

SmartStep Quick Reference Guide



SmartStep is an incredibly powerful and flexible drive system, yet is remarkably simple to set up.

It's estimated that 80% of applications using SmartStep can be set up and configured using just 6 DIP switches and 1 rotary switch for tuning.

Control of SmartStep is from a separate controller, which sends positional information in the form of pulses. SmartStep follows this position information using closed loop servo control, and then reports back to the controller when the move has been completed.

Omron's CJ1M range of PLC's has been chosen in this guide as the host controller, although any PLC, which is capable of pulse output, can be used.

An understanding of setting up and using the host controller is therefore required, with CX-Programmer being used in this guide. It is assumed that the user can connect to the PLC, make basic CPU settings, create I/O tables and simple ladder programs using CX-Programmer.

Section 1.

The aim of section 1 is to produce simple jogging of the motor, under control of the host.

Provides step-by-step instructions to connect and use SmartStep with the CJ1M.

Section 2.

Provides more information about DIP switch setting and gain structure.

Enables a custom set-up to be created which simplifies control from the host.

Section 3.

Explains the use of the PLC's pulse instructions.

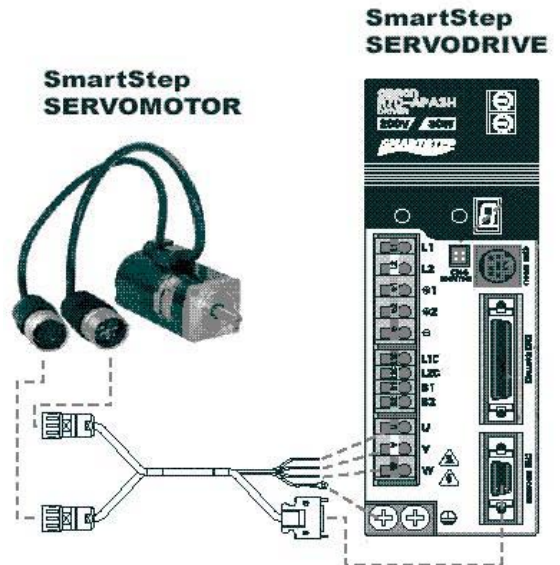
Provides programming examples for homing, jogging and indexing,

Section 1 – Step-by-Step Configuration

Connect the motor to the SmartStep Driver

The motor and encoder cable are combined into one lead. The driver end of the cable consists of three phase cables, an earth and a 15-way connector. The three phase cables U, V and W, coloured red, white and blue respectively, should be connected to the corresponding colours of the motor connector block using the plastic tool provided. The earth should be connected to one of the earth screws on the heat sink and the encoder connector should be plugged into CN2.

At the motor end of the cable, the two IP67 connectors should connect with the corresponding connectors from the motor. Ensure that each connector is correctly aligned before tightening fully.

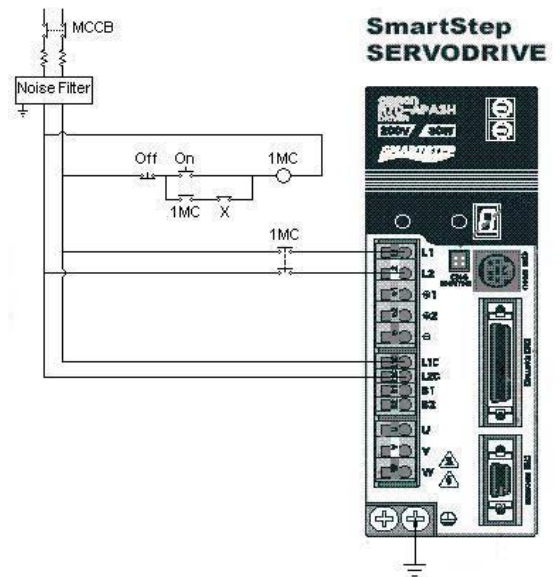


Connect the supply to the Driver

Each drive requires a 230V single-phase supply brought in as two supplies: **Control Power** and **Main Power**

Control Power is connected to **L1C (Live)** and **L2C (Neutral)**. Control power is used by the drive to power the internal logic circuits and processor. This maintains the drives ability to monitor faults etc. During an E-Stop condition on the machine, this supply is normally maintained.

Main Power is connected to **L1 (Live)** and **L2 (Neutral)**. Main power is used to maintain the drives' DC bus, which is used to drive the motor. In an E-Stop condition, this power is removed to prevent motion. The control circuits detect the loss of main power, during running, as a fault condition and cause a rapid stop of motion.



Connect the Drive I/O

Connect the XW2Z-100J-B5 cable between the SmartStep CN1 connector and the CN2 connector of the servo relay unit XW2B-20J6-8A.

Connect an external 24V power supply to pin 10 (24V) and pin 0 (0V) of the servo relay unit.

Test the drive is working normally.

Power on the SmartStep Control power and the 24V supply.

Power on the SmartStep Main power.

The fan on the SmartStep will start and the green CHARGE indicator should light, indicating that the DC bus is powered.

The 7 segment display on the SmartStep will indicate a minus sign and a full stop.



Connect a small piece of wire between pins 5 and 15 of the servo relay unit.

This will enable the drive, and the – sign on the 7 segment display will disappear, leaving just the full stop.



The motor shaft will be locked, indicating that the SmartStep is holding position.

Remove the link from pins 5 and 15 of the servo relay unit to disable the drive, leaving the motor shaft free to rotate.

The – sign on the 7 segment display will be shown again.

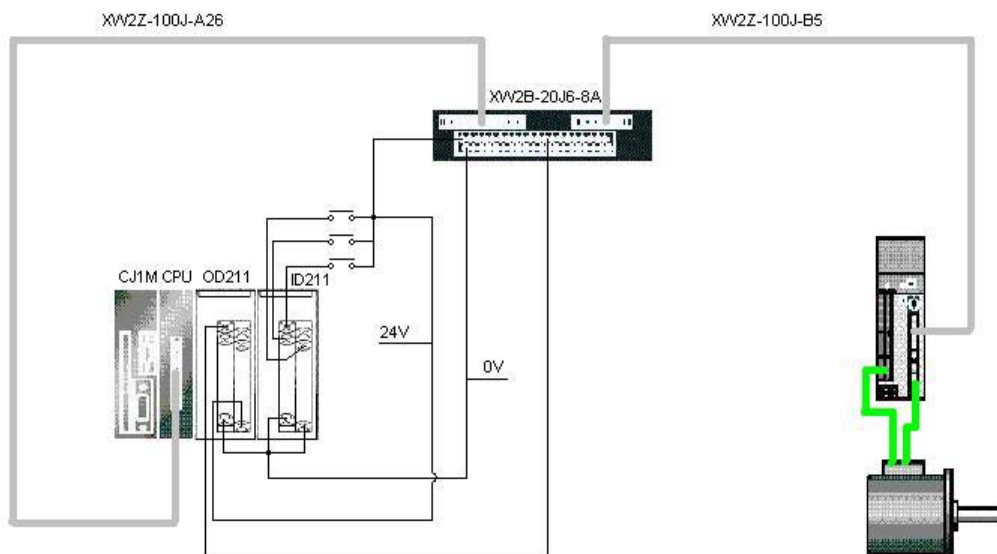
Power off the 24V and SmartStep. Wait for the charge indicator to go out before making further connections.

Connect the CJ1M CPU to the servo relay unit CN1 connector with the XW2Z-100J-A26 cable.

In order to complete the test, some I/O needs to be added to the CPU. It is assumed that an input unit, (ID211) and an output unit (OD211) are available. The first three inputs of the ID211 are connected to three toggle switches as follows. Input 0 – Forward run, Input 1 – Reverse Run, Input 2 – Servo enable.

