Jetting Interface 2 – Jetting Controller – Protocol

Issue 1

Introduction

This document will define the protocol that the Jetting Interface 2 will expose and detail other implementation considerations.

The Jetting Interface 2 will provide three non-blocking TCP/IP sockets allowing multiple Jetting Controller client connections on each of the following ports:

Port 9110 – Command Port ①
Port 9111 – Imaging Port ②
Port 9112 – Status Port ③

All protocol messages will be constructed as follows…

<CMND>[parameter list]<terminator>

…where <CMND> is the command token and <terminator> is a user configurable message terminating character (default: ASCII char 10, line-feed). A comma should separate each parameter in the optional parameter list. String parameters will be braced by inverted commas (empty strings = ""). If a command requires a reply from the Jetting Interface the same command token will be used with the reply list constructed as a parameter list.

Examples (\n = LF):

No parameters	CMND\n
One parameter	CMND,1\n
Two parameters	CMND,1,2\n
String parameter	CMND,"some string"\n

Command requiring a reply (get connected client jetting controller ID, software version and number of connected printheads):

JI2 -> JC	GS_JC_VERSION\n
JC -> JI2	GS_JC_VERSION,1,”1.05”,15\n

The Jetting Interface 2 will periodically (option default is every second) transmit a keep-alive message (KA_PING). If no response is offered for this message the server will assume the connection is dead and close the server end of the socket for the connected client.

Document History

ISSUE	COMMAND	COMMENT
1	- all -	First issue

PROTOCOL

Status Requests (GS_)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①②③	GS_JC_VERSION	Get the just connected Jetting Controller ID and Software Version.	None	1] Jetting Controller ID (int) 2] Firmware Version (string) 3] Hardware Version (string) 4] Number of connected Printheads (int)
1	①	GS_PH_VERSION	Get the specified Printhead version.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] MCU Firmware Version (string) 4] MCU Hardware Version (string) 5] MCU Firmware Variant (string) 6] FPGA Firmware Version (string) 7] FPGA Hardware Version (string) 8] Bootloader Version (string)

Control Commands (CN_)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①	CN_JETTING_ALL_ON	Switch jetting on for all Printheads.	None	1] Jetting Controller ID (int) 2] Success Flag (int) 0 – Failed 1 – OK
1	①	CN_JETTING_ON	Switch jetting on for all Printheads, dependent on Jetting Mask. **Note:** 12 chars per printhead (so, if 15 printheads then 15 x 12 = 180 chars = Jetting Mask)	1] Jetting Mask (string – 180 chars)	1] Jetting Controller ID (int) 2] Success Flag (int) 0 – Failed 1 – OK
1	①	CN_JETTING_OFF	Switch jetting off for all Printheads.	None	1] Jetting Controller ID (int) 2] Success Flag (int) 0 – Failed 1 – OK
1	①	CN_PH_JETTING_ON	Switch on jetting on specified Printhead dependent on Jetting Mask. **Note:** 12 chars for a printhead	1] Printhead ID (int) 2] Jetting Mask (string – 12 chars)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag (int) 0 – Failed 1 – OK
1	①	CN_PH_JETTING_OFF	Switch off jetting on specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag (int) 0 – Failed 1 - OK
1	①	CN_JC_ID_LED_ON	Switch LED on for specified Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CN_JC_ID_LED_OFF	Switch LED off for specified Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CN_PH_ID_LED_ON	Switch LED on for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①	CN_PH_ID_LED_OFF	Switch LED off for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CN_JC_CALIBRATION	Do calibration on all Printheads.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CN_PH_CALIBRATION	Do calibration on specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CN_PH_CALIBRATION_DATA	Get Printhead's Nozzle Calibration Data **Note:** If Nozzle not calibrated then Calibrated Frequency will be -1.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3-50] Calibrated Frequency [KHz] (float) (48 comma-delimited values)
1	①	CN_PH_CALIBRATION_RAW_DATA	Get Printhead's Nozzle Raw Calibration Data **Notes:** If Nozzle not calibrated then Raw Calibrated Frequencies will be -1.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3-50] Raw Calibrated Frequency [KHz] (float) (48 comma-delimited values)
1	①	CN_PH_CALIBRATED_BASE_FREQUENCY	Get Printhead's Base Frequency and Active Base Frequency	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Base Frequency (float) 4] Active Base Frequency (float)
1	③	CN_JC_STATUS_MESSAGING_START	Start sending jetting controller status messages according to level setting. See Appendix A for breakdown of Status Levels. See EV_JC_STATUS_MSG.	1] Status Level (int) 2] Send Interval (msecs) (int)	1] Jetting Controller ID (int) 2] Status Level (int) 3] Send Interval (msecs) (int) 4] Success Flag 0 – Failed 1 – OK
1	③	CN_JC_STATUS_MESSAGING_STOP	Stop sending jetting controller status messages.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	③	CN_PH_STATUS_MESSAGING_START	Start sending printhead status messages according to level setting. *See Appendix A for breakdown of Status Levels.* *See EV_PH_STATUS_MSG.*	1] Status Level (int) 2] Send Interval (msecs) (int)	1] Jetting Controller ID (int) 2] Status Level (int) 3] Send Interval (msecs) (int) 4] Success Flag 0 – Failed 1 – OK
1	③	CN_PH_STATUS_MESSAGING_STOP	Stop sending printhead status messages.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CN_JC_RESET_FAULT_CODES	Reset fault codes for all Printheads connected to specified Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CN_PH_RESET_FAULT_CODES	Reset fault codes for specified Printhead connected to specified Jetting Controller.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CN_PH_NOZZLES_DISABLED	Disable nozzles from jetting for specified Printhead dependent on Mask. Note: If Mask is "000000000000" then all nozzles will be enabled and will jet.	1] Printhead ID (int) 2] Mask (string – 12 chars)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag (int) 0 – Failed 1 – OK

