



Introduction and programming of CoDeSys

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➤ 一、Brief introduction of CoDeSys

1.1 Introduction of CoDeSys

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1.3 Advantages of CoDeSys

—、Brief introduction of CoDeSys

1.1 Introduction of CoDeSys

What is CoDeSys?

CoDeSys is the complete development environment of programmable logic controller PLC (CoDeSys is the abbreviation of Controlled Development System), which is developed by 3S company in Germany (Smart Software Solutions GmbH), and it is a soft PLC programming system platform which is totally independent of the running system.

CoDeSys is actually a development programming system based on industrial automation field. Its applications include plant automation, automotive automation, embedded automation, process automation, building automation, and so on.

—、Brief introduction of CoDeSys



CoDeSys is a programming tool which is applied in industrial controllers and PLC components. It is not only advanced in function and structure, but also easy to be mastered. It has become the leading programming tool in the automation product market.

So far , there are almost 400 control system manufacturers which are the users of CoDeSys, such as: ABB、Schneider、EATON、Rexroth、BECKHOFF、KEBA、HITACHI、MITSUBISHI、OMRON、ADLINK、SUPCON 、KINCO、INOVANCE and so on.

一、CoDeSys的简单介绍

1.2 Programming language of CoDeSys

CoDeSys is based on IEC61131-3 standard which can support 6 programming languages:

- ST
- LD
- IL
- FBD
- CFC
- SFC

Users can choose different language edit subprograms or function modules in one project.

—、Brief introduction of CoDeSys

1.3 Advantages of CoDeSys

1、 Standardization accords with IEC 61131-3 international standard (support 6 programming languages) , IEC 61508 (safety standard) and EN ISO 13849 (mechanical safety standard) 。

2、 Open, reconfigurable and component-based platform architecture.

Based on NET architecture, and CoDeSys software consists of various component-based functional component(Compiler, debugger, motion control, CNC, bus configuration, etc.). Users can choose it according to their actual needs.

CoDeSys provide fully open component interface and library programming template, which is easy to make users achieve two depth development based on specific industry or special technical needs and completely supports users to integrate their own development tools and technical modules(library) in CoDeSys development platform.

—、Brief introduction of CoDeSys



3、 Good portability and powerful communication function.

CoDeSys completely supports CANopen、 Profibus、 EtherCAT、 Modbus、 Ethernet/IP、 serial port (RS232、 RS485) and so on.

Runtime System, the running system of CoDeSys, can run in various main **CPU** (such as ARM、 X86、 PowerPC、 TriCore 、 DSP) , and support Windows XP、 WindowsCE、 Windows XP Embedded、 Windows 7、 Linux、 VxWorks 、 QNX operation systems、 or architectures without operation system.

4、 Powerful motion control and CNC function

Uniaxial control: current loop、 velocity loop、 position loop control

Master-slave control: The realization of electronic gear (with phase synchronization function), electronic cam and so on.

CNC control: realize Complex multi axis motion trajectory interpolation control , support G code.

Robot control: Complex robot control with multiple joints.

—、Brief introduction of CoDeSys



5、 Greatly support for third party development tools and applications.

OPC , OPC UA function

Support database of ODBC interface

6、 Support redundancy control function and customization development.

7、 Realize the safety control that conforms to TUV-SIL3 international specification and customized development of customization security controller.

8、 CoDeSys Application Composer can support IAP

CoDeSys Application Composer is based on IEC 61131- 3 international standard, which is perfect extension of CoDeSys. It simplifies the technical complexity of application programming, reduce the workload of application developers, increase the stability of software and improve the efficiency of application programming.

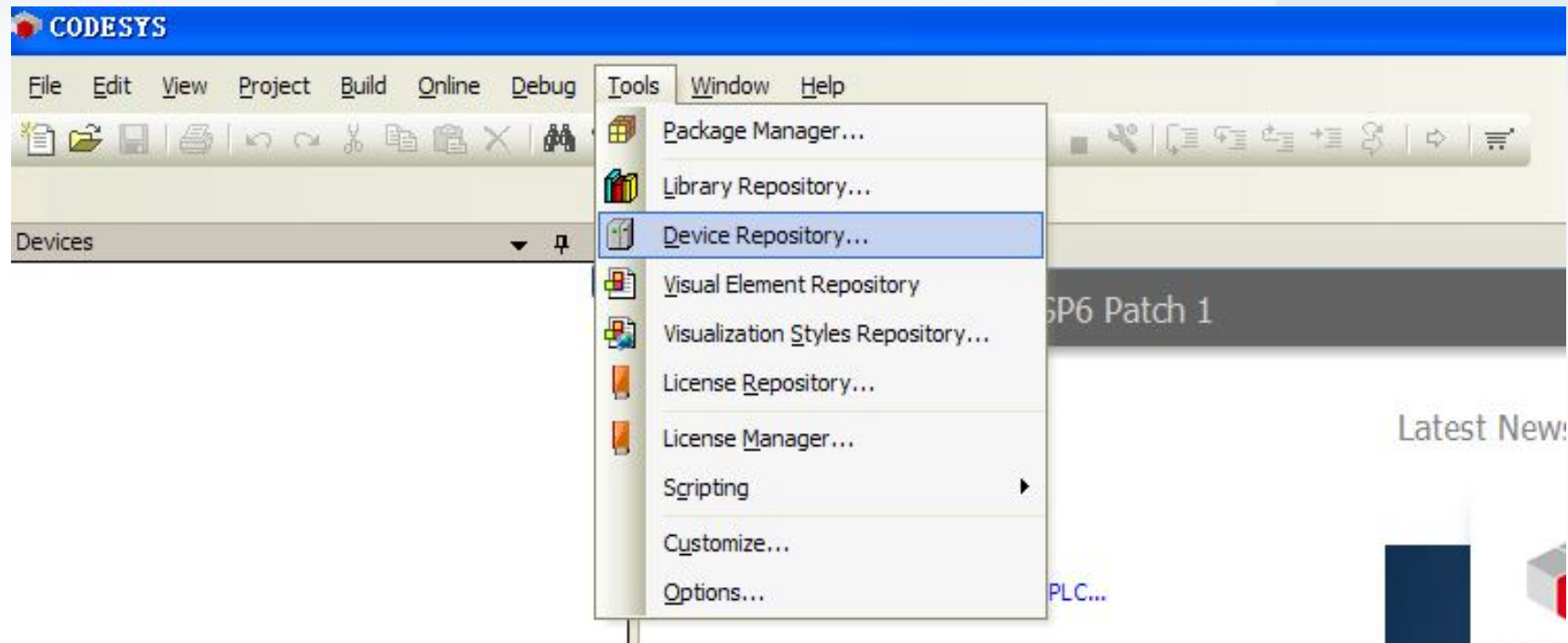
➤ 二、Programming environment of CoDeSys

二、Programming environment of CoDeSys

Device file installation

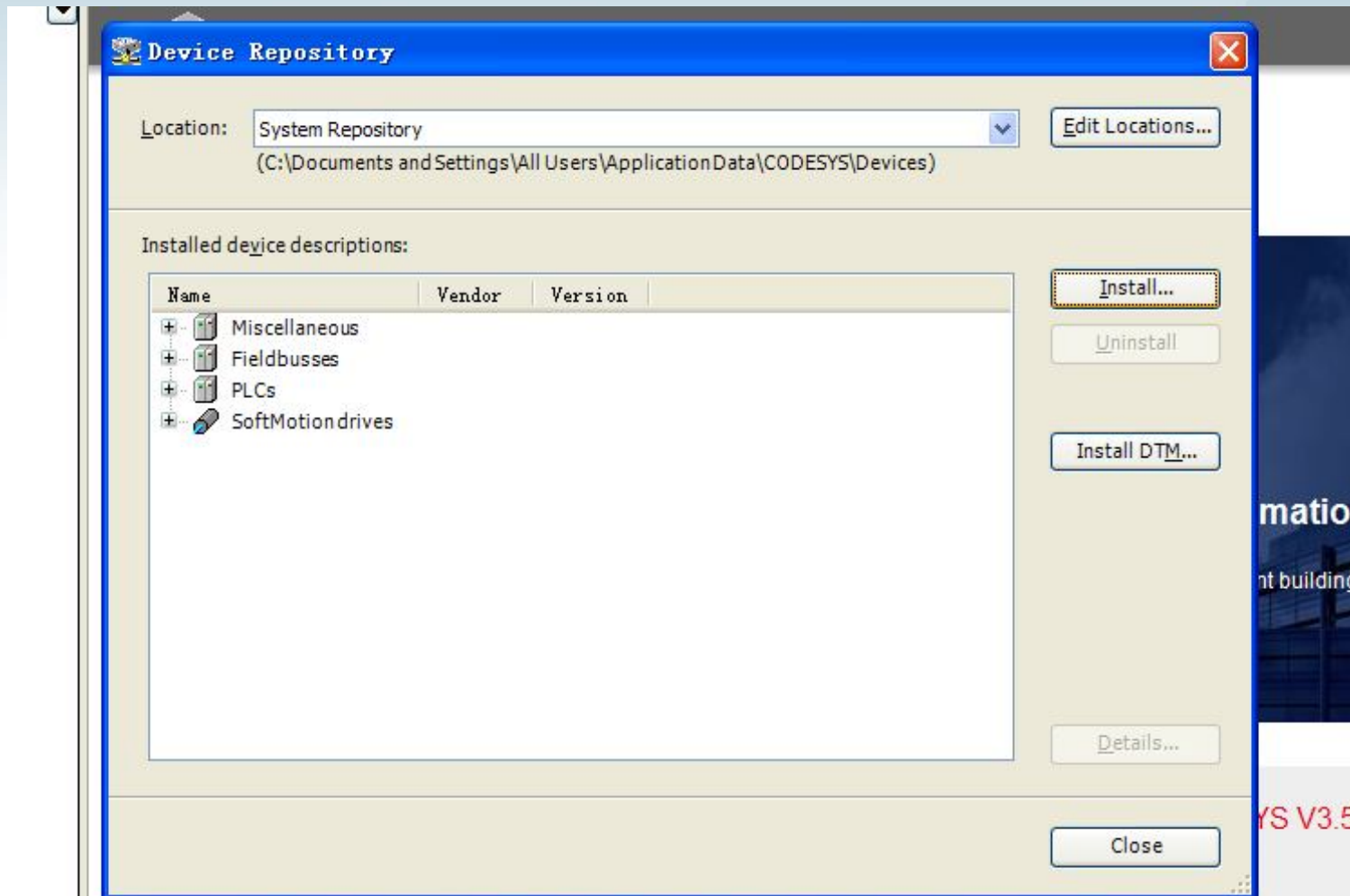
Different devices need to install different device files.

