ifm electronic

CE

Process interface

efector250®

UK

O3D200

704980 / 00 08 / 2011

Contents

Process data protocol

The process interface ensures communication between the process PC (e.g. PLC or controlling PC) and the device. A command from the process PC can for example activate trigger pulses, select applications or provide statistic information.

Establish the TCP/IP connection

The process interface is changed to TCP/IP via the operating program or the two-button menu of the device.

Command types

There are two different types of commands to the device: actions and queries. Actions have the device do something, e.g. take an image and evaluate it.

Requests are used to retrieve information from the device.

The replies by the device are either status information, reply messages or results.

Results are transmitted by the device without a request being sent to the device before.

The device transmits status information and reply messages as direct reply to action commands or request commands.

Communication basics

7-bit ASCII characters are allowed.

All transmissions to the device are terminated with a carriage return and a linefeed character (CR + LF = ASCII 13 dec + 10 dec).

All transmissions from the device are terminated with a carriage return and a linefeed character (CR + LF = ASCII 13 dec + 10 dec).

As a reply to a valid command the device provides the character string
* CR LF (ASCII 42 dec + 13 dec + 10 dec).

As a reply to an invalid command the device provides the character string
? CR LF (ASCII 63 dec + 13 dec + 10 dec).

If the device cannot carry out a message, the device provides the character string
! CR LF (ASCII 33 dec + 13 dec + 10 dec).

Protocol versions

The device supports 4 different protocol versions with different message formats.

Version	Format request	Format reply
V01	<contents>CR LF	same as request
V02	<ticket><contents>CR LF	same as request
V03	<ticket><length>CR LF <ticket><contents>CR LF	same as request
V04	<contents>CR LF	<length>CR LF <contents>CR LF

<contents>	is the command to the device or the reply by the device (e.g. evaluation results).
<ticket>	is a character string of 4 digits 0-9, to be interpreted as decimal number. If a message with a specific ticket is sent to the device, its reply will contain the same ticket. Ticket 0000 is reserved for messages sent by the device independently.
<length>	is a character string beginning with the letter 'L' followed by 9 digits to be interpreted as decimal number. This figure indicates the length of the following data (<contents>CR LF) in bytes. Blanks are padded with leading zeros.

Factory setting and reset condition are V02.

Select protocol version

Command	v <digit><digit>	
Type	Action	
Reply	*	Normal case
	!	The device does not support the protocol version indicated.
Note	<digit><digit>: to be interpreted as two-digit decimal number for the protocol version. The protocol version is not changed before the reply by the device.	

Request the protocol version

Command	V?
Type	Request
Reply	<current><blank><min><blank><max> <current> two-digit decimal number with current version <blank> blank <min> two-digit decimal number with minimum version <max> two-digit decimal number with maximum version

Note	Reply in case of factory setting: 02 01 04 Example of protocol version V04: Command to device 'V?\r\n' Reply from device 'L000000010\r\n03 01 04\r\n' 'L000000010\r\n' describes the length of the following data '03 01 04\r\n' '\n' stands for ASCII code 10d '\r' stands for ASCII code 13d

Release the trigger pulse

Command	t	
Description	Release the trigger and evaluate the image.	
Type	Action	
Reply	*	The trigger was released.
	!	● The device is busy with evaluation. ● The device is in an invalid state, e.g. administer applications. ● Currently set trigger mode not possible via TCP/IP
Note	Activation of the output → Activate / deactivate result output (p1/p0).	

Change the trigger mode

Command	m <digit = 0><digit>	
Type	Action	
Reply	*	Successful execution
	!	● <digit> contains incorrect value. ● The device is in an invalid state.
Note	<digit = 0> the first digit is always 0 <digit> the second digit 1 Trigger input positive edge 2 Trigger input negative edge 3 Free-running trigger (continuous) 4 Trigger source XML-RPC interface 5 Trigger source process interface Example: m05 activates the trigger via the process interface	

Request the trigger mode

Command	g?	
Type	Action	
Reply	T1 T2 T3 T4 T5	Trigger input positive edge Trigger input negative edge Free-running trigger (continuous) Trigger source XML-RPC interface Trigger source process interface
	!	● The device is busy with evaluation. ● No active application.

