PMA Prozeß- und Maschinen-Automation GmbH

Temperature controller KS 50-1

KS50-1 TCont

expert line for tempering units and hot runners

Operating Note

English

9499-040-64411

Valid from: 8403

Contents

A publication of PMA Prozeß- und Maschinen- Automation
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Germany

1 Introduction

Thank you for buying a KS 50-1 *TCont*.
This expert line unit offers special functions for tempering and hot-runner equipment. An optional 20mA current loop or an RS485/422 interface are available for easy connection of peripheral units including a KS 50-1 *TCont* to a machine control system.
The protocol is widely used in the plastics industry and supported by many injection moulder and extruder manufacturers, e.g. Arburg, Engel and Krauss-Maffei. Another name for it is ”ARBURG protocol”.

This operating note describes the extended functions and features of KS 50-1 *TCont*. For all other functions, refer to operating manual 9499-040-62811 for KS 50-1 Industrial Controller.

1.1 *Definitions*

A current loop interface transmits serial data by switching on and off a 20mA current in a conductor loop at the data bit clock. During the rest condition, or during transmission of ”1” bits, a constant 20 mA current is flowing, whilst the current flow is intermittent with ”0” bits.

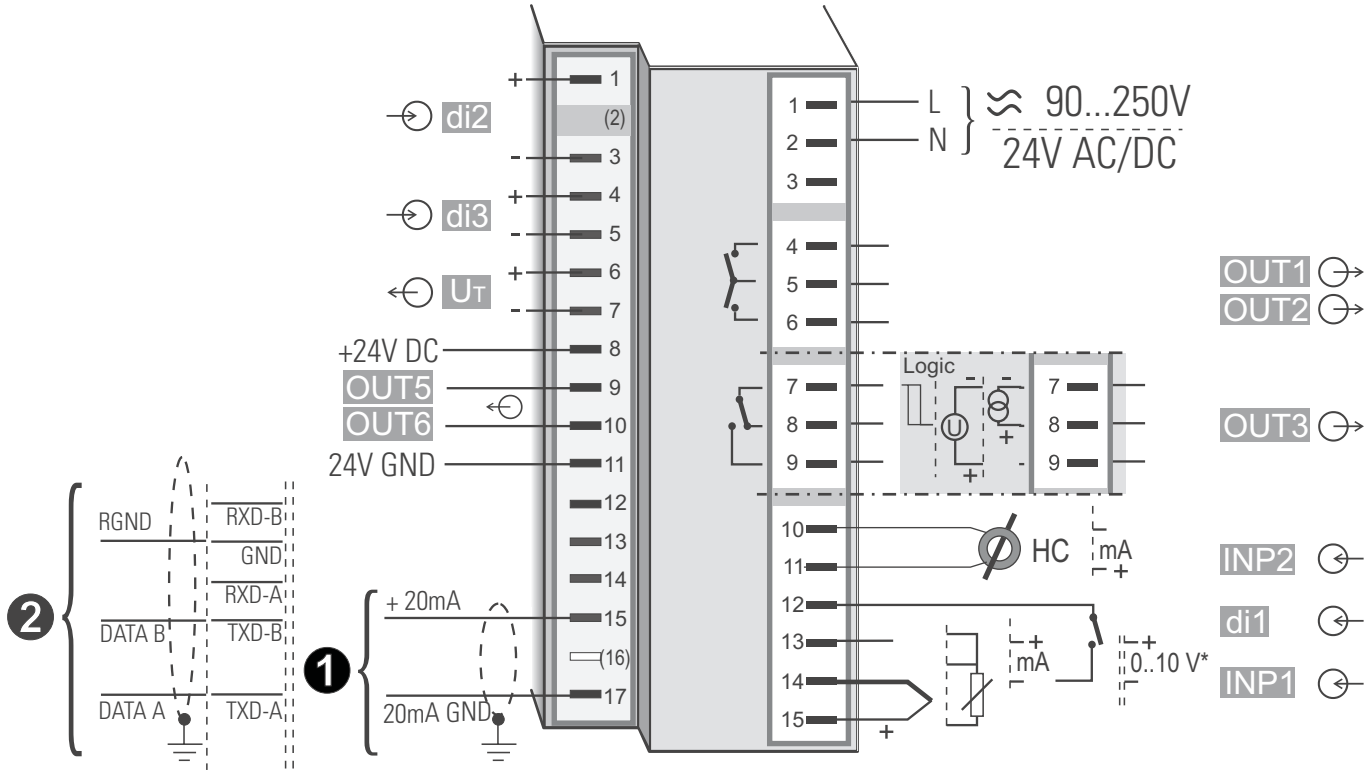
Another name for 20mA current loop interface is TTY interface (TeleTYpe(writer)).

Caution! The unit contains ESD-hazarded components.

ARBRUG is a registered trademark of ARBURG GmbH + CO, D-Loßburg.

2 Hints on operation

2.1 *Electrical connections*



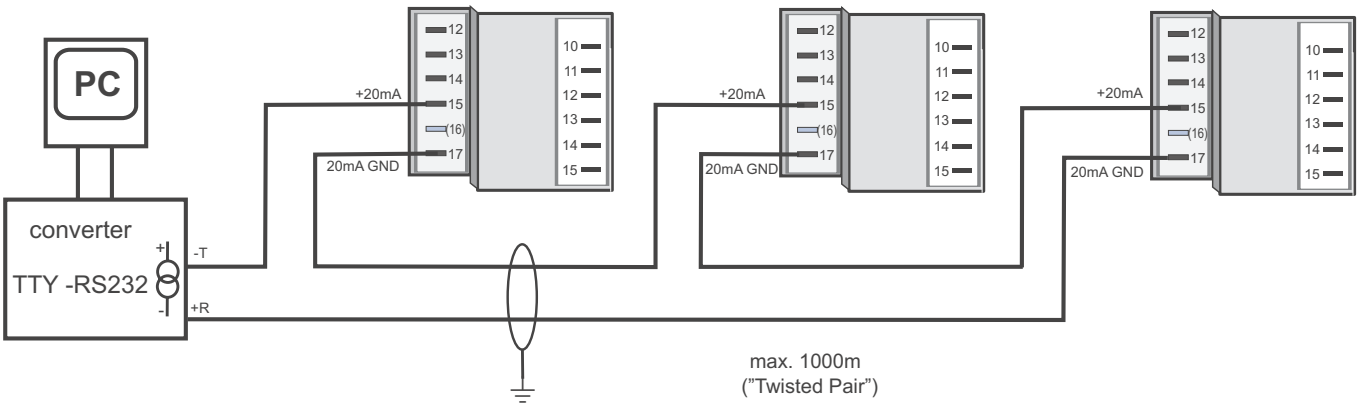
alternativ ***RS485 / RS422*** ***TTY***

