

optris MS/ LS/ P20 series Communication interface

(Revision 1.5 / 06.09.2011)

1 Serial interface parameters

Baud rate: 115200
Data bits: 8
Parity: none
Stop bits: 1
Flow control: off

2 Protocol

The protocol of the optris MS/ LS/ P20 is a binary protocol. A checksum is needed for all commands. The protocol has no additional overhead with CR, LR or ACK bytes. This makes the communication fast. Any command starts with a single byte command code.

Read commands: $01_{\text{hex}} \dots 2F_{\text{hex}}$

Set commands: $81_{\text{hex}} \dots AF_{\text{hex}}$

Example: To get the current object temperature the user must send a simple 01_{hex} byte (and checksum 01_{hex}) and the device will respond with the two byte temperature. Deducted by 1000_{dec} the result is the temperature in tenth degrees. For more examples see last section of this document.

Set command byte must be followed by the appropriate data. For example to set the emissivity to 0.95 the user must send the set command byte $A0_{\text{hex}}$, the data bytes 03_{hex} $B6_{\text{hex}}$, and the checksum 15_{hex} .

3 Data formats

All numbers with more than one byte are big ending encoded (most significant byte first).

Data	Bytes	Encoding	Example	Remarks
Temperatures / V_{CC}	2	$(\text{byte1} * 256 + \text{byte2} - 1000) / 10$	04 D3 -> $= (04D3_{\text{hex}} - 1000) / 10$ $= (1235 - 1000) / 10 = 23.5^{\circ}\text{C}$	Any temperature on the interface is in Celsius. Conversion from/to Fahrenheit must be done by the PC.
Emissivity	2	$(\text{byte1} * 256 + \text{byte2}) / 1000$	03 B6 -> $= 03B6_{\text{hex}} / 1000$ $= 950 / 1000 = 0.950$	
Energy Gain	2	$(1/2^{15}) * (\text{byte1} * 256 + \text{byte2})$	81 93 -> $(1/2^{15}) * 8193_{\text{hex}}$ $= 33171 / 32768 = 1.0123$	
Firmware/ Hardware revision	2	Fixed point encoding: High byte = major Low byte = minor	02 12 -> $= \text{rev } 2.18$	
Serial number	4	unsigned long	003DCC5D -> $= 3DCC5D_{\text{hex}} = 4050013$	

4 Command list

The following table lists all commands accessible for the user.

Function	Data bytes	R read	W write	Unit	Description / remarks	MS	LS	P20
Device					static device data			
Firmware revision	2	10	-		See data format	x	x	x
Hardware revision	2	11	-		See data format	x	x	x
Serial no.	4	12	-		See data format	x	x	x
Production date	3	13	-			?	?	?
Calibration date	3	14	-			?	?	?
Lower limit of device range	2	15	-	°C	For example -40.0°C	x	x	x
Upper limit of device range	2	16	-	°C	For example 900.0°C	x	x	x
Model code	1	17	-		To distinguish different models	x	x	x
Code for device capabilities	2	18	-		for different capabilities	x	x	x
Setup					User device data			
Emissivity	2	20	A0	ε	Default = 0.95	x	x	x
High alarm value	2	21	A1	°C	Default = 100°C	x	x	x
Low alarm value	2	22	A2	°C	Default = 0°C	x	x	x
Gain	2	24	A4		External adjustable gain (energy) Default = 1.0	x	x	x
Offset	2	25	A5	°C	Ext. adjustable offset (temperature) Default = 0.0	x	x	x
Ambient temperature	2	26	A6	°C	Ambient-Control, Default = 23°C		x	
Setup word	2	27	A7		See table	x	x	x
Bargraph cycle time	1	28	A8	mec	Cycle time of the LS display's bargraph Default = 40ms		x	
Date / time	4	29	A9	sec.	Seconds since 1.1.2001 00:00	x	x	x
Data					Read only data			
T _{Obj}	2	01	-	°C	Object temperature	x	x	x
T _{Int}	2	02	-	°C	Internal temperature / head Temperature	x	x	x
T _{Obj} Max	2	03	-	°C	Maximum object temperature	x	x	x
T _{Obj} Min	2	04	-	°C	Minimum object temperature	x	x	x
T _{Obj} Avg	2	05	-	°C	Average object temperature	x	x	x
T _{TC}	2	06	-	°C	TC probe temperature	x	x	x
T _{TC-Socket}	2	07	-	°C	Temperature of the TC socket	x	x	x
V _{cc}	2	0E	-	V	Battery voltage (debug only)		x	
Control								
Control byte	1	-	AD		Delete logger, set default: see control byte	x	x	x
Start boot loader	x		3F		Firmware update only	x	x	x
Memory					Data logger			
Used data logger entries	2	19	-		Number of used logger entries	x	x	x
Data logger entry	x	1A	-		The command must follow the number of the logger entry 1A 00: live data burst (current temp's) 1A 01: first logger entry	x	x	x
Misc.								
LCD memory	20	1C	-		For debug only		x	
ADC-Werte	16	1D	-		For debug only		x	
General status	2	1E	-		See status general word	x	x	x
Key status	2	1F	9F		See key status word.		x	
Material table	x * 6	2B	AB		2 bytes for emissivity / 4 bytes for material		x	
Table for predefined data of logger remarks	x * 4	2C	AC		4 bytes for any predefined remark		x	

