Camera Control XML Database User's Manual

P/N 6762 Rev. +1

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Parameter and Status Types for G4 and XML-controlled Cameras:

XML-controlled cameras are currently all Ethernet, 1110 Series, 1400 Series, and 1500 Series cameras.

XML tag definitions:

Our XML implementation uses a limited number of XML tags to describe the camera data. To allow human and machine reading of the data, a limited set of predefined unit types describe physical characteristics of the camera or its control subsystems. The numbers assigned to unit types are to be controlled so as to prevent non-conforming usage in multiple programs. The unit types used by our cameras are as follows:

unit_type	Description	Signed Value
0	not used	N/A
1	a pressure in S800 units (use the 800 series pressure look-up table)	No
2	a pressure in milliTorr	No
3	a temperature in °K * 10	No
4	a Voltage in millivolts	**Yes**
5	a Voltage in Volts	**Yes**
6	a current in milliamps	No
7	a time in milliseconds	No
8	a list index value	No
9	a sparse list index value	No
10	a bit field	No
11	a number without units	No
12	a number with custom units	No
13	an IP address	No
14	a relative humidity in % * 100	No
15	a distance in nanometers	**Yes**
16	a time in nanoseconds	No
17	text consisting of bytes representing printable ASCII characters	No

The XML standard describes the tags within a file by using a document type definition (DTD). Our parameter and status data are transported in XML files that use simple DTDs, described in the next section.

XML files will comply with one of the following document type definitions:

For status lists:

```
<?xml version="1.0" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT display (#PCDATA)>
<!ELEMENT mask (#PCDATA)>
<!ELEMENT bit_field (mask, display)>
<!ELEMENT value (#PCDATA)>
<!ELEMENT pull_down (value, display)>
<!ELEMENT step (#PCDATA)>
<!ELEMENT unit_type (#PCDATA)>
<!ELEMENT units (#PCDATA)>
<!ELEMENT index (#PCDATA)>
<!ELEMENT entries (#PCDATA)>
<!ELEMENT item (index, display, value, unit_type, (units | step | bit_field | (entries, pull_down+))?)>
<!ELEMENT status (item+)>
<!ELEMENT si_data (status)>
]>
```

Or the "quick" format

```
<?xml version="1.0" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT quick_status (#PCDATA)>
<!ELEMENT si_data (quick_status)>
]>
```

For parameter lists:

```
<?xml version="1.0" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT display (#PCDATA)>
<!ELEMENT mask (#PCDATA)>
<!ELEMENT bit_field (mask, display)>
<!ELEMENT value (#PCDATA)>
<!ELEMENT pull_down (value, display)>
<!ELEMENT step (#PCDATA)>
<!ELEMENT unit_type (#PCDATA)>
<!ELEMENT units (#PCDATA)>
<!ELEMENT max (#PCDATA)>
<!ELEMENT min (#PCDATA)>
<!ELEMENT post_name (#PCDATA)>
<!ELEMENT parameter (post_name, display, value, min, max, unit_type, (units | step | bit_field | pull_down+)?)>
<!ELEMENT read_only (#PCDATA)>
<!ELEMENT list (display, read_only?, parameter+)>
<!ELEMENT si_data (list+)>
]>
```

Or the "quick" format

```
<?xml version="1.0" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT display (#PCDATA)>
<!ELEMENT read_only (#PCDATA)>
<!ELEMENT value (#PCDATA)>
<!ELEMENT parameter (display, value)>
<!ELEMENT list (display, read_only?, parameter+)>
<!ELEMENT si_data (list+)>
]>
```

For image header lists:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT display (#PCDATA)>
<!ELEMENT mask (#PCDATA)>
<!ELEMENT selection (#PCDATA)>
<!ELEMENT step (#PCDATA)>
<!ELEMENT units (#PCDATA)>
<!ELEMENT unit_type (#PCDATA)>
<!ELEMENT value (#PCDATA)>
<!ELEMENT bit_field (mask, display)>
<!ELEMENT item (display, value, unit_type, (units | selection | step | bit_field)?)>
<!ELEMENT list (display, item+)+>
<!ELEMENT si_data (list+)>
]>
```

For file lists:

```
<?xml version="1.0" standalone="yes"?>
<!DOCTYPE si_data [
<!ELEMENT name (#PCDATA)>
<!ELEMENT Content-Type (#PCDATA)>
<!ELEMENT brief (#PCDATA)>
<!ELEMENT read_only (#PCDATA)>
<!ELEMENT volatile (#PCDATA)>
<!ELEMENT command_file (#PCDATA)>
<!ELEMENT software_summary (#PCDATA)>
<!ELEMENT file (name, Content-Type, brief, read_only, volatile, command_file, software_summary)>
<!ELEMENT filelist (file+)>
<!ELEMENT si_data (filelist)>
]>
```

Status vs. Parameter XML Files:

1. As noted in the relevant DTDs above, status files will contain exactly one <status> tag and parameter files will contain one or more <list> tags.
2. A <status> tag will contain one or more <item> tags. These are the data records from the camera.
3. A <list> tag will contain a single <display> tag and one or more <parameter> tags. The <parameter> tags are the data records from the camera. The <display> tag is a name for the particular list. No special significance should be ascribed to the name in the <display> tag.
4. A <parameter> tag is a proper superset of the <item> tag used within the <status> tag. The additional sub-tags present only in a <parameter> tag will be noted in the detailed descriptions in following sections.

Quick Format XML Files:

1. The "quick" status format consists of a single data block with index, value pairs on each line within the block. Only the active status values will be presented in this data block. This allows the status to be transmitted without the overhead of the descriptions of each value. The mechanism for making a particular status value active or inactive is described by the contents of the file with its command_file tag containing a non-zero value.
2. The "quick" parameter format abbreviates the contents of each parameter tag. Only the display names and values are presented. This allows the parameters to be transmitted without the overhead of the descriptions of each value.

The "step" tag:

1. The "step" tag optionally modifies the scaling of unit types 2, 3, 4, 5, 6, 7, 14, 15, and 16. The "step" tag, if present, will contain a floating point value by which the value of the parameter must be multiplied. If the "step" tag is not present for parameters of these unit types, the values must be interpreted as though a "step" tag containing "1.0" was present.
2. The "step" tag contains a multiplicative factor. It is not required and should not be expected to be a power of 10.
3. The "step" tag must remain constant for a particular parameter. This is necessary because the quick formats do not include the "step" tag. An application will read the full parameter description, typically once, and then read only quick format parameter lists. If the "step" tag changed from one read to the next, the meaning of the parameter value would be indeterminate in the quick formats.
4. Using unit type 4 (millivolts) with a "step" tag of "1000" would make the interpretation of the parameter value identical to unit type 5 (Volts) without a "step" tag. Using unity type 7 (milliseconds) with a "step" tag of "0.000001" would make the interpretation of the parameter value identical to unit type 16 (nanoseconds) without a "step" tag.

Extensible Communications Protocol Overview

Cameras that comply with the extensible communications protocol (XCP) will use either a serial link (such as is provided within the CameraLink data transport) or the primary data transport layer (such as Ethernet) to receive and send commands and responses. The camera and the host computer must both be able to accommodate the slow rate of data transfer available via a serial link. For multiple-CCD cameras the volume of data in a response can be several hundred kilobytes.

Commands to the camera and responses from the camera are plain text. Response data sets from the camera are presented as XML. Each parameter set will be encapsulated in XML according to the standard described in this document. Use of XML eliminates many problems normally encountered transporting data from one digital environment to another. Similarly, commands are sent to the camera using simple text commands that are described by the XML data the camera provides. The camera will only send data through the communications interface when requested to do so by the host computer.

A command to the camera will consist of a text line followed by a carriage return ('\r'). The command interface will echo each character sent up to and including the carriage return. After that the command will be executed and any text produced by that command will be sent to the host computer.

The only command universally accepted by cameras adhering to the XCP is the "GET" command. When the host software establishes communications with the camera it should issue the command "GET FILES.XML" to get the list of available files. All parameter, command, and status data sets will be listed in this XML file.