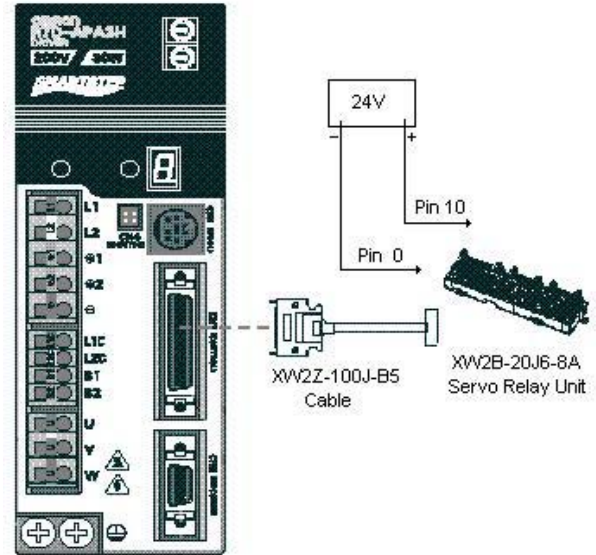
Output 0 of the OD211 unit is connected to pin 15 of the servo relay unit to enable the drive from the PLC

The full configuration of the I/O is as shown below.



Check that all the Dip Switches on the SmartStep are off (To the right)

**SmartStep
SERVODRIVE**



Set the rotary gain switch to 4 or 5

Power on the CPU, SmartStep and 24V supply.

Connect to the CPU using CX-Programmer.

Set the CPU setting to their default values and create the necessary I/O table.

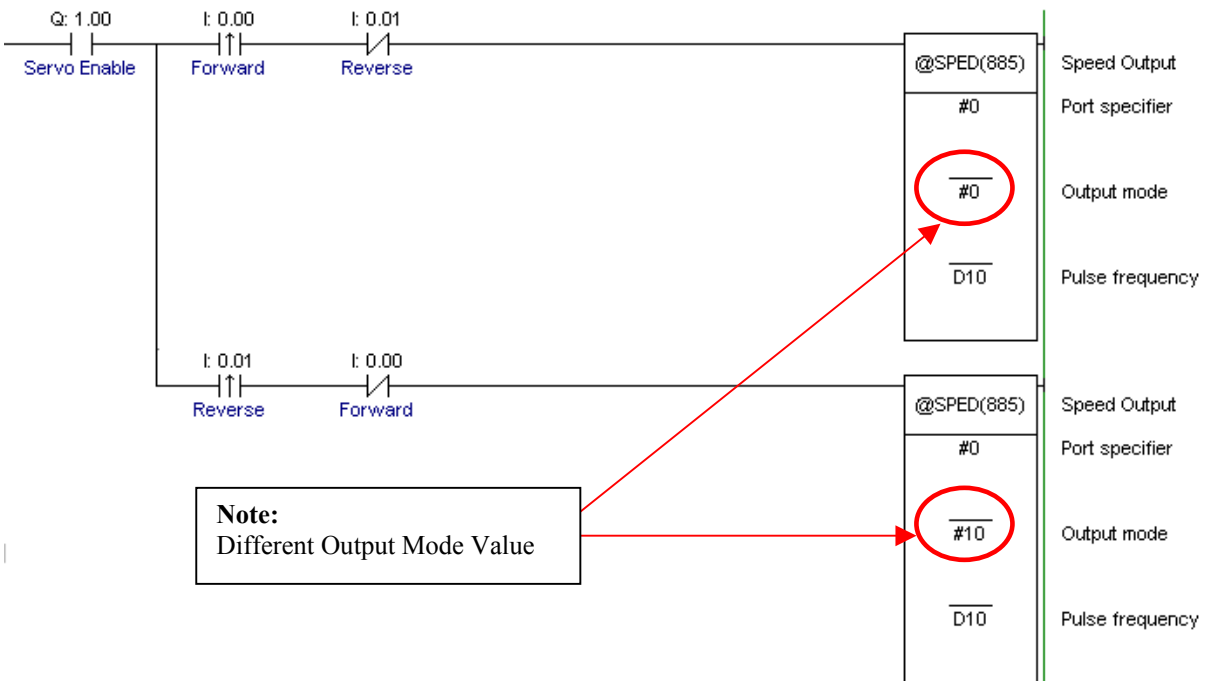
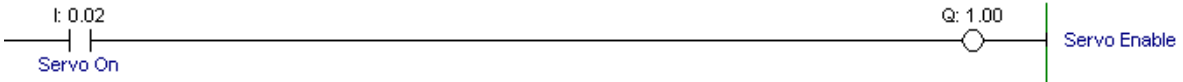
Enter the ladder diagram shown on the following page.

Ensure that the CPU is in Monitor mode.

Turn on switch 2 – This enables the drive where the shaft is locked.

Turn on switch 0 or switch 1 – The drive should rotate forwards or backward at a speed of approx 60rpm.

Turning off either switch, turning both on at the same time, or turning off the enable, will stop the motor rotation.



Section 2 – SmartStep Gains, Setting & Parameters.

Servo Gains.

Generally, with servo systems, the higher the gain, the more dynamic and responsive the system behaves. Too high a gain however, can result in instability. Rigid, or directly coupled systems can usually tolerate higher gains than a system that uses belts and pulleys.

Too high a gain results in oscillations at the motor shaft and/or load. This causes severe vibration, which can damage the load/coupling etc.

Too low a gain results in poor performance and settling time of the load, and an inability to give repeatable positional accuracy, when subject to differing loads.

Most servos have a number of gain parameters, which must be tuned or optimised, by looking at the system response.

SmartStep Gains

The SmartStep gains can be very easily set to predefined values (which covers the majority of applications) by simply adjusting the rotary switch. This adjustment is dynamic and takes place immediately. Enable the servo and starting at a low value, increase the position of the rotary switch while observing the load behaviour. Increase until the motor starts to vibrate, then decrease the setting by one or two positions. This is normally the optimum gain for the application. Each change of the rotary switch causes the 7-segment display to flash briefly with the new gain setting.

Although SmartStep allows users to tune the servo response by adjusting the rotary switch, advanced users can still gain access to the parameter values by setting the rotary switch to 0 (zero) and manually changing the parameter values.

The default gains relating to the switch positions are shown in the following table.

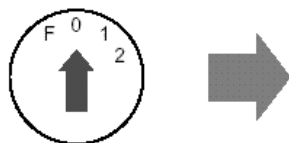
■ Switch Operations

Gain Adjustment Switch

Adjusts the motor's responsiveness.

When this switch is set to 0, the Unit will operate according to the settings in the internal parameters (Pn100, Pn101, Pn102, and Pn401).

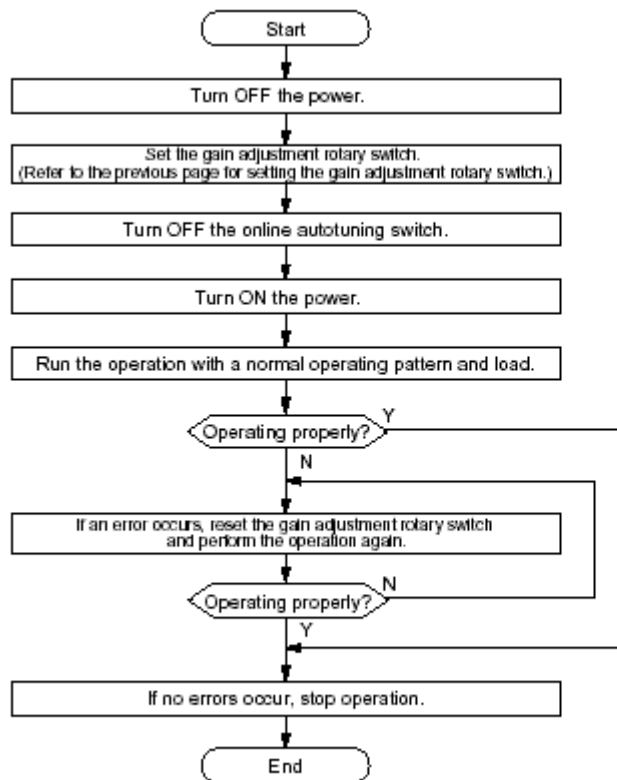
When this switch is set to 1 through F, the Unit will operate according to the rotary switch's setting.




Decrease the switch setting to lower the motor's responsiveness (i.e., so that it moves more smoothly).

