

MPS TESTING PROCEDURE STEP BY STEP

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1 Introduction

This document describes step by step the testing procedure for the MPS (Machine Protection System). The goal is to execute, in the proper way, each item reported in the testLogMPS_FG660_504_xxxxxxx.pdf file table and this document gives the instruction to do it.

NOTE!!!: Before starting the test, please pay attention to the Electrostatic Discharge Protection (ESD) equipment.

- Be sure that your Device Under Test (DUT) lays always over a dissipative work surface.
- Don't forget to connect yourself to ground through the Wrist Strap device.

Your testing area should look like the picture below.

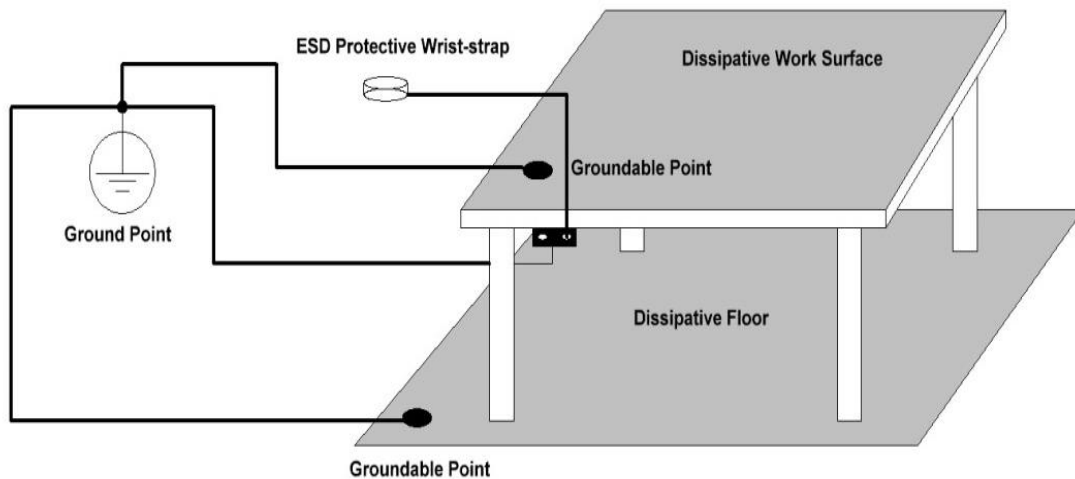


Figure 1: Testing area

2 Step description

The MPS card has to be tested in cooperation with a working standard ACU system (MFU, ICM and ADC).

The testing procedure is divide in two steps:

- 1) MPS in standalone.
- 2) MPS and the latest Optic extension module version (FG660_13x_Opto_Extensionmodule) in cascade.

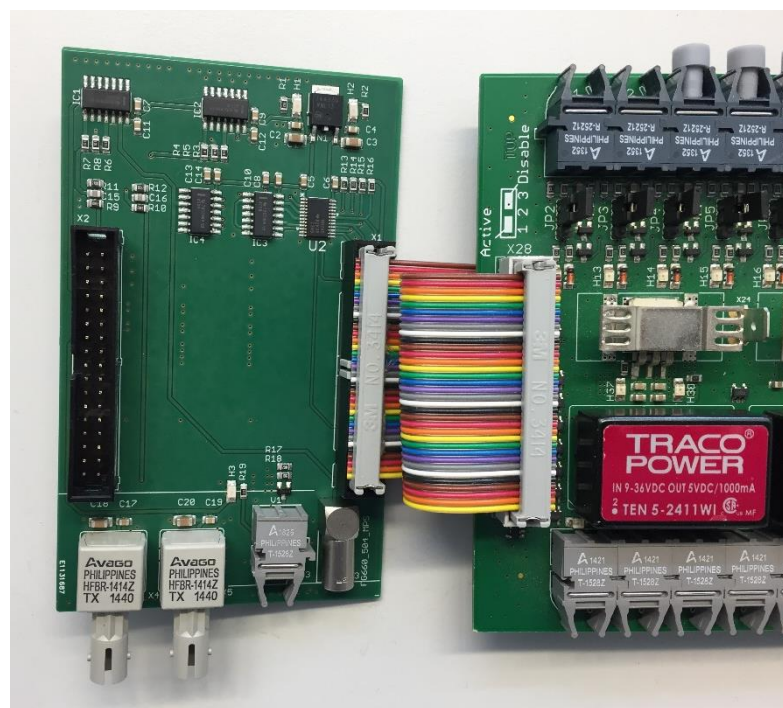
In both cases the cards are connected to the ICM on X28 connector.

