

## Программируемые логические контроллеры SIMATIC. Инженерная среда SIMATIC TIA-portal. Step-7 V12 Pro.

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта. Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги. Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500



## Раздел 1

Элементы алгебры логики.  
Системы счисления.

The screenshot displays the SIMATIC TIA-portal software interface. The main window shows a project titled "Totally Integrated Automation PORT" with a "RampFunction generator" block. The block is configured with a "Ramp-up time" of 10.000 s, a "Ramp-down time" of 10.000 s, and "Final rounding" of 0.000 s. The graph shows a smooth ramp-up and ramp-down curve. A secondary window shows a network diagram with PLC\_1 (CPU 1513-1 PN) and Drive\_1 (G120 CU240E-2) connected via PN1E\_1.



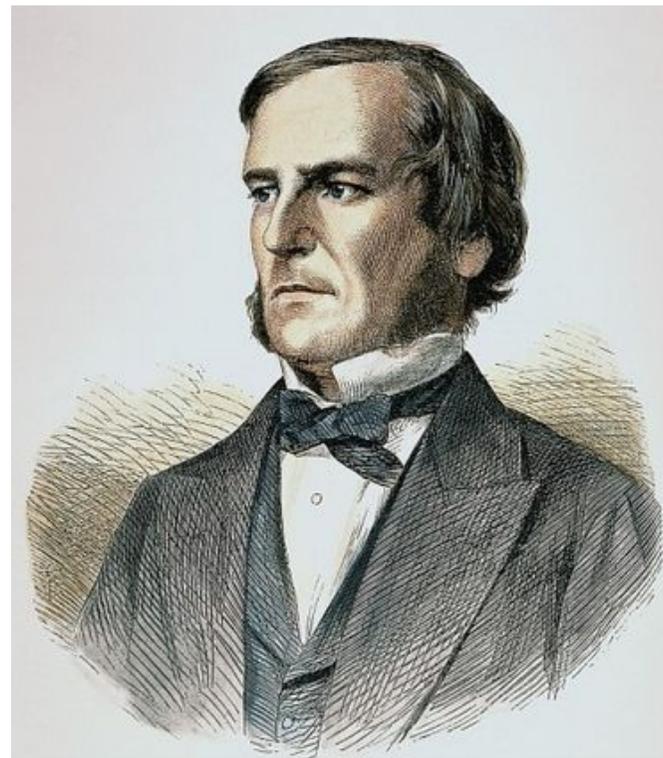
## Коротко о математическом аппарате «Алгебра логики»

В основу инженерного построения дискретных цепей, использующихся в электротехнике, в электронике, в программно реализуемых алгоритмах управления, положен математический аппарат двоичной логики – алгебры логики.

Создатель этого математического аппарата, который еще называют алгеброй событий или высказываний, английский математик Джордж Буль показал, как математическим путем из какого-то исходного количества логических высказываний можно вывести логическое заключение, являющееся функцией этих высказываний. Аппарат алгебры логики предполагает, что область существования переменных, как функций, так и аргументов ограничена двумя значениями:

- «истинно» (**true**), которому в уравнениях соответствует знак «1» - логическая единица
- «ложно» (**false**), которому в уравнениях соответствует знак «0» - логический ноль .

Из полного набора предложенных Булем функций (их 16) рассмотрим те, которые применяются в инженерной практике чаще всего.



# Функция логического умножения – «И»

«Релейное» представление

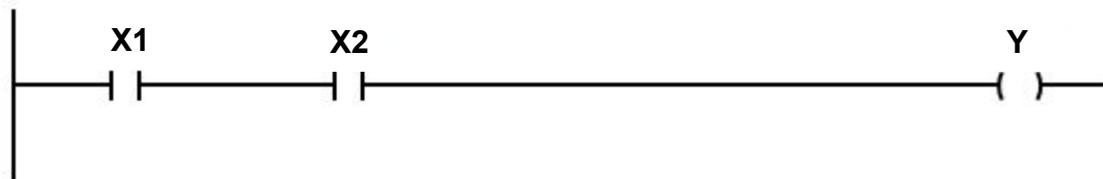


Таблица истинности

X1	X2	Y
0	0	0
0	1	0
1	0	0
1	1	1

Для того, чтобы переменная  $Y = 1$ , необходимо, чтобы **и**  $X1$ , **и**  $X2$  были  $= 1$ .

Эта функция носит название «логическое умножение» (конъюнкция), функция «И».

Записывается как  $Y = X1 \& X2$

Вид построчных инструкций

A	X1
A	X2
=	Y

Команда **A**: AND logic operation

Функциональная схема



# Функция логического сложения – «ИЛИ»

«Релейное» представление

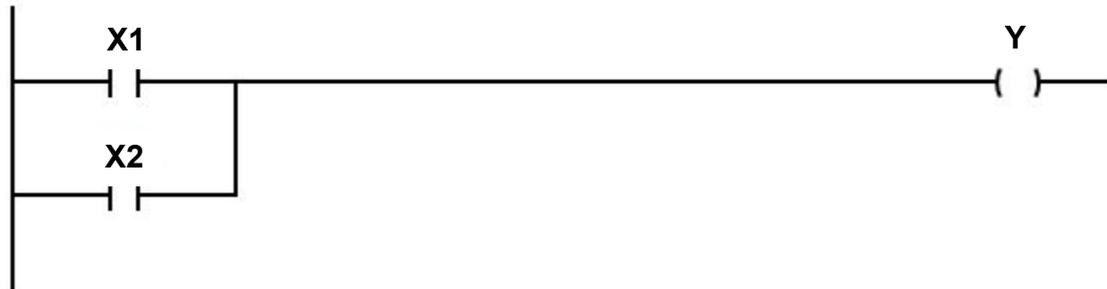


Таблица истинности

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	1

Для того, чтобы переменная  $Y = 1$ , необходимо, чтобы **или**  $X1 = 1$ , **или**  $X2 = 1$ , **или** обе вместе.

Эта функция носит название «логическое сложение» (дизъюнкция), функция «ИЛИ».

Записывается как  $Y = X1 || X2$

Вид построчных инструкций

A	X1
O	X2
=	Y

Команда O: OR logic operation

Функциональная схема



# Функция логического отрицания – «НЕ» (инверсия)

«Релейное» представление

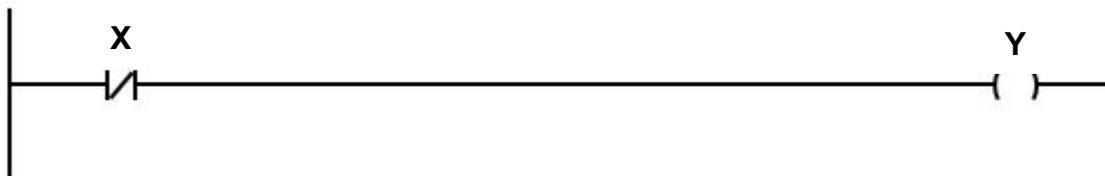


Таблица истинности

X	Y
0	1
1	0

Такая цепочка в терминах алгебры логики описывается как «высказывание Y является истинным, когда исходное высказывание X ложно и наоборот». Y есть **не** X, или функция есть *инверсия* аргумента.

В отличие от предыдущих функция унитарная, записывается как  $Y = \bar{X}$

Вид построчных инструкций

AN	X
=	Y

Команда **AN**: AND NOT logic operation

Функциональная схема



## Функция «Исключающее ИЛИ»

Рассмотренные функции «И» «ИЛИ» «НЕ» представляют собой полный функциональный набор, то есть их сочетанием можно представить логическую цепь любой степени сложности. Кроме них распространена еще одна логическая функция – «Исключающее ИЛИ» (альтернатива). Для того, чтобы переменная  $Y = 1$ , необходимо, чтобы **или**  $X1=1$ , **или**  $X2 = 1$ , но не обе вместе.

«Релейное» представление

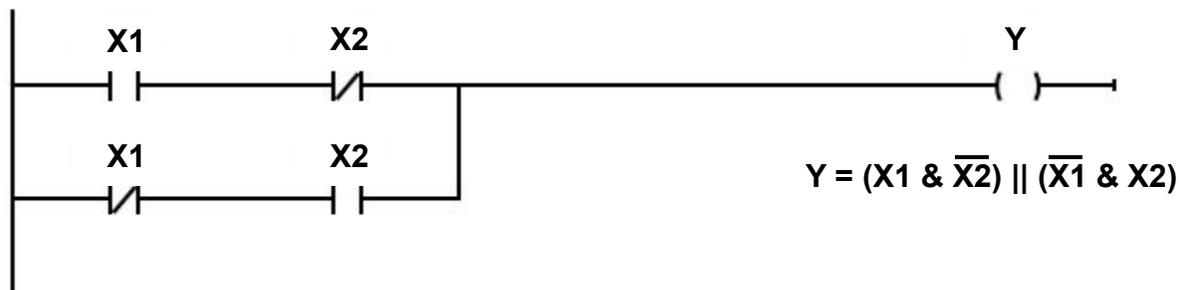


Таблица истинности

X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	0

Вид построчных инструкций

```

X      X1
X      X2
=      Y
  
```

Команда **X**: EXCLUSIVE OR logic operation

Функциональная схема



## Позиционная система счисления

Позиционной называется система счисления, в которой число представлено суммой произведений степени основания на число, представленное цифрой в текущем разряде (позиции).

В общем виде число в такой системе счисления записывается так:

$$[A \times N^k] + \dots + [A \times N^3] + [B \times N^2] + [C \times N^1] + [D \times N^0]$$

Где  $A, B, C, D$  – цифры,  $N$  – целое основание системы счисления,  $(0, 1, 2, 3, \dots, k)$  – степени основания. (Здесь следует помнить, что любое число, отличное от нуля, в нулевой степени = 1).

Привычная нам десятичная система счисления является позиционной с основанием 10 и оперирует с десятью знаками (цифрами) – от 0 до 9.

Например:

возьмем любое число, допустим, число 9345 и разложим его на составляющие. Мы увидим, что оно является суммой следующих чисел:

9 тысяч + 3 сотни + 4 десятка + 5 единиц

или:  $9 \times 10^3 + 3 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$

вес разряда = 1000

вес разряда = 100

вес разряда = 10

вес разряда = 1

→ позиции или разряды

Мы видим, что от местоположения цифры в числе (позиции или разряда) зависит ее «вес», который определяется степенью основания системы счисления – в данном случае это возрастающие справа налево степени числа 10.



## Представление чисел в двоичной и шестнадцатиричной системах

- Цифровые системы работают в множестве только двух значений – «0» (выключено) и «1» (включено). Соответственно, все математические операции в них могут быть произведены только в двоичной системе счисления, в которой построение числа основано на использовании двух цифр – «0» и «1», а «вес» позиции определяется степенью числа 2.

Например, возьмем произвольное двоичное число  $(1011)_2$  и разложим на составляющие по правилам позиционной системы:

$$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

При прочтении приведенного двоичного числа в десятичной форме мы имеем:

$$8 + 0 + 2 + 1 = 11, \text{ т.е. } (1011)_2 = 11_{10}$$

- Для представления чисел в цифровой технике часто используется **шестнадцатиричная система (hex)**. Она удобна тем, что число 16 также является степенью 2 и переход к прочтению чисел в этих системах достаточно прост. Прочтение цифр в шестнадцатиричной системе следующее:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

Легко посчитать по ряду, что  $A_{16} = 10_{10}$  и, соответственно,  $F_{16} = 15_{10}$

Для написания любой шестнадцатиричной цифры в символах «0» и «1» достаточно четырех двоичных разрядов.

Например,  $A_{16} = (1010)_2$ ,  $F_{16} = (1111)_2$

Представим десятичное число 1250 в шестнадцатиричной и двоичной форме:

$$1250_{10} = 04E2_{16} = (\underline{0000} \underline{0100} \underline{1110} \underline{0010})_2$$

Видно, что шестнадцатиричное число легко «развернуть» в двоичную форму поразрядно соответствующими тетрадами двоичного представления, а по исходному написанию оно короче.



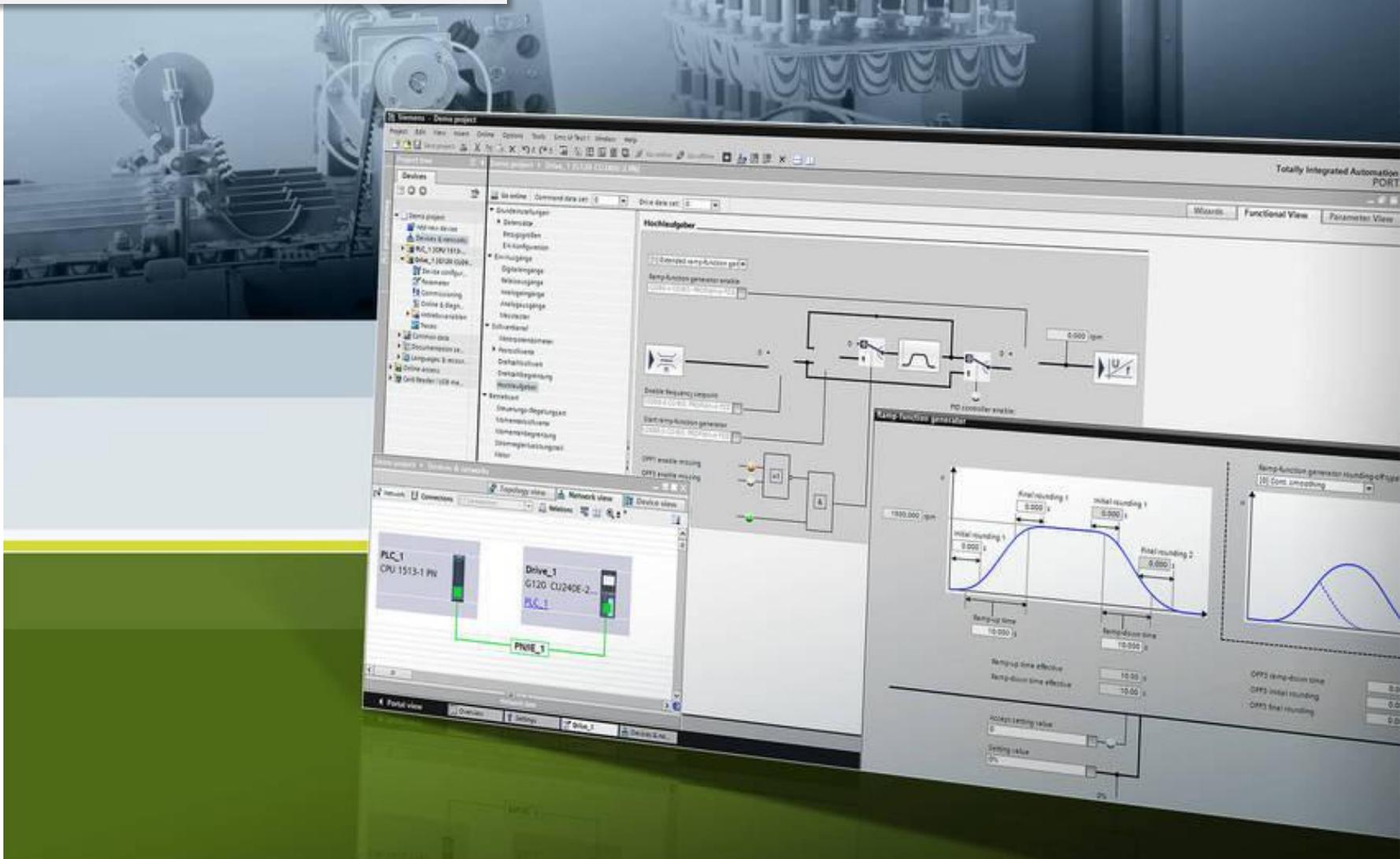
## Конец раздела 1. Окно навигации

### Основы алгебры логики

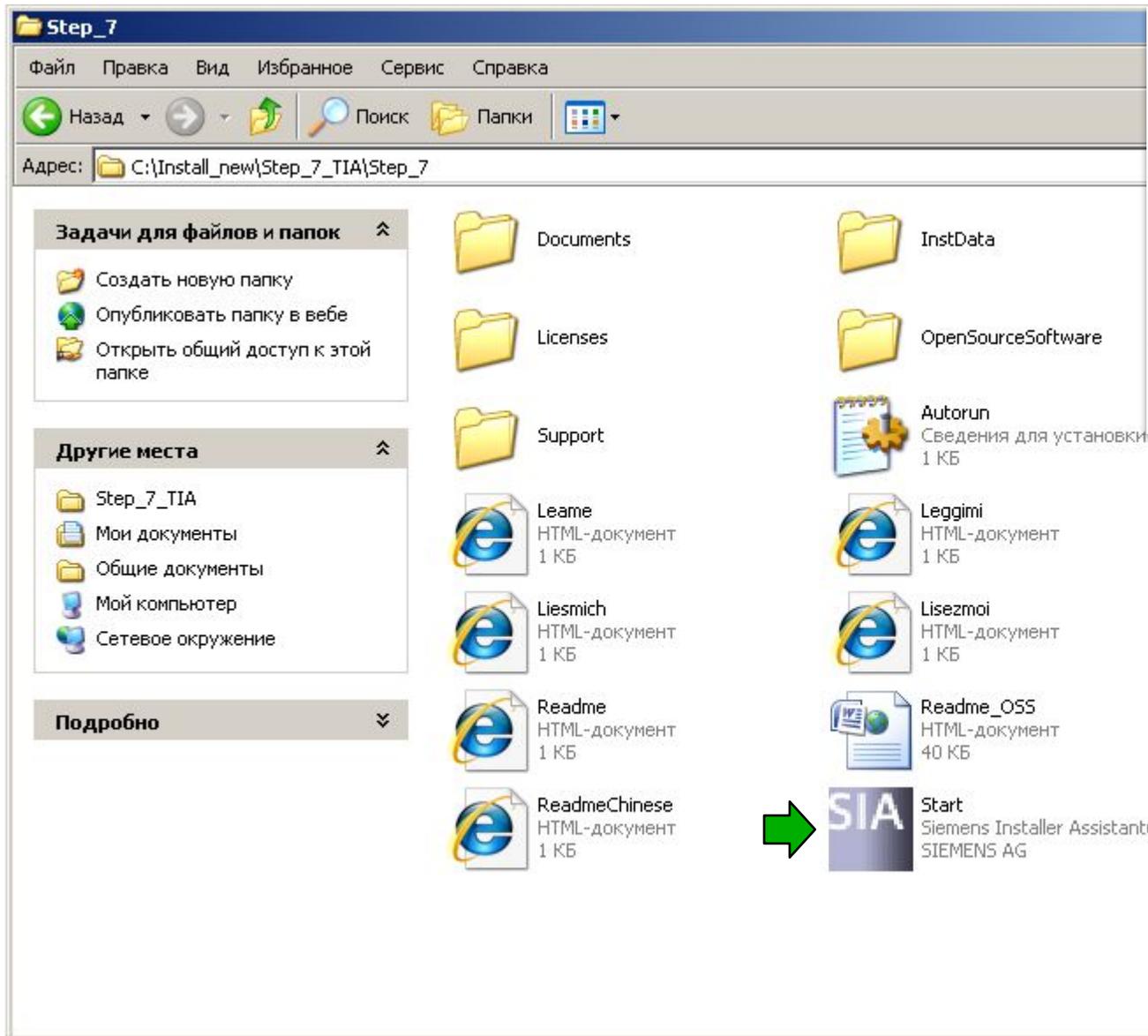
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
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## Раздел 2

Общие сведения, создание проекта,  
конфигурирование станции



## TIA-portal V12.0 SP1. Установка.



## TIA-portal V12.0 SP1. Установка.

Welcome to STEP 7 Professional  
V12.0 SP1

- General settings
- Configuration
- Install
  - Overview
  - Modify system
  - System configuration
- Summary



Please select the product features you want to install. If you deselect components which are already installed, they will be uninstalled.

Minimal Typical User-defined

- SIMATIC STEP 7 Professional V12.0 SP1
- SIMATIC WinCC Basic V12.0 SP1
- Tools
- Migration
  - Project migration for STEP 7 V5.4 SP5 or higher
  - Project migration for WinCC flexible 2008 SP2/SP3, SQL installation
- Automation License Manager
- Welcome Tour

Selection of components for the migration of project data

Create desktop icon

Hard Disk Drive space:

Drive	Size	Available	Required	Temp	Remaining
C:\	78,1GB	37,8GB	2,0GB	11,0MB	35,8GB
E:\	136,7GB	35,5GB	0,0B	0,0B	35,5GB

Target directory:

C:\Program Files\Siemens\Automation

Browse...

< Back

Next >

Cancel



## TIA-portal V12.0 SP1. Установка.

Welcome to STEP 7 Professional  
V12.0 SP1

- General settings
- Configuration
- Install
  - Overview
  - Modify system
  - System configuration
- Summary



You must accept all license terms.

License terms:

- |                                     |  |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | License agreement Siemens AG (EULA)            |
| <input checked="" type="checkbox"/> | Confirmation of the security information       |
| <input checked="" type="checkbox"/> | Open Source and Third Party Licenses           |
| <input checked="" type="checkbox"/> | Microsoft SQL-Server License Conditions        |
| <input checked="" type="checkbox"/> | Microsoft XML Core Services License Conditions |

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## TIA-portal V12.0 SP1. Установка.

Welcome to STEP 7 Professional  
V12.0 SP1

- General settings
- Configuration
- Install
  - Overview
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  - System configuration
- Summary



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Cancel



# Проверка необходимых лицензий

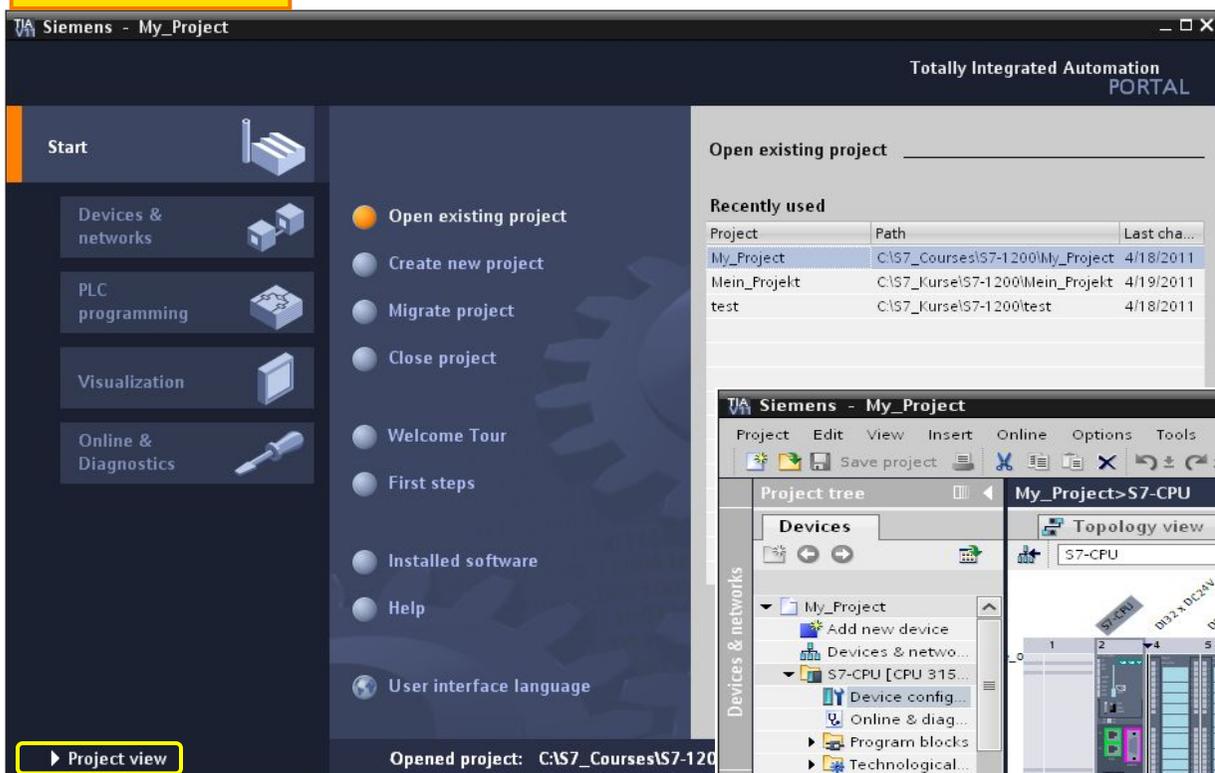
The screenshot shows the 'Automation License Manager' window. The title bar reads 'Automation License Manager'. The menu bar includes 'File', 'Edit', 'License Key', 'View', and 'Help'. The toolbar contains various icons for navigation and actions. The main area is titled 'Licensed software - My Computer' and displays a table of software licenses. The table has five columns: Status, Family, Product, Version, and Amount of software. There are three rows of data, each with a green checkmark icon in the Status column. The status bar at the bottom indicates '3 Software entries' and includes a filter icon and the text 'Unknown NUM'. A 'Press F1 for Help' message is visible in the bottom left corner.

Status	Family	Product	Version	Amount of software
	SIMATIC STEP 7	S7-PLCSIM	5.4	1
	SIMATIC STEP 7	STEP 7 Professional	12.0	1
	SIMATIC HMI	WinCC Basic	12.0	1

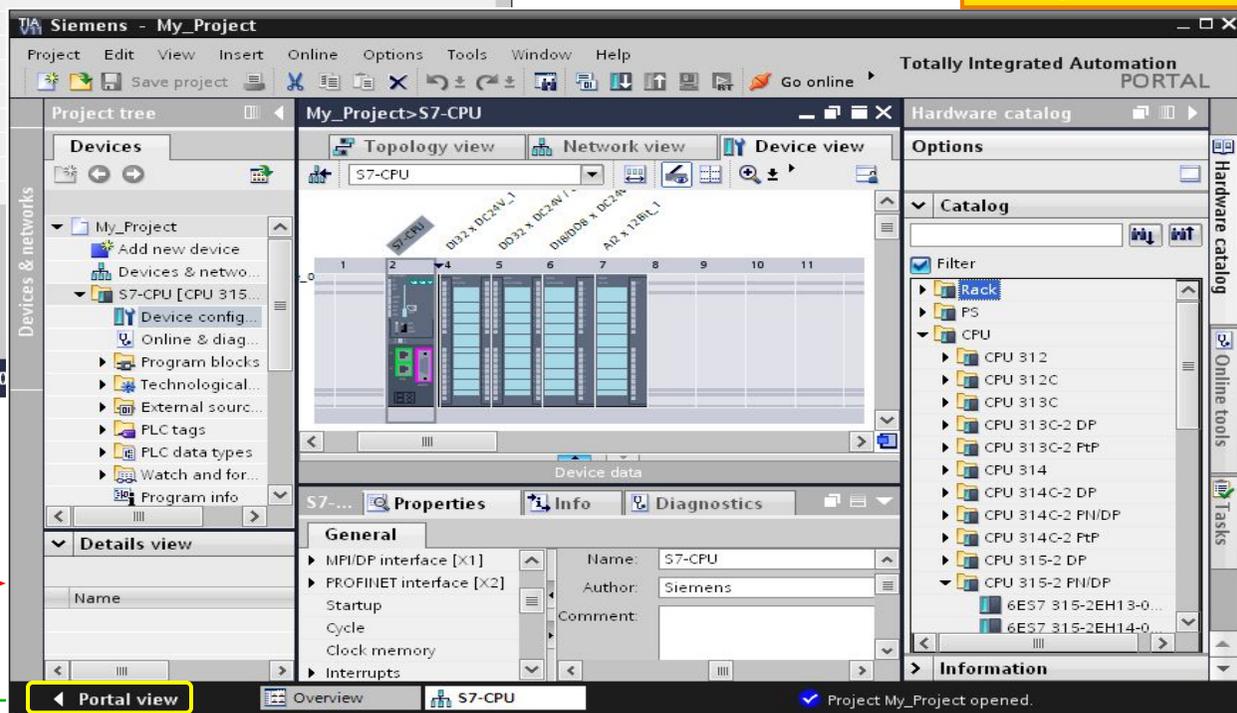


# Виды пользовательского интерфейса

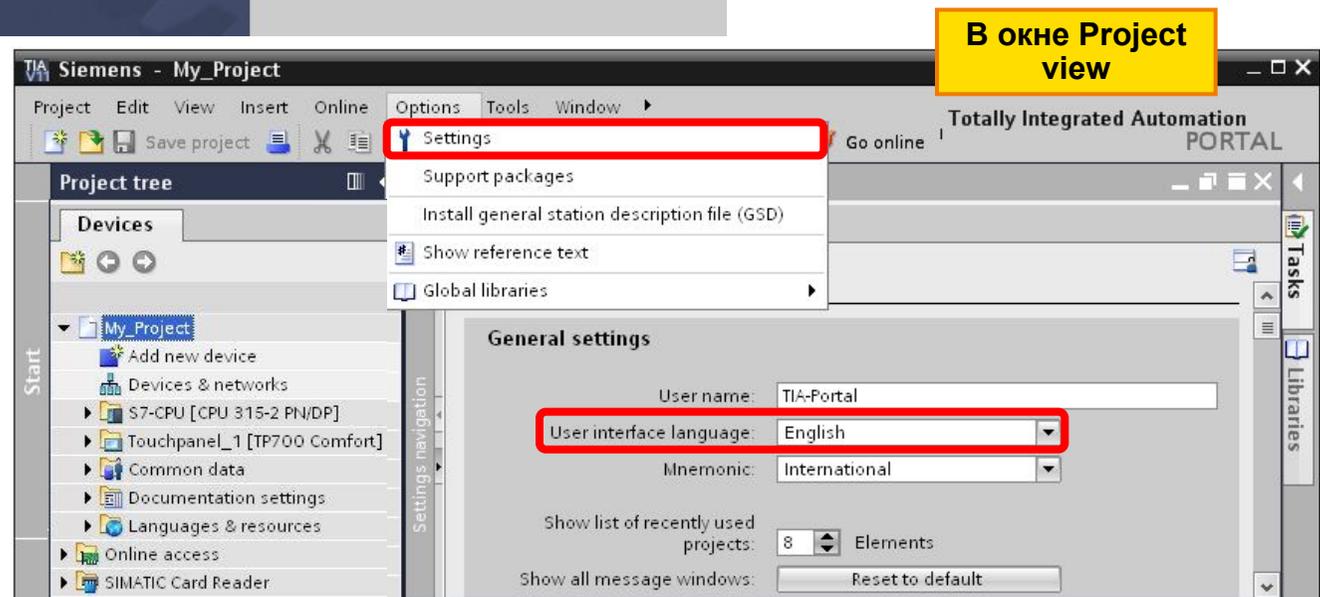
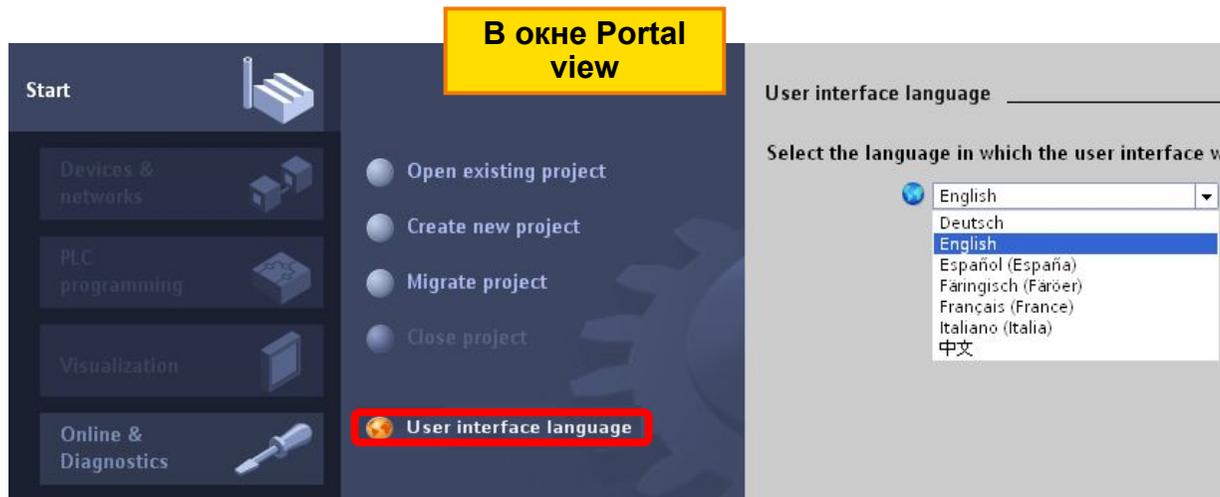
## Portal view



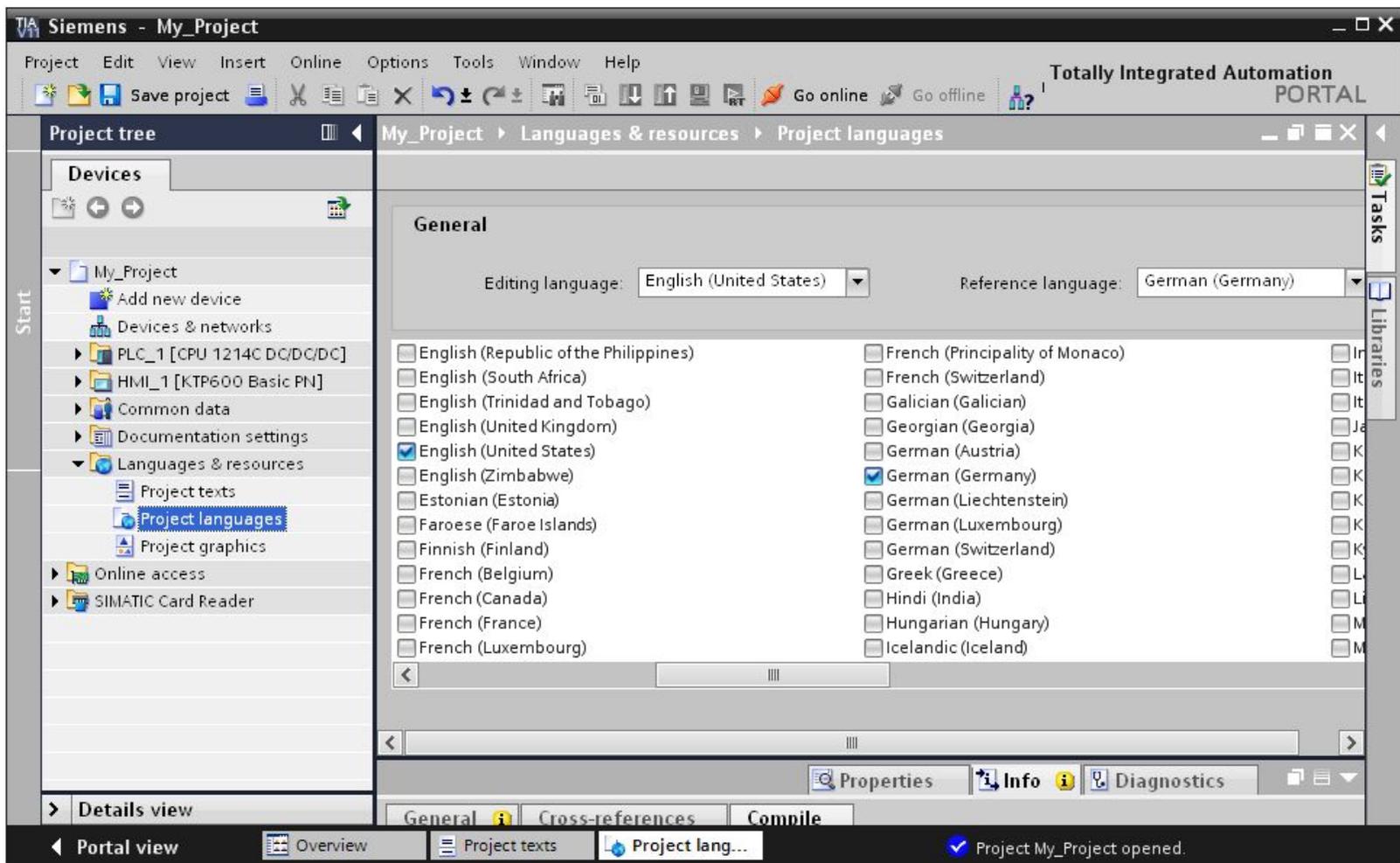
## Project view



# Языки пользовательского интерфейса



# Языки проекта



## Тексты проекта

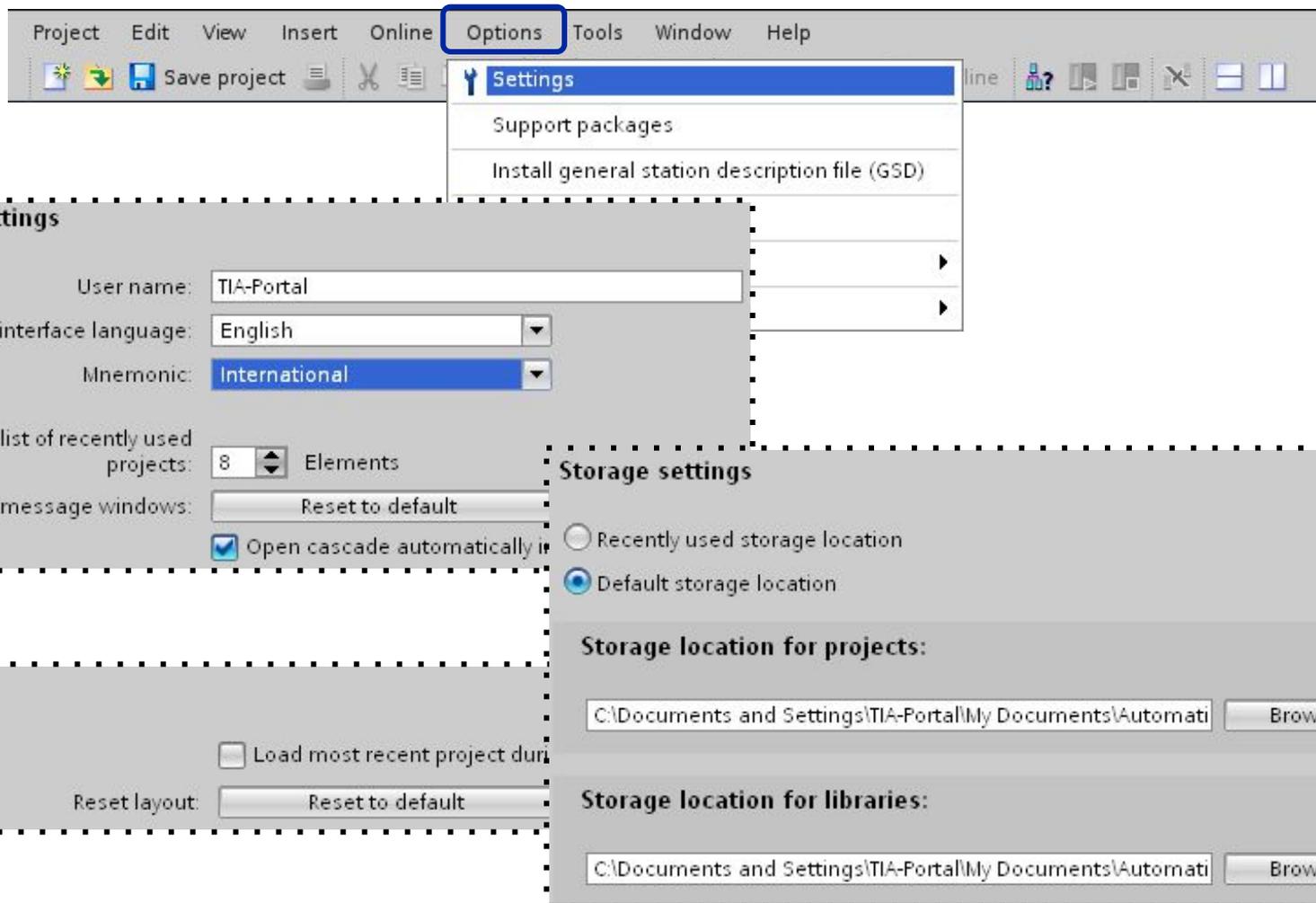
The screenshot displays the Siemens TIA Portal interface for a project named 'My\_Project'. The main workspace shows a table of project texts, categorized into 'User texts' and 'System texts'. The table lists various objects and their associated text categories.

Object	Text Category	Reference
German (Ge...)		reference
My_Project		My_Project\PLC_1 [CPU 1214C DCI...
HMI_1		My_Project\HMI_1 [KTP600 Basic PI...
PLC_1		My_Project\PLC_1 [CPU 1214C DCI...
Systemfehler m...	Alarm text	My_Project\SYSTEM_AlarmServices...
Baugruppenträ...	Rack message: @1W%t#7...	Alarm text
QGR	QGR	Alarm text
Q	Q	Alarm text
Initiator Platz 1	Proximity sensor Bay 3	Text category tag comment
Initiator Platz 2	Proximity sensor Bay 2	Text category tag comment
Initiator Ülatz 3	Proximity sensor Bay 1	Text category tag comment
Betrieb EIN	Operation ON	Hmi screen
Betrieb AUS	Operation OFF	Hmi screen
Betrieb EIN	Operation ON	Text List Text Category

The bottom status bar indicates 'Project My\_Project opened.' and shows tabs for 'General', 'Cross-references', and 'Compile'.



# Настройки: язык, место сохранения, отображение





# Перечень установленного софта.

The screenshot displays the Siemens TIA Portal interface. The top bar shows 'TIA Siemens' on the left and 'Totally Integrated Automation PORTAL' on the right. The main area is divided into a left sidebar, a central menu, and a right pane.

**Left Sidebar:** Contains navigation options: Start, Devices & networks, PLC programming, Motion & technology, Visualization, and Online & Diagnostics.

**Central Menu:** Lists project management tasks: Open existing project, Create new project, Migrate project, Close project, Welcome Tour, First steps, **Installed software** (highlighted with a yellow box), Help, and User interface language.

**Right Pane:** Titled 'Installed software', it lists the following components:

- Totally Integrated Automation Portal** (Version V12 SP1)
- STEP 7 Professional** (Version V12 SP1)
- WinCC Basic** (Version V12 SP1)

A link for [Detailed information about installed software](#) is located below the list.



## Обзор пакета ПО STEP 7 V12 в составе TIA-portal

### SIMATIC STEP 7 V12

**S7-1500**

(вкл. Failsafe)

**S7-400**

(вкл. Failsafe)

**S7-300**

ET 200 CPU, (вкл. Failsafe)

**S7-1200**

Professional

Basic

### STEP 7 Basic V12 для S7-1200

- LAD, FBD, SCL

### STEP 7 Professional V12 для S7-1200, S7-300, S7-400, S7-1500

- LAD, FBD, SCL для S7-1200
- LAD, FBD, STL, SCL, S7-GRAPH для S7-300/400, S7-1500

### Дополнительные пакеты

(STEP 7 Safety, PID controller пакет, STEP 7 Easy Motion)

### Коммуникации

- PROFIBUS, PROFINET, AS-i, IO-Link, ET 200, топология сети

### Расширенные функции

- Системная диагностика, импорт/экспорт в Excel.



# Встроенная информационная поддержка

The screenshot shows the SIMATIC TIA-portal interface. On the left, a sidebar contains various project management options. The 'Help' button is highlighted with a yellow box and a yellow arrow pointing to the 'Information System' window. The 'Information System' window displays a table of contents with the following items:

- Information system
- System overview of STEP 7 and WinCC
- Readme
- Installation
- Migrating projects and programs
- First steps
- Introduction to the TIA Portal
- Editing projects
- Editing devices and networks
- Programming a PLC
- Visualize processes
- Using technology functions
- Using online and diagnostics functions
- Support Packages
- Hardware documentation
- Glossary

The right side of the 'Information System' window shows a list of topics with corresponding icons:

- Readme
- Getting Started
- Introduction to the TIA Portal
- Editing projects
- Editing devices and networks
- Programming a PLC
- Visualizing Processes
- Using online and diagnostics functions
- Support
- Help on the Information System
- Glossary



## Миграция в проект TIA-portal программы из Step-7

Siemens Totally Integrated Automation PORTAL

Start

- Devices & networks
- PLC programming
- Motion & technology
- Visualization
- Online & Diagnostics

Open existing project

Create new project

**Migrate project**

Close project

Installed software

Help

User interface language

Project view

Migrate project

Select project to be migrated.

Project name: Profi\_Ne

Source path: E:\Step\_programm\Profi\_Net\_new\Profi\_Ne ...

Include hardware configuration

Target

Project name: Profi\_Net\_new

Target path: E:\Step\_programm\Profi\_Net\_new\_V12 ...

Author: home

Comment:

Migrate

При активизации этой опции следует учесть, что TIA-portal «примет» только то «железо», которое есть в его библиотеке



# Миграция в проект TIA-portal программы из Step-7

The screenshot shows the Siemens TIA Portal interface. A dialog box titled "(0039:000010)" displays a red 'X' icon and the text "Error during migration." with a yellow arrow pointing to "Migration log" and the Russian text "Процесс прерван" (Process interrupted). Below this, a message log window is open, showing the following entries:

Type	Message
	Migration log
	Station: SIMATIC 300(1) <b>«Железа» в библиотеке не оказалось</b>
	Hardware configuration
	Central
✗	Module CPU 315-2 DP (6ES7 315-2AF03-0AB0 V1.2) in rack 0, slot 2 cannot be migrated.
✗	Module DI16xDC24V (6ES7 321-1BH00-0AA0) in rack 0, slot 4 cannot be migrated.
	Slave: IM 153-1 (Device number 3, PROFIBUS(1): DP master system (1))
✗	Module DO16xDC24V/0.5A (6ES7 322-1BH00-0AA0) in slot 4 cannot be migrated.
✗	Error during migration.

The interface also shows a "Find and replace" panel on the right and a "Cancel" button in the background.



## TIA-portal V12.0 SP1. Создание нового проекта

TIA Siemens

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Project view

Create new project

Open existing project

Create new project

Created project...

Installed software

Help

User interface language

Project name:

Path:

Author: home

Comment:

Create

Creating project...

Creating project...

The project E:\TIA\_programm\Project\_1\Project\_1.ap12 is being created.  
Please wait.

Cancel

Дадим проекту имя

Определим путь



## TIA-portal V12.0 SP1. Создание нового проекта

Siemens - Project\_1

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Open existing project

Create new project

Migrate project

Close project

Welcome Tour

**First steps**

Installed software

Help

User interface language

First steps

Project: "Project\_1" was opened successfully. Please select the ...

Start

Devices & networks

Configure a device

PLC programming

Write PLC program

Motion & technology

Configure technology objects

Visualization

Configure an HMI s...

Project view

Opened project: E:\TIA\_programm\Project\_1\Project\_1



## Конфигурация оборудования и установка параметров

Назначение конфигурации

С помощью опции **Configure a device** производится общая компоновка проекта на основе выбора компонентов из встроенного каталога оборудования. При необходимости использования стоек расширения или многопроцессорной конфигурации производится создание и конфигурирование подсетей.

Назначение параметров

Производится установка необходимых параметров ЦПУ, функциональных сопроцессоров и интерфейсных модулей. Производится адресация, выбор характеристик и диапазонов измерения аналоговых модулей, выбор и адресация модулей обработки дискретных сигналов

Проектная конфигурация

Итогом является проектная конфигурация, строго соответствующая техническому заданию на проектируемую систему управления с оптимальным уровнем затрат на оборудование.



## TIA-portal V12.0 SP1. Общий каталог устройств

Siemens - Project\_1

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure networks

Help

Add new device

Device name:

Controllers

HMI

PC systems

Controllers

- SIMATIC 7-1200
- SIMATIC 7-1500
- SIMATIC 7-300
- SIMATIC 7-400
- SIMATIC ET 200 CPU

Project view

Opened project: E:\TIA\_programm\Project\_1\Project\_1



## TIA-portal V12.0 SP1. Общий каталог устройств

Siemens - Project\_3

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure networks

Help

Add new device

Device name:

Controllers

HMI

PC systems

- ▶ HMI
- ▶ SIMATIC Basic Panel
  - ▶ 3" Display
  - ▶ 4" Display
  - ▶ 6" Display
  - ▶ 10" Display
  - ▶ 15" Display
- ▶ SIMATIC WinAC for Multi Panel
  - ▶ WinAC MP 177
  - ▶ WinAC MP 277
  - ▶ WinAC MP 377

Project view

Opened project: E:\TIA\_programm\Project\_3\Project\_3



## TIA-portal V12.0 SP1. Общий каталог устройств

Siemens - Project\_3

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure networks

Help

Add new device

Device name:

Controllers

HMI

PC systems

PC systems

- PC general
  - PC station
    - SIMATIC Box PC
    - SIMATIC Panel PC
    - SIMATIC Rack PC
    - SIMATIC S7 Embedded Controller
    - SINUMERIK Operator Components
    - SIMATIC Controller Application
    - SIMATIC HMI Application
    - User applications

Project view

Opened project: E:\TIA\_programm\Project\_3\Project\_3



## TIA-portal V12.0 SP1. Каталог устройств CPU SIMATIC S-7xx

Siemens - Project\_2

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Project view

Opened project: E:\Programm\_V12\Programm\_V12\_1\Project\_2

Add new device

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300
- SIMATIC S7-400
- SIMATIC ET 200 CPU

PC systems



## TIA-portal V12.0 SP1. Каталог устройств CPU SIMATIC S-7xx

Siemens - Project\_2

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Help

Project view

Opened project: E:\Programm\_V12\Programm\_V12\_1\Project\_2

Add new device

HMI

PC systems

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500**
- SIMATIC S7-300
- SIMATIC S7-400
- SIMATIC ET 200 CPU



## TIA-portal V12.0 SP1. Каталог устройств CPU SIMATIC S-7xx

The screenshot displays the Siemens TIA-portal V12.0 SP1 interface. The main window is titled "Siemens - Project\_2" and "Totally Integrated Automation PORTAL". The left sidebar contains navigation options: Start, Devices & networks (selected), PLC programming, Motion & technology, Visualization, and Online & Diagnostics. The central area shows a list of devices with options: Show all devices, Add new device, Configure network, and Help. A large image of a SIMATIC S7-300 CPU is displayed in the center. The right sidebar shows a tree view of controllers, with "SIMATIC S7-300" highlighted in red. The bottom status bar indicates the opened project: "E:\Programm\_V12\Programm\_V12\_1\Project\_2".

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure network

Help

PC systems

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300**
- SIMATIC S7-400
- SIMATIC ET 200 CPU

Opened project: E:\Programm\_V12\Programm\_V12\_1\Project\_2



## TIA-portal V12.0 SP1. Каталог устройств CPU SIMATIC S-7xx

Siemens - Project\_2

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure network

Help

PC systems

Opened project: E:\Programm\_V12\Programm\_V12\_1\Project\_2

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300
- SIMATIC S7-400**
- SIMATIC ET 200 CPU



## TIA-portal V12.0 SP1. Каталог устройств CPU SIMATIC S-7xx

Siemens - Project\_2

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Project view

Opened project: E:\Programm\_V12\Programm\_V12\_1\Project\_2

Add new device

Show all devices

Add new device

Configure

Help

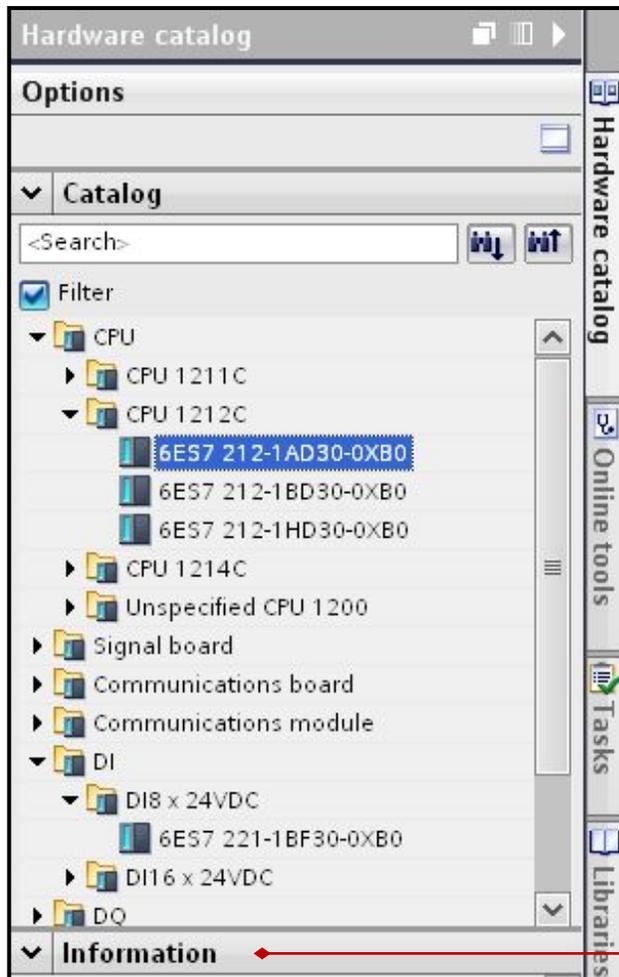
Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300
- SIMATIC S7-400
- SIMATIC ET 200 CPU**

PC systems



## Информация о выбранном устройстве



# Компоненты отображения в Project view

**Окно проекта**

**Рабочая область**

**Карты задач**

**Элементы структуры окна**

**Окно Inspector window**

**Детальный вид**

Project tree: ...S7\_ALL\_CPU > Group\_PLC > PLC\_2 [CPU 1516-3 PN/DP]

Hardware catalog: Options, Catalog, Filter, PM, PS, CPU, DI, DQ, AI, AO, Communication modules, Technology modules

Reference projects

Name	Details
Automatic update	0
Const_0	%M20.0
DI_16x24VDC_HF_1[DI]	259
DI_16x24VDC_HF_2[DI]	260
DI_32x24VDC_HF_1[DI]	258

PLC\_2 [CPU...] Properties

General IO tags Texts

PROFINET i...

General Ethernet Time sy...

Set IP address in the project

IP address: 192 . 168 . 0 . 2

Subnet mask: 255 . 255 . 255 . 0

Плавающее окно

Увеличенное окно

Внедренное окно

Горизонтальные окна

Вертикальные окна

Information

Portal view Overview PLC\_2

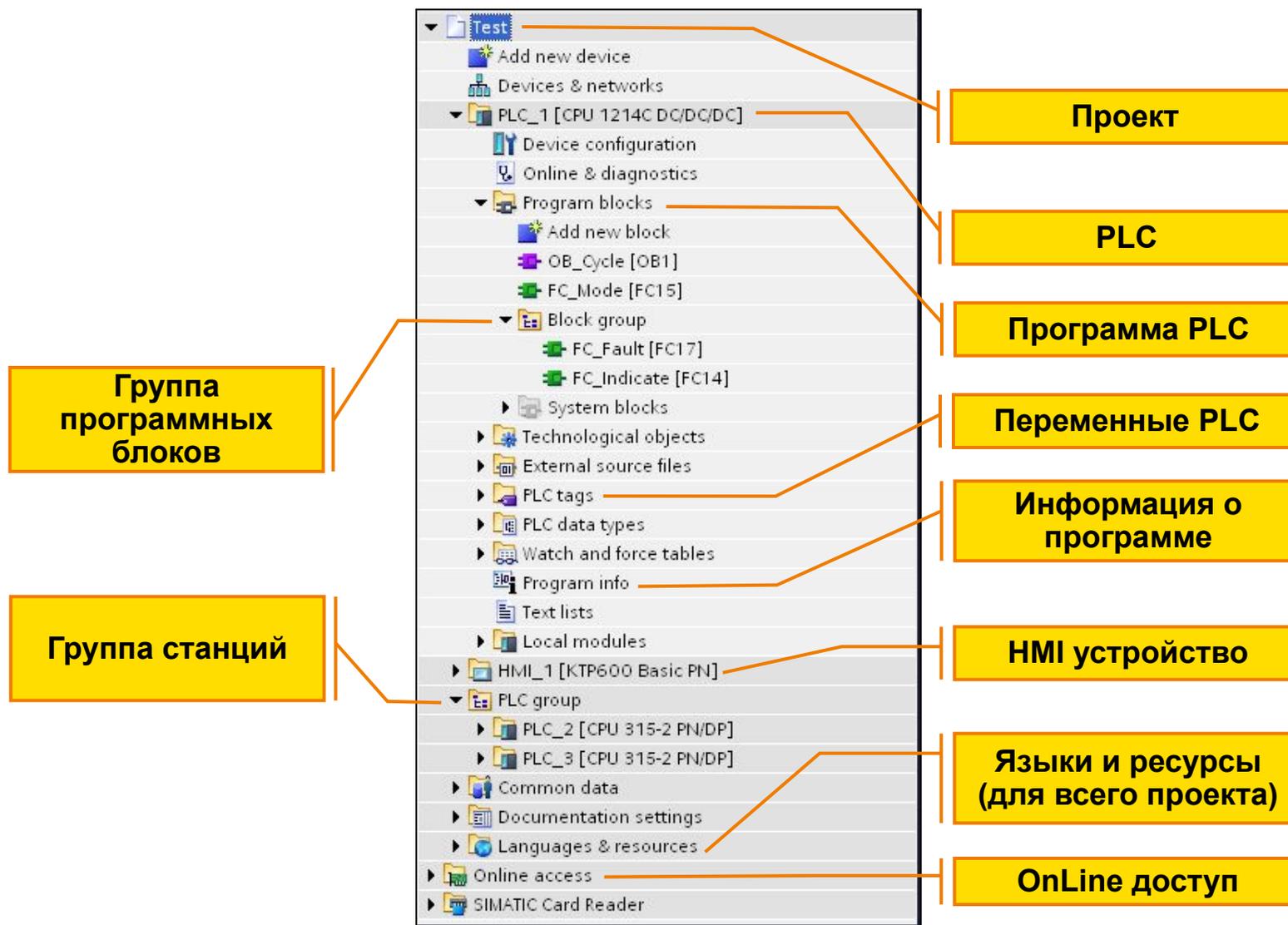
Project Project\_S7\_ALL\_CPU opened.

## Просмотр двух проектов в разделенных окнах

The screenshot displays the SIMATIC TIA-portal interface with two project windows open side-by-side. The left window shows the 'Project tree' for 'Project\_1200\_1500', with 'PLC\_2 [CPU 1516-3 PN/DP]' selected. The right window shows the 'Details' view for the selected project, displaying a list of project components. A red arrow points from the 'Start' button in the left window to the 'Program info' entry in the right window's details view. A blue arrow points from the 'Start' button to the 'PLC\_2' project in the tree. A blue box highlights the window management icons at the top of the right window.

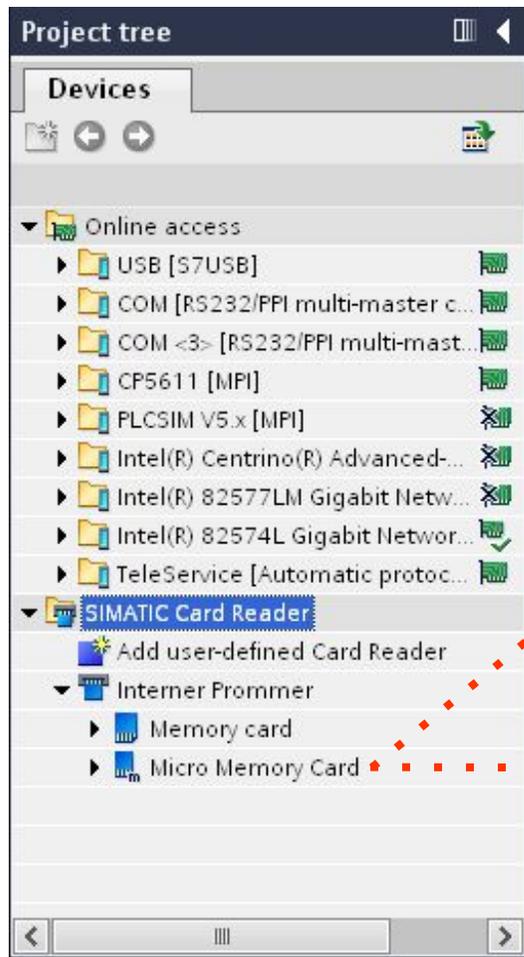
Name	Modified	Remark
Device configuration		
Online & diagnostics		
Program blocks	8/24/2014 5:05 PM	(none)
Technology objects	8/23/2014 12:59 PM	(none)
External source files	8/23/2014 12:59 PM	(none)
PLC tags	8/23/2014 12:59 PM	(none)
PLC data types	8/23/2014 3:16 PM	(none)
Watch and force tables	8/23/2014 12:59 PM	(none)
Traces		
Program info		
PLC alarms		
Text lists		
Local modules		

## Навигация в окне проекта



# Выбор режима использования программной карты

S7-120  
0



Storage medium

Memory space

Free space: 7826424 Bytes

Used space: Bytes

Write-protected

Card characteristics

Name: SD card (I:)

Card type: Program

File system: Please select...

Capacity: Transfer

Serial number: SMC\_08ee13cd00

Для обновления версии ОС необходимо иметь MMC емкостью от 2 до 8 мБ

S7-30  
0

Card characteristics

Name: SD card (E:)

File system:

Capacity: 7826424 Bytes

Serial number:

Usable for: Unknown

PLC card mode

Card type: Program

Please select...

Program

Transfer

Update firmware



## Разделы инспекционного окна (Inspector window)

The screenshot displays the SIMATIC TIA-portal Inspector window, which is divided into three main sections. Each section has a red box highlighting its respective tab in the top toolbar.

**General Panel:** Shows the 'General' tab selected. The 'Properties' tab is highlighted in the toolbar. The main area displays the following details for the selected object:

- Name: Main
- Type: OB
- Number: 1
- Language: LAD

**Info Panel:** Shows the 'Info' tab selected. The 'Info' tab is highlighted in the toolbar. The main area displays the following information:

- General ⓘ
- Cross-references
- Compile
- Syntax
- Compiling completed (errors: 0; warnings: 0)

!	Path	Description	Go to	?	Errors	Warnings	Time
✓	Group_PLC		↗		0	0	12:24:27 PM
✓	PLC_3		↗		0	0	12:24:27 PM
✓	Program blocks		↗		0	0	12:24:27 PM
✓	Main (OB1)	Block was successfully compiled.	↗		0	0	12:24:27 PM
✓		Compiling completed (errors: 0; warnings: 0)			0	0	12:24:34 PM

**Diagnostics Panel:** Shows the 'Diagnostics' tab selected. The 'Diagnostics' tab is highlighted in the toolbar. The main area displays the following information:

- Device information
- Connection information
- Alarm display
- 1 Devices with problems

Onlin...	Oper...	Device/module	Message	Details	Help
✓ OK	STOP	PLC_3	STOP	For more detailed information, refer to mo...	?



