

# **kSA Communications Interface**

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## **Table of Contents**

Table of Contents .....	2
1 Modes of Operation.....	4
2 Configuration .....	4
3 Protocol Monitoring .....	6
4 Protocol Version Negotiation.....	6
5 List of commands .....	7
5.1 INITIALIZE.....	9
5.2 SET_DATA_FIELDS .....	10
5.3 RUN .....	11
5.4 GET_DATA.....	12
5.5 STOP.....	13
5.6 GET_DATA_SPECIFIC.....	14
5.7 RESTART_GROWTHRATE_FIT .....	20
5.8 OPEN_ACQUIRE .....	21
5.9 CLOSE_ACQUIRE .....	22
5.10 GET_STATUS.....	23
5.11 GET_APP_VERSION .....	24
5.12 TEXT_CMD .....	25
5.12.1 TEXT_CMD Example #1 .....	25
5.12.2 TEXT_CMD Example #2 .....	26
6 Text Commands .....	27
6.1 Laser Power Commands .....	27
6.1.1 Get Laser Power Set Point .....	27
6.1.2 Set Laser Power Set Point.....	27
6.1.3 Read Laser Power .....	28
6.1.4 Get Laser Power State.....	28
6.1.5 Set Laser Power State .....	28
6.2 Exposure Time .....	28
6.2.1 Get Exposure Time .....	28
6.2.2 Set Exposure Time .....	29
6.3 Automatic Spot Intensity .....	29
6.3.1 Get Automatic Spot Intensity.....	29
6.3.2 Set Automatic Spot Intensity .....	30



6.4	Fit Control.....	30
6.5	Text Command Notes: .....	31
6.5.1	Acquire Source Index {[index]} .....	31
7	Data types .....	32
8	Command and reply encoding.....	33
9	Error Codes .....	33
10	Data Fields .....	34
10.1	Common Data Fields .....	34
10.1.1	kSA .....	34
10.2	Application Specific Data Fields .....	34
10.2.1	kSA MOS/Curvature.....	34
10.2.2	kSA RateRat/Reflectivity.....	34
10.2.3	kSA Bandit/BandEdge/Blackbody.....	35
10.2.4	kSA 400 .....	35
10.2.5	ECP .....	35
10.3	Application Specific Acquire Modes.....	35
10.3.1	kSA MOS/Curvature.....	35
10.3.2	kSA ICE .....	36
10.3.3	kSA 400 .....	36
10.3.4	kSA BanditMW.....	36
10.3.5	kSA Bandit.....	36



## 1 Modes of Operation

The kSA Communications Interface can run in two (2) modes, free-running and polled.

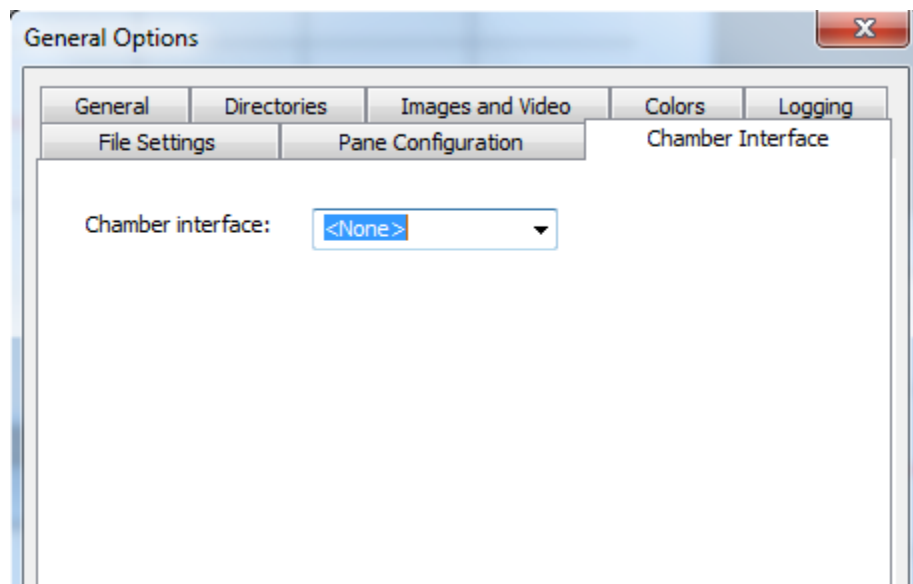
In the free-running mode, once the RUN command has been issued, the application will process data as fast as it acquires. A client can get a copy of the latest data by issuing the GET DATA command.

In the polled mode, the RUN command will configure the acquisition, but data will not be processed until it receives the GET\_DATA command. At that point, one (1) data point will be processed, the data returned and the acquisition will pause until the next GET\_DATA command.

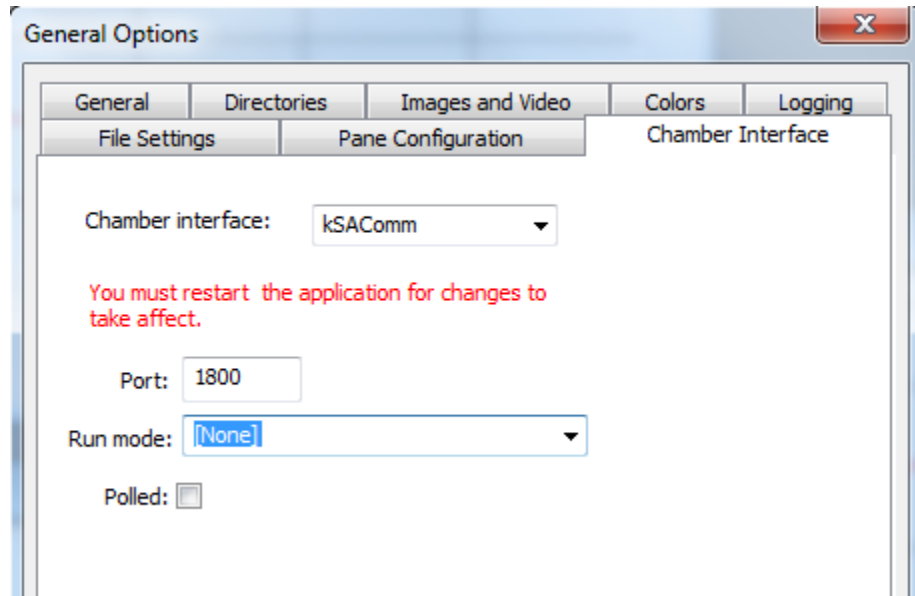
## 2 Configuration

The kSA Communications Interface is a TCP/IP connection between the kSA application and a client application. This communication is established by specifying a port to communicate with.