2.1 Visual Inspection

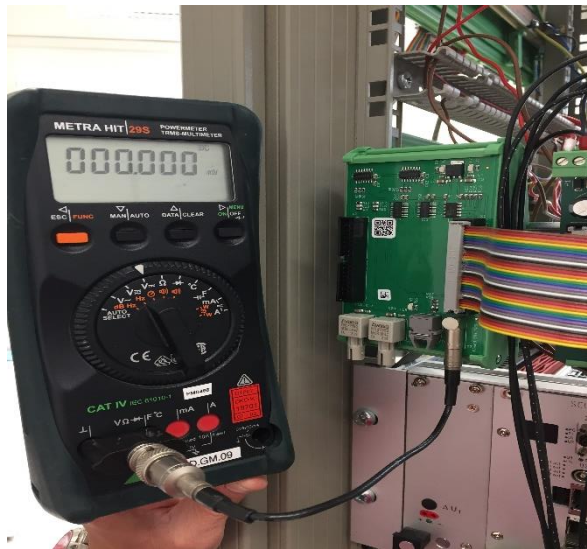
- Check if all the components are mounted in the right position taking care of the connectors X1 and X2 (sometimes they can be mounted mirrored).
- Check for tomb stones and missing parts.
- Check if the PCB surface is clean (no extra soldering materials or burnt areas).
- Check if the PCB is straight: the maximum accepted bending can be calculated with the following formula:
 - $(\text{MaxDeviation}/\text{PCB_length}) * 100 \leq 0.75$
- Check if the PCB edges are decent in shape.
- Check if all the labels on the PCB are printed and readable.

2.2 MPS in standalone

- Connect the MPS card to the ICM X28 connector as shown in the picture below.



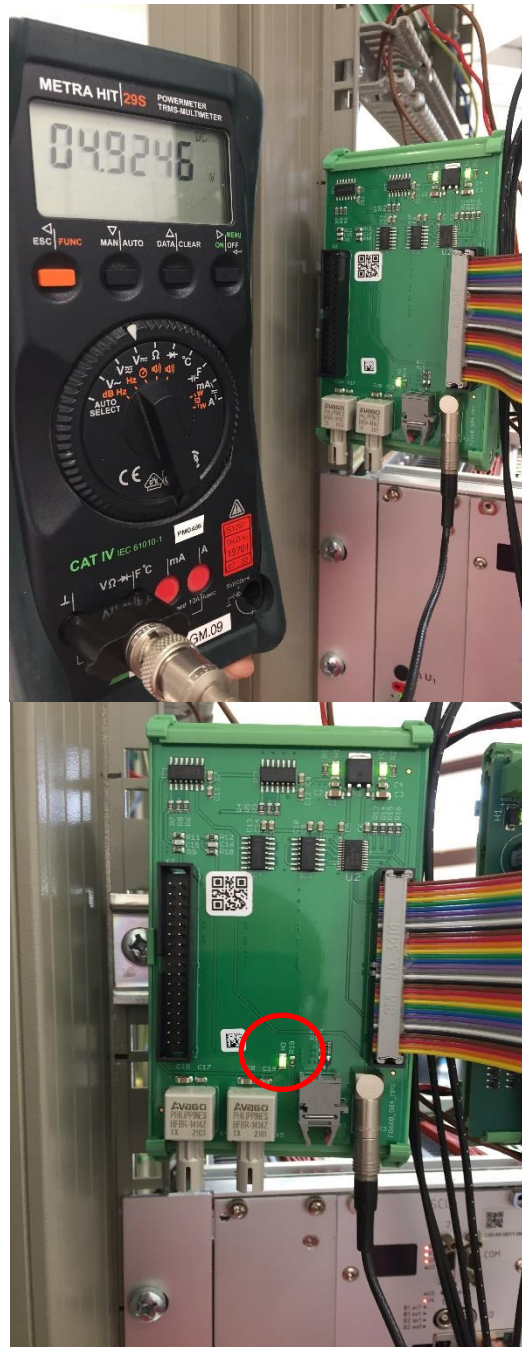
- Connect to X3 a multi-meter set in DC mode and remove all the plastic covers from the optical outputs (X4, X5 and D3).



