

# CNC Power Engineering

## Always on the move



## CNC and Drives

### Training catalogue 2017

## Who besides you has the best expertise in your area of business?

The answer is obvious and quite simple: you are the expert in your field. Similarly, no one other than NUM could claim to have the deepest expertise of our extended range of drives and CNCs. After all, this has been our business for fifty years. This is why we are your number one partner for the training of your teams.

Whether you are a User, an OEM, a Maintenance specialist or a System builder, NUM has in its catalog all kind of training sessions dedicated to your applications and this for all generation of NUM products making parts on today machines.

Of course each customer has its own requirements, each machine and each application has its own specificities, and this is why we can also offer customized training sessions focused on your particular needs.

As a provider of CNC High End Applications, we have organized our training sessions by features and level of knowledge required, in order to help you to get all the data you need and only the data you need to be the most efficient. These sessions are conducted by training specialists and applications engineers so you can be assured that you will always get the most accurate and professional answers, whatever your question or concern might be. These sessions will give a chance to develop a durable relationship between our companies to further develop cooperation for the full benefit of all.

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## Training with NUM: your advantages

- Technical data are up to date
- Should you need a specific function, you will get in depth information
- Partnership development
- You will be in touch with the experts in every domain of NUM activity
- Whatever your area of expertise might be (Maintenance, Service, Programming, Setup...), you will find the courses you need
- Full range of products and software in one location

## Training centers

All NUM technical centers are equipped to provide training. These sessions will either take place in our premises or in your facility.



Some training facilities



## Flexium CNC and drives training courses

The different training modules are linked in a way to provide a logical path for mastering our application solutions in your area of expertise.

The training sessions can be

- Generic FXTR...
- Flexium specific FLTR...
- Flexium+ specific FPTR...

The four main categories are

- Product characteristics F.TR001..
- Operation F.TR002..
- Maintenance F.TR003..
- Engineering and Setup F.TR004..

They are organized in three levels of expertise with a logical progression path

- Beginner 01
- Advanced 02
- Specialist x3 : x specific function
- Drive specialist x4 : x specific function

This structure is intended to providing you with the shortest and most efficient path to the success

The following sessions are available:

### Cross range sessions

FXTR 101	Flexium system description
FXTR 102	Flexium and Safety
FXTR 201	Operation and basic maintenance
FXTR 202	Advanced part programming
FXTR 213	Flexium 3D
FXTR 223	Dynamic operators in C
FXTR 233	High speed cutting – 5 axes functions
FXTR 301	Flexium system maintenance
FXTR 401	Flexium system initial setup
FXTR 423	NUMDrive C on CANOpen
FXTR 433	Extended NCK Access (ENA)
FXTR 443	Flexium HMI personalization
FXTR 453	Communication with Flexium

