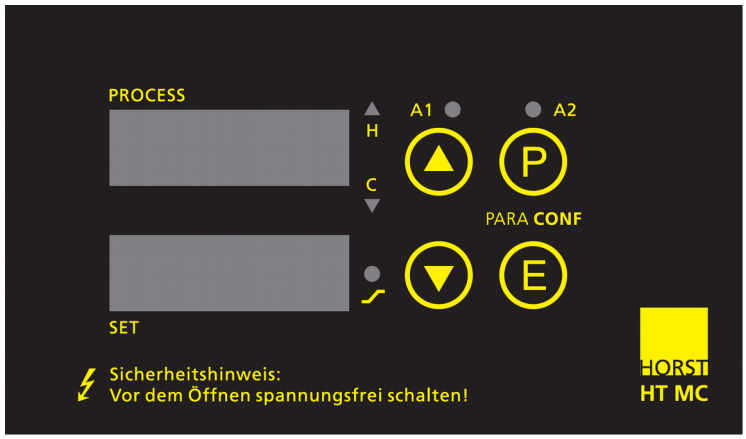
2 Display and Keypad



LED **H** Heating active

LED **C** Cooling, function not implemented

LED **A1** Alarm 1

LED **A2** Alarm 2 (Temperature supervision)

LED _/‾ Setpoint ramp active

Key functions:

key **P**	Parameter selection
keys ▲ ▼	Adjustment of chosen parameter (e.g. setpoint) to higher or lower values. Short operation: single-step adjustment, longer operation: quick-scanning When the parameter adjustments have been altered but not entered, the display will flash. Press "**E**" to confirm. In program controller mode keys ▲/▼ are used for program functions instead of setpoint selection.
key **E**	Confirmation and storage of the preselected values. The display briefly shows a light chain for confirmation.

Typographical conventions used in this manual:

ConF	message/value shown on the display
highlighted yellow	factory setting
highlighted red	important basic settings for proper functioning, should not be changed by the user
>PID<	parameter only used in PID controller mode
framed blue	only relevant for option „heating current monitoring“
framed green	only relevant for option „analog input/output“

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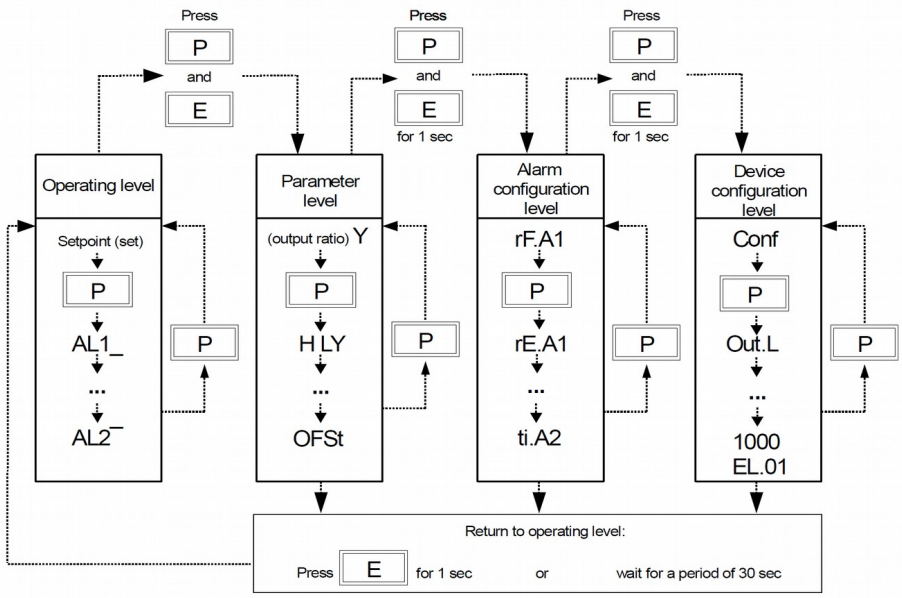
2.1 Operation

The regulator is operated by four keys.

After power up, the device is on operating level.



Operating level
Process and setpoint value are displayed simultaneously.
Setpoint and other parameters can be adjusted by pressing keys ▲ / ▼.
Each adjustment must be stored by pressing key "**E**".
Parameter values of each level can be adjusted by pressing key "**P**".

Three other levels are accessible for further adjustments.

Parameter level is reached by briefly pressing key "**P**" and "**E**" together.

Alarm configuration level can be entered by pressing keys "**P**" and "**E**" for approx. 1 second, by pressing keys "**P**" and "**E**" longer, the device configuration level can be reached.

Selection and adjustment of parameters as described for operating level.

After pressing key "**E**" for approx. 1 second or after a period of approx 30 seconds, the regulator returns to operating level.

Parameter level
On the parameter level the regulator parameters and functions are adapted to the individual process.

Alarm configuration level
for adjustment of alarm monitoring parameters.

Device configuration level
for basic configuration settings. These settings must be adjusted at first use.

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3 Advice for Start-up

Do not apply voltage before regulator and heating are completely mounted!

A professional electrical connection is the precondition for safe operation of the regulator. A certified electrician is required for electrical installation of the temperature regulator and connection of the heating.

Please check following points carefully:

- Compare mains voltage with data on the type plate
- Ensure that the load circuit is switched-off while the configuration of the regulator is changed. Unplug heating, if applicable. Reduce setpoint to prevent unintended temperature rise.
- The heating power of the connected heating, respectively the sum of the heating power rates of all connected heatings must not exceed the maximum switching power of the regulator (see type plate).
- nOnly connect ohmic consumers to the regulator.
- Permissible ambient temperature 0 ... 40 °C must be observed even in unfavorable circumstances. Avoid direct sunlight. Ensure sufficient ventilation.
- The regulator should be installed protected from humidity and dirt. Do not install the regulator near to inductive consumers/contactors.
- Connect the regulator in a separate electric circuit. Do not directly connect any further control circuits (e.g. contactors, ventilators) to the clamps.
- nAlways superpose a master switch to the heating/regulator.
- Protection category of the regulator (IP) only valid with plugged-in mating plug and sealed cable screwings!

4 Mounting Advice

- Only install the regulator on suitable heat-conducting mounting surface (e.g. brickwork, metal console) with good contact to the bottom of the enclosure to dissipate internal heat.
- Recommended mounting position: vertical, if possible
- Use boreholes in the housing for mounting.

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5 Electrical Connection

Electrical connection has to be carried out according to respective national/ legal regulations (in Germany e.g. VDE 0100).

We would like to point out again that the electrical connection must only be carried out by an electrician.

Mains and temperature sensors must be connected according to the wiring diagram (see appendix). Only use temperature sensors suitable for the configuration.

