1. Command protocol

1.1. Start command

Name	H	#	Description	Syntax	Response
SET_START	S	0	Send out command to start the robot, when received the robot will start homing it's axes.	<S0[]>	No

!table - *Start commands*

1.2. Movement command

Name	H	#	Description	Syntax	Response
SET_INVERSE	M	0	Send movement command with cartesian coordinates.	<M0[X,Y,Z,G]>	No
SET_FORWARD	M	1	Send movement command with angle positions.	<M1[A0,A1,A2,A3]>	No
SET_GRIPPER	M	2	Send movement command with gripper PWM values.	<M2[G0,G1]>	No

!table - *Movement commands*

1.3. Stop command

Name	H	#	Description	Syntax	Response
SET_PAUSE	E	0	Send stop command with duration, this will pause the robot for the given amount of time.	<E0[ms]>	No
STOP_ROBOT	E	1	Send stop command, this will move the robot to the idle position and disable all the joints.	<E1[]>	No
ESTOP_ROBOT	E	2	Send E-stop command, this will stop the robot directly and disable all the joints.	<E2[]>	No

!table - *Stop commands*

1.4. Data command

Name	H	#	Description	Syntax	Response
GET_RUNTIME	D	0	Send out data command for runtime data.	<D0[]>	Yes
GET_DYNAIC	D	1	Send out data command for dynamic data.	<D1[]>	Yes

Name	H	#	Description	Syntax	Response
GET_STATIC	D	2	Send out data command for static data.	<D2[]>	Yes
SET_SPEED_ACCEL	D	3	Send out command to set new speed and accel values.	<D3[speed,accel]>	No
SET_VERBOSITY	D	4	Send out command to set new verbosity values.	<D4[E,W,I,D]>	No
SET_FRAME_OFFSET	D	5	Send out command to set new a frame offset value.	<D5[offset]>	No
SET_GRIP_OFFSET	D	6	Send out command to set new a gripper offset value.	<D6[offset]>	No
SET_IDLE_POSITIONS	D	7	Send out command to set new idle positions.	<D7[P0,P1,P2,P3]>	No
HOMING_COMPLETE	D	8	Send out command to let the user know the homing sequence is complete.	<D8[]>	No

!table - *Data commands*

2. Response protocol

2.1. Runtime data response

> Runtime data response syntax:
> `#D0[CURRENT_POS_00,CURRENT_POS_01,CURRENT_POS_02,CURRENT_POS_03,IS_RUNNING_00,IS_RUNNING_01,IS_RUNNING_02,IS_RUNNING_03,POSITION_X,POSITION_Y,POSITION_Z,GRIPPER_SIG_00,GRIPPER_SIG_01]*`

Index	Field	Type	Description
00	CURRENT_POS_00	float	Current position segment 00
01	CURRENT_POS_01	float	Current position segment 01
02	CURRENT_POS_02	float	Current position segment 02
03	CURRENT_POS_03	float	Current position segment 03
04	IS_RUNNING_00	bool	If segment 00 is currently moving.
05	IS_RUNNING_01	bool	If segment 01 is currently moving.
06	IS_RUNNING_02	bool	If segment 02 is currently moving.
07	IS_RUNNING_03	bool	If segment 03 is currently moving.
08	POSITION_X	float	Cartesian coordinate X of gripper position.

Index	Field	Type	Description
09	POSITION_Y	float	Cartesian coordinate Y of gripper position.
10	POSITION_Z	float	Cartesian coordinate Z of gripper position.
11	GRIPPER_SIG_00	unsigned char	Current PWM value for gripper pin 0.
12	GRIPPER_SIG_01	unsigned char	Current PWM value for gripper pin 1.

