

Parrot Vendor Extension to Picture Transfer Protocol (PTP)

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1. INTRODUCTION

Table 1	
Operation	Code
GetSunshineValues	0x9201
GetTemperatureValues	0x9202
GetAngleValues	0x9203
GetGPSValues	0x9204
GetGyroscopeValues	0x9205
GetAccelerometerValues	0x9206
GetMagnetometerValues	0x9207
GetIMUValues	0x9208
GetStatusMask	0x9209
EjectStorage	0x920a
StartMagnetoCalib	0x9210
StopMagnetoCalib	0x9211
MagnetoCalibStatus	0x9212
SendFirmwareUpdate	0x9213

Table 2	
Event	Code
Status	0xC201
MagnetoCalibrationStatus	0xC202

Table 3	
Properties	Code
PhotoSensorEnableMask	0xD201
PhotoSensorsKeepOn	0xD202
MultispectralImageSize	0xD203
MainBitDepth	0xD204
MultispectralBitDepth	0xD205
HeatingEnable	0xD206
WifiStatus	0xD207
WifiSSID	0xD208
WifiEncryptionType	0xD209
WifiPassphrase	0xD20A

WifiChannel	0xD20B
Localization	0xD20C
WifiMode	0xD20D
AntiFlickeringFrequency	0xD210
DisplayOverlayMask	0xD211
GPSInterval	0xD212

2. PTP VENDOR EXTENSION ID

For this section, you should refer to the DeviceInfo data set in section 5.5.2 of the ISO 15740 specification (table 7).

This identifies the PTP Vendor Extension versions that are in use by this device. For devices implementing the Parrot PTP Extension or a part of it, this value should be set to 0x0000001B if it is the default set of supported extension(s).

3. AMENDMENT TO STANDARD PTP

3.1. StillCaptureMode

Parrot Extension defines new setting for StillCaptureMode. The device property (0x5013) is shown below.

Value	Description
0x8001	Video Capture
0x8002	GPS position
0x8003	Automatic Overlap
0x8004	Calibration

Video Capture: the camera will record a video rather than taking still pictures. It may be possible to use InitiateCapture (0x100E) to take photos at the same time as a video is being recorded.

GPS position: the camera will take pictures according to the GPS position. The goal is to have equal spacing between pictures (for mapping an area). The interval between each picture is defined by the GPSInterval property (0xD212) described in section 6.16.

Automatic Overlap: the camera will take picture that will overlap each other by a percentage defined by the device property OverlapRate (0xD219) described in section 6.23.

An OverlapRate of 100% should not be possible since this would mean that there is no movement.

An OverlapRate of 0% means that next image will not overlap the previous one at all.

When moving too fast, the device might not be able to reach the targeted OverlapRate.

Calibration: The camera will take a serie of calibration pictures. The number of capture taken and the calibration method is device dependent.

4. OPERATIONS DESCRIPTION

The Inertial Measurement Unit, or IMU, provides data on the orientation of the sensor. It compensates for variations in the orientation of the sensor due to the movements of the drone.

For all commands using an IMU_ID, the parameter is optional and represents the IMU number by starting with 0 (0 means by default). For example: there are two IMU for Sequoia: 0 and 1.

4.1. GetSunshineValues

OperationCode: 0x9201

Operation Parameter: none

Response data: AUINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the sunshine sensors by returning a SunshineValues data set consisting an Array of UUINT32. Each element of this array corresponds to the value given by one sensor (for example different sensors can be used to catch different wavelength).

4.2. GetTemperatureValues

OperationCode: 0x9202

Operation Parameter: none

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the temperature of the device by returning a TemperatureValues data set consisting an Array of INT32. Each element of this array corresponds to the value given by one temperature probe. The unit will be millidegree Celsius.

NOTE: If a temperature can not be read because a sensor is not available, an invalid temperature shall be returned for this sensor. Typically, a value below the absolute zero (-273,15°C) is considered as an invalid temperature.

4.3. GetAngleValues

OperationCode: 0x9203

Operation Parameter: IMU ID

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the angle of the device by returning an AngleValues data set consisting an Array of INT32. Each element of this array corresponds to one angle (for example: yaw, pitch, roll). The unit will be microdegree.

