User guide for MyDrive® HIL

Danfoss Drives iC7 and VLT® Frequency Converters

Content

1 Introduction

This document describes how to work with the Danfoss Drives iC7 and VLT® Frequency Converters in combination with Typhoon HIL, after this; *MyDrive® HIL*, see Figure 1.

It is expected that the user has completed the HIL Specialist 2.0 course at the HIL Academy and is familiar with the Danfoss Drives iC7 / VLT® Frequency Converters including supporting PC tools. How-to videos can be found in the MyDrive® Suite.

The following programs must be installed on the host Windows PC[1]:

- MCT-10 for VLT® (a license is required to update software on the VLT® control board[2]),
- MyDrive® Insight for iC7,
- Typhoon HIL Control Center (THCC), version 2023.3 sp1 or higher,

The document is divided into 3 sections. An initial setup section which describes the delivered hardware and host PC setup, a "how to use" section that covers more general topics such as simulation model and configuration of the MyDrive® HIL setup, and finally a FAQ including list of delivered items.

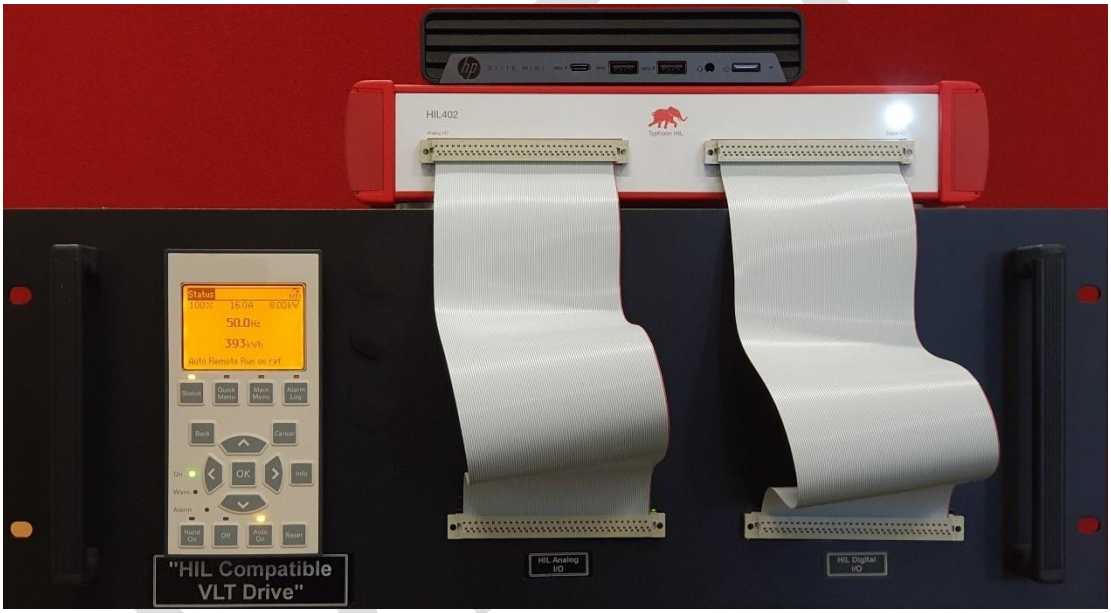


Figure 1: MyDrive® HIL for VLT® Frequency Converter, front with LCP mounted.

[1] We recommend having a fixed host PC installed with the MyDrive® HIL setup. Users can then log in locally or through remote desktop.

[2] MCT10 license can be purchased online from MyDrive® Suite by clicking on the VLT Motion Control Tool MCT10 card → Buy License.

2 Setup of HIL Compatible VLT® Frequency Converter

2.1 Hardware Setup

Connections needed to operate the MyDrive® HIL, see figures below for details:

1. HIL Compatible VLT® ⇔ HIL402 using the two ribbon cables,
2. HIL Compatible VLT® ⇔ host PC using USB,
3. Main power supply to the HIL Compatible VLT® (100 – 240 V, 50/60 Hz),
4. HIL402 ⇔ host PC using USB,
5. Main power supply to the HIL402 device,
6. LCP connector ⇔ host PC using RS485/USB converter (for using LCP simulator on host PC),
7. RS485[3] based Fieldbus for the VLT Frequency Converter ⇔ 3rd part equipment, e.g., external PLC (where applicable).

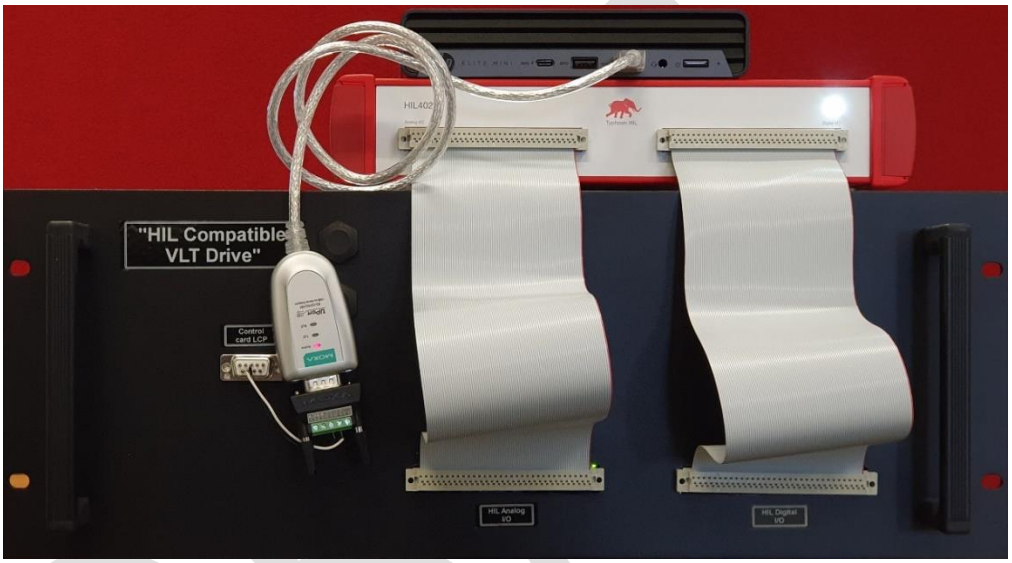
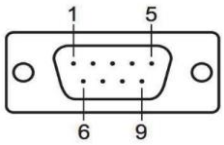


Figure 2: Front with RS485 / USB converter for LCP simulator.

[3] Connected with VLT control board, terminals 61 (common ground), 68 (P, TX+, RX+), and 69 (N, TX-, RX-). Lines are internally terminated on the VLT control board.

Figure 3: Rear with connection for mains, USB and RS485 for control board.

Pin specifications for VLT® control board, RS485 serial communication.

RS485 D-SUB9	Pin	VLT® Control board terminal number	Description
	1	69	N, TX-, RX-
	5	61	Common ground
	6	68	P, TX+, RX+

2.2 LCP simulator for VLT®

Emulating the LCP (Local Control Panel) can be convenient when using the MyDrive® HIL remote and having the need for local control (Hand On) of the VLT® through the LCP.