The kSA Communication Interface can be configured to start a specific acquisition mode and can be configured to run in free-running or polled mode. To configure within a kSA application, select the Options->General from the main application menu. Then select the Chamber Interface tab. You will see the dialog below:



You can now select kSAComm from the dropdown. You will see the dialog below:



You can specify the TCP/IP port on which the server will communicate or use the default. You may select the run mode. The Run mode is the default acquire mode for a kSAComm acquisition. If specified, this mode will automatically be opened as part of the RUN and/or OPEN\_ACQUIRE command processing.

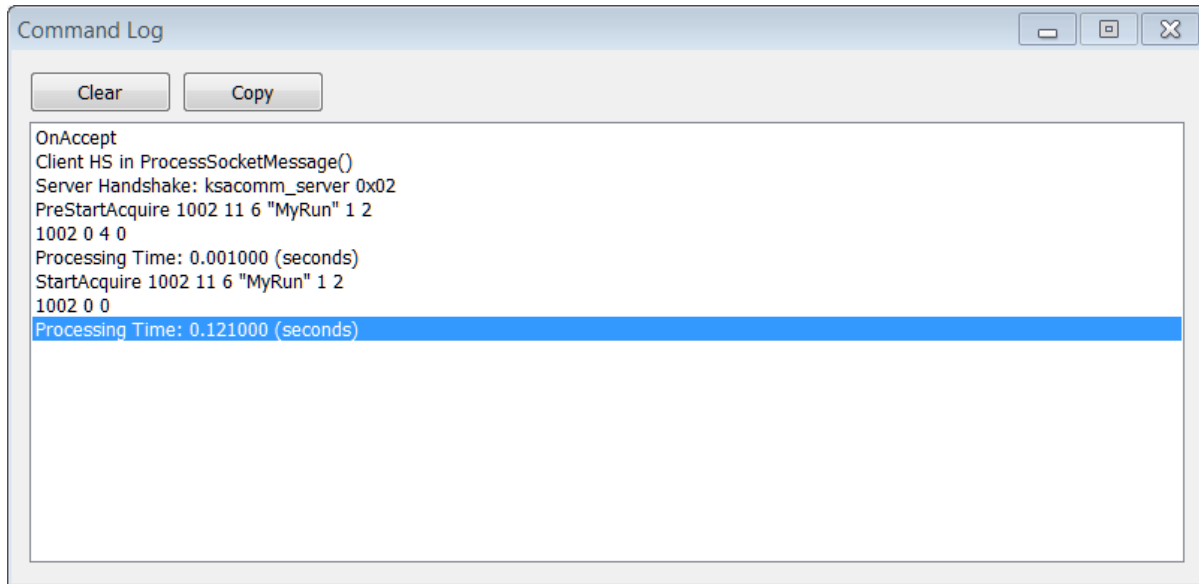
You can also select whether you would like to run kSAComm in polled mode. In polled mode, the acquisition will pause between each GET\_DATA command.

Select Ok and restart the application.



### 3 Protocol Monitoring

You can monitor the TCP/IP messages by using the Command Log dialog. It is located under the View menu within the kSA application.



### 4 Protocol Version Negotiation

Upon successful connection to a kSAComm server, the client must issue the handshake string, “ksacomm\_client” (without quotes). This string is sent using the normal string protocol, see Data Types. The handshake string is not case sensitive. The server will respond with a “ksacomm\_server” string followed by a 2 byte (short) protocol version number. It is up to client to determine if further communication will continue. A server must support ALL protocol versions up to and including the one sent in the handshake. This allows for backward compatibility with older clients. Newer clients may choose to downgrade their protocol to communicate with older servers or terminate the connection.



## **5 List of commands**

The following table contains the complete list of the commands defined in the current version of the protocol. Any other command must be replied to with *unknown command* error code.

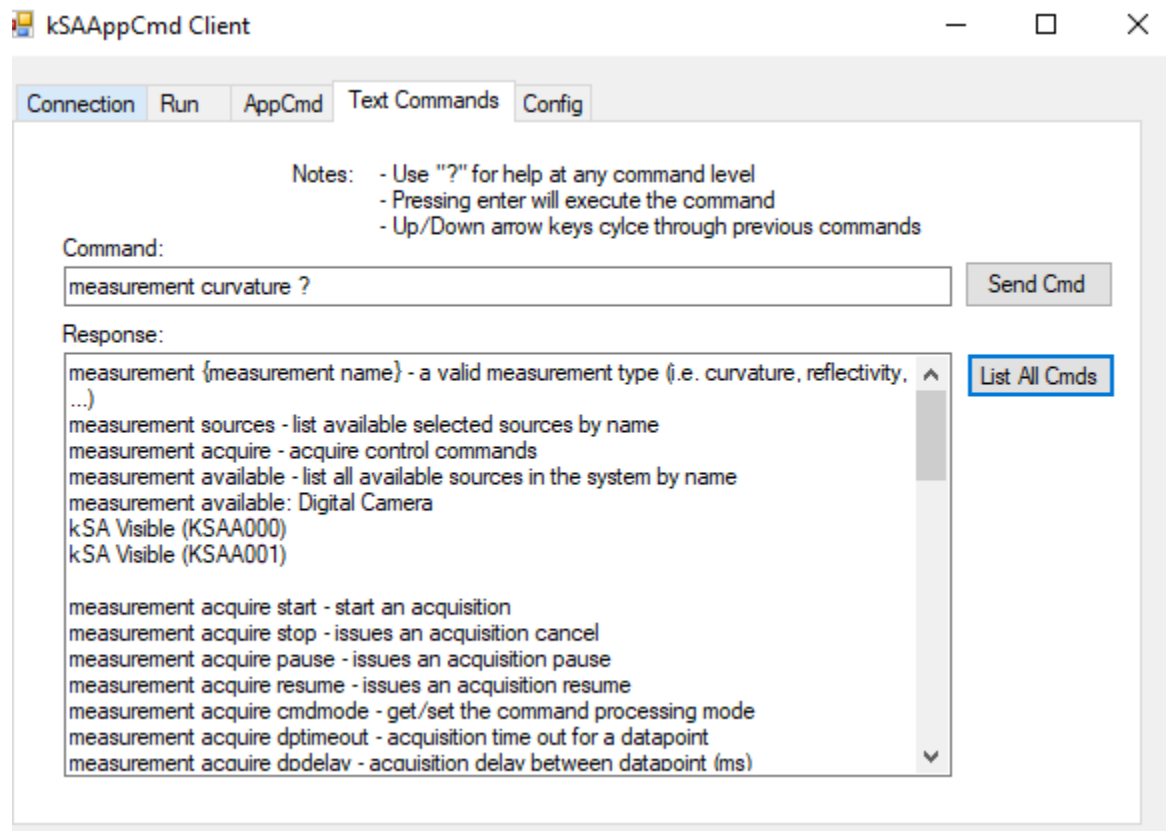
<b>Code</b>	<b>Name</b>	<b>Timeout, seconds</b>	<b>Description</b>
1000	INITIALIZE	5	Reset the communication protocol and device. The device becomes idle, aborts acquisition, if there was any;
1001	SET_DATA_FIELDS	1	Selects fields incorporated in the reply to <i>GET_DATA</i> command.
1002	RUN	5	Starts execution
1003	GET DATA	variable	Returns 1 data point worth of data. What data point depends on the mode of operation.
1004	STOP	5	STOP acquisition
1005	GET_DATA_SPECIFIC	variable	Returns one (1) set of data as defined in the message
1006	RESTART_GROWTHRATE_FIT	1	Restarts a growth rate fit
1007	OPEN_ACQUIRE	1	Opens a designated acquire
1008	CLOSE_ACQUIRE	1	Closes any open acquire
1009	GET_STATUS	1	Gets the system status
1010	GET_APP_VERSION	1	Gets the application's version
1011	TEXT_CMD	variable	Performs the command's action