## Пример выбора процессора в окне Portal view

TIA Siemens - Project\_1

Totally Integrated Automation  
PORTAL

Start

Devices & networks

PLC programming

Motion & technology

Visualization

Online & Diagnostics

Show all devices

Add new device

Configure networks

Help

Add new device

Controllers

HMI

PC systems

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300
  - CPU
    - CPU 312
    - CPU 312C
    - CPU 313C
    - CPU 313C-2 DP
    - CPU 313C-2 PtP
    - CPU 314
    - CPU 314C-2
    - CPU 314C-2 PN/DP
    - 6ES7 314-6EH04-0AB0**
    - CPU 314C-2 PtP
    - CPU 315-2 DP
    - CPU 315-2 PN/DP
    - CPU 317-2 DP
    - CPU 317-2 PN/DP
    - CPU 319-3 PN/DP
    - CPU 315E-2 DP

Двойной щелчок

Project view

Opened project: E:\TIA\_programm\Project\_1\Project\_1



# Активизация окна свойств выбранного процессора

The screenshot displays the Siemens TIA Portal interface for configuring a PLC1 [CPU 314C-2 PN/DP]. The main workspace shows a rack of modules with slots 1 through 11. Slot 2 contains the PLC CPU. A yellow callout bubble with the text "Двойной щелчок" (Double click) points to a blue double-click icon on the PLC rack. The right-hand side features a "Hardware catalog" pane with a search bar and a list of components including Rack, PS, CPU, IM, DI, DO, DI/DO, AI, AO, AI/AO, Communications modules, FM, IQ-SENSE, Special, and Interface modules. The bottom status bar includes navigation buttons: "Portal view", "Overview", and "PLC1". A notification at the bottom right states "Project Project\_1 created."

## Свойства ЦПУ. MPI-адрес

The screenshot displays the SIMATIC TIA-portal interface for configuring the MPI address of a CPU 314C-2 PN/DP. The main window is titled 'Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]'. The 'Device data' section is active, showing the 'Properties' tab for the selected device. The left sidebar, 'Devices & networks', lists various configuration options, with 'MPI address' selected under the 'MPI/DP interface [X1]' category. The main configuration area is divided into two sections: 'Interface networked with' and 'Parameters'. In the 'Parameters' section, the 'Address' field is set to '2' and is highlighted with a blue box. Other parameters include 'Interface type' set to 'MPI', 'Highest address' set to '31', and 'Transmission speed' set to an empty dropdown. The 'Subnet' dropdown in the 'Interface networked with' section is set to 'Not networked'.



# Свойства ЦПУ. Ethernet-адрес

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] | Properties | Info | Diagnostics

General | IO tags | Texts

Subnet: Not networked

Если подсети нет, ее можно задать → Add new subnet

**IP protocol**

Set IP address in the project

IP address: 192 . 168 . 0 . 1

Subnet mask: 255 . 255 . 255 . 0

Use router

Router address: 0 . 0 . 0 . 0

Set IP address using a different method

**PROFINET**

Set PROFINET device name using a different method.

Generate PROFINET device name automatically

PROFINET device name: plc\_1

Converted name: plcx1d0ed

Device number: 0

- IP-адрес **192.168.x.y** является стандартным идентификатором частной сети, которая не находится в Интернете.
- Маска подсети **255.255.255.0** означает, что все IP-адреса локальной сети должны иметь одинаковые первые 3 байта, различные устройства в этой сети идентифицируются последним байтом.
- Соединение между различными подсетями осуществляется через маршрутизатор, который должен иметь свой IP адрес для каждого соединения.
- Каждое устройство в подсети PROFINET должно иметь уникальное имя.

# Свойства ЦПУ. Адресация встроенных дискретных вх/вых.

Project\_2 ▸ PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] Properties Info Diagnostics

General IO tags Texts

General

MPI/DP interface [X1]

PROFINET interface [X2]

DI24/DO16

General

Catalog information

Inputs

**I/O addresses**

AI5/AO2

Count

Positioning

Startup

Cycle

Clock memory

Interrupts

Diagnostics system

System diagnostics

Time of day

Web server

Retentive memory

Protection

Connection resources

Overview of addresses

I/O addresses

**Input addresses**

Start address: 136

End address: 138

Process image: OB1-PI

Interrupt OB number: OB1-PI

PIP 1

**Output addresses**

Start address: 136

End address: 137

Process image: OB1-PI

OB1-PI

PIP 1

Если модуль сконфигурирован для работы с частью образа процесса PIP (Process image partition), то CPU работает с этим модулем по запросу аппаратного прерывания. Перед вызовом соответствующего OB (OB40) и после его завершения CPU актуализирует ту часть образа процесса, которая относится к адресному пространству этого модуля. В данном случае это область адресов i136.0 – i138.7



# Свойства ЦПУ. Параметры встроенных аналоговых входов.

Project\_2 ▸ PLC\_1 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] | Properties | Info | Diagnostics

General | IO tags | Texts

General

MPI/DP interface [X1]

PROFINET interface [X2]

DI24/DO16

AI5/AO2

General

**Inputs**

Channel 0

Channel 1

Channel 2

Channel 3

Channel 4

Outputs

I/O addresses

Count

Positioning

Startup

Cycle

Clock memory

Interrupts

Diagnostics system

System diagnostics

Time of day

Web server

Inputs

Temperature unit: Degrees Celsius

Channel 0

Measuring type: Voltage

Measuring range: +/- 10 V

Interference frequency suppression: 50 Hz

Integration time: 20 ms

Channel 1

Measuring type: Voltage

Measuring range: +/- 10 V

Interference frequency suppression: 50 Hz

Integration time: 20 ms

Deactivated

Voltage

Current

0..10

+/- 10

0..20

4..20

+/- 20

Hardware catalog

Online tools

Tasks

Libraries



# Свойства ЦПУ. Параметры встроенных аналоговых выходов.

The screenshot displays the configuration interface for the CPU 314C-2 PN/DP. The left sidebar shows the 'Outputs' section expanded. The main area shows the configuration for 'Output 0' and 'Output 1'. Both are set to 'Voltage' output type and '+/- 10' output range. A dropdown menu is open, showing options: 'Deactivated', 'Voltage', 'Current', '0..10', and '+/- 10'. The 'Voltage' and '+/- 10' options are selected. Another dropdown menu is open, showing options: '0..20', '4..20', and '+/- 20'.



# Свойства ЦПУ. Параметры старта.

Project\_2 ▸ PLC\_1 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] | Properties | Info | Diagnostics

General | IO tags | Texts

Devices & networks

- General
- MPI/DP interface [X1]
- PROFINET interface [X2]
- DI24/DO16
- AI5/AO2
- Count
- Positioning
- Startup**
- Cycle
- Clock memory
- Interrupts
- Diagnostics system
- System diagnostics
- Time of day
- Web server
- Retentive memory
- Protection
- Connection resources
- Overview of addresses

Hardware catalog

Online tools

Tasks

Libraries

**Startup**

Startup if preset configuration does not match actual configuration

Startup after POWER ON: Warm restart

**Monitoring time for**

Ready message from modules: 650 x 100 ms

Parameter transfer to modules: 100

▼ Ready message from modules

Maximum duration for the completion report from all configured modules after POWER ON.

S7-300, S7-400

▶ [Startup parameters](#)

▼ Parameter transfer to modules

The maximum time for distributing the parameters to the programmable modules. The time starts after the "Completion report from modules [ms]".

S7-300, S7-400

▶ [Startup parameters](#)

С описанием параметров можно подробно ознакомиться в окне информационной поддержки



# Свойства ЦПУ. Время цикла.

Project\_2 ▸ PLC\_1 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] | Properties | Info | Diagnostics

General | IO tags | Texts

Devices & networks

- General
- MPI/DP interface [X1]
- PROFINET interface [X2]
- DI24/DO16
- AIS/AO2
- Count
- Positioning
- Startup
- Cycle**
- Clock memory
- Interrupts
- Diagnostics system
- System diagnostics
- Time of day
- Web server
- Retentive memory
- Protection
- Connection resources
- Overview of addresses

**Cycle**

Cycle monitoring time: 150 ms

Cycle load due to communication: 20 %

Size of the process image input: 256

Size of the process image output: Value range: [0..2048]

OB85 call if I/O access error occurs: No OB85 call

▼ Cycle monitoring time

If the cycle time exceeds the scan cycle monitoring time, the CPU status changes to STOP.

S7-300, S7-400

▸ [Settings for the cycle behavior](#)

▼ Cycle load due to communication

Limits the time allotted for communication processes in the cycle.

S7-1200

▸ [Cycle loading by communications](#)

S7-300, S7-400

▸ [Settings for the cycle behavior](#)

▼ Size of the process image input:

Only relates to special CPUs.

The range of the process image always starts at input or output byte 0.

S7-300, S7-400

▸ [Settings for the cycle behavior](#)

▸ [Memory areas of the S7-400-CPU](#)



## Свойства ЦПУ. Байт в качестве побитных генераторов импульсов.

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] | Properties | Info | Diagnostics

General | IO tags | Texts

Clock memory  
 Memory byte: 0  
 Value range: [0..255].

**Available frequencies**  
 Each bit of the clock bit memory byte is assigned a frequency. The following table shows the assignment:

Bit of the clock memory byte	7	6	5	4	3	2	1	0
Period (s)	2.0	1.6	1.0	0,8	0.5	0,4	0.2	0.1
Frequency (Hz)	0.5	0.625	1	1.25	2	2.5	5	10

**Каждый бит представляет собой генератор импульсов заданной частоты. Использовать эти биты в программе можно только в этом качестве.**



# Свойства ЦПУ. Сохраняемые области при рестарте.

Project\_2 ▸ PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP] Properties Info Diagnostics

General IO tags Texts

Retentive memory

Number of memory bytes starting at MB 0:

Number of S7 timers starting at T 0:

Number of S7 counters starting at C 0:

Value range: [0..256].

**Заданные области памяти сохраняют свои значения при рестарте.**



## Свойства ЦПУ. Защита паролем.

The screenshot displays the SIMATIC TIA-portal interface for configuring a CPU 314C-2 PN/DP. The main window shows the 'Properties' tab for the device, with the 'Protection' section expanded. The 'Write protection' radio button is selected, and the 'Can be canceled with password' checkbox is also checked. Below these options, there are two password input fields labeled 'Password:' and 'Confirm password:'. The left sidebar shows a tree view of device properties, with 'Protection' highlighted. The top of the window shows the project path 'Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]' and various view options like 'Topology view', 'Network view', and 'Device view'.

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

Device data

PLC\_1 [CPU 314C-2 PN/DP]

Properties Info Diagnostics

General IO tags Texts

Protection

No protection

Write protection

Write/Read protection

Can be canceled with password

Password for read/write access

Password: [password field]

Confirm password: [password field]

Devices & networks

- General
- MPI/DP interface [X1]
- PROFINET interface [X2]
- DI24/DO16
- AI5/AO2
- Count
- Positioning
- Startup
- Cycle
- Clock memory
- Interrupts
- Diagnostics system
- System diagnostics
- Time of day
- Web server
- Retentive memory
- Protection**
- Connection resources
- Overview of addresses

Hardware catalog

Online tools

Tasks

Libraries



# Выбор модулей центральной стойки

Siemens - Project\_1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_1 > PLC1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC1 100%

Devices & networks

Rail\_0 1 2 4 5 6 7 8 9 10 11

PLC1

Выберем необходимые модули, которые будут работать в центральной стойке

Перетащим

Добавим остальные модули

Окно данных об устройстве.

Hardware catalog

Options

Catalog

<Search>

Filter

- IM
- DI
  - DI16 x 24VDC
  - DI16 x 24VDC, interrupt
  - DI16 x 24/125VDC, int...
  - DI32 x 24VDC
  - 6ES7 321-1BL00-
  - DI64 x 24VDC
  - DI16 x 48/125VDC
  - DI16 x 24/48VUC
  - DI32 x 120VAC
  - DI8 x 230VAC
  - DI8 x 120/230VAC
  - DI16 x 120/230VAC
  - DI4 x NAMUR, Ex
  - DI16 x NAMUR

Information

Properties Info Diagnostics

General

Portal view Overview PLC1

Project Project\_1 created.



# Окно просмотра данных об устройстве

Project\_1 > PLC\_2 [CPU 314C-2 PN/DP]

Topology view | Network view | Device view

PLC\_2 100%

Device overview

Module	Rack	Slot	I address	Q addr...	Type	Order no.	Firmware	Comment
	0	1						
▼ PLC_2	0	2			CPU 314C-2 PN/DP	6ES7 314-6EH04-0AB0	V3.3	
MPI/DP interface_1	0	2 X1	2047*		MPI/DP interface			
▶ PROFINET interface_1	0	2 X2	2046*		PROFINET interface			
DI24/DO16_1	0	2 5	136...138	136...137	DI24/DO16			
AI5/AO2_1	0	2 6	800...809	800...803	AI5/AO2			
Count_1	0	2 7	816...831	816...831	Count			
Positioning_1	0	2 8	832...847	832...847	Positioning			
	0	3						
DI32 x 24VDC_1	0	4	0...3		DI32 x 24VDC	6ES7 321-1BL00-0AA0		
DI16 x 24VDC_1	0	5	4...5		DI16 x 24VDC	6ES7 321-1BH02-0AA0		
DI16 x 24VDC_2	0	6	8...9		DI16 x 24VDC	6ES7 321-1BH02-0AA0		
DI16 x 24VDC_3	0	7	12...13		DI16 x 24VDC	6ES7 321-1BH02-0AA0		
DI16 x 24VDC_4	0	8	16...17		DI16 x 24VDC	6ES7 321-1BH02-0AA0		
DO32 x 24VDC / 0.5A_1	0	9		20...23	DO32 x 24VDC / 0.5A	6ES7 322-1BL00-0AA0		
DO32 x 24VDC / 0.5A_2	0	10		24...27	DO32 x 24VDC / 0.5A	6ES7 322-1BL00-0AA0		
DO32 x 24VDC / 0.5A_3	0	11		28...31	DO32 x 24VDC / 0.5A	6ES7 322-1BL00-0AA0		

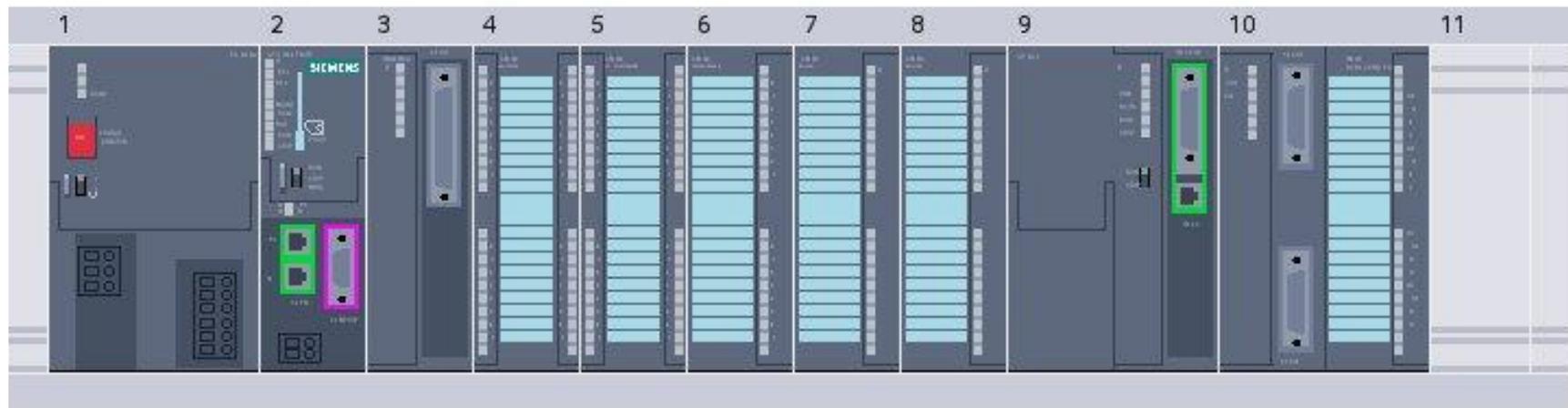
Properties | Info | Diagnostics

Portal view | Overview | PLC\_2

The project Project\_1 was saved succes...



## Пример ряда модулей центральной стойки S7-300



↓  
**PS**  
(опция)

↓  
**CPU**

↓  
**IM**  
(опция)

↓  
**SM:  
DI**

↓  
**SM:  
DO**

↓  
**SM:  
AI**

↓  
**SM:  
AO**

↓  
**CP:**

- Point-to Point
- PROFIBUS
- PROFINET
- Industrial Ethernet

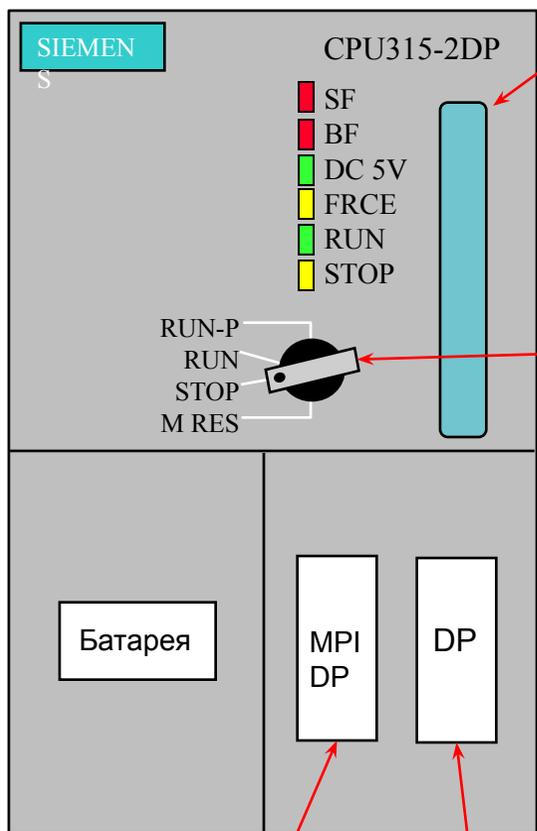
↓  
**FM:**

- счётчики
- позиционеры
- PID-регуляторы



# Передняя панель CPU 315-2DP

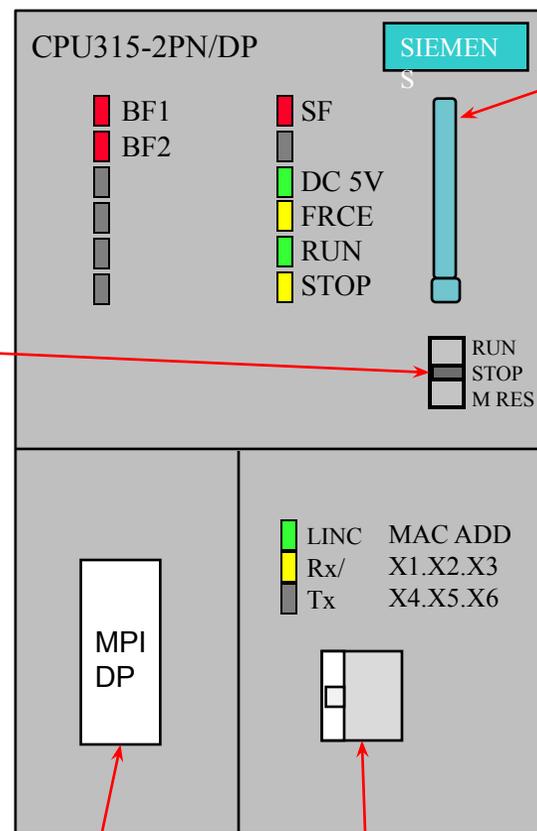
**CPU 315-2DP до октября 2002**  
**(не поддерживается в TIA Portal)**



Разъем  
Порта MPI/DP

Разъем  
Порта DP

**CPU 315-2PN/DP после октября 2002**  
**(с V2.6 поддерживается в TIA Portal)**



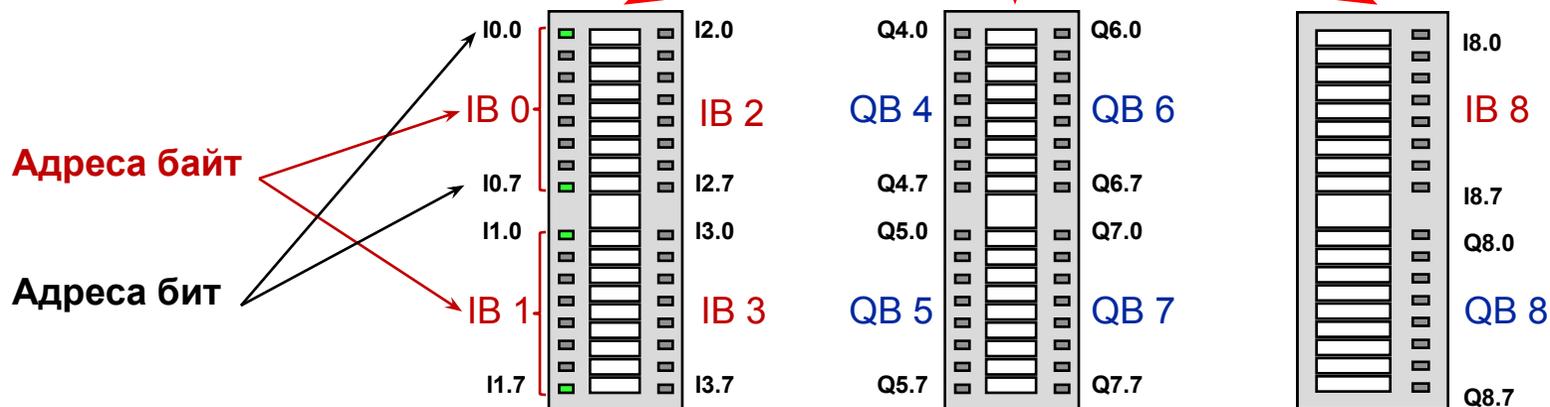
Разъем  
Порта MPI/DP

Разъем  
Порта ETHERNET

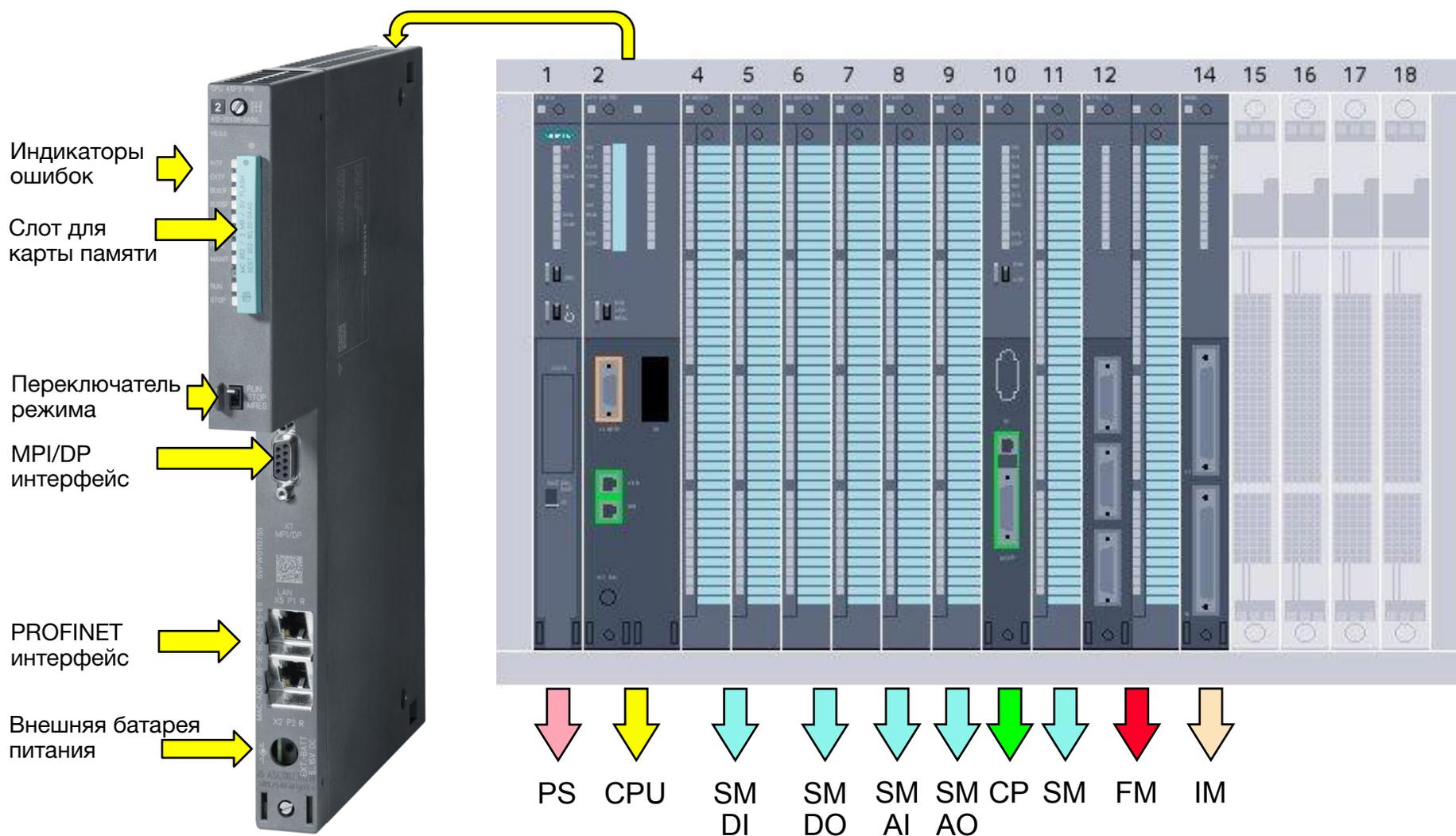


## Пример адресации модулей центральной стойки S7-300

Слот №:	1	2	4	5	6	7
Модуль:	PS	CPU	DI 32	DO 32	DI8/DO8	AI 2



## Пример ряда модулей центральной стойки S7-400



# Пример многорядной конфигурации ПЛК с модулями IM360

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Центральная стойка

PLC\_1 IM 360\_1

Rail\_0 1 2 3 4 5 6 7 8 9 10 11

Перетащим в слот интерфейсный модуль

Hardware catalog

Options

Catalog

<Search>

Filter

- Rack
- PS
- CPU
- IM**
  - IM 360 IM S
    - 6ES7 360-3AA01-0AA0
  - IM 361 IM R
  - IM 365 IM S-R
- DI
- DO
- DI/DO
- AI
- AO
- AI/AO
- Communications modules
- FM
- IO-SENSE

Information

Portal view Overview PLC\_1

Project Project1 opened.



# Пример многорядной конфигурации ПЛК с модулями IM360

The screenshot shows the Siemens TIA Portal interface for configuring a PLC system. The main workspace displays a rack configuration for 'PLC\_1 [CPU 314C-2 PN/DP]'. The rack is labeled 'Стойка расширения' (Expansion rack) and 'Профильная рейка' (Profile rail). The rack has 11 slots, numbered 1 to 11. The hardware catalog on the right shows the 'Rack' category selected, with a red dashed arrow pointing to the '6ES7 390-1\*\*\*0-0AA0' module. The interface includes a menu bar, toolbar, and status bar.

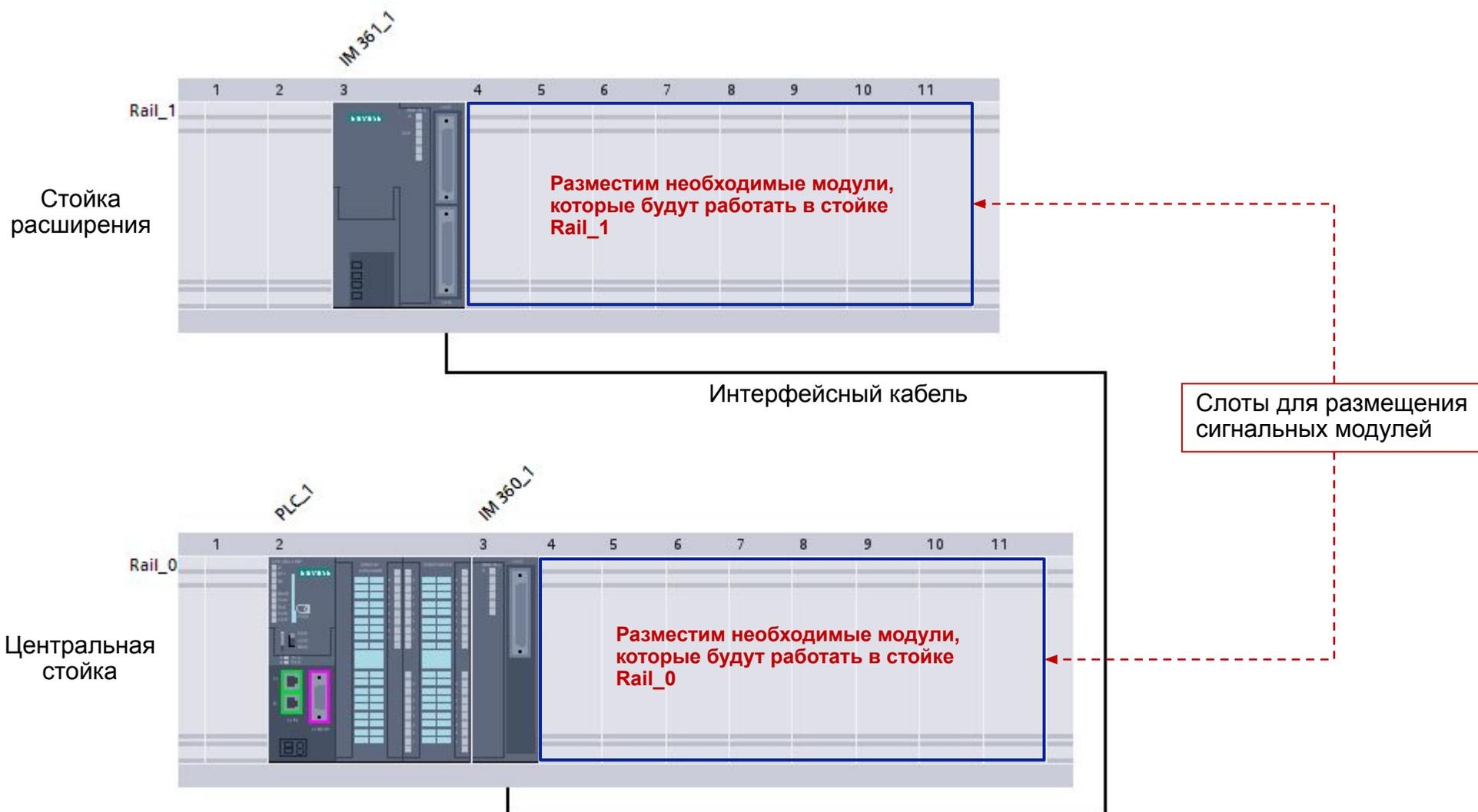


# Пример многорядной конфигурации ПЛК с модулями IM360

The screenshot shows the Siemens TIA Portal interface for configuring a PLC rack. The main workspace displays a rack with 11 slots, labeled "Стойка расширения" (Expansion rack). A Siemens IM 361-1 module is installed in slot 3. The hardware catalog on the right shows the selection path: Catalog > IM > IM 361 IM R > 6ES7 361-3CA01-0AA0. A red dashed arrow points from the selected module in the catalog to the module in the rack. The interface includes a menu bar, toolbar, and various toolbars for device data and properties.



# Пример многорядной конфигурации ПЛК с модулями IM360



# Конфигурирование распределенного ввода-вывода с подсетью PN

The screenshot displays the Siemens TIA Portal interface for configuring a distributed I/O system. The main workspace shows a network diagram with a PLC\_1 (CPU 314C-2 PN) and an IO device. A context menu is open over the IO device, with the option 'Assign to new IO controller' highlighted. A yellow callout box with the text 'Правой клавишей' (Right mouse button) points to the context menu. The hardware catalog on the right shows the selection of 'Distributed I/O' and 'IM 153-4 PN' modules. The 'Network overview' table at the bottom shows the configuration of the S7-300 station and its components.

Device	Type	Address in subn...	Subnet	Master / IO system
▼ S7-300 station_1	S7-300 station			
▶ PLC_1	CPU 314C-2 PN/DP			



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▸ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection 100%

PLC\_1 CPU 314C-2 PN/DP

IO d IM 1 Not assigned

Правой клавишей

- Add IO system
- Assign to new IO controller
- Disconnect from IO system
- Highlight IO system
- Export to XML

Hardware catalog

Options

Catalog

Filter

- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
  - ET 200SP
  - ET 200MP
  - ET 200S
  - ET 200M
    - Interface modules
      - PROFINET
        - IM 153-4 PN
          - 6ES7 153-4AA01-0XB0
          - 6ES7 153-4BA00-0XB0
        - PROFIBUS
  - ET 200ISP
  - ET 200pro

Network overview Connections I/O communication VPN

Device	Type	Address in subn...	Subnet	Master / IO system
▼ S7-300 station_1	S7-300 station			
▶ PLC_1	CPU 314C-2 PN/DP			

Properties Info Diagnostics

Portal view Overview Devices & ne...

Project Project\_2 created.



# Конфигурирование распределенного ввода-вывода с подсетью PN

The screenshot displays the Siemens TIA Portal interface for configuring a distributed I/O system. The main window shows the 'Devices & networks' view with a table of devices:

Device	Type	Address in subn...	Subnet	Master / IO system
<ul style="list-style-type: none"> <li>S7-300 station_1           <ul style="list-style-type: none"> <li>PLC_1</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>S7-300 station</li> <li>CPU 314C-2 PN/DP</li> </ul>			

A dialog box titled 'Select IO controller' is open, showing a list of IO controllers. The selected item is 'PLC 1 PROFINET interface 1'. A red arrow points to this item with the text 'Тип сети и сетовой «компаньон»'. A yellow arrow points to the 'OK' button.

The 'Hardware catalog' on the right shows the following structure:

- Filter
- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
  - ET 200SP
  - ET 200MP
  - ET 200S
  - ET 200M
    - Interface modules
      - PROFINET
        - IM 153-4 PN
          - 6ES7 153-4AA01-0XB0
          - 6ES7 153-4BA00-0XB0
        - PROFIBUS
      - ET 200iSP
      - ET 200pro



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_1 ▶ Devices & networks

**TIA-portal предлагает также более простой и удобный способ соединения компонентов в сеть**

Hardware catalog

Options

Catalog

<Search>

Filter

- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
  - ET 200SP
  - ET 200MP
  - ET 200S
  - ET 200M
    - Interface modules
      - PROFINET
        - IM 153-4 PN
          - 6ES7 153-4AA01-0XB0
          - 6ES7 153-4BA00-0XB0
        - PROFIBUS
    - ET 200iSP

Hardware catalog

Online tools

Tasks

Devices & networks

Network Connections HMI\_connection

IO system: PLC\_2.PROFINET IO-System (100)

PLC\_2  
CPU 314C-2 PN/...

IO device\_1  
IM 153-4PN  
[PLC\\_2](#)

PLC\_2.PROFINET IO-Syste...

Network overview Connections I/O communication VPN

Device	Type	Address in subn...	Subnet	Master / IO system
▼ S7-300 station_2	S7-300 station			
▶ PLC_2	CPU 314C-2 PN/DP			
▼ S7-300 station_1	S7-300 station			
▶ IO device_1	IM 153-4 PN			

Properties Info Diagnostics

Portal view Overview Devices & ne...

Project Project\_1 opened.



## Конфигурирование распределенного ввода-вывода с подсетью PN Назначение и загрузка IP-адреса

The screenshot displays the SIMATIC TIA-portal configuration interface. On the left, a navigation tree shows the following structure:

- ▼ Diagnostics
  - General
  - Diagnostic status
  - ▶ PROFINET interface [X1]
- ▼ Functions
  - Assign IP address** (highlighted in blue)
  - Assign name
  - Firmware update
  - Reset to factory settings

The main configuration area is titled "Assign IP address" and contains the following fields and controls:

- MAC address: 00 - 1B - 1B - 69 - B0 - 5D (with an "Accessible devices" button to its right)
- IP address: 192 . 168 . 0 . 8
- Subnet mask: 255 . 255 . 255 . 0
- Use router
- Router address: 192 . 168 . 0 . 8
- Assign IP address (button, highlighted in blue with a yellow arrow pointing to it)



## Конфигурирование распределенного ввода-вывода с подсетью PN. Назначение и загрузка сетевого имени

Assign name \_\_\_\_\_

PROFINET device name:

Type:

Type of the PG/PC interface:

PG/PC interface:

Only show devices of the same type

Only show devices with bad parameter settings

Only show devices without names

Accessible devices in the network:

IP address	MAC address	Type	Name	Status
192.168.0.7	00-1B-1B-61-42-EC	S7-300	main	✓ OK
192.168.0.8	00-1B-1B-69-B0-5D	IM151-3	io device_1	✓ OK

LED flashes

**В подсети ETHERNET без загрузки сетевого имени в модуль IM.xxx CPU его не увидит!**



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_1 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection

Двойной щелчок

PLC\_2  
CPU 314C-2 PN/...

IO device\_1  
IM 153-4PN  
PLC\_2

PN/E\_1

Откроем окно Device view для конфигурирования стойки расширения

Hardware catalog

Options

Catalog

<Search>

Filter

- Controllers
- HMI
- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
- Field devices
- Other field devices

Hardware catalog Online tools Tasks

Properties Info Diagnostics Information

Portal view Overview Devices & ne... The project Project\_1 was saved succes...



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project

Totally Integrated Automation PORTAL

Project\_2 > Unassigned devices > IO device\_1

Topology view Network view Device view

IO device\_1

100%

Devices & networks

Rail\_0

0 1 2 3 4 5 6 7 8 9 10 11 12

Выберем необходимые модули, которые будут работать в стойке IO device\_1

Hardware catalog

Options

Catalog

Filter

DI

- DI16 x 24VDC
  - 6ES7 321-1BH02-0AA0
  - 6ES7 321-1BH10-0AA0
  - 6ES7 321-1BH50-0AA0
- DI16 x 24VDC, interrupt
- DI16 x 24/125VDC, inter...
- DI32 x 24VDC
- DI64 x 24VDC
- DI16 x 48/125VDC
- DI16 x 24/48VUC
- DI32 x 120VAC
- DI8 x 230VAC
- DI8 x 120/230VAC
- DI16 x 120/230VAC
- DI4 x NAMUR, Ex

Hardware catalog

Online tools

Tasks

Information

Properties Info Diagnostics

Portal view Overview IO device\_1

Project Project\_2 created.



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > Unassigned devices > IO device\_1

Topology view Network view Device view

IO device\_1

25%  
50%  
75%  
**100%**  
200%  
400%  
500%  
Fit to screen  
Fit to width  
Fit to height

Увеличим масштаб.  
(см. след стр.)

IO device\_1  
DI 16 x 24VDC\_1

Rail\_0

Hardware catalog

Options

Catalog

Filter

- DI
  - DI 16 x 24VDC
    - 6ES7 321-1BH02-0AA0
    - 6ES7 321-1BH10-0AA0
    - 6ES7 321-1BH50-0AA0
  - DI 16 x 24VDC, interrupt
  - DI 16 x 24/125VDC, inter...
  - DI 32 x 24VDC
  - DI 64 x 24VDC
  - DI 16 x 48/125VDC
  - DI 16 x 24/48VUC
  - DI 32 x 120VAC
  - DI 8 x 230VAC
  - DI 8 x 120/230VAC
  - DI 16 x 120/230VAC
  - DI 4 x NAMUR, Ex

Hardware catalog

Online tools

Tasks

Device data

Properties Info Diagnostics

Portal view Overview IO device\_1

Project Project\_2 created.



# Конфигурирование распределенного ввода-вывода с подсетью PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

...4C-2 PN/DP] > Distributed I/O > PROFINET IO-System (100): PNIE\_1 > IO device\_1

Topology view Network view Device view

IO device\_1 200%

0 1 2 3 4 5

SIEMENS

DE 4.0  
DE 4.1  
DE 4.2  
DE 4.3  
DE 4.4  
DE 4.5  
DE 4.6  
DE 4.7

DE 5.0  
DE 5.1  
DE 5.2  
DE 5.3  
DE 5.4  
DE 5.5  
DE 5.6  
DE 5.7

Для работы интерфейсных модулей ET200x PN требуется карта памяти MMC, в которой хранятся сетевые настройки PROFINET

Hardware catalog

Options

Catalog

Filter

- Rack
- PS
- CPU
- IM
- DI
  - DI16 x 24VDC
    - 6ES7 321-1BH02-0AA0
    - 6ES7 321-1BH10-0AA0
    - 6ES7 321-1BH50-0AA0
  - DI16 x 24VDC, interrupt
  - DI16 x 24/125VDC, interrupt
  - DI32 x 24VDC
  - DI64 x 24VDC
  - DI16 x 48/125VDC
  - DI16 x 24/48VDC
  - DI32 x 120VAC
  - DI8 x 230VAC

Information

The project Project\_2 was saved succes...

Portal view Overview IO device\_1



# Пример конфигурации распределенного ввода-вывода в подсети PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection 100%

IO system: PLC\_1.PROFINET IO-System (100)

PLC\_1 CPU 314C-2 PN/...

IO device\_1 IM 153-4PN PLC\_1

IO device\_2 IM 151-3PN PLC\_1

PLC\_1.PROFINET IO-Syste...

Аналогично добавим корзину расширения из ряда ET200S и конфигурируем ее

Hardware cat... Options Catalog Filter

- Controllers
- HMI
- PC systems
- Drives & starters
- Network components
- Detecting & Monitori...
- Distributed I/O
- Field devices
- Other field devices

Hardware catalog Online tools Tasks

Network data

Properties Info Diagnostics Information

Portal view Overview Devices & ne... The project Project\_2 was saved succes...



# Создание топологии соединений подсети PN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▸ Devices & networks

Topology view Network view Device view

100%

PLC\_1  
CPU 314C-2 PN/...

IO device\_1  
IM 153-4PN  
PLC\_1

IO device\_2  
IM 151-3PN  
PLC\_1

HMI\_1  
TP 1500 Basic c...

Hardware catalog

Online tools

Tasks

К следующему устройству

Topological data

Properties Info Diagnostics

Portal view Overview Devices & ne... Project Project\_2 opened.

Топология (монтажная схема) создается вручную и может быть загружена в память CPU как часть проекта



# Конфигурации распределенного ввода-вывода в подсети DP

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project1

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules
  - Common data
  - Documentation settings

Project1 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection

PLC\_1 CPU 314C-2 PN/...

Slave IM 153-1

Правой клавишей

Not assigned

Select master:

Name

PLC\_1 MPI/DP interface 1

При конфигурировании подсети DP создается иерархическая структура Master - slave

Assign to new master

Disconnect from master system

Highlight master system

Export to XML

OK Cancel

Hardware catalog

Options

Catalog

<Search>

Filter

- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
  - ET 200SP
  - ET 200MP
  - ET 200S
  - ET 200M
  - Interface modules
    - PROFINET
    - PROFIBUS
      - IM 153-1
        - 6ES7 15...
      - IM 153-2 FO
      - IM 153-2
      - IM 153-2 OD

Hardware catalog

Online tools

Tasks

Network overview Connections I/O communication

Properties Info Diagnostics

Information

Portal view Overview Devices & ne...

Project Project1 created.



# Конфигурации распределенного ввода-вывода в подсети DP

The screenshot shows the Siemens TIA Portal interface for configuring a distributed I/O system. The main workspace displays a network topology with a master system (PLC\_1) and a slave system (Slave\_1). A yellow callout box points to the master system with the text "На следующей странице откроем окно свойств объекта". The hardware catalog on the right shows the selected components: IM 153-1 and 6ES7 15... The interface includes a Project tree on the left, a Hardware catalog on the right, and a Properties window at the bottom.



# Конфигурации распределенного ввода-вывода в подсети DP

The screenshot displays the Siemens TIA Portal interface for configuring a distributed I/O station. The main window is titled "Siemens - Project1" and shows the "Devices & networks" view for a PLC\_1 [CPU 314C-2 PN/DP].

**Project tree (left):** Shows the project structure, including "Devices & networks" and "PLC\_1 [CPU 314C-2 PN/DP]".

**Properties window (right):** Shows the configuration for the "MPI/DP interface [X1]". The "General" tab is active, displaying the following settings:

- PROFIBUS address: \_\_\_\_\_
- Interface networked with:
  - Subnet: PROFIBUS\_1
  - Buttons: Add new subnet
- Parameters:
  - Interface type: PROFIBUS
  - Address: 2
  - Highest address: 126
  - Transmission speed: 1.5 Mbps
- Operating mode: \_\_\_\_\_

The bottom status bar indicates "Project Project1 created."



# Компилирование аппаратной конфигурации

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices & networks

Devices

PLC\_1 [CPU 314C-2 PN/DP]

Device configuration

Online & diagnostics

Program blocks

Technology objects

External source files

PLC tags

PLC data types

Watch and force tables

Online backups

Program info

PLC alarms

Text lists

Local modules

Distributed I/O

Common data

Reference projects

Details view

Portal view

Open

Open in new editor

Search in PLC and open... F7

Cut Ctrl+X

Copy Ctrl+C

Paste Ctrl+V

Delete Del

Rename F2

Go to topology view

Go to network view

Compile

Download to device

Backup from online device

Go online Ctrl+K

Go offline Ctrl+M

Online & diagnostics Ctrl+D

Start simulation Ctrl+Shift+X

Compare

Cross-references F11

Call structure

Assignment list

Print... Ctrl+P

Print preview...

Properties... Alt+Enter

Topology view

Network view

Device view

HMI\_connection

100%

IO device\_1  
IM 153-4PN  
PLC\_1

IO device\_2  
IM 151-3PN  
PLC\_1

Hardware and software (only changes)

Hardware (only changes)

Software (only changes)

Software (rebuild all blocks)

Hardware catalog

Online tools

Tasks

Network data

Properties

Info

Diagnostics

Project Project\_3 opened.

Правой клавишей



# Компилирование аппаратной конфигурации

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices & networks

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules
  - Distributed I/O
  - Common data
- Reference projects
- Details view

Project\_3 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection

100%

PLC\_1 CPU 314C-2 PN/...

IO device\_1 IM 153-4PN PLC\_1

IO device\_2 IM 151-3PN PLC\_1

PN/IE\_1

Network data

Properties Info Diagnostics

General Cross-references **Compile**

Compiling completed (errors: 0; warnings: 0)

!	Path	Description	Go to	?	Err
✓	PLC_1		↗		0
✓	Hardware configuration		↗		0
✓		Compiling completed (errors: 0; warnings: 0)			0

Компиляция прошла успешно

Portal view Overview Devices & ne... Project Project\_3 opened.



# Загрузка аппаратной конфигурации в PLC

The screenshot displays the Siemens TIA Portal interface for 'Project\_3'. The 'Project tree' on the left shows the 'Devices & networks' folder expanded to 'PLC\_1 [CPU 314C-2 PN/DP]'. A context menu is open over this folder, with 'Download to device' selected. The main workspace shows a network diagram with two IO devices connected to PLC\_1. The 'Properties' window is open, showing the 'General' tab. The message log at the bottom right contains the following entries:

- Project closed.
- Project Project\_3 opened.
- Start downloading to device.
- PLC\_1
  - Hardware configuration was loaded successfully.
- Connected to PLC\_1, address IP=192.168.0.1.
- Connection to PLC\_1 terminated.
- Loading completed (errors: 0; warnings: 0). **Загрузка прошла успешно**

The status bar at the bottom right indicates 'Project Project\_3 opened.' with a green checkmark.



## Создание проекта с «пустым» ЦПУ

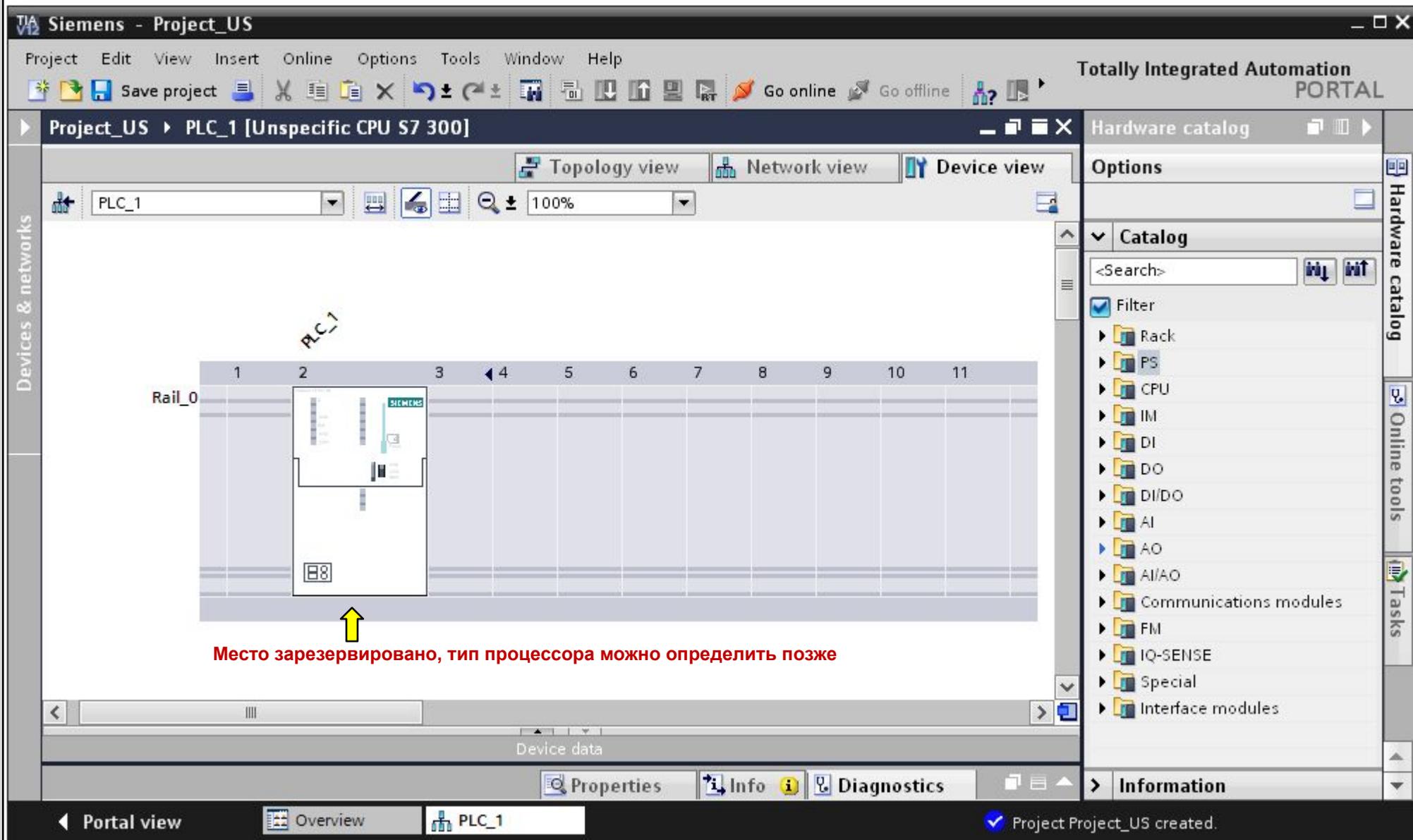
The screenshot shows the 'Add new device' dialog in SIMATIC TIA-portal. The left sidebar has a yellow arrow pointing to 'Devices & networks'. The main area is divided into three panes:

- Left Pane (Tree View):** Shows a hierarchy of SIMATIC S7-300 controllers. Under 'CPU', 'Unspecified CPU 300' is selected and highlighted with a red box. Below it, the order number '6ES7 3XX XXXXX XXXX' is also highlighted with a red box.
- Center Pane (Device Properties):** Shows the selected device as 'Unspecified CPU 300'. The 'Order no.' field contains '6ES7 3XX-XXXXX-XXXX'. The 'Description' field also contains 'Unspecified CPU 300'.
- Right Pane (Tree View):** Shows the same hierarchy as the left pane, but 'Unspecified CPU 300' is highlighted with a red box.

At the bottom left, there is a 'Project view' button. At the bottom right, there is a language dropdown set to '\_US'.



# Создание проекта с «пустым» ЦПУ



Siemens - Project\_US

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_US ▶ PLC\_1 [Unspecific CPU S7 300]

Topology view Network view Device view

PLC\_1 100%

Rail\_0

PLC\_1

1 2 3 4 5 6 7 8 9 10 11

Место зарезервировано, тип процессора можно определить позже

Hardware catalog

Options

Catalog

<Search>

Filter

- ▶ Rack
- ▶ PS
- ▶ CPU
- ▶ IM
- ▶ DI
- ▶ DO
- ▶ DI/DO
- ▶ AI
- ▶ AO
- ▶ AI/AO
- ▶ Communications modules
- ▶ FM
- ▶ IQ-SENSE
- ▶ Special
- ▶ Interface modules

Properties Info Diagnostics Information

Portal view Overview PLC\_1

Project Project\_US created.



# Создание проекта с «пустым» ЦПУ

Siemens - Project\_US

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_US ▶ PLC\_1 [Unspecific CPU S7 300]

Topology view Network view Device view

PLC\_1 100%

PS 307 2A\_1 PLC\_1 DI16 x 24VDC\_1 DO16 x 24VDC / 0...

Rail\_0 1 2 3 4 5 6 7 8 9 10 11

Возможна установка в слоты необходимых модулей

Hardware catalog

Options

Catalog

<Search>

Filter

- DO
  - DO8 x 24VDC / 0.5A
  - DO8 x 24VDC / 2A
  - DO16 x 24VDC / 0.5A
    - 6ES7 322-1BH01-...
    - 6ES7 322-1BH10-...
    - 6ES7 322-8BH00-...
    - 6ES7 322-8BH01-...
    - 6ES7 322-8BH10-...
  - DO32 x 24VDC / 0.5A
  - DO64 x 24VDC / 0.3A
  - DO4 x 24VDC / 10mA, Ex
  - DO4 x 15VDC / 20mA, Ex
  - DO16 x 24/48VUC
  - DO8 x 230VAC / 2A
  - DO8 x AC Iso

Properties Info Diagnostics

Portal view Overview PLC\_1

Project Project\_US created.



# Создание проекта с «пустым» ЦПУ

The screenshot displays the Siemens TIA Portal interface for creating a project with an empty CPU. The main workspace shows a rack configuration with the following components:

- Slot 1: PS 307 2A-1 (Power supply)
- Slot 2: PLC\_1 (CPU)
- Slot 4: DI 16 x 24VDC\_1 (Digital input module)
- Slot 5: DO 16 x 24VDC / 0.... (Digital output module)

The project tree on the left shows the following structure:

- Project\_US
  - Add new device
  - Devices & networks
    - PLC\_1 [Unspecific CPU S...
      - Device configuration
      - Program blocks
      - Technology objects
      - External source files
      - PLC tags
      - PLC data types
      - Watch and force tables
      - Program info
      - PLC alarms
      - Text lists
      - Local modules
    - Common data
    - Documentation settings
    - Languages & resources

A red arrow points to the 'PLC\_1 [Unspecific CPU S...]' folder in the project tree, with a text box containing the Russian text: "В остальном проект создается так же, как и при наличии штатного CPU".

The bottom status bar shows: "Project Project\_US created."

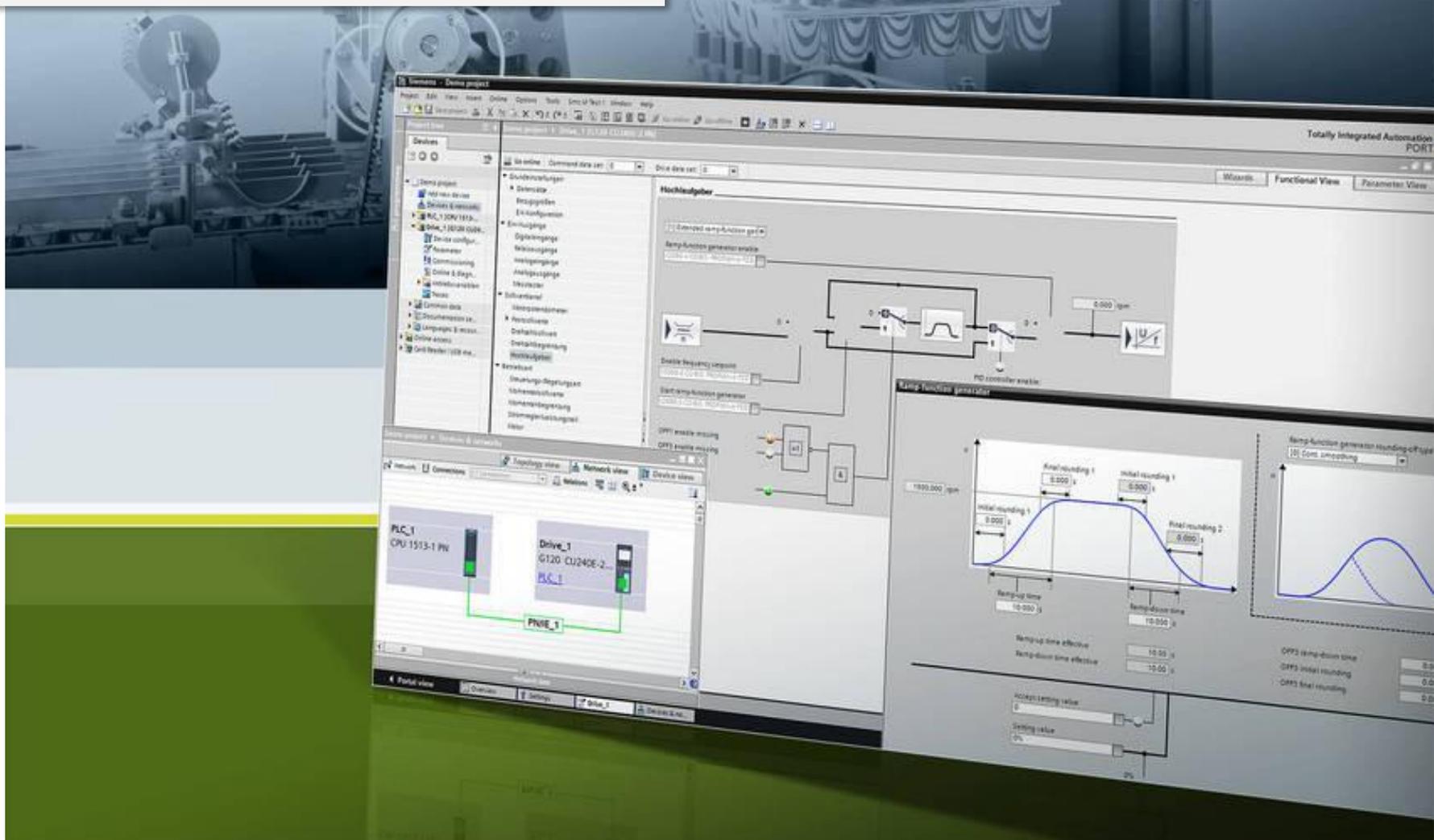


## Конец раздела 2. Окно навигации

- ▶ Основы алгебры логики  
Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 3

Области данных, форматы и типы данных.  
Структура программы.  
Программный редактор, программные блоки



## Области данных PLC SIMATIC S-7

- Память дискретных входов (образ процесса)
- Память дискретных выходов (образ процесса)
- Память меркеров (меток)
- Память данных общего назначения
- Память временных переменных (стек локальных данных)
- Память внутренних подпрограмм (счетчики, таймеры и т.д.)
- Память данных периферии (в частности, аналоговые входы и выходы)



## Форматы и основные типы данных

Формат данных

- **Бит** – один двоичный разряд
- **Байт** – 8 двоичных разрядов
- **Слово** – 16 двоичных разрядов
- **Двойное слово** – 32 двоичных разряда (в S7-1200/1500 есть 64-х битные данные)

Типы данных

- **Bool** – битные данные (дань вежливости автору булевой алгебры)
- **Byte** – число в формате байта
- **Word**- число без учета знака. Формат слова
- **Int**- число с учетом знака. Формат слова
- **DWord** – число без учета знака. Формат двойного слова
- **DInt** - число с учетом знака. Формат двойного слова
- **Real**- число с плавающей точкой. Формат двойного слова
- **S5Time** – задание уставки подпрограммы «таймер». Формат слова
- Типы данных **Char**, **String**, составные типы данных



## Пример типа данных INT (16-разрядное целое)

Диапазон значений от -32768 до +32767  
(Без знака: от 0 до 65535)

Арифметические операции:  
+ |, - |, \*|, /|

Операции сравнения:  
>|, ==|, >=|

DEC: + 662

BIN.: 2#

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

0 0 0 0 0 0 1 0 1 0 0 1 0 1 1 0

Знак положительного числа

HEX:

W#16

0 2 9 6

Прочтение  
положительного  
числа

$$\begin{array}{r} \dots 6 \times 16^0 = 6 \\ \dots 9 \times 16^1 = 144 \\ \dots 2 \times 16^2 = 512 \\ \hline 662 \end{array}$$

DEC: - 662

BIN.: 2#

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

1 1 1 1 1 1 0 1 0 1 1 0 1 0 1 0

Знак отрицательного числа

HEX:

W#16

F D 6 A

Прочтение  
без учета  
знака

$$\begin{array}{r} \dots 10 \times 16^0 = 16 \\ \dots 6 \times 16^1 = 96 \\ \dots 13 \times 16^2 = 3328 \\ \dots 15 \times 16^3 = 61440 \\ \hline 64874 \end{array}$$



## Пример типа данных REAL (32-разрядное число с плавающей точкой)

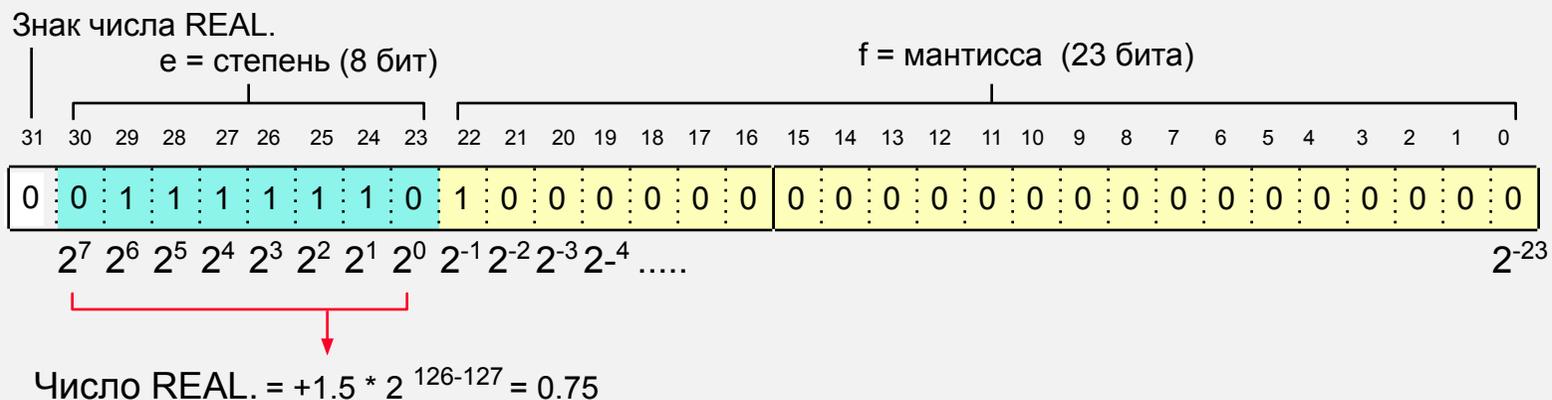
Диапазон значений от  $-1.175495 \cdot 10^{-38}$  до  $3.402823 \cdot 10^{+38}$

Общий формат числа REAL =  $(\text{Sign}) \cdot (1.f) \cdot (2^{e-127})$

Математические операции:  
+ R, - R, \*R, /R  
sin, cos, ln,  
exp, SQR

Операции сравнения:  
><R, ==R, >=R

Пример: 7.50000e-001 ( $7.5 \cdot 10^{-1} = 0.75$ )



## Адресация дискретных входов/выходов через образ процесса

При обращении в программе пользователя в контроллерах S7-300/S7-400 к областям дискретных входов (I x.y) и выходов (Q x.y) опрашиваются не сигналы непосредственно на цифровых сигнальных модулях, а происходит обращение к выделенной области в системной памяти CPU. Эту область памяти называют образом процесса. Образ процесса делится на две части

- образ процесса входов
- образ процесса выходов

Для чего это нужно.