* Safety switch mA ↔ V turned left

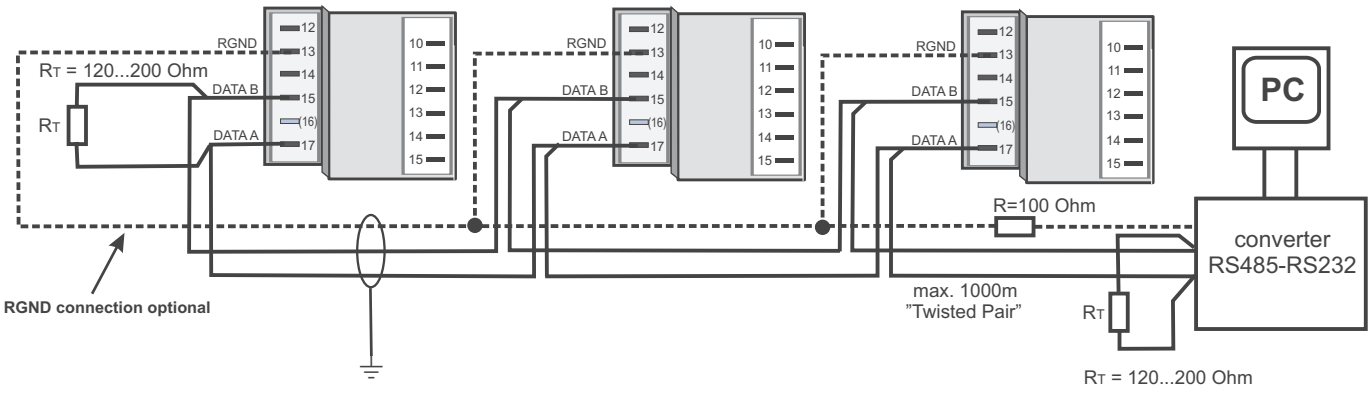
The controller is provided with flat-pin terminals 1 x 6,3mm or 2 x 2,8mm to DIN 46 244. Or with screw terminals depending on ordering code.

2.2 *Bus interface*

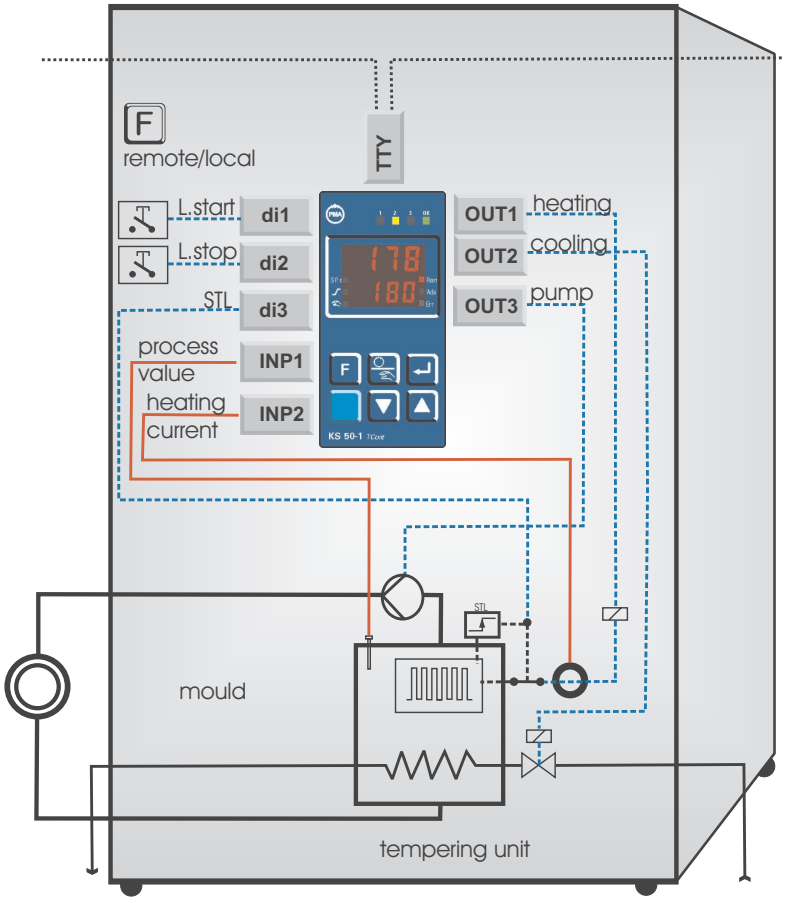
❶ Connection of the TTY bus interface (example)



❷ Alternative connection of the RS485/422 bus interface (example)

