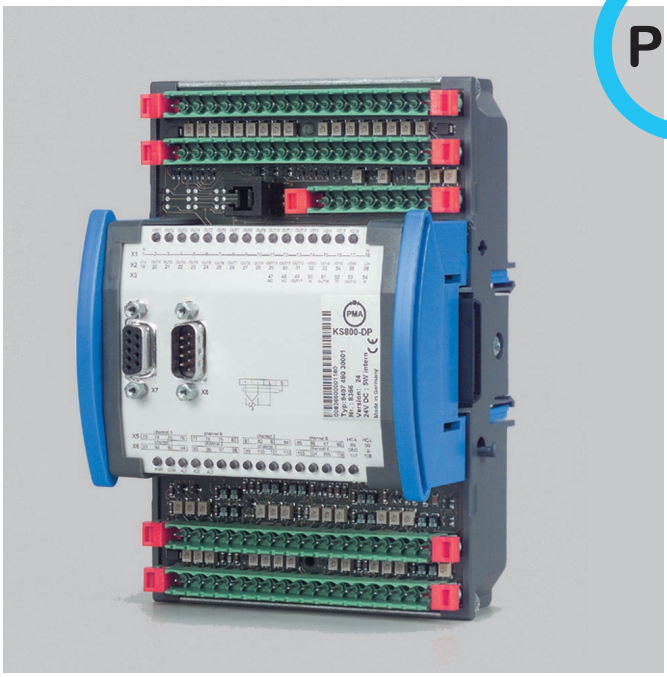


KS 800

Multiple temperature controller

8-channel controller in housing for rail mounting
CAN/ CANopen, PROFIBUS-DP, DeviceNet, RS 485/422
Connection of Engineering Tool or local operation
Self-Tuning to the setpoint without oscillation
Automatic start-up circuit
Switch-over to output "hold "on sensor break
Monitoring for heating current and actuator
3 configurable alarm outputs or relays
8 analog outputs (option)
Direct connection of melt pressure sensors (option)

advanced line

GENERAL

The microprocessor-controlled KS 800 ensures precise, low-cost multi-loop control of temperature, and features an interface for bus or field-bus. Standard functions such as "set-point lowering" and "heating/cooling with four alarms" make the KS 800 ideally suited for temperature control of plastics processing machines, heated moulds, packaging machines, tempering units, and other similar thermal processes.

Furthermore, with high-power heating elements (e.g. in hot-runner moulds), the selectable functions "output hold "in case of sensor break, and "start-up circuit "ensure increased element life and prevent interruptions during Production. The self-tuning feature guarantees very short start-up times.

For implementing continuous and split-range controllers, the KS 800 can be fitted with 8 additional analog control outputs.

DESCRIPTION

The following description is based on the fact that every one of the 8 control loops contains a completely independent controller.

Input circuit monitoring

Incase of a fault in sensor or leads, the built-in monitor provides increased operational safety. The controller output action after monitor triggering can be configured for:

- downscale (min. output)
- upscale (max. output)
- outputs switched off
- switch-over to average output value

Thermocouple input

The monitor is triggered by wrong sensor polarity or TC break.

Resistive input

The input is monitored for a break or a short circuit in the sensor and leads.

Measurement value correction for thermocouples, Pt 100, linear input

The correcting function is used to change or scale he measurement value.

It can be applied either for zero offset (b)or for gain adjustment (m), or both, according o he equation "mx +b ". For this, the controller computes the values for m and b from two input values (x1in, x2in)and two set-points (x1out, x2out).

Easy calibration is possible online via an operating page of the engineering tool.

Heating current monitoring and alarm

The KS 800 has an input for an external current transformer, whereby rectification of the input signal is done on board. All the connected heating leads of the KS 800 's controllers are passed through the current transformer.
If the monitoring function has been activated, the heating outputs of all the control loops are switched on briefly in succession, and the heating current is measured. If the measured current is lower than a defined limit value, this information can be signalled to one of the alarm outputs or transmitted via the field bus.

Similarly, the heating output can be monitored for a short-circuited actuator (SSR).In this case, the heating current is measured when the heating output is switched off. If the measured current exceeds 3% of the selected range, an alarm is triggered.
In addition to checking for exceeded heating current limits, the actuator (solid state relays) is checked for short circuit. With the outputs switched off, the heating current must not exceed 1,5% of the selected heating current measuring range. With detected errors, the relevant channel number is also output by KS 800.

