

3kW LLC_Graphical User Interface (GUI): getting started sequence

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July 2016

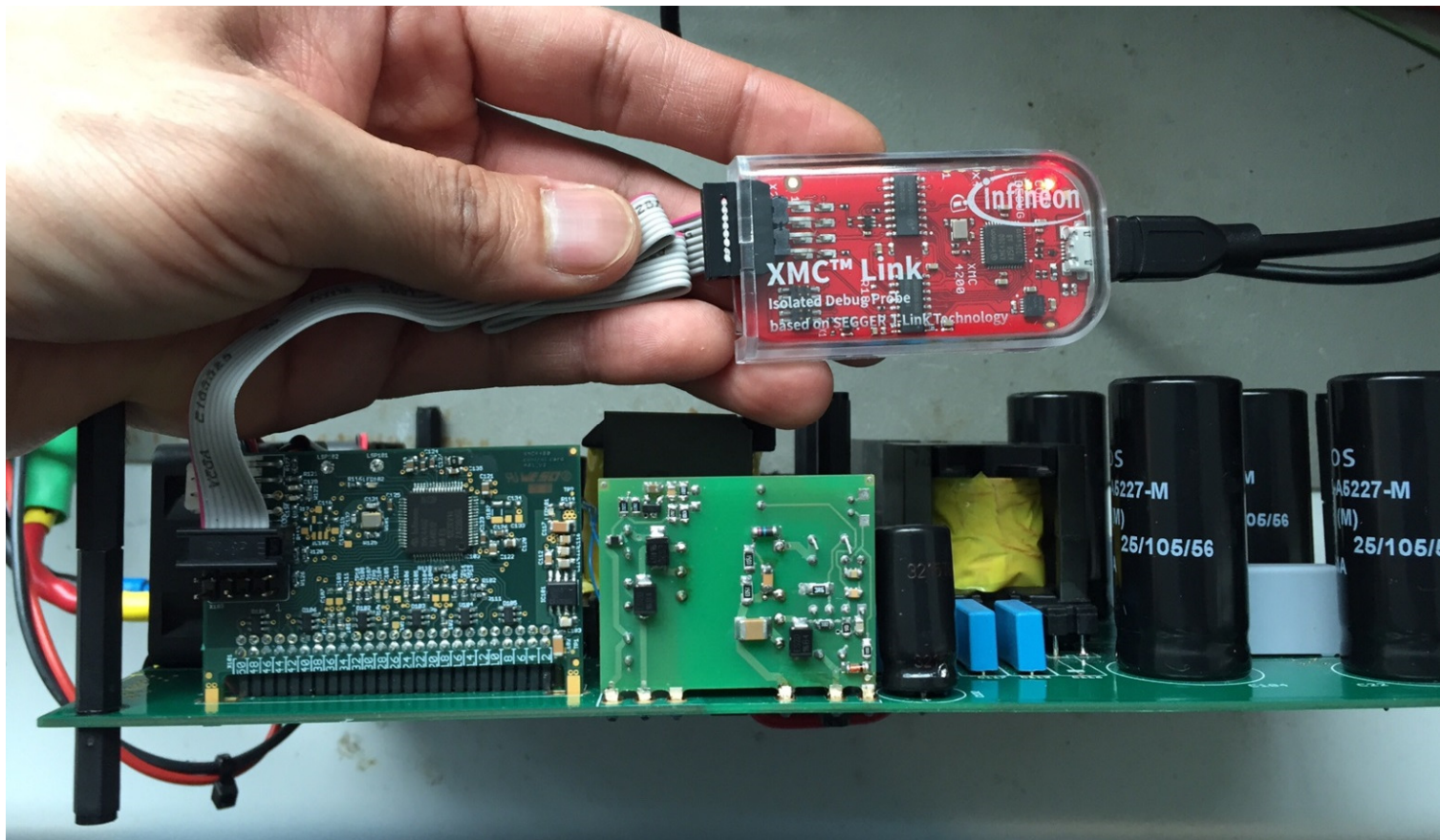


Introduction

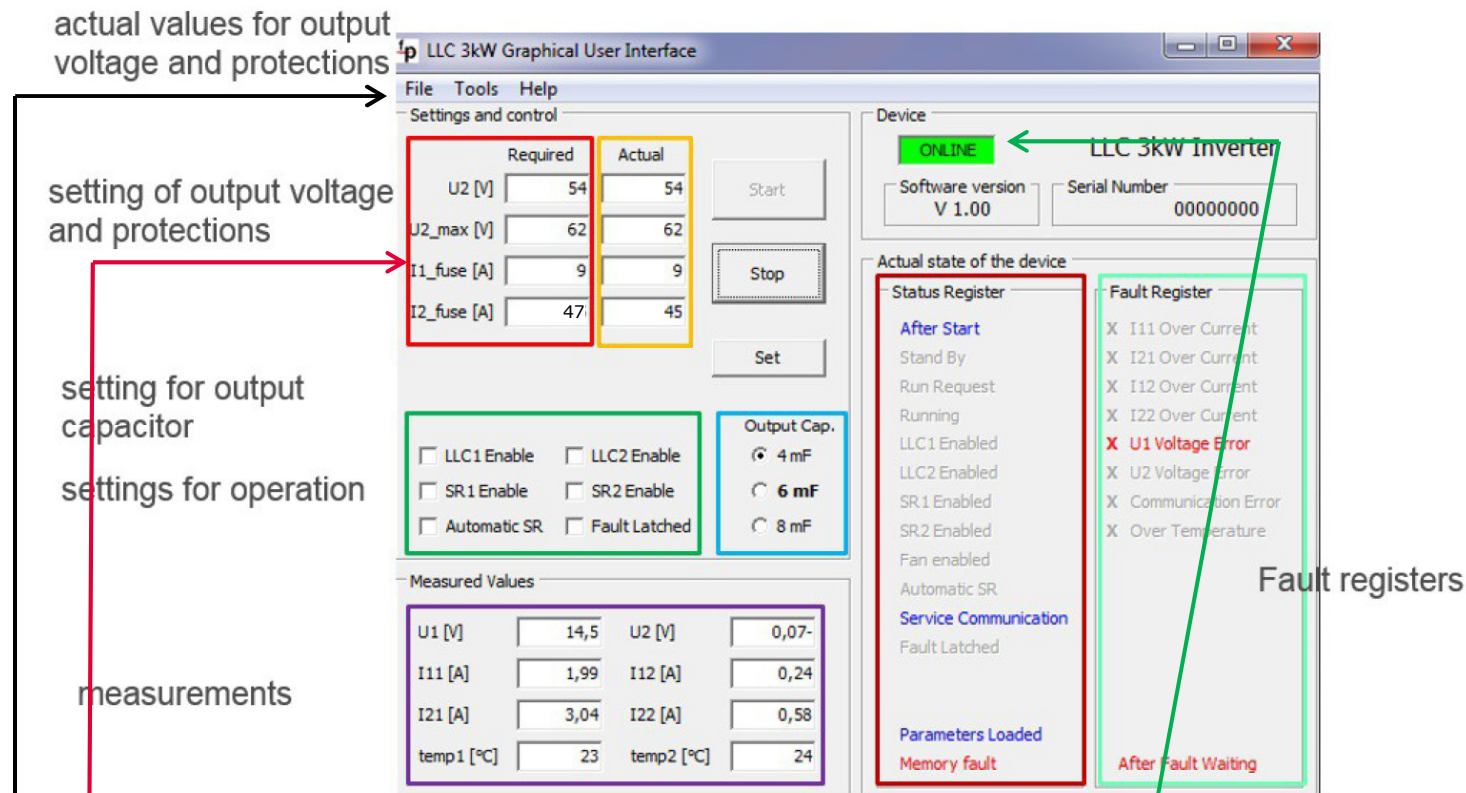
- › The 3kW Dual Phase demo board is able to immediately work without connection to the Graphical User Interface (GUI), since a set of operating parameters is already stored in the Memory of the MCU during the mass production.
- › The GUI provides an immediate and intuitive way to set some electrical 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:
 - $V_{in_nom}=380V_{dc}$; V_{in} : [350, 410]Vdc
 - $V_{out_nom}= 54V$; V_{out} : [44, 58]V.
 - $I_{out_max}=55A$, so max OverCurrent level=62A.