NOTE: As of 2020, most new commands are type TEXT\_CMD. This allows the most extensibility. As such we do not maintain this document.

The best way to determine the list of commands available to a given application version is to use the kSAAppComClient.exe provided in this SDK.

Once connected to the specific application, the “List App Cmds” function can be used to provide the most up to date command list







## **5.1 INITIALIZE**

### **Purpose:**

The command is used to bring the kSA Software to a known state

### **Command Format:**

The INITIALIZE command is a simple command.

<b>Name</b>	<b>Size</b>	<b>Type</b>	<b>Description</b>
CmdCode	2	Integer	Command code (1000)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

### **Response Format:**

The INITIALIZE command has a simple response.

### **Actions:**

Upon reception of the command, the kSA Software:

- Stops any active acquisition
- Clears list of selected fields
- Initializes hardware

### **Limitations:**

- None



## 5.2 SET\_DATA\_FIELDS

### Purpose:

The Client selects fields it is interested in with the *SET\_DATA\_FIELDS* command. A *SET\_DATA\_FIELDS* command referencing an unknown field should be replied to with an error. The *SET\_DATA\_FIELDS* is capable of returning data for multiple markers.

### Command Format:

Name	Size	Type	Description								
MarkerCount	2	Unsigned short	The number of markers to get data from. If markers are not available, this value should be zero (0). The following is repeated MarkerCount times.								
<table><tr><th>Name</th><th>Size</th><th>Type</th><th>Description</th></tr><tr><td>MarkerID</td><td>2</td><td>Unsigned short</td><td>The one-based marker number. This is omitted from the message if MarkerCount is zero (0).</td></tr></table>				Name	Size	Type	Description	MarkerID	2	Unsigned short	The one-based marker number. This is omitted from the message if MarkerCount is zero (0).
Name	Size	Type	Description								
MarkerID	2	Unsigned short	The one-based marker number. This is omitted from the message if MarkerCount is zero (0).								
FieldCount	4	Integer	Number of fields to report. The following is repeated FieldCount times.								
<table><tr><th>Name</th><th>Size</th><th>Type</th><th>Description</th></tr><tr><td>FieldID</td><td>4</td><td>Integer</td><td>Field ID to report</td></tr></table>				Name	Size	Type	Description	FieldID	4	Integer	Field ID to report
Name	Size	Type	Description								
FieldID	4	Integer	Field ID to report								

### Response Format:

The *SET\_DATA\_FIELDS* has a simple response.

### Actions:

Upon reception of the command, the kSA Software:

- Clears any old list of selected fields
- Configures to collect the designated fields

### Limitations:

#### Version 1:

- The acquisition must not be started

#### Version 2:

- None



### 5.3 ***RUN***

**Purpose:**

Starts the acquisition and depending on the mode of operation, begins processing data or waits for a separate GET\_DATA command.

**Command Format:**

Name	Size	Type	Description
RunName		String	
Number of samples	2	short	
Duration Type	2	Unsigned short	How the acquisition should be terminated 0 = by Time 1 = by Number of DataPoints 2 = Unlimited (Continuous)  The following field depends on the duration type
Duration Value	8	Double	The number of seconds to acquire data (DT = 0)
	4	Unsigned	The number of datapoints to acquire (DT=1)

**Response Format:**

The RUN command has a simple response.

**Actions:**

Upon reception of the command, the kSA Software:

- Ensures the proper acquire mode is active if one has been specified
- Configures the acquisition to the specified parameters
- If free-running mode: begins data acquisition
- If polled mode: waits for GET\_DATA command

**Limitations:**

- The acquisition must not be started otherwise will return an Invalid State error
- An Acquire mode (dialog) must be active



## 5.4 **GET\_DATA**

### Purpose:

Retrieves the data requested by the SET\_DATA\_FIELDS

### Command Format:

The GET\_DATA command is a simple command.

