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Subject: PnP (SMAC) Head Tuning Guide

This document provides guidelines on tuning the PnP (SMAC) head, especially if it exhibits errors while homing the Z-Axis or the probe "vibrates" when it is at home position. It also outlines configuring (calibrating) MEI and saving MEI parameter file.

These errors, especially "vibration" on the SMAC head may be due to some output voltage "drift" from either the SMAC head or MEI card.

First "configure" the MEI card. This will test the MEI card, configure its internal DAC offsets and re-load the motion parameters from motion parameter file. **Exit completely from AH400**, navigate to "C:\Install\MEI and Autopak\" directory.

DOS Mode

Open DOS window and at DOS command prompt type config –f mei.abs -f C:\Install\MEI and Autopak\config –f mei.abs -v Where mei.abs should be the actual file name of MEI motion parameter on Handler Computer for the particular PP100/PS-System, for example 102002M.abs

Windows Mode (recommended)

Invoke the Motion Console program MC_DSP_95.EXE

Click on "Configure Controller", select all axes, check the box labeled "Save to Boot Memory" and then click on "Calibrate DAC Offset" button



Once calibration is done, the screen will contain New Offset Values.

Saving Parameter File

- Save values to Boot Memory, ensuring "User I/O Configuration and Settings" box is checked.
- Save parameters to file, by clicking on "Upload To File" button, which will upload firmware from controller's memory into a parameter file.

State	Axis	Name	Offset	New Offset
Currently Enabled		X-Gantry	45	135
Currently Enabled		Y-Gantry	318	305
Currently Enabled		Z-Gantry	229	82
Currently Enabled		R -Rotation	234	44
Currently Enabled	4	Not Used	55	344
Currently Enabled		Not Used	187	338
Currently Enabled	6	Option Shuttle	271	52
Currently Enabled	7	Not Used	282	128
Calibrate DAC Offset				<u>E</u> nable <u>D</u> isabl





When saving the parameter file, give it a name in format **MTSSyymmdd.abs**

- M = Servo Motor and Amplifier type M for Mitsubishi, Y for Yaskawa
- T = Gantry Type, T for THK, N for NSK
- S = PnP Head type,
 - S for SMAC
 - I for IntellePro
- S = Shuttle Transfer Motor,
- S for Single Stack (2" tall) and D for Double Stack (3" tall) yymmdd = Year, Month Day
- Extension MUST be abs

Here file is: MTSD050506.abs

After Saving the file, delete the file 8Axis.abs and then Copy this new file and rename the copied version to 8Axis.abs

 Upload Firmware From Controller "0" To File
 ? ×

 Save in:
 Motion_and_IO
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To load a particular MEI firmware file into MEI card's memory:-

	Download Firmware To Controller "O" From File	? ×
	Look in: 🔁 Motion_and_IO 💿 🖻 💆 💣	
Click on the button "Download From File" IN the dialog window select the required file, here the selected file is MTSD050506.abs And click on Open.	i Baxis.abs MTSD050506.abs MTSS040910.abs MTSS040910.abs MYSS040910.abs	
	File <u>n</u> ame: MTSD050506.abs	<u>O</u> pen
	Files of type: Firmware Files (*.abs)	Cancel

2 X

If Configure and Calibrate DAC Offsets procedures do not solve the problem, then proceed with the following guidelines.

Invoke AH400, go to System \rightarrow Servo, and select Z-Axis and "Home" the Z-Axis. Note: If vibration occurs at "Park" position, then repeat following steps with SMAC head in the "Park" position.

On Handler computer, navigate to "C:\Install\MEI and Autopak\" directory and invoke the MC_DSP_95.EXE Motion Console program.

Motion Console				
<u>E</u> dit <u>V</u> iew <u>W</u> indow <u>H</u> el	p			
Hardware Summary				
Controller List		-A <u>x</u> is List		
Controller Status Typ	e Address Axes	Controller	Axis	Name
😃 O OK PC>	< 0x300 8	0	0	X-Axis
			1	Y-Axis
			2	Z-Axis
		Q0	3	R-Rotation
[Q0	4	Controller Mitsubishi,
Add Controller	About Controller	Q⁰	5	Controller Mitsubishi,
		LQ0	6	Option Shuttle
Remove Controller	Configure Controller	$\square \bigcirc 0$	7	Controller Mitsubishi,
Refresh Controller List	R <u>e</u> set Controller			
Firmware	User1/0			
Upload To File				
	Close All <u>W</u> indows			
Download From File				
No. 2010-00	Save To Boot Memory	Open Axis	Window	v Close Axis Window

Select Axis-2, which is the Z-Axis

Within "Motion Configuration" tab note the value for "Int. Max", "Offset" and "Error". Here, the error is -3 when Offset is 0 (zero)

Hotion Console File Edit View Window Help			
Axis Operation: Controller "0", Axis Name: "Z-Axis"	Axis 2		
Motion Configuration Axis Configuration	Graph	- Tuning Parameters	1
Absolute Position 1	Delay 0 (Seconds)	Select Coefficient Set: Stand	ard 💌
(Counts)	Velocity 100000	Kp 38	Int. Max 500
C Belative	Acceleration	Kd 180	Line 32/67
(Counts) Repeat C © Irapezoidal	(Cnts/Secs2)	Accel FF 10	Scale 1
Sync. Motion C S-Curve	Uerk 0 (Cnts/Secs3)	Vel. FF 0	Friction FF 0
Decelerate Position Status Stop Stop E-Stop Error: Abort (Space) Celeration: Clear Position	Axis Status Clear Fault Clear Fault State: NO EVENT Source: None	Status Sequencing? No In Motion? No In Position? Yes Frames Left? No Motion Done? Yes	Dedicated I/O Positive Overtravet: High Negative Overtravet: High Home Sensor: High Amplifier Fault: High Amp Enable: Low Amplifier € Enable
	-7000	Сору	Save <u>C</u> lose