При обработке программы важно, чтобы в текущем цикле значения входов были одинаковы во всех точках обращения к ним. Иначе могут возникнуть логические конфликты. Для выходов это не так критично, но обращение к внутренней памяти по времени гораздо короче, чем обращение к памяти модулей, что необходимо для сокращения общего времени цикла .

Реализуется этот механизм следующим образом:

в начале цикла программы производится опрос сигнальных модулей ввода, их значения заносятся в память образа процесса входов. При обработке программы производится опрос значений входов из памяти образа процесса. Далее производится передача полученных в результате обработки программы значений дискретных выходов из памяти образа процесса выходов в сигнальные модули выходов в начале следующего цикла.

### Примечание:

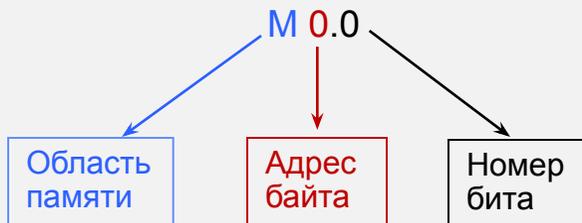
в контроллерах серии S7-1200/S7-1500 для сокращения времени реакции на событие возможно непосредственное обращение к модулям дискретных входов-выходов, минуя память образа процессора. Синтаксис обращения: I x.y:P или Q x.y:P. Если префикса (:P) нет, опрашивается образ процесса.



# Адресация и структура представления данных

Адресация

Обращение к биту данных

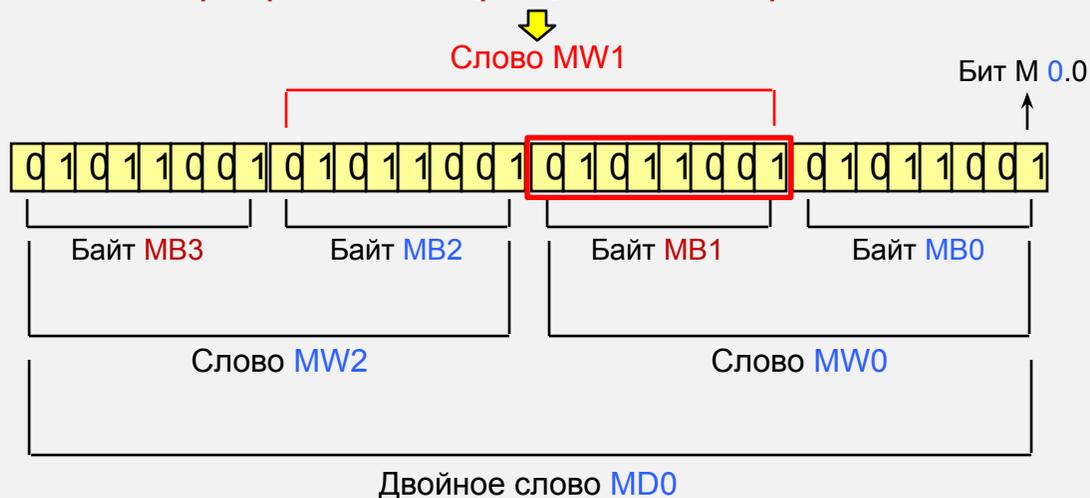


Обращение к данным в других форматах

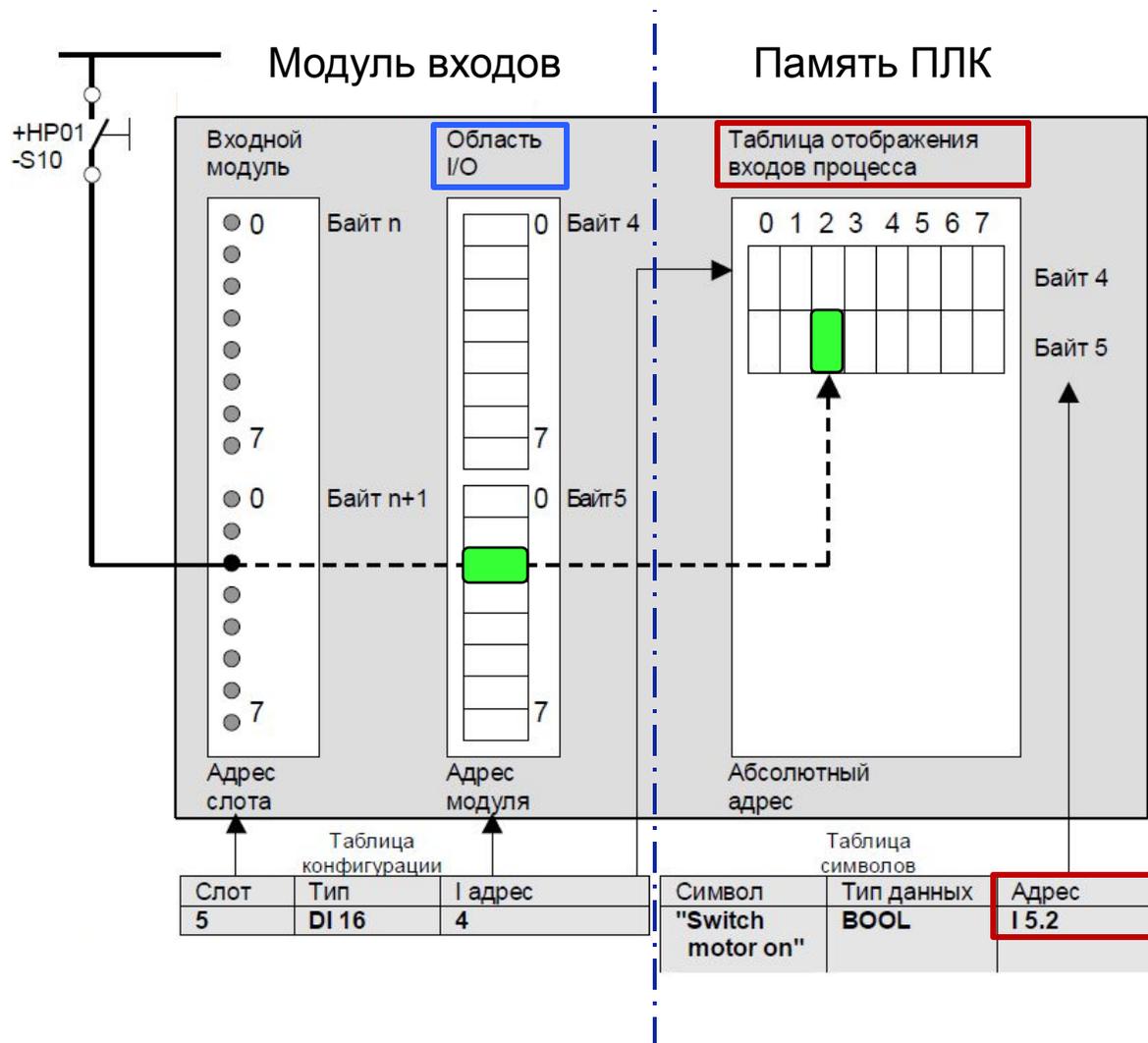
- к байту меркеров **MB0**
- к слову меркеров **MW0**
- к двойному слову меркеров **MD0**

Структура представления

Пример ошибочной адресации n-байтной переменной



## Пример адресации дискретного входа I 5.2 через образ процесса



## Типы программных блоков

Структурно программа выполняется в виде программных блоков, которые разделяются по их назначению:



Организационные блоки. Осуществляют связь операционной системы с программой пользователя. Различаются способом запуска. Могут выполняться циклически (основной способ), по времени, по аппаратным прерываниям. В одних ОБ осуществляется вызов программных блоков, другие производят диагностику и выполняют ряд других функций. Могут выполнять роль программных и содержать программу пользователя.



Блоки данных предназначены для хранения данных пользователя. Их два вида. Одни DB могут содержать глобальные данные, доступные в любой точке программы, а другие (IDB) содержат данные для использования их в конкретном программном блоке, который называется функциональным (FB). В блоках данных могут быть организованы данные всех типов.



Функциональные блоки являются программными и содержат программу пользователя. Входные данные, внутренние переменные и результаты обработки, загружаются в выделенный для этой цели блок данных IDB (Instance data Block).



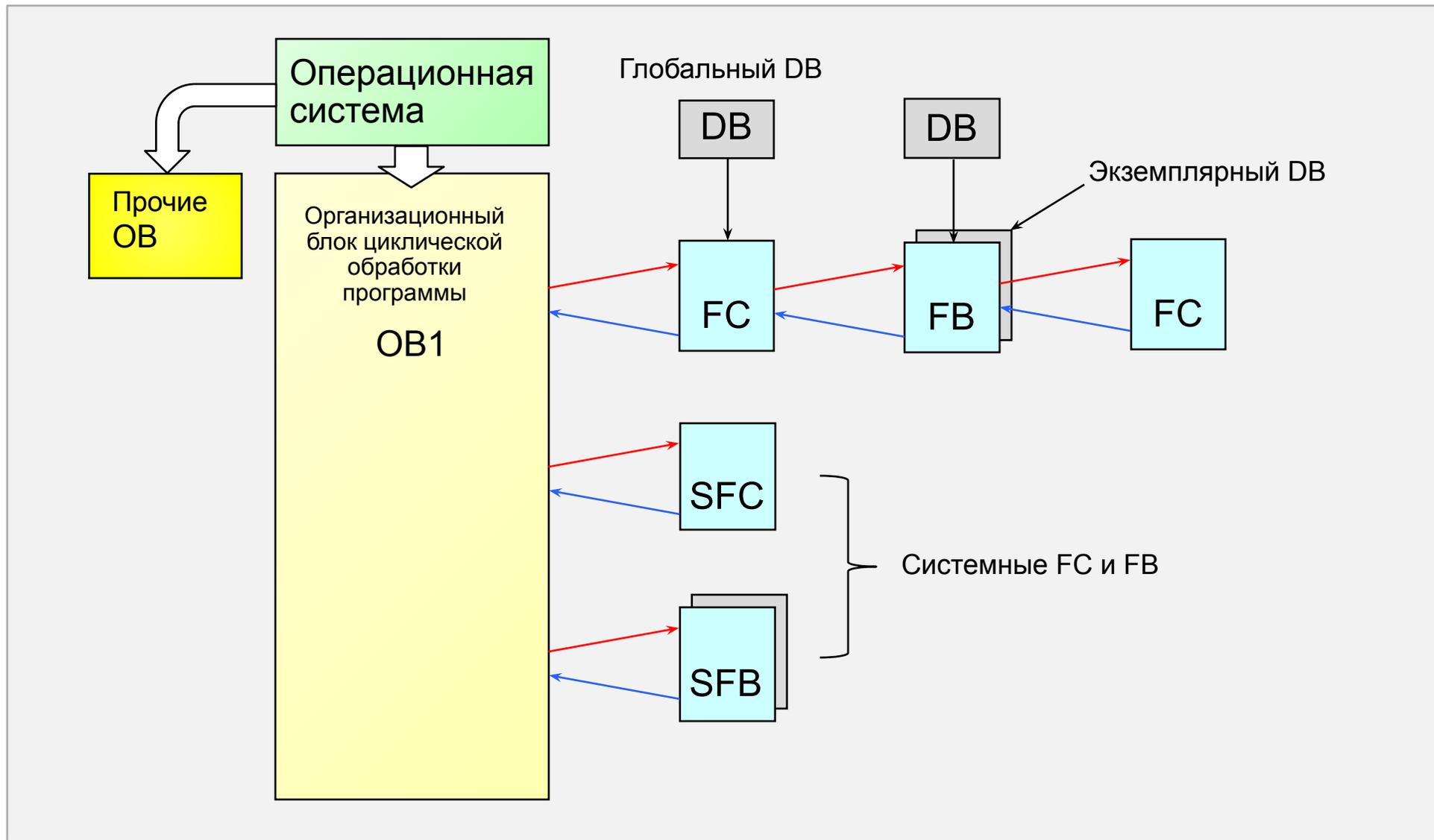
Функции – блоки, которые также являются программными и содержат программу пользователя. К моменту вызова функции все ее входные данные должны быть определены. Такой механизм позволяет использовать функции без выделенных блоков данных.



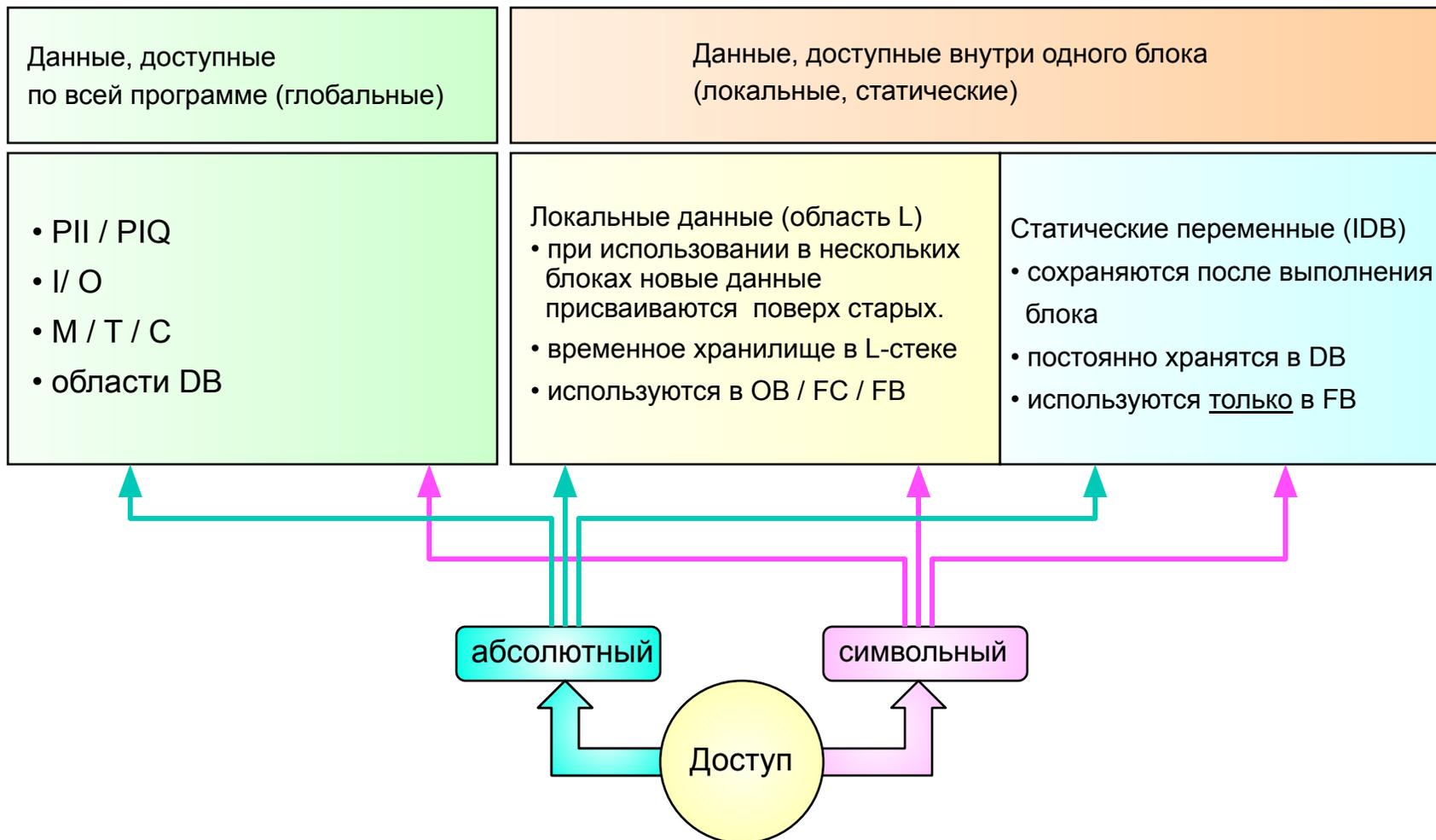
Системные функциональные блоки (SFB) и системные функции (SFC), которые имеются в составе ПЛК и предназначены для выполнения стандартных функций, например передачи данных, чтения времени и даты из ПЛК и т. д.



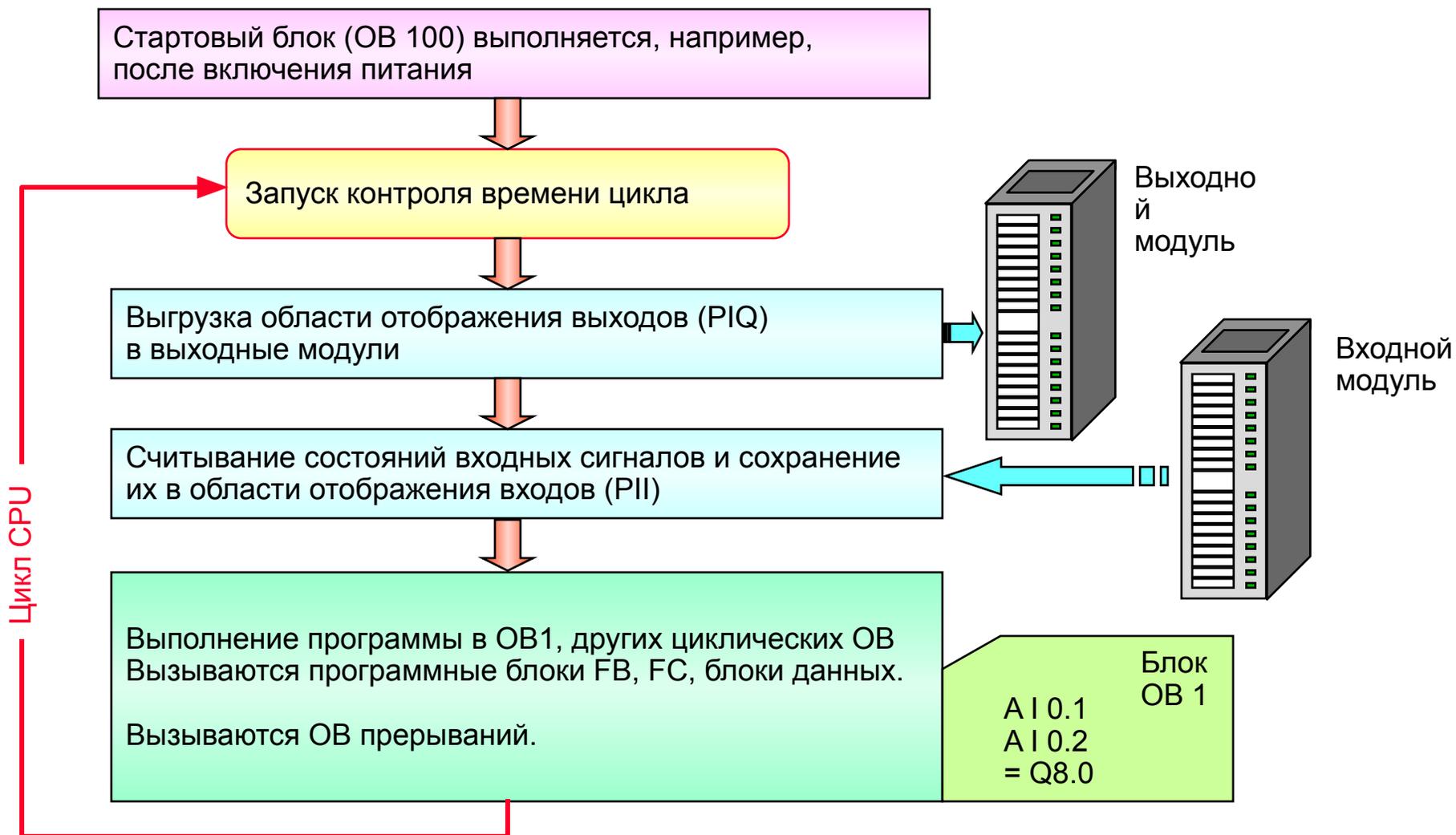
# Общая структура вызова и обработки программных блоков



# Распределение данных в ПЛК



## Циклическое выполнение программы



# Структура проекта, языки представления программы

The screenshot shows the Siemens TIA Portal interface. The 'Edit' menu is open, and the 'Switch programming language' option is selected. A sub-menu displays three options: STL (Statement List), LAD (Ladder Diagram), and FBD (Function Block Diagram). Three text boxes provide detailed descriptions for each language.

Name	Modified	Remark	Title	Address	Type	Language
Add new block						
Main [OB1]	5/25/2014 - 12:29:40 PM		"Main Program Sweep (Cycle)"	OB1	OB	LAD

**STL**  
Список инструкций (Statement List – STL). Программы, написанные на STL, занимают минимальный объем в памяти программ контроллеров и обладают наиболее высоким быстродействием.

**LAD**  
Диаграммы лестничной логики (Ladder Diagram – LAD). В отечественной литературе этот язык известен как язык релейно-контактных схем – РКС.

**FBD**  
Язык функциональных блоков (Function Block Control Diagram – FBD). Язык, позволяющий выполнять разработку программы по аналогии с разработкой функциональной схемы, создаваемой на основе цифровых интегральных микросхем.

## Настройка редактора

The screenshot displays the Siemens TIA Portal interface for 'Project\_2'. The 'Options' menu is open, with 'Settings' selected. The 'Settings' dialog box is open to the 'PLC programming' section, which is highlighted with a green box. The 'View' section is expanded, showing options for 'With comments' (unchecked) and 'With tag information' (checked). The 'Compilation' section has 'Delete actual parameters on interface up' (unchecked). The 'Default settings for new blocks' section has 'IEC check' (unchecked). The 'Additional settings' section is currently empty. The bottom status bar shows 'Portal view', 'Overview', 'Block\_2 (FC2)', 'Tag table\_1', and 'Settings'.

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project

Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Devices

Add new device

Devices & networks

PLC\_1 [CPU 314C-2 PN/DP]

Device configuration

Online & diagnostics

Program blocks

Technology objects

External source files

PLC tags

PLC data types

Watch and force tables

Online backups

Program info

PLC alarms

Text lists

Local modules

Distributed I/O

HMI\_1 [TP 1500 Basic colo...]

Reference projects

Details view

Hardware configuration

PLC programming

Simulation

Online & Diagnostics

Visualization

Keyboard shortcuts

PLC programming

General

View

With comments

With tag information

Compilation

Delete actual parameters on interface up

Default settings for new blocks

IEC check

Additional settings

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Tag table\_1 Settings

The project Project\_2 was saved succes...

## Настройка редактора

**Settings**

- ▶ General
- ▶ Hardware configuration
- ▼ **PLC programming**
  - General
  - LAD/FBD (Ladder / Function block diagram)
  - STL (Statement list)
  - GRAPH
  - SCL (Structured Control Language)
- ▶ Simulation
- ▶ Online & Diagnostics
- ▶ Visualization

**Font**

Font size:

---

**View**

Layout:  Compact  
 Wide  
 With absolute information

---

**Operand field**

Maximum width:  characters  
Maximum height:  characters

**View**

With comments  
 With tag information

---

**Compilation**

Delete actual parameters on interface update

---

**Default settings for new blocks**

IEC check

---

**Additional settings**

Show autocomplete list  
Mnemonics:

---

**Download without reinitialization**

Memory reserve:  Bytes

---

**Block interface**

Set "Accessible from HMI" for new elements

# Создание программного блока FC

The screenshot shows the Siemens TIA Portal interface. The title bar reads "Siemens - Project\_2". The menu bar includes Project, Edit, View, Insert, Online, Options, Tools, Window, and Help. The toolbar contains various icons for file operations and online/offline status. The main window is titled "Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks".

The "Project tree" on the left shows the following structure:

- Project\_2
  - PLC\_1 [CPU 314C-2 PN/DP]
    - Program blocks
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Online backups
    - Local modules
    - Distributed I/O
    - Common data
    - Documentation settings
    - Languages & resources
    - Online access
    - Card Reader/USB memory

The main window displays a table of program blocks:

	Modified	Remark	Title	Address	Type	Language	Optimiz
							<input type="checkbox"/>
	5/25/2014 - 12:29:40 PM		"Main Program Sweep (Cycle)"	OB1	OB	LAD	<input type="checkbox"/>

A yellow callout bubble with the text "Двойной щелчок" (Double click) points to the "Add new block" entry in the table.

The bottom of the interface shows the "Details view" and "Portal view" tabs, along with "Properties", "Info", and "Diagnostics" buttons. A status bar at the bottom right indicates "Project Project\_2 opened."



# Создание программного блока FC

Siemens - Project

Project Edit View In

Save project

Project tree

Devices

Start

Project\_2

PLC\_1 [CPU 31]

Program bl

Technology

External so

PLC tags

PLC data ty

Watch and t

Online back

Local modu

Distributed

Common data

Documentatio

Languages &

Online access

Card Reader/USB

Details view

Portal view

Add new block

Name: Block\_1

Language: LAD

Number:

Description: Functions are code blocks or subroutines without dedicated memory.

more...

Additional information

Add new and open

OK Cancel

Об этом будет сказано в разделе программирования на языках SCL и GRAPH

Выберем создание программного блока FC (функция).

# Выбор инструментов построения цепи в языке LAD

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_1 [FC1]

Devices

PLC programming

Block interface

Линейка выбора элемента цепи.

Block title: .....

Comment

Network 1: .....

Comment

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) Project Project\_2 opened.

# Выбор инструментов построения цепи в языке LAD

The screenshot displays the Siemens TIA Portal software interface for editing a Ladder Logic (LAD) network. The main window title is "Siemens - Project\_2". The menu bar includes "Project", "Edit", "View", "Insert", "Online", "Options", "Tools", "Window", and "Help". The toolbar contains various icons for file operations, online/offline status, and help. The "Project tree" on the left shows the project structure: "Project\_2" > "PLC\_1 [CPU 314C-2 PN/DP]" > "Program blocks" > "Block\_1 [FC1]". The main editor area shows the "Block interface" for "Block\_1 [FC1]". A toolbar within this interface contains several icons for LAD construction, including a blue box highlighting a set of icons (left-pointing arrow, right-pointing arrow, normally open contact, normally closed contact, coil, and reset coil). A green box highlights the text "Линейка выбора элемента цепи." with a yellow arrow pointing to the highlighted icons. The editor area shows a network with a single horizontal line. The bottom status bar includes "Portal view", "Overview", "Block\_1 (FC1)", "Properties", "Info", "Diagnostics", and "Project Project\_2 opened.".

# Выбор инструментов построения цепи в языке LAD

The screenshot displays the Siemens TIA Portal interface for editing a Ladder Logic (LAD) program. The main workspace shows a network editor with a toolbar containing various logic symbols. A yellow speech bubble with the text "Или щелчок мышью" (Or mouse click) points to the network editor area. A red dashed arrow labeled "Перетащим" (We drag) points from the "Basic instructions" section in the right-hand "Instructions" panel to the network editor. The "Instructions" panel is expanded to show "Basic instructions" with a list of categories like General, Bit logic operations, Timer operations, etc. The "Favorites" section is also visible, containing a set of logic symbols similar to the main toolbar.

## Выбор и адресация элемента цепи

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_2'. The main window shows the 'Block interface' for 'Block\_1 [FC1]'. A 'Normally open contact [Shift+F2]' is selected in the ladder logic network. Below it, 'Network 1' is expanded to show a table of variables. The table has the following structure:

i0.0	%I0.0	Bool	Tag_1
------	-------	------	-------

The 'Tag\_1' cell in the table is highlighted with a red box. A red arrow points from the text annotation to this cell.

**Система автоматически генерирует символическое имя переменной в таблице тегов**

At the bottom of the interface, a status bar indicates: 'The project Project\_2 was saved succes...'

# Таблица тегов PLC. Символьное имя переменной

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Default tag table [1]

Tags | User constants | System constants

Default tag table

	Name	Data type	Address	Retain	Visible in HMI	Accessible from HMI
1	Tag_1	Bool	%I0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	<Add new>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Details view: Portal view | Overview | Block\_1 (FC1)

The project Project\_2 was saved succes...

## Типы переменных в таблице тегов.

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Default tag table [1]

Tags User constants System constants

Default tag table

	Name	Data type	Address	Retain	Visible in HMI	Accessible from HMI
1	Switch_STOP_range	Bool	%I0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	<Add new>	<ul style="list-style-type: none"> <li>Bool</li> <li>Byte</li> <li>Char</li> <li>Counter</li> <li>Date</li> <li>DInt</li> <li>DWord</li> <li>Int</li> <li>Real</li> <li>S5Time</li> <li>Time of Day</li> <li>Timer</li> <li>Word</li> </ul>				

Operand identifier: I  
Operand type: I  
Address: M  
Bit number: 0

Позволяет использовать символьные имена переменных, что упрощает написание и чтение программы, а также уменьшает вероятность ошибки при использовании переменной, поскольку она поименована.

Portal view Overview Block\_1 (FC1) Default tag t... Properties Info Diagnostics

The project Project\_2 was saved succes...

## Просмотр свойств выбранного тега

The screenshot displays the Siemens TIA Portal interface. The main window is titled "Siemens - Project\_2". The "Edit" menu is open, and the "Properties" option is highlighted with a yellow arrow. The "Properties" dialog box is open, showing the "General" tab for the selected PLC tag "Switch\_STOP\_range".

**General**

Tag: Switch\_STOP\_range

**General**

Name: Switch\_STOP\_range  
Data type: Bool  
Address: %I0.0  
Comment:

**History**

Date created: 5/27/2014 12:09 PM  
Last modified: 5/27/2014 1:02 PM

**Usage**

Accessible from HMI  
 Visible in HMI

Buttons: OK, Cancel

Bottom status bar: Portal view, Overview, Block\_1 (FC1), Default tag t..., The project Project\_2 was saved succes...

# Экспорт таблицы тегов в файл Excel

The screenshot shows the Siemens TIA Portal interface. The main window displays the 'Tag table\_1 [13]' for 'PLC\_1 [CPU 314C-2 PN/DP]'. A yellow arrow points to the 'Export to Excel' icon in the toolbar. The 'Export to Excel' dialog is open, showing the 'Path of export file:' field and the 'Elements to be exported' section, where 'Tags' is selected. The 'Сохранить как' (Save As) dialog is also open, showing the file name 'PLC tags' and the file type 'Xlsx files (\*.xlsx)'. The 'PLC tags' folder is selected in the file list.

**Export to Excel Dialog:**

- Path of export file: [ ]
- Elements to be exported:
  - Tags
  - Constants

**Сохранить как Dialog:**

- Панка: System\_disk (C:)
- Имя файла: PLC tags
- Тип файла: Xlsx files (\*.xlsx)

## Вид таблицы тегов в формате файла Excel

PLC tags - Microsoft Excel

Главная Вставка Разметка страницы Формулы Данные Рецензирование Вид Разработчик

Вставить Буфер обмена Шрифт Выравнивание Число Стили Ячейки Редактирование

L18

	A	B	C	D	E	F	G	H	I
1	Name	Path	Data Type	Logical Address	Comment	Hmi Visible	Hmi Accessible		
2	Switch_STOP_range	Tag table_1	Bool	%I0.0		True	True		
3	Break_Q1	Tag table_1	Bool	%I0.2		True	True		
4	Switch_START_range	Tag table_1	Bool	%I0.1		True	True		
5	Feedback_K1M	Tag table_1	Bool	%I0.3		True	True		
6	Output_K1M_ON	Tag table_1	Bool	%Q0.0		True	True		
7	Visible_K1M_ON	Tag table_1	Bool	%Q0.1		True	True		
8	Start_motor_PO	Tag table_1	Bool	%M50.0		True	True		
9	Switch_START_range_1	Tag table_1	Bool	%I1.0		True	True		
10	Break_Q1_1	Tag table_1	Bool	%I1.2		True	True		
11	Feedback_K1M_1	Tag table_1	Bool	%I1.3		True	True		
12	Output_K1M_ON_1	Tag table_1	Bool	%Q1.0		True	True		
13	Visible_K1M_ON_1	Tag table_1	Bool	%Q1.1		True	True		
14	Stop_motor_PO	Tag table_1	Bool	%M50.1		True	True		
15									
16									
17									
18									

PLC Tags

Готово 100%



# Просмотр символьной таблицы для адресов выбранного модуля

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

- Online backups
- Program info
- PLC alarms
- Text lists
- Local modules
  - PLC\_1 [CPU 314C-2 PN/DP]
    - DI32 x 24VDC\_1
    - AI8 x 12 bits\_1
    - AI8 x 13 bits\_1
    - AO4 x 12 bits\_1

Reference projects

Details view

Name	Type	Address
Switch_STOP_range	Bool	DI 0.0
Switch_START_range	Bool	DI 0.1
Breack_Q1	Bool	DI 0.2
Feedback_K1M	Bool	DI 0.3
	Bool	DI 0.4

Block interface

Block title: .....

Comment

Network 1: .....

Network 2: .....

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Project Project\_2 opened.

# Возможные ошибки определения переменных в таблице тегов

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Tag table\_1 [14]

Devices: Online & diagnostics, Program blocks, Technology objects, External source files, PLC tags, Show all tags, Add new tag table, Default tag table [29], Tag table\_1 [14], PLC data types, Watch and force tables, Online backups, Program info, PLC alarms, Text lists, Local modules, Distributed I/O, HMI\_1 [TP 1500 Basic colo...]

Reference projects, Details view

Properties, Info, Diagnostics

Portal view, Overview, Block\_2 (FC2), Tag table\_1, Project Project\_2 opened.

**Tag table\_1**

	Name	Data type	Address	Retain	Visibl...	Acces...	Comment
1	Switch_STOP_range	Byte	%I0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2	Breck_Q1	Bool	%I0.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Switch_START_range	Bool	%I0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	Feedback_K1M	Bool	%I0.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
5	Output_K1M_ON	Bool	%Q0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
6	Visible_K1M_ON	Bool	%Q0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
7	Start_motor_PO	Bool	%M50.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
8	Switch_START_range_1	Bool	%I1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
9	Breck_Q1_1	Bool	%I1.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
10	Feedback_K1M_1	Bool	%I1.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
11	Output_K1M_ON_1	Bool	%Q1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
12	Visible_K1M_ON_1	Bool	%Q1.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
13	Stop_motor_PO	Bool	%M50.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
14	Stop_motor_PO_1	Bool	%M50.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
15	<Add new>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

**Абсолютный адрес не соответствует типу данных тега**

**Этот абсолютный адрес используется дважды**

# Задание констант пользователя

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Tag table\_1 [13]

Tags User constants

Tag table\_1

	Name	Data type	Address	Retain	Visibl...	Acces...	Comment
1	Switch_STOP_range	Bool	%I0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
2	Breach_Q1	Bool	%I0.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Switch_START_range	Bool	%I0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	Feedback_K1M	Bool	%I0.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
5	Output_K1M_ON	Bool	%Q0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
6	Visible_K1M_ON	Bool	%Q0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
7	Start_motor_PO	Bool	%M50.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
8	Switch_START_range_1	Bool	%I1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
9	Breach_Q1_1	Bool	%I1.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
10	Feedback_K1M_1	Bool	%I1.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
11	Output_K1M_ON_1	Bool	%Q1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
12	Visible_K1M_ON_1	Bool	%Q1.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
13	Stop_motor_PO	Bool	%M50.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
14	<Add new>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Tag table\_1

The project Project\_2 was saved succes...



## Задание констант пользователя

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Tag table\_1 [13]

Tags User constants

PLC programming

Devices

- Technology objects
- External source files
- PLC tags
  - Show all tags
  - Add new tag table
  - Default tag table [29]
  - Tag table\_1 [13]
- PLC data types
- Watch and force tables
- Online backups
- Program info
- PLC alarms
- Text lists
- Local modules
- Distributed I/O
- HMI\_1 [TP 1500 Basic colo...]
- Common data
- Documentation settings

Reference projects

Details view

Portal view Overview Tag table\_1

Properties Info Diagnostics

Project Project\_2 opened.

	Name	Data type	Value	Comment
1	Constant_0_Real	Real	0.0	

Выберем тип

Присвоим имя

Зададим значение

# Использование шаблона Empty box

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_2'. The main workspace shows a ladder logic diagram with two networks. Network 2 is highlighted and contains an 'Empty box' template, which is a rectangular block with 'IN' and 'OUT' terminals. A red dashed arrow points to this template in the toolbar above the workspace. Network 3 is currently empty. The left sidebar shows the project tree with 'PLC\_1 [CPU 314C-2 PN/DP]' expanded. The bottom status bar indicates that the project was saved successfully.



# Использование шаблона Empty box

The screenshot displays the Siemens SIMATIC TIA Portal interface for a project named 'Project\_2'. The main workspace shows a ladder logic diagram with two networks. Network 2 contains a logic element with 'IN' and 'OUT' terminals. A yellow arrow points from the 'Empty box' icon in the 'Network 2' toolbar to the 'IN' terminal. A context menu is open over the logic element, listing various instructions such as 'Instruction', '<NOT>', '<0', '<=0', and '<=0'. The bottom status bar indicates that the project 'Project\_2' was saved successfully.



# Пример построения цепи в LAD. Переход к другим представлениям.

The screenshot displays the Siemens TIA Portal interface. On the left, the 'Project tree' shows the hierarchy: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program\_1 > Block\_1 [FC1]. A yellow callout bubble with the text 'Правой клавишей' (Right-click) points to the 'Block\_1 [FC1]' item. A context menu is open over the diagram, listing various actions such as 'Open', 'Cut', 'Copy', 'Paste', 'Delete', 'Rename', 'Compile', 'Download to device', 'Go online', 'Go offline', 'Generate source from blocks', 'Cross-reference information', 'Cross-references', 'Call structure', 'Assignment list', 'Switch programming language', 'Know-how protection', 'Print...', 'Print preview...', and 'Properties...'. The 'Switch programming language' option is selected, and its sub-menu is visible, showing 'STL', 'LAD', and 'FBD'. The main workspace shows a Ladder Logic (LAD) diagram with a network containing four elements: a normally open contact labeled '%I0.1 "Switch\_START\_range"', a normally open contact labeled '%I0.3 "Feedback\_K1M"', a normally open coil labeled '%Q0.0 "Output\_K1M\_ON"', and a normally open coil labeled '%Q0.1 "Visible\_K1M\_ON"'. The status bar at the bottom indicates 'The programming language of the sele...'. Navigation icons at the bottom of the page include 'Конец раздела' (End of section), 'Программные блоки (FC/FB)' (Program blocks), and 'Страница' (Page).

# Представление цепи в STL

The screenshot displays the Siemens TIA Portal interface for editing a function block (FC1). The main editor shows the following STL code for Network 1:

```

1      AN    "Switch_STOP_range"      %I0.0    Ключ в положении СТОП
2      A      "Breack_Q1"              %I0.2    Блок-контакт автомата
3
4      A(
5      O      "Switch_START_range"     %I0.1    Ключ в положении СТАРТ
6      O      "Feedback_K1M"           %I0.3    Подтверждение контактора
7      )
8      =      "Output_K1M_ON"          %Q0.0    Включение контактора
9      =      "Visible_K1M_ON"         %Q0.1    Сигнализация включения
  
```

The interface also shows a project tree on the left with the following structure:

- Project\_2
  - Add new device
  - Devices & networks
  - PLC\_1 [CPU 314C-2 PN/DP]
    - Device configuration
    - Online & diagnostics
    - Program blocks
      - Add new block
      - Main [OB1]
      - Block\_1 [FC1]
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Online backups
    - Program info
    - PLC alarms

The status bar at the bottom indicates that the project "Project\_2" was saved successfully.

# Представление цепи в FBD

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Diagram description: The FBD shows a logic chain. On the left, three normally open contacts are connected in series to an AND gate (&). The contacts are labeled: "Switch\_START\_range" (address %IO.1), "Feedback\_K1M" (address %IO.3), and "Switch\_STOP\_range" (address %IO.0). The output of the AND gate is connected to two output coils: "Output\_K1M\_ON" (address %Q0.0) and "Visible\_K1M\_ON" (address %Q0.1).

"Switch_STOP_range"	%IO.0	Ключ в положении СТОП
"Break_Q1"	%IO.2	Блок-контакт автомата
"Switch_START_range"	%IO.1	Ключ в положении СТАРТ
"Output_K1M_ON"	%Q0.0	Включение контактора

Reference projects

Details view

Portal view Overview Block\_1 (FC1)

Properties Info Diagnostics

The programming language of the sele...

# Компиляция программного блока

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows the "Block interface" for "Block\_2 [FC2]". The block title is "Block\_2 [FC2]" and the comment is empty. The network configuration for "Network 1" is visible, showing the following variables:

- %I0.0: "Switch\_STOP\_range"
- %I0.2: "Breack\_Q1"
- %I0.1: "Switch\_START\_range"
- %Q0.0: "Output\_K1M\_ON"

The bottom status bar shows the compilation log:

!	Path	Description	Go to	?	Err
✓	PLC_1		↗		0
✓	Program blocks		↗		0
✓	Block_2 (FC2)	Block was successfully compiled.	↗		0
✓		Compiling completed (errors: 0; warnings: 0)	↗		0

The status bar also indicates: "The project Project\_2 was saved succes..."

# Загрузка программного блока в PLC

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_2'. The main workspace shows the 'Block interface' for 'Block\_2 [FC2]' within 'PLC\_1 [CPU 314C-2 PN/DP]'. The 'Messages' window at the bottom shows a sequence of events:

- Project closed.
- Project Project\_2 opened.
- Start downloading to device.
- PLC\_1
- Block\_2 (FC2) was loaded successfully.
- Connected to PLC\_1, address IP=192.168.0.1.
- Connection to PLC\_1 terminated.
- Loading completed (errors: 0; warnings: 0).

# Работа с интерфейсом программного блока. Формальные параметры

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

PLC programming

PLC\_1 [CPU 314C-2 PN/DP]

Program blocks

Block\_2 [FC2]

Interface

	Name	Data type	Offset	Comment
1	Input			
2	<Add new>			
3	Output			
4	<Add new>			
5	InOut			
6	<Add new>			
7	Temp			
8	<Add new>			
9	Return			
10	Block_2	Void		

Annotations:

- Формальные параметры (Formal parameters) - points to Input, Output, InOut
- Входные (Inputs) - points to Input
- Выходные (Outputs) - points to Output
- Выходные, которые могут быть опрошены, как входы (Outputs that can be queried like inputs) - points to InOut
- Область локальных данных (Local data area) - points to Temp

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Block\_1 (FC1)

The project Project\_2 was saved succes...

# Работа с интерфейсом программного блока

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Interface

	Name	Data type	Offset	Comment
1	Input			
2	Switch_START	Bool		Ключ в положении СТАРТ
3	<Add new>	Any		
4	Output	Array [lo .. hi] of type		
5	<Add new>	Block_DB		
6	InOut	Block_FB		
7	<Add new>	Block_FC		
8	Temp	Block_SDB		
9	<Add new>	Bool		
10	Return	Byte		
11	Block_2	C_Alarm_s		

Annotations:

- Дадим переменной ИМЯ (We will give the variable a name) - points to the Name column.
- Дадим комментарий (We will give a comment) - points to the Comment column.
- Определим тип переменной (We will determine the variable type) - points to the Data type column.

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Block\_1 (FC1)

The project Project\_2 was saved succes...

# Работа с интерфейсом программного блока

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Interface

	Name	Offset	Comment
1	Input		
2	Switch_START		Ключ в положении СТАРТ
3	Breach_Q1		Проверка автомата
4	Feedback_K1M		Блок-контакт автомата
5	<Add new>		
6	Output		
7	Output_K1M		Команда включения K1M
8	Visible_work		Индикация включения
9	<Add new>		
10	InOut		
11	<Add new>		
12	Temp		
13	<Add new>		
14	Return		
15	Block_2		

Необходимые формальные параметры заданы

Portal view Overview Block\_2 (FC2) Block\_1 (FC1) Main (OB1) The project Project\_2 was saved succes...

# Использование параметров в качестве переменных

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Devices

PLC programming

Interface

	Name	Offset	Comment
1	Input		
2	Switch_START		Ключ в положении СТАРТ
3	Breack_Q1		Проверка автомата
4	Feedback_K1M		Блок-контакт автомата

Network 1:

Использование формальных параметров в качестве операндов

Reference projects

Details view

Portal view

Overview

Block\_2 (FC2)

Block\_1 (FC1)

Main (OB1)

Properties

Info

Diagnostics

The project Project\_2 was saved succes...

# Вызов программного блока без параметров (FC1)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]**
    - Block\_2 [FC2]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms

Reference projects

Details view

Portal view Overview Block\_2 (FC2) Block\_1 (FC1) Main (OB1)

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Interface

Block title: "Main Program Sweep (Cycle)"

Network 1:

EN ENO

Network 1:

1 CALL "Block\_1" %FC1

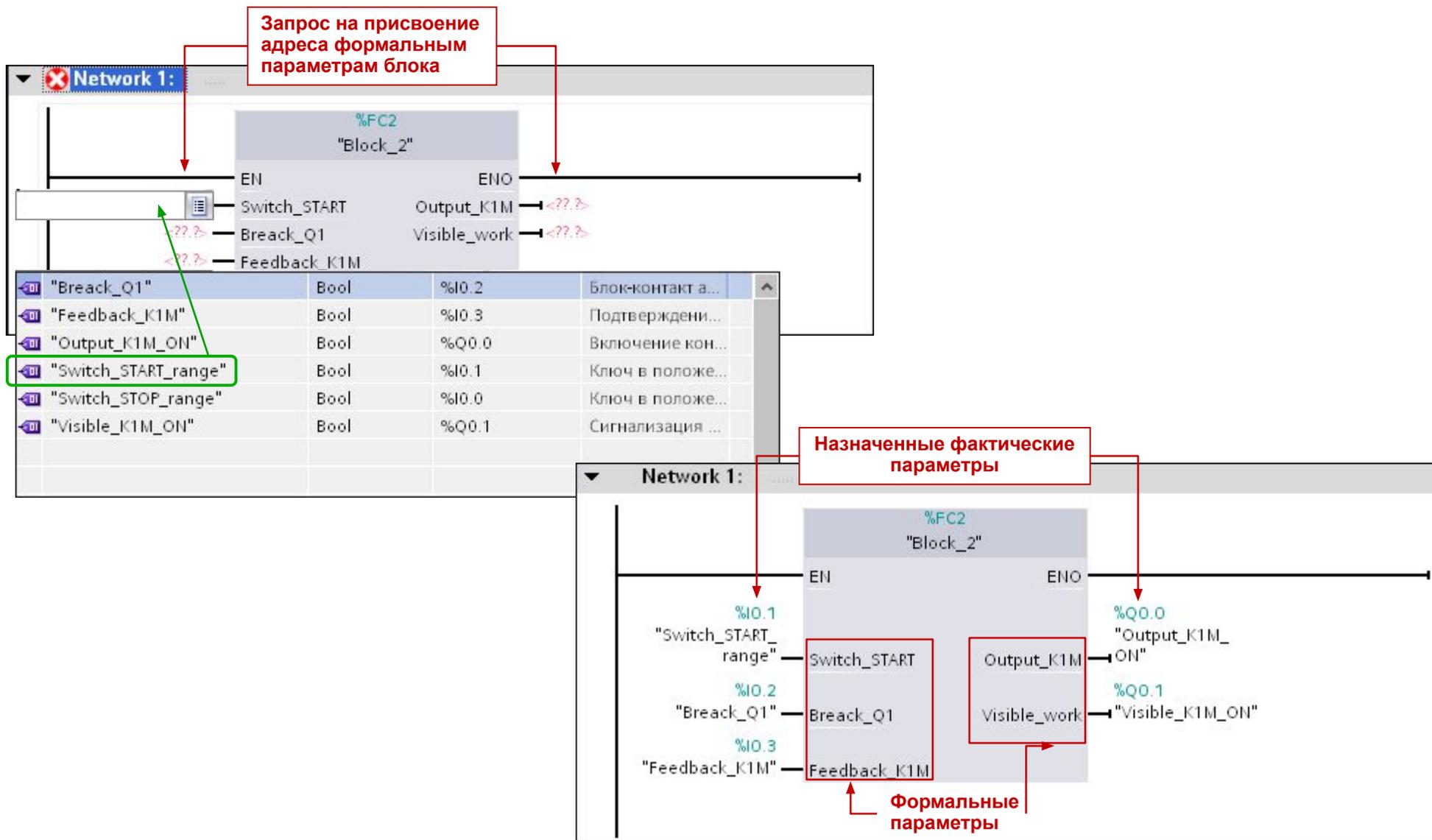
2 NOP 0

Та же цепь в представлении STL

Properties Info Diagnostics

The project Project\_2 was saved succes...

## Вызов программного блока с параметрами (FC2)



# Вызов программного блока с параметрами (FC2)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Save project Go online Go offline

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC tags > Default tag table [12]

Tags User constants System constants

Tasks Libraries

PLC programming

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
- PLC data types
- Watch and force tables
- Online backups
- Program info
- PLC alarms
- Text lists

Дополним таблицу символов переменными для обработки второго механизма

Reference projects

Details view

Portal view Overview Default tag t...

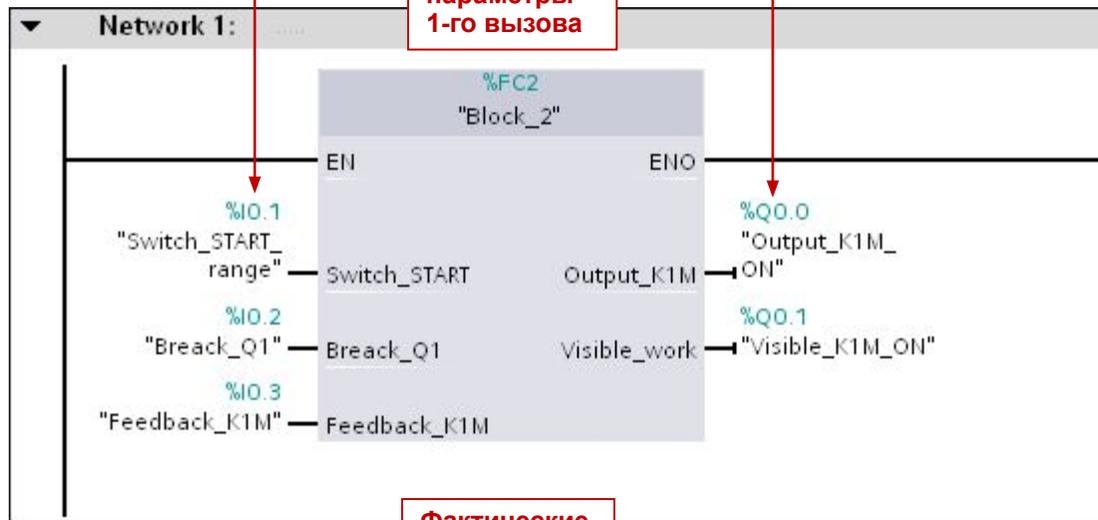
Properties Info Diagnostics

Project Project\_2 opened.

	Name	Address	Retain	Visibl...	Acces...	Comment
1	Switch_STOP_range	%I0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ключ в положении СТОП
2	Switch_START_range	%I0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ключ в положении СТАРТ
3	Breack_Q1	%I0.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Блок-контакт автомата
4	Feedback_K1M	%I0.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Подтверждение контактора
5	Output_K1M_ON	%Q0.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Включение контактора
6	Visible_K1M_ON	%Q0.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Сигнализация включения
7	Switch_STOP_range_1	%I1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ключ в положении СТОП_1
8	Switch_START_range_1	%I1.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ключ в положении СТАРТ_1
9	Breack_Q1_1	%I1.2		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Блок-контакт автомата_1
10	Feedback_K1M_1	%I1.3		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Подтверждение контактора_1
11	Output_K1M_ON_1	%Q1.0		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Включение контактора_1
12	Visible_K1M_ON_1	%Q1.1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Сигнализация включения_1
13	<Add new>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

# Вызов программного блока с параметрами (FC2)

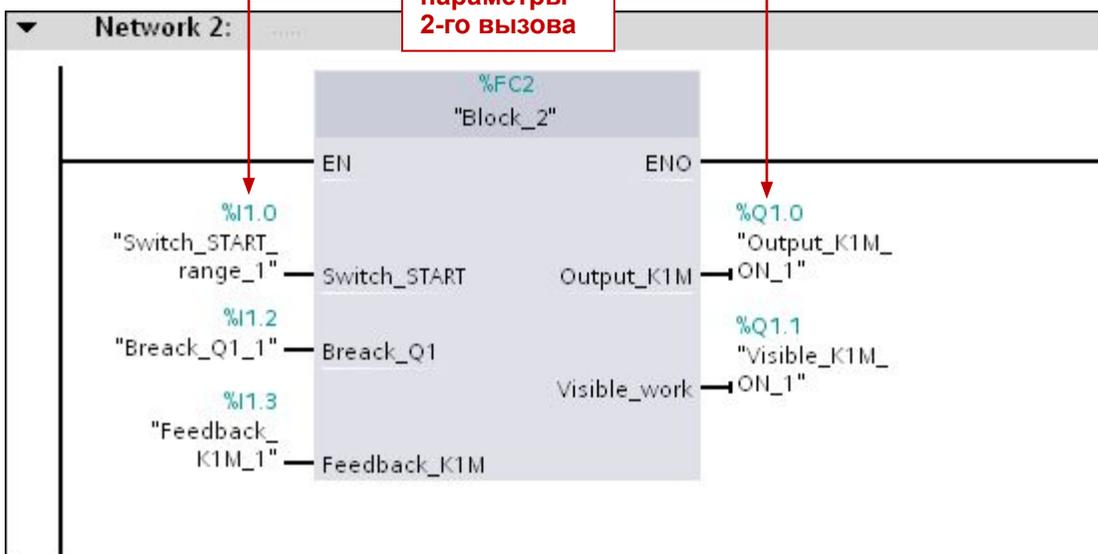
Фактические  
параметры  
1-го вызова



Локальные данные

1	A	"Switch_START_range"	%IO.1
2	=	%L20.0	%L20.0
3	BLD	103	103
4	A	"Breack_Q1"	%IO.2
5	=	%L20.1	%L20.1
6	BLD	103	103
7	A	"Feedback_K1M"	%IO.3
8	=	%L20.2	%L20.2
9	BLD	103	103
10	CALL	"Block_2"	%FC2
11		Switch_START :=%L20.0	%L20.0
12		Breack_Q1 :=%L20.1	%L20.1
13		Feedback_K1M :=%L20.2	%L20.2
14		Output_K1M := "Output_K1M_ON"	%Q0.0
15		Visible_work := "Visible_K1M_ON"	%Q0.1
16		NOP 0	

Фактические  
параметры  
2-го вызова



1	A	"Switch_START_range_1"	%I1.0
2	=	%L20.0	%L20.0
3	BLD	103	103
4	A	"Breack_Q1_1"	%I1.2
5	=	%L20.1	%L20.1
6	BLD	103	103
7	A	"Feedback_K1M_1"	%I1.3
8	=	%L20.2	%L20.2
9	BLD	103	103
10	CALL	"Block_2"	%FC2
11		Switch_START :=%L20.0	%L20.0
12		Breack_Q1 :=%L20.1	%L20.1
13		Feedback_K1M :=%L20.2	%L20.2
14		Output_K1M := "Output_K1M_ON_1"	%Q1.0
15		Visible_work := "Visible_K1M_ON_1"	%Q1.1
16		NOP 0	



# Обновление интерфейса FC

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Interface

	Name	Data type	Offset	Comment
1	Input			
2	Switch_START	Bool		Ключ в положении СТАРТ
3	Break_Q1	Bool		Проверка автомата
4	Feedback_K1M	Bool		Блок-контакт автомата
5	Input_new	Bool		
6	<Add new>			
7	Output			
8	Output_K1M	Bool		Команда включения K1M
9	Visible_work	Bool		Индикация включения
10	InOut			
11	<Add new>			
12	Temp			
13	<Add new>			
14	Return			
15	Block_2	Void		

Введем новый параметр

Portal view Overview Main (OB1) Block\_2 (FC2) The project Project\_2 was saved succes...

# Обновление интерфейса FC в точке вызова

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_2'. The main window shows a ladder logic network with a function block call for 'Block\_2' (FC2). The call is highlighted with a red box, and a yellow speech bubble points to it with the text 'Правой клавишей' (Right-click). A context menu is open over the call, with the 'Update' option highlighted in blue and a yellow arrow pointing to it. Below the function block call, a red error message reads: 'В вызывающем блоке появилась ошибка' (An error has appeared in the calling block). The project tree on the left shows the hierarchy: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]. The bottom status bar shows 'Portal view', 'Overview', 'Main (OB1)', and 'Block\_2 (FC2)'.

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Block title: "Main Program Sw  
Comment

Network 1:

%FC2  
"Block\_2"

EN ENO

%IO.1 "Switch\_START\_range" Switch\_START Output\_K1M

%IO.2 "Break\_Q1" Break\_Q1 Visible\_work

%IO.3 "Feedback\_K1M" Feedback\_K1M

В вызывающем блоке появилась ошибка

Network 2:

Context menu options:

- Open
- Open and monitor
- Define tag... Ctrl+Shift+I
- Rename tag... Ctrl+Shift+T
- Rewire tag... Ctrl+Shift+P
- Cut Ctrl+X
- Copy Ctrl+C
- Paste Ctrl+V
- Delete Del
- Go to
- Cross-reference information Shift+F11
- Create instance...
- Update**
- Insert network Ctrl+R
- Insert STL network
- Insert empty box Shift+F5
- Insert input and output Ctrl+Shift+3
- Insert comment
- Generate ENO
- Do not generate ENO
- Properties Alt+Enter

# Обновление интерфейса FC в точке вызова

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Devices

PLC programming

Old interface:

New interface:

**FC и блок вызова должны быть загружены заново. Лучше в режиме STOP, чтобы избежать ошибок**

OK Cancel

Details view: Properties Info Diagnostics

Portal view Overview Main (OB1) Block\_2 (FC2)

The project Project\_2 was saved succes...



# Обновление интерфейса FC в точке вызова

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_2

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
    - Block\_3 [FB1]
    - Block\_3\_DB [DB1]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables

Reference projects

Details view

Portal view Overview Main (OB1) Block\_2 (FC2)

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Block interface

Block title: "Main Program Sweep (Cycle)"

Comment

Network 1:

Diagram showing the block interface for "Block\_2" (FC2):

- EN (Enable) input
- ENO (Enable Out) output
- Inputs:
  - %IO.1 "Switch\_START\_range" → Switch\_START
  - %IO.2 "Breach\_Q1" → Breach\_Q1
  - %IO.3 "Feedback\_K1M" → Feedback\_K1M
  - <???.?> → Input\_new (highlighted with a red box)
- Outputs:
  - %Q0.0 "Output\_K1M\_ON" → Output\_K1M
  - %Q0.1 "Visible\_K1M\_ON" → Visible\_work

Новому формальному параметру необходимо сопоставить фактический

Properties Info Diagnostics

The project Project\_2 was saved succes...

## Создание программного блока FB

The screenshot displays the Siemens TIA Portal interface. On the left, the 'Project tree' shows a project named 'Project\_2' with a sub-project 'PLC\_1 [CPU 314C-2 PN/DP]'. Under 'Program blocks', the 'Function blocks' folder is selected. The 'Insert' menu is open, and the 'Block...' option is highlighted. The 'Add new block' dialog box is open, showing the following details:

- Name: Block\_3
- Language: LAD
- Number: 1
- Block type:  automatic (selected),  manual
- Description: Function blocks are code blocks that store their values permanently in instance data blocks, so that they remain available after the block has been executed.

The 'Function block' (FB) icon is highlighted with a blue border. The 'OK' button at the bottom right of the dialog is highlighted with a yellow arrow.

# Создание программного блока FB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_3 [FB1]

Block interface

	Name	Data type	Offset	Default value	Setpoint	Comment
1	▼ Input				<input type="checkbox"/>	
2	Switch_START	Bool	...	false	<input type="checkbox"/>	Ключ в положении СТАРТ
3	Breack_Q1	Bool	...	false	<input type="checkbox"/>	Проверка автомата
4	Feedback_K1M	Bool	...	false	<input type="checkbox"/>	Блок-контакт автомата
5	<Add new>				<input type="checkbox"/>	
6	▼ Output				<input type="checkbox"/>	
7	Output_K1M	Bool	...	false	<input type="checkbox"/>	Команда включения K1M
8	Visible_work	Bool	...	false	<input type="checkbox"/>	Индикация включения
9	<Add new>				<input type="checkbox"/>	
10	▼ InOut				<input type="checkbox"/>	
11	<Add new>				<input type="checkbox"/>	
12	▼ Static				<input type="checkbox"/>	
13	Value_1	Int	...	0	<input type="checkbox"/>	Сумма 1
14	Value_2	Int	...	0	<input type="checkbox"/>	Сумма 2
15	Sum	Int	...	0	<input type="checkbox"/>	Сумма
16	<Add new>				<input type="checkbox"/>	

Задать параметры

Задать внутренние переменные

Properties Info Diagnostics

Portal view Overview Block\_3 (FB1) The project Project\_2 was saved succes...

# Создание программного блока FB

PLC programming

Block interface

Block title: .....

Comment

Network 1: .....

Построим ту же цепь, что и в FC2

Network 2: .....

Выберем инструкцию в цепи Network 2

Представление в STL

```

1  L   #Value_1
2  L   #Value_2
3  +I
4  T   #Sum
5  NOP 0

```

#Sum	Int	сумма
#Value_1	Int	Снараемое 1
#Value_2	Int	Снараемое 2

Выберем переменные из области Static в интерфейсе блока. Это внутренние переменные, они не являются формальными параметрами и при вызове блока не определяются.

100%

Extended instructions

Favorites

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
  - ADD
  - SUB
  - MUL
  - DIV
  - MOD
  - NEG
  - ABS
  - MIN
- LN
- EXP
- SIN
- COS
- TAN
- ASIN

Testing

Tasks

Libraries

# Вызов программного блока FB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Block interface

Block title: "Main Program Sweep (Cycle)"

Network 1:

Comment

Запрос на создание IDB

EN

Switch\_START

Breach\_Q1

Feedback\_K1M

%FB1

"Block\_3"

ENO

Output\_K1M

Visible\_work

Network 2:

Comment

100%

Properties Info Diagnostics

Portal view Overview Main (OB1)

The project Project\_2 was saved succes...