When the "GET" command is issued, the camera will echo the command a second time and then send the XML data file requested. After the XML data file the camera will send a carriage return-line feed pair ("\r\n") and a line containing the number of bytes transmitted. This line will contain an ASCII representation of the number followed by another carriage return-line feed pair ("\r\n"). After this the camera will send a CRC calculated on the characters sent, also in ASCII text, and a third carriage return-line feed pair.

The structure of the FILES.XML file is governed by the document type description in the previous section.

Each data line in the XML file contains a <file> tag enclosing the attributes of each file available in the camera. The first attribute is "name". This is the text that should be used with the "GET" command to request the particular file.

The second attribute is "Content-Type". All files generated by the camera will have "Content-Type" equal to "text/xml". Files stored in the FLASH file system within the camera will also appear on this list. They *may* have other values in "Content-Type".

The third attribute is "brief". When this is non-zero it indicates that a file contains the same value data as another file in the list, but does not contain the descriptive information. This permits the brief files to be transmitted much faster.

The fourth attribute is "read_only". When this is non-zero it indicates that the file contents will not be altered in the course of normal camera operations. Read only files are only altered during factory setup of the camera.

The fifth attribute is "volatile". When this is non-zero it indicates that the values in the file are subject to change by the camera without outside intervention. Status parameters, such as the current CCD temperature, fall into this category.

The sixth attribute is "command_file". When this is non-zero it indicates that the file describes the command interface to the camera.

All XML files will comply with one of the document type definitions in the previous section.

XML Record Details for Each Unit Type:

Unit_type=1, a pressure in S800 units. ***This unit type is deprecated.*** It is only present here to clarify its historical usage in older cameras that are still in service.

Values of this type must be converted using the following table:

Reading From Camera	Pressure in Torr
169	0.000
180	0.001
197	0.003
223	0.005
241	0.007
266	0.01
396	0.03
481	0.05
560	0.07
654	0.1
1048	0.3
1281	0.5
1446	0.7
1621	1
2126	3
2304	5
2395	7
2457	10
2573	30
2597	50
2608	70
2615	100

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 1 in this case.
	<parameter> tags will not use this unit type.

Unit_type=2, a pressure in milliTorr.

Values of this type are pressure in milliTorr. If the <value> tag contains 142, the pressure is 0.142 Torr.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 2 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=3, a temperature in °K * 10.

Values of this type are temperature expressed in °K * 10. If the <value> tag contains 2732, the temperature is 273.2°K.

Tag Name	Use
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 3 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=4, a Voltage in millivolts.

Values of this type are Voltage in millivolts. If the <value> tag contains 3299, the Voltage is 3.299V. These values may be negative numbers.

Tag Name	Use
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 4 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=5, a Voltage in Volts.

Values of this type are Voltage in Volts. If the <value> tag contains 329, the Voltage is 329V. These values may be negative numbers.

Tag Name	Use
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 5 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=6, a current in milliamps.

Values of this type are current in milliamps. If the <value> tag contains 5432, the current is 5.432A.

Tag Name	Use
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 6 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=7, a time in milliseconds.

Values of this type are time in milliseconds. If the <value> tag contains 500, the time is 0.5 seconds.

Tag Name	Use
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 7 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=8 or 9, a pull-down menu.

Records of this type contain a pull-down menu. The only permissible values are those listed in the <pull_down> records contained within this record. Records with a <unit_type> of 8 are sequential from zero, records with a <unit_type> of 9 are non-sequential or begin with a non-zero value.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 8 or 9 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: always zero.
max	<parameter> only: the number of items on the menu.
pull_down	<parameter> only: one record for each item on the menu.
display	Within <pull_down>: the user-presentable name of this item on the menu.
value	Within <pull_down>: the value of this item on the menu.

Note that in the image header lists, unit types 8 and 9 do not include the entire pull-down menu. The alternate form for these unit types in an image header is as detailed here:

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 8 or 9 in this case.
selection	This tag contains a single text string extracted from the pull-down menu entry that corresponds to the value above.

Unit_type=10, a bit-field containing several flags.

Values of this type are made up of multiple bits representing different flags.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 10 in this case.
bit_field	An enclosing tag to contain a record describing the bits.
mask	Within <bit_field>: a numerical value in ASCII text with all named bits set.
display	Within <bit_field>: a comma-delimited string with a name for each bit set in the <mask> tag's numerical value. An example: <bit_field><mask>3</mask><display>Shutter,Trigger</display></bit_field> This example indicates that if the contents of <value> is zero, neither flag is true; if it is 1, Shutter is true; if it is 2, Trigger is true; and if it is 3 both are true.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=11, a number without units.

Values of this type are just numbers. They have no units.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 11 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=12, a number with a human-readable (but not machine-specified) units string.

Values of this type are just numbers to the computer. The units string is only significant to the human operator. It is not parsed, it is only displayed

Tag Name	**Use**
Display	User-presentable name of the value
Value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 12 in this case.
units	A string describing the units to the human operator.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=13, an IP address.

Values of this type are an IP address. They may be displayed in normal octet with dots format.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 13 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=14, a relative humidity in % * 100.

Values of this type are relative humidity expressed in % * 100. If the <value> tag contains 2732, the relative humidity is 27.32%.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 14 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=15, a distance in nanometers.

Values of this type are nanometers. Since parameters are 32-bit numbers, this allows representation of positional data on a focal plane of up to just over 4 meters. It allows description of distances of up to 2 meters.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 15 in this case.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Unit_type=16, a time in nanoseconds.

Values of this type are time in nanoseconds. The <step> tag allows the <value> tag to represent multiples of this time.

Tag Name	**Use**
display	User-presentable name of the value
value	The numerical value in ASCII text
unit_type	The identifier of the type of record, 16 in this case.
step	This tag may not be present. If not, it should be presumed that the <value> tag represents nanoseconds. If it is present, the <value> tag is in units of the number of nanoseconds represented. For example: <value>20</value><step>1000</step> represents 20 microseconds. Similarly, <value>4</value><step>1000000</step> represents 4 milliseconds and <value>821</value><step>1000000000</step> represents 821 seconds. Step will not necessarily be a power of 10.
post_name	<parameter> only: the command name sent to the camera to set this value.
min	<parameter> only: the lowest numerical value permitted when setting the value.
max	<parameter> only: the highest numerical value permitted when setting the value.

Example Records for Status Lists:

unit_type	Tags
1	
2	<item><index>33</index><display>Chamber Pressure</display> <value>65535</value><unit_type>2</unit_type></item>
3	<item><display>CCD Temperature</display> <value>1842</value><unit_type>3</unit_type></item>
4	<item><display>-13.2 Volt Supply</display><value>-13158</value> <unit_type>4</unit_type></item>
5	
6	<item><index>46</index><display>Primary 28V Current</display> <value>0</value><unit_type>6</unit_type></item>
7	<item><display>Camera Up Time</display> <value>18527857</value><unit_type>7</unit_type></item>
8	N/A
9	N/A
10	<item><display>Flags</display><value>4</value><unit_type>10</unit_type><bit_field> <mask>63551</mask><display>Cooler On,Cooler Enabled,Back plate sensor detected,Back plate overtemp.,Shutter,Trigger,HKS Com. Error,Supply Error,Rail Error,CRC Error,Alarm</display></bit_field></item>
11	<item><display>HKS Version</display> <value>15183</value><unit_type>11</unit_type></item>
12	<item><index>65</index><display>CryoTiger Supply</display> <value>0</value><unit_type>12</unit_type><units>PSI</units></item>
13	
14	
15	
16	
17	

Example Records for Parameter Lists:

unit_type	Tags
1	
2	<parameter><post_name>MISC_14</post_name><display>Operational Pressure</display> <value>100</value><min>0</min><max>720000</max><unit_type>2</unit_type></parameter>