Click 'device repository' in pull-down menu of Tools



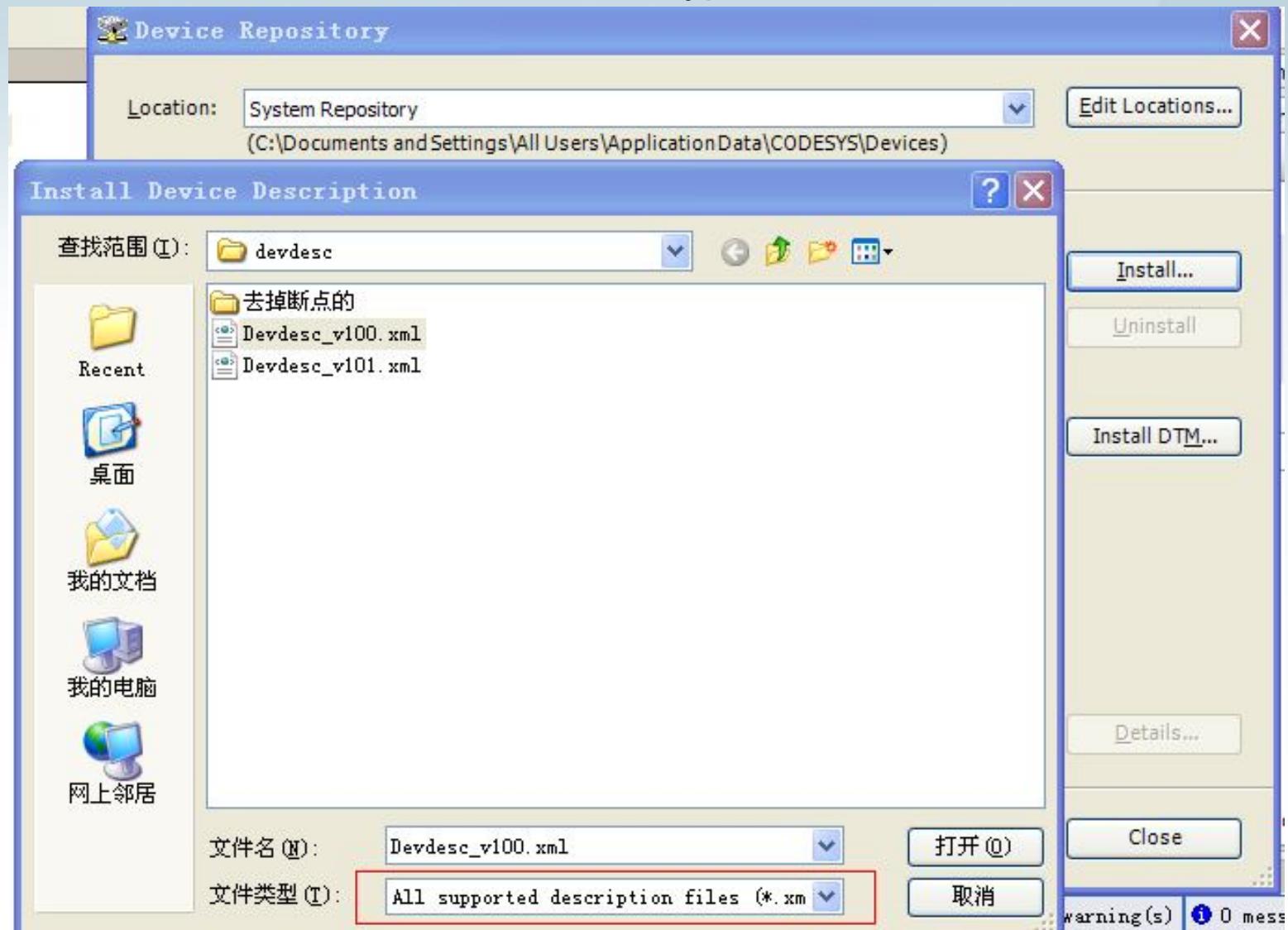
二、Programming environment of CoDeSys

Click 'install' button



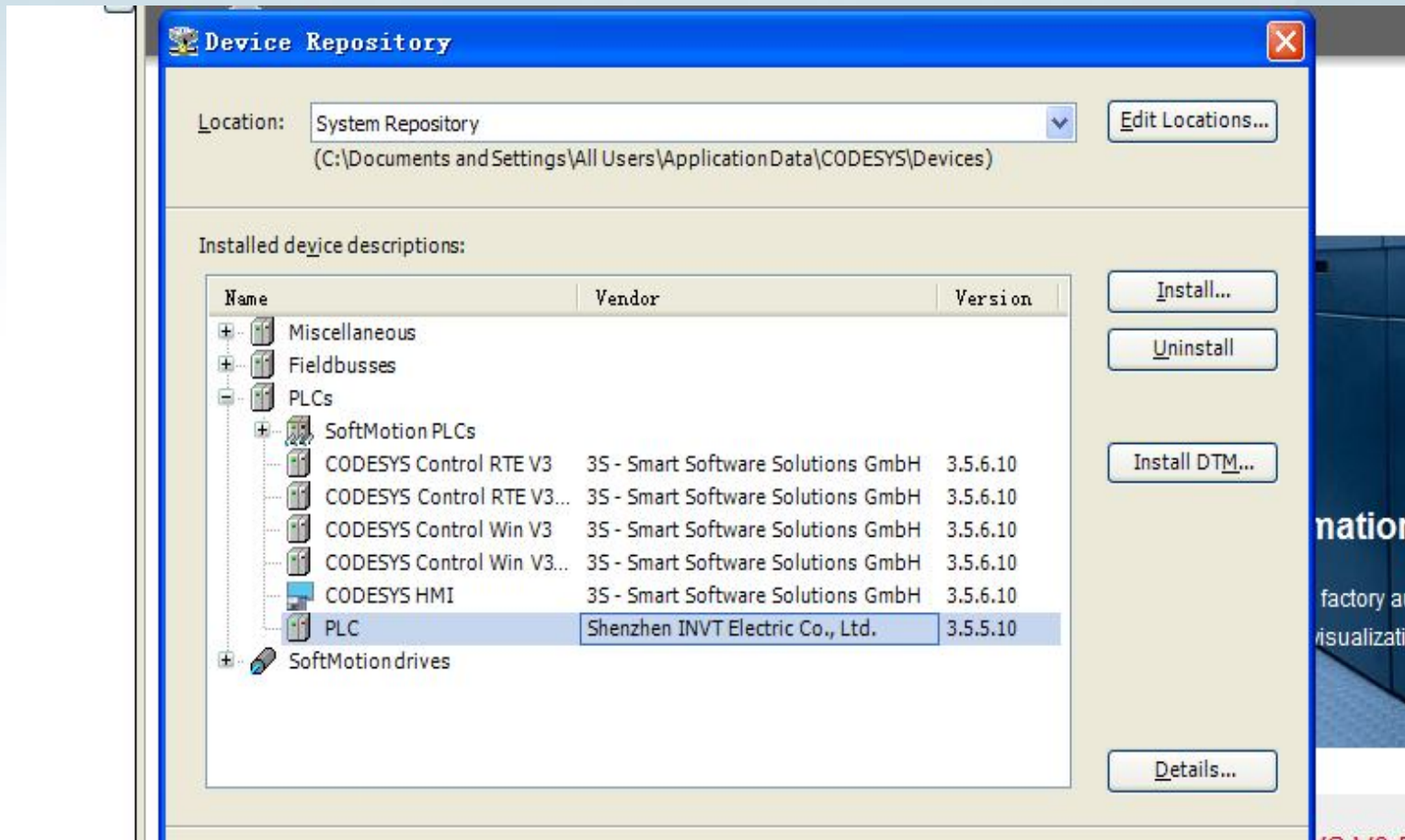
二、Programming environment of CoDeSys

Choose the device file in all files type



二、Programming environment of CoDeSys

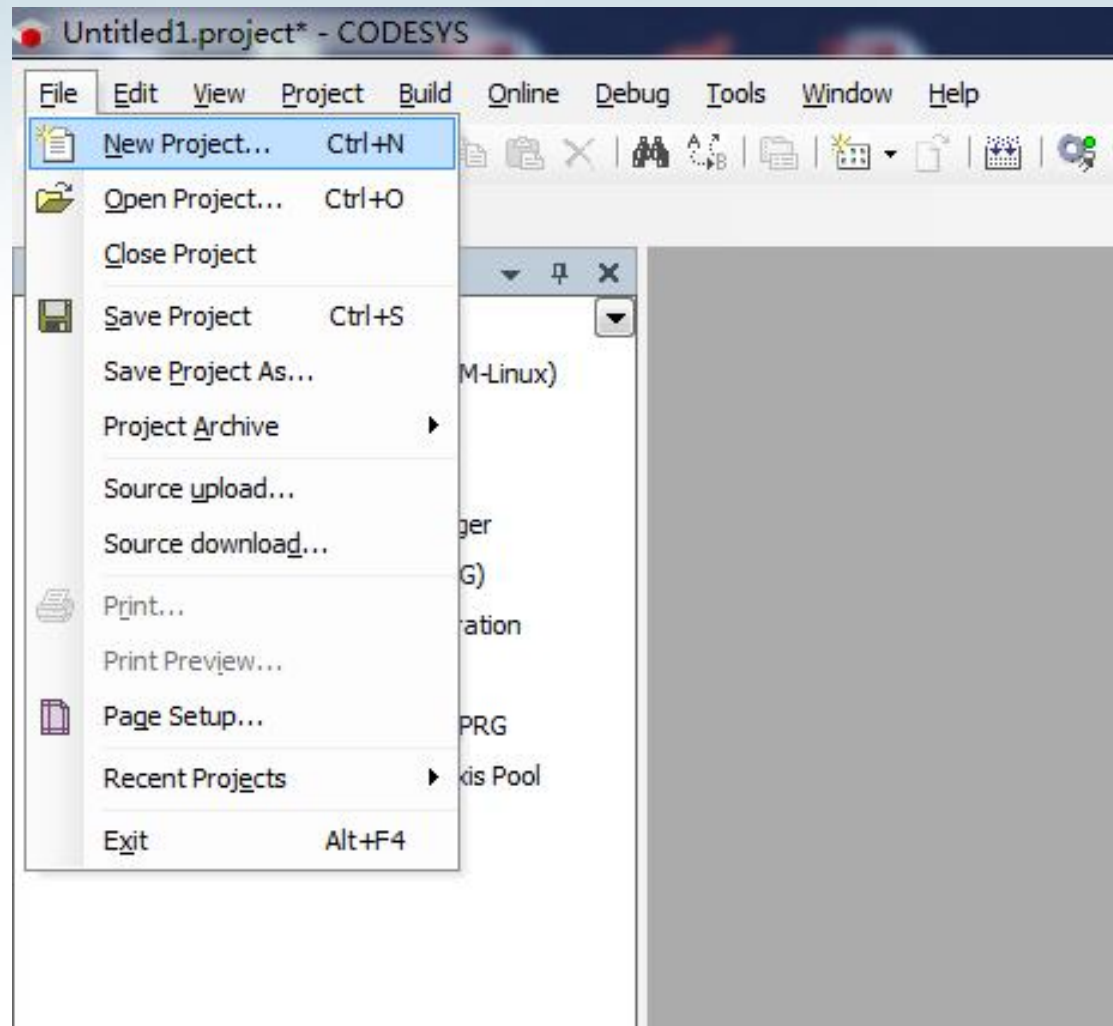
After installing it , you can see it as following picture.



二、Programming environment of CoDeSys

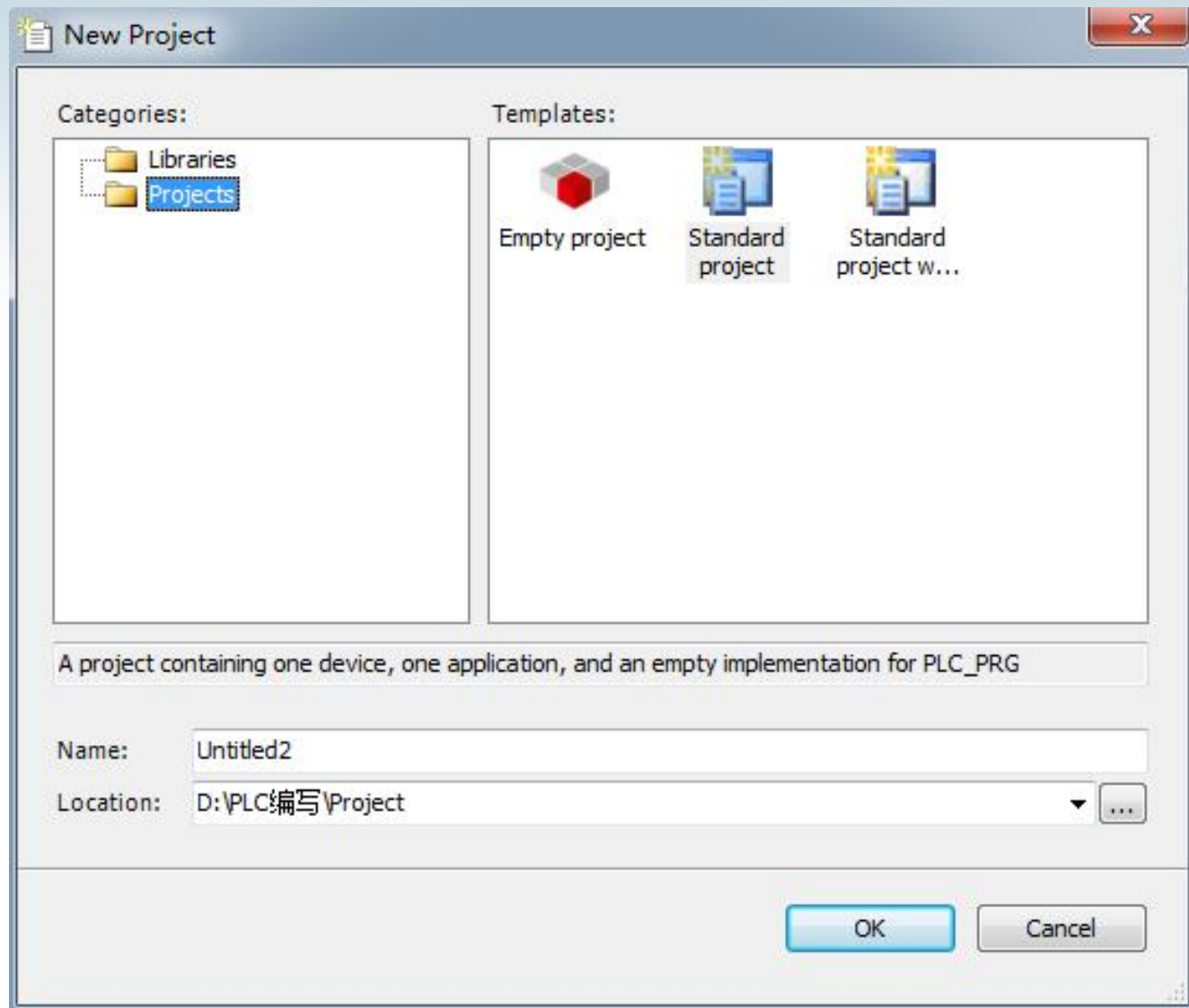
Create new project

Open the software and then create a new standard project



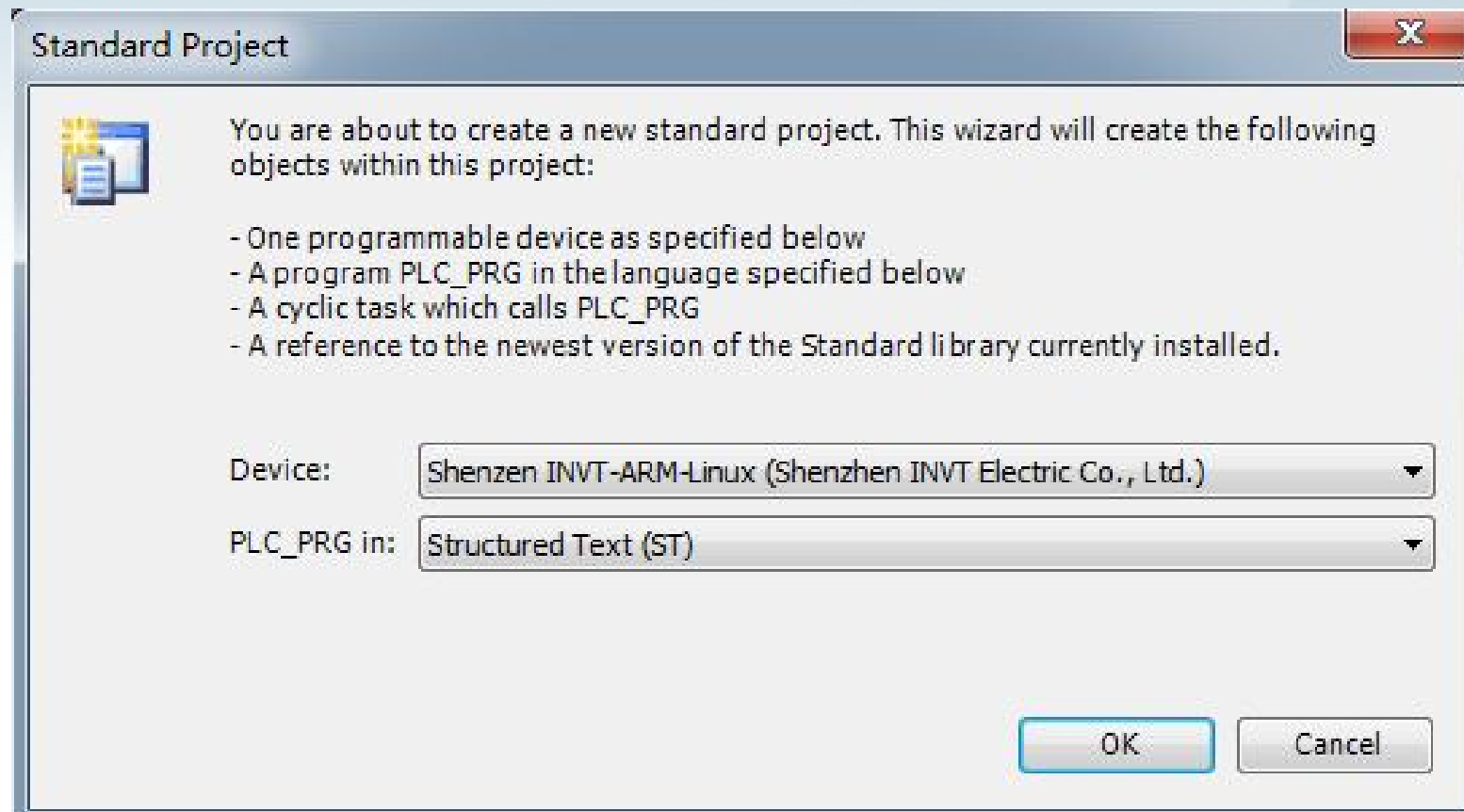
二、Programming environment of CoDeSys

Choose 'standard project'



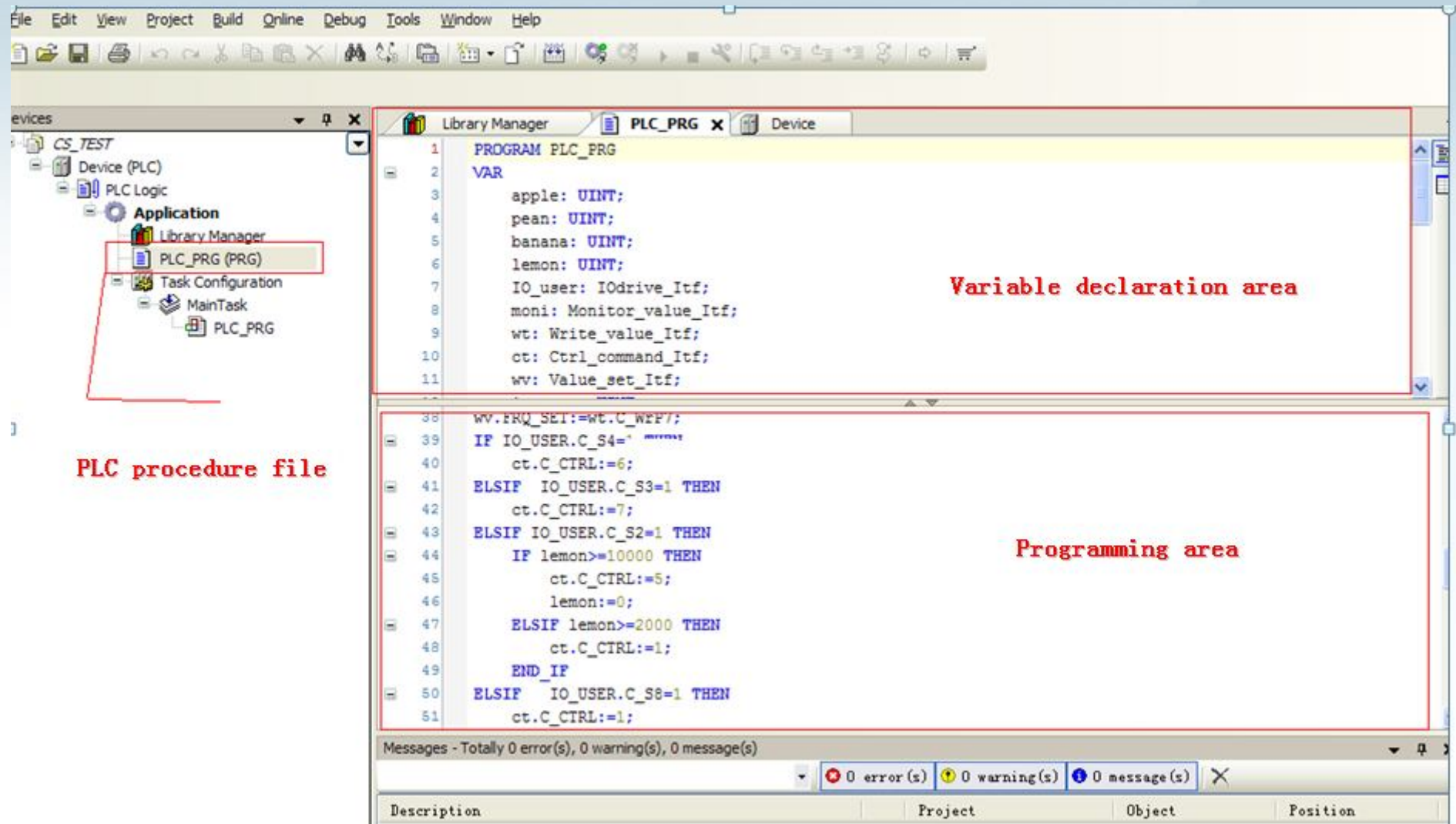
二、Programming environment of CoDeSys

Choose the device file and programming language(ST, LD or others)



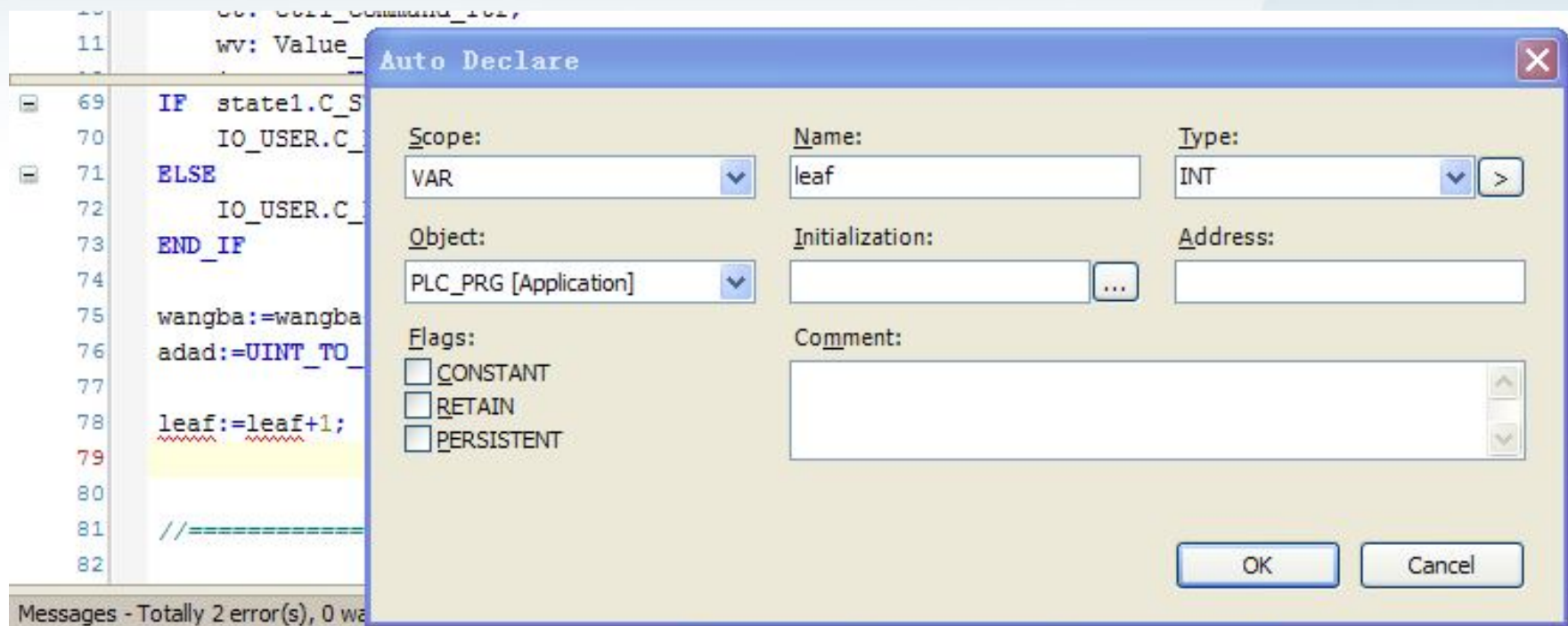
二、Programming environment of CoDeSys

Basic programming interface:



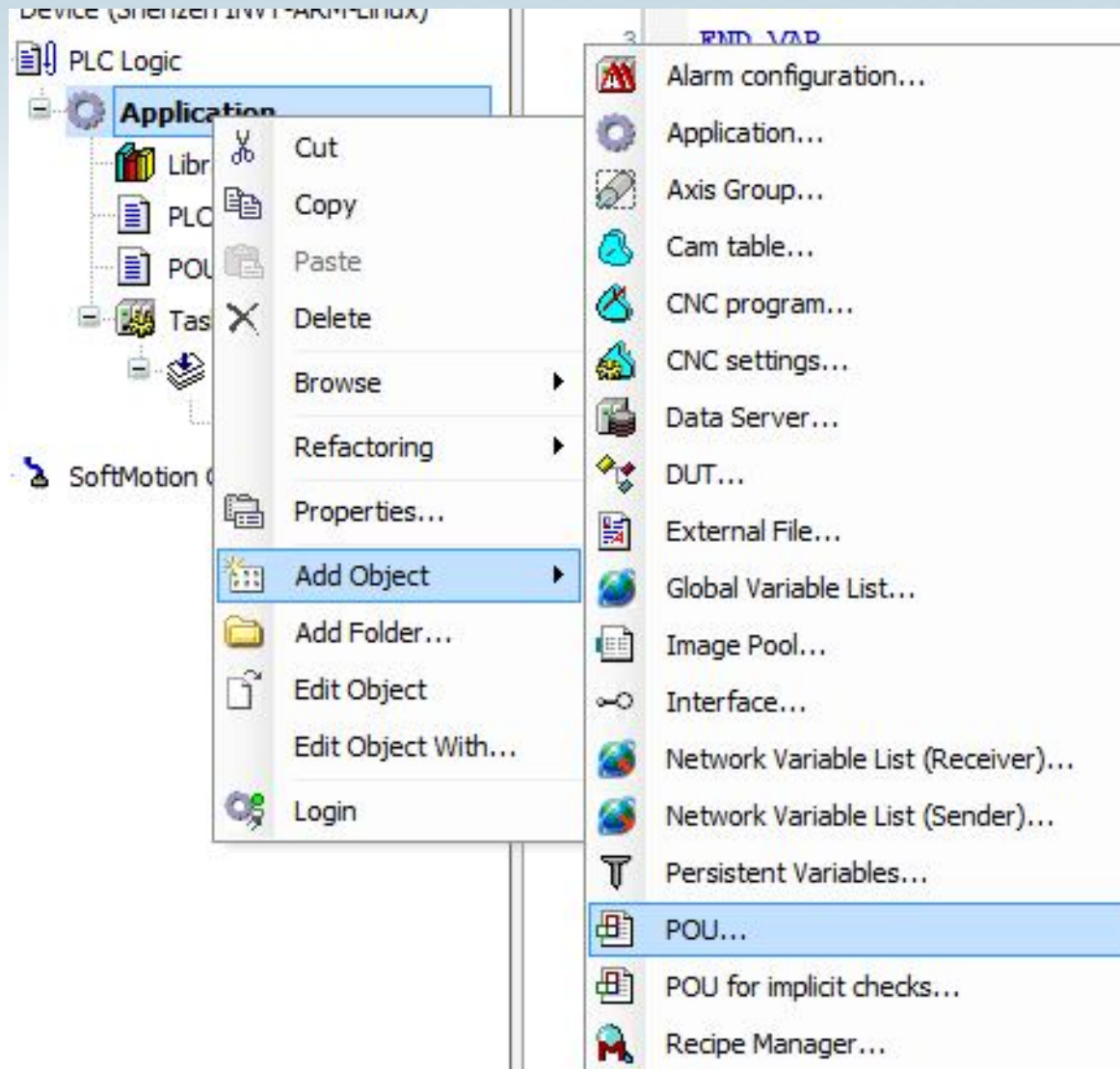
二、CoDeSys编程环境的介绍和说明

When program a new variable in programming area, and then press 'enter' in the keypad. The users should define the variable in the interface as following picture.



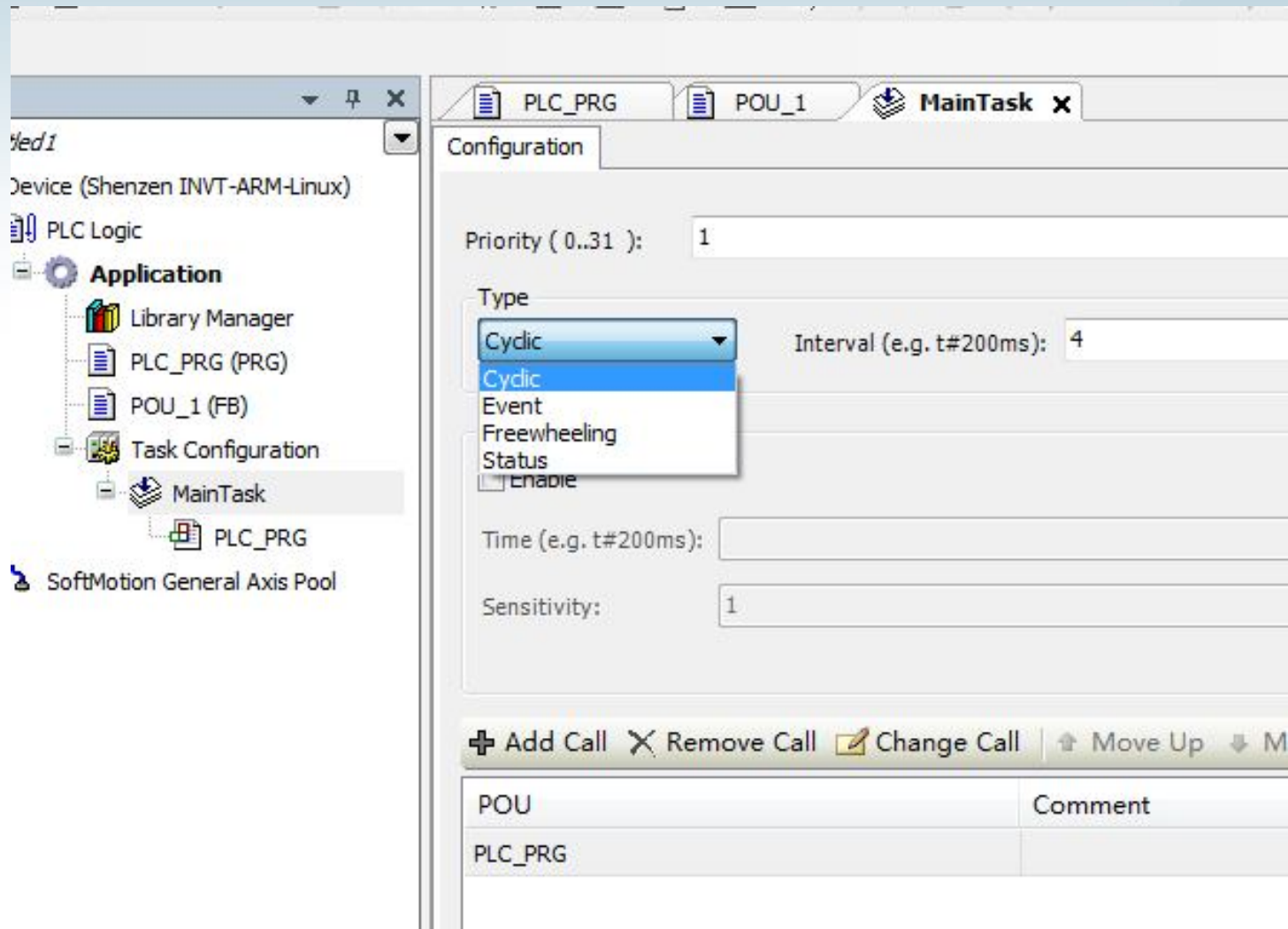
二、Programming environment of CoDeSys

You can add several POU(procedure organization unit) in one project if needed:



二、Programming environment of CoDeSys

You can choose the task type and Priority in 'MainTask':



二、Programming environment of CoDeSys

There are 4 types of task execution:

- 1) Cyclic: The task is carried out in a fixed circle.
- 2) Event: The task is carried out when the variables get a signal of rising edge.
- 3) Freewheeling: The task ends until the last instruct was already carried out.
- 4) Status: The task starts when the status of variables becomes true.

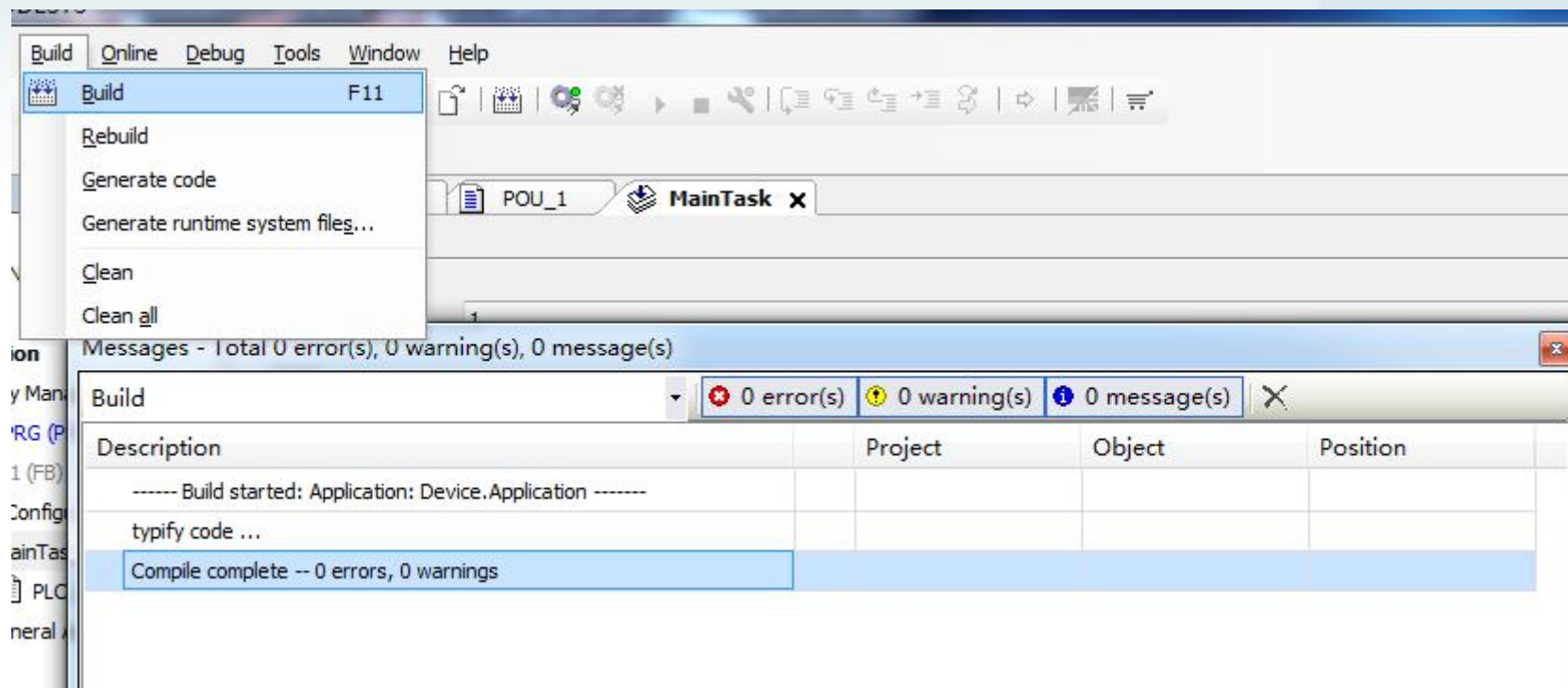
When there are many tasks, you can set priority:

Priority levels:0~15, real-time task;

Priority levels:16~31, un-real time task;

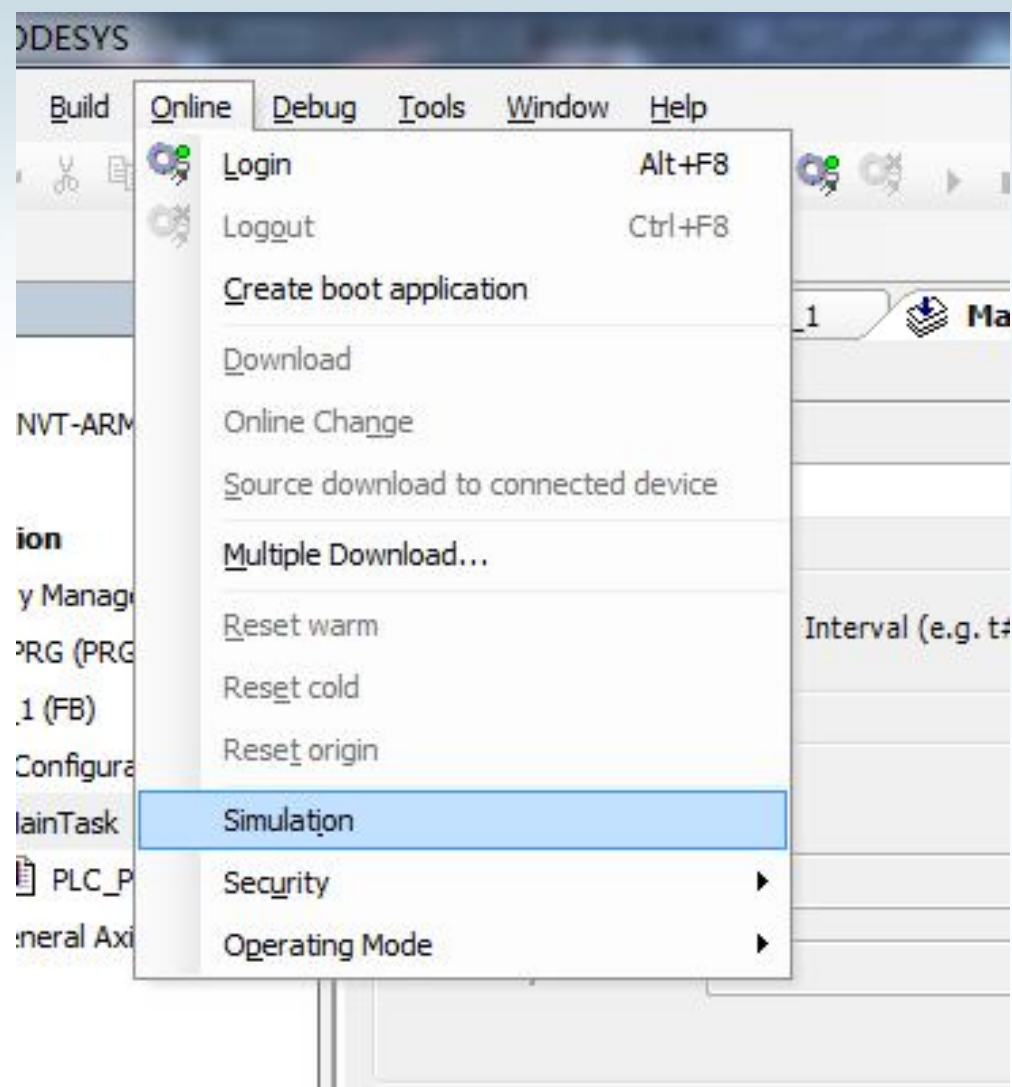
二、Programming environment of CoDeSys

After programming, build the procedure first to check whether there is any error.



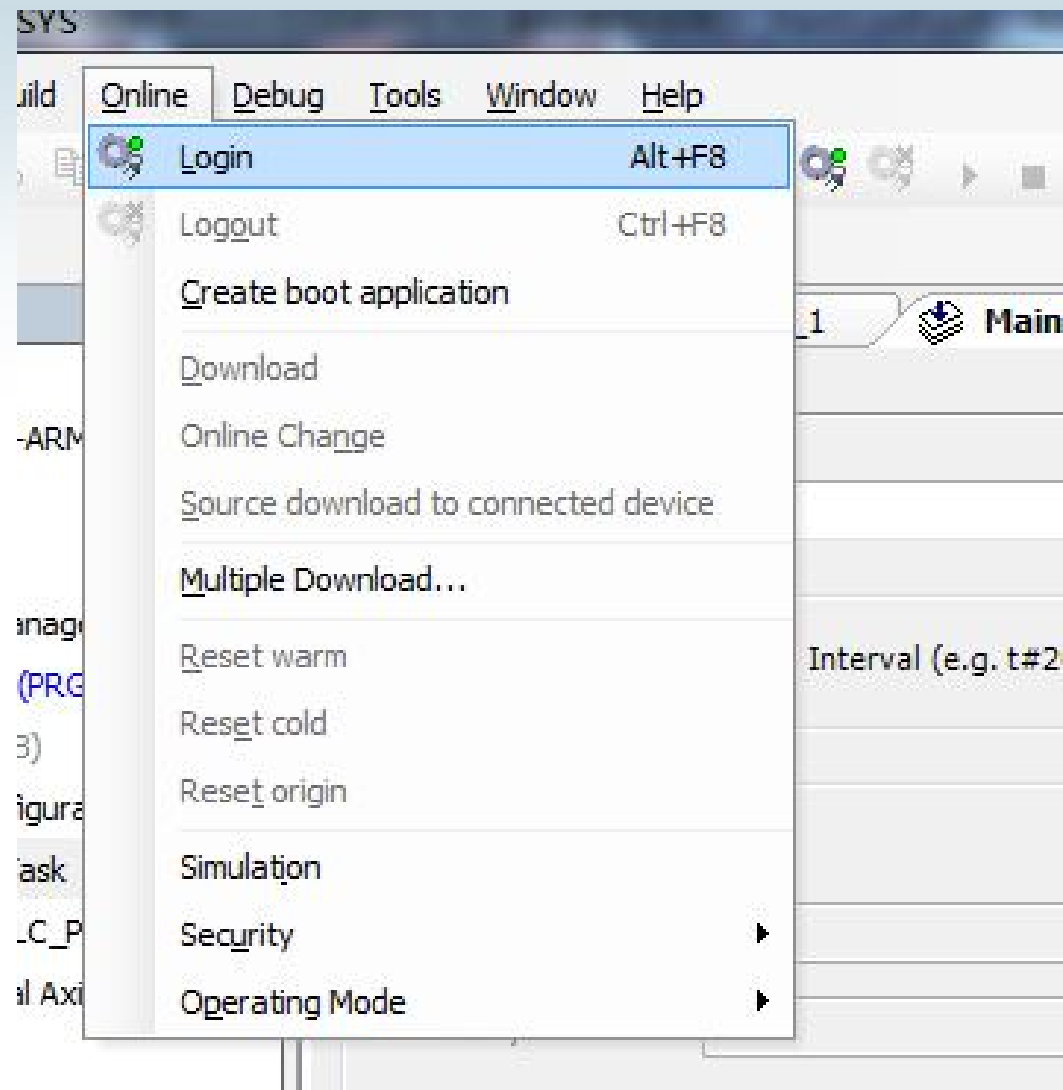
二、Programming environment of CoDeSys

If the device isn't connected, we can simulate online. Choose 'Simulation'



二、Programming environment of CoDeSys

Then Login,



二、Programming environment of CoDeSys

You can write values to test the procedure in simulation,

The screenshot displays the CoDeSys software interface. On the left, the 'Devices' tree shows a project named 'CMDSET_test' containing a 'Device [connected] (PLC)' and a 'PLC Logic' folder. Under 'PLC Logic', the 'Application [run]' is selected, which includes a 'Library Manager', 'PLC_PRG (PRG)', 'Task Configuration', 'MainTask', and 'PLC_PRG'. The 'Debug' menu is open, showing various options. The 'Write values' option, with the keyboard shortcut 'Ctrl+F7', is highlighted. Other options in the menu include 'Start' (F5), 'Stop' (Shift+F8), 'Single Cycle' (Ctrl+F5), 'New Breakpoint...', 'Edit Breakpoint...', 'Toggle Breakpoint' (F9), 'Disable Breakpoint', 'Enable Breakpoint', 'Step Over' (F10), 'Step Into' (F8), 'Step Out' (Shift+F10), 'Run to Cursor', 'Set next Statement', 'Show next Statement', 'Force values' (F7), 'Unforce values' (Alt+F7), 'Flow Control', 'Core Dump', and 'Display Mode'. The background shows the 'PLC_PRG' editor with a table and some code.

Type	Value	Prepared value
Ctrl_command_Itf		
Value_set_Itf		
IOdrive_Itf		
Write_value_Itf		
Display_Inverter_State1_Itf		
UINT	1250	3000
Monitor_value_Itf		

```
CTRL:= , C_MFrq:= , C_SpI:= );  
S( );  
;  
A( );  
( );  
);  
DATA.C_WrP1 0 >=1 THEN  
MD.C_CTRL 5 :=1;  
IF IO.C_S5=1 THEN  
MD.C_CTRL:=2;  
IF IO.C_S3=1 THEN
```

➤ 三、Function library of CoDeSys

3.1 introduction of CoDeSys function library

3.2 installation and addition of function library

3.3 calling of function library

3.4 creation of function library

三、Function library of CoDeSys

3.1 Introduction of CoDeSys function library

Why do we create function library?

The reasons are simple, and there are two general situations: for one, it is easy for users to call function library once they make some special functions into function library, but don't need to program it when use it every time. For another, when users want to program some arithmetic which isn't offered to others, they can create function library to program the arithmetic, and then if others want to call the function library, the users can just offer the interface to them so that they can't know the procedure.

CoDeSys itself can create and program function library that users can program according to their needs.

三、Function library of CoDeSys

The CoDeSys function library is generally divided into two types:

The first one is so called 'external library' which is mainly used by the underlying driver development personnel. It is a library for hardware interfaces. Simply speaking, that is, the interface function library is a bridge between PLC program card with PLC. PLC card's hardware interface through the interface function library provide CoDeSys with PLC programming, and result output after PLC programming is also transmitted to PLC card's hardware or command to output through interface library .

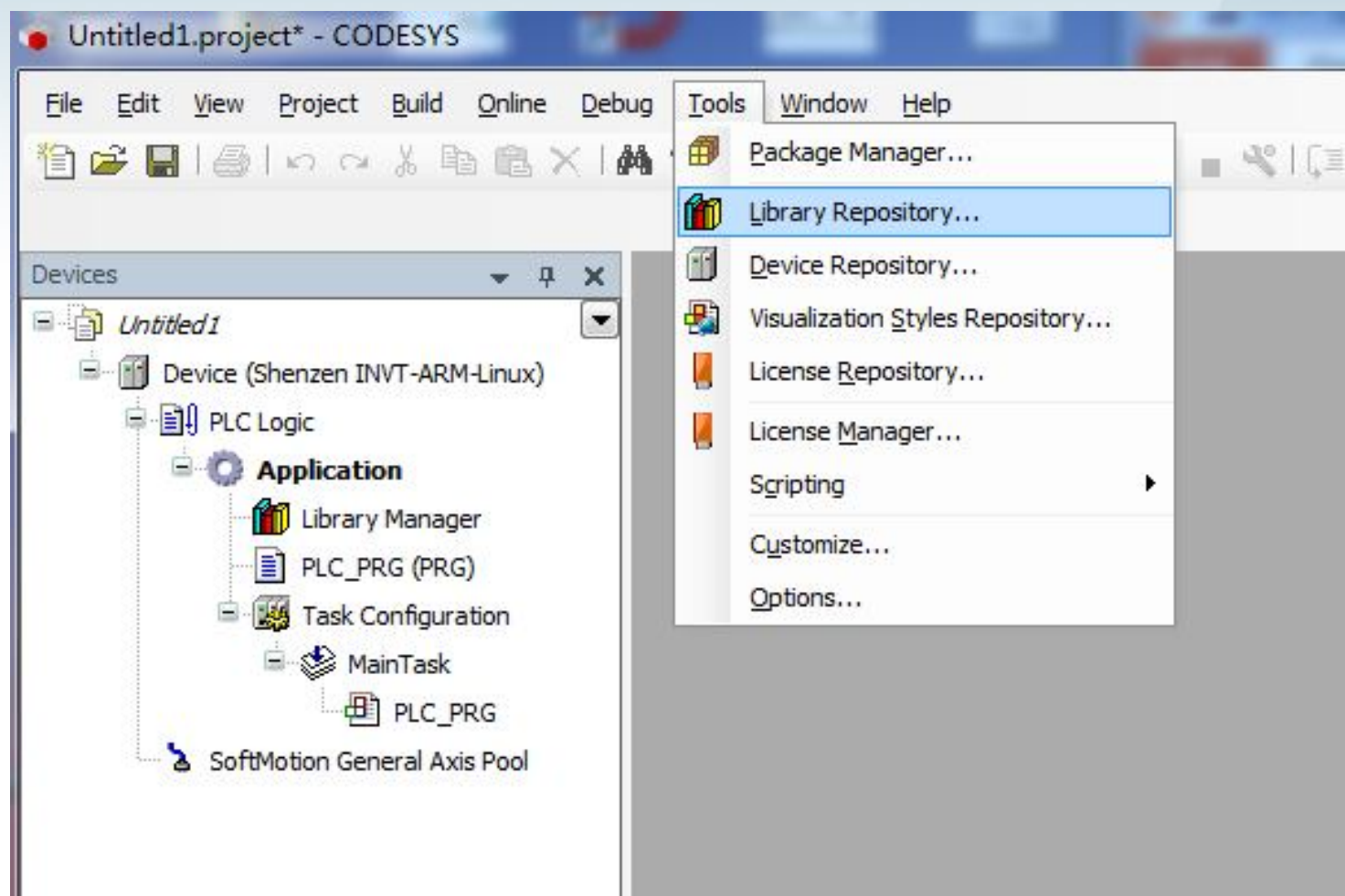
For the library used in hardware interface which is provided by research personnel, users can use it directly. But before using, the function library need to be installed, and then it can be called after added in content of library manager.

The second is aimed at the application layer which is internal algorithm of function library that PLC programming personnel design and define input and output ports by themselves. It is also the method that programming personnel have to master

三、Function library of CoDeSys

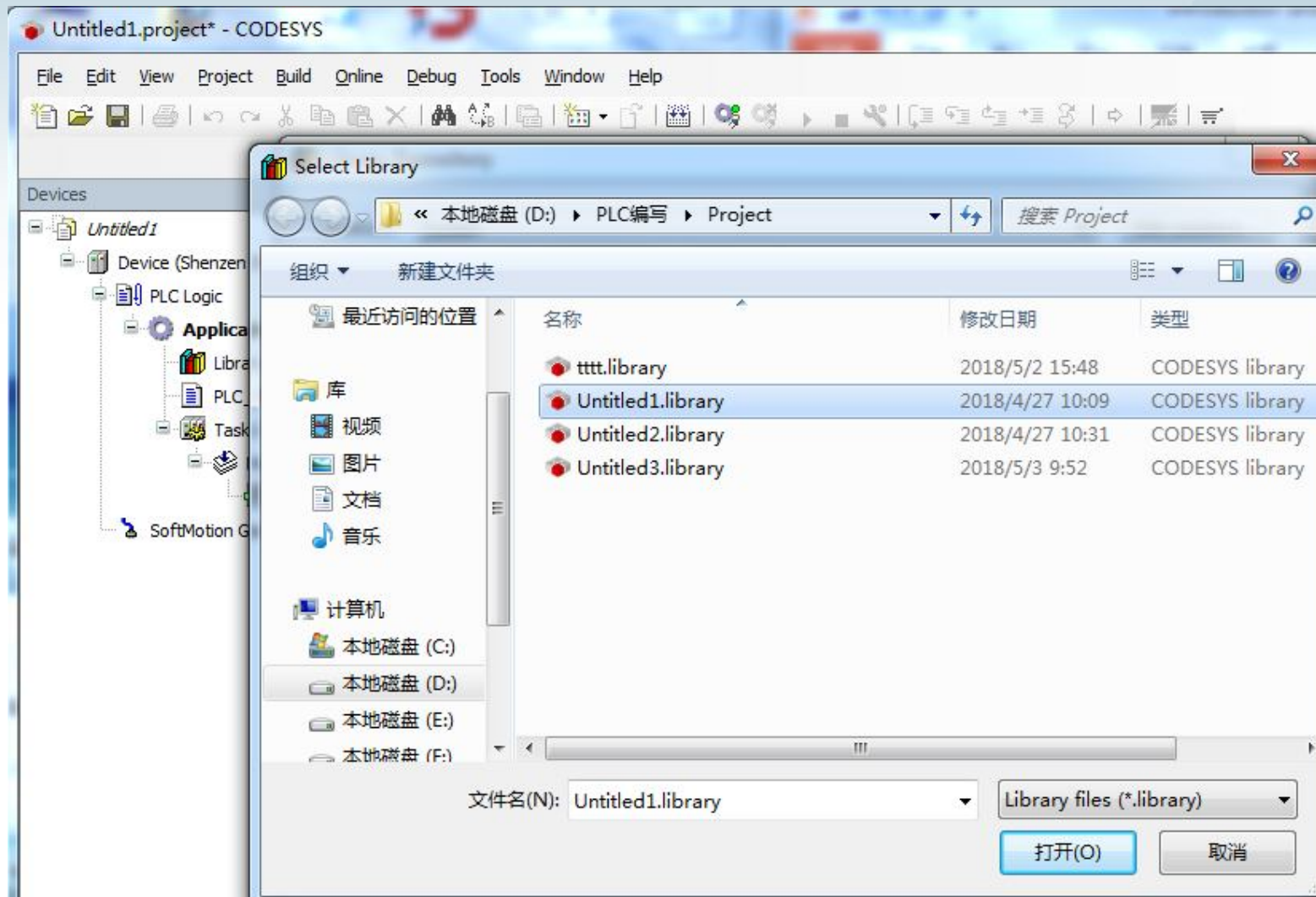
3.2 Installation and addition of function library

Choose 'library repository' in Tools menu 点击确认即可。



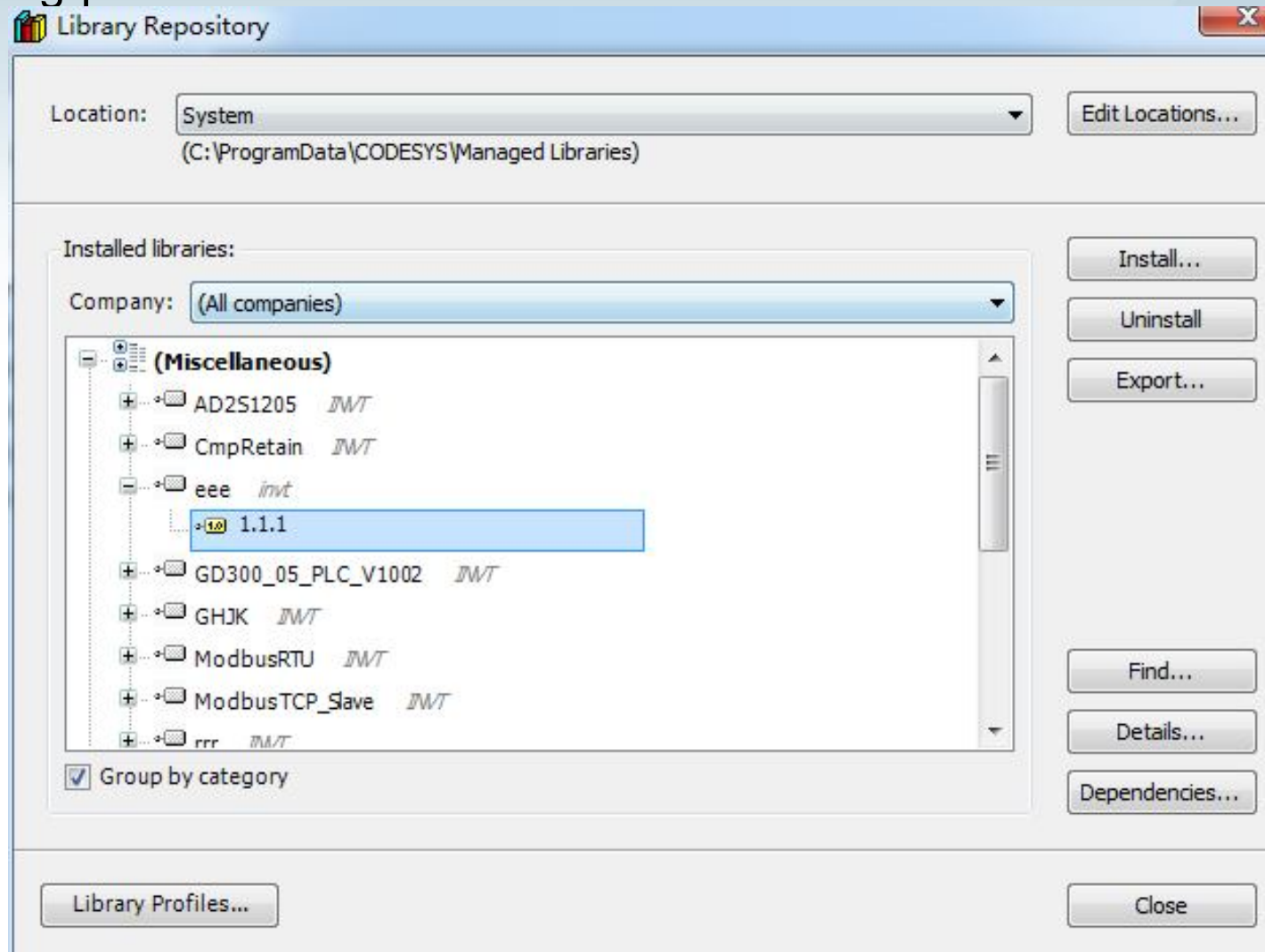
三、Function library of CoDeSys

Click 'install' and then choose a library file



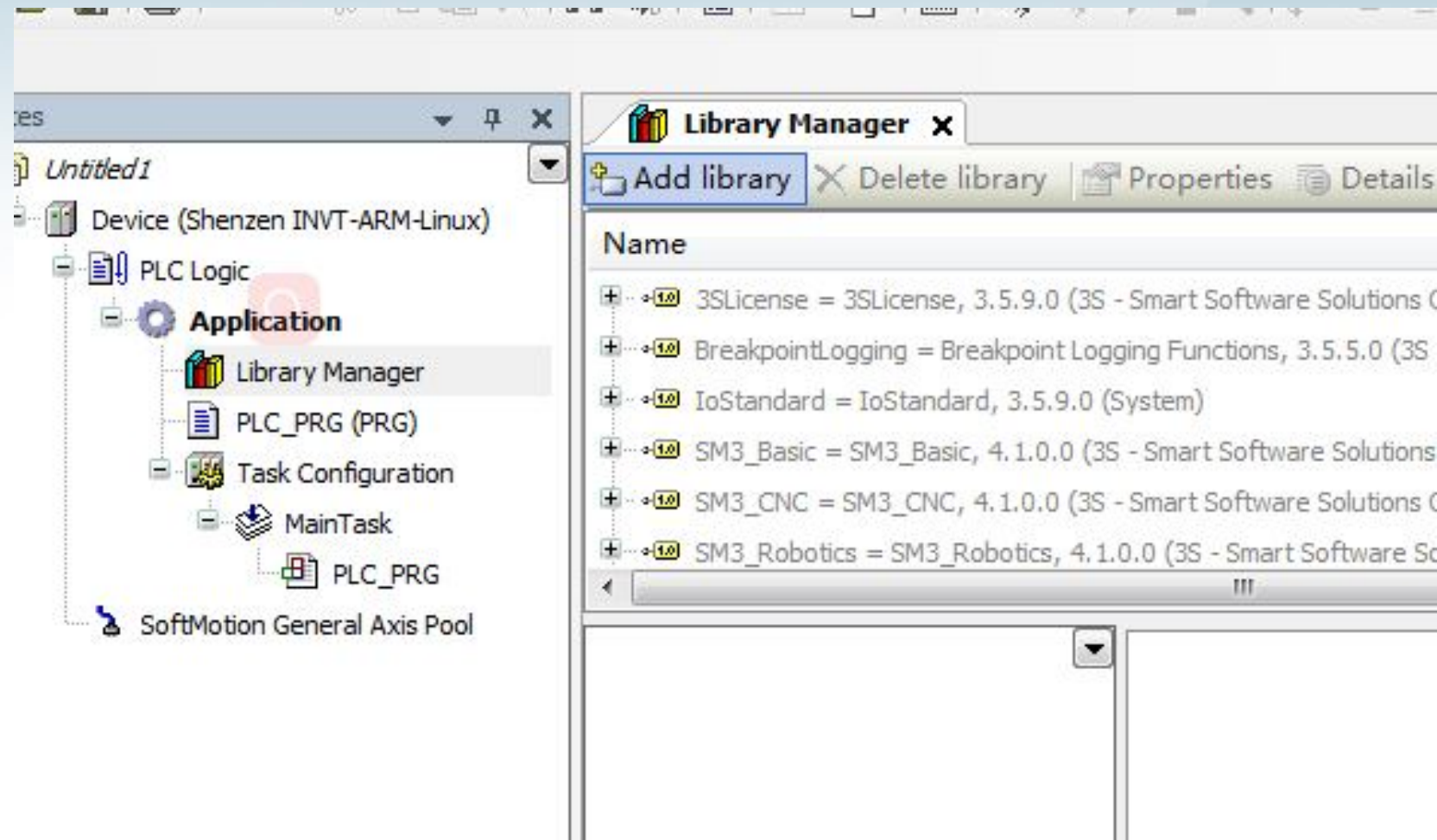
三、Function library of CoDeSys

After installing successfully, you can see the library as shown in following picture



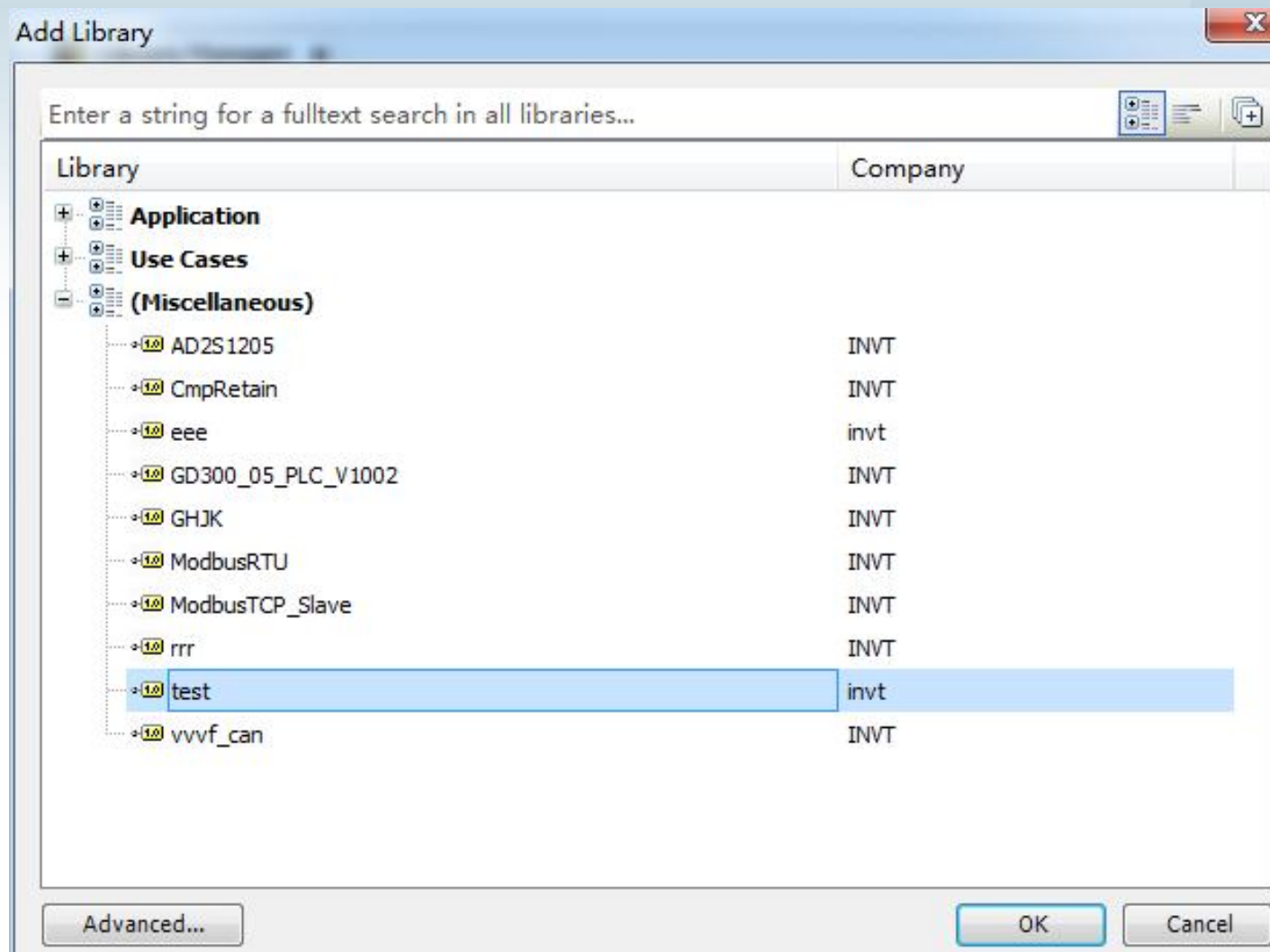
三、Function library of CoDeSys

Then add library in library manager



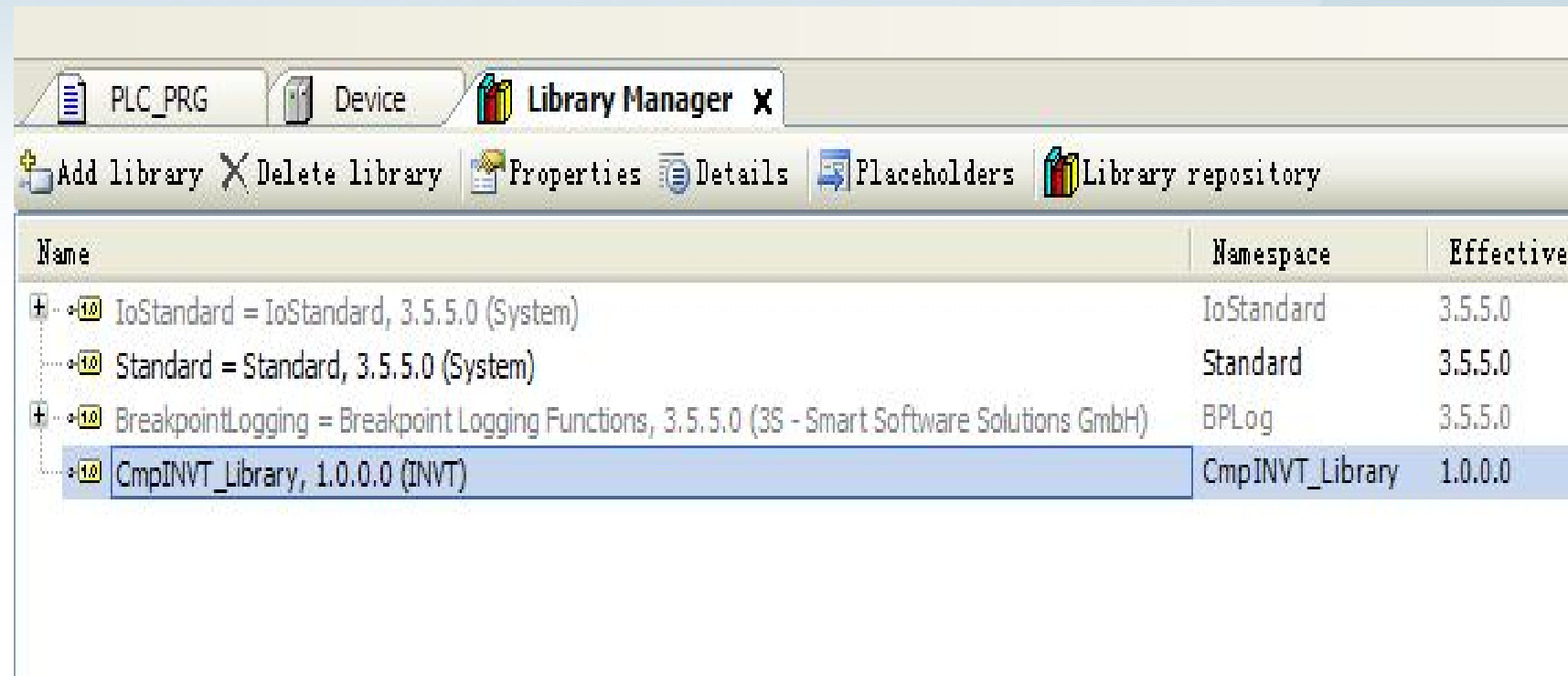
三、Function library of CoDeSys

Choose the library in right file selection



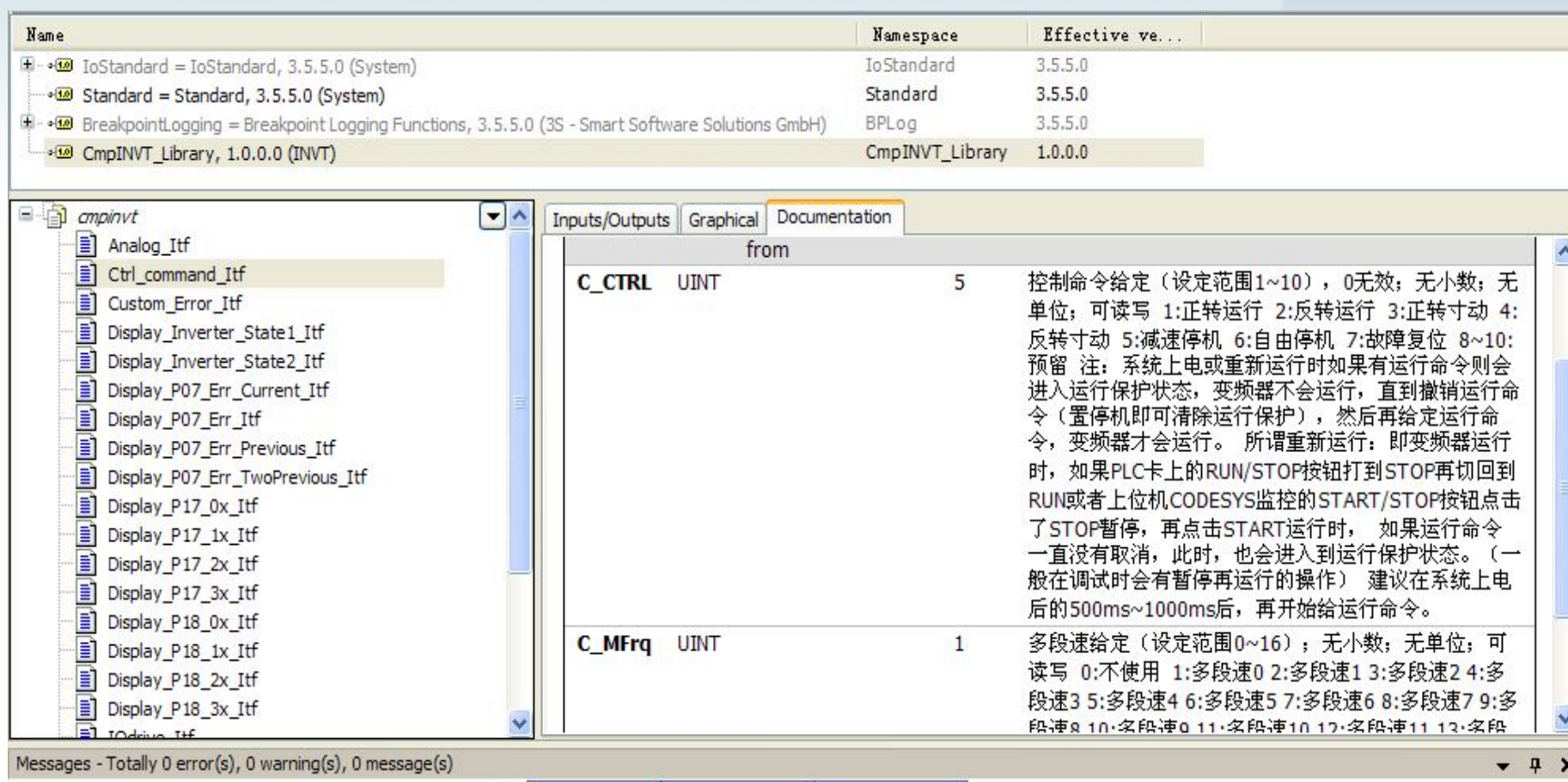
三、Function library of CoDeSys

If you add the library successfully, you can see it in library manager. Also if you don't need some library, you can delete it.



三、Function library of CoDeSys

You can see the information of library when clicking it in library manager.



The screenshot displays the CoDeSys library manager interface. The top table lists installed libraries, with 'CmpINVT_Library, 1.0.0.0 (INVT)' highlighted. Below, the 'Documentation' tab for 'cmpinvt' is active, showing a list of functions on the left and their details on the right.

Name	Namespace	Effective ve...
IoStandard = IoStandard, 3.5.5.0 (System)	IoStandard	3.5.5.0
Standard = Standard, 3.5.5.0 (System)	Standard	3.5.5.0
BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.5.0
CmpINVT_Library, 1.0.0.0 (INVT)	CmpINVT_Library	1.0.0.0

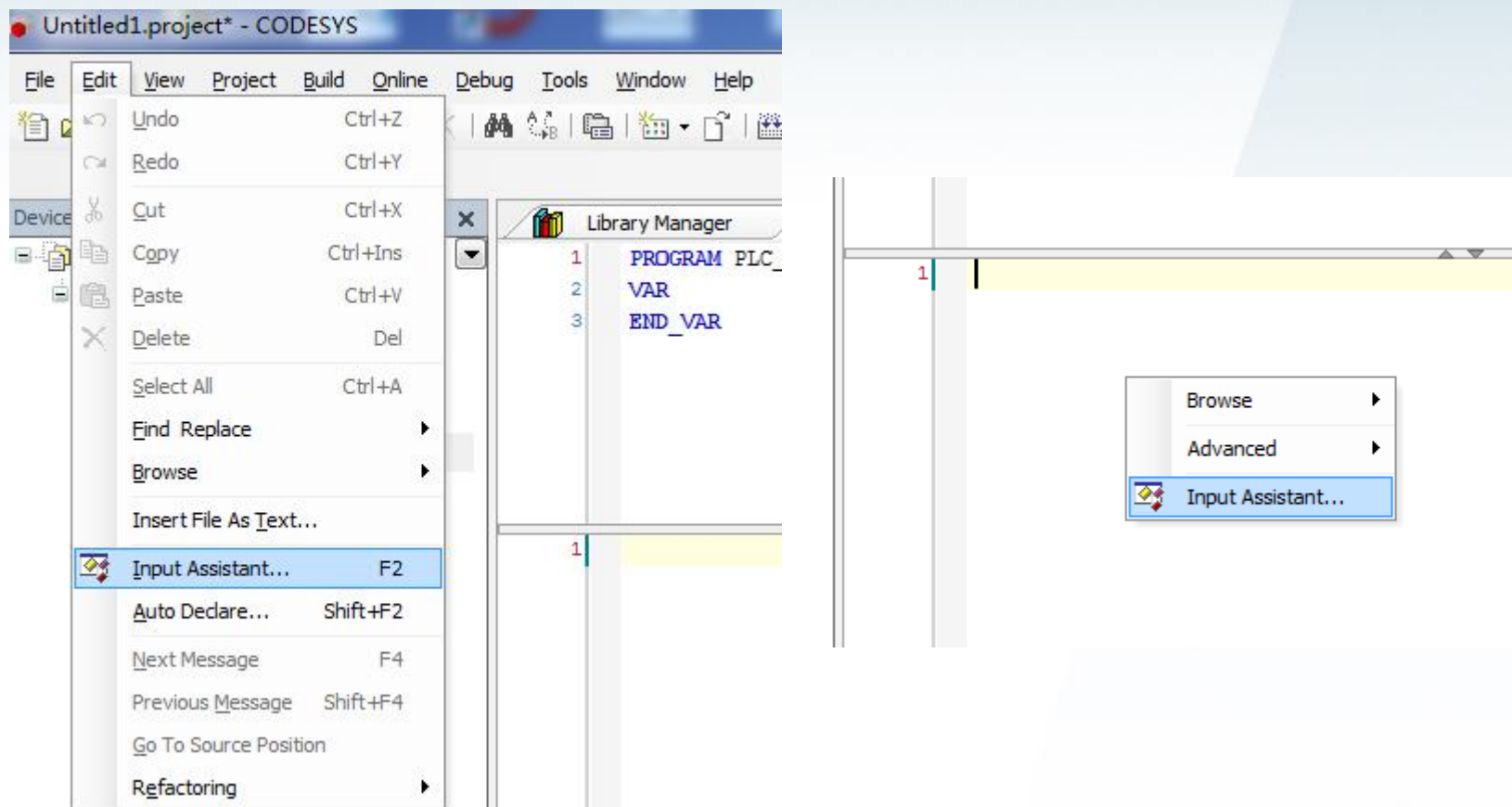
from
C_CTRL UINT 5 控制命令给定（设定范围1~10），0无效；无小数；无单位；可读写 1:正转运行 2:反转运行 3:正转寸动 4:反转寸动 5:减速停机 6:自由停机 7:故障复位 8~10:预留 注：系统上电或重新运行时如果有运行命令则会进入运行保护状态，变频器不会运行，直到撤销运行命令（置停机即可清除运行保护），然后再给定运行命令，变频器才会运行。所谓重新运行：即变频器运行时，如果PLC卡上的RUN/STOP按钮打到STOP再切回到RUN或者上位机CODESYS监控的START/STOP按钮点击了STOP暂停，再点击START运行时，如果运行命令一直没有取消，此时，也会进入到运行保护状态。（一般在调试时会有暂停再运行的操作）建议在系统上电后的500ms~1000ms后，再开始给运行命令。
C_MFrq UINT 1 多段速给定（设定范围0~16）；无小数；无单位；可读写 0:不使用 1:多段速0 2:多段速1 3:多段速2 4:多段速3 5:多段速4 6:多段速5 7:多段速6 8:多段速7 9:多段速8 10:多段速9 11:多段速10 12:多段速11 13:多段速14 15:多段速15 16:多段速16

Messages - Totally 0 error(s), 0 warning(s), 0 message(s)

三、Function library of CoDeSys

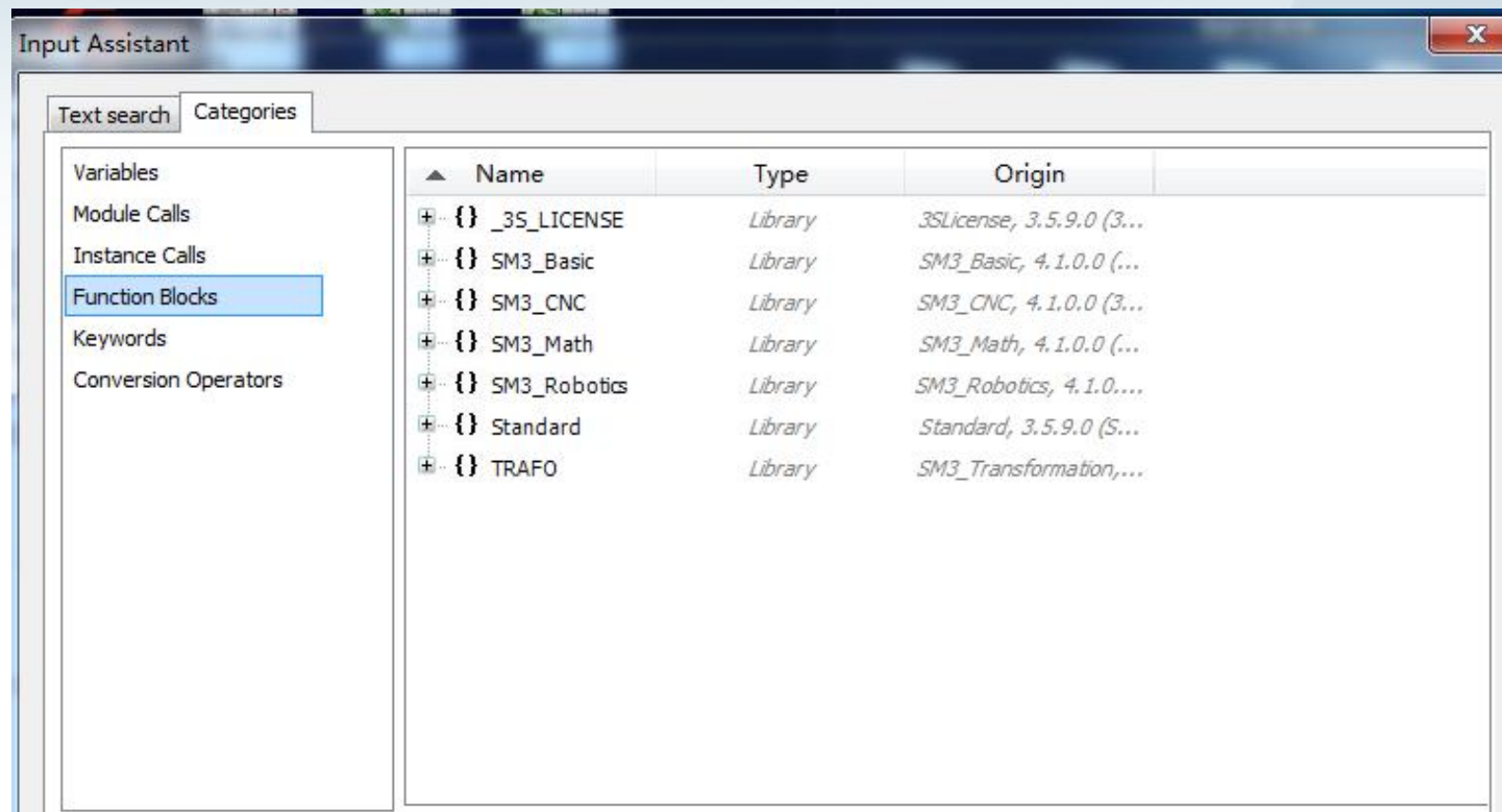
3.3 Calling of function library

In programming area, press 'F2' or 'Fn+F2', or choose 'input assistant' in Edit menu, or click right mouse button.



三、Function library of CoDeSys

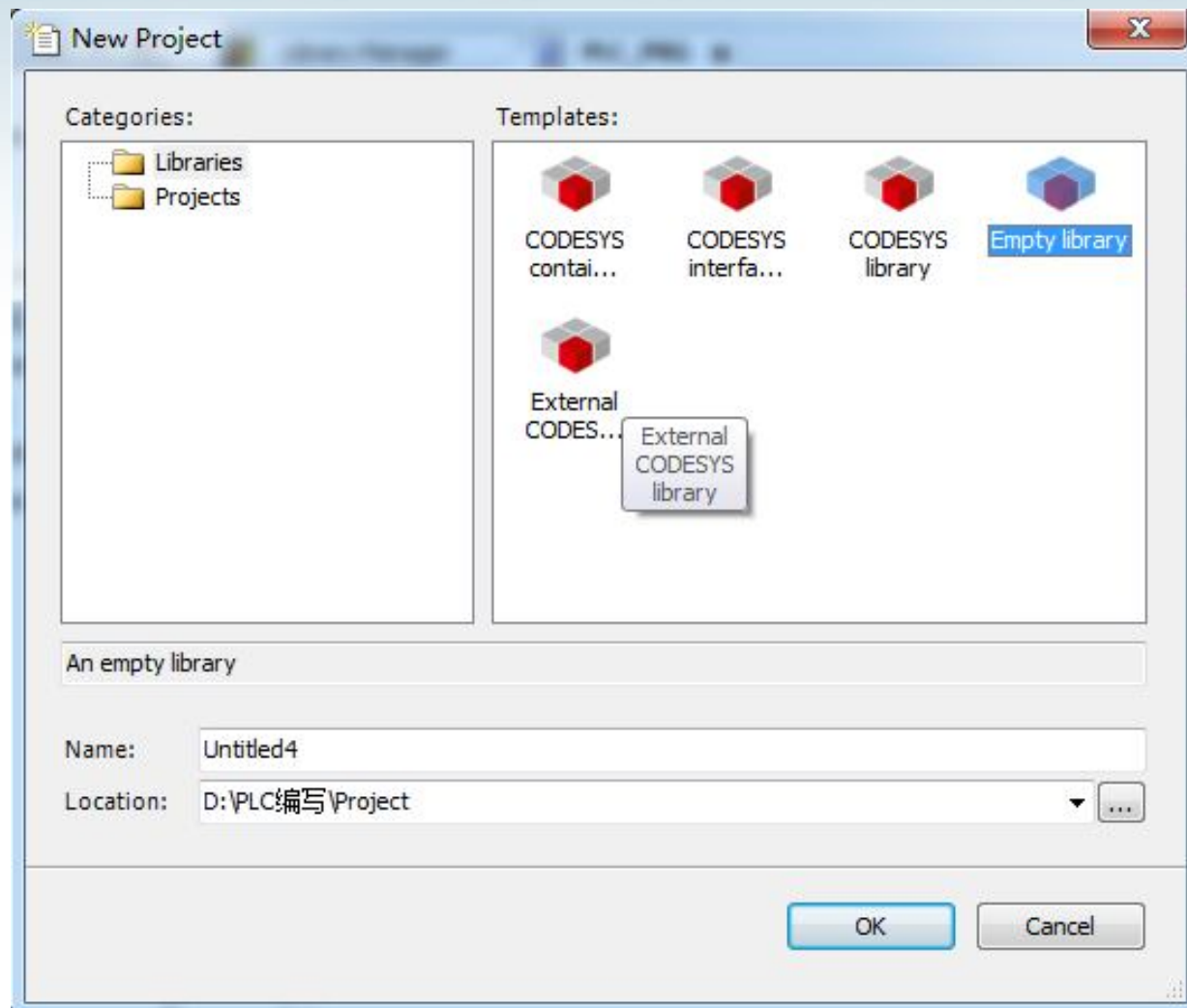
Choose function block in input assistant and find the library



三、Function library of CoDeSys

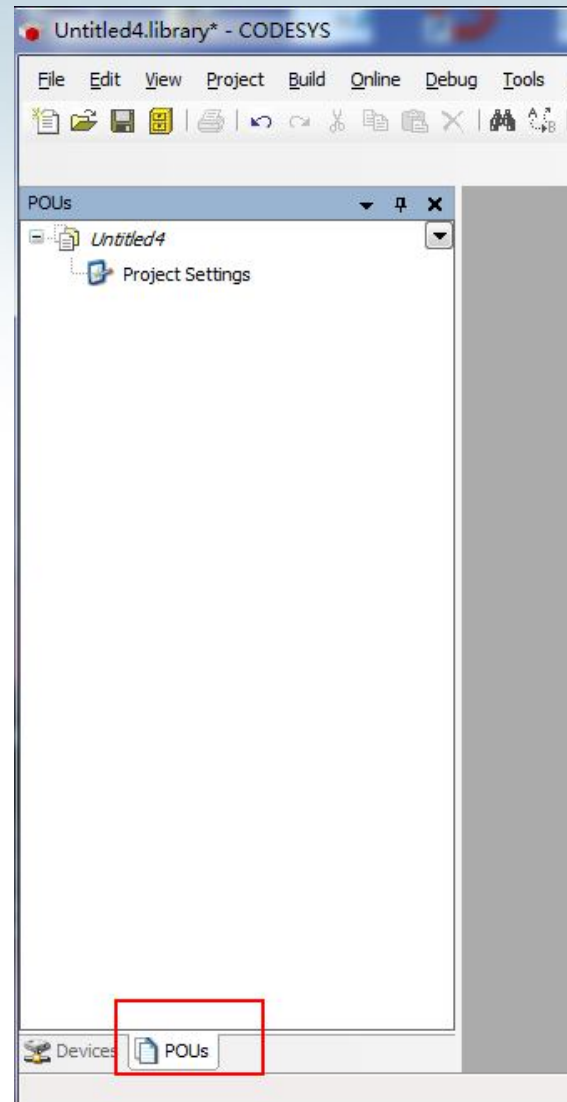
3.4 Creation of function library

Create empty library



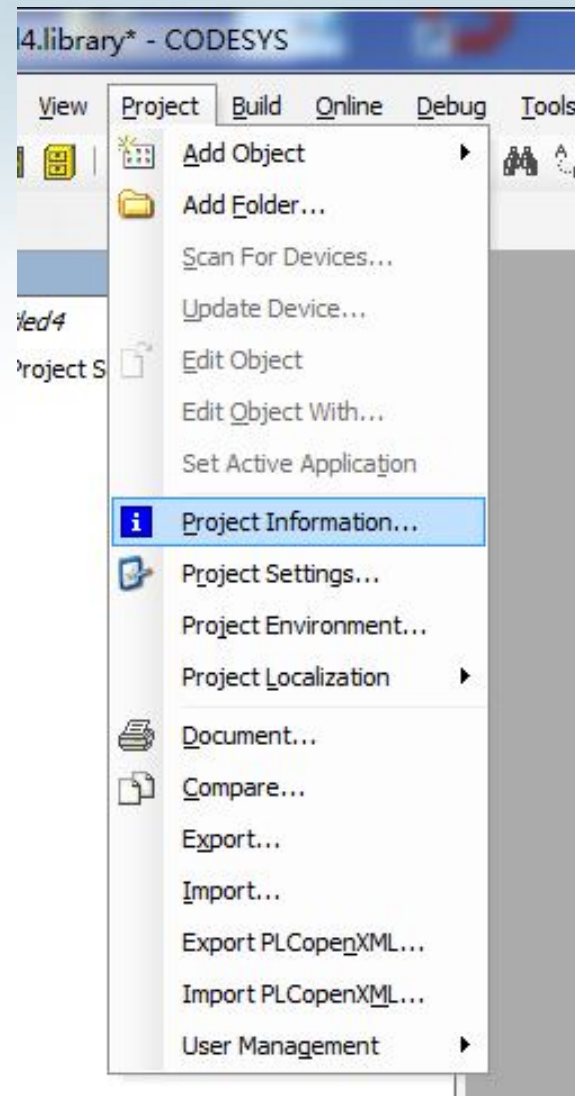
三、Function library of CoDeSys

Choose 'POUs'



三、Function library of CoDeSys

Choose 'project information'



三、Function library of CoDeSys

Fill out three main information

Project Information

File Summary Properties Statistics Licensing Signing

Company: invnt

Title: testing

Version: 0.0.0 ☐ Released

Library Categories: ...

Default namespace:

Author:

Description:

The fields in bold letters are used to identify a library.

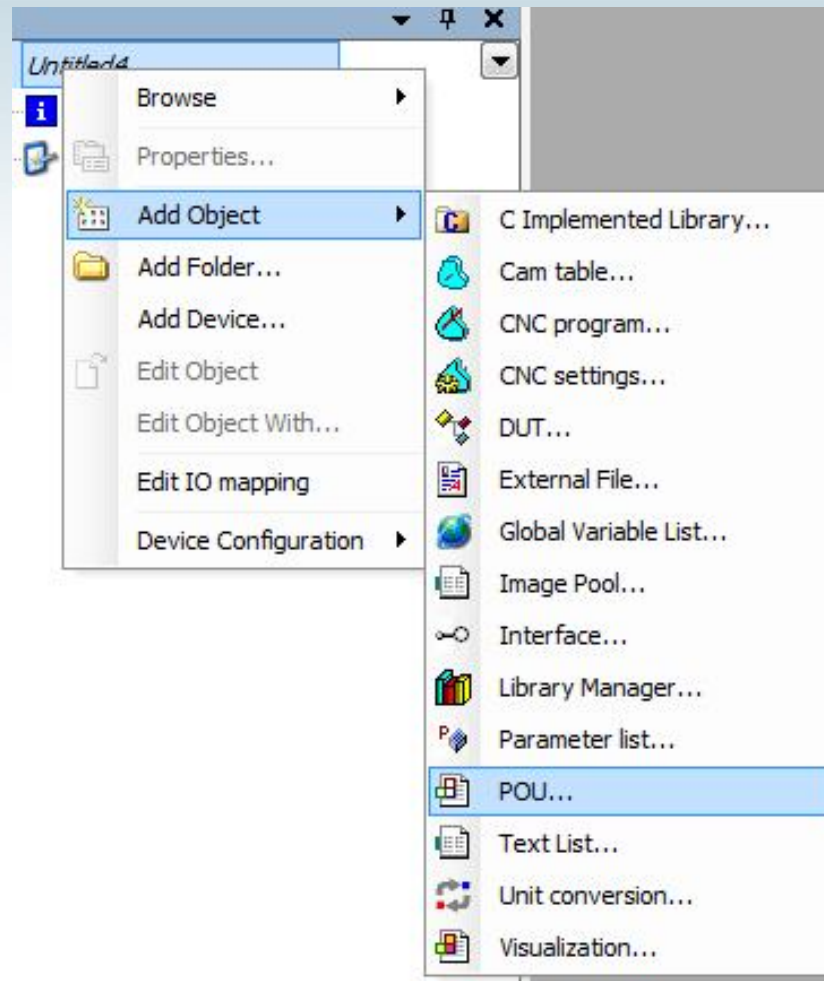
☐ Automatically generate 'Library Information' POU's

☐ Automatically generate 'Project Information' POU's

OK Cancel

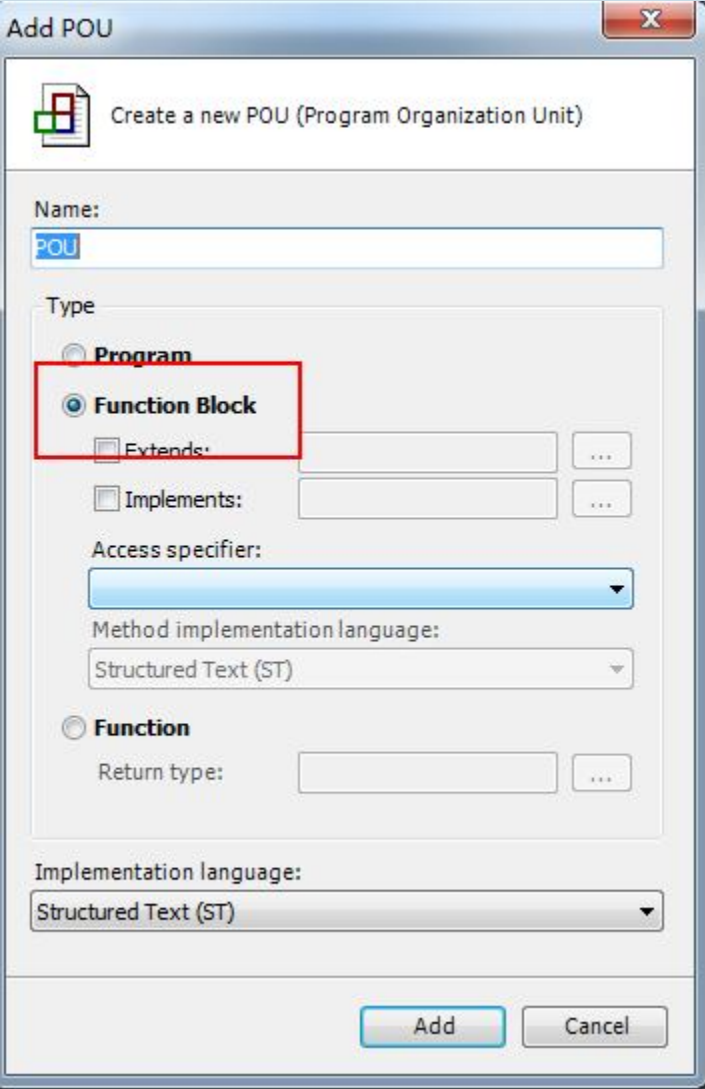
三、Function library of CoDeSys

Add POU and the program



三、Function library of CoDeSys

Generally we choose 'function block'

