**Mounting Card Incremental DVT**

**UUT**

|  |  |
| --- | --- |
| Top Level Part # ...………………….. | FMP100-25-EMA |
| Revision …………....………………….. | A |
| Version……………..………………….. | 0.01 |

**Initial Reviewer**:

|  |  |  |
| --- | --- | --- |
| Name…..……………………………….. | J. Stewart |  |

**Status**:

|  |  |
| --- | --- |
| Engineering Approvals………………… |  |
| Total Units Tested……………………... | 1 |
| Open Items……………………………... | none |
| Critical Failures….……………………... | none |

##### Summary:

|  |
| --- |
| Fan Controller/Temp   * Large temperature delta between U7 IC on MC and baseplate temperature, just an observation, no failure. Right before the fan comes on at around 70 degrees C baseplate was 30 degrees C cooler than U7 on MC.   STO   * Tested unit output is not disabled by STO, during current tests 24v was applied to STO connector but it could be disconnected, and output current would not be affected. This was due to buss wire jumpers on R14, R15, and R16 bypassing STO on this mounting card. R14, R15 were removed to verify STO functionality, R16 was very hard to reach as it is under the drive which is already soldered so it was left. * With R14, R15 jumpers removed the STO fault would toggle properly, but as soon as 24v was applied to turn off STO fault short circuit fault would come up. This short circuit fault cannot be removed without power cycling or fault reset. After having this problem efforts were made to remove R16 to see if that one remaining jumper was the cause. After removing R16 the short circuit error persisted. * **FINAL ANSWER** The STO issue was finally solved by installing a resistor and a bypass cap on a GPIO expander chip. A 1k ohm resistor was installed @ RY109 and a .1Y cap installed @ CY1. These were pads for NI components. Mason is working on ECO for this issue.   Peak Current/Foldback   * Peak current can be commanded; however, current scaling is off by a factor of ten times lower. 10VDC ref I/P s/b 50A @ 5 A/V, it is only 5A. Unit needs to be set to 50A/V to drive peak current of 50A. Looking at some production unit project files they are set at 50 A/v which seems to be a production workaround for this scaling issue. THIS WAS FOUND TO BE AN ISSUE WITH ACE, USING ACE 1.2021.4 WORKED CORRECTLY, (when current scaling at 50 A/v was set in older versions of ACE and saved to the drive then the drive opened in ACE 1.2021.4 it will show 5 A/v. It looks like a decimal or something in the wrong place the way the older versions of ACE save scaling.) Tri suggested I try the newer ACE; thanks go to him for the suggestion. * Foldback as stated in datasheet Pg. 3 says the drive can be commanded to up to 10 seconds of foldback. The foldback is controllable in ACE 1.2020.3 but not to any value over 2 seconds. This is caused by the data in the M.B. EEPROM (Value 40 in EEPROM), I verified it was set to 2 seconds maximum fold back. Either changing the datasheet to reflect 2 seconds foldback time max or changing the EEPROM data for 10 second maximum would fix this incongruency. |

**Equipment Used in Test**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Part Number** | **Serial Number** | **Accuracy** | **Cal Date** | **Cal Due**  **Date** |
| Digital Multi-Meter | HP-E2373A | 3803J31313 | 0.7% +10Mv | 8/23/21 | 8/23/22 |
| Power Supply | BK 1760 | 99081067 | ± 1.0% full scale | 8/23/21 | 8/23/22 |
| Current Probe | Agilent 1146A | US40000875 | ± 10.0% full scale | 9/7/21 | 9/7/22 |
| Oscilloscope | Tektronix TDS1032B | C030136 | ± 2.0% full scale | 9/7/21 | 9/7/22 |
| Function Generator | Wavetek 19 | 152217 | Function Generator | 8/23/21 | 8/23/22 |
| 50A 100Mv Shunt | Empro  HA-50-100 | Not Serialized | 0.002Ω  0.25% | Not Required |  |
| 200A 100Mv Shunt | Empro  HA-200-100 | Not Serialized | 0.0005Ω  0.25% | Not Required |  |
|  |  |  |  |  |  |

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**Information to Gather Before Starting the Test**

**ECO or Production Manual:**

|  |  |
| --- | --- |
| ECO #**. . . . . .. . .. . . . . . . . .. .** | 15404 |
| Model, Rev & Version of Top Assembly, from ECO | FMP100-25-EMA |
| Rev & Version of Mounting Card | XMC1XFCE01A-100=0.01 |
| Product Engineer **. . .. . . . . . . . .** | Mason Karbassian |
| Product Manager **. . .. . . . . . .** | Tri Phan |
| Customer **. . . . . . . . . . . . . . ..** | AMC |

**Under Test:**

|  |  |
| --- | --- |
|  | **FMP100-25-EMA** |
| Top Level Serial Number **. . . . . . . . . . . ..** | Not Serialized |
| Amplifier Rev & Version **. . . . . . . . ..** | A/0.01 |
| Amplifier SN **. . . . . . . . . . . . . . . . . .** | 99999-1001 |
| Mounting Card Rev & Version**. . . . . . . . .** | XMC1XFCE01A-100=0.01 |
| Mounting Card SN **. . . . . . . . . . . . . . . . . .** | 85203-1001 |