Leakage current monitoring

Heating elements with a high leakage current (e.g. due to penetrated moisture) are detected by this circuit.

Monitoring is carried out with the heating output switched off. An external current relay monitors the difference between the phase currents and the current in the neutral lead. If the difference exceeds a pre-defined value of 10...100 mA, the system transmits a 24 V DC alarm signal to the controller module.

Through cyclical activation of the heating circuits and corresponding scanning, a single current relay can be used for all 8

control loops. The leakage current monitor is coupled internally to the heating current monitor.

Controller and positioner functions

The KS 800 is configurable as a signaller, as a two-point or three-point controller, three-point controller with water evaporation cooling, as a master controller or as a three-point stepping controller. Alternatively, two and three-point controllers can be configured for continuous or split-range control. All versions feature auto/manual switch-over, also via the interface.

In manual operation, the output has an adjustable duty cycle of 0...100%. With cascaded operation, the slave controllers can also be operated as positioners, whereby the positioning signal is defined from the output of he master controller (Y_{slave} =m*Y_{master}).

Melt pressure measurement for extruders

For direct connection of melt pressure sensors, a KS800 version provides the precise supply voltage required for up to 2 sensors (typ. 10 V ± 0,3 %) and the 2 relays required for 80% calibration. The relays can be switched via 2 digital inputs and via fieldbus.

The millivolt output of the pressure sensor must be taken to one of the 8 KS800 inputs. With this KS800 version, external transmitters (also transmitters in the pressure sensor), supply voltage and relays are saved

Alarm functions, alarm outputs

Triggered alarms can be used to operate the relevant alarm outputs, or can be scanned via the fieldbus. The monitored signals are process value x, set-point w, control deviation x., and output signal y. Furthermore,4 limit values (2 low alarms and 2 high alarms) can be adjusted for every control loop.

For each of these 4 limit values per channel, the monitoring function can be adjusted (absolute, relative, etc.)

The following alarm functions are freely configurable for outputs 1,2 and 3 and for each of the control loops:

- *Relative alarm* for monitoring the control deviation (relative o set-point)
- *Absolute alarm* for limit monitoring (independent of set-point)
- *Relative alarm with alarm suppression* The alarm is not triggered during start-up or after set-point changes.
- *Sensor fault alarm*
- *Heating current alarm*
- *Monitoring of digital outputs*

If more than one alarm function is allocated to an alarm output, the functions are combined internally.

Loop Alarm

Used for checking the functionality of the complete control loop. Failure of the process value on an output variable is detected in order to react accordingly.

Second set-point with ramp function

The external control signal W/W2 is used to activate a second set-point (e.g. standby set-point, which can be used when starting after mains recovery).Switch-over to the second set-point is immediate, or follows a gradient (GRW2).

Set-point gradient functions

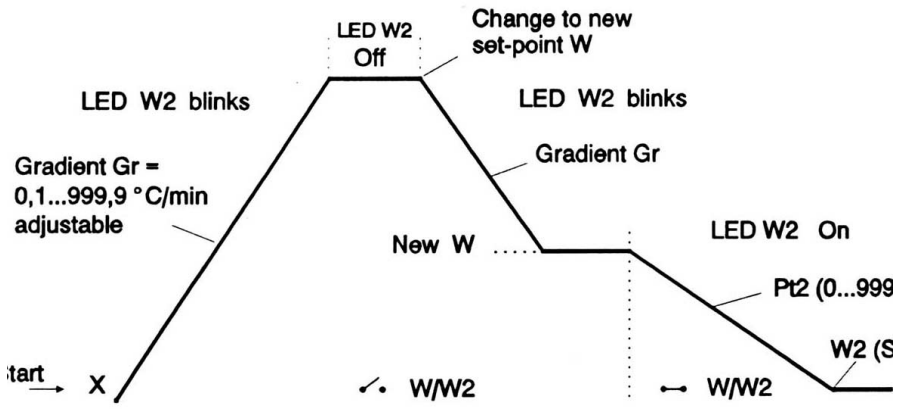
This function (Fig.1) can be adjusted by means of parameters Gr+(positive gradient)and Gr-(negative gradient). After start-up, the function starts at process value x, and changes at the adjusted speed (e.g. 5°C/ min) until it reaches the adjusted set-point. If a new set-point is adjusted, the function ramps up or down to the new value.

