# 6   SI Image SGL TCP/IP Camera Control

All commands are sent as command packets. Parameters to the server are included in the **Command** packet as specified. The server acknowledges the command immediately with an **Acknowledge** packet. Following this, the server sends the requested **Data** packet(s). (**NOTE:** The commands **InquireAcquisitionStatus** and **TerminateAcquisition** are special cases in that they do NOT return an **Acknowledge** packet, only a data packet.
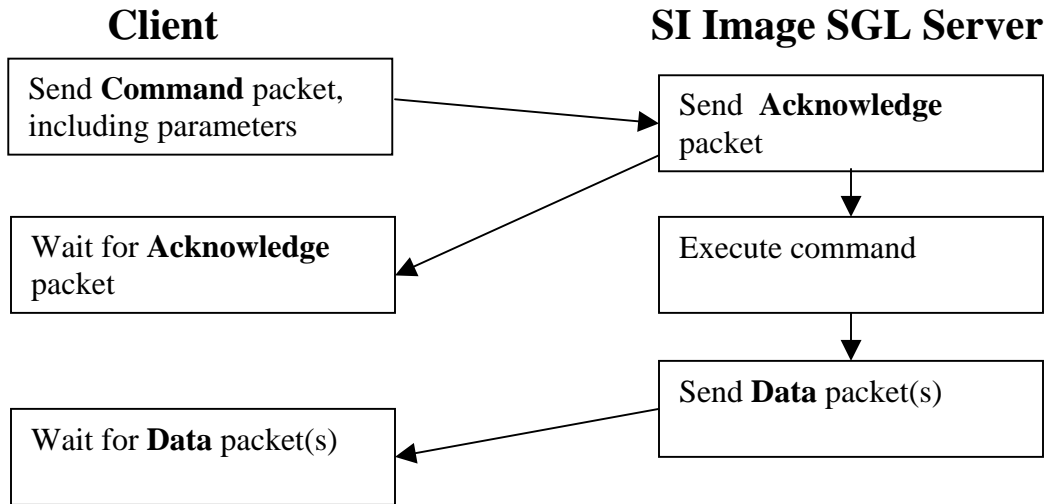
6.1   TCP IP packet definition

All transfer is binary. Data are sent in big endian format. The optimal packet size for image packets is ~5KB.

6.1.1   Command packet (10 bytes + parameter structure)

Packet length	U32	- total number of bytes in packet
Packet identifier	U8	- 128
Camera identifier	U8	- 0 for server commands, Camera number (1..max) otherwise
Function number	U16	- function to be executed (1000 .. 1999)
Parameter structure length	U16	- length of parameter block following (0, if none)
Parameter structure	arbitrary format	

6.1.2   Acknowledge packet (8 bytes)

Packet length	U32	- total number of bytes in packet
Packet identifier	U8	- 129
Camera identifier	U8	- Camera ID (1..max)
Accepted flag	U16	- true ($\neq 0$) or false (0)

6.1.3   Data packet (14 bytes + data structure – see below)

Packet length	U32	- total number of bytes in packet
Packet identifier	U8	- 131
Camera identifier	U8	- Camera ID (1..max)
Error Code	I32	- 0 = no error
Data type	U16	- 2000 .. 2999
Bytes in Data Structure	U16	- length of data structure that is following
Data structure	arbitrary format	

6.1.4   Image packet (30 bytes + Image structure)

Packet length	U32	- total number of bytes in packet
Packet identifier	U8	- 132
Camera identifier	U8	- Camera ID (1..max)
Error Code	I32	- 0 = no error
Image identifier	U16	- a number unique to this image
Image type	U16	- 0=U16, 1=I16, 2=U32, 3=I32, 4=SGL, 5=DBL
Serial Length	U16	- number of columns in the image
Parallel Length	U16	- number of rows in the image
Total number of packets	U16	- total number of packets in this image
Current packet number	U16	- number (0..N) of currently transmitted package
Offset	U32	- packet's offset into the linear image array
Bytes in Image structure	U32	- length of Image structure that is following in bytes
Image structure	n Image type data – big endian	

