COMMUNICATION MANUAL

EON and EON-LT

2.0.2

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Contents

Serial Setup

The table below shows the configuration for the RS-232 port. It is recommended that the included USB to serial cable is used.

Table 1- Communication Setup

Terminal ID	VT100 With Local Echo
Coding (Receive)	UTF-8
New Line Receive	CR+LF
New Line Transmit	CR+LF
Baud Rate	115200
Data Bit	8
Parity	None
Stop bit	1
Flow Control	NONE

Message Structure

Commands transmitted follow a basic structure. See the table below.

Table 2- Message Structure

	Initiator	Command	Command Parameters	Additional separator	Command terminator	Checksum	Transmission Terminators
Example	$	C	0,2.74,1.8,.75	,	!	868	CR+LF

1.1.1. Important Notes

1. Between the command (e.g. “C”) and the first command parameter (e.g. “0”) there is no separator.
2. Between every command parameter there is a separator (i.e. “,”)
3. Before the command terminator (i.e “!”) there is always an additional separator (i.e. “,”)
4. The checksum is an integer sum of the all of the values including the command terminator (i.e. “!”)
5. The checksum is transmitted as individual characters (e.g. “868” is transmitted as char 8, char 6 char 8)
6. The transmission must be ended with a carriage return and line feed.

Command Parameters

The parameters of each command will be different depending on each command. See the table below for a basic structure of the command parameters.

Table 3- Command Parameters Structure

	Sensor (if applicable)	Separator	Value	Separator	Value	Separator	Value
Example	0	,	2.74	,	1.8	,	.75

Checksum

A checksum is used in order to validate the data transmitted between devices. The checksum is the sum of the characters before the checksum. An "!" indicates that transmission has ended and the next value is the checksum. While the checksum is summed to be an integer, it is still treated as a character when transmitted.

1.1.1. Example Checksum

Assuming all of the ASCII values in the message sum to an integer 868, the checksum would be transmitted as each individual character. See the table below.

Table 4- Checksum Conversion

	Digit 1	Digit 2	Digit 3
ASCII	8	6	8
DEC	56	54	56

C Command Example:

This example will show how to send the parameters of the C command to EON.

Table 5- C Command Parameters

Parameter	Value
Sensor	0 (zero indexed, 0=sensor 1, 1=sensor 2)
Density [g/cm^3]	2.74
Z-Factor	1.8
Tooling [%]	75

These parameters will result in the following string.

$C0,2.74,1.8,.75

This string includes the command and all of its parameters but it does not include any of the final termination values.

First, the string must be concatenated with the additional separator and the command terminator. This results in the following string.

$C0,2.74,1.8,.75,!

This is now the final string that must be check-summed before it is transmitted. The table below shows the ASCII representation as DECIMAL values.

Table 6: Checksum Calculation

Initiator	CMD	Sensor	SEP.	2.74 Density				SEP.	1.8Z-Ratio			SEP.	75% Tooling Factor			SEP.	TERM	CHKSM
$	C	0	,	2	.	7	4	,	1	.	8	,	.	7	5	,	!	NA
36	67	48	44	50	46	55	52	44	49	46	56	44	46	55	53	44	33	868

After creating the checksum, the string now is concatenated with the checksum. The resulting string is:

$C0,2.74,1.8,75,!868

The final step is to concatenate the string with the transmission terminators (i.e. CR+LF). There is no example of this string since carriage return and line feed have no ASCII representations.

The string can now be transmitted. The following table shows the transmit buffer array to be transmitted.

Table 7- Transmit Buffer Array

INDEX	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
ASCII	$	C	0	,	2	.	7	4	,	1	.	8	,	.	7	5	,	!	8	6	8	CR	LF
DEC	36	67	48	44	50	46	55	52	44	49	46	56	44	46	55	53	44	33	56	54	56	13	10

Application Notes:

Note 1:

The corresponding values for the sources inside of the code are 0 & 1. This table identifies the values used inside of the code to the corresponding sensor label on the case of the EON and EON-LT.

Table 8: Source # Reference

Code Source #	EON Sensor Label	EON-LT Sensor Label
0	1	2
1	2	1

Note 2:

Commas are not shown in the tables. Please refer to the “Command Parameters” and “Message Structure”.

Note 3:

“Legacy commands” are still available but it is highly recommended that their replacement commands be used.

$@ Command Structure:

The @ Command returns the identity of the device and also the current firmware version. EON will return a 1-4 after the '@' character to identify the device type. The firmware version of EON will then be displayed afterwards.

To EON Syntax:

$@

Table 9: Example Command to EON

	$	@
Units	NA	NA
Range	NA	NA
Example	$	@
Comment	NA	NA

From EON Syntax:

$@[1-4], [Version Number]

Table 10: Example Command from EON

	$	@	EON Type C	Version Number
Units	NA	NA	NA	NA
Range	NA	NA	1-4	NA
Example	$	C	1	1.1.05
Comment	NA	NA	NA	Firmware Version

Table 11: Device Type

	1	2	3	4
Device	EON Controller	EON Monitor	EON-LT Controller	EON-LT Controller

$A Command Structure:

The **A** Command returns the current frequencies of both crystals in hertz. If the crystal frequency has not updated since last read, it will return an $A0 instead of the frequencies. See notes below for more information.

