TB112 (Rev2) - Mitsubishi a500 Inverter ATC Settings

Overview:

This technical bulletin describes how to set the parameters for the Mitsubishi a500 series inverter and applies to ATC2 and current PLC programs. The previous version of this document applied to the ATC1 PLC program and contained instructions on using vector mode.

Inverter Connections:

R, S, T – 3-Phase Power In

U, V, W – Spindle Motor Power Out

STF - Spindle Forward
STR - Spindle Reverse
RES – Spindle Reset
RH – Spindle Orient
SD - Input Common
2 - 0-10VDC Analog Input
5 - 0-10VDC Common
A - Inverter Fault - (Normally Open)
C - Inverter Fault Common
FU - Orient Complete
RUN - Zero Speed
SE - Inverter Output Common

P, P1 - Braking Resistor

FR-A5AP Add-on Card Connection
5V – 5VDC from 5th axis encoder input and 5VDC to spindle encoder
SG – 5VDC common from 5th axis encoder input and 5VDC common to spindle encoder
PA1 - Channel A to 5th axis encoder input and channel A from spindle encoder
PA2 - Channel A' to 5th axis encoder input and channel A from spindle encoder
PB1 - Channel B to 5th axis encoder input and channel B from spindle encoder
PB2 - Channel B' to 5th axis encoder input and channel B' from spindle encoder
PC1 - Channel Z to 5th axis encoder input and channel Z from spindle encoder
PC2 - Channel Z' to 5th axis encoder input and channel Z' from spindle encoder
**Mitsubishi Inverter Parameter Settings:**
Model: **FR-A520-7.5k-NA** and **FR-A5AP** Orientation Control/PLG Feedback optional card

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Name</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>High-speed maximum freq.</td>
<td>200 Hz - must set this first to change parameter 1</td>
</tr>
<tr>
<td>1</td>
<td>Maximum Frequency</td>
<td>200Hz (4-pole@6000RPM) - see parameter 18</td>
</tr>
<tr>
<td>2</td>
<td>Minimum Frequency</td>
<td>0 Hz</td>
</tr>
<tr>
<td>3</td>
<td>Base Frequency</td>
<td>60 Hz</td>
</tr>
<tr>
<td>7</td>
<td>Acceleration Time</td>
<td>2-5 sec</td>
</tr>
<tr>
<td>8</td>
<td>Deceleration Time</td>
<td>2-5 sec</td>
</tr>
<tr>
<td>13</td>
<td>Starting Frequency</td>
<td>0 Hz</td>
</tr>
<tr>
<td>20</td>
<td>Accel/decel reference frequency</td>
<td>Same as parameter 1</td>
</tr>
<tr>
<td>52</td>
<td>DU/PU main display data selection</td>
<td>19 - to monitor encoder position</td>
</tr>
<tr>
<td>72</td>
<td>PWM frequency selection</td>
<td>10 - eliminates the metallic sound at low speeds</td>
</tr>
<tr>
<td>73</td>
<td>0-5V/0-10V Selection</td>
<td>0</td>
</tr>
<tr>
<td>79</td>
<td>Operation Mode Selection</td>
<td>2 - External Operation Mode prevents change of parameters. Set to 1 to change parameters.</td>
</tr>
<tr>
<td>80</td>
<td>Motor Capacity</td>
<td>9999</td>
</tr>
<tr>
<td>81</td>
<td>Number of Poles</td>
<td>9999</td>
</tr>
<tr>
<td>182</td>
<td>RH terminal function</td>
<td>22 - Orientation Start</td>
</tr>
<tr>
<td>190</td>
<td>RUN terminal</td>
<td>100 - for negative logic output</td>
</tr>
<tr>
<td>194</td>
<td>FU terminal function</td>
<td>27 - Orientation Complete</td>
</tr>
<tr>
<td>240</td>
<td>Soft-PWM setting</td>
<td>1 - allows p72 to be set &gt;5</td>
</tr>
<tr>
<td>902</td>
<td>Freq. setting voltage bias</td>
<td>Set according to procedure in inverter manual. Commanded speed should be zero (M3S0)</td>
</tr>
<tr>
<td>903</td>
<td>Freq. setting voltage gain</td>
<td>Set according to procedure in inverter manual. Commanded speed should be max (M3Smax)</td>
</tr>
<tr>
<td>350</td>
<td>Stop position command selection</td>
<td>0 - Internal stop position</td>
</tr>
<tr>
<td>355</td>
<td>Dynamic Braking width</td>
<td>12</td>
</tr>
<tr>
<td>356</td>
<td>Internal stop position</td>
<td>Depends upon the spindle encoder index pulse in relation to the orientation position.</td>
</tr>
<tr>
<td>357</td>
<td>In-position zone</td>
<td>24</td>
</tr>
<tr>
<td>358</td>
<td>Orientation Torque</td>
<td>2 – Provides greater torque during orientation</td>
</tr>
<tr>
<td>359</td>
<td>PLG rotation direction</td>
<td>1 or 0 depending upon how A/B encoder channel wired</td>
</tr>
<tr>
<td>362</td>
<td>Position loop gain</td>
<td>1</td>
</tr>
<tr>
<td>369</td>
<td>PLG pulse count</td>
<td>1024, but depends upon encoder cpr</td>
</tr>
<tr>
<td>370</td>
<td>Control mode selection</td>
<td>1 - V/F control with PLG feedback</td>
</tr>
<tr>
<td>199</td>
<td>Reset to factory defaults</td>
<td>9999</td>
</tr>
</tbody>
</table>
Programming Mitsubishi A500 Inverter:

**Note** - When setting up a Mitsubishi inverter for the first time, set parameter 18 **FIRST**. This allows you to change parameter 1 and set the others without difficulty.

1. Press [MODE] until you see **OPnd** on the screen.
2. Press the up arrow key. You will see **PU**.
3. Press [MODE] until you see **Pr.** on the screen.
4. Press [SET]. You should see P.000 with the first zero flashing.
5. Use the up or down arrow keys to set the first number of the parameter.
6. Press [SET]. The next zero should be flashing.
7. Repeat steps 3 and 4 to set the parameter number.
8. Press [SET]. Set parameter 78 to 1 or (79 to 4) in order to set the other parameters.
9. Use the up or down arrow key to edit the parameter value.
10. Press and hold [SET] for 1.5 seconds to set the value. - Wait for blink
11. Either press [SET] and use the up or down arrow keys to step through the parameters in sequential order or press [MODE] and start from step 1 to set other parameters.
12. Continue until all the parameters have been set. Set parameter 78 back to a 2 or (79 to 2) otherwise you won't be able to get back to **OPND** mode.
13. Press [MODE] until you see **PU** on the screen.
14. Press the down arrow key. You will see **OPND**.

**Special Parameters:**

Parameters 902 and 903 are slightly different than the rest of the parameters. 902 and 903 have two values in each parameter. Parameter 902 contains the Low Frequency (in Hz) and the corresponding voltage from the PLC for that frequency. Parameter 903 contains the High Frequency (in Hz) and the corresponding voltage from the PLC for that frequency. Parameters 902 and 903 will automatically display the voltage being sent from the PLC when they are set. To do this, follow the procedure below.