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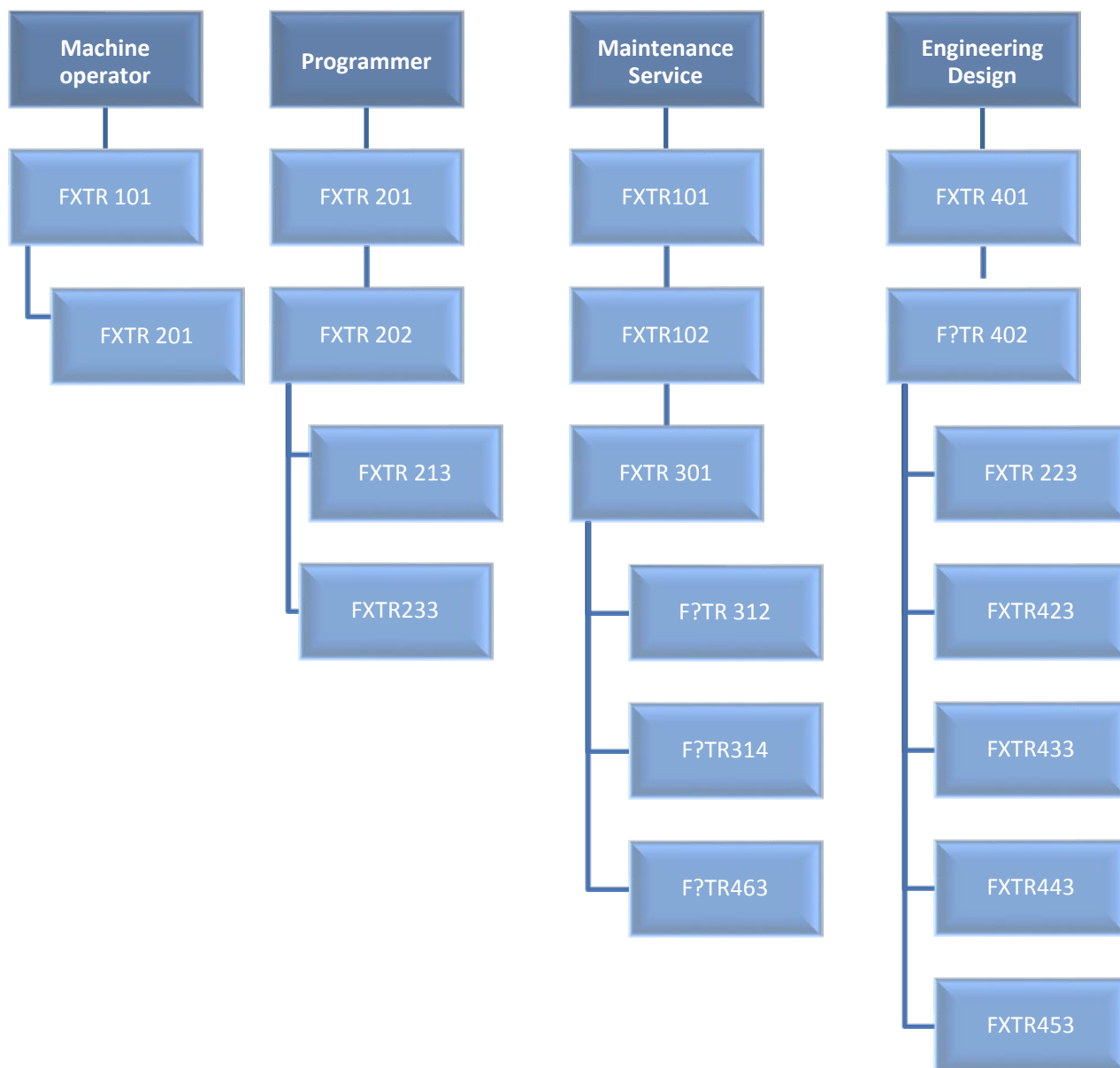
### Flexium specific sessions

FLTR 312	Flexium advanced maintenance
FLTR 314	NUMDrive C advanced maintenance
FLTR 402	Flexium system advanced setup
FLTR 463	Safety including SAM

### Flexium+ specific sessions

FPTR 312	Flexium+ system advanced maintenance
FPTR 314	NUMDrive X advanced maintenance
FPTR 402	Flexium+ system advanced setup
FPTR 463	Safety including NUM-SAMX

Training path proposal



N.B.: For simplification purposes the three 0 digits following FXTR code has been suppressed in this figure. They are used to define the language of the training sessions

N.B. 2: The sessions for specialists are chosen according to the options required. There is no need to attend them in sequence

N.B 3: Training courses for previous products are built on request

N.B. 4: The question mark in F?TR stands for **L** (Flexium) or **P** (Flexium<sup>+</sup>)

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## Your training contacts

### Austria:

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For other countries, please contact your local sales representative or NUM Switzerland (sales.ch@num.com).



## **Training organization**

### **Quotation**

Offers can be asked at your training contacts (see section 'Your training contacts').