The correct position of the temperature sensor is important for reliable function of the controller. The temperature sensor of the regulator should be situated as close as possible to the heating. This will avoid swinging of the controlled system or the temperature.

Important advice for temperature sensor connection:

- Only use suitable sensor types (see configuration sheet)
- Lay the connection line of the temperature sensor in sufficient distance to current-carrying cables.
- The sensor line should be as short as possible in order to minimize interference.
- Only use appropriate compensating cables to extend thermocouple connection lines.

6 Special Functions

6.1 Temperature Supervision

The regulator is equipped with integrated temperature supervision. The heating current relay is switched off if the temperature exceeds the limit value. The limit value is adjusted with parameter AL.L_ (see page 10).

The supervision function must be activated by the parameter rEL.C. It is possible to select whether the heating starts operating again after the temperature has fallen below the limit value, or if the heating is switched off permanently and must be restarted manually. If self hold is active, it can be released by pressing keys "▼" and "**E**" simultaneously.

If the parameter Co.c 1 is set to CL.SH, self hold can also be released by closing the external contact (terminals 24, 25, see wiring diagram in the appendix).

The switching status of the heating current relay is indicated by LED **A2**.

If the temperature supervision alarm has been triggered, the flashing text AL.L 1 is displayed.

The temperature sensor for temperature supervision is selected with parameter SEn.L. This setting is independent of the sensor for temperature regulation.

The actual value of the temperature sensor for temperature supervision is displayed by the parameter t.L 1 in the operating level.

PLEASE NOTE:

If the temperature supervision function in combination with a second temperature sensor is not activated, the heating current relay is opened when the setpoint is exceeded by the value which is adjusted in parameter AL2. (default setting: 30 K).

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only relevant for option
"heating current monitoring"

6.2 Heating Current Monitoring (Option)

If the heating current monitoring option is used, no free signal contact is available.

Alarm is active, if

- leakage current (current when solid state relay is switched off) > 0.3 A

or

- measured heating current falls below value set in parameter AL 1.

Heating current is measured at fixed intervals (set with parameter Lw.CY in s). Alternately, heating current (output active) and leakage current (output switched off, leakage current of SSR or RC circuits) are measured. During measurement the output is switched on respectively off for approx. 100 ms independently of the control loop.

If a leakage current > 0.3 A is detected, the alarm is activated and Er.Lw is displayed, because there is probably a short-circuit at the switching element. We recommend defining an alarm delay to avoid false alarm caused by short-term mains voltage fluctuations.

The actual current value is displayed in parameter Cur on the operating level. By pressing key "▼" the leakage current is displayed.

only relevant for option
"analog input/output 0-10 V"

6.3 Analog Input/Output 0...10 V DC (Option)

1. The analog output works as a process value output.

The output voltage value (range 0 … 10 V) corresponds to the measurement range (min. measuring range value … max. measuring range value) of the selected control sensor.

2. The analog output works in output ratio mode

The output ratio is used e.g. for thyristor control (see page 9 Out.H). Connection via connection board terminal 24+35.

6.4 Setpoint Adjustment 0...10 V DC (Option)

The measured voltage value 0 … 10 V is converted corresponding to the measurement range (min. measuring range value … max. measuring range value) and used as setpoint. External setpoint adjustment is activated by setting parameter Co.SP = SP. E (see page 11).

6.5 Potential-Free Switching

Separate power supply of temperature regulator electronics and heating circuit is possible.

Temperature regulator electronics:	standard operating voltage U = 230 V AC
Heating circuit:	operating voltage 24 V … 250 V AC, switching power 10 A or 15 A depending on model

7 Before First Operation

The housing cover of the regulator must be closed and cable glands must be checked before switching on the device. Only then the protection guarantee of the regulator is ensured.

If the start-up characteristics of the heating are not sufficiently known, you are urgently advised to observe the temperature profile carefully during first operation to avoid overshoots of the heating.

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8 Parameter Description

Red highlighted parameters are important basic settings for proper functioning and should not be changed by the user.

8.1 Device Configuration Level

Out.H Assignment of signal "heating" to output ports	LOG.	Logic output is used for heating	
	rELY	**Not applicable for HT MC11!** Relay A output is used for heating	
	StEt	Continuous output is used for heating	
	tr.A	**Not applicable for HT MC11!** Triac output is used for heating	
rEL.C Assignment of signal for output relay AL2	AL 2	Alarm 2 (uses controller's actual value)	
	L.	Temperature supervision	
	L.H	Temperature supervision with self hold	
SEn Sensor selection for control (**Sen**sor)		**Sensor type**	**Measuring range**
	Pt°C	Pt100	-50...800 °C
	Pt°F	Pt100	-58...1472 °F
	n2°C	Ni120	0...250 °C
	n2°F	Ni120	32...482 °F
	L4°C	Thermocouple (TC) Fe-CuNi (L)	0...400 °C
	L4°F	Thermocouple (TC) Fe-CuNi (L)	32...752 °F
	L8°C	Thermocouple (TC) Fe-CuNi (L)	0...800 °C
	L8°F	Thermocouple (TC) Fe-CuNi (L)	32...1472 °F
	J8°C	Thermocouple (TC) Fe-CuNi (J)	0...800 °C
	J8°C	Thermocouple (TC) Fe-CuNi (J)	32...1472 °F
	K 1°C	Thermocouple (TC) NiCr-Ni (K)	0...800 °C
	K 1°C	Thermocouple (TC) NiCr-Ni (K)	32...1472 °F
	S 1°C	Thermocouple (TC) PtRh-Pt (S)	0...1600 °C
	S 1°F	Thermocouple (TC) PtRh-Pt (S)	32...2912 °F
	n 1°C	Thermocouple (TC) NiCr-NiSi (N)	0...1200 °C
	n 1°F	Thermocouple (TC) NiCr-NiSi (N)	32...2192 °F
	P0°C	Pt1000	-50...400 °C
	P0°F	Pt1000	-58...752 °F
SP.Lo Lower setpoint limitation	Lowest adjustable setpoint <0 °C> adjustment range: min. measuring range value ... SP.H.		
SP.H. Upper setpoint limitation	Highest adjustable setpoint <500 °C> adjustment range: SP.Lo ... max. measuring range value		
SEn.L Sensor for temperature supervision	Pt°C to n 1°F : see parameter Scn		
AL.L. Limit value for temperature supervision	Adjustment range: OFF, min. measuring range value ... max. measuring range value of sensor for temperature supervision		

Analog output / output ratio
0..10 V = 0%..100% output ratio

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Ramp Function:

A programmed ramp is active when the setpoint has been changed or when mains supply is switched on. The ramp starts at the actual process value and ends at the adjusted setpoint.