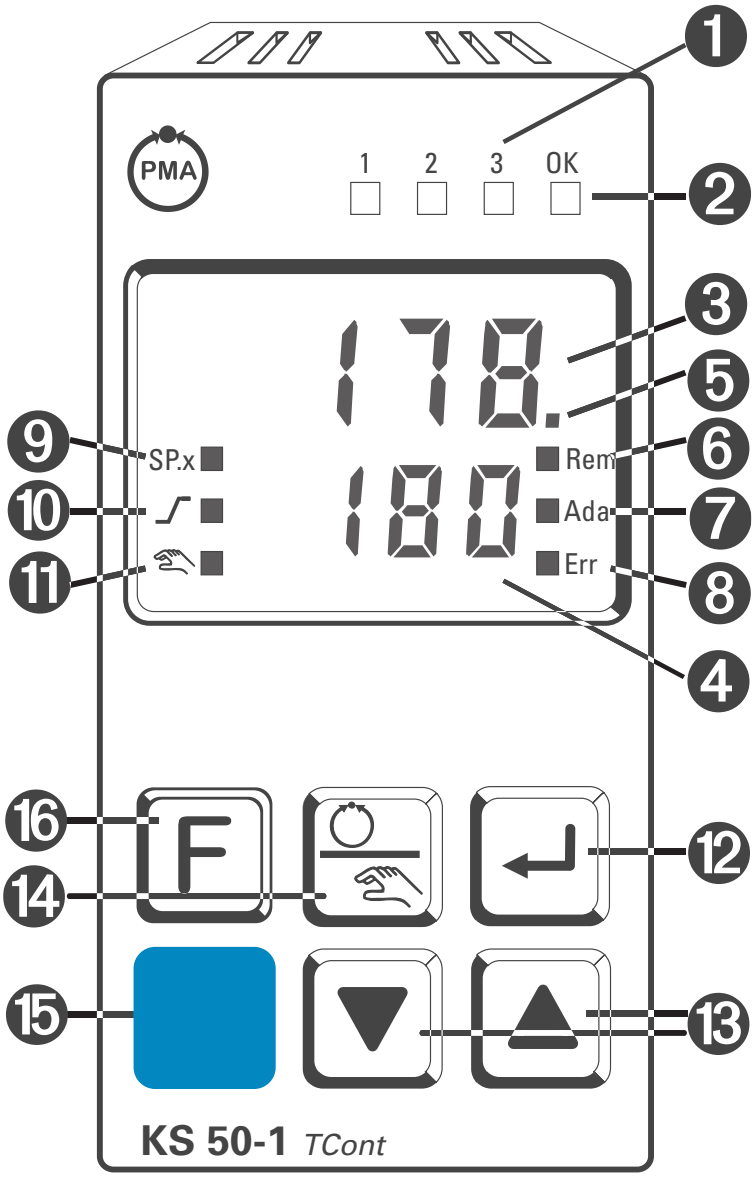


2.3 *Connection example*



3 Operation

3.1 *Front view*



❶ Status of switching outputs Out.1...6
❷ Lights with limit value 1 (PArA / L iM) not exceeded
❸ Process value display
❹ Set-point, controller output
❺ Signals ConF and PArA level
❻ Device in remote mode
❼ Self-tuning active
❽ Entry in error list
❾ Set-point SP.2 or SP.E is effective
❿ Set-point gradient is effective
⓫ Manual/automatic switch-over:
Off: Automatic
On: Manual (changing possible)
Blinks: Manual (changing not possible)
(→ ConF / Entr / MAn))
⓬ Enter key: calls up extended operating level / error list
⓭ Up/ Down keys: changing the set-point or the controller output value
⓮ Manual mode /spec. function (→ ConF / LOCI)
⓯ PC connection for BlueControl (engineering tool
⓰ Remote/local-switch / spec. function (→ ConF / LOCI)

LED colours :
LED 1, 2, 3: yellow
LED OK: green
other LEDs: red

In the upper display line, the process value is always displayed. At parameter, configuration, calibration as well as extended operating level, the bottom display line changes cyclically between parameter name and parameter value.

LED *REM* - ❻ displays the remote/local mode. In mode remote this LED lights and value changes via front keys are locked.

3.2 *Behaviour after power-on*

After supply voltage switch-on, the unit starts with the remote mode and goes then into the standby mode. The controller mode is switched off. (SP = OFF).

3.3 *Functions for tempering units*

KS 50-1 *TCont* has a lot of possibilities to connect signals coming from and going to the tempering unit.

- The process value is connected to INP1.
- An output signal of a safety temperature limiter (STL) can be attached alternatively to di1 to di3. When responding the STL the controller goes into the switching off mode (stop). The signal is passed on in the protocol (see page 18).
- The operation of the controller can be accomplished in the remote or in local operation. For the change-over the inputs di1 to di3 or the F-key are available. In remote mode values can be given only over the attached interface; inputs via the front are blocked. Vice versa in local mode set-point operations over the interface are not permitted. As answer the device supplies a NAK message.
- For local starting and stopping of the tempering unit push-buttons or switches can be selected and attached at the inputs di1 to di3. The function start or stop is released with the change of 0 to 1, independently of the configuration of di.Fn as push-button or switch.
- Selected signals for sensor mode, level alarm or flow alarm can be connected to di1 to di3. They are only through-handed in the device, but indicated in the protocol (see page 17).
- The alarm for safety temperature - monitoring can be determined with limit 1 (Lim.1).
- KS 50-1 *TCont* supplies a continuous signal to control a pump, which can be connected to OUT1 to OUT6.
- After a stop command the pump is only switched off, if the return flow temperature is fallen below the adjusted limit, which is defined over the set-point SP2.