To EON Syntax:
$A

Table 12: Example Command to EON

	$	A
Units	NA	NA
Range	NA	NA
Example	$	A
Comment	NA	NA

From EON Syntax:
$A0
Or
$A[Crystal 0 Frequency],[Crystal 1 Frequency]

Table 13: Example Command from EON

	$	A	Crystal 0 Frequency	Crystal 1 Frequency
Units	NA	NA	Hz	Hz
Range	NA	NA	-2-6100000	-2-6100000
Example	$	A	5999999.999	5999999.999
Comment	NA	NA	NA	NA

NOTES:

$A0 - $A0 is returned if there is no value change from the A command since the last reading. By allowing the code to identify that no values have changed, the user can save space when saving the collected data to media by reducing the amount of data points collected.

$B Command Structure:

This is a legacy command and has been replaced by $b. This command requires that the Fmax, Fmin, Finit values still be transmitted but they are no longer used.

EON will automatically select the best averaging parameters based on the sample period. These factors are returned from the command. These factors can also be overridden with the R Command. The period selected will be set for both sensors.

To EON Syntax:
$B[Sensor],[Frequency Max],[Frequency Min],[Frequency Initial],[Period]

Table 14: Example Command to EON

	$	B	Sensor	Frequency Max	Frequency Min	Frequency Initial
Units	NA	NA	NA	Hz	Hz	Hz
Range	NA	NA	0-1	5000000-6000000	5000000-6000000	5000000-6000000
Example	$	B	1	5999999.984	5999999.984	5999999.984
Comment	NA	NA	NA	NA	NA	NA

	Period
Units	Seconds
Range	0.1-1.0
Example	0.5
Comment	NA

From EON Syntax:
$B[Sensor],[Period],[FIFO Filter Length],[Alpha]

Table 15: Example Command from EON

	$	B	Sensor	Period	FIFO Filter Length	Alpha
Units	NA	NA	NA	Seconds	NA	NA
Range	NA	NA	0-1	0.1-1	0-10	0-1
Example	$	B	1	0.26	8	0.5
Comment	NA	NA	NA	NA	NA	NA

$b Command Structure:

The b command sets the period at which the crystals are read. It is the inverse of the sampling rate. See notes below about e/E command updates for more information.

To EON Syntax:

$b[Period]

Table 16: Example Command to EON

	$	b	Period
Units	NA	NA	Sec
Range	NA	NA	0.10-1.00
Example	$	b	0.52
Comment	NA	NA	NA

From EON Syntax:

$b[Period],[FIFO Filter Length],[Alpha]

Table 17: Example Command from EON

	$	b	Period	FIFO Filter Length	Alpha
Units	NA	NA	Seconds	NA	NA
Range	NA	NA	0.10-1.00	0-10	0-1
Example	$	b	0.26	8	0.52
Comment	NA	NA	NA	NA	NA

$C Command Structure:

This is a legacy command and has been replaced by $c. The **C** command sets the parameters for the material during deposition. See Note Below for more information.

To EON Syntax:
$C[Sensor],[Density],[Z-Factor],[Tooling]

Table 18: Example Command to EON

	$	C	Sensor	Density	Z-Factor	Tooling
Units	NA	NA	NA	gm/cc	NA	Decimal
Range	NA	NA	1-2	0.100-99.999	0.100-15.000	.1-9.999
Example	$	C	1	58.568	2.325	5.253
Comment	NA	NA	NA	NA	NA	NA

From EON Syntax:
$C

Table 19: Example Command from EON

	$	C
Units	NA	NA
Range	NA	NA
Example	$	C
Comment	NA	NA

This command sets the Density, Z-Factor, and Tooling settings for the selected sensor. A Sensor value of 1 corresponds to Sensor 0, and a sensor value of 2 corresponds to Sensor 1. This has since been resolved in the new c command. See table below.

Table 20: C Command Sensor Value Reference

Sensor Value Entered	Corresponding Sensor Controlled
1	0
2	1

$c Command Structure:

The **c** command sets the parameters for the material during deposition. This command sets the **[Density**] of the material being applied. Also sets the **[Z-Factor]** and the **[Tooling**] values for the sensor calculations during the deposition process.

To EON Syntax:

$c[Sensor],[Density],[Z-Factor],[Tooling]

Table 21: Example Command to EON

	$	**c**	**Sensor**	**Density**	**Z-Factor**	**Tooling**
Units	NA	NA	NA	gm/cc	NA	Decimal
Range	NA	NA	0-1	0.100-99.999	0.100-15.000	.1-9.999
Example	$	c	1	58.568	2.325	5.253
Comment	NA	NA	NA	NA	NA	NA

From EON Syntax:

$c[Sensor],[Density],[Z-Factor],[Tooling]

Table 22: Example Command from EON

	$	**c**	**Sensor**	**Density**	**Z-Factor**	**Tooling**
Units	NA	NA	NA	gm/cc	NA	Decimal
Range	NA	NA	0-1	0.100-99.999	0.100-15.000	1.0-9.999
Example	$	c	1	58.568	2.325	5.253
Comment	NA	NA	NA	NA	NA	NA

$D Command Structure:

The **D** command zeroes the thickness by setting the current frequency of the crystal as the starting point for the deposition. Each crystal can be zeroed independently. Transmitting a 1 or 2 for Crystal Select will zero the corresponding crystal. Transmitting a 3 will zero both sensors.

To EON Syntax:

$D[Crystal Select]

Table 23: Example Command to EON

	$	D	Crystal Select
Units	NA	NA	NA
Range	NA	NA	1-3
Example	$	D	1
Comment	NA	NA	NA

From EON Syntax:

$D

Table 24: Example Command from EON

	$	D
Units	NA	NA
Range	NA	NA
Example	$	D
Comment	NA	NA

$E Command Structure:

This is a legacy command and has been replaced by $e. Returns the current readings from the EON required for the deposition process such as: Crystal Frequency, Rate of deposition, Material Thickness, Thermocouple Temperature, RTD Temperature, Source Power Output, Relay Status. This command will return $E0 if no values has changed. See notes below for more details.