SPr^ Ramp rising	OFF ; 0.1 … 100.0 °C/min
SPr_ Ramp falling	OFF ; 0.1 … 100.0 °C/min

Softstart Function (General Description):

For slow drying of heating elements with magnesium oxide (ceramic) insulation (e.g. high-performance cartridge heaters), the heating output of the regulator is limited to a preselectable ratio value during start-up.

The switching frequency is increased by a factor of 4 (selected switching cycle time is divided by 4) for slower and more uniform heating-up.

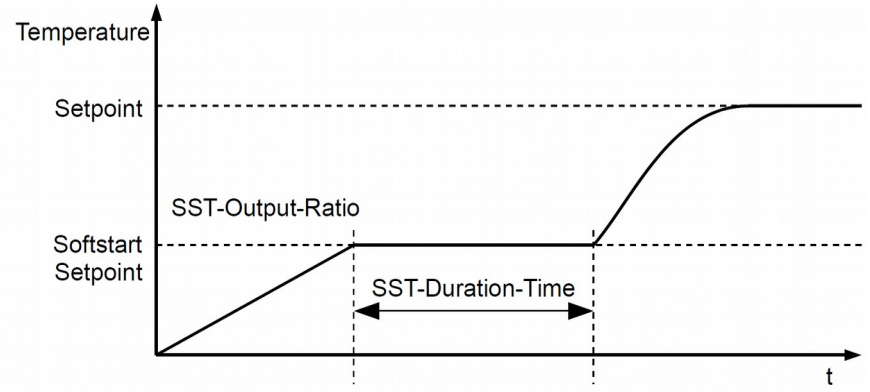
Once the process value reaches the softstart setpoint, the temperature is kept constant for a preselectable duration time. At the end of this period the temperature rises to the adjusted setpoint.

When softstart function is active, the autotune function is not available (error message: Er.OP).

If a setpoint ramp is programmed, softstart has priority and the ramp function is not active during softstart.

Parameters for softstart function are only available if parameter P (xp) is > 0.1 % (adjustment in parameter level).

Softstart function only starts if the process value is lower than the softstart setpoint when switching on the regulator.



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So.St Softstart (**So**ft**st**art) >PID<	OFF	Softstart function not active. Softstart parameters are not displayed.
	on	Softstart function is active.
So. y Softstart output ratio (**So**ftstart **y**) >PID<	Range: 10 … 100 % <30>	
So.SP **So**ftstart Set**p**oint >PID<	Range: SP.Lo … SP.Hi <0>	
So.ti **So**ftstart duration **ti**me >PID<	Range: OFF; 0.1 … 10.0 min <1.0>	
Co.SP **Co**nfiguration **S**et**p**oint (setpoint selection)	SP. 1	Setpoint 1
	SP. 2	Setpoint 2
	SP. E	External setpoint
rEC.2 2nd parameter set (**rec**ord **2**)	- -	Not adjusted
	SP. 2	Save actual parameters as 2nd parameter set
	SP. E	Load 2nd parameter set as actual parameters

Only displayed if So.St = on

External setpoint adjustments 0..10 VDC = measuring range of the adjusted sensor (page 9)

The second parameter set can be used to store and – if necessary – to restore following actual parameters: control parameters, setpoints and setpoint configuration, process offset, ramps, softstart and alarm configuration.

The factory setting of the second parameter set is identical to the actual parameter set.

HAnd Operating mode of the regulator (Manual mode)	OFF	Controller mode
	Auto **Auto**matic mode	In case of a sensor break, the regulator mode is automatically changed to "manual mode" using the last valid output ratio. Manual mode is indicated with a leading "H" in the setpoint display, followed by the output ratio. The output ratio can be changed manually. In following cases the output ratio is 0 %: • if the output ratio was 100 % at the time of the sensor break • if a setpoint ramp is active • if the control deviation from the measuring range was > 0.25% at the time of the sensor break • if parameter P (xp) = 0 (OFF) • if softstart was active at the time of the sensor break A few seconds after the sensor break has been rectified, the controller returns to automatic operation and calculates the required output ratio. Alarm contact 1 can be programmed to activate an additional signal in case of sensor break.
<PID>	MAn **Man**ual mode	Device operates as a power controller. Temperature regulation function is not active. "PROCESS display" shows the actual process value. "SETPOINT display" shows a leading "H" followed by the actual adjustable output ratio. Negative value: cooling, positive value: heating The output ratio can be changed manually.

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only relevant for option
"heating current monitoring"

Cu.CY **Cu**rrent **cy**cle time	Adjustment range: 2 … 200 s <5> Cycle time of heating current measurements	
F.t. **Fi**lter **ti**me	Adjustment range: OFF; 0.1 … 10.0 s If the process is not stable, filter time can be set to reduce fluctuations of the process display. The controlling process is not influenced.	
Co.c 1 **Co**nfiguration external **c**ontact **1**	Loc	Ext. contact closed, LOC parameter not adjustable
	SP2	Ext. contact closed, setpoint 2 is active
	Pr.St	Close ext. contact: start program controller, Open ext. contact: stops program controller
	CL.SH	Close ext. contact: release self hold of temperature monitoring (**CL**ear **S**elf **H**old)
LOC Adjustment **loc**k	OFF	No adjustment lock
	P C	**P**arameter and **c**onfiguration levels locked
	n.SP 1	all parameters except setpoint 1 locked (**n**ot **SP1**)
	ALL	**all** parameters locked
Adr	Adjustment range: 1 … 255	
LUMI **Lumi**nance	Luminance adjustment of 7-segment-display Adjustment range: 0...6	
1080	Hr.01	Device code and version

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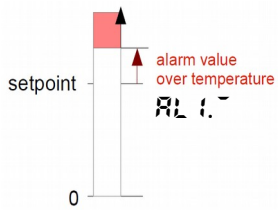
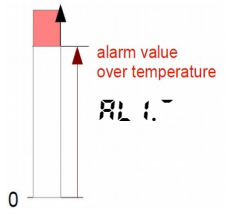
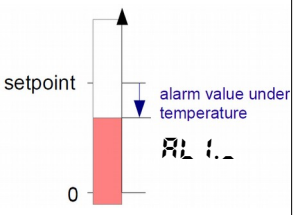
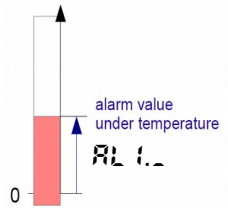
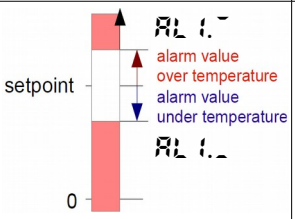
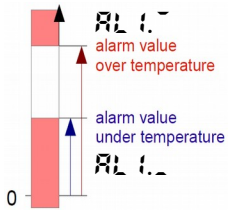
8.2 Alarm Configuration Level

General information using the example of Alarm 1:

Description	**Based on setpoint**	**Absolute**
Alarm configuration rF.A1	bASE	Abs or Cur
Range of alarm value	0...100 / -100...0	Whole measuring range
Switch point	Setpoint + alarm value	Alarm value
One-sided alarm "top": (over temperature alarm) AL1.- Temperature must be higher to activate alarm. Under temperature alarm is not active: AL1._ = OFF		
One-sided alarm "bottom": (under temperature alarm AL1._ Temperature must be lower to activate alarm. Over temperature alarm is not active: AL1.- = OFF		
Both-sided alarm: (limit alarm) Temperature must be outside the selected range to activate alarm. Both alarms (AL1.- and AL1._) must be set.		

