

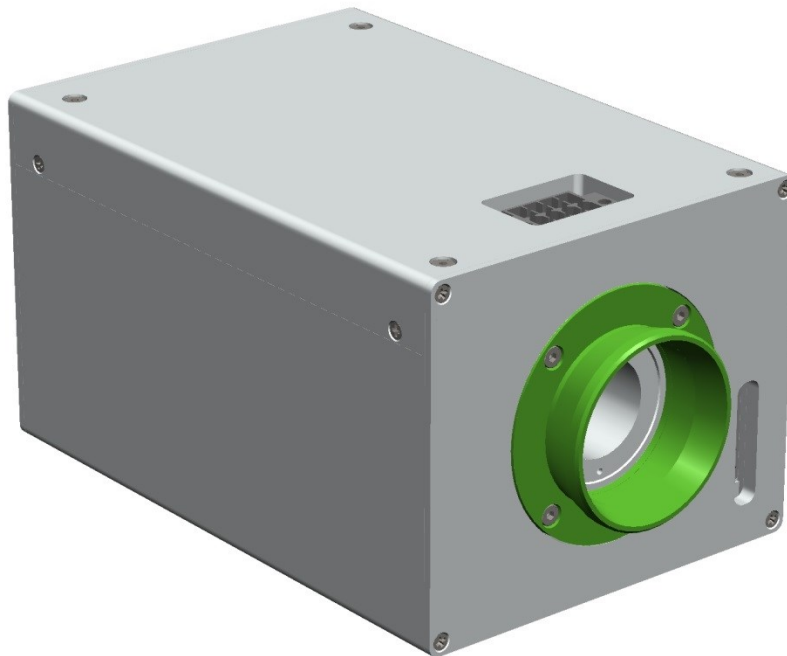
Fetura+ Developer Guide

Version 0.1

This document summarizes the communications protocol as implemented in the Fetura+ Advanced Zoom Imaging System 4401-592-000-21.

The Fetura+ Advanced Zoom Imaging System is a flexible platform for high speed / high reliability vision applications. The Fetura+ provides improved centration and magnification repeatability over an extended lifetime, and is up to 10X faster than conventional cam-driven zoom lenses.

The Fetura+ incorporates embedded microcontrollers that apply closed loop control over the lens system and provide communication with a host computer. Host computer control is possible with an imaging application **communicating to the Fetura+ via RS-232**. A set of messages have been defined to allow Fetura+users to integrate Fetura+ control functions into their proprietary imaging applications. This document describes the message protocol used to communicate with and to control the Fetura.



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Dev. Guide	Firmware	Changes
0.1	0.1	New Version for Fetura+ 4401-592-000-21 - not compatible with 4401-572-000-20 or 4401-563-000-20/21 Version. ATTENTION: the features “CZM” and “Joystick” are still under test and are not fully qualified! Please contact Qioptiq for further information if necessary.



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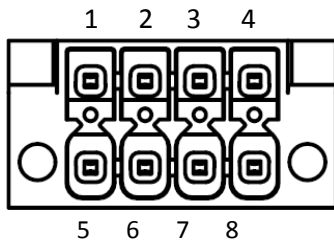
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1 – Fetura+ / PC Communications

The Fetura+ is connected via RS-232 to the computer using a Phoenix Connector. An appropriate connector is supplied with each Fetura+ system.

2 - Hardware and Software Installation

Connector (female), unit side:



- | | |
|--|---------------------------|
| 1: Power: V _{in} (16-36 VDC / 2A) | 5: Power: GND |
| 2: Communication: Rx | 6: Communication: GND |
| 3: Communication: Tx | 7: Joystick: GND |
| 4: Joystick: +5V out | 8: Joystick: Reference in |

Refer to the Fetura+ User Guide for instructions regarding Fetura+ hardware connections and software installation.

3 - Serial Port Settings

The table below lists the serial COM port settings that must be used with the Fetura+ for the RS-232 interface.

Fetura+ Serial COM Port Settings

Baudrate	9600
Data bits	8
Parity	None
Stop bits	2
Flow control	None

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4 – Fetura+ Message Set

The host computer and the Fetura+ communicate via messages consisting of byte strings. In this document we show these byte strings as a sequence of hex bytes, where each hex byte is enclosed in square brackets, e.g. [06] [00] [10] [21] [C9] [03] [E8] [EB]. The structure of the messages and the definition of the bytes are described in the following sections.

