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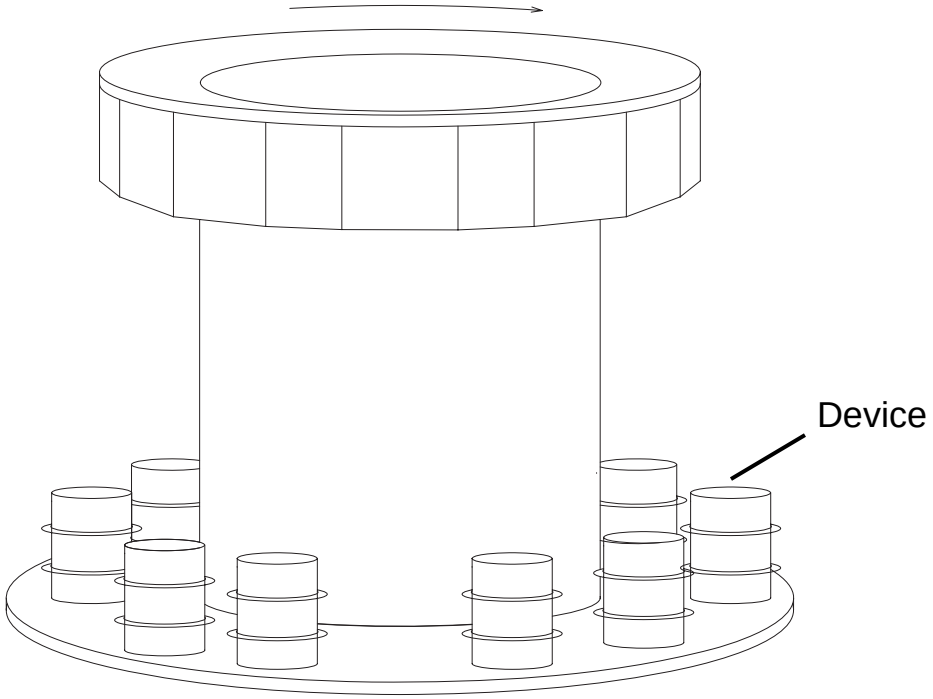
PRODUCT FAMILY: *Sure*Servo
Number: AN-SERV-005
Subject: Sureservo position with incremental position
Date issued: Nov-18-2007
Revision: First edition

In this example we will control the position of a rotary table that test widgets.

In this example, we will determine the kinematics of the movement, the sizing of the servo motor and discuss some design considerations and we will show how to wire the servo drive to the PLC DL06. We will show the detailed wiring of the drive, the PLC program code and the servo drive parameter values; at the end we suggest actions to tune the servo. The control will be done with a C-more panel

See the following diagram to understand the concept.



The rotary table rotates 18 steps in only one direction to complete a total revolution, that is, rotates 20 degrees in the circle per each step; every time the table stops, a device is loaded into the table by operators, do some adjustments and then, when the conditions are set, the new motion is initiated.

Let's assume that the motion of every step occurs in 3 seconds. In this case, the total time for the 18 steps is 3x18= 54 seconds; The rest of the time is the time allowed for loading the air brakes into the rotating table.

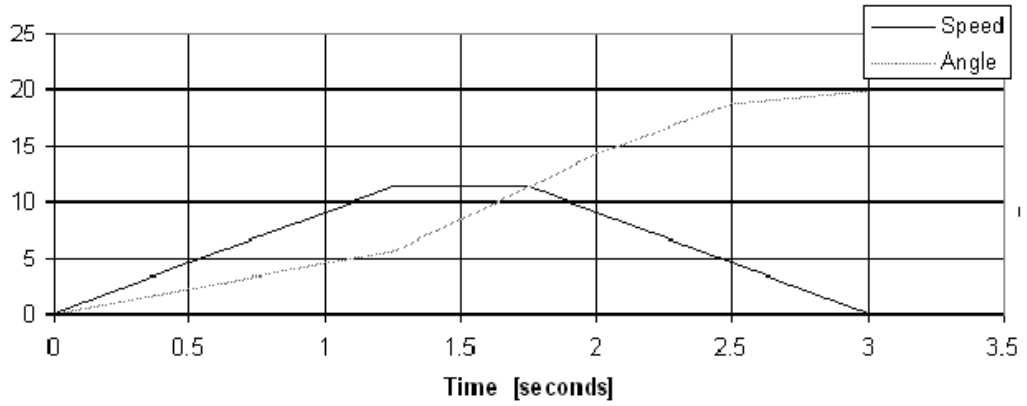
The time to load and unload the devices is about 25 seconds.

Friction torque on the rotary table is 10 N-m, obtained empirically

The inertia of the rotary table is 130 Kg-m^2 including the widgets.

Kinematic studies

Let's consider one motion in the time of 3 seconds. We will consider a speed trapezoidal profile of 1.25 second acceleration, 0.5 second constant speed and 1.25 seconds for deceleration. See the planned motion trapezoidal profile below:



What is the maximum speed that the rotary table will develop?

If the angle is 20 degrees, then the maximum speed on the trapezoidal profile is determined by 20/1.75 = 11.428 deg/s or 11.428/360 = 0.03175 rev/s or 1.905 rpm or even in in radians, 11.428/360*2*π= 0.19945 rad/s approximately.

The speed is really very slow: Let's estimate that **the servo motor could run up to a rated speed to 3000 rpm**. We will do later some calculations to define the proper motor to be used here.

If the rotary table rotates at the maximum speed of 1.905 rpm, the ratio could be up to 3000 rpm /1.905 rpm = 1574:1

A selection of a gearhead with a bigger ratio, will be useful to increase the torque to the load and also reduce the reflected inertia and reach a inertia ratio close to the ideal ratio in the range 10:1 or smaller. However, practical gear head sizes do not go above a ratio 512 :1.

Dynamics

Let's do some torque calculations to size the motor.

The dynamic torque will be given by the well known formula **Tm -Tr = Jxdω/dt.**

The static torque is given by the frictions in the gear reducer and the rotary table.

We know that the inertia of the rotary table is 130 Kg-m^2 ; it is important to check that the dynamical forces will be below the available motor torque.

For this specific case, we do not know for now the inertia of the motor and the gear reducer at this time. We will calculate the torque needed to move the rotary table and then we will decide what motor and gear head to use.

The acceleration dω/dt is calculated by knowing that the ramp to go to the maximum speed is 1.25 second, per the figure above, and the maximum speed is 0.19945 rad/s; that is, the acceleration **dω/dt** is 0.15956 rad/s^2.

The dynamic torque on the rotary table shaft while accelerating is then T = **Jxdω/dt** = 130 [Kg-m2]x0.17453 [rad/s^2]= 20.74 [N-m].

Let's add the friction torque: If 10 N-m is considered on the load side, we will have a total torque during acceleration, of 30.74 N-m.

The result when decelerating is -20.74 + 10 N-m = -10.74 [N-m].

Let's select a right angle gear head from Neugart USA, type PLS70, that has at least a torque output of 37 N-m, with the ratio 8:1 with some margin.

There is a trade off between the higher ratio and the torque available. In this case, the torque on the motor side would be 37/8= 4.625 [N-m] at efficiency of 100%. This takes us to a large motor, such is the SVM-210.

Let's increase the ratio to make it 64:1. In this case would be 37/64 = 0.578 N-m. The motor would be SVL-202. This motor SVL-202 has a rated torque of 0.64 N-m.

Notice that, if the reducer is selected with a ratio of about 120 :1 or more, the motor will go to higher speeds with lower power (or equivalent torque). This exercise is left to the reader.