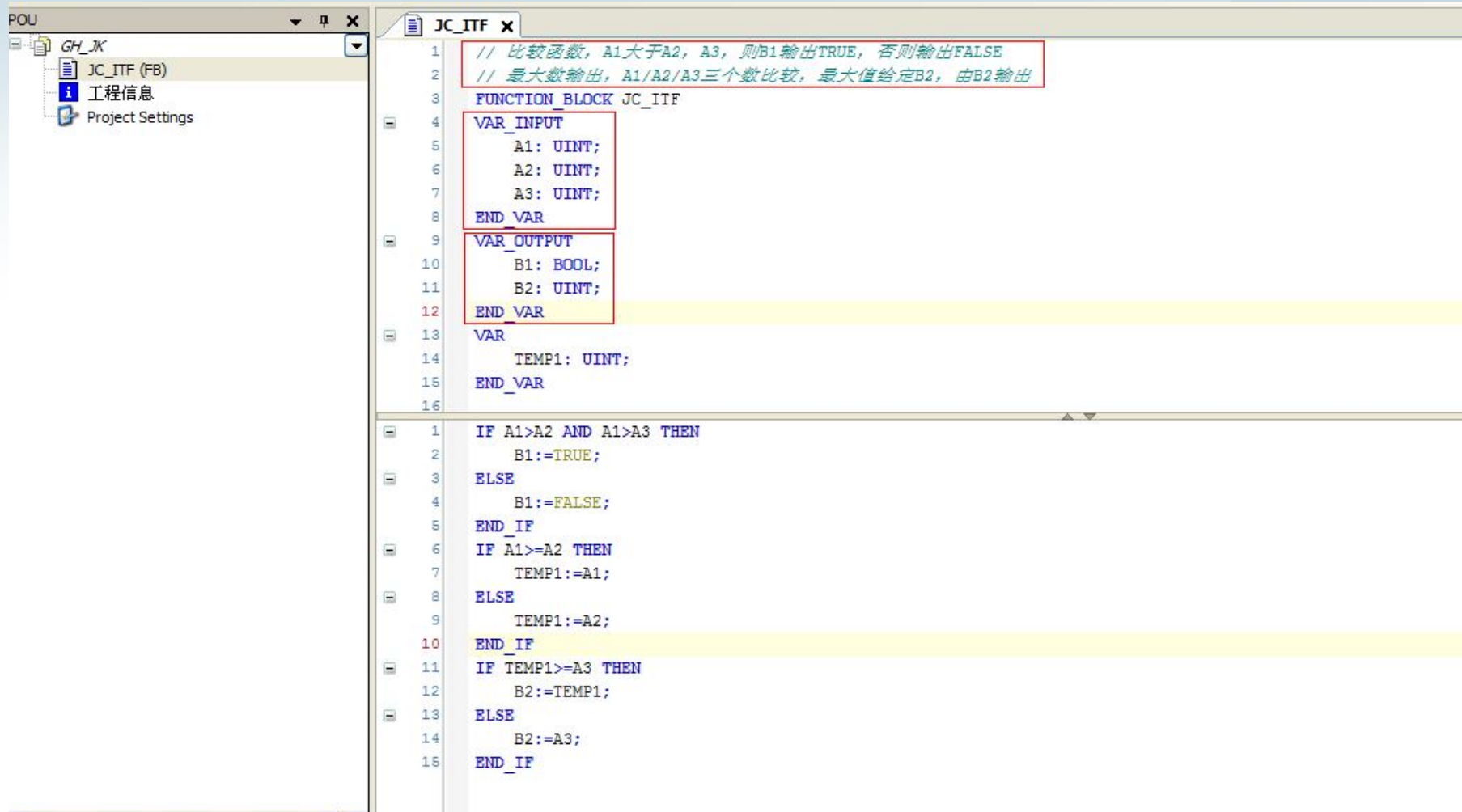


The screenshot shows the 'Add POU' dialog box in the CoDeSys software. The dialog is titled 'Add POU' and contains the following fields and options:

- Name:** A text field containing 'POU'.
- Type:** A section with two radio buttons: 'Program' and 'Function Block'. The 'Function Block' option is selected and highlighted with a red rectangular box.
- Extends:** A checkbox and a text field, currently unchecked.
- Implements:** A checkbox and a text field, currently unchecked.
- Access specifier:** A dropdown menu.
- Method implementation language:** A dropdown menu set to 'Structured Text (ST)'.
- Function:** A radio button option, currently unselected.
- Return type:** A text field and a button, currently empty.
- Implementation language:** A dropdown menu set to 'Structured Text (ST)'.
- Buttons:** 'Add' and 'Cancel' buttons at the bottom right.

三、Function library of CoDeSys

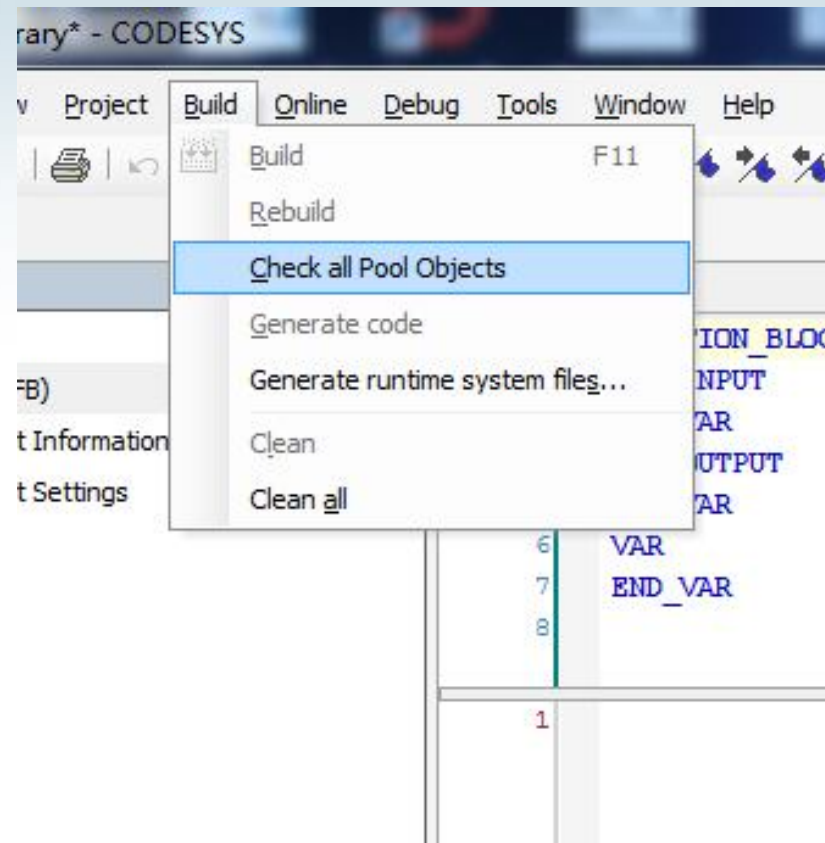
Define the interface variables first, and then program



```
1 // 比较函数, A1大于A2, A3, 则B1输出TRUE, 否则输出FALSE
2 // 最大数输出, A1/A2/A3三个数比较, 最大值给定B2, 由B2输出
3 FUNCTION BLOCK JC_ITF
4   VAR_INPUT
5     A1: UINT;
6     A2: UINT;
7     A3: UINT;
8   END_VAR
9   VAR_OUTPUT
10    B1: BOOL;
11    B2: UINT;
12  END_VAR
13  VAR
14    TEMP1: UINT;
15  END_VAR
16
17  IF A1>A2 AND A1>A3 THEN
18    B1:=TRUE;
19  ELSE
20    B1:=FALSE;
21  END_IF
22  IF A1>=A2 THEN
23    TEMP1:=A1;
24  ELSE
25    TEMP1:=A2;
26  END_IF
27  IF TEMP1>=A3 THEN
28    B2:=TEMP1;
29  ELSE
30    B2:=A3;
31  END_IF
```

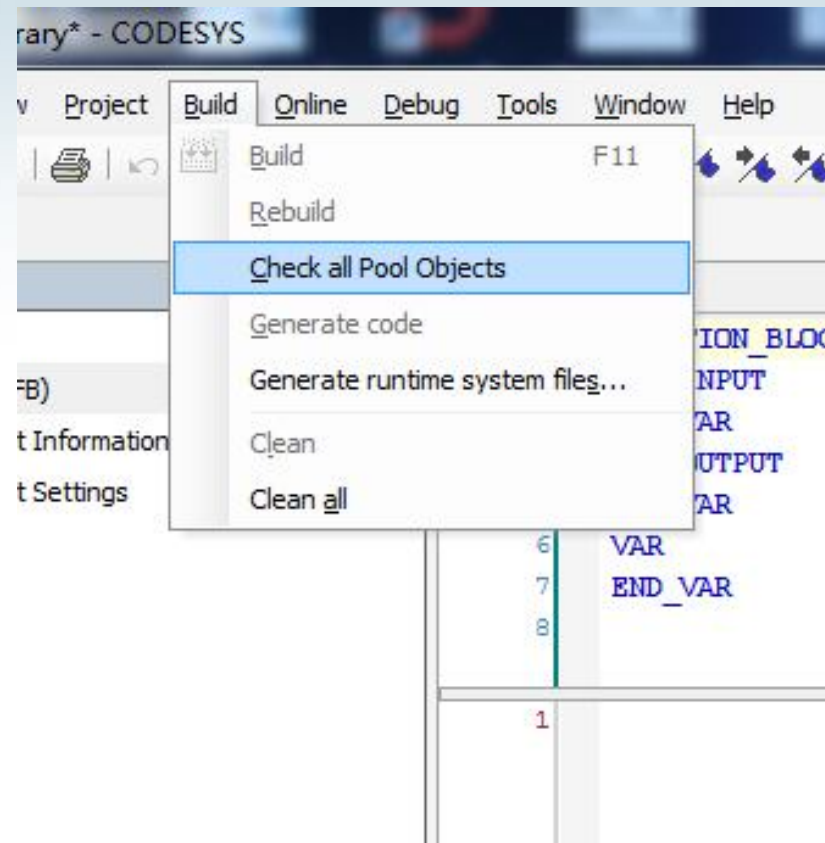
三、Function library of CoDeSys

After programming, check all pool objects and save it.



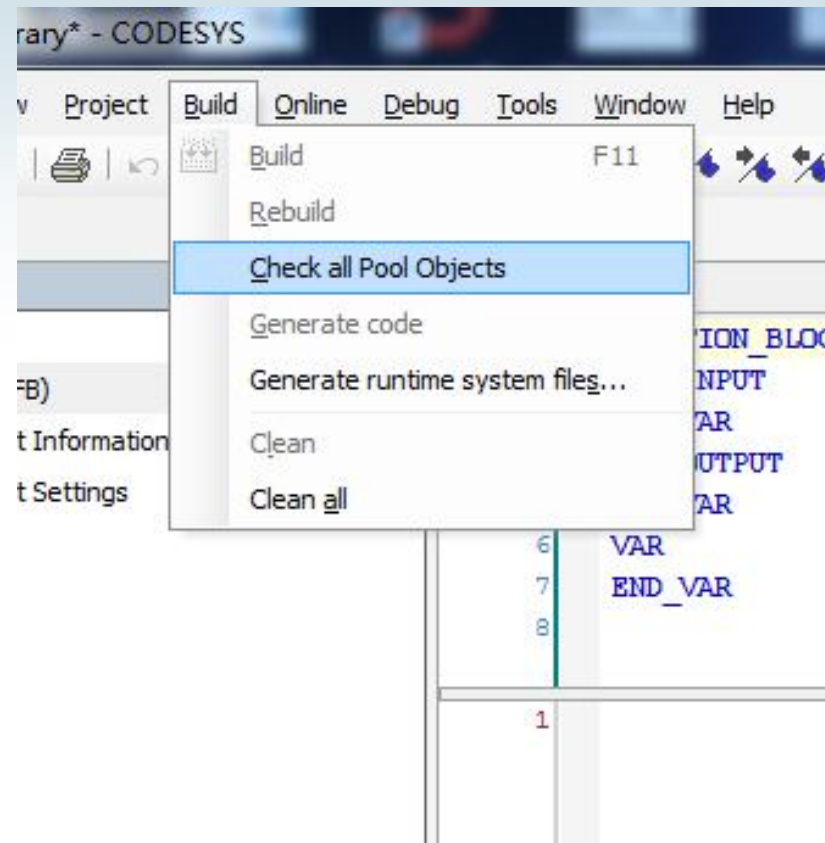
三、Function library of CoDeSys

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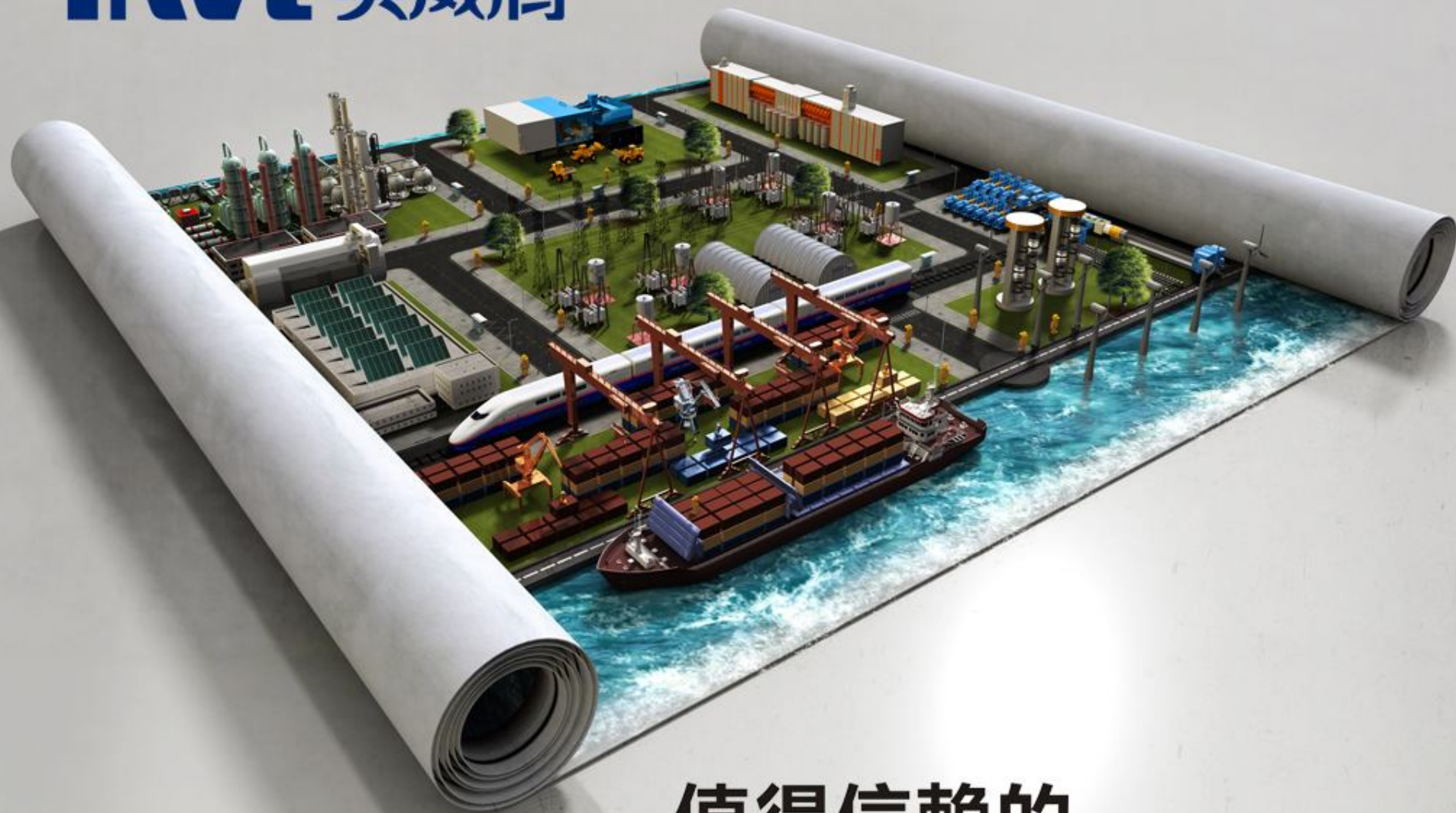


三、Function library of CoDeSys

After programming, check all pool objects and save it.



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