5 Data structures

Setup word (R:27 / W:A7)

Data	Bit	Default		MS	LS	P20
High Alarm	0	On	1 = trigger high Alarm		x	
Low Alarm	1	On	1 = trigger low alarm		x	
Temperature unit	2	°C	0 = °C, 1 = °F	x	x	x
Audible alarm	3	On	1 = Audible alarm available	x	x	x
TC	4	Off	1 = TC-Temp. Available in display		x	
Lock	5	Off	1 = device do not turn off automatically	x	x	x
Disable user interface (key's)	6	Off	1 = user interface is locked		x	
Ambient Source	7	T _{int}	1 = T _{int} , 0 = user value (cmd. 0xA6)		x	
LASER-Flash	8	Off	1 = LASER flashes on alarm condition		x	
Bargraph mode	9	1	1 = Difference between Max und Min 0 = Difference between Hi/Lo-Alarm		x	
Makro mode	10,11	Auto	0 = Off, 1 = On, 2= Auto		x	
Material table available	12	Off	1 = besides emissivity the material names are usable		x	
User definable remarks for data logger	13	Off	1 = User definable remarks for data logger are available		x	
LASER	14	On	1 = LASER available	x	x	x
Backlight	15	On	1 = Backlight available	x	x	x

Control byte (W: AD)

Command	Data		MS	LS	P20
Delete data logger	0x03	Deletes all data logger entries	x	x	x
Set default	0x05	Set device to factory default	x	x	x

General status word (R:1E)

Command	Bit		MS	LS	P20
High alarm	0	True, if alarm is active	x	x	x
Low alarm	1	True, if low alarm is active	x	x	x
LASER	3	True, if LASER is on	x	x	x
Back light	4	True, if back light is on	x	x	x
CF/SF	5	1 = Close focus, 0 = Standard focus		x	
Tilt sensor	6	1 = device is tilt		x	
Logger full	8	All Logger entries are used	x	x	x
Thermocouple	15	True, if TC present	x	x	x

Key status word (R:1F / W:9F)

Set command can be used to emulate a pressed key.

Note: Emulating the Trigger will not activate the LASER (for security)

MS/ P20		
Command	Bit	
Trigger	0	1, if trigger is pushed
Up	1	1, if Up is pushed
Down	2	1, if Down is pushed
Mode	3	1, if Mode is pushed

LS		
Command	Bit	
Trigger	0	1, if trigger is pulled
Up	1	1, if Up is pushed
Down	2	1, if Down is pushed
Mode1	3	1, if Mode1 is pushed
Mode2	4	1, if Mode2 is pushed

6 Data logger

Byte sequences for command 1A:

MS/ P20		
Value	Bytes	Unit
Entry number	1	-
T _{Obj}	2	°C
T _{Int}	2	°C
T _{TC}	2	°C
	Σ=7	

LS		
Value	Bytes	Unit
Entry number	1	-
T _{Obj}	2	°C
T _{Int}	2	°C
T _{Obj} Max	2	°C
T _{Obj} Min	2	°C
T _{Obj} Avg	2	°C
T _{TC}	2	°C
High alarm	2	°C
Low alarm	2	°C
Emissivity	2	-
Time	4	sec.
Remark	4	ASCII
	Σ=27	

7 Checksums

Any command must have a checksum suffix. Any answer has a checksum suffix.
The checksum byte is build by the arithmetical XOR of all command bytes.

8 Examples

Read Commands	Send *)	Receive*)	
Reading a target temperature	01 [01]	04 D3 [D7]	$(04D3_{\text{hex}} - 1000)/10 = (1235-1000)/10 = 23.5^{\circ}\text{C}$
Reading emissivity	20 [20]	03 B6 [B5]	$03B6_{\text{hex}}/1000 = 950/1000 = 0.950$
Reading serial number	12 [12]	3D CC 5D	$3DCC5D_{\text{hex}} = 4050013$
Reading first data logger entry	1A 01 [1B]	04 D3 ... [xx]	22 bytes (MS/LS/ P20)
Reading status	1E [1E]	31 [31]	High alarm condition, LASER and back light is active
Reading key status	1F [1F]	08 [08]	LS: Mode1 is pushed

Set Commands	Send *)	Receive*)	
Setting the high alarm value	A1 04 D3 [76]	04 D3 [D7]	$(04D3_{\text{hex}} - 1000)/10 = (1235-1000)/10 = 23.5^{\circ}\text{C}$
Setting the emissivity to 0.95	A0 03 B6 [15]	03 B6 [B5]	$03B6_{\text{hex}}/1000 = 950/1000 = 0.950$
Delete data logger	AD 03 [AE]	03 [03]	Deletes all data logger entries
Set default	AD 05 [A8]	05 [05]	Set device to factory default
Push a key via ser. interface	9F 04 [9B]	04 [04]	Simulates push "Down"

*) Checksum in square brackets