Header						Address	Sub-Address	Command	Data Length	Data
0	0	0	0	0	FF	0-FF	0-FF	0-FF	0-FF	

								Data											
	Notes	Action	Sub-Address	Command	Command (HEX)	Data Length	Byte:1	2	3	4	5	6	7	8	9	10	11	12
Main		NOOP	0	0	0	0												
		Reserve for core protocol	0	1	1	0												
	Starts planned move	Start	0	2	2	0												
		Pause	0	3	3	0												
	Stops planned move. Must be executed before controller will accept other commands.	Stop	0	4	4	0												
	Toggles on/off state of debug LED	Debug LED	0	5	5	0												
		Timing Master	0	6	6	0												
		Set Stored Name	0	7	7	1-10	String [1-10 Characters, Null-terminated, Null padded]											
		Set Device Address	0	8	8	1	2-255 [Byte]											
		Set Common Line for Step Pulsing	0	9	9	1	0,1,2 [Byte]											
		Return Home All Motors	0	10	A	0												
		Motors Max Step Rate	0	11	B	2	Steps/Second [Int]											
		Alt Input Edge (RISING, FALLING, or CHANGE)	0	12	C	1	0,1,2 [Byte]											
		Alt I/O Mode	0	13	D	2	Ring (0-255) [Byte]	Tip (0-255) [Byte]										
		Set Joystick Watchdog	0	14	E	1	True/False (1,0) [Byte]											
		Alt Output Before Shot Delay Time	0	15	F	2	Time (ms) [int]											
		Alt Output After Shot Delay Time	0	16	10	2	Time (ms) [Int]											
		Alt Output Before Shot Time	0	17	11	2	Time (ms) [Int]											
		Alt Output After Shot Time	0	18	12	2	Time (ms) [Int]											
		Alt Output Trigger level	0	19	13	1	HIGH/LOW (1,0) [Byte]											
		Max Program Run Time	0	20	14	4	Max Run Time (mS) [Ulong]											
		Start Program Delay	0	21	15	4	Start Time Delay (seconds) [Ulong]											
		Set SMS / Continuous Program Mode	0	22	16	1	0 (SMS), 1 (Time Lapse Cont.), 2 (Video Cont.) [Byte]											
		Set Joystick Mode	0	23	17	1	True/False (1,0) [Byte]											
	Causes the motors to go back and forth Between the start and stop positions	Set Ping-Pong Flag	0	24	18	1	True/False (1,0) [Byte]											
		Send all Motors to Program Start	0	25	19	0												
		Set Program Start point	0	26	1A	0												
		Set Program Stop point	0	27	1B	0												
	True indicates 24 FPS, false indicates 30 FPS	Set Frames/Second Flag	0	28	1C	0	True/False (1,0) [Byte]											
		Status Request	0	100			<Status Type>	<returns> with header and master address in front (00 00 00 00 00 FF 00 00 01 Length Data)										
		Firmware Version	0	100	64	0	Value Type [Int]	Version #										
		Run Status	0	101	65	0	Value Type [Byte]	0 = Stopped, 1 = Paused, 2 = Running										
		Run Time	0	102	66	0	Value Type [Ulong]	Time (ms)										
		Currently Exposing	0	103	67	0	Value Type [Byte]	True/False										
		Timing Master Value	0	104	68	0	Value Type [Byte]	True/False										
		Name	0	105	69	0	Value Type [String]	String [1-10 Characters, Null-terminated, Null padded]										
		Motors Max Step Rate	0	106	6A	0	Value Type [Uint]	Steps/Second										
		Voltage Reading	0	107	6B	0	Value Type [Fixed]	Voltage (V) (Fixed point – must divide by 100 on master side)										
		Current to Motors	0	108	6C	0	Value Type [Fixed]	Current (amps) (Fixed point – must divide by 100 on master side)										
		Alt Input Edge (RISING, FALLING, or CHANGE)	0	109	6D	0	Value Type [Byte]	0,1,2										
		Alt I/O Mode	0	110	6E	0	Value Type [Int]	[Byte 0] Ring (0-255)	[Byte 1] Tip (0-255)									
		Limit Switch High/Low Status	0	111	6F	0	Value Type [Int]	[Byte 0] Ring, High/Low (1,0)	[Byte 1] Tip, High/Low(1,0)									
		Alt Output Before Shot Delay Time	0	112	70	0	Value Type [Uint]	Time (ms)										
		Alt Output After Shot Delay Time	0	113	71	0	Value Type [Uint]	Time (ms)										
		Alt Output Before Shot Time	0	114	72	0	Value Type [Uint]	Time (ms)										
		Alt Output After Shot Time	0	115	73	0	Value Type [Uint]	Time (ms)										
		Alt Output Trigger level	0	116	74	0	Value Type [Byte]	HIGH/LOW (1,0)										
		Start Program Delay	0	117	75	0	Value Type [Ulong]	Start Time Delay (seconds)										
		SMS / Continuous Program Mode	0	118	76	0	Value Type [Byte]	0 (SMS), 1 (Cont.), 2(Vid. Cont.)										
		Controller Power Cycle	0	119	77	0	Value Type [Byte]	True/False (1,0)										
		Joystick Mode	0	120	78	0	Value Type [Byte]	True/False (1,0)										
		Ping-Pong Flag	0	121	79	0	Value Type [Byte]	True/False (1,0)										
		Joystick Watchdog Mode Status	0	122	7A	0	Value Type [Byte]	True/False (1,0)										
	Reports the percentage complete of the current program as a whole number	Program % Complete	0	123	7B	0	Value Type [Byte]	0-100										
	The three least significant bits of the byte represent the motor attach states for each of the motors. Motor 1 = bit 0, motor 2 = bit 1, motor 3 = bit 2.	Check Motor Attachment	0	124	7C	0	Value Type [Byte]	0-7										
	Reports the total length in milliseconds of the program based on currently set parameters, not just the currently elapsed time.	Total Program Run Time	0	125	7D	0	Value Type [Ulong]	Time (ms)										
		Program Complete?	0	126	7E	0	Value Type [Byte]	True/False (1,0)										
	True indicates 24 FPS, false indicates 30 FPS	Check Frames/Second Flag	0	127	7F	0	Value Type [Byte]	True/False (1,0)										