### **Date and time table**

Training dates and time tables will be part of a quotation.

### **Journey**

Your local sales representative of NUM will provide you with journey information.

### **Hotels**

Your local sales representative of NUM can recommend you hotels near to the training places.

# Flexium system description

# FXTR 101

Your area of interest	Prerequisite
General knowledge	None
Objectives	Supports
<ul style="list-style-type: none"> <li>✓ Understanding the Flexium range structure (CNCs and Drives)</li> <li>✓ Understanding the main functions</li> <li>✓ Ability to define a configuration with the Flexium catalogue</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Individual components</li> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> <li>○ Flexium catalogue (on CD)</li> </ul>
Training Content	
<p>Flexium CNC presentation</p> <ul style="list-style-type: none"> <li>○ The different models of CNCs</li> <li>○ Hardware structure – Software functions</li> </ul> <p>The panels</p> <ul style="list-style-type: none"> <li>○ PC Panels</li> <li>○ Machine panels</li> </ul> <p>The PLC</p> <ul style="list-style-type: none"> <li>○ Structure</li> <li>○ Programming languages</li> <li>○ IOs</li> </ul> <p>NUMDrive C presentation</p> <ul style="list-style-type: none"> <li>○ Hardware structure</li> <li>○ Drives functions and performances</li> <li>○ Axes and spindle motors</li> </ul>	<p>NUMDrive X presentation</p> <ul style="list-style-type: none"> <li>○ Hardware structure</li> <li>○ Drives functions and performances</li> <li>○ Axes and spindle motors</li> </ul> <p>Tools</p> <ul style="list-style-type: none"> <li>○ PLC programming</li> <li>○ Web tools</li> </ul> <p>Applications</p> <ul style="list-style-type: none"> <li>○ From the single unit CNC to the multi CNC - multi panels configurations</li> </ul> <p>Questions and answers (1/2 hour)</p>
Duration	Date / Costs
1 day	Please consult your local training contact

# Flexium and Safety

# FXTR 102

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## Your area of interest

General knowledge

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## Prerequisite

None

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## Objectives

- ✓ Understanding the Flexium and Flexium<sup>+</sup> safety concepts
- ✓ Understanding the various safety features
- ✓ Ability to define the components and development required for a particular configuration

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## Supports

- Training materials
- Individual components
  - Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)
  - Flexium catalogue (on CD)

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## Training Content

Safety: What is it?

- Safety PLCs
- Safe motions
- Safety level

General on EtherCAT and FSoE

The Safe PLC

- Structure
- Programming languages
- I/Os

Safety and Motions

- SAM, STO and NUMDrive C
- SAMX, STOx and NUMDrive X

Questions and answers (1/2 hour)

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## Duration

1 day

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## Date / Costs

Please consult your local training contact

# Operation and basic maintenance

# FXTR 201

Your area of interest	Prerequisite
Machine operator – 1 <sup>st</sup> level maintenance	Knowledge of NUM products or FXTR 101
Objectives	Supports
<ul style="list-style-type: none"> <li>✓ Ability to run a machine equipped with Flexium system</li> <li>✓ Understanding and adjusting the coordinate systems and tools offsets</li> <li>✓ Understanding operators message and status indicators to perform a first level maintenance</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Individual components</li> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> <li>○ Programming manual (CD)</li> </ul>
Training Content	
<p>Operation</p> <ul style="list-style-type: none"> <li>○ Using the HMI</li> <li>○ Modes of operation</li> <li>○ ISO concepts (interpolation – feedrate – tools offsets – main canned cycles)</li> <li>○ Coordinate systems – programmable axes</li> <li>○ Work preparation, tools offsets, origin presets</li> <li>○ Basic of parametric programming</li> </ul> <p>Maintenance</p> <ul style="list-style-type: none"> <li>○ Status indicators</li> <li>○ Operators messages</li> <li>○ LED indications</li> <li>○ Backup of essential data</li> <li>○ Adding a system option</li> </ul>	<p>Tools</p> <ul style="list-style-type: none"> <li>○ Web tools</li> <li>○ Flexium license loader</li> </ul> <p>Questions and answers (2 hours)</p>
Duration	Date / Costs
3 days	Please consult your local training contact

