02-2410

FASTUS
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INDEX LIST

Non-contact thermometer stationary type

TI-S Series

IO-Link setting file (IODD file) can be downloaded from our web site.
https://www.optex-fa.com

IO-Link

OPTEX FA CO.,LTD.

Communication specifications

Minimum cycle time	0.5 ms	
Baud rate	COM 3 (230.4 kbps)	
M-Sequence code in Pre-operate mode	0	
M-Sequence code in Operate mode	4	
ISDU support	Yes	
IO-Link revision	1.1.3	
Number of process input data bytes	4 bytes	
Number of process output data bytes	1 bytes	
Vender ID	DEC: 1076	HE: 0434
Device ID	DEC: 98306	HE: 18002
Data storage class	Data Storage class 1:automatic DS	
Profile	ProfileID : 10(0x000a) Measuring Sensor ProfileID : 16384(0x4000) Common Profile	

Process Data Format

Input data (IO-Link Master ← TI-SC controller)

Byte number	Bit 7	6	5	4	3	2	1	0
n+0	Upper eight bits of the measured temperature *1							
n+1	Lower eight bits of the measured temperature *1							
n+2	Scale eight bits *2							
n+3	Not used (fixed at 0)						Laser output	Upper limit alarm	Lower limit alarm

*1: The measured temperature is sent as an integer multiplied by 10. When the data is 1000, this indicates 100°C.
*2: The scale is fixed at -1. This indicates that the measured temperature data must be multiplied by 10 to the power of -1.

Word allocation

(Example) When an OPTEX FA IO-Link UR Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	Process data n+2	Process data n+3
N+1	Process data n+0	Process data n+1

Word number	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	n+2 (scale eight bits)								Reserved					Laser output	Upper limit alarm	Lower limit alarm
N+1	n+0 (upper eight bits of the measured temperature)								n+1 (lower eight bits of the measured temperature)							

Output data (IO-Link Master → TI-SC controller)

The functions are the same as the external input when a general-purpose I/O cable connection is used.

Byte number	Bit 7	6	5	4	3	2	1	0
n+0	Not used					Hold	Trigger	Laser control

Word allocation

(Example) When an OPTEX FA IO-Link UR Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	Not used	Process data n+0

Word number	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	Not used								Not used					Hold	Trigger	Laser control