The communications protocol consists of two types of host messages. **Host Message Type A** is a message sent by the host computer to the Fetura+ that does not lead to a response from the Fetura+. This type of message would be used to set a parameter in the Fetura+ motion controller. **Host Message Type B** is a message sent from the host to the Fetura+ that prompts a response message from the Fetura+. This type of message would be used to request status or a query a parameter value from the Fetura+. The Fetura+ responds to the information request and transmits back a byte string containing the relevant information about the Fetura+ to the host system.

For either message type, the Fetura+ will confirm the host's message was received successfully with an **acknowledgement byte** = [4F]. If the Fetura+ does not recognize the host message, the [4F] byte will not be sent. In this case, to re-establish communication, the host program should synchronize communications (see procedure in SYNC BYTE Message section) and then re-send the original message.

Refer to the following sections for detailed descriptions:

- 4.1 General Message Structure
- 4.2 Checksum Byte
- 4.3 SYNC BYTE Message
- 4.4 CHECK STATUS Message
- 4.5 CHECK HOMING Message
- 4.6 CHECK SERIAL NUMBER Message
- 4.7 CHECK FIRMWARE VERSION Message
- 4.8 CHECK MANUFACTURING DATE Message
- 4.9 CHECK NUMBER OF LENS MOVES Message
- 4.10 MOVE TO ZOOM POSITION Message
- 4.11 CHECK ZOOM POSITION Message
- 4.12 CHECK ZOOM STATUS Message
- 4.13 SET ZOOM TIME Message
- 4.14 CHECK ZOOM TIME Message
- 4.15 SET JOYSTICK Message
- 4.16 CHECK JOYSTICK Message
- 4.17 CHECK TEMPERATURE Message
- 4.18 RESET Message
- 4.19 CHANGE BAUDRATE Message
- 4.20 Message Summary Table



4.1 – General Message Structure

Host Message Type A:

The general message structure used to set parameters or command the Fetura+ to move to a new zoom position is shown in the following byte string:

[06] [00] [10] [oc byte 1] [oc byte 2] [data byte 1] [data byte 2] [cs byte]

where:

[06] = number of bytes that follow in string, not including checksum byte **16Bit**

[00] [10] = address ID for Fetura

[oc byte 1] [oc byte 2] = op code that identifies a write operation to a specific register address

[data byte 1] [data byte 2] = data value being written to register **16Bit**

[cs byte] = checksum byte

The Byte-String above shows an example for a **16Bit** register access. There exists also one for **32Bit**:

[08] [00] [10] [oc byte 1] [oc byte 2] [data byte 1] [data byte 2] [data byte 3] [data byte 4] [cs byte]

where:

[08] = number of bytes that follow in string, not including checksum byte **32Bit**

[00] [10] = address ID for Fetura

[oc byte 1] [oc byte 2] = op code that identifies a write operation to a specific register address

[data byte 3] [data byte 4] [data byte 1] [data byte 2] = data value being written to register **32Bit**

[cs byte] = checksum byte

Steering and control commands also belong to the group of Host Message Type A. They always consist of 6 Bytes and have the following structure:

[04] [10] [00] [oc byte 1] [oc byte 2] [cs byte]

where:

[04] = number of bytes that follow in string, not including checksum byte

[10] [00] = address ID for Fetura

[oc byte 1] [oc byte 2] = op code that identifies a write operation to a steering or control command

[cs byte] = checksum byte

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The Fetura+ responds to Type A messages with an **acknowledgement byte [4F]**. The response should be read at the input buffer within a **waittime of 5 to 50 ms**. If the message is not received properly, the host will not receive the acknowledgement byte and should re-synchronize communications as described in the SYNC BYTE Message section.

Host Message Type B:

The general message structure used to check parameters or status is shown in the following byte string. The example below is for **16Bit** structures.

[08] [00] [10] [B0] [04] [00] [11] [add byte 1] [add byte 2] [cs byte]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [04] = op code that identifies a **16Bit** read operation (use [B0] [05] for 32-bit read)

[00] [11] = address ID for host computer

[add byte 1] [add byte 2] = register address to be read

[cs byte] = checksum byte

The responses to these messages are:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [oc byte 1] [oc byte 2] [data byte 1] [data byte 2] [cs byte]

where:

[0A] = number of bytes that follow in string, not including checksum byte **16Bit**

[00] [11] = address ID for host computer

[B4] [04] = op code that identifies a **16Bit** read operation

[00] [10] = address ID for Fetura

[oc byte 1] [oc byte 2] = register address to be read

[data byte 1] [data byte 2] = data value being read from register **16Bit**

[cs byte] = checksum byte

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The same exists also for **32Bit** messages:

[08] [00] [10] [B0] [05] [00] [11] [oc byte 1] [oc byte 2] [cs byte]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [05] = op code that identifies a **32Bit** read operation

[00] [11] = address ID for host computer

[oc byte 1] [oc byte 2] = register address to be read

[cs byte] = checksum byte

The responses to these messages are:

[4F] acknowledgement, then

[0C] [00] [11] [B4] [05] [00] [10] [oc byte 1] [oc byte 2] [data byte 1] [data byte 2] [data byte 3]

[data byte 4] [cs byte]

where:

[0C] = number of bytes that follow in string, not including checksum byte **32Bit**

[00] [11] = address ID for host computer

[B4] [05] = op code that identifies a **32Bit** read operation

[00] [10] = address ID for Fetura

[oc byte 1] [oc byte 2] = register address to be read

[data byte 3] [data byte 4] [data byte 1] [data byte 2] = data value being read from register **32Bit**

[cs byte] = checksum byte

The Fetura+ responds to Type B messages with an **acknowledgement byte [4F]**. The response should be read at the input buffer within a **waittime of 5 to 50 ms**. If the message is not received properly, the host will not receive the acknowledgement byte and should re-synchronize communications as described in the SYNC BYTE Message section. After the acknowledgement byte is sent, the Fetura+ response to the Type B message request and data will be received by the host. The Fetura+ response messages are described in each section below.

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4.2 – Checksum Byte

A checksum byte is appended to the messages to ensure the integrity of the data being received. The method used to generate the checksum byte is the **sum modulo 256** of all the bytes of the message (except the checksum byte itself).

Example

For example, to calculate the checksum for the message:

[06] [00] [10] [21] [C9] [03] [E8]

1. First add all the individual bytes

$$[06] + [00] + [10] + [21] + [C9] + [03] + [E8] = [01] [EB]$$

2. Perform a modulo operation on the sum

$$[01] [EB] \text{ modulo } 256 = [EB]$$

3. The message complete with checksum is

[06] [00] [10] [21] [C9] [03] [E8] [EB]

The host application should calculate the checksum and append it to any messages sent to the Fetura. The host application should also confirm that the checksum is correct for any incoming messages from the Fetura.

4.3 – SYNC BYTE Message

If any error occurs during the message reception (e.g. wrong checksum) the Fetura+ **will not send the [4F] acknowledgement byte**. If the host does not receive the acknowledgement byte within **50 ms** after the message was sent, this indicates that synchronization between the host and the Fetura+ is lost. To restore synchronization, the host should do the following:

1. Send the **SYNC BYTE message = [FF]** (note: checksum is not used with SYNC BYTE)
2. Wait 50 ms for an answer
3. If the host receives a **[0D] response byte**, then communications have been restored. If no response is received, or any byte response other than [0D] is received, resend the SYNC BYTE message. If success is not achieved after 5 attempts, then a serious communication problem exists and one of the following items should be checked:
 - COM-Port Settings
 - Serial Communication Cable
 - Fetura+ Power Reset

This procedure should also be used to confirm communications when the host application program initializes for the first time.

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4.4 – CHECK STATUS Message

To obtain the current status of the Fetura+ system, the CHECK STATUS message can be sent to the Fetura+ device. Upon receiving the CHECK STATUS message the Fetura+ responds to the host with a message indicating the current status. The CHECK STATUS message is composed of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [BD] [9D]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [BD] = (status) register address to be read

[9D] = checksum byte

The responses to this message are:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [BD] [xx] [xx] [cs byte]

where:

[xx] [xx] =	Status	[cs byte] =
[00] [00]	ready	[A3]
[00] [01]	busy	[A4]

The Fetura+ will respond with status = busy if the last commanded move has not been completed or a reset or homing mode is just in action.

To prevent non-deterministic behavior, new messages should only be sent if the Fetura+ is in ready-state.

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4.5 – CHECK HOMING Message

In order to check the Homing Status of the Fetura+ after Power On, the CHECK HOMING Message can be sent to the Fetura+ device. After receiving the CHECK HOMING message the Fetura+ responds to the host with a message indicating the current status of the Homing Routine of the Fetura+ device. The CHECK HOMING message is composed of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [C0] [A0]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [C0] = (status) register address to be read

[A0] = checksum byte

The potential Fetura+ responses to this message are:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [C0] [xx] [xx] [cs byte]

where:

[xx] [xx] =	Status	[cs byte] =
[00] [00]	Homing just in action	[A6]
[00] [01]	Homing done	[A7]

The Fetura+ will respond with status = Homing just in action if the lenses are just moving after power on and the Homing Routine isn't finished yet.