Alarm value parameters (AL1._, AL1.-, AL2._, AL2.-) can be adjusted on operating level.

Please note:

In case of sensor error the alarms react in the same way as in case of range overflow. Therefore alarm contacts do not provide protection against all potential faults. If necessary, we recommend to use a second independent monitoring device.

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only relevant for option
"heating current monitoring"

rF.A1 Alarm 1 configuration (**ref**erence. **A**larm **1**)	Abs	**abs**olute
	bASE	**base**d on setpoint
	Cur	Heating current monitoring, works like absolute alarm
rE.A1 **Re**lay action for **a**larm **1**	OFF	Relay is switched off if alarm 1 is active
	on	Relay is switched on if alarm 1 is active
Ld.A1 Display of front **LE**D at **a**larm **1**	OFF	LED is off if alarm 1 is active
	on	LED is on if alarm 1 is active
St.A1 **St**art up suppression **a**larm **1**	OFF	Start up suppression deactivated
	Strt	**St**art up suppression activated. Temperature must reach "OK range" once, before alarm can be released in case the temperature reaches alarm limits.
t .A1 Delay **ti**me **A**larm **1**	OFF, 1 … 1000 s	

Factory settings
do not change

rF.A2 Alarm 1 configuration (**ref**erence. **A**larm **2**)	Abs	**abs**olute
	bASE	**base**d on setpoint
	Cur	Heating current monitoring, works like absolute alarm
rE.A2 **Re**lay action for **a**larm **2**	OFF	Relay is switched off if alarm 2 is active
	on	Relay is switched on if alarm 2 is active
Ld.A2 Display of front **LE**D at **a**larm **2**	OFF	LED is off if alarm 2 is active
	on	LED is on if alarm 2 is active
St.A2 **St**art up suppression **a**larm **2**	OFF	Start up suppression deactivated
	Strt	**St**art up suppression activated. Temperature must reach "OK range" once, before alarm can be released in case the temperature reaches alarm limits.
t .A2 Delay **ti**me **A**larm **2**	OFF, 1 … 1000 s	

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8.3 Parameter Level

Y actual output ratio >PID<	0 … 100% The actual calculated output ratio is displayed. Cannot be changed. Display in percent of installed heating power. Negative values for cooling.
H Ly Max. output ratio limitation "heating" >PID<	0 … 100% Max. output ratio limitation is only necessary for strongly over-sized heating power supply. Under normal conditions output ratio limitation is not necessary (setting: 100 %). The limitation intervenes if the calculated output ratio is higher than the adjusted max. output ratio limitation value. **Warning!** Output ratio limitation does not work during autotune.
C Ly Max. output ratio limitation "cooling" >PID<	0 … 100% See output ratio limitation "heating"

Factory settings do not change

Adjustment of Control Parameters:

Normally the controller operates in PD/I control mode, without control deviation and largely without overshoot during start-up.

The control action can be altered by adjusting following parameters:

a.	no control action, on-off	setting	P = OFF
b.	P action	setting	D and I = OFF
c.	PD action	setting	I = OFF
d.	PI action	setting	D = OFF
e.	PD/I	modified PID-mode (set P, D, I) According to the configuration, certain parameters are not visible.	

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H P prop. band (**P**) "**h**eating" >PID<	OFF 0.1 … 100% <3.0> If OFF, next visible parameter: H Sd
H d rate (**D**) "**h**eating" >PID<	OFF 1 … 200 s <30>
H J reset (**I**) "**h**eating" >PID<	OFF 1 … 1000 s <150>
H Cy **cy**cle time "**h**eating" >PID<	0.5 … 240.0 s <0.5> Cycle time specifies the switching frequency of the actuator. In this period the controller switches on and off once. Voltage outputs for SSRs: cycle time: 0.5...10 s optimal value for fast control loops: 0.8 s Relay outputs: cycle time: > 15 s The adjusted cycle time should be as long as possible to minimize the wear of the relay contacts.
C P prop. band (**P**) "**c**ooling" >PID<	**Factory setting**, not applicable
C d rate (**D**) "**c**ooling" >PID<	**Factory setting**, not applicable
C J reset (**I**) "**c**ooling" >PID<	**Factory setting**, not applicable
C Cy **cy**cle time "**c**ooling" >PID<	**Factory setting**, not applicable
C Sd **s**witching sensitivity "**c**ooling" >PID<	**Factory setting**, not applicable

Factory settings do not change

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Autotune:

The tuning algorithm determines characteristic values within the controlled process and calculates valid feedback parameters (P, D, I) and cycle time (= 0.3 x D) for a PD/I-controller.

The autotune mode is activated during start-up shortly before the setpoint is reached.

If autotune is activated after the setpoint has already been reached, the temperature will first fall approx. 5 % below the measuring range in order to determine optimal control system parameters.

Autotune can be initiated any time by setting OPt = on.

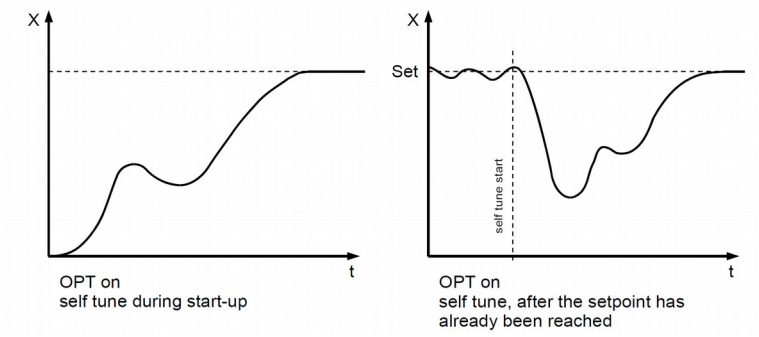
After finishing calculation of feedback parameters, the controller leads the process value to the setpoint value.

Autotune can be stopped by setting OPt = OFF.

During autotune the display shows OPt alternating with the setpoint value.