При вызове FB система требует создания IDB, но не требует постановки фактических параметров в соответствии формальным, поскольку им в соответствии по умолчанию будут поставлены данные в сгенерированном IDB.

# Вызов программного блока FB

**Call options**

**Data block**

Name:

Number:

Manual

Automatic

The called function block saves its data in its own instance data block.

[More...](#)

**Заявление на создание IDB**

**При необходимости поставим физические адреса в соответствии формальным параметрам блока**

Network 2: ...

Comment

100%

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Вызов программного блока FB, создание IDB

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows a ladder logic network (Network 1) with the following components:

- Block title:** "Main Program Sweep (Cycle)"
- Network 1:**
  - EN (Enable) input connected to %DB1 "Block\_3\_DB".
  - EN (Enable) input connected to %IO.1 "Switch\_START\_range".
  - EN (Enable) input connected to %IO.2 "Breack\_Q1".
  - EN (Enable) input connected to %IO.3 "Feedback\_K1M".
  - Block: %FB1 "Block\_3".
  - ENO (Enable Out) output connected to %Q0.0 "Output\_K1M\_ON".
  - Output: Output\_K1M connected to %Q0.1 "Visible\_K1M\_ON".

Red annotations highlight the following elements:

- Назначенные фактически параметры:** Points to the EN input of the block and the ENO output.
- Формальные параметры:** Points to the EN input of the block.

In the project tree on the left, "Block\_3\_DB [DB1]" is highlighted with a blue box and labeled "Откроем DB1".

# Блок данных IDB, работающий совместно с FB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_3\_DB [DB1]

**Block\_3\_DB**

	Name	Data type	Offset	Start value	Setpoint	Comment
1	Input				<input type="checkbox"/>	
2	Switch_START	Bool	0.0	false	<input type="checkbox"/>	Ключ в положении СТАРТ
3	Break_Q1	Bool	0.1	false	<input type="checkbox"/>	автомата
4	Feedback_K1M	Bool	0.2	false	<input type="checkbox"/>	акт автомата
5	Output				<input type="checkbox"/>	
6	Output_K1M	Bool	2.0	false	<input type="checkbox"/>	включения K1M
7	Visible_work	Bool	2.1	false	<input type="checkbox"/>	Индикация включения
8	InOut				<input type="checkbox"/>	
9	Static				<input type="checkbox"/>	
10	Value_1	Int	4.0	0	<input type="checkbox"/>	Считаемое 1
11	Value_2	Int	6.0	0	<input type="checkbox"/>	Считаемое 2
12	Sum	Int	8.0	0	<input type="checkbox"/>	Сумма

**Формальным параметрам поставлены в соответствие переменные IDB**

**Внутренние переменные**

Portal view | Overview | Main (OB1) | Block\_3\_DB

The project Project\_2 was saved succes...

# IDB может быть также создан из меню создания блоков

**Add new block**

Name: Data\_block\_1

Type: Global DB

Language: Block\_3 [FB1]

Number: SUM\_1 [FB2], SUM\_2 [FB3], CALL\_FB [FB4], User\_data\_type\_1, User\_data\_type\_2, User\_data\_type\_TEMP, Receive\_Conditions, WS\_RULES, FILE\_DB\_HEADER, CNT2\_CHANTYPE

Description: Data blocks (DBs) are used to store data. Select one of the following options:  
 - A global data block (Global DB) to store data for the entire project.  
 - An instance data block (Instance DB) to store data for a specific instance of a block.

Organization block (OB)

Function block (FB)

Function (FC)

Data block (DB)

Additional information

Add new and open

OK Cancel

# Обновление интерфейса FB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_3 [FB1]

Interface

	Name	Data type	Offset	Default value	Setpoint	Comment
2	Switch_START	Bool	...	false	<input type="checkbox"/>	Ключ в положении
3	Breack_Q1	Bool	...	false	<input type="checkbox"/>	Проверка автомата
4	Feedback_K1M	Bool	...	false	<input type="checkbox"/>	Блок-контакт автом
5	Input_new	Bool	...	false	<input type="checkbox"/>	
6	<Add new>				<input type="checkbox"/>	
7	Output				<input type="checkbox"/>	
8	Output_K1M	Bool	...	false	<input type="checkbox"/>	Команда включени
9	Visible_work	Bool	...	false	<input type="checkbox"/>	Индикация включе
10	InOut				<input type="checkbox"/>	
11	<Add new>				<input type="checkbox"/>	
12	Static				<input type="checkbox"/>	
13	Value_1	Int	...	0	<input type="checkbox"/>	Слагаемое 1
14	Value_2	Int	...	0	<input type="checkbox"/>	Слагаемое 2
15	Sum	Int	...	0	<input type="checkbox"/>	сумма
16	Value_new	Int	...	0	<input type="checkbox"/>	
17	<Add new>				<input type="checkbox"/>	

Введем новые переменные

Portal view Overview Main (OB1) Block\_3\_DB Block\_3 (FB1) The project Project\_2 was saved succes...

# Обновление интерфейса FB в точке вызова

The screenshot displays the Siemens TIA Portal interface. The main window shows a ladder logic network with a function block call for "Block\_3" (FB1). The context menu is open over the block call, and the "Update" option is highlighted with a yellow arrow. A yellow speech bubble points to the "Update" option with the text "Правой клавишей".

**Project tree (left):**

- Devices
  - Add new device
  - Devices & networks
  - PLC\_1 [CPU 314C-2 PN/DP]
    - Device configuration
    - Online & diagnostics
    - Program blocks
      - Add new block
      - Main [OB1]
      - Block\_1 [FC1]
      - Block\_2 [FC2]
      - Block\_3 [FB1]
      - Block\_3\_DB [DB1]
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Online backups

**Main window (center):**

Block title: "Main Program Sweep (Cycle)"

Network 1:

- Inputs: %IO.1 "Switch\_START\_range", %IO.2 "Breack\_Q1", %IO.3 "Feedback\_K1M"
- Block: "Block\_3" (%FB1)
- Outputs: Output\_K1M, Visible\_work

Context menu options:

- Open
- Open and monitor
- Define tag... (Ctrl+Shift+I)
- Rename tag... (Ctrl+Shift+T)
- Rewire tag... (Ctrl+Shift+P)
- Cut (Ctrl+X)
- Copy (Ctrl+C)
- Paste (Ctrl+V)
- Delete (Del)
- Go to
- Cross-reference information (Shift+F11)
- Create instance...
- Update** (highlighted)
- Insert network (Ctrl+R)
- Insert STL network
- Insert empty box (Shift+F5)
- Insert input and output (Ctrl+Shift+3)
- Insert comment
- Generate ENO
- Do not generate ENO
- Properties (Alt+Enter)

# Обновление интерфейса FB в точке вызова

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PMDP] > Program blocks > Main [OB1]

Old interface:

New interface:

**FB и блок вызова должны быть загружены заново. Лучше в режиме STOP, чтобы избежать ошибок**

100%

Properties Info Diagnostics

Portal view Overview Main (OB1) Block\_3\_DB

The project Project\_2 was saved succes...

# Обновление IDB, работающего с FB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

Block in

Block\_3\_DB

Network 1:

IDB должен быть загружен заново.  
Лучше в режиме STOP, чтобы избежать ошибок

Name	Data type	Offset
Input		
Switch_START	Bool	0.0
Breack_Q1	Bool	0.1
Feedback_K1M	Bool	0.2
Input_new	Bool	0.3
Output		
Output_K1M	Bool	2.0
Visible_work	Bool	2.1
InOut		
Static		
Value_1	Int	4.0
Value_2	Int	6.0
Sum	Int	8.0
Value_new	Int	10.0

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Использование FB с экземплярным IDB в каждом вызове

Block interface

**Block title:** "Main Program Sweep (Cycle)"

Comment

**Network 1:** .....

**Network 2:** .....

**Network 3:** .....

**Data block**

Name  FB1\_IDB1

Number 1

Manual

Automatic

The called function block saves its data in its own instance data block.

[More...](#)

Single instance

Multi instance

**"FB1\_IDB1"**

**"FB1\_IDB2"**

**В каждой точке вызова FB1 используется свой IDBn**

EN ENO

"Switch\_START\_range" Switch\_START "Output\_K1M\_ ON"

"Breack\_Q1" Breack\_Q1 Visible\_work "Visible\_K1M\_ON"

"Feedback\_K1M" Feedback\_K1M

EN ENO

"Switch\_START\_range\_1" Switch\_START "Output\_K1M\_ ON\_1"

"Breack\_Q1\_1" Breack\_Q1 Visible\_work "Visible\_K1M\_ ON\_1"

"Feedback\_K1M\_1" Feedback\_K1M

100%

# Мультиэкземплярная модель вызова FB

Создадим блоки FB2 и FB3, определим в них внутренние переменные для операции, например, сложения двух чисел

PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ SUM\_1 [FB2]

Interface					
	Name	Data type	Offset	Default value	Comment
1	▶ Input				
2	▶ Output				
3	▶ InOut				
4	▼ Static				
5	ADD_1_FB2	Int	0.0	0	Слагаемое_1_FB2
6	ADD_2_FB2	Int	2.0	0	Слагаемое_2_FB2
7	SUM_FB2	Int	4.0	0	Сумма_FB2
8	▼ Temp				

Block title: .....

Comment

Network 1: .....

▼ #ADD_1_FB2	Слагаемое_1_FB2
#ADD_2_FB2	Слагаемое_2_FB2
#SUM_FB2	Сумма_FB2

PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ SUM\_2 [FB3]

Interface					
	Name	Data type	Offset	Default value	Comment
1	▶ Input				
2	▶ Output				
3	▶ InOut				
4	▼ Static				
5	ADD_1_FB3	Int	0.0	0	Слагаемое_1_FB3
6	ADD_2_FB3	Int	2.0	0	Слагаемое_2_FB3
7	SUM_FB3	Int	4.0	0	Сумма_FB3
8	▶ Temp				

Block title: .....

Comment

Network 1: .....

▼ #ADD_1_FB3	Слагаемое_1_FB3
#ADD_2_FB3	Слагаемое_2_FB3
#SUM_FB3	Сумма_FB3

# Мультиэкземплярная модель вызова FB

**Project tree**

Devices

Project\_2

PLC\_1 [CPU 314C-2 PN/DP]

Program blocks

System blocks

Technology objects

External source files

PLC tags

PLC data types

Watch and force tables

Online backups

Local modules

Distributed I/O

HMI\_1 [TP 1500 Basic color PN]

Common data

Documentation settings

Languages & resources

Online access

Card Reader/USB memory

Reference projects

Details view

Portal view

Overview

Name: Block\_4

Language: LAD

Number: 4

manual

automatic

Organization block

Function block

Function

Data block

more...

Additional information

Add new and open

OK Cancel

проект проект\_2 открыт

**Создадим FB4, из которого будут вызваны FB2 и FB3**

Description:  
Function blocks are code blocks that store their values permanently in instance data blocks, so that they remain available after the block has been executed.

# Мультиэкземплярная модель вызова FB

Project\_2

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/...
- Device configuration
- Online & diagnostics
- Program blocks
  - Add new block
  - Main [OB1]
  - Block\_1 [FC1]
  - Block\_2 [FC2]
  - Block\_10 [FC10]
  - Block\_3 [FB1]
  - Block\_4 [FB4]
  - SUM\_1 [FB2]**
  - SUM\_2 [FB3]**
  - Data\_block\_1 [DB8]
  - Data\_block\_2 [DB6]
  - Data\_block\_3 [DB9]
  - Data\_block\_4 [D...]
  - Data\_block\_5 [D...]
  - Data\_block\_6 [D...]
  - FB1\_IDB1 [DB1]
  - FB1\_IDB2 [DB2]
  - Global\_DB1 [DB4]
  - Recipe\_1 [DB5]
  - Recipe\_2 [DB7]
- System blocks
- Technology objects
- External source files

Interface			
	Name	Data type	Offset
1	Input		
2	Output		
3	InOut		
4	Static		
5	Temp		

Block title: **Block\_4 [FB4]**

Comment

Network 1:

<No tags used>

Network 2:

**Аналогично произведем вызов FB3**

<No tags used>

Interface						
	Name	Data type	Offset	Default value	Visible in HMI	Setpoint
1	Input				<input type="checkbox"/>	<input type="checkbox"/>
2	Output				<input type="checkbox"/>	<input type="checkbox"/>
3	InOut				<input type="checkbox"/>	<input type="checkbox"/>
4	Static				<input type="checkbox"/>	<input type="checkbox"/>
5	Temp				<input type="checkbox"/>	<input type="checkbox"/>

Block title: ...

Comment

Network 1:

???

%FB2 "SUM\_1"

EN ENO

**Запрос на создание IDB в точке вызова**

**Multiple instance**

Name in the interface: **SUM\_1\_Instance**

The called function block saves its data in the instance data block of the calling function block and not in its own instance data block. This allows you to concentrate the instance data in a single block and to get by with fewer instance data blocks in your program.

**Создается не самостоятельный IDB, а область в интерфейсе вызывающего блока**

Single instance

Multi instance



# Мультиэкземплярная модель вызова FB

Interface							
	Name	Data type	Offset	Default value	Visible in HMI	Setpoint	Comment
1	▶ Input				<input type="checkbox"/>	<input type="checkbox"/>	
2	▶ Output				<input type="checkbox"/>	<input type="checkbox"/>	
3	▶ InOut				<input type="checkbox"/>	<input type="checkbox"/>	
4	▼ Static				<input type="checkbox"/>	<input type="checkbox"/>	
5	▶ SUM_1_Instance	"SUM_1"	...		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	▶ SUM_2_Instance	"SUM_2"	...		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7	▶ Temp				<input type="checkbox"/>	<input type="checkbox"/>	

**В интерфейсе блока FB4 система сконфигурировала области для данных FB2 и FB3**

**Block title:** Block\_4 [FB4]

**Network 1:**

```

#SUM_1_Instance
  %FB2
  "SUM_1"
EN  ENO
  
```

▶ "SUM\_1"      %FB2

**Network 2:**

```

#SUM_2_Instance
  %FB3
  "SUM_2"
EN  ENO
  
```

▶ "SUM\_2"      %FB3



# Интерфейс вызывающего блока FB4

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_4 [FB4]

Interface

	Name	Data type	Offset	Default value	Visible in HMI	Setpoint	Comment
1	▶ Input				<input type="checkbox"/>	<input type="checkbox"/>	
2	▶ Output				<input type="checkbox"/>	<input type="checkbox"/>	
3	▶ InOut				<input type="checkbox"/>	<input type="checkbox"/>	
4	▼ Static				<input type="checkbox"/>	<input type="checkbox"/>	
5	▼ SUM_1_Instance	"SUM_1" ...			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	Input				<input type="checkbox"/>	<input type="checkbox"/>	
7	Output				<input type="checkbox"/>	<input type="checkbox"/>	
8	InOut				<input type="checkbox"/>	<input type="checkbox"/>	
9	▼ Static				<input type="checkbox"/>	<input type="checkbox"/>	
10	ADD_1_FB2	Int	...	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Слагаемое_1_FB2
11	ADD_2_FB2	Int	...	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Слагаемое_2_FB2
12	SUM_FB2	Int	...	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Сумма_FB2
13	▼ SUM_2_Instance	"SUM_2" ...			<input checked="" type="checkbox"/>	<input type="checkbox"/>	
14	Input				<input type="checkbox"/>	<input type="checkbox"/>	
15	Output				<input type="checkbox"/>	<input type="checkbox"/>	
16	InOut				<input type="checkbox"/>	<input type="checkbox"/>	
17	▼ Static				<input type="checkbox"/>	<input type="checkbox"/>	
18	ADD_1_FB3	Int	...	0	<input type="checkbox"/>	<input type="checkbox"/>	Слагаемое_1_FB3
19	ADD_2_FB3	Int	...	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Слагаемое_2_FB3
20	SUM_FB3	Int	...	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Сумма_FB3
21	▶ Temp				<input type="checkbox"/>	<input type="checkbox"/>	

Область, выделенная для данных FB2 (SUM\_1)

Область, выделенная для данных FB3 (SUM\_2)



# Вызов блока FB4 из OB1 с созданием мультиэкземплярного IDB

The screenshot displays the Siemens TIA Portal interface for configuring a function block call. The main window shows a ladder logic network with a call to block "Block\_4" (FB4). A "Call options" dialog box is open, showing the configuration for the data block:

- Data block:**
  - Name: Block\_4\_DB
  - Number: 3
  - Options:  Manual,  Automatic

The "Automatic" option is selected, indicating that the called function block will save its data in its own instance data block. The "OK" button is highlighted with a yellow arrow.

## Мультиэкземплярный IDB, содержащий области данных FB2 и FB3

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > CALL\_FB\_DB [DB3]

Devices

- Add new block
- Main [OB1]
- Block\_1 [FC1]
- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- CALL\_FB\_DB [DB3]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Program info

CALL\_FB\_DB

	Name	Data type	Offset	Start value	Setpoint	Comment
5	▼ SUM_1_Instance	"SUM_1"	0.0			
6	Input					
7	Output					
8	InOut					
9	▼ Static					
10	ADD_1_FB2	Int	0.0	0		Слагаемое_1_FB2
11	ADD_2_FB2	Int	2.0	0		Слагаемое_2_FB2
12	SUM_FB2	Int	4.0	0		Сумма_FB2
13	▼ SUM_2_Instance	"SUM_2"	6.0			
14	Input					
15	Output					
16	InOut					
17	▼ Static					
18	ADD_1_FB3	Int	0.0	0		Слагаемое_1_FB3
19	ADD_2_FB3	Int	2.0	0		Слагаемое_2_FB3
20	SUM_FB3	Int	4.0	0		Сумма_FB3

Область, выделенная для хранения данных FB2 (SUM\_1)

Область, выделенная для хранения данных FB3 (SUM\_2)

Reference projects

Details view

Portal view Overview Main (OB1) CALL\_FB\_DB

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Стек локальных данных. Область TEMP в интерфейсе блока

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface:

Network 1: "Switch\_STOP\_range" (NO) - "%IO.2" "Breack\_Q1" (NC) - "Switch\_START\_range" (NO) - "Output\_K1M\_ON" (NO) - "%L0.0" (NO) - "Feedback\_K1M" (NC) - "Output\_K1M\_ON" (NO) - "%L0.0" (NO)

Network 2: "%L0.0" (NO) - "%Q1.1" "Visible\_K1M\_ON\_1" (NO)

Reference projects: Details view

Portal view: Overview Block\_1 (FC1)

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Стек локальных данных. Область TEMP в интерфейсе блока

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Interface

	Name	Data type	Offset	Comment
7	Temp			
8	Visible	Bool	...	
9	<Add new>			

Network 1:

Reference projects

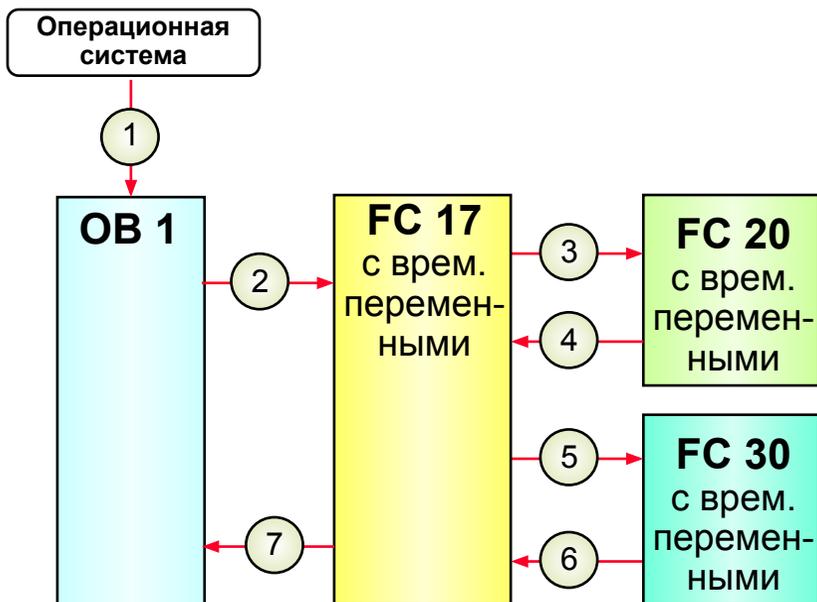
Details view

Portal view Overview Block\_1 (FC1)

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Стек локальных данных. Распределение памяти

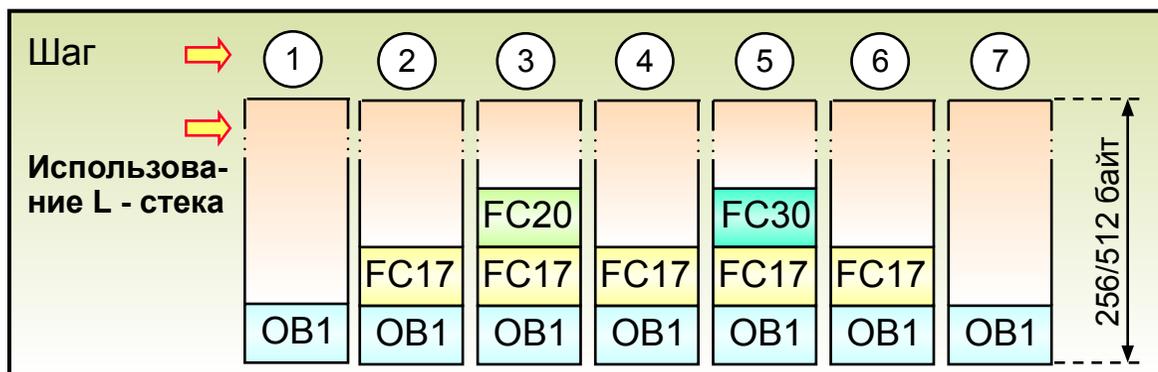


...\_L > Mig\_Chap13\_OB [Unspecific CPU S7 300] > Mig\_Chap13\_OB

Call structure    Dependency structure    Assignment list

Call structure of Mig\_Chap13\_OB

Call structure	! Address	...	Local data (in path)	Local data (for blocks)
1	OB_Cycle	OB1	22	22
2	FC_ConvMotor	FC16	...	22
3	FC_Count_Add	FC19	...	22
4	FC_Fault	FC17	...	28
5	DB_OP	DB99	...	28
6	FB_Fault...	FB20, DB2	...	28
7	FB_Fault...	FB20, DB3	...	28
8	FC_FaultEval...	FC20	...	28



# Объединение блоков пользователя в группы

The image illustrates the process of grouping user blocks in the SIMATIC TIA-portal Project tree through three sequential screenshots:

- Initial State:** The 'Program blocks' folder is selected, and a context menu is open, showing options like 'Open', 'Add group', 'Cut', 'Copy', and 'Paste'.
- Group Creation:** A new folder named 'Group\_1' is created within the 'Program blocks' folder. A yellow box highlights this folder with the text: **Вставка блоков в новую папку перетаскиванием мышкой** (Inserting blocks into a new folder by dragging with the mouse).
- Block Migration:** The blocks from 'Group\_1' are moved into a new folder named 'Machine\_1'.



## Конец раздела 3. Окно навигации

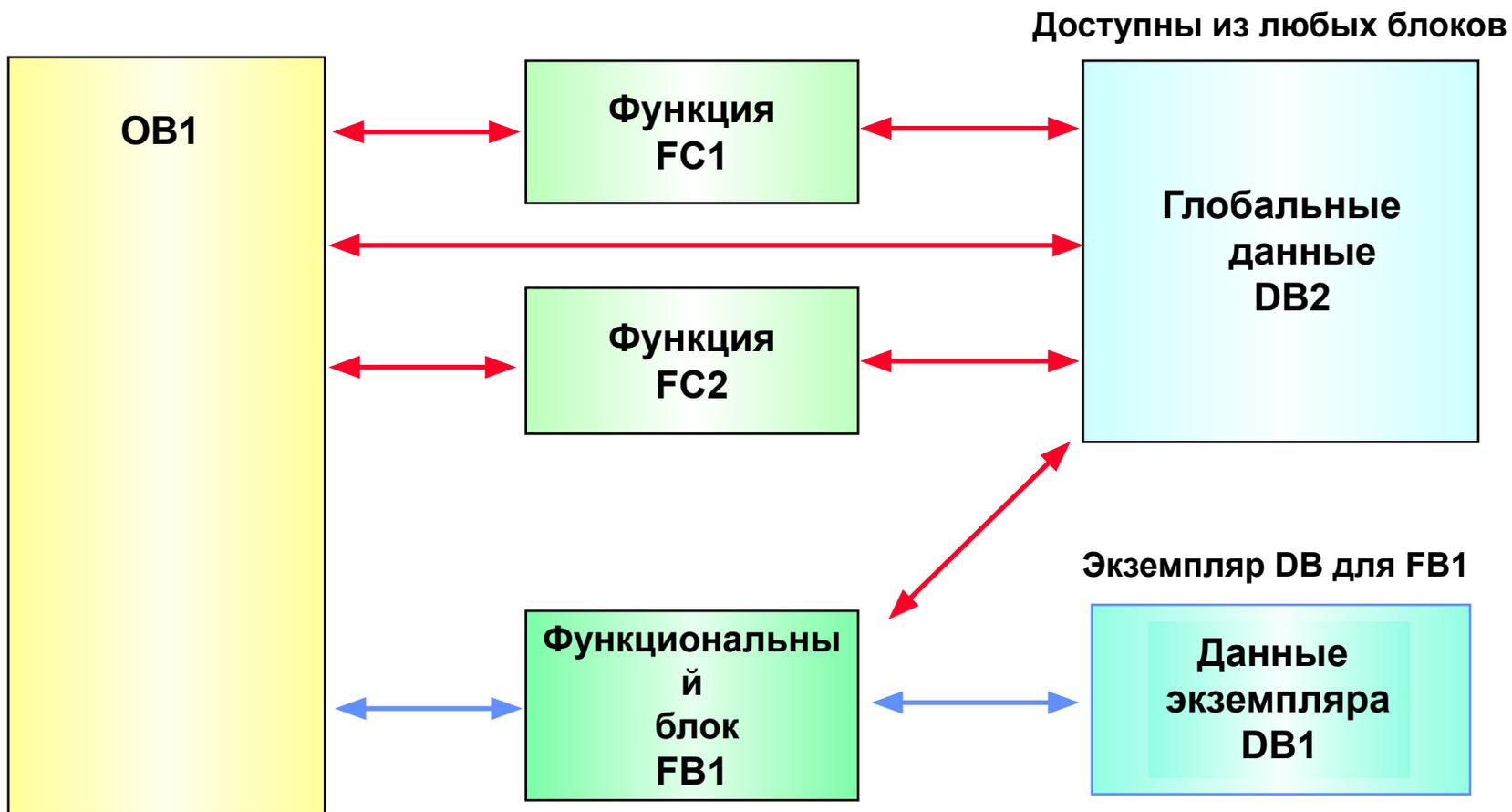
- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 4

## Блоки данных. Типы и назначение.



## Блоки данных (DB)



## Элементарные типы данных

Обозначение		Длина (биты)	Пример константы данного типа
BOOL	1	1 или 0	
BYTE	8	B#16#A9	
WORD	16	W#16#12AF	
DWORD	32	DW#16#ADAC1EF5	
CHAR	8	'w'	
S5TIME	16	S5T#5s_200ms	
INT	16	34789 (-34789)	
DINT	32	109765	
REAL	32	1245.098	
TIME	32	T#2D_1H_3M_45S_12MS	
DATE	16	D#1993-01-20	
TIME_OF_DAY	32	TOD#12:23:45.12	



## Сложные типы данных

Ключевое слово	Длина (биты)	Пример
<b>DATE_AND_TIME</b>	64	DT#97-09-24-12:14:55.0
<b>STRING</b> (строка символов макс. 254 символа)	8 * (число символов +2)	'This is a string'  'SIEMENS'
<b>ARRAY</b> (Группа элементов одного типа)	определяется пользователем	Measured values: ARRAY[1..20]  INT
<b>STRUCT</b> (Группа элементов различных типов)	определяется пользователем	Motor: STRUCT Speed : INT Current: REAL END_STRUCT
<b>UDT</b> ( <b>U</b> ser <b>D</b> efined <b>D</b> ata <b>T</b> ype = пользовательский тип данных "Шаблон")	UDT как блок определяется пользователем	UDT - элемент определяется пользователем STRUCT Speed : INT UDT1 Drive: ARRAY[1..4] Current: REAL END_STRUCT



## Создание глобального DB

**Project tree**

- Devices
  - PLC
    - Program blocks** (Правой клавишей)
    - Technology objects
    - External sources
    - PLC tags
    - PLC data types
    - Watch and force
    - Online backups
    - Local modules
    - Distributed I/O
    - Common data
    - Documentation set
    - Languages & resources
    - Online access
    - Card Reader/USB memory
  - Reference projects
  - Details view
  - Portal view

**Add new block**

Name: Global\_DB1

Type: Global DB

Language: Global DB

Number:

Description: Data blocks (DBs) are used to store data that is shared between programs. Select one of the following options:
 

- A global data block (DB) to store data that is shared between all programs in the project.
- An instance data block (IDB) to store data that is shared between all instances of a program.

Additional information

Add new and open

OK Cancel

## Создание глобального DB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB1 [DB4]

Devices

Devices & networks

PLC\_1 [CPU 314C-2 PN/DP]

Device configuration

Online & diagnostics

Program blocks

Add new block

Main [OB1]

Block\_1 [FC1]

Block\_2 [FC2]

Block\_3 [FB1]

CALL\_FB [FB4]

SUM\_1 [FB2]

SUM\_2 [FB3]

CALL\_FB\_DB [DB3]

FB1\_IDB1 [DB1]

FB1\_IDB2 [DB2]

Global\_DB1 [DB4]

Technology objects

Reference projects

Details view

Portal view Overview Global\_DB1

The project Project\_2 was saved succes...

Global\_DB1

Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint
1	Static			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<Add new>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Array [lo .. hi] of type

Bool

Byte

Char

Dint

DWord

Date

Date\_And\_Time

Int

Real

SSTime

String

Struct

Time

Time\_Of\_Day

Word

"User\_data\_type\_1"

## Создание глобального DB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB1 [DB4]

Devices

Devices & networks

PLC\_1 [CPU 314C-2 PN/DP]

Device configuration

Online & diagnostics

Program blocks

Add new block

Main [OB1]

Block\_1 [FC1]

Block\_2 [FC2]

Block\_3 [FB1]

CALL\_FB [FB4]

SUM\_1 [FB2]

SUM\_2 [FB3]

CALL\_FB\_DB [DB3]

FB1\_IDB1 [DB1]

FB1\_IDB2 [DB2]

Global\_DB1 [DB4]

Technology objects

Reference projects

Details view

Portal view Overview Global\_DB1

Properties Info Diagnostics

The project Project\_2 was saved succes...

Global\_DB1

	Name	Data type	Offset	Start value	Retain	Visible in HMI	Setpoint	Comment
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Bit_1	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Bit_2	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Bit_3	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	Bit_4	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	Bit_5	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7	Bit_6	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8	Bit_7	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9	Word_1	Word	...	16#0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
10	Int_1	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
11	Dword_1	DWord	...	16#0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12	Dint_1	DInt	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
13	Real_1	Real	...	0.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
14	Timer_1	S5Time	...	S5T#0ms	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
15	<Add new>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## Создание массива в DB

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB3 [DB9]

Global\_DB3

Name	Data type	Offset	Start value	Retain	Visible in ...	Setup
1 Static				<input type="checkbox"/>	<input type="checkbox"/>	
2 Static_1	Array [0..1] of Bool			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3 <Add new>				<input type="checkbox"/>	<input type="checkbox"/>	

Data type: Bool

Array limits: Bool, Byte, Char, Dint, DWord, Date, Date\_And\_Time, Int

Properties Info Diagnostics

Portal view Overview Global\_DB3

The project Project\_3 was saved succes...

## Создание массива в DB

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB3 [DB9]

Devices

PLC programming

Program blocks

- Add new block
- Main [OB1]
- Block\_1 [FC1]
- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- Block\_recipe [DB6]
- CALL\_FB\_DB [DB3]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Global\_DB1 [DB4]
- Global\_DB2 [DB8]
- Global\_DB3 [DB9]
- Recipe\_1 [DB5]
- Recipe\_2 [DB7]

Global\_DB3

Name	Data type	Offset	Start value	Retain	Visible in ...	Setp
1	Static			<input type="checkbox"/>	<input type="checkbox"/>	
2	Static_1			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	<Add new>			<input type="checkbox"/>	<input type="checkbox"/>	

Array [0..10] of Int

Data type: Int

Array limits: 0..10

Examples: 0..99 or 0..99,0..10

Properties Info Diagnostics

Portal view Overview Global\_DB3

The project Project\_3 was saved succes...

## Создание массива в DB

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB3 [DB9]

Devices

Program blocks

- Add new block
- Main [OB1]
- Block\_1 [FC1]
- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- Block\_recipe [DB6]
- CALL\_FB\_DB [DB3]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Global\_DB1 [DB4]
- Global\_DB2 [DB8]
- Global\_DB3 [DB9]
- Recipe\_1 [DB5]
- Recipe\_2 [DB7]

Global\_DB3

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setup
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	
2	Static_1	Array [0..10] of Int	...		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Static_1[0]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	Static_1[1]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
5	Static_1[2]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
6	Static_1[3]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
7	Static_1[4]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
8	Static_1[5]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
9	Static_1[6]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
10	Static_1[7]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
11	Static_1[8]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
12	Static_1[9]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
13	Static_1[10]	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
14	<Add new>				<input type="checkbox"/>	<input type="checkbox"/>	

Массив данных одного типа

Reference projects

Details view

Portal view Overview Global\_DB3

Properties Info Diagnostics

The project Project\_3 was saved succes...

# Создание структуры в DB

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Global\_DB3 [DB9]

Global\_DB3

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setup
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	
2	Static_1	Array [0..10] of Int	...		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3	Motor_1	Struct	...		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	Input_Start	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
5	Input_Stop	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
6	Output	Bool	...	false	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
7	Meass_themp	Int	...	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
8	Meass_speed	Real	...	0.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Область данных разных типов

Reference projects

Details view

Portal view Overview Global\_DB3

The project Project\_3 was saved succes...

# Общий вид и мониторинг данных в DB

My\_Project > S7-CPU [CPU 315-2 PN/DP] > Program blocks > DB\_Weights [DB35]

**Вставка нового тега**

**Сброс начальных значений**

**Мониторинг ВКЛ / ВЫКЛ**

**Скрыть/показать колонки**

**Мгновенный снимок данных**

**Фактическое значение в CPU**

**Структуры и массивы можно сворачивать**

**Абсолютный адрес переменной в структуре DB**

**Сохраняемость:**  
 В ПЛК S7-300/400 устанавливается для всего блока DB  
 В ПЛК S7-1200 устанавливается для каждой переменной

**Тег виден при выборе со стороны WinCC**

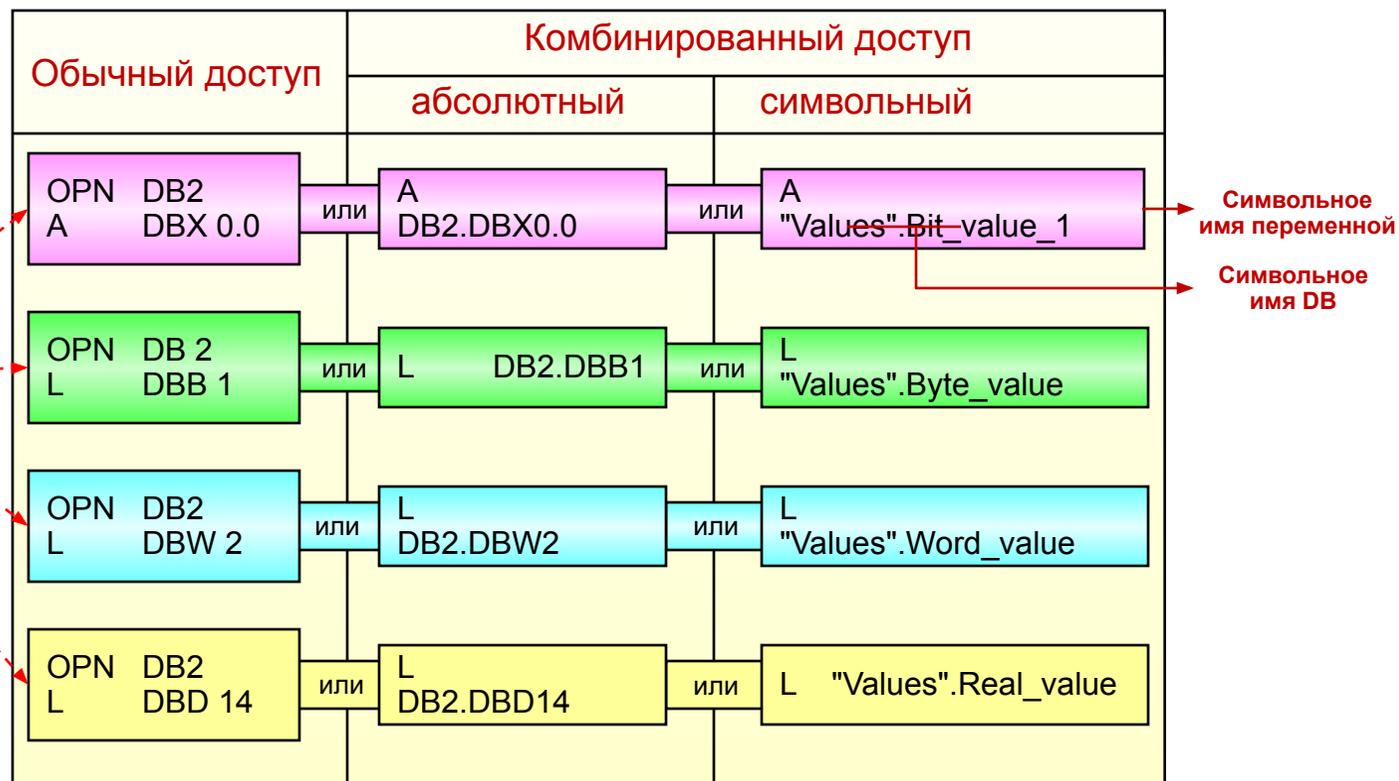
**Show/hide columns**

- Offset
- Default value
- Start value
- Snapshot
- Monitor value
- Retain
- Visible in HMI
- Accessible from HMI
- Comment

	Name	Data type	Offset	Default value	Start value	Snapshot	Monitor value	Retain	Visible in HMI
1	Static								
2	Weight_Store1	"UDT_Weight_Store"	0.0					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Weight_Store2	"UDT_Weight_Store"	24.0					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Weight_Store	Struct	0.0					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	Max_no	Int	0.0	10	10	—	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
6	Act_no	Int	2.0	0			2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
7	Weight	Array [1..10] of Int	4.0					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8	Weight[1]	Int		0	0	—	296	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9	Weight[2]	Int		0	0	—	353	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
10	Weight[3]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
11	Weight[4]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
12	Weight[5]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
13	Weight[6]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
14	Weight[7]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
15	Weight[8]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
16	Weight[9]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
17	Weight[10]	Int		0	0	—	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
18	Weight_Store3	"UDT_Weight_Store"	48.0					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

# Доступ к элементам данных в DB

	Name	Data type
1	Static	
2	Bit_value_1	Bool
3	Byte_value_1	Byte
4	Word_value	Word
5	Int_value	Int
6	DWord_value	DWord
7	DInt_value	DInt
8	Real_value	Real



# Создание таблицы данных пользователя (UDT-1)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_2

- PLC\_1 [CPU 314C-2 PN/DP]
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Local modules
  - Distributed I/O
- Common data
- Documentation settings
- Languages & resources
- Online access
- Card Reader/USB memory

Reference projects

Details view

Portal view Overview

PLC\_1 [CPU 314C-2 PN/DP] > PLC data types

Details List Thumbnails

Name	Modified	Remark	Title
Add new data type			
User_data_type_1	5/29/2014 12:2...		

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Заполнение таблицы данных пользователя UDT-1

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC data types > User\_data\_type\_1

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
    - Add new data type
    - User\_data\_type\_1
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules

- Reference projects
- Details view

PLC programming

Tasks

Libraries

User\_data\_type\_1

	Name	Data type	Default value	Visible in ...	Setpoint	Comment
1	Recipe_1_comp_1	Real	10.0	<input type="checkbox"/>	<input type="checkbox"/>	

Properties Info Diagnostics

Portal view Overview User\_data\_ty...

The project Project\_2 was saved succes...

# Заполнение таблицы данных пользователя UDT-1

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC data types > User\_data\_type\_1

Devices

PLC programming

Tasks

Libraries

User\_data\_type\_1

	Name	Data type	Default value	Visible in ...	Setpoint	Comment
1	Recipe_1_comp_1	Real	10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Recipe_1_comp_2	Real	20.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Recipe_1_comp_3	Real	30.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Recipe_1_comp_4	Real	40.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	Recipe_1_comp_5	Real	50.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Reference projects

Details view

Portal view

Overview

Block\_rec...

User\_dat...

User\_dat...

User\_dat...

Properties

Info

Diagnostics

The project Project\_2 was saved succes...



## Создание таблицы данных пользователя (UDT-2)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC data types

Devices

Project\_2

- PLC\_1 [CPU 314C-2 PN/DP]
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Local modules
  - Distributed I/O
- Common data
- Documentation settings
- Languages & resources
- Online access
- Card Reader/USB memory

Reference projects

Details view

Portal view Overview

Name	Modified	Remark	Title
Add new data type			
User_data_type_1	5/29/2014 12:42 PM		
User_data_type_2	9/4/2014 7:19 PM		

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Заполнение таблицы данных пользователя UDT-2

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > PLC data types > User\_data\_type\_2

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
    - Add new data type
    - User\_data\_type\_1
    - User\_data\_type\_2
    - User\_data\_type\_3
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms

Reference projects

Details view

User\_data\_type\_2

	Name	Data type	Default value	Visible in ...	Setpoint	Comment
1	Recipe_2_comp_1	Real	15.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Recipe_2_comp_2	Real	25.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Recipe_2_comp_3	Real	35.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Recipe_2_comp_4	Real	45.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	Recipe_2_comp_5	Real	55.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Properties Info Diagnostics

Portal view Overview User\_data\_ty... User\_data\_ty...

The project Project\_2 was saved succes...

# Использование таблицы UDT как шаблона данных в DB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_recipe [DB6]

Devices:

- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- Block\_recipe [DB6]
- Global\_DB1 [DB4]
- Recipe\_1 [DB5]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Program info

Block\_recipe

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<Add new>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Static

- 55Time
- String
- Struct
- Time
- Time\_Of\_Day
- Word
- "User\_data\_type\_1"
- "User\_data\_type\_2"

Создадим глобальный DB6, в котором в качестве структур используем таблицы UDT

Properties Info Diagnostics

Portal view Overview Block\_recipe

The project Project\_2 was saved succes...

# Использование таблицы UDT как шаблона данных в DB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_recipe [DB6]

Devices

- Block\_1 [FC1]
- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- Block\_recipe [DB6]
- CALL\_FB\_DB [DB3]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Global\_DB1 [DB4]
- Recipe\_1 [DB5]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups

Block\_recipe

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Static_1	"User_data_type_1" ...			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	<Add new>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Reference projects

Details view

Portal view Overview Block\_recipe

Properties Info Diagnostics

The project Project\_2 was saved succes...



# Использование таблицы UDT как шаблона данных в DB

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_recipe [DB6]

Devices:

- Block\_1 [FC1]
- Block\_2 [FC2]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- Block\_recipe [DB6]
- CALL\_FB\_DB [DB3]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Global\_DB1 [DB4]
- Recipe\_1 [DB5]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups

Block\_recipe

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Static_1	"User_data_type_1"			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Recipe_1_comp_1	Real	...	10.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Recipe_1_comp_2	Real	...	20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Recipe_1_comp_3	Real	...	30.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Recipe_1_comp_4	Real	...	40.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Recipe_1_comp_5	Real	...	50.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Static_2	"User_data_type_2"	...		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Recipe_2_comp_1	Real	...	15.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Recipe_2_comp_2	Real	...	25.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11	Recipe_2_comp_3	Real	...	35.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
12	Recipe_2_comp_4	Real	...	45.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13	Recipe_2_comp_5	Real	...	55.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Reference projects

Details view

Portal view Overview Block\_recipe

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Просмотр глобального DB с двумя массивами рецептов

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_recipe [DB6]

Block\_recipe

	Name	Data type	Offset	Start value	Monitor value	Retain	Visible in ...	Setpoint	Comment
1	▼ Static					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	▼ Static_1	"User_data_typ...	0.0			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	■ Recipe_1_comp_1	Real	0.0	10.0	10.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	■ Recipe_1_comp_2	Real	4.0	20.0	20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	■ Recipe_1_comp_3	Real	8.0	30.0	30.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	■ Recipe_1_comp_4	Real	12.0	40.0	40.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7	■ Recipe_1_comp_5	Real	16.0	50.0	50.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8	▼ Static_2	"User_data_type_2"	20.0			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9	■ Recipe_2_comp_1	Real	0.0	15.0	15.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
10	■ Recipe_2_comp_2	Real	4.0	25.0	25.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
11	■ Recipe_2_comp_3	Real	8.0	35.0	35.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12	■ Recipe_2_comp_4	Real	12.0	45.0	45.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
13	■ Recipe_2_comp_5	Real	16.0	55.0	55.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Properties Info Diagnostics

Portal view Overview Block\_recipe

Connected to PLC\_1, address IP=192.1...

# Создание DB с одним массивом UDT

Siemens - Project\_2

Project Edit View Insert Online Options T...

Save project

Project tree

Devices

Program blocks

Technology obje

External source

PLC tags

PLC data types

Watch and force

Online backups

Local modules

Distributed I/O

Common data

Documentation se

Languages & reso

Online access

Card Reader/USB mer

Reference projects

Details view

Portal view

Правой клавишей

Add group

Add new block

Search in PLC and op

Edit type

Cut

Copy

Paste

Compile

Download to device

Go online

Go offline

Start simulation

Cross-references

Call structure

Assignment list

Switch programming

Print...

Print preview...

Properties...

OB

Organization block

FB

Function block

FC

Function

DB

Data block

more...

Name:

Data\_block\_2

Type:

Global DB

Language:

Number:

Description:

Data blocks (DBs) are used to store data. Select one of the following options:

- A global data block
- An instance data block

Global DB

Global DB

Block\_3 [FB1]

SUM\_1 [FB2]

SUM\_2 [FB3]

CALL\_FB [FB4]

User\_data\_type\_1

User\_data\_type\_2

User\_data\_type\_3

Receive\_Conditions

WS\_RULES

FILE\_DB\_HEADER

CNT2\_CHANTYPE

Выбираем необходимый

Additional information

Add new and open

OK

Cancel

## Создание DB с одним массивом UDT

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Data\_block\_2 [DB6]

Devices

PLC programming

Program blocks

- Add new block
- Main [OB1]
- Block\_1 [FC1]
- Block\_10 [FC10]
- Block\_3 [FB1]
- CALL\_FB [FB4]
- SUM\_1 [FB2]
- SUM\_2 [FB3]
- CALL\_FB\_DB [DB3]
- Data\_block\_1 [DB8]
- Data\_block\_2 [DB6]
- FB1\_IDB1 [DB1]
- FB1\_IDB2 [DB2]
- Global\_DB1 [DB4]
- Recipe\_1 [DB5]
- Recipe\_2 [DB7]
- System blocks

Tasks

Libraries

Data\_block\_2

	Name	Data type	Offset	Start value	Retain	Visible in HMI	Setpoint	Comment
1	Static				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Recipe_1_comp_1	Real	0.0	10.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Recipe_1_comp_2	Real	4.0	20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Recipe_1_comp_3	Real	8.0	30.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	Recipe_1_comp_4	Real	12.0	40.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	Recipe_1_comp_5	Real	16.0	50.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Options menu:

- Insert row
- Add row
- Cut (Ctrl+X)
- Copy (Ctrl+C)
- Paste (Ctrl+V)
- Delete (Del)
- Rename (F2)
- Update interface
- Cross-reference information (Shift+F11)

Options недоступны

Reference projects

Details view

Portal view Overview Data\_block\_2

Properties Info Diagnostics

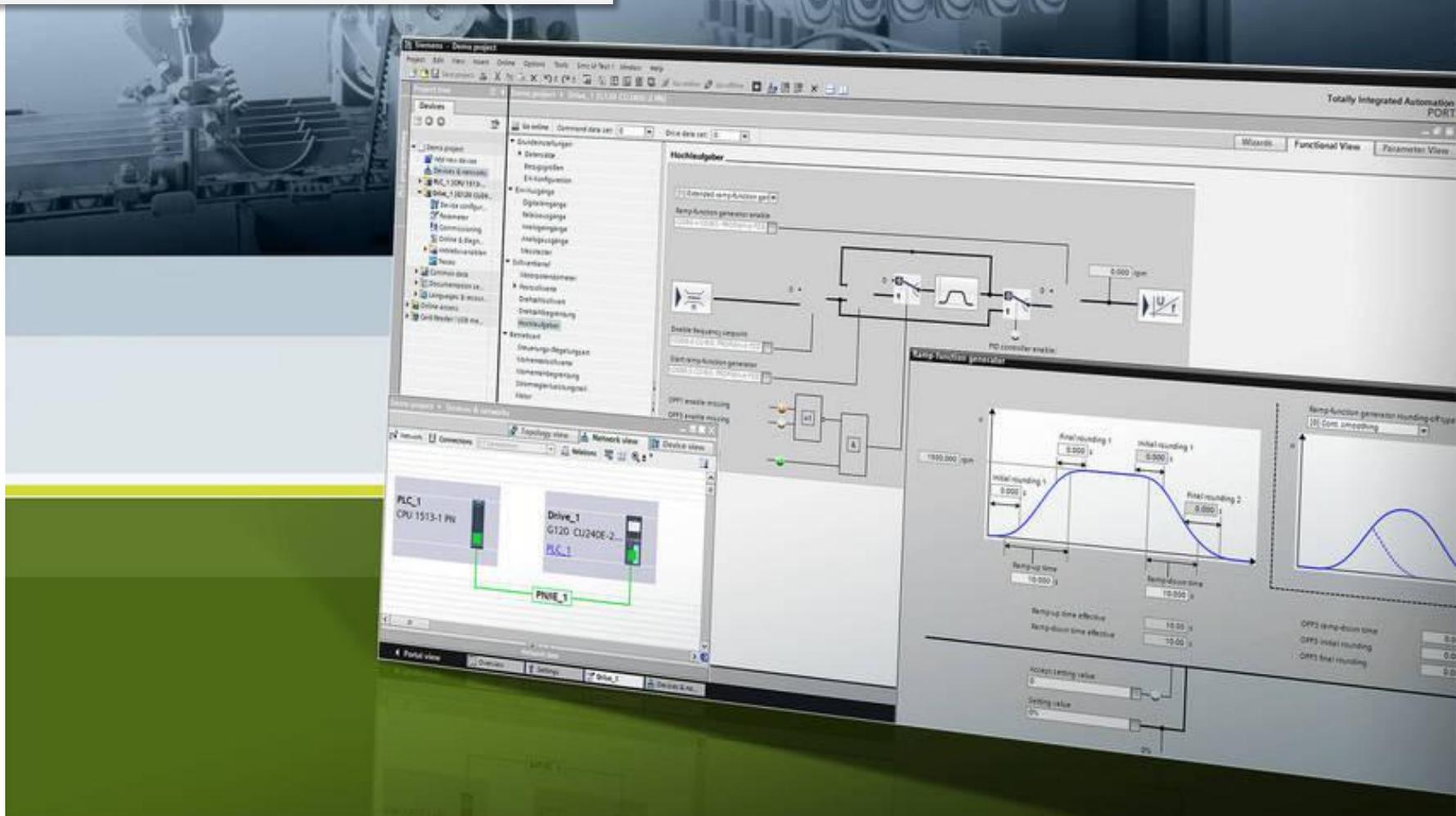
The project Project\_2 was saved succes...

## Конец раздела 4. Окно навигации

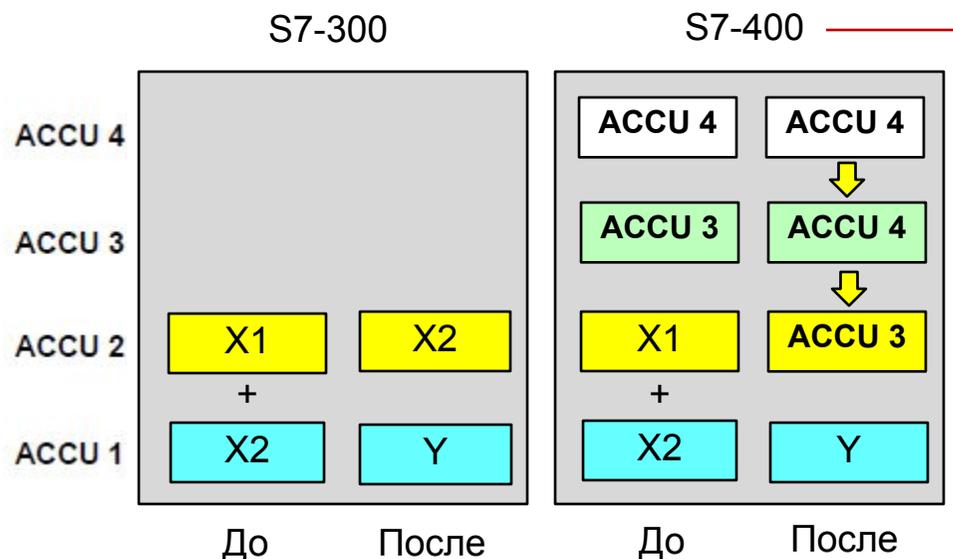
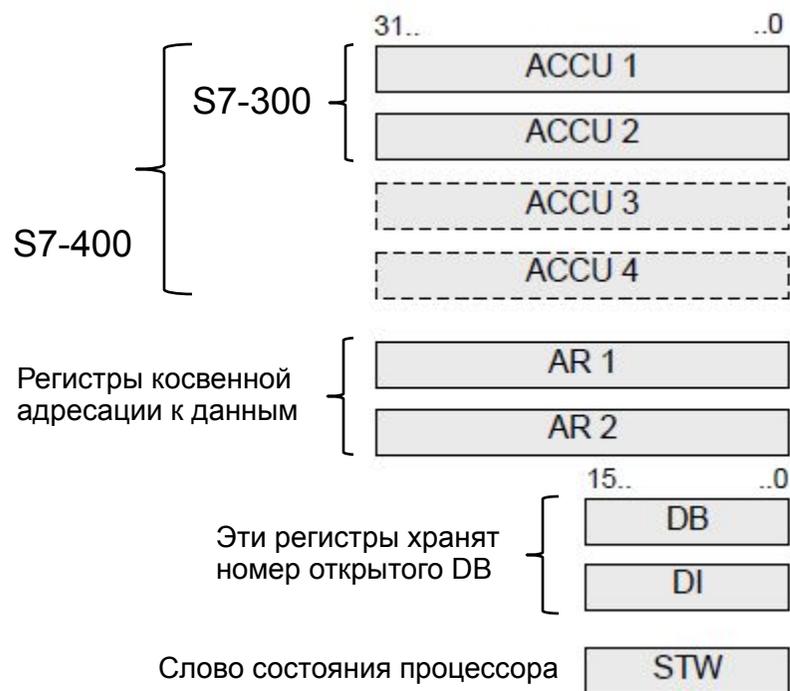
- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)  
Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 5

Регистры, служебные флаги процессора.  
Программные инструкции, библиотека  
стандартных функций. Переходы на  
метку.



# Регистры и аккумуляторы S7-300, S7-400



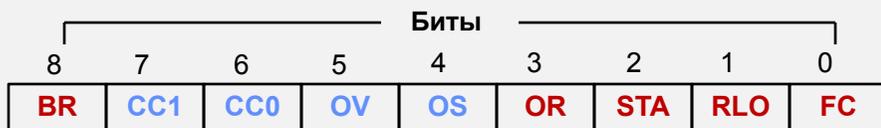
**Пример:** работа с четырьмя аккумуляторами. Команда **ENT** (ввод в стек аккумуляторов) копирует содержимое ACCU 3 в ACCU 4 и содержимое ACCU 2 в ACCU 3.

		Value	
L	%MD100	5.0	//Загрузка MD100 в ACCU1
L	%MD104	5.0	//Передача MD100 в ACCU2, загрузка md104 в ACCU1
+R		10.0	//Сложение ACCU1+ACCU2 и пересылка результата в ACCU1
L	%MD108	15.0	//Пересылка из ACCU1 в ACCU2. Загрузка в ACCU1 MD108
ENT		10.0	//Пересылка ACCU3 в ACCU4, пересылка ACCU2 в ACCU3
L	%MD112	10.0	//Загрузка MD112 в ACCU1
-R		5.0	//Вычитание ACCU1-ACCU2, результат в ACCU1. Копирование ACCU3 в ACCU2, ACCU4 в ACCU3
/R		2.0	//Деление ACCU2/ACCU1 (MD100+MD104)/(MD108-MD112). Результат в ACCU1
T	%MD116	2.0	//Пересылка ACCU1 в MD116



# Служебные флаги состояния процесса (STW)

## Слово состояния процессора



Бит	Двоичные флаги (binary flags)	
0	/FC	Первичный опрос (first check) ←
1	RLO	Результат логической операции ←
2	STA	Состояние (статус - "status") ←
3	OR	Бит состояния OR (OR status bit) ←
8	BR	Двоичный результат (binary result) ←
Бит	Числовые флаги (digital flags)	
4	OS	Для сохранения информации о переполнении (stored overflow) ←
5	OV	Переполнение (overflow) ←
6	CC0	Условный код (condition code) ←
7	CC1	Условный код (condition code) ←

- В начале цепи (сегмента LAD) производится проверка состояния этого бита
- Служит для сохранения результата текущего логического сопряжения
- Бит статуса двоичной переменной
- Сохраняет результат логической операции «И» перед операцией «ИЛИ».
- Служит для промежуточного хранения значения RLO

Указывают на ошибки, возникшие в результате выполнения операций с числами (переполнение)

Несут информацию о результатах выполнения операций с числами



CC0	CC 1	Пояснение
0	0	результат операции =0
1	0	результат операции <0
0	1	результат операции >0



# Программные инструкции. Способ «перетаскивания»

The screenshot displays the Siemens TIA Portal interface for editing a PLC program. The main workspace shows a ladder logic network with a normally open contact labeled "%I0.0" and a normally closed contact labeled "Tag\_3". A red dashed arrow points from the "Favorites" section of the "Instructions" panel to the "Tag\_3" contact, with the Russian text "Перетаскиваем" (Dragging) written diagonally across the arrow. The "Instructions" panel on the right is expanded to show "Favorites" and includes a toolbar with icons for adding instructions. The bottom status bar shows "Portal view", "Overview", and "Block\_1 (FC1)". A notification at the bottom right states "The project Project\_2 was saved succes...".



# Ячейка памяти (SR)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 2:

Instructions

Options

Favorites

Basic instructions

Name	Version
Bit logic operations	
I  - I	
I  - I -	
I  - NOTI -	
(O) -( )-	
(O) -(R)	
(O) -(S)	
SR	

Set/reset flip-flop

Sets or resets the bit of a specified operand based on the signal state of the inputs S and R1.

S7-300, S7-400

SR: Set/reset flip-flop

Пример использования информационной системы поддержки

Portal view Overview Block\_1 (FC1)

Properties Info Diagnostics Communication

The project Project\_2 was saved succes...

# Описание ячейки памяти SR в информационной системе

Information System
\_ □ X

Содержание
Указатель
Поиск
Избр

- Information system
- System overview of STEP 7 and WinCC
- Readme
- Installation
- Migrating projects and programs
- First steps
- Introduction to the TIA Portal
- Editing projects
- Editing devices and networks
- Programming a PLC
  - Creating a user program
  - Displaying program information
  - Displaying cross-references
  - Testing the user program
  - Configuring alarms
  - Using global project functions
  - Programming examples
- References
  - References (S7-1200, S7-1500)
  - References (S7-300, S7-400)
    - General parameters of the SR instruction
    - Basic instructions (S7-300, S7-400)
      - LAD (S7-300, S7-400)
        - Bit logic operations
          - AND
          - OR
          - XOR
          - NOT
          - ASSIGN

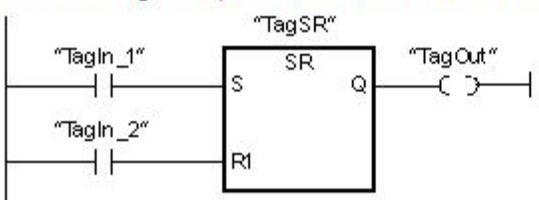
Examples
See also
History
Extra

## SR: Set/reset flip-flop

<Operand>	InOut	BOOL	I, Q, M, D, L	Operand that is set or reset.
Q	Output	BOOL	I, Q, M, D, L	Signal state of the operand

**Example**

The following example shows how the instruction works:



```

graph LR
    TagIn_1[TagIn_1] --> S((S))
    TagIn_2[TagIn_2] --> R((R))
    S --- SR[TagSR]
    R --- SR
    SR --> Q((Q))
    Q --- TagOut[TagOut]
  
```

The operands "TagSR" and "TagOut" are set when the following conditions are fulfilled:

- The operand "TagIn\_1" has the signal state "1".
- The operand "TagIn\_2" has the signal state "0".

The operands "TagSR" and "TagOut" are reset when one of the following conditions is fulfilled:

- The operand "TagIn\_1" has signal state "0" and the operand "TagIn\_2" has signal state "1".
- The operands "TagIn\_1" and "TagIn\_2" have signal state "1".



# Приоритеты команд в ячейках памяти SR/RS

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 2:

Comment

1	A	"Switch_START_range"	%I0.1	Ключ в положении СТАРТ
2	S	"Output_K1M_ON"	%Q0.0	Включение контактора
3	A{			
4	ON	"Breack_Q1"	%I0.2	Блок-контакт автомата
5	O	"Switch_STOP_range"	%I0.0	Ключ в положении СТОП
6	}			
7	R	"Output_K1M_ON"	%Q0.0	Включение контактора
8	A	"Output_K1M_ON"	%Q0.0	Включение контактора
9	=	"Visible_K1M_ON"	%Q0.1	Сигнализация включения

Программа выполняется «сверху-вниз», приоритет имеет команда R (reset), поскольку выполняется последней

Соответственно ячейка RS будет иметь обратный приоритет

Portal view Overview Block\_1 (FC1) Properties Info Diagnostics

The programming language of the sele...



# Использование отдельных команд S и R

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 4:

%I0.1 "Switch\_START\_range" (S) %Q0.0 "Output\_K1M\_ON"

%I0.2 "Breack\_Q1" (R) %Q0.0 "Output\_K1M\_ON"

%I0.0 "Switch\_STOP\_range"

Instructions

Options

Favorites

Basic instructions

Name	Version
General	
Bit logic operations	
HI -	
HI - /	
HI - NOT	
O -( )	
O -(R)	
O -(S)	
SR	
RS	
HI - P	
HI - N	
P_TRIG	
AL_TRIG	

Extended instructions

Technology

Communication

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The programming language of the sele...