4.4. GetGPSValues

OperationCode: 0x9204

Operation Parameter: none

Response data: AINT32 [lon_angle, lon_minute, lon_microsecond, lat_angle, lat_minute, lat_microsecond, altitude] (altitude in centimeter)

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read GPS data)

Description: returns information and capabilities about the GPS of the sensor by returning a GPSValues data set consisting an Array of INT32. Each element of this array is described in the following table.

Field Order	Field
0	Array Number of Elements
1	Longitude angle
2	Longitude minutes
3	Longitude microseconds
4	Latitude angle
5	Latitude minutes
6	Latitude microseconds
7	Altitude

4.5. GetGyroscopeValues

OperationCode: 0x9205

Operation Parameter: IMU ID

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the gyroscope of Sequoia by returning a GyroscopeValues data set consisting an Array of 3 INT32 [X, Y, Z]. The unit will be microradian per second.

4.6. GetAccelerometerValues

OperationCode: 0x9206

Operation Parameter: IMU ID

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the accelerometer of the device by returning a AccelerometerValues data set consisting an Array of 3 INT32 [X, Y, Z]. The unit will be micrometer per second squared ($\mu\text{m.s}^{-2}$).

4.7. GetMagnetometerValues

OperationCode: 0x9207

Operation Parameter: IMU ID

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the magnetometer of the device by returning a MagnetometerValues data set consisting an Array of 3 INT32 [X, Y, Z]. The unit will be nanotesla.

4.8. GetIMUValues

OperationCode: 0x9208

Operation Parameter: IMU ID

Response data: AINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read sensors)

Description: returns information and capabilities about the IMU of the device by returning a IMUValues data set consisting an Array of 12 INT32.

The goal of this command is to retrieve all values provided by GetGyroscopeValues, GetAccelerometerValues, GetMagnetometerValues and GetAngleValues at once and in this order.

Refer to those commands for more information about the meaning of their values (section 3.5, 3.6 and 3.7).

4.9. GetStatusMask

OperationCode: 0x9209

Operation Parameter: none

Response data: UINT32 containing a mask of status

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read general status, internal communication error)

Description: returns information and capabilities about the status mask by returning a StatusMask bit field as described in.

4.10. EjectStorage

OperationCode: 0x920a

Operation Parameter: StorageID

Response data: None

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- Invalid_Storage_ID
- Invalid_Parameter (storage ID is valid, but can't be ejected)
- General_Error (system error while un-mounting storage)

Description: removable storage might be sensitive to hot unplug. The EjectStorage command allows user to safely un-mount the given storage before physically unplugging it. Ejecting the storage will prevent data corruption.

4.11. StartMagnetoCalib

OperationCode: 0x9210

Operation Parameter: IMU ID

Response data: none

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (error starting calibration)

Description: this operation starts the magnetometer calibration for the given IMU ID. MagnetoCalibrationStatus events will be sent later to notify user what is expected (stats and rotation on which axis).

4.12. StopMagnetoCalib

OperationCode: 0x9211

Operation Parameter1: IMU ID

Response data: none

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (error stopping calibration)

Description: this operation stops the magnetometer calibration for the given IMU ID.

4.13. MagnetoCalibStatus

OperationCode: 0x9212

Operation Parameter1: IMU ID

Response data: UINT32

ResponseCode options:

- Response_OK
- Session_Not_Open
- Invalid_Transaction_ID
- General_Error (cannot read calibration status)

Description: this operation gives the status of the calibration for the given IMU ID.

4.14. SendFirmwareUpdate

OperationCode: 0x9213

Operation Parameter1: UINT32 DataObject size in bytes

Response data: DataObject (binary file content)

ResponseCode options:

- Response_OK
- Operation_Not_Supported
- Session_Not_Open
- Invalid_TransactionID
- Device_Busy
- Invalid_Dataset

Description: used to upload a firmware to the device and trigger update. The update process itself will be subsequently handled by the device with or without an optional sanity check. And for this purpose, an integrity control mechanism should be embedded to the firmware update file (ex: sha256). If the sanity check fails, Invalid_Dataset response shall be returned. It is up to the manufacturer to run any integrity check on the received firmware. It is up to the manufacturer to handle the update process itself.

Parameter 1 should be used to write the size in bytes of the DataObject, but it can be set to 0xFFFFFFFF if size is unknown or bigger than 4GB, in this case the responder must read until there is no more data to read.