The status of the Homing Routine of the Fetura+ should be proved after the initialization (Sync Byte message) and before the first Zooming Command will be sent.



4.6 - CHECK SERIAL NUMBER Message

The host computer is able to query the Fetura+ and read what serial number is saved on the Fetura+ Unit.
The CHECK SERIAL NUMBER message is composed of the following byte string:

[08] [00] [10] [B0] [05] [00] [11] [03] [B2] [93]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [05] = op code that identifies a 32-bit read operation

[00] [11] = address ID for host computer

[03] [B2] = (serial number) register address to be read

[93] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then

[0C] [00] [11] [B4] [05] [00] [10] [03] [B2] [xx] [xx] [xx] [xx] [cs byte]

where: [xx] [xx] [xx] [xx] = hex value of the serial number of the Fetura+ Unit.

4.7 - CHECK FIRMWARE VERSION Message

The host computer is able to query the Fetura+ and read the Fetura+ firmware version.
The CHECK FIRMWARE VERSION message is composed of the following byte string:

[08] [00] [10] [B0] [05] [00] [11] [03] [B4] [95]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [05] = op code that identifies a 32-bit read operation

[00] [11] = address ID for host computer

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[03] [B4] = (firmware version) register address to be read

[95] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then

[0C] [00] [11] [B4] [05] [00] [10] [03] [B4] [xx] [xx] [xx] [xx] [cs byte]

where: [xx] [xx] . [xx] [xx] = firmware version. The last two bytes are the most significant bytes and contain the integer value of the firmware version; the first two bytes contain the sub-integer (tenths) value. Therefore the byte pairs should be swapped, and a decimal point inserted between in order to arrive at the correct firmware version.

Example

The firmware version bytes are shown in bold in the Fetura+ response:

[0C] [00] [11] [B4] [05] [00] [10] [03] [B4] [00] [05] [00] [01] [A3]

Swap the last two bytes with the first two bytes and place a decimal point between:

[00] [01] [00] [05] = 1.5 = Fetura+ firmware version

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4.8 - CHECK MANUFACTURING DATE Message

The host computer is able to query the Fetura+ and read what manufacturing date is saved on the Fetura+ Unit. Therefore three parameters are able to read out: **Year**, **Month** and **Day**

The CHECK MANUFACTURING DATE message is composed of the following byte strings:

[08] [00] [10] [B0] [04] [00] [11] [03] [B6] [96]	Year
[03] [B7] [97]	Month
[03] [B8] [98]	Day

where:

[08] = number of bytes that follow in string, not including checksum byte
[00] [10] = address ID for Fetura
[B0] [04] = op code that identifies a 16-bit read operation
[00] [11] = address ID for host computer
[03] [B6] = (manufacturing **year**) register address to be read
[03] [B7] = (manufacturing **month**) register address to be read
[03] [B8] = (manufacturing **day**) register address to be read
[96] = checksum byte
[97] = checksum byte
[98] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then
[0A] [00] [11] [B4] [04] [00] [10] [03] [B6] [xx] [xx] [cs byte]
[03] [B7] [xx] [xx] [cs byte]
[03] [B8] [xx] [xx] [cs byte]

where: [xx] [xx] = hex value of the manufacturing **year** of the Fetura+ Unit.
[xx] [xx] = hex value of the manufacturing **month** of the Fetura+ Unit.
[xx] [xx] = hex value of the manufacturing **day** of the Fetura+ Unit.

4.9 - CHECK NUMBER OF LENS MOVES Message

The host computer is able to query the Fetura+ and read how many lens moves has been done so far.

The CHECK NUMBER OF LENS MOVES message is composed of the following byte string:

[08] [00] [10] [B0] [05] [00] [11] [03] [B9] [9A]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[B0] [05] = op code that identifies a 32-bit read operation

[00] [11] = address ID for host computer

[03] [B9] = (number of lens moves) register address to be read

[9A] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then

[0C] [00] [11] [B4] [05] [00] [10] [03] [B9] [xx] [xx] [xx] [xx] [cs byte]

where: [xx] [xx] [xx] [xx] = hex value of the number of lens moves.