- Turn the ACU system on and wait till the booting is over. After that, press the reset button on the MFU.
- Check if H1 and H2 are on. If even one of them is not on, it means there is a power supply issue on the board.



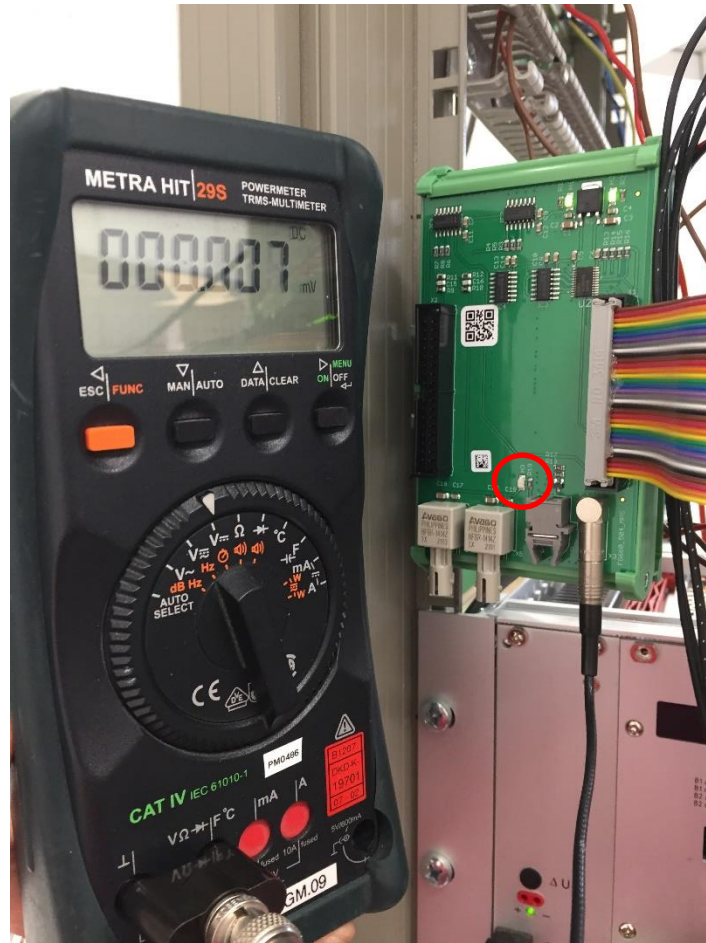
In case the power supply is working properly and there is any interlock triggered (so no trip-line pulled), H3 should be on, all the optical outputs should “shine on” and on the multimeter 5V +/- 5% should be displayed.



- Push the turn on button on the MFU.
- As soon as the system is on, trigger an interlock on the ICM.

Doing that, the trip-line should be pulled, the TFT screen should be red and H3 on the MPS board should be off as well as the MPS optical outputs.

In this case the multimeter should measure almost zero volts.

