

ServoCenter3.1 Serial Communication Protocol Reference

1. Protocol Overview

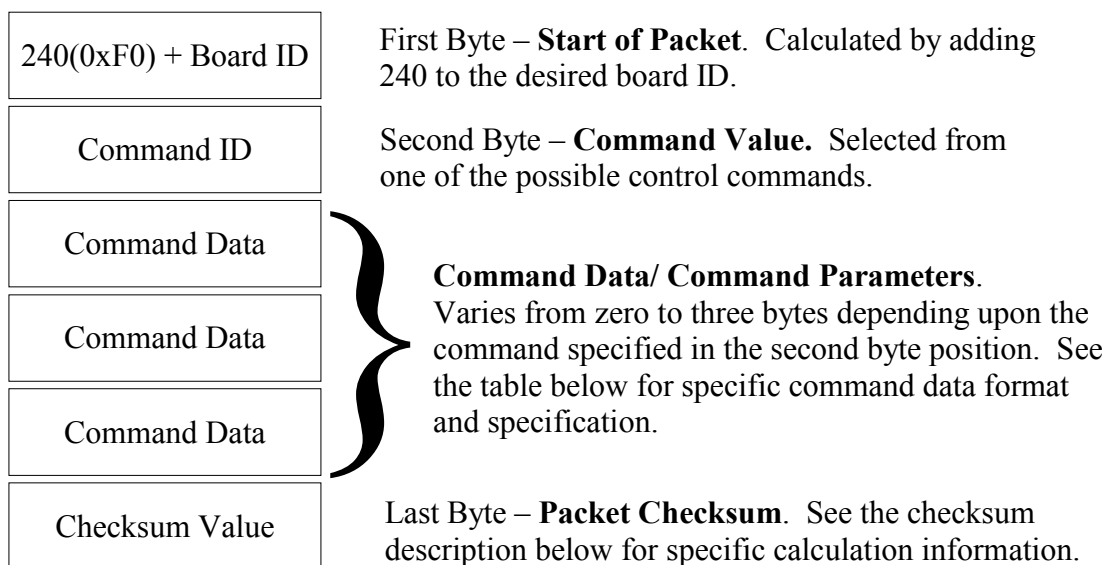
The ServoCenter3.1 controller receives messages from the controlling system in the form of sequences of serial communication bytes called packets. Each byte is serial encoded using 8N1 serial encoding (8 data bits, no parity, and 1 stop bit). The packet size can range from three to six bytes in length, depending upon the nature of the command being sent to the controller. Each packet consists of an initial “**start of packet**” byte (which includes a board ID specifier), followed by a “**command value**” specifier byte, followed by zero to three “**command data**” bytes, and terminated by a packet “**checksum value**” byte.

The ServoCenter3.1 controller buffers the incoming command stream and will only take an action once the entire packet has been received and the checksum has been verified as correct. Incomplete packets, packets with inappropriate board IDs, and packets with incorrect checksums will be ignored. This allows the controlling system to send command data at leisure without loss of function. The command buffer will, however, be cleared whenever the ServoCenter controller is either reset or powered off/on.

Most ServoCenter commands return no result data. Certain commands, however, are designed to return status information about the current settings and positions of connected servos. It is important to note that although many ServoCenter3.1 boards can be connected and controlled simultaneously by a single PC, only one of the connected boards may be configured to send data back to the controlling system. The transmit/receive functionality is controlled by the various jumper settings of jumper block JP1.

2. Packet Format

Each packet is from 3 to 6 bytes in length and is formatted as follows:



Typical ServoCenter Command Packet Format

3. Command Summary

The table below summarizes the ServoCenter3.1 command set.