**Setting Parameters 902 and 903:**

1. Put the inverter in PU mode.
2. Change to parameter 902 in the programming mode.
3. The value displayed should be 0.00 Hz. If it is not, use the arrow keys to adjust it to 0.
5. Issue an M3S0 command in MDI.
7. Change to parameter 903.
8. The value displayed should be the same as parameter 1, 18, or 20, i.e., the maximum output frequency. For the typical 6000RPM setting, it would be 200.0 Hz. The default setting is at 60Hz, so use the arrow keys to set it at 200Hz.
10. Issue an M3S6000 in MDI and make sure the spindle override is at 100%.
11. You will notice the display is indicating the voltage, without the implied decimal point. A 100 corresponds to 10.0V for example. It is normal to see the value change slightly, say from 101 to 102.
12. Repeat step 4.
13. Engage E-stop and change the inverter to OPND mode.
ATC Override:

When using the ATC1/2 PLC program, the technician is required to use an override to perform certain M functions when using them from MDI. To perform an M80 or M81 from MDI, the operator must press and hold the AUX12 key on the jog panel prior to entering MDI. The key must continue to be pressed while the custom M functions are used. The Aux 12 key is not labeled but can be seen on the picture above and is marked with the * directly above the MPG button.

Orienting the Spindle for Proper ATC Use:

Parameter # 356 tells the inverter where to position the spindle by encoder counts to properly orient for use with an ATC.

1. Home the machine.
2. Bring the carousel in with an M80 while holding AUX12.
3. Slowly jog the Z-axis down and rotate the spindle by hand until the "half key" is lined up with the notch in the ATC carousel rack.
4. From the run menu on the inverter, press [MODE] until the LED beside MON lights up.
5. Press [SET] to change monitor display. (2 times for encoder counts)
6. Record this number and enter this number in parameter 356.
ATC Installation Checklist

Once all the Mitsubishi parameters are correct, you must ensure that the relevant ATC parameters are set on the Centroid control.

"Umbrella" type tool changers:

- 1. Power-up and home.
- 2. Air Pressure regulator set at ~7kg/cm^2.
- 3. Air Pressure switch Range is 90psig.
- 5. Check head mounted unclamp switch for operation with spindle off. Remove any tool.
- 6. Enter manual spindle mode & start spindle at slow speed, check that unclamp switch doesn't work.
- 7. Execute M80* - carousel should come in. Adjust speed and cushioning if needed.
- 8. Execute M81* - carousel should go out. Adjust speed and cushioning if needed.
- 9. Execute M15* - drawbar should unclamp and air blow will come on. Adjust airflow if needed.
- 10. Execute M16* - drawbar will clamp and air blow goes off.
- 11. Execute M22 - Z axis moves to tool change position.
- 12. Execute M21 - Z axis moves home.
- 14. Execute M19 - Spindle will orient. Check to make sure it is aligned.
- 15. Execute M80* to bring carousel in. Check alignment with ATC tabs.
- 16. Execute M81* to retract carousel.
- 17. Execute M5 to turn off orient. Move spindle by hand.
- 18. Check the Tool Index + and - functions. Reverse motor operation if needed.
- 19. Use the tool index keys to align tool #1.
- 20. Execute an M18, verify "Tool #1 set in ATC" message in the message window.
- 22. Verify ATC changed to tool #2 – Press Alt + K to verify carousel at Bin 2.

* - AUX12 must be pressed.

"Swing Arm" type tool changers:

- 1. Power-up and home.
- 2. Air Pressure regulator set at ~7kg/cm^2.
- 3. Air Pressure switch Range is 90psig.
- 5. Check head mounted unclamp switch for operation with spindle off. Remove any tool.
- 6. Enter manual spindle mode & start spindle at slow speed, check that unclamp switch doesn't work.
- 7. Execute M22 - Z axis moves to tool change position.
- 10. Execute M19 - Spindle will orient. Check to make sure it is aligned.
- 11. Execute M5 to turn off orient. Move spindle by hand.
- 12. Check the Tool Index + and - functions. Reverse motor operation if needed.
- 13. Use the tool index keys to align tool #1.
- 14. Execute an M18, verify "Tool #1 set in ATC" message in the message window.
• 15. Execute a T2M6.
• 16. Verify ATC changed to tool #2.

Document History

Rev2 Created on 2015-04-29 by #270
Rev1 Created on 2009-12-10 by #240