Service Data

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]
Aapplication reset	Aapplication reset	2 (0x02)	0	W	-	UINT	1	—	129: Returns the settings to their initial status. 160: Resets the graph display and displays it again from the beginning. 161: Initializes bank 1. 162: Initializes bank 2. 163: Initializes bank 3. 164: Initializes bank 4. 165: Error (warning) cancel	
Unit interface	Device lock	12 (0x0C)	0	RW	○	UINT	2	0	bit 02: 1 (Device lock activated)	
Device information	Serial number (Sensor head)	21 (0x0E)	0	R		UINT	14	—		
	Application tag	24 (0x18)	0	RW	○	STRING	32	**...**		
	Function tag	25 (0x19)	0	RW	○	STRING	32	**...**		
	Location tag	26 (0x1A)	0	RW	○	STRING	32	**...**		
Operation mode	Operation mode	64 (0x40)	0	RW	○	UINT	2	100	40:High speed 50:50ms 100:100ms 200:200ms 500:500ms 1000:1 s 2000:2 s 5000:5 s 10000:10 s 20000:20 s	
Alarm	Alarm select	65 (0x41) *2	0	RW	○	UINT	1	3	0:Not use 1:upper limit only 2:lower limit only 3:Upper & lower	
	Upper limit	66 (0x42) *2	0	RW	○	INT	2	5000	-400 to 5000	Units: °C
								9320	-400 to 9320	Units: °F
	Lower limit	67 (0x43) *2	0	RW	○	INT	2	-400	-400 to 5000	Units: °C
								-400	-400 to 9320	Units: °F
	Hysteresis	68 (0x44) *2	0	RW	○	UINT	1	20	0 to 100	Units: °C
								36	0 to 180	Units: °F
										* The upper/lower limit settings are sent/received as integers multiplied by 10. Specify 250 for 25.0°C.
Bank	Selected bank number	69 (0x45)	0	RW		UINT	1	1	1 to 4	
Emissivity	Emissivity	70 (0x46) *1	0	RW	○	UINT	2	950	100 to 1200	* Emissivity is sent/received as an integer multiplied by 1000. Specify 850 for 0.850.
	Auto calculation	71 (0x47)	0	RW		INT	2	—	-400 to 5000	Units: °C
									-400 to 9320	Units: °F
										If the emissivity of the measurement target is not known and the target temperature is known, emissivity is calculated automatically. *3
	Result of auto calculation	72 (0x48)	0	R		UINT	1	—	0: Successful 1: Calculation result was not within the valid range. 2: Calculation is not possible because the target temperature and head temperature are too close.	
Display	Sensor head internal temperature	73 (0x49)	0	R		INT	2	—	-400 to 5000	Units: °C
									-400 to 9320	Units: °F
										* Temperature is received as an integer multiplied by 10. When the data is 1000, this indicates 100.0°C.
Measurement mod	Measurement mode	96 (0x60)	0	RW	○	UINT	1	0	0 : Normal 1 : Sample hold 2 : Peak hold 3 : Valley hold 4 : Edge detection	
	Edge detect time	97 (0x61)	0	RW	○	UINT	1	10	1 to 100	Units: Seconds * Enabled only when index number 96 (measurement mode) is "4" (edge detection mode). * Edge detect time is sent/received as an integer multiplied by 10. Specify 80 for 8.0 seconds.
	Edge detect diff	98 (0x62)	0	RW	○	UINT	2	10	10 to 1000	Units: °C
								18	10 to 1800	Units: °F
										* Enabled only when index number 96 (measurement mode) is "4" (edge detection mode). * Edge detect diff is sent/received as an integer multiplied by 10. Specify 250 for 25.0°C.
I/O settings	I/O settings	128 (0x80)	0	RW	○	UINT	1	0	0:NPN 1:PNP	* Setting is only possible when an IO-Link cable connection is used. In order to enable the setting value, only a general-purpose I/O cable connection can be used.
	Output mode	129 (0x81)	0	RW	○	UINT	1	0	0:N.O. 1:N.C.	
Timer function	Timer mode	130 (0x82) *1	0	RW	○	UINT	1	0	0:Not use (real time) 1:One shot 2:/Delay	
	One shot time	131 (0x83) *1	0	RW	○	UINT	2	10	1 to 1000	Units: Seconds * Enabled only when index number 130 (timer mode) is "1" (one-shot). * One shot time is sent/received as an integer multiplied by 100. Specify 100 for 1.00 seconds.
	On delay time	132 (0x84) *1	0	RW	○	UINT	2	10	1 to 1000	Units: Seconds * Enabled only when index number 130 (timer mode) is "2" (delay). * When the specified value is 0.00, delay operation is not performed. * To use only one side (ON or OFF), set 0.00 for the side that is not used. * ON/OFF delay time is sent/received as an integer multiplied by 100. Specify 100 for 1.00 seconds.
	Off delay time	133 (0x85) *1	0	RW	○	UINT	2	10	1 to 1000	
Analog output	Analog output	134 (0x86)	0	RW	○	UINT	1	0	0:Not use 1:Current 2:Voltage	* Setting is only possible when an IO-Link cable connection is used. In order to enable the setting value, only a general-purpose I/O cable connection can be used. * Temperature is sent/received as an integer multiplied by 10. Specify 1000 for 100.0°C.
	Specified temperature at analog output maximum value (20 mA/10 V)	135 (0x87) *1	0	RW	○	INT	2	5000	-400 to 5000	Units: °C
								9320	-400 to 9320	Units: °F
	Specified temperature at analog output minimum value (4 mA/0 V)	136 (0x88) *1	0	RW	○	INT	2	-400	-400 to 5000	Units: °C
								-400	-400 to 9320	Units: °F