Increase the switch setting to raise the motor's responsiveness (i.e., so that it moves faster).

Setting	Position Loop Gain	Speed Loop Gain	Speed Loop Integral Constant	Torque Command Filter Time Constant
0	Enables parameter settings (including settings other than gain settings).			
1	15	15	4,000	250
2	20	20	3,500	200
3	30	30	3,000	150
4	40	40	2,000	100
5	60	60	1,500	70
6	85	85	1,000	50
7	120	120	800	30
8	160	160	600	20
9	200	200	500	15
A	250	250	400	10
B	250	250	400	10
C	250	250	400	10
D	250	250	400	10
E	250	250	400	10
F	250	250	400	10



 Do not perform extreme adjustment and setting changes as they may destabilize the operation. Adjust the gain a little at a time while checking the Servomotor operation.

Mechanical system default gains for each switch position

- Select a switch setting from the following 10 levels (switches A to F are the same setting) to suit the mechanical system.

Response	Switch setting	Position loop gain (s ⁻¹)	Speed loop gain (Hz)	Speed loop integral time constant (×0.01 ms)	Torque command filter time constant (×0.01 ms)	Typical applications (mechanical system)
Low	1	15	15	4,000	250	Articulated robots, harmonic drives, chain drives, belt drives, rack and pinion drives, etc.
	2	20	20	3,500	200	
	3	30	30	3,000	150	
Medium	4	40	40	2,000	100	XY tables, orthogonal robots, general-purpose mechanical systems, etc.
High	5	60	60	1,500	70	Ball screws (direct couplings), feeders, etc.
	6	85	85	1,000	50	
	7	120	120	800	30	
	8	160	160	600	20	
	9	200	200	500	15	
	A	250	250	400	10	
	B	250	250	400	10	
	C	250	250	400	10	
	D	250	250	400	10	
	E	250	250	400	10	
F	250	250	400	10		

Note The servo system loop gain will increase in response to a higher switch setting value, shortening positioning time. If the setting is too large, however, the machinery may vibrate. Reduce the setting if vibration is a problem.

The SmartStep driver is configured by setting various parameters within the drive. To simplify set-up, the more common parameter setting can be configured by changing DIP switches on the front panel. More advanced users can still gain access to the parameters for more comprehensive/detailed set-up.

NOTE: Setting the rotary switch to 0, also disables the DIP Switch Settings

■ Turning Function Switches ON and OFF

The default setting for all function switches is OFF. Use a thin-blade non-conductive ceramic screwdriver or equivalent to turn the switches ON and OFF. In the following diagrams, the left diagram shows a switch turned OFF, and the right diagram a switch turned ON.

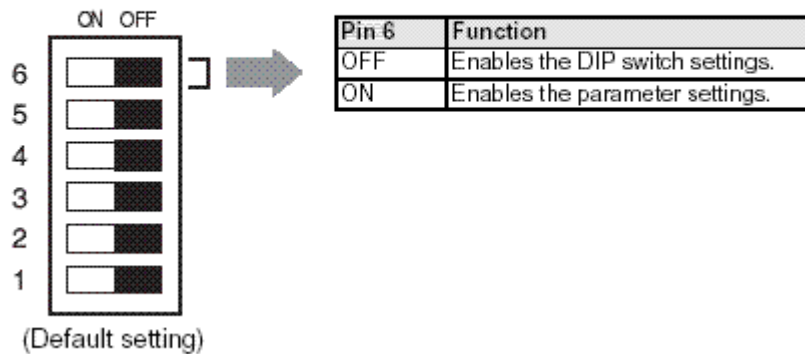


The front panel DIP switches have the following functions.

DIP Switch 6 Enable/Disable Parameter settings

Enable Switch/Parameter Setting

Pin 6 of the DIP switch selects whether the Servo Driver operates according to the DIP switch settings or parameter settings.

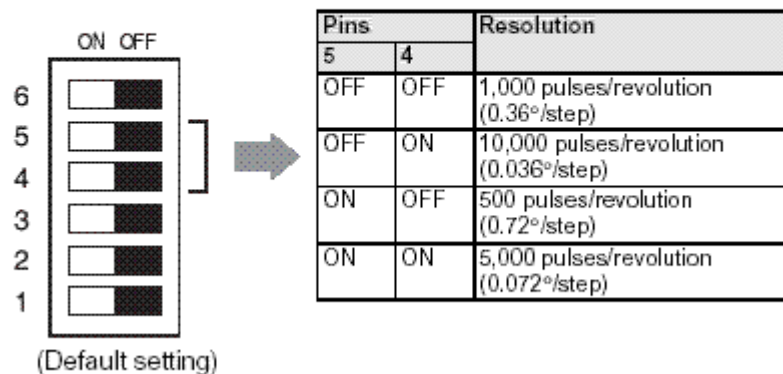


Dip Switch 4 & 5 Resolution

Resolution Setting

Pins 4 and 5 select the positioning resolution.

If the resolution is set to 1,000 (the default setting), the motor makes one revolution for every 1,000 pulses input.



Note:

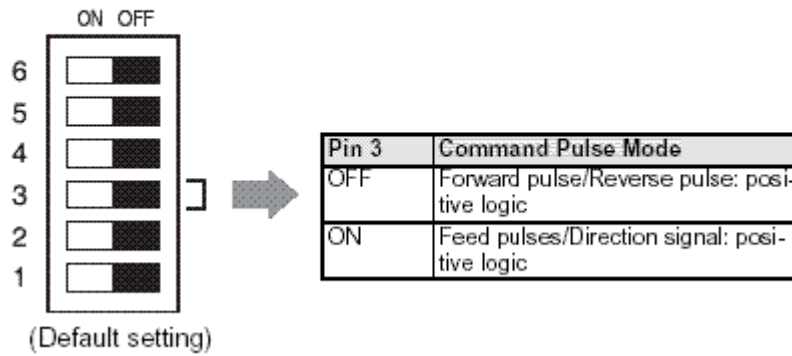
Changing the resolution setting does NOT change the motor encoder resolution. The resolution setting determines how many pulses from the controller will be received for the motor to make one complete revolution. Set according to the resolution required on the machine. There is no point in setting the resolution too high if it is not required, as this may limit the maximum speed, because the pulse frequency may be above the maximum output speed of the controller.

Dip Switch 3

Command pulse input form

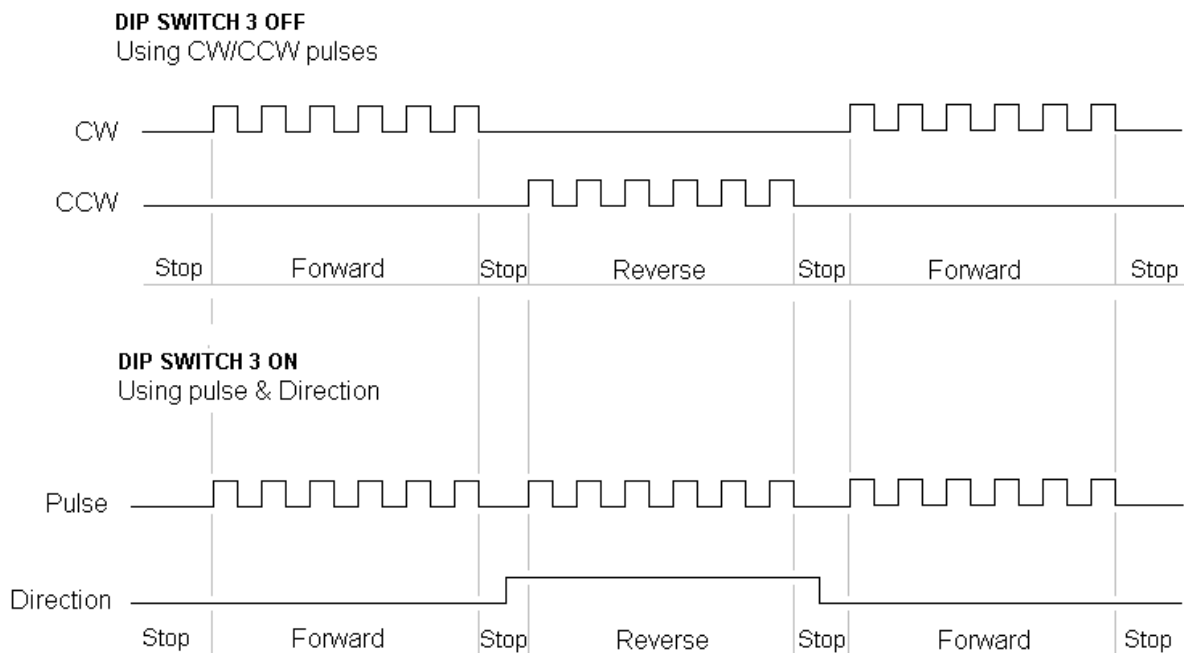
Command Pulse Input Setting

Pin 3 selects the command pulse mode. Select "Forward pulse/Reverse pulse: positive logic" or "Feed pulses/Direction signal: positive logic."