5. EVENT DESCRIPTION

5.1. Status

EventCode: 0xC201

Event Parameter1: Status Mask

StatusMask bit field.

Table 4		
Status Mask	Code	Meaning

CameraRunning	0x00000001	Camera(s) is/are running. The camera(s) is/are taking pictures or videos (mandatory).
MainIMUCalibRunning	0x00000002	Main IMU calibration is running.
AuxiliaryIMUCalibRunning	0x00000004	Auxiliary IMU calibration is running (if 2 IMUs are available).
AuxiliaryConnected	0x00000008	Auxiliary module connected (for example: Sequoia has an auxiliary Irradiance module).
GPSRunning	0x00000010	GPS chip is present and running.
RemoteGPSRunning	0x00000020	A Remote GPS is connected and running.
CamNumber01Error	0x00000040	Camera number 1 is malfunctioning (in an error state). For example: Sequoia RGB.
CamNumber02Error	0x00000080	Camera number 2 is malfunctioning (in an error state). For example: Sequoia Green cam.
CamNumber03Error	0x00000100	Camera number 3 is malfunctioning (in an error state). For example: Sequoia Red cam.
CamNumber04Error	0x00000200	Camera number 4 is malfunctioning (in an error state). For example: Sequoia Red-edge cam.
CamNumber05Error	0x00000400	Camera number 5 is malfunctioning (in an error state). For example: Sequoia Near Infrared cam.
CamNumber06Error	0x00000800	Camera number 6 is malfunctioning (in an error state).
CamNumber07Error	0x00001000	Camera number 7 is malfunctioning (in an error state).
CamNumber08Error	0x00002000	Camera number 8 is malfunctioning (in an error state).
CamNumber09Error	0x00004000	Camera number 9 is malfunctioning (in an error state).
CamNumber10Error	0x00008000	Camera number 10 is malfunctioning (in an error state).
CamNumber11Error	0x00010000	Camera number 11 is malfunctioning (in an error state).
CamNumber12Error	0x00020000	Camera number 12 is malfunctioning (in an error state).
CamNumber13Error	0x00040000	Camera number 13 is malfunctioning (in an error state).
CamNumber14Error	0x00080000	Camera number 14 is malfunctioning (in an error state).
CamNumber15Error	0x00100000	Camera number 15 is malfunctioning (in an error state).
CamNumber16Error	0x00200000	Camera number 16 is malfunctioning (in an error state).

Remaining bits might be used in future Parrot extension release.

5.2. MagnetoCalibrationStatus

EventCode: 0xC202

Event Parameter1: IMU_ID

Event Parameter2: status

The status is listed in table 5.

Table 5		
CalibrationStatusCode	Code	Meaning

MagnetoCalibrationNone	0	No calibration.
MagnetoCalibrationOk	1	Calibration seems OK.
MagnetoCalibrationRunning	2	Calibration is running.
MagnetoCalibrationRollPending	3	Waiting rotation on 'roll' axis.
MagnetoCalibrationPitchPending	4	Waiting rotation on 'pitch' axis.
MagnetoCalibrationYawPending	5	Waiting rotation on 'yaw' axis.
MagnetoCalibrationFailed	6	Calibration process failed.
MagnetoCalibrationAborted	7	Calibration process was aborted by user.

Remaining values might be used in future Parrot extension release.

6. PROPERTIES DESCRIPTION

All properties are described via the 0x1014 command (GET_DEVICE_PROP_DESC). You need to refer to it in order to know the possible values for a property (these values are specific to a product).

6.1. AntiFlickeringFrequency

DevicePropCode = 0xD210

Data type: UINT16

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property defines the frequency for the anti-flickering functionality (for example: avoid seeing blinking lights), the special value 0x0000 means that no anti-flickering will be used.

This property is expressed as an enumerated list of allowed frequency in Hertz, or as a range of allowed frequency.

6.2. DisplayOverlayMask

DevicePropCode = 0xD211

Data type: UINT32

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property defines the overlay mask “OverlayFormatMask” to be applied on top of the picture. The overlay mask is a bitfield described in [table 6](#). Use this for streaming purpose. Do not record the overlay layers in produced image files or video files.

This property should be expressed as an enumerated list of allowed combinations, if the list of all combination is not too long. Or it can be expressed as a range of allowed combinations if there are a lot of possible combinations.