The corresponding 20 degrees will correspond to 20x64 degrees or 1280 degrees, that corresponds to approximately 12890/360= 3 revolutions and 5555 fractions of a revolution. This is the angle to move for one step.

This can be treated as an increment, which is constant. Notice that there is an small error due to approximation on the completion of one table revolution (3.5555 revolutions x18 steps=63.998 revs and not 64 revolutions).

In this assumption, the 200 Watt sureservo motor could do the job, if the efficiency were 100%, which is not the case. We may adjust the motor, if necessary, after re-doing calculations to include the inertias.

In this case we could have an available continuous torque of 0.64 [N-m]x32x0.94 (efficiency)=38.5 [N-m], slightly above the the gearbox rated torque of 37 [N-m].

For this specific case, we the inertia of the motor is $0.18x10^{-4}$ Kg-m^2 and the gear reducer inertia is $0.000102x10^{-4}$ kg-m^2.

Let's now calculate the inertia referred to the motor side:

Motor inertia	= $0.180\ x10^{-4}$ kg-m^2
Gear inertia	= $0.0001\ x10^{-4}$ kg-m^2
Coupling (estimated)	= $0.050\ x\ 10^{-4}$ kg-m^2
Rotary table inertia/ratio^2=	= $130/64^2$ = $317.38\ x10^{-4}$ kg-m^2
Total inertia referred to motor	**= $317.61x10^{-4}$ Kg-m^2**

The acceleration referred to the motor side is 10.212 rad/s^2 (0.15956 rad/s^2x64).

The dynamic torque on the motor side is T = $\mathbf{J x d\omega/dt/\eta}$ = 0.3243 [N-m].

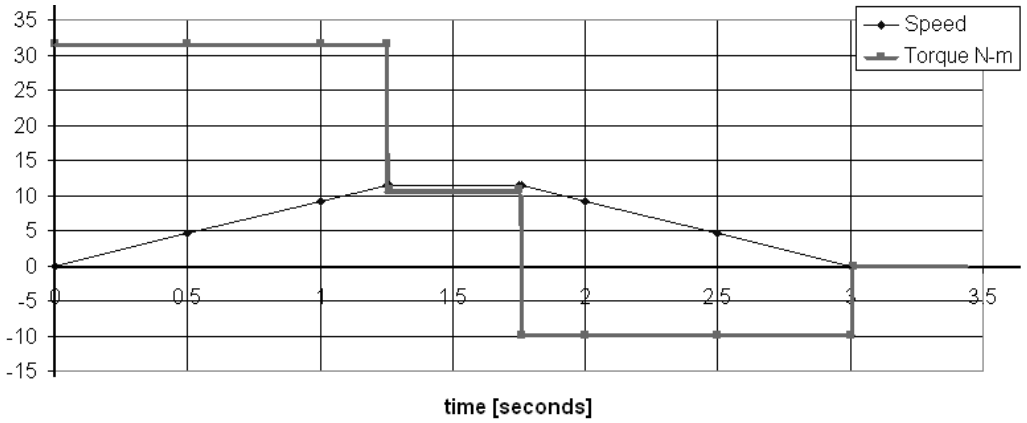
Let's add the friction torque: If 10 N-m is considered on the load side, we will have a friction torque on the motor side of 10/64/0.92 = 0.1698 [N-m] and the total torque during acceleration, is 0.4941N-m (on the load side is 31.624 N-m).

The result when decelerating is -0.3243 +0.1698 N-m = -0.1545 [N-m]. On the load side is -9.888 N-m. Note that the addition of the motor and gearhead inertia was not significant in this case.

The motor torque when at steady speed is 0.1698 [N-m], referred to the motor side, which is insignificant in this example. The load side reflect to 10.867 N-m./

The maximum speed that the servomotor will run will be 1.905x64 = 121.92 rpm.

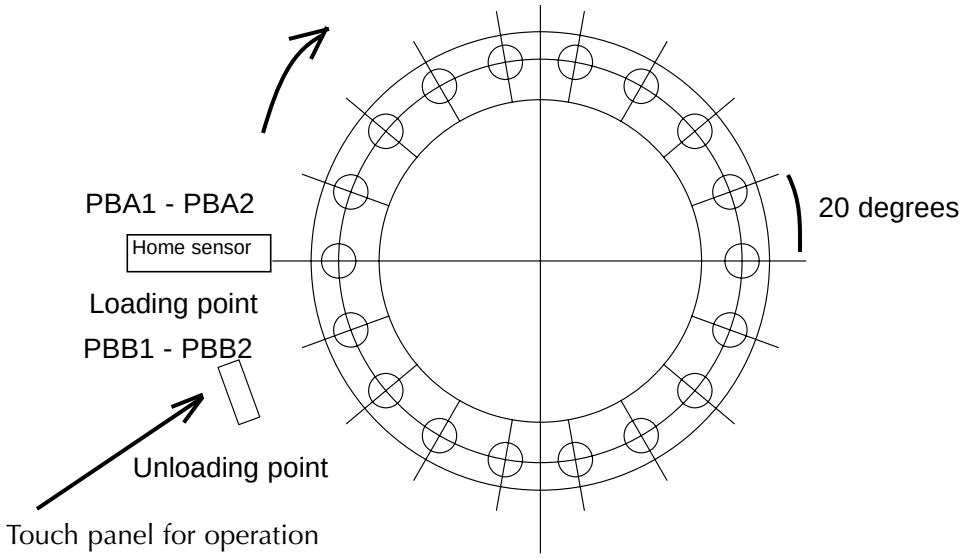
A load torque/time chart is shown below:



Control criteria

The next step will be to define the PLC control.

See the figure below to follow the explanation on the next description:



There are 2 operators that are loading and unloading the pieces; they have a button close to the panel to authorize the next move, when the air brake has been loaded or unloaded,respectively. This is a touch panel of the type C-more .

The pushbuttons are activated by the operators, for safety reasons, to give the permissive to start the next step cycle

It is necessary to have a means to return to Home, in case there is a power shutdown during the operation, to define the proper initial position.

The operation mode will be incremental mode with registers (Pr) Parameter P1-01 should be 101. There are other options not described here.

By the requirements of the control, the PLC and the panel should know at any time the step that the table is located. This can be done with a simple counter, as explained later.

The sequence of operation will be the following:

A - When the control is powered up, first the PLC turns on and this will, by logic and a contactor, turn on the the servo drive, then the servo is enabled.

B - The operator should generate a command to **Search Home**, with the digital input DI2, arbitrarily defined, from the panel; the parameter P2-11 should be 127; the servo is enabled with DI1. The Home position is determined by a proximity sensor located in DI3, defined with parameter P2-12 as 124. The mechanical zero is different from the sensor position.

C - A position counter CT0, arbitrarily defined, will keep the position number. When the PLC is energized, the counter should be reset and the count will be 0. When the **Home completed** output signal is generated (defined as DO3 arbitrarily), the counter CT0 will increment the count to 1. This would allow the operators to load the untested piece (and unload the tested one, if there is one there) and for safety reasons, they should press pushbuttons to acknowledge the completion of the loading and unloading. This is one criteria. The code can be done differently if desired.

D - The operators are ready in about 25 seconds or less. Let's define the input of these pushbuttons X7, arbitrarily defined.

E - When both acknowledgements occur, the PLC can generate the trigger to move the rotary table one step, The increment will be defined in P1-15 and P1-16, being P1-15 3 revolutions and P1-16 5555 counts. The **trigger to move** command will be defined in DI5, with parameter P2-13 set as 108.

F - The servo will execute the move and then, when completed the move, it will turn on the **At position** output, that arbitrarily will be D04. The counter CT0 will increment the count to 2 with this. This would allow the operators to load the untested piece (and unload the tested one, if there). The operators are again ready in about 25 seconds. They may complete the actions before this time. Notice that this action is the same as the sequence C.

And then the sequence will continue on the same way until a complete table rotation has been done. At this time, the counter can be reset. It might exist an offset due to the errors in calculations. The step 9 will be incremented in other slightly different increment to compensate the offset errors caused by calculation and keep the 18 steps exactly at 360 degrees.

The cycle can be repeated as many times as necessary.

Let's expand on the errors of the calculation. The total counts for a complete rotary table revolution are 64 revolutions when there is a gear reducer of ratio 64:1; also, we have seen that every move will be done with 3 revolutions and 5555 counts. Let's see what is the addition of all the moves: 3x18 steps gives 54 revolutions; 0.5555x18 gives 9.999 revolutions. That is, at the end of the 18 steps, there is a total of 63.999 revolutions and then an error of 64 -63.9999 or 0.0001 revolutions. This can be compensated in several ways, and one of them is to add another increment in any of the steps, to reach exactly 64 revolutions when the rotary table makes one complete revolution.

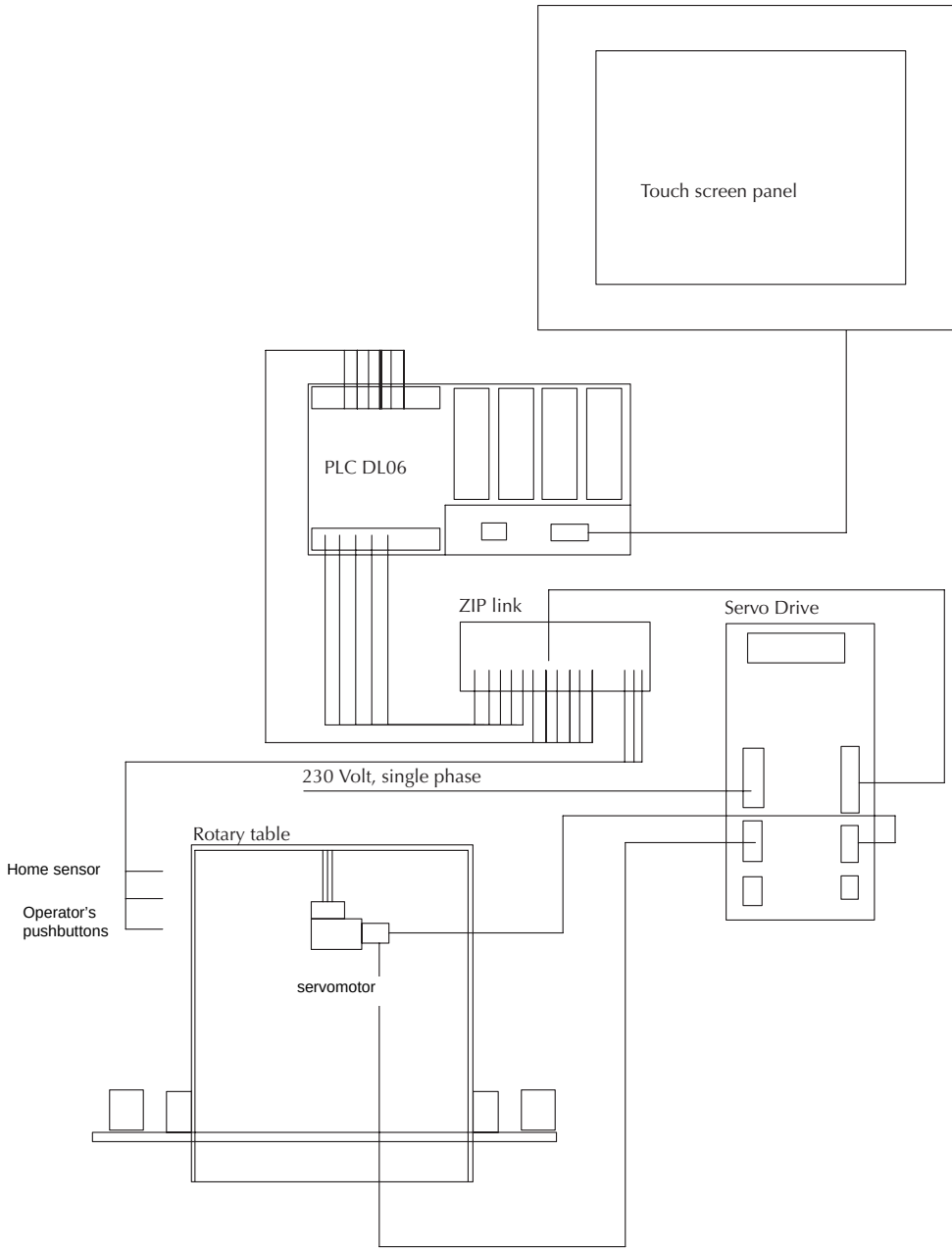
That is, on step 9 we will add an increment of 3 revolutions and 5556 counts, this can be selected with a position select 0 PLC output digital output to change in this case the parameters P1-17 and P1-18, using a digital; input on the servo drive.

There is no need to use MODBUS communications here with this control criteria, even though this is other option.

General control diagram

The control system can be comprised of the *Sures*ervo drive, the PLC and the accessories such as the thumbs pushbuttons (to acknowledge that the operators are with the hands free), the home sensor, a proximity switch etc.

See the following diagram to see the relationship among the various devices.



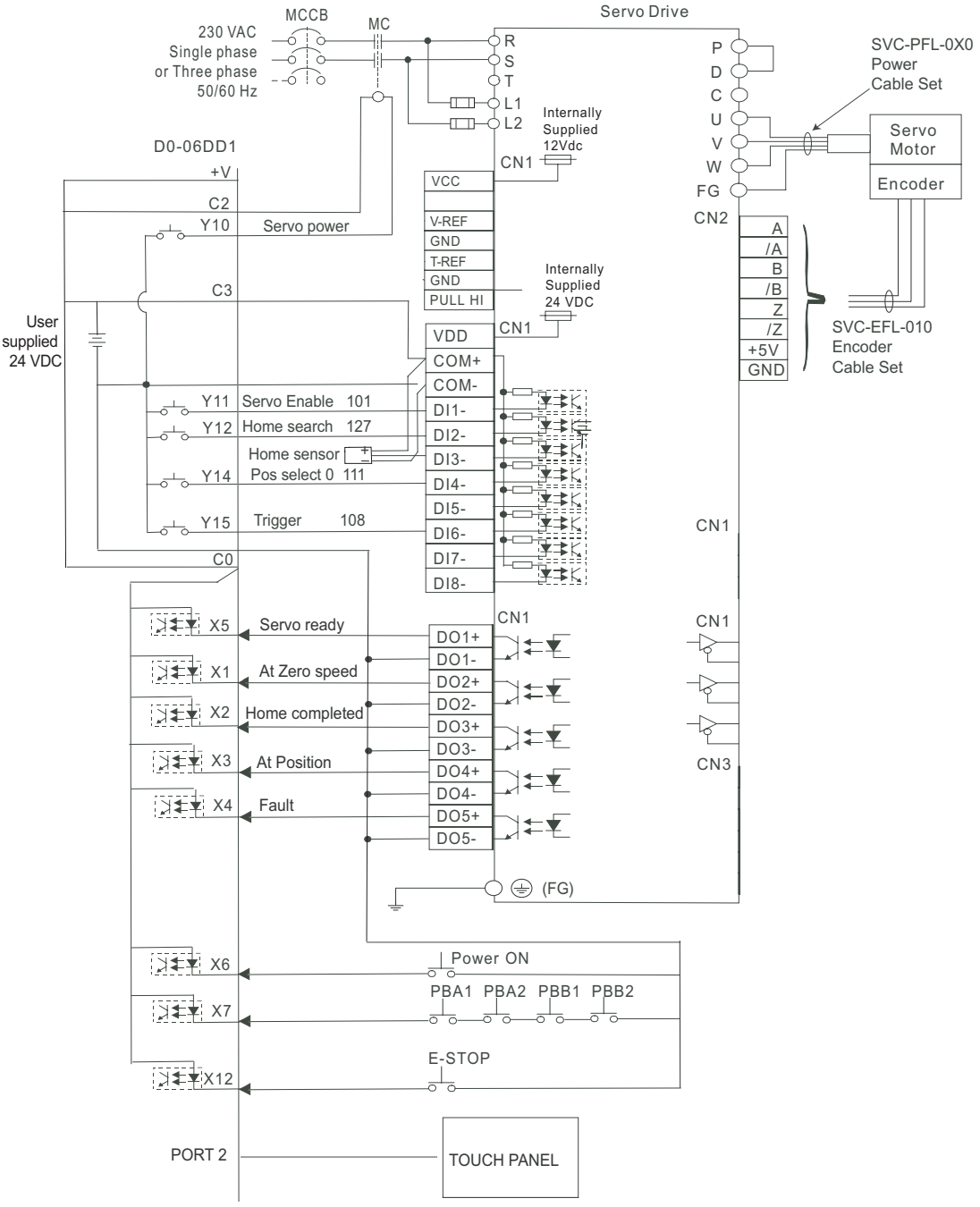
Wiring between PLC and servo drive

See on diagram below the selection of the functions and the corresponding outputs:

The C-more panel has been selected to start the system as well as generate the **Home search**. The **operators acknowledgement and the stop** are hardwired.

X2 will receive the signal from the servo drive to report **Home completed** and X3 will receive the signal from the servo drive to report **At position.**

Additionally, the home sensor will be wired directly to the digital input DI3. In the diagram below are shown the control connections between the drive and the PLC, necessary to make the system work as required.



PLC and C-more touch panel programming

The servo drive has to be programmed to follow the criteria defined.

The maximum speed is defined on parameter P1-55; the acceleration time and deceleration time defined on parameters P1-34 and P1-35 are defined based on this speed. the speed is defined in units of rpm. In this case I would recommend to use 122 on the parameter P1-55 and 1.25 seconds on P1-34 and P1-35. P1-36 can be set to 10 or 20 to make a slight s-curve.

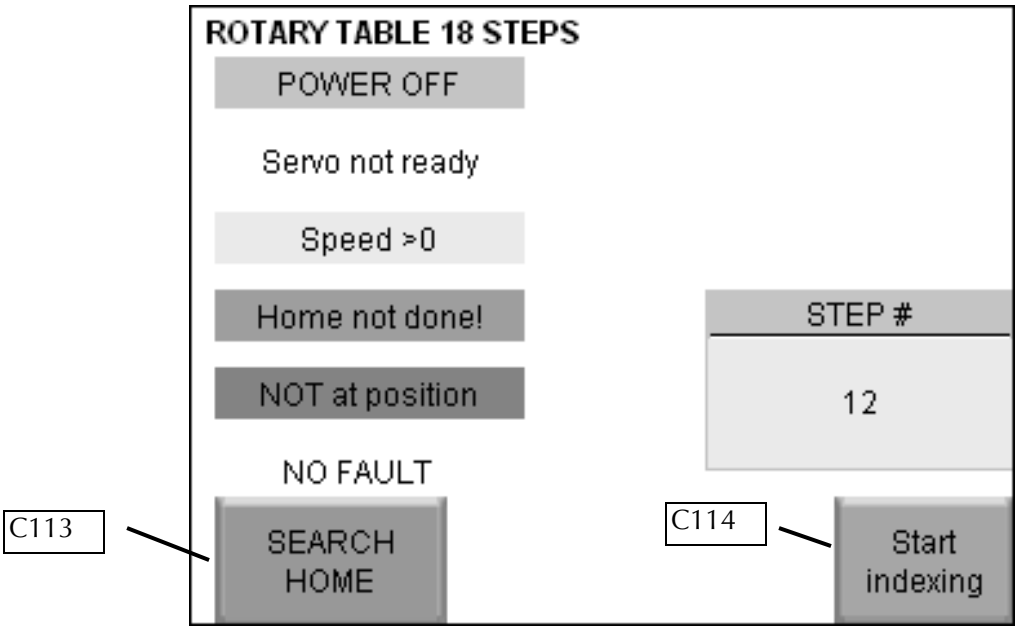
P1-47 is the configuration for the Home search procedure.

When the parameter setting is completed, it is necessary to remove the control power of the servo drive for a couple of seconds, to allow the saving the parameters into the drive (This is true for any parameter marked with 3 in user manual).

In order to check that the drive has the proper setting on all the parameters, we recommend to print the parameters with the help of the *Sure*servo Pro software.

A list of parameters is shown at the end of this document.

The C-more panel has the following objets (See the figure below) :



- A button **Search home**, associated to C113. The signal C113 will turn on every time the pushbutton is touched.
- A button **Start indexing**, associated to C114. The signal C114 will turn on every time the pushbutton is touched.
- A numeric display “Step #”, associated to the memory V1000, which is the current value of the counter CT0,
- An indicator of **Power ON** or not, associated to the PLC output Y10. Power On is true when the output Y10 is ON.
- An indicator of “Servo ready” or Servo not ready”, associated to X5. Servo ready is true when X5 is ON.
- An indicator of **At zero speed** or not, associated to X1. At zero Speed is true when

X1 is ON.

- An indicator of **Home completed** or not, associated to X2. Home completed is true when X2 is ON.
- An indicator of **At position** or not, associated to X3. The servo output signal At position is true when X3 is ON.
- 5 indicators of the stages, associated to S0 to S6.

The next step is to create the PLC program code.

We decided to use stage programming in this case.

See on the next section details of the code that will be programmed into the PLC.

PLC programming explanation

Stage 0 - At PLC power up: The first PLC scan or the return to Stage 0 will load a value of K0 to CTA0 (Basically the counter counts are reset to zero). As long as no jumps to other stages occur, this stage will keep C0-C17 and PLC outputs Y10-Y17 reset. This is a safety feature.

When X6 (The selector switch to give the signal power ON) becomes TRUE, then, there is a jump to Stage 1 "Power ON"

Stage 1- At start we SET Y10 "Servo Power" and Y11"Servo Enable" (Y10 and Y 11 turn on). Stage 1 will monitor various inputs to determine where program control will JUMP to.

IF C113 (Search Home button on the touch screen panel) goes TRUE, then there is a jump to S2 "Home Stage"

IF X2 (Homing completed) AND C114 (Start indexing button on the touch screen panel) are TRUE, then there is a jump to S3 "Run Stage"

IF X12(Stop All PB) is FALSE then there is a jump to ISG 0 "Initial Stage"

Stage 2-When S2 "Home Stage" is active the on delay timer T5 (Home Trigger Duration) is enabled.

IF the stage S2 is TRUE AND the timer done bit T5 is FALSE, then turn on Output Y12 "Home Command".

IF the timer done bit T5 is TRUE AND X2 (Homing completed) are TRUE , then there is a jump to Stage 1 "Power up"

IF X12 (Stop All PB) is FALSE, there is a jump to Stage ISG 0 "Initial Stage".

Stage 3-IF the count on the counter CT0 is CTA0 = 9, then SET the output Y14 (Turn ON Position Command Select 0).

This will call Position 2 from the Servo. Position 2 has the offset necessary to make an exact 360 degree revolution.

IF the count on the counter CT0 is CTA0 < > 9, then RST Y14 (Turn off Position Command Select 0) .

IF X7 (Operator Start) AND X1(At zero speed) are TRUE, then there is a jump to Stage S4 "Advance 1 stage"

IF X12 (Stop All PB) is FALSE THEN there is a jump to Stage ISG 0 "Initial Stage".

Stage 4-IF the stage S4 is TRUE start the timer T6 " Trigger Command Duration".

When S4 "Power On" is TRUE AND T6 is FALSE, then SET the PLC output Y16 "Trigger Command".

IF CT0 "Index Counter" is TRUE, THEN, OUT C20 "Index Counter Reset".

IF S4 AND X3 (At Position) are TRUE, THEN increment count in CT0 "Index Counter",IF C20 "Index Counter Reset" is TRUE, THEN, RST CT0 (Resets index counter).

IF the timer done bit T6 "Trigger Command Duration" is TRUE, THEN RST Y16 "Trigger Command"(Turn OFF Y16).

In normal Indexing Operation, the program will be toggling back and forth between stage 1 (Power On), then Stage 3, to check the count and define the increment to be used and stage 4. This represents Stage 1 "Power ON Stage" going thru the Operator signal X7 to start the force to go to Stage 3. Stage 3 defines the increment and then jumps to Stage 4. When in Stage 4, the output Y16 is active for the time defined in T6, the actual Servo signal to move, and move completion. When the move has been confirmed, Stage 4 will jump back to Stage 1 and wait for the next operator signal on X7.

Startup procedures

The program has to be tested in conjunction with the servo drive.

The recommended steps are:

a - Test the operation of the drive with a basic jog command. No PLC has been connected

b - Connect the servo enable and test the operation of the PLC, when connected to the drive

c -Connect all the other servo inputs and test the operation of home search. You can monitor the servo with the help of the *Sure*servo Pro software.

d - Test the outputs of the drive.

e - Make a complete sequence, running the 18 steps. The count at the end of one rotary revolution should be 64 revolutions on the *Sure*servo drive..

f - Tune the drive, if necessary. The load/motor inertias ratio is about 1700 in this case but the motor is not performing too sharp in this example.

The tuning can be done with the help of the *Sure*Servo Pro software: The standard white cable SVC-PCCFG-CBL is used to connect the PC with the servo.

Create a new configuration, give a name, reset the parameters to default, setting 10 on parameter P2-08, and use the parameters defined earlier:

For this action, go to the menu **Utilities>Current config>Print current config.**

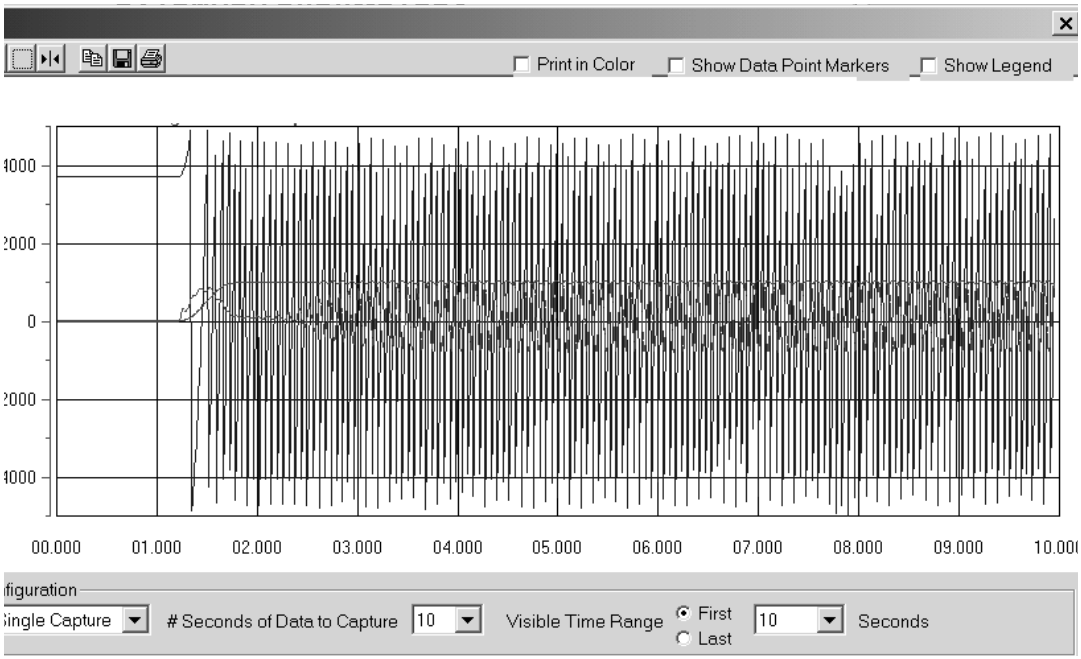
The tuning of the system can be done with any of the methods offered by the drive.

The task here is to move the load without overshoots, from the home position to all the positions. In this case, only one position tuning may be needed because the other positions are basically the same movement.

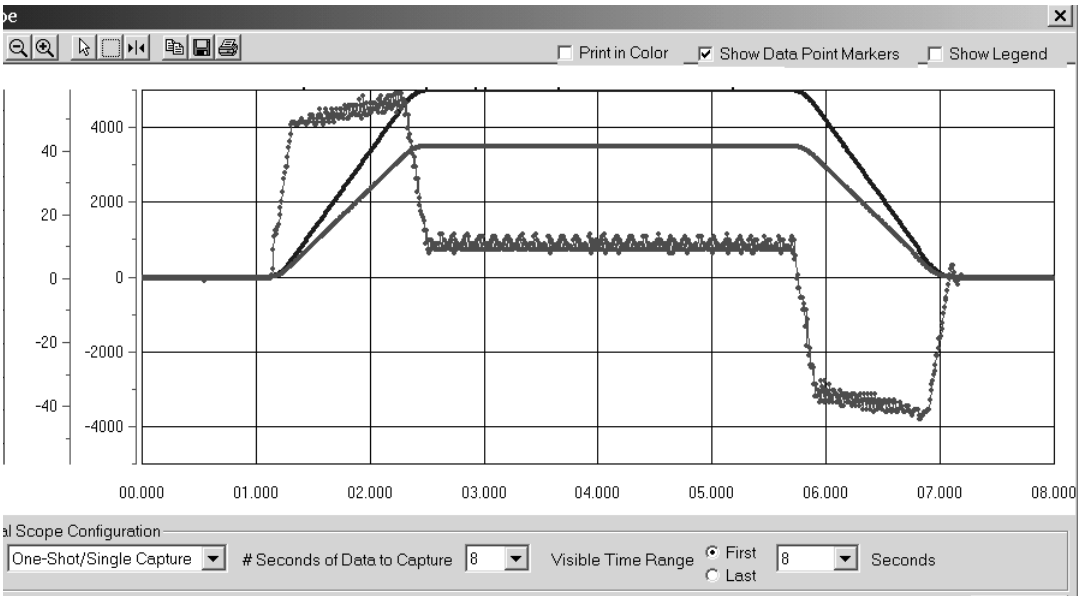
Finally, document all the project for future troubleshooting and housekeeping,.

Also, create an operating manual for the operators, that do not have to understand all the details, but they have to understand what makes every action they may generate. Finally, make backups of the programs.

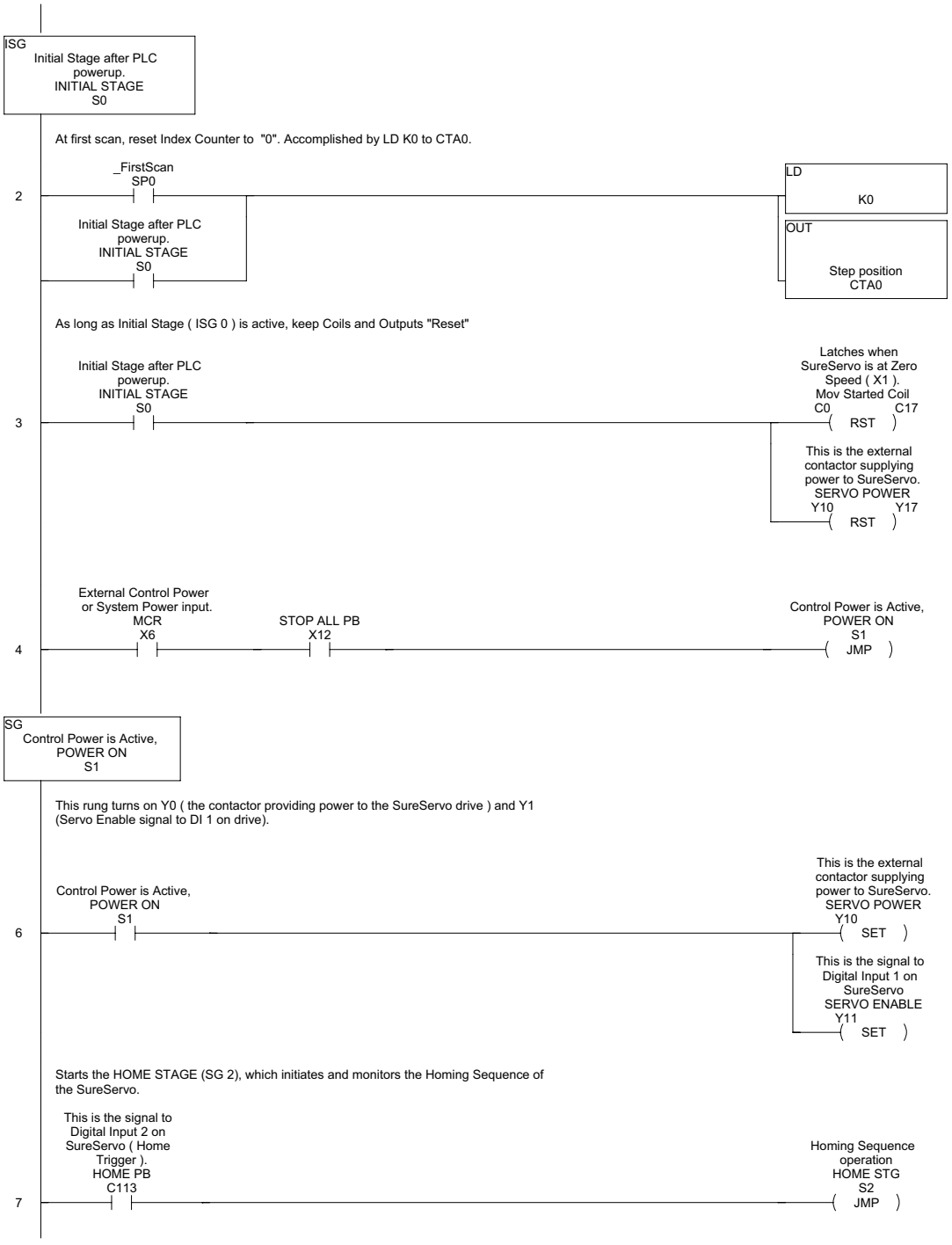
The servo should be connected to the load in normal condition.The first attempt to tune the system might result in a behavior as that shown in the figure below. This is



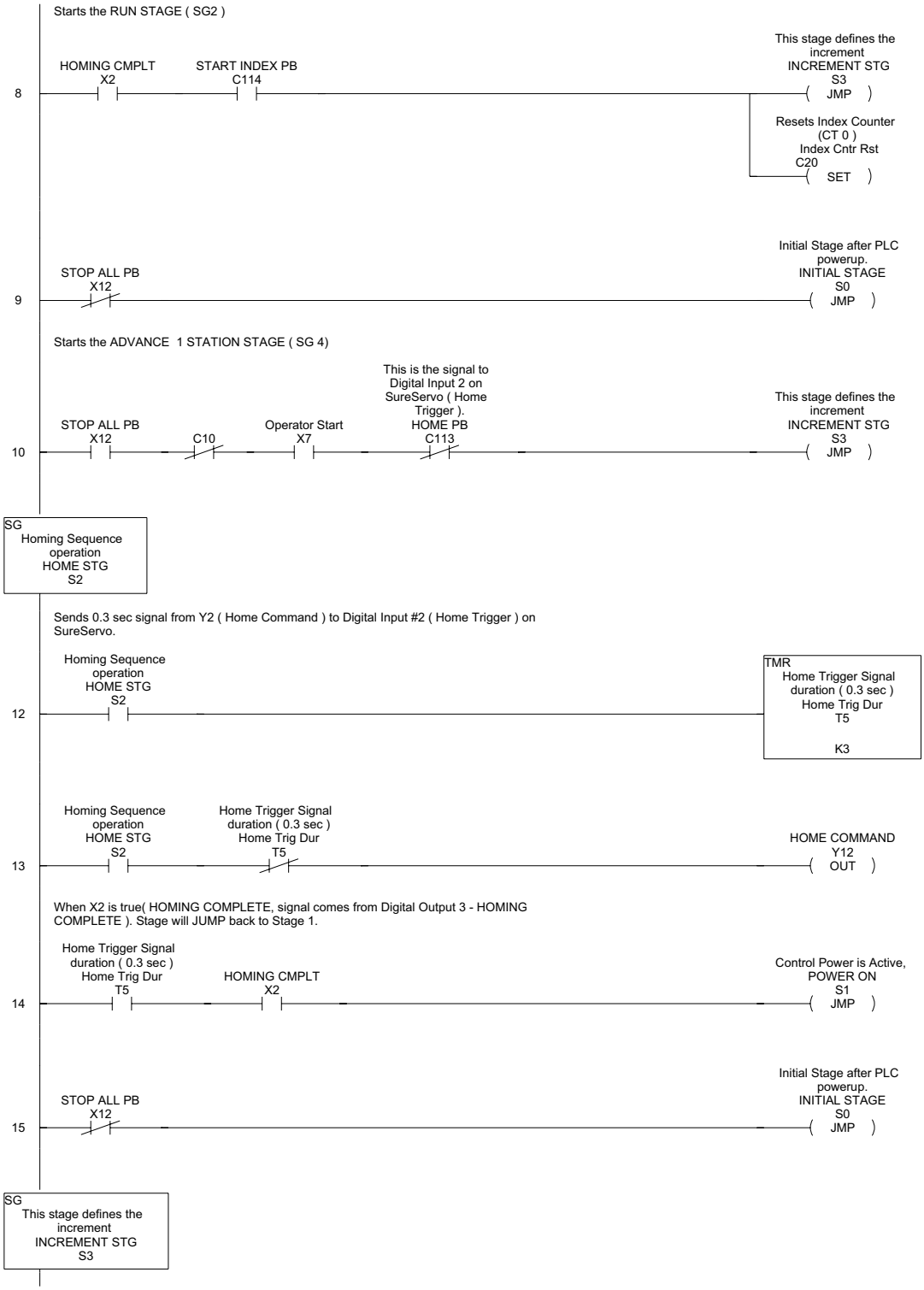
an extreme case.The target of the tuning should result in a behavior similar to as the following figure:



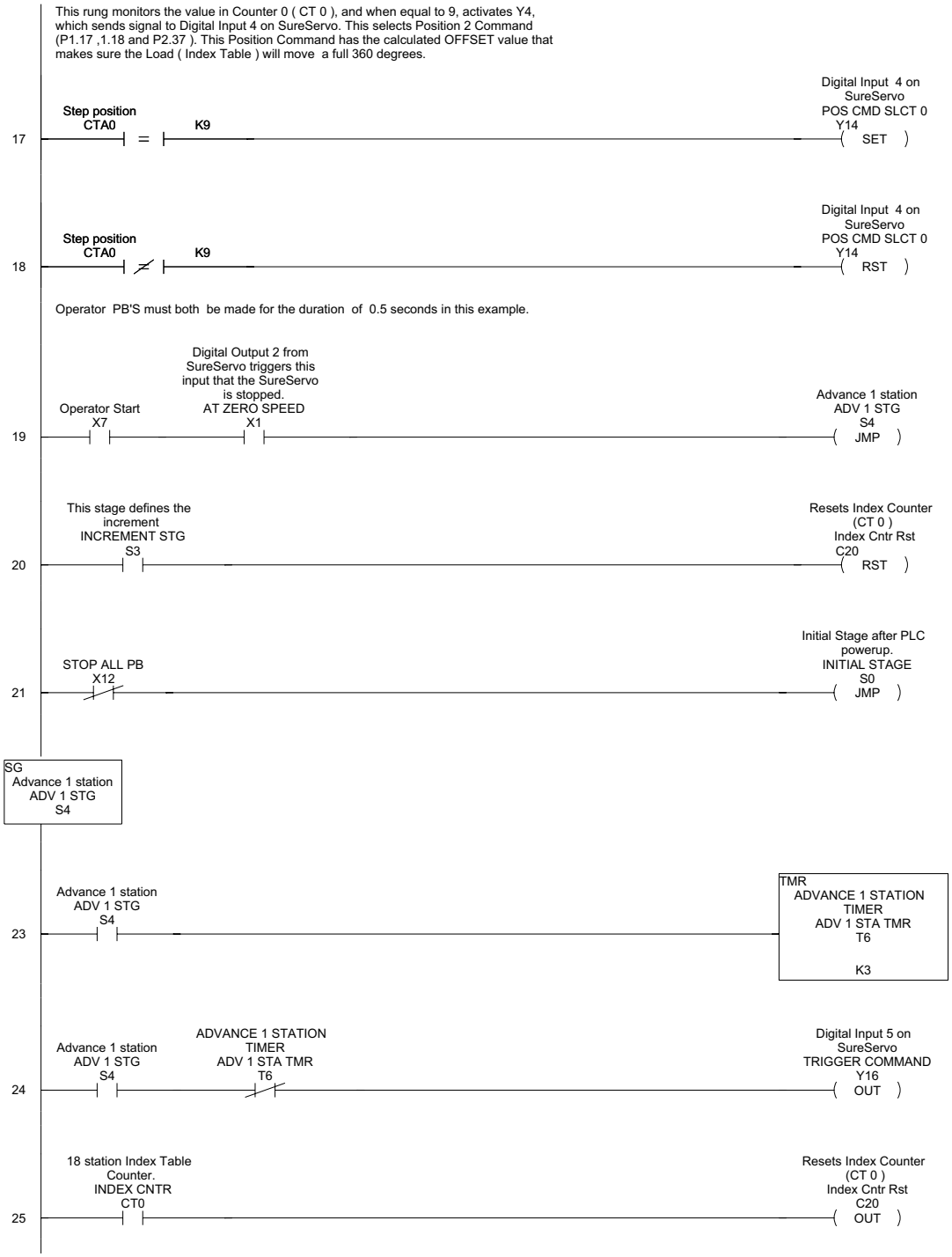
Ladder program



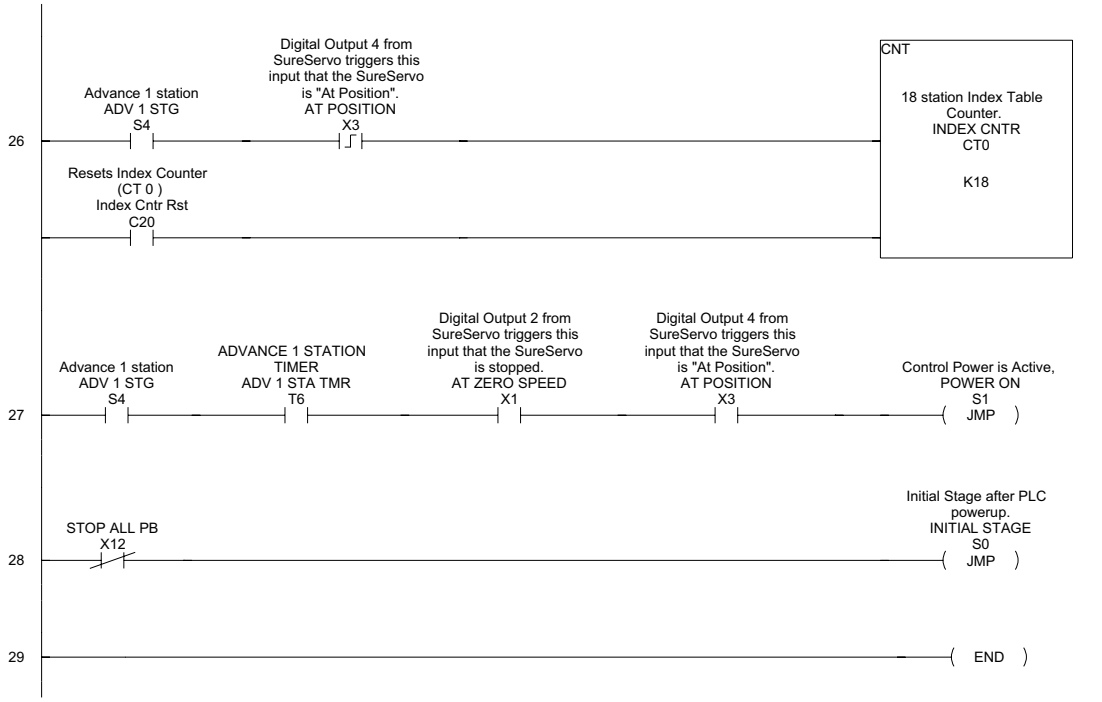
Ladder program continued



Ladder program continued



Ladder program continued



Automation Direct SureServo PRO Drives Configuration Report
Report Generated: 10/9/2007 6:38:41 PM
Config Name: AN-SERV-005 Servo Config.ssc
Motor Code: 11
Rev: 2.001

Parameter	Value
P0.00 - Software Version	2001
P0.01 - Drive Fault Code	0
P0.02 - Drive Status (Front panel display)	0
P0.03 - Analog Monitor Outputs	1
P0.04 - Status Monitor 1	0
P0.05 - Status Monitor	0
P0.06 - Status Monitor 3	0
P0.07 - Status Monitor 4	0
P0.08 - Status Monitor 5	0
P1.00 - External Pulse Input Type	2
P1.01 - Control Mode and Output Direction	1
P1.02 - Speed and Torque Limit	0
P1.03 - Output Polarity Setting	0
P1.04 - Analog Monitor Output Scaling 1 (CH1)	100
P1.05 - Analog Monitor Output Scaling 2 (CH2)	100
P1.06 - Analog Velocity Command Low-pass Filter	0
P1.07 - Analog Torque Command Low-pass Filter	0
P1.08 - Position Command Low-pass Filter	0
P1.09 - Preset Velocity Command / Limit 1	100
P1.10 - Preset Velocity Command / Limit 2	200
P1.11 - Preset Velocity Command / Limit 3	300
P1.12 - Preset Torque Command / Limit 1	100
P1.13 - Preset Torque Command / Limit 2	100
P1.14 - Preset Torque Command / Limit 3	100
P1.15 - Position 1 Command (Revolutions)	3
P1.16 - Position 1 Command (Counts)	5555
P1.17 - Position 2 Command (Revolutions)	3
P1.18 - Position 2 Command (Counts)	5556
P1.19 - Position 3 Command (Revolutions)	0
P1.20 - Position 3 Command (Counts)	0
P1.21 - Position 4 Command (Revolutions)	0

P1.22 - Position 4 Command (Counts)	0
P1.23 - Position 5 Command (Revolutions)	0
P1.24 - Position 5 Command (Counts)	0
P1.25 - Position 6 Command (Revolutions)	0
P1.26 - Position 6 Command (Counts)	0
P1.27 - Position 7 Command (Revolutions)	0
P1.28 - Position 7 Command (Counts)	0
P1.29 - Position 8 Command (Revolutions)	0
P1.30 - Position 8 Command (Counts)	0
P1.31 - Motor Code	11
P1.32 - Motor Stop Mode Selection	0
P1.33 - Position Control Mode (Internal Indexer)	1
P1.34 - Acceleration Time (Internal Indexer)	1250
P1.35 - Deceleration Time (Internal Indexer)	1250
P1.36 - Accel / Decel S-Curve	10
P1.37 - Inertia Mismatch Ratio	1761
P1.38 - Zero Speed Output Threshold	10
P1.39 - Target Speed Output Threshold	3000
P1.40 - Max Analog Velocity Cmd or Velocity Limit	3000
P1.41 - Max Analog Torque Cmd or Torque Limit	100
P1.42 - On Delay Time of Electromagnetic Brake	20
P1.43 - Off Delay Time of Electromagnetic Brake	20
P1.44 - Electronic Gear Numerator 1	1
P1.45 - Electronic Gear Denominator	1
P1.46 - Encoder Output Scaling Factor	1
P1.47 - Homing Mode	222
P1.48 - Homing Speed 1 Fast Search Speed	60
P1.49 - Homing Speed 2 Creep Speed	30
P1.50 - Home Position Offset (Revolutions)	-3
P1.51 - Home Position Offset (Counts)	0
P1.52 - Regenerative Resistor Value	40
P1.53 - Regenerative Resistor Capacity	60
P1.54 - In Position Window	100
P1.55 - Maximum Speed Limit	122
P2.00 - Proportional Position Loop Gain (KPP)	35
P2.01 - Position Loop Gain Boost	100
P2.02 - Position Feed Forward Gain (KFF)	5000
P2.03 - Smoothing Constant of Position Feed Forward Gain	5

P2.04 - Velocity Loop Proportional Gain (KVP)	500
P2.05 - Velocity Loop Gain Boost	100
P2.06 - Velocity Loop Integral Compensation (KVI)	100
P2.07 - Velocity Feed Forward Gain (KVF)	0
P2.08 - Factory Defaults and Security	0
P2.09 - Bounce Filter	2
P2.10 - Digital Input Terminal 1 (DI1)	101
P2.11 - Digital Input Terminal 2 (DI2)	127
P2.12 - Digital Input Terminal 3 (DI3)	124
P2.13 - Digital Input Terminal 4 (DI4)	111
P2.14 - Digital Input Terminal 5 (DI5)	0
P2.15 - Digital Input Terminal 6 (DI6)	108
P2.16 - Digital Input Terminal 7 (DI7)	0
P2.17 - Digital Input Terminal 8 (DI8)	0
P2.18 - Digital Output Terminal 1 (DO1)	101
P2.19 - Digital Output Terminal 2 (DO2)	103
P2.20 - Digital Output Terminal 3 (DO3)	109
P2.21 - Digital Output Terminal 4 (DO4)	105
P2.22 - Digital Output Terminal 5 (DO5)	107
P2.23 - Notch Filter (Resonance Suppression)	1000
P2.24 - Notch Filter Attenuation (Resonance Suppression)	0
P2.25 - Low-pass Filter (Resonance Suppression)	2
P2.26 - External Anti-Interference Gain	0
P2.27 - Gain Boost Control	0
P2.28 - Gain Boost Switching Time	10
P2.29 - Gain Boost Switching Condition	10000
P2.30 - Auxiliary Function	0
P2.31 - Auto and Easy Tuning Mode Response Level	68
P2.32 - Tuning Mode	4
P2.33 - Reserved	0
P2.34 - Overspeed Fault Threshold	5000
P2.35 - Position Deviation Fault Window	30000
P2.36 - Position 1 Velocity	122
P2.37 - Position 2 Velocity	122
P2.38 - Position 3 Velocity	1000
P2.39 - Position 4 Velocity	1000
P2.40 - Position 5 Velocity	1000
P2.41 - Position 6 Velocity	1000

P2.42 - Position 7 Velocity	1000
P2.43 - Position 8 Velocity	1000
P2.44 - Digital Output Mode	0
P2.45 - Index Mode Output Signal Delay Time	1
P2.46 - Index Mode Stations	6
P2.47 - Position Deviation Clear Delay Time	0
P2.48 - Backlash Compensation (Index Mode)	0
P2.49 - Jitter Suppression	0
P2.50 - Clear Position Mode	0
P2.51 - Servo Enable Command	0
P2.52 - Dwell Time 1 - Auto Index Mode	0
P2.53 - Dwell Time 2 - Auto Index Mode	0
P2.54 - Dwell Time 3 - Auto Index Mode	0
P2.55 - Dwell Time 4 - Auto Index Mode	0
P2.56 - Dwell Time 5 - Auto Index Mode	0
P2.57 - Dwell Time 6 - Auto Index Mode	0
P2.58 - Dwell Time 7 - Auto Index Mode	0
P2.59 - Dwell Time 8 - Auto Index Mode	0
P2.60 - Electronic Gear Numerator 2	1
P2.61 - Electronic Gear Numerator 3	1
P2.62 - Electronic Gear Numerator 4	1
P2.63 - Velocity and Position Deviation Scaling Factor	0
P3.00 - Communication Address	2
P3.01 - Transmission Speed	3
P3.02 - Communication Protocol	8
P3.03 - Communication Fault Action	0
P3.04 - Communication Watchdog Time Out	0
P3.05 - Communication Selection	0
P3.06 - Reserved	0
P3.07 - Communication Response Delay Time	0
P4.00 - Fault Record - Most recent (N)	14
P4.01 - Fault Record (N-1)	14
P4.02 - Fault Record (N-2)	9
P4.03 - Fault Record (N-3)	9
P4.04 - Fault Record (N-4)	9
P4.05 - JOG Function	160
P4.06 - Force Outputs Command	0
P4.07 - Input Status	5

P4.08 - Reserved	8
P4.09 - Output Status	11
P4.22 - Analog Velocity Input Offset	0
P4.23 - Analog Torque Input Offset	0