CC/CCW command form uses each channel of the pulse train input to determine the amount of movement (the number of pulses received) and the direction in which to move (the channel on which the pulses are received)

Pulse/Direction command form uses one channel to determine the amount of movement (the number of pulses received) and the direction to move determined by the level of the other channel (off = forward, on = reverse)



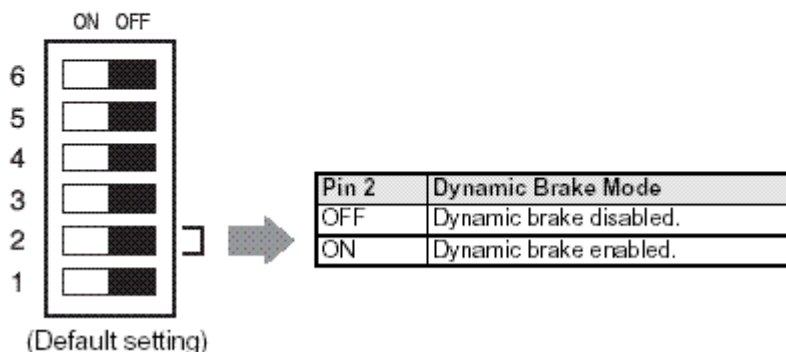
NOTE: When using the pre-assembled cables with the CJ1M PLC's, only CW/CCW command mode is available.

Dip Switch 2

Dynamic Brake

Dynamic Brake Setting

Pin 2 enables or disables dynamic brake operation. If the dynamic brake is enabled, the motor can be brought to an emergency stop when the RUN command goes OFF or an alarm occurs.



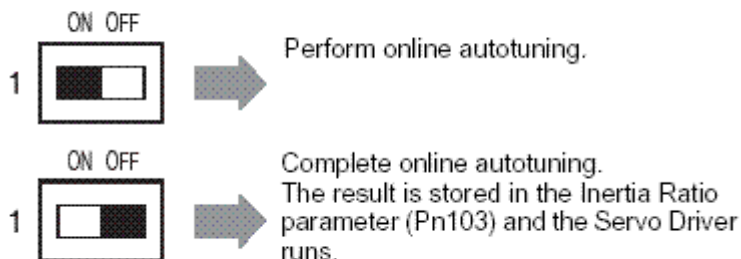
The dynamic brake is an internally connected resistor when the SmartStep is not enabled (in Baseblock). Any motion of the motor in this mode, generates a voltage across this resistor proportional to the speed of the motor, and is used to prevent the motor from rotating. Try turning the motor shaft while the DB switch is off and the motor is not enabled. The motor shaft will be quite free. Power off the SmartStep and enable the dynamic brake. Power on and with the servo not enabled, the shaft will be harder to rotate. The faster the motor is rotated, the more effective the dynamic brake will be.

Dip Switch 1

On-Line Autotuning

Online Autotuning Setting

The Autotuning Switch selects whether the gain will be adjusted automatically during operation.



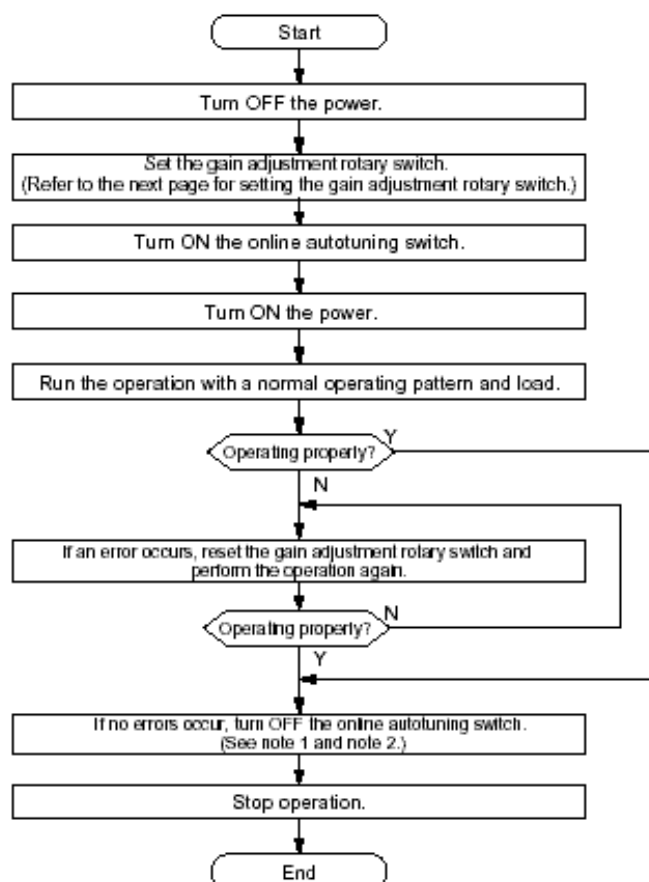
Online Auto tuning attempts to calculate the load inertia at the motor shaft. In order to do this, the motor speed must be above 500 rpm and the load torque must exceed 50%. Auto tuning is normally performed by repeatedly applying a high-speed step type movement in first one direction, then the other. The SmartStep can then dynamically calculate the load inertia.

On-line auto tuning is started by powering off the unit and setting the rotary switch to the required position, and setting DIP switch 1 on. The unit is then powered up and the motor is stepped as above. If the servo response is good, then DIP switch 1 is moved to the off position, which causes the calculated motor inertia to be written in parameter pn103.

This parameter is one of the gain parameters that the servo uses for servo response.

Once auto-tuning has been completed, it need not be performed again unless the load characteristics change significantly causing the load to vibrate. This procedure is detailed in the following flowchart.

■ Online Autotuning Procedure



Do not perform extreme adjustment and setting changes as they may destabilize the operation. Adjust the gain a little at a time while checking the Servomotor operation.

- Note 1.** When the online autotuning switch is turned OFF, the tuning results will be stored in parameter Pn103 (inertia ratio). Operation from this point will run according to the value stored in Pn103.
- Note 2.** If the online autotuning switch is set to always ON, the Servomotor may become unstable due to extreme vibration when the load fluctuates. It is recommended that you perform on-line autotuning once, write the results (inertia ratio) to the user parameter, then operate with the online autotuning turned OFF.

Other parameters

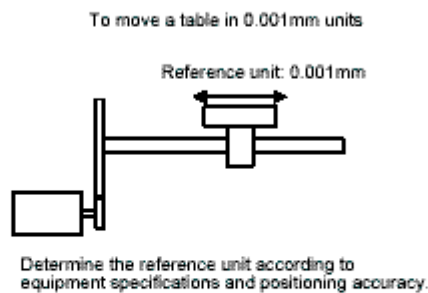
Electronic Gear Ratio

SmartStep allows the user to input any number of pulses to equate to the distance the load moves.

Use the following to determine the electronic gear ratio:

1. Determine the reference unit used.

A reference unit is the minimum position data unit used to move a load.
(Minimum unit of reference from the host controller).