**Firmware Version:**

|  |  |
| --- | --- |
|  | **FMP100-25-EMA** |
| Drive Firmware **. . . . . . . . . . . . . . . . . . . . . . . .** | FE-EM-1-2021-4-2.fcf |
| Ace Version **. . . . . . . . . . . . . . . . . . . . .** | 1.2021.4 Patch 1.1 |

**Tested By:**

|  |  |
| --- | --- |
|  | FMP100-25-EMA |
| Name **. . . . . . . . . . . . . . . . . . . . . . . . . . .** | J. Stewart |
| Date **. . . . . . . . . . . . . . . . . . . . . . . . . . .** | 10/11/2021 |
| Has computer test been performed? **. . . . . .** | No N/A |
| Has burn-in been performed? **. . . . . . . . . .** | No N/A |

# Top Level DVT Tests

## Manual Tests

Objectives:

* Use test station and test cable to verify amplifier functionality.

Setup:

|  |  |
| --- | --- |
| Test Station HV | 72VDC |
| STO test voltage | 24VDC |
| Inductive Load | 150 Uh |
| Network connection type | USB & ECAT |

Test Cases:

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Case** | **Description** | **Results** | **Notes** |
| Analog Input |  | N/a | Previously tested on FMP060-25-EM |
| Digital I/O |  |  | Previously tested on FMP060-25-EM |
| Motor Feedback |  |  | Previously tested on FMP060-25-EM |
| STO(s) |  |  |  |
| +5V User Supply |  |  | Previously tested on FMP060-25-EM |
| EtherCAT |  |  | PASS |
| Load Test (25A) |  |  | PASS0 |
| Peak Current (50A) |  |  | PASS |
| Fan Control |  |  | PASS |
| Address Switches |  |  | Previously tested on FMP060-25-EM |
| LEDs |  |  | PASS |

## Fan Control Temperature Test

Objectives:

* Operate MC in Kuka style case and fan.
* Plot cooling fan operation.

Setup:

|  |  |
| --- | --- |
| Test Station HV | 72VDC |
| STO test voltage | 24VDC |
| Inductive Load | 300uH ph-ph |
| Network connection type | USB |

**Results:**

**A picture containing text, indoor

Description automatically generated**

Chart

Description automatically generated



## Network Performance

### FMP100-25-EMA

Objectives: This tests the drive’s ability to communicate via Ethernet. under a variety of circumstances including powering the drive via 3-phase AC (if appropriate) and enabling the bridge, pushing current into a load.

**Setup:**

|  |  |
| --- | --- |
| HV Voltage [<Rated HV>](#_Additional_Details:_Rated_1) | 2 |
| HV: DC | DC |
| HV test station | Test station |
| Logic Power Voltage | External |
| Loads: Inductance | 150 mH |
| Load Inductance from test station | Test station |
| Load Resistance | None |
| Commanded phase currents MAX |  |
| Commanded Phase Currents MIN | 0 |
| Commutation | Yes |
| Commutation Trap mode | Trap |
| Source of commutation signals |  |
| Network Communication Protocol | EtherCAT |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ether Cat LED Table | IN PORT |  | OUT PORT |  |
| LED ---> | LINK | STATUS | LINK | ERROR |
|  |  |  |  |  |
| STATE |  |  |  |  |
|  |  |  |  |  |
| INIT | G |  | G |  |
| PREOP | Green Flickering | 200mS on 200mS off | Green Flickering |  |
| SAFEOP | Green Flickering | 200mS on 1000mS off | Green Flickering |  |
| OP | Green Flickering | G | Green Flickering |  |
|  |  |  |  |  |

Evaluating Results:

|  |  |
| --- | --- |
| PASS / FAIL |  |
|  | Network communication functioned reliably, while drives were powered up and delivering output current into loads. |
|  | Host application reported no gross communications failure and no more than a limited number of retry, single failures. |

## Peak Current and Fold-back

Objectives:

* Measure the amplifier’s peak current while operating at high working temperature.
* Observe output current folding back from peak to continuous level.

**Results:**

|  |  |
| --- | --- |
| Peak Current Measurement | **FMP100-25-EMA** |
| Bus Voltage **. . . . . . . . . . . . . . .** | 72 V |
| Measured peak current **. . . . . . . . . . . . . . .** | Phase A |
| Which phases **. . . . . . . . . . . . . . . . . ..** | A 🡪 C |
|  |  |
| Current Fold-back | Yes |
| Time at Peak Current | 2.0 Sec |
| Fold-back Time | 2.0 Sec |
| Is fold-back linear? | Yes |
| Measured continuous current | 24.8 Amps |
|  |  |

**Fig.1 Peak Current**

A screenshot of a computer

Description automatically generated with medium confidence

**Figure.2 Nominal current, 40% of peak 20A 10 mV per amp**

Graphical user interface

Description automatically generated

Evaluating Results:

|  |  |
| --- | --- |
| PASS / FAIL |  |
| PASS | Measured peak output current is within +/- 10% of rated peak current in all commutation angles and polarities. |
| PASS | Current folds back smoothly in a straight line from peak to continuous, at +/-10% rated values for peak time and fold-back time. |
| NOTE | Ferrite was used to achieve peak currents on all motor outputs and bus voltage. |