

thermoMETER CTR communication interface

Serial interface parameters

Baud rate:	9600...115200, set by user (factory default: 9600)
Data bits:	8
Parity:	none
Stop bits:	1
Flow control:	off

Protocol

The protocol of the thermoMETER CT is a binary protocol. Checksum is needed for set commands but not for read commands. The protocol has no additional overhead with CR, LR or ACK bytes. This makes the communication fast.

To get the current object temperature the user must send a simple 01_{hex} byte and the CT will respond with the two byte temperature. To get the temperature as floating value subtract 1000 and divide by 10.

Checksum's

If the device is setup to use checksums any SET command must have a checksum suffix.

The checksum can be switched off with command AD. After every "Power on" the device will expect the checksum again.

The checksum byte is build by the arithmetical XOR of all command bytes except of the address prefix.

To switch off the checksums with the SET command AD you must send the checksum.

To switch on the checksums with the SET command AD you must not send the checksum.

Addressing RS485

This is relevant for communication with the RS485 bus only. thermoMETER CT's with RS232 or USB communication will respond to any address. If you use the RS485 interface board you must use the multidrop addresses.

A multidrop address is a simple prefix byte to the command. The byte is build by adding the hexadecimal value B0 to the device address. B5 01 will read the temperature from the device with the address 5.

The address of any device can be set by the device user interface ("M__01") or by the communication interface with the command 90.

A special case is address prefix B0 for set commands. Because there is no multidrop address 0 this addresses no certain device. But a SET command with prefix broadcast the command to all devices at the RS485 bus.

Note: The command is executed immediately on any of the devices even if they do not respond to the command. That is because all are slaves and can't talk at the same time.

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Basic Functions

DECIMAL	HEX	Command	Data	Answer	Result	Unit
99	0x63	READ 2C Temp	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C
98	0x62	READ 1C Temp	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C
100	0x64	READ Attenuation	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	
3	0x03	READ Temp - Box	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C
129	0x81	READ Act. Temp.	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C
108	0x6C	Process Source read/set	byte1	byte1	0x00 = T2C , 0x01 = T1C 0x02 = At 0xff for reading	
1	0x01	READ Tprocess temp.	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C
73	0x49	Read/Set Maindisplay	Byte1	Byte1	0 = 2C, 1 = 1C 2 = Attenuation 3 = Box Temp., 4 = Process 255 = reading	

IR- Settings

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
88	0x58	Read/Set SLOPE	byte1 byte2	byte1 byte2	$(\text{byte1} * 256 + \text{byte2}) / 1000$ (for reading all Bytes = 0)		yes
90	0x5A	Read/Set Epsilon	byte1 byte2	byte1 byte2	$(\text{byte1} * 256 + \text{byte2}) / 1000$ (for reading all Bytes = 0)		yes
93	0x5D	Read/Set max attenuation	byte1 byte2	byte1 byte2	$(\text{byte1} * 256 + \text{byte2}) / 1000$ (for reading all Bytes = 0)		yes

Aiming

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
37	0x25	READ Spot Illumination	none	byte1	ON if byte1 =1 OFF if byte1=0		no
165	0xA5	SET Spot Illumination	byte1	byte1	ON if byte1 =1 OFF if byte1=0		yes

Signal Processing

Averaging (applies to Tprocess)

Smart averaging stops averaging if big temperature changes are occurring. For more information see manual.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
6	0x06	READ AVG Time	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2}) / 10$	seconds	no
134	0x86	SET AVG Time	byte1 byte2	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2}) / 10$	seconds	yes
28	0x1C	READ AVG Mode (smart averaging)	none	byte1	1 = smart averaging 0 = normal		no
156	0x9C	SET AVG Mode (smart averaging)	byte1	byte1	1 = smart averaging 0 = normal		yes

Hold Functions (applies to Tprocess)