These steps are needed to setup the LCP simulator on the host PC:

2.2.1 Driver and port configuration

1) Install the driver for the RS485 converter. The driver may be found here: https://www.moxa.com/en/products/industrial-edge-connectivity/usb-to-serial-converters-usb-hubs/usb-to-serial-converters/uport-1000-series - resources.
   Look under *Software, Firmware, and Drivers* and filter on the operating system that matches the one on the host PC,
2) Open *Device Manager,*
3) Under *Multi-port serial adapters* double-click on *Uport 1150*,
4) In the new window that opens look under the *Ports Configuration* pane,
5) Double-click on the port and change the interface to *RS-485 2W.*

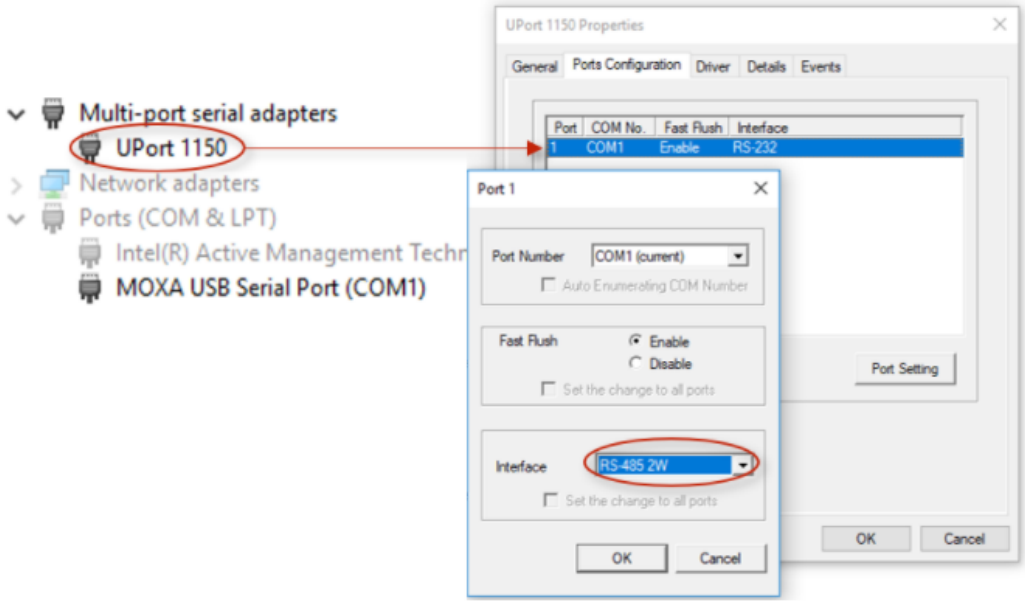


Figure 4: COM port configuration.

2.2.2 Create and configure shortcut

To create and configure the desktop shortcut for the LCP simulator please follow the steps below. It is expected that the connection between the host PC and the VLT® control board is made as described in Figure 4 and that the COM port has been configured as described in Driver and port configuration.

Find the COM port:

1) Open Device Manager,
2) Locate *Ports (COM & LPT)* and unfold it,
3) Read the COM port number for the *MOXA USB Serial Port* and store the number for later.

Create the shortcut:

The following steps can first be performed when the MyDrive® HIL package has been installation installed. Instructions about the installation can be found in MyDrive® HIL package installation section.

1) Right click on *lcpsim.exe* (placed in the additional_files/lcp_sim folder which can be loaded via Typhoon Hil's Package Manager, see Figure 5),
2) Select *Create Shortcut.*

The shortcut is now created. It can be renamed as desired.

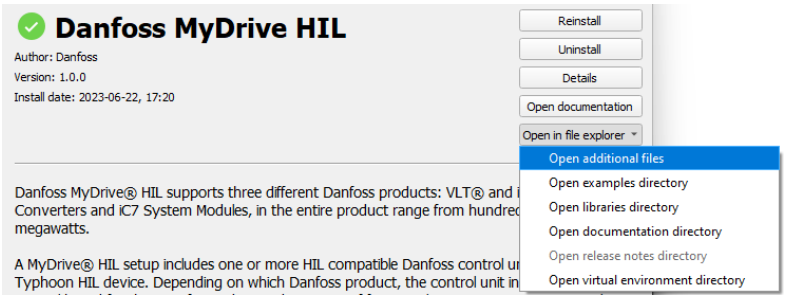


Figure 5: Directories found in Package Manager.

Configure the shortcut:

1) Open the shortcuts *properties,*
2) Find *Target* on the *Shortcut* tab,
3) Store the target path which is already there and add *-rs232 <COM port number>*[4] *-topmost* e.g. C:\MyDriveHIL\lcp_sim\lcpsim.exe -rs232 2 -topmost,
4) Change the icon. Click on the *Change icon* button and browse for *LCPsim.ico* (placed in the *lcp_sim* folder).

[4] COM port number is the number that was found in step 3 under Find the COM port

3 Setup of HIL Compatible iC7 Frequency Converter

3.1 Hardware Setup

Connections needed to operate the MyDrive® HIL, see figures below for details:

1. HIL Compatible iC7 ⇔ HIL402/404 using the two ribbon cables,
2. HIL Compatible iC7 ⇔ HIL404 using RS232 serial connection,
3. HIL Compatible iC7 ⇔ host PC using USB,
4. Main power supplies to the HIL Compatible iC7 (24 V and 5 V),
5. HIL402/404 ⇔ host PC using USB,
6. Main power supply to the HIL402/404 device (12 V)[5],
7. Ethernet based Fieldbus for the iC7 Frequency Converter ⇔ 3rd part equipment, e.g., external PLC (where applicable).

Figure 6: Front with ribbon-cables to HIL402 device.

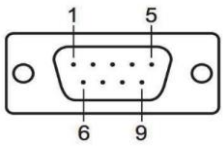
Figure 7: Rear with connection for main power supplies, USB for access to the service-port of iC7 control unit, Ethernet based Fieldbus for control unit and serial communication with HIL404 device.

[5] **NOTICE:** The DC power-connectors for the HIL device and the HIL Compatible iC7® Frequency Converter matches together. Applying 24 V to the HIL device will damage it.

3.2 Serial Communication

Serial communication is needed between the HIL Compatible iC7 Frequency Converter and the HIL device. The HIL402 device supports serial communication through the digital IO on the front (ribbon cable), whereas the HIL404/604/606 devices have a dedicated RS232 port, see picture below. The selector-switch must be set accordingly to which HIL device is used, otherwise the MyDrive® HIL will not operate.

Figure 8: Selector between HIL402 and HIL404/604/606 devices and RS232 port for serial communication.