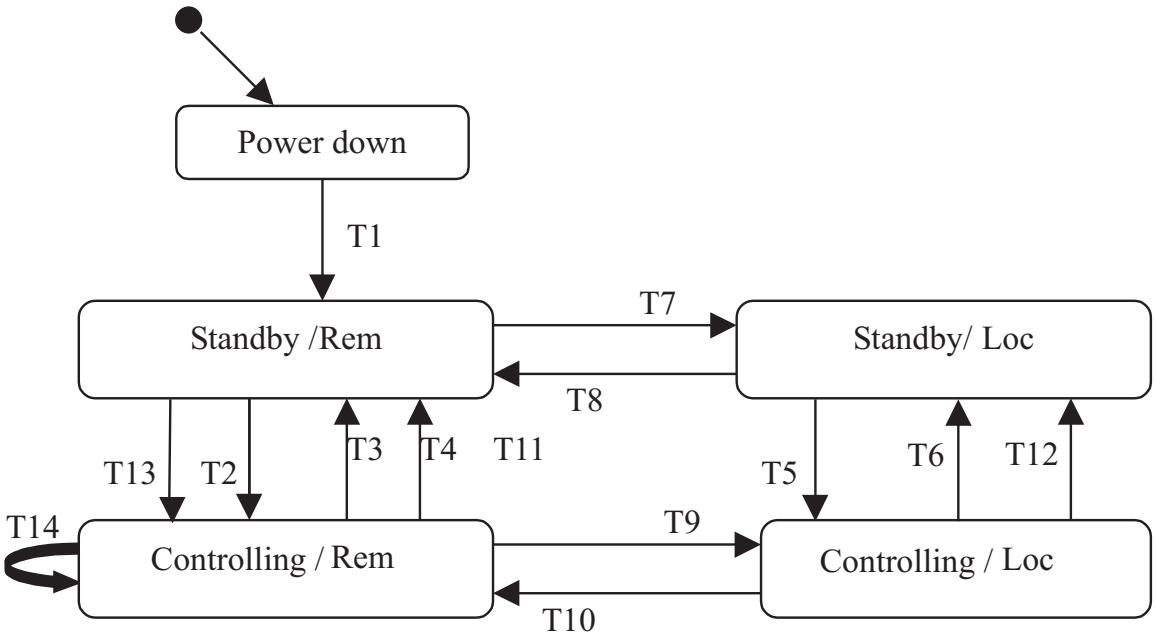
If the inputs for start and stop are not wired, then the same functionality can be achieved in local mode by switching on and off the controller function (for switching off put the set-point SP to OFF; for switching on enter a valid set-point). The start instruction corresponds to the control command (r) in the remote mode, the stop command to the control command (p).

Signal connection types

Signal	Connection types	Remarks
Pt100 / TC – sensor, internal or external	INP1	
Heating current input, if applicable	INP2	
STL input from safety temperature limiter	di1...3	❷
remote – local – switch-over	di1...3, F-Key	❷
local – start; push-button function	di1...3	❷
local – stop; push-button function	di1...3	❷
Sensor operating mode: 0= internal; 1= external;	di1...3	❶ ❷
Input for alarm "level": 0= ok; 1= alarm	di1...3	❶ ❷
Input for alarm "flow": 0= ok, 1= alarm	di1...3	❶ ❷
Output heating	relay OUT1..3, OUT5..6	❷
Output cooling	relay OUT1..3, OUT5..6	❷
Output pump	relay OUT1..3, OUT5..6	❷
alarm safety temperature	L in.1	
Set-point for return flow temperature	SP.2	

❶ Signals are only transferred in communication protocol.
❷ Alternative connection types

The function flow is described in the following state diagram.



The implemented actions executed at a change-over of states are shown in the following table.

Transition	previous state	following state	event	condition	action
T1	Power down	Standby/Rem	Power on	none	- start-initialization - controller switched off - remote mode - no self-tuning
T2	Standby/Rem	Controlling/ Rem	Control command (r)	remote	- switch on pump - switch on controller - start self-tuning, if applicable - control to set-point
T3	Controlling/ Rem	Standby/Rem	Control command (k)	remote	- if X > SP2: cooling - then switch off controller - switch off pump
T4	Controlling/ Rem	Standby/Rem	Control command (p)	remote	- if X > SP2: cooling - then switch off controller - witch off pump
T5	Standby/Loc	Controlling/ Loc	local start signal	local	as T2
T6	Controlling/ Loc	Standby/Loc	local stop signal	local	as T4
T7	Standby/Rem	Standby/Loc	r/l-switch-over	local	toggle to local
T8	Standby/Loc	Standby/Rem	r/l-switch-over	remote	toggle to remote
T9	Controlling/ Rem	Controlling/ Loc	r/l-switch-over	local	toggle to local
T10	Controlling/ Loc	Controlling/ Rem	r/l-switch-over	remote	toggle to remote
T11	Controlling/ Rem	Standby/Rem	STL active	remote	as T4
T12	Controlling/ Loc	Standby/Loc	STL active	local	as T4
T13	Standby/Rem	Controlling/ Rem	identifier (R)	remote	-Acknowledge/delete the existing alarms - continue with T2
T14	Controlling/ Rem	Controlling/ Rem	identifier (R)	remote	- Acknowledge/delete the existing alarms - continue with T2 (however without self-tuning)

3.4 *Functions for hot-runner*

To operate with the protocol extension for hot-runners only a few additional inputs and outputs are needed.

- The operation of the automatic controller can be switched over from remote to local operation. Therefore the inputs di1 to di3 or the F-key are available.

In local operation a start-/stop functionality can be achieved by switching on and off the controller (for switching off put the set-point SP to OFF ; for switching on enter a valid set-point). The start command corresponds to the control command (r) in the remote mode, the stop command to the control command (a).

4 Configuration extensions

The KS 50-1 *TCont* configuration values are extended by the following settings compared with the standard version.

❑ Protocol selection

In configuration menu `othr` , item `Prot` is available for definition of the protocol to be used.

`othr`

Name	Range	Description	Default
`Prot`		Protocol selection for rear interface	1
	0	MODBUS RTU	
	1	Protocol for tempering unit	
	2	Protocol for hot runner	

❑ Output selection

Control of a pump can be selected via parameter `PuñP` in the configuration menu for `OUt.1`, `OUt.2`, `OUt.3`, `OUt.5` or `OUt.6` . The default is an active OUT.3.

`OUt.1`, `OUt.2`, `OUt.3`, `OUt.5`, `OUt.6`

Name	Range	Description	Default
`PuñP`		output pump	0
	0	Not active	
	1	Active	

❑ Self-tuning start

For KS 50-1 *TCont*, the self-tuning behaviour during start-up was changed. Self-tuning is suppressed during power-on and called up only when starting control operation, if permitted (see `OrEL`).

`Cntr`

Name	Range	Description	Default
`Strt`		Self-tuning start	0
	0	Manual self-tuning start via the front panel, or when starting control operation, if permitted.	
	1	Manual self-tuning start via the front panel, when starting control operation, if permitted, and when detecting oscillation.	