### Response Format:

Name	Size	Type	Description
NumberOfMarkers	2	Unsigned short	The number of markers worth of data. This may be less than the number of markers configured. If markers are not available this will be one (1). The following will be repeated NumberOfMarker times.
<b>Name</b>	<b>Size</b>	<b>Type</b>	<b>Description</b>
Marker number	2	Unsigned short	The marker number where data was collected. If markers are not available this will be one (1)
Marker data			Data is structured as a sequence of all the fields requested in the SET_DATA_FIELDS and is in the same order. Each field is encoded according to its type

### Actions:

Upon reception of the command, the kSA Software:

- If polled mode; resume the acquisition for one (1) data point
- Fill in as much of the request as is available

### Limitations:

- The acquisition must be started otherwise will return an Invalid State error



## 5.5 **STOP**

Purpose:

Stops the acquisition

Command Format:

The STOP command is a simple command.

Name	Size	Type	Description
CmdCode	2	Integer	Command code (1004)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

Response Format:

The STOP command has a simple response

Actions:

Upon reception of the command, the kSA Software will terminate the current acquisition.

Limitations:

- None



## 5.6 **GET\_DATA\_SPECIFIC**

kSA applications are capable of acquiring and making various types of measurements. Some acquisitions allow for multiple measurements from the same type of source such as kSA Bandit while others allow for multiple measurements from a variety of sources such as kSA ICE. Unlike the SET\_DATA\_FIELDS which assumes a homogenous set of information from all markers, the GET\_DATA\_SPECIFIC can target unique information both from a source and marker standpoint. In addition, the GET\_DATA\_SPECIFIC command can request individual region specific information.

For kSA 400 you may replace the word “Marker” with “Dataset” in the following definitions.

### Purpose:

The Client defines the specific data to retrieve. This definition includes the measurement type, the source, marker, field and the index (region) information.

### Command Format:

Name	Size	Type	Description
MeasCount	2	Integer	The number of measurement sources to obtain data from. The following is repeated MeasCount times.
MeasID	2	Integer	The measurement identifier. 100 – Generic Image Measurement (kSA400/kSAMOS) 101 – Image Curvature(kSAMOS/kSAICE) 200 – Generic Analog Input 300 – Generic Block Analog Input (kSA Raterat) 301 – Reflectivity (kSA Raterat/kSA ICE) 302 – ECP (kSA ICE) 400 – Generic Spectra (kSA Bandit) 401 – Spectra Temperature (kSA Bandit/kSA ICE) 402 – Spectra Blackbody (kSA Bandit/kSA ICE)
SourceID	2	Integer	The source to obtain the measurement from. . Used when multiple sources are available for the same measurement type, otherwise it should be specified as 1 or -1. For example if the kSA application supports two (2) spectrometers, specifying either a 1 or a 2 would obtain information from only one of them. Use a -1 to indicate that all sources that supply the requested measurement should obtain data. Although, the exact meaning of the SourceID is acquisition specific, in general it is the 1-based index of the selected source starting from the top.
MarkerCount	2	Integer	The number of markers to obtain data from for the measurement. The following is repeated MarkerCount times. This must be specified as 1 if the kSA application is NOT marker based (kSA Singlewafer Bandit/kSA Singlewafer Raterat/kSA MOS). It may also be specified as -1 to indicate ALL markers. In the latter case, the following is specified only once.



Name	Size	Type	Description
MarkerID	2	Integer	The one-based marker number or 0 to get data from the Platen. Ignored if MarkerCount is -1, but a value must still be specified.
FieldCount	2	Integer	Number of fields to report. The following is repeated FieldCount times.
Name	Size	Type	Description
FieldID	4	Integer	Field ID to report
IndexCount	2	Short	The number of indexed data to obtain for this field. If the data is NOT indexed, this should be zero (0). -1 indicates that ALL indexes should be returned. The following is repeated IndexCount times. If IndexCount is 0 or -1 the following is NOT specified.
IndexID	2	Short	The one-based index number

#### Examples:

kSA 400 has 3 Datasets defined. Dataset 1 has 4 regions of analysis. Dataset 2 has 3 regions and Dataset 3 has 2 regions.

To get the Average Intensity for all datasets and regions the request would be:

Value	Description
1005	GET_DATA_SPECIFIC command
18	Command length; 18 Bytes
1	One (1) measurement being requested (2 Bytes)
100	Generic Image measurement (2 Bytes)
1 or -1	Source 1 or All since kSA 400 only supports one (1) (2 Bytes)
-1	All datasets are being requested (2 Bytes)
-1	Placeholder (2 Bytes)
1	One (1) item being requested (2 Bytes)
3	Average Intensity being requested (ID=3) (4 Bytes)
-1	All regions are being requested (2 Bytes)



To get the Average Intensity for Dataset 2, region 2 the request would be:

Value	Description
1005	GET_DATA_SPECIFIC command
20	Command length; 20 Bytes
1	One (1) measurement being requested (2 Bytes)
100	Generic Image measurement (2 Bytes)
1 or -1	Source 1 or All since kSA 400 only supports one (1) (2 Bytes)
1	One (1) dataset being requested (2 Bytes)
2	Dataset 2 being requested (2 Bytes)
1	One (1) item being requested (2 Bytes)
3	Average Intensity being requested (ID=3) (4 Bytes)
1	One (1) region being requested (2 Bytes)
2	Region 2 being requested (2 Bytes)

kSA ICE has Reflectivity, Curvature, Temperature and Blackbody/Pyrometer measurements enabled. The acquisition has been configured to have six (6) markers. To obtain, Reflectivity, End Point H Curvature, Temperature, Average Temperature, Average Bandedge Wavelength, Blackbody Temperature, Pyrometer Temperature, Average Blackbody Temperature and Average Pyrometer temperature from ALL markers the request would be:

Value	Description
1005	GET_DATA_SPECIFIC command
96	Command length; 96 Bytes
4	four (4) measurements are being requested (2 Bytes)
301	Reflectivity measurement (2 Bytes)
1 or -1	Reflectivity Source 1 or All since kSA ICE only supports one (1) reflectivity (2 Bytes)
-1	All markers are being requested, this includes the platen (2 Bytes)
-1	Placeholder (2 Bytes)
1	One (1) item is being requested (2 Bytes)
800	Reflectivity being requested (ID=800) (4 Bytes)
0	No index (2 Bytes)
101	Image Curvature measurement (2 Bytes)
1 or -1	Image Source 1 or All since kSA ICE only supports one (1) image source (2 Bytes)
-1	All markers are being requested (2 Bytes)
-1	Placeholder (2 Bytes)
1	One (1) item is being requested (2 Bytes)
41029	End Point H Curvature being requested (ID=41209) (4 Bytes)
0	No index (2 Bytes)
401	Spectra Temperature measurement (2 Bytes)
1 or -1	Temperature source 1 or -1 since kSA ICE only supports one (1) temperature source
-1	All markers are being requested, this includes the platen (2 Bytes)
-1	Placeholder (2 Bytes)
3	Three (3) items are being requested (2 Bytes)
507	Temperature is being requested (ID=507) (4 Bytes)
0	No index (2 Bytes)