RS232 D-SUB9	HIL Compatible iC7 Frequency Converter	HIL 404 / 604 / 606	Description
	2	2	TX
	3	3	RX
	5	5	GND

3.3 LEDs on front side of HIL Compatible iC7 Frequency Converter

The enclosure includes two LEDs on the front.

- '24 V Supply ON' is permanently on when external 24 V power supply is provided,
- 'CC Supply ON' turns on when the iC7 control board is powering the basic IO board. There is a delay (up to 30 second) from turning on the grid in the simulation until the LED is lit up (typical boot time of the iC7 Frequency Converter).

4 MyDrive® HIL package installation

The MyDrive® HIL package must be installed through the Typhoon HIL Control Center[6], see Figure 9. Select {1} 'Additional tools' → {2} 'Package Manager' → {3} 'Package actions …' → 'Install package from disk …' find and select the *danfoss_mydrive_hil.tpkg* file. More information is available in the Typhoon HIL Documentation.

Once installed, the MyDrive® HIL package becomes visible in the 'Installed' tab, see Figure 10.

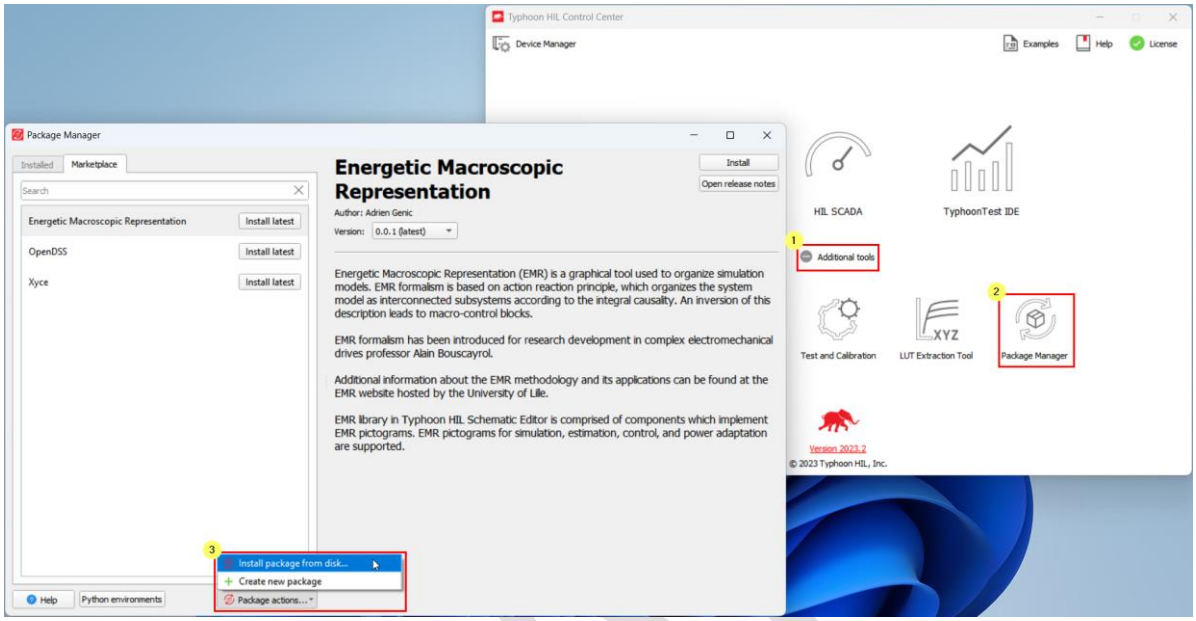


Figure 9: Installing the MyDrive® HIL package.

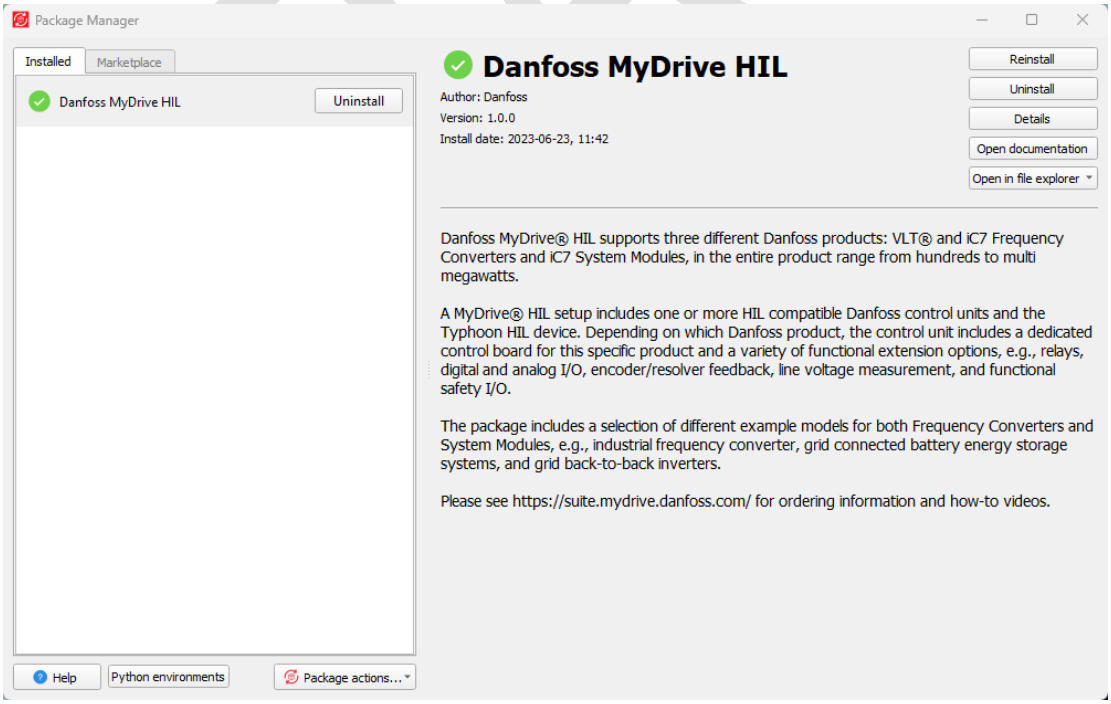


Figure 10: MyDrive® HIL successfully installed.

[6] **NOTICE**: Internet access is required during installation in order to download required python packages.

5 General Use

This section describes how to configure the (example) simulation model and the iC7 / VLT® Frequency Converter such that a HIL simulation can be made.

5.1 Open Example Simulation Model

To open the simulation model, select: {1} '*Examples*' → {2} '*Danfoss MyDrive® HIL*' → {3} 'Open model' (it takes some time to load), see Figure 11.