Configuration Commands (CF_)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①	CF_PH_SET_ID	Set the Printhead ID.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_DEASSIGN_ID	De-assign the Printhead ID.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_SET_JETTING_PARAMS	Set the Jetting Parameters for all Printheads connected to specified Jetting Controller.	1] Duty Cycle (int) 2] PWM Frequency (int) 3] Drive (int) 4] Nozzle Drive Frequency (int) 5] Nozzle Drive Duty Cycle (int)	1] Jetting Controller ID (int) 2] Duty Cycle (int) 3] PWM Frequency (int) 4] Drive (int) 5] Nozzle Drive Frequency (int) 6] Nozzle Drive Duty Cycle (int) 7] Success Flag -5 – Nozzle Drive Duty Cycle -4 – Nozzle Drive Frequency -3 – Drive -2 – PWM Frequency -1 – Duty Cycle 0 – Failed 1 – OK
1	①	CF_PH_SET_JETTING_PARAMS	Set the Jetting Parameters for specified Printhead.	1] Printhead ID (int) 2] Duty Cycle (int) 3] PWM Frequency (int) 4] Drive (int) 5] Nozzle Drive Frequency (int) 6] Nozzle Drive Duty Cycle (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Duty Cycle (int) 4] PWM Frequency (int) 5] Drive (int) 6] Nozzle Drive Frequency (int) 7] Nozzle Drive Duty Cycle (int) 8] Success Flag -5 – Nozzle Drive Duty Cycle

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
					-4 – Nozzle Drive Frequency -3 – Drive -2 – PWM Frequency -1 – Duty Cycle 0 – Failed 1 – OK
1	①	CF_PH_GET_JETTING_PARAMS	Get the Jetting Parameters from the specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Duty Cycle (int) 4] PWM Frequency (int) 5] Drive (int) 6] Nozzle Drive Frequency (int) 7] Nozzle Drive Duty Cycle (int) 8] Success Flag -5 – Nozzle Drive Duty Cycle -4 – Nozzle Drive Frequency -3 – Drive -2 – PWM Frequency -1 – Duty Cycle 0 – Failed 1 – OK
1	①	CF_JC_SAVE_CALIBRATION	Save calibration for all Printheads.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_SAVE_CALIBRATION	Save calibration for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_RESET_CALIBRATION	Reset calibration settings to previous settings for all Printheads.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_RESET_CALIBRATION	Reset calibration settings to previous settings for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
					0 – Failed 1 – OK
1	①	CF_JC_SET_PURGE_SETTINGS	Set purge settings for all Printheads connected to specified Jetting Controller. **Note:** Purge Time (how long to jet) must be less than Purge Interval	1] Purge Interval (msecs) (int) 2] Purge Time (msecs) (int)	1] Jetting Controller ID (int) 2] Purge Interval (msecs) (int) 3] Purge Time (msecs) (int) 4] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_SWITCH_OFF_PURGE	Switch off purge for all Printheads connected to specified Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_SETTER	Set Jetting Controller setting according to Setter ID *See Appendix D*	1] Save New Value (bool) 2] Setter ID (int) 3] New Value (string)	1] Jetting Controller ID (int) 2] Save New Value (bool) 3] Setter ID (int) 4] New Value (string) 5] Success Flag -1 – Incorrect New Value 0 – Failed 1 – OK
1	①	CF_PH_SETTER	Set Printhead setting according to Setter ID *See Appendix D*	1] Printhead ID (int) 2] Save New Value (bool) 3] Setter ID (int) 4] New Value (string)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Save New Value (bool) 4] Setter ID (int) 5] New Value (string) 6] Success Flag -1 – Incorrect New Value 0 – Failed 1 – OK
1	①	CF_JC_GETTER	Get Jetting Controller setting according to Getter ID *See Appendix D*	1] Get Saved Value (bool) 2] Getter ID (int)	1] Jetting Controller ID (int) 2] Saved Value (bool) 3] Getter ID (int) 4] Current Value (string) 5] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_GETTER	Get Printhead setting according to Getter ID *See Appendix D*	1] Printhead ID (int) 2] Get Saved Value (bool) 3] Getter ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Saved Value (bool) 4] Getter ID (int) 5] Current Value (string)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
					6] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_RESET_SETTINGS_ALL_PRINTHEADS	Reset settings for all Printheads connected to Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_RESET_ALL_SETTINGS	Reset settings for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_REBOOT_ALL_PRINTHEADS	Reboot all Printheads connected to Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_REBOOT	Reboot the specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_RESET_CONTROLLER_SOFTWARE	Reset Jetting Controller software.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_RESTART	Restart the Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 - OK
1	①	CF_JC_SHUTDOWN	Shutdown the Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_JC_SAVE_ALL_PRINTHEAD_SETTINGS	Save settings for all Printheads connected to Jetting Controller.	None	1] Jetting Controller ID (int) 2] Success Flag 0 – Failed 1 – OK
1	①	CF_PH_SAVE_SETTINGS	Save settings for specified Printhead.	1] Printhead ID (int)	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Success Flag 0 – Failed

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
					1 – OK

Imaging (m and n)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	②	m2	Start imaging.	1] Imaging Speed (float)	*See (n) Imaging reply.*
1	②	m4	Stop imaging.	None	1] Success Flag 0 – Failed 1 – OK
1	②	m0 **Note:** m0 starts msg but msg not sent until m1 added at end of msg.	Image mask start. Added to front of formatted message. **Note:** 12 chars per printhead (so, if 15 printheads then 15 x 12 = 180 chars = image line)	1] Formatted message (see (n) imaging reply for number of image lines in formatted message)	None
1	②	m1	Image mask end. Added to end of formatted message. Formatted message then transmitted to Jetting Controller.	1] Added to end of formatted message.	*See (n) Imaging reply.*
1	②	m5 **Note:** m5 starts duty cycle msg but msg not sent until m6 added at end of duty cycle msg.	Image mask start – duty cycle **Note:** 12 chars per printhead so will add 2 chars (hex) duty cycle at start of each printhead 12 chars.	1] Formatted message (see (n) imaging reply for number of image lines in formatted message).	None
1	②	m6	Image mask end – duty cycle	1] Added to end of formatted duty cycle mask.	*See (n) Imaging reply.*
1	②	m3	Image counting so check to make sure all image lines have been sent for last image. **Note:** Waits for imaging reply to be zero before stopping imaging.	None	*See (n) Imaging reply.*
1	②	n JC -> JI	Imaging reply **Note:** Number of image lines to send can change whilst imaging.	None	1] Number of image lines to send - hex (string)

Keep-Alive (KA_)

ISSUE	PORT	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①②③	KA_PING	Keep-alive message sent periodically by server to test for functioning client (option default is every second).	None	1] Always 1 (int)

Events (EV_)

ISSUE	PORT	DIRECTION	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	①②③	JI2 -> JC	EV_SHUTTING_DOWN	Jetting Interface is shutting down.	None	None
1	③	JC -> JI2	EV_STATUS_MSG_JC	Jetting Controller status message. ***NOTE:*** *See Appendix A for list of Jetting Controller Status Parameters according to Status Level*	1] Jetting Controller ID (int) 2] Status Level (int) 3] *(See Appendix A for list of Jetting Controller Status Parameters according to Status Level)*	None
1	③	JC -> JI2	EV_STATUS_MSG_PH	Printhead status message. *NOTE: See Appendix B for list of Printhead Status Parameters according to Status Level*	1] Jetting Controller ID (int) 2] Status Level (int) 3] Printhead ID (int) 4] (See Appendix B for list of Printhead Status Parameters according to Status Level)	None
1	①	JC -> JI2	EV_JC_ERROR_CODE	Jetting Controller error. ***NOTE:*** *See Appendix C for error codes and required parameters (if any)*	1] Jetting Controller ID (int) 2[Error Code (int) *(see Appendix C)* 3] Parameter Count (int) 4] Parameters (number of parameters is dependent on error code) (always strings – if no parameters then empty string)	None
1	①	JC -> JI2	EV_PH_ERROR_CODE	Printhead error. ***NOTE:*** *See Appendix C for error codes and required parameters (if any)*	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Error Code (int) *(see Appendix C)* 4] Parameter Count (int) 5] Parameters (number of parameters is dependent on error code) (always strings – if no parameters then empty string)	None
1	②	JC -> JI2	EV_IMG_ERROR_CODE	Jetting Controller imaging error. ***NOTE:*** *See Appendix C for error codes and required parameters (if any)*	1] Jetting Controller ID (int) 2] Error Code (int) *(see Appendix C)* 3] Parameter Count (int) 4] Parameters (number of parameters is dependent on error code) (always strings – if no parameters then empty string)	None

ISSUE	PORT	DIRECTION	COMMAND	DESCRIPTION	PARAMETERS	RETURN
1	③	JC -> JI2	EV_STATUS_ERROR_CODE	Jetting Controller status error. ***NOTE:*** *See Appendix C for error codes and required parameters (if any)*	1] Jetting Controller ID (int) 2] Error Code (int) *(see Appendix C)* 3] Parameter Count (int) 4] Parameters (number of parameters is dependent on error code) (always strings – if no parameters then empty string)	None
1	①	JC -> JI2	EV_PH_CONNECTION_CHANGED	Printhead has either disconnected or re-connected.	1] Jetting Controller ID (int) 2] Printhead ID (int) 3] Connection Status (int) 0 – Disconnected 1 – Connected	None

Examples:

Get the just connected Jetting Controller information…

Jetting Interface > GS_JC_VERSION <LF>
Jetting Controller > GS_JC_VERSION,1,”1.02”,15<LF>
(ID=1, Version=1.02, 15 printheads connected)

Jetting Interface >
CN_JETTING_ON,”FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF FFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF”<LF>
Jetting Controller > CN_JETTING_ON,1,1<LF>
(15 Printheads jetting all nozzles on Jetting Controller)

Jetting Interface >
CN_JETTING_ON,”000000000000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF000000000000”<LF>
Jetting Controller > CN_JETTING_ON,1,1<LF>
(No jetting on Printheads 1 & 15, jetting on for Printheads 2-14, on Jetting Controller)

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Appendix A

Status Message – EV_STATUS_MSG_JC

Status Level	Status Parameters
1	3] CPU Percentage Busy (float) 4] Rail 5V (float) 5] Rail CAN Bus 8V (float) 6] Temperature (float) 7] Humidity Percentage (float) 8] BUS current (float) 9] On Time Seconds (int)
2	*… all of Status Level 1 and …* 10] IP Address (string) 11] eFuse Voltage (float) 12] eFuse Bus Enabled (bool) 13] Bus Power Enabled (bool) 14] Bus Power OK (bool) 15] Switch Value (int) 16] Firmware Version (string) 17] Hardware Version (string) 18] Indicator 0 (bool) 19] Indicator 1 (bool) 20] Indicator 2 (bool) 21] Indicator 3 (bool) 22] Indicator 4 (bool) 23] Indicator 5 (bool)