# Advanced part programming

# FXTR 202

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## Your area of interest

Advanced part programming – custom macros – special functions for OEM

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## Prerequisite

Level FXTR 201

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## Objectives

- ✓ Mastering the advanced ISO functions of the system
- ✓ Ability to create a custom macro (tool changer – milling head exchange – probing etc.)

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## Supports

Training materials

- Individual components
- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Programming and advanced programming manual (CD)

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## Training Content

Advanced ISO functions

- Polar programming
- Probing management
- Pocket cycles
- Complements on parametric programming
  - Detailed information on E parameters
  - Relation with the outside via the PLC
- Structured programming
- Dynamic operators
- Customized G codes

Exercises

Questions and answers

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## Duration

4 days

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## Date / Costs

Please consult your local training contact

# Flexium 3D

# FXTR 213

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## Your area of interest

Machine operation - Programming

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## Prerequisite

Knowledge of NUM products or FXTR 201

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## Objectives

- ✓ Using Flexium 3D to validate a part program
- ✓ Interacting with Flexium HMI to correct possible programming faults
- ✓ Optional : Customizing Flexium 3D for machine simulation

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## Supports

- Training materials
- Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)

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## Training Content

Flexium 3D presentation

- Principle of operation
- The different screens

Running Flexium 3D

- Program configuration
- Defining the blank and the tools
- Off line and On line simulation

Exercises

Optional

- Designing a machine model

Questions and answers (2 hours)

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## Duration

1 day + 1 day optional

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## Date / Costs

Please consult your local training contact

# Dynamic operators in C

**FXTR 223**

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## Your area of interest

General knowledge

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## Prerequisite

FXTR 202 and C language

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## Objectives

- ✓ Develop an application using dynamic operators in C

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## Supports

Training materials

- Individual components
- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Flexium catalogue (on CD)

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## Training Content

- Principle of dynamic operators
- Short example using classic dynamic operators
- Review list of parameters
- The compiler
- Examples
- Trace and debug

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## Duration

1 day

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## Date / Costs

Please consult your local training contact

# High Speed Cutting – 5 axes functions

**FXTR 233**

## Your area of interest

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General knowledge

## Prerequisite

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FXTR 202 and FXTR 401

## Objectives

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- ✓ Mastering 5 axes machining functions
- ✓ RTCP (Rotating Tool Centre Point)
- ✓ Inclined plane
- ✓ High speed cutting

## Supports

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- Training materials
- Individual components
  - Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)
  - Flexium catalogue (on CD)

## Training Content

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- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>○ NC 5 axes functions</li> <li>○ RTCP and inclined plane parameterization</li> <li>○ Application</li> <li>○ High speed machining functions</li> <li>○ Speed and acceleration controls</li> <li>○ Optimization of parameters</li> </ul> | <ul style="list-style-type: none"> <li>○ Axes adjustments</li> <li>○ Flexium tools instruments</li> <li>○ Practical case</li> </ul> <p>Questions and answers (1/2 hour)</p> |
|---|---|

## Duration

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2 days

## Date / Costs

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Please consult your local training contact



# Flexium system maintenance

# FXTR 301

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## Your area of interest

Maintenance

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## Prerequisite

Level FXTR 101

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## Objectives

- ✓ Ability to detect and replace defective components in a short time
- ✓ Predictive maintenance

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## Supports

- Training materials
- Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)

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## Training Content

Flexium system maintenance

- System structure
- Components
- System startup
- Diagnostics
- Software updates
- Service tool
- Safety
- Part replacement