4.10 – MOVE TO ZOOM POSITION Message

The lens system inside the Fetura+ is capable of moving to 1000 predefined magnification (zoom) positions. This can be done using two different modes: Using Fast Zoom Mode the desired magnification is reached as fast as possible (<1s). While moving, Fetura+ will NOT feature a focused optical system. Using Continuous Zoom Mode the system will be stay focused while moving. The valid range of zoom positions that the Fetura+ accepts via the MOVE TO ZOOM POSITION message is:

Fast Zoom Mode (FZM):

0001 to 1000 (in decimal) = 0x0001 to 0x03E8 (in hex) = [00] [01] to [03] [E8] byte values

Continuous Zoom Mode (CZM):

**ATTENTION: the feature CZM is still under test and not fully qualified!
Please contact Qioptiq for further information if necessary.**

1001 to 2000 (in decimal) = 0x03E9 to 0x07D0 (in hex) = [03] [E9] to [07] [D0] byte values

Attention: Zoom Positions keep the same (1001 CZM \triangleq 1 FZM and 2000 CZM \triangleq 1000 FZM).

The MOVE TO ZOOM POSITION message is composed of the following byte string:

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[06] [00] [10] [21] [C7] [xx] [xx] [cs byte]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura

[21] [C7] = op code that identifies a write operation to zoom position register

[xx] [xx] = desired zoom position (in hex)

[cs byte] = checksum byte

The Fetura+ will send a [4F] acknowledgement byte upon message receipt.

If the Zooming was successfully performed should be check with the CHECK STATUS message in the following.

An example on how to instruct the Fetura+ system to move to a particular zoom position is described below:

Example

To instruct the Fetura+ system to move to the zoom position 720 (in decimal):

1. Convert 720 to two hex bytes:

720 → 0x02D0 → [02] [D0]

2. Assign [02] to the first zoom position byte and [D0] to the second zoom position byte to form the following byte string:

[06] [00] [10] [21] [C7] [02] [D0]

3. Calculate the checksum byte:

[06] + [00] + [10] + [21] + [C7] + [02] + [D0] = [01] [D0]

checksum = [01] [D0] modulo 256 = [D0]

4. Append the checksum byte to the overall string, to obtain the message string that instructs the Fetura+ system to move to zoom position 720:

[06] [00] [10] [21] [C7] [02] [D0] [D0]

There is also the opportunity to set the Fetura+ in an automatic acknowledgement mode, which tells the host when the movement is complete.

Therefore the following byte string has to send to the Fetura+:

[06] [00] [10] [21] [CE] [00] [08] [0D]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[21] [CE] = op code that identifies a write operation to config register

[00] [08] = automatic mode **ON** (in hex)

[0D] = checksum byte

The Fetura+ will send a [4F] acknowledgement byte.

After sending a new zoom position, the Fetura+ will send a [4F] acknowledgement upon message receipt, and then after the move is complete it will automatically send the following message:

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[08] [00] [11] [D4] [01] [03] [EC] [xx] [xx] [cs byte]

where:

[xx] [xx] = [00] [01] if move was completed successfully, and [cs byte] = [DE]
= [00] [00] if timeout error occurred, and [cs byte] = [DD]

If a timeout error is reported, send the RESET message in order to initialize the Fetura+ again.

To disable the automatic acknowledgement mode the following byte string is used:

[06] [00] [10] [21] [CE] [00] [00] [05]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[21] [CE] = op code that identifies a write operation to config register

[00] [00] = automatic mode **OFF** (in hex)

[05] = checksum byte

The Fetura+ will send a [4F] acknowledgement byte.

Use the following equations to relate **Magnification to Zoom Position #:**

$$MAG = LOWMAG * 12.5^{\frac{POS\#-1}{999}}$$

And

$$POS\# = 999 * \frac{\log \frac{MAG}{LOWMAG}}{\log (12.5)} + 1$$

where:

MAG = Magnification (acceptable value within the range 0.52x to 6.5x for a base configuration)

LOWMAG = Minimum Magnification (nominally 0.52x for a base configuration)

POS# = Discrete magnification position (range 1 to 1000, decimal integer)
To enable Continuous Zoom Mode add 1000 to the calculated value.

The MAG and LOWMAG values depend on the Fetura+ system configuration. TV tube and AUX lens magnifications other than the 1.0x (base configuration) will change these values. Refer to the Optical Performance tables in the Fetura+ documentation for MAG range and LOWMAG values for your Fetura+ system configuration. The MAG values calculated with the above equation are nominal values; actual values should be measured via a calibration process for critical applications.