To set peak or valley hold set a value <0 seconds. Valley hold disables peak hold and vice versa. Note, that the peak pick function is only available on short wavelength sensors (M-1/2/3, ratio), see manual.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
8	0x08	READ Peak Hold Time	none	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$	seconds	no
136	0x88	SET Peak Hold Time	byte1 byte2	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$	seconds	yes
7	0x07	READ Valley Hold Time	none	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$	seconds	no
135	0x87	SET Valley Hold Time	byte1 byte2	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$	seconds	yes
29	0x1D	READ Advanced Hold Mode	none	byte1	0 = off 1 = Peak 2 = Valley		no
157	0x9D	SET Advanced Hold Mode	byte1	byte1	0 = off 1 = Peak 2 = Valley		yes
30	0x1E	READ Advanced Hold threshold	none	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2} - 1000) / 10$		no
158	0x9E	SET Advanced Hold Threshold	byte1 byte2	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2} - 1000) / 10$		yes
34	0x22	READ Adv. Hold Hysteresis	none	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$		no
162	0xA2	SET Adv. Hold Hysteresis	byte1 byte2	byte1 byte2	$=(\text{byte1} * 256 + \text{byte2}) / 10$		yes
65	0x41	READ Pick Mode	none	byte1	0 - off 1 - Peak Pick 2 - Valley Pick		no
174	0xAE	SET Pick Mode	byte1	byte1	0 - off 1 - Peak Pick 2 - Valley Pick		yes

Analog output settings

For the analog output there are the output channels 1 and 2. They are to be set up with the ALARMx. An output which is set up to digital is an alarm output. Details are shown in the tables below. For further information see the examples.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
40	0x28	READ ALARMx Mode	byte1	byte1 byte2			no
168	0xA8	SET ALARMx Mode	byte1 byte2	byte1 byte2			yes

First byte defines the output channel to be set up. The output channel is channel 4->

Byte1=3,

Byte 2 is the sum of bit0-bit7

Bit	Description	valence
Bit7	Source for the alarm is the box temperature	128
Bit 6	0	
Bit5	Source for the alarm is the Tprocess	32
Bit4	0 = contact is normally closed, 1 = contact is normally open	16
Bit3	1 = Output is digital, 0 = output is analog (if not used for alarm)	8

Bit2, Bit1 and Bit0 decode binary the value 0 to 3:

0 = Output as 0...10mV

1 = Output as 0...5V

2 = Output as 0...20mA

3 = Output as 4...20mA

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
24	0x18	READ Low End for outputs	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C	no
152	0x98	SET Low End for outputs	byte1 byte 2	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C	yes
25	0x19	READ High End for outputs	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C	no
153	0x99	SET High End for outputs	byte1 byte 2	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C	yes
17	0x11	READ Skal_Out_Min	none	byte1 byte2	mV or µA		no
145	0x91	SET Skal_Out_Min	byte1 byte2	byte1 byte2	mV or µA		yes
18	0x12	READ Skal_Out_Max	none	byte1 byte2	mV or µA		no
146	0x92	SET Skal_Out_Max	byte1 byte2	byte1 byte2	mV or µA		yes

Alarm Settings

The optris has up to five alarms. AL 1 sets the blue LED of the electronic box. AL 2 sets the red LED. AL4 sets the analog output (out-mV/mA) to an alarm output. DAL1 sets the I/O1 Pin. DAL2 sets the I/O2 Pin.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
		READ AL4					no
13	0x0D	value	none	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$	°C	
		SET AL4					yes
141	0x8D	value	byte1 byte2	byte1 byte2	$= (\text{byte1} * 256 + \text{byte2} - 1000) / 10$		