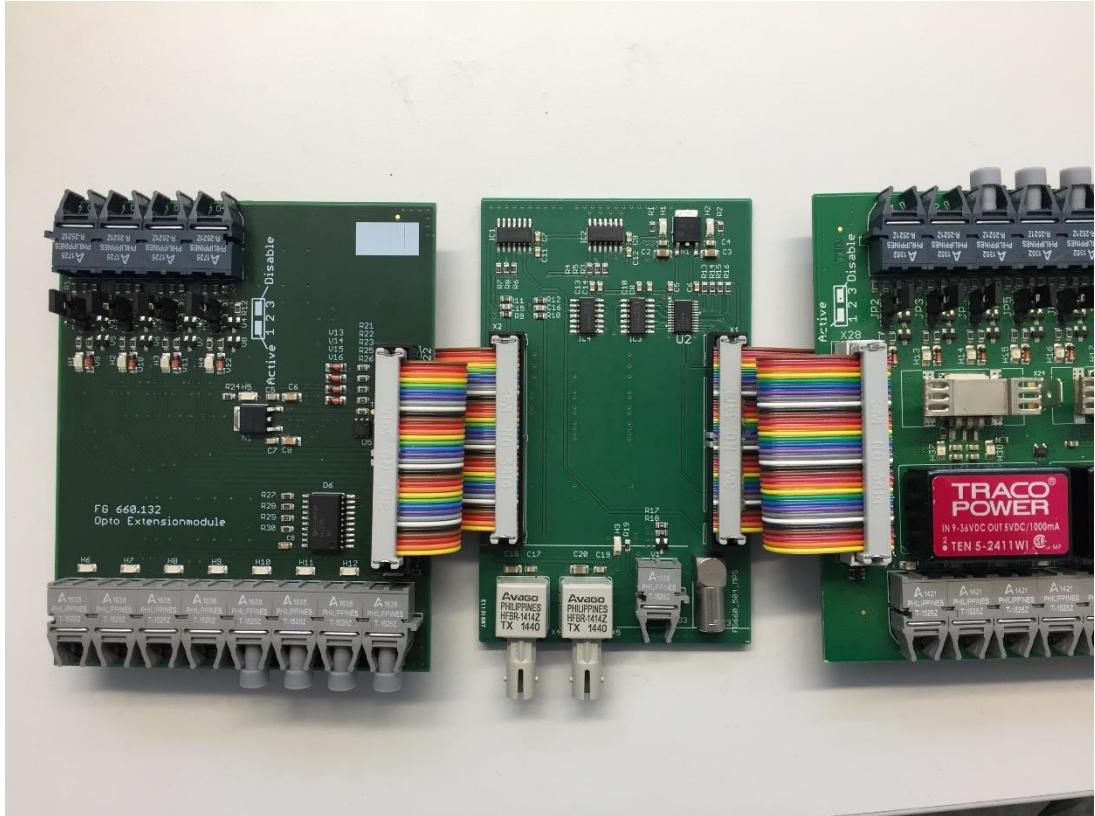


- Restore the interlock and push the reset button.
- Push the on button on the MFU and as soon as the system is on, disconnect the cable between the ICM and the MPS card.

The consequent action to that is a system switched off and a trip-line pulled.

2.3 MPS in cascade

- Connect the MPS card to the ICM X28 connector as shown in the picture below.