6.2 Data Packet Structures:

6.2.1 Status structure 2002 (60 bytes)

Name	Type	Description
CCDTemperature	U32	CCD Temperature
BackplateTemperature	U32	* Back plate temperature
CCDChamberPressure	U32	* CCD Chamber Pressure
Spare3	U32	spare
Spare4	U32	spare
Spare5	U32	spare
Spare6	U32	spare
Spare7	U32	spare
ShutterStatus	U32	0 = closed and 1 = open
XIRQStatus	U32	0 = no external IRQ and 1 = external IRQ occurred
Spare10	U32	spare
Spare11	U32	spare
Spare12	U32	spare
Spare13	U32	spare
Spare14	U32	spare
Spare15	U32	spare

*Not active on all cameras

6.2.2 Arbitrary byte array structure 2003 (n bytes)

Array of n bytes   n x U8

6.2.3 Acquisition Status structure 2004 (8 bytes)

Name	Type	Description
% exposure done	U16	% of the exposure time that has elapsed
% readout done	U16	% of the readout that is complete
Relative position of readout	U32	Relative position of readout pointer

6.2.4 Image Header structure 2006 (variable length)

Name	Type	Description
Image header	String	Null (0) terminated FITS file header string that contains the required FITS entries, time, date and all the status, readout & format and configuration parameters (see **Error! Reference source not found.**) for the image.

6.2.5   Command Done structure 2007 (2 bytes)

Name	Type	Description
Function Number	U16	function that was executed

6.3   Camera Commands:

6.3.1   GetStatus FromCamera

- Camera Command
- Receives the camera status

Function number: **1011**
Parameters: none
Returns: Data packet 2002 (Status structure)

6.3.2   Image Acquisition

- Camera Command
- Starts an image acquisition

Function number: **1012**
Parameters: U32: Exposure time
                              U16: Mode (see 6.3.3 below)
                              U16: Buffer Number (1 or 2)
                              U16: Save As (see 6.3.4 below)
                              File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.3   Mode Parameter values:

The image is always held in the selected Server Image Buffer after an image is acquired. Depending on the acquisition **Mode**, the image is transmitted to the client and/or saved to the Server's disk.

1   Acquire Image and transmit to client when Image data are available
2   Acquire Image and hold in Server Image Buffer
3   Acquire Image, transmit to client and save to Server's disk when Image data are available
4   Acquire Image, save to Server's disk when Image data are available and hold in Server Image Buffer

6.3.4   Save As:

0 – U16 FITS
1 – I16 FITS
2 – I32 FITS
3 – SGL FITS
4 – U16 TIFF
5 – I16 TIFF
6 – I32 TIFF
7 – SGL TIFF

6.3.5   Dark Acquisition

- Camera Command
- Starts an acquisition without opening the shutter

Function number: **1013**
Parameters: U32: Exposure time
                              U16: Mode (see 6.3.3 above)
                              U16: Buffer Number (1 or 2)
                              U16: Save As (see 6.3.4 above)
                              File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.6   Test Pattern Acquisition

- Camera Command
- Starts an acquisition of a test pattern

Function number: **1014**
Parameters: U32: Exposure time
                     U16: Mode (see 6.3.3 above)
                     U16: Buffer Number (1 or 2)
                     U16: Save As (see 6.3.4 above)
                     File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.7   Triggered Acquisition

- Camera Command
- Starts an image acquisition with trigger

Function number: **1016**
Parameters: U32: Exposure time
                     U16: Mode (see 6.3.3 above)
                     U16: Buffer Number (1 or 2)
                     U16: Save As (see 6.3.4 above)
                     File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.8   Inquire Acquisition Status

- Camera Command
- Receive status of current acquisition
- **Special case command** where no **Acknowledge** packet is returned. Only a **Data** packet is returned.

Function number: **1017**
Parameters: none
Returns: Data Packet 2004 (Acquisition Status structure)
                     U16:   % exposure done
                     U16:   % readout done
                     U32:   Relative position of readout
Notes: No **Acknowledge** packet is returned

6.3.9   Terminate Acquisition

- Camera Command
- Terminates an acquisition in progress
- **Special case command** where no **Acknowledge** packet is returned

Function number: **1018**
Parameters: none
Returns: Data Packet 2007 (Command Done structure)
Notes: If internal buffer was created, it will be destroyed, no **Acknowledge** packet is returned.