Appendix B

Status Message – EV_STATUS_MSG_PH

Status Level	Status Parameters
1	4] Temperature (float) 5] Humidity (float) 6] MCU Temperature (float) 7] PDS Voltage (float) 8] MDS Voltage (float) 9] System Voltage (float) 10] eFuse Current (float) 11] Nozzle Current (float) 12] VDD (float) 13] Temperature Trip (bool) 14] PDS Over Voltage Trip (bool) 15] PDS Under Voltage Trip (bool) 16] PDS Supply Error Trip (bool) 17] MDS Over Voltage Trip (bool) 18] MDS Under Voltage Trip (bool) 19] Supply Over Voltage Trip (bool) 20] Supply Under Voltage Trip (bool) 21] eFuse Over Current Trip (bool) 22] eFuse Input Voltage Error Trip (bool) 23] eFuse Fault Trip (bool) 24] Flash Faulty Trip (bool) 25] Flash Checksum Error Trip (bool) 26] Duty Cycle (float) 27] PWM Frequency (float) 28] Drive (int) 29] Nozzle Drive Frequency (float) 30] Nozzle Drive Duty Cycle (float) 31] On Time Seconds (int)

2	*… all of Status Level 1 and …* 32] Accelerometer ID (int) 33] MCU ID (string) 34] Flash Memory ID (string) 35] Temperature Sensor Serial Number (int) 36] MCU Hardware Version (string) 37] MCU Firmware Version (string) 38] MCU Firmware Variant (string) 39] FPGA Hardware Version (string) 40] FPGA Firmware Version (string) 41] Bootloader Version (string) 42] Max Allowed Temperature (float) 43] PDS Voltage Max (float) 44] PDS Voltage Min (float) 45] MDS Voltage Max (float) 46] MDS Voltage Min (float) 47] eFuse Current Max (float) 48] Measured Hardware Version (string) 49] Gyro X (int) 50] Gyro Y (int) 51] Gyro Z (int) 52] Acceleration X (int) 53] Acceleration Y (int) 54] Acceleration Z (int) 55] Purge (int) 56] Purge State (int) 57] Purge Delay (int) 58] Purge Counter (int) 59] Cleaning Start Period (int) 60] Cleaning End Period (int) 61] Cleaning Step Period (int) 62] Cleaning Period (int)

Appendix C

Jetting Controller (JC) Error Messages

Code	Internal Identifier	Error Message	Parameter Count	Parameters
3000				

Printhead (PH) Error Messages

Code	Internal Identifier	Error Message	Parameter Count	Parameters
4000				

Imaging (IM) Error Messages

Code	Internal Identifier	Error Message	Parameter Count	Parameters
5000				

Status (ST) Error Messages

Code	Internal Identifier	Error Message	Parameter Count	Parameters
6000				

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Appendix D

Configuration – Jetting Controller / Printhead Setters/Getters (green signifies available)

ID	Name	Target	Setter	Getter	Var Type	Format	Min Value	Max Value	Default Value
1	CPU Busy Percentage	JC			Float	0.00%	0	100	-
2	Rail 5V	JC			Float	0.00V	0	5	-
3	Rail CAN Bus 8V	JC			Float	0.00V	0	8	-
4	Temperature	JC			Float	0.00°C	0	100	-
5	Humidity	JC			Float	0.00%	0	100	-
6	BUS Current	JC			Float	0.00mA	?	?	-
7	IP Address	JC			String	0.0.0.0	-	-	-
7	On Time Seconds	JC			Int	0	-	-	-
8	eFuse Voltage	JC			Float	0.00V	?	?	-
10	eFuse BUS Enabled	JC			Bool	-	0	1	1
11	BUS Power Enabled	JC			Bool	-	0	1	1
12	BUS Power OK	JC			Bool	-	0	1	1
13	Switch Value	JC			Int	?	?	?	?
14	Firmware Version	JC			String	0.00	-	-	-
15	Hardware Version	JC			String	0.00	-	-	-
16	Indicator 0	JC			Bool	-	0	1	-
17	Indicator 1	JC			Bool	-	0	1	-
18	Indicator 2	JC			Bool	-	0	1	-
19	Indicator 3	JC			Bool	-	0	1	-
20	Indicator 4	JC			Bool	-	0	1	-
21	Indicator 5	JC			Bool	-	0	1	-