Preconditions for starting the autotune algorithm:

- Setpoint value must be higher than 5 % of measuring range
- Sensor must not have a failure
- Softstart function must not be active



OPt autotune	OFF autotune not active
	on autotune active (one time)
	Auto Autotune starts each time the controller is turned on if the difference between setpoint and actual process value is more than 7 % of the measuring range.
OFSt process value **Offset**	-999 … OFF … 1000 Parameter for correction of input signal: • correction of a gradient between measuring point and sensor tip • line resistance balancing of 2-line RTD (Pt100) sensors • correction of control deviation when using P or PD action Example: if the offset value is set to +5 °C, the real temperature measured by the sensor (when process is balanced) is 5 °C less than the setpoint and the displayed actual process value. Ensure that the corrected temperature process value is within the selected measuring range.

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8.4 Operating Level

The controller shows the process and the setpoint value if none of the following parameters are selected.

t.L temperature **li**mit	Display of temperature of the supervision unit	
Cur actual heating **cur**rent value	Display of actual heating current value. By pressing key ▼ the leakage current is displayed.	
SP2 setpoint 2	OFF, SP.Lo ... SP.H	
Function and configuration of alarms are described in chapter "alarm configuration level". On operating level only alarm values can be set.		
	Alarm reference	**Adjustment range**
AL1._ Alarm 1: alarm value under-temperature or current underrun	rF.A1 = Abs absolute	OFF, SP.Lo ... SP.H Alarm active if actual process value is lower than alarm value
	rF.A1 = bASE based on setpoint	OFF, -1 ... -100 K Alarm active if actual process value is lower than (setpoint + alarm value)
AL1.¯ Alarm 1: alarm value over-temperature or current overrun	rF.A1 = Abs absolute	OFF, SP.Lo ... SP.H <500> Alarm active if actual process value is higher than alarm value
	rF.A1 = bASE based on setpoint	OFF, 1 ... 100 K Alarm active if actual process value is higher than (setpoint + alarm value)
AL2._ Alarm 2: alarm value under-temperature or current underrun	rF.A2 = Abs absolute	OFF, SP.Lo ... SP.H Alarm active if actual process value is lower than alarm value
	rF.A2 = bASE based on setpoint	OFF, -1 ... -100 K Alarm active if actual process value is lower than (setpoint + alarm value)
AL2.¯ Alarm 2: alarm value over-temperature or current overrun	rF.A2 = Abs absolute	OFF, SP.Lo ... SP.H Alarm active if actual process value is higher than alarm value
	rF.A2 = bASE based on setpoint	OFF, 1 ... 100 K <30> Alarm active if actual process value is higher than (setpoint + alarm value)
Prob **Prog**ram controller	OFF Program controller not activated on Program controller activated	
cnt.5 and following parameters see "program controller"	Following parameters are not available if parameter Prob = OFF .	

only relevant for option "heating current monitoring"

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9 Program Controller

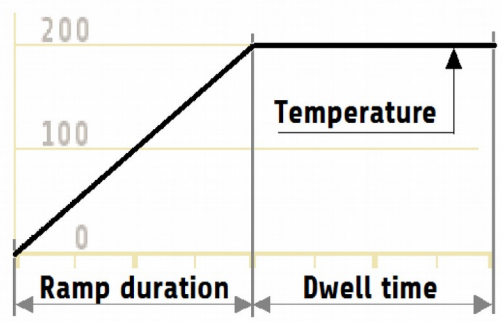

Fig 1: One step of the program controller.

9.1 Course of Program Control:

1. Define the number of steps with parameter cnt.S.

   Each step consists of ramp time, ramp setpoint and dwell time. Periods can be deactivated by setting value to 0.
2. Define behavior at end of ramp phase. Normally the controller waits for the adjusted ramp time before dwell time starts. Setting: End.S to t inE. If parameter End.S is set to tEnP, dwell time starts regardless the ramp time of the actual value has reached the setpoint of the respective step.
3. Define behavior at end of program with parameter End.P: control operation using setpoint 1, control operation with last ramp setpoint or restart of program.
4. Select values for ramp time, ramp setpoint and dwell time.
5. Working with the program controller:

   Start program by pressing key ▲. Display shows Strt for a short time, ramp LED flashes.

   Pressing again key ▲ sets program on hold. Display shows hoLd for a short time, ramp LED is on.

   Resume program by pressing key ▲ again. Display shows rESu, ramp LED flashes.

   Stop program by pressing key ▼. Display shows StoP, ramp LED is off.

   Afterwards, program can be started for a new cycle by pressing key ▲.

Course of ramp depends on ramp time, last setpoint and actual setpoint. When starting the program, the first ramp starts from the actual process value.

If configured, the program can also be started and stopped by using the external contact.

Following parameters are only visible if parameter Prob is "on".

cnt.S number of steps	1 … 6	
End.S Behavior at end of a ramp phase	t inE	The dwell time starts after completing ramp time. All steps will be processed according to adjusted time schedule.
	tEnP	Dwell time starts as soon as the process value has reached the ramp setpoint (+/-2 K). The adjusted ramp time defines the rate of the setpoint, but has no influence on the beginning of the dwell time.

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End.P Behavior after program has finished	SP. 1	Control operation with actual setpoint. Normally: Setpoint 1.
	LASt	Control operation with setpoint of last step
	rEPt	Restart program beginning with first step.
1.rA Step 1 Ramp time	0 ... 6000 min In this time interval the setpoint runs linearly from the last step temperature to the setpoint of the actual step. First step starts with actual process value. *Switch off ramp function by setting value to 0 min.	
1.SP Step 1 Ramp setpoint	SP.Lo ... SP.H ı Setpoint for this step.	
1.t ı Step 1 Dwell time	0 ... 6000 min The dwell time starts after the ramp has finished. The controller works using the ramp setpoint for this time. If behavior at end of a ramp phase End.S is set to tEnP, dwell time does not start before the ramp setpoint has been reached.	
...	...	
6.rA Step 6 Ramp time	0 ... 6000 min	
6.SP Step 6 Ramp setpoint	SP.Lo ... SP.H ı	
6.t ı Step 6 Dwell time	0 ... 6000 min	

Please note: installed heating power can be insufficient to realize programmed temperature ramp.

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10 Error and Status Messages

Display	Cause	Possible solution
SP.Lo	Lower setpoint limit has been reached	Reduce limit (parameter SP.Lo)
SP.H	Upper setpoint limit has been reached	Increase limit (parameter SP.H)
LOC	Parameter is locked	Unlock parameter, if necessary Parameter: LOC on device configuration level
Er.H	Top range end has been exceeded, sensor defect	Check sensor and cable
Er.Lo	Bottom range end has been exceeded, sensor defect	Check sensor and cable Check process value offset
Er.OP	Self tuning error	Quit error message by pressing key „**E**“. Check self tuning conditions and restart.
Er.SY Err.0	System error	Quit error message by pressing key „**E**“. Check all parameters. If error message continues, please send the controller back to the manufacturer
Err.9	Internal Error	Communication error Send the controller back to the manufacturer.
Er.Cn	Reference junction temperature error	The sensor for the reference junction measurement is located on the connection board. Check the cable.
AL.L	Temperature AL2 has been exceeded (over-temperature)	
AL.Cu	Heating leakage current > 0.3 A	A current is detected while the heating should be switched off.
OFF	When starting the program controller: no ramp or dwell time is set.	Check program parameters. Set times for t.rA and/or t.t for the desired steps.
Strt	Program controller started	Only info message
hoLd	Program controller set to hold	Only info message
rESu	Program controller resumed	Only info message
StoP	Program controller stopped	Only info message

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11 Technical Data

General sensor inputs	Influence of ambient temperature: < 0.01 % / K
Sensor Pt100 (RTD)	2- or 3-wire connection possible Built-in protection against sensor break and short circuit Sensor current: < 0.5 mA Calibration accuracy: < 0.2 %, linear error: < 0.2 %
Sensor Pt1000 (RTD)	2- or 3-wire connection possible Built-in protection against sensor break and short circuit Sensor current: < 0.05 mA Calibration accuracy: < 0.2 % Linear error: < 0.2 %
Sensor Thermocouple	Protection against sensor break and incorrect polarity. External compensation point on connection board. Calibration accuracy: < 0.25 % Linear error: < 0.2 % Influence of resistance of the sensor cable on measured voltage: <5 µV at 10 Ohm. Resulting temperature error depends on sensor type. (e.g. 20 Ohm, 10 µV - type J: 0.2 °C, type S: 0.5 °C)
External compensation point	Calibration accuracy: < 0,.5 % Linear error: < 0.2 % Plus accuracy of measuring resistor on connection board (1 %)
Continuous input	0...10 V; Input resistance > 100 kOhm
Heating current measurement input	Internal measuring range 0..20 mA corresponding to 0.0..20.0 A when using a current transformer 1: 1000. If the range is exceeded, the controller may be damaged.
Logic output	Bist. voltage signal, 0/9.5 V DC, max. 10 mA, short-circuit proof.
Output relay AL1	Relay, max. 250 VAC, max. 2 A (ohmic load)
Output triac	Control output exclusively for controlling an external power triac. NOT short-circuit proof.
Output continuous	0...10 V, resistance load > 15 kOhm
7 segment display	4 digits; Process: 10 mm red, Set: 10 mm red
Data backup	EAROM, solid state memory
CE marking	Tested according to 2014/30/EU; EN 61326-1 Electrical safety: EN 61010-1
Communication interface	RS485; Communication parameters: 115200 Baud 8 N 1
Nominal voltage	230 V AC, 48...62 Hz (other voltages are available as an option)
Electrical connections	Spring-cage terminals, protection category IP 20 (DIN 40050), Insul. class: I Nominal cross section: max 2.5 mm²
Permissible operating conditions	Operating temperature: 0...40 °C / 32...104 °F Storage temperature: -30...70 °C / -22...158 °F Climate class: KWF DIN 40040; equivalent to annual average, max. 75 % rel. humidity, no condensation
Protection category housing	IP 65
Safety class	I
Housing material	Die-cast aluminum housing
Power control	Solid state relay
Fuse 10A- / 15A-models	FF10A: 5x20 mm / FF16A: 6.3x32 mm

Subject to technical improvements.