# Команда выделения переднего фронта (P\_TRIG)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

PLC programming

Network 12:

Network 13:

Network 14:

После перехода M10.1 из «0» в «1» переменная M10.3 = «1» до конца текущего цикла программы

Instructions

Options

Favorites

Basic instructions

Name	Version
Bit logic operations	
- -	
- /	
- NOT -	
-( )	
-(R)	
-(S)	
SR	
RS	
- P -	
- N -	
P_TRIG	
N_TRIG	
Timer operations	

Extended instructions

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The programming language of the sele...



# Команда выделения переднего фронта (P\_TRIG)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 13:

1	A	%M10.1
2	FP	%M10.2
3	=	%M10.3

Выделяется передний фронт переменной M10.1

Network 14:

1	A	%M10.3
2	JNB	Label_0
3	L	%MW100
4	L	1
5	+I	
6	T	%MW100
7	Label_0 : NOP 0	

Сложение выполняется пока переменная M10.3 = «1», т.е. значение переменной MW100 будет неизменным до следующего перехода M10.1 из «0» в «1»

Network 15:

1		
2		

М10.1

М10.3

Конец текущего цикла

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The programming language of the sele...

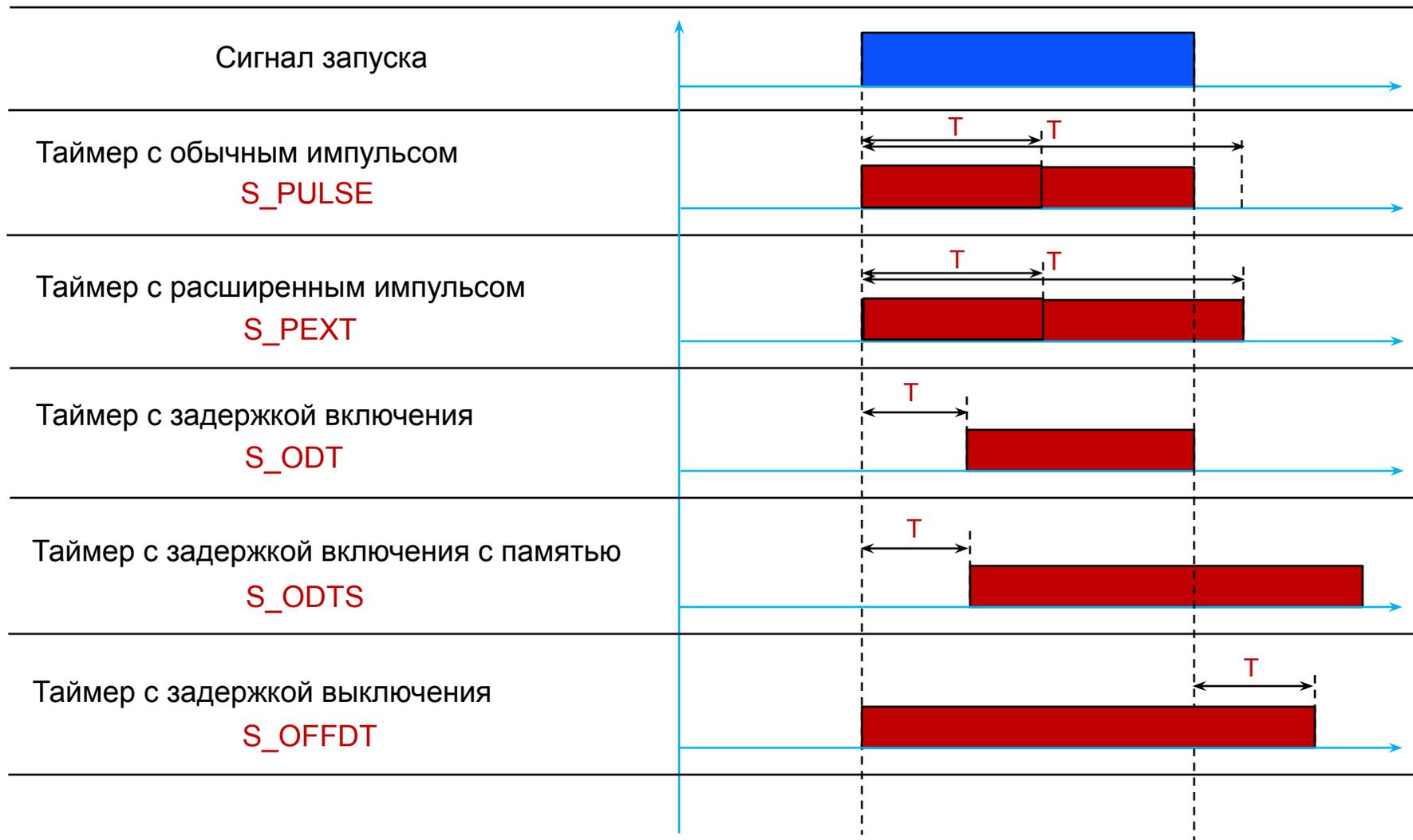


# Инструкции SIMATIC Timers

The screenshot displays the Siemens TIA Portal interface. The main window shows the 'Block interface' for 'Block\_1 [FC1]'. The right-hand pane is titled 'Instructions' and contains a tree view of instruction categories. The 'Timer operations' category is expanded, showing 'IEC Timers' and 'SIMATIC Timers'. The 'SIMATIC Timers' sub-category is further expanded, listing several instructions: S\_PULSE, S\_PEXT, S\_ODT, S\_ODTS, and S\_OFFDT. These five instructions are highlighted with a green rectangular box. Other categories visible include 'Extended instructions', 'Technology', and 'Communication'. The bottom status bar shows 'Portal view', 'Overview', and 'Block\_1 (FC1)' selected, along with a notification: 'The project Project\_2 was saved succes...'



# Диаграммы работы таймеров SIMATIC



## Двоично-десятичный код (BCD)

**Диапазон значений** 16 бит: от -999 до + 999  
 32 бит: от -9999999 до + 9999999

### Инструкции

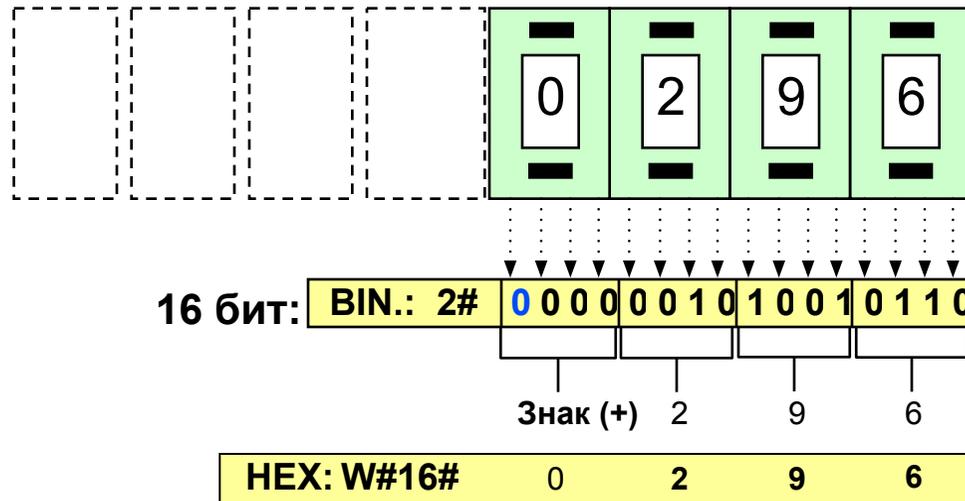
**преобразования:** BTI, BTD, ITB, DTB (не арифметические, поскольку BCD системой счисления не является!)

Каждый знак десятичного числа от 0 до 9 представлен в виде четырехбитового двоичного числа

0 → 0000  $0x 2^3 + 0x 2^2 + 0x 2^1 + 0x 2^0$

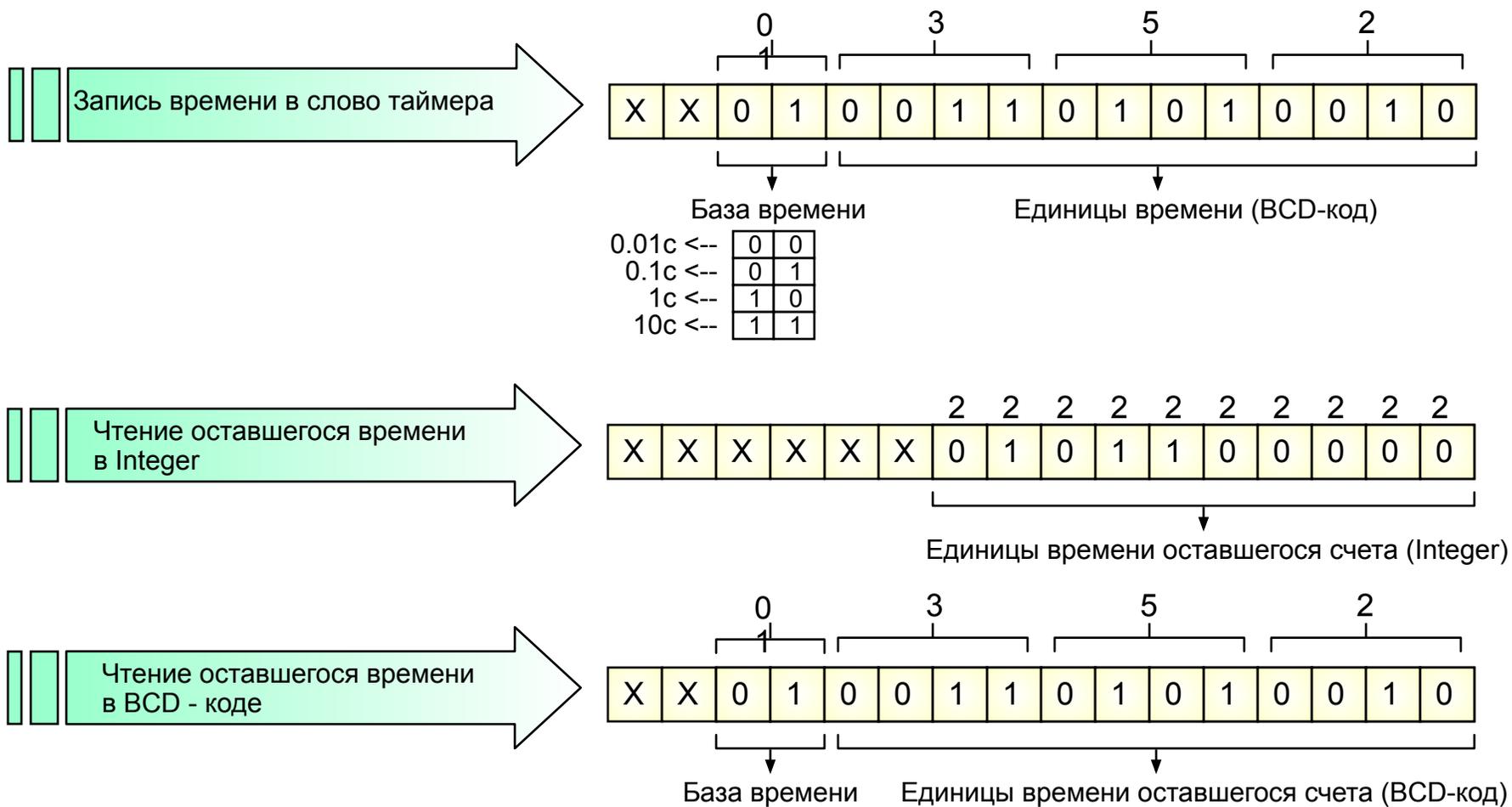
1 → 0001  $0x 2^3 + 0x 2^2 + 0x 2^1 + 1x 2^0$

9 → 1001  $1x 2^3 + 0x 2^2 + 0x 2^1 + 1x 2^0$



# Форматы записи/чтения времени для таймеров SIMATIC

Предположим, уставка таймера составляет 35 секунд 200 миллисекунд (формат записи S5T#35s200ms)



# Пример программирования таймера «задержка включения»

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 1:

Network 2:

Network 3:

Instructions

Options

Favorites

Basic instructions

Name	Version
Timer operations	
IEC Timers	
TP	
TON	
TOF	
SIMATIC Timers	
S_PULSE	
S_PEXT	
S_ODT	

Assign on-delay timer parameters and start

Starts the programmed timer as an ON delay when a transition from "0" to "1" in the RLO is detected at the S input.

S7-300, S7-400

[S\\_ODT: Assign on-delay timer parameters and start](#)

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The programming language of the sele...



# Диаграмма работы таймера «задержка включения»

Information System
\_ □ ✕

🏠 ↶ ↷ 📄

Содержание    Указатель    Поиск    Избр

- ⊕ [ ] Displaying program information
- ⊕ [ ] Displaying cross-references
- ⊕ [ ] Testing the user program
- ⊕ [ ] Configuring alarms
- ⊕ [ ] Using global project functions
- ⊕ [ ] Programming examples
- ⊖ [ ] References
  - ⊕ [ ] References (S7-1200, S7-1500)
  - ⊖ [ ] References (S7-300, S7-400)
  - ⊕ [ ] General parameters of the timer
  - ⊖ [ ] Basic instructions (S7-300, S7-400)
  - ⊖ [ ] LAD (S7-300, S7-400)
  - ⊕ [ ] Bit logic operations
  - ⊖ [ ] Timer operations
    - ⊕ [ ] IEC Timers (S7-300, S7-400)
    - ⊖ [ ] SIMATIC Timers
      - 🔍 S\_PULSE
      - 🔍 S\_PEXT
      - 🔍 S\_ODT: Assign on-delay timer parameters and start
      - 🔍 S\_ODT: Assign on-delay timer parameters and start
      - 🔍 S\_OFFD
      - 🔍 --( SP ):
      - 🔍 --( SE ):
      - 🔍 --( SD ):
      - 🔍 --( SS ):
      - 🔍 --( SF ):
- ⊕ [ ] Counter operations
- ⊕ [ ] Comparator operations
- ⊕ [ ] Math functions

Examples    See also    History    Extra

## S\_ODT: Assign on-delay timer parameters and start

**Pulse timing diagram**

The following figure shows the pulse timing diagram of the "Assign on-delay timer parameters and start" instruction:

t = programmed timer



# Сравнение форм представления таймера

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 1: .....

Network 2: .....

Network 3: .....

Network 2: .....

1	A	%M0.0
2	L	s5t#3s500ms
3	SD	%T1
4	A	%M0.1
5	R	%T1
6	L	%T1
7	T	%MW100
8	LC	%T1
9	T	%MW200
10	A	%T1
11	=	%M0.1

Могут быть заменены командой NOP 0

Network 3: .....

1	A	%M0.0
2	L	s5t#3s500ms
3	SD	%T1

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) The programming language of the sele...



# Пример программирования реверсивного счетчика

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 1: .....  
 Network 2: .....  
 Network 3: .....  
 Network 4: .....  
 Network 5: .....  
 Network 6: .....

Instructions

Options

Favorites

Basic instructions

Name	Version
CTU	
CTD	
CTUD	
SIMATIC Counters	
S_CU	
S_CD	
S_CUD	
-(SC)	
-(CU)	
-(CD)	
Comparator operations	
Math functions	
Move operations	
Conversion operations	

Extended instructions

Technology

Communication

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The programming language of the sele...



# Пример программирования счетчика отдельными командами

The screenshot displays the Siemens TIA Portal interface for programming a counter. The main workspace shows two ladder logic networks:

- Network 5:** A normally open contact labeled %M0.2 is connected to a set counter instruction (S\_C) for counter C1 with a preset value of 10. A red arrow points from the instruction to the library entry S\_CUD.
- Network 6:** A normally open contact labeled %M0.0 is connected to a counter type instruction (C\_U) for counter C1. A red arrow points from the instruction to the library entry -(CU).

The right-hand pane shows the 'Instructions' library, with 'Basic instructions' expanded to show 'SIMATIC Counters'. The following table represents the visible entries in this library:

Name	Version
CTU	
CTD	
CTUD	
SIMATIC Counters	
S_CU	
S_CD	
S_CUD	
-(S)	
-(CU)	
-(CD)	
Comparator operations	
Math functions	
Move operations	
Conversion operations	
Extended instructions	
Technology	
Communication	

At the bottom of the interface, the status bar shows 'Portal view', 'Overview', and 'Block\_1 (FC1)'. A tooltip at the bottom right reads: 'The programming language of the sele...'



# Пример программирования компараторов

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

PLC programming

**Network 7:**

Сравнение на равенство

Address	Display format	Monitor value
%MW100	DEC	100
%MW200	DEC	100
%M10.0	Bool	TRUE

**Network 8:**

Сравнение на неравенство

Address	Display format	Monitor value
%MW100	DEC	100
%MW200	DEC	150
%M10.0	Bool	TRUE

Instructions

Options

Favorites

Basic instructions

Name	Version
General	
Bit logic operations	
Timer operations	
Counter operations	
Comparator operations	
CMP ==	
CMP <	
CMP >=	
CMP <=	
CMP >	
CMP <	
Math functions	
Move operations	
Conversion operations	

Extended instructions

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The project Project\_2 was saved succes...



# Пример применения функции MIN

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows the "Block interface" for "Block\_1 [FC1]". In "Network 9", a "MIN" function block is configured. The block has three input terminals (IN1, IN2, IN3) and one output terminal (O). The data type for the output is set to "Int". A red dashed arrow points from the "MIN" block in the network to the "MIN" instruction in the "Basic instructions" list on the right-hand side of the interface.

The "Instructions" panel on the right shows the following structure:

- Instructions
- Options
- Favorites
- Basic instructions
  - Comparator operations
  - Math functions
    - ADD
    - SUB
    - MUL
    - DIV
    - MOD
    - NEG
    - ABS
    - MIN
    - MAX
    - LIMIT
    - SQR
    - SQRT
- Extended instructions
- Technology
- Communication



# Пример применения функции MIN

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows the "Block interface" for "Block\_1 [FC1]". The "Network 9" is highlighted with a red error icon, indicating a configuration issue. The "MIN" function block is being configured with the following parameters:

Parameter	Type	Value
EN	Bool	EN
ENO	Bool	ENO
N1	Real	<???
OUT	Real	<???

A yellow arrow points to the "Global\_DB1" entry in the parameter selection list, which is highlighted in blue. The list includes:

- "Block\_recipe" Global DB DB6
- "CALL\_FB\_DB" Instance DB of CALL\_FB [FB4] DB3
- "FB1\_IDB1" Instance DB of Block\_3 [FB1] DB1
- "FB1\_IDB2" Instance DB of Block\_3 [FB1] DB2
- "Global\_DB1" Global DB DB4
- "Recipe\_1" Data block derived from User\_data\_type\_1 DB5

The right-hand side of the interface shows the "Instructions" pane, with the "Basic instructions" category expanded to "Math functions". The "MIN" instruction is selected and highlighted in blue. The status bar at the bottom indicates that the project "Project\_2" was saved successfully.



# Пример применения функции MIN

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows "Network 9" with a function block call for "MIN Real". The block's parameters are as follows:

Parameter	Type	Value
EN	Bool	EN
ENO	Bool	ENO
N1	Real	"Global_DB1".[N1]
OUT	Real	<???

A yellow arrow points to the "Real" data type in the parameter list. The right-hand pane shows the "Instructions" library, with the "Math functions" category expanded to show the "MIN" instruction.

At the bottom of the interface, a status bar indicates: "The project Project\_2 was saved succes..."



# Пример применения функции MIN

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 9:

Network 10:

100%

Instructions

Options

Favorites

Basic instructions

Name	Version
Math functions	
ADD	
SUB	
MUL	
DIV	
MOD	
NEG	
ABS	
MIN	

Get minimum

Compares the values at the IN1, IN2 and IN3 inputs and writes the lowest value to the OUT output.

S7-300, S7-400

MIN: Get minimum

Extended instructions

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) Global\_DB1

The project Project\_2 was saved succes...



# Описание функции MIN в информационной системе

Information System

Содержание
Указатель
Поиск
Избр

- Introduction to the TIA Portal
- Editing projects
- Editing devices and networks
- Programming a PLC
  - Creating a user program
  - Displaying program information
  - Displaying cross-references
  - Testing the user program
  - Configuring alarms
  - Using global project functions
  - Programming examples
- References
  - References (S7-1200, S7-1500)
  - References (S7-300, S7-400)
  - General parameters of the PLC
  - Basic instructions (S7-300, S7-400)
    - LAD (S7-300, S7-400)
      - Bit logic operations
      - Timer operations
      - Counter operations
      - Comparator operations
      - Math functions (
        - ADD: Add
        - SUB: Subtract
        - MUL: Multiply
        - DIV: Divide
        - MOD: Return
        - NEG: Create

Examples
See also
History
Extra

## MIN: Get minimum

**Example**

The following example shows how the instruction works:

The following table shows how the instruction works using specific operand values:

Parameter	Operand	Value
IN1	TagIn_Value1	12222
IN2	TagIn_Value2	14444
IN3	TagIn_Value3	13333
OUT	TagOut_Value	12222

# Пример применения функции BLKMOV

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 14:

Network 15:

EN

ENO

RET\_VAL — %MW102

DSTBLK — P#DB7.DBX0.0  
BYTE 10

BLKMOV  
Any

P#DB5.DBX0.0  
BYTE 10 — SRCBLK

Функция осуществляет перенос первых десяти байт из DB5 в первые десять байт DB7

BLKMOV

"Recipe_2"	%DB7
"Recipe_1"	%DB5
"Tag_12"	%MW102

Network 16:

100%

Instructions

Options

Favorites

Basic instructions

Name	Version
General	
Bit logic operations	
Timer operations	
Counter operations	
Comparator operations	
Math functions	
Move operations	
MOVE	
BLKMOV	V1...
UBLKMOV	V1.1
FILL	V1.1
Conversion operations	
Program control operati...	
Word logic operations	

Extended instructions

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The project Project\_2 was saved succes...



# Пример применения функции CONVERT

The screenshot shows the Siemens TIA Portal interface for a project named "Project\_2". The main workspace displays a ladder logic network (Network 16) with a "CONV" instruction. The instruction's data type is currently set to "Int", which is highlighted in a green box. A dropdown menu is open, showing the following options: "Int", "Dint", "Bcd16", and "Bcd32". The source and target fields of the instruction are marked with "???", indicating they are not yet configured. The right-hand side of the interface features a "Instructions" panel with a tree view of instruction categories, including "Basic instructions" and "Extended instructions". The "CONVERT" instruction is listed under "Conversion operations". The bottom status bar shows "Block\_1 (FC1)" is active and a notification that the project was saved successfully.



# Пример применения функции CONVERT

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows a ladder logic network (Network 16) with a "CONV" instruction. The instruction's parameters are being configured:

- Input: "Int" (highlighted in blue)
- Output: "Dint" (highlighted in green)

The right-hand pane shows the "Instructions" library, with "Basic instructions" expanded to "Conversion operations", where the "CONVERT" instruction is selected. The bottom status bar indicates "The project Project\_2 was saved succes..."



# Пример применения функции CONVERT

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 16:

Address	Display format	Monitor value
%MW102	Bin	2#0000_0000_0110_0100
%MD200	Bin	2#0000_0000_0000_0000_0000_0000_0110_0100

Network 17:

<No tags used>

100%

Instructions

Options

Favorites

Basic instructions

Name	Version
Move operations	
Conversion operations	
CONVERT	
ROUND	
CEIL	
FLOOR	
TRUNC	
SCALE	V1.1
UNSCALE	V1.1
Program control operati...	
Word logic operations	
Shift and rotate	
Additional instructions	

Extended instructions

Technology

Communication

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1)

The project Project\_2 was saved succes...



# Пример применения функций побитной логики в словах

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 5:

Network 6:

Properties

Portal view Overview Block\_1 (FC1)

The programming language of the sele...

Instructions

Options

Favorites

Basic instructions

Name Version

PLC programming

15 0

IW2 = 0 1 0 0 0 0 0 0 0 0 1 1 0 0 1 0

W#16#5F2A = 0 1 0 1 1 1 1 1 0 0 1 0 1 0 1 0

AND OR XOR

MW10 после "AW" 0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0

MW10 после "OW" 0 1 0 1 1 1 1 1 0 0 1 1 1 0 1 0

MW10 после "XOW" 0 0 0 1 1 1 1 1 0 0 0 1 1 0 0 0



## Выбор ПИД-регулятора в папке “Technology objects”.

The screenshot shows the SIMATIC TIA-portal interface. On the left, the Project tree is visible, with the 'Technology objects' folder selected. A red dashed arrow points from this folder to the 'Add new object' dialog box. The dialog box has the name 'CONT\_C\_1' entered. In the object list, 'CONT\_C' is selected. The 'Type' is set to 'CONT\_C', the 'Number' is '2', and the 'automatic' radio button is selected. The 'OK' button is highlighted with a yellow arrow.

**Add new object**

Name: CONT\_C\_1

**PID**

Name	Version
PID Control	
PID Basic functions	V1.1
CONT_C	V1.1
CONT_S	V1.1
TCONT_CP	V1.1
TCONT_S	V1.1
PID Self-Tuner	V1.1
TUN_EC	V1.1
TUN_ES	V1.1

Type:  CONT\_C

Number: 2

manual

automatic

Description:

The technology object CONT\_C provides a step controller for continuous control. It corresponds to an instance data block of the instruction CONT\_C. When calling the instruction CONT\_C, this data block will have to be transferred. CONT\_C includes all settings for one specific control loop. When you open this technology object, you will be supported by a special editor in the configuration of the controller.

**Additional information**

Add new and open

**OK** **Cancel**

# Отображение выбранного ПИД-регулятора в “Technology objects”.

Siemens - Project\_1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_1 > PLC1 [CPU 314C-2 PN/DP] > Technology objects

Details | List | Thumbnails

Name	Modified	Remark
Add new object		
CONT_C_1 [DB2]	2/10/2014 - 3:24:4...	

Add new object [ShortCut] | Properties | Info | Diagnostics

Portal view | Overview | Block\_1 (FC1)

The project Project\_1 was saved succes...



# Переходы. Пример построения перехода на метку Lable\_1

**При написании в STL доступны команды:**

- **JU** безусловный переход
- **JL** распределенный переход (по листу)
- **JC** переход при RLO = 1
- **JCN** переход при RLO = 0
- **JCB** переход при RLO = 1 с сохранением в BR
- **JNB** переход при RLO = 0 с сохранением в BR
- **JBI** переход при BR = 1
- **JNBV** переход при BR = 0
- **JO** переход при OV = 1
- **JOS** переход при OS = 1
- **JZ** переход при нулевом результате
- **JN** переход при ненулевом результате
- **JP** переход при положительном результате
- **JM** переход при отрицательном результате
- **JPZ** переход при неотрицательном результате
- **JMZ** переход при отрицательном или нулевом результате
- **JUO** переход при недействительном результате

**Network 17:** Comment: %M10.0

**Network 18:** Если M10.0 = «1», программа цепи Network 18 не выполняется,

**Network 19:** происходит переход на выполнение цепи Network 19

**Lable\_1**

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) The project Project\_2 was saved succes...



# Пример построения перехода при вызове FC по условию

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main window shows a ladder logic network (Network 2) with the following components:

- Network 2:** A normally open contact labeled "%M10.0" with the comment "Tag\_8".
- Function Call Block:** A block labeled "%FC2" with the comment "Block\_2".
- Inputs:**
  - Switch\_START: "%I0.1" with comment "Switch\_START\_range"
  - Breach\_Q1: "%I0.2" with comment "Breach\_Q1"
  - Feedback\_K1M: "%I0.3" with comment "Feedback\_K1M"
- Outputs:**
  - Output\_K1M: "%Q0.0" with comment "Output\_K1M\_ON"
  - Visible\_work: "%Q0.1" with comment "Visible\_K1M\_ON"

A yellow callout box with a downward arrow points to the function call block, containing the text: "FC2 вызывается при условии M10.0 = «1»". A blue circle highlights the "%M10.0" contact.

The interface includes a Project tree on the left, a menu bar at the top, and a status bar at the bottom. The status bar shows "The project Project\_2 was saved succes..." and navigation buttons for "Portal view", "Overview", "Main (OB1)", and "Block\_2 (FC2)".



# Пример построения перехода при вызове FC по условию

The screenshot displays the SIMATIC Manager TIA Portal interface. The main window shows 'Network 2' with the following logic:

Line	Symbolic Name	Address	Comment
1	A	"Switch_START_range"	≈IO.1 Ключ в положении СТАРТ
2	=	≈L20.0	≈L20.0
3	BLD	103	103
4	A	"Breack_Q1"	≈IO.2 Блок-контакт автомата
5	=	≈L20.1	≈L20.1
6	BLD	103	103
7	A	"Feedback_K1M"	≈IO.3 Подтверждение контактора
8	=	≈L20.2	≈L20.2
9	BLD	103	103
10	A	"Tag_8" = 0	≈M10.0
11	JNB	Label_0	
	CALL	"Block_2"	≈FC2
		Switch_START :=≈L20.0	≈L20.0
		Breack_Q1 :=≈L20.1	≈L20.1
		Feedback_K1M :=≈L20.2	≈L20.2
		Output_K1M := "Output_K1M_ON"	≈Q0.0 Включение контактора
		Visible_work := "Visible_K1M_ON"	≈Q0.1 Сигнализация включения
18	Label_0	: NOP 0	

A red box highlights the condition `"Tag_8" = 0` on line 10, and a red line connects it to the `JNB Label_0` instruction on line 11, indicating a conditional jump.



# Использование команды RET

Siemens - Project\_3

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_3 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

PLC programming

Block interface

Network 5:

%M10.0

RLO (RET)

При необходимости формируется условие выхода из текущего блока

Network 6:

Network 7:

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) The programming language of the sele...

Instructions

Options

Favorites

Basic instructions

Name

- Move operations
- Conversion operations
- Program control operations
  - (JMP)
  - (JMPN)
  - Label
  - (RET)
  - (OPN)
  - (OPNI)
- Runtime control
  - RE\_TRIGR
  - STP
  - WAIT
  - PROTECT

Extended instructions

Technology

Communication



# Работа с главным управляющим реле

The screenshot shows the Siemens TIA Portal interface. The main workspace displays the following code for Network 1:

```

1      MCRA                               //Активация MCR области
2      A      %IO.0
3      MCR(                               //Сохранение RLO в стеке MCR. Зона MKR включена, если RLO = 1
4      A      %IO.1
5      =      %Q0.0                       //Если MCR off, выход Q0.0 =0 вне зависимости от статуса IO.1
6      L      %MW10
7      T      %MW12                       //Если MCR off, в слово MW12 будет положен 0
8      )MCR                               //Закрытие MCR зоны
9      MCRD                               //Деактивация MCR области
10     A      %IO.2                       //Дальнейшие инструкции не зависят от значения бита MCR
11     =      %Q0.1
  
```

Команда **MCRA** активирует работу с MCR зоной. В зависимости от состояния бита MCR вложенные в MCR зону инструкции будут выполняться либо на обнуление результата сопряжения или передачи данных, если MCR=0, либо выполняться в нормальном режиме, если MCR=1. Команды SET и RESET при MCR=0 не меняют значения операнда. Деактивация работы с зоной MCR производится командой **MCRD**.

Команда **MCRA** должна выполняться обязательно в паре с командой **MCRD**, а команда открытия зоны **MCR(** в паре с командой закрытия зоны **)MCR**.

Глубина вложения MCR зоны – 8 инструкций.



# Параметры EN/ENO (для представления в LAD/FBD)

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 21:

Comment

"Tag_12"	%MW102	
"Tag_13"	%MW104	
"Tag_17"	%MW106	
"Tag_18"	%MW108	
"Tag_19"	%MW110	
"Tag_20"	%MW112	

Network 22:

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) The programming language of the sele...



# Функциональность параметров EN/ENO

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

PLC programming

Network 21:

1	A(			
2	L	"Tag_12"	‡MW102	
3	L	"Tag_13"	‡MW104	
4	+I			
5	T	"Tag_17"	‡MW106	
6	AN OV			ENO
7	SAVE			
8	CLR			EN
9	A BR			
10	)			
11	JMB	Label_1		
12	L	"Tag_18"	‡MW108	
13	L	"Tag_19"	‡MW110	
14	+I			
15	T	"Tag_20"	‡MW112	
16	Label_1 : NOP 0			

Проверка выполнения операции на ошибку  
Значение RLO заносится в бит результата BR

Очистка RLO

Опрос BR на «1».

Если да, разрешение обработки следующей операции

Network 22:

100%

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) The programming language of the sele...



## Примеры косвенной адресации

При косвенной адресации вместо указания адреса указывается место, где адрес может быть найден. Есть два типа косвенной адресации:

### 1.Посредством памяти, когда указывается адрес в системной памяти, в которой можно найти адрес операнда

```

Network 24:
1 L 10
2 T %MW100 //Область памяти с адресом операнда
3 OPN DB [ %MW100]

Network 25:
1 L P#4.0
2 T %MD200 //Область памяти с адресом операнда
3 A %M10.1
4 = Q [ %MD200]
  
```

При косвенной адресации посредством памяти (memory indirect addressing) адрес указывается посредством адресованной ячейки памяти. Адрес должен иметь размер:

- размер слова (WORD), если требуется использовать число в качестве указателя.
- двойного слова (DWORD), если требуется использовать указатель на область P# (area pointer)

### 2.Посредством адресного регистра

```

Network 26:
1 LAR1 P#4.0 //загрузка указателя в AR1
2 A %M10.1
3 = Q [ AR1 , P#0.5 ]

Network 27:
1 LAR2 P#Q4.0 //загрузка указателя в AR2
2 A %M10.1
3 = [ AR2 , P#0.5 ]
  
```

При косвенной адресации посредством регистра (register-indirect addressing) адрес указывается посредством одного из двух адресных регистров AR1 или AR2.



## Загрузка и пересылка данных в адресные регистры

- В случае, если не задан адрес операнда, оператор **LARn** пересылает содержимое аккумулятора **ACCU 1** в адресный регистр **ARn**.
- Если используется инструкция **TAR1 AR2**, то при ее выполнении происходит копирование содержимого адресного регистра **AR1** в адресный регистр **AR2**.
- Оператор **TARn** пересылает содержимое **ARn** в **ACCU 1**

```

Network 28:
1      L      P#4.0      //загрузка указателя в ACCU1
2      LAR1      //пересылка содержимого ACCU1 в AR1
3      A      %M10.0
4      = Q [ AR1 , P#0.1 ]

Network 29:
1      TAR1 AR2      //пересылка содержимого AR1 в AR2
2      A      %M10.0
3      = Q [ AR2 , P#0.1 ]

Network 30:
1      TAR1      //пересылка содержимого AR1 в ACCU1
2      LAR2      //загрузка содержимого ACCU1 в AR2
3      A      %M10.0
4      = Q [ AR2 , P#0.1 ]

```



## Конец раздела 5. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)  
  
Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

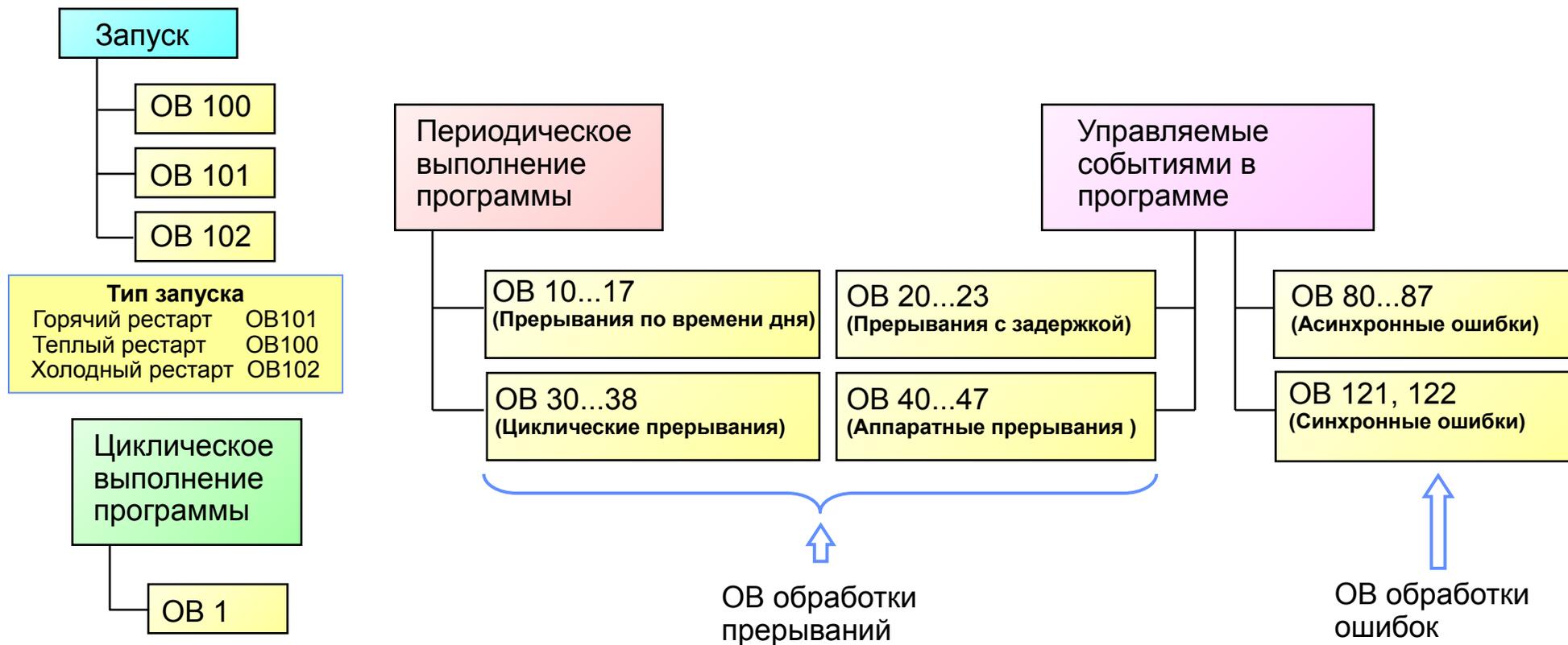
## Раздел 6

Организационные блоки в ПЛК.  
Обзор, предназначение и примеры  
использования.

The image displays the SIMATIC TIA-portal software interface. The main window shows a project titled 'Totally Integrated Automation PORT'. The left sidebar contains a project tree with folders for 'Hardware', 'Networks', 'Ladder Logic', and 'Object Properties'. The main workspace shows a 'MotorControl' block with a 'RampFunction generator' and a 'PD controller' block. A 'RampFunction generator' block is highlighted, showing a graph of the ramp function with parameters: 'Ramp-up time: 10.000 s', 'Ramp-down time: 10.000 s', 'Initial rounding: 0.000 s', and 'Final rounding: 0.000 s'. The 'RampFunction generator' block is also shown in a separate window, displaying the same graph and parameters. The bottom left window shows a network diagram with 'PLC\_1 CPU 1513-1 PN' and 'Drive\_1 G120 CU240E-2' connected via 'PNIE\_1'.



## Обзор организационных блоков



## Прерывания циклической программы



Организационный блок		Приоритет в S7-300	Функция для управления OB	Примечание
Функция	Номер (зависит от CPU)			
Прерывание по времени дня	OB 10 ... 17	2	SET_TINT, ACT_TINT	Альтернатива конфигурированию
Циклическое прерывание	OB 30 ... 38	12	нет	
Прерывание с задержкой	OB 20 ... 23	3	SRT_DINT	Обязательное использование
Аппаратное прерывание	OB 40 ... 47	16	нет	
Диагностическое прерывание	OB 81 ... 87	26	нет	

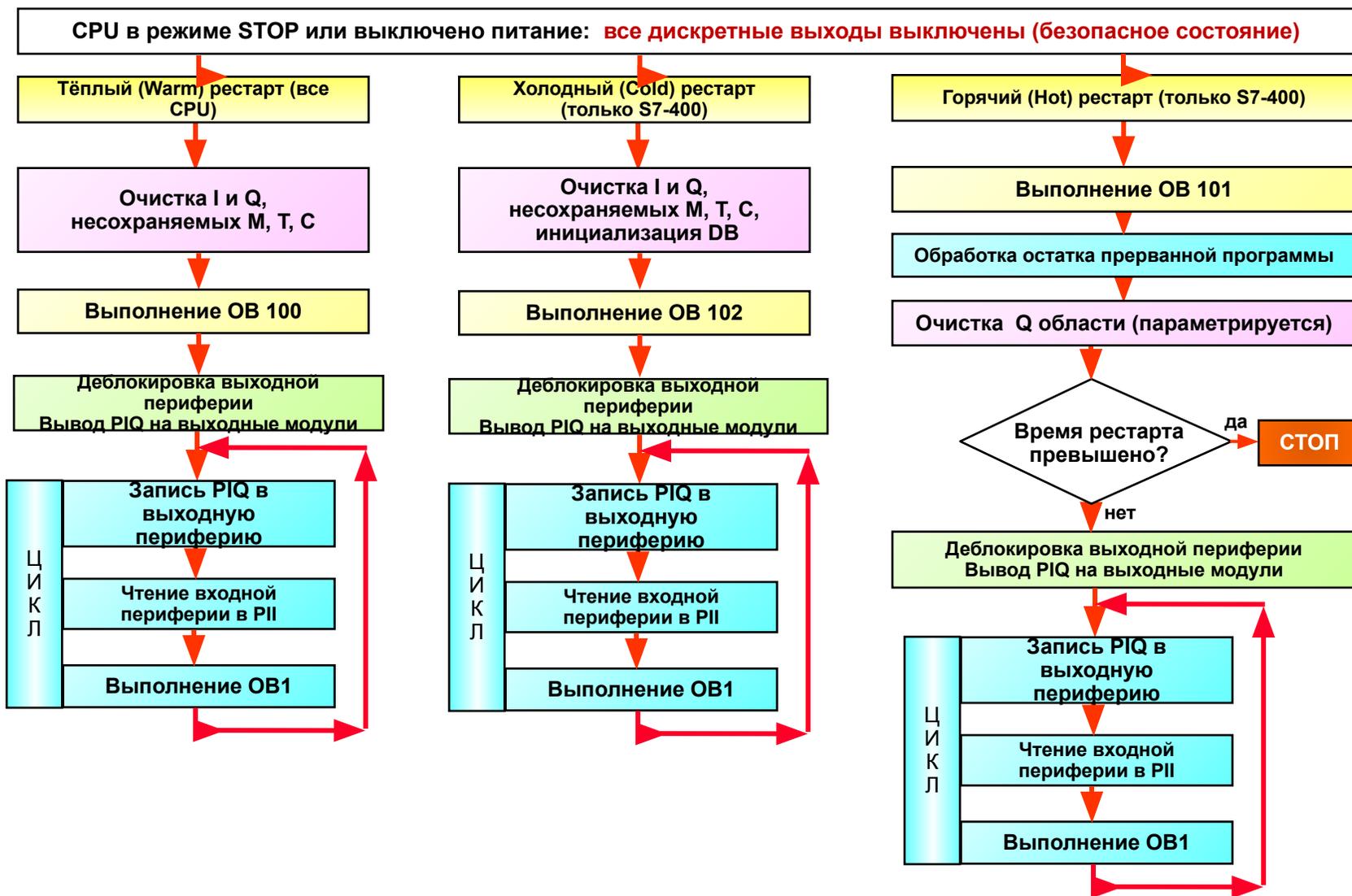


## Стартовая информация ОВ (содержится в области L)

Байты L-стека			
0 / 1	Стартовое событие	Кодовое значение	Управляющая информация
2 / 3	Приоритет	Номер ОВ	
4 / 5	Форматы данных в байтах локального стека 8, 9, 10, 11		Стартовая информация
6 / 7	Дополнительная информация 1 (например, начальный адрес модуля прерывания)		
8 / 9	Дополнительная информация 2 (например, статус прерывания)		
10 / 11	Дополнительная информация 3 (Например, номер канала)		Стартовое время
12 / 13	Год	Месяц	
14 / 15	День	Часы	
16 / 17	Минуты	Секунды	
18 / 19	1/10 секунды, 1/100 секунды	1 /1000 секунды, день недели	



# Виды рестарта и вызываемых ОВ



# Свойства ЦПУ. ОВ обработки рестарта

The screenshot displays the Siemens TIA Portal interface for configuring a PLC. The main window shows the 'Properties' dialog for 'PLC\_1 [CPU 314C-2 PN/DP]'. The 'Startup' tab is active, showing the following configuration:

- Startup if preset configuration does not match actual configuration
- Startup after POWER ON: Warm restart
- Monitoring time for:
  - Ready message from modules: 650 x 100 ms
  - Parameter transfer to modules: 100 x 100 ms

A red text annotation **Выполняется только OB100** is overlaid on the 'Warm restart' dropdown menu, indicating that this setting is specific to OB100.

# Свойства ЦПУ. ОВ обработки прерываний

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_2

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
    - Block\_3 [FB1]
    - CALL\_FB [FB4]
    - SUM\_1 [FB2]
    - SUM\_2 [FB3]
    - Block\_recipe [DB6]
    - CALL\_FB\_DB [DB3]
    - FB1\_IDB1 [DB1]

Reference projects

Details view

PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

Device data

Properties Info Diagnostics

General IO tags Texts

General

- MPI/DP interface [X1]
- PROFINET interface [X2]
- DI24/DO16
- AIS/AO2
- Count
- Positioning
- Startup
- Cycle
- Clock memory
- Interrupts
  - Time-of-day interrupts
  - Time-delay interrupts
  - Cyclic interrupts
  - Hardware interrupts
  - Interrupts for DPV1
  - Isochronous mode i...

OB 61:

Time-of-day interrupts

OB number	Priority	Activated	Interval	Start time
OB 10:	2	<input type="checkbox"/>	Once	Tuesday, ...

Portal view Overview PLC\_1

The project Project\_2 was saved succes...



# Свойства ЦПУ. ОВ обработки прерываний

The screenshot shows the Siemens TIA Portal interface for configuring a PLC. The main window displays the 'Properties' for 'PLC\_1 [CPU 314C-2 PN/DP]'. The 'Time-delay interrupts' table is highlighted, showing the following data:

OB number	Priority	Process image ...
OB 20:	3	None
OB 21:	4	None

The 'Interrupts' section in the left sidebar is expanded, and 'Time-delay interrupts' is selected. The status bar at the bottom indicates 'The project Project\_2 was saved succes...'.



# Свойства ЦПУ. ОВ обработки прерываний

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Devices: Add new device, Devices & networks, PLC\_1 [CPU 314C-2 PN/DP], Device configuration, Online & diagnostics, Program blocks, Add new block, Main [OB1], Block\_1 [FC1], Block\_2 [FC2], Block\_3 [FB1], CALL\_FB [FB4], SUM\_1 [FB2], SUM\_2 [FB3], Block\_recipe [DB6], CALL\_FB\_DB [DB3], FB1\_IDB1 [DB1]

PLC\_1 [CPU 314C-2 PN/DP] Properties

General IO tags Texts

Cyclic interrupts

OB number	Priority	Interval	Phase offset	
OB 32:	9	1000	0	ms
OB 33:	10	500	0	ms
OB 34:	11	200	0	ms
OB 35:	12	100	0	ms

Diagram illustrating the execution sequence of cyclic interrupts (OB32-35) during the RUN phase. The sequence shows a period (период) followed by the execution of OB32-35, which includes OB1, O, and B1 blocks. This sequence repeats three times.

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Свойства ЦПУ. ОВ обработки прерываний

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_2

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
    - Block\_3 [FB1]
    - CALL\_FB [FB4]
    - SUM\_1 [FB2]
    - SUM\_2 [FB3]
    - Block\_recipe [DB6]
    - CALL\_FB\_DB [DB3]
    - FB1\_IDB1 [DB1]

Reference projects

Details view

Portal view Overview PLC\_1

PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

Device data

Properties Info Diagnostics

General IO tags Texts

General

- MPI/DP interface [X1]
- PROFINET interface [X2]
- DI24/DO16
- AI5/AO2
- Count
- Positioning
- Startup
- Cycle
- Clock memory
- Interrupts
  - Time-of-day interrupts
  - Time-delay interrupts
  - Cyclic interrupts
  - Hardware interrupts**
  - Interrupts for DPV1
  - Isochronous mode i...

OB 61:

Hardware interrupts

OB number	Priority
OB 40:	16

The project Project\_2 was saved succes...



# Свойства ЦПУ. ОВ обработки асинхронных ошибок

The screenshot shows the Siemens TIA Portal interface. The main window displays the configuration for a PLC\_1 [CPU 314C-2 PN/DP]. The 'Properties' window is open to the 'Interrupts' tab, showing the configuration for asynchronous error interrupts. The table below lists the OB numbers and their priorities:

OB number	Priority
OB 82:	26
OB 83:	26
OB 85:	26
OB 86:	26
OB 87:	26

The 'Interrupts' section in the left pane is expanded to show 'Asynchronous error interrupts'.

## ОВ обработки асинхронных ошибок

Тип ошибки	Пример	ОВ	Приоритет
Ошибка времени	Превышено максимальное время цикла	ОВ80	26
Неисправность питания	Неисправность буферной батареи	ОВ81	26 / 28
Диагностическое прерывание	Обрыв провода на входе модуля с внутренней диагностикой	ОВ82	
Вставка/удаление модуля	Удаление сигнального модуля во время функционирования S7-400™	ОВ83	
Дефект аппаратуры CPU	Неправильный уровень сигнала в интерфейсе MPI	ОВ84	
Ошибка выполнения программы	Ошибка в обновлении областей отображения процесса (дефект модуля)	ОВ85	
Дефект стойки	Неисправность в корзине расширения или В DP- слэйве	ОВ86	
Ошибка связи	Ошибка при чтении телеграммы сообщения	ОВ87	

# Пример обработки прерывания по времени дня

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Block interface

Network 3:

Network 4:

Вызываемый OB

Параметр PERIOD

- Однократно W#16#0000
- Ежеминутно W#16#0201
- Ежечасно W#16#0401
- Ежедневно W#16#1001
- Ежедневно W#16#1201
- Ежемесячно W#16#1401
- Ежегодно W#16#1801
- В конце месяца W#16#2001

Блок активизации обработки прерывания

Instructions

Options

Favorites

Basic instructions

Extended instructions

Name

- ▶ Date and time-of-day
- ▶ String + Char
- ▶ Process image
- ▶ Distributed I/O
- ▶ PROFINergy
- ▶ Module parameter assignment
- ▼ Interrupts
  - Time-of-day interrupt
  - SET\_TINT
  - CAN\_TINT
  - ACT\_TINT
  - QRY\_TINT
  - Time delay interrupt
  - SET\_EINT

Technology

Communication

Portal view Overview Block\_2 (FC2)

The project Project\_2 was saved succes...



# Пример обработки прерывания с задержкой времени

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Block interface

Network 5:

Вызываемый OB

Импульс заднего фронта

Точка вызова OB20

Network 6:

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Global\_DB1

The programming language of the sele...

Instructions

Options

Favorites

Basic instructions

Extended instructions

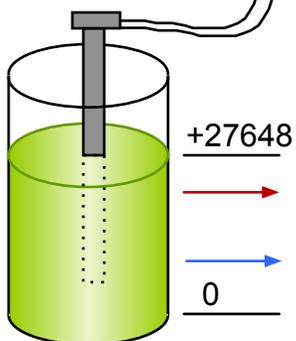
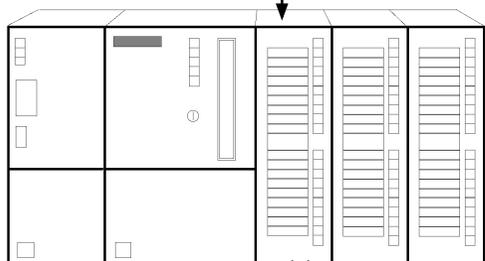
Name	Version
Interrupts	
Time-of-day interrupt	
SET_TINT	
CAN_TINT	V1.1
ACT_TINT	V1.1
QRY_TINT	V1.1
Time delay interrupt	
SRT_DINT	
CAN_DINT	
QRY_DINT	
Synchronous error event	
MSK_FLT	
DMSK_FLT	
READ_ERR	

Technology

Communication

# Аппаратное прерывание по ограничениям уровней (OB40)

Модуль аналоговых входов

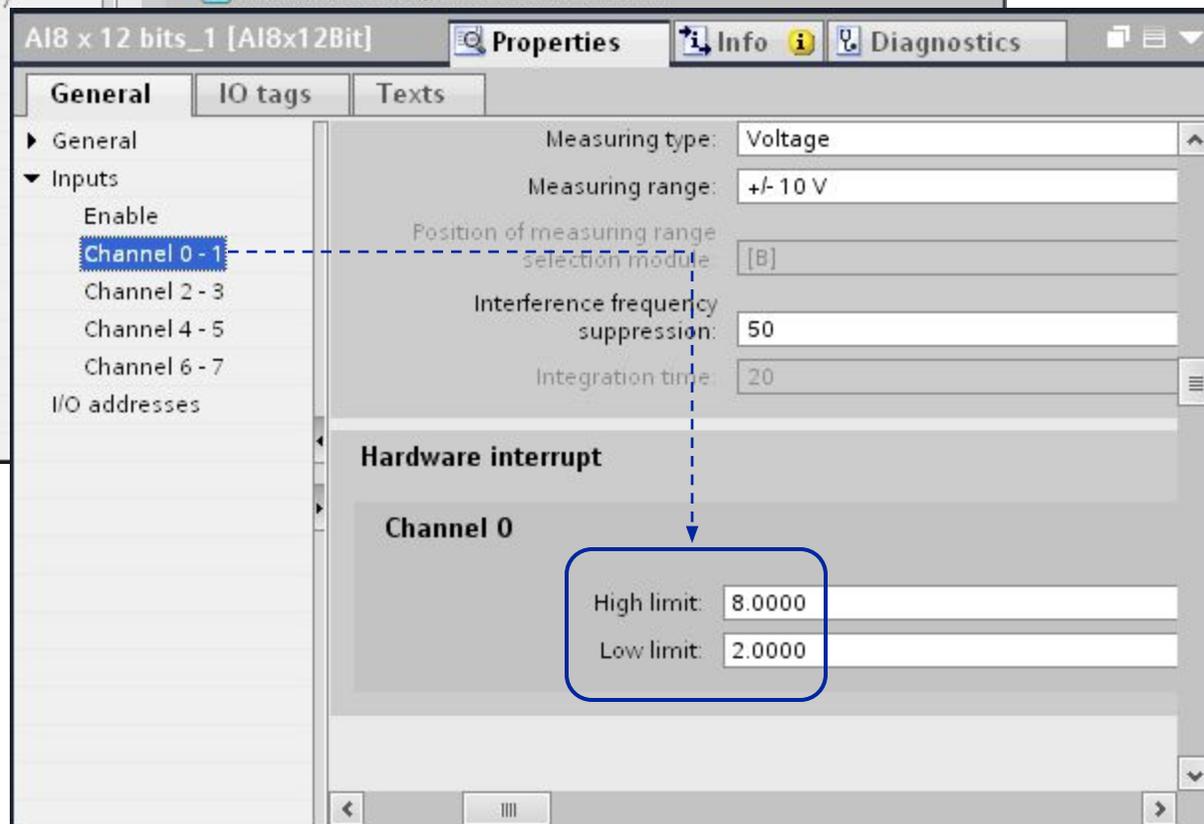
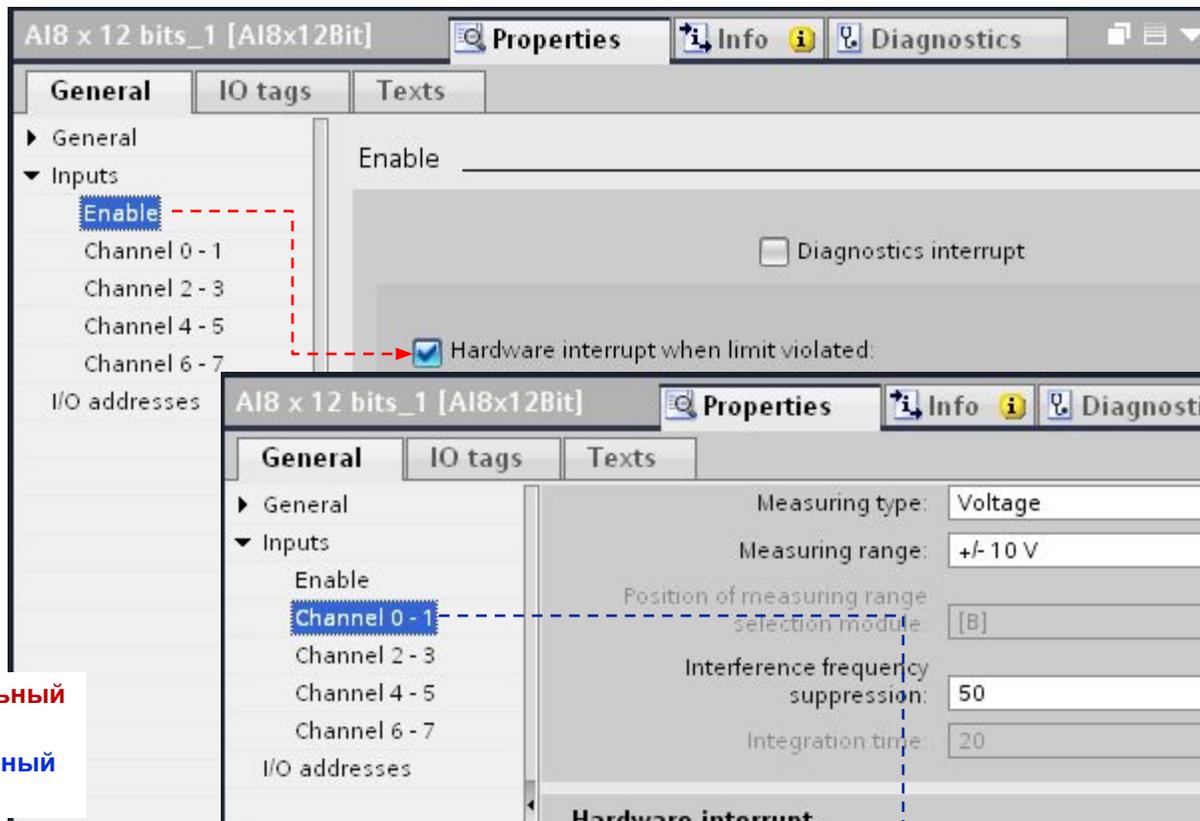


Верхний предельный уровень

Нижний предельный уровень

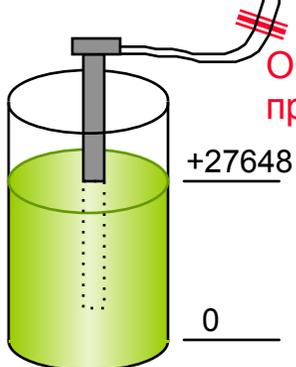
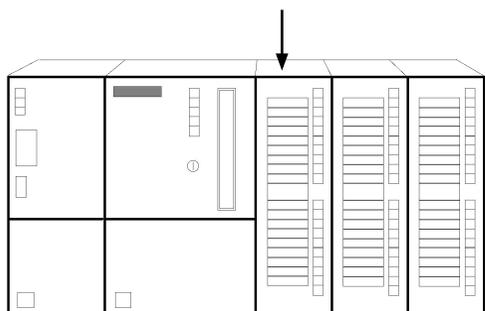


При выходе сигнала за заданные пределы системой будет вызван OB40



# Обработка ОВ обрыва провода модуля входа AI с диагностикой

Модуль аналоговых входов  
4-20 mA



Обрыв  
провода

При обрыве провода системой  
будет вызван OB82

**AIB x 12 bits\_1 [AIBx12Bit] Properties**

General | IO tags | Texts

Enable   Diagnostics interrupt

Hardware interrupt when limit violated:

**PLC\_1 [CPU 314C-2 PN/DP] Properties**

General | IO tags | Texts

Asynchronous error interrupts

OB number	Priority
OB 82:	26
OB 83:	26
OB 85:	26
OB 86:	26
OB 87:	26

## ОВ обработки синхронных ошибок

Тип ошибки	Пример	ОВ	Приоритет
Ошибка программирования	В программе вызван блок, который отсутствует в CPU	ОВ121	Тот же, что у ОВ, который прерван в результате ошибки в нем
Ошибки доступа	В программе производится обращение к модулю, который или неисправен, или отсутствует (например, при прямом доступе к несуществующему периферийному модулю )	ОВ122	



## Конец раздела 6. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 7

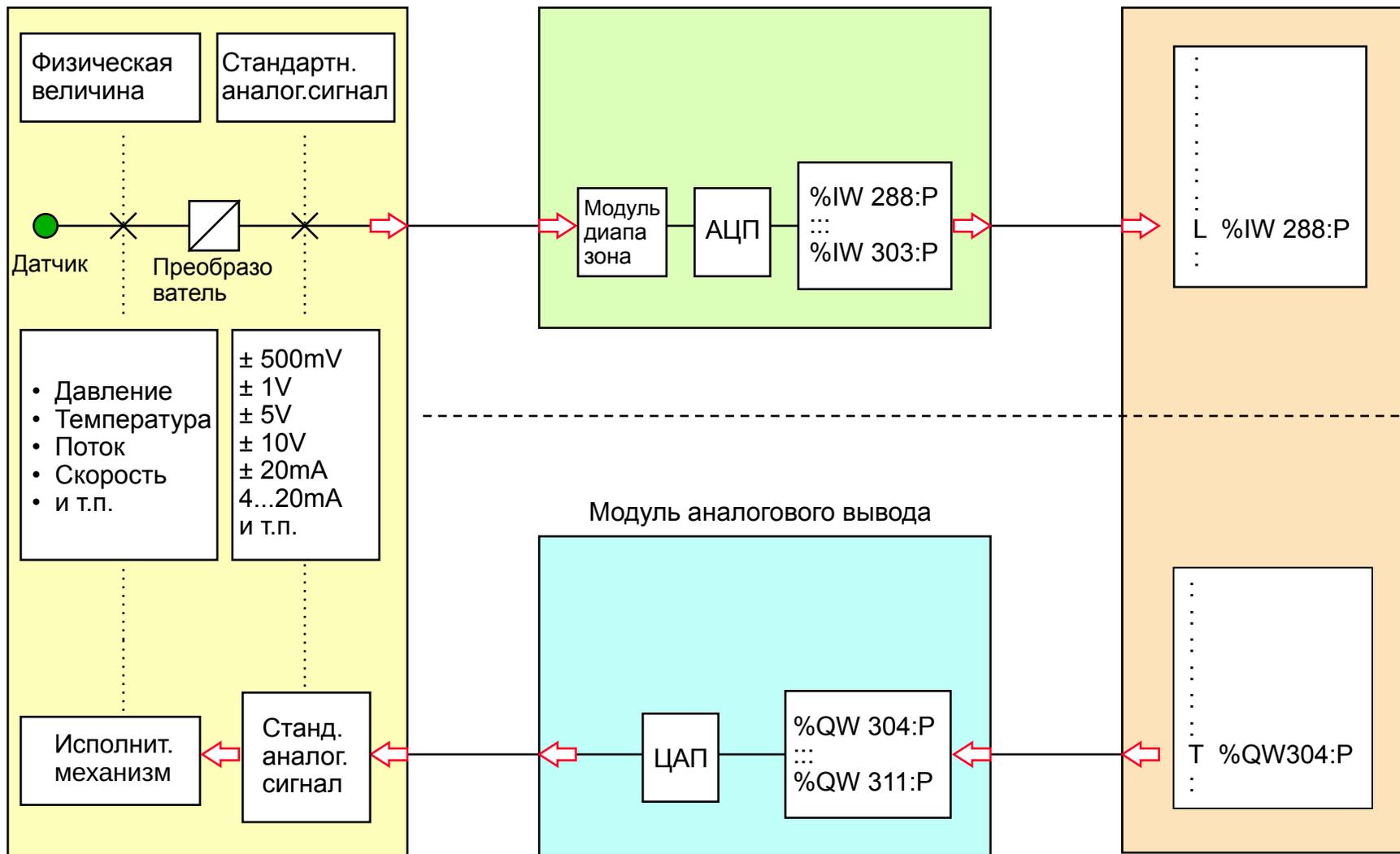
Обработка аналоговых сигналов. Структура и представление аналоговых величин. Модули обработки.