To EON Syntax:

$E

Table 25: Example Command to EON

	$	E
Units	NA	NA
Range	NA	NA
Example	$	E
Comment	NA	NA

From EON Syntax:

$E0 **(See Note Below)**

OR

$E[Crystal 0 Frequency],[Crystal 1 Frequency], [Material Application Rate 0],[Material Application Rate 1],[Sensor 0 Thickness],[Sensor 1 Thickness], [Thermocouple 0 Temp],[Thermocouple 1 Temp],[RTD 0 Temperature],[RTD 1 Temperature],[Source 0 Power (%)],[Source 1 Power (%)],[Heater Power (%)],[Relay 0 Status],[Relay 1 Status]

Table 26: Example Command from EON

	$	E	Crystal 0 Frequency	Crystal 1 Frequency	Material Rate 0	Material Rate 1
Units	NA	NA	Hz	Hz	Å/s	Å/s
Range	NA	NA	-2-6100000	-2-6100000	0-999.9	0-999.9
Example	$	E	5999999.999	5999999.999	105.5	105.5
Comment	NA	NA	NA	NA	NA	NA

	Sensor 0 Thickness	Sensor 1 Thickness	Thermocouple 0 Temp	Thermocouple 1 Temp	RTD 0 Temperature	RTD 1 Temperature
Units	kÅ	kÅ	Celsius	Celsius	Celsius	Celsius
Range	0-9999.99	0-9999.99	0-999.9	0-999.9	0-999.9	0-999.9
Example	34.675	34.675	125.5	125.5	125.5	125.5
Comment	NA	NA	NA	NA	NA	Not Used

$E Command Structure (Continued):

	Source 0 Power (%)	Source 1 Power (%)	Heater Power (%)	Relay 0 Status	Relay 1 Status
Units	Decimal	Decimal	Decimal	NA	NA
Range	0-1.000	0-1.000	0-1.000	0-1	0-1
Example	0.543	0.543	0.534	1	1
Comment	0-5V	0-5V	NA	1=ON/0=OFF	1=ON/0=OFF

NOTES:
$E0 - $E0 is returned if there is no value change from the E command since the last reading. By allowing the code to identify that no values have changed, the user can save space when saving the collected data to media by reducing the amount of data points collected.

$e Command Structure:

The **e** command returns the information required for deposition, and also the current status of several of the EON's systems. Information returned includes: Crystal Frequency, Rate of deposition, Material Thickness, Thermocouple Temperature, RTD Temperature, Source Power Output, Relay Status, Active Process, Process Status, Max Frequency Reached Flag, and if PID is setup. The e command will return $e0 if no values have changed. See notes below for more details.

To EON Syntax:

$e

Table 27: Example Command to EON

	$	e
Units	NA	NA
Range	NA	NA
Example	$	e
Comment	NA	NA

From EON Syntax:

$e0

OR

$e[Crystal 0 Frequency],[Crystal 1 Frequency],[Material Application Rate 0],[Material Application Rate 1],[Sensor 0 Thickness],[Sensor 1 Thickness],[Thermocouple 0 Temp],[Thermocouple 1 Temp],[RTD 0 Temperature],[RTD 1 Temperature], [Source 0 Power (%)],[Source 1 Power (%)],[Heater Power (%)],[Relay 0 Status],[Relay 1 Status],[Active Process 0],[Active Process 1],[Active Process 2], [Process Status 0], [Process Status 1], [Max Power Flag 0], [Max Power Flag 1],[Max Power Flag 2],[PID Sensor Select Source 0],[PID Sensor Select Source 1]

Table 28: Example Command from EON

	$	e	Crystal 0 Frequency	Crystal 1 Frequency	Material Application Rate 0	Material Application Rate 1
Units	NA	NA	Hz	Hz	Å/s	Å/s
Range	NA	NA	-2-6100000	-2-6100000	0-999.9	0-999.9
Example	$	e	5999999.999	5999999.999	556.3	556.3
Comment	NA	NA	NA	NA	NA	NA

	Sensor 0 Thickness	Sensor 1 Thickness	Thermocouple 0 Temp	Thermocouple 1 Temp	RTD 0 Temperature	RTD 1 Temperature
Units	kÅ	kÅ	Celsius	Celsius	Celsius	Celsius
Range	0-9999.99	0-9999.99	0-999.9	0-999.9	0-999.9	0-999.9
Example	34.675	34.675	125.5	125.5	125.5	125.5
Comment	NA	NA	NA	NA	NA	Not Used

$e Command Structure (Continued):

	Source 0 Power (%)	Source 1 Power (%)	Heater Power (%)	Relay 0 Status	Relay 1 Status	Active Process 0
Units	Decimal	Decimal	Decimal	NA	NA	NA
Range	0-1	0-1	0-1	0-1	0-1	0-1
Example	0.523	0.523	0.523	1	1	1
Comment	0-5V	0-5V	NA	1=ON/0=OFF	1=ON/0=OFF	1=ON/0=OFF

	Active Process 1	Active Process 2	Process Status 0	Process Status 1	Max Power Flag 0	Max Power Flag 1
Units	NA	NA	NA	NA	NA	NA
Range	0-1	0-1	0-5	0-5	0-1	0-1
Example	1	1	3	3	1	1
Comment	See Below	See Below	See Below	See Below	1=ON/0=OFF	1=ON/0=OFF

	Max Power Flag 2	PID Sensor Select Source 0	PID Sensor Select Source 1
Units	NA	NA	NA
Range	0-1	0-1	0-1
Example	1	1	1
Comment	1=ON/0=OFF	See Below	See Below

NOTES:

PID Sensor Select Source# - This flag identifies which sensor will be used to control the PID mode for the specified source.

[PID Setup 0] displays which sensor will control source 0 (0 = Sensor 0, 1 = Sensor 1)
[PID Setup 1] displays which sensor will control source 1 (0 = Sensor 0, 1 = Sensor 1)

Max Power Flag # - The Max Power Flag is only active in PID mode. The PID will be limited to the user defined max power (Set by the $O Command) for the corresponding source. If the PID reaches the max power, this flag will read as a 1, otherwise a 0. Due to the nature of the PID continually making adjustments to the source power, it is possible for this flag to continually swing between 1 and 0 (bounce) when the PID is at the maximum limit. This is due to the PID continually trying to increase power to the source to meet the pre-defined settings and pushing the power slightly over the limit. The EON will then automatically throttle the power back, causing the flag to bounce between 0 and 1.

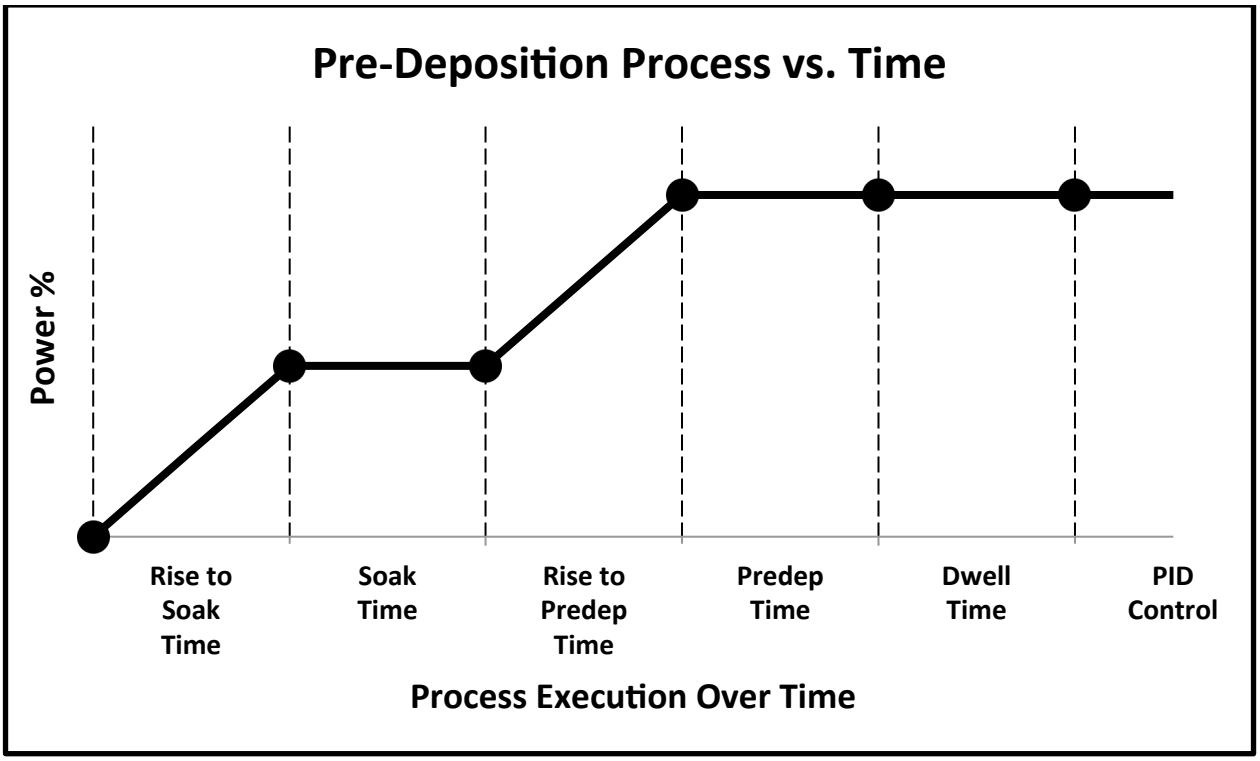
[Max Power Flag 0-1] are the sources.
[Max Power Flag 2] is the heater.

$e Command Structure (Continued):

Active Process # – This is set as 1 if the corresponding source is currently in PID mode otherwise it is set as 0.

Process Status # – This value represents the current process being executed in pre-deposition mode (See $S Command for more information). When in the deposition process, the Process Status will output a 5 for a fraction of a second and then return to 0. At this point, if auto PID mode is set, Process Status will read 0, however, Active Process will change to a value of 1, indicating that PID mode has taken over. See $S command for more information.

Figure 1: Pre-Deposition Process



0 = Not in pre-deposition / Rise to Soak
1 = Soak
2 = Rise to Pre-deposition
3 = Pre-Deposit
4 = Dwell (Time to wait before taking readings)
5 = Depositing

$e0 - $e0 is returned if there is no value change from the e command since the last reading. By allowing the code to identify that no values have changed, the user can save space when saving the collected data to media by reducing the amount of data points collected.

$F Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The **F** command is used to initialize the PID mode directly (0 = Disabled | 1 = Enabled). This command can be used to bypass the Pre-Deposition. To initialize channel 2 for PID, a heater must be connected. To exit PID mode see notes below. (See $h for setting the PID parameters)

To EON Syntax:
$F[Channel #]

Table 29: Example Command to EON

	$	F	Channel
Units	NA	NA	NA
Range	NA	NA	0-2
Example	$	F	1
Comment	NA	NA	NA

From EON Syntax:
$F

Table 30: Example Command from EON

	$	F	
Units	NA	NA	
Range	NA	NA	
Example	$	F	
Comment	NA	NA	

Note:

This command will only initialize the PID mode. To exit PID mode, send a $G command for the specified source you would like to take out of PID mode.

The command $G0,0 will take sensor 0 out of PID mode and set source 0's power to 0%.

See $G command for more information.

$G Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The **G** command is used to adjust the voltage **[Power]** output (0-5v) of the selected source. The voltage output is a percentage of the Channel from 0-5[vdc]. This will cause the selected source to disable PID mode if it is active.

To EON Syntax:
$G[Channel],[Power %]

Table 31: Example Command to EON

	$	G	Channel	Power %
Units	NA	NA	NA	Decimal
Range	NA	NA	0-2	0-1
Example	$	G	2	0.25
Comment	NA	NA	See Below	NA

From EON Syntax:
$G

Table 32: Example Command from EON

	$	G
Units	NA	NA
Range	NA	NA
Example	$	G
Comment	NA	NA

NOTE:

Channels 0-1 reference the sources; channel 2 references the heater power.

$H Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

This is a legacy command and has been replaced by $h. The $**H** command is used to set the PID parameters and the desired thickness of the material to apply.

To EON Syntax:
$H[Channel],[P],[I],[D],[Desired Thickness]

Table 33: Example Command to EON

	$	**H**	**Channel**	**[P]proportional**	**[I]integral**	**[D]derivative**
Units	NA	NA	NA	NA	NA	NA
Range	NA	NA	0-2	0-9999	0-99.9	0-99.9
Example	$	H	1	2.7	1.08	5.2
Comment	NA	NA	NA	NA	NA	NA

	Desired Rate
Units	Å/s
Range	0-9999.9
Example	2.8
Comment	NA

From EON Syntax:
$H

Table 34: Example Command from EON

	$	**H**
Units	NA	NA
Range	NA	NA
Example	$	H
Comment	NA	NA

NOTE:

Source 0-1 specifies the source selection to control.

Source 2 specifies the PID control for the heater. The desired rate is the temperature set-point.

$h Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The **h** command is used to set the PID parameters for the selected **[Source]**. The **[P]**orpotional **[I]**ntegrel **[D]**irivative with the **[Rate Set Point]** for the desired application rate until the desired **[Thickness Set Point]** is reached.

To EON Syntax:
$h[Source],[P],[I],[D],[Rate of Deposition],[Desired Thickness]

Table 35: Example Command to EON

	$	h	Source	[P]proportional	[I]integral	[D]erivative
Units	NA	NA	NA	NA	NA	NA
Range	NA	NA	0-2	0-9999	0-99.9	0-99.9
Example	$	h	1	2.7	1.08	5.2
Comment	NA	NA	NA	NA	NA	NA

	Rate of Deposition	Desired Thickness
Units	Å/s	Å
Range	0-999.9	0-9999.9
Example	1.08	1.08
Comment	NA	NA

From EON Syntax:
$h[Source],[P],[I],[D],[Rate of Deposition],[Desired Thickness]

Table 36: Example Command from EON

	$	h	Source	[P]proportional	[I]integral	[D]erivative
Units	NA	NA	NA	NA	NA	NA
Range	NA	NA	0-2	0-9999	0-99.9	0-99.9
Example	$	h	1	2.7	1.08	5.2
Comment	NA	NA	NA	NA	NA	NA

	Rate of Deposition	Desired Thickness
Units	Å/s	Å
Range	0-999.9	0-9999.9
Example	1.08	1.08
Comment	NA	NA

$h Command Structure (Continued):

***** This command is only available if the EON is a controller. *****

NOTE:

Source 0-1 specifies the source selection to control.

Source 2 specifies the PID control for the heater. When addressing the heater, desired thickness is not needed.

$I Command Structure:

This is a legacy command and has been replaced by $i. The **I** command sets the states of the built in relays on the EON. This command sets the state for both relays at the same time.

To EON Syntax:

[Relay 1 State] (1 = On | 0 = Off), [Relay 2 State] (1 = On | 0 = Off)

Table 37: Example Command to EON

	$	I	Relay 1 State	Relay 2 State
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	I	1	1
Comment	NA	NA	(0=OFF|1=ON)	(0=OFF|1=ON)

Table 38: Example Command from EON

	$	I
Units	NA	NA
Range	NA	NA
Example	$	I
Comment	NA	NA

$i Command Structure:

The **i** command is used to set the state of the EON's internal relays individually. Relay select specifies which relay to control, and relay state sets the state of that relay.

To EON Syntax:

$i[Relay Select],[Relay State]

Table 39: Example Command to EON

	$	i	Relay Select	Relay State
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	i	1	1
Comment	NA	NA	NA	(0=OFF|1=ON)

$i[Relay Select],[Relay State]

Table 40: Example Command from EON

	$	i	Relay Select	Relay State
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	i	1	1
Comment	NA	NA	NA	(0=OFF|1=ON)

$J Command Structure:

The **J** command is used to set the conversation rate from the RTD value to degrees Celsius using a linear equation. The conversion in C is then returned through the E/e commands.

To EON Syntax:

$J[Channel],[Y-Intercept],[Slope]

Table 41: Example Command to EON

	$	J	[Channel]	Y-Intercept	Slope
Units	NA	NA	NA	Celsius	Celsius/Ohm
Range	NA	NA	0-1	-999.9-999.9	-999.99-999.99
Example	$	J	1	32	64
Comment	NA	NA	NA	NA	NA

From EON Syntax:

$J

Table 42: Example Command from EON

	$	J
Units	NA	NA
Range	NA	NA
Example	$	J
Comment	NA	NA

NOTE:

This sets the conversion factor for the RTD. The RTD is read in Ohms. This linear equation calculates the degrees in Celsius from the resistance to give accurate readings.

$L Command Structure:

This is a legacy command and has been replaced by $I. The $L command is used to control the status of both LEDs on the front of the EON at the same time.

To EON Syntax:

$L[LED1(STAT 1)],[LED2](STAT_2)

Table 43: Example Command to EON

	$	L	LED 1 (STAT 1)	LED 2 (STAT 2)
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	L	1	1
Comment	NA	NA	NA	NA

From EON Syntax:

$L

Table 44: Example Command from EON

	$	L
Units	NA	NA
Range	NA	NA
Example	$	L
Comment	NA	NA

$l Command Structure:

The $**l** command is used to control the status LEDs on the front of the EON individually.

To EON Syntax:

$l[LED Select],[State]

Table 45: Example Command to EON

	$	l	LED Select	State
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	l	1	1
Comment	NA	NA	NA	(0=OFF|1=ON)

From EON Syntax:

$l[LED Select],[State]

Table 46: Example Command from EON

	$	l	LED Select	State
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	l	1	1
Comment	NA	NA	NA	(0=OFF|1=ON)

$M Command Structure:

The $**M** command is used to display the raw resistance values read from the RTD.

To EON Syntax:

$M

Table 47: Example Command to EON

	$	M
Units	NA	NA
Range	NA	NA
Example	$	M
Comment	NA	NA

From EON Syntax:

$M[RTD 1 Value],[RTD 2 Value]

Table 48: Example Command from EON

	$	M	RTD 1 Value	RTD 2 Value
Units	NA	NA	Ohms	Ohms
Range	NA	NA	0-65536.000	0-65536.000
Example		M	35502.435	35502.435
Comment	NA	NA	NA	NA

$N Command Structure:

The $**N** Command selects the current heater to use. Currently only channel 0 is used. See notes below for more details about switching.

To EON Syntax:
$N[Source]

Table 49: Example Command to EON

	$	N	Source
Units	NA	NA	NA
Range	NA	N	0-1
Example	$	NA	1
Comment	NA	NA	NA

From EON Syntax:
$N

Table 50: Example Command from EON

	$	N
Units	NA	NA
Range	NA	NA
Example	$	N
Comment	NA	NA

NOTES:

Switching this value to the incorrect heater can cause the heater not to operate. This can be remedied by selecting the correct heater. The default heater source is heater 0. [$N0]

$O Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The $**O** Command is used to set the maximum power the PID is allowed to reach. See notes below for more information on when the flag is set in the e command.

To EON Syntax:
$O[Source],[Max Power %]

Table 51: Example Command to EON

	$	O	Source	Max Power %
Units	NA	NA	NA	Decimal
Range	NA	NA	0-2	0-1
Example	$	O	1	0.25
Comment	NA	NA	NA	NA

From EON Syntax:
$O[Source],[Max Power %]

Table 52: Example Command from EON

	$	O	Source	Max Power %
Units	NA	NA	NA	Decimal
Range	NA	NA	0-2	0-1
Example	$	O	1	0.25
Comment	NA	NA	NA	NA

NOTE: The maximum limit set by the $O command does not affect the $G command (Source manual control). The source output can be set above the maximum value using the $G command. Using $G to set the source output power % above the maximum set by $O will NOT set the corresponding max power flag in the e command. The flag will only activate when the source is in PID mode and goes above the maximum power setting. This command is to prevent damage when the PID command is initiated by limiting the maximum power that the source can reach.

$P Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The **P** command specified which sensor should be set for the current source. Use this command to specify which sensor you would like to control the selected source while in PID mode.

To EON Syntax:
$P[Source],[Sensor]

Table 53: Example Command to EON

	$	P	Source	Sensor
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	P	1	1
Comment	NA	NA	NA	NA

From EON Syntax:
$P[Source],[Sensor]

Table 54: Example Command from EON

	$	P	Source	Sensor
Units	NA	NA	NA	NA
Range	NA	NA	0-1	0-1
Example	$	P	1	1
Comment	NA	NA	NA	NA

NOTE:
Use this command to specify which sensor you would like to use to control a specific source. i.e. If you would like source 0 to be controlled by sensor 1, then send $P0,1.

$R Command Structure:

The **R** command is used to specify the filter settings. The filter calculates the average frequency for the specified crystal source for more accurate readings. See notes below for more details about the filter's operation.

To EON Syntax:
$R[Channel],[Flag][Alpha],[Filter]

Table 55: Example Command to EON

	$	R	Channel	Flag	Alpha	Filter
Units	NA	NA	NA	NA	NA	NA
Range	NA	NA	0-1	0-1	0-1	0-10
Example	$	R	1	1	0.23	8
Comment	NA	NA	(0=Sensor0|1=Sensor1)	(0=Off|1=ON)	See Notes	See Notes

From EON Syntax:
$R[Channel],[Flag][Alpha],[Filter],[Filter Period]

Table 56: Example Command from EON

	$	R	Channel	Flag	Alpha	Filter
Units	NA	NA	NA	NA	NA	NA
Range	NA	NA	0-1	0-1	0-1	0-10
Example	$	R	1	1	0.23	8
Comment	NA	NA	(0=Sensor0|1=Sensor1)	(0=Off|1=ON)	See Notes	See Notes

	Filter Time
Units	Seconds
Range	0.1-10
Example	5
Comment	NA

NOTES:

Flag - The flag specifies if the filter should be used (0 = No Filter || 1 = Filter).

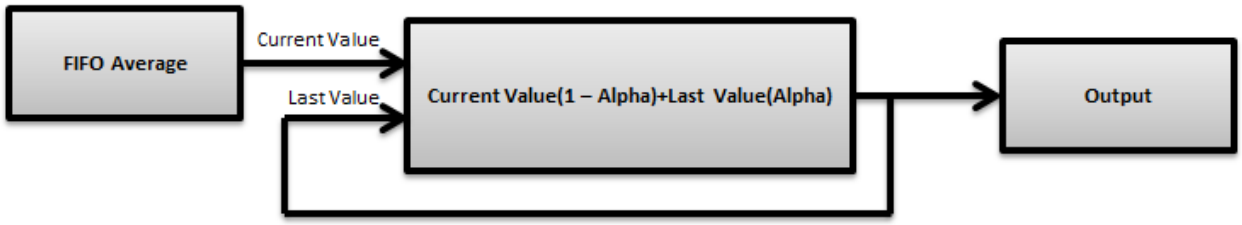
Filter - Filter is the size of the FIFO. The FIFO is used to store several readings from the crystal. The Filter value specifies how many previously recorded values are used in the average calculation. (0 -> 32 previous values to average).

Filter Time – Specifies over what period of time to calculate the average values of the crystal reading.

$R Command Structure (Continued):

Alpha –The alpha value is used to set how much weight to give the average of the FIFO Filter compared to the averaging of the last FIFO values read. (1= Weigh previously recorded values heavily | 0 = Do not give weight to previous calculations in the filter at all). See Figure 1 below for an example of dataflow.

Figure 2 – Alpha Calculation



$S Command Structure (CONTROLLER ONLY):

***** This command is only available if the EON is a controller. *****

The **S** command is used to setup and start the pre-deposition process. Once this command is sent, the pre-deposition will start. See notes below for more information on this process.

To EON Syntax:
$S[Channel],[Rise to Soak Time],[Soak Power %],[Soak Time],[Rise to Predep Time],[Predep Power %],[Predep Time],[Dwell Time],[PID Flag]

Table 57: Example Command to EON

	$	S	Channel	Rise to Soak Time	Soak Power %	Soak Time
Units	NA	NA	NA	Seconds	Decimal	Seconds
Range	NA	NA	0-1	0.1-9999.9	0-1	0-9999.9
Example	$	S	1	52.3	0.25	52.3
Comment	NA	NA	NA	NA	NA	NA

	Rise to Predep Time	Predep Power %	Predep Time	Dwell Time	PID Flag
Units	Seconds	Decimal	Seconds	Seconds	NA
Range	0.1-9999.9	0-1	0-9999.9	0-9999.9	0-1
Example	52.3	0.25	52.3	52.3	1
Comment	NA	NA	NA	NA	NA

From EON Syntax:
$S[Channel],[Rise to Soak Time],[Soak Power %],[Soak Time],[Rise to Predep Time],[Predep Power %],[Predep Time],[Dwell Time],[PID Flag]

Table 58: Example Command from EON

	$	S	Channel	Rise to Soak Time	Soak Power %	Soak Time
Units	NA	NA	NA	Seconds	Decimal	Seconds
Range	NA	NA	0-1	0.1-9999.9	0-1	0.1-9999.9
Example	$	S	1	52.3	0.25	52.3
Comment	NA	NA	NA	NA	NA	NA

$S Command Structure (Continued):

	Rise to Predep Time	Predep Power %	Predep Time	Dwell Time	PID Flag	
Units	Seconds	Decimal	Seconds	Seconds	NA	
Range	0.1-9999.9	0-1	0-9999.9	0-9999.9	0-1	
Example	52.3	0.25	52.3	52.3	1	
Comment	NA	NA	NA	NA	NA	NA

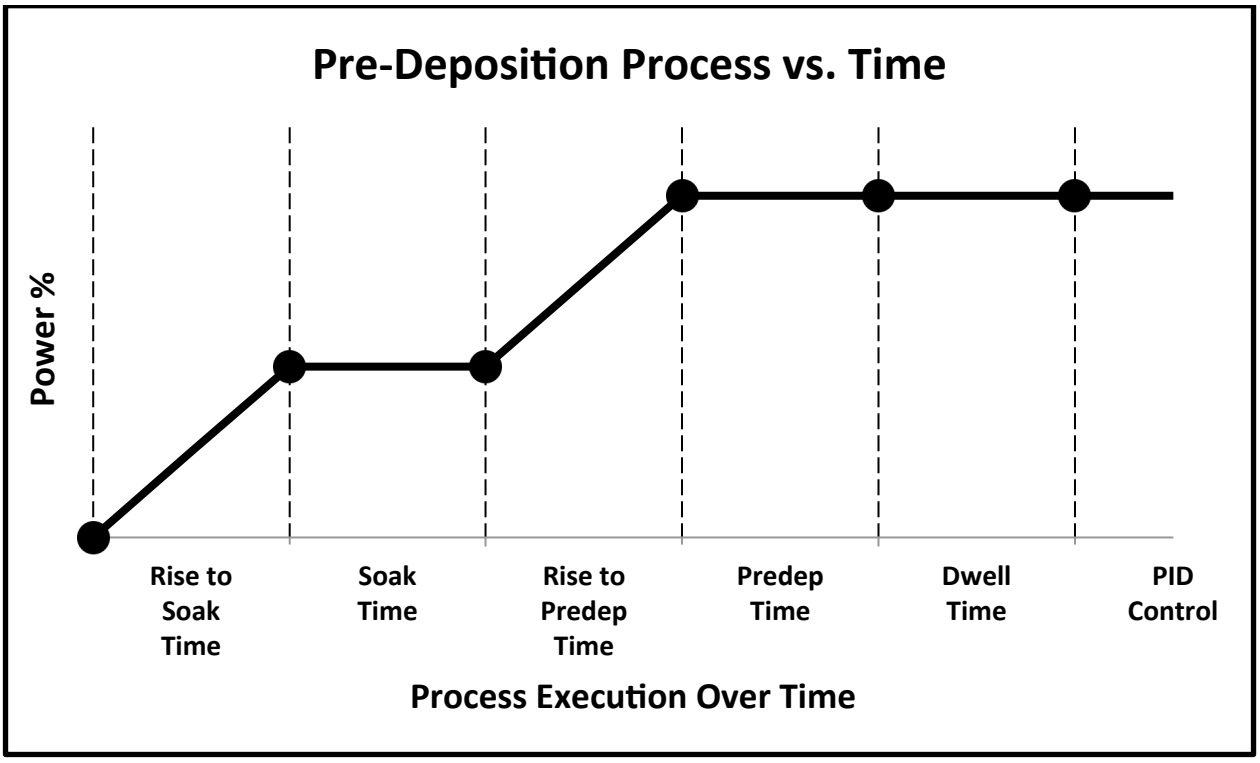
NOTES:

During the Pre-Deposition phase, the EON will report the current step in the Pre-deposition process it is at through the e/E command. See **e** command “Process Status” notes for more details.

$S Command Structure (Continued):

This is a visual representation of the pre-deposition process overtime.

Figure 3: Pre-Deposition Process



Pre-Deposition Process

- **Rise to Soak Time -** Specifies the time in seconds to reach the set soak power level.
- **Soak Time -** Once “soak power” is reached, "Soak Time" is the time in seconds to idle at “soak power” before continuing to increase power for the next phase.
- **Rise to Predep Time -** Specifies the time in seconds the EON should use to increase power from “soak power” to the set "Pre-deposition power".
- **Predep Time -** The specified amount of time to wait before continuing when the "Pre-Deposition power is reached".
- **Dwell Time -** Specifies the time to wait before reading the deposition rate.
    - This is used to prevent inaccurate readings while the deposition material starts to enter the chamber and initially lands on the crystal sensor.
- **Auto Flag -** Set to specify if PID mode should be started immediately after the pre-deposition process has been completed. (0 = Do not enter PID mode after Pre-deposition | 0 = Enter PID mode after Pre-deposition.)

$T Command Structure:

The **T** command is used to specify the analog output voltage vs the material deposit rate in angstroms for the specified channel. See notes below for setup details.

To EON Syntax:
$T[Channel],[Flag],[Range]

Table 59: Example Command to EON

	$	T	Channel	Flag	Range
Units	NA	NA	NA	NA	Volts
Range	NA	NA	0-1	0-1	0-5.000
Example	$	T	1	1	2.341
Comment	NA	NA	NA	NA	NA

From EON Syntax:
$T[Channel],[Flag],[Range]

Table 60: Example Command from EON

	$	T	Channel	Flag	Range
Units	NA	NA	NA	NA	Å
Range	NA	NA	0-1	0-1	0-999.9
Example	$	T	1	1	2.341
Comment	NA	NA	NA	NA	NA

NOTES:

The flag sets if the output is enabled or disabled. (0 = Disabled | 1 = Enabled). \

The [**Range]** specifies what material deposit rate in angstroms will equivalent to 5v out. I.e. If 8 angstroms is set for the range, 2.5v out will represent 4 angstroms.

Conversion Calculations:

$$\frac{\mathbf{5[VDC]}}{\mathbf{[Range[\AA/s]]}}\mathbf{(Current\ Rate[\AA/s])} = \mathbf{Voltage\ Out\ [Volts]}$$

$$\frac{\mathbf{Range[\AA/s]}}{\mathbf{5[VDC]}}\mathbf{[Voltage\ Out]} = \mathbf{Current\ Rate[\AA/s]}$$

$# Command Structure:

The **#** command is used to display the current material settings for the deposition.

To EON Syntax:

$#[Channel]

Table 61: Example Command to EON

	$	#	Channel
Units	NA	NA	NA
Range	NA	NA	0-1
Example	$	#	1
Comment	NA	NA	NA

From EON Syntax:

$#[Channel],[Density],[Z-Factor],[Tooling]

Table 62: Example Command from EON

	$	#	Channel	Density	Z-Factor	Tooling
Units	NA	NA	NA	gm/cc	NA	Decimal
Range	NA	NA	0-1	0.100-99.999	0.100-15.000	1.0-9.999
Example	$	#	1	58.568	2.325	5.253
Comment	NA	NA	NA	NA	NA	NA

$* Error Return

If the EON receives an invalid command, the EON will respond with a $* string. This response will return with the character of the command that caused the error, in addition to an error code.

From EON Syntax:
$*,[Command Sent],[Error Code]

Table 63: Example Command from EON

	$	*	Command	Error Code
Units	NA	NA	NA	NA
Range	NA	NA	A-Z	0-3
Example	$	*	B	1
Comment	NA	NA	NA	NA

Figure 4: Error Codes

Error Code	Description	Output
0	Checksum Error	$*[Command],0
1	Command Does Not Exist	$*[Command],1
2	Structure Invalid	$*[Command],2
3	Incorrect device type for command	$*[Command],3