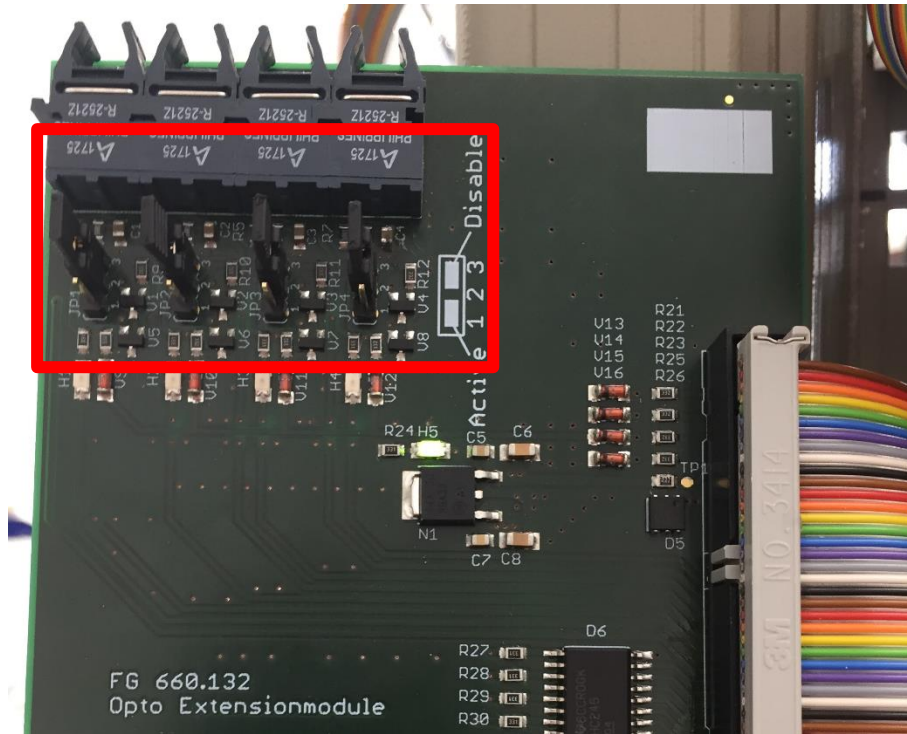


- Open PCA and check the optic extension interlocks on the ICM interlock tab. They have to be monitored and not masked as shown in the picture below.

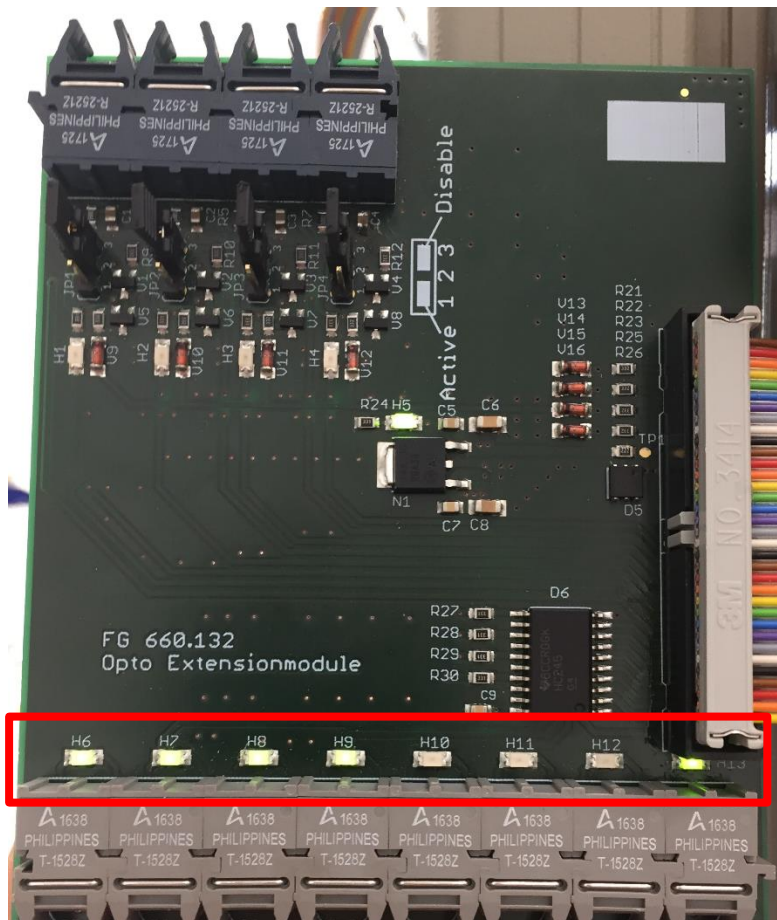
*Interlock und Control Module Ver.III V7.4.x - USI No.:03 - Module No.:01 - HW:03.00 : 01.01.2017 - FW:07.04.00 : 18.12.2020