The image displays the SIMATIC TIA-portal software interface, which is used for configuring and commissioning SIMATIC 300 and 400 PLC systems. The main window shows a project titled 'Totally Integrated Automation PORT'. The interface is divided into several panes:

- Left Pane (Project Tree):** Shows the project structure, including the PLC (CPU 1513-1 PN) and the drive (G120 CU240E-2).
- Top Pane (Hardware Catalog):** Lists various modules and components available for selection.
- Main Workspace:** Displays a ladder logic diagram for a 'RampFunction generator analog'. It includes a 'RampFunction generator analog' block, a 'PD controller analog', and a 'RampFunction generator' block. The diagram shows the flow of analog signals and the control logic.
- Bottom Pane (Parameter View):** Shows the parameters for the 'RampFunction generator' block. It includes a graph of the ramp function with parameters such as 'Ramp-up time', 'Ramp-down time', 'Initial rounding', and 'Final rounding'. The graph shows a smooth ramp function with rounded start and end points.



# Функциональная структура обработки аналоговых сигналов



## Представление входной аналоговой величины

Диапазон	Напряжение		Ток		Сопротивление		Температура (PT100)	
	Например, ± 10В	Значение	Например, 4 .. 20 мА	Значение	Например, 0...300 Ом	Значение	Например, -200...+850°C	Значение
Переполнение	>= 11.759	32767	>= 22.815	32767	>=352.778	32767	>= 1000.1	32767
Превышение верхней границы	11.7589	32511	22.810	32511	352.767	32511	1000.0	10000
	⋮ 10.0004	⋮ 27649	⋮ 20.0005	⋮ 27649	⋮ 300.011	⋮ 27649	⋮ 850.1	⋮ 8501
Номинальный диапазон	10.00	27648	20.000	27648	300.000	27648	850.0	8500
	7.50	20736	16.000	20736	225.000	20736	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	-7.5 -10.00	-20736 -27648	⋮ 4.000	⋮ 0	⋮ 0.000	⋮ 0	⋮ -200.0	⋮ -2000
Превышение Нижней границы	- 10.0004	- 27649	3.9995	- 1	Отрицат. значения невозможны	- 1	- 200.1	- 2001
	⋮ - 11.759	⋮ - 32512	⋮ 1.1852	⋮ - 4864		⋮ - 4864	⋮ - 243.0	⋮ - 2430
Переполнение	<= - 11.76	- 32768	<= 1.1845	- 32768		- 32768	<= - 243.1	- 32768



## Представление выходной аналоговой величины

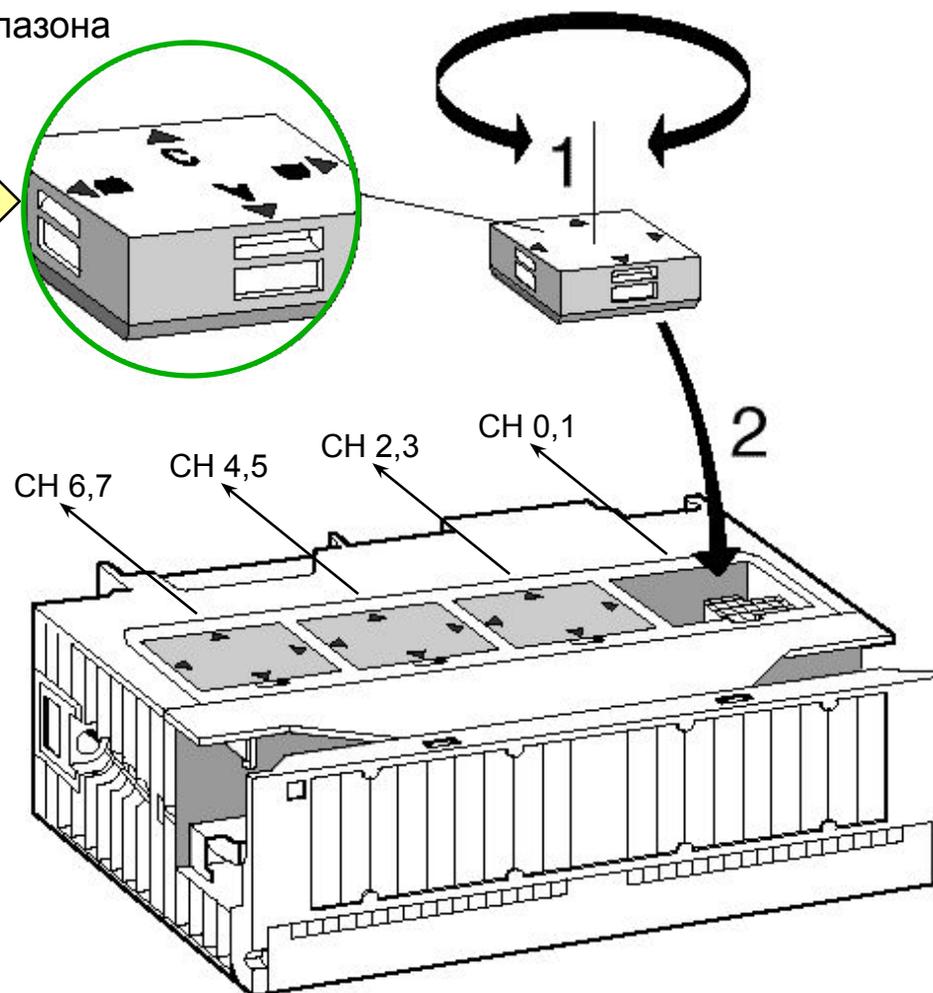
Диапазон	Значение	Напряжение			Ток			
		Выходные диапазоны:			Выходные диапазоны:			
		0 – 10 В	1 – 5 В	± 10 В	0 – 20 мА	4 – 20 мА	± 20 мА	
Переполнение	<b>&gt;=32767</b>	0	0	0	0	0	0	
Верхний диапазон	32511 ⋮ 27649	11.7589 ⋮ 10.0004	5.8794 ⋮ 5.0002	11.7589 ⋮ 10.0004	23.515 ⋮ 20.0007	22.81 ⋮ 20.005	23.515 ⋮ 20.0007	
Номинальный диапазон	27648 ⋮ 0 ⋮ - 6912 ⋮ - 6913 ⋮ ⋮ ⋮ ⋮ - 27648	10.0000 ⋮ 0	5.0000 ⋮ 1.0000	10.0000 ⋮ 0 ⋮ ⋮ ⋮ ⋮ -10.0000	20.000 ⋮ 0	20.000 ⋮ 4.000	20.000 ⋮ 0 ⋮ ⋮ ⋮ ⋮ -20.000	
	Нижний диапазон	- 27649 ⋮ - 32512	0.9999 ⋮ 0	0.9999 ⋮ 0	- 10.0004 ⋮ - 11.7589	3.9995 ⋮ 0	3.9995 ⋮ 0	- 20.007 ⋮ - 23.515
	Переполнение	<b>&lt;= - 32513</b>	0	0	0	0	0	0



## Выбор и параметрирование аналоговых модулей 7KF0xx

Установка коммутатора величины и диапазона измерений для модулей серии 7KF0xx

**A:** 80/250/500/1000mv/Pt100  
**B:** 2,5/5/10V  
**C:** 4 WIRE CURRENT  
**D:** 2 WIRE CURRENT



# Выбор и параметрирование аналоговых модулей 7KF0xx

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows a rack of modules for "PLC\_1 [CPU 314C-2 PN/DP]". The rack is labeled "Rail\_0" and has slots numbered 1 through 11. Slot 4 is currently occupied by a module labeled "DI32x24VDC\_1". A red dashed arrow points from the "6ES7 331-7KF02-0AB0" module in the hardware catalog to slot 5 of the rack.

The hardware catalog on the right side of the screen is open, showing the "Options" and "Catalog" sections. The "Catalog" section is expanded to show the "AI" (Analog Input) category, which is further expanded to show "AI8 x 12 bits". The "6ES7 331-7KF02-0AB0" module is highlighted in the catalog.

The bottom status bar shows "Portal view", "Overview", and "PLC\_1" tabs. A notification at the bottom right states: "The project Project\_2 was saved succes..."



# Выбор и параметрирование аналоговых модулей 7KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Devices & networks

Rail\_0 1 2 4 5 6 7 8 9 10 11

PLC\_1

DI32x24VDC\_1

Двойной щелчок

Hardware catalog

Options

Catalog

Filter

- DO
- DI/DO
- AI
  - AI2 x 12 bits
  - AI8 x 12 bits
    - 6ES7 331-7KF02-0AB0
  - AI8 x 13 bits
  - AI8 x 14 bits
  - AI8 x 16 bits
  - AI8 x 16 bits HART
  - AI8 x RTD
  - AI6 x TC
  - AI8 x TC
  - AI4 x 0/4 to 20mA, Ex
  - AI8 x TC / AI4 x RTD, Ex
  - AI2 x HART, Ex
- AO

Information

Properties Info Diagnostics

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей 7KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▶ PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AI8 x 12 bits\_1 [AI8x12Bit]

Properties Info Diagnostics

General IO tags Texts

General

Inputs

I/O addresses

Name: AI8 x 12 bits\_1

Author: home

Comment:

Rack: 0

Slot: 5

Catalog information

Hardware catalog

Options

Catalog

Filter

- DO
- DI/DO
- AI
  - AI2 x 12 bits
  - AI8 x 12 bits
    - 6ES7 331-7KF02-0AB0
  - AI8 x 13 bits
  - AI8 x 14 bits
  - AI8 x 16 bits
  - AI8 x 16 bits HART
  - AI8 x RTD
  - AI6 x TC
  - AI8 x TC
  - AI4 x 0/4 to 20mA, Ex
  - AI8 x TC / AI4 x RTD, Ex
  - AI2 x HART, Ex
- AO

Information

Portal view Overview PLC\_1

The project Project\_2 was saved succes...



# Выбор и параметрирование аналоговых модулей 7KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AI8 x 12 bits\_1 [AI8x12Bit]

Properties Info Diagnostics

General IO tags Texts

General

Inputs

Enable

Channel 0 - 1

Channel 2 - 3

Channel 4 - 5

Channel 6 - 7

I/O addresses

Channel 0 - 1

Diagnostics

Group diagnostics

Check for wire break

Measuring

Measuring type: Voltage

Measuring range: Deactivated

Position of measuring range selection module: Voltage

Interference frequency suppression: Power (4-wire measuring transducer)

Integration time: Power (2-wire measuring transducer)

Resistor (4-wire terminal)

RT thermal resistor (linear)

TC-I thermocouple (int. comp.)

TC-E thermocouple (ext. comp.)

TC-IL thermocouple (int. comp., linear)

TC-EL thermocouple (ext. comp., linear)

Hardware catalog

Options

Catalog

Filter

DO

DI/DO

AI

AI2 x 12 bits

AI8 x 12 bits

6ES7 331-7KF02-0AB0

AI8 x 13 bits

AI8 x 14 bits

AI8 x 16 bits

AI8 x 16 bits HART

AI8 x RTD

AI6 x TC

AI8 x TC

AI4 x 0/4 to 20mA, Ex

AI8 x TC / AI4 x RTD, Ex

AI2 x HART, Ex

AO

Information

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей 7KF0xx

The screenshot displays the Siemens TIA Portal interface for configuring a PLC module. The main window shows the 'Device data' for 'AI8 x 12 bits\_1 [AI8x12Bit]'. The 'Properties' tab is active, showing the 'Diagnostics' and 'Measuring' sections. The 'Measuring range' dropdown is open, showing the following options:

- +/- 10 V
- +/- 80 mV
- +/- 250 mV
- +/- 500 mV
- +/- 1 V
- +/- 2.5 V
- +/- 5 V
- 1.5 V
- +/- 10 V

The 'Hardware catalog' on the right shows the selected module: 6ES7 331-7KF02-0AB0. The 'Information' section at the bottom right shows the project name: Project\_2.

# Выбор и параметрирование аналоговых модулей 7KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AI8 x 12 bits\_1 [AI8x12Bit]

Properties Info Diagnostics

General IO tags Texts

General

Inputs

Enable

Channel 0-1

Channel 2-3

Channel 4-5

Channel 6-7

I/O addresses

I/O addresses

Input addresses

Start address: 272

End address: 287

Process image: None

Interrupt OB number: 40

Обращение в программе %IW 272:P

С префиксом :P CPU обращается к модулю непосредственно, без участия образа процесса

Hardware catalog

Options

Catalog

Filter

DO

DI/DO

AI

AI2 x 12 bits

6ES7 331-7KB02-0AB0

AI8 x 12 bits

AI8 x 13 bits

AI8 x 14 bits

AI8 x 16 bits

AI8 x 16 bits HART

AI8 x RTD

AI6 x TC

AI8 x TC

AI4 x 0/4 to 20mA, Ex

AI8 x TC / AI4 x RTD, Ex

AI2 x HART, Ex

AO

Information

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей 1KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Devices & networks

Rail\_0

PLC\_1

DI32x24VDC\_1

AI8x12bits\_1

1 2 4 5 6 7 8 9 10 11

Hardware catalog

Options

Catalog

Filter

- DO
- DI/DO
- AI
  - AI2x12bits
    - 6ES7 331-7KB02-0AB0
  - AI8x12bits
    - 6ES7 331-1KF01-0AB0
    - 6ES7 331-1KF02-0AB0
  - AI8x13bits
    - 6ES7 331-1KF01-0AB0
    - 6ES7 331-1KF02-0AB0
  - AI8x14bits
  - AI8x16bits
  - AI8x16bits HART
  - AI8xRTD
  - AI6xTC
  - AI8xTC
  - AI4x0/4 to 20mA, Ex
  - AI8xTC / AI4xRTD, Ex

Information

Properties Info Diagnostics

Portal view Overview PLC\_1

The project Project\_2 was saved succes...



# Выбор и параметрирование аналоговых модулей 1KF0xx

The screenshot displays the Siemens TIA Portal interface for configuring a PLC rack. The main workspace shows a rack with slots 1 through 11. Slot 1 contains the CPU 314C-2 PN/DP. Slots 4, 5, and 6 contain analog modules. A yellow callout bubble with the text "Двойной щелчок" (Double click) points to slot 6. The hardware catalog on the right shows the selection of an AI8 x 12 bits module (6ES7 331-1KF01-0AB0). The interface includes a menu bar, a toolbar, and a status bar at the bottom.

Hardware catalog options:

- Filter
- DO
- DI/DO
- AI
  - AI2 x 12 bits
    - 6ES7 331-7KB02-0AB0
  - AI8 x 12 bits
  - AI8 x 13 bits
    - 6ES7 331-1KF01-0AB0
    - 6ES7 331-1KF02-0AB0
  - AI8 x 14 bits
  - AI8 x 16 bits
  - AI8 x 16 bits HART
  - AI8 x RTD
  - AI6 x TC
  - AI8 x TC
  - AI4 x 0/4 to 20mA, Ex
  - AI8 x TC / AI4 x RTD, Ex

# Выбор и параметрирование аналоговых модулей 1KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Save project

Topology view Network view Device view

PLC\_1

100%

Device data

AI8 x 13 bits\_1 [AI8x13Bit]

Properties Info Diagnostics

General IO tags Texts

General

Inputs

Measuring

Channel 0

Channel 1

Channel 2

Channel 3

Channel 4

Channel 5

Channel 6

Channel 7

I/O addresses

Measuring

Temperature unit: Degrees Celsius  
Degrees Celsius  
Degrees Fahrenheit  
Kelvin

Выбирается шкала измерения температуры

Hardware catalog

Options

Catalog

Filter

DO

DI/DO

AI

AI2 x 12 bits

6ES7 331-7KB02-0AB0

AI8 x 12 bits

AI8 x 13 bits

6ES7 331-1KF01-0AB0

6ES7 331-1KF02-0AB0

AI8 x 14 bits

AI8 x 16 bits

AI8 x 16 bits HART

AI8 x RTD

AI6 x TC

AI8 x TC

AI4 x 0/4 to 20mA, Ex

AI8 x TC / AI4 x RTD, Ex

Information

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей 1KF0xx

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AI8 x 13 bits\_1 [AI8x13Bit] Properties Info Diagnostics

General IO tags Texts

General

Inputs

Measuring

Channel 0

Channel 1

Channel 2

Channel 3

Channel 4

Channel 5

Channel 6

Channel 7

I/O addresses

Channel 0

Measuring type: Voltage

Measuring range: Voltage

Deactivated

Voltage

Current

R resistance

RTD thermal resistor (lin.)

Hardware catalog

Options

Catalog

Filter

DO

DI/DO

AI

AI2 x 12 bits

6ES7 331-7KB02-0AB0

AI8 x 12 bits

AI8 x 13 bits

6ES7 331-1KF01-0AB0

6ES7 331-1KF02-0AB0

AI8 x 14 bits

AI8 x 16 bits

AI8 x 16 bits HART

AI8 x RTD

AI6 x TC

AI8 x TC

AI4 x 0/4 to 20mA, Ex

AI8 x TC / AI4 x RTD, Ex

Information

The project Project\_2 was saved succes...

Portal view

Channel x

Монтаж на модуле

V

A

mV

R

Модуль имеет 8 каналов, в каждом выбирается необходимый вход

# Выбор и параметрирование аналоговых модулей 1KF0xx

The screenshot displays the Siemens TIA Portal interface for configuring a PLC module. The main window shows the 'Device data' for 'AI8 x 13 bits\_1 [AI8x13Bit]'. The 'General' tab is active, and the 'Inputs' section is expanded to show 'Channel 0'. The 'Measuring input' section is visible, with the 'Measuring type' set to 'Voltage' and the 'Measuring range' dropdown menu open. The dropdown menu lists several options, with '+/- 10 V' selected. The hardware catalog on the right shows the selected module '6ES7 331-1KF01-0AB0' under the 'AI8 x 13 bits' category. The status bar at the bottom indicates that the project 'Project\_2' was saved successfully.



# Выбор и параметрирование аналоговых модулей АО

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_2". The main workspace shows a rack configuration for "PLC\_1 [CPU 314C-2 PN/DP]". The rack contains a CPU module in slot 1 and several analog modules in slots 4, 5, and 6. The modules are labeled as follows:

- Slot 4: DI32x24VDC\_1
- Slot 5: AI8x12bits\_1
- Slot 6: AO8x13bits\_1

The "Hardware catalog" is open on the right side, showing the "AO" category expanded. The "AO4x12bits" sub-category is selected, and the specific module "6ES7 332-5HD01-0AB0" is highlighted with a blue box. A red dashed arrow points from this module in the catalog to the corresponding slot in the rack configuration.

The interface includes a menu bar (Project, Edit, View, Insert, Online, Options, Tools, Window, Help), a toolbar with icons for saving, opening, and online/offline operations, and a status bar at the bottom indicating "The project Project\_2 was saved succes...".



# Выбор и параметрирование аналоговых модулей АО

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Devices & networks

Rail\_0

PLC\_1

DI32x24VDC\_1

AI8x12bits\_1

AO8x12bits\_1

Двойной щелчок

Hardware catalog

Options

Catalog

Filter

- Rack
- PS
- CPU
- IM
- DI
- DO
- DI/DO
- AI
- AO
  - AO2 x 12 bits
  - AO4 x 12 bits
    - 6ES7 332-5HD01-0AB0
  - AO8 x 12 bits
  - AO4 x 16 bits
  - AO4 x 0/4 to 20mA, Ex
  - AO2 x HART, Ex
  - AO8 x 16 bits HART

Information

Properties Info Diagnostics

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей АО

The screenshot displays the Siemens TIA Portal interface for configuring an AO4 x 12 bits module. The main window shows the 'Device data' for 'AO4 x 12 bits\_1 [AO4x12Bit]'. The 'General' tab is active, and the 'Outputs' section is expanded to show 'Channel 0'. The 'Output type' dropdown menu is open, with 'Voltage' selected. Other options include 'Deactivated' and 'Current'. The 'Diagnostics' section has a 'Group diagnostics' checkbox. The 'Information' section at the bottom right shows a status message: 'The project Project\_2 was saved succes...'. The hardware catalog on the right side of the screen shows the selection path: Rack > PS > CPU > IM > DI > DO > DI/DO > AI > AO > AO4 x 12 bits > 6ES7 332-5HD01-0AB0.



# Выбор и параметрирование аналоговых модулей АО

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 ▶ PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AO4 x 12 bits\_1 [AO4x12Bit]

Properties Info Diagnostics

General IO tags Texts

General

Outputs

Channel 0

Channel 1

Channel 2

Channel 3

I/O addresses

Channel 0

Diagnostics

Group diagnostics

Output

Output type: Voltage

Output range: 0..10 V

Reaction to CPU STOP: 0..10 V

Substitute value: +/- 10 V

Hardware catalog

Options

Catalog

Filter

- Rack
- PS
- CPU
- IM
- DI
- DO
- DI/DO
- AI
- AO
  - AO2 x 12 bits
  - AO4 x 12 bits
    - 6ES7 332-5HD01-0AB0
  - AO8 x 12 bits
  - AO4 x 16 bits
  - AO4 x 0/4 to 20mA, Ex
  - AO2 x HART, Ex
  - AO8 x 16 bits HART

Information

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей АО

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP]

Topology view Network view Device view

PLC\_1 100%

Device data

AO4 x 12 bits\_1 [AO4x12Bit]

Properties Info Diagnostics

General IO tags Texts

General

Outputs

Channel 0

Channel 1

Channel 2

Channel 3

I/O addresses

Channel 0

Diagnostics

Group diagnostics

Output

Output type: Voltage

Output range: 0..10 V

Reaction to CPU STOP: Output has no current or voltage

Substitute value:

- Output has no current or voltage
- Keep last value
- Substitute a value

**Выбор состояния выхода при переходе CPU в STOP**

Hardware catalog

Options

Catalog

Filter

- Rack
- PS
- CPU
- IM
- DI
- DO
- DI/DO
- AI
- AO
  - AO2 x 12 bits
  - AO4 x 12 bits
    - 6ES7 332-5HD01-0AB0
  - AO8 x 12 bits
  - AO4 x 16 bits
  - AO4 x 0/4 to 20mA, Ex
  - AO2 x HART, Ex
  - AO8 x 16 bits HART

Hardware catalog Online tools Tasks

Portal view Overview PLC\_1

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей АО

The screenshot displays the Siemens TIA Portal interface for configuring a PLC module. The main window shows the 'Properties' view for the 'AO4 x 12 bits\_1 [AO4x12Bit]' module. The 'Output' section is active, showing the following parameters:

- Output type: Voltage
- Output range: 0..10 V
- Reaction to CPU STOP: Substitute a value (highlighted in the dropdown menu)
- Substitute value: Output has no current or voltage (highlighted in the dropdown menu)

The 'Hardware catalog' on the right side shows the navigation tree with the following structure:

- Hardware catalog
  - Options
  - Catalog
    - Filter
    - Rack
    - PS
    - CPU
    - IM
    - DI
    - DO
    - DI/DO
    - AI
    - AO
      - AO2 x 12 bits
      - AO4 x 12 bits (selected)
        - 6ES7 332-5HD01-0AB0
      - AO8 x 12 bits
      - AO4 x 16 bits
      - AO4 x 0/4 to 20mA, Ex
      - AO2 x HART, Ex
      - AO8 x 16 bits HART

The status bar at the bottom indicates: 'Portal view', 'Overview', 'PLC\_1', and 'The project Project\_2 was saved succes...'.

# Выбор и параметрирование аналоговых модулей АО

The screenshot displays the Siemens TIA Portal interface for configuring a PLC module. The main window shows the 'Properties' view for the 'AO4 x 12 bits\_1 [AO4x12Bit]' module. The 'Output addresses' section is active, with the 'Start address' field set to 304. A red arrow points to this field with the text 'Обращение в программе %QW 304:P'. The 'End address' is 311, and the 'Process image' is 'None'. The hardware catalog on the right shows the selected module '6ES7 332-5HD01-0AB0' under the 'AO4 x 12 bits' category. The status bar at the bottom indicates 'The project Project\_2 was saved succes...'.



# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

PM

AI

2AI x U ST

6ES7 134-4FB01-0AB0

2AI x U HF

2AI x U HS

2AI x I 2WIRE ST

2AI x I 4WIRE ST

2AI x I 2WIRE HS

2AI x I 4WIRE HS

2AI x I 2/4WIRE HF

4AI x I 2WIRE ST

4AI x TC ST

2AI x TC ST

2AI x TC HF

2AI x RTD ST

2AI x RTD HF

Information

The project Project\_2 was saved succes...

Devices & networks

IO device\_2

Topology view Network view Device view

IO device\_2

96%

Rack

0	1	2	3	4	5	6	7	...15	...23	...31	...39	...47	...55	...63	
SIEMENS															
[Image of rack modules]															
								8	16	24	32	40	48	56	
								-	-	-	-	-	-	-	
								15	23	31	39	47	55	63	

Device data

Properties Info Diagnostics

Portal view Overview IO device\_2

Выберем модуль обработки сигналов напряжения

# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- PM
- AI
  - 2AI x U ST
    - 6ES7 134-4FB01-0AB0**
    - 2AI x U HF
    - 2AI x U HS
    - 2AI x I 2WIRE ST
    - 2AI x I 4WIRE ST
    - 2AI x I 2WIRE HS
    - 2AI x I 4WIRE HS
    - 2AI x I 2/4WIRE HF
    - 4AI x I 2WIRE ST
    - 4AI x TC ST
    - 2AI x TC ST
    - 2AI x TC HF
    - 2AI x RTD ST
    - 2AI x RTD HF

Hardware catalog Online tools Tasks

Devices & networks

IO device\_2

Topology view Network view Device view

IO device\_2 96%

IO device\_2

Двойной щелчок

Rack

0	1	2	3	4	5	6	7	15	23	31	39	47	55	63
SIEMENS		AI												
AI		AI												
								15	23	31	39	47	55	63

Device data

Properties Info Diagnostics

Portal view Overview IO device\_2

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Hardware catalog

Online tools

Tasks

Information

The project Project\_2 was saved succes...

Portal view Overview IO device\_2

Devices & networks

IO device\_2

Topology view Network view Device view

IO device\_2 96%

Device data

2AI x U ST\_1 [2AI U ST]

Properties Info Diagnostics

General IO tags Texts

General

Inputs

Channel 0

Channel 1

I/O addresses

Channel 0

Type/range of measurement:

- Voltage +/- 10 V
- Deactivated
- Voltage +/- 10 V

Smoothing:

- Voltage +/- 5 V
- Voltage 1 to 5 V

Hardware catalog

Catalog

Filter

- PM
- AI
  - 2AI x U ST
    - 6ES7 134-4FB01-0AB0
  - 2AI x U HF
  - 2AI x U HS
  - 2AI x I 2WIRE ST
  - 2AI x I 4WIRE ST
  - 2AI x I 2WIRE HS
  - 2AI x I 4WIRE HS
  - 2AI x I 2/4WIRE HF
  - 4AI x I 2WIRE ST
  - 4AI x TC ST
  - 2AI x TC ST
  - 2AI x TC HF
  - 2AI x RTD ST
  - 2AI x RTD HF

# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- PM
- AI
  - 2AI x U ST
    - 6ES7 134-4FB01-0AB0
  - 2AI x U HF
  - 2AI x U HS
  - 2AI x I 2WIRE ST
  - 2AI x I 4WIRE ST
    - 6ES7 134-4GB11-0AB0
  - 2AI x I 2WIRE HS
  - 2AI x I 4WIRE HS
  - 2AI x I 2/4WIRE HF
  - 4AI x I 2WIRE ST
  - 4AI x TC ST
  - 2AI x TC ST
  - 2AI x TC HF
  - 2AI x RTD ST

Выберем модуль обработки тока

Devices & networks

IO device\_2

Topology view Network view Device view

IO device\_2

2AI x U ST\_1

Rack

0	1	2	3	4	5	6	7	15	23	31	39	47	55	63
SIEMENS														
								8	16	24	32	40	48	56
								15	23	31	39	47	55	63

Device data

Properties Info Diagnostics

Portal view Overview IO device\_2

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project

Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- PM
- AI
  - 2AI x U ST
    - 6ES7 134-4FB01-0AB0
  - 2AI x U HF
  - 2AI x U HS
  - 2AI x I 2WIRE ST
  - 2AI x I 4WIRE ST
    - 6ES7 134-4GB11-0AB0
  - 2AI x I 2WIRE HS
  - 2AI x I 4WIRE HS
  - 2AI x I 2/4WIRE HF
  - 4AI x I 2WIRE ST
  - 4AI x TC ST
  - 2AI x TC ST
  - 2AI x TC HF
  - 2AI x RTD ST

Hardware catalog

Online tools

Tasks

Information

The project Project\_2 was saved succes...

Portal view Overview IO device\_2

# Выбор и параметрирование аналоговых модулей AI в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- PM
- AI
  - 2AI x U ST
    - 6ES7 134-4FB01-0AB0
  - 2AI x U HF
  - 2AI x U HS
  - 2AI x I 2WIRE ST
  - 2AI x I 4WIRE ST
    - 6ES7 134-4GB11-0AB0
  - 2AI x I 2WIRE HS
  - 2AI x I 4WIRE HS
  - 2AI x I 2/4WIRE HF
  - 4AI x I 2WIRE ST
  - 4AI x TC ST
  - 2AI x TC ST
  - 2AI x TC HF
  - 2AI x RTD ST

Information

The project Project\_2 was saved succes...

Portal view Overview IO device\_2



# Выбор и параметрирование аналоговых модулей АО в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- ET 200S CPU
- Interface modules
- Master interface
- PM
- AI
- AO
  - 2AO x U ST
    - 6ES7 135-4FB01-0AB0**
    - 2AO x U HF
    - 2AO x U HS
    - 2AO x I ST
    - 2AO x I HF
    - 2AO x I HS
  - DI
  - DO
  - DI/DO
  - Communications modules

Выберем модуль формирования сигналов напряжения

Devices & networks

IO device\_2

Topology view Network view Device view

IO device\_2

2AI x U ST\_1  
2AI x I AWIRE

Rack

Slot	0	1	2	3	4	5	6	7	15	23	31	39	47	55	63
AI															
AO									8	16	24	32	40	48	56
DI															
DO									15	23	31	39	47	55	63

Device data

Properties Info Diagnostics

Portal view Overview IO device\_2

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей АО в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

...314C-2 PN/DP] Distributed I/O PROFINET IO-System (100): PNIE\_1 IO device\_2

Topology view Network view Device view

IO device\_2 96%

Devices & networks

Rack

SIEMENS

0 1 2 3 4 5 6 7 ...15 ...23 ...31 ...39 ...47 ...55 ...63

2AO x U ST 1 2AO x U ST 1

Двойной щелчок

Hardware catalog

Options

Catalog

Filter

- ET 200S CPU
- Interface modules
- Master interface
- PM
- AI
- AO
  - 2AO x U ST
    - 6ES7 135-4FB01-0AB0
  - 2AO x U HF
  - 2AO x U HS
  - 2AO x I ST
  - 2AO x I HF
  - 2AO x I HS
- DI
- DO
- DI/DO
- Communications modules

Information

Properties Info Diagnostics

Portal view Overview IO device\_2

The project Project\_2 was saved succes...

# Выбор и параметрирование аналоговых модулей АО в ET200S

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Hardware catalog

Options

Catalog

Filter

- ET 200S CPU
- Interface modules
- Master interface
- PM
- AI
- AO
  - 2AO x U ST
    - 6ES7 135-4FB01-0AB0
  - 2AO x U HF
  - 2AO x U HS
  - 2AO x I ST
  - 2AO x I HF
  - 2AO x I HS
- DI
- DO
- DI/DO
- Communications modules

Information

The project Project\_2 was saved succes...

Portal view Overview IO device\_2

Devices & networks

IO device\_2

Topology view Network view Device view

Device data

2AO x U ST\_1 [2AO U ST]

Properties Info Diagnostics

General IO tags Texts

General

Outputs

Channel 0

Channel 1

I/O addresses

Output range: Voltage +/- 10 V  
Deactivated  
Voltage +/- 10 V  
Voltage 1 to 5 V

Substitute value:

При необходимости иметь токовый выход выбираются эти модули

# Чтение аналогового входа функцией SCALE

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 22:

Comment

EN ENO

IN RET\_VAL

HI\_LIM

LO\_LIM

BIPOLAR

OUT

%IW272:P  
"Tag\_21":P

100.0

0.0

%M10.0  
"Tag\_8"

%MW100  
"Tag\_1"

%MD220  
"Tag\_22"

Instructions

Options

Favorites

Basic instructions

Name	Version
Move operations	
Conversion operations	
CONVERT	
ROUND	
CEIL	
FLOOR	
TRUNC	
SCALE	V1.1
UNSCALE	V1.1
Program control operati...	
Word logic operations	
Shift and rotate	
Additional instructions	

Extended instructions

Technology

Communication

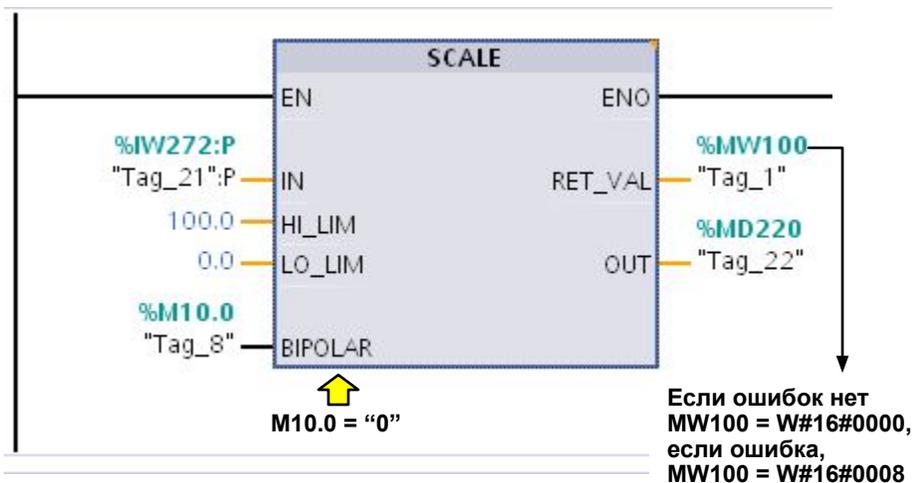
Properties Info Diagnostics

Portal view Overview IO device\_2 Block\_1 (FC1)

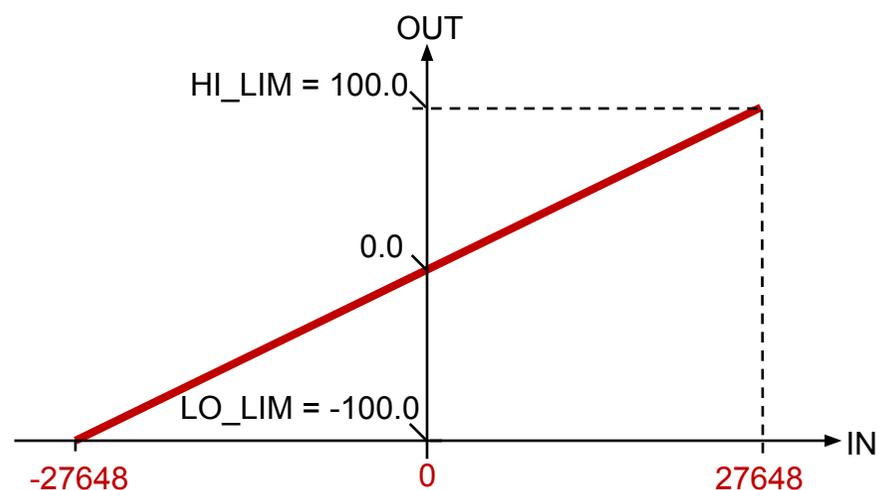
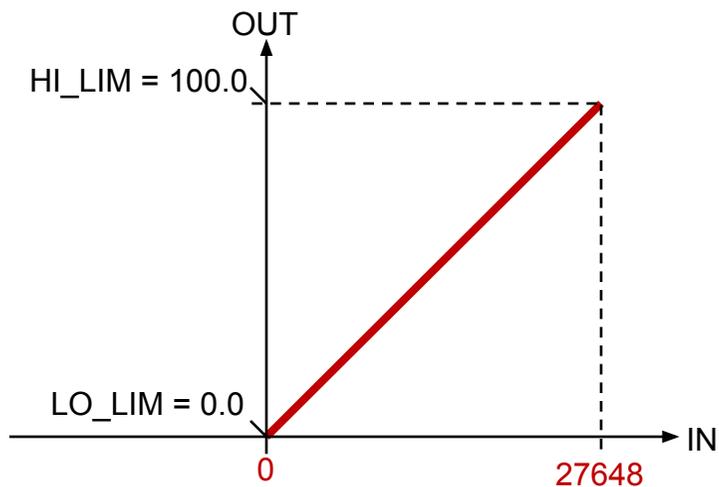
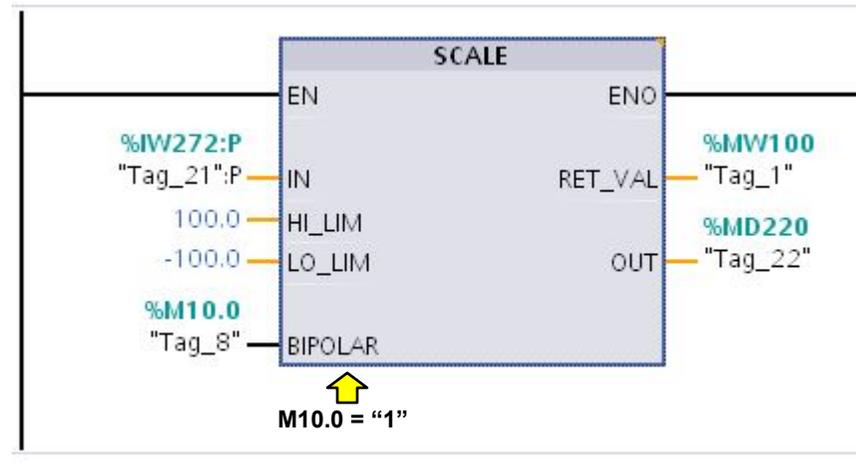
The project Project\_2 was saved succes...

# Чтение аналогового входа функцией SCALE

Датчик выдает только положительный сигнал



С датчика приходят сигналы обеих полярностей



# Формирование аналогового выхода функцией UNSCALE

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 23:

Comment

Network 24:

100%

Properties Info Diagnostics

Portal view Overview IO device\_2 Block\_1 (FC1)

The project Project\_2 was saved succes...

Instructions

Options

Favorites

Basic instructions

Name	Version
Move operations	
Conversion operations	
CONVERT	
ROUND	
CEIL	
FLOOR	
TRUNC	
SCALE	V1.1
UNSCALE	V1.1
Program control operati...	
Word logic operations	
Shift and rotate	
Additional instructions	

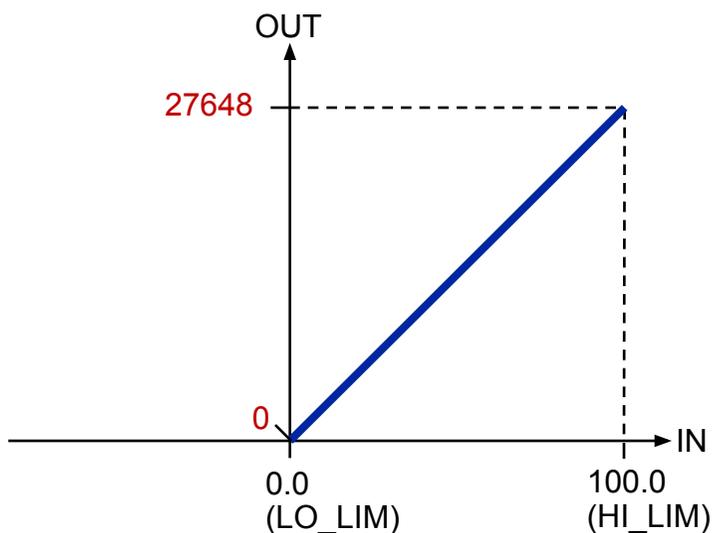
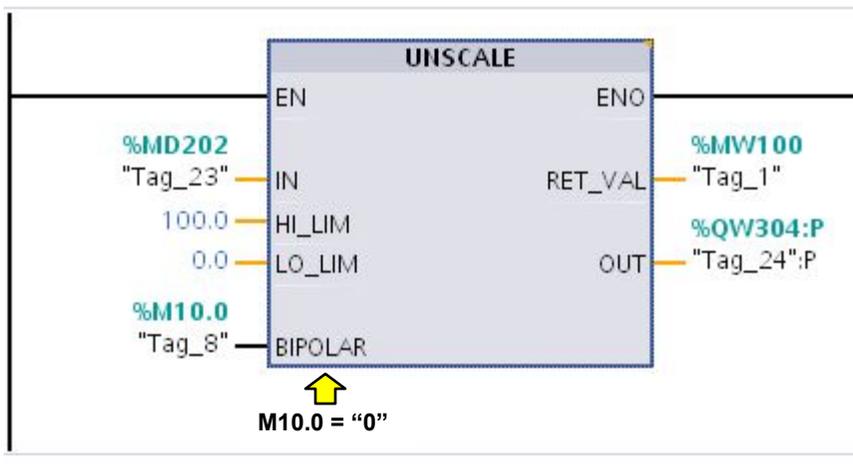
Extended instructions

Technology

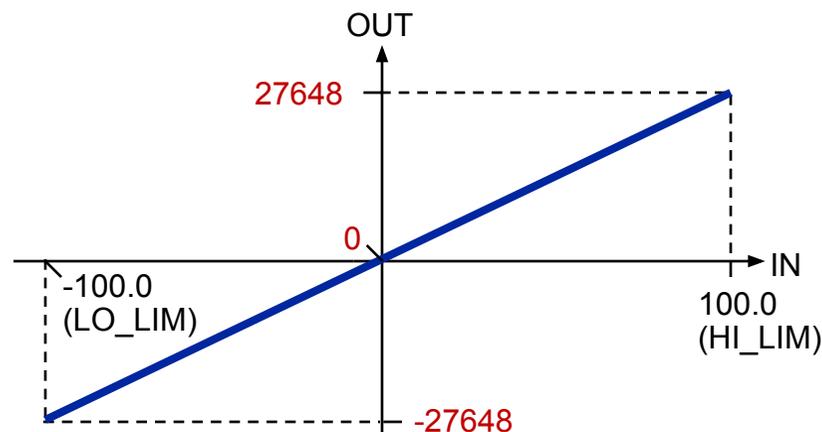
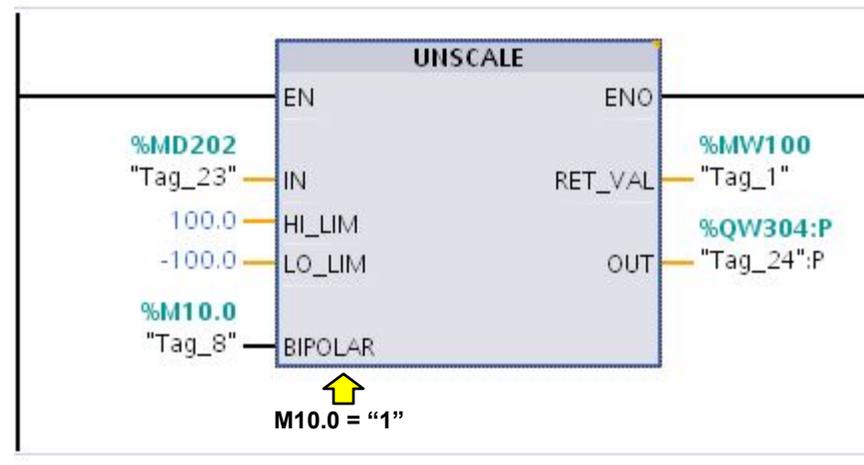
Communication

# Формирование аналогового выхода функцией UNSCALE

На выходе только положительные значения



На выходе как положительные, так и отрицательные значения



## Конец раздела 7. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 8

Программирование на  
языках SCL и GRAPH

The screenshot displays the SIMATIC TIA-portal software interface for a motor control project. The main window shows a ladder logic diagram for a 'RampFunction generator' block, which is connected to a 'PD controller enable' block. The diagram includes a 'Ramp function generator' block with a graph showing a trapezoidal velocity profile. The graph parameters are: Ramp-up time: 10.000 s, Initial rounding: 0.000 s, Final rounding: 0.000 s, Ramp-down time: 10.000 s, and Final speed: 0.000 rpm. The software interface also includes a project tree on the left, a network view at the bottom left showing PLC1 and Drive1 connected via PN1E\_1, and various parameter settings for the ramp function generator.



## Операторы языка SCL

	Описание	Оператор
Присваивание	Присваивание	:=
Круглые скобки	(выражение)	(,)
Двоичная логика	Отрицание И ИЛИ Исключающее ИЛИ	NOT AND, & OR XOR
Сравнение	меньше, меньше или равно, больше, больше или равно, равно, не равно	<, <=, >, >= =, <>
Арифметика	плюс, минус (знак) сложение, вычитание умножение, деление возведение в степень	+,- +,- *, /, DIV, MOD **



## Управляющие инструкции языка SCL

	Ключевое слово	Функция
Ветвление	<b>IF</b>	Ветвление программы со значением типа BOOL
	<b>CASE</b>	Ветвление программы со значением типа INT
Цикл (остановка возможна)	<b>FOR</b>	Цикл со счетчиком
	<b>WHILE</b>	Цикл с предварительной оценкой условия
	<b>REPEAT</b>	Цикл с оценкой условия в конце цикла
Остановка цикла	<b>CONTINUE</b>	Переход к следующему шагу цикла
	<b>EXIT</b>	Выход из цикла
Выход из блока	<b>RETURN</b>	Выход из блока



## Прямая адресация переменных

	Область	Пример обозначения	Примеры
Абсолютная адресация	Бит	DBz.DBXy.x , Iy.x	DB5.DBX0.7 , I 0.0
	Байт	DBz.DBBy , MWy	DB5.DBB2 , QB2
	Слово	DBz.DBWy , QWy	DB5.DBW4 , MW20
	Двойное слово	DBz.DBDy, QDy	DB5.DBD8 , ID40
Символьная адресация		"<Имя блока DB>".<Имя переменной>	"Motor".Setpoint
	Только для S7-1200	<Имя переменной>.X<номер бита> < Имя переменной >.V<номер байта> < Имя переменной >.W<номер слова>	"Motor".Alarms.X1 (бит 1 переменной "Alarms" блока DB "Motor")
Прямая адресация для входов, выходов, меркеров и переменных DB схожа с LAD/FBD/STL			



## Примеры косвенной адресации

	Область	Пример обозначения	Примеры
Косвенная адресация	Бит	DBz.DBX[номер байта.бит] I[номер байта.бит]	DB10.DBX[a.b] , "Motor".DBX[a.b] , I[a.b]
	Слово	DBz.DBW[номер слова] MW[номер слова]	"Motor".DBW[a] , MW[a+b]
	Массив элементов	„<Символьное имя блока DB>“. <Символьное имя массива>[Индекс]	"Motor".Value[i]
	DB	Word_to_Block_DB[index].DW0	Word_to_Block_DB[i].DW0
Косвенная адресация для входов, выходов, меркеров и переменных DB схожа LAD/FBD/STL			



# Создание программного блока с выбором языка SCL

The screenshot illustrates the process of creating a new program block in Siemens TIA Portal. The main window shows the 'Project tree' on the left, where the 'Program blocks' folder is selected. A context menu is open over this folder, with 'Add new block' highlighted. A yellow callout bubble points to this menu item with the text 'Правой клавишей' (Right-click). The 'Add new block' dialog box is open in the foreground. The 'Name' field contains 'Block\_5'. The 'Language' dropdown menu is open, showing options: LAD, LAD, FBD, STL, SCL, and automatic. The 'SCL' option is selected, indicated by a yellow arrow. The 'Function' block type is selected in the list of block types, also indicated by a yellow arrow. The 'Description' field contains the text: 'Functions are code blocks or subroutines without dedicated memory.' At the bottom right of the dialog, the 'OK' button is highlighted with a yellow arrow.

# Окна инструментов программирования

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]

Interface

	Name	Data type	Offset	Comment
1	Input			
2	<Add new>			
3	Output			
4	<Add new>			
5	InOut			
6	<Add new>			
7	Temp			
8	<Add new>			
9	Return			

Instructions

Options

Favorites

IF... CASE... OF... FOR... TO DO... WHILE... DO... (\*...\*)

Basic instructions

Name	Ve
Timer operations	
Counter operations	
Math functions	
Move operations	
Conversion operations	
Program control operations	
Word logic operations	
Shift and rotate	
Additional instructions	

Extended instructions

Technology

Communication

Portal view Overview Block\_5 (...) Default ta... Block\_2 (...) Block\_3 (...)

The programming language of the sele...

# Примеры программирования в рабочем окне редактора

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]

PLC programming

Block interface

**Представление цепи в STL**

```

1 //Цепь запуска двигателя
2 "Output_K1M_ON":=
3 NOT"Switch_STOP_range"
4 AND "Breack_Q1"
5 AND(
6 "Switch_START_range"
7 OR "Feedback_K1M"
8 );
9 //Индикация запуска двигателя
10 "Visible_K1M_ON":="Output_K1M_ON";
11 //Таймер SIMATIC
12 #RESULT_T1:=
13 S_ODT(T_NO:=1, S:="Start_motor_P0", TV:=s5t#10s);
14 //Сложение чисел
15 "SUM":= "NUM_1" + "NUM_2" + "NUM_3";

```

**Представление цепи в LAD**

1 | AN | %I0.0  
 2 | A | %I0.2  
 3 | A |  
 4 | O | %I0.1  
 5 | O | %I0.3  
 6 | ) |  
 7 | = | %Q0.0

▶ "Visible_K1M_ON"	%Q0.1
"Start_motor_P0"	%M50.0
▶ "SUM"	%MD112

100%

Properties Info Diagnostics

Portal view Overview Block\_5 (FC3) Default tag t... Block\_2 (FC2) The programming language of the sele...

# Примеры программирования в рабочем окне редактора

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]

PLC programming

Block interface

**Представление цепи в STL**

```

1 //Цепь запуска двигателя
2 "Output_K1M_ON":=
3 NOT"Switch_STOP_range"
4 AND "Breack_Q1"
5 AND(
6 "Switch_START_range"
7 OR "Feedback_K1M"
8 );
9 //Индикация запуска двигателя
10 "Visible_K1M_ON":="Output_K1M_ON";
11 //Таймер SIMATIC
12 #RESULT_T1:=
13 S_ODT(T_NO:=1, S:="Start_motor_P0", TV:=s5t#10s);
14 //Сложение чисел
15 "SUM":="NUM_1" + "NUM_2" + "NUM_3";

```

**Представление цепи в LAD**

**Свернуто: показаны только результаты**

▶	"Visible_K1M_ON"	%Q0.1
	"Start_motor_P0"	%M50.0
▶	"SUM"	%MD112

100%

Properties Info Diagnostics

Portal view Overview Block\_5 (FC3) Default tag t... Block\_2 (FC2) The programming language of the sele...

## Вариант развернутого показа переменных

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]

PLC programming

Block interface

```

1 //Цепь запуска двигателя
2 "Output_K1M_ON":=
3 NOT"Switch_STOP_range"
4 AND "Breack_Q1"
5 AND(
6 "Switch_START_range"
7 OR "Feedback_K1M"
8 );
9 //Индикация запуска двигателя
10 "Visible_K1M_ON":="Output_K1M_ON";

11 //Таймер SIMATIC
12 #RESULT_T1:=
13 S_ODT(T_NO:=1, S:="Start_motor_P0", TV:=s5t#10s);
14 //Сложение чисел
15 "SUM":= "NUM_1" + "NUM_2" + "NUM_3";

```

"Output_K1M_ON"	%Q0.0
"Switch_STOP_range"	%I0.0
"Breack_Q1"	%I0.2
"Switch_START_range"	%I0.1
"Feedback_K1M"	%I0.3
"Visible_K1M_ON"	%Q0.1
"Output_K1M_ON"	%Q0.0
"Start_motor_P0"	%M50.0
"SUM"	%MD112
"NUM_1"	%MD100
"NUM_2"	%MD104
"NUM_3"	%MD108

100%

Properties Info Diagnostics

Portal view Overview Block\_5 (FC3) Default tag t... Block\_2 (FC2)

The programming language of the sele...

Instructions Testing Tasks Libraries

Развернуто: показаны все операнды

# Вызов созданного в CSL блока

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_4". The main window shows the "Main [OB1]" program block. In the "Project tree" on the left, the "Program blocks" folder is expanded, and "Block\_5 [FC3]" is highlighted with a red arrow. The main editing area shows a ladder logic network with the following details:

- Block title:** "Main Program Sweep (Cycle)"
- Network 1:** A normally open contact labeled "%FC3" is connected to a coil labeled "Block\_5". The coil has "EN" on the left and "ENO" on the right.
- Network 2:** A single horizontal line representing a connection.

The interface includes a menu bar (Project, Edit, View, Insert, Online, Options, Tools, Window, Help), a toolbar with icons for saving, undo, redo, and online/offline status, and a right-hand sidebar with "Instructions", "Testing", "Tasks", and "Libraries". The status bar at the bottom indicates "Project Project\_4 opened." and shows the current view as "Main (OB1)".



# Просмотр состояния переменных в режиме On-Line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]

Block interface

No condition defined.

1 //Цепь запуска двигателя			
2 "Output_K1M_ON":=	"Output_K1M_ON"	%Q0.0	TRUE
3 NOT"Switch_STOP_range"	"Switch_STOP_ra...	%I0.0	FALSE
4 AND "Breack_Q1"	"Breack_Q1"	%I0.2	TRUE
5 AND{			
6 "Switch_START_range"	"Switch_START_r...	%I0.1	TRUE
7 OR "Feedback_K1M"	"Feedback_K1M"	%I0.3	FALSE
8 };			
9 //Индикация запуска двигателя			
10 "Visible_K1M_ON":="Output_K1M_ON";	▼ "Visible_K1M_ON"	%Q0.1	TRUE
	"Output_K1M_ON"	%Q0.0	TRUE
11 //Таймер SIMATIC			
12 #RESULT_T1:=	#RESULT_T1		S5T#0MS
13 S_ODT(T_NO:=1, S:="Start_motor_PO", TV:=s5t#10s);	"Start_motor_PO"	%M50.0	TRUE
14 //Сложение чисел			
15 "SUM":= "NUM_1" + "NUM_2" + "NUM_3";	▼ "SUM"	%MD112	9.914200E+002
	"NUM_1"	%MD100	2.345800E+002
	"NUM_2"	%MD104	7.568400E+002
	"NUM_3"	%MD108	0.000000E+000

100%

Properties Info Diagnostics

## Генерация исходного файла

The screenshot displays the Siemens TIA Portal interface for generating source code from a PLC block. The main window shows the project structure: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_5 [FC3]. A yellow arrow points to the 'Generate source from block' button in the toolbar. The code editor displays the following SCL code:

```

1 //Цепь запуска двигателя
2 "Output_K1M_ON":=
3 NOT"Switch_STOP_range"
4 AND "Breack_Q1"
5 AND(
6 "Switch_START_range"
7 OR "Feedback_K1M"
8 );
9 //Индикация запуска двигателя
10 "Visible_K1M_ON":="Output_K1M_ON";
11 //Таймер SIMATIC
12 #RESULT_T1:=
13 S_ODT(T_NO:=1, S:="Start_motor_PO", TV:=s5t#10s);
14 //Сложение чисел
15 "SUM":= "NUM_1" + "NUM_2" + "NUM_3";

```

The 'Сохранить как' (Save As) dialog is open, showing the file name 'FC5\_SCL' and the folder 'TEMP'. The code window on the right shows the generated SCL code for 'FUNCTION "Block\_5" : Void'.

```

FUNCTION "Block_5" : Void
{ S7_Optimized_Access := 'FALSE' }
VERSION : 0.1
VAR_TEMP
    RESULT_T1 : S5Time;
END_VAR

BEGIN
    //Цепь запуска двигателя
    "Output_K1M_ON":=
    NOT"Switch_STOP_range"
    AND "Breack_Q1"
    AND(
        "Switch_START_range"
        OR "Feedback_K1M"
    );
    //Индикация запуска двигателя
    "Visible_K1M_ON":="Output_K1M_ON";
    //Таймер SIMATIC
    #RESULT_T1:=
    S_ODT(T_NO:=1, S:="Start_motor_PO", TV:=s5t#10s);
    //Сложение чисел
    "SUM":= "NUM_1" + "NUM_2" + "NUM_3";
END_FUNCTION

```

The status bar at the bottom indicates 'Portal view', 'Overview', 'Block\_5 (FC3)', and 'Project Project\_4 opened'.

# Примеры вызова программных блоков в редакторе SCL

The screenshot displays the Siemens TIA Portal SCL editor interface. The main window shows the SCL code for Block\_3 [FC5]. The code includes comments in Russian and two function block calls:

```

1 //Вызов программного блока без параметров
2 "Block_5"();
3 //Вызов программного блока FC с параметрами
4 "Block_2"(Switch_START:="Switch_START_range",
5
6
7
8
9 //B
10
11

```

The 'Block interface' table on the right shows the parameters for the called blocks:

Block Name	Parameter	Value
"Block_5"		%FC3
"Block_2"		%FC2
		%IO.2
		%IO.3
		%Q0.0
		%Q0.1

The 'Call options' dialog box is open, showing the 'Data block' configuration:

- Data block:** Single instance
- Name:** Block\_6\_DB
- Number:** 2
- Mode:** Automatic (selected)

The dialog box also includes an 'OK' button, which is highlighted with a yellow arrow, and a 'Cancel' button. The status bar at the bottom indicates that the project 'Project\_4' was saved successfully.

# Примеры вызова программных блоков в редакторе SCL

The screenshot displays the Siemens TIA Portal interface for editing SCL code. The main window shows the SCL editor with the following code:

```

1 //Вызов программного блока без параметров
2 "Block_5"();
3 //Вызов программного блока FC с параметрами
4 □"Block_2"(Switch_START:="Switch_START_range",
5     Breack_Q1:="Breack_Q1",
6     Feedback_K1M:="Feedback_K1M",
7     Output_K1M=>"Output_K1M_ON",
8     Visible_work=>"Visible_K1M_ON");
9 //Вызов программного блока FB с параметрами
10 □"Block_6_DB"(Switch_START:=false,
11     Breack_Q1:=false,
12     Feedback_K1M:=false,
13     Output_K1M=>bool_out_,
14     Visible_work=>bool_out_);
15

```

On the right side, the 'Block interface' table lists the parameters for the called blocks:

"Block_5"	‡FC3
"Block_2"	‡FC2
"Breack_Q1"	‡IO.2
"Feedback_K1M"	‡IO.3
"Output_K1M_ON"	‡Q0.0
"Visible_K1M_ON"	‡Q0.1
"Block_6_DB"	‡DB2

The left sidebar shows the 'Project tree' with the following structure:

- Project\_4
  - PLC\_1 [CPU 314C-2 PN/DP]
    - Program blocks
      - Block\_3 [FC5] (selected)
      - Block\_4 [FC4]
      - Block\_5 [FC3]
      - Block\_6 [FB1]
      - Block\_6\_DB [DB2]
      - Data\_block\_1 [DB1]
      - System blocks
        - Program reso...
      - Technology objects
      - External source files
      - PLC tags

The bottom status bar shows the current project is saved successfully.

# Примеры вызова программных блоков в редакторе SCL

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_3 [FC5]

Devices

PLC programming

Block interface

```

1 //Вызов программного блока без параметров
2 "Block_5"();
3 //Вызов программного блока FC с параметрами
4 □"Block_2"(Switch_START:="Switch_START_range",
5     Breack_Q1:="Breack_Q1",
6     Feedback_K1M:="Feedback_K1M",
7     Output_K1M=>"Output_K1M_ON",
8     Visible_work=>"Visible_K1M_ON");
9 //Вызов программного блока FB с параметрами
10 □"Block_6_DB"(Switch_START:="Switch_START_range",
11     Breack_Q1:="Breack_Q1",
12     Feedback_K1M:="Feedback_K1M",
13     Output_K1M=>"Output_K1M_ON",
14     Visible_work=>"Visible_K1M_ON");
15

```

"Block_5"	‡FC3
"Block_2"	‡FC2
"Breack_Q1"	‡IO.2
"Feedback_K1M"	‡IO.3
"Output_K1M_ON"	‡Q0.0
"Visible_K1M_ON"	‡Q0.1
"Block_6_DB"	‡DB2
"Breack_Q1"	‡IO.2
"Feedback_K1M"	‡IO.3
"Output_K1M_ON"	‡Q0.0
"Visible_K1M_ON"	‡Q0.1

100%

Properties Info Diagnostics

Portal view Overview Tag table\_1 Block\_5 (FC3) Block\_3 (FC5)

The project Project\_4 was saved succes...

# Построение программы в редакторе GRAPH. Создание FB

**Add new block**

Name: Block\_2

Language: LAD (dropdown menu open showing LAD, FBD, STL, SCL, GRAPH)

Number:

Description: Function blocks are code blocks that store their values permanently in instance data blocks, so that they remain available after the block has been executed.

more...

Additional information

Add new and open

OK Cancel

## Окно написания программы до активизации пошагового режима

The screenshot displays the Siemens TIA Portal software interface. The title bar reads "Siemens - Project1". The menu bar includes "Project", "Edit", "View", "Insert", "Online", "Options", "Tools", "Window", and "Help". The toolbar contains various icons for file operations and online/offline status. The breadcrumb path is "Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]". The main workspace is titled "Block interface" and shows the "Permanent pre-instructions" section, which is highlighted with a yellow box. Below this section, there is a "Comment" field and a list of instructions, with the first one being "1: <new permanent instruction>". The left sidebar shows the "Navigation" pane with "Permanent pre-instructions (1)" selected. The bottom status bar indicates "Project Project1 opened." and shows the current view as "Block\_2 (FB1)".