Start-up circuit

For temperature control, e.g. with hot runners (Fig.2).

High-performance heating elements with magnesium oxide insulation must be heated slowly, to remove any humidity and to prevent destruction.

With activated start-up circuit, the controller uses the adjusted start-up temperature (e.g. 40%)until reaching the start-up set-point (e.g. 95°C). For protection



Fing.1 Set-Point gradient function

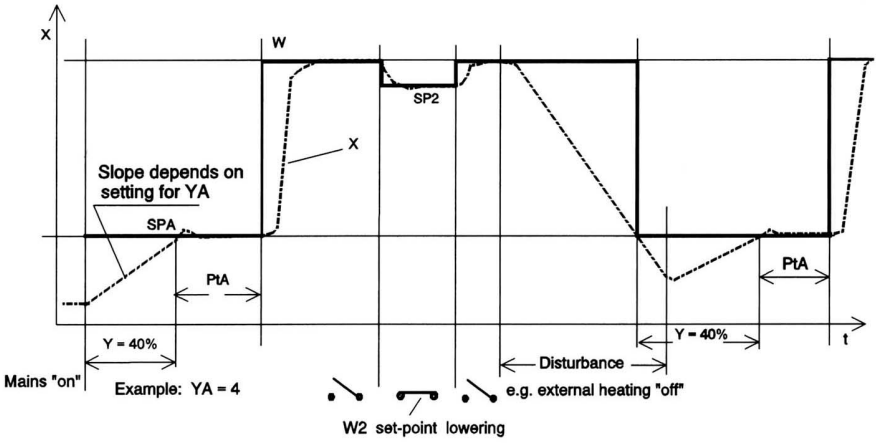


Fig.2 Start-up circuit

of the heating elements, the duty cycle is reduced to ¼ during start-up.

The start-up set-point (e.g.95°C)is maintained during the selected start-up holding time. Subsequently, the controller uses main set-point W.

"Hold "function for output signal

In order to continue with production in case of sensor break, the KS800 offers the possibility of maintaining the temperature a the last mean value of the output signal.

On sensor break, the KS 800 generates an according signal via the alarm outputs or via the field-bus, so that the sensor can be replaced.

As soon as the KS 800 detects a valid input value after replacement, controller operation is continued automatically. The "hold "value is determined continuously from the mean output value, provided that the process value is within an adjustable response threshold (e.g. X_W=±2K).
After switching on the supply voltage again or after re-configuration, the "hold "output value is set to 0%. To prevent excessively high output values, i.e. overheating with TC break, the "hold "output value can be limited.

Self-tuning

This function is fitted as standard for automatic determination of the best control parameters. Self-tuning is started at the push of a button and uses the delay time Tu and the max. rate of change Vmax of the temperature control loop to calculate the optimum settings for fast line-out without overshoot.

With three-point controller configuration, the "cooling "parameters are determined separately. For applications with adjacent heating zones and strong thermal coupling, synchronous self-tuning can be started for the loops involved. Synchronous self-tuning can be activated or disabled individually for every control loop.

Self-tuning at the set-point

The new method determines the optimum control parameters also at the set-point either on request or automatically (if a trend towards oscillation was noticed). The method works without osccillation and with only a minimum control variable deviation.

Configurable digital inputs

If not required otherwise, 4 of the "cooling "outputs can be configured as Inputs. These inputs can be used for remote activation of the following functions:

- Input 1:
  switch-over to a 2nd set of parameters
- Input 2:
  disabling all outputs
- Input 3:
  input for leakage current monitoring
- Input 4:
  switch-over to a 2nd set-point (W/W2)

Digital outputs

In total, the multicontroller has nineteen optocoupler-isolated short circuit proof outputs. The switching states of the outputs is displayed at the unit.

Analog outputs, transmitter function

KS800 has 8 other optional analog outputs (20mA), the function of which is configurable.

They can be configured as:

- outputs for continuous or split-range controllers
- Transmitter function: analog output of input and controller signals is possible (process value, set-point, correcting variable)
- remote outputs which can be written via fieldbus

Connection and operation of the Engineering Tool

The Engineering Tool runs on a standard PC, which is connected to the KS 800 via an additional serial interface. The Tool is used for remote Configuration, parameter setting and operation of the KS 800.
The same (UART)interface can be used to connect a simple operating/display unit for local use.

Address selector switch

Three rotary switches are fitted for adjusting transmission speed and address of the KS 800. Alternatively, these adjustments can be done via the bus or by means of the Engineering Tool.

Watchdog timer

An on-board watchdog timer checks the module 's hardware every 1,6 Seconds.

TECHNICAL DATA

INPUTS

Thermocouples

Types L, J, K, N, S, R to DIN IEC584.

Type	Measuring range	Error
L	0... 900 °C	≤ 2 K
J	0... 900 °C	≤ 2 K
K	0...1350 °C	≤ 2 K
N	0...1300 °C	≤ 2 K
S	0...1760 °C	≤ 3 K
R	0...1760 °C	≤ 3 K
T	-200...400 °C	≤ 2 K
W	0...2300 °C	≤ 2 K
E	0...1000 °C	≤ 2 K

Output: in °C or °F
Input resistance:=1M Ω
TC break monitor: built-in, configurable output action
Monitoring current:=1 µ A
Polarity monitoring: responds when input signal is 30 K below span start
Temperature compensation: built in
Sensor or compensating leads must be taken up to the controller terminals.
Additional error: ≤ 1K/ 10K change of terminal temperature
Permissible voltages between inputs: 1V DC and 2V AC
Permissible voltage between inputs and ground:5 V AC

Resistance thermometer

Pt 100 Ω to DIN IEC 751
Range: –100,0...850,0 °C
With linearization (temperature-linear)
Error: ≤ 2K
Connection in three-wire technique without lead adjustment.
With two-wire connection, a calibrating resistor equal to the lead resistance must be fitted.
Lead resistance: ≤ 30 Ω
Sensor current: ≤ 0,3 mA
Input circuit monitoring for break in sensor or lead, or short circuit.
Configurable output action.

Resistance linear

Range: 0...400 Ω, without linearization
Connection in 3-wire circuit without lead resistance adjustment
2-wire connection: with compensating resistor
Sensing current: ≤ 0,3 mA
Input circuit monitoring for sensor and lead break

Direct voltage

-100...100 mV, linear
Input resistance: ≤1M Ω
Error: ≤0,1%
Input span scalable via measurement correction.

Scanning frequency

With thermocouple or Pt 100 input, all 8 inputs are scanned within 625 ms.

Heating current input

Connection of normal current transformers
Input range: 0...42 mA AC
Ri approx.. 170 Ω
Resolution > 14bit
e.g. for PMA standard current transformer 0...30A/ 0...30 mA AC.

Digital inputs

The 4 digital inputs can also be configured as digital outputs. Galvanic isolation via opto-couplers.
Rated voltage:24 V DC external
Current sink (IEC 1131 type 1)
Logic "0 "=–3...5 V
Logic "1 "=15...30 V
Current requirement:approx.5 mA
The digital inputs are galvanically isolated from the other temperature inputs.

Digital inputs for relay switching

2 optional inputs
Rated voltage:24 V DC external
Current sink (IEC 1131 type 1)
galvanically isolated

INTERFACES

- KS 800-RS
  Stand-alone temperature controller with RS 485 /RS 422 interface and ISO 1745 protocol.
- KS 800-CAN
  Stand-alone temperature controller with integrated CANbus interface and CAL/CANopen protocol.
- KS 800-DP
  Stand-alone temperature controller with integrated PROFIBUS-DP interface and PROFIBUS-DP protocol. Data to be transmitted are freely configurable
- KS 800-DN
  Stand-alone temperature controller with integrated CANbus interface and DeviceNet protocol.

Interface for PC and remote operation

An additional serial interface is provided for connecting the PC-based Engineering Tool, which is used for remote configuration, parameter setting and operation of the KS 800.

OUTPUTS

Logic outputs

12 logic outputs are available for direct connection of solid-state relays. If required,4 digital inputs can also be configured as digital outputs.

In addition, 3 outputs are available for alarm signalling. All outputs are short-circuit proof, and switch 24 V DC (grounded load). Nominal range of switched output voltage:18...30 V DC to DIN 19 240.
Nominal output current: ≤ 70 mA Voltage drop across output a full load: 0,6 V typical,1 V max.