Table 6		
OverlayFormatMask	Code	Description
OverlayFormatShootingGrid	0x0001	Display a grid to help the user framing shots.
OverlayFormatHistogram	0x0002	Display the image histogram.
OverlayFormatCentralPoint	0x0004	Display a cross or another type of marker showing the center of the picture.
OverlayFormatOverexposure	0x0008	Display indicator over the over-exposed areas of the picture.
OverlayFormatQuickReview	0x0010	When in video streaming mode, quickly display the photos for a few seconds after they are taken.
OverlayFormatAutoExposureArea	0x0020	Display used area(s) for auto exposure process.
OverlayFormatAutoFocusArea	0x0040	Display used area(s) for auto focus process.

6.3. PhotoSensorEnableMask

DevicePropCode = 0xD201

Data type: UInt32

DescForms: Enum / Range

Get/Set: Get/Set

Description: mask of photo sensors that are/will be used. This command is used when multiple photo sensors are available, each sensor is being represented by the corresponding bit of the mask.

6.4. PhotoSensorsKeepOn

DevicePropCode = 0xD202

DataType: UInt32

DescForm: Enum / Range

Get/Set: Get/Set

Description: activates/deactivates the mode sensors keep-on (sensors always turned on). This allows to keep photo sensors active (use more energy) all the time, and to be able to execute the INITIATE_CAPTURE operation faster (activating/deactivating sensors will not slow down the process).

6.5. MultispectralImageSize

DevicePropCode = 0xD203

DataType: String

DescForm: Enum / Range

Get/Set: Get/Set

Description: image size for multispectral monochrome sensors "W x H". Null terminated string that is parsed as follows: "W x H" where W represents the width (in pixels) and H represents the height (in pixels) interpreted as unsigned integers. This property is the counter part of ImageSize (0x5003) property, but for multispectral sensor(s) when present aside a conventional photo sensor.

6.6. MainBitDepth

DevicePropCode = 0xD204

DataType: UINT32

DescForm: Enum / Range

Get/Set: Get/Set

Description: main sensor bit depth (ex: 8, 10 or 12 bits).

6.7. MultispectralBitDepth

PropCode = 0xD205

DataType: UINT32

DescForm: Enum / Range

Get/Set: Get/Set

Description: multispectral sensors bit depth (ex: 8, 10 or 12 bits).

6.8. HeatingEnable

PropCode = 0xD206

Data type: (UInt32) activates/deactivates heating resistors mask

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property is used to heat and keep a constant temperature. Activating heating resistors might increase significantly the power consumption of the device. But this will also increase the reliability of the measures.

The data is a mask of resistor, the corresponding bit is set to 1 if resistor is active and 0 if not active.

6.9. WifiStatus

PropCode = 0xD207

DataType: String

DescForm: Enum / Range

Get/Set: Get/Set

Description: indicates the Wi-Fi status (for example: "ON", "OFF", "ERROR", "RESTART"...). This property can also be used to control the Wi-Fi status (for example: to turn it ON/OFF...).

6.10. WifiSSID

PropCode = 0xD208

DataType: String

DescForm: Enum / Range

Get/Set: Get/Set

Description: Wi-Fi SSID to be used

6.11. WifiEncryptionType

PropCode = 0xD209

DataType: UINT8

DescForm: Enum/Range

Get/Set: Get/Set

Description: type of Wi-Fi encryption (for example: None, WEP, WPA...)

Possible values are described in table 7, WifiEncryption format.

Table 7	
WifiEncryption format	Code

WifiEncryptionNone	0x00
WifiEncryptionWep	0x01
WifiEncryptionWpaPsk	0x02
WifiEncryptionWpaTkip	0x03
WifiEncryptionWpa2Psk	0x04
WifiEncryptionWpa2Tkip	0x05
WifiEncryptionWpa2Ccmp	0x06

6.12. WifiPassphrase

PropCode = 0xD20A

DataType: String

DescForm: Enum / Range

Get/Set: Get/Set

Description: Wi-Fi password to be used if encryption is active.

6.13. WifiChannel

PropCode = 0xD20B

DataType: UINT16

DescForm: Enum / Range

Get/Set: Get/Set

Description: Wi-Fi channel to be used. An enumeration MUST be provided if there are holes in allowed bands (for example: 5Ghz bands).