Environment data	Interlock configuration	Controller configuration	USI highspeed configuration	Waterflow configuration	Datalogger	SPI CH1	SPI CH2	SPI CH3	SPI C										
Bit Nr.	Interlock name	Interlock type	Filter R	Filter C	Adj.Trsh	MeasTrs	JSet	JAct	MskP	MskM	Mode	llkP	llkM	T1	T2	T3	T4	DigF	*
BIT:21	Electrical Interlock 04	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:22	Electrical Interlock 05	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:23	Electrical Interlock 06	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:24	Electrical Interlock 07	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:25	Electrical Interlock 08	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:26	Electrical Interlock 09	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis
BIT:27	Electrical Interlock 10	Digital electrical					armed	armed	masked	masked	normal	OK	OK	✓	✓				Dis
BIT:28	WaterFlow 01	Pulsed water			0,00l/min	0,00l/min			masked	masked	normal	OK	OK						
BIT:29	WaterFlow 02	Pulsed water			0,00l/min	0,00l/min			masked	masked	normal	OK	OK						
BIT:30	USI_Highspeed	Digital software							masked	masked	normal	OK	OK						
BIT:31	This interlock bit is not used.																		
BIT:32	Extension Optical Interlock 01	Digital optical					armed	armed	capture	capture	normal	Trpd	Trpd	✓	✓	✓	✓		
BIT:33	Extension Optical Interlock 02	Digital optical					armed	armed	capture	capture	normal	Trpd	Trpd	✓	✓	✓	✓		
BIT:34	Extension Optical Interlock 03	Digital optical					armed	armed	capture	capture	normal	Trpd	Trpd	✓	✓	✓	✓		
BIT:35	Extension Optical Interlock 04	Digital optical					armed	armed	capture	capture	normal	Trpd	Trpd	✓	✓	✓	✓		
BIT:36	This interlock bit is not used.																		
BIT:37	This interlock bit is not used.																		
BIT:38	This interlock bit is not used.																		
BIT:39	This interlock bit is not used.																		

- Check on the optical extension module that the jumpers JP1 to JP4 are in *Disabled* position.



- Turn the system on and check, in the optic extension module, if H6 to H9 and H13 are on.



- Check in PCA, on the ICM environment tab, if the optic extension module serial number is detected.

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Environment data Interlock configuration Controller configuration USI highspeed configuration Waterflow configuration Datalogger SPI CH1 SPI CH2

Digital power supplies: +1.2V, 1.21V, +3.3V, 3.33V, +2.5V, 2.49V, +5.0V, 4.93V

Analog power supplies: +12.0V, 12.13V, -12.0V, -12.16V, +2.75V, 2.74V

Temperatures: 41°C, 50°C, 36°C, 50°C

Comparator	Comparator 01	Comparator 03	Comparator 05	Comparator 07	Comparator 09
	CH 1	CH 2	CH 3	CH 4	CH 5
Meas. pos. threshold	9,48V	9,70V	9,21V	9,27V	9,84V
Adj. pos. threshold	0,00V	0,00V	0,00V	0,00V	0,00V
Meas. neg. threshold	-7,43V	-9,73V	-9,17V	-8,75V	
Adj. neg. threshold	0,00V	0,00V	0,00V	0,00V	
Measured voltage	-0,01V	0,00V	0,00V	0,00V	-0,01V
Filtered voltage	-0,01V	0,00V	0,00V	0,00V	-0,10V
Read module s/n	13D70719	13D5ACC1	0E9A8034	13D55E58	10B4BB00
Exp. module s/n	13D70719	13D5ACC1	0E9A8034	13D55E58	10B4BB00