649	Average Temperature requested (ID=649) (4 Bytes)
0	No Index (2 Bytes)
652	Average Bandedge Wavelength requested (ID=652) (4 Bytes)
0	No Index (2 Bytes)
402	Spectra Blackbody measurement (2 Bytes)
1 or -1	Blackbody source 1 or -1 since kSA ICE only supports one (1) blackbody source (2 Bytes)
-1	All markers are being requested, this includes the platen (2 Bytes)
-1	Placeholder (2 Bytes)
4	Four (4) items are being requested (2 Bytes)
567	Blackbody Temperature (ID=567) (4 Bytes)
0	No Index (2 Bytes)
539	Pyrometer Temperature requested (ID=539) (4 Bytes)
0	No Index (2 Bytes)
650	Average Blackbody Temperature (ID=650) (4 Bytes)
0	No Index (2 Bytes)
651	Average Pyrometer Temperature (ID=651) (4 Bytes)
0	No Index (2 Bytes)

To request Peak Intensity from the Temperature source for markers 2 and 4 and from the Blackbody source for markers 1 and 5 the request would be:

Value	Description
1005	GET_DATA_SPECIFIC command
54	Command length; 54 Bytes
2	two (2) measurements are being requested (2 Bytes)
401	Spectra Temperature measurement (2 Bytes)
1 or -1	Temperature source 1 or All since kSA ICE only supports one (1) temperature (2 Bytes)
2	Two (2) markers are being requested (2 Bytes)
2	Marker 2 is being requested (2 Bytes)
1	One (1) item is being requested (2 Bytes)
522	Peak Intensity is being requested (ID=522) (4 Bytes)
0	No index (2 Bytes)
4	Marker 4 is being requested (2 Bytes)
1	One (1) item is being requested (2 Bytes)
522	Peak Intensity is being requested (ID=522) (4 Bytes)
0	No index (2 Bytes)
402	Spectra Blackbody Measurement (2 Bytes)
1 or -1	Blackbody source 1 or All since kSA ICE only supports one (1) blackbody (2 Bytes)
2	Two (2) markers are being requested (2 Bytes)
1	Marker 1 is being requested (2 Bytes)
1	One (1) item is being requested
522	Peak Intensity is being requested (ID=522) (4 Bytes)
0	No index (2 Bytes)
5	Marker 5 is being requested (2 Bytes)
1	One (1) item is being requested (2 Bytes)
522	Peak Intensity is being requested (ID=522) (4 Bytes)



0	No index
---	----------

#### Response Format:

Immediately following the normal response header (command echo, command status, reply length), the GET\_DATA\_SPECIFIC command returns a System Status.

Name	Size	Type	Description
StatusSize	2	Integer	The number of bytes contained in the status.
StatusVersion	2	Integer	The version of the status header. kSA reserves the right to add fields at any time. Clients that are interested in the status information can read the size and versions fields and extract the necessary information.
Operational Status	2	Integer	The current acquisition operational status. 0 – Not operational; An acquire dialog is not open 1 – Idle; The acquisition is not running. 2 – Acquiring; The acquisition is currently running and acquiring data 3 – Paused; The acquisition is paused.
LastHomePulse	8	Double	RESERVED. Currently zero(0)
Rpm Status	2	Integer	The stability of the Rpm. 0 – Unstable 1 – Stable 2 – Artificial
Rpm	8	Double	The current Rpm.

You can get the system status by issuing the GET\_DATA\_SPECIFIC command without any measurements.

Value	Description
1005	GET_DATA_SPECIFIC command
2	Command length; 2 Bytes
0	No measurements are being requested (2 Bytes)

Following the System status, the response payload format.

Name	Size	Type	Description
MeasCount	2	Integer	The number of measurements that obtained data. The following is repeated MeasCount times.
MeasID	2	Integer	The measurement type of the data. This corresponds to the request's MeasID
SourceID	2	Integer	The source identifier
MarkerCount	2	Integer	The number of markers that obtained data. The following is repeated MarkerCount times.
Name	Size	Type	Description
MarkerID	2	Integer	The one-based marker number or 0 to indicate Platen
FieldCount	2	Integer	The number of fields that were obtained. The following is repeated FieldCount times.



Name	Size	Type	Description
FieldID	4	Integer	Field ID to report
IndexCount	2	Integer	The number of data values obtained for this field. The following is repeated IndexCount times.
IndexID	2	Short	The 1-based index number or 0 if data is not indexed
Value	8	Double	The current value for SourceID,MarkerID,FieldID,IndexID

**Actions:**

Upon reception of the command, the kSA Software will try to fulfill as much of the request as possible. Misconfigured requests (e.g., sources, markers, etc. not currently available) are not treated as errors. The response will indicate what data was obtained, the client should NOT assume that the data returned is in any particular order.

**Limitations:**

- To obtain data values the acquisition must be started. The command will always return the System status.



## **5.7     *RESTART\_GROWTHRATE\_FIT***

Purpose:

Restart a growth rate fit.

Command Format:

The RESTART\_GROWTHRATE\_FIT command is a simple command.

<b>Name</b>	<b>Size</b>	<b>Type</b>	<b>Description</b>
CmdCode	2	Integer	Command code (1007)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

Response Format:

The RESTART\_GROWTHRATE\_FIT command has a simple response

Actions:

Upon reception of the command, the kSA Software will restart a growth rate fit if the current acquire mode supports such an action. Otherwise an Invalid State error will be returned.

Limitations:

- None



## 5.8 **OPEN\_ACQUIRE**

### Purpose:

The command is used to open a designated acquire mode.

### Command Format:

The OPEN\_ACQUIRE command specifies the acquire mode to open. The acquire mode identifier has different meanings depending upon the kSA application.