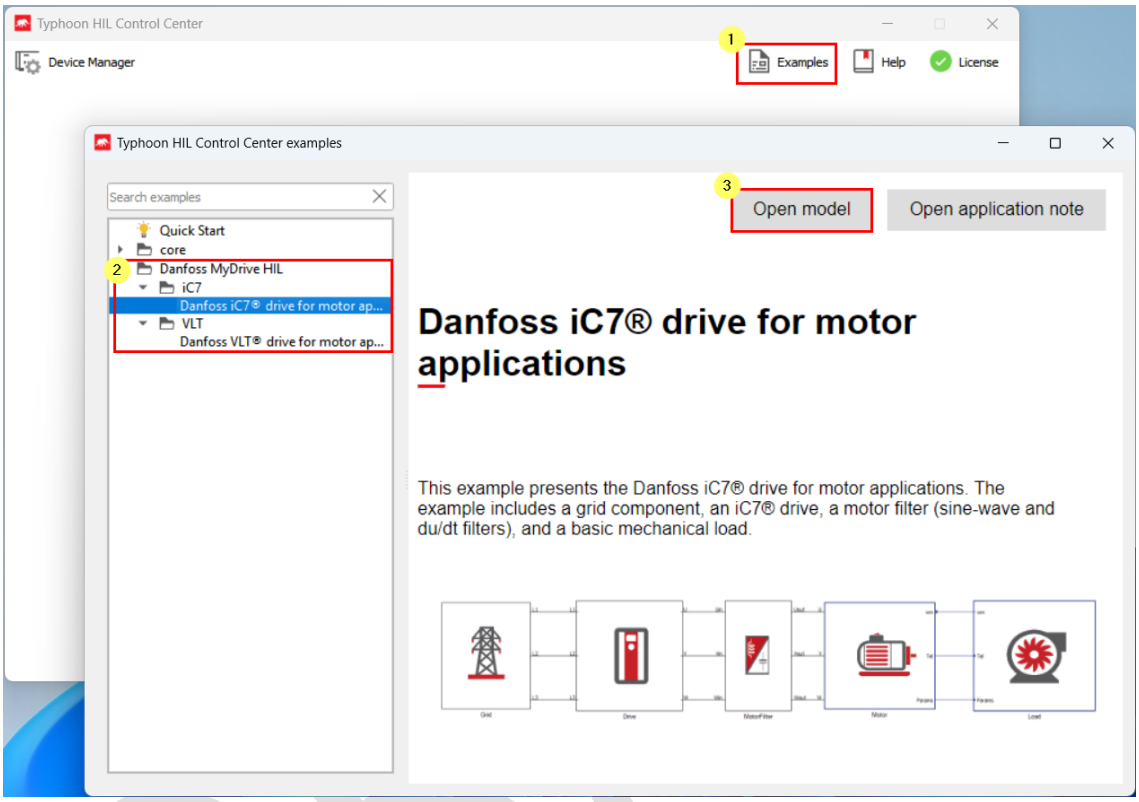


Figure 11: Opening the Danfoss MyDrive® HIL example simulation model.

5.2 Configuring and Compiling Example Simulation Model

The example simulation model is configured to represent a frequency converter with matching motor-filter and induction motor. The load is a basic load with support for speed and torque modes and mechanical brake. The grid impedance is calculated based on the frequency converters nominal current, see Figure 12 for details.

To reconfigure a component, double-click on it and modify the data[7]. Some components support data loading from file. Data for these components can be found in the folder that is given in the *Data path* property value. To get this path click the *Copy Path* button in the component's mask. For more info about the data files, and how to create new data files, please read the Data Files and Schemas section.

[7] **NOTICE**: The following steps can change the example simulation models from how they were originally created. It is possible to restore the file by reinstalling the Danfoss MyDrive HIL package. In this case, the changes made on the example simulation models will be lost! It is therefore good practice to save the example simulation model into another file (File → Save as…) before modifying it.

When the simulation model has been configured click the '*Compile and (re)load model in HIL SCADA*' button  .

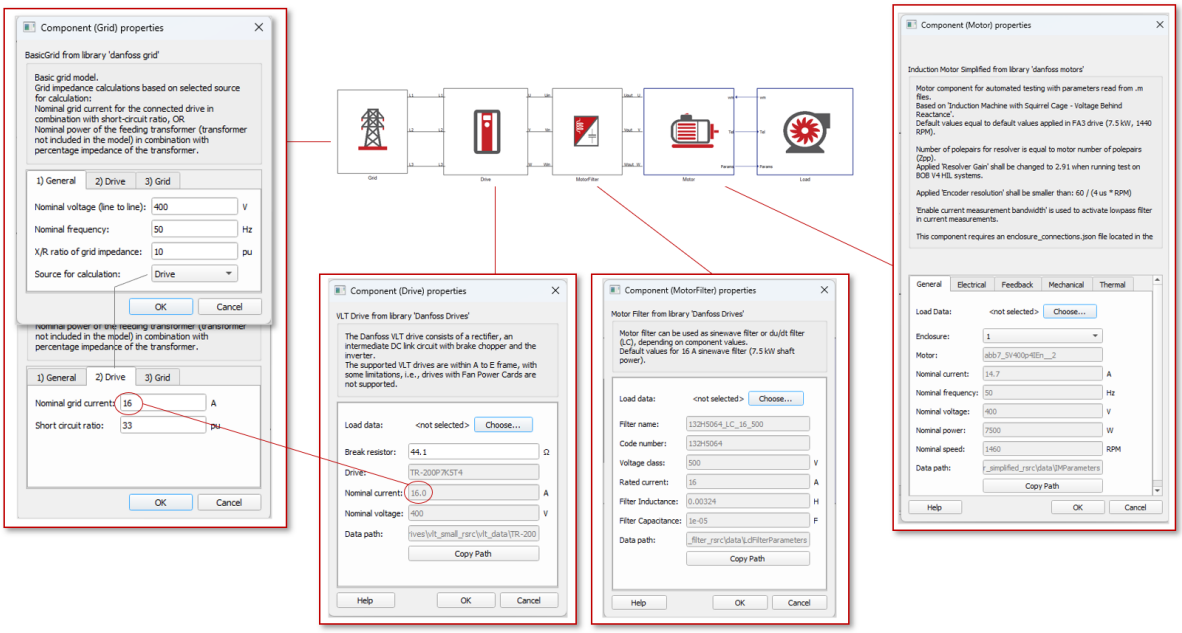


Figure 12: Configuring Danfoss components.

5.3 Simulation in HIL SCADA

When the simulation model is compiled, the simulation can be started in HIL SCADA. (If *compile and load in HIL SCADA* button was used in Schematic Editor, the first 3 step below are automatically performed)

1) Start THCC and select HIL SCADA,
2) In HIL SCADA select File → Load model,
3) Browse for the compiled simulation model[8] (*.cpd),
4) As the simulation model has been loaded, select a SCADA panel (*.cus),
5) Start the simulation by clicking on the simulation icon ,
6) In the Basic Grid widget, set Grid Mode to 'Nominal' to turn on the simulated grid,
7) Connect to the frequency converter with the usual tools (MyDrive® Insight, MCT 10, LCP Simulator).