UK

Release the trigger and request the result output via the process interface

Command	T?	
Type	Request	
Reply	Message in result format → chapter Result message	Normal case
	!	● Currently no application active. ● Application is being edited. ● Currently set trigger mode not possible via TCP/IP.
Note	The result format normally contains the following element: <roiprocval> (provides a 4-digit value with three decimal places per image zone e.g.: 0012.120) The list of the requested elements can be freely configured via the operating program. (See available elements of the result message)	

Activate / deactivate the result output

Command	p <digit>	
Type	Action	
Reply	*	Successful execution
	!	● No active application. ● <digit> contains incorrect value. ● The device is in an invalid state.
Note	<digit> is either 0 or 1. 1 enables the result output. 0 disables the result output. See message T?.	

Select the application

Command	c <group><number>	
Type	Action	
Reply	*	Successful change
	!	● The device is in an invalid state. e.g. administer applications. ● Invalid or not existing group or application number.
Note	<group>: digit for the application group (always 0 for O3D200). <number>: two-digit character string, to be interpreted as decimal number for the application number.	

Request the assignment of the application data from the device

Command	a?	
Type	Request	
Reply	<number><blank><group><number><blank><group> <number><blank>...<group><number>	Normal case
	!	No application active on the device.
Note	<number>: character string with 3 digits for the number of applications on the device as decimal number. <group>: digit for the application group (always 0 for O3D200). <number>: two-digit character string, to be interpreted as decimal number for the application number. At first the number of the active configuration is output. <blank>: individual blank.	

Request the last result from the device

Command	R?	
Type	Request	
Reply	Message in result format → chapter Result message	Normal case
	!	● Currently no application active. ● Application is being edited. ● No results available yet.
Note	The result format normally contains the following element: <roiprocval> (provides a 4-digit value with three decimal places per image zone e.g.: 0012.120) The list of the requested elements can be freely configured via the operating program. (See available elements of the result message)	

Request the statistics from the device

Command	s?	
Type	Request	
Reply	<trigger count><blank><minimum eval time><blank><maximum eval time><blank><count low switching output 1><blank><count high switching output 1><blank><count low switching output 2><blank><count high switching output 2><blank><minimum temperature><blank><maximum temperature>	Normal case
	!	No application active on the device.
Note	<trigger count> Number of trigger results (10-digit decimal number with leading zeros) <minimum eval time> Minimum evaluation time (in milliseconds, 4-digit decimal number with leading zeros) <maximum eval time> Maximum evaluation time (in milliseconds, 4-digit decimal number with leading zeros) <count low switching output 1> Number of "low" states on the switching output (10-digit decimal number with leading zeros) Switching output is set to analogue: <count low switching output 1> provides the minimum of the previous analogue values. (16-bit values) <count high switching output 1> Number of "high" states on the switching output (10-digit decimal number with leading zeros) Switching output is set to analogue: <count high switching output 1> provides the maximum of the previous analogue values. (16-bit values) <count low switching output 2> Number of "low" states on the switching output (10-digit decimal number with leading zeros) <count high switching output 2> Number of "high" states on the switching output (10-digit decimal number with leading zeros) <minimum temperature> Minimum temperature (A/D digits not calibrated, 4-digit decimal number with leading zeros) <maximum temperature> Maximum temperature (A/D digits not calibrated, 4-digit decimal number with leading zeros) <blank> individual blank	

UK

Request the device information

Command	D?
Type	Request
Reply	<manufacturer><t><article number><t><name><t><location><t><ip><t> <subnet><t><gateway><t><MAC><t><DHCP><t><XML_port><t><video_port> <manufacturer> IFM ELECTRONIC <article number> Article designation and status, e.g. O2D220AC <Name> Enter the sensor name as in the operating program <location> Enter the sensor location as in the operating program <ip> IP address of the device <subnet> Subnet mask of the device <gateway> Gateway address of the device <MAC> MAC address of the device <DHCP> 0 if DHCP is disabled, 1 if DHCP is enabled <t> Tabulator character <XML_port> XML-RPC port number <video_port> image data port number
Note	None

Request the device time

Command	d?	
Type	Action	
Reply	<10 bytes padded with 0><blank><10 bytes padded with 0>	Normal case
	!	No application active on the device.
Note	The first 10 bytes contain the seconds since system start-up, the second 10 bytes contain the milliseconds Example 1234d? 12340000015730 0000000951	

Request the error code from the device

Command	E?
Type	Request
Reply	<code>
Note	<code> is the numerical value of the error code, character string with 4 digits, to be interpreted as decimal number. → chapter Error codes

Error codes from the device

Definition	SENSOR_NO_ERRORS
Numeric value	0
Description	No errors
Solution/remedy	–

Definition	SENSOR_INVALID_PARM
Numeric value	0105
Description	Invalid input parameter
Solution/remedy	Read the command documentation to send the required information to the device.