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]
Mainte-nance	Estimated days until maintenance is required	160 (0x89)	0	R		UINT	2	-	0 to 7305	Units: Days
	Time until maintenance event	161 (0xA1)	0	RW	○	UINT	4	0	0 to 88000	Units: Hours ・Set in units of 1 hour. (Internally converted to units of seconds.) ・When read, the remaining time is returned (rounded up when 30 minutes or more).
Information	Operation time (sensor head)	162 (0xA2)	0	R		UINT	4	—		Units: Hours
	Operation time (laser)	163 (0xA3)	0	R		UINT	4	—		Units: Hours
	Operation time (controller)	164 (0xA4)	0	R		UINT	4	—		Units: Hours
	EEPROM update count (sensor head)	165 (0xA5)	0	R		UINT	4	—		
	EEP update count (Controller)	166 (0xA6)	0	R		UINT	4	—		
	Software version (Sensor head)	167 (0xA7)	0	R		UINT	2	—		
	Software version (Controller)	168 (0xA8)	0	R		UINT	2	—		
	Software version (LCD)	169 (0xA9)	0	R		UINT	2	—		
	Serial number (Controller)	170 (0xAA)	0	R		UINT	14	—		
Display	Process data selection	192 (0xC0)	0	RW		UINT	1	—	Temperature display units. The temperature display units for other items also change according to this setting. 0: °C (Celsius) 1: °F (Fahrenheit)	According to the contents of this setting, the temperature units (°C/°F) are set for sending the measured temperature to IO-Link Master.
Laser control	Laser settings	193 (0xC1)	0	RW	○	UINT	1	0	0: OFF 1: Specified period 2: Manual 3: Blink 4: ON	
	Lighting period	194 (0xC2)	0	RW	○	UINT	1	10	1 to 90 (sec)	Enabled only when index number 193 (laser control) is "1" (specified period).
	Blink on error	195 (0xC3)	0	RW	○	UINT	1	0	0: Laser blinks when an error occurs. 1: Laser does not turn ON when an error occurs.	
Graph	Time Scale	196 (0xC4)	0	RW	○	UINT	1	0	0: Auto 1: 2 min 2: 10 min 3: 30 min 4: 1 hour 5: 3 hour 6: 6 hour 7: 12 hour 8: 24 hour	
	Disply area:	197 (0xC5)	0	RW	○	UINT	1	0	0: Auto 1: Specify	
	Specify temperature (Max)	198 (0xC6)	0	RW	○	INT	2	5000	-400 to 5000	Units: °C ・Enabled only when index number 197 (graph temperature display range) is "1" (specify). ・Temperature is sent/received as an integer multiplied by 10. Specify 1000 for 100.0°C.
								9320	-400 to 9320	Units: °F
	Specify temperature (Min)	199 (0xC7)	0	RW	○	INT	2	-400	-400 to 5000	Units: °C
								-400	-400 to 9320	Units: °F
Display settings	Brightness	200 (0xC8)	0	RW	○	UINT	1	15	1 to 15	
	Display direction	201 (0xC9)	0	RW	○	UINT	1	3	0: Horizontal 1: VerticalRev. 2: HorizontalRev. 3: Vertical	
	Language	234 (0xEA)	0	RW	○	UINT	2	17	9: English 2052: Simplified Chinese 17: Japanese	When a language other than "17" or "2052" is specified, it is handled as English.
Diagnosis: device parameter	Batch reading	16512 (0x4080)	0	R		-	11	—		For the batch reading locations at the time of read-all, refer to *4.
	Minimum measurable temperature		1	R		INT	4	—		・The measurable temperatures are sent as integers multiplied by 10. When the data is 1000, this indicates 100°C.
	Maximum measurable temperature		2	R		INT	4	—		・The measurable temperatures are sent as integers multiplied by 10. When the data is 1000, this indicates 100°C.
	Unit code		3	R		UINT	2	—	1001: °C (Celsius) 1002: °F (Fahrenheit)	
	Scale		4	R		UINT	1	—		・The scale is fixed at -1. This indicates that the measured temperature data must be multiplied by 10 to the power of -1.

*1: R: Read only, W: Write only, R/W: Read/Write

*2: Reading and writing settings for each bank

When an index number in the table above is specified, the settings of the bank that is currently in use are read from or written to.