Examples (in mm):

- Reference unit can be 0.1in or 0.01in or 0.01mm or 0.001mm, etc.
A reference unit of one pulse moves the load by one reference unit.
- When the reference unit is 1µm
If a reference of 50000 units is input, the load moves 50mm (1.97in)
(50000 × 0.001mm = 50mm).

2. Determine the load travel distance per load shaft revolution in reference units.

$$\text{Travel distance per load shaft revolution} = \frac{\text{Travel distance per load shaft revolution}}{\text{Reference Unit}}$$

When the ball screw pitch is 0.20in (5mm) and the reference unit is 0.00004in (0.001mm),

$$\frac{0.20}{0.00004} = 5000 \text{ (reference units)}$$

Ball Screw	Disc Table	Belt and Pulley
<p>Load shaft</p> <p>p</p> <p>P: Pitch</p> <p>1 revolution = $\frac{P}{\text{reference unit}}$</p>	<p>Load shaft</p> <p>360°</p> <p>1 revolution = $\frac{360^\circ}{\text{reference unit}}$</p>	<p>Load shaft</p> <p>D: Pulley</p> <p>nD</p> <p>1 revolution = $\frac{nD}{\text{reference unit}}$</p>

3. Electronic gear ratio is given as: $\left(\frac{B}{A}\right)$

If the gear ratio of the motor and the load shaft is given as: $\frac{m}{n}$
 where m is the rotation of the motor and n is the rotation of the load shaft,

$$\text{Electronic gear ratio } \left(\frac{B}{A}\right) = \frac{\text{Number of encoder pulses} \times 4}{\text{Travel distance per load shaft revolution (reference unit)}} \times \frac{m}{n}$$

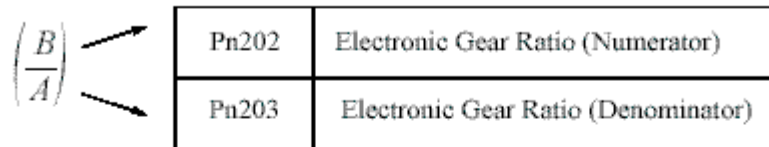
Note: Make sure the electronic gear ratio satisfies the following condition:

$$0.01 \leq \text{Electronic gear ratio } \left(\frac{B}{A}\right) \leq 100$$

The servo amplifier will not work properly if the electronic gear ratio exceeds this range. In that case, modify either the load configuration or the reference unit.

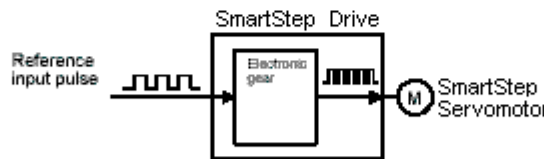
4. Set the parameters.

Reduce the electronic gear ratio to the lower terms so that both A and B are integers smaller than 65535, then set A and B in the respective parameters:



Parameter	Signal	Setting	Control Mode
Pn202	Electronic Gear Ratio (Numerator)	Range: 1 to 65535 Default Setting: 4	Position Control
Pn203	Electronic Gear Ratio (Denominator)	Range: 1 to 65535 Default Setting: 1	Position Control

Set the electronic gear ratio according to equipment specifications.

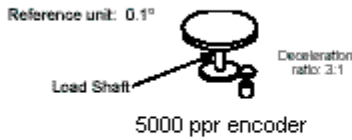


$$\text{Electronic gear ratio} = \left(\frac{B}{A}\right) = \frac{\text{Pn202}}{\text{Pn203}}$$

- B = [(Number of encoder pulses) × 4] × [motor speed]
- A = [Reference units (travel distance per load shaft revolution)] × [load shaft revolution speed]

E.g. using a rotary table with 0.1° resolution.
 The following is an example of using a SmartStep set to 5000 pulses / rev and using a 3:1 gearbox between motor and load.

Circular Tables



$$\text{Travel distance per load shaft revolution} = \frac{360^\circ}{0.1^\circ} = 3600$$

$$\text{Electronic gear ratio} = \left(\frac{B}{A}\right) = \frac{5000 \times 4 \times 3}{3600} = \frac{\text{Pn202}}{\text{Pn203}}$$

Preset Values	Pn202	60000
	Pn203	3600

NOTE: Pn202/Pn203 must lie between 0.1 and 100.
 In this instance 60000/3600 = 16.666 and so is OK.

Motor Direction.

If the motor forward rotation is not correct for the machine, it is NOT possible to simply change two phases of the motor around, as is the case with an induction motor. In this instance, forward direction can be changed by parameter. **This parameter requires a power up reset to be effective**

Set pn000, digit place 0 as follows

- Pn000.0 = 0 CCW is defined as forward rotation
- Pn000.0 = 1 CW is defined as forward rotation

Torque limits

■ **Functions**

- The torque limit function limits the Servomotor's output torque.
- This function can be used to protect the Servomotor and mechanical system by preventing excessive force or torque on the mechanical system when the machine (moving part) pushes against the workpiece with a steady force, such as in a bending machine.
- The steady force applied during normal operation is limited with user parameters Pn402 (forward torque limit) and Pn403 (reverse torque limit).

■ **Parameters Requiring Settings**

● **Limiting the Steady Force Applied during Normal Operation**

Parameter No.	Parameter name	Explanation
Pn402	Forward torque limit	Set the output torque limit for the forward direction as a percentage of the rated torque (setting range: 0% to 800%).
Pn403	Reverse torque limit	Set the output torque limit for the reverse direction as a percentage of the rated torque (setting range: 0% to 800%).

Note 1. Set these parameters to 350 (the default setting) when the torque limit function is not being used.

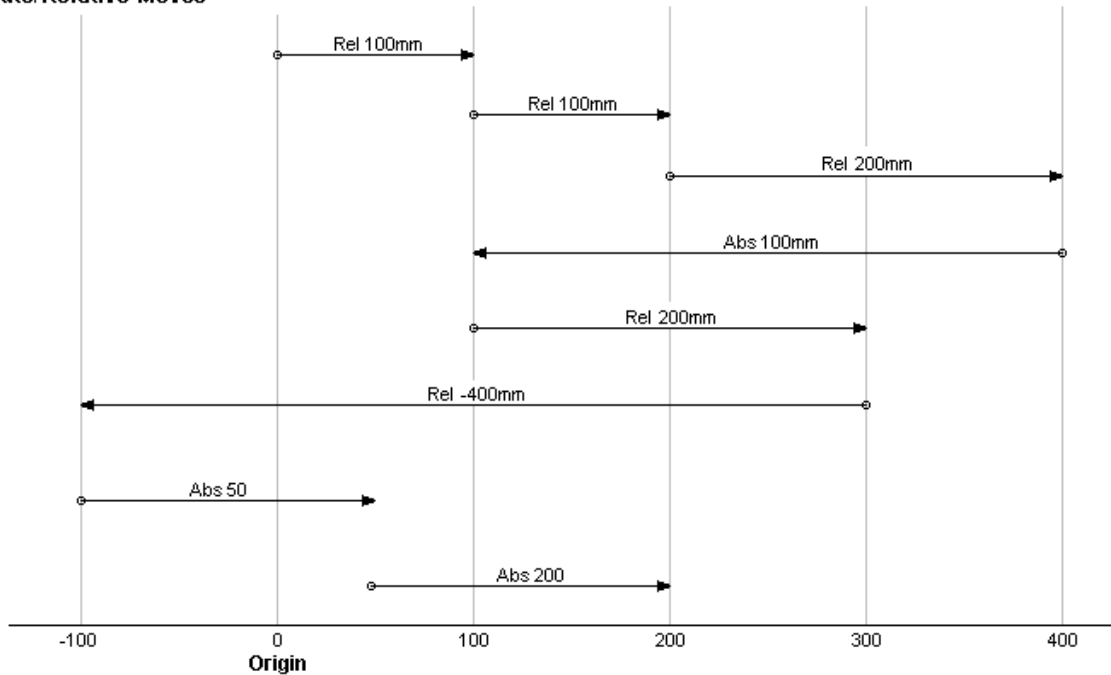
Note 2. If the connected Servomotor is set to a value greater than the maximum momentary torque, the maximum momentary torque will become the set limit.