Preliminary operations with XMC-Link

- › Install in 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



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

- Settings and control:** Contains input fields for 'Required' and 'Actual' values for U2 [V], U2_max [V], I1_fuse [A], and I2_fuse [A]. It also has 'Start', 'Stop', and 'Set' buttons.
- Device:** Shows 'ONLINE' status, 'Software version V 1.00', and 'Serial Number 00000000'.
- Actual state of the device:** Includes a 'Status Register' and a 'Fault Register'.
- Measured Values:** Displays real-time data for U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

Annotations on the screenshot include:

- A black arrow pointing to the 'Required' and 'Actual' columns in the 'Settings and control' section, labeled 'actual values for output voltage and protections'.
- A red arrow pointing to the 'Required' column for U2 [V], labeled 'setting of output voltage and protections'.
- A red arrow pointing to the 'Required' column for I1_fuse [A], labeled 'setting for output capacitor'.
- A red arrow pointing to the 'Required' column for I2_fuse [A], labeled 'settings for operation'.
- A red arrow pointing to the 'Measured Values' section, labeled 'measurements'.
- A green arrow pointing to the 'ONLINE' status, labeled 'LLC 3kW Inverter'.
- A green arrow pointing to the 'Fault Register', labeled 'Fault registers'.

- > Apply Vin=100V 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 the following sections:

- Settings and control:**
 - Required/Actual table:**

	Required	Actual
U2 [V]	54	54
U2_max [V]	62	62
I1_fuse [A]	9	9
I2_fuse [A]	47	47
 - Buttons:** Start, Stop, Set
 - Output Cap.:** 4 mF, 6 mF, 8 mF (6 mF is selected)
 - Settings for operation:**
 - ☒ LLC1 Enable, ☒ LLC2 Enable
 - ☐ SR1 Enable, ☐ SR2 Enable
 - ☒ Automatic SR, ☐ Fault Latched
- Device:** ONLINE, LLC 3kW Inverter, Software version V 1.00, Serial Number 00000000
- Actual state of the device:**
 - Status Register:** 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, Memory fault.
 - Fault Register:**
 - X I11 Over Current
 - X I21 Over Current
 - X I12 Over Current
 - X I22 Over Current
 - X U1 Voltage Error
 - X U2 Voltage Error
 - X Communication Error
 - X Over Temperature
- Measured Values:**

U1 [V]	14,5	U2 [V]	0,07-
I11 [A]	1,99	I12 [A]	0,24
I21 [A]	3,04	I22 [A]	0,58
temp1 [°C]	23	temp2 [°C]	24

Fault registers

status registers

- › 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

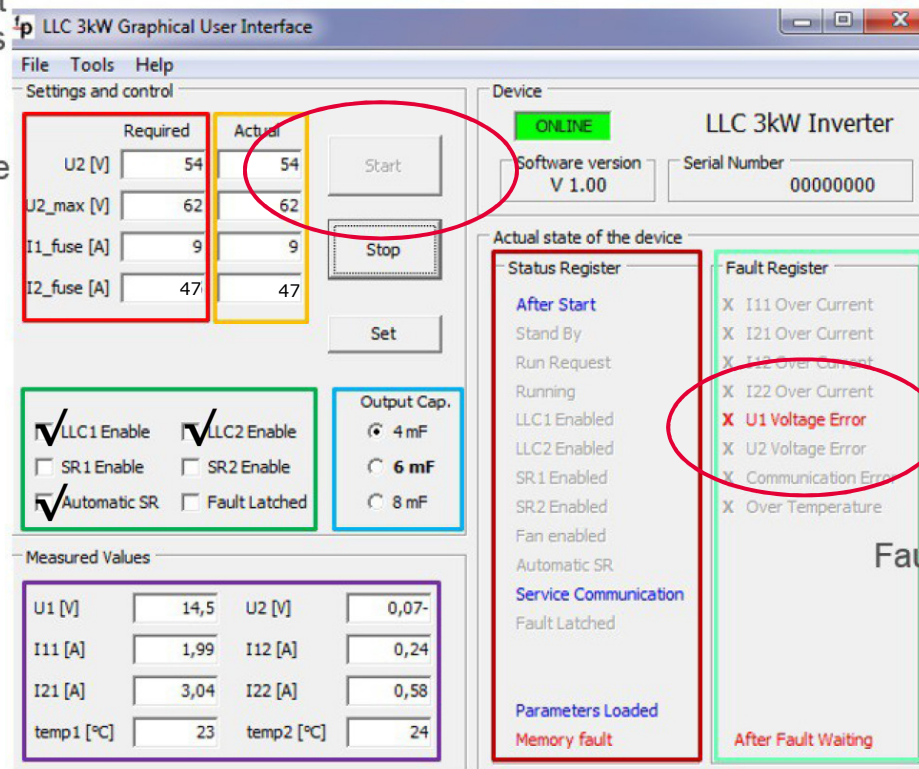
actual values for output voltage and protections