❑ Input selection

For configuration menu LOGI additional menus for selecting typical digital inputs for tempering equipment are available.

LOGI

Name	Range	Description	Default
StB		Source for safety temperature limiter signal	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	
L.StA		Source for local function start	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	
L.Sto		Source for local function stop	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	
SEnS		Source for sensor operating mode (internal, external)	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	
LEVL		Source for level alarm	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	
FLo		Source for flow alarm	0
	0	interface only	
	2	di1 switches	
	3	di2 switches	
	4	di3 switches	

5 Parameter extensions

The KS 50-1 *TCont* parameters are extended by the following settings compared to the standard version.

❑ Self-tuning switch-off

For CntR control and adaptation, parameter OrEL is used to permit self-tuning.

CntR

Name	Range	Description	Default
OrEL		Enable self-tuning at control operation start	0
	0	Self-tuning permitted	
	1	Self-tuning not permitted	

Hints on self-tuning

To meet the special requirements of fast control loops, e.g. with tempering units, the following information should be taken into account.

By setting the input filter for measurement input 1 (Par3 / 1 nP.1 / t.F 1) to a filter time ≥ 15 s, input variable fluctuations can be reduced, i.e. earlier settling of the input variable.

To improve the optimization result, the control range should be limited to the actual range. For this purpose, the min. and max. control range limit must be matched, e.g. with a range of 20°C ... 150°C, value rnG.L = 20 and rnG.H = 150 in Conf / CntR must be set.

The minimum cycle times t 1 and t2 should be as low as possible. If a defined min. pulse duration must not be exceeded, changing during self-tuning can be prevented via configuration parameter Adt0 = 1. Please, note that the shortest pulses result from ¼ x t 1 or ¼ x t2.

6 Communication protocol

KS50-1 *TCont* supports a simple protocol for injection moulders and extruders widely used in the plastics industry, which is used for connecting peripheral equipment and easy simple data exchange. This protocol, which is also called ”ARBURG” protocol, is designed according to the specification of the Arburg company.

This protocol is also supported by other machine manufacturers, e.g. Engel, Krauss-Maffei, etc. Any adaptation required can be done by changing the Baudrate or the parity.

Communication is according to the master / slave principle. KS 50-1 is always slave and polled for a message by the machine control system. Exchanging messages is done in half-duplex operation.
The transmission parameters are adjustable via the front panel or via **BlueControl**®.

❑ **Baudrate (bAud):**

- 2400 ,
- 4800,
- 9600,
- 19200 Bits/s

❑ **Parity (PrtY):**

- Even,
- Odd,
- None

❑ **Address settings (Addr):**

- 1 to 32

❑ **Byte format (fixed):**

- Number of data bits: 8
- Number of stop bits: 1
- Number of start bits: 1

The LSB is sent first.

Exchanging messages is subjected defined time conditions:

- Character delay time T1:< 50 ms
  (The max. possible time which can pass between sending of the start bits of two successive bytes a message)
- Acknowledgement delay time T2: <100ms
  (The max. possible time which can pass between the end of an inquiry sent by the master and reception of the first character of the slave reply)

6.1 *Data format*

For transmission of block length and checksum, the hexadecimal format is used, whilst set-points and process values are transmitted in BCD format. For transmission, hexadecimal values are converted into ASCII. For simplification, values above 9 (A-F) are coded as 3Ah - 3Fh instead of 41h-46h (ASCII A-F).

6.2 *Protocol structure*

1	2	3	4	5	6	...	n	n+1	n+2
Address	Length			Identificaton	Message			Checksum	

Byte 1: Device address of instruments 1 – 32, default 1

- Master → slave (range: B1h...D1h, B0h: reserved)
- Slave → master (range: 31h...51h, 30h: reserved)

Byte 2-4: Block length; each message contains 3 bytes, which include (ASCII-coded) the binary number of bytes of the overall message (including checksum bytes). When receiving, the correct number of bytes is checked
(range: 30h,30h,37h ... 3Fh,3Fh,3Fh)

Byte 5: Identification marks the message type,(range: 41h, 7Fh), see below

Byte 6-n: Information bytes, see below

Byte n+1,n+2: Checksum; every message is completed by 2 checksum bytes, which are also counted in the block length bytes. The checksum bytes are the (ASCII-coded) 8 bit wide sum of all bytes of the message including block length bytes, checksum bytes not included.
(range: 30h,30h...3Fh,3Fh)

Hexadecimal numbers are coded in form xxh, e.g. 41h means decimal 65 or ‘A’ in ASCII.

7 Protocol for tempering equipment

The protocol for tempering equipment is selected via parameter Prot = 1 .

7.1 *Master telegram*

The following telegrams sent by the master are supported by KS 50-1 *TCont*.

… 4	5	6	...	12	13+14
...	Identification	Message			Check sum

Byte 5: Identification: **41h** (‚A') and **52h** (‚R') is supported.

Byte 6-9: Set-point (= SP) in 0,1 degrees Celsius
(3 digits before, 1 digit behind the decimal point);
negative temperatures up to –99 degrees Celsius are possible
(1st byte = 2Dh)
Range: -99,9 ... 999,9 °C
Examples: 12,3 °C → 30h 31h 32h 33h
-5,6 °C → 2Dh 30h 35h 36h

Byte 10: Mould type = parameter set:
60h (`): is supported (self-tuning acc. to KS 50-1 *TCont* setting)
61h (a)...6Ah(j): commands are accepted; function as 60h

Byte 11: Control commands = operating mode:

61h (a), 6Bh (k): Switch-off function;
cooling down to return flow temperature, switch off
feedback signals: (k) cooling, (p) switched off

70h (p): Switch-off function;
heating off, cooling down to return flow temperature,
cooling off, pump off, switch off
feedback signals: (k) cooling, (p) switched off

72h (r): Switch-on function;
pump on, self-tuning on (if permitted),
closed-loop control (normal operation)
feedback signals: (r) closed-loop control

73h (s): Switch-off function;
cooling down to return flow temperature, switch off
feedback signals: (s) cooling, (p) switched off

Byte 12: Reserved, always 20h

Byte 13,14: Checksum

7.2 *Slave telegram*

With correctly received master telegram, the following reply telegram is sent by KS 50-1 *TCont* :

...4	5	6	...	17	17+18
...	Identification	Message			Checksum

Byte 5: Identification: **41h** (‚A') and **72h** (‚r') are supported.