Motors		NOOP	1-3	0	0	0												
		Reserve for core protocol	1-3	1	1	0												
General Motor Commands	Cuts power to motor when not executing a move. True by default.	Motor Sleep	1-3	2	2	1	True/False (1,0) [Byte]											
	Must enabled before executing a move.	Motor Enable	1-3	3	3	1	True/False (1,0) [Byte]											
	Stops motor, even if a planned move is in progress.	Stop Motor Now	1-3	4	4	0												
	Number of steps the motor should move in addition to the commanded distance when reversing direction.	Set Backlash Steps	1-3	5	5	2	Steps [Uint]											
	Number of microsteps per full motor step. There are 200 full steps per rotation of the motor (and ~3800 full steps per gearbox output shaft rotation)	Set Microstep Value	1-3	6	6	1	1, 2, 4, 8, 16 [Byte]											
		Set Motor Max Step Speed	1-3	7	7	2	Steps/Second [Uint]											
	Flips motor direction, regardless of current program	Set Direction	1-3	8	8	1	0, 1 [Byte]											
	Saves home limit position	Set Home Limit Here	1-3	9	9	0												
	Saves end limit position	Set End Limit Here	1-3	10	A	0												
		Send Motor to Home Limit	1-3	11	B	0												
		Send Motor to End Limit	1-3	12	C	0												
Manual Move Commands	Does not apply to finite manual moves	Set Continuous Speed	1-3	13	D	4	Steps/Second [float]											
	Does not apply to finite manual moves	Set Motor Continuous Motion Accel/Decel Rate	1-3	14	E	4	Steps/Second^2 [float]											
	Direct move command, does not require use of "start" and "stop" commands.	Execute Simple Motor Move	1-3	15	F	5	Dir (0, 1) [Byte]	Steps [Ulong]										
Programmed Travel Commands		Set Program Start point	1-3	16	10	4	Step position [long]											
		Set Program Stop point	1-3	17	11	4	Step position [long]											
	1 = Linear, 2 = Quadratic, 3 = Inverted Quadratic	Set Easing (Ramping) Mode	1-3	18	12	1	1, 2, 3											
	How many shots should this motor wait before moving?	Set Lead-In Shots / Time	1-3	19	13	2	Shots (SMS or time lapse cont.) / Time ms (Video cont.) [Uint]											
		Set Travel Shots(SMS) / Travel Time (Cont.)	1-3	20	14	4	Shots (SMS) or Total Travel Time (ms) (cont.) [Ulong]											
		Set Program Accel	1-3	21	15	4	Accel Period – Shots (SMS) or Time in ms (Cont.) [Ulong)]											
		Set Program Decel	1-3	22	16	4	Decel Period – Shots (SMS) or Time in ms (Cont.) [Ulong]											
		Send Motor to Program Start Point	1-3	23	17	0												
		Send Motor to Program Stop Point	1-3	24	18	0												
Stop-Motion Travel Commands	Manual SMS movement. Not yet implemented.	Advance One SMS Increment	1-3	25	19	0												
	Manual SMS movement. Not yet implemented.	Go Back One SMS Increment	1-3	26	1A	0												
	Sets the current position as home, disables limits, and sets start/stop positions to home position.	Reset Limits and Program Start/Stop Positions	1-3	27	1B	0												
	The controller will automatically select the highest resolution microstepping (up to 1/4 stepping) that can be used to achieve the program parameters. It will also report back the setting it uses. 0 will be reported when the command is called at an illegal time (i.e. when the motor is in motion). 255 will be reported when the speed required by the current plan parameters exceeds the controller's top speed.	Auto Set Program Microsteps	1-3	28	1C	0	Value Type [Uint]	0, 4, 8, 16, 255										
		Set Start Here	1-3	29	1D	0												
		Set Stop Here	1-3	30	1E	0												
		Status Request	1-3	100			<Status Type>	<returns> with header and master address in front (00 00 00 00 00 FF 00 00 01 Length Data)										
General Motor Query Commands		Motor Enable	1-3	100	64	0	Value Type [Byte]	True/False (1,0)										
		Backlash Steps	1-3	101	65	0	Value Type [Uint]	Steps										
		Microstep Value	1-3	102	66	0	Value Type [Byte]	1, 2, 4, 8, 16										
		Direction	1-3	103	67	0	Value Type [Byte]	0, 1										
		Motor Max Step Speed	1-3	104	68	0	Value Type [Int]	Steps/Second										
		End Limit Position	1-3	105	69	0	Value Type [Long]	Position										
		Current Motor Position	1-3	106	6A	0	Value Type [Long]	Position										
		Motor Running	1-3	107	6B	0	Value Type [Byte]	True/False (1,0)										
Manual Move Query Commands		Continuous Speed	1-3	108	6C	0	Value Type [Psudo-float--Fixed point – must divide by 100 on master side]	Steps/Second										
		Motor Continuous Motion Accel/Decel Rate	1-3	109	6D	0	Value Type [Psudo-float--Fixed point – must divide by 100 on master side]	Steps/Second^2										
Programmed Travel Query Commands		Easing (Ramping) Mode	1-3	110	6E	0	Value Type [Byte]	1, 2, 3										
		Program Start point	1-3	111	6F	0	Value Type [Long]	Position										
		Program Stop point	1-3	112	70	0	Value Type [Long]	Position										
		Travel Shots(SMS) / Travel Time (Cont.)	1-3	113	71	0	Value Type [Ulong]	Shots (SMS) or Total Travel Time (ms) (cont.)										
		Lead-In Shots / Time	1-3	114	72	0	Value Type [Int]	Shots (SMS or time lapse cont.) / Time ms (Video cont.)										
		Program Accel	1-3	115	73	0	Value Type [Ulong]	Accel Period – Shots (SMS) or Time in ms (Cont.)										
		Program Decel	1-3	116	74	0	Value Type [Ulong]	Decel Period – Shots (SMS) or Time in ms (Cont.)										
		Check Motor Sleep State	1-3	117	75	1	Value Type [Byte]	True/False (1,0)										