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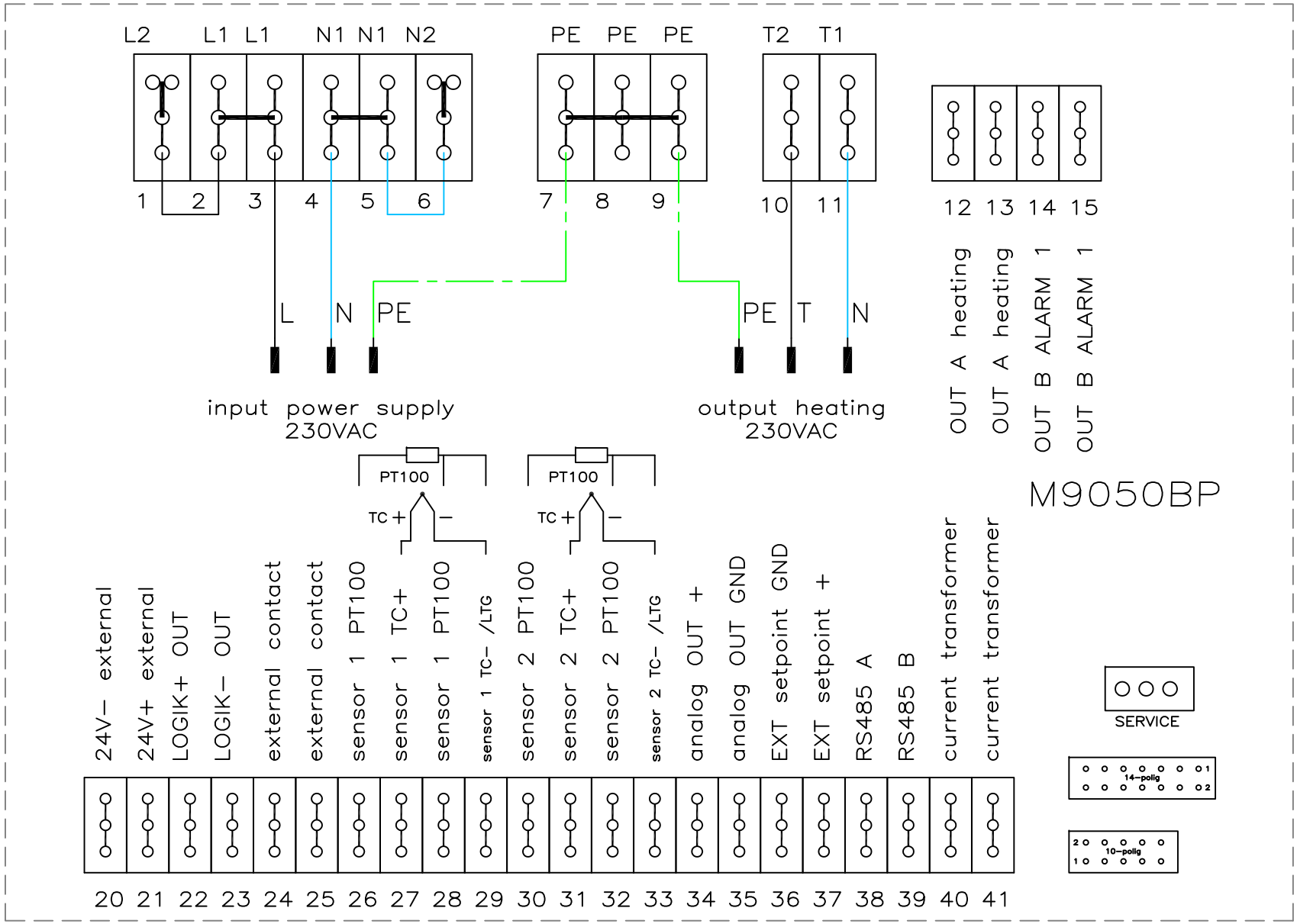
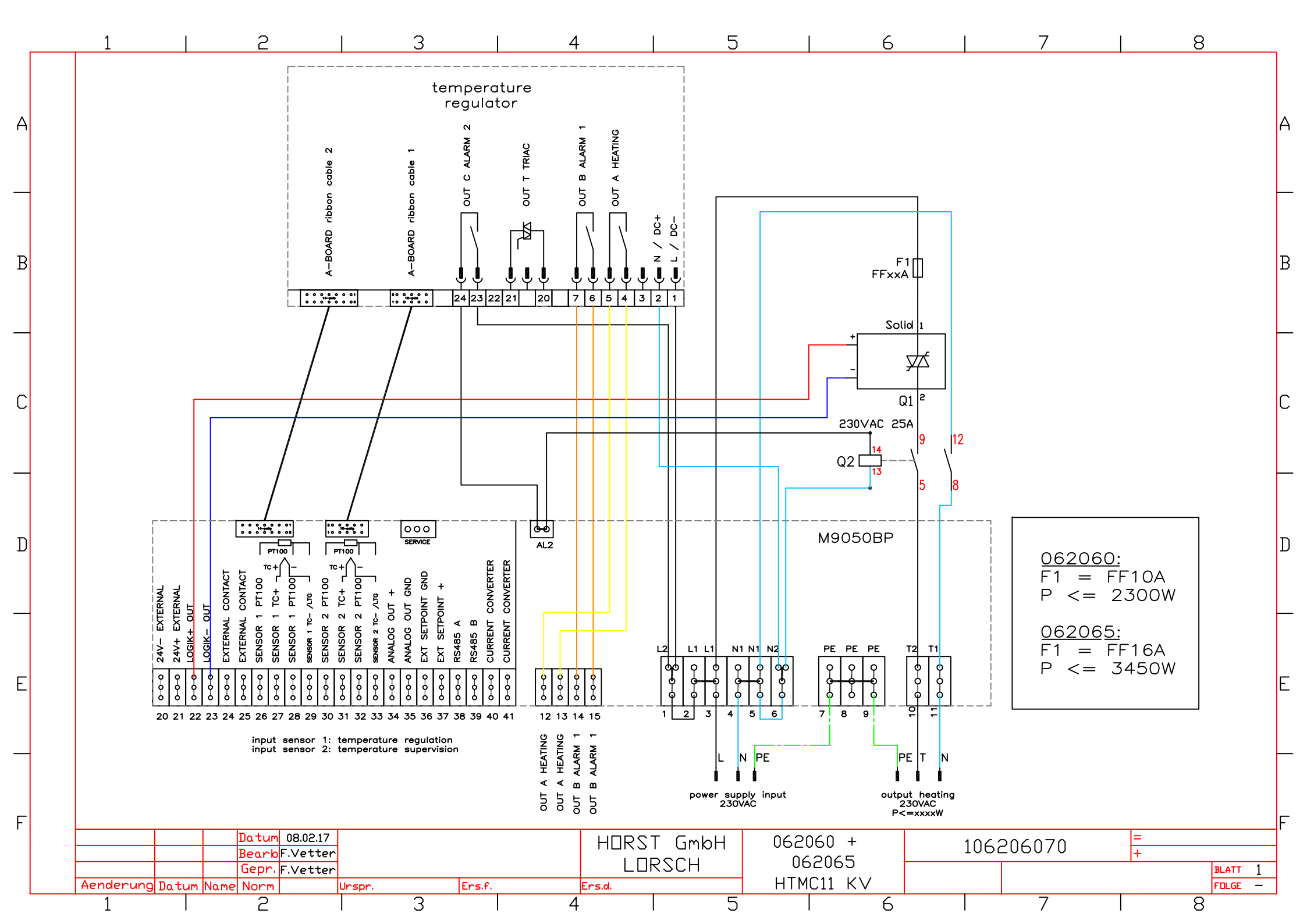


input sensor 1: temperature regulation
input sensor 2: temperature supervision

			Datum	04.01.17		HORST GmbH LORSCH	connection board HT MC11	254290650	=
			Bearb	F.Vetter					+
			Gepr.	F.Vetter					
Aenderung	Datum	Name	Norm		Urspr.	Ers.f.	Ers.d.		BLATT 1 FOLGE –