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4.11 - CHECK ZOOMPOSITION Message

The host computer is able to query the Fetura+ and read what zoom position value is currently being accessed. The CHECK ZOOMPOSITION message is composed of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [C7] [A7]

where:

[08] = number of bytes that follow in string, not including checksum byte
[00] [10] = address ID for Fetura+
[B0] [04] = op code that identifies a 16-bit read operation
[00] [11] = address ID for host computer
[03] [C7] = (zoom position) register address to be read
[A7] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then
[0A] [00] [11] [B4] [04] [00] [10] [03] [C7] [xx] [xx] [cs byte]

where: [xx] [xx] = hex value of the zoom position in relative units. See the previous section for acceptable values and more details.

Attention: This is the value where the Fetura+ is currently driving to. **Not** where it currently stays.

4.12 - CHECK ZOOMSTATUS Message

The host computer is able to query the Fetura+ and read out to which zoom position the Fetura+ is currently located.

This value will only be updated, when the Fetura+ has reached a valid and stable zoom position.

The CHECK ZOOMSTATUS message is composed of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [C8] [A8]

where:

[08] = number of bytes that follow in string, not including checksum byte
[00] [10] = address ID for Fetura+

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[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [C8] = (zoom status) register address to be read

[A8] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [C8] [xx] [xx] [cs byte]

where: [xx] [xx] = hex value of the zoom status in relative units. See the previous section for acceptable values and more details.

Attention: This value will only be updated, when the Fetura+ has reached a valid and stable position. It corresponds

to the zoom position **only when the motion is completed.**

4.13 – SET ZOOMTIME Message

**ATTENTION: the feature CZM is still under test and not fully qualified!
Please contact Qioptiq for further information if necessary.**

When the Fetura+ is driven in the **Continuous Zoom Mode** it is possible to set the velocity to reach the desired magnification position. Therefore the SET ZOOMTIME Message can be used. The valid range of values that the Fetura+ system accepts via the SET ZOOMTIME message is:

1 to 10 (in decimal) = 0x0001 to 0x000A (in hex) = [00] [01] to [00] [0A] byte values

The **default** is 5.

The SET ZOOMTIME message is composed of the following byte string:

[06] [00] [10] [21] [CD] [xx] [xx] [cs byte]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[21] [CD] = op code that identifies a write operation to zoomtime register

[xx] [xx] = desired zoomtime (in hex)

[cs byte] = checksum byte

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Attention: The bytes (values for the zoomtime) represent reciprocal values for the velocity

[xx] [xx] =	max Duration [absolute] from High to Low	Velocity [relative]
[00] [0A] / 10	10s	1
[00] [05] / 5	5s	6
[00] [04] / 4	4s	7
[00] [03] / 3	3s	8
[00] [02] / 2	2s	9
[00] [01] / 1	1s	10

The Fetura+ will send a [4F] acknowledgement byte upon message receipt.

Note: This message only affects Continuous Zoom Mode - not Fast Zoom mode.

Example

To instruct the Fetura+ system to move from one Zoom Position to another one in a maximal time of 5s, the following SET ZOOMTIME message has to be sent:

- Convert 5 to two hex bytes:
 $5 \rightarrow 0x0005 \rightarrow [00] [05]$
- Assign [00] to the first zoomtime byte and [05] to the second zoomtime byte to form the following string:
 $[06] [00] [10] [21] [CD] [00] [05]$
- Calculate the checksum byte:
 $[06] + [00] + [10] + [21] + [CD] + [00] + [05] = [01] [0D]$
checksum = $[01] [0D] \text{ modulo } 256 = [0D]$
- Append the checksum byte to the overall string, to obtain the message string that instructs the Fetura+ to do the Continuous Zoom in maximal 5s:
 $[06] [00] [10] [21] [CD] [00] [05] [0D]$

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4.14 – CHECK ZOOMTIME Message

**ATTENTION: the feature CZM is still under test and not fully qualified!
Please contact Qioptiq for further information if necessary.**

The host computer is able to query the Fetura+ and read what zoomtime value is currently being used.

The CHECK ZOOMTIME message is composed of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [CD] [AD]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [CD] = (zoomtime) register address to be read

[AD] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [CD] [xx] [xx] [cs byte]

where: [xx] [xx] = hex value of the zoomtime in relative units. See the previous section for acceptable values and more details.

4.15 – SET JOYSTICK Message

**ATTENTION: the feature “Joystick” is still under test and not fully qualified!
Please contact Qioptiq for further information if necessary.**

There is also the opportunity to control the Fetura+ via the analog voltage input. Therefore the +5V reference input can be used. See section [Hardware and Software Installation](#) section for more details. The most often application which is used in that context is the Joystick-Mode.

