



R256 Command List

Version 1.00

Commands to the R256 Controller can be issued from a HyperTerminal connection. The syntax is intuitive and easy to follow.

DT Protocol syntax:

The DT Protocol allows the unit to be commanded over a simple serial port.

Start Character	Address	Commands	Run	End of a string
/	1-9*	Command strings	R	<CR>

*To Access Drivers 10 – 16 use the following:

Driver #	Command
A	: (colon)
B	; (semi colon)
C	< (less than)
D	= (equals)
E	> (greater than)
F	? (question mark)
0	@ (at sign)

Running two or more motors together:

Motors 1 and 2:	“A”
Motors 3 and 4:	“C”
Motors 5 and 6:	“E”
Motors 7 and 8:	“G”
Motors 9 and 10:	“I”
Motors 11 and 12:	“K”
Motors 13 and 14:	“M”
Motors 15 and 16:	“O”
Motors 1, 2, 3 and 4:	“Q”
Motors 5, 6, 7 and 8:	“U”
Motors 9, 10, 11 and 12:	“Y”
Motors 13, 14, 15 and 16:	“]” (close bracket)
For all motors:	“_” (underscore)

Example: /CA5000R will move “C” (Driver 3 and 4) to “A” (Absolute Position) 5000.

LIST OF COMMANDS FOR THE R256

Command (Case Sensitive)	Operand	Example	Description
HOMING & POSITIONING			
Z	0-max*	/1A1000R	Initialize the Motor. Motor will turn towards 0 until the home opto sensor is interrupted. If already interrupted it will back out of the opto and come back in until re-interrupted. Current motor position is set to zero. Speed of homing is set by lower case v.
z	0-max*	/1z65536R	Sets current position without moving motor
A	0-max*	/1A1000R	Move Motor to Absolute position
f	0 or 1	/1f1R	Flag polarity. Sets polarity of home sensor, default is 0.
P	0-max*	/1P1000R	Move Motor relative number of steps in positive direction. A value of zero will cause an endless forwards move at speed V. By doing so, it enters into Velocity Mode. Any other finite number will set the mode to be in Position Mode.
D	0-max*	/1D1000R	Move Motor relative number of steps in negative direction (Note: Motor will not run in the negative direction if the position is at 0. You can use the 'z' command to set the 0 position to be further away in the negative direction.) A value of zero will cause an endless backwards move at speed V. This will enter Velocity Mode. Any other finite number will set the mode to be in Position Mode.
T		/1TR	Terminate current command
F	0, 1	/1F1R	Reverses the positive direction to be negative. The P and D command will reverse directions. Default is 0.
VELOCITY & ACCELERATION			
v	200-2500	/1v500R	In Position Mode, this sets the Start Speed of the Motor in half steps per second. Also sets the Z command speed.
V	100-2 ²⁴	/1V2000R	In Position Mode, this sets the Top Speed of the Motor in half steps per second.
V	100-10000	/1V2000R	In Velocity Mode, changes the Top Speed "on the fly".
c	300-900	/1c400R	In Position Mode, this sets the stop speed of the motor in half steps per second.
L	0-65000	/1L5000R	In Position Mode, this sets the Acceleration factor (acceleration = L*microsteps /sec ²)

Command (Case Sensitive)	Operand	Example	Description
SETTING CURRENT			
m	0-100	/1m50R	Sets "Fast Move" Current on a scale of 0 to 100% of the max current, 2.0A. Default setting is m40.
l	0-100	/1m50R	Sets "Slow Move" Current on a scale of 0 to 100% of the max current, 2.0A. Use this when V<v. Default is l40.
h	0-50	/1h20R	Sets the Hold Current on a scale of 0 to 50% of the max current. Default setting is h10.
LOOPING & BRANCHING			
g		/1gP10G1R	Beginning of a repeat loop
G	0-30000	/1gP10G1R	End of a repeat loop. Loops can be nested up to 4 levels. A value of 0 causes the loop to be infinite.
M	0-30000	/1M2000R	Delay for "M" milliseconds
H	Blank 01 11 02 12 03 13 04 14	/1gH02P10 000G20R	Halt current command string and wait until condition specified. Wait for switch 2 closure Wait for low on input 1 (Pin 2) Wait for high on input 1 (Pin 2) Wait for low on input 2 (Pin 8) Wait for high on input 2 (Pin 8) Wait for low on input 3 (Pin 7) Wait for high on input 3 (Pin 7) Wait for low on input 4 (Pin 5) Wait for high on input 4 (Pin 5) Halted operation can also be resumed by typing /1R
S	01 11 02 12 03 13 04 14	/1gS02A100 00A0G20R	Skip next instruction if low on input 1 (Pin 2) Skip next instruction if hi on input 1 (Pin 2) Skip next instruction if low on input 2 (Pin 8) Skip next instruction if hi on input 2 (Pin 8) Skip next instruction if low on input 3 (Pin 7) Skip next instruction if hi on input 3 (Pin 7) Skip next instruction if low on input 4 (Pin 5) Skip next instruction if hi on input 4 (Pin 5)
N	1-2	/1N1R	Special Modes 1 = Encoder With No Index (Default). Homes to Opto. 2 = Encoder With Index. Homes to index.