3	<parameter><post_name>PARAM3</post_name><display>CCD Temperature Setpoint</display> <value>2532</value><min>2332</min><max>2932</max><unit_type>3</unit_type></parameter>
4	
5	
6	
7	<parameter><post_name>PARAM6</post_name><display>Exposure Time</display> <value>100</value><min>0</min><max>16777215</max><unit_type>7 </unit_type></parameter>
8	<parameter><post_name>PARAM8</post_name><display>Initial Clear Mode</display> <value>0</value><min>0</min><max>3</max><unit_type>8</unit_type> <pull_down><value>0</value><display>Enable</display></pull_down> <pull_down><value>1</value> <display>Disable 1 cycle</display></pull_down> <pull_down><value>2</value><display>Disable</display> </pull_down></parameter>
9	<parameter><post_name>PARAM20</post_name><display>Camera De-interlace</display> <value>1</value><min>0</min><max>1</max><unit_type>9</unit_type> <pull_down><value>1</value><display>Hardware de-interlace</display> </pull_down></parameter>
10	
11	<parameter><post_name>PARAM10</post_name><display>Serial Origin</display> <value>10</value><min>0</min><max>8191</max><unit_type>11</unit_type> </parameter>
12	<parameter><post_name>PARAM7</post_name><display>TDI Delay</display> <value>500</value><min>0</min><max>8191</max><unit_type>12</unit_type> <units>usec.</units></parameter>
13	<parameter><post_name>PARAM0</post_name><display>IP Address</display> <value>2886731011</value><min>0</min><max>4294967295</max> <unit_type>13</unit_type></parameter>
14	
15	<parameter><post_name>MISC_16</post_name><display>CCD 0 Focal Plane X</display> <value>-15360000</value><min>-2147483648</min><max>2147483647</max> <unit_type>15</unit_type></parameter>
16	<parameter><post_name>SETUP 19</post_name><display>Parallel Shift Delay</display> <value>17</value><min>17</min><max>4095</max><unit_type>16</unit_type><step>10</step> </parameter>
17	<parameter><post_name>MISC_1</post_name><display>CCD Model</display> <value>STA3700C</value><min>0</min><max>0</max><unit_type>17</unit_type></parameter>

Reserved <display> Tag Names for Status and Parameter Lists:

Note: the contents of the <display> tag should be checked with a case *insensitive* comparison.

<display> Tag Text	**Meaning**
"Acquisition mode"	Indicates the type of acquisition that the camera will perform. Possible settings are camera dependent and will be presented in a pull-down menu.
"Backplate Temperature"	Temperature of the plate into which the TEC dumps heat.
"Bits Per Pixel"	Indicates the number of bits present in each pixel.
"CCD %u De-interlace Position"	Indicates the order in which pixels from this CCD are transferred from the camera. %u is replaced by the CCD #.
"CCD %u Port %u ADC Offset"	Analog offset for a port on a CCD. %u is replaced by the CCD/Port # as appropriate.
"CCD %u Port %u Correlation Bias"	Offset between the correlated double samples for a port on a CCD. . %u is replaced by the CCD/Port # as appropriate.
"CCD %u Port %u Gain Correction"	Gain correction factor for a port on a CCD. . %u is replaced by the CCD/Port # as appropriate.
"CCD %u CCD Temp."	Temperature of the CCD as measured by the control system. %u is replaced by the CCD # as appropriate.
"CCD Enable Mask"	A bit mask indicating the enabled CCDs. Bit 0 set indicates CCD 0 is enabled, etc. If this record is missing, it can be presumed that there is only 1 CCD installed and it is always enabled.
"CCD Temperature Setpoint"	Temperature to which the CCD is regulated by the cooling system.
"CCD Type"	Full-frame or Frame Transfer.
"Camera De-interlace"	The de-interlacing function is performed by Hardware (in the camera), Software (in the host computer), or Serial Register Hardware (serial registers are de-interlaced in the camera, all other de-interlacing is done in the host computer).
"Camera Up Time"	Time since the last camera reset or power-on.
"Chamber Pressure"	If present, this indicates the vacuum chamber pressure. Not all cameras support reporting of the vacuum chamber pressure.
"Cold End Temperature Setpoint"	Temperature to which the cryogenic cold end is regulated by the cooling system. This only exists in cryogenic systems.
"De-interlace Order"	Indicates if the port or CCD increments first in a multiple-CCD camera. CCD Increments First or CCD Increments Last. This has no meaning and is not present in single-CCD cameras.
"DSI Sample Time"	Time the dual-slope integrator will sample the video signal.
"Exposure Time"	Time the CCD will integrate charge from photon collection.
"Frame Count"	For cameras that support multiple-frame operation, this parameter indicates the number of frames to acquire for each command. A count of zero indicates to acquire frames until an abort is issued to the camera. Cameras that do not support multiple-frames operation will not present this parameter.
"Gain"	Selects the gain of the analog electronics. Possible settings are camera dependent and will be presented in a pull-down menu.
"Initial Clear Mode "	Continuous clear selector when the camera is turned on or reset: enabled, disabled 1 cycle, or disabled.
