

# 3 kW LLC graphical user interface (GUI): getting started sequence

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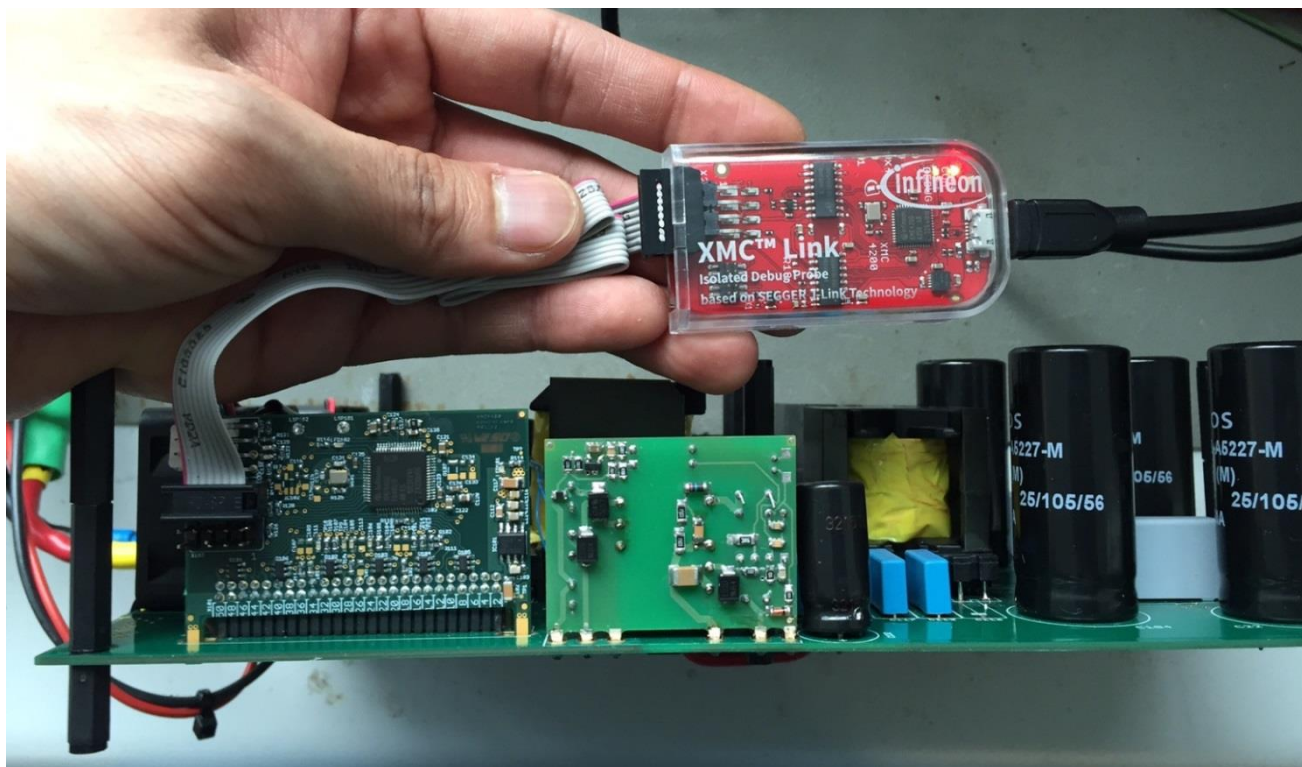


# Introduction

- › The 3 kW dual phase demo board is able to immediately work without connection to the graphical user interface (GUI), since a set of operating parameters is already stored in the memory of the MCU during the mass production
- › The GUI provides an immediate and intuitive way to set some electrical parameters and to monitor them during the operation
- › The following procedure shows:
  - How getting started with the operation when the control board is connected to the GUI
  - How to pre-set the converter parameters
  - How to measure some parameters during the converter operation
- › The setting of the converter parameters via GUI shall be done in accordance with the max specified ratings of the board:
  - $V_{in\_nom} = 380 V_{dc}$ ;  $V_{in}$ : [350, 410]  $V_{dc}$
  - $V_{out\_nom} = 54 V$ ;  $V_{out}$ : [44, 58]  $V$ .
  - $I_{out\_max} = 55 A$ , so max over current level = 62 A.

# Preliminary operations with XMC™ Link

- › Install on your laptop the Segger driver, which can be downloaded at the following link: <https://www.segger.com/jlink-software.html>
- › Connect the XMC™ Link to the control card as illustrated in the picture below, then you go to the USB port of your laptop through a proper adapter cable.



# Step 1. First Connection and initial setting

actual values for output voltage and protections

setting of output voltage and protections

setting for output capacitor

settings for operation

measurements

The screenshot shows the 'LLC 3kW Graphical User Interface' with several key sections:

- Settings and control:** A table for output voltage and protection settings. The 'Required' column is highlighted in red, and the 'Actual' column is highlighted in yellow.
- Device:** Shows the device is 'ONLINE' (highlighted in green), with software version 'V 1.00' and serial number '00000000'.
- Actual state of the device:** Contains a 'Status Register' (highlighted in red) and a 'Fault Register' (highlighted in green). The 'Fault Register' shows 'U1 Voltage Error' with a red 'X'.
- Measured Values:** A table showing real-time measurements for voltage (U1, U2) and current (I11, I12, I21, I22) across two channels, along with temperatures.

status registers

Fault registers

- > Apply  $V_{in}=100$  V to the power converter
- > File > Setting > COM Port > select the proper port
- > Press "connect" button > ON LINE is highlighted in green
- > Setting of output voltage and protections:

**U2=54; U2\_max=62; I1\_fuse=9; I2\_fuse=47**

# Step 2. Setting for operation

actual values for output voltage and protections

setting of output voltage and protections

setting for output capacitor

settings for operation

measurements

The screenshot shows the 'LLC 3kW Graphical User Interface' with several key sections:

- Settings and control:** A table for Required vs. Actual values for U2 [V], J2\_max [V], I1\_fuse [A], and I2\_fuse [A]. A 'Set' button is highlighted with a green arrow.
- Device:** Shows 'ONLINE' status, 'LLC 3kW Inverter', 'Software version V 1.00', and 'Serial Number 00000000'.
- Actual state of the device:** A list of status registers including 'After Start', 'Stand By', 'Run Request', 'Running', 'LLC1 Enabled', 'LLC2 Enabled', 'SR1 Enabled', 'SR2 Enabled', 'Fan enabled', 'Automatic SR', 'Service Communication', 'Fault Latched', 'Parameters loaded', and 'Memory fault'.
- Fault Register:** A list of fault registers including 'I11 Over Current', 'I21 Over Current', 'I12 Over Current', 'I22 Over Current', 'U1 Voltage Error', 'U2 Voltage Error', 'Communication Error', and 'Over Temperature'.
- Measured Values:** A table showing real-time measurements for U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

- > Setting for operation
  - Check "LLC1 enable" and "LLC2 enable"
  - Check "Automatic SR"
  - **Do not check "SR1 Enable", nor "SR2 Enable" (done by only expert users for fine tuning)**
- > Press "Set" to store the settings (status register update)

# Step 3. Start-up procedure

actual values for output voltage and protections

setting of output voltage and protections

setting for output capacitor

settings for operation

measurements

The screenshot shows the 'LLC 3kW Graphical User Interface' with several key sections:

- Settings and control:** A table for Required vs. Actual values for U2 [V], U2\_max [V], I1\_fuse [A], and I2\_fuse [A]. The 'Start' button is highlighted with a red circle.
- Device:** Shows 'LLC 3kW Inverter' is 'ONLINE', with software version V 1.00 and serial number 00000000.
- Actual state of the device:**
  - Status Register:** Lists operational states like Stand By, Run Request, Running, etc. The 'Start' button is greyed out.
  - Fault Register:** Lists various faults. 'U1 Voltage Error' is highlighted in red and circled with a red oval.
- Measured Values:** A table showing real-time measurements for U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