[8] For the VLT example model it would be %APPDATA%\typhoon\<THCCversion> \package-examples\Danfoss MyDrive HIL\models\VLT\vlt_frequency_converter_hil_402 Target files\vlt_frequency_converter_hil_402.cpd

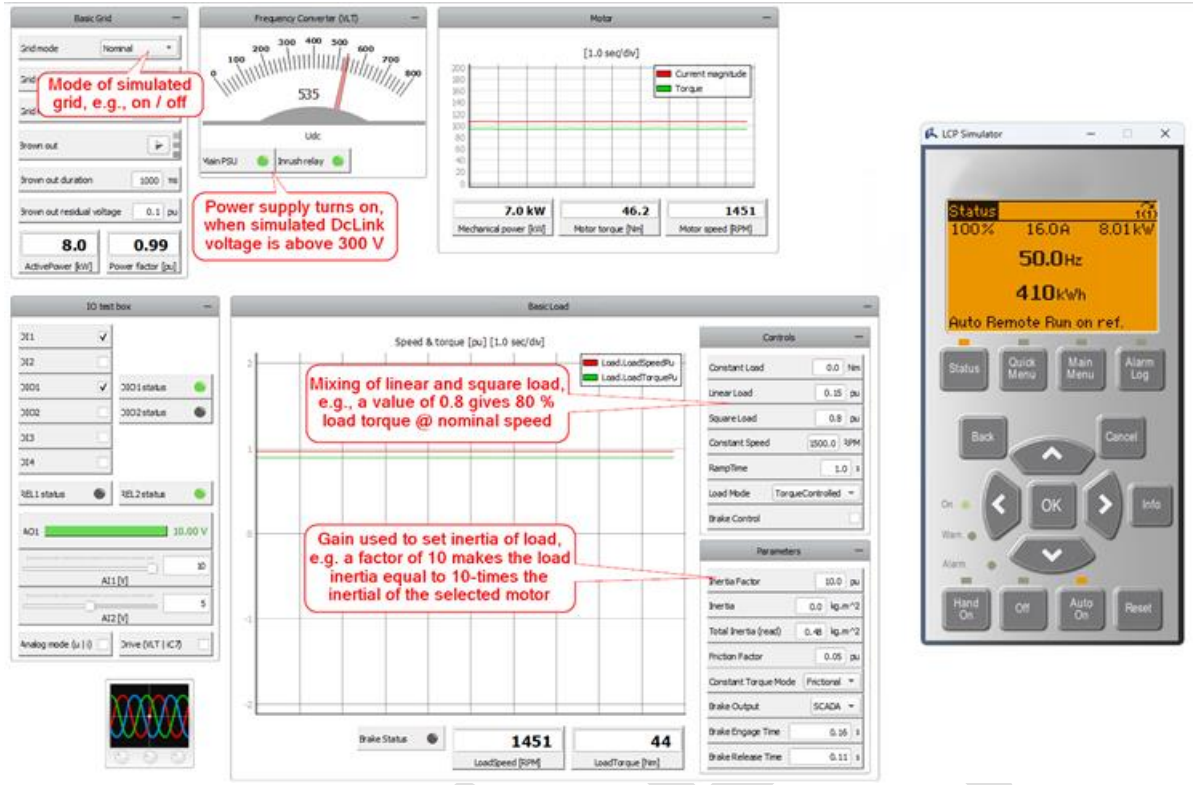


Figure 13: HIL SCADA Panel for example simulation model together with LCP simulator.

5.4 Commissioning Frequency Converter

Motor and filter parameters as well as frequency converter size must match the settings in the simulation model. Two different widgets are available to support this: *iC7 Frequency Converter Commissioning* and *VLT Frequency Converter Commissioning*. These widgets are available from the library-dock in the HIL SCADA and is part of the *app_basic_load* HIL SCADA panel.

The widget gets data from the simulation model. Based on the data it is possible to update power size of the frequency converter, motor data and filter data, when included in the simulation model.

The simulation must run while commissioning the Frequency Converter[9].

Once the commissioning process is completed, please validate exact state in MyDrive® Insight / MCT 10, Typhoon HIL SCADA should be restarted to remove persistent data in memory. The Frequency Converter may otherwise rise a warning about being inconsistent or power board failure.

If required, the Frequency Converter can be reset to factory settings by MyDrive® Insight / MCT 10.

5.4.1 VLT® Frequency Converter

The status of the commissioning can be followed in the HIL SCADA console.

[9] **NOTICE**: Do not interrupt the simulation or in other ways power down the setup during commissioning!!!

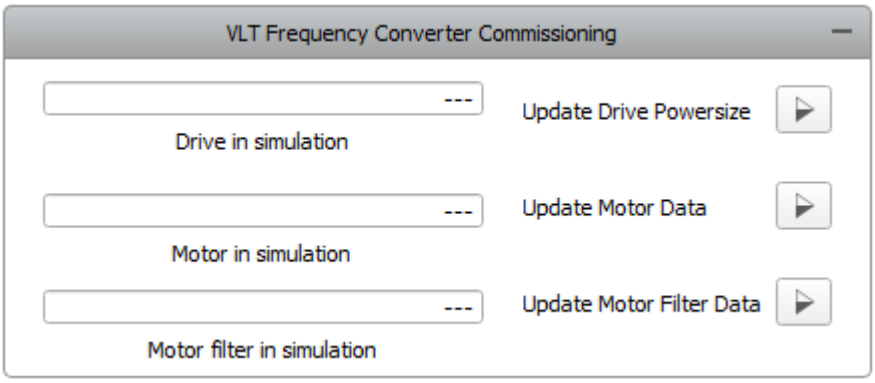


Figure 14: VLT® commissioning widget.

5.4.2 iC7 Frequency Converter

This is a silent process where no information is presented to the user. The process of commissioning takes a few minutes. The Frequency Converter is ready again when the 'Inrush Relay' LED is green in the Frequency Converter widget.

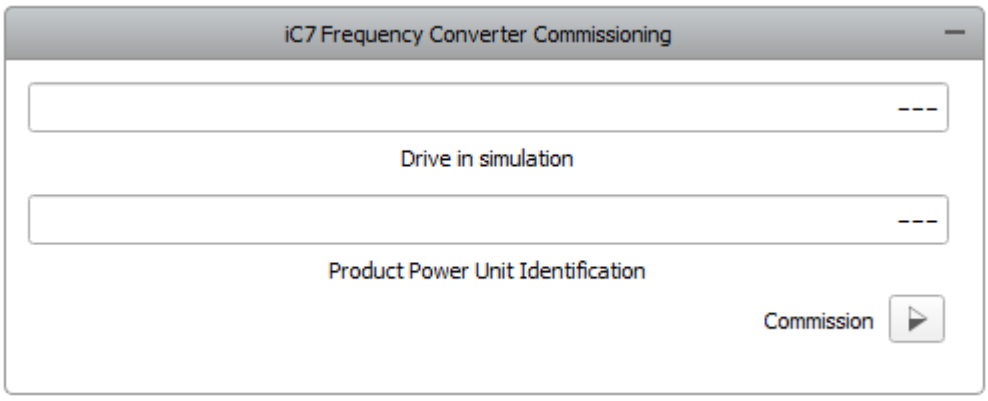


Figure 15: iC7 commissioning widget.