For activation the following byte string has to send to the Fetura+ :

[06] [00] [10] [21] [CE] [00] [08] [0D]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[21] [CE] = op code that identifies a write operation to Config register

[00] [08] = joystick mode ON (in hex)

[0D] = checksum byte

The Fetura+ will send a [4F] acknowledgement byte.

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To disable the joystick mode the following byte string is used:

[06] [00] [10] [21] [CE] [00] [00] [05]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[21] [CE] = op code that identifies a write operation to Config register

[00] [00] = joystick mode **OFF** (in hex)

[05] = checksum byte

The Fetura+ will send a [4F] acknowledgement byte.

4.16 – CHECK JOYSTICK Message

**ATTENTION: the feature “Joystick” is still under test and not fully qualified!
Please contact Qioptiq for further information if necessary.**

To obtain the current status of the joystick mode, the CHECK JOYSTICK message can be sent to the Fetura+ .

Therefore the following byte string is used

[08] [00] [10] [B0] [04] [00] [11] [03] [CE] [AE]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [CE] = (config) register address to be read

[AE] = checksum byte

The responses to this message are:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [CE] [xx] [xx] [cs byte]

where:

[xx] [xx] =	Status	[cs byte] =
[00] [00]	OFF	[B4]
[00] [08]	ON	[BC]

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4.17 – CHECK TEMPERATURE Message

The command for reading out the temperature of the Fetura+ consists of the following byte string:

[08] [00] [10] [B0] [04] [00] [11] [03] [DB] [BB]

where:

[08] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Motion Controller with Temperature Sensor

[B0] [04] = op code that identifies a 16-bit read operation

[00] [11] = address ID for host computer

[03] [DB] = temperature register address to be read

[BB] = checksum byte

The responses to this message are:

[4F] acknowledgement, then

[0A] [00] [11] [B4] [04] [00] [10] [03] [DB] [xx] [xx] [cs byte]

where: [xx][xx] represents the Temperature in Hexadecimal Counts [°C]

4.18 – RESET Message

If communication or control problems occur, the Fetura+ can be reset with the RESET message. Once this message is sent to the Fetura+, the embedded microcontrollers will be reset and the homing routine will be executed. Once the homing routine has completed, the Fetura+ will be ready for operation. Use the CHECK STATUS and CHECK HOMING DONE messages to verify when the homing routine is completed and the Fetura+ status returns to ready. Sending the SYNC BYTE is not required, unless the Fetura+ does not respond to the CHECK STATUS or CHECK HOMING DONE message properly.

The RESET message is composed of the following byte string:

[04] [10] [00] [04] [02] [1A]

where:

[04] = number of bytes that follow in string, not including checksum byte

[10] [00] = group address ID for both Fetura+ microcontrollers

[04] [02] = op code for reset

[1A] = checksum byte

The Fetura+ response to this message is:

[4F] acknowledgement (sent to the host immediately, before the reset is executed)

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Attention: The acknowledgement byte should be read at the input buffer in the **first 50 ms**. Then a **waittime of 500 ms** should be added. **After that the input buffer should be flushed**. Then the status of the Fetura+ should be proved with the **CHECK STATUS** and **CHECK HOMING DONE** messages.

4.19 – CHANGE BAUDRATE Message

It is possible to change the Baudrate of the Fetura+ to different modes. The result is a much higher data rate due to a smaller Waittime and a higher Transmittingspeed.

The CHANGING BAUDREATE message is composed of the following byte string:

[06] [00] [10] [08] [20] [xx] [xx] [cs byte]

where:

[06] = number of bytes that follow in string, not including checksum byte

[00] [10] = address ID for Fetura+

[08] [20] = op code that identifies a write operation to baudrate register

[xx] [xx] = desired baudrate (as enumerator)

[cs byte] = checksum byte

[xx] [xx] =	Baudrate in kB/s	[cs byte] =
[00] [00]	9600	[3E]
[00] [01]	19200	[3F]
[00] [02]	38400	[40]
[00] [03]	57600	[41]
[00] [04]	115200	[42]

The Fetura+ will send a [4F] acknowledgement byte upon message receipt.

When the Baudrate Change was successfully confirmed the Waittime can be changed regarding the table below.

Baudrate in kB/s	Waittime in ms
9600	50
19200	30
38400	25
57600	10
115200	5

After changing the Baudrate the communication status should be proved by sending the Sync-Byte. See therefore the **SYNC BYTE Message**.