6.3.10 Retrieve Image

- Server Command
- Retrieves the current image

Function number: **1019**
Parameters: U16: Buffer Number (1 or 2)
  Returns: Multiple Image packets

6.3.11 Get Image Header

- Server Command
- Retrieves complete image header information

Function number: **1024**
Parameters: U16: Buffer Number (1 or 2)
Returns: Data packet 2006 (Image Header structure)
                     Null (0) terminated FITS file header string that contains the required FITS
                     entries, time, date and all the status, readout & format and configuration
                     parameters for the image.
Notes: sends data packet with all image header information

6.3.12 Averaged Light Images Acquisition

- Camera Command
- Starts an Average Images acquisition

Function Number: **1028**
Parameters: U32: Exposure time
                     U16: Mode (see 6.3.3 above)
                     U16: Number of images to average (1 or 2)
                     U16: Save As (see 6.3.4 above)
                     File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.13 Averaged Dark Images Acquisition

- Camera Command
- Starts an Average Images acquisition

Function Number: **1029**
Parameters: U32: Exposure time
                     U16: Mode (see 6.3.3 above)
                     U16: Number of images to average (1 or 2)
                     U16: Save As (see 6.3.4 above)
                     File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.14 Averaged Triggered Images Acquisition

- Camera Command
- Starts an Average Images acquisition

Function Number: **1030**
Parameters: U32: Exposure time
                        U16: Mode (see 6.3.3 above)
                        U16: Number of images to average (1 or 2)
                        U16: Save As (see 6.3.4 above)
                        File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.15 Save Image

- Server Command
- Saves Image on the server

Function Number: **1031**
Parameters: U16: Buffer Number (1 or 2)
                        U16: Save As (see 6.3.4 above)
                        File Name String (null terminated)
Returns: Data Packet 2007 (Command Done structure)

6.3.16 TDI (Time Delay Integration) Acquisition, Internally paced

- Camera Command
- Starts an acquisition without opening the shutter

Function number: **1032**
Parameters: U32: Exposure time
                        U16: Mode (see 6.3.3 above)
                        U16: Buffer Number (1 or 2)
                        U16: Save As (see 6.3.4 above)
                        File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.17 TDI (Time Delay Integration) Acquisition, Externally paced

- Camera Command
- Starts an acquisition without opening the shutter

Function number: **1033**
Parameters: U32: Exposure time
                        U16: Mode (see 6.3.3 above)
                        U16: Buffer Number (1 or 2)
                        U16: Save As (see 6.3.4 above)
                        File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.18 Set Acquisition Mode

- Camera Command
- Sets the Acquisition Mode

Function number: **1034**
Parameters: U8: Acquisition Mode (0=Single Image, 1=Average, 3=Multiple Frames)
Returns: Command Done Data packet

6.3.19 Set Exposure Time

- Camera Command
- Sets the exposure time for subsequent acquisitions

Function number: **1035**
Parameters: U32: Exposure time (in ms)
Returns: Command Done Data packet

6.3.20 Set Acquisition Type

- Camera Command
- Sets the Acquisition Type

Function number: **1036**
Parameters: U16: Buffer Number (1 or 2)
                       U8: Acquisition Type
Returns: Command Done Data packet

> **Acquisition Types:**
> 0=Light Exposure
> 1=Dark Exposure
> 2=Test Exposure
> 3=Triggered Exposure
> 4=TDI Internal Paced Exposure
> 5=TDI External Paced Exposure

6.3.21 Acquire

- Camera Command
- Starts an acquisition that has been setup previously

Function number: **1037**
Parameters: U16: Mode (see 6.3.3 above)
                       U16: Buffer Number (1 or 2)
                       U16: Save As (see 6.3.4 above)
                       File Name String (null terminated)
Returns: Command Done Data packet or Image packets depending on the Mode

6.3.22 Set Number of Averages

- Camera Command
- Sets the Number of Averages in a Average Images Acquisition

Function number: **1038**
Parameters: U16: Number of Averages
Returns: Command Done Data packet

6.3.23 Set Number of Frames

- Camera Command
- Sets the Number of Frames in a Multiple Frame Acquisition

Function number: **1039**
Parameters: U16: Number of Frames
Returns: Command Done Data packet

6.3.24 Set Multiple Frame Buffer Mode

- Camera Command
- Sets Multiple Frame Acquisition Buffer Mode

Function number: **1040**
Parameters: U8: Buffer Mode (0=Single Frame Buffer, 1=Multiple Frame Buffer)
Returns: Command Done Data packet

Notes: In Single Buffer mode, the frames are saved to a multiple frame U16 FITS file and the file name is set to Date-Time mode. In Multiple Frame Buffer mode, if a Save to Server's Disk mode is selected, it is recommended to select FITS format so that the files can be dealt with on a Frame basis.