Drives maintenance

- Product knowledge
- Drives exchange procedure

Questions and answers (1 hour)

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## Duration

3 days

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## Date / Costs

Please consult your local training contact

# Flexium system advanced maintenance

FLTR 312

<b>Your area of interest</b>	<b>Prerequisite</b>
Maintenance	Level FXTR 301
<b>Objectives</b>	<b>Supports</b>
<ul style="list-style-type: none"> <li>✓ Ability to detect and replace defective components in a short time</li> <li>✓ Predictive maintenance</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> </ul>
<b>Training Content</b>	
<p>Flexium system maintenance</p> <ul style="list-style-type: none"> <li>○ Detailing the product structure</li> <li>○ Exchange zone</li> <li>○ Troubleshooting with Flexium HMI</li> <li>○ Flexium Tools</li> <li>○ Parameters modification</li> <li>○ Debugging with the PLC</li> <li>○ PLC program adjustments</li> <li>○ Backup and restore</li> </ul>	<p>NUMDrive C advanced maintenance</p> <ul style="list-style-type: none"> <li>○ Detailed analysis</li> <li>○ Drives instruments</li> <li>○ Drives exchange procedure</li> <li>○ Safety application maintenance</li> </ul> <p>Questions and answers (1 hour)</p>
<b>Duration</b>	<b>Date / Costs</b>
3 days	Please consult your local training contact

# Flexium<sup>+</sup> system advanced maintenance

**FPTR 312**

## Your area of interest

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Maintenance

## Prerequisite

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Level FXTR 301

## Objectives

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- ✓ Ability to detect and replace defective components in a short time
- ✓ Predictive maintenance

## Supports

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- Training materials
- Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)

## Training Content

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### Flexium<sup>+</sup> system maintenance

- Detailing the product structure
- Exchange zone
- Troubleshooting with Flexium HMI
- Flexium Tools
- Parameters modification
- Debugging with the PLC
- PLC program adjustments
- Backup and restore

### NUMDrive X drives advanced maintenance

- Detailed analysis
- Drives instruments
- Drives exchange procedure
- Safety application maintenance

Questions and answers (1 hour)

## Duration

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3 days

## Date / Costs

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Please consult your local training contact

# NUMDrive C advanced maintenance

FLTR 314

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## Your area of interest

Machine maintenance

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## Prerequisite

Level FXTR 301

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## Objectives

- ✓ Ability to detect and replace components or adjust parameters

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## Supports

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)

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## Training Content

Review

- Range description
- Troubleshooting with Flexium HMI

Components connections

- Structure of a NUMDrive C application

Adjustments

- Using Flexium Tools for diagnostic
- Main drive parameters
- Adjustment and control

Questions and answers

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## Duration

3 days

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## Date / Costs

Please consult your local training contact

# NUMDrive X advanced maintenance

**FPTR 314**

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## Your area of interest

Machine maintenance

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## Prerequisite

Level FXTR 301

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## Objectives

- ✓ Ability to detect and replace components or adjust parameters

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## Supports

- Training materials
- Simulator
- Deliveries
- Course presentation (printed and .pdf on CD)

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## Training Content

### Review

- Range description
- Troubleshooting with Flexium HMI

### Components connections

- Structure of a NUMDrive X application

### Adjustments

- Using Flexium Tools for diagnostic
- Main drive parameters
- Adjustment and control

### Questions and answers

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## Duration

3 days

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## Date / Costs

Please consult your local training contact

# Flexium system initial setup

# FXTR 401

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## Your area of interest

Engineering and Setup

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## Prerequisite

FXTR 201

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## Objectives

- ✓ Create a first Flexium application for a machine
- ✓ Control basic functions – Run two axes and a spindle

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## Supports

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Installation manual – Commissioning manual – Flexium Tools (all on CD)

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## Training Content

Understanding Flexium structure

Questions and answers

Flexium Tools presentation

- Getting familiar with the package
- Languages
- Variables
- Structure of a project