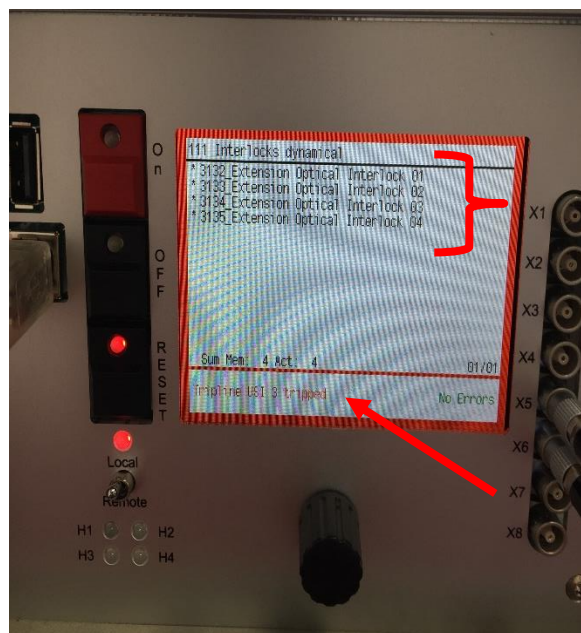
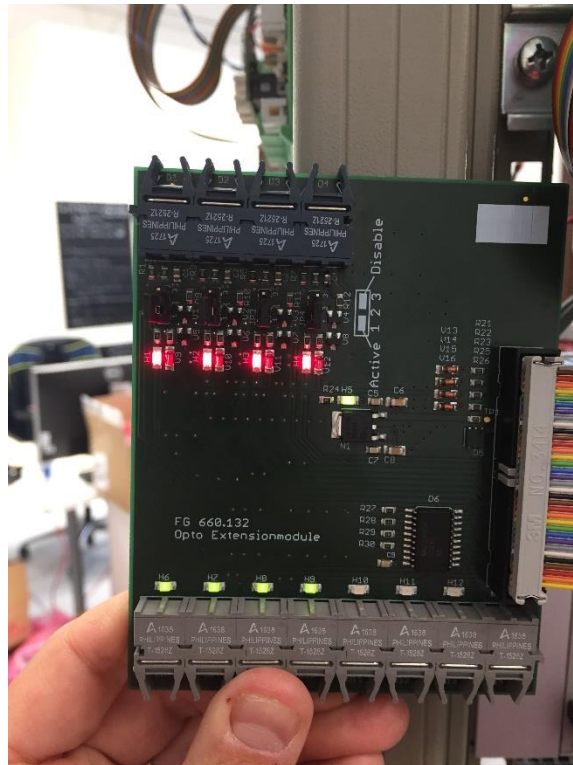
ExtM SN: 1AC5280E (circled in red), ICM SN: 1E5A64F3

Migrate read module s/n into expected module s/n

- Trigger an interlock on the ICM and check if the MPS board behavior is the same shown in the stand alone test performed above.
- Restore the interlock and turn the system on.
- Move the JP1 jumper on the optic extension module from *Disable* to *Active* without any input signal on D1.

As consequent action, the system should turn off and the relative interlock should be displayed on the TFT.

- Replace JP1 to *Disable*, turn the system on and repeat the last test above for the other 3 jumpers.