Byte 6-9: Process value (=`Ist.1`) in 0,1 °C
(3 digits before, 1 digit behind the decimal point);
Negative temperatures up to –99 °C are possible (1st byte = 2Dh)
Range: -99,9 ... 999,9 °C
Examples: 12,3 °C → 30h 31h 32h 33h
-5,6 °C → 2Dh 30h 35h 36h

Byte 10-13: Duty cycle in % (=`YP id`) ;
negative polarity sign for cooling (1st byte = 2Dh)
Range: -100 ... 100 %
Examples: 12 % → 30h 30h 31h 32h
-34 % → 2Dh 30h 33h 34h

Byte 14: Status bit feedback

Bit 0:	controller mode	1: local 0: remote
Bit 1:	sensor mode	1: internal; (selection via `SEnS`)
Bit 2:	inadmissible set-point	1: fault
Bit 3:	(fixed)	0
Bit 4:		1: common alarm occurred (see status alarms1)
Bit 5, 6, 7: (fixed)		1, 1, 0

Byte 15: Status alarms 1

Bit 0:	sensor break	1: sensor break detected (`FbF.1`)
Bit 1:	heating defective	1: HCA error (`HCA` or `LooP`)
Bit 2:	cooling defective	0, not supported.
Bit 3:	level alarm	0, (optionally adjustable via `LEVL`)
Bit 4:	flow alarm	0, (optionally adjustable via `FLo`)
Bit 5:	temperature > safety limit	1: yes (optional `Stb` or `Lim.1`)
Bit 6, 7:	(fixed)	1, 0

Byte 16: Status alarms 2

Bit 0:	pump defective:	0; not supported
Bit 1:	phase failure:	0; not supported
Bit 2:	system error	1: input STL has responded (StL) or instrument error (E.1, E.2)
Bit 3, 4, 5, 6, 7: (fixed)		0, 0, 0, 1, 0

Byte 17: Status feedback

6Bh (k)	switch-off: cooling down to return flow temperature
6Fh (o)	during control operation: self-tuning busy
70h (p)	switch-off: heating, cooling, pump switched off
72h (r)	control operation
73h (s)	switch-off: cooling down to return flow temperature

Byte 18-19: Checksum

7.3 *Error messages*

With parity or framing errors, or with undefined characters, no reply is provided. If the checksum in the master telegram is faulty, or with an error in the message, KS 50-1 *TCont* sends a NAK message.

Not Acknowledge message structure:

1	2	3	4	5	6	7
Address	Length			Identification	check	sum

Byte 1: device address, e.g. 31h device no. 1
Byte 2-4: length (message is 7 bytes long: 30h, 30h, 37h)
Byte 5: identification: 7Fh “Not Acknowledge”
Byte 6-7: checksum

The message is also sent, if an invalid value was sent, because e.g. set-point changing via the interface is not possible during local mode.

7.4 *Alarm Reset*

During remote mode, a pending STL alarm can be acknowledged and deleted via command ”Alarm Reset”..

❑ **Master telegram:**

Structure of the alarm reset message:

...4	5	6	...	12	13+14
...	Identification		Message		Checksum

Byte 5: Instead of identification 41h (‚A‘), identification 52h (‚R‘) Alarm Reset is sent. Sending and handling of the remaining parameters are as in the standard protocol (see page 16)

❑ **Slave telegram**

...4	5	6	...	17	18+19
...	Identification		Message		Checksum

Byte 5: Identification 72h (‚r‘) instead of 41h (‚A‘) is sent. The remaining functions are as in the standard protocol (see page 17).

8 Protocol for hot-runner systems

Selecting the hot-runner protocol is done via setting Prot = 2 .
With a hot-runner system, KS 50-1 *TCont* covers one channel.

8.1 *Master telegram*

The structure of the inquiry telegram is:

...4	5	6	...	10	11+12
...	Identification		Message		Checksum

Byte 5: Identification: **41h** (‚A') is supported.

Byte 6-9:
- Set-point with command for closed-loop control: (= SP) in 0,1 °C (3 digits before, 1 digit behind the decimal point);
  Negative temperatures up to –99 °C are possible (1st *byte = 2dh)*
- Output value with command for positioning: in % (= Y̆ăBn)
  (3 digits before, 1 digit behind the decimal point)

Byte 10: Control commands

72h (r): closed-loop control (normal operation), in °C; instrument in automatic mode; after control function switch-off, self-tuning is done, if permitted

73h (s): positioning, in %; instrument in manual mode

61h (a): switch off channel, control function switched off

Byte 11-12: Checksum

Special case: first message after control system start-up: system can read up to 25 channels per device address. Therefore, the message contains up to 25 times the set-point or output value, and the control command.
However, a KS 50-1 *TCont* only uses the values for channel 1 from the message, and indicates in the reply that only one channel is provided.

8.2 *Slave telegram*

The structure of the slave telegram is.

...4	5	6	...	12	13+14
...	Identification		Message		Checksum

Byte 5: Identification: 41h (‚A‘) is supported.