4.20 – Message Summary Table

No.	Host Message	Host Byte String	Fetura+ Byte String Response
01	GENERAL MESSAGE STRUCTURE	Type A and Type B	---
02	CHECHSUM BYTE	Sum modulo 256	---
03	SYNC BYTE	[FF]	[0D] if synchronized, no response or other response if not synchronized
04	CHECK STATUS	[08][00][10][B0][04][00][11][03][BD][9D]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][BD][xx][xx][cs] where [xx][xx] = [00][00] if ready, [cs] = [A3] = [00][01] if busy, [cs] = [A4]
05	CHECK HOMING	[08][00][10][B0][04][00][11][03][C0][A0]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][C0][xx][xx][cs] where [xx][xx] = [00][00] if homing in action, [cs] = [A6] = [00][01] if homing done, [cs] = [A7]
06	CHECK SERIAL NUMBER	[08][00][10][B0][05][00][11][03][B2][93]	[4F] acknowledgement, then [0C][00][11][B4][05][00][10][03][B2][xx][xx][xx][xx][cs] where [xx][xx][xx][xx] = serial number
07	CHECK FIRMWARE VERSION	[08][00][10][B0][05][00][11][03][B4][95]	[4F] acknowledgement, then [0C][00][11][B4][05][00][10][03][B4][xx][xx][xx][xx][cs] where [xx][xx] . [xx][xx] = firmware version
08	CHECK MANUFACTURING DATE	[08][00][10][B0][04][00][11][03][B6][96] [03][B7][97] [03][B8][98]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][B6][xx][xx][cs] [03][B7][xx][xx][cs] [03][B8][xx][xx][cs] where [xx][xx] = year, [xx][xx] = month, [xx][xx] = day
09	CHECK NUMBER OF LENS MOVES	[08][00][10][B0][05][00][11][03][B9][9A]	[4F] acknowledgement, then [0C][00][11][B4][05][00][10][03][B9][xx][xx][xx][xx][cs] where [xx][xx][xx][xx] = number of lensmoves
10	MOVE TO ZOOM POSITION	[06][00][10][21][C7][xx][xx][cs] where [xx][xx] = [00][01] to [03][E8] for Fast Zoom and [03][E9] to [07][D0] for Continuous Zoom	[4F] acknowledgement 0001 to 1000 (in decimal) 1001 to 2000 (in decimal) \triangleq 0001 to 1000 (in decimal)
11	CHECK ZOOM POSITION	[08][00][10][B0][04][00][11][03][C7][A7]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][C7][xx][xx][cs] where [xx][xx] = value set by MOVE TO ZOOMPOSITION message (SOLL)

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12	CHECK ZOOM STATUS	[08][00][10][B0][04][00][11][03][C8][A8]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][C8][xx][xx][cs] where [xx][xx] = value set by MOVE TO ZOOMPOSITION message (IST)
13	SET ZOOM TIME	[06][00][10][21][CD][xx][xx][cs] where [xx][xx] = [00][01] to [00][0A]	[4F] acknowledgement 1 \triangleq 1s maximal zoom time 10 \triangleq 10s maximal zoom time
14	CHECK ZOOM TIME	[08][00][10][B0][04][00][11][03][CD][AD]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][CD][xx][xx][cs] where [xx][xx] = value set by SET ZOOMTIME message
15	SET JOYSTICK	[06][00][10][21][CE][00][08][0D] ON [06][00][10][21][CE][00][00][05] OFF	[4F] acknowledgement
16	CHECK JOYSTICK	[08][00][10][B0][04][00][11][03][CE][AE]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][CE][xx][xx][cs] where [xx][xx] = [00][08] if ON, [cs] = [BC] - [00][00] if OFF, [cs] = [B4]
17	CHECK TEMPERATURE	[08][00][10][B0][04][00][11][03][DB][BB]	[4F] acknowledgement, then [0A][00][11][B4][04][00][10][03][DB][xx][xx][cs] where [xx][xx] = Hexadecimal Counts [°C]
18	RESET	[04][10][00][04][02][1A]	[4F] acknowledgement
19	CHANGING BAUDRATE	[06][00][10][08][20][xx][xx][cs] where [00][00][3E] for 9600 kB/s [00][01][3F] for 19200 kB/s [00][02][40] for 38400 kB/s [00][03][41] for 57600 kB/s [00][04][42] for 115200 kB/s	[4F] acknowledgement

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NOTES

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