Flexi Line

CONFIGURATION WITHIN THE FLEXI SOFT DESIGNER

Safety controllers

SICK
Sensor Intelligence.

Software status described

Software / Tool	Function	Status
Flexi Soft Designer	Configuration software	V1.7.0
		13.08.2014

Table of Contents

1 About this document

Please read this document carefully if you do not have any previous knowledge of the configuration of a Flexi Line system. Should you be not familiar with the Flexi Soft Designer you can download further information as well as the license free software on www.sick.com/flexisoft. It will simplify your work when dealing with configuration software.

Function of this document

This document will help you when configuring your Flexi Line system. Nevertheless, this document is not substitute for the Flexi Soft hardware operating instructions (document no. 8012478) or the Flexi Soft Designer operating instructions (document no. 8012480). This document merely serves as a guideline and not to provide safety-relevant instructions.

Target group

The target group for this document consists of people in the following roles:

Roles	Target group
Commissioning and configuration	Expert personnel, such as technicians or engineers

Information depth

This document takes you through the configuration of a Flexi Line system using the Flexi Soft Designer configuration software

For information on mounting, installation, maintenance and troubleshooting, see the Flexi Soft hardware operating instructions (document no. 8012478) and the Flexi Soft Designer software operating instructions (document no. 8012480).

Important

You can get further information on Flexi Soft safety control and Flexi Soft Designer configuration software from SICK AG, Division Industrial Safety Systems.

2 Flexi Line – Online Help

2.1 About Flexi Soft Designer

Flexi Soft Designer (FSD) is a tool that allows you to configure your Flexi Soft Station. It helps you when selecting and connecting your modules and elements with simple hardware configuration and the logic editor.

2.2 Overview Flexi Line

Flexi Line enables you to reliably network up to 32 Flexi Soft stations. Only FX3-CPU3 modules can be used in a Flexi Line system. It is not possible to connect any other main modules (FX3-CPU0, FX3-CPU1, FX3-CPU2).

A uniform process image is defined for the entire Flexi Line system. Each byte of this process image is either global, i.e. in the entire system, or local, i.e. only for the related station and its neighboring stations. Each Flexi Line station communicates with its neighboring stations via this process image. The topology permits communication without addressing.

Features

- Safe connection of up to 32 Flexi Soft stations via the Flexi Line interface
- Topology without addressing: In case of a change in the order of the stations, it is sufficient to confirm the new arrangement either using a Teach pushbutton or via the Flexi Soft Designer.
- The EFI interface remains available without limitation:
  - It is possible to connect EFI-compatible sensors.
  - It is possible to connect a Flexi Link system.
- A global process image is defined for all stations.
- Within the process image, global or local bytes can be defined.
- The process image can contain up to 12 bytes or 96 bits.
- The maximum cable length between 2 stations is 1000 meters. The possible total length of a system with 32 stations is therefore 31 kilometers.

2.3   System requirements

For Flexi Line the following system requirements must be met as a minimum:

	Version
Hardware	FX3-CPU3
Software	Flexi Soft Designer version 1.6.0 or higher

- You can also use Flexi Link or EFI communication at the same time as Flexi Line, which means it is possible to additionally connect either EFI-compatible devices or Flexi Link stations.
- The process image is transferred from station to station with a fixed update rate. The processing (logic) on the individual stations is, however, not necessarily simultaneous, as the stations are not synchronized with each other.
- The update rate of the Flexi Line system is dependent on the maximum length of cable between two stations and the size of the process image.

Max. cable length	32 bits	64 bits	96 bits
125 m	2 ms	2 ms	4 ms
250 m	2 ms	4 ms	8 ms
500 m	4 ms	8 ms	12 ms
1000 m	8 ms	12 ms	20 ms

3 Hardware configuration

Note This chapter describes how to configure your Flexi Line system.

3.1 Getting started

After you have started the software Flexi Soft Designer you can choose **Create new project.**

3.2 Selecting the main module

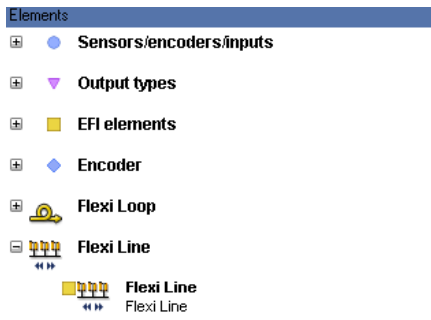Choose the **main module CPU3**.
For a Flexi Line system only this type of CPU-modules can be chosen.
Drag the CPU3 into the main window or simply click on it.
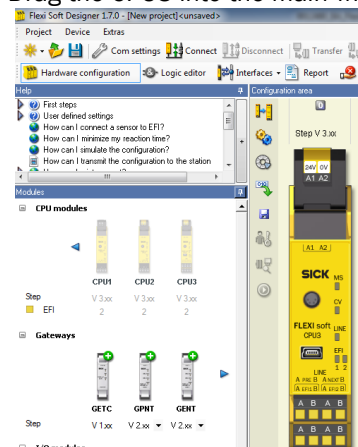
The Online Help Flexi Soft Designers 8014174 will give you further information on choosing I/O modules, gateways and relays.
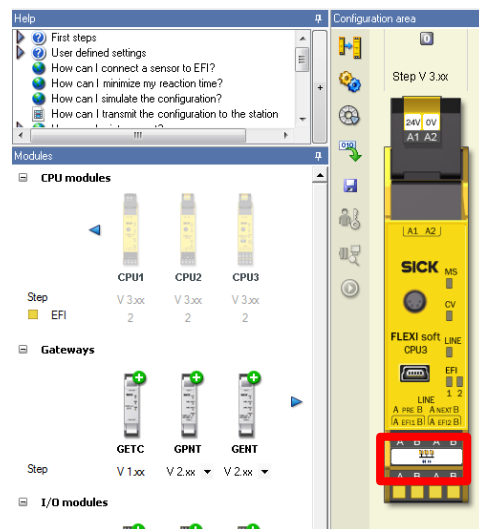
3.3   Selecting Flexi Line element

As soon as all desired I/O modules are chosen you can click on **Elements**.

Afterwards choose the Flexi Line element and drag it on the available CPU.

3.4   Flexi Line definition

A window appears which you confirm by selecting **New Flexi Line definition.**
The Flexi Line definition has to be configured only once for the first Flexi Soft station within a Flexi Line system. Afterwards this definition can be used for all other stations within the Flexi Line system (see chapter 5 commissioning of the Flexi Line system).
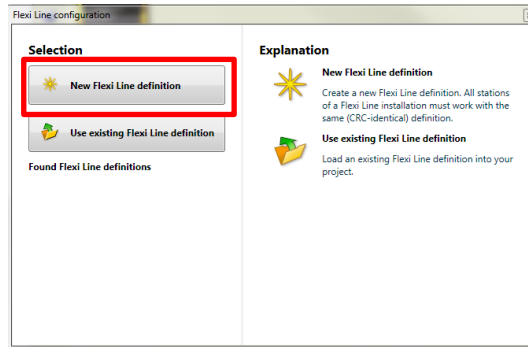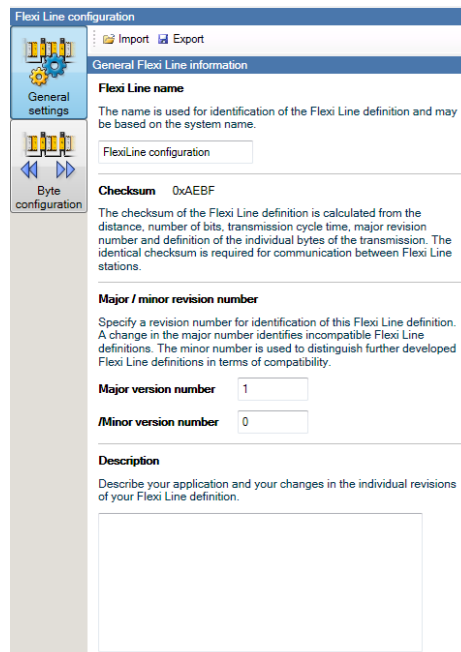

You will be forwarded to the Flexi Line configuration window. Within this window the Flexi Line system can be defined. In addition the Flexi Line configuration area can be reached by the button Interface within the menu bar.

3.4.1   General settings

First of all you can set general setting.
On the left you can first define your Flexi Line name.

Two windows below the name the selection window for revision numbers is given.
Revision numbers help identifying your Flexi Line system. A change in the **Major version number** characterizes incompatible Flexi Line definitions.
Minor revision number helps to distinguish different versions of the Flexi Line definition.

In addition you can add descriptions to your application.

You can specify your configuration on the right side of the window. Here you can choose the desired bit number, length of cable as well as the send cycle time.
If a cell in the table is displayed in red, the related combination of segment length and data size is not possible with the update rate set. To be able to select this combination, you must first set a higher value for the update rate.

The **Checksum** shown on the left side is calculated from all settings you do within this window apart from the name, minor revision number and the description.
The checksum is required so that the stations in a Flexi Line system can communicate with each other. All stations in a Flexi Line system must have an identical checksum.

Note   If the process image is changed on any station such that the checksum changes, then you must transfer this new image to all other stations. In this way you will set the checksum in all stations to the same value. Otherwise there will be different checksums in the Flexi Line system such that the safety communication between the stations cannot be established. The checksum is part of the configuration that is saved in the system plug for each CPU3 module connected.

3.4.2 Byte configuration

After finishing the general settings access the byte configuration window by clicking on the button **Byte configuration**.

In this window you can adjust all settings for the Flexi Line process image. Depending on which general settings you have set before 4 – 12 different rows appear in which you can do you byte-configuration.

Select the first byte and edit the setting for it on the right.
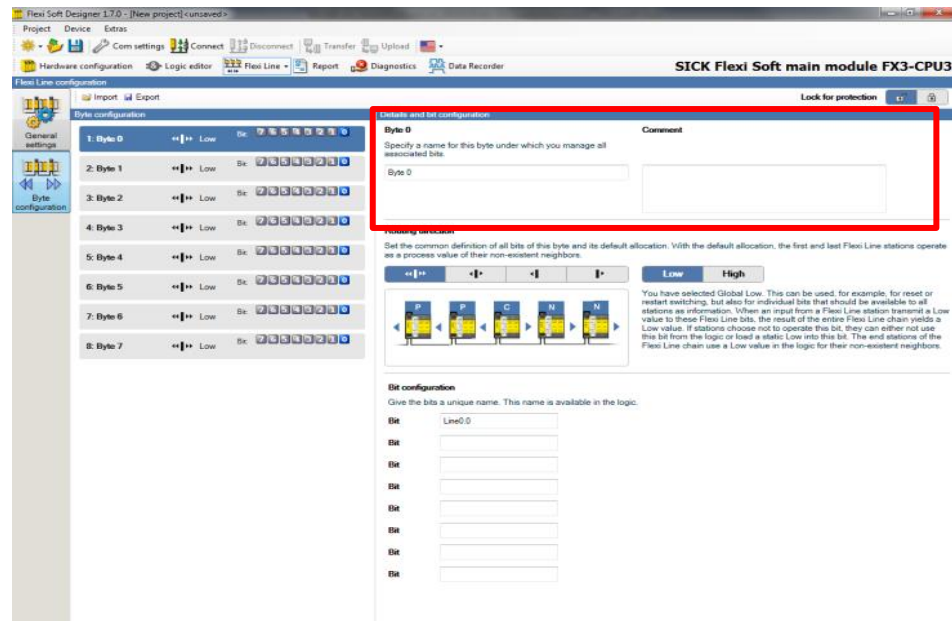
At first you can name your byte and add some comments. These comments are shown within the byte-list on the left side of the window. The comments can give you a better overview when working with a comprehensive Flexi Line definition.

Afterwards you can adjust the desired **routing direction**:

If you want your station to share its byte with all other stations choose the setting global:

If a byte transfer is desired to the neighbor stations only you have three different possibilities:

Transfer to previous and following station:

Transfer to previous station only:

Transfer to following station only: .

The **default value** on the right defines how a bit is affected by a station:

A bit with the default value High is set to 1 (logic status high) if all stations signal a 1 for this bit (logical AND). As soon as only one station sets the bit to the logic status low, the bit is set to 0.

A bit with the default value Low is set to 0 (logic status low) if all stations signal a 0 for this bit (logical OR). As soon as only one station sets the bit to the logic status high, the bit is set to 1.

Below you can set your bit configuration.

By giving the bits names you activate them. This activation is also shown on the left side of the window. The color changes from grey to blue. Please note that only bits that are activated will be available in the logic.
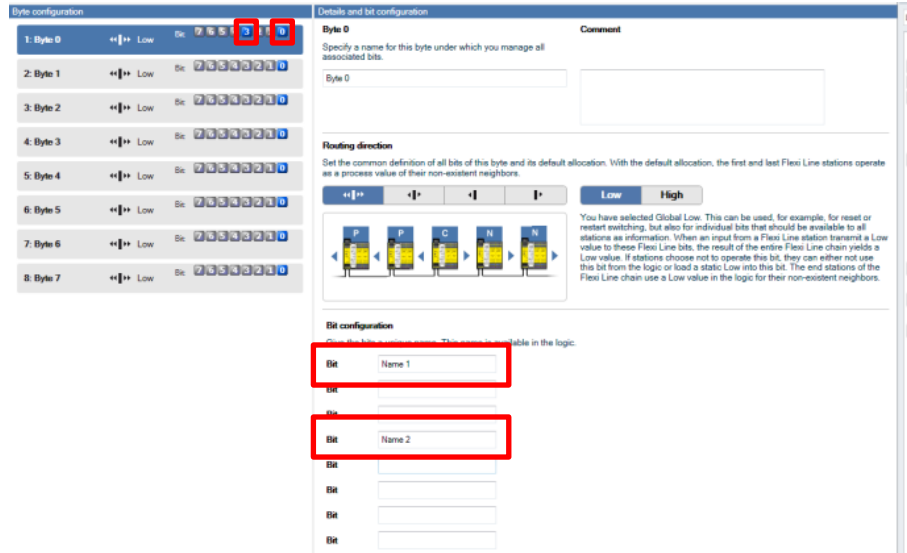
These settings can be adjusted for all other bits simultaneously.
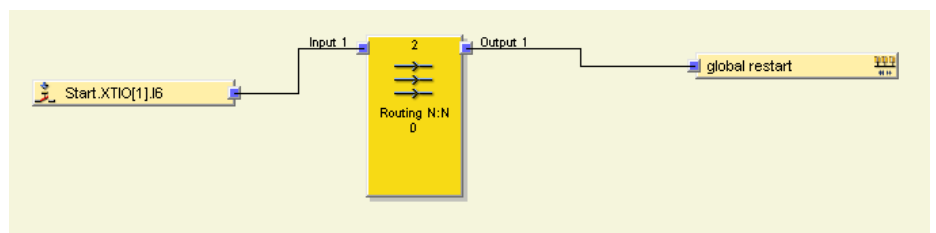
4   Flexi Line in the Logic editor

Note   This chapter describes how to set up the logic in your Flexi Line system.

You will find the Flexi Line bits that have been defined before in the input and output tabs
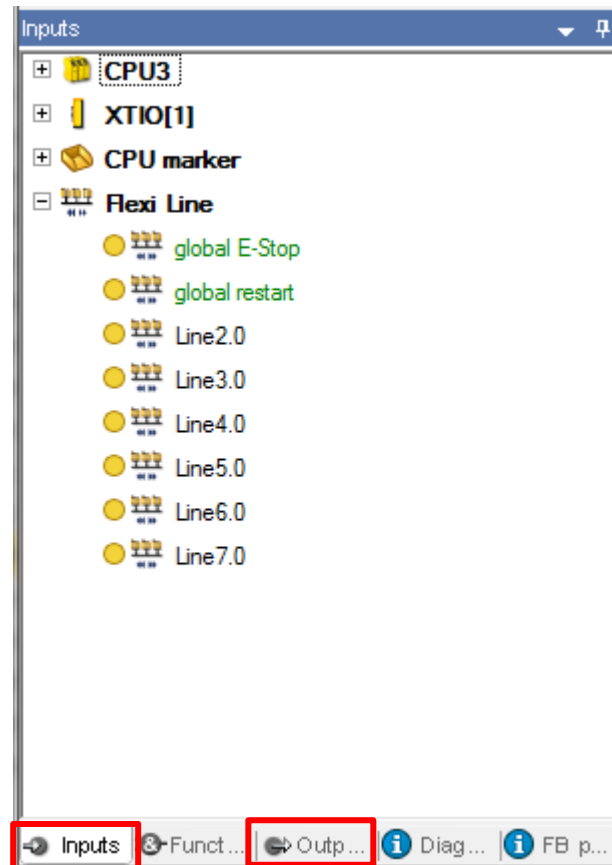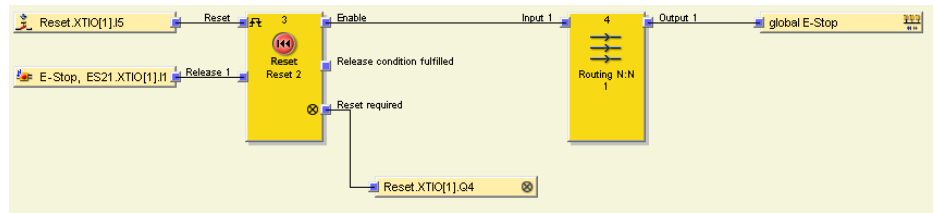

There are two possibilities integrating the local inputs to your Flexi Line system:

1. Routing the local inputs to the Flexi Line bits directly:

2. Inputs that are connected locally are processed on a local basis at first. Afterwards the routing to the Flexi Line bits can be started.

In order to integrate the outputs that are connected locally into your Flexi Line system you need the information from the Flexi Line process image at first. Drag and drop the Flexi Line input bits into the main window of your logic editor. After this you can process the requirements of your application by using function blocks and select the local outputs.
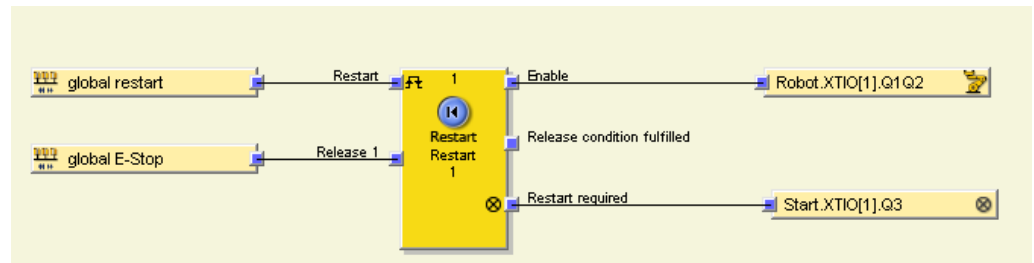
Tip You can recognize Flexi Line elements with help of the symbol:

Tip If you do not want a Flexi Soft station to influence a Flexi Line bit that has the default value high, the input static 1 has to be used.

We will illustrate this with a short example: A global e-stop function should be set up. However, one of the Flexi Soft station within the Flexi Line system does not have an e-stop button. For this Flexi Soft station a static 1 has to be used within the logic editor. Static 1 replaces the sensor and is forwarded to the global e-stop bit.

Should this not be the case the Flexi Soft station without the global e-stop button will transfer a 0 for the global e-stop bit and the machine will not start.
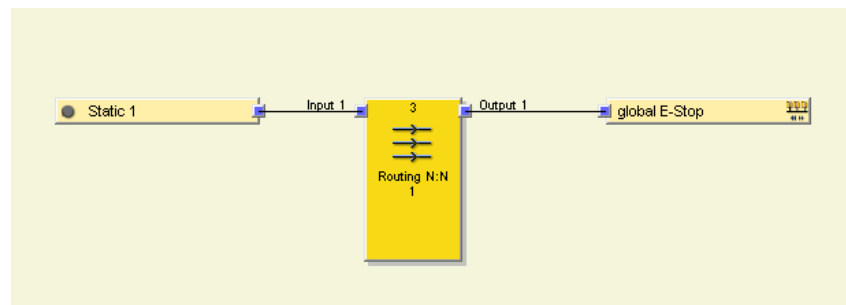
5 Export and import of a Flexi Line configuration

Note In this chapter you will learn how to export your final Flexi Line project. Exporting the final Flexi Line project enables you a more efficient configuration process. It is not necessary to do the same definition for every Flexi Soft station as you can simply import this definition. In addition you will make sure that the check sum in each Flexi Soft station is identically. As soon as you change any settings that are related to the checking sum you have to make sure that these changings have been made in all of the related Flexi Line definitions. The Flexi Line station can only work when the checksums of all definitions are exactly the same.
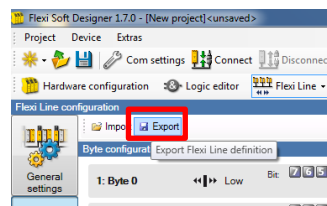
Within the Flexi Line configuration view click Export and safe it to the folder of your choice.

Afterwards open a new project (chapter 3.1 to 3.4), choose the Flexi Line element and drag it onto the main module.

After you added the Flexi Line element to the required interface of the CPU3 a new window pops up. Now you can choose the button **Use existing Flexi Line definition** and navigate to that folder you have exported your Flexi Line configuration before.
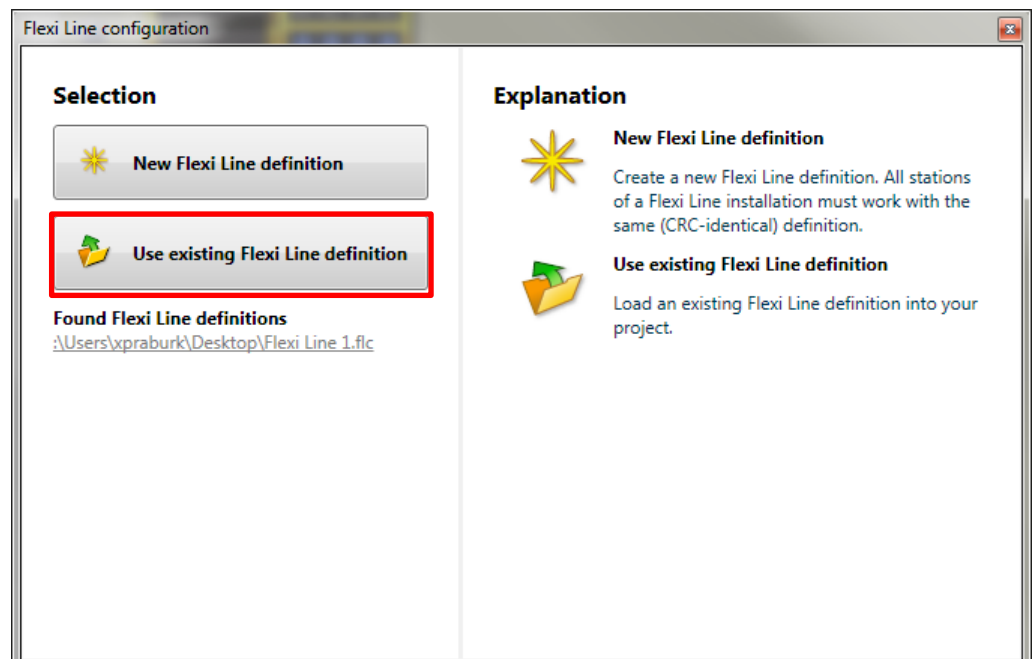
Another possibility to open your Flexi Line definition is given in the area **Found Flexi Line definitions.**
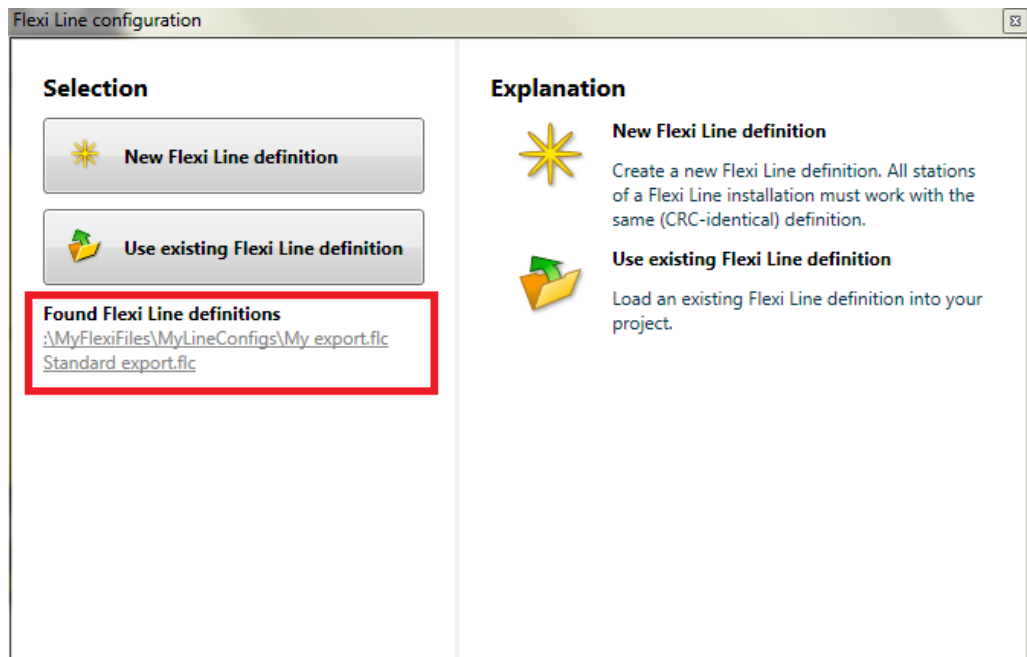
In this section all definitions are shown that have been saved either to the standard folder or to any folder you defined

The Flexi Line configuration will be taken from the specified data to the current Flexi Line settings.
The shown checking sum, that is the same in both definitions, can confirm this.

6   Commissioning of a Flexi Line system

**Note** This section describes how you can setup a new Flexi Line system and place it in operation.

6.1   Configuration of the individual local stations

After you have imported the Flexi Line definition you can change into the logic view and configure the logic of every single station (Chapter 4 Logic editor).

Connect the individual Flexi Line stations as described in the operating instructions "Flexi Soft Hardware".

Place in operation each individual station as a standalone system. The stations change to the **Teach required** status and the LINE LED flashes **Green** at 2 Hz.
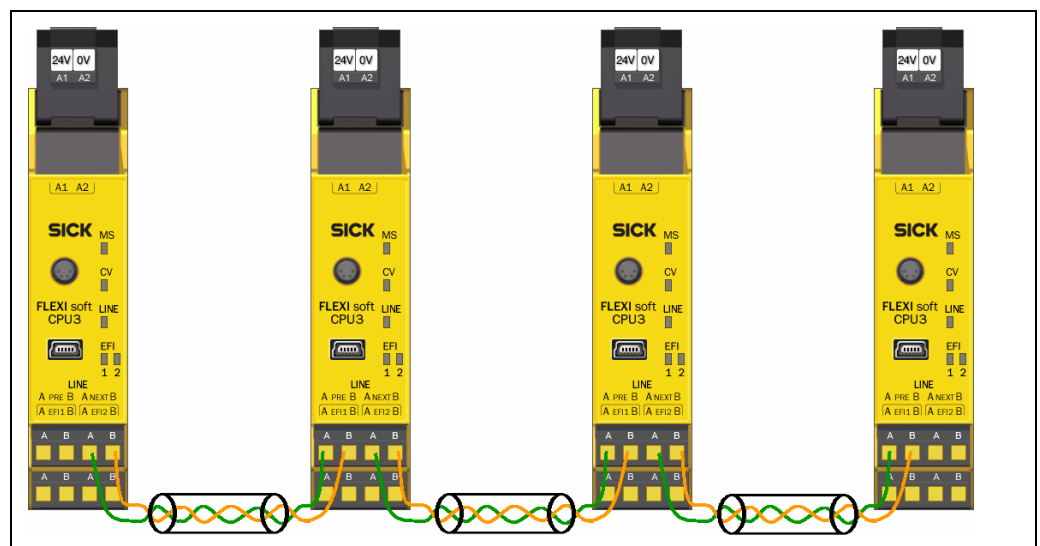
6.2   Teach function

If you connect your Flexi Line system the first time or do you want to change it is necessary to use the teach function. The teach function confirms the topology within your Flexi Line system in order to activate the functions.

Topology:

The individual stations within a Flexi Line system are not identified using addresses. Instead, each station is connected to its immediate neighbors. Communication is with the previous station and the next station (see Chapter 3.4.2 Byte configuration).

The arrangement of the stations in the Flexi Line system must be confirmed during commissioning by means of a teach process and subsequently monitored. If a station is disconnected from the system, replaced or added, then the arrangement of the stations must be confirmed again.

Important If you do no longer need a Flexi Line station it can be disconnect on live-mode. However, the connection of a Flexi Line station must only be done when it is switched off!

The teach function can either be processed by using the Flexi Soft Designer or by a switch that has been configured before. A switch is very useful if you want to change the topology at a later point of time.

Before you use the Teach function, check whether a dangerous state can occur!

If the Teach function is used, the safety outputs on any of the still active stations may be High.

- Analyze your application and check whether additional safety measures have to be implemented if the Teach function is enabled.

- Consider how to handle the disconnected machine modules. Point out that the control parts and sensors have no effect to the previously connected machine modules (e.g. install "out of order" signs at E-stops).

- The teach function must be considered as a configuration process. Therefore the teach function needs to be secured according to the respective safety requirements, e.g. by using a key operated switch that is wired to the logic teach input and a restart function block in the logic to check the timing condition.

- Only authorized and especially trained personnel are allowed to activate the Teach function.

- Before using the Teach function, make sure that nobody is in the hazardous area or has access to the hazardous area while the Teach function is active.
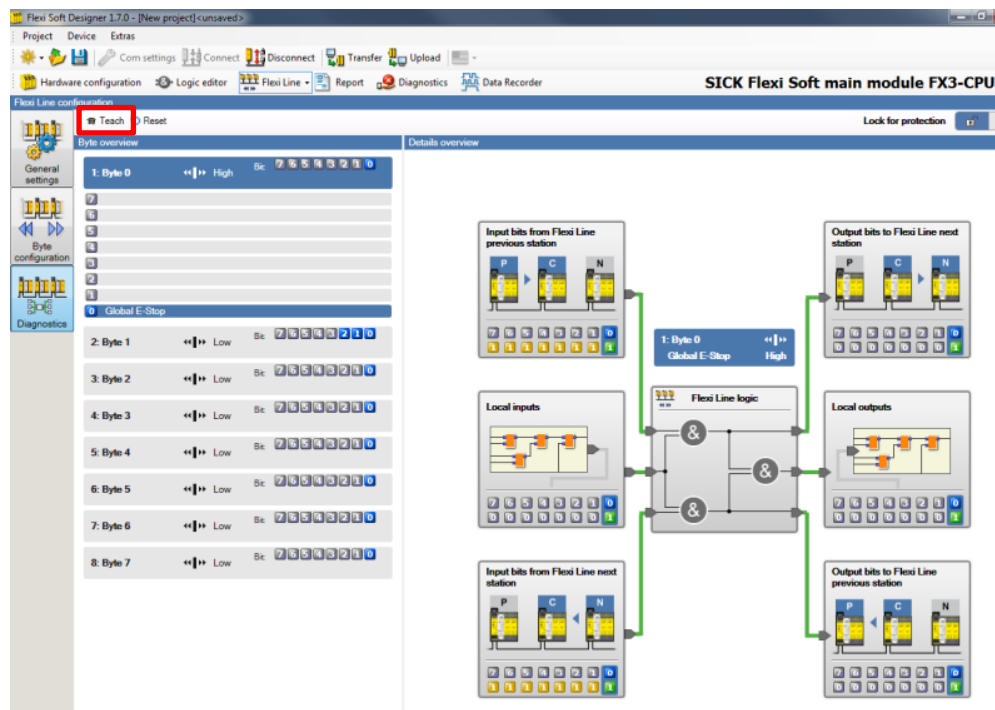
Teach function within the Flexi Soft Designer

Note The teach function is only available when the Flexi Soft station is in online mode.

You will find the teach function within **Interfaces** and **Flexi Line**:
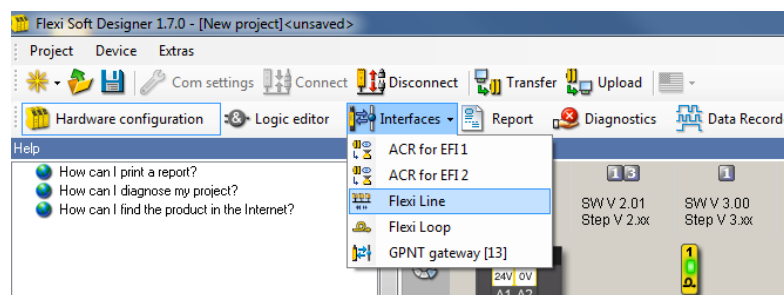
Within the Flexi Line configuration view press the **Teach** button:

During commissioning press the button Teach as soon as all stations are switched on and in mode *teach*. The typology is being checked and confirmed and the Flexi Line system will be started.

Teach function with a pushbutton

Furthermore you have the possibility of configuring a teach function pushbutton.

Connect a Teach button to the inputs of the station in the Flexi Line system that shall be able to activate the Teach function. The Teach button can be e.g. a dual channel key operated switch. So you could make sure that only autorized people can process the teach function.

In the logic editor for this station, use a Restart function block to connect the Teach button input to this station's Teaching output. This output can be found on tab CPU3.
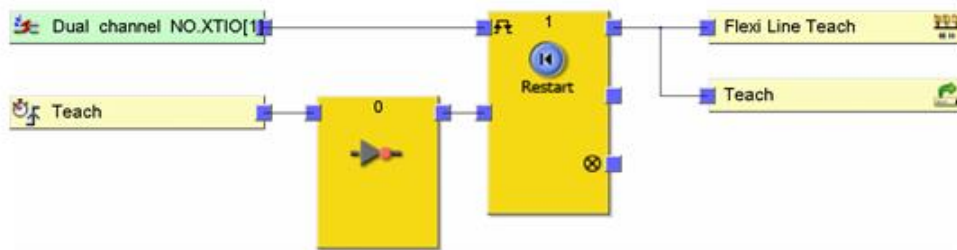

If the Teach button is pressed, the Teaching output will become High for one logic cycle. The rising edge (Low to High) on the Teaching output triggers the Teach function. The jump address *teach* prevents the teach bit to stay more than one logic cycle high.

6.3   Status and diagnostics

While your Flexi Soft station is connect to the FSD the diagnostics view shows you which data have been received, used and forwarded

Within the Flexi Line configuration view press the diagnostics button on the left toolbar.
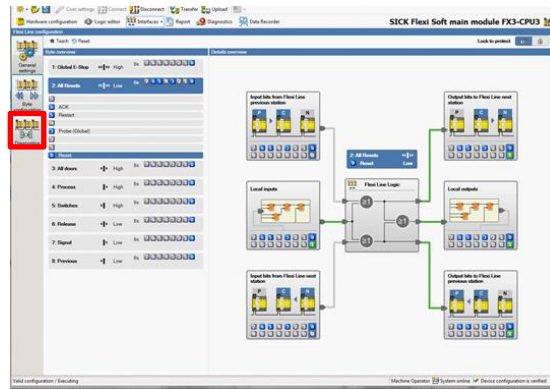

The bytes in the process image for the actual station are shown in the **Byte overview** area on the left. If you select one of the bytes, the related bits are shown underneath together with their tag names.

The processing of the selected bits is shown in the **Detail overview** area on the right:

- On the left you can see the input bits that are received from the two neighboring stations as well as the status of the local inputs.
- On the right you can see the output bits that are sent to the two neighboring stations, as well as the status of the local outputs.

If the Flexi Line system is online, active bits are shown in color and inactive bits in gray.

In the area on the left you can select the individual bits in the byte currently shown. The processing of these bits is shown in detail on the right:
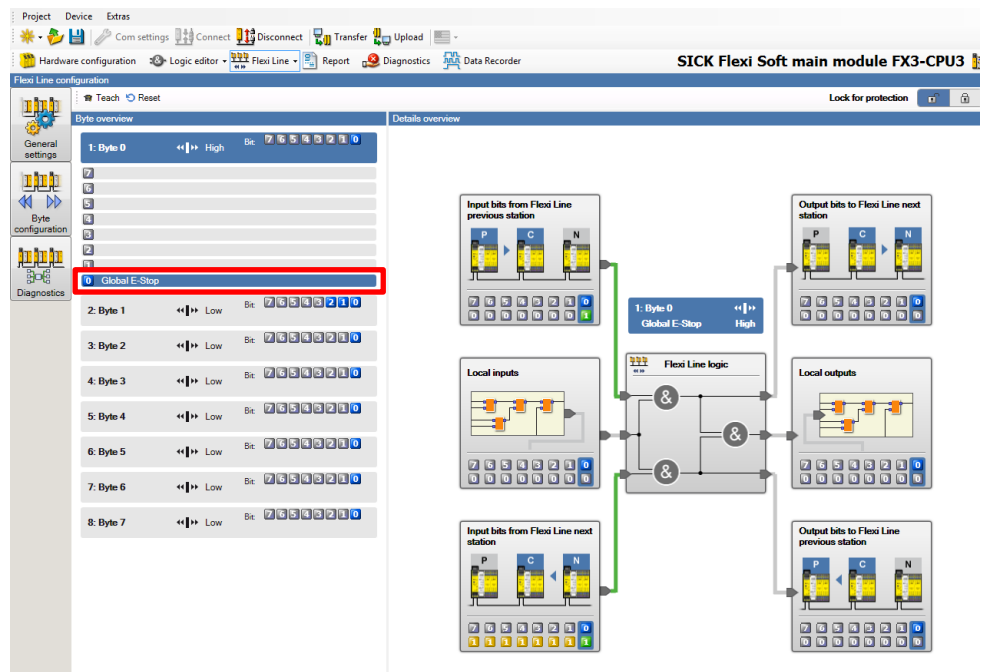
SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for factory, logistics, and process automation. With more than 6,000 employees and over 40 subsidiaries worldwide, we are always close to our customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in various industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services round out our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is "Sensor Intelligence."

Worldwide presence:

Australia, Belgium/Luxembourg, Brasil, Česká republika, Canada, China, Danmark, Deutschland, España, France, Great Britain, India, Israel, Italia, Japan, México, Nederland, Norge, Österreich, Polska, România, Russia, Schweiz, Singapore, Slovenija, South Africa, South Korea, Suomi, Sverige, Taiwan, Türkiye, United Arab Emirates, USA.

Please find detailed addresses and additional representatives and agencies in all major industrial nations at: www.sick.com

SICK
Sensor Intelligence.

SICK AG | Waldkirch | Germany | www.sick.com