Description	Command	Data Len	Data Descriptions
QuickMove	0 (0x00)	2	SvNum(0~15), SvPosition(0~200)
Scaled QuickMove	1 (0x01)	2	SvNum(0~15), %SvPosition(0~100%)
Servo Enable	2 (0x02)	1	SvNum(0~15)
Servo Disable	3 (0x03)	1	SvNum(0~15)
Set Min	4 (0x04)	2	SvNum(0~15), SvPosition(0~200)
Set Max	5 (0x05)	2	SvNum(0~15), SvPosition(0~200)
Set Start	6 (0x06)	2	SvNum(0~15), SvPosition(0~200)
Set Max Speed	7 (0x07)	2	SvNum(0~15), SvMaxSpeed(1~200) in ms/60°
Set Min to Current	8 (0x08)	1	SvNum(0~15)
Set Max to Current	9 (0x09)	1	SvNum(0~15)
Set Start To Current	10 (0x0a)	1	SvNum(0~15)
Get Current Position	11 (0x0b)	1	SvNum(0~15)
Get Min Position	12 (0x0c)	1	SvNum(0~15)
Get Max Position	13 (0x0d)	1	SvNum(0~15)
Get Start Position	14 (0x0e)	1	SvNum(0~15)
Get Max Speed	15 (0x0f)	1	SvNum(0~15)
Move Raw	16 (0x10)	3	SvNum(0~15), SvPosition(0~200), SvSpeed(1~100)
Move Raw CW	17 (0x11)	3	SvNum(0~15), ΔSvPosition(0~200), SvSpeed(1~100)
Move Raw CCW	18 (0x12)	3	SvNum(0~15), ΔSvPosition(0~200), SvSpeed(1~100)
Move Scaled	19 (0x13)	3	SvNum(0~15), %SvPosition(0~100), SvSpeed(1~100)
Move Scaled CW	20 (0x14)	3	SvNum(0~15), Δ%SvPosition(0~100), SvSpeed(1~100)
Move Scaled CCW	21 (0x15)	3	SvNum(0~15), Δ%SvPosition(0~100), SvSpeed(1~100)
Set Pulse Width Min	22 (0x16)	1	PwValue(1 – 239) in 10us units.
Set Pulse Width Max	23 (0x17)	1	PwValue(1 – 239) in 10us units.
Servo Invert	24 (0x18)	1	SvNum(0~15)
Servo UnInvert	25 (0x19)	1	SvNum(0~15)
Show Settings	235 (0xeb)	0	None.
Commit Settings	236 (0xec)	0	None.
Load Factory Settings	237 (0xed)	0	None.
Reset as Startup	238 (0xee)	0	None.
Display Version	239 (0xef)	0	None.

4. Start of Packet Byte

Each command packet starts with a specific type of byte called the “Start of Packet” byte. The “Start of Packet” byte serves two purposes: to signify the start of a command packet and to identify the board ID of the intended recipient. This byte's value is calculated by adding 240 (0xf0 hex) to the board ID of the board to which you are sending the command message. Thus a byte value of 240(0xf0 hex) would be used to send a message to the board with ID 0, 241(0xf1) for board ID 1, 242(0xf2) for board ID 2, etc.

5. The Checksum Value

The checksum is computed as an arithmetic summation of all of the characters in the packet (except the checksum value itself) modulus 239 plus one. This gives a resulting checksum in the range 1 to 239. The checksum will be ignored if a 0 byte value is passed in the checksum position of the packet.

6. Command Details

In the tables below you'll find a description of each of the ServoCenter commands and a brief explanation of how and where each command would be used.

Function:	QuickMove
Command Value:	0 (0x00)
Data Bytes:	2
Data Format:	SvNum(0~15), SvPosition(0~200)
Description:	The QuickMove command provides a method of instantly moving a single servo (specified by SvNum) to a specified raw position (specified by SvPosition). This function is useful when it is desired to move a servo to a position as fast as possible. With QuickMove no servo position interpolation is performed and the control signal for that specified servo is immediately modified when the command is issued.

Function:	Servo Enable
Command Value:	2 (0x02)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Servo Enable command provides a method of enabling a servo(specified by SvNum). This function is used to enabled a servo channel that has been previously disabled. With the control signal enabled the servo will actively hold its position. Enabled servos will draw significantly more power than disabled servos.

Function:	Servo Disable
Command Value:	3 (0x03)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Servo Disable command provides a method of disabling a servo(specified by SvNum). This function is used to remove the control signal for a servo channel. With the control signal disabled the servo will not actively hold its position. This can be useful for disabling a servo without having to physically disconnect it from the board. A disabled servo can generally be moved by hand and will draw significantly less power than an enabled servo.

Function:	Set Minimum
Command Value:	4 (0x04)
Data Bytes:	2
Data Format:	SvNum(0~15), SvPosition(0~200)
Description:	The Set Minimum command sets the minimum raw servo position set-point(specified by SvPosition) of the specified servo (specified by SvNum). This minimum position is used in all scaled movement modes of operation. Setting the minimum position above the start position will cause the start position to be set equal to the minimum. Setting the minimum position above the maximum will cause the maximum position to be set equal to the minimum.