Byte 6: Status device
Bit 0 1: power supply failure during operation (e.g. heating current alarm)
Bit 1, 2 (fixed) 0 0
Bit 3 1: other internal error, e.g. E.1, E.2 ...
Bit 4, 5, 6, 7: (fixed) 0 1 1 0

Byte 7-10: Channel 1
• Process value with command for closed-loop control: (=In.1) in 0,1 degrees Celsius
(3 digits before, 1 digit behind the decimal point); negative temperatures up to –99 degrees Celsius are possible (1st byte = 2Dh)
• Output variable with command for positioning: in % (=YP.id)
(3 digits before, 1 digit behind the decimal point)

Byte 11: Channel 1 : status alarms 1
Bit 0 1: switched on (C.OFF = 0)
Bit 1 1: lowering on (with SP.2 = 1)
Bit 2 0: closed-loop control (automatic),
1: positioning (manual mode)
Bit 3 (fixed) 0
Bit 4, 5, 6, 7 : (fixed) 0 1 1 0

Byte 12: Channel 1 : status alarms 2
Bit 0 1: lead break, e.g.: LooP = 1
Bit 1 1: only undercurrent, e.g. HCA = 1
Bit 2 1: sensor defective, e.g. FbF.1 , Sht.1 , POL.1
Bit 3 0
Bit 4, 5, 6, 7 : (fixed) 0 1 1 0

Byte 13-14: Checksum

9 ORDERING INFORMATION

KS 50-1 *TCont*

K	S	5	0	-	1			-		0	3			-		46

Flat pin connectors	**0**			
Screw terminals	**1**			
90..250V AC, 3 relays		**0**		
24VAC / 18..30VDC, 3 relays		**1**		
90..250V AC, 2 relays + mA/V/logic		**2**		
24VAC / 18..30VDC, 2 relays + mA/V/logic		**3**		
RS485/422 + U_T + di2/3 + OUT5/6			**1**	
TTY + U_T + di2/3 + OUT5/6			**3**	
Standard configuration				**0**
Configuration to specification				**9**
no manual				**0**
manual german				**D**
manual english				**E**
Standard (CE certified)				**0**
UL-certified (on request)				**U**

Accessories delivered with the controller
Operating instructions (if selected in ordering code)

- 2 mounting clamps
- operating note in 15 languages

Optional accessories and ordering information

Description			Order no.
Current converter 50A AC			9404-407-50001
PC adapter, for connecting the **BlueControl**® software to the **BluePort**			9407-998-00001
Standard rail adapter			9407-998-00061
Operating manual KS 50-1 (Standard)	German		9499-040-62818
Operating manual KS 50-1 (Standard)	English		9499-040-62811
Operation notes *TCont*	German		9499-040-64418
Operation notes *TCont*	English		9499-040-64411
BlueControl (Engineering-Tool)	Mini	Download	www.pma-online.de
BlueControl (Engineering-Tool)	Basic		9407-999-11001
BlueControl (Engineering-Tool)	Expert		9407-999-11011

10 TECHNICAL DATA

INPUTS

SURVEY OF THE INPUTS

Input	Used for:
INP1	x (process value)
INP2	Heating current, ext. set-point
di1	Operation disabled, switch-over to second setpoint SP.2, external setpoint SP.E, fixed output value Y2, manual operation, controller off, disabling of manual key, reset of stored alarms, boost, parameters 1/2, safety temperature limiter, start/stop with local operation, sensor operating mode, level alarm, flow alarm
di2	
di3	

PROCESS VALUE INPUT INP1

Resolution: > 14 Bit
Decimal point: 0 to 3 decimals
Limiting frequency: adjustable 0.000...9999 s
Scanning cycle: 100 ms
Measured value correction: 2-point or offset correction

Thermocouples

Input impedance: 1 MΩ
Effect of source resistance: 1 µV/Ω

Cold junction compensation

Max. additional error 0.5 K

Sensor break monitoring

Sensor current: 1 µA
Operating sense configurable

Resistance thermometer

Connection: 3-wire
Lead resistance: max. 30 Ohm
Input circuit monitor: Break and short circuit

Resistance measuring range

The **BlueControl** software can be used to match the input to the sensor KTY 11-6 (characteristic is stored in the controller).

Physical measuring range: 0...4500 Ohm
Linearization segments: 16

Current and voltage signals

→ Table 3 (page 24)

Span start, end of span: anywhere within measuring range
Scaling: selectable -1999...9999
Linearization: 16 segments, adaptable with **BlueControl**

Table 1 Thermocouple ranges

Thermocouple		Range		Accuracy	Resolution (∅)
L	Fe-CuNi (DIN)	-100...900°C	-148...1652°F	≤ 2K	0.1 K
J	Fe-CuNi	-100...1200°C	-148...2192°F	≤ 2K	0.1 K
K	NiCr-Ni	-100...1350°C	-148...2462°F	≤ 2K	0.2 K
N	Nicrosil/Nisil	-100...1300°C	-148...2372°F	≤ 2K	0.2 K
S	PtRh-Pt 10%	0...1760°C	32...3200°F	≤ 2K	0.2 K
R	PtRh-Pt 13%	0...1760°C	32...3200°F	≤ 2K	0.2 K
	special	-25 … 75 mV		0.1%	0.01%

Table 2 Resistance transducers

Type	Sensor current	Range		Accuracy	Resolution (∅)
Pt100	0,2mA	-200...850°C	-328...1562°F	≤ 1K	0.1K
Pt1000		-200...850°C	-328...1562°F	≤ 2K	0.1K
Resistance		4500 Ω		≤ 0.1%	0.051%

Table 3 Current and voltage

Range	Input resistance	Accuracy	Resolution (∅)
0-10 Volt	≈ 110 kΩ	≤ 0.1 %	0.6 mV
0-20 mA	49 Ω (voltage requirement ≤ 2.5 V)	≤ 0.1 %	1.5 µA

Decimal point: adjustable
Input circuit monitor:: 12.5% below span start (2mA, 1V)

SUPPLEMENTARY INPUT INP2

Resolution: > 14 Bit
Scanning cycle: 100 ms
Accuracy: better 0.1%

Heating current measurement

via current transformer

Measuring range: 0...50mA AC
Scaling: adjustable; -1999...0.000...9999 A

Current measurement range

Input resistance: approx. 120 Ω
Span: configurable within 0 to 20mA
Scaling: adjustable -1999...9999
Input circuit monitor: 12.5% below span start (4...20mA → 2mA)

CONTROL INPUT DI1

Configurable as direct or invers switch or push-button! Connection of a potential-free contact suitable for switching „dry" circuits.