Continuous outputs

For continuous and split-range control, the KS 800 can be fitted with 8 additional analog outputs. The outputs are short-circuit proof and galvanically isolated from the inputs.

Current output

Signal: 0/4...20 mA, configurable
Resolution: 10 bits
Error: typically ±0,2 %±1 digit
Load: max.470 Ω
Settling time: within 625 ms

Constant voltage output *(optional)*

For melt pressure sensor energization:
Output voltage:10 V ±0,3 % typically
Max.load: 60 mA protected against short circuit (not permanently short circuit proof) The constant voltage source is galvanically isolated.

Relay outputs *(optional)*

2 potential-free changeover contacts
Contact rating: 24 V, 2 A
When used for strain gauge bridge (melt pressure) calibration, a relay load of 2 mA must not be exceeded.

POWER SUPPLY

Voltage: 24 V DC (+24 V, gnd)
Nominal range:18...30 V DC
Power consumption: approx.5 W
Protection class III (protective low voltage).

CONTROL CHARACTERISTICS

Control output: 0...100% duty cycle.
Modules configurable as:
–signaller with 1 or 2 outputs
–two-point DPID controller
–three-point DPID/DPID controller
–three-point controller with DPID/DPID behaviour and output algorithm for water evaporation cooling (extruders
–split-range controller
–continuous controller
–positioner function with manual operation of three-point controller
–three-point stepping controller
–cascade controller

Control parameters

Self-tuning or adjustable.

ALARM FUNCTIONS

Output: logic signal or via interface. The following functions are configurable for every control loop and every limit value:
–relative or absolute alarm
–relative alarm with alarm suppression
–loop alarm
–sensor break alarm
–heating current alarm
–output monitor alarm

HEATING CURRENT MONITOR

Heating current is monitored with an external transformer (see Accessories).
Transformer rating:0...30A /30 mA AC
For smaller heating currents, the load cable can be looped through the transformer several times for higher accuracy, e.g.2 x 15A /30 mA AC. Range selectable 1,0...99,0 A, so that other current transformers can be used.
Error: ±5% of display range
Heating current limit: adjustable within selected range, acting on an alarm output. Monitoring for undercurrent or short-circuited actuator (SSR).

Trigger value for short-circuit monitor: 1,5% of selected range (e.g.0,45 A with range 0...30 A).

SET-POINT

Upper and lower limits of the set-point range are selectable within the measuring range limits.

DISPLAYS

Status LEDs
–for "module OK "
–for "communication OK "
LEDs for switching status
One LED for each input/output.
LED lights if input or output is active (High).

PROGRAM MEMORY

EEPROM

ENVIRONMENTAL CONDITIONS

Permissible temperatures:
For specified accuracy: 0...55 °C
(0...50°C for versions with analog outputs)
Operation: 0...60 °C
Storage/transport: –20...60 °C

Climatic category

KUF to DIN 40 040
Relative humidity: ≤ 75% yearly average, no condensation

INFLUENCING FACTORS

Power supply effect

None. In case of mains failure, the configuration data are stored in a non-volatile EEPROM.

Shock and vibration

Vibration test Fc to DIN 68-2-6 (10...150 Hz)
Unit in operation: 1g or 0,075 mm
Unit not in operation: 2g or 0,15 mm
Shock test Ea to DIN I.C. 68-2-27
(15g,11 ms)

ELECTROMAGNETIC COMPATIBILITY

Electromagnetic immunity

(complies with EN 50 082-2)
Leads of measurement inputs and analog outputs must be screened.

Electrostatic discharge

Test to I.C. 801-2
Air discharge:8 kV
Contact discharge:4 kV

High-frequency interference

Test of IEC 801-3 (ENV50140)
Frequency: 80...1000 MHz,10 V/m

HF interference on leads

Test to IEC 801-6 (ENV 50 141)
Frequency:0,15...80 MHz,10 V
Effect:=13 K (no effect with screened leads)

Fast pulse trains (burst)

Test to IEC 801-4
2 kV applied o leads for supply voltage and signal leads

ELECTROMAGNETIC RADIATION

(complies with EN 50 081-2)

GENERAL

Housing

Dimensions:
124 x 170 x 85 mm (Wx H xD)

Protection mode

(to IEC 529, DIN 40 050)
Housing: IP 20
Terminals: IP 00

CE-marking

Fulfils the European Directives for electromagnetic compatibility and low voltage.