!table - *Runtime data response*

2.2. Static data response

> Static data response syntax:
> `#D1[HALL_SENSOR_00,HALL_SENSOR_01,HALL_SENSOR_02,HALL_SENSOR_03,MOTOR_STP_00,MOTOR_DIR_00,MOTOR_ENB_00,MOTOR_STP_01,MOTOR_DIR_01,MOTOR_ENB_01,MOTOR_STP_02,MOTOR_DIR_02,MOTOR_ENB_02,MOTOR_STP_03,MOTOR_DIR_03,MOTOR_ENB_03,GRIPPER_SIGNAL_00,GRIPPER_SIGNAL_01,MAX_HEIGHT_SEGMENT_00,MIN_HEIGHT_SEGMENT_00,MAX_ANGLE_SEGMENT_01,MIN_ANGLE_SEGMENT_01,MAX_ANGLE_SEGMENT_02,MIN_ANGLE_SEGMENT_02,MAX_ANGLE_SEGMENT_03,MIN_ANGLE_SEGMENT_03,MAX_SPEED_SEGMENT_00,MAX_ACCEL_SEGMENT_00,MAX_SPEED_SEGMENT_01,MAX_ACCEL_SEGMENT_01,MAX_SPEED_SEGMENT_02,MAX_ACCEL_SEGMENT_02,MAX_SPEED_SEGMENT_03,MAX_ACCEL_SEGMENT_03,LENGTH_SEGMENT_01,LENGTH_SEGMENT_02,LEAD_SCREW_PITCH,MICRO_STEPPING_00,MICRO_STEPPING_01,MICRO_STEPPING_02,MICRO_STEPPING_03,STEPS_PER_MILLIMETER_00,STEPS_PER_DEGREE_01,STEPS_PER_DEGREE_02,STEPS_PER_DEGREE_03]*`

Index	Field	Type	Description
00	HALL_SENSOR_00	unsigned char	Hall sensor 0 pin.
01	HALL_SENSOR_01	unsigned char	Hall sensor 1 pin.
02	HALL_SENSOR_02	unsigned char	Hall sensor 2 pin.
03	HALL_SENSOR_03	unsigned char	Hall sensor 3 pin.
04	MOTOR_STP_00	unsigned char	Step pin motor 0.
05	MOTOR_DIR_00	unsigned char	Direction pin motor 0.
06	MOTOR_ENB_00	unsigned char	Enable pin motor 0.
07	MOTOR_STP_01	unsigned char	Step pin motor 1.
08	MOTOR_DIR_01	unsigned char	Direction pin motor 1.
09	MOTOR_ENB_01	unsigned char	Enable pin motor 1.
10	MOTOR_STP_02	unsigned char	Step pin motor 2.
11	MOTOR_DIR_02	unsigned char	Direction pin motor 2.
12	MOTOR_ENB_02	unsigned char	Enable pin motor 2.
13	MOTOR_STP_03	unsigned char	Step pin motor 3.

Index	Field	Type	Description
14	MOTOR_DIR_03	unsigned char	Direction pin motor 3.
15	MOTOR_ENB_03	unsigned char	Enable pin motor 3.
16	GRIPPER_SIGNAL_00	unsigned char	Gripper signal pin 01.
17	GRIPPER_SIGNAL_01	unsigned char	Gripper signal pin 02.
18	MAX_HEIGHT_SEGMENT_00	unsigned short	Maximal height segment 00.
19	MIN_HEIGHT_SEGMENT_00	unsigned short	Minimal height segment 00.
20	MAX_ANGLE_SEGMENT_01	unsigned short	Maximal angle segment 01.
21	MIN_ANGLE_SEGMENT_01	unsigned short	Minimal angle segment 01.
22	MAX_ANGLE_SEGMENT_02	unsigned short	Maximal angle segment 02.
23	MIN_ANGLE_SEGMENT_02	unsigned short	Minimal angle segment 02.
24	MAX_ANGLE_SEGMENT_03	unsigned short	Maximal angle segment 03.
25	MIN_ANGLE_SEGMENT_03	unsigned short	Minimal angle segment 03.
26	MAX_SPEED_SEGMENT_00	unsigned short	Maximal speed segment 00.
27	MAX_ACCEL_SEGMENT_00	unsigned short	Maximal acceleration segment 00.
28	MAX_SPEED_SEGMENT_01	unsigned short	Maximal speed segment 01.
29	MAX_ACCEL_SEGMENT_01	unsigned short	Maximal acceleration segment 01.
30	MAX_SPEED_SEGMENT_02	unsigned short	Maximal speed segment 02.
31	MAX_ACCEL_SEGMENT_02	unsigned short	Maximal acceleration segment 02.
32	MAX_SPEED_SEGMENT_03	unsigned short	Maximal speed segment 03.
33	MAX_ACCEL_SEGMENT_03	unsigned short	Maximal acceleration segment 03.
34	LENGTH_SEGMENT_01	unsigned short	Fysical length segment 01.
35	LENGTH_SEGMENT_02	unsigned short	Fysical length segment 02.
36	LEAD_SCREW_PITCH	unsigned short	Thread pitch of the used lead screw.
37	MICRO_STEPPING_00	unsigned short	Microstepping configuration segment 00
38	MICRO_STEPPING_01	unsigned short	Microstepping configuration segment 01
39	MICRO_STEPPING_02	unsigned short	Microstepping configuration segment 02
40	MICRO_STEPPING_03	unsigned short	Microstepping configuration segment 03
41	STEPS_PER_MILLIMETER_00	float	Steps per millimeter value segment 00.
42	STEPS_PER_DEGREE_01	float	Steps per degree value segment 01.
43	STEPS_PER_DEGREE_02	float	Steps per degree value segment 02.