Fault registers

status registers

- > Increase  $V_{in}$  of the power converter. Until  $V_{in} < 350 V_{dc}$ , "U1 voltage error" is highlighted in red in the Fault Register and the START button will remain "grey"
- > When  $V_{in} \geq 360 V_{dc}$ , "U1 voltage error" is removed and "START" will become available for activation.
- > Increase  $V_{in}$  up to **380  $V_{dc}$** , then press "START"

# Measurements info

actual values for output voltage and protections

setting of output voltage and protections

setting for output capacitor

settings for operation

measurements

The screenshot shows the 'LLC 3kW Graphical User Interface' with several key sections:

- Settings and control:** A table for Required vs. Actual values for U2 [V], U2\_max [V], I1\_fuse [A], and I2\_fuse [A]. A red circle highlights the 'Stop' button.
- Device:** Shows 'LLC 3kW Inverter' is 'ONLINE' with software version V 1.00 and serial number 00000000.
- Actual state of the device:** A list of status indicators including 'After Start', 'Stand By', 'Run Request', 'Running', 'LLC1 Enabled', 'LLC2 Enabled', 'SR1 Enabled', 'SR2 Enabled', 'Fan enabled', 'Automatic SR', 'Service Communication', 'Fault Latched', 'Parameters Loaded', and 'Memory fault'.
- Fault Register:** A list of fault indicators including 'I11 Over Current', 'I21 Over Current', 'I12 Over Current', 'I22 Over Current', 'U1 Voltage Error' (highlighted in red), 'U2 Voltage Error', 'Communication Error', and 'Over Temperature'.
- Measured Values:** A table showing real-time measurements for U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

Fault registers

status registers

- > Increase the output load: the measured values are visible in the dedicated box
- > Press "STOP" in case you want to shut down the converter

# Example of protection mode: Input under-voltage protection

actual values for output voltage and protections

setting of output voltage and protections

setting for output capacitor

settings for operation

measurements

The screenshot shows the 'LLC 3kW Graphical User Interface' with several panels:

- Settings and control:** A table for 'Required' and 'Actual' values for U2 [V], U2\_max [V], I1\_fuse [A], and I2\_fuse [A]. Buttons for 'Start', 'Stop', and 'Set' are present.
- Device:** Shows 'ONLINE' status, 'LLC 3kW Inverter', 'Software version V 1.00', and 'Serial Number 00000000'.
- Actual state of the device:** A list of status items including 'After Start', 'Stand By', 'Run Request', 'Running', 'LLC1 Enabled', 'LLC2 Enabled', 'SR1 Enabled', 'SR2 Enabled', 'Fan enabled', 'Automatic SR', 'Service Communication', and 'Fault Latched'. A red box highlights this section.
- Fault Register:** A list of fault events with checkboxes. 'U1 Voltage Error' is checked and highlighted in red. A red circle around this section is labeled 'Fault registers'.
- Measured Values:** A table showing real-time measurements for U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

status registers

- > Reduce  $V_{in}$  below  $350 V_{dc}$  at  $I_{out}=25 A$ : the converter will be automatically shutdown and the related notification will appear in the Fault Registers panel. A red LED is lighted in the main board
- > After increasing again the  $V_{in}$  up to  $380 V_{dc}$ , the fault is removed, and you can re-start the converter by clicking on the "START" button



# GUI user manual

- › For any other detail about the GUI usage and functions, you can refer to the Chapter 3 of the document **“LLC3kW\_GUI\_Manual\_v1.01”**, which is included in the boards documentation

# Recommendations

- › The XMC™ Link is a new communication tool still under debug. Unfortunately, during the power converter operation, some losses of communication have been sometimes experienced. In those cases the user needs to reset the MCU ( $V_{in}: 380 > 0 V_{dc}$ ) and repeat the entire initial setting sequence before powering-up again the converter. No problem occurs during the parameter setting at  $V_{in}=100V_{dc}$ , when the power converter is OFF
- › The reasons of this communication issue are under investigation. In the meantime, until further notice, it is recommended:
  - to use the board without GUI: the converter will run according to the default settings stored in the MCU memory during the mass production
 or
  - to use the GUI only for parameter setting while  $V_{in}=100 V_{dc}$ , then disconnect the XMC™ Link from the control board before the converter is powered-up (so measurements in operation via GUI will be not available)



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