Approval

UL-listed, CSA-approved

Electrical safety

Tested to I.C. 348 (VDE 0411)
Protection class III (protective low voltage)

Electrical connections

Choice of screw terminals (Phoenix type FRONT-MSTB 2,5/18-ST-5, 08) or screwless spring-clamp connection.
Both terminal types simply plug onto the connector strips of the KS 800.

Mounting method

Clip-on rail mounting
("top-hat "rails to DIN EN 50 022)

Weight:

approx.0,65 kg

Accessories

Operating instructions

ACCESSORY EQUIPMENT

BlueControl (Engineering Tool)

PC-based program for configuring, setting parameters, and operating (commissioning) the KS 50-1 controller. Moreover, all the settings are saved, and can be printed on demand.
Depending on version, a powerful data acquisition module is available, complete with trend graphics.

Simulation

The built-in simulation serves to test the controller settings, but can also be used for general training and observing the interaction between controller and control loop.

Software requirements:
Windows 95/98/NT/2000.

Hardware requirements:

A PC adapter (see „Accessories") is required for connecting the controller.

Updates and demo software can be downloaded from:
www.pma-online.de

Functionality	Mini	Basic	Expert
parameter and configuration setting	yes	yes	*
controller and control loop simulation	yes	yes	*
download: writes an engineering to the controller	yes	yes	*
online mode/ visualisation	SIM only	yes	*
upload: reads an engineering from the controller	SIM only	yes	*
basic diagnosis function	SIM only	yes	*
file, save engineering data	no	yes	*
printer function	no	yes	*
online documentation, help system	no	yes	*
measurement correction (calibration procedure)	no	yes	*
data acquisition and trend function	SIM only	yes	*
personal assistant function	yes	yes	*

* expert version planned.

ORDERING DATA

	9407	480	0001
Multiple temperature controller			
KS 800-RS (RS 422/485)			0
KS 800-DP (Profibus DP)			3
KS 800-CAN (CANopen)			6
KS 800-DN (DeviceNet)			7
With current outputs 0/4...20 mA [1]			1
With voltage outputs 0...10 V (on request) [1]			2
With constant voltage source and 2 relays [1]			3

[1] two additional 8-pin connectors are required for analog outputs/constant voltage

ORDERING DATA FOR ACCESSORIES

Description		Order no.
BlueControl (Engineering-Tool)	German/English	**9407 999 09101**
Engineering Set Profibus	German	**9407 999 09111**
	English	**9407 999 09211**
PC-Adaptor	for connecting the Engineering Tool	**9407 998 00001**
Screw terminals		
FRONT-MSTB 2,5/18-ST-5,08 18 terminals (4x required)		**9407 799 00001**
FRONT-MSTB 2,5/8-ST-5,08 8 terminals (1x required)		**9407 799 00011**
CANbus termination resistor		**9407 800 90021**
CANbus termination resistor with plug		**9407 800 90051**
CANbus cable for connecting CAN bus modules, standard length 5 m		**9407 800 90041**
DeviceNet adaptor		**9407 799 00301**
Current transformer		**9404 407 50001**
3-phase current transformer		**9404 407 50022**
75 A current transformer		**9404 829 10222**
Active current transformer 75 A		**9404 829 10223**
Solid-state relays		
SSR 25A,230V		**9407 509 22221**
SSR 50A,230V		**9407 509 22421**
SSR 50A,480V		**9407 509 22431**
Solid-state relay with heat sink		
SSR 10A,480V		**9407 509 32031**
SSR 20(25)A,480V		**9407 509 32131**
SSR 30A,480V		**9407 509 32231**
SSR 50A,480V		**9407 509 32431**
Manual (functional description)	German	**9499 040 49218**
	English	**9499 040 49211**
Operating instructions	German	**9499 040 49118**
	English	**9499 040 49111**
Interface instructions		
ASCII (ISO 1745)	German	**9499 040 49418**
	English	**9499 040 49411**
CANopen	German	**9499 040 49518**
	English	**9499 040 49511**
Profibus DP	German	**9499 040 50518**
	English	**9499 040 50511**
DeviceNet	German	**9499 040 57718**
	English	**9499 040 57711**

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