"Installed CCDs"	Number of CCDs installed in the camera. If this record is missing, it can be presumed that there is 1 CCD installed.
"Installed Ports"	Number of ports installed for each CCD in the camera.
"Instrument Model"	Camera model number. This is not the part number (see "Hardware Part

	Number" in Appendix A).
"Instrument SN"	Camera serial number.
"Parallel Active Pix."	The actual pixel count on the CCD in the parallel direction (excluding masked pixels).
"Parallel Binning"	The binning to be applied in the parallel direction during readout.
"Parallel Clear Count"	The number of parallel shifts that are to be done between serial clears during continuous clear.
"Parallel Clock Regions"	The number of regions that have separate parallel clock drivers. This will normally be 1 (for single serial register full frame CCDs), 2 (for single serial register frame transfer CCDs or curtain-mode CCDs that are not frame transfer), or 4 (for curtain-mode frame transfer CCDs).
"Parallel Length"	The number of times the parallel binning will be done to produce readable serial registers during readout.
"Parallel Origin"	The number of parallel shifts that will be discarded prior to starting parallel binning during readout.
"Parallel Phasing"	The direction control for parallel shifting. Typically: normal, reverse, or split.
"Parallel Post Scan"	The number of parallel shifts that need to be done to clear the CCD after readout completes.
"Parallel Post-Masked"	The number of masked parallel rows after the last active pixels.
"Parallel Pre-Masked"	The number of masked parallel rows before the first active pixel.
"Parallel Region %u Masked"	An indicator if a parallel clocking region has an optical mask. %u will be replaced by the parallel clocking region #.
"Parallel Region %u Shift Cap."	An indicator of the parallel clocking region's shift capability (can shift to SR0, SR1, or both). %u will be replaced by the parallel clocking region #.
"Parallel Shift Delay"	The duration of each state in the parallel clocking table.
"Pixel Pipeline"	The number of pixels in the ADC pipeline.
"Port %u ADC Offset"	See "CCD %u Port %u ADC Offset" for this deprecated record.
"Port %u Correlation Bias"	See "CCD %u Port %u Correlation Bias" for this deprecated record.
"Port %u Gain Correction"	See "CCD %u Port %u Gain Correction" for this deprecated record.
"Port Select"	Specifies the ports that are to be used during readout.
"Serial Active Pix."	The actual pixel count on the CCD in the serial direction (excluding masked pixels).
"Serial Binning"	The binning to be applied in the serial direction during readout.
"Serial Clear Count"	The number of serial discards that will be performed for each serial register clear during continuous clear.
"Serial Length"	The number of serial reads that will be performed during readout.
"Serial Origin"	The number of serial discards that will be performed prior to reading pixels during readout.
"Serial Phasing"	The direction control for serial shifting. Typically: normal, reverse, or split.
"Serial Post Scan"	The number of serial shifts that need to be done to clear the serial register after reading the serial length.
"Serial Post-Masked"	The number of inactive pixels in the serial register after the active pixels.
"Serial Pre-Masked"	The number of inactive pixels in the serial register before the active pixels.
"Shutter Close Delay"	The time to wait for the shutter to close after issuing the close command.

"Shutter Open Delay"	The time to wait for the shutter to open after issuing the open command.
"SREG %u De-interlace Position"	Indicates the order in which serial registers are transferred from the camera. %u will be replaced by the serial register #.
"TDI Delay"	The delay for each parallel shift during internally-paced TDI readout.
"Two Serial Registers"	Indicates the presence of SR0 only if the <value> tag contains "0", or both SR0 and SR1 otherwise.

Reserved <display> Tag Names for Camera Commands:

Note: the contents of the <display> tag should be checked with a case *insensitive* comparison.

<display> Tag Text	**Meaning**
"Abort an exposure or readout."	The post_name tag contained in this <parameter> tag is the command to abort an exposure or data transfer to the host computer.
"Acquire an image."	The post_name tag contained in this <parameter> tag is the command to initiate an image acquisition. The argument required to select different types of image acquisition will be presented as a pull-down menu.
"Get/set the continuous clear mode."	The post_name tag contained in this <parameter> tag is the command that controls the active continuous clear mode. The argument required to select different continuous clear modes will be presented as a pull-down menu. If the command is issued with no arguments, the current continuous clear mode will be returned.
"Get/set the cooler enable flag."	The post_name tag contained in this <parameter> tag is the command to set or clear the cooler enable flag. The argument required to select different cooler states will be presented as a pull-down menu. If the command is issued with no arguments, the cooler state will be returned.