## Окно написания программы в пошаговом режиме

The screenshot displays the Siemens TIA Portal interface for editing a PLC program in step-by-step mode. The main window shows a ladder logic diagram with a single step, 'Step1', which is active. A transition 'T1 Trans1' is shown below the step. The left sidebar contains a 'Navigation' pane with a tree view showing 'Permanent pre-instructions (1)', 'Sequences (1)', and 'Alarms'. The 'Sequences (1)' folder is highlighted with a yellow box, and it contains a sub-entry '1: <new sequence>' with a red 'X' icon. The top menu bar includes 'Project', 'Edit', 'View', 'Insert', 'Online', 'Options', 'Tools', 'Window', and 'Help'. The right sidebar contains 'Instructions', 'Testing', 'Tasks', and 'Libraries'. The bottom status bar shows 'Portal view', 'Overview', 'Block\_2 (FB1)', and 'Project Project1 opened.'.



## Окно написания программы после окончания пошагового режима

The screenshot displays the Siemens TIA Portal software interface. The title bar reads "Siemens - Project1". The menu bar includes "Project", "Edit", "View", "Insert", "Online", "Options", "Tools", "Window", and "Help". The toolbar contains various icons for file operations and online/offline status. The breadcrumb path is "Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]".

The main workspace is titled "Block interface" and shows the "Permanent post-instructions" section. A "Comment" field is at the top. Below it, a list of instructions is shown, with the first one expanded to show a ladder logic diagram. The diagram consists of a single horizontal line with a vertical line on the left. Below the diagram, a text field contains "<No tags used>".

The left sidebar is labeled "PLC programming" and contains a "Navigation" pane with the following items: "Permanent pre-instructions (1)", "Sequences (1)", "Permanent post-instructions (1)" (highlighted with a yellow box), and "Alarms".

The bottom status bar shows "Portal view", "Overview", "Block\_2 (FB1)", and "Project Project1 opened.".



## Окно предупреждений об ошибках

Project1 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_2 [FB1]

Navigation

- ▶ Permanent pre-instructions (1)
- ▶ Sequences (1)
- ▶ Permanent post-instructions (1)
- ▼ Alarms
  - Alarms

Alarms

Enable alarms

Interlock alarms

Acknowledge interlock alarms

Interlock alarm properties:

- CPU name
- FB name
- FB number
- Instance DB name
- Instance DB number
- Step-specific text

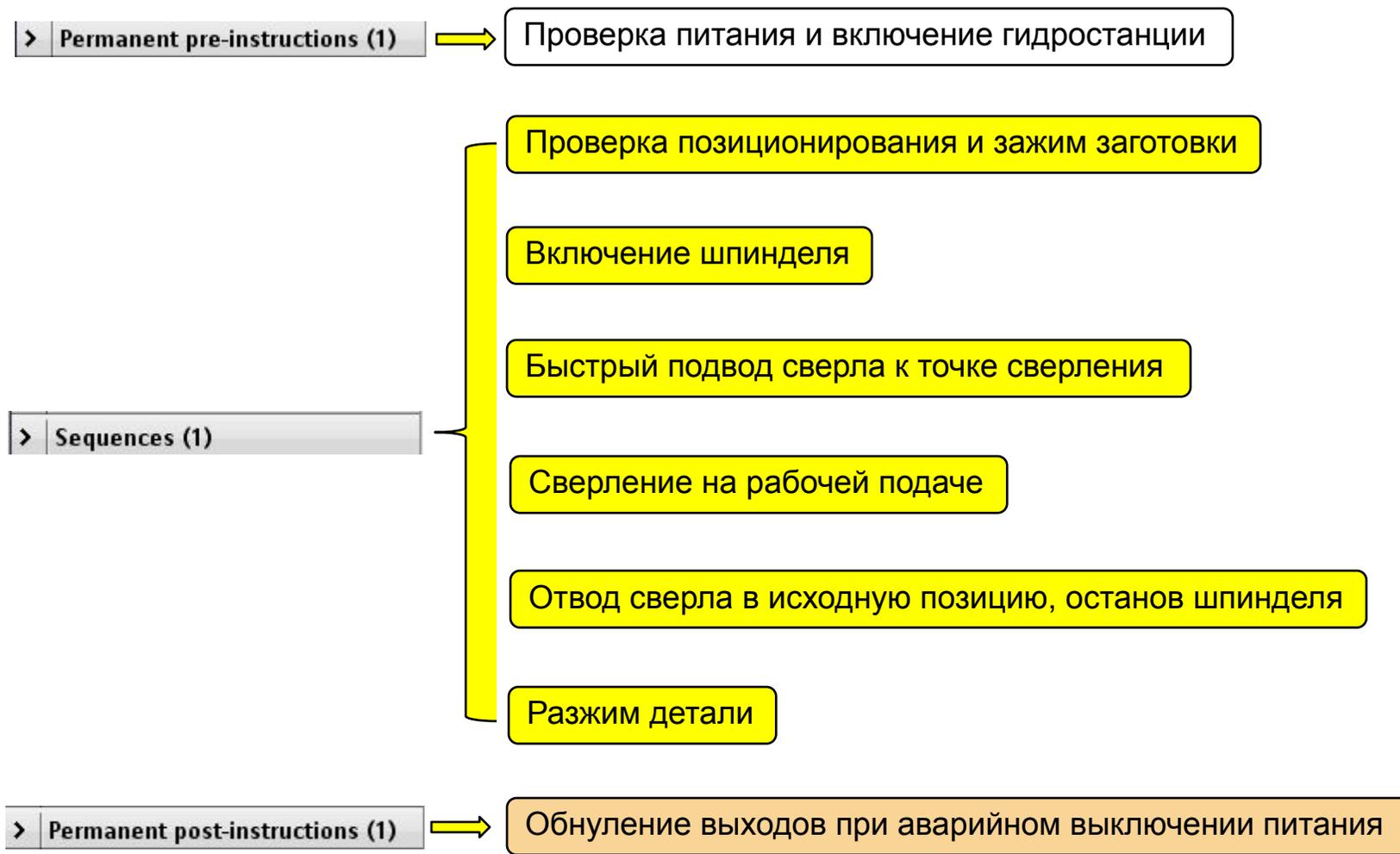
Interlock alarm:

GRAPH7\_INTERLOCK\_ERROR <CPU name>, <FB name>, <FB number>, <instance DB name>, <instance DB number>, <step name>, <step number>, <step-specific text>

Portal view Overview Block\_2 (FB1) Properties Info Diagnostics Project Project1 opened.

# Пример построения программы в редакторе GRAPH

Построим программу управления сверлильным станком



# Написание инструкций в разделе Permanent pre-instructions

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Block interface

Navigation

Permanent pre-instructions (1)

1: Проверка питания и включение гидростанции

Permanent pre-instructions

Comment

1: Проверка питания и включение гидростанции

► "Control\_supple" %I0.0

► "Button\_Turn\_gidro\_off" %I0.6

► "Button\_Turn\_gidro\_on" %I0.1

► "Feedback\_gidro\_on" %I0.2

► "Command\_Turn\_gidro\_ON" %Q0.0

Properties Info Diagnostics

Portal view Overview Block\_2 (FB1) Tag table\_1

The project Project1 was saved success...

# Структура реализации пошагового алгоритма Sequences

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Block interface

Navigation

- Permanent pre-instructions (1)
- Sequences (1)
  - 1: <new sequence>
    - S1 Step1
- Permanent post-instructions (1)
- Alarms

1: <new sequence>

Comment

Действия, выполняемые в этом шаге

S1 - Step1:

Interlock	Event	Qualifier	Action
	S0	CU	"Count_details"
		<Add new>	"Count_details" %C0

Условие для выполнения следующего шага

100%

Properties Info Diagnostics

Portal view Overview Block\_2 (FB1) Tag table\_1

The project Project1 was saved success...

# Написание условий для выполнения очередного шага

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Block interface

PLC programming

Navigation

Instructions

Options

Favorites

Basic instructions

Name

Ve

GRAPH actions

LAD

General

Bit logic operations

-||-

-|/-

-|NOT|-

Comparator operations

Graph structure

Step and transition

Step

Transition

Sequence end

Jump to step

Alternative branch

Simultaneous branch

Close branch

Extended instructions

Technology

Communication

Properties

Info

Diagnostics

100%

Step1

Step2

Step3

T2 Trans1

T3 Trans2

T2 - Trans1:

%I0.2 "Feedback\_gidro\_on"

%I1.2 "Drill\_in\_beginn\_position"

%I0.3 "Detail\_in\_position"

Логическое условие выполнения шага 2

T3 - Trans2:

%I0.3 "Detail\_in\_position"

%I0.7 "Feedback\_Clip\_detail"

%I0.4 "Feedback\_spindle\_drive"

Логическое условие выполнения шага 3

# Действия, выполняемые в шагах Step 2 и Step 3

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Block interface

1: <new sequence>

Comment

**S2 - Step2:** Зажим заготовки, включение вращения сверла

Interlock	Event	Qualifier	Action
		D	"Command_spindle_drive", t#1s
		R	"Command_Unclamping_detail"
		S	"Command_Clip_detail"
		<Add new>	
			"Command_spindle_drive" %Q0.2
			"Command_Unclamping_detail" %Q0.6
			"Command_Clip_detail" %Q0.1

**S3 - Step3:** Включение режима "Быстрый подвод шпинделя"

Interlock	Event	Qualifier	Action
		S	"Fast_speed_drill_down"
		<Add new>	
			"Fast_speed_drill_down" %Q0.3

100%

Properties Info Diagnostics



# Завершающий шаг, переход к шагу Step 1

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Navigation

- Permanent pre-instructio...
- Sequences (1)
  - Step1
  - Step2
  - Step3
  - Step4
  - Step5
  - Step6
- Permanent post-instructi...
- Alarms

Block interface

S4 Step4

T5 Trans4

S5 Step5

T6 Trans5

S6 Step6

T7 Trans6

S1

S5 - Step5:

Interlock	Event	Qualifier	Action
		R	"Command_spindle_drive" "Com... %Q0.2
		R	"Working_stroke_drill" "Wor... %Q0.4
		D	"Fast_speed_drill_up", t#1s "Fas... %Q0.5
		<Add new>	

S6 - Step6:

Interlock	Event	Qualifier	Action
		R	"Fast_speed_drill_up" "Fas... %Q0.5
		R	"Command_Clip_detail" "Com... %Q0.1
		S	"Command_Unclamping_detail" "Com... %Q0.6
		<Add new>	

100%

Properties Info Diagnostics



# Написание инструкций в разделе Permanent post-instructions

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FB1]

Block interface

Navigation

- > Permanent pre-instructions (1)
- > Sequences (1)
- > Permanent post-instructions (1)
  - 1: Обнуление выходов в случае аварийного выкл...

Permanent post-instructions

Comment

1: Обнуление выходов в случае аварийного выключения силового питания станка

Properties Info Diagnostics



## Вызов созданного блока

**Project tree**

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]

**Devices**

- Program blocks
  - Add new block
  - Main [OB1]
  - Block\_1 [FC1]
  - Block\_2 [FB1]
  - Block\_2\_DB [DB9]
- System blocks
  - Program resources
    - G7\_STD\_3 [FC72]
    - GET\_E [FB34]
    - GET\_DB\_4 [DB8]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
- Local modules
  - PLC\_1 [CPU 314C-2 PN/DP]
  - DI16 x 24VDC\_1

**Block interface**

Block title: "Main Program Sweep (Cycle)"

Comment

**Network 1:**

%DB9  
"Block\_2\_DB"

%FB1  
"Block\_2"

EN — ENO

false — OFF\_SQ — S\_NO

false — INIT\_SQ — S\_MORE

false — ACK\_EF — S\_ACTIVE

false — S\_PREV — ERR\_FLT

false — S\_NEXT — AUTO\_ON

false — SW\_AUTO — TAP\_ON

false — SW\_TAP — TOP\_ON

false — SW\_TOP — MAN\_ON

false — SW\_MAN

0 — S\_SEL

false — S\_ON

false — S\_OFF

false — T\_PUSH

**Используется стандартная FC, содержащая основную часть кода для всех FB при создании нескольких блоков. Эта FC автоматически копируется в проект при создании блока.**

**FB создан со стандартным набором параметров. При необходимости они могут быть заданы разработчиком**

Reference projects

Details view

Properties Info Diagnostics

# Смысл и значение параметров Input/Output вызываемого блока

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2\_DB [DB9]

Block\_2\_DB

Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint	Comment
Input				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
OFF_SQ	Bool	0.0	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Turn sequence off
INIT_SQ	Bool	0.1	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Set sequence to initial state
ACK_EF	Bool	0.2	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Acknowledge all errors and faults
S_PREV	Bool	0.3	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Output previous step in parameter S_NO
S_NEXT	Bool	0.4	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Indicate next step in parameter S_NO
SW_AUTO	Bool	0.5	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Automatic mode
SW_TAP	Bool	0.6	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Semiautomatic/switch with transition
SW_TOP	Bool	0.7	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Semiautomatic/ignore transition
SW_MAN	Bool	1.0	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Manual mode
S_SEL	Int	2.0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Select step to be output to S_NO
S_ON	Bool	4.0	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Activate step indicated in S_NO
S_OFF	Bool	4.1	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Deactivate step indicated S_NO
T_PUSH	Bool	4.2	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enable transition to switch in semi automatic mode
Output				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
S_NO	Int	6.0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Step number
S_MORE	Bool	8.0	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	More steps are available and can be shown in S_NO
S_ACTIVE	Bool	8.1	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Step indicated in S_NO is active
ERR_FLT	Bool	8.2	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Interlock or supervision group error
AUTO_ON	Bool	8.3	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Automatic mode is active
TAP_ON	Bool	8.4	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Semiautomatic mode/step with transition enabled
TOP_ON	Bool	8.5	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Semiautomatic mode/ignore transition enabled
MAN_ON	Bool	8.6	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Manual mode is active
InOut				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Properties Info Diagnostics



## Конец раздела 8. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов  
Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 9

Отладка проекта. Инструментальные средства контроля и диагностики процесса.

The screenshot displays the SIMATIC TIA-portal software interface. The main window shows a project configuration for a drive system. The left sidebar contains a tree view with categories like 'Hardware', 'Software', and 'Commissioning'. The main workspace shows a 'RampFunction generator' block connected to a 'PD controller analog' block. Below this, there are two graphs: one showing a ramp function with parameters like 'Ramp-up time', 'Ramp-down time', and 'Final rounding', and another showing a 'Ramp function generator standing-off type'. The bottom left shows a 'Partial view' of the hardware configuration, including 'PLC\_1 CPU 1513-1 PN' and 'Drive\_1 G120 CU240E-2...'. The bottom right shows a 'Partial view' of the drive configuration, including 'Drive\_1 G120 CU240E-2...' and 'PNE\_1'.



# Классификация ошибок и инструментов отладки

## Ошибки, определяемые системой

Запись, индикация и оценка ошибок в контроллере (как правило: CPU -> **"STOP"**)

- Ошибка в модуле
- Короткое замыкание в сигнальном кабеле
- Превышение времени цикла
- Ошибка программирования, например, вызов несуществующего блока.

### Инструменты отладки:

- Module Information
  - Диагностический буфер
  - Стек прерываний
  - Стек блоков
  - Локальный стек
- Hardware Diagnostics

## Ошибки функционирования

Необходимые функции не выполняются или выполняются с ошибкой

- Ошибки процесса (датчик/исполнительное устройство, дефект проводки)
- Логические ошибки программирования, не обнаруженные при отладке

### Инструменты отладки :

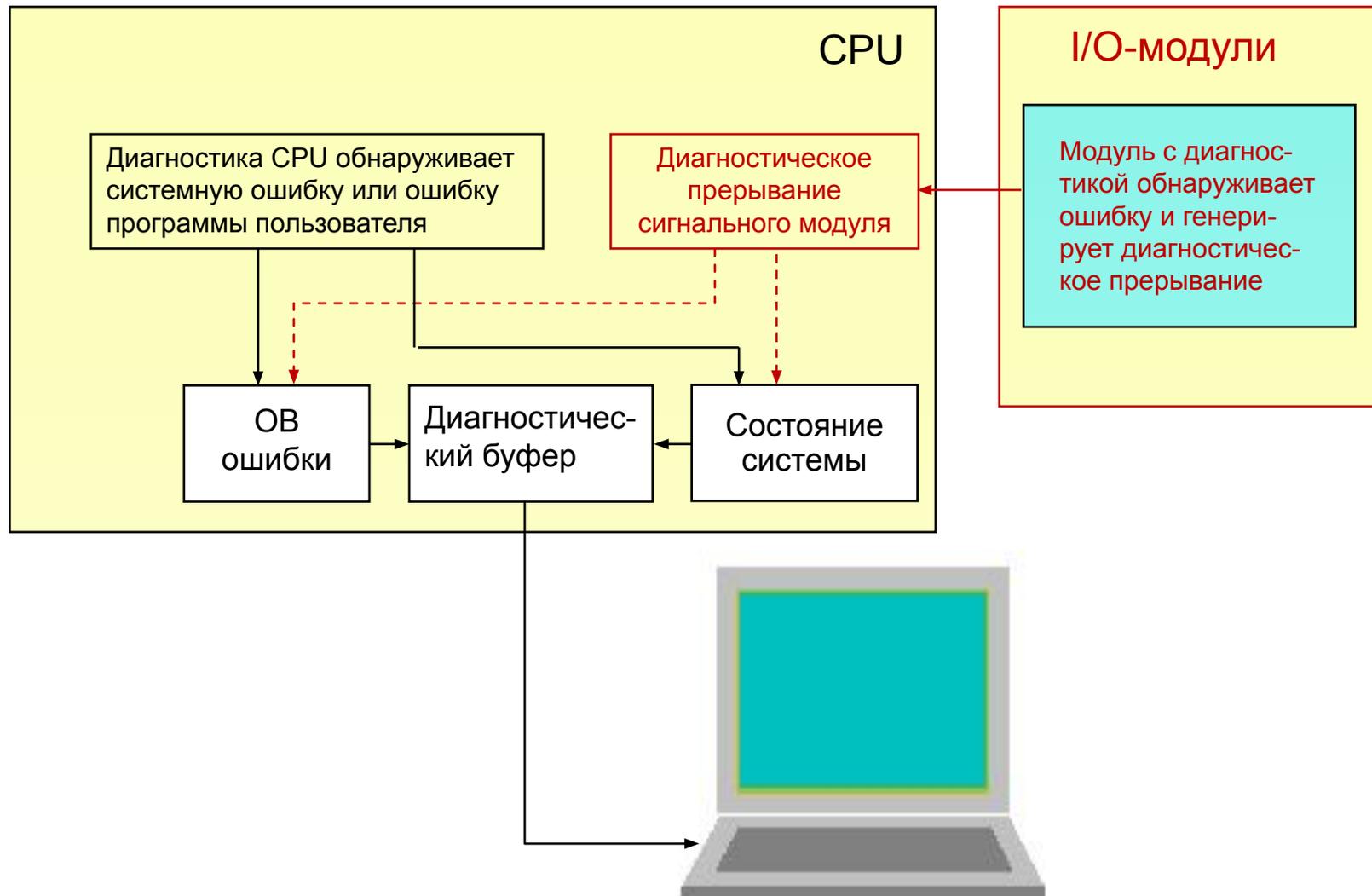
- |                     |                               |
|---------------------|-------------------------------|
| • Watch table       | Управление переменными        |
| • Monitoring on/off | Просмотр программы OnLine     |
| • Reference Data    | Справочные данные             |
| - Cross References  | Перекрестные ссылки           |
| - Assignment list   | План использования переменных |
| • Call Structure    | Структура вызовов             |

Дополнительные возможности поиска ошибок:

- Функция "Force"
- Сравнение блоков в проекте и в ПЛК
- Использование точек останова (Breakpoint)



# Системная диагностика



# Настройка соединения ПК - ПЛК



Маска подсети: 255.255.255. 0

IP – адрес: 192.168. 0 . 1

Адрес сети      Подсеть      Адрес хоста

Чтобы ПК и ПЛК увидели друг друга, они должны быть в одной сети и подсети

Маска подсети :  
255.255.255. 0

IP – адрес: 192.168 . 0 . 2



# Переход в режим On-line

The screenshot shows the Siemens TIA Portal interface for 'Project\_4'. The main window displays the 'Project tree' on the left and a list of project components on the right. The 'Go online' button in the toolbar is highlighted with a yellow box. The status bar at the bottom indicates 'Connection to PLC\_1 terminated'.

**Project tree (Left Panel):**

- Project\_4
  - PLC\_1 [CPU 314C-2 PN/DP]
    - Program blocks
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Online backups
    - Local modules
    - Common data
    - Documentation settings
    - Languages & resources
    - Online access
    - Card Reader/USB memory
  - Reference projects
  - Details view

**Main Window (Right Panel):**

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP]

Name	Modified	Remark	Type
Device configuration			
Online & diagnostics			
Program blocks	6/14/2014 3:11 PM	(none)	
Technology objects	5/25/2014 12:29 PM	(none)	
External source files	5/25/2014 12:29 PM	(none)	
PLC tags	6/9/2014 6:12 PM	(none)	
PLC data types	5/30/2014 8:48 AM	(none)	
Watch and force tables	5/25/2014 12:29 PM	(none)	
Online backups			
Program info			
PLC alarms			
Text lists			
Local modules			

**Toolbar:** Save project, Go online (highlighted), Go offline, Help.

**Status Bar:** Connection to PLC\_1 terminated.

# Переход в режим On-line

The screenshot shows the Siemens TIA Portal interface for 'Project\_4'. The main window is titled 'Online access' and displays the 'Status' section with a large 'Online' indicator. A diagram shows a laptop connected via a green line to a PLC rack, with a 'Flash LED' indicator. Below the status section, the 'Online access' configuration is shown with the following settings:

- Type of the PG/PC interface: PN/IE
- PG/PC interface: NVIDIA nForce Networkin...
- Connection to subnet: PN/IE\_1
- 1st gateway: (empty)
- Device address: 192.168.0.7

The bottom status bar indicates 'Connected to PLC\_1, address IP=192.1...'. The interface includes a menu bar (Project, Edit, View, Insert, Online, Options, Tools, Window, Help), a toolbar with icons for saving and online/offline modes, and a project tree on the left showing the 'Online access' folder expanded.



# Анализ ЦПУ в режиме On-line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP]

Details List Thumbnails

Name	Modified	Remark
Device configuration		
Online & diagnostics		
Program blocks	6/14/2014 3:11 PM	(none)
Technology objects	5/25/2014 12:29 PM	(none)
External source files	5/25/2014 12:29 PM	(none)
PLC tags	6/9/2014 6:12 PM	(none)

Properties Info Diagnostics

Device information Connection information Alarm display

No devices with problems

Online status	Operating mode	Device/module	Message	Details

Portal view Overview

Connected to PLC\_1, address IP=192.1...

# Просмотр ресурсов ЦПУ

Project\_4 ▶ PLC\_1 [CPU 314C-2 PN/DP]

Online access

- ▼ Diagnostics
  - General
  - Diagnostics status
  - Diagnostics buffer
  - Cycle time
  - Memory
  - Communication
  - MPI/DP interface [X1]
  - ▶ PROFINET interface [X2]
  - Operating hours counter
  - Performance data**
  - ▶ Functions

Operand areas:

Operand type	Number	Area from	to/max. len...
Process image input	2048 (bits)	I0.0	I255.7
Process image output	2048 (bits)	Q0.0	Q255.7
Bit memory	131072 (bits)	M0.0	M16383.7
Timers	2048	T0	T2047
Counter	2048	C0	C2047

Organization blocks:

No.	Function
OB 1	Free cycle start event: startup, end OB1
OB 10	Time-of-day interrupt start event: Time-of-day signal
OB 11	Time-of-day interrupt start event: Time-of-day signal
OB 12	Time-of-day interrupt start event: Time-of-day signal
OB 13	Time-of-day interrupt start event: Time-of-day signal

System blocks:

No.	Name	Symbol comment
SFB 0	CTU	Count up
SFB 1	CTD	Count down
SFB 2	CTUD	Count up / down
SFB 3	TP	Generate a pulse
SFB 4	TON	Generate On delay

Online tools

Options

▼ CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

▼ Cycle time

▼ Memory

Load memory

RAM:  Free: 100%

Work memory  Free: 100%

Retentive memory data

Properties Info Diagnostics

# Установка системного времени

**Project\_4 > PLC\_1 [CPU 314C-2 PN/DP]**

**Online & Diagnostics**

- ▼ Diagnostics
  - General
  - Diagnostic status
  - Diagnostics buffer
  - Cycle time
  - Memory
  - Communication
  - MPI/DP interface [X1]
  - ▼ PROFINET interface [X2]
    - ▼ Ethernet address
      - Network conn...
      - IP parameters
    - Ports
    - Statistics
  - ▼ Domain
    - Sync domain
    - MRP domain
  - Operating hours co...
  - Performance data
- ▼ Functions
  - Assign IP address
  - Set time**
  - Firmware update
  - Assign name
  - Reset of PROFINET in...

**Set time**

**PG/PC time:**  
 (GMT+04:00) Волгоград, Москва, Санкт-Петербург  
 June 16, 2014 07:41:35 PM

**Module time**  
 June 16, 2014 07:41:13 PM  
 Apply

**Time s**  
 Time s

Real-time clock: Available  
 Correction factor: 0 ms/day

**Online tools**

**Options**

▼ **CPU operator panel**

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

▼ **Cycle time**

11 6000 ms

▼ **Memory**

Load memory

RAM:  Free:100%

Work memory  Free:100%

Retentive memory data

Properties Info Diagnostics

# Просмотр состояния модулей в режиме On-line

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_4'. The main window shows the 'Device view' of a PLC rack (Rail\_0) with three modules installed. The status bar at the bottom indicates 'Connected to PLC\_1, address IP=192.1...'. A red arrow points from the text 'Нет ошибок' (No errors) to green checkmarks in the 'Local modules' list and on the PLC rack. The rack shows modules: PLC\_1, DI32 x 24VDC\_1, and DO16 x 24VDC / 0.5....

**Project tree (Left):**

- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Program info
- PLC alarms
- Text lists
- Local modules:
  - PLC\_1 [CPU 314C-2 ...]
  - DI32 x 24VDC\_1
  - DO16 x 24VDC / 0.5...
- Common data
- Documentation settings
- Languages & resources
- Online access
- Card Reader/USB memory

**Device view (Right):**

Topology view | Network view | Device view

PLC\_1 | 100%

1 2 3 4 5 6 7 8 9 10 11

Rail\_0

SIEMENS

DI32 x 24VDC\_1

DO16 x 24VDC / 0.5...

Device data

Properties | Info | Diagnostics

Connected to PLC\_1, address IP=192.1...

# Просмотр состояния модулей в режиме On-line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

ET200\_S

Topology view Network view Device view

Hardware catalog Online tools Tasks

Local modules

- PLC\_1 [CPU 314...
- DI16 x 24VDC\_1
- Distributed I/O
- PROFINET IO-S...
- ET200\_S
  - Device co...
  - Online & ...
  - ET200\_S
  - PM-E 24V...
  - 8DI x 24V...

Ошибка модуля

0	1	2	3	4	5	6	7	15	23	31	39	47	55	63
	✓	✓	✓											
8	16	24	32	40	48	56								
15	23	31	39	47	55	63								

Device data

Properties Info Diagnostics

Portal view Overview ET200\_S Online & dia...

The PROFINET device name was assign...

# Просмотр и контроль программных блоков в режиме On-line

The screenshot displays the Siemens TIA Portal interface for 'Project\_4'. The main window shows the 'Program blocks' list for 'PLC\_1 [CPU 314C-2 PN/DP]'. The table below summarizes the data shown in the interface:

Name	Modified	Remark
Add new block		
Main [OB1]		
MOD_ERR [OB122]	7/13/2014 11:42 AM	
PROG_ERR [OB121]		
Block_1 [FC1]	7/13/2014 11:42 AM	
Block_2 [FC2]	7/13/2014 11:42 AM	
Block_4 [FC4]		
Data_block_1 [DB1]	7/13/2014 11:42 AM	
FC3 [FC3]		

Annotations in the image:

- Block in project and in PLC do not match:** Points to 'Main [OB1]'.
- Blocks loaded in PLC and match with project blocks:** Points to 'MOD\_ERR [OB122]' and 'PROG\_ERR [OB121]'.
- Block exists in project, but not in PLC memory:** Points to 'Block\_4 [FC4]'.
- Block loaded in PLC, but not in project:** Points to 'FC3 [FC3]'.

# Сравнение открытого блока на идентичность.

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Devices

PLC programming

Interface

Comment

Network 1:

1	AN	"Switch_STOP_range"	%I0.0	
2	A	"Breack_Q1"	%I0.2	
3	A(			
4	O	"Switch_START_range"	%I0.1	
5	O	"Feedback_K1M"	%I0.3	
6	)			
7	=	"Output_K1M_ON"	%Q0.0	
8	=	"Visible_K1M_ON"	%Q0.1	

Network 2:

1	L	"Tag_1"	%MW100	
2	L	"Tag_12"	%MW102	
3	+I			
4	T	"Tag_13"	%MW104	
5	NOP 0			

Reference projects

Details view

Portal view Overview Block\_2 (FC2)

Properties Info Diagnostics

Connected to PLC\_1, address IP=192.1...

# Сравнение открытого блока на идентичность.

The screenshot displays the Siemens TIA Portal interface for 'Project\_4'. The main workspace is titled 'Code block comparison (FC2)'. It is split into two panels: 'Block\_2 - Offline' and 'FC2 - Online'. Both panels show a 'Block interface' with a 'Block title' field and a 'Comment' field. Below these, there are three network sections: 'Network 1', 'Network 2', and 'Network 3'. In the 'Block\_2 - Offline' panel, 'Network 3' is expanded and contains a ladder logic network with the following steps:

1	L	"Tag_13"
2	L	"Tag_17"
3	+I	
4	T	"Tag_18"
5	NOP	0
6		

In the 'FC2 - Online' panel, the 'Network 3' section is collapsed and displays the message: 'No corresponding network found.' A red dashed arrow points from the 'Network 3' section in the offline panel to this message in the online panel. A red text annotation in the original image reads: 'В ПЛК в блоке FC2 не оказалось цепи Network 3'.

The interface also includes a 'Project tree' on the left, a 'Reference projects' and 'Details view' section at the bottom left, and a 'Portal view' section at the bottom. The status bar at the bottom right indicates 'Connected to PLC\_1, address IP=192.1...'.

# Просмотр состояния переменных в цепи в режиме On-line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_2 [FC2]

Devices

PLC programming

Project\_4

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules
  - Common data

Reference projects

Details view

Block interface

Network 1:

"Breack_Q1"	%I0.2
"Switch_START_range"	%I0.1
"Feedback_K1M"	%I0.3
"Output_K1M_ON"	%Q0.0
"Visible_K1M_ON"	%Q0.1
"Switch_STOP_range"	%I0.0

Properties Info Diagnostics

Portal view Overview Block\_2 (FC2) Connection to PLC\_1 terminated.

# Просмотр состояния переменных в цепи в режиме On-line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_4

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info

Reference projects

Details view

Block\_2 [FC2]

Block interface

No condition defined.

Block title: ...

Comment

Network 1:

		Address	RLO	Value
1	AN	№IO.0	1	0
2	A	№IO.2	0	0
3	A(		0	
4	0	№IO.1	0	0
5	0	№IO.3	0	0
6	)		0	
7	=	№Q0.0	0	0
8	=	№Q0.1	0	0

Network 2: ...

Network 3: ...

Вход IO.0 был проинвертирован

Testing

Options

CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error  
 RUN  
 STOP  
 FORCE

RUN STOP MRES

Keyswitch: RUN\_P

Call environment

Breakpoints

PLC register

BR CC 1 CC 0

OV OS OR I0

STA RLO /FC

Call hierarchy

No call path available

Portal view Overview Block\_2 (FC2)

Connected to PLC\_1, address IP=192.1...

# Просмотр состояния переменных в цепи в режиме On-line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_4

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info

Block interface

No condition defined.

Block title: .....

Comment

Network 1:

		Address	RLO	Value	Ex
1	AN	№IO.0	1	0	
2	A	№IO.2	1	1	
3	A(		1		
4	0	№IO.1	0	0	
5	0	№IO.3	1	1	
6	)		1		
7	=	№Q0.0	1	1	
8	=	№Q0.1	1	1	

Network 2:

Результат сопряжения – из RLO в образ процесса выходов

Testing

Options

CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Keyswitch: RUN\_P

Call environment

Breakpoints

PLC register

BR  CC 1  CC 0

OV  OS  OR lo

STA  RLO  /FC

Call hierarchy

No call path available

Portal view Overview Block\_2 (FC2)

Connected to PLC\_1, address IP=192.1...

# Просмотр программных блоков в памяти ПЛК в режиме On-Line

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Details List Thumbnails

Name	Modified	Remark
block		
[OB122]	7/13/2014 10:39 AM	
[OB121]	7/13/2014 10:39 AM	
Block_1 [FC1]		
Block_2 [FC2]		
Block_3 [FC3]		
Data_block_1 [DB1]		

Двойной щелчок

В режиме On Line откроем блок FC2, находящийся в памяти ПЛК, для перехода в режим HOLD и пошагового просмотра выполнения инструкций и состояния флагов.

Properties Info Diagnostics

Connected to PLC\_1, address IP=192.1...



# Просмотр инструкций и флагов в цепи в режиме HOLD

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Devices

Project\_4

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info

Reference projects

Details view

Portal view Overview Block\_2 (FC2)

Properties Info Diagnostics

Device information Connection information

1 Devices with problems

Online status	Operating mode	Device/module	Message
OK	HOLD	PLC_1	HOLD

Testing

Options

CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error  
 RUN  
 STOP  
 FORCE

Keyswitch: RUN\_P

Call environment

Breakpoints

Enable output in run

PLC register

BR	CC 1	CC 0
OV	OS	OR I0
STA	RLO	/FC

Call hierarchy

Connected to PLC\_1, address IP=192.1...

Светодиод мигает

Цикл выполнения программы «заморожен», программа будет выполняться по шагам, с остановкой в точке каждого шага

# Пошаговый просмотр инструкций и флагов

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_2 [FC2]

Block interface

Block title: .....

Comment

Network 1:

1	AN	"Switch_STOP_range"	%I0.0	
2	A	"Breack_Q1"	%I0.2	
3	A(			
4	O	"Switch_START_range"	%I0.1	
5	O	"Feedback_K1M"	%I0.3	
6	)			
7	=	"Output_K1M_ON"	%Q0.0	
8	=	"Visible_K1M_ON"	%Q0.1	

Network 2: .....

Network 3: .....

Testing

Options

▼ CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Keyswitch: RUN\_P

> Call environment

▼ Breakpoints

Enable output in run

▼ PLC register

BR	<input type="checkbox"/>	CC 1	<input type="checkbox"/>	CC 0	<input type="checkbox"/>
OV	<input type="checkbox"/>	OS	<input type="checkbox"/>	OR I0	<input type="checkbox"/>
STA	<input checked="" type="checkbox"/>	RLO	<input checked="" type="checkbox"/>	/FC	<input type="checkbox"/>

> Call hierarchy

Portal view Overview **Block\_2 (FC2)** Connected to PLC\_1, address IP=192.1...

# Пошаговый просмотр инструкций и флагов

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project\_4 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_2 [FC2]

Block interface

Block title: .....

Comment

Network 1:

1	AN	"Switch_STOP_range"	%I0.0	
2	A	"Breack_Q1"	%I0.2	
3	A(			
4	O	"Switch_START_range"	%I0.1	
5	O	"Feedback_K1M"	%I0.3	
6	)			
7	=	"Output_K1M_ON"	%Q0.0	
8	=	"Visible_K1M_ON"	%Q0.1	

Network 2: .....

Network 3: .....

Testing

Options

▼ CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Keyswitch: RUN\_P

> Call environment

▼ Breakpoints

Enable output in run

▼ PLC register

BR	<input type="checkbox"/>	CC 1	<input type="checkbox"/>	CC 0	<input type="checkbox"/>
OV	<input type="checkbox"/>	OS	<input type="checkbox"/>	OR I0	<input type="checkbox"/>
STA	<input type="checkbox"/>	RLO	<input type="checkbox"/>	/FC	<input checked="" type="checkbox"/>

> Call hierarchy

Portal view Overview **Block\_2 (FC2)** Connected to PLC\_1, address IP=192.1...

# Выход из режима HOLD с возвратом в RUN

The screenshot shows the Siemens TIA Portal interface for a project named "Project\_4". The main window displays the "Block interface" for "Block\_2 [FC2]". A context menu is open over the block, showing options like "Delete breakpoint", "Disable breakpoint", "Run", "Run to cursor", "Step over", "Step into", and "Step out". A red arrow points from the "Step out" option to the "Continue program execution?" dialog box.

The dialog box contains the following text:

**Continue program execution?**  
There is no calling block with test functions. Do you want to continue the program on the CPU?

Buttons: Yes, No

The CPU operator panel on the right shows the following settings:

- PLC\_1 [CPU 314C-2 PN/DP]
- Buttons: RUN, STOP, MRES
- Keyswitch: RUN\_P
- Call environment
- Breakpoints
- PLC register
- Call hierarchy

The status bar at the bottom indicates "Connected to PLC\_1, address IP=192.1..."

# Диагностический буфер. Пример поиска и анализа неисправности

The screenshot shows the Siemens TIA Portal interface. The main window displays the 'Project\_4' project structure. The 'Project tree' on the left shows the 'PLC\_1 [CPU 314C-2 PN/DP]' device selected. A yellow callout bubble with the text 'Правой клавишей' (Right mouse button) points to the context menu that is open over the device. The context menu includes options like 'Open', 'Copy', 'Paste', 'Compile', 'Download to device', 'Upload from device', 'Go online', 'Go offline', 'Online & diagnostics', 'Receive alarms', 'Start simulation', 'Compare', 'Cross-references', 'Call structure', 'Assignment list', and 'Properties...'. The 'Online & diagnostics' option is highlighted in blue. A yellow arrow points to this option. Below the context menu, a red text annotation reads 'Возникла проблема, свалились в "STOP"' (A problem occurred, fell into "STOP").

The main window displays the 'Diagnostics' tab, which shows the 'Connection information' and 'Alarm display' sections. The 'Alarm display' section shows a table with the following data:

Operating mode	Device/module	Message	Details
	PLC_1	STOP	For more detailed information, refer to module diagnosis...

The status bar at the bottom indicates 'Connected to PLC\_1, address IP=192.1...'.

# Диагностический буфер. Пример поиска и анализа неисправности

Online access

- ▼ Diagnostics
  - General
  - Diagnostic status
  - Diagnostics buffer**
  - Cycle time
  - Memory
  - Communication
  - MPI/DP interface [X1]
  - PROFINET interface [X2]
    - Operating hours counter
    - Performance data
  - Functions

Diagnostics buffer

Events

Display CPU Time Stamps in PG/PC local time

No.	Date and time	Event
1	6/17/2014 12:41:52.829	New startup information in STOP mode
2	6/17/2014 12:41:52.829	STOP caused by programming error (OB not loaded or not possible, or no FRB)
3	6/17/2014 12:41:52.829	<b>FC not loaded</b>
4	6/17/2014 12:41:52.829	Mode transition from STARTUP to RUN
5	6/17/2014 12:41:52.829	Request for manual warm restart
6	6/17/2014 12:41:52.782	Mode transition from STOP to STARTUP
7	6/17/2014 12:41:52.782	New startup information in STOP mode
8	6/17/2014 12:40:11.786	New startup information in STOP mode

Freeze display

Details on event:

Details on event: 3 of 10 Event ID: 16# 253C

Description: **FC not loaded**  
 FC number: 1  
 OB number: 1  
 Module address: 6  
 Requested OB: Programming error OB (OB121)  
 OB not found, or disabled, or cannot be started in the in the current operating mode

Time stamp: 6/17/2014 12:41:52.829

Incoming/outgoing: Incoming event

Help on event Open in editor Save as...

**Следствие**  
**Причина**

**Вызов отсутствующего в памяти PLC программного блока FC1**



# Точка вызова отсутствующего в памяти PLC блока FC1

The screenshot displays the Siemens TIA Portal interface for a project named "Siemens - Project\_4". The breadcrumb navigation shows the path: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Main [OB1]. The main workspace shows the "Interface" view of the "Main Program Sweep (Cycle)" block. A red rectangle highlights a call to function block "%FC1" labeled "Block\_1" in Network 1. The call is shown as a box with "EN" on the left and "ENO" on the right, connected to a horizontal line. Below the call, a legend shows "Block\_1" and "%FC1". Network 2 shows a call to function block "%FC2" labeled "Block\_2", which is connected to input "%I0.1" and output "%Q0.0". The bottom status bar shows "Action canceled before download." and navigation buttons for "Portal view", "Overview", "Online & dia...", and "Main (OB1)".

# Блокировка перехода в STOP при помощи OB121

**Add new block**

Name:

Language:

Select OB:

Description:  
Organization blocks (OBs) control program execution. With OBs, you can respond to cyclic, time-based or interrupt-driven events during program execution.

**Organization block** (highlighted)

- Time interrupts
  - Time of day
    - TOD\_INT0 [OB 10]
  - Time delay
  - Cyclic
- Hardware interrupts
- Startup
- Alarming
- Fault interrupts
  - CYCL\_FLT [OB 80]
  - I/O\_FLT1 [OB 82]
  - I/O\_FLT2 [OB 83]
  - OBNL\_FLT [OB 85]
  - RACK\_FLT [OB 86]
  - COMM\_FLT [OB 87]
  - PROG\_ERR [OB 121]** (highlighted with yellow arrow)
  - MOD\_ERR [OB 122]

Function block (FB)

Function (FC)

Data block (DB)

Additional information

Add new and open

**OK** (highlighted with yellow arrow) Cancel

# Блокировка перехода в STOP при помощи OB121

Online & Diagnostics

Display CPU Time Stamps in PG/PC local time

No.	Date and time	Event
1	6/17/2014 13:22:08.361	FC not loaded
2	6/17/2014 13:22:08.350	FC not loaded
3	6/17/2014 13:22:08.339	FC not loaded
4	6/17/2014 13:22:08.329	FC not loaded
5	6/17/2014 13:22:08.318	FC not loaded
6	6/17/2014 13:22:08.307	FC not loaded
7	6/17/2014 13:22:08.296	FC not loaded
8	6/17/2014 13:22:08.286	FC not loaded

Freeze display

Details on event:

Details on event: 1 of 10 Event ID: 167

Description: FC not loaded  
FC number: 1  
OB number: 1  
Module address: 6  
Requested OB: Programming error OB (OB121)  
Priority class: 1

Time stamp: 6/17/2014 13:22:08.361

Incoming/outgoing: Incoming event

Help on event Open in editor Save as...

Options

CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error  
 RUN RUN  
 STOP STOP  
 FORCE MRES

Keyswitch: RUN\_P

Online tools Tasks Libraries

Properties Info Diagnostics

Cycle time Memory

Вызывается не загруженный FC1, PLC показывает ошибку, но в STOP не сваливается

# Блокировка перехода в STOP при помощи OB122

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP]

Online & Diagnostics

Organization block

Function block

Function

Time interrupts

Time of day

TOD\_INT0 [OB 10]

Time delay

Cyclic

Hardware interrupts

Startup

Alarming

Fault interrupt:

CYCL\_FLT [OB 80]

I/O\_FLT1 [OB 82]

I/O\_FLT2 [OB 83]

OBNL\_FLT [OB 85]

RACK\_FLT [OB 86]

COMM\_FLT [OB 87]

MOD\_ERR [OB 122]

PLC показывает ошибку, но в STOP не сваливается

Online tools

Options

CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

MRES

Keyswitch: RUN\_P

Tasks

Libraries

Diagnosics buffer

Events

Display CPU Time Stamps in PG/PC local time

No.	Date and time	Event
1	6/17/2014 17:02:23.800	New startu
2	6/17/2014 17:02:23.800	STOP causa
3	6/17/2014 17:02:23.800	I/O access
4	6/17/2014 17:02:23.800	Mode trans
5	6/17/2014 17:02:23.799	Request fo
6	6/17/2014 17:02:22.782	Mode trans
7	6/17/2014 17:02:22.782	New startu
8	6/17/2014 17:01:44.200	New startu

Freeze display

Details on event:

Details on event: 2 of 10 Event ID: 16# 45

Description: STOP caused by I/O access error (OB not loaded or not possible, or no FRB)  
Breakpoint in user program: Cyclic program (OB1)  
Priority class: 1  
FC number: 1  
Module address: 0  
Previous operating mode: RUN  
Requested operating mode: STOP (internal)

Обращение к несуществующему периферийному адресу

Properties

Info

Diagnosics

Cycle time

Memory



# Работа с таблицей переменных Watch table

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_4'. The main window shows the 'Watch and force tables' configuration for a PLC\_1 [CPU 314C-2 PN/DP]. The interface includes a menu bar, a toolbar, a project tree on the left, and a main table area. A yellow callout bubble points to the 'Watch and force tables' folder in the project tree, with the text 'Двойной щелчок' (Double click).

The main table area displays the following data:

Watch table	Modified	Remark
Watch table_1	6/16/2014 12:50 PM	
Watch table_1	7/9/2014 4:32 PM	

The interface also shows various toolbars and panels, including 'Reference projects', 'Details view', 'Portal view', 'Overview', 'Device information', 'Connection information', 'Alarm display', 'Properties', 'Info', 'Diagnostics', 'Tasks', and 'Libraries'. The status bar at the bottom indicates 'Project Project\_4 opened.'

# Работа с таблицей переменных Watch table

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

Devices

PLC programming

Testing

Tasks

Libraries

	Name	Address	Display format	Monitor value	Modify value	Co
1		%I0.2	Bool			
2	"Breach_Q1"		Bool	%I0.2		
	"Breach_Q1_1"		Bool	%I1.2		
	"Feedback_K1M"		Bool	%I0.3		
	"Feedback_K1M_1"		Bool	%I1.3		
	"Output_K1M_ON"		Bool	%Q0.0		
	"Output_K1M_ON_1"		Bool	%Q1.0		
	"Start_motor_PO"		Bool	%M50.0		
	"Stop_motor_PO"		Bool	%M50.1		

Reference projects

Details view

Portal view

Overview

Watch table\_1

Properties Info Diagnostics

Device information Connection information Alarm display

Project Project\_4 opened.

# Работа с таблицей переменных Watch table

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

Devices

PLC programming

Project\_4

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
    - Add new watch table
    - Force table
    - Watch table\_1
  - Online backups
  - Program info
  - PLC alarms

Reference projects

Details view

Portal view Overview Watch table\_1

Properties Info Diagnostics

Device information Connection information Alarm display

Project Project\_4 opened.

	i	Name	Address	Display format	Monitor value	Modify value	⚡	Com
1		"Breack_Q1"	%I0.2	Bool			<input type="checkbox"/>	
2		"Breack_Q1_1"	%I1.2	Bool			<input type="checkbox"/>	
3		"Feedback_K1M"	%I0.3	Bool			<input type="checkbox"/>	
4		"Feedback_K1M_1"	%I1.3	Bool			<input type="checkbox"/>	
5		"Output_K1M_ON"	%Q0.0	Bool			<input type="checkbox"/>	
6		"Output_K1M_ON_1"	%Q1.0	Bool			<input type="checkbox"/>	
7		"Start_motor_PO"	%M50.0	Bool			<input type="checkbox"/>	
8		"Stop_motor_PO"	%M50.1	Bool			<input type="checkbox"/>	
9			<Add new>				<input type="checkbox"/>	



# Работа с таблицей переменных Watch table OnLine

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

	Name	Address	Display format	Monitor value	Modify value	Com
1	"Breack_Q"					
2	"Breack_Q"					
3	"Feedback_K1M"	%I0.3	Bool			
4	"Feedback_K1M_1"	%I1.3	Bool			
5	"Output_K1M_ON"	%Q0.0	Bool			
6	"Output_K1M_ON_1"	%Q1.0	Bool			
7	"Start_motor_PO"	%M50.0	Bool			
8	"Stop_motor_PO"	%M50.1	Bool			
9		<Add new>				

Context menu for "Breack\_Q":

- Monitor all
- ! "Monitor all" command for tags

Properties Info Diagnostics

Device information Connection information Alarm display

Portal view Overview Watch table\_1

Connected to PLC\_1, address IP=192.1...

# Работа с таблицей переменных Watch table OnLine

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

	Name	Address	Display format	Monitor value	Modify value	Com
1	"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE		
2	"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE		
3	"Feedback_K1M"	%I0.3	Bool	<input type="checkbox"/> FALSE		
4	"Feedback_K1M_1"	%I1.3	Bool	<input type="checkbox"/> FALSE		
5	"Output_K1M_ON"	%Q0.0	Bool	<input type="checkbox"/> FALSE		
6	"Output_K1M_ON_1"	%Q1.0	Bool	<input type="checkbox"/> FALSE		
7	"Start_motor_PO"	%M50.0	Bool	<input type="checkbox"/> FALSE		
8	"Stop_motor_PO"	%M50.1	Bool	<input type="checkbox"/> FALSE		
9		<Add new>				

Reference projects

Details view

Portal view Overview Watch table\_1

Properties Info Diagnostics

Device information Connection information Alarm display

Connected to PLC\_1, address IP=192.1...



# Работа с таблицей переменных Watch table OnLine

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

	i	Name	Address	Display format	Monitor value	Modify value	⚡	Com
1		"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
2		"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
3		"Feedback_K1M"	%I0.3	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
4		"Feedback_K1M_1"	%I1.3	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
5		"Output_K1M_ON"	%Q0.0	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
6		"Output_K1M_ON_1"	%Q1.0	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
7		"Start_motor_PO"	%M50.0	Bool	<input type="checkbox"/> FALSE	1	<input type="checkbox"/>	
8		"Stop_motor_PO"	%M50.1	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
9		<Add new>					<input type="checkbox"/>	

Reference projects

Details view

Portal view Overview Watch table\_1

Properties Info Diagnostics

Device information Connection information Alarm display

Connected to PLC\_1, address IP=192.1...

# Работа с таблицей переменных Watch table OnLine

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

Devices

PLC programming

	i	Name	Address	Display format	Monitor value	Modify value	⚡	Com
1		"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
2		"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
3		"Feedback_K1M"	%I0.3	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
4		"Feedback_K1M_1"	%I1.3	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
5		"Output_K1M_ON"	%Q0.0	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
6		"Output_K1M_ON_1"	%Q1.0	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
7		"Start_motor_PO"	%M50.0	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/> ⚠	
8		"Stop_motor_PO"	%M50.1	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
9		"Tag_1"	%MW100	DEC	100	100	<input checked="" type="checkbox"/> ⚠	
10		<Add new>					<input type="checkbox"/>	

Reference projects

Details view

Portal view

Overview Watch table\_1

Properties Info Diagnostics

Device information Connection information Alarm display

Connected to PLC\_1, address IP=192.1...

# Работа с таблицей переменных Watch table OnLine

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

Devices

PLC programming

	Name	Address	Display format	Monitor value	Monitor with trig...	Modify with trig...
1	"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
2	"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
3	"Feedback_K1M"	%I0.3	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
4	"Feedback_K1M_1"	%I1.3	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
5	"Output_K1M_ON"	%Q0.0	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
6	"Output_K1M_ON_1"	%Q1.0	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
7	"Start_motor_PO"	%M50.0	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
8	"Stop_motor_PO"	%M50.1	Bool	<input type="checkbox"/> FALSE	Permanent	Permanent
9	"Tag_1"	%MW100	DEC	0	Permanent	Permanent
10	<Add new>					

Reference projects

Details view

Portal view

Properties Info Diagnostics

Device information Connection information Alarm display

Connected to PLC\_1, address IP=192.1...



# Принудительная установка выходов в режиме STOP

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Wat

	Name	Address	Display format	Monitor value
1	"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE
2	"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE

**Enable peripheral outputs (0610:003)**

**Enable peripheral outputs**

CAUTION: The "Enable peripheral outputs" function cancels the output disable (OD). This will enable all output modules. Analog output modules will output their last value. Do you want to execute "Enable peripheral outputs"?

Do not show this message again

Yes No

Testing Options

**CPU operator panel**

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Keyswitch: STOP

Portal view Overview Watch table\_1

Connected to PLC\_1, address IP=192.1...

# Принудительная установка выходов в режиме STOP

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Watch table\_1

Devices

PLC programming

	i	Name	Address	Display format	Monitor value	Modify value		Comm
1		"Breack_Q1"	%I0.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
2		"Breack_Q1_1"	%I1.2	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
3		"Feedback_K1M"	%I0.3	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
4		"Feedback_			<input type="checkbox"/> FALSE		<input type="checkbox"/>	
5		"Output_K1"			<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>	!
6		"Output_K1"			<input type="checkbox"/> FALSE		<input type="checkbox"/>	
7		"Start_motor_PO"	%M50.0	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
8		"Stop_motor_PO"	%M50.1	Bool	<input type="checkbox"/> FALSE		<input type="checkbox"/>	
9		"Tag_1"	%MW100	DEC	0		<input type="checkbox"/>	
10		<Add new>					<input type="checkbox"/>	

Режим может быть полезен при проверке монтажа выходов без обработки программы

Properties Info Diagnostics

Device information Connection information Alarm display

Portal view Overview Watch table\_1

Connected to PLC\_1, address IP=192.1...

# Таблица принудительной установки входов/выходов Force

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables

Devices

Details List Thumbnails

Tasks

Libraries

Start

Project\_4

- PLC\_1 [CPU 314C-2 PN/DP]
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables**
  - Online backups
  - Local modules
  - Distributed I/O
- Common data
- Documentation settings
- Languages & resources
- Online access
- Card Reader/USB memory

Reference projects

Details view

Portal view Overview

Name	Modified	Remark
Force table	7/12/2014 4:46 PM	
Watch table_1	7/11/2014 5:36 PM	

Properties Info Diagnostics

Connection to PLC\_1 terminated.

# Таблица принудительной установки входов/выходов Force

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Force table

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules
  - Distributed I/O
  - Common data

Reference projects

Details view

Portal view Overview Force table

Properties Info Diagnostics

Connection to PLC\_1 terminated.

	Name	Address	Display format	Monitor value	Force value	F	Comment
1	"Switch_STOP_range":P	%I0.0:P	Bool		TRUE	<input checked="" type="checkbox"/>	
2	"Output_K1M_ON":P	%Q0.0:P	Bool			<input type="checkbox"/>	
3		<Add new>				<input type="checkbox"/>	

# Таблица принудительной установки входов/выходов Force

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables > Force table

Devices

Name	Address	Display format	Monitor value	Force value	F	Comment
1 "Switch_STOP_range".P	%I0.0.P	Bool	FALSE	TRUE	<input checked="" type="checkbox"/>	

**Force all (0710:001)**

**Force all**

CAUTION: Forcing with 'PLC\_1 (S7300 CPU)' !

Do you want to start "forcing" now?

Portal view Overview Force table

Connected to PLC\_1, address IP=192.1...

# Таблица принудительной установки входов/выходов Force

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables

Testing Options

PLC programming

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms
  - Text lists
  - Local modules
  - Distributed I/O
  - Common data

Reference projects

Details view

	Name	Address	Display format	Monitor
1	"Switch_STOP_range":P	%I0.0:P	Bool	<input checked="" type="checkbox"/> TRUE
2	"Output_K1M_ON":P	%Q0.0:P	Bool	<input type="checkbox"/> FALSE
3	<Add new>			

Testing

Options

▼ CPU operator panel

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Mode selector: RUN\_P

Properties

Portal view Overview Force table

Connected to PLC\_1, address IP=192.1...

## Выход из режима FORCE

Siemens - Project\_4

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_4 > PLC\_1 [CPU 314C-2 PN/DP] > Watch and force tables

	Name	Address	Display format	Monitor
1	"Switch_STOP_range":P	%I0.0:P	Bool	<input type="checkbox"/> FALSE
2	"Output_K1M_ON":P	%Q0.0:P	Bool	<input type="checkbox"/> FALSE
3		<Add new>		

**Stop forcing (0710:007)**

**Stop forcing**

CAUTION: If you have not personally initiated this force job, with the generator of this job.

Do you want to continue this action?

Testing Options

**CPU operator panel**

PLC\_1 [CPU 314C-2 PN/DP]

Error

RUN

STOP

FORCE

Mode selector: RUN\_P

Portal view Overview Force table

Connected to PLC\_1, address IP=192.1...

# Структура вызовов программных блоков и функций

The screenshot displays the Siemens TIA Portal interface for 'Project\_2'. The 'Tools' menu is open, and the 'Call structure' option is highlighted with a green box. A yellow arrow points to the 'Tools' menu. In the Project tree on the left, 'Program blocks' is highlighted with a red box. The main workspace shows a table of program blocks with the following data:

Modified	Title	Address	Type	Language	Opt
2/2/2014 - 9:34:01 AM	"Main Program Sweep (Cycle)"	OB1	OB	LAD	<input type="checkbox"/>
4/2/2014 - 2:10:02 PM		FC1	FC	LAD	<input type="checkbox"/>
4/2/2014 - 2:10:02 PM		FC2	FC	LAD	<input type="checkbox"/>
4/2/2014 - 2:10:02 PM		FB1	FB	LAD	<input type="checkbox"/>
5/28/2014 - 6:27:26 PM	CALL_FB [FB4]	FB4	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:17 PM	SUM_1 [FB2]	FB2	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:28 PM	SUM_2 [FB3]	FB3	FB	LAD	<input type="checkbox"/>
5/29/2014 - 1:54:41 PM	Block_recipe [DB6]	DB6	DB	DB	<input type="checkbox"/>
5/28/2014 - 6:51:26 PM	CALL_FB_DB [DB3]	DB3	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:48:58 PM	FB1_IDB1 [DB1]	DB1	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:50:58 PM	FB1_IDB2 [DB2]	DB2	DB	DB	<input type="checkbox"/>
6/1/2014 - 1:58:48 PM	Global_DB1 [DB4]	DB4	DB	DB	<input type="checkbox"/>
5/29/2014 - 1:05:31 PM	Recipe_1 [DB5]	DB5	DB	DB	<input type="checkbox"/>
5/30/2014 - 12:34:27 PM	Recipe_2 [DB7]	DB7	DB	DB	<input type="checkbox"/>
5/29/2014 4:49 PM	System blocks				<input type="checkbox"/>

The bottom status bar shows 'Portal view', 'Overview', 'Block\_1 (FC1)', and 'Cross refere...'. A notification at the bottom right states: 'The project Project\_2 was saved succes...'

# Структура вызовов программных блоков и функций

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Call structure of PLC\_1

Call structure	Address	Details	Local data (in path)	Loc
1 Main	OB1		22	22
2 Block_2	FC2	Main NW1	26	4
3 FB1_IDB1 (instance DB of Block_3)	DB1		0	0
4 FB1_IDB2 (instance DB of Block_3)	DB2		0	0
5 CALL_FB_DB (instance DB of CALL_FB)	DB3		0	0
6 Global_DB1 (global DB)	DB4		0	0
7 Recipe_1 (Data block derived from User_data_type_1)	DB5		0	0
8 Block_recipe (global DB)	DB6		0	0
9 Recipe_2 (Data block derived from User_data_type_2)	DB7		0	0
10 Block_1	FC1		0	0
11 Global_DB1	DB4	Block_1 NW12	0	0
12 Global_DB1	DB4	Block_1 NW12	0	0
13 Global_DB1	DB4	Block_1 NW12	0	0
14 Global_DB1	DB4	Block_1 NW12	0	0
15 MIN	FC27	Block_1 NW12	8	8
16 Recipe_1 (instance DB of User_data_type_1)	DB5	Block_1 NW15	0	0
17 Recipe_2 (instance DB of User_data_type_2)	DB7	Block_1 NW15	0	0

Portal view Overview Program info

The project Project\_2 was saved succes...



# Структура зависимостей вызовов

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Call structure | **Dependency structure** | Assignment list | Resources

PLC programming

Devices

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
  - Technology objects
  - External source files
  - PLC tags
    - Show all tags
    - Add new tag table
    - Default tag table [29]
    - Tag table\_1 [13]
  - PLC data types
  - Watch and force tables
  - Online backups
  - Program info
  - PLC alarms

Reference projects

Details view

Properties | Info | Diagnostics

Portal view | Overview | Program info

The project Project\_2 was saved succes...

**Dependency structure of PLC\_1**

Dependency structure	Address	Details
1 User_data_type_1		
2 Recipe_1 (Data block derived from ...)	DB5	
3 Block_recipe, #Static_1		Interface
4 User_data_type_2		
5 Recipe_2 (Data block derived from ...)	DB7	
6 Block_1	FC1	Block_1 NW15
7 Block_recipe, #Static_2		Interface
8 User_data_type_TEMP		
9 FB1_IDB1 (instance DB of Block_3)	DB1	
10 FB1_IDB2 (instance DB of Block_3)	DB2	
11 CALL_FB_DB (instance DB of CALL_FB)	DB3	
12 Global_DB1 (global DB)	DB4	
13 Block_1	FC1	Block_1 NW12
14 Block_1	FC1	Block_1 NW12
15 Block_1	FC1	Block_1 NW12
16 Block_1	FC1	Block_1 NW12
17 Recipe_1 (Data block derived from Use...)	DB5	

## Поиск точки вызова программного блока

The screenshot shows the Siemens TIA Portal interface. The 'Tools' menu is open, and the 'Cross-references' option (F11) is highlighted. The 'Project tree' on the left shows the 'Program blocks' folder selected. The main window displays a table of program blocks with columns for Modified, Title, Address, Type, Language, and Opt.

Modified	Title	Address	Type	Language	Opt
2/2014 - 9:34:01 AM	"Main Program Sweep (Cycle)"	OB1	OB	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FC1	FC	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FC2	FC	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FB1	FB	LAD	<input type="checkbox"/>
5/28/2014 - 6:27:26 PM		FB4	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:17 PM		FB2	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:28 PM		FB3	FB	LAD	<input type="checkbox"/>
5/29/2014 - 1:54:41 PM		DB6	DB	DB	<input type="checkbox"/>
5/28/2014 - 6:51:26 PM		DB3	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:48:58 PM		DB1	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:50:58 PM		DB2	DB	DB	<input type="checkbox"/>
6/1/2014 - 1:58:48 PM		DB4	DB	DB	<input type="checkbox"/>
5/29/2014 - 1:05:31 PM		DB5	DB	DB	<input type="checkbox"/>
5/30/2014 - 12:34:27 PM		DB7	DB	DB	<input type="checkbox"/>
5/29/2014 4:49 PM					<input type="checkbox"/>

## Поиск точки вызова программного блока

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Cross-references of: Program blocks

Used by	Uses	Object	Point of use	Address	Type	Path
		Main		OB1	LAD-Organization Block	Project_2\PLC_1\Program
		UNSCALE		FC106	STL-Function	Project_2\PLC_1\Program
		SCALE		FC105	STL-Function	Project_2\PLC_1\Program
		MIN		FC27	STL-Function	Project_2\PLC_1\Program
		Block_2		FC2	LAD-Function	Project_2\PLC_1\Program
		Block_1		FC1	LAD-Function	Project_2\PLC_1\Program
		Main		OB1	LAD-Organization Block	Project_2\PLC_1\Program
		CALL_FB				Project_2\PLC_1\Program
		SUM_2				Project_2\PLC_1\Program
		SUM_1				Project_2\PLC_1\Program
		Block_3				Project_2\PLC_1\Program
		Recipe_2				Project_2\PLC_1\Program
		Block_recipe				Project_2\PLC_1\Program
		Recipe_1				Project_2\PLC_1\Program
		Global_DB1		DB4	Global DB	Project_2\PLC_1\Program

Main NW1

Network 1:

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) Cross refere... Cross refere... The project Project\_2 was saved succes...