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 sections:

- Settings and control:** Includes 'Required' and 'Actual' columns for U2 [V], U2_max [V], I1_fuse [A], and I2_fuse [A]. The 'Start' button is highlighted with a red circle.
- Device:** Shows 'ONLINE' status, 'Software version V 1.00', and 'Serial Number 00000000'.
- Actual state of the device:** Contains a 'Status Register' and a 'Fault Register'. The 'Fault Register' has a red circle around 'U1 Voltage Error'.
- Measured Values:** Displays 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 $V_{in} < 350V_{dc}$, "U1 voltage error" is highlighted in red in the Fault Register and the START button will remain "grey"
- › When $V_{in} \geq 360V_{dc}$, "U1 voltage error" is removed and "START" will become available for activation.
- › Increase V_{in} up to **380Vdc**, 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 displays the 'LLC 3kW Graphical User Interface' with the following sections:

- Settings and control:**
 - Required/Actual table:**

Parameter	Required	Actual
U2 [V]	54	54
U2_max [V]	62	62
I1_fuse [A]	9	9
I2_fuse [A]	47	47
 - Buttons:** Start, Stop, Set.
 - Output Cap.:** 4 mF (selected), 6 mF, 8 mF.
 - Operation Settings:**
 - LLC1 Enable (checked), LLC2 Enable (checked)
 - SR1 Enable (unchecked), SR2 Enable (unchecked)
 - Automatic SR (checked), Fault Latched (unchecked)
- Measured Values:**

U1 [V]	14,5	U2 [V]	0,07-
I11 [A]	1,99	I12 [A]	0,24
I21 [A]	3,04	I22 [A]	0,58
temp1 [°C]	23	temp2 [°C]	24
- Device Status:** ONLINE, LLC 3kW Inverter, Software version V 1.00, Serial Number 00000000.
- Actual state of the device:**
 - Status Register:** 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, Memory fault.
 - Fault Register:**
 - X I11 Over Current
 - X I21 Over Current
 - X I12 Over Current
 - X I22 Over Current
 - X U1 Voltage Error
 - X U2 Voltage Error
 - X Communication Error
 - X Over Temperature

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:** Contains a table for Required and Actual values for U2 [V], U2_max [V], I1_fuse [A], and I2_fuse [A]. It also has Start, Stop, and Set buttons.
- Device:** Shows the device is ONLINE, LLC 3kW Inverter, Software version V 1.00, and Serial Number 00000000.
- Actual state of the device:** Contains a Status Register and a Fault Register.
- Measured Values:** A table showing U1 [V], U2 [V], I11 [A], I12 [A], I21 [A], I22 [A], temp1 [°C], and temp2 [°C].

Annotations on the screenshot:

- A red box highlights the Required and Actual values for U2 [V], U2_max [V], I1_fuse [A], and I2_fuse [A].
- A green box highlights the LLC1 Enable, LLC2 Enable, SR1 Enable, SR2 Enable, Automatic SR, and Fault Latched checkboxes.
- A blue box highlights the Output Cap. settings (4 mF, 6 mF, 8 mF).
- A red box highlights the Status Register.
- A green box highlights the Fault Register.
- A red oval highlights the 'Fault registers' text.

status registers

- › Reduce V_{in} below 350Vdc at $I_{out}=25A$: 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 380Vdc, 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.

Additional Info

- › The XMC-Link is a new communication tool still under evaluation. Sometime, during the power converter operation, losses of communication have been observed. Communication can be recovered with a new power up (remove input supply).
- › The user has the option to:
 - Operate the board without parameters setting by GUI
 - Set parameters by GUI when input voltage is 100V (power stage OFF, auxiliary supply ON) and remove the XMC-Link connection before applying nominal input voltage
- › Monitoring while operation is possible but communications may be lost due to noise (it has been observed that RC filters added to communication lines correct the issue)



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