Practical exercise

- Creating the machine structure
- Integrating IOs (CANopen and Ethernet)
- Integrating a panel
- Handling modes, manual and automatic commands
- Operator messages
- Power on, security
- Integrating axes and spindle
- First level of parameterization
- Running a simple part program
- Introduction to the custom visualization

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## Duration

5 days

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## Date / Costs

Please consult your local training contact

# Flexium system advanced setup

FLTR 402

Your area of interest	Prerequisite
Engineering and Setup	FXTR 401
Objectives	Supports
<ul style="list-style-type: none"> <li>✓ Commissioning a Flexium system on any kind of machine</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> <li>○ Full set of Flexium manuals – Flexium Tools – Example project (all on CD)</li> </ul>
Training Content	
Detailed analysis of exchange variables	Questions and answers
<p>Flexium Tools complements</p> <ul style="list-style-type: none"> <li>○ Project simulation and debug</li> <li>○ Application control (Tasks – automated checks)</li> <li>○ Field bus control</li> <li>○ Advanced functions (Probing – tool wear – shutdown etc.)</li> <li>○ Custom screens complements</li> <li>○ Optional functions (multi NCK – multi panels etc.)</li> <li>○ Writing custom libraries</li> </ul>	
Duration	Date / Costs
5 days	Please consult your local training contact

# Flexium<sup>+</sup> system advanced setup

**FPTR 402**

Your area of interest	Prerequisite
Engineering and Setup	FXTR 401
Objectives	Supports
<ul style="list-style-type: none"> <li>✓ Commissioning a Flexium system on any kind of machine</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> <li>○ Full set of Flexium manuals – Flexium Tools – Example project (all on CD)</li> </ul>
Training Content	
Detailed analysis of exchange variables	Questions and answers
<p>Flexium Tools complements</p> <ul style="list-style-type: none"> <li>○ Project simulation and debug</li> <li>○ Application control (Tasks – automated checks)</li> <li>○ Field bus control</li> <li>○ Advanced functions (Probing – tool wear – shutdown etc.)</li> <li>○ Custom screens complements</li> <li>○ Optional functions (multi NCK – multi panels etc.)</li> <li>○ Writing custom libraries</li> </ul>	
Duration	Date / Costs
5 days	Please consult your local training contact



# NUMDrive C on CANopen

**FXTR 423**

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## Your area of interest

Engineering and Setup

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## Prerequisite

F?TR 402 required

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## Objectives

- ✓ Control of one or more NUMDrive C over CANopen

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## Supports

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Full set of Flexium manuals – Flexium Tools – Example project (all on CD)

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## Training Content

Recalls on CANopen

NUMDrive C library

- Available parameters and functions

Application

- Parameters settings
- Position control
- Velocity control

Questions and answers

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## Duration

2 days

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## Date / Costs

Please consult your local training contact

## Extended NCK Access (ENA)

**FXTR 433**

Your area of interest	Prerequisite
Engineering and Setup	F?TR 402 required
Objectives	Supports
<ul style="list-style-type: none"> <li>✓ Exchange of additional data between NCK and PLC</li> </ul>	<p>Training materials</p> <ul style="list-style-type: none"> <li>○ Simulator</li> </ul> <p>Deliveries</p> <ul style="list-style-type: none"> <li>○ Course presentation (printed and .pdf on CD)</li> <li>○ Flexium Tools – Example project</li> </ul>
Training Content	
Structure of internal communication in Flexium systems	
ENA library <ul style="list-style-type: none"> <li>○ Available parameters and functions</li> </ul>	
Application <ul style="list-style-type: none"> <li>○ Reading parameters</li> <li>○ Writing parameters</li> <li>○ Files management</li> </ul>	
Questions and answers	
Duration	Date / Costs
2 days	Please consult your local training contact