Name	Size	Type	Description
CmdCode	2	Integer	Command code (1007)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to four (4)
Acquire Mode ID	4	Integer	The value of the acquire mode ID is kSA application specific. TODO: Define the tables. If the kSAComm server is configured to run a specific mode (See configuration) then specifying a -1 will open that mode.

### Response Format:

The OPEN\_ACQUIRE command has a simple response.

### Actions:

Upon reception of the command, the kSA Software:

- Will try to open the designated acquire mode

### Limitations:

- An acquire dialog cannot already be open. This will cause an Invalid State (-4) error to be returned.
- The acquire mode specified must be one that the kSA application supports. If not, then an Invalid Parameter (-3) error will be returned.



## 5.9 **CLOSE\_ACQUIRE**

### Purpose:

The command is used close the currently opened acquire mode.

### Command Format:

The CLOSE\_ACQUIRE command is a simple command.

Name	Size	Type	Description
CmdCode	2	Integer	Command code (1008)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

### Response Format:

The CLOSE\_ACQUIRE command has a simple response.

### Actions:

Upon reception of the command, the kSA Software:

- Closes the current acquire mode

### Limitations:

- The acquisition cannot be acquiring data. This will cause an Invalid State (-4) error to be returned.



## 5.10 **GET\_STATUS**

### Purpose:

The command is used to obtain the current state of the acquisition.

### Command Format:

The GET\_STATUS command is a simple command.

Name	Size	Type	Description
CmdCode	2	Integer	Command code (1009)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

### Response Format:

Immediately following the normal response header (command echo, command status, reply length), the GET\_STATUS message returns the System Status information. This is the same information returned with the GET\_DATA\_SPECIFIC command.

Name	Size	Type	Description
StatusSize	2	Integer	The number of bytes contained in the status.
StatusVersion	2	Integer	The version of the status header. kSA reserves the right to add fields at any time. Clients that are interested in the status information can read the size and versions fields and extract the necessary information.
Operational Status	2	Integer	The current acquisition operational status. 0 – Not operational; An acquire dialog is not open 1 – Idle; The acquisition is not running. 2 – Acquiring; The acquisition is currently running and acquiring data 3 – Paused; The acquisition is paused.
LastHomePulse	8	Double	RESERVED. Currently zero(0)
Rpm Status	2	Integer	The stability of the Rpm. 0 – Unstable 1 – Stable 2 – Artificial
Rpm	8	Double	The current Rpm.

### Actions:

Upon reception of the command, the kSA Software:

- Obtains the system status

### Limitations:

- None



## 5.11 **GET\_APP\_VERSION**

### Purpose:

The command is used to obtain the current version of the kSA application.

### Command Format:

The GET\_APP\_VERSION command is a simple command.

Name	Size	Type	Description
CmdCode	2	Integer	Command code (1010)
CmdLength	2	Integer	Length of the command-specific data in bytes. This must be set to zero (0)

### Response Format:

The GET\_APP\_VERSION returns a fixed length string of thirty-two (32) characters.

Name	Size	Type	Description
CmdCode	2	Integer	Command code, as defined in the list of commands
CmdLength	2	Integer	Length of the command-specific data in bytes. (Always 33)
Version Length	1	Integer	Always 32
Version string	32	String	

### Actions:

Upon reception of the command, the kSA Software:

- Obtains the application's version

### Limitations:

- None





## 5.12 TEXT\_CMD

### Purpose:

Issue a generic parameterized text command, with a generic parameterized text response.

### Command Format:

Name	Size	Type	Description
Command	Variable	Long String	Space separated case insensitive parameterized command string (content dictated by the command represented herein).

### Response Format:

Name	Size	Type	Description
Response	Variable	Long String	Free form response string (format dictated by the text command represented in Command Format described above).

### Actions:

Dependent on the text command issued.

### Limitations:

Length of the command and response text is limited to the size of Long String type (theoretically 2,147,483,647 chars).

### 5.12.1 TEXT\_CMD Example #1

Command: Read laser set point value

Byte#	Hex	Decimal	Description
1	0xF3	1011	TEXT_CMD command
2	0x03		
3	0x2F	47	Total number of bytes to follow.
4	0x00		
5	0x2B	43	Number of characters in the string to follow plus null terminator
6	0x00		
7	0x00		
8	0x00		
9-50	0x--	ASCII	The text command string "measurement curvature laser power setpoint"
51	0x00	0	The Null terminator for the string.

### Response:

Byte#	Hex	Decimal	Description
1	0xF3	1011	TEXT_CMD command
2	0x03		
3	0x00	0	Error code (success)
4	0x00		
5	0x0E	14	Total number of bytes to follow.
6	0x00		
7	0x0A	10	Number of characters in the string to follow plus null terminator
8	0x00		



9	0x00		
10	0x00		
11-19	0x--	ASCII	The text response string “32.600000”
20	0x00	0	The Null terminator for the string.

### 5.12.2 TEXT\_CMD Example #2

Command: Set laser set point value

Byte#	Hex	Decimal	Description
1	0xF3	1011	TEXT_CMD command
2	0x03		
3	0x34	52	Total number of bytes to follow.
4	0x00		
5	0x30	48	Number of characters in the string to follow plus null terminator
6	0x00		
7	0x00		
8	0x00		
9-54	0x--	ASCII	The text command string “measurement curvature laser power setpoint 35.3”
55	0x00	0	The Null terminator for the string.

Response:

Byte#	Hex	Decimal	Description
1	0xF3	1011	TEXT_CMD command
2	0x03		
3	0x00	0	Error code (success)
4	0x00		
5	0x0E	14	Total number of bytes to follow.
6	0x00		
7	0x0A	10	Number of characters in the string to follow plus null terminator
8	0x00		
9	0x00		
10	0x00		
11-19	0x--	ASCII	The text response string “35.300000”
20	0x00	0	The Null terminator for the string.



## 6 Text Commands

The following text commands are to be used as the data string sent in the TEXT\_CMD specified above.

- Parameters are all text.
- Parameters are space separated.
- Parameters are case insensitive (though for readability capital letters can be used).
- Text shown in brackets (“{ }”) are variable, described in the “Where:” section of each command description below.