"Delete the mode at [INDEX]."	The post_name tag contained in this <parameter> tag is the command to remove a mode from the internal non-volatile storage in the camera. An argument which is the index of the mode is required.
"Read the mode from [INDEX]."	The post_name tag contained in this <parameter> tag is the command to make a mode from the internal non-volatile storage in the camera active. An argument which is the index of the mode is required.
"Save the mode to [INDEX]."	The post_name tag contained in this <parameter> tag is the command to save the active mode to the internal non-volatile storage in the camera. An argument which is the index of the mode is required.
"Display the Mode Mask."	The post_name tag contained in this <parameter> tag is the command to inquire the mode mask. This is a bit mask with a bit set for each mode that exists in the camera's non-volatile storage. Bit zero (the LSB) set indicates mode zero exists, etc.
"Display the Frame Clear Time."	The post_name tag contained in this <parameter> tag is the command to inquire the time continuous clear takes to clear the CCD.
"Display the CCD Read Time."	The post_name tag contained in this <parameter> tag is the command to inquire the time to read the CCD with the current control settings.
"Display the remaining exposure milliseconds."	The post_name tag contained in this <parameter> tag is the command to inquire the number of milliseconds remaining in an exposure.
"Get/set the shutter open flag."	The post_name tag contained in this <parameter> tag is the command to inquire or alter the current state of the shutter (if one exists on the camera).
"Clear a status index enable bit ['ALL',INDEX]. "	The post_name tag contained in this <parameter> tag is the command to clear a single or all status enable bits. This removes status values from those reported in the "quick" status file.
"Set a status index enable bit ['ALL',INDEX]."	The post_name tag contained in this <parameter> tag is the command to set a single or all status enable bits. This adds status values to those reported in the "quick" status file.

Appendix A – the miscellaneous.xml file.

The miscellaneous.xml file contains records that must be customized for each camera before the file is uploaded into the camera. These records contain data of interest to top-level software, but not used by the camera.

Required <display> Tag Entries

<display> Tag Text	**Meaning**
"CCD %u Focal Plane X"	X-axis position of the first pixel in the focal plane. %u is replaced by the CCD #.
"CCD %u Focal Plane Y"	Y-axis position of the first pixel in the focal plane. %u is replaced by the CCD #.
"CCD %u SN"	The serial number of the CCD. %u is replaced by the CCD #.
"CCD %u SR0 Orientation"	Position of SR0 on the focal plane. %u is replaced by the CCD #.
"CCD Model"	The model number of the CCD or CCDs installed in the camera.
"Image Area Size X"	This record indicates the size of the CCD in the x axis of the imaging plane. This may be modified by a taper bonded to the CCD.
"Image Area Size Y"	This record indicates the size of the CCD in the y axis of the imaging plane. This may be modified by a taper bonded to the CCD.
"Hardware Part Number"	The Spectral Instruments, Inc. part number for the camera top-level assembly.
"Hardware Revision"	The revision of the camera top-level assembly.
"High Pressure Limit"	Maximum pressure for safe operation of the TEC or cryogenic cooler.
"Low Temp Limit"	Minimum temperature for safe operation of the CCD.
"Operational Pressure"	Maximum pressure for the specified performance of the TEC or cryogenic cooler.
"Operational Temp"	Maximum temperature for the specified performance of the CCD.
"Tested Speeds"	Indicates the "DSI Sample Time" values that have been tested for the camera test report. Possible settings will be presented in a pull-down menu.

Optional <display> Tag Entries

<display> Tag Text	**Meaning**
"CCD %u Stub SN"	The serial number of the stub or face-plate bonded to the CCD. %u is replaced by the CCD #.
"CCD %u Taper SN"	The serial number of the fiber taper bonded to the CCD. %u is replaced by the CCD #.
"Rectangular CCD Array"	This parameter is not present in most single-CCD cameras. If the camera has multiple CCDs and is arranged in a rectangular array, this should be set to non-zero. If the camera has multiple CCDs and is not arranged in a rectangular array, this should be set to zero.
"Rectangular Grid X"	This parameter is not present in most single-CCD cameras. If the "Rectangular CCD Array" record is present and its value is non-zero this record indicates the number of CCDs in the x dimension of the array.
"Rectangular Grid Y"	This parameter is not present in most single-CCD cameras. If the "Rectangular CCD Array" record is present and its value is non-zero this record indicates the number of CCDs in the y dimension of the array.