The 'Product Power Unit Identification' in the widget contains the same information as the Power Unit Identification in MyDrive® Insight, as seen in Figure 16.

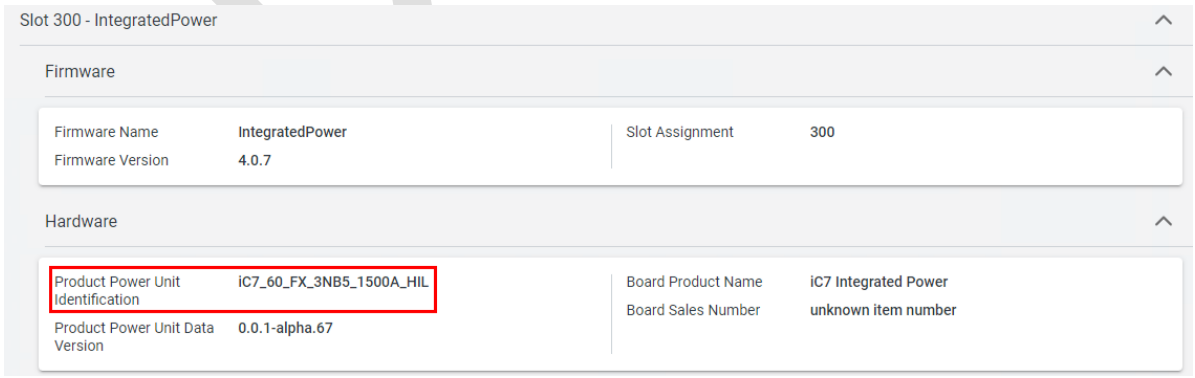


Figure 16: Product power unit identification as seen in MyDrive® Insight.

5.5 Controlling Frequency Converter through analog / digital IOs

The IO test box widget makes it possible to manually control the Frequency Converter through the analog/digital IO's on the control board, see Figure 17.

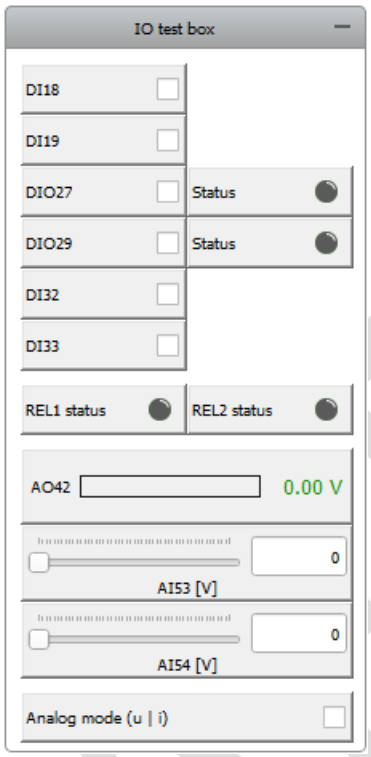


Figure 17: IO test box widget.

6 Data Files and Schemas

The Danfoss libraries comes with a predefined set of data files for iC7 and VLT® Frequency Converters and motors. Since there can be a need to generate user defined data files, a folder named *schemas* is placed in the additional files folder, see Figure 5. The folder contains schemas for the different data files. An *examples* folder is places inside the schemas folder. This folder holds example files for the different file types.

7 Troubleshooting

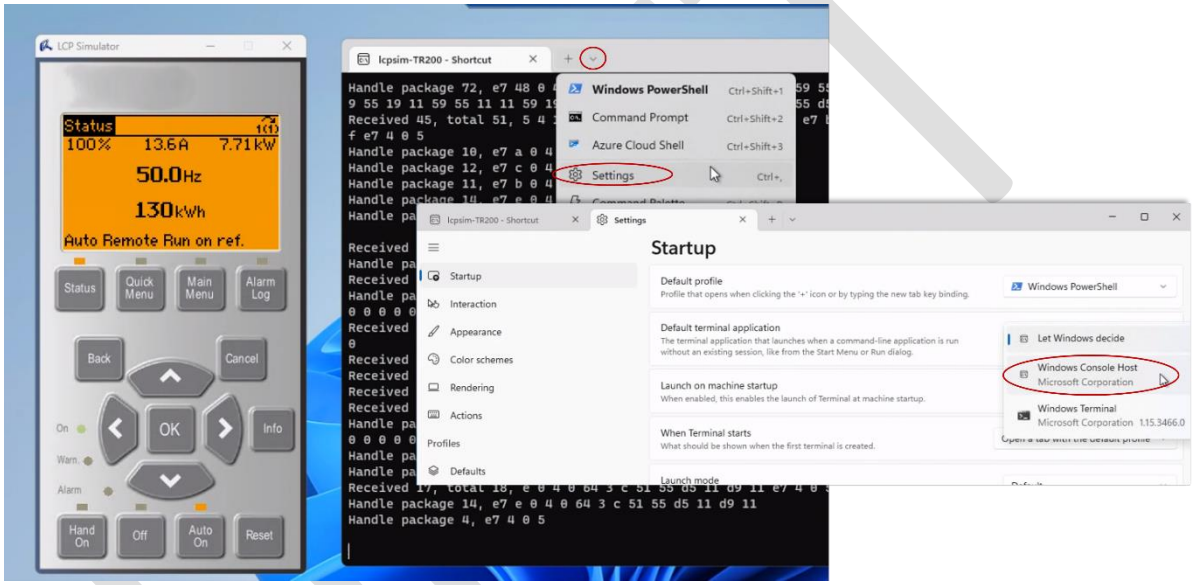
7.1 LCP simulator does not open, or nothing is shown on the screen

- Check that the COM port has been correctly configured, see Driver and port configuration
- Check that the COM port number is not be too big. COM1 or COM2 is preferred if possible
- Check that the connection between the host PC and the Frequency Converter is ok

7.2 How to avoid console opening when using LCP

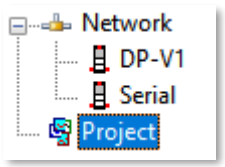
On Windows 11 a console window will by default open when the LCP is opened. To prevent this the following steps must be performed.

1. Open the LCP using the shortcut,
2. In the console click on the small arrow at the top of the window, see figure below,
3. A new window opens,
4. Select Windows Console Host for the default terminal application,
5. Click save and close the windows.



7.3 USB is not shown under Network in MCT 10

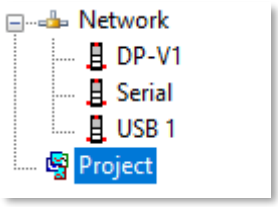
If only DP-V1 and Serial is seen under Networks, check the following:



- Is the frequency converter powered on?
- Is there a cable going from the frequency converter to the host PC?
  (it must be connected directly to the host PC, using a USB hub can create problems).
- Plug the USB cable out and in again.
- Replace the USB cable with another.