ID	Name	Target	Setter	Getter	Var Type	Format	Min Value	Max Value	Default Value
1	Temperature	PH			Float	0.00°C	0	100	-
2	Humidity	PH			Float	0.00%	0	100	-
3	MCU Temperature	PH			Float	0.00°C	0	100	-

4	PDS Voltage	PH			Float	0.00V	20	45	36
5	MDS Voltage	PH			Float	0.00V	?	?	-
6	System Voltage	PH			Float	0.00V	?	?	-
7	eFuse Current	PH			Float	0.00mA	?	?	-
8	Nozzle Current	PH			Float	0.00mA	?	?	-
9	VDDVoltage	PH			Float	0.00V	?	?	-
10	Temperature Trip	PH			Bool	-	0	1	-
11	PDS Over Voltage Trip	PH			Bool	-	0	1	-
12	PDS Under Voltage Trip	PH			Bool	-	0	1	-
13	PDS Supply Error Trip	PH			Bool	-	0	1	-
14	MDS Over Voltage Trip	PH			Bool	-	0	1	-
15	MDS Under Voltage Trip	PH			Bool	-	0	1	-
16	Supply Over Voltage Trip	PH			Bool	-	0	1	-
17	Supply Under Voltage Trip	PH			Bool	-	0	1	-
18	eFuse Over Current Trip	PH			Bool	-	0	1	-
19	eFuse Input Voltage Error Trip	PH			Bool	-	0	1	-
20	eFuse Fault Trip	PH			Bool	-	0	1	-
21	Flash Faulty Trip	PH			Bool	-	0	1	-
22	Flash Checksum Error Trip	PH			BOOL	-	0	1	-
23	Duty Cycle	PH			Float	0	0	100	-
24	PWM Frequency	PH			Float				
25	Drive	PH			Int				
26	Nozzle Drive PWM Frequency	PH			Float				
27	Nozzle Drive Duty Cycle	PH			Float				
28	On Time Seconds	PH			Int	0	-	-	-
29	Accelerometer ID	PH			Int	-	-	-	-
30	MCU ID	PH			Int	-	-	-	-
31	Flash Memory ID	PH			Int	-	-	-	-
32	Temperature Serial Sensor Number	PH			Int	-	-	-	-
33	MCU Hardware Version	PH			String	0.0.0.0	-	-	-

34	MCU Firmware Version	PH			String	0.0.0.0	-	-	-
35	MCU Firmware Variant	PH			String	0	-	-	-
36	FPGA Hardware Version	PH			String	0.0.0.0	-	-	-
37	FPGA Firmware Version	PH			String	0.0.0.0	-	-	-
38	Bootloader Version	PH			String	0.00	-	-	-
39	Max Allowed Temperature	PH			Float	0.00°C	0	100	-
40	PDS Voltage Max	PH			Float	0.00V	?	?	?
41	PDS Voltage Min	PH			Float	0.00V	?	?	?
42	PDS Voltage Setting	PH			Float	0.00V	20	45	36
43	MDS Voltage Max	PH			Float	0.00V	?	?	?
44	MDS Voltage Min	PH			Float	0.00V	?	?	?
45	eFuse Current Max	PH			Float	0.00V	?	?	?
46	Measured Hardware Version	PH			String	0.00	-	-	-
47	Gyro X	PH			Int	-	-	-	-
48	Gyro Y	PH			Int	-	-	-	-
49	Gyro Z	PH			Int	-	-	-	-
50	Acceleration X	PH			Int	-	-	-	-
51	Acceleration Y	PH			Int	-	-	-	-
52	Acceleration Z	PH			Int	-	-	-	-
53	Purge Length	PH			Int	?	?	?	?
54	Purge State	PH			Int	?	?	?	?
55	Purge Delay	PH			Int	?	?	?	?
56	Purge Counter	PH			Int	?	?	?	?
57	Cleaning Start Period	PH			Int	?	?	?	?
58	Cleaning End Period	PH			Int	?	?	?	?
59	Cleaning Step Period	PH			Int	?	?	?	?
60	Cleaning Period	PH			Int	?	?	?	?
61	Frequency	PH			Float	0.00	?	?	?

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