6.14. Localization

PropCode = 0xD20C

DataType: String

DescForm: Enum / Range

Get/Set: Get/Set

Description: country code for the current localization. Current localization country code string. The country code shall be formatted as described by ISO 3166-1.

6.15. WifiMode

PropCode = 0xD20D

DataType: UINT16

DescForm: Enum / Range

Get/Set: Get/Set

Description: Wi-Fi mode to be used (ex: 0 = AP, 1 = Client).

6.16. GPSInterval

PropCode = 0xD212

DataType: UINT32

DescForm: Enum / Range

Get/Set: Get/Set

Description: Interval in centimeter (cm) between each capture when using GPS mode (cf. StillCaptureMode).

6.17. MultisensorsExposureMeteringMode

PropCode = 0xD213

DataType: AUINT16

DescForm: Enum/Range

Get/Set: Get/Set

Description: The device enumerates the supported values of this property for each photo sensor available. For each element of the table, the value listed in Table 36 of the ISO 15740 specification is defined.

The advantage of ExposureMeteringMode is that MultisensorsExposureMeteringMode allows each photo sensor to define its independent behavior.

This property replaces the ExposureMeteringMode (0x500B) with multi-sensor cameras; if you choose to implement both, then ExposureMeteringMode must control only the main photo sensor (index 0 of the MultisensorsExposureMeteringMode array).

6.18. MultisensorsexposureTime

PropCode = 0xD214

DataType: AUINT32

DescForm: Enum/Range

Get/Set: Get/Set

Description: This property corresponds to the shutter speed of each available photo sensor. It has units of seconds scaled by 1000000. When it is in an automatic exposure program mode, the settings of this property (via SetDeviceProp) may cause other properties to change. The device is required to issue DevicePropChanged events for the other properties that change as a result of the initial change.

Typically, this property is only used when MultisensorsExposureProgramMode is set to manual or shutter priority for the corresponding sensor.

The advantage of ExposureTime is that MultisensorsExposureTime allows each photo sensor to define its independent behavior.

This property replaces the ExposureTime (0x500D) with multi-sensor cameras; if you choose to implement both, then ExposureTime must control only the main photo sensor (index 0 of the MultisensorsExposureTime array)

6.19. MultisensorsExposureProgramMode

PropCode = 0xD215

DataType: AUINT16

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property allows each photo sensor of the device to correspond to the “Exposure Program” tag within an EXIF or TIFF/EP image file. It can also be constrained by a list of permitted exposure program mode settings supported by the device. The values listed in Table 38 of the ISO 15740 specification are defined.

The advantage of ExposureProgramMode is that MultisensorsExposureProgramMode allows each photo sensor to define its independent behavior.

This property replaces the ExposureProgramMode (0x500E) with multi-sensor cameras; if you choose to implement both, then ExposureProgramMode must control only the main photo sensor (index 0 of the MultisensorsExposureProgramMode array).

6.20. MultisensorsExposureIndex

PropCode = 0xD216

DataType: AUINT16

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property allows the emulation of the film speed settings on a digital camera for each available photo sensor; the settings correspond to the ISO designation (ASA/DIN). Typically, a device supports discrete enumerated values but continuous control over a range is possible. A value of 0xFFFF corresponds to the automatic ISO setting.

The advantage of ExposureIndex is that MultisensorsExposureIndex allows each photo sensor to define its independent behavior.

This property replaces the ExposureIndex (0x500F) with multi-sensors cameras, if you choose to implement both, then ExposureIndex must control only the main photo sensor (index 0 of the MultisensorsExposureIndex array).

6.21. MultIrradianceGain

PropCode = 0xD217

DataType: AUINT32

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property allows to define the gain applied to each available Irradiance sensors. The settings correspond to arbitrary values depending of the used sensor(s). A device might supports discrete enumerated values if there is a limited set of combination or a range if there are too many possibilities.

6.22. MultIrradianceIntegrationTime

PropCode = 0xD218

DataType: AUINT32

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property allows to define the integration time used by each available Irradiance sensors. The settings correspond to time given in micro-seconds (μ s). A device might supports discrete enumerated values if there is a limited set of combination or a range if there are too many possibilities.

6.23. **OverlapRate**

PropCode = 0xD219

DataType: UINT8

DescForm: Enum/Range

Get/Set: Get/Set

Description: this property defines the overlapping percentage between each photos when using the Automatic Overlap mode (cf. StillCaptureMode, section 3.1)