Switched voltage: 2.5 V
Switched current: 50 µA

CONTROL INPUTS DI2, DI3

Configurable as switch or push-button !
Optocoupler input for active triggering

Nominal 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

TRANSMITTER SUPPLY U_T

Output: 22 mA / ≥ 18 V

If the universal output OUT3 is used there may be no external galvanic connection between measuring and output circuits!

OUTPUTS

SURVEY OF THE OUTPUTS

Output	Used for
OUT1 OUT2 (relay)	Control output for heating/cooling or open/close, limit contacts, alarms, end of program, pump control *
OUT3 (relay or logic)	as OUT1 and OUT2
OUT3 (continuous)	Control output, process value, set-point, control deviation, transmitter supply 13 V / 22 mA
OUT5 OUT6 (optocoupler)	as OUT1 and OUT2

** All logic signals can be OR-linked !*

RELAY OUTPUTS OUT1, OUT2

Contacts: 2 NO contacts with common connection
Max. contact rating: 500 VA, 250 VAC, 2A at 48...62 Hz, resistive load
Min. contact rating: 6V, 1 mA DC
Operating life (electric): 800,000 duty cycles with max. rating

OUT3 USED AS RELAY OUTPUT

Contacts: Potential-free changeover contact
Max. contact rating: 500 VA, 250 VAC, 2A at 48...62 Hz, resistive load
Min. contact rating: 5V, 10 mA AC/DC
Operating life (electric): 600,000 duty cycles with max. rating

Galvanic isolations:

Safety isolation	
Functional isolation	

Mains supply	Process value input INP1 Supplementary input INP2 Digital input di1
Relay outputs OUT1,2	RS485 /422 interface TTY interface
Relay output OUT3	Digital inputs di2, 3
	Universal output OUT3 Transmitter supply U_T
	OUT5, OUT6

Note: If the relays OUT1...OUT3 operate external contactors, these must be fitted with RC snubber circuits to manufacturer specifications to prevent excessive switch-off voltage peaks.

OUT3 AS UNIVERSAL OUTPUT

Galvanically isolated from the inputs.

Freely scalable

Resolution:	11 bit
Time constant of the D/A converter T_{90}:	50 ms
Limiting frequency of the continuous controller:	> 2 Hz

Current output

0/4...20 mA, configurable.

Signal range:	0...approx. 21.5mA
Load :	≤ 500 Ω
Load effect:	0.02%/100 Ω
Resolution:	≤ 22 µA (0.1%)
Error:	≤ 40 µA (0.2%)

Voltage output

0/2...10V configurable

Signal range:	0...11 V
Load:	≥ 2 kΩ
Load effect:	none
Resolution:	≤ 11 mV (0.1%)
Error:	≤ 20 mV (0.2%)

OUT3 used as transmitter supply

Output:	22 mA / ≥ 13 V

OUT3 used as logic output

Load ≤ 500 Ω	0/≤ 20 mA
Load > 500 Ω	0/> 13 V

OUTPUTS OUT5, OUT6

Galvanically isolated opto-coupler outputs.
Grounded load: common positive control voltage.
Output rating: 18...32 VDC; ≤ 70 mA
Internal voltage drop: ≤ 1V with I_{max}
Protective circuit: built-in against short circuit, overload, reversed polarity (free-wheel diode for relay loads).

POWER SUPPLY

Depending on version:

AC SUPPLY

Voltage:	90...260 V AC
Frequency:	48...62 Hz
Power consumption:	approx. 7.0 VA

UNIVERSAL SUPPLY 24 V UC

AC voltage:	20,4...26,4 V AC
Frequency:	48...62 Hz
DC voltage:	18...31 V DC
Power consumption:	approx. 7 VA (W)

BEHAVIOUR WITH POWER FAILURE

Configuration, parameters, and adjusted set-points, control mode: non-volatile storage in EEPROM

BLUEPORT® FRONT INTERFACE

Connection of PC via PC adapter (see „Accessories"). **The BlueControl®** software is used to configure, set parameters, and operate the KS 50-1 *TCont*.

BUS INTERFACE

Galvanically isolated.
Screened cables must be used.

RS 485 / 422

Physical:	RS 485/422
Transmission speed:	2400, 4800, 9600, 19.200 Bit/s
Parity:	Even, odd, none
Address range:	1...32
Number of controllers/segm:	32

TTY (20 mA CURRENT LOOP)

Physical:	20 mA current loop
Transmission speed:	2400, 4800, 9600, 19.200 Bit/s
Parity:	Even, odd, none
Address range:	1...32
Voltage drop:	≤ 2.2V

Protocols

MODBUS RTU, protocol for tempering units*, protocol for hot runner systems*
* according to Arburg specification

ENVIRONMENTAL CONDITIONS

Protection modes

Front panel:	IP 65
Housing:	IP 20
Terminals:	IP 00

Permissible temperatures

For specified accuracy:	0...60°C
Warm-up time:	< 15 minutes
Temperature effect::	< 100ppm/K
For operation:	-20...65°C
For storage:	-40...70°C

Humidity

75% yearly average, no condensation

Shock and vibration

Vibration testFc (DIN 68-2-6)

Frequency:	10...150 Hz
Unit in operation:	1g or 0.075 mm
Unit not in operation:	2g or 0.15 mm

Shock test Ea (DIN IEC 68-2-27)

Shock:	15g
Duration:	11ms

Electromagnetic compatibility

Complies with EN 61 326-1

- Meets the immunity requirements for continuous, unattended operation
- Meets the radiation requirements of Class B for rural areas
- In case of surge interference, increased measurement errors must be expected

GENERAL

Housing

Material:	Makrolon 9415 flame-retardant
Flammability class::	UL 94 V0, self-extinguishing

Plug-in module, inserted from the front

Safety tests

Complies with EN 61010-1 (VDE 0411-1):
Over voltage category II
Contamination class 2
Working voltage range 300 V
Protection class II

Certifications

UL certification (applied for)

Electrical connections

- Flat-pin connectors 1 x 6.3 mm or 2 x 2.8 mm to DIN 46 244
- Screw terminals

Mounting

Panel mounting with two fixing clamps at top/bottom or left/right
Close mounting possible

Mounting position:	not critical
Weight:	0.27kg

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