# Flexium HMI personalization

**FXTR 443**

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## Your area of interest

Engineering and Setup

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## Prerequisite

- FXTR 101
- Windows knowledge
- Programming knowledge of script languages

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## Objectives

- ✓ Creating Flexium HMI custom pages in HTML/JavaScript

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## Supports

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Software Development Kit access
- Example (on CD)

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## Training Content

Introduction in the architecture of Flexium HMI

Explanation of the Flexium HMI components

- FXBrowser
- FXServer
- FXLib
- FXLog

Structure of configuration files

- FXServer.ini
- FXUser.ini

Explanation of the FXServer architecture

- Event handling
- task management
- ...

Abstract of development tools

Exercises related to practice using HTML and JavaScript

- Object instancing of the classes of the development components
- Using of the development components
- Characteristics of the array structure of event classes
- Programming examples

Questions and answers

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## Duration

3 days

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## Date / Costs

Please consult your local training contact

# Communication with Flexium

# FXTR 453

## Your area of interest

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Engineering and Setup

## Prerequisite

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- FXTR 101
- Windows knowledge
- Knowledge of object oriented programming (OOP) and use of COM server

## Objectives

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- ✓ Using of FXServer for the communication with the different components of Flexium

## Supports

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Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Software Development Kit access
- Programming examples in C# and C++ (on CD)

## Training Content

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Introduction in the architecture of FXServer

Explanation of the Flexium components (FXServer, FXLib, FXLog) and configuration file (FXServer.ini)

Explanation of the FXServer architecture (Event handling, task management, ...)

Exercises related to practice using C#

- Object referencing and instancing of the classes of the development components
- Using of the development components
- Characteristics of the array structure of event classes
- Programming examples

Questions and answers

## Duration

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2 days

## Date / Costs

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Please consult your local training contact

# Safety including SAM

**FLTR 463**

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**Your area of interest**

Engineering and Setup

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**Prerequisite**

FXTR 102 or FLTR 402

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**Objectives**

- ✓ Understand concept.
- ✓ Program and Set-Up a safety application on a Flexium system

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**Supports**

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Software Development Kit access
- Example (on CD)

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**Training Content**

Hardware structure

Safety functions

Safety application concept

Safe PLC programming

Drive functions

- STO setup
- SAM setup

Questions and answers

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**Duration**

1 day

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**Date / Costs**

Please consult your local training contact

# Safety including NUM-SAMX

**FPTR 463**

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**Your area of interest**

Engineering and Setup

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**Prerequisite**

FXTR 102 or FPTR 402

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**Objectives**

- ✓ Understand concept.
- ✓ Program and setup a safety application on a Flexium system

---

**Supports**

Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Software Development Kit access
- Example (on CD)

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**Training Content**

Hardware structure

Safety functions

Safety application concept

Safe PLC programming

Drive functions

- NUM-STOX setup
- NUM-SAMX setup

Questions and answers

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**Duration**

2 days

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**Date / Costs**

Please consult your local training contact

## Individual trainings

### Your area of interest

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Something around NUM controls

### Prerequisite

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Depending on the training content

### Objectives

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✓ Will be defined with you

### Supports

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Training materials

- Simulator

Deliveries

- Course presentation (printed and .pdf on CD)
- Example (on CD) if available

### Training Content

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Will be developed with you

### Duration

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To be defined

### Date / Costs

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Please consult your local training contact

Individual trainings can happen at NUM locations or customer site.

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## Booking form

For booking of training please send an e-mail to one of the following address with content below:

**France:** centre.formation@num.com

**Germany:** daniel.ursic@num.com

**Italy:** alessandra.villa@num.com

**Switzerland:** sales.ch@num.com

**United Kingdom:** sales.uk@num.com

For other countries, please contact your local sales representative or NUM Switzerland (sales.ch@num.com).

### E-mail content

Company name:

Contact person:

Function:

Phone:

Address:

Your order number:

Training number:

Training date:

Training location:

Names of the participants: