
MP113 Troubleshooting Guide

INTRODUCTION

This guide is intended to assist customers with diagnosing MP113 problems. It assumes the rest of the customer system functions properly and it is NOT intended as a design guide.

For the purpose of in-system trouble shooting it is assumed that the user is experienced in working with high voltages, print heads, and other typical features of industrial inkjet printers.

The MP113 and its companion analog power module MP104 are NOT user-serviceable. Any modifications made to these devices voids the warranty. If an MP113 is malfunctioning after following this guide, the unit should be returned to Apex, following a proper RMA procedure.

REQUIRED TOOLS

- 3 ½ -digit multi-meter
- Laptop with 1 free USB port
- MP113 Manager GUI (software)
- USB-to-UART interface cable, as described in MP113 Manager GUI Manual
- Hand tools to remove MP113 (including its MP104 power analog module)
- 2-channel oscilloscope

WHERE DOES MP113 SIT IN AN INKJET PRINTER SYSTEM?

Figure 1: Inkjet Printer System

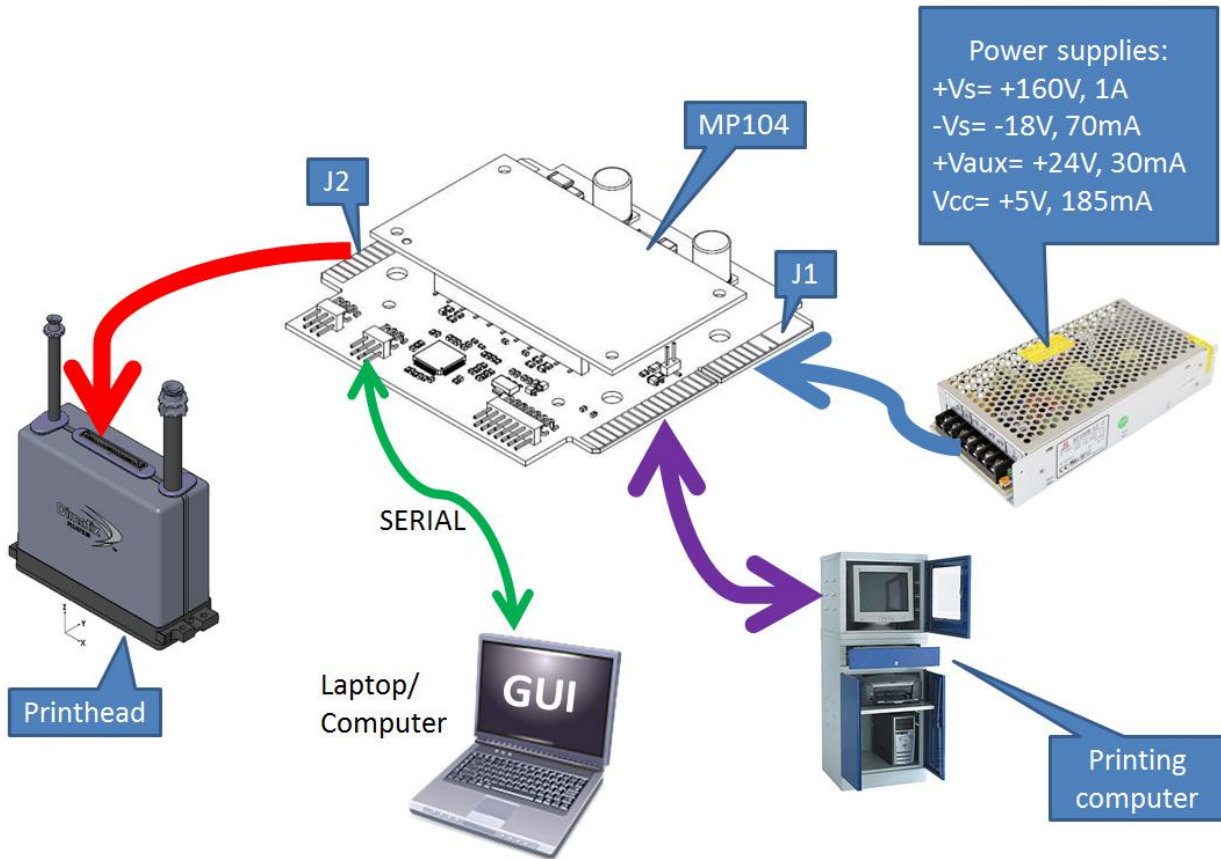


Figure 1 is a simplified overview of an inkjet printer system. MP113 has 2 card edge connectors, J1 and J2. J1 is for connection to power supplies (MP113 requires 4 supply voltages) and a printing computer. J2 is for connection to the print head. MP113 can be connected to a laptop by means of a serial data cable, containing a UART-to-USB converter. The MP113 GUI running on the laptop can be used to control MP113 for setup, testing, or maintenance purposes.

DIAGNOSIS

DEMARCATON OF TROUBLESHOOTING AREA

The inkjet printer was functional, but now there is a problem. Testing of the print head according to the manufacturer's instructions has shown the print head and its wiring to J2 of MP113 is valid. Checking of the digital printing data streams in/out of J1 with a logic analyzer demonstrates that these (including the wiring!) are 100% correct.

CHECKING THE POWER SUPPLIES

With the power ON, but printer functionality OFF, check the following power supply voltages, measuring those at the output of the power supply with a DMM (write the measurements in table 1):

Voltage	Referenced To	Value [V]	Range [V]
V_{CC}	DGND		+4.75 to +5.5
$+V_S$	HVGND		+50 to +160
V_{AUX}	AGND		+20 to +25
$-V_S$	AGND		-20 to -15

If all measured supply voltages are within their range, move on to the next step. Otherwise the power supply is malfunctioning.

With the power ON, but printer functionality OFF (MP113 is in OFFLINE MODE), check the following supply voltages, measuring those with a DMM at J1, according to the following table. Write the measured values in table 2:

J1 PIN#	Card Edge#	Voltage	Referenced To	Ref J1 PIN#	Ref Card Edge#	Value [V]
51,53	26,27 ¹	V_{CC}	DGND	55	28	
2	64	V_{AUX}	AGND	36	47	
4, 6, 8, 10, 12, 14, 16, 18	63, 62, 61, 60, 59, 58, 57, 56 ¹	$-V_S$	AGND	36	47	
38, 40, 42, 44, 46, 48, 50, 52	46, 45, 43, 42, 41, 40, 39 ¹	$+V_S$	HVGND	20	55	

Note: 1) These contacts merge into larger copper contact areas on the PCB (see Figure 2). Measuring one contact per area would suffice.

Check if each power supply value recorded in table 2 concurs with the same power supply value recorded in table 1. If not, there is something wrong with the cabling between the power supplies and MP113.

THERMAL PROTECTION

MP113 has built-in thermal sensors located between the output transistors of the analog fire pulse amplifier (MP104). If the sensed temperature exceeds 85°C the MP113 shuts itself down and a register flag will be raised. It will resume functioning (clearing the register flag) after the measured temperature has fallen below 83°C.

A practical way to find out if there are issues due to over-temperature is to ping MP113 with the “Read Status Information” command (see the MP113 Communication Protocol Description) every 1 – 5 seconds during operation to watch for the over-temperature flag. If this flag is captured, then the problem is identified.

If the thermal protection of MP113 trips during normal printer operation, this indicates that there is either excessive power dissipation (check the load), or the cooling system is not functioning adequately.

USING THE LAPTOP AND THE MP113 GUI

A laptop can be connected to J5 while the MP113 is in the printing system, leaving it connected to power supplies, print head, and printing computer. Be aware this depends on how the MP113 is mounted in the printing system. If it is mounted in such a way that J5 cannot be accessed, then this will not be possible.

CONNECTING MP113 TO A LAPTOP COMPUTER

Make sure the laptop, GUI, and interface cable are functioning properly by following the instructions in the MP113 Manager GUI Manual up to and including the section “First Time Start”. This section recommends “that you do not provide a high voltage ($+V_S$, $-V_S$) or the auxiliary voltage (V_{AUX}) to the board, nor to connect a print head to the 60-pin card edge connector at that time, allowing you to get familiar with the MP113 Manager and its functionality without causing any unexpected outputs or high voltage signals”.

Ensure that the MP113 is not connected to +5V through both J5 AND J1. Since MP113 is already connected to +5V through J1, make sure it's not connected to +5V coming from the USB-to-serial-converter cable.

If the connection with the laptop fails, then the MP113 is permanently broken. If the connection is successful, the user will be able to see the MP113 status: online, offline, error flags, loaded waveforms, FPGA status, etc.

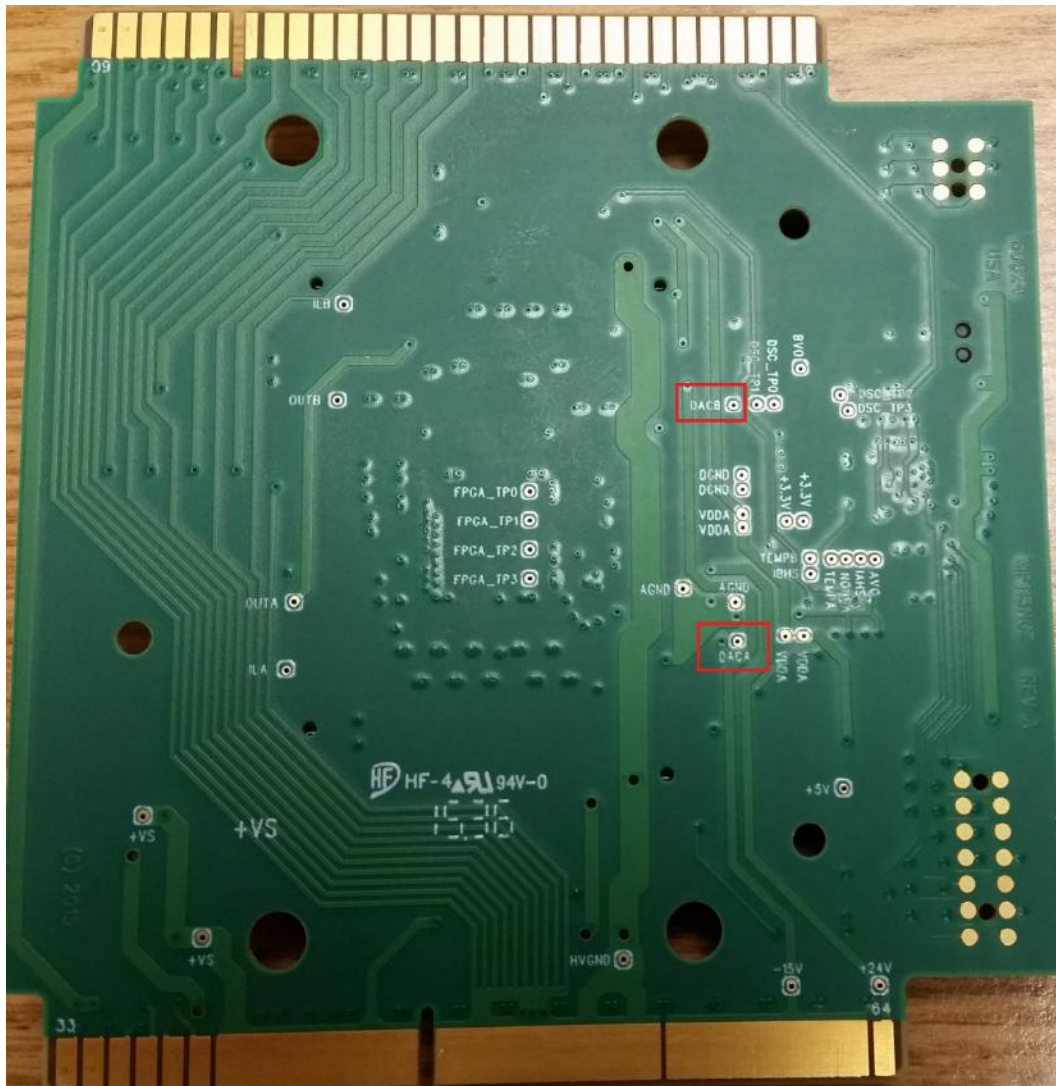
LOOKING FOR FIRE PULSES

If the board is not firing, check the following items:

- If the board is in dual color or binary mode, ensure waveforms are loaded on both channels.
- $+V_S$ power supply is between 50 – 160 V. MP113 will shut down beyond these limits.

If there is nothing wrong with the waveforms and the power supplies, but MP113 does not produce fire pulses, the outputs of the DACs can be checked to see if the issue is in the MP104 power analog module. There are labeled test points on the underside of the board for both DAC outputs (DACA, DACB), see Figure 2.

Figure 2: Board Layout



Connect a scope to these test points and check if fire pulses are being generated if the fire button is pushed in the GUI.

If testing with a laptop and the MP113 Manager reveals issues with MP113, it should be returned (including the power analog MP104 module) to Apex for further investigation.

REFERENCES

- MP113 Datasheet: <https://apexanalog.com/resources/products/mp113u.pdf>
- MP113 Communication Protocol Description: <https://apexanalog.com/resources/products/mp113cpu.pdf>
- MP113 Manager GUI Manual: <https://apexanalog.com/resources/products/mp113gmu.pdf>
- MP113 Manager GUI Software: <https://apexanalog.com/products/mp113-swdl.html>

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