Section 3 – Programming Examples

Explanation of the CJ1M pulse output instructions.

ORG Instruction

Absolute/Relative Moves



An absolute move, tells the SmartStep, where the move should end, in relation to a fixed origin position (Position 0)

A Relative move, tells the SmartStep, where the move should end in relation to the current position.

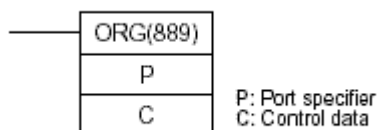
Issuing a relative move of 100 from position 200 will end up at position 300. The same move issued at current position 260, will end up at position 360. Issuing an absolute move 100, will always end up at position 100 and the motor could move backwards or forwards from the current position to reach absolute position 100.

If an absolute move to say position 100 is issued twice in succession, the motor could move to position 100 on the first move, but will not move on the second command, as it is already at absolute position 100.

Clearly, an origin position must be defined, before an absolute move can be issued, as the controller and SmartStep have no idea where the motor is when the machine is powered on. The current positional data is lost when the PLC is powered off. Although the current position could be stored in retentive memory at power off, an operator could move the machine while the power is off, making the stored positional data invalid.

The ORG instruction is used to define the origin position on the machine, normally as the first operation at power on. Before an absolute move can be issued, the machine must have been homed to define the zero or home position. Until the origin is defined, only relative moves can be issued, with the controller resetting the current position to zero at power on.

The format of the ORG instruction is as follows:

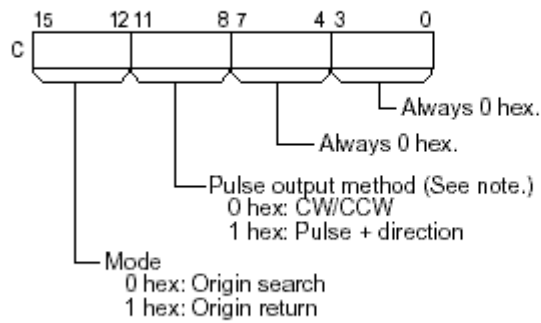


P: Port Specifier

0000 Use output port 0
0001 Use output port 1

C: Control Data

The value of C determines the origin search method.

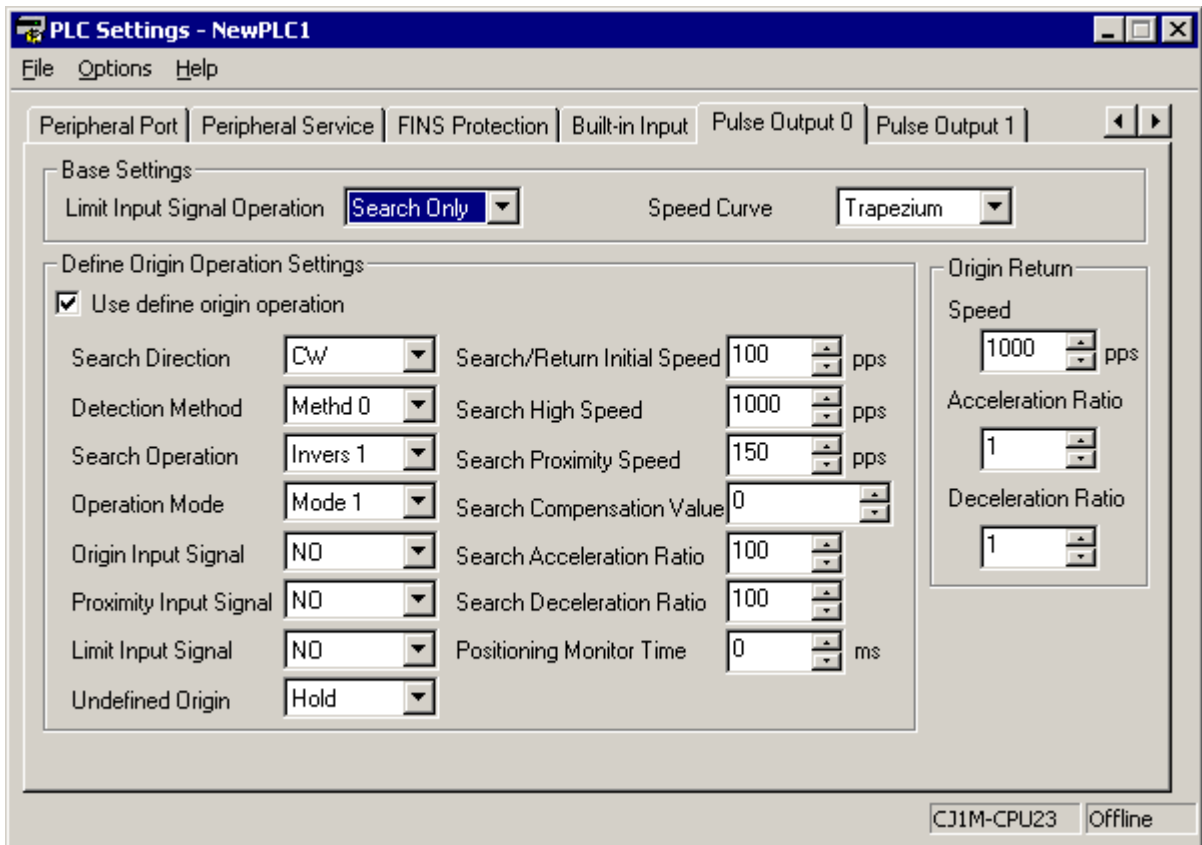


Note: Use the same pulse output method when using both pulse outputs 0 and 1.

An origin search is used to find the origin position on the machine, using proximity switches.

An origin return is used to return to a previously defined home position (with the ORG instruction) and is equivalent to an absolute move of 0.

In order to be able to use the ORG instruction, various settings must be made in the PLC. These settings are accessed via the settings in CX-Programmer.

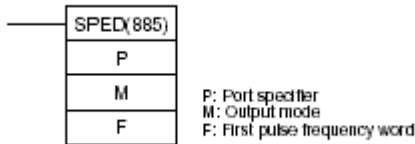


Unless the settings are made in the PLC, the ORG instruction cannot be used. The Use define origin operation checkbox is not made effective until the PLC is next powered up.

These settings are explained by accessing the Help menu. Click Help – Help Contents – CS/CJ-Series PLC Settings and then click on the Pulse Output0/1 (CJ1M CPU2x)

SPED instruction

The format of the SPED instructions is as shown below.



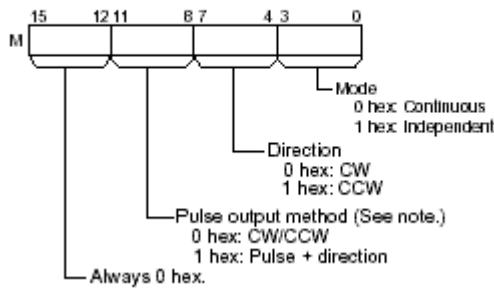
This is a fairly simple instruction to use, which produces output pulses in the form required, and at a specified frequency. Each part of the instruction is detailed below.

P: Port Specifier

- 0000 Use output port 0
- 0001 Use output port 1

M: Output mode

M :Output Mode
The value of M determines the output mode.



The right hand digit specifies continuous or independent mode. Continuous mode will continue to output pulses until stopped elsewhere in the program by using an **INI** instruction. Independent mode will output a specific number of pulses. (The number of pulses to output must have been specified prior to the **SPED** instruction by using a **PULS** instruction.

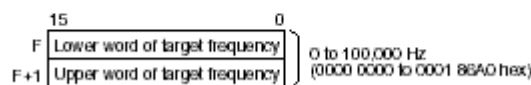
The next digit from the right specifies the motor direction.

The next digit specifies the output form of CW/CCW pulses. When using Omron pre-assembled cables, always use CW/CCW mode.

The leftmost digit is always 0.

F: First pulse frequency word.

F: First Pulse Frequency Word
The value of F and F+1 sets the pulse frequency in Hz.

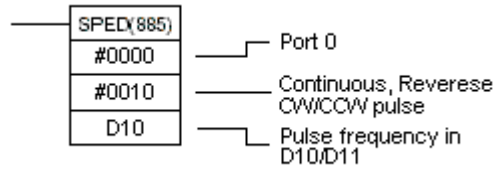


Specifies a memory address holding a LONG value of the output frequency of the pulses in HEX

i.e. To output pulses at a frequency of 1.5Kz.
1500 decimal = 3E8 hex = 0000 03E8 Long.

- F = 03E8
- F+1 = 0000

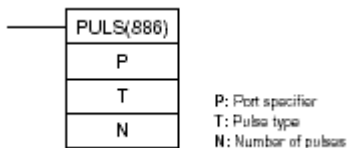
E.g. To output pulses continuously, in a reverse direction, at a pulse frequency of 500Hz (000001F4₁₆) stored in D10 and D11, using CW/CCW control method on output port 0, use the following instruction.



If the SmartStep encoder resolution is set to 500ppr, this will turn the motor, in reverse at a speed of 60rpm (1 rev/second)

PULS Instruction

The format of the **PULS** instructions is as shown below.



Again, this is a fairly simple instruction to use, and pre-loads the required number of pulses to output, prior to using the SPED command in independent mode. Each part of the instruction is detailed below.

P: Port Specifier

- 0000 Use output port 0
- 0001 Use output port 1

T: Pulse type

T: Pulse Type

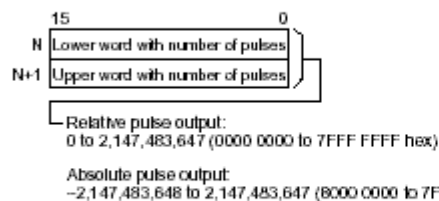
T specifies the type of pulses that are output as follows:

T	Pulse type
0000 hex	Relative
0001 hex	Absolute

N: Number of pulses

N and N+1: Number of Pulses

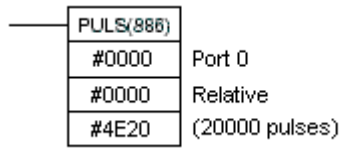
N and N+1 specify the number of pulses for relative pulse output or the absolute target position for absolute pulse in 8-digit hexadecimal.



The actual number of movement pulses that will be output are as follows:

For relative pulse output, the number of movement pulses = the set number of pulses. For absolute pulse output, the number of movement pulses = the set number of pulses – the PV.

E.g. To preload 20000 forward incremental pulses, (40 turns with a 500ppr encoder resolution) on port 0.

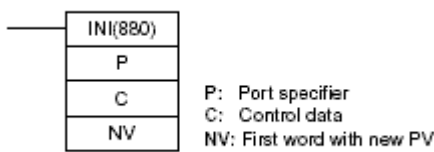


Alternatively, instead of using #4E20, it is possible to use an area of PLC memory to store this value.

Eg
Storing 0000 4E20 in say DM11 and 10 and specifying D10 for N, this will have the same effect.

The advantage of doing it this way is that simply by changing the value in D10 and D11, the number of pulses will be different each time the instruction is used.

INI Instruction



INI is a multi-purpose instruction that allows several different operations to be performed on the pulse output depending on the value of C (The control word). Using a value of 03 for this word stops pulse output on the specified port. (Other functions of C will not be covered in this guide). When used in conjunction with the SPED instruction, outputting pulses in continuous mode, this function will stop pulse output.

NV must still be included as a memory address, although the data in this address contains the new Present Value of the pulse output, it is disregarded when the control word is set to 03 and as such can be any value.

P: Port Specifier

P specifies the port to which the operation applies.

P	Port
0000 hex	Pulse output 0
0001 hex	Pulse output 1
0010 hex	High-speed counter 0
0011 hex	High-speed counter 1

(High speed counters are not used in this guide, so only values of 0000 and 0001 will be considered).

C: Control Data

The function of INI(880) is determined by the control data, C.

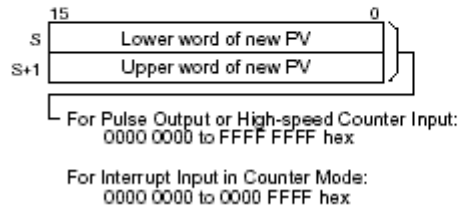
C	INI(880) function
0000 hex	Starts comparison.
0001 hex	Stops comparison.
0002 hex	Changes the PV.
0003 hex	Stops pulse output.

Only a value of 0003 is considered in this guide.

NV: First Word with New PV

NV and NV+1 contain the new PV when changing the PV.

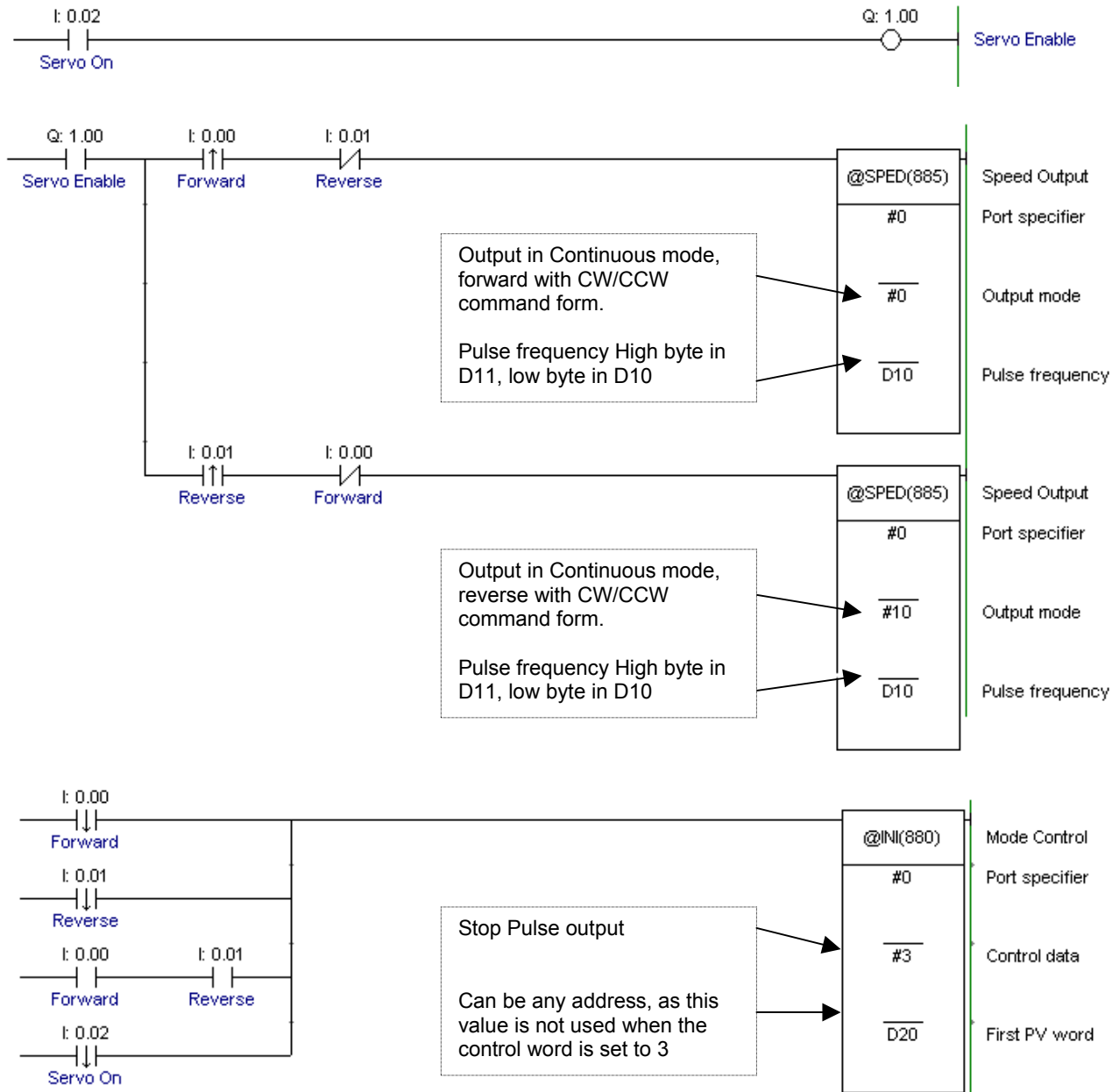
If C is 0002 hex (i.e., when changing a PV), NV and NV+1 contain the new PV. Any values in NV and NV+1 are ignored when C is not 0002 hex.