To read/write settings for setting items that have different settings in each bank, use the calculation formula below and calculate the index number of the bank that you want to read from or write to.

Index number = Index number in table above + (256 × Bank number (1 to 4))

Example: For index number: 65 (alarm)

Specify using the following index number for each bank number.

Bank 1: 321 (0x141)

Bank 2: 577 (0x241)

Bank 3: 833 (0x341)

Bank 4: 1089 (0x441)

*3: When automatically calculating emissivity via IO-Link, perform using the following procedure.

1. Configure the measurement target for measurement conditions.
   Wait until the ambient temperature has also stabilized. (Wait approximately 10 minutes after power ON.)
2. Write the target temperature (value multiplied by 10) in index number 71 (auto calculation).
3. Allow 100 ms to pass.
4. Read index number 71 (auto calculation). If the measured temperature is close to the target temperature, then calculation was successful.

*4: Batch reading locations at the time of read-all

Data is stored in the following sequence when read-all is performed. (Big-endian)

Device parameter	Location	Description
Device parameter	n+0	Upper eight bits of lowest measurable temperature
	n+1	2nd digit upper eight bits of lowest measurable temperature
	n+2	3rd digit upper eight bits of lowest measurable temperature
	n+3	Lower eight bits of lowest measurable temperature
	n+4	Upper eight bits of highest measurable temperature
	n+5	2nd digit upper eight bits of highest measurable temperature
	n+6	3rd digit upper eight bits of highest measurable temperature
	n+7	Lower eight bits of highest measurable temperature
	n+8	Upper eight bits of units code
	n+9	Lower eight bits of units code
	n+10	Scale

Word allocation

(Example) When an OPTEX FA IO-Link Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	n+9	n+10
N+1	n+7	n+8
N+2	n+5	n+6
N+3	n+3	n+4
N+4	n+1	n+2
N+5	Reserved	n+0

Word number	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	n+9 (lower eight bits of units code)								n+10 (scale eight bits)							
N+1	n+7 (lower eight bits of highest measurable temperature)								n+8 (upper eight bits of units code)							
N+2	n+5 (2nd digit upper eight bits of highest measurable temperature)								n+6 (3rd digit upper eight bits of highest measurable temperature)							
N+3	n+3 (lower eight bits of lowest measurable temperature)								n+4 (upper eight bits of highest measurable temperature)							
N+4	n+1 (2nd digit upper eight bits of lowest measurable temperature)								n+2 (3rd digit upper eight bits of lowest measurable temperature)							
N+5	Reserved								n+0 (upper eight bits of lowest measurable temperature)							

Event Functions

Code		Type	Event name	Description
DEC	HEX			
6144	0x1800	Notice	Maintenance timing	The referential time for calibration or the user-specified time for cleaning has been reached.
6145	0x1801	Fault	Memory rewrite lifetime	Setting value memory has exceeded the limit of write cycle. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6149	0x1805	Fault	Laser error	An error was detected at the laser. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6150	0x1806	Warning	Unstable head internal temperature	The head internal temperature is changing. Temperature measurement is possible, however the error will be large.
6151	0x1807	Warning	Laser lifetime	The laser lighting period has exceeded the prescribed time. We recommend you replace it as soon as possible.
6153	0x1809	Warning	Controller lifetime	The controller use time has exceeded the prescribed time. We recommend you replace it as soon as possible.
6154	0x180A	Warning	Measured temperature upper limit exceeded	The upper limit for measurable temperature has been exceeded.
6155	0x180B	Warning	Measured temperature lower limit exceeded	The lower limit for measurable temperature has been exceeded.
6156	0x180C	Fault	Memory rewrite lifetime (head)	Setting value memory has exceeded the limit of write cycle. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6157	0x180D	Fault	Memory read invalid (head)	Information could not be read correctly from the settings memory. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
16912	0x4210	Warning	Head internal temperature exceeded	Head internal temperature exceeded the prescribed temperature.
20480	0x5000	Fault	Head system error	An error was detected inside the head. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
20497	0x5011	Fault	Memory read invalid	Information could not be read correctly from the settings memory. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
20736	0x5100	Fault	Power supply trouble	An error was detected in the power supply. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.

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