Development Kit

The netX 90 real-time communication and motor control development kit enables the design of a speed controlled closed-loop motor control application profile synchronized over a real-time Ethernet industrial communication protocol. The kit consists of complementary hardware, software, and tool components as outlined below.

The available NXHX 90-MC software development board works out-of-the-box with Hilscher's netX Studio CDT, a free Eclipse-based IDE that includes everything needed to configure, develop, and debug embedded applications. Intended to be used for rapid prototyping and evaluation purposes, Hilscher offers a range of plug-in modules as add-on accessories for the development board. Further information can be found in the manual of the board.

Product Name	Part Number	Product Description	NXHX 90-MC Connector
NXHX-DH	7924.100	Digital halls/quadrature encoder interface adapter	X901, J3, J4, and J7
NXHX-ENC	7924.000	BiSS/EnDat/SSI encoder interface adapter	X901
NXHX-DP	7923.410	PROFIBUS-DP network interface adapter	X900
NXHX-CO	7923.500	CANopen network interface adapter	X900

Table 1: Applicable add-on accessories for the NXHX 90-MC software development board

The NXHX-DH adapter as piggyback board for the NXHX 90-MC board enables converting RS-422 (5V differential) and TTL (5V single-ended) quadrature encoder signals to 3.3V inputs for the netX 90 and provides the supply voltage for the encoder and hall senors, including analog filter circuits for the digital hall inputs. Push-in connectors for up to two quadrature encoders and three digital hall sensors facilitate the interconnection of industrial motors with position feedback. Board schematics and layout files of both NXHX-DH and NXHX 90-MC, including the BOM components list, are available for download as PCB reference design for KiCad EDA.

The available netX Studio CDT example projects offer different entry points, depending on project needs, and serve as starting point for application developments. The application sample code, including the documentation of the sources in doxygen, is provided as open source software for download. The different components and their licenses are listed and described in more detail below.

1. Motor control application

The software example demonstrates the implementation of a FOC algorithm with position feedback for a 3-phase PMSM using a software-defined MCL API for the higher application layer APPL. It "explains by use" the application-tailored interplay between hardware assisted features and algorithmic software, intended to be used in a motor control laboratory to define, setup, and optimize motor-specific control parameters. As illustrated in Figure 2, the algorithmic software, consisting of FOC, PSE, and SC, developed by motor control experts, is based on a development board setup that serves as application example for a specific PMSM with integrated digital hall sensors or optional quadrature encoder. Enclosed, within the project sources, is a Hilscher compliant dummy communication firmware file that, if programmed, generates xC trigger pulses of 4 kHz to emulate how the MPWM, hence the FOC, can be synchronized to hardware-assisted cyclic network events.

Software Name	Chip Segment	License Type	Delivered As	Obtained From	Project Download
xC Trigger Unit 4kHz	COM	Limited evaluation version	Firmware binary file	Hilscher	netMOTION Examples
FOC API example	APP	See disclaimer notice	C example source code	Eonas	

Table 2: Components and licenses - motor control application software example

> **Technology Partner**
> Eonas is a Hilscher technology partner specialized in the design and development of advanced hardware and software components for motor control solutions. Eonas offers design services for netX 90 based motor control applications, including sensor-based and sensorless, software-in-the-loop, co-simulation (Simulink), motor testing, performance analysis, thermal optimization, and more.
>
> The motor control software example "as it is" can be freely used by customers to adapt, modify, and enhance the FOC to their application and motor needs. Applied with practical motor control theory knowledge, available graphical interface application programs that enable visualizing software variables of embedded systems in real-time can be put into use to fine-tune control parameters.

2. Vendor application profile

The software example brings together Eonas' MCL API for the speed control of a 3-phase PMSM and Hilscher's cifX API for a cyclic data exchange with the protocol stack interface using the iDPM. It "explains by use" the initialization and configuration of the underlying communication protocol stack over the iDPM to connect the device to a Real-time Ethernet network, intended to be used as starting point for the development of a custom-specific vendor application profile.

Software Name	Chip Segment	License Type	Delivered As	Obtained From	Project Download

PROFINET IO-Device V5 / EtherCAT Slave V5 / EtherNet/IP Adapter V5	COM	Limited evaluation version	LFW/MFW binary files	Hilscher	netMOTION Examples
Device configuration	COM	n.a.	HWC/FDL config files	netX Studio CDT Tools	
FOC API example	APP	See disclaimer notice	C example source code	Eonas	
cifX API example	APP	See disclaimer notice	C example source code	Hilscher	

Table 3: Components and licenses - vendor application profile software examples

3. PROFIdrive application class

The software example brings together Eonas' MCL API for the speed control of a 3-phase PMSM, Hilscher's cifX API for a cyclic data exchange with the protocol stack interface using the iDPM and Siemen's publicly available open source code for PROFIdrive device as a vendor-neutral application class 1 (AC1) for PROFINET. It "explains by use" the network setup and configuration of the device with a PROFIdrive PLC, intended to be used as starting point for the development and as basis for application class 4 (AC4).

Software Name	Chip Segment	License Type	Delivered As	Obtained From	Project Download
PROFINET IO-Device V5	COM	Limited evaluation version	LFW/MFW binary files	Hilscher	Release in Q2 2021
Device configuration	COM	n.a.	FDL/HWC config files	netX Studio CDT Tools	
FOC API example	APP	See disclaimer notice	C example source code	Eonas	
cifX API example	APP	See disclaimer notice	C example source code	Hilscher	
PROFIdrive example	APP	See disclaimer notice	C example source code	Siemens	

Table 4: Components and licenses - PROFIdrive application class software example

Subpages

- How to get started with netMOTION
- Board application setup PMSM
- Software application note FOC