Index	Field	Type	Description
44	STEPS_PER_DEGREE_03	float	Steps per degree value segment 03.

!table - *Static data response*

2.3. Dynamic data response

> Dynamic data response syntax:
> `#D2[CURRENT_SPEED_00,CURRENT_ACCEL_00,CURRENT_SPEED_01,CURRENT_ACCEL_01,CURRENT_SPEED_02,CURRENT_ACCEL_02,CURRENT_SPEED_03,CURRENT_ACCEL_03,VERBOSITY_ERROR,VERBOSITY_WARNING,VERBOSITY_INFO,VERBOSITY_DEBUG,FRAME_HEIGHT_OFFSET,GRIPPER_HEIGHT_OFFSET,ACTUAL_ZERO_POS_SEG_00,IDLE_POS_SEGMENT_00,IDLE_POS_SEGMENT_01,IDLE_POS_SEGMENT_02,IDLE_POS_SEGMENT_03]*`

Index	Field	Type	Description
00	CURRENT_SPEED_00	float	Current speed segment 00.
01	CURRENT_ACCEL_00	float	Current acceleration segment 00.
02	CURRENT_SPEED_01	float	Current speed segment 01.
03	CURRENT_ACCEL_01	float	Current acceleration segment 01.
04	CURRENT_SPEED_02	float	Current speed segment 02.
05	CURRENT_ACCEL_02	float	Current acceleration segment 02.
06	CURRENT_SPEED_03	float	Current speed segment 03.
07	CURRENT_ACCEL_03	float	Current acceleration segment 03.
08	VERBOSITY_ERROR	bool	Current verbosity setting Error
09	VERBOSITY_WARNING	bool	Current verbosity setting Warning
10	VERBOSITY_INFO	bool	Current verbosity setting Info
11	VERBOSITY_DEBUG	bool	Current verbosity setting Debug
12	FRAME_HEIGHT_OFFSET	unsigned short	Current frame height offset.
13	GRIPPER_HEIGHT_OFFSET	unsigned short	Current gripper height offset.
14	ACTUAL_ZERO_POS_SEG_00	unsigned short	Actual zero position, after frame and gripper conversion.
15	IDLE_POS_SEGMENT_00	unsigned short	Idle position segment 00.
16	IDLE_POS_SEGMENT_01	unsigned short	Idle position segment 01.

Index	Field	Type	Description
17	`IDLE_POS_SEGMENT_02`	unsigned short	Idle position segment 02.
18	`IDLE_POS_SEGMENT_03`	unsigned short	Idle position segment 03.

!table - *Dynamic data response*

3. Log protocol

> Log message syntax:
> `@verbosityIndex[messageString;caller;file;lineNum;variables]*`

Index	Variable	Description	Values
00	`@`	Log message start char	`@`
01	**verbosityIndex**	Index of severity.	0..3 [ERROR,WARNING,INFO,DEBUG]
02	**messageString**	Actual message string.	String
03	**caller**	Caller of log message.	String
04	**file**	File name of caller.	String
05	**lineNum**	Line number of caller.	uint16_t
06	**variables**	Variable string, seperated by comma.	String
07	`*`	Log message stop char	`*`

!table - *Log message protocol*