(Please reference sections 5.12.1 “TEXT\_CMD Example #1” and 5.12.2 “TEXT\_CMD Example #2” for detailed examples of the command and response formats)

### 6.1 Laser Power Commands

#### 6.1.1 Get Laser Power Set Point

Purpose	Get the laser power set point.	
Command Syntax	Measurement Curvature{[index]} Laser Power SetPoint Where: {[index]}                      Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.	
Response Syntax	{setpoint} Where: {[setpoint]}                      A floating point number representing the current power set point.	

#### 6.1.2 Set Laser Power Set Point

Purpose	Set the laser power set point.	
Command Syntax	Measurement Curvature{[index]} Laser Power SetPoint {setpoint} Where: {[index]}                      Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information. {setpoint}                      A floating point number representing the desired power setpoint.	
Response Syntax	{setpoint} Where: {[setpoint]}                      A floating point number representing the current power set point.	



### 6.1.3 Read Laser Power

Purpose	Get the current laser power.
Command Syntax	Measurement Curvature{[index]} Laser Power Read Where: {[index]}                   Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.
Response Syntax	{power} Where: {power}                   A floating point number representing the current power.

### 6.1.4 Get Laser Power State

Purpose	Get the laser power state, on or off.
Command Syntax	Measurement Curvature{[index]} Laser Power State Where: {[index]}                   Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.
Response Syntax	{state} Where: {state}                   Text representing the current state, “on” or “off”.

### 6.1.5 Set Laser Power State

Purpose	Set the laser power state, on or off.
Command Syntax	Measurement Curvature{[index]} Laser Power State {state} Where: {[index]}                   Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information. {state}                   Text representing the desired power state “on” or “off”.
Response Syntax	{setpoint} Where: {setpoint}                   Text representing the current/new power state.

## 6.2 **Exposure Time**

### 6.2.1 Get Exposure Time

Purpose	Get the camera exposure time.
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Command Syntax	Measurement Curvature{[index]} ExposureTime Where: {[index]}                      Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.
Response Syntax	{exposure} Where: {exposure}                      A floating point number representing the current exposure time in seconds.

### 6.2.2 Set Exposure Time

Purpose	Set the camera exposure time in seconds.
Command Syntax	Measurement Curvature{[index]} ExposureTime {exposure} Where: {[index]}                      Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information. {exposure}                      A floating point number representing the desired exposure time in seconds
Response Syntax	{exposure} Where: {exposure}                      A floating point number representing the current/new exposure time in seconds.

## 6.3 ***Automatic Spot Intensity***

### 6.3.1 Get Automatic Spot Intensity

Purpose	Get the automatic spot intensity setting.
Command Syntax	Measurement Curvature{[index]} AutomaticSpotIntensity Where: {[index]}                      Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.
Response Syntax	{intensity} Where: {intensity}                      Text representing the current automatic spot intensity setting.

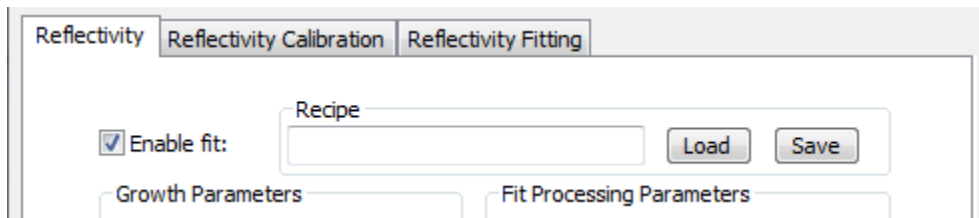


### 6.3.2 Set Automatic Spot Intensity

Purpose	Set the automatic spot intensity setting.	
Command Syntax	Measurement Curvature{[index]} AutomaticSpotIntensity {setting}  Where: <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 30%;">{[index]}</div> <div style="width: 70%;">Optional, if present represents the index of the curvature acquire source. Please reference section 6.5.1 for further information.</div> </div> <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 30%;">{setting}</div> <div style="width: 70%;">Text representing the desired automatic spot intensity setting:                “off” – laserpower, checkbox unchecked                “laserpower” – laserpower, checkbox checked                “exposuretime” – exposuretime, checkbox checked             </div> </div>	
Response Syntax	{setting}  Where: <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 30%;">{setting}</div> <div style="width: 70%;">Text representing the current/new automatic spot intensity setting:                “off” – laserpower, checkbox unchecked                “laserpower” – laserpower, checkbox checked                “exposuretime” – exposuretime, checkbox checked             </div> </div>	

## 6.4 *Fit Control*

The Fit Control command is applicable to both Curvature and Reflectivity measurements. For the command to be effective fitting must be enabled in the “Reflectivity” tab of the config/advanced property sheet in the acquire dialog in the kSA User Interface:



If the “enable fit:” checkbox is not unchecked the Fit Control command will remain in the disabled state.

Due to the nature of the “enable” and “disable” actions, it is not possible to query the current enable/disable state.

Purpose	Control the enable/disable and restart of fitting.	
Command Syntax	Measurement {type}{[index]} fit {action}  Where: <div style="display: flex; justify-content: space-between; width: 100%;"> <div style="width: 30%;">{type}</div> <div style="width: 70%;">Required, text representing the desired measurement type to be affected:</div> </div>	



	<div>“curvature” “reflectivity” { [index] } Optional, if present represents the index of the measurement acquire source. Please reference section 6.5.1 for further information. { action } Optional, text representing the action to initiate:  “enable” Enables the “restart” action to initiate a restart fit. Note:<ul style="list-style-type: none"><li>Fitting must be enabled in the “Reflectivity” tab of the config/advanced property sheet in the acquire dialog in the kSA User interface.</li><li>When transitioning fit control state from disabled to enabled a restart fit action will automatically be initiated.</li></ul> “disable” Disables fitting, and prevents the “restart” action from initiating a fit restart. Note:<ul style="list-style-type: none"><li>This action will also disable the action generated by the “Restart Fit” button in the kSA User Interface.</li></ul> “restart” Initiates a restart fit action.</div>
Response Syntax	<div>{ status } Where: { status } Text representing the result status of the operation.</div>

## 6.5 **Text Command Notes:**

### 6.5.1 Acquire Source Index { [index] }

If it is possible to have two (or more) acquire sources for a given measurement type selected, index 0 (i.e. “measurement curvature[0] laser power setpoint”) would route the command (in this case “laser power setpoint”) to the first source. Likewise, index 1 (i.e. “measurement curvature[1] laser power setpoint”) would route the command to the second source.

Omitting this variable (i.e. “measurement curvature laser power setpoint”) will route the command to the first available curvature acquire source.



## 7 Data types

The following data types are used in the protocol:

- Boolean is a byte, non-zero value means true.
- Single and multiple bytes integers, least significant byte first;
- 4 and 8 bytes floating point values, least significant bit first;
- A text string (length limited to 127 chars)

Name	Size	Type	Description
Len	1	Integer	The length of the string including terminating zero byte
String	Len-1	Sequence of chars	Text
Zero	1	Integer	Zero byte.

- A long text string (length theoretically limited to 2,147,483,647 chars)

Name	Size	Type	Description
Len	4	Integer	The length of the string including terminating zero byte
String	Len-1	Sequence of chars	Text
Zero	1	Integer	Zero byte.





## 8 Command and reply encoding

Each command is encoded as following:

Name	Size	Type	Description
CmdCode	2	Integer	Command code, as defined in the list of commands
CmdLength	2	Integer	Length of the command-specific data in bytes
CmdData	CmdLength		Command-specific data, as defined by command descriptions. <i>Simple</i> commands do not carry any data, CmdLength for a <i>simple</i> command is 0.

Each command reply is encoded as following:

Name	Size	Type	Description
CmdCode	2	Integer	Command code, must match the code in the command.
ErrCode	2	Integer	Command completion error code
ReplyLength	2	Integer	Length of the command reply payload
ReplyData	ReplyLength		Command-reply payload, as defined by command descriptions. <i>Simple</i> replies do not carry any data, ReplyLength for a <i>simple</i> reply is 0.

## 9 Error Codes

The following error codes are defined

Code	Description
0	Success
-1	General error.
-2	Unknown command.
-3	Invalid parameter or parameters combination.
-4	Invalid state.



## **10 Data Fields**

### **10.1 Common Data Fields**

#### **10.1.1 kSA**

<b>Name</b>	<b>FieldID</b>	<b>Size</b>	<b>Type</b>
Elapsed Time	0	8	Double
Data Point	8	8	Double
Rotation Number	88	8	Double
Rotation Position	89	8	Double
RPM	91	8	Double

### **10.2 Application Specific Data Fields**

#### **10.2.1 kSA MOS/Curvature**

<b>Name</b>	<b>FieldID</b>	<b>Size</b>	<b>Type</b>
Bow	41067	8	Double
End Pt. H Curvature	41029	8	Double
End Pt. H Mean Differential	41019	8	Double
End Pt. H Radius Of Curvature	41022	8	Double
End Pt. H Strain	41021	8	Double
End Pt. H Stress	41023	8	Double
End Pt. H Stress Thickness Product	41020	8	Double
End Pt. V Curvature	41030	8	Double
End Pt. V Mean Differential	41024	8	Double
End Pt. V Radius Of Curvature	41027	8	Double
End Pt. V Strain	41026	8	Double
End Pt. V Stress	41028	8	Double
End Pt. V Stress Thickness Product	41025	8	Double
Film Thickness	41001	8	Double
Laser Power	41013	8	Double
Mirror X Position	41058	8	Double
Mirror Y Position	41059	8	Double
Temperature	41055	8	Double
Tilt H	41065	8	Double
Tilt V	41066	8	Double

#### **10.2.2 kSA RateRat/Reflectivity**

<b>Name</b>	<b>FieldID</b>	<b>Size</b>	<b>Type</b>
Reflectivity	800	8	Double
Growth Rate	805	8	Double
Film Thickness	819	8	Double



### 10.2.3 kSA Bandit/BandEdge/Blackbody

Name	FieldID	Size	Type
Band Edge Temp.	507	8	Double
Band Gap Slope	593	8	Double
Blackbody Temp.	567	8	Double
Blackbody GOF	568	8	Double
Confidence.	509	8	Double
Film Thickness	559	8	Double
Film Thick. StdDev.	611	8	Double
Peak Intensity	522	8	Double
Pyro Temp.	539	8	Double
Avg. Band Edge Temp.	649	8	Double
Avg. Blackbody Temp.	650	8	Double
Avg. Pyrometer Temp.	651	8	Double
Avg. Band Edge Wavelength	652	8	Double

### 10.2.4 kSA 400

Name	FieldID	Size	Type
Average Intensity	3	8	Double
Center Intensity	21	8	Double
Centroid Intensity	11	8	Double
Minimum Intensity	80	8	Double
Normalized Intensity	23	8	Double
Peak Intensity	1	8	Double
Summed Intensity	2	8	Double

### 10.2.5 ECP

Name	FieldID	Size	Type
ECP Temperature	40025	8	Double
ECP Uncorrected Temperature	40027	8	Double
ECP Reflectivity	40028	8	Double
ECP Raw Reflectivity	40031	8	Double

## 10.3 *Application Specific Acquire Modes*

### 10.3.1 kSA MOS/Curvature

Acquire Mode ID	Description
0	Curvature/Stress
1	X/Y Scan
2	Thermal Scan
3	Focus Mode
4	Reflectivity



### 10.3.2 kSA ICE

Acquire Mode ID	Description
0	Multi-wafer Measurement
1	Single-wafer Measurement
2	Multi-wafer Temperature
3	Full Platen Temperature Scan
4	Single Radius Temperature Scan
5	Single-wafer Temperature
6	Single-wafer Reflectivity
7	Single-wafer Curvature/Stress
8	Single-wafer ECP

### 10.3.3 kSA 400

Acquire Mode ID	Description
0	Scan Mode
1	Interactive Accumulation
2	Phase-Locked Epitaxy
3	LEED I/V Mode
4	Auger Spectroscopy
5	Beam Rocking
6	Sample Rocking
7	ER-RHEED

### 10.3.4 kSA BanditMW

Acquire Mode ID	Description
0	Multi-wafer Temperature
1	Single Radius Platen Temperature
2	Full Platen Temperature
3	Single-wafer Temperature
4	Temperature Scan

### 10.3.5 kSA Bandit

Acquire Mode ID	Description
0	Temperature
1	Temperature Scan