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
104	0x68	Dig. ALx Function	byte1 byte2	byte1 byte2	byte1: 0=DAL1 / 1=DAL2 , byte2: 0=dig. Alarm / 1=Valid Lo / 2=Valid Hi / 3=Hold LoHi / 4=Hold HiLo (0x FF for reading)	°C	yes
105	0x69	Dig. ALx Source	byte1 byte2	byte1 byte2	byte1: 0=DAL1 / 1=DAL2 / 2=AL1 / 3=AL2 byte2 : 0=off / 1=T2C / 2=T1C / 3=Tau / 4=Tbox (0x FF for reading)		yes
106	0x6A	Dig. ALx Value	byte1 byte2 byte3	byte1 byte2 byte3	byte1: 0=DAL1 / 1=DAL2 / 2=AL1 / 3=AL2 , byte2*256+byte3 = Temperature (0x 00 00 for reading)		yes
107	0x6B	Dig. ALx No/Nc	byte1 byte2	byte1 byte2	byte1: 0=DAL1 / 1=DAL2 / 2=AL1 / 3=AL2 , byte2 : 0=no / 1=nc (0x FF for reading)		yes

Advanced Settings

Sensor Information/ Calibration

If sensor head or electronic is exchanged it is necessary to set the right head code. With the tweak function the sensor can be linear recalibrated.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
14	0x0E	READ Serial number	none	byte1 byte2 byte3	=byte1*65536 + byte2*256 + byte3		no
15	0x0F	READ FW Rev.	none	byte1 byte2	=byte1*256 + byte2		no
69	0x45	READ Sensor information	none	byte1 - byte6	byte1,byte2 = Modelword , byte3,byte4 = lower temperature byte5,byte6 = upper temperature		no
91	0x5B	Read/Set Gain1C	byte1 byte2	byte1 byte2	(byte1*256+byte2)/1000 (for reading all Bytes = 0)		Yes
89	0x59	Read/Set Gain2C	byte1 byte2	byte1 byte2	(byte1*256+byte2)/1000 (for reading all Bytes = 0)		yes

Advances Digital Communication Settings

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
45	0x2D	READ if check sum expected	none	byte1	0 - without check sum 1 - with check sum		no
173	0xAD	SET check sum expected	byte1	byte1	0 - CT expects no check sum 1 - CT expects check sum		yes
80	0x50	Read out Burst String		byte1 byte2 byte3 byte4	Burstmode Description below		no
81	0x51	Set Burst String	byte1 byte2 byte3 byte4	byte1 byte2 byte3 byte4			yes
82	0x52	Set Burstmode	byte1	byte1	1 = start , 0 = stop		yes
130	0x82	SET Baudrate	byte1		Parameter byte1 = 0 - 9600 , 1 - 19200 , 2 - 38400 , 3 - 57600 4 - 115200		yes

Loop Maintenance

In order to simulate hot objects in the scene and double check the analog circuits the loop maintenance makes the analog output sending fixed values. Note: It is necessary to reset DAC percentage to get back to measure mode.

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
26	0x1A	READ Out value for IR-DAC percentage	none				no
154	0x9A	SET IR DAC percentage	byte1	byte1	0..100		yes
27	0x1B	READ Out value for Amb. DAC percentage	none				no
155	0x9B	SET AMB. DAC percentage	byte1	byte1	0..100		yes
143	0x8F	RESET the DAC percentage output	none				yes

Further Advanced Settings

DECIMAL	HEX	Command	Data	Answer	Result	Unit	Check sum
169	0xA9	SET DEFAULT	none	byte1	Set CT default Data (as MODE + DOWN button)		yes
67	0x43	READ PANEL LOCK	none	byte1	0 - Keys available 1 - Keys locked		no
68	0x44	SET PANEL LOCK	byte1	byte1	0 - Keys available 1 - Keys locked		yes
9	0x09	READ temp. Unit	none	byte1	C if byte1 = 1 / °F if byte1 = 0		no
137	0x89	SET Temp. Unit	byte1	byte1	C if byte1 = 1 / °F if byte1 = 0		yes

Contact information

If you plan your own software to query and control the thermoMETER CT sensor and you have further questions please contact:

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