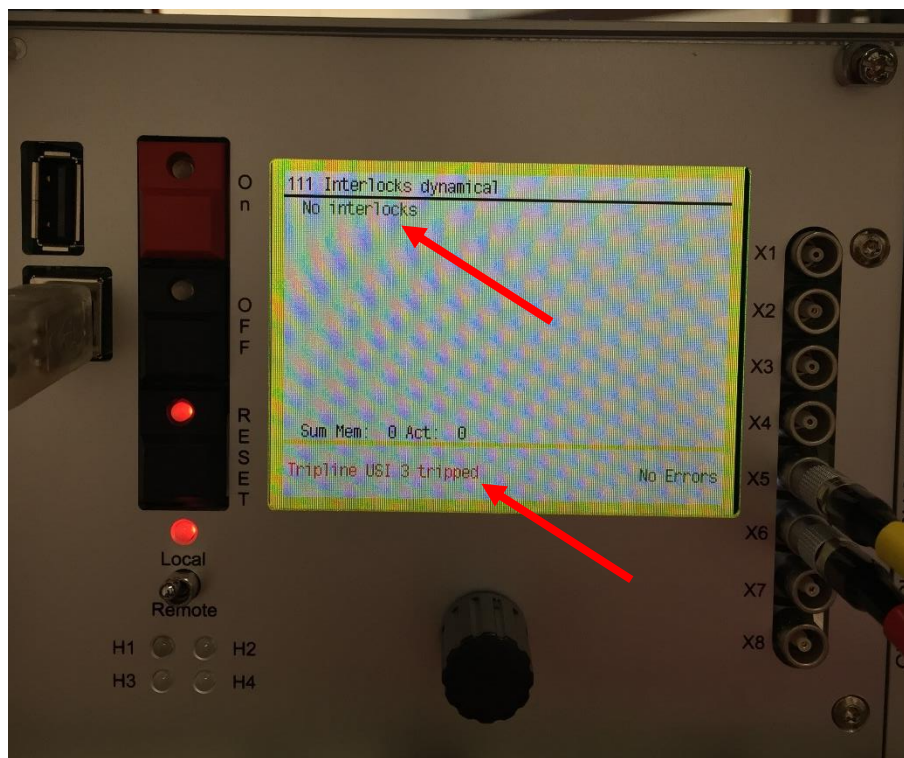
- Mask the optic extension interlocks in PCA.

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Bit Nr.	Interlock name	Interlock type	Filter R	Filter C	Adj.Trsh	MeasTrs	JSet	JAct	MskP	MskM	Mode	IikP	IikM	T1	T2	T3	T4	DigF	*	
BIT:21	Electrical Interlock 04	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:22	Electrical Interlock 05	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:23	Electrical Interlock 06	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:24	Electrical Interlock 07	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:25	Electrical Interlock 08	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:26	Electrical Interlock 09	Digital electrical					armed	armed	capture	capture	normal	OK	OK	✓	✓				Dis	
BIT:27	Electrical Interlock 10	Digital electrical					armed	armed	masked	masked	normal	OK	OK	✓	✓				Dis	
BIT:28	WaterFlow 01	Pulsed water			0,00l/min	0,00l/min			masked	masked	normal	OK	OK							
BIT:29	WaterFlow 02	Pulsed water			0,00l/min	0,00l/min			masked	masked	normal	OK	OK							
BIT:30	USI_Highspeed	Digital software							masked	masked	normal	OK	OK							
BIT:31	This interlock bit is not used.																			
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BIT:38	This interlock bit is not used.																			
BIT:39	This interlock bit is not used.																			

- Turn the system on (JP1 to JP4 on the optic extension module have to be placed to *Disable*).
- Place JP1 to *Active* without any signal in input to D1.

As consequent action the system should turn off, the trip-line has to be pulled and the TFT screen has to be yellow.



- Place back JP1 to *Disable*, push the reset button, turn again the system on and repeat the test above for the other three jumpers.

2.4 Check QR codes and print out label:

The MPS board should be already equipped by the PCB manufacturer with some QR code stickers. Read them with a scanner and report the value on the test log file (generated on the next step).

If all the test cases above were successfully executed, print out one additional sticker (labels) with date and tester name.



2.5 Test Log file generation

Generate the testLogMPS_FG660_504_xxxxxxx.docx file and save it in pdf format in the dedicated eet-common folder (Arbeitsordner ACU\ACU - outgoing).

FOR ANY DOUBT, EVEN THE SMALLEST ONE, PLEASE CONTACT YOUR SUPERVISOR!