7.4 USB is shown under Network, but the frequency converter is available

If USB is seen under Network but the frequency converter is not seen under USB



- Right click on USB and select ,
    - Scan Bus for Active Drives (active frequency converters).

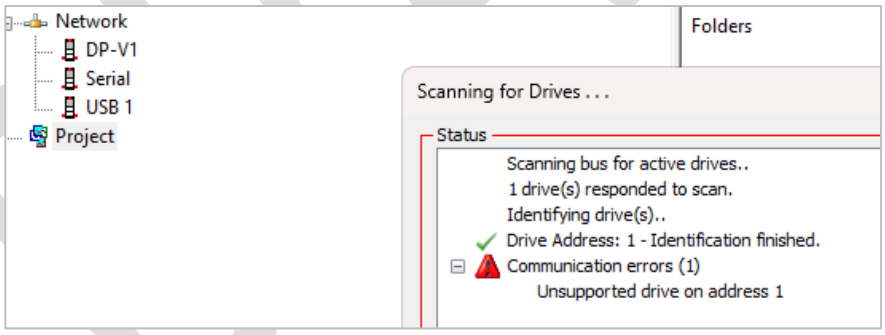
If the frequency converter still don't appear

- Right click on USB again and select,
    - Switch Frequency Converter to Normal Mode.

If all the above do not solve the problem, check that Protocol.Rerence.Server.CMD.exe is not running in Task Manager. If it is, the process must be stopped. The Protocol.Rerence.Server.CMD.exe process is started when communication to the frequency converter is established via the communication module. If the communication is interrupted before it is correctly closed the Protocol.Rerence.Server.CMD.exe may become unresponsive.

7.5 Error: Unsupported drive (frequency converter) on address

If an unsupported drive (frequency converter) error like the one below is shown in MCT 10, it is most likely a license issue. Please ensure that the MCT 10 license you are using is supporting the frequency converter type you try to use.

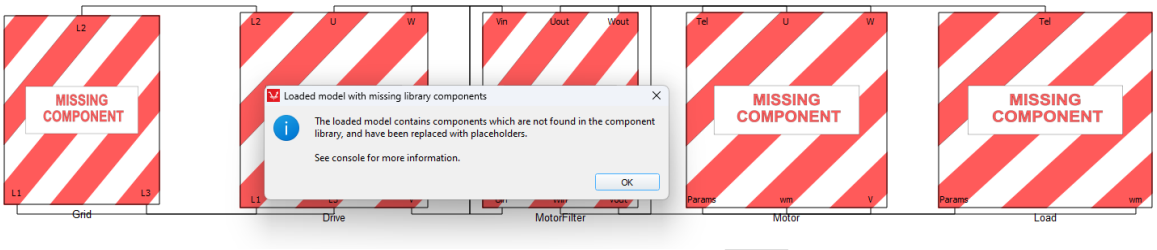


7.6 Error while loading model

If a message like the one below is displayed while loading the schematic model, it is because the Typhoon Hil license does not support for the Danfoss VLT®Toolbox. Please contact Danfoss regarding the license.

7.7 Loaded simulation model with missing library components

If a message like the one below is displayed and some of the components are red and white striped, it means that libraries are missing. If the missing library components are Danfoss components please try to reinstall the MyDrive® HIL package again in Package Manager. If this does not resolve the problem, please contact Danfoss.

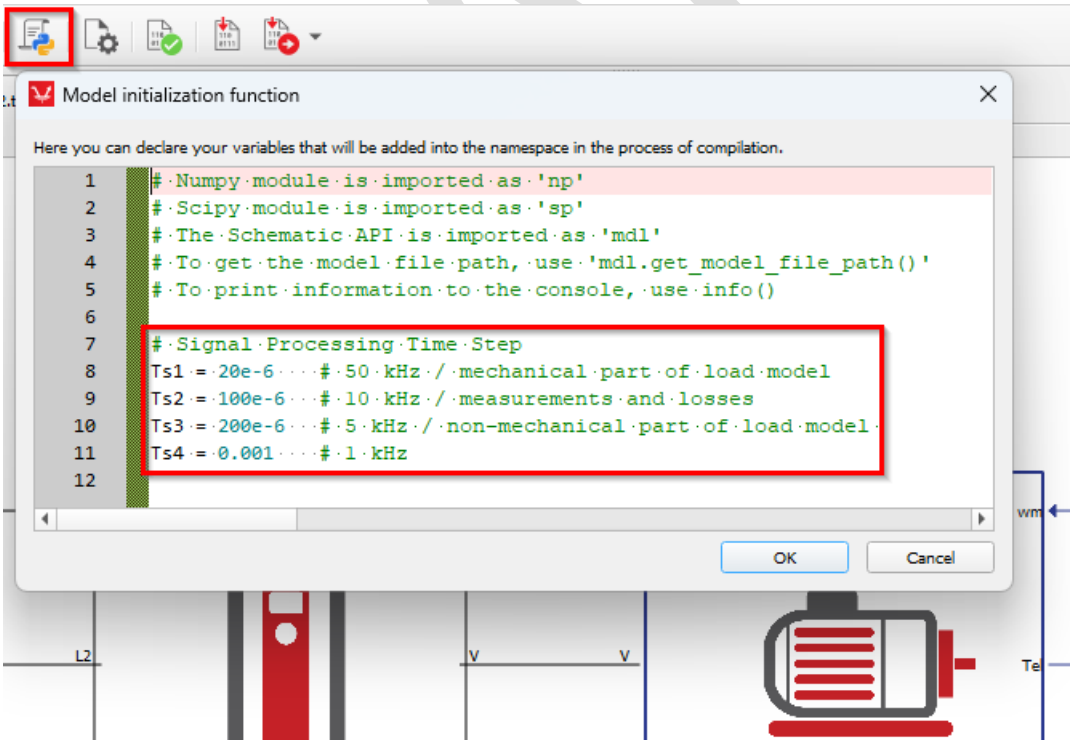


7.8 Typhoon HIL Control Center doesn't start

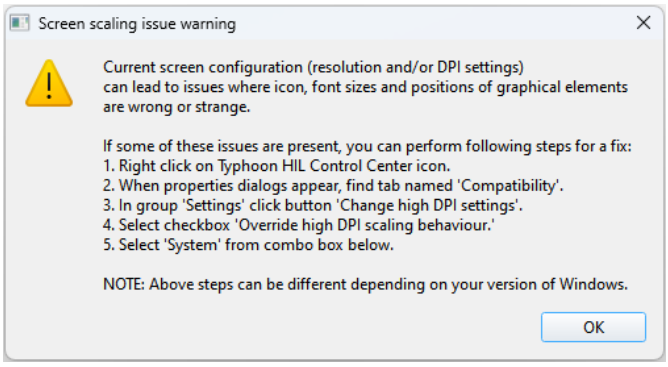
In some cases, another instance of THCC is already running on the host PC. Open task manager, find all instances of running THCC and end the tasks.