Cameras		NOOP	4	0	0	0													
		Reserve for core protocol	4	1	1	0													
		Camera Enable	4	2	2	1	True/False (1,0) [Byte]												
	Triggers exposure with length set by "Exposure Time" command.	Expose Now	4	3	3	0													
		Trigger Time	4	4	4	4	Exposure Time (mS) [Ulong]												
		Focus Time	4	5	5	2	Focus Time (mS) [Uint]												
	The system will stop a move once it reaches the max number of camera exposures.	Max Shots	4	6	6	2	Count [Uint]												
		Exposure Delay	4	7	7	2	Delay (mS) [Uint]												
		Focus w Shutter	4	8	8	1	True/False (1,0) [Byte]												
	This causes two trigger signals to be sent to the camera in the event that the user has the camera in "mirror up" mode.	Mirror Up (Repeat Shot)	4	9	9	1	True/False (1,0) [Byte]												
	Length of SMS interval	Interval	4	10	A	4	Interval Time (mS) [Ulong]												
		Camera Test Mode	4	11	B	1	True/False (1,0) [Byte]												

		Status Request	4	100			<Status Type>	<returns> with header and master address in front (00 00 00 00 00 FF 00 00 01 Length Data)											
		Camera Enable	4	100	64	0	Value Type [Byte]	True/False (1,0)											
		Exposing now?	4	101	65	0	Value Type [Byte]	True/False (1,0)											
		Trigger Time	4	102	66	0	Value Type [Ulong]	Exposure Time (mS)											
		Focus Time	4	103	67	0	Value Type [Uint]	Focus Time (mS)											
		Max Shots	4	104	68	0	Value Type [Ulong]	Count											
		Exposure Delay	4	105	69	0	Value Type [Uint]	Delay (mS)											
		Focus w Shutter	4	106	6A	0	Value Type [Byte]	1, 0											
		Mirror Up (Repeat Shot)	4	107	6B	0	Value Type [Byte]	True/False (1,0)											
		Interval Time	4	108	6C	0	Value Type [Ulong]	Interval Time (mS)											
	Number of shots that have been taken so far during the current program.	Current Shots	4	109	6D	0	Value Type [Uint]	Number of shots taken											
		Camera Test Mode	4	110	6E	0	Value Type [Byte]	True/False (1,0)											

			Address	Sub-Address	Command	Data Length	Data
Broadcasts	These function the same as the start, stop, and pause commands above, but can be used to synchronize movement of multiple controllers.	Start	1	0	1	0	
		Stop	1	0	2	0	
		Pause	1	0	3	0	
	Use this to assign an address to a controller with an unknown address. Don't use when controllers are daisy-chained together.	Assign Address	1	0	4	1	2-255

Note: nodes do not give a response to broadcast commands.

Query Value Types	
0	Byte
1	Unsigned Int
2	Int
3	Long
4	Unsigned Long
5	Float
6	String

The floats are actually fixed points. They are multiplied by 100 and transmitted as longs, so they need to be divided by 100 on the master side to resolve the true value.