Switch to "Graph" tab, click on the drop down arrow for "Graph When" and select "Continuous" from the options. Similarly, for "Graph What" select "Error". Observe the "Error (counts)"



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In Motion Configuration change the DAC output offset by setting the "Offset" value such that there is no vibration, typical values for some SMAC heads were 300, 400 and 450. Set the "Int. Max" to about twice the value of "Offset", for example 600, 800 or 900.

Name: "Z-Gantry"		
otion Configuration Axis Config	uration Graph	
Motion Profile	Motion Parameters	Tuning Parameters
<u>Absolute</u> Position 1 (Counte)	0 (Seconds)	0 Select Coefficient Set: Standard
Position 2 70	Nelecity Free	NP 60 / Int. Max 600
(Counts)	(Cnts/Secs)	UU Ki 5 Offset B00
Carment	Acceleration 1e+0	06 Kd 280 Lin DAC output offset
Benest C G Tranez	oidal	Accel. FF 10 Scale 1
Sync. Motion T C S-Curv C Parabo	e Jerk lic (Cnts/Secs3)	0 Vel. FF 0 Friction FF 0
Decelerate	Axis Status	Dedicated I/O
Stop		ar Fault Sequencing? No. Negative Overtravel: High
	State: NO	VENT In Motion? No Home Sensor: Low
Velocity:	Source: N	one In Position? Yes Amplifier Fault: High
ort (Space) Acceleration:		Frames Left? No Amp Enable: Low Motion Dono? You Amplifier
Clear	Position 1	C Disable

After changing the "Offset" and "Int Limit" observe the "Error (counts)" on the Graph screen. Ideally, there should be no error – zero error, like below.

If error is not close to zero, try different values for "Offset"

Action Configurat	ion Axis Configuration Graph			
1.0 [] 0.8 unpunpunpunpunpunpunpunpunpunpunpunpunpu	Error (counts)			Graph Continuous
Decelerate	Postition Status Command: 0 Actual: 0 Error: 0 Velocity: 0 Acceleration: 0	Axis Status Clear <u>Fault</u> State: NO EVENT Source: None	Status Sequencing? No In Motion? No In Position? Yes Frames Left? No Motion Done? Yes	Dedicated I/O Positive Overtravet: High Negative Overtravet: High Home Sensor: Low Amplifier Fault: High Amp Enable: Low Amplifier

Within "Axis Configuration" tab, under "Software Limit Configuration" set the 1000 as "Maximum Error" value.

sis marile. Zhuanuy	,						
Motion Configuration	Axis Configuration Graph						
Servo 💌 M	otor Type Closed Loop		Software Lir	nit Configuration Maximu	m Error	Action:	
-Stepper Configurat	ion		Error Limit	•	1000	Abort	-
Step Output Speer	d 🔽 Disable step pulse	output 💌	Hardware Li	mit Configuration	e limit value	Action:	
Bipolar (-10V to +10	V) 💌 Output Control Volta	ge	Negative L	mit 🗾 High-A	ctive 💌	None	•
Home only (active h	igh or active low) 🗾 Hor	me/Index	- General Par	ameters			- 6
Low-Active	Amp Enable Polarity		Stop Decel	Rate 💌	e+006	counts/[sec^2	r I
Encoder 💌 Fer	edback Standing Only 💌	Integration Mode					
Decelerate	Postition Status	Axis Status -		Chabin	Ded	icated I/O	-
	Command: 317		Clear <u>F</u> ault	Status	Pos	itive Overtravel:	High
	Actual: 317	State:		Sequencing? No	Ney	Home Sensor:	Low
E-Stop	Error:	Source:	None	In Position? Yes		Amplifier Fault:	High
	velocity:	coarce.	T CONS	Frames Left? Yes		Amp Enable:	Low
bort (Space)				Motion Done? Yes		Amplifier	
bort (Space) A		f					8 8 -

Save every thing - see Saving Parameter File on page-2

If the Error can not be brought near zero and there is still vibration on the PnP nozzle, then within AH400 Gantry screen, bring PnP head to "Park" position and change Z_{Drop} and Z_{Pick} from default value of -0.250 to -0.300 or -0.350 but not less than -0.400. Do the same for "Vision" location and save the package file. If this reduces Error and vibration, change all package files accordingly.

Technical Background

The MEI card produces an analog $\pm 10V_{DC}$ signal for motion control. While in a "wait" state, this voltage will drift and the encoders on the amplifiers will try to compensate for the change in position, these results in vibration. To nullify the drift on the SMAC, a voltmeter can be placed between GND (pin 1 of P7) to (Pin 9 of P7). The MEI motion parameters must be opened and the OFFSET box adjusted until the meter reading is $0V_{DC} \pm 500mv$. The OFFSET box value can be adjusted in either the positive or negative direction. For example - on one machine the value read 2.5V_{DC} $\pm 300mv$, a value of -240 was placed into the OFFSET box and the value read at the meter dropped to +500mv from zero.

Watch the encoder count error displayed on the MEI Motion Console screen, with the objective of having the error as close to zero as possible.