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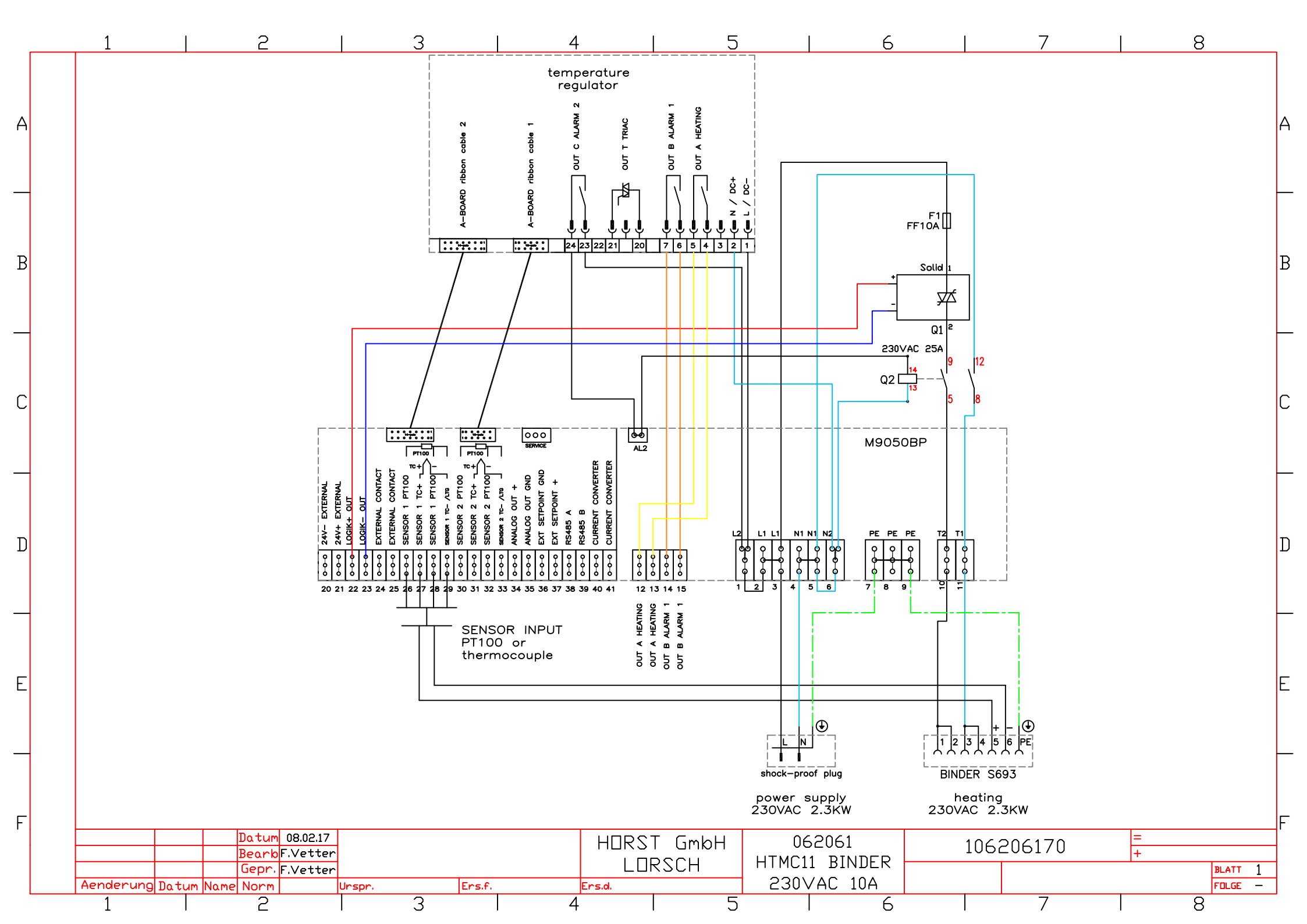
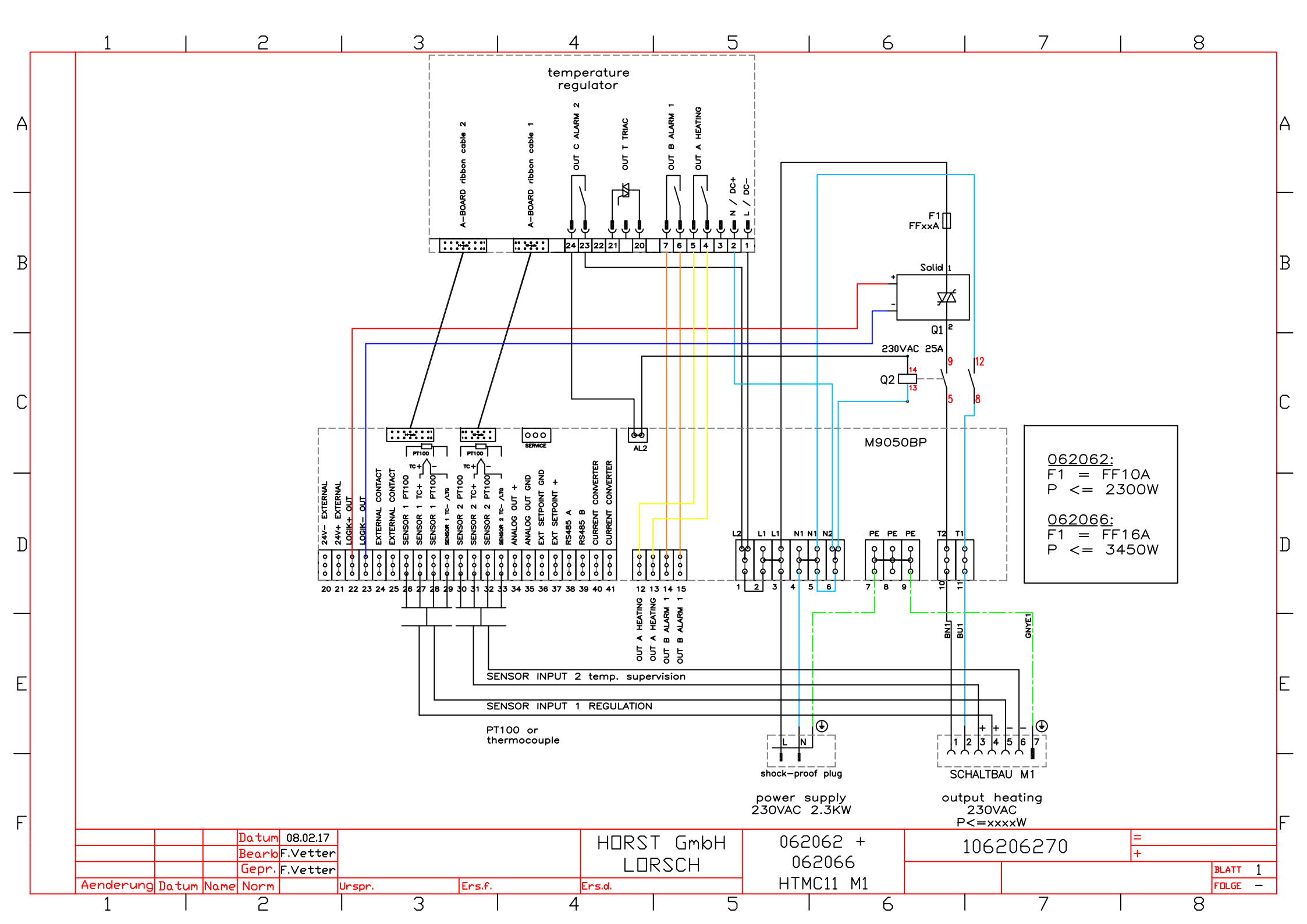
			Bearb	F.Vetter					+
			Gepr.	F.Vetter					
Aenderung	Datum	Name	Norm		Urspr.	Ers.f.	Ers.d.		BLATT 1 FOLGE –



			Datum	08.02.17		HORST GmbH LORSCH	062061 HTMC11 BINDER 230VAC 10A	106206170	=
			Bearb	F.Vetter					+
			Gepr.	F.Vetter					BLATT 1
Aenderung	Datum	Name	Norm		Urspr.	Ers.f.	Ers.d.		FOLGE –



			Datum	08.02.17	HORST GmbH LORSCH	062062 + 062066 HTMC11 M1	106206270	=	
			Bearb	F.Vetter				+	
			Gepr.	F.Vetter					BLATT 1
Aenderung	Datum	Name	Norm		Urspr.	Ers.f.	Ers.d.		FOLGE –