Function:	Set Maximum
Command Value:	5 (0x05)
Data Bytes:	2
Data Format:	SvNum(0~15), SvPosition(0~200)
Description:	The Set Maximum command sets the maximum raw servo position set-point(specified by SvPosition) of the specified servo (specified by SvNum). This maximum position is used in all scaled movement modes of operation. Setting the maximum position below the start position will cause the start position to be set equal to the maximum. Setting the maximum position below the minimum will cause the minimum position to be set equal to the maximum.

Function:	Set Start
Command Value:	6 (0x06)
Data Bytes:	2
Data Format:	SvNum(0~15), SvPosition(0~200)
Description:	The Set Start command sets the starting raw servo position set-point(specified by SvPosition) of the specified servo (specified by SvNum). The start position is the position that the servo will assume when the system is powered-up or reset. The start position is capped and cannot be set greater than the max or less than the min.

Function:	Set Maximum Speed
Command Value:	7 (0x07)
Data Bytes:	2
Data Format:	SvNum(0~15), SvMaxSpeed(1~200)
Description:	The Set Maximum Speed command sets the maximum speed (as specified by SvMaxSpeed and measured in milliseconds per 60° of travel) that is allowed for a particular servo channel (specified by SvNum). This maximum speed is used to calculate all speed related seek commands. Different servos have different rated travel speeds depending upon the manufacturer, model, and power supply voltage. These speeds are generally rated in seconds per 60° of travel so the programmer will have to convert the rated speed (in seconds) to milliseconds by multiplying by 100. The ServoCenter3.1 controller allows the maximum allowable travel speed to be set independently for each of the 16 servo channels.

Function:	Set Minimum to Current
Command Value:	8 (0x08)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Set Minimum to Current command sets the minimum raw servo position set-point to the current raw position of the servo of the specified servo (specified by SvNum). This minimum position is used in all scaled movement modes of operation. Setting the minimum position above the start position will cause the start position to be set equal to the minimum. Setting the minimum position above the maximum will cause the maximum position to be set equal to the minimum.

Function:	Set Maximum to Current
Command Value:	9 (0x09)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Set Maximum to Current command sets the maximum raw servo position set-point to the current raw position of the specified servo (specified by SvNum). This maximum position is used in all scaled movement modes of operation. Setting the maximum position below the start position will cause the start position to be set equal to the maximum. Setting the maximum position below the minimum will cause the minimum position to be set equal to the maximum.

Function:	Set Start to Current
Command Value:	10 (0x0a)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Set Start to Current command sets the startup raw servo position set-point to the current raw position of the specified servo (specified by SvNum). The start position is the position that the servo will assume when the system is powered-up or reset. The start position is capped and cannot be set greater than the maximum or less than the minimum.

Function:	Get Current Position
Command Value:	11 (0x0b)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Get Current Position command causes the ServoCenter board to transmit a one byte message corresponding to the raw servo position of a particular servo (specified by SvNum). The ability of the board to send these responses is partially dependent upon the jumper settings of jumper block JP1 (see section 3.4.1 of the user's manual for details).

Function:	Get Min Position
Command Value:	12 (0x0c)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Get Min Position command causes the ServoCenter board to transmit a one byte message corresponding to the currently set minimum servo position of a particular servo (specified by SvNum). The ability of the board to send these responses is partially dependent upon the jumper settings of jumper block JP1 (see section 3.4.1 of the user's manual for details).

Function:	Get Max Position
Command Value:	13 (0x0d)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Get Max Position command causes the ServoCenter board to transmit a one byte message corresponding to the currently set maximum servo position of a particular servo (specified by SvNum). The ability of the board to send these responses is partially dependent upon the jumper settings of jumper block JP1 (see section 3.4.1 of the user's manual for details).

Function:	Get Start Position
Command Value:	14 (0x0e)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Get Start Position command causes the ServoCenter board to transmit a one byte message corresponding to the currently set starting servo position of a particular servo (specified by SvNum). The ability of the board to send these responses is partially dependent upon the jumper settings of jumper block JP1 (see section 3.4.1 of the user's manual for details).

Function:	Get Max Speed
Command Value:	15 (0x0f)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Get Max Speed command causes the ServoCenter board to transmit a one byte message corresponding to the currently set maximum speed setting of a particular servo channel (specified by SvNum). The ability of the board to send these responses is partially dependent upon the jumper settings of jumper block JP1 (see section 3.4.1 of the user's manual for details).

Function:	Move Raw
Command Value:	16 (0x10)
Data Bytes:	3
Data Format:	SvNum(0~15), SvPosition(0~200), SvSpeed(1~100)
Description:	The Move Raw command is used to move a servo's position at a specified speed. The move raw command moves a servo (specified by SvNum) to a raw position (specified by SvPosition) at a particular speed (specified by SvSpeed). Raw movement modes do not use the set minimum and maximum points to determine the servo's position. The specified speed is calculated as a percentage of the preset maximum servo speed for the specified servo channel. Thus, a speed of 50 is half as fast as a speed of 100, a speed of 1 is 1/100 th as fast as a speed of 100, etc.

Function:	Move Raw CW (Clockwise)
Command Value:	17 (0x11)
Data Bytes:	3
Data Format:	SvNum(0~15), ΔSvPosition(0~200), SvSpeed(1~100)
Description:	The Move Raw CW command is used to move a servo's position clockwise by a certain amount at a specified speed. The move raw clockwise command moves a servo (specified by SvNum) clockwise by a certain number of units (specified by ΔSvPosition) at a particular speed (specified by SvSpeed).

Function:	Move Raw CCW (Counter-Clockwise)
Command Value:	18 (0x12)
Data Bytes:	3
Data Format:	SvNum(0~15), ΔSvPosition(0~200), SvSpeed(1~100)
Description:	The Move Raw CCW command is used to move a servo's position counter-clockwise by a certain amount at a specified speed. The move raw counter-clockwise command moves a servo (specified by SvNum) clockwise by a certain number of units (specified by ΔSvPosition) at a particular speed (specified by SvSpeed).

Function:	Move Scaled
Command Value:	19 (0x13)
Data Bytes:	3
Data Format:	SvNum(0~15), %SvPosition(0~100), SvSpeed(1~100)
Description:	The Move Scaled command is used to move a servo's position at a specified speed. The move scaled command moves a servo (specified by SvNum) to a scaled position (specified by SvPosition) at a particular speed (specified by SvSpeed). Scaled movement modes use the set minimum and maximum points to determine the servo's position. The scaled position value can be thought of as a percentage of the range from the minimum to the maximum. Thus 0 is the minimum, 100 is the maximum, and 50 is the midpoint between the set minimum and maximum. The specified speed is calculated as a percentage of the preset maximum servo speed for the specified servo channel. Thus, a speed of 50 is half as fast as a speed of 100, a speed of 1 is 1/100 th as fast as a speed of 100, etc.

Function:	Move Scaled CW (Clockwise)
Command Value:	20 (0x14)
Data Bytes:	3
Data Format:	SvNum(0~15), Δ%SvPosition(0~100), SvSpeed(1~100)
Description:	The Move Scaled CW command is used to move a servo's position clockwise at a specified speed. The move scaled clockwise command moves a servo (specified by SvNum) clockwise by a certain percentage (specified by Δ%SvPosition) at a particular speed (specified by SvSpeed). The percentage indicated by the %SvPosition byte is based upon a percentage of the distance between the minimum position and the maximum position. Thus a distance of 10 units would move the servo clockwise by a distance of 1/10 th of the entire scaled travel range, a distance of 1 unit would move the servo by 1/100 th of the entire scaled travel range, etc.

Function:	Move Scaled CCW (Counter-Clockwise)
Command Value:	21 (0x15)
Data Bytes:	3
Data Format:	SvNum(0~15), Δ%SvPosition(0~100), SvSpeed(1~100)
Description:	The Move Scaled CCW command is used to move a servo's position counter-clockwise at a specified speed. The move scaled counter-clockwise command moves a servo (specified by SvNum) counter-clockwise by a certain percentage (specified by Δ%SvPosition) at a particular speed (specified by SvSpeed). The percentage indicated by the %SvPosition byte is based upon a percentage of the distance between the minimum position and the maximum position. Thus a distance of 10 units would move the servo clockwise by a distance of 1/10 th of the entire scaled travel range, a distance of 1 unit would move the servo by 1/100 th of the entire scaled travel range, etc.

Function:	Set Pulse Width Min
Command Value:	22 (0x16)
Data Bytes:	1
Data Format:	PwValue (1-239)
Description:	The Set Pulse Width Minimum command lets the user specify the minimum value of the range of control pulses that are produced by the ServoCenter3.1 board for all raw position modes. This minimum value is applied globally to all servo channels of the board. Since some servos have slightly different control pulse width ranges this value may have to be tweaked to get a full servo motion range out of all raw position modes. The PwValue is measured in 10 microsecond units thus allowing the board to produce any range of pulses in the range from 10 to 2390 microseconds.

Function:	Set Pulse Width Max
Command Value:	23 (0x17)
Data Bytes:	1
Data Format:	PwValue (1-239)
Description:	The Set Pulse Width Maximum command lets the user specify the maximum value of the range of control pulses that are produced by the ServoCenter3.1 board for all raw position modes. This maximum value is applied globally to all servo channels of the board. Since some servos have slightly different control pulse width ranges this value may have to be tweaked to get a full servo motion range out of all raw position modes. The PwValue is measured in 10 microsecond units thus allowing the board to produce any range of pulses in the range from 10 to 2390 microseconds.

Function:	Servo Invert
Command Value:	24 (0x18)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Servo Invert command causes the servo channel specified by the first data byte (SvNum) to have its positions seek in an inverted manner. This means that a raw position value of zero is the servo's extreme counter-clockwise rotational position and 200 is the extreme clockwise position. This function can be useful for dealing with paired servos or with servos that are mounted in such a way that an inverted positional system is more natural.

Function:	Servo Normal (UnInvert)
Command Value:	25 (0x19)
Data Bytes:	1
Data Format:	SvNum(0~15)
Description:	The Servo Normal command causes the servo channel specified by the first data byte (SvNum) to have its positions seek in the normal, non-inverted, manner. This means that a raw position value of zero is the servo's extreme clockwise rotational position and 200 is the extreme counter-clockwise position.

Function:	Show Settings
Command Value:	235 (0xeb)
Data Bytes:	0
Data Format:	None.
Description:	The Show Settings command causes the board to transmit a table of the current settings for all channels of the ServoCenter3.1 board. The format of the returned data is a human-readable table composed of ASCII characters. This function is useful when troubleshooting a board's settings or simply verifying current board settings. The ability of the board to transmit data is dependent upon the jumper settings of jumper block JP1 (see section of the user's manual 3.4.1 for details).

Function:	Commit Settings
Command Value:	236 (0xec)
Data Bytes:	0
Data Format:	None.
Description:	The Commit Settings command causes the board to save the current settings into the EEPROM storage. Once the board's settings are stored in the EEPROM settings of the ServoCenter3.1 they will be restored every time the board is either reset or powered up. This allows the configuration to be saved thus avoiding a configuration process every time the board is reset. Note: the EEPROM storage of the ServoCenter3.1 board has a limited lifetime of rewritability (about 100,000 rewrites) so avoid writing a programmatic loop that continuously commits the settings of the board. The current rewrite count can be viewed by using the "Show Settings" command. A user can prevent board settings from being written by using jumper JP3 position 1 (see user's manual section 3.4.3 for info)

Function:	Load Factory Settings
Command Value:	237 (0xed)
Data Bytes:	0
Data Format:	None.
Description:	The Load Factory Settings command causes all of the board's settings to revert to the state that they were in when shipped as new. This command only loads the settings and doesn't commit the settings to the EEPROM of the board. To restore the settings and save these settings, the user should perform a "Commit Settings" command following the "Load Factory Settings" command.

Function:	Reset as Startup
Command Value:	238 (0xee)
Data Bytes:	0
Data Format:	None.
Description:	The Reset as Startup command causes the board to perform a software reset of the control software. This command is functionally equivalent to resetting or cycling the power of the board. All EEPROM settings are loaded and all servo channels are modified according to these stored settings.

Function:	Display Version
Command Value:	239 (0xef)
Data Bytes:	0
Data Format:	None.
Description:	The Display Version command simply displays the version of the firmware embedded within your ServoCenter3.1 board. This can be useful for allowing software to query the board's version to ensure interoperability between this and other/future YEI products.