Command (Case Sensitive)	Operand	Example	Description
LOOPING & BRANCHING (Cont.)			
n	0-4095	/ln2R	<p>Sets Modes – Interpret as combination of Binary Bits Bit0 (LSB) - /ln1R Enable Pulse Jog Mode. Jog distance is given by “B” command. Velocity is given by “V” command . The Switch Inputs become the Jog Inputs.</p> <p>Bit1 : /ln2R Enable Limits. (The two optos become limits switches). The polarity of the limits is set by the “f” command</p> <p>Bit2 : /ln4R Enable Continuous Jog Mode. Continuous run of motor while switch is depressed. Velocity is given by “V” command. Note that the jog mode allows moves below zero, which will be interpreted by any subsequent “A” command as a large positive number. If this is undesirable, please use the “z” command to define zero position to be some positive number so that underflow will not occur.</p> <p>Bit3 : /ln8R Reserved</p> <p>Bit4 : /ln16R Reserved</p> <p>Bit5 : /ln32R Reserved</p> <p>Bit6 : /ln64R Reserved</p> <p>Bit7 : /ln128R Reserved</p> <p>Bit8 : /ln256R Reserved</p> <p>Bit9 : /ln512R Reserved</p> <p>Bit10 : /ln1024R Reserved</p> <p>Bit11 : /ln2048R Reserved</p>
PROGRAM STORAGE & RECALL			
s	0-15	/ls1A10000 A0R	Stores a program. Program 0 is executed on power up (Total of 14 commands max per string)
e	0-15	/le1R	Executes the Stored Programs 0-15
PROGRAM EXECUTION			
R		/1R	Run the command string that is currently in the execution buffer – Always end commands with ‘R’.
X			Repeat the current command string
MICROSTEPPING			
j	2, 4, 8, 16, 32, 64, 128, 256	/lj256R	Adjusts the resolution in micro-steps per step.
o	0-3000		Allows user to correct any unevenness in microstep size. Adjusts audible noise and should be executed while motor is running.

Command (Case Sensitive)	Operand	Example	Description
ON/OFF DRIVERS			
J	0-3		On/Off Driver. It's a two bit Binary value: 3=11=Both Drivers On, 2=10=Driver2 on, Driver1 off, etc.
QUERY COMMANDS			
The following commands are queries and cannot be cascaded in strings or stored. They can be executed while other commands are still running.			
?	0	/1?0R	Returns the current motor position
?	1	/1?1R	Returns the current Start Velocity
?	2	/1?2R	Returns the current Slew Speed for Position mode
?	3	/1?3R	Returns the current Stop Speed
?	4	/1?4R	Returns the status of all four inputs, 0-15 representing a 4 bit binary pattern: Bit 0 = Input 1 (Pin 2) Bit 1 = Input 2 (Pin 8) Bit 2 = Input 3 (Pin7) Bit 3 = Input 4 (Pin 5)
?	5	/1?5R	Returns the current Velocity mode speed
?	6	/1?6R	Returns the current step size
?	7	/1?7R	Returns the current 'o' value
?	8	/1?8R	Returns the Encoder Position (can be zeroed by "z" command) *Only available on CE Version
?	9	/1?9R	Erases all stored commands in EEPROM
&			Returns the current Firmware revision and date
Q			Query current status of the controller: 0 = No Error 1 = Initialization error 2 = Bad Command 3 = Operand out of range
T		/1TR	Terminate current commands
max			*2^31
BAUD CONTROL			
b	9600, 19200, 38400	/1b19200R	Adjustable baud rate. This command will usually be stored as program zero and execute on power up. Default baud rate is 9600.