E.g. To stop pulse output on port 0, use

INI(880)	
#0000	Port 0
#0003	Stop pulse output
D100	Any memory address

Simple Jog Program

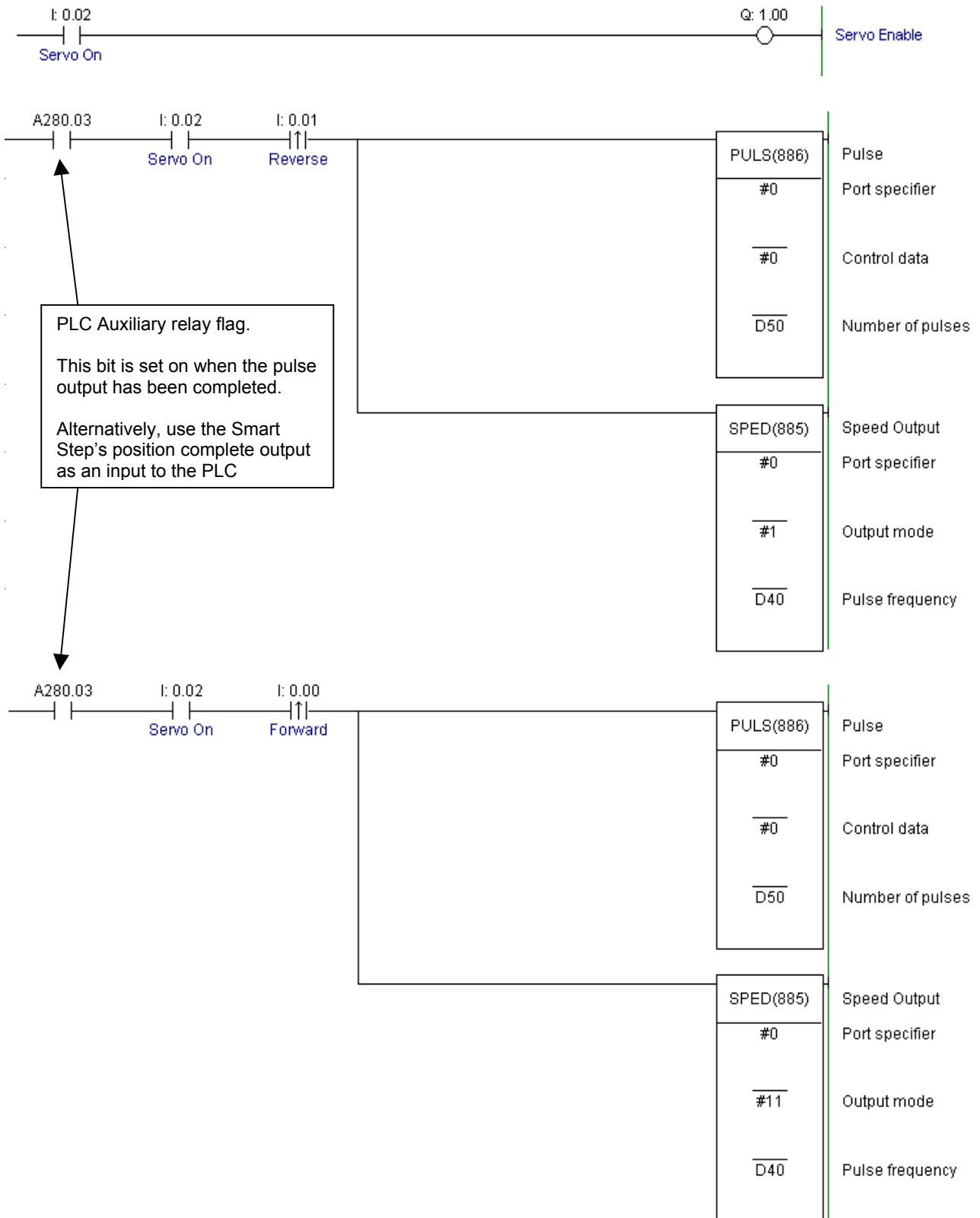


Ensure that the value in D10 and D11 is written prior to executing the above code by including a move value in for example a first scan contact

If D10 and D11 contain the following values, then the output frequency will be:

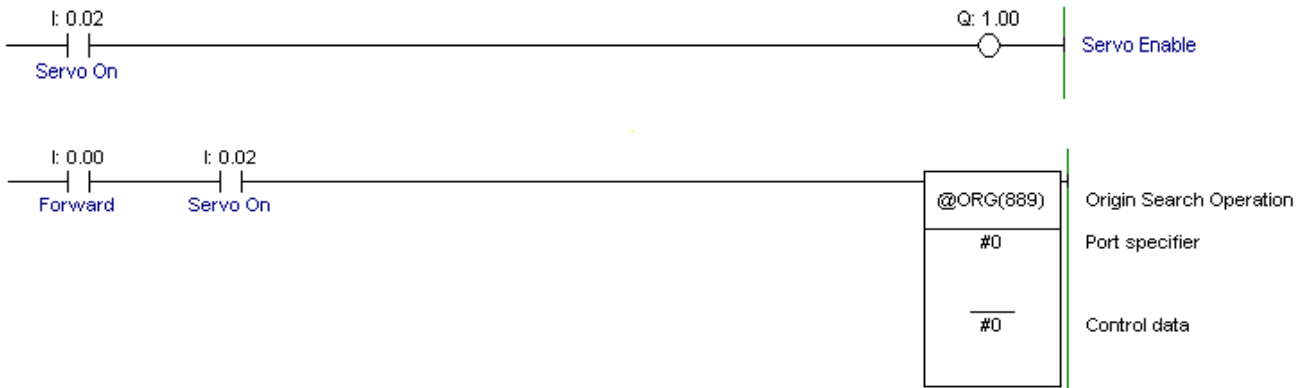
Value in D11	Value in D10	Output frequency
0000	09C4	2500Hz
0001	0000	65536Hz
0000	0064	100Hz

Simple Indexing program



A280.03 is a PLC status bit, which is high when the PLC is not outputting pulses, i.e. a move is considered complete within the controller. If the SmartStep gain is low, then the motor may still be moving to its final position. Using the Position complete bit from the SmartStep is an indication that the SmartStep is within a 'window' of the final position. The width of this window is set by SmartStep parameter Pn500 and can't be changed by Dip Switch settings.

Simple Origin Return Program



This program will perform an origin search using CW/CCW pulses to an origin proximity switch. This switch is a Normally open contact applied between pins 14 and 6 of the servo relay unit XW2B-20J6-8A.. When the ORG instruction is executed, the motor will accelerate to the search high speed as defined in the PLC settings. As the proximity switch goes Low – High, the motor will slow to Search proximity speed again as defined in the PLC settings. Operation will continue at this speed until the proximity switch goes High – Low. At this point, the motor will stop at the next Z pulse of the motor encoder. The Z pulse a single pulse that occurs at the same point every motor rotation. This ensures that the motor stops at the same point every time.

Other methods are available, such as stopping immediately as the proximity switch goes High – Low, or using the SmartStep’s position complete output. These other methods are detailed in the Help menu of the PLC settings window.

Please Note:

The SmartStep does not have direct inputs for CW and CCW machine limits. Should limits be required, they must be set in the PLC Settings as NO or NC. The physical inputs should then be mapped to the appropriate auxiliary relay in the PLC using the ladder program. If not required, then they should be set to NO and do not provide ladder code.

The auxiliary relay bits are:

CW Limit Input Signal A540.08

CCW Limit Input Signal A540.09