7.9 Exception during compilation

If an "*Evaluation failed for the property 'execution_rate' of the component ...*" exception is encountered during compilation, then the execution rates for the Danfoss components has not been set correctly. Open the 'Model initialization function' and add the four lines as depicted below (can also be copied from the example models).



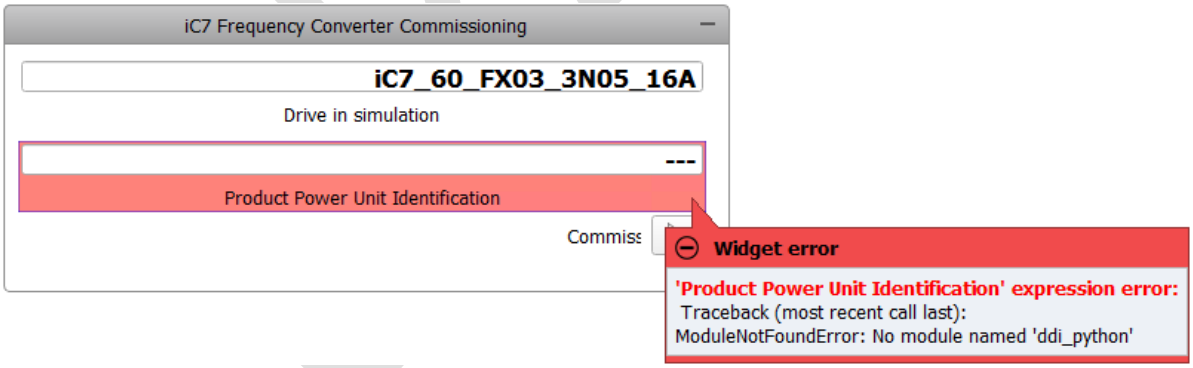
7.10 HIL SCADA Trace graph incorrect rendering



7.11 No module named 'ddCommunication' or 'ddi_python'

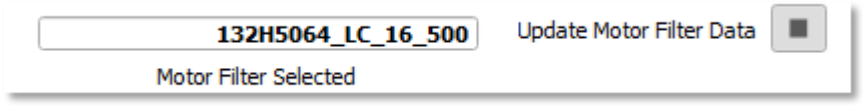
If an error like the one below appears when loading the *Frequency Converter (VLT) Commissioning* widget in SCADA, it is because the package for the frequency converter communication is not correctly installed. Ensure that the PC has access to the internet and try to reinstall the MyDrive® HIL Package in Package Manager again. If this does not resolve the problem, please contact Danfoss.

```
[08:37:19] : Error occurred!
 'Frequency Converter (VLT) Commissioning' namespace initialization error:
 Traceback (most recent call last):
ModuleNotFoundError: No module named 'ddCommunication'

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
Exception: Seems like the module for communicating with the Danfoss drive i
s not installed. Please try to run the package installation script for the
Danfoss libraries.
```



7.12 Macro execution hangs in HIL SCADA while communicating with the VLT

If a macro hangs while communicating with the VLT® the Typhoon Hil Control Center must be restarted. This should resolve the problem.



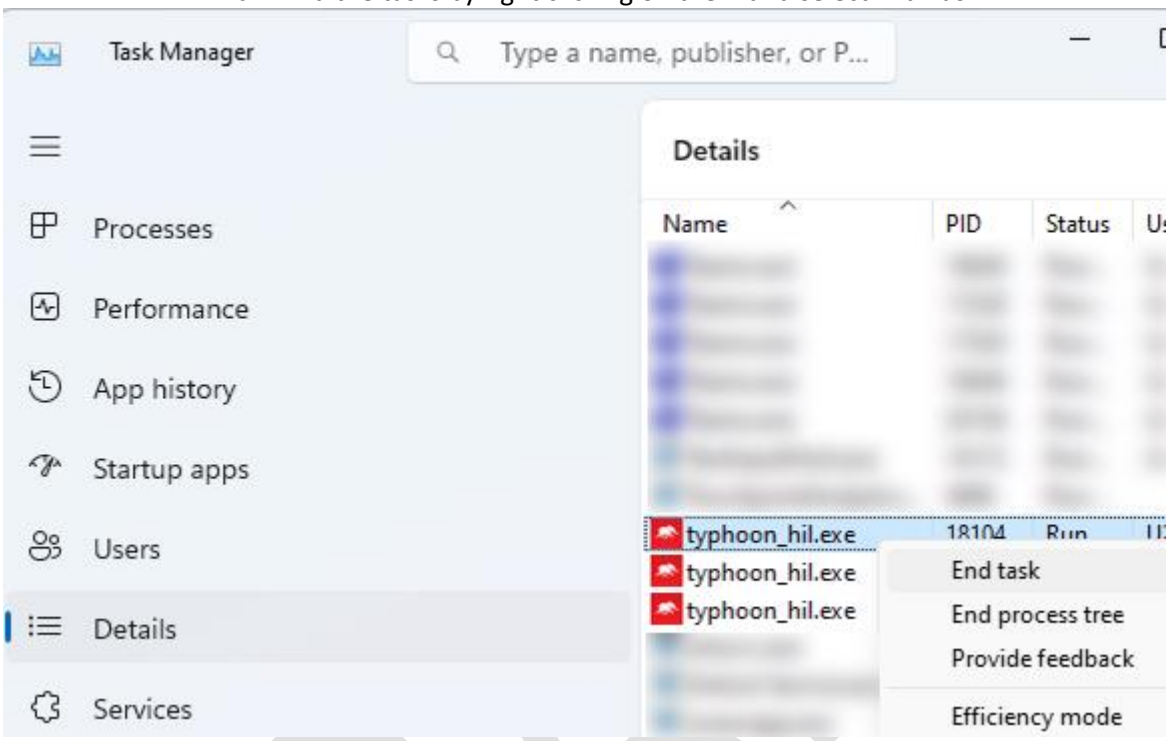
The reason why this is needed is because the macros for communicating with the VLT, starts python processes within the control center. Hence to terminate these, the control center must be terminated.

Note: Please inform Danfoss about the issue so that it can be resolved.

7.12.1 Terminating Typhoon Hil Control Center

When terminating the Typhoon Hil Control Center after an error, it is good practice to ensure that all *typhoonhil.exe* processes are killed:

- Start Task Manager,
- In the *Details* tab search for running *typhoonhil.exe* processes,
    - End the tasks by right clicking on them and select *End Task*.



7.13 Inconsistent / faulty iC7 Frequency Converter after Commissioning

Restart Typhoon HIL SCADA to remove persistent data in memory.

Danfoss A/S
Ulsnaes 1
DK-6300 Graasten
Denmark