Definition	SENSOR_INVALID_STATE
Numeric value	0108
Description	The device is in an operation mode which does not permit the execution of commands.
Solution/remedy	Check the command documentation to see when the command can be executed.

Definition	SENSOR_ERR_NO_MEM
Numeric value	0110
Description	Fatal internal error.
Solution/remedy	Restart the device.

Definition	SENSOR_CONFIG_NOT_FOUND
Numeric value	0902
Description	Application to be activated not found.
Solution/remedy	Check whether the application number is correct. Check also if the application can be edited using the operating program.

Definition	SENSOR_INVALID_TRIGGER_MODE
Numeric value	1000
Description	It is not possible to trigger the sensor because the trigger function via TCP/IP is not active.
Solution/remedy	Check the trigger mode of the device. (g?)

Definition	SENSOR_CONFIG_SWITCHING_ACTIVE
Numeric value	1603
Description	It is not possible to upload an application to the device if the external selection of the application is activated.
Solution/remedy	Use the operating program to deactivate the external selection of the application.

Definition	SENSOR_TRIGGER_NOT_AVAILABLE
Numeric value	1604
Description	The user sends a trigger to the device via TCP/IP. Due to an internal fault the device cannot process the trigger.
Solution/remedy	This error code shows a device failure. Normally the device tries to remedy the failure itself. If this error occurs again, restart the device.

Result message

An evaluation result is transmitted in the following format:

<start>[<procval><sc>][<procvalmin><sc>][<procvalmax><sc>][<config_id><sc>][<roicnt><sc>]{[<roiprocval><sc>][<roipos><sc>]}[<intensity_image>][<distance_image>]<stop>

Elements in square brackets [] are optional. If no elements are selected, <start> and <stop> are not transmitted either.

Elements in curly brackets {} are repeated for each image zone (ROI).

Available elements of the result message

Element name	Description	Format
<start>	Start string according to the setting in the operating program.	Character string
<sc>	Separator according to the setting in the operating program.	Character string
<stop>	Stop string according to the setting in the operating program.	Character string
<roiprocval>	Image zone process value	Floating point
<config_id>	Active application	Integer 3
<roicnt>	Number image zones	Integer 3
<roipos>	Image zone position in the format <roileft><roiright><roitop><roibottom> <roileft> image zone left coordinate <roiright> image zone right coordinate <roitop> image zone upper coordinate <roibottom> image zone lower coordinate	Integer 8
<procval>	Overall process value	Floating point
<procvalmin>	Minimum overall process value of all image zones	Floating point
<procvalmax>	Maximum overall process value of all image zones	Floating point
<intensity_image>	Intensity or grey scale value image	Graphics format
<distance_image>	Distance image	Graphics format

Note	Factory setting process values of all image zones <start><roiprocval><sc><stop> Start character string = star Separator = ; Stop character string = stop Character string = ASCII or Unicode in UTF-8 coding possible Floating point = 10 characters padded with "0", 3 decimal places, decimal separators "," e.g.: 1.234 / 000001,234 Integer 3 = natural number with 3 characters, padded with "0", e.g.: 12 / 012 Integer 8 = natural number with 8 characters, 2 characters for left position, 2 characters for right position, 2 characters for upper position, 2 characters for lower position all padded with "0" e.g.: 1,48,1,64 / 01480164
	Graphics format according to image format setting in the operating program (BMP, CSV...)

Intensity image (<intensity_image>)

In the grey scale table the RGB values are the same for all indices. Overexposed pixels are shown in orange RGB (255,153,0) according to the operating program. Underexposed pixels are shown in red RGB (255,0,0), also according to the operating program. Colour table for grey scale values:

Index	R	G	B
0	0	0	0
1	1	1	1
2	2	2	2
...	...	...	...
254	254	254	254
255	255	255	255

Distance image (<distance_image>)

For the distance image the JET colour table is used. Here as well, the invalid pixels are handled separately. Overexposed pixels are shown in white, underexposed pixels in black. The colour coding is also identical with the display of the operating program.

Index	R	G	B
Black	0	0	0
0	0	0	128
1	0	0	131
...	...	...	...
254	131	0	0
255	128	0	0
White	255	255	255

Calculation rule for the CSV format

The CSV (comma-separated values) file is generated in the same way as in the operating program. The values are separated by a semicolon ";" and provided with 8 decimal places. The comma is used as a decimal separator. There are 64 values in a line, the number of lines is 50. This results in an image of the dimensions 64x50.