Responses from the R256 in HyperTerminal

Syntax	Hex value	Description
/0'□	0x60	Command is terminated
/0@□	0x40	Good command, command received
/0C□	0x43	Command out of range
/0b□	0x62	Bad Command
/0O□	0x4F	Overflow

† There are known issues involving the Halt command (i.e., H01) when stored in memory location zero. Upon power up, the remaining command string after the Halt command might be executed if the user types in a new command. If memory location zero is not being used, the user is advised to always clear everything in memory by typing */I?9*. Otherwise, the user may terminate the remaining command string in the buffer by issuing a */IT*.

Example: /1gP1000D1000G10R will move the motor 1000 steps counterclockwise, then 1000 steps clockwise, in a loop for 10 times.

/	Always begin a program with the forward slash
1	Address of controller (Check with the Red Dial on the unit)
g	Beginning of loop (All commands within 'g' and 'G' will repeat)
P1000	Move counterclockwise 1000 steps
D1000	Move clockwise 1000 steps
G10	End loop, repeat 10 times (G0 will repeat infinitely, type /1T to terminate)
R	Run this command

Example: /1s0gH01A100H01A0G0R will store a program to memory, and run upon power up. This program will move 100 steps (90° for a 1.8° step motor) when you press a push button. And it will return to its original position when pressing the button a second time. This will repeat infinitely

/	Always begin a program with the forward slash
1	Address of controller (Check with the Red Dial on the unit)
s0	Store to program 0 – defined as running upon power up
g	Beginning of loop (All commands within 'g' and 'G' will repeat)
H01	Halt commands until a low '0' is seen on input 1. Push button is pressed.
A100	Move 100 steps (Absolute position)
H01	Halt again until a low '0' is seen on input 1. Push button is pressed.
A0	Move back to Position 0
G0	End loop, repeat infinitely, type /1T to terminate)
R	Run this command

To execute the program, type /1e0R. Or, power down and power up. Only program 0 will start upon power up. To terminate out of this infinite loop, type /1T

Homing Sensor

The "Z" command is used to initialize the motor to a generally known amount of steps (a maximum of 10000 steps + 400 default steps). When issued, i.e. /1Z5000R, the motor will turn towards zero at a maximum step of 5400 until the home opto sensor is interrupted. If issued a /1Z0R, motor will only move 400 steps to find the opto sensor

If the sensor is already interrupted, and 1Z5000R was issued, the motor will move in the opposite direction until the sensor is un-cut again. At this time, the motor moves towards home in the same way described above. When sensor is cut, motor stops motion and current position is reset to zero. Speed is set by lower case 'v', i.e. /1v4000Z5000R.

The Z command is used in conjunction with Pins 7 and 9. An appropriate optical sensor must be attached to Pins 7 and 9 in order for the homing command to work properly. The Z command allows the motor to rotate until Pin 7, Input 3, goes from low to high.

Understanding the Response

The R256 controller board sends commands to a Master Device, i.e. a PC, and is dedicated as Address 0. The Master Device looks for the response from the controller in a certain syntax that is partially transparent in HyperTerminal. /0 is the beginning of the syntax which the Master Device looks for.

Following the /0 characters are the status characters which is a compilation of 8 bits:

Bit 7	Reserved
Bit 6	Always set
Bit 5	Ready Bit – Set when controller is ready to accept commands
Bit 4	Reserved
Bit 3-0	Status code: 0 = No Error 1 = Initialization Error 2 = Bad Command 3 = Operand Out of Range 7 = Overload Error

Example Responses to command /1?4

FFh	RS485 line turn around character
2Fh	ASCII '/' Start character. The DT Protocol uses '/' as the start
30h	ASCII 0. Master Device's Address
60h	Status character as explained above
31h	Two bytes are the actual answer in ASCII. This is an eleven (11) which represents the status of the four inputs: Bit 0 = Switch 1 Bit 1 = Switch 2 Bit 2 = Opto 1 Bit 3 = Opto 2 (eleven is 1011 in binary)
03h	This is the ETX or end of text character. It's the end of the answer string
0Dh	Carriage Return
0Ah	Line Feed