# План использования переменных

The screenshot shows the Siemens TIA Portal interface. The 'Tools' menu is open, and the 'Assignment list' option is highlighted with a yellow arrow. The main window displays a table of program blocks under the 'Program blocks' folder.

Modified	Title	Address	Type	Language	Opt
2/2014 - 9:34:01 AM	"Main Program Sweep (Cycle)"	OB1	OB	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FC1	FC	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FC2	FC	LAD	<input type="checkbox"/>
4/2014 - 2:10:02 PM		FB1	FB	LAD	<input type="checkbox"/>
5/28/2014 - 6:27:26 PM	CALL_FB [FB4]	FB4	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:17 PM	SUM_1 [FB2]	FB2	FB	LAD	<input type="checkbox"/>
5/28/2014 - 4:41:28 PM	SUM_2 [FB3]	FB3	FB	LAD	<input type="checkbox"/>
5/29/2014 - 1:54:41 PM	Block_recipe [DB6]	DB6	DB	DB	<input type="checkbox"/>
5/28/2014 - 6:51:26 PM	CALL_FB_DB [DB3]	DB3	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:48:58 PM	FB1_IDB1 [DB1]	DB1	DB	DB	<input type="checkbox"/>
5/28/2014 - 5:50:58 PM	FB1_IDB2 [DB2]	DB2	DB	DB	<input type="checkbox"/>
6/1/2014 - 1:58:48 PM	Global_DB1 [DB4]	DB4	DB	DB	<input type="checkbox"/>
5/29/2014 - 1:05:31 PM	Recipe_1 [DB5]	DB5	DB	DB	<input type="checkbox"/>
5/30/2014 - 12:34:27 PM	Recipe_2 [DB7]	DB7	DB	DB	<input type="checkbox"/>
5/29/2014 4:49 PM	System blocks				<input type="checkbox"/>

# План использования переменных

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Save project

Go online Go offline

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Call structure Dependency structure Assignment list Resources

Assignment list of PLC\_1

Input, Output

Address	7	6	5	4	3	2	1	0	B	W	DW
QB0							◆	◆			
QB1							◆	◆			
QB136											
QB137											
QB256											
QB257											
QB258											
QB259											
QB304											
QB305											
QB306											
QB307											
QB308											
QB309											
QB310											

Bit memory

Address	7	6	5	4	3	2	1	0
MB0						◆	◆	◆
MB10						◆	◆	◆
MB100								
MB101								
MB102								
MB103								
MB104								
MB105								
MB106								
MB107								
MB108								
MB109								
MB110								
MB111								
MB112								

Использованные в программе

Switch\_STOP\_range [PLC tag]

Properties Info Diagnostics

Portal view Overview Block\_1 (FC1) Program info

The project Project\_2 was saved succes...

# План использования переменных

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Call structure | Dependency structure | Assignment list | Resources

<No filter> [Filter icon]

Bit memory

Address	7	6	5	4	3	2
MB0					◆	◆
MB10					◆	◆
MB100						
MB101						
MB102						
MB103						
MB104						
MB105						
MB106						
MB107						
MB108						
MB109						
MB110						
MB111						
MB112						

Output\_K1M\_ON [PLC tag]

Filter for assignment list

<No filter> [Filter icon] [Close icon]

Address \_\_\_\_\_

Filter area

- Input \* \_\_\_\_\_
- Output \* \_\_\_\_\_
- Memory \* \_\_\_\_\_
- Timers \* \_\_\_\_\_
- Counters \* \_\_\_\_\_

Edit address numbers and/or address areas separated by comma, e.g. 1;3,5-12.

OK Cancel

Portal view | Overview | Block\_1 (FC1) | Program info

The project Project\_2 was saved succes...



# План использования переменных

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks

Call structure | Dependency structure | Assignment list | Resources

<No filter> [Filter icon]

Bit memory

Address	7	6	5	4	3	2
MB0					◆	◆
MB10					◆	◆
MB100						
MB101						
MB102						
MB103						
MB104						
MB105						
MB106						
MB107						
MB108						
MB109						
MB110						
MB111						
MB112						

Output\_K1M\_ON [PLC tag]

Filter for assignment list

Filter\_3 [Filter icon]

Address \_\_\_\_\_

Filter area

- Input \*
- Output \*
- Memory \*
- Timers \*
- Counters \*

Edit address numbers and/or address areas separated by comma, e.g. 1;3,5-12.

OK Cancel

Portal view | Overview | Block\_1 (FC1) | Program info

The project Project\_2 was saved succes...

Оставим только  
область входов

# Фильтр при определении плана использования переменных

The screenshot shows the Siemens TIA Portal interface. The main window displays the 'Assignment list of PLC\_1' for a CPU 314C-2 PN/DP. The list includes addresses from 7 to 1, with inputs IB0-IB5 and IB136-IB261. A 'Filter for assignment list' dialog box is open, showing a filter area with checkboxes for Input, Output, Memory, Timers, and Counters. The 'Input' checkbox is checked, and the filter area contains a text input field with an asterisk (\*). A yellow arrow points to the filter icon in the main window's toolbar.

**Assignment list of PLC\_1**

Input, Output	Address	7	6	5	4	3	2	1
IB0						◆	◆	
IB1						◆	◆	
IB2								
IB3								
IB4								
IB5								
IB136								
IB137								
IB138								
IB256								
IB257								
IB258								
IB259								
IB260								
IB261								

**Filter for assignment list**

Filter\_3

**Address** \_\_\_\_\_

Filter area

- Input \* \_\_\_\_\_
- Output \* \_\_\_\_\_
- Memory \* \_\_\_\_\_
- Timers \* \_\_\_\_\_
- Counters \* \_\_\_\_\_

Edit address numbers and/or address areas separated by comma, e.g. 1;3,5-12.

OK Cancel



# Изменение символического имени

The screenshot shows the Siemens TIA Portal interface. The main window displays a ladder logic network with a normally open contact labeled "Switch\_STOP\_range" connected to a coil labeled "Output\_K1M\_ON". A context menu is open over the contact, listing actions like "Define tag...", "Rename tag...", "Rewire tag...", "Cut", and "Copy". A red box with the text "Правой клавишей" (Right mouse button) points to the contact. Below the network editor, the "Rename tag" dialog box is open, showing the current tag name "Switch\_STOP\_range" and its properties. A red box with the text "Мы можем изменить символическое имя" (We can change the symbolic name) points to the "Change" button in the dialog.

**Project tree:** Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

**Block title:** Network 1

**Block interface:** %I0.0 "Switch\_STOP\_range" — (%Q0.0 "Output\_K1M\_ON")

**Rename tag dialog:**

Name	Section	Adresse	Data type	PLC tag table	Comment
Switch_STOP_range	Global Input	%I0.0	Bool	Default tag table	Ключ в положении СТОП

**Context menu actions:**

- Define tag... (Ctrl+Shift+I)
- Rename tag... (Ctrl+Shift+T)
- Rewire tag... (Ctrl+Shift+P)
- Cut (Ctrl+X)
- Copy (Ctrl+C)

**Other context menu actions:**

- Insert STL network
- Insert empty box (Shift+F5)
- Insert input and output (Ctrl+Shift+3)
- Insert comment
- Generate ENO
- Do not generate ENO
- Properties (Alt+Enter)

# Изменение адресации переменной (перемонтаж)

The screenshot shows the Siemens TIA Portal interface for editing a PLC program. The project tree on the left shows the hierarchy: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]. The main workspace displays a ladder logic network with a normally open contact labeled '%I0.0' and a coil labeled '%Q0.0'. A context menu is open over the '%I0.0' contact, with the 'Rewire tag...' option selected. The 'Rewire tag' dialog box is open, showing a table with the following data:

Name	Section	Address	Data type	PLC tag table	Comment
Switch_STOP_range	Global Input	%I0.0	Bool	Default tag table	Ключ в положении СТОП

A red text box with a yellow arrow points to the address field '%I0.0' in the dialog, containing the text: **Мы можем изменить адрес переменной**. The 'Change' button is also highlighted with a yellow arrow. The status bar at the bottom indicates 'The project Project\_2 was saved successfully'.

# Определение модуля с физическим адресом переменной

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree: Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface: Network 1: %I0.0 "Switch\_STOP\_range" (NO) — (%Q0.0 "Output\_K1M\_ON") (%Q0.1 "Visible\_K1M\_ON")

Context menu options:

- Define tag... (Ctrl+Shift+I)
- Rename tag... (Ctrl+Shift+T)
- Rewire tag... (Ctrl+Shift+P)
- Cut (Ctrl+X)
- Copy (Ctrl+C)
- Paste (Ctrl+V)
- Delete (Del)
- Go to (highlighted with yellow arrow)
- Cross-reference information (Shift+F11)
- Insert network (Ctrl+R)
- Insert STL network
- Insert empty box (Shift+F5)
- Insert input and output (Ctrl+Shift+3)
- Insert comment
- Generate ENO
- Do not generate ENO
- Properties (Alt+Enter)
- Device view (highlighted with yellow arrow)

Red text box: **Надо найти в стойке модуль входов с этим адресом**

# Определение модуля с физическим адресом переменной

The screenshot displays the Siemens TIA Portal interface for a project named 'Project\_2'. The main window shows a 'Topology view' of a PLC rack. The rack consists of 10 slots. Slot 1 is occupied by the CPU module 'PLC\_1 [CPU 314C-2 PN/DP]'. Slot 4 is occupied by a digital input module 'DI32x24VDC\_1', which is highlighted with a blue box and a yellow arrow. A red text label below the arrow reads 'В этом модуле находится вход с адресом I0.0'. The interface includes a menu bar at the top, a project tree on the left, and a hardware catalog on the right.

# Поиск использования в программе выбранной переменной

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 ▶ PLC\_1 [CPU 314C-2 PN/DP] ▶ Program blocks ▶ Block\_1 [FC1]

Block interface

Block title: ...

Comment

Network 1: ...

Define tag... Ctrl+Shift+I  
Rename tag... Ctrl+Shift+T  
Rewire tag... Ctrl+Shift+P  
Cut Ctrl+X  
Copy Ctrl+C  
Paste Ctrl+V  
Delete Del  
Go to  
Cross-reference information Shift+F11  
Insert network Ctrl+R  
Insert STL network  
Insert empty box Shift+F5  
Insert input and output Ctrl+Shift+3  
Insert comment  
Generate ENO  
Do not generate ENO  
Properties Alt+Enter

Надо найти, где еще в программе используется операнд с этим адресом

%I0.0  
"Switch\_STOP\_range"

%Q0.0  
"Output\_K1M\_ON"

%Q0.1  
"Visible\_K1M\_ON"

Properties Info Diagnostics

The project Project\_2 was saved succes...

# Поиск использования в программе выбранной переменной

Siemens - Project\_2

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project tree

Project\_2 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Devices

PLC programming

Project\_2

- Add new device
- Devices & networks
- PLC\_1 [CPU 314C-2 PN/DP]
  - Device configuration
  - Online & diagnostics
  - Program blocks
    - Add new block
    - Main [OB1]
    - Block\_1 [FC1]
    - Block\_2 [FC2]
    - Block\_3 [FB1]
    - CALL\_FB [FB4]
    - SUM\_1 [FB2]
    - SUM\_2 [FB3]
    - Block\_recipe [DB6]
    - CALL\_FB\_DB [DB3]
    - FB1\_IDB1 [DB1]

Reference projects

Details view

Block\_1 [FC1]

Properties Info Diagnostics

General Cross-references Compile Syntax

Cross-reference information for: Block\_1

Object	Point of use	Access	Address	Monitor value	Type
"Switch_STOP_range"			%I0.0		Bool
Block_1 NW1	Read-only		FC1		LAD-Function
Block_1 I					LAD-Function
Block_1 I					LAD-Function
Block_2 I					LAD-Function
Block_2 I					LAD-Function
Block_3 I					LAD-Function
Block_3 I					LAD-Function

Правой клавишей

Open

Network 1:

The diagram shows a single network with two contacts in series. The first contact is a normally open contact (NO) labeled "%I0.0 'Switch\_STOP\_range'". The second contact is a normally closed contact (NC) labeled "%I0.2 'Break\_Q1'".

Portal view Overview Block\_1 (FC1)

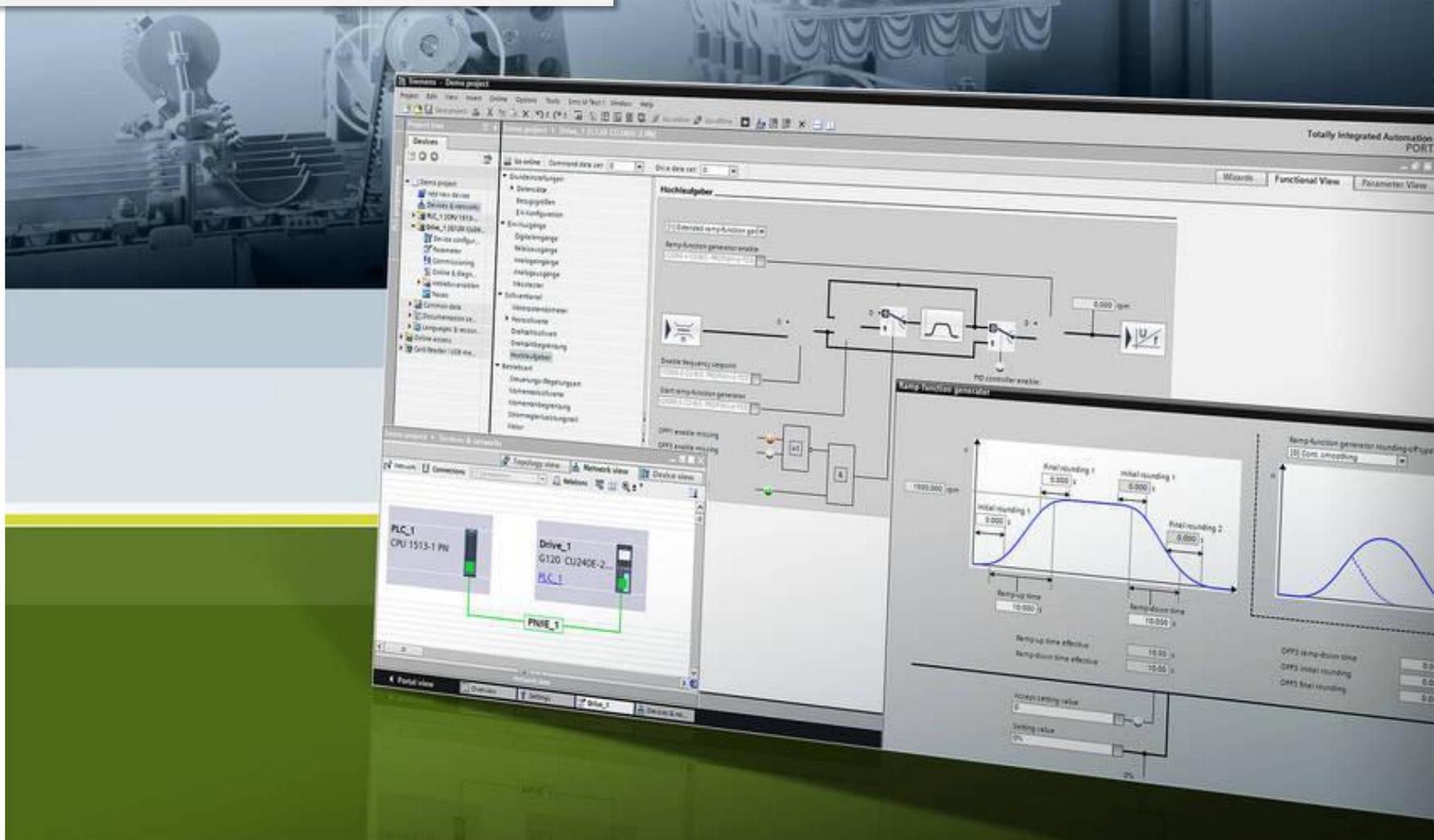
The project Project\_2 was saved succes...

## Конец раздела 9. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- Тестирование и отладка
- ▶ Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

## Раздел 10

Сетевые структуры. Типы сетей, организация соединений, программная обработка передачи данных.



# Шинные системы SIMATIC NET

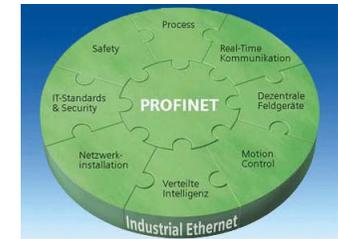
## Industrial Ethernet

- Производительная сеть верхнего уровня
- Стандарт IEEE 802.3 (ETHERNET), Стандарт 802.11 (Wireless LAN)



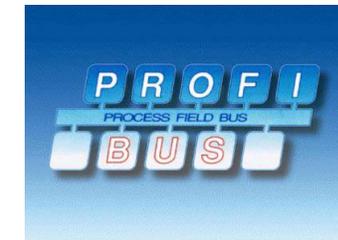
## PROFINET

- Для работы в сегменте от полевого уровня до уровня управления
- Открытый Industrial Ethernet Стандарт (IEC 61158)



## PROFIBUS

- Для работы в сегменте от полевого уровня до уровня ячеек
- PROFIBUS DP, PROFIBUS PA, PROFIBUS FMS



## AS-interface

- Непосредственное подключение шины полевого уровня к датчикам и исполнительным устройствам



# Создание одноранговой сети PLC – PLC на базе ETHERNET

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection 100%

PLC\_1 CPU 314C-2 PN/...

PLC\_2 CPU 312

Добавим процессор без встроенного порта ETHERNET

Hardware catalog

Options

Catalog

<Search>

Filter

- SIMATIC S7-1200
- SIMATIC S7-1500
- SIMATIC S7-300
  - CPU
    - CPU 312
      - 6ES7 312-1AE13-0AB0
      - 6ES7 312-1AE14-0AB0
    - CPU 312C
    - CPU 313C
    - CPU 313C-2 DP
    - CPU 313C-2 PtP
    - CPU 314
    - CPU 314C-2 DP
    - CPU 314C-2 PN/DP
    - CPU 314C-2 PtP
    - CPU 315-2 DP
    - CPU 315-2 PN/DP

Properties Info Diagnostics

Portal view Overview Devices & ne...

The project Project1 was saved success...



# Создание одноранговой сети PLC – PLC на базе ETHERNET

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection 100%

PLC\_1 CPU 314C-2 PN/...

PLC\_2 CPU 312

«Соединим» порты ETHERNET

Hardware catalog

Options

Catalog

<Search>

Filter

- SIMATIC S7-1500
- SIMATIC S7-300
  - CPU
  - Communications modules
    - PROFINET/Ethernet
      - CP 343-1
        - 6GK7 343-1EX11-0...**
        - 6GK7 343-1EX21-0...
        - 6GK7 343-1EX30-0...
      - CP 343-1 Lean
      - CP 343-1 Advanced-IT
      - CP 343-1 ERPC
    - PROFIBUS
    - AS interface
    - Point-to-Point
  - SIMATIC S7-400

Hardware catalog Online tools Tasks

Properties Info Diagnostics

Portal view Overview Devices & ne...

The project Project1 was saved success...



## Вызов окна свойств первого процессора

The screenshot shows the Siemens TIA Portal interface. The main workspace displays a network configuration with two PLCs: PLC\_1 (CPU 314C-2 PN/IE) and PLC\_2 (CPU 312). They are connected via a network link labeled 'PN/IE\_1'. A yellow callout bubble with the text "Двойной щелчок" (Double click) points to the first PLC. The right sidebar shows the "Hardware catalog" with "Controllers" selected. The bottom status bar shows "The project Project1 was saved success...".



# Сетевой адрес первого процессора

The screenshot displays the Siemens TIA Portal interface for configuring a PLC's network settings. The main window shows the 'Properties' dialog for 'PLC\_1 [CPU 314C-2 PN/DP]'. The 'Ethernet addresses' tab is selected, and the 'Interface networked with' section is expanded. The 'Subnet' is set to 'PN/IE\_1'. The 'IP protocol' section is also expanded, showing the 'Set IP address in the project' option selected. The IP address is set to '192.168.0.1' and the subnet mask is '255.255.255.0'. The 'Use router' option is unchecked, and the 'Router address' is set to '0.0.0.0'. The 'Set IP address using a different method' option is also unchecked.



# Вызов окна свойств второго процессора

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ Devices & networks

Topology view Network view Device view

Network Connections HMI\_connection

PLC\_1 CPU 314C-2 PN/...

PLC\_2 CPU 312

PN/IE\_1

Двойной щелчок

Hardware catalog

Options

Catalog

<Search>

Filter

- Controllers
- HMI
- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
- Field devices
- Other field devices

Hardware catalog Online tools Tasks

Properties Info Diagnostics

Information

Portal view Overview Devices & ne...

The project Project1 was saved success...



## Сетевой адрес второго процессора

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ Devices & networks

Topology view Network view Device view

Network data

CP 343-1\_1 [CP 343-1] Properties Info Diagnostics

General IO tags Texts

General

MPI address

Options

PROFINET interface [X1]

General

**Ethernet addresses**

Advanced options

I/O addresses

Ethernet addresses

Interface networked with

Subnet: PN/IE\_1

Add new subnet

ISO protocol

Use ISO protocol

MAC address: 08 - 00 - 06 - 01 - 00 - 00

IP protocol

Use IP protocol

IP address: 192 . 168 . 0 . 2

Subnet mask: 255 . 255 . 255 . 0

Hardware catalog

Options

Catalog

<Search>

Filter

- Controllers
- HMI
- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
- Field devices
- Other field devices

Information

Portal view Overview Devices & ne...

The project Project1 was saved success...



## Активация опции «показать адреса абонентов сети»

The screenshot shows the Siemens TIA Portal interface for Project1. The main workspace is in 'Network view', displaying a network diagram with two PLCs: PLC\_1 (CPU 314C-2 PN/IE) and PLC\_2 (CPU 312), connected via a PN/IE\_1 link. A yellow arrow points to the 'Show address labels' button in the network view toolbar. The right sidebar shows the 'Hardware catalog' with a tree view of components like Controllers, HMI, and PC systems. The bottom status bar indicates 'The project Project1 was saved success...'.



## Активация опции «показать адреса абонентов сети»

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 ▶ Devices & networks

Topology view Network view Device view

Network Conn... ction

100%

Show address labels

Двойной щелчок

PLC\_1  
CPU 314C-2 PN/...

PLC\_2  
CPU 312

PN/IE\_1: 192.168.0.1 2

2 PN/IE\_1: 192.168.0.2

PN/IE\_1

Hardware catalog

Options

Catalog

<Search>

Filter

- Controllers
- HMI
- PC systems
- Drives & starters
- Network components
- Detecting & Monitoring
- Distributed I/O
- Field devices
- Other field devices

Properties Info Diagnostics

Information

Portal view Overview Devices & ne...

The project Project1 was saved success...

## Конфигурирование порта партнера

The screenshot displays the Siemens TIA Portal interface for configuring a partner port. The main window is titled "Siemens - Project1" and shows the "Devices & networks" view. The left sidebar contains a tree view with the following structure:

- Project1
- Devices & networks
  - PROFINET interface [X2]
    - General
    - Ethernet addresses
    - Time synchronization
    - Operating mode
    - Advanced options
      - Interface options
      - Media redundancy
      - Real time settings
        - Port [X2 P1 R]
          - General
          - Port interconnection (highlighted with a blue arrow)
          - Port options
          - Diagnostics addresses
  - Port [X2 P2 R]
    - General
    - Port interconnection
    - Port options
    - Diagnostics addresses

The main workspace shows the "Port interconnection" configuration for the selected "Port\_1 [X1 P1]". The "Local port" section is expanded to show the hierarchy: S7-300 station\_2 > CP 343-1\_1 > PROFINET interface\_1 [X1] > Port\_1 [X1 P1]. The "Partner port" field is set to "CP 343-1\_1\PROFINET interface\_1 [X1]\Port\_1 [X1 P1]", with a yellow arrow pointing to the dropdown menu. The "Medium" field is currently empty. The status bar at the bottom indicates "The project Project1 was saved success...".



# Настройки сети

The screenshot displays the Siemens TIA Portal interface for network configuration. The main workspace shows a network topology with two PLCs, PLC\_1 (CPU 314C-2 PN/IE) and PLC\_2 (CPU 312), connected to a central PN/IE\_1 interface. A yellow callout bubble with the text "Двойной щелчок" (Double click) points to the connection line between the PLCs and the interface. The interface is connected to a network data block. The right-hand side of the screen features a "Catalog" panel with a search bar and a list of components including Controllers, HMI, PC systems, Drives & starters, Network components, Detecting & Monitoring, Distributed I/O, Field devices, and Other field devices. The bottom status bar indicates "Project Project1 opened."

# Определение идентификаторов объектов сети

The screenshot displays the Siemens TIA Portal interface for configuring a network object. The main window is titled "Siemens - Project1" and shows a menu bar with options like Project, Edit, View, Insert, Online, Options, Tools, Window, and Help. Below the menu is a toolbar with icons for saving, undo, redo, and online/offline status. The main workspace is divided into several panes:

- Left Pane:** "Devices & networks" tree view showing a hierarchy: Project1 > Devices & networks > PN/IE\_1 [Industrial Ethernet]. Under "General", there are sub-panels for "Domain management" (Sync domains, MRP domains) and "Overview isochronous mode".
- Top Right Pane:** "Network data" view with tabs for "Topology view", "Network view", and "Device view".
- Right Pane:** "Properties" dialog for the selected object, showing "General" settings. The "Name" field contains "PN/IE\_1". The "S7 subnet ID" field is split into two parts: "891E" and "1", with the "1" field highlighted by a green box. A checked checkbox below reads "Connect devices that are not linked with this subnet in case of port connection."
- Bottom Pane:** "Portal view" navigation bar with "Overview" and "Devices & ne..." tabs. A status bar at the bottom right indicates "Project Project1 opened."



# Создание и программирование логического соединения

The screenshot displays the Siemens TIA Portal interface for configuring a logical connection. The main workspace shows a ladder logic network with a 'GET' instruction block. The block is titled 'GET' and is connected to a data block '%DB8' labeled 'GET\_DB\_4'. The instruction has several input and output terminals: EN, REQ (set to FALSE), ID (set to W#16#0), ADDR\_1 (set to <??>), RD\_1 (set to <??>), ENO, NDR, ERROR, and STATUS. A yellow callout box with the text 'Start configuration' and a red dashed arrow points to the configuration icon on the ENO terminal.

The right-hand side of the interface features a 'Totally Integrated Automation PORTAL' sidebar with a tree view of communication instructions. The 'Communication' folder is expanded, showing a list of instructions including GET, PUT, USEND, URCV, BSEND, BRCV, and C\_CNTRL. The 'GET' instruction is highlighted in blue.

The bottom status bar shows 'Portal view', 'Overview', and 'Block\_1 (FC1)'. A notification message at the bottom right states: 'The project Project1 was saved success...'



# Создание и программирование логического соединения

The screenshot displays the Siemens TIA Portal interface for configuring a connection parameter. The main window title is "Siemens - Project1". The menu bar includes Project, Edit, View, Insert, Online, Options, Tools, Window, and Help. The toolbar contains various icons for file operations and online/offline status. The breadcrumb path is "Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]".

The left sidebar shows "PLC programming" with a tree view containing "GET\_E [FB34]" and "Block para...". The "Configuration" tab is active, showing the "Connection parameter" dialog. The "General" section is expanded, displaying fields for "Local" and "Partner" endpoints, "Interface", "Interface type", "Subnet name", "Address", "Connection ID (dec)", and "Connection name".

In the "Partner" dropdown menu, "Unspecified" is selected, and a yellow arrow points to "PLC\_2 [CPU 312]". The status bar at the bottom indicates "The project Project1 was saved success...".



# Создание и программирование логического соединения

Siemens - Project1

Project Edit View Insert Online Options Tools Window Help

Totally Integrated Automation PORTAL

Project1 > PLC\_1 [CPU 314C-2 PN/DP] > Program blocks > Block\_1 [FC1]

Select connection

	Local connection name	Local end point	Local ID (hex)	Partner ID (hex)	Partner
1	S7_Connection_1	PLC_1	1	1	PLC_2

PLC programming

Properties Info Diagnostics

CPU 312]

1\_1, PROFINET interface\_1[X1]

et

8.0.2

Testing Tasks Libraries

Connection name: S7\_Connection\_1 ...

Active connection establishment

One-way

Portal view Overview Block\_1 (FC1) Devices & ne... The project Project1 was saved success...



# Программирование процесса передачи данных партнеру

The screenshot displays the Siemens TIA Portal interface for programming a PLC. The main window shows the 'Block interface' for 'Block\_1 [FC1]'. The 'Network 1' contains a 'GET' block (Any - Any) with the following connections:

- EN:** Connected to a power rail.
- REQ:** Connected to 'FALSE'.
- ID:** Connected to 'W#16#1' (highlighted with a blue box).
- ADDR\_1:** Connected to 'P#DB10.DBX0. 0 BYTE 50'.
- RD\_1:** Connected to 'P#DB100.DBX0. 0 BYTE 50'.
- ENO:** Connected to a power rail.
- NDR:** Connected to '...'.
- ERROR:** Connected to '...'.
- STATUS:** Connected to '...'.

The right-hand side of the interface features a 'Totally Integrated Automation PORTAL' sidebar with a tree view under 'Communication'. The tree structure is as follows:

- 57 communication
  - GET
  - PUT
  - USEND
  - URCV
  - BSEND
  - BRCV
  - C\_CNTRL
  - Others
  - Open user communication
  - WEB Server
  - Communication processor
  - 300C functions
  - Communication with iSlave/iDevic...

The bottom status bar shows 'Portal view', 'Overview', 'Block\_1 (FC1)', and 'Devices & ne...'. A notification at the bottom right states: 'The project Project1 was saved success...'



# Создание сети PLC – PLC на базе PROFIBUS

The screenshot displays the Siemens TIA Portal interface for a project named "Project\_1". The main workspace shows two PLC units, PLC\_1 and PLC\_2, both identified as CPU 313C-2 DP. They are connected via a dashed red line representing a network link. The interface includes a menu bar (Project, Edit, View, Insert, Online, Options, Tools, Window, Help), a toolbar with icons for saving, undo, redo, and online/offline status, and a "Totally Integrated Automation PORTAL" header. The "Devices & networks" window is active, showing "Topology view" and "Network view" tabs. The "Hardware catalog" on the right lists various CPU models, with "CPU 313C-2 DP" expanded to show specific part numbers like "6ES7 313-6CF03-..." and "6ES7 313-6CG04-0...". A red dashed arrow points from the selected part number in the catalog to the corresponding connection point on the PLC\_2 unit in the workspace. The bottom status bar indicates "Project Project\_1 opened."



# Настройки сети

The screenshot displays the Siemens TIA Portal interface for configuring a network. The main workspace shows two PLCs, PLC\_1 and PLC\_2, both using CPU 313C-2 DP. They are connected to a central PROFIBUS\_1 network. The connection points are labeled '2 PROFIBUS\_1: 2' and '2 PROFIBUS\_1: 3'. A yellow callout bubble with the text 'Двойной щелчок' (Double click) points to a double-click icon on the network line. The hardware catalog on the right shows the selected CPU 313C-2 DP model, with the specific part number 6ES7 313-6CG04-0... highlighted. The interface includes a menu bar, a toolbar, and a status bar at the bottom.



# Определение идентификаторов объектов сети

The screenshot displays the Siemens TIA Portal interface for configuring a network. The main window is titled "Siemens - Project\_1" and shows the "Devices & networks" view. The network configuration is for "PROFIBUS\_1 [Profibus]". The "General" tab is selected, showing the following settings:

- Name: PROFIBUS\_1
- S7 subnet ID: 256E - 1

The "1" in the S7 subnet ID field is highlighted with a blue box. The interface includes a menu bar (Project, Edit, View, Insert, Online, Options, Tools, Window, Help), a toolbar with icons for saving, undo, redo, and online/offline status, and a sidebar with "Hardware catalog", "Online tools", and "Tasks". The bottom status bar shows "Project Project\_1 opened."



# Программирование процесса передачи данных партнеру

Siemens - Project\_1

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline

Totally Integrated Automation PORTAL

Project\_1 > PLC\_1 [CPU 313C-2 DP] > Program blocks > Block\_1 [FC1]

Block interface

Network 3:

%DB6  
"USEND\_DB\_1"

	USEND	Any	
EN	ENO		
FALSE — REQ	DONE	→ ...	
W#16#1 — ID	ERROR	→ ...	
DW#16#0 — R_ID	STATUS	→ ...	
P#DB20.DBX0.0 BYTE 10 — SD_1			
... — SD_2			
... — SD_3			
... — SD_4			

Instructions

Options

Favorites

Basic instructions

Extended instructions

Technology

Communication

Name

- 57 communication
  - GET
  - PUT
  - USEND
  - URCV
  - BSEND
  - BRCV
  - C\_CNTRL
- Others
- Open user communication
- WEB Server
- Communication processor
- 300C functions
- Communication with iLevel/Device

Properties Info Diagnostics

Portal view Overview Devices & ne... Block\_1 (FC1)

The project Project\_1 was saved succes...

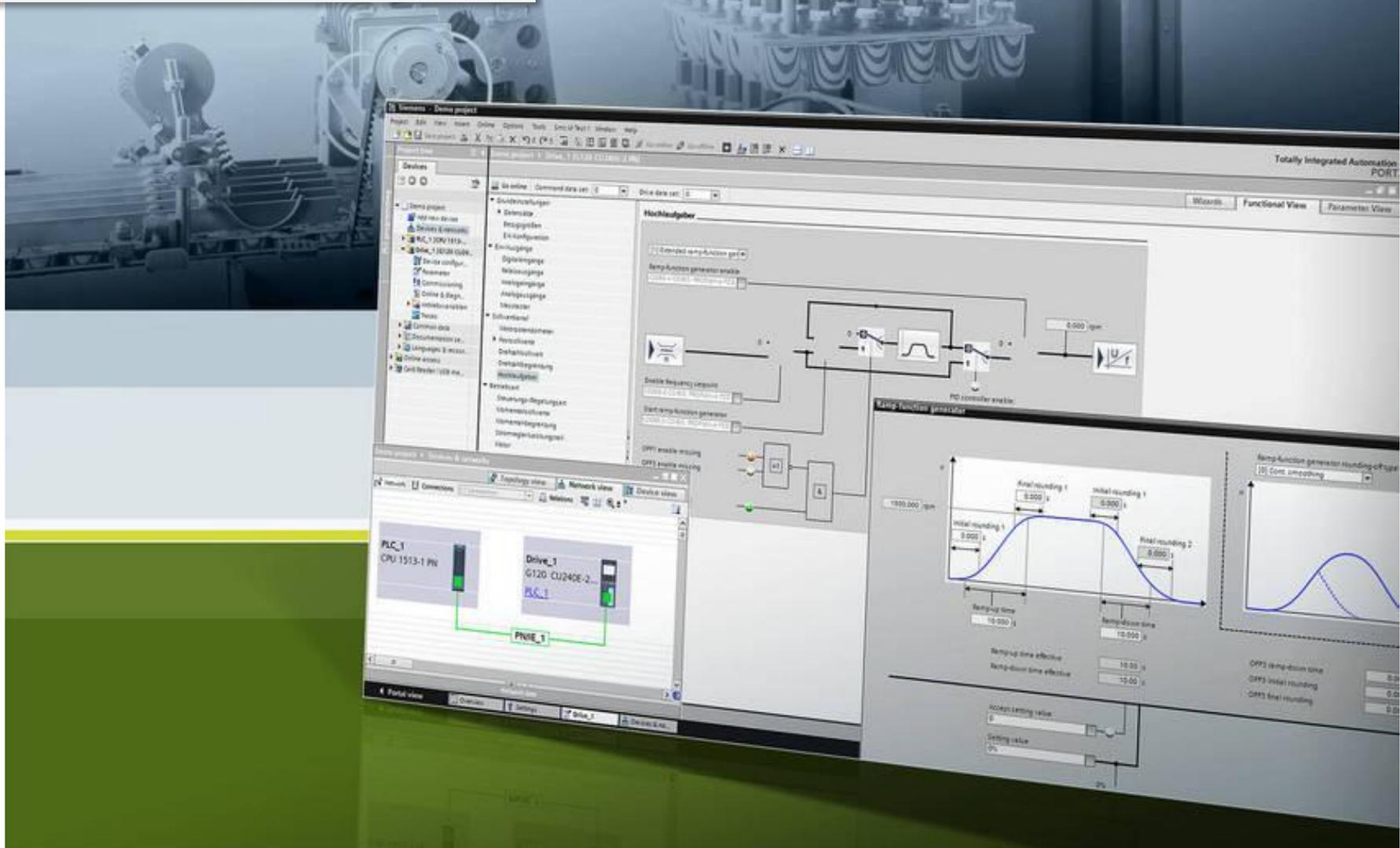


## Конец раздела 10. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- Системы с сетевой конфигурацией
- ▶ Конфигурирование ПЛК S7-1200, S7-1500

# Раздел 11

Коротко о PLC новых серий  
SIMATIC S7-1200, S7-1500



## Позиционирование новых моделей PLC SIMATIC S7

SIMATIC S7-400



SIMATIC  
S7-1500



Модульный контроллер для систем автоматизации производств среднего и высокого уровня сложности

SIMATIC S7-300



SIMATIC S7-1200 (Взамен S7-200)



Компактный модульный контроллер для решения базовых задач автоматизации производств и построения **автономных** систем

LOGO!



Логические модули для решения простейших задач автоматизации и построения **автономных** систем



## Основные характеристики CPU S7-1200

Характеристика	CPU 1211C	CPU 1212C	CPU 1214C
Физический размер (мм)	90 x 100 x 75		110 x 100 x 75
Пользовательская память <ul style="list-style-type: none"> <li>Рабочая память</li> <li>Загрузочная память</li> <li>Сохраняемая память</li> </ul>	<ul style="list-style-type: none"> <li>25 Кбайт</li> <li>1 Мбайт</li> <li>2 Кбайта</li> </ul>		<ul style="list-style-type: none"> <li>50 Кбайт</li> <li>2 Мбайта</li> <li>2 Кбайта</li> </ul>
Локальные встроенные входы/выходы <ul style="list-style-type: none"> <li>цифровые</li> <li>аналоговые</li> </ul>	<ul style="list-style-type: none"> <li>6 входов/4 выхода</li> <li>2 входа</li> </ul>	<ul style="list-style-type: none"> <li>8 входов/6 выходов</li> <li>2 входа</li> </ul>	<ul style="list-style-type: none"> <li>14 входов/10 выходов</li> <li>2 входа</li> </ul>
Величина образа процесса	1024 байта входов (I) и 1024 байта выходов (Q)		
Битовая память (M)	4096 байт		8192 байта
Дополнительные сигнальные модули	Нет	2	8
Сигнальная плата	1		
Коммуникационные модули	3 (левостороннее расширение)		
Скоростные счетчики <ul style="list-style-type: none"> <li>однофазные</li> <li>со сдвигом фаз на 90°</li> </ul>	3 <ul style="list-style-type: none"> <li>3 на 100 кГц</li> <li>3 на 80 кГц</li> </ul>	4 <ul style="list-style-type: none"> <li>3 на 100 кГц</li> <li>1 на 30 кГц</li> <li>3 на 80 кГц</li> <li>1 на 20 кГц</li> </ul>	6 <ul style="list-style-type: none"> <li>3 на 100 кГц</li> <li>3 на 30 кГц</li> <li>3 на 80 кГц</li> <li>3 на 20 кГц</li> </ul>
Импульсные выходы	2		
Карта памяти	Карта памяти SIMATIC (факультативно)		
Длительность сохранения времени для часов реального времени	Тип. 10 дней / 6 дней минимум при 40 градусах С.		
PROFINET	1 коммуникационный порт для связи с Ethernet		
Скорость выполнения арифметических операций	18 мкс/команду		
Скорость выполнения булевых операций	0,1 мкс/ команду		



## Выбор процессора S7-1200

**Project tree**

Project\_1200

- Common d
- Documenta
- Languages
- Online access
- Card Reader/U

**Context menu:**

- Add new device
- Add group
- Cut Ctrl+X
- Copy Ctrl+C
- Paste Ctrl+V
- Go online Ctrl+K
- Go offline Ctrl+M
- Upgrade
- Print... Ctrl+P
- Print preview...
- Properties... Alt+Enter

**Controllers**

- HMI
- PC systems

**Controllers**

- SIMATIC S7-1200
  - CPU
    - CPU 1211 C AC/DC/Rly
    - CPU 1211 C DC/DC/DC
    - CPU 1212 C AC/DC/Rly
    - CPU 1212 C DC/DC/DC
    - CPU 1212 C DC/DC/Rly
    - CPU 1214 C AC/DC/Rly
    - CPU 1214 C DC/DC/DC (Selected)
    - 6ES7 214-1AG31-0XB0
    - CPU 1214 C DC/DC/Rly
    - CPU 1215 C AC/DC/Rly
    - CPU 1215 C DC/DC/DC
    - CPU 1215 C DC/DC/Rly
    - Unspecified CPU 1200
  - SIMATIC S7-1500
  - SIMATIC S7-300
  - SIMATIC S7-400
  - SIMATIC ET 200 CPU

**Device:**

CPU 1214C DC/DC/DC

Order no.: 6ES7 214-1AE30-0XB0

Version: V2.2

**Description:**

Work memory 50 KB; 24VDC power supply with DI14 x 24VDC SINK/SOURCE, DQ10 x 24VDC and AI2 on board; 6 high-speed counters and 2 pulse outputs on board; signal board expands on-board I/O; up to 3 communication modules for serial communication; up to 8 signal modules for I/O expansion; 0.1 ms/1000 instructions; PROFINET interface for programming, HMI and PLC to PLC communication

**Buttons:** OK, Cancel

# Перечень слотов для установки плат, модулей S7-1200

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC]

Topology view Network view Device view

PLC\_1

100%

Devices & networks

S7-1200 rack

PLC\_1

Встроенный слот для установки сигнальной платы

Слоты для установки коммуникационных модулей

Слоты для установки сигнальных модулей

Hardware catalog

Online tools

Tasks

Libraries

Device data

Properties Info Diagnostics

Portal view Overview PLC\_1

Project Project\_1200 created.





## Установка коммуникационных модулей из каталога S7-1200

The screenshot displays the SIMATIC TIA-portal interface. The main window shows a rack configuration for a PLC\_1 [CPU 1214C DC/DC/DC]. The rack contains a CPU module (SIEMENS S7-1200) and three empty slots. A red line indicates the selection of a communication module from the hardware catalog.

**Hardware catalog**

**Options**

**Catalog**

- <Search>
- Filter
  - CPU
  - Signal boards
  - Communications boards
  - Battery boards
  - DI
  - DQ
  - DI/DQ
  - AI
  - AQ
  - AI/AQ
  - Communications modules
    - Industrial Remote Control
    - PROFIBUS
      - CM 1242-5
        - 6GK7 242-5DX30-0XE0**
        - CM 1243-5
      - Point-to-point
      - AS interface
      - Technology modules

**Information**

Project Project\_1200 opened.

## Установка сигнальных модулей из каталога S7-1200

The screenshot shows the SIMATIC TIA Portal interface for configuring a Siemens S7-1200 PLC. The main window displays a rack configuration with a CPU module at slot 1 and seven empty slots. The hardware catalog on the right shows the selection of a DI18 x 24VDC module (6ES7 221-1BF30-0XB0). A red arrow points from the selected module in the catalog to the empty slots in the rack.

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC]

Topology view | Network view | Device view

PLC\_1

101 1

103

101

Hardware catalog

Options

Catalog

<Search>

Filter

- CPU
- Signal boards
- Communications boards
- Battery boards
- DI
  - DI8 x 24VDC
    - 6ES7 221-1BF30-0XB0
    - 6ES7 221-1BF32-0XB0
  - DI16 x 24VDC
- DQ
- DI/DQ
- AI
- AQ
- AI/AQ
- Communications modules
- Technology modules

Online tools

Tasks

Libraries

Information

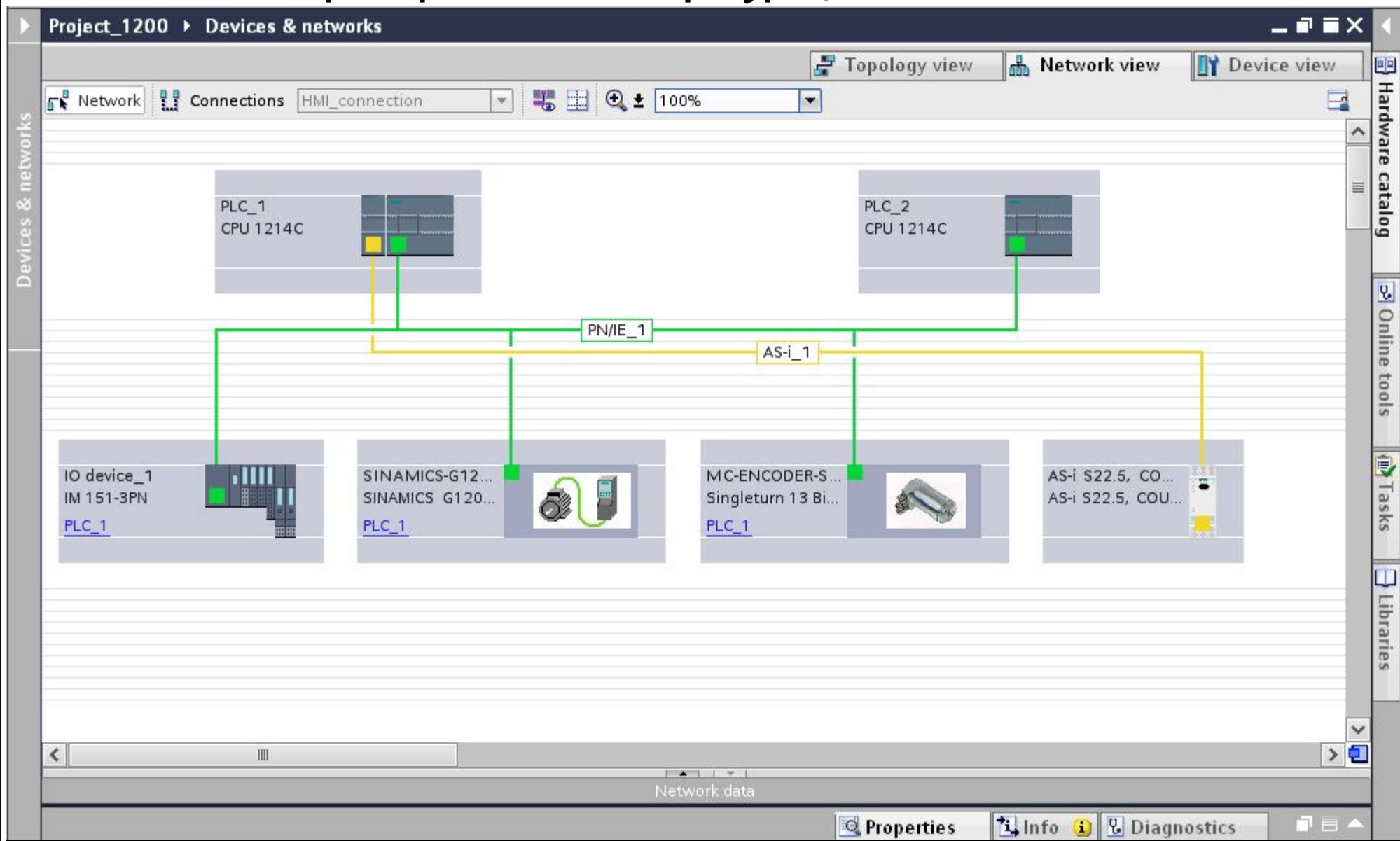
Device data

Properties | Info | Diagnostics

Portal view | Overview | PLC\_1

Project Project\_1200 opened.

## Пример сетевой конфигурации ПЛК S7-1200



## Основные характеристики CPU S7-1500

Центральный процессор	6ES7	511-1AK00-0AB0 CPU 1511-1 PN	513-1AL00-0AB0 CPU 1513-1 PN	515-2AM00-0AB0 CPU 1515-2 PN	516-3AN00-0AB0 CPU 1516-3 PN/DP	518-4AP00-0AB0 CPU 1518-4 PN/DP
<b>Элементы управления</b>						
Дисплей с диагональю экрана		3.45 см	3.45 см	6.1 см	6.1 см	6.1 см
Количество клавиш		6	6	6	6	6
Переключатель режимов работы		1	1	1	1	1
<b>Параметры аппаратной конфигурации</b>						
Количество модулей на стойку, не более		32: центральный процессор + 31 модуль				
Количество базовых стоек, не более		1	1	1	1	1
Количество ведущих DP устройств на систему, не более:						
• встроенных		Нет	Нет	Нет	1	1
• в виде коммуникационных модулей		4: суммарно не более 4 CM/CP	6: суммарно не более 6 CM/CP	8: суммарно не более 8 CM/CP	8: суммарно не более 8 CM/CP	8: суммарно не более 8 CM/CP
для обмена данными через PROFIBUS, PROFINET, Ethernet						
<b>Счетчики и таймеры</b>						
<b>S7 счетчики:</b>						
• количество		2048	2048	2048	2048	2048
- с сохранением состояний при перебоях в питании контроллера		Настраивается	Настраивается	Настраивается	Настраивается	Настраивается
<b>IEC счетчики:</b>						
• количество		Ограничено только размером рабочей памяти данных				
- с сохранением состояний при перебоях в питании контроллера		Настраивается	Настраивается	Настраивается	Настраивается	Настраивается
<b>S7 таймеры:</b>						
• количество		2048	2048	2048	2048	2048
- с сохранением состояний при перебоях в питании контроллера		Настраивается	Настраивается	Настраивается	Настраивается	Настраивается
<b>IEC таймеры:</b>						
• количество		Ограничено только размером рабочей памяти данных				
- с сохранением состояний при перебоях в питании контроллера		Настраивается	Настраивается	Настраивается	Настраивается	Настраивается



# Выбор процессора S7-1500. Функции передней панели.

Правой клавишей

Project tree

Device:

Controllers

HMI

PC systems

Controllers

- SIMATIC S7-1200
- SIMATIC S7-1500
  - CPU
    - CPU 1511-1 PN
    - CPU 1513-1 PN
    - CPU 1516-3 PN/DP
      - 6ES7 516-3AN00-0AB0**
      - Unspecified CPU 1500
  - SIMATIC S7-300
  - SIMATIC S7-400
  - SIMATIC ET 200 CPU

Device:

1516-3 PN/DP

6ES7 516-3AN00-0AB0

Съемная передняя панель

Дисплей для обслуживания и диагностики

- Установка/ изменение параметров (IP адресов, имени станции) без использования программатора
- Отображение диагностической информации и аварийных сообщений
- Отображение состояний модулей в системах локального и распределенного ввода-вывода
- Отображение заказных и серийных номеров, версий встроенного программного обеспечения для модулей систем локального и распределенного ввода-вывода
- Выбор одного из двух языков для отображения меню и сообщений
- Парольный доступ, установка и удаление во время работы

Open device view

OK Cancel

# Перечень слотов для установки модулей S7-1500

Project\_1500 > PLC\_1 [CPU 1516-3 PN/DP]

Topology view | Network view | Device view

PLC\_1

Devices & networks

Rail\_0

Slot	0	1	2	3	4	5	6	7	8	15	16	23	24	31
Module		PLC_1												
Address									8	15	16	23	24	31
Sub-address									-	-	-	-	-	-
Sub-address									15	23	31			

Hardware catalog

Options

Catalog

<Search>

Filter

- PM
- PS
- CPU
- DI
- DQ
- AI
- AQ
- Communication modules
- Technology modules
- PROFINET

Online tools

Tasks

Libraries

Slot 0: Slot for installation of the main power supply (БП)

Slot 1: Additional Ethernet port with its own IP address

Slots 8-15, 16-23, 24-31: Slots for installation of signal modules and additional power supplies (БП)

Device data

Properties | Info | Diagnostics | Information

# Установка основного блока питания в конфигурации S7-1500

Project\_1500 ▶ PLC\_1 [CPU 1516-3 PN/DP]

Topology view | Network view | Device view

PLC\_1

Devices & networks

Rail\_0

	0	1	2	3	4	5	6	7	...15	...23	...31
											
									8	16	24
									15	23	31

Hardware catalog

Options

Catalog

<Search>

Filter

- PM
  - PM 70W 120/230VAC
    - 6EP1 332-4BA00**
  - PM 190W 120/230VAC
- PS
  - PS 25W 24VDC
    - 6ES7 505-0KA00-0AB0
  - PS 60W 24/48/60VDC
  - PS 60W 120/230VAC/DC
- CPU
- DI
- DQ
- AI
- AQ
- Communication modules
- Technology modules
- PROFINET

Hardware catalog | Online tools | Tasks | Libraries

Device data

Properties | Info | Diagnostics | Information



# Сигнальные модули и доп.блока питания в конфигурации S7-1500

Project\_1500 ▶ PLC\_1 [CPU 1516-3 PN/DP]

Topology view | Network view | Device view

PLC\_1 100%

Devices & networks

Rail\_0

	0	1	2	3	4	5	6	7	...	15	...	23	...	31
														
									8	16	24			
									15	23	31			

Hardware catalog

Options

Catalog

<Search>

Filter

- PM
  - PM 70W 120/230VAC
    - 6EP1332-4BA00
  - PM 190W 120/230VAC
- PS
  - PS 25W 24VDC
  - PS 60W 24/48/60VDC
  - PS 60W 120/230VAC/DC
    - 6ES7 507-0RA00-0AB0**
- CPU
- DI
- DQ
- AI
- AQ
- Communication modules
- Technology modules
- PROFINET

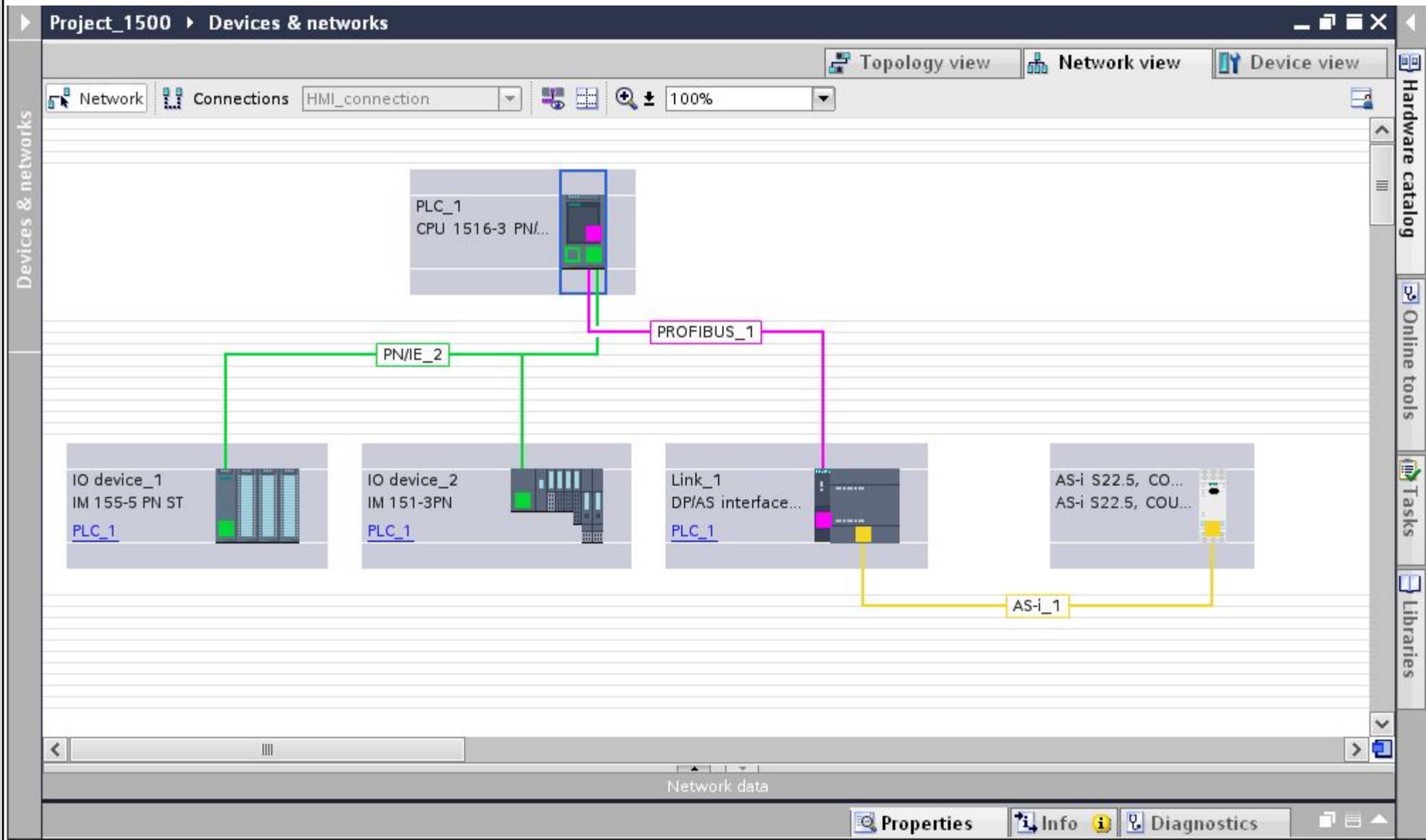
(До трех БП)

Device data

Properties | Info | Diagnostics | Information



## Пример сетевой конфигурации ПЛК S7-1500

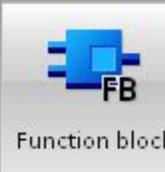


# Сравнительный перечень доступных языков программирования

S7-300, S7-400, S7-1500



Organization block



Function block



Function



Data block

Language:

Select OB:

Description:

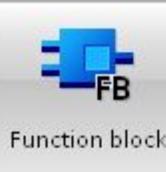
Organization blocks (OBs) control program execution. With OBs, you can re time-based or inter program execution.

[more...](#)

S7-1200



Organization block



Function block



Function



Data block

Language:

Number:

manual

automatic

Description:

A "Program cycle" O and is the main block of the program. This is where you place the instructions that control your application, and call additional user blocks.

[more...](#)



## Типы данных, применяемые в S7-1200, S7-1500

Тип данных	Размер (в битах)	Диапазон	Примеры ввода констант
Bool	1	от 0 до 1	TRUE, FALSE, 0, 1
Byte	8	от 16#00 до 16#FF	16#12, 16#AB
Word	16	от 16#0000 до 16#FFFF	16#ABCD, 16#0001
DWord	32	от 16#00000000 до 16#FFFFFFFF	16#02468ACE
Char	8	от 16#00 до 16#FF	'A', 't', '@'
Sint	8	от -128 до 127	123, -123
Int	16	от -32768 до 32767	123, -123
Dint	32	от -2147483648 до 2147483647	123, -123
USInt	8	от 0 до 255	123
UInt	16	от 0 до 65 535	123
UDInt	32	0 до 4294967295	123
Real	32	от +/-1,18 x 10 <sup>-38</sup> до +/-3,40 x 10 <sup>38</sup>	123.456, -3.4, -1.2E+12, 3.4E-3
LReal	64	от +/-2,23 x 10 <sup>-308</sup> до +/-1,79 x 10 <sup>308</sup>	12345.123456789 -1.2E+40
Time	32	от T#24d_20h_31m_23s_648ms до T#24d_20h_31m_23s_647ms Хранится как: от -2,147,483,648 мс до +2,147,483,647 мс	T#5m_30s 5#-2d T#1d_2h_15m_30x_45ms
String	переменный	от 0 до 254 символов в размере байта	'ABC'



# Установка и сброс битового поля в S7-1200, S7-1500

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_2 [FB2]

Block interface

Block title: .....

Comment

Network 1:

Если M0.0 = «1», пять бит, начиная с M10.0, устанавливаются в «1»

Network 2:

Если M0.1 = «1», пять бит, начиная с M10.0, сбрасываются в «0»

Network 3:

100%

Instructions

Options

Favorites

Basic instructions

Name

General

Bit logic operations

Set bit field

Sets several bits starting at a specific address.

S7-1200, S7-1500

SET\_BF: Set bit field

-(S)

SET\_BF

RESET\_BF

SR

RS

-|P|-

-|N|-

Extended instructions

Technology

Communication

Properties

Info

Diagnostics

# Обращение в программе к физическим входам-выходам

Project\_S7\_ALL\_CPU > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_1 [FC1]

Block interface

Block title: .....

Comment

Network 1: .....

"Tag_2":P	%I0.0:P	
"Tag_3":P	%Q0.0:P	

Обращение к переменной с префиксом :P позволяет сократить время реакции на событие, так как команда обращается к физическому входу или выходу, минуя образ процесса.

Instructions

Options

Favorites

Basic instructions

Name

Extended instructions

Technology

Communication

100%

Properties Info Diagnostics



# Таймеры в системе команд S7-1200, S7-1500

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_2 [FB2]

Block interface

Network 3:

Network 4:

Instructions

Options

Generate on-delay  
 Delays the setting of the Q output by the programmed time PT.  
 S7-1200, S7-1500  
 TON: Generate on-delay

- TON
- TOF
- TONR
- (TP)-
- (TON)-
- (TOF)-
- (TONR)-
- (RT)-
- (PT)-

SIMATIC Timers

- S\_PULSE
- S\_PEXT
- S\_ODT
- S\_ODTS
- S\_OFFDT
- (SP)
- (SE)
- (SD)
- (SS)
- (SF)

Properties Info Diagnostics

В S7-1500 используются также таймеры SIMATIC

# Таймер-аккумулятор

...t\_S7\_ALL\_CPU > Group\_PLG > PLC\_2 [CPU 1516-3 PN/DP] > Program blocks > Block\_1 [FC1]

Block interface

Block title: .....

Comment

Network 1:

Network 2:

TONR

"Tag\_3" %IO.0

Если сигнал IN прерывается, с каждым его новым появлением время накапливается

Процесс в любой момент можно сбросить сигналом по входу R

Instructions

Options

Favorites

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
  - IEC Timers
    - TP
    - TON
    - TOF
    - TONR**
    - (TP)-
    - (TON)-
    - (TOF)-
    - (TONR)-
    - (RT)-
    - (PT)-
  - SIMATIC Timers
    - S\_PULSE
    - S\_PEXT
    - S\_ODT
    - S\_ODTS

- Extended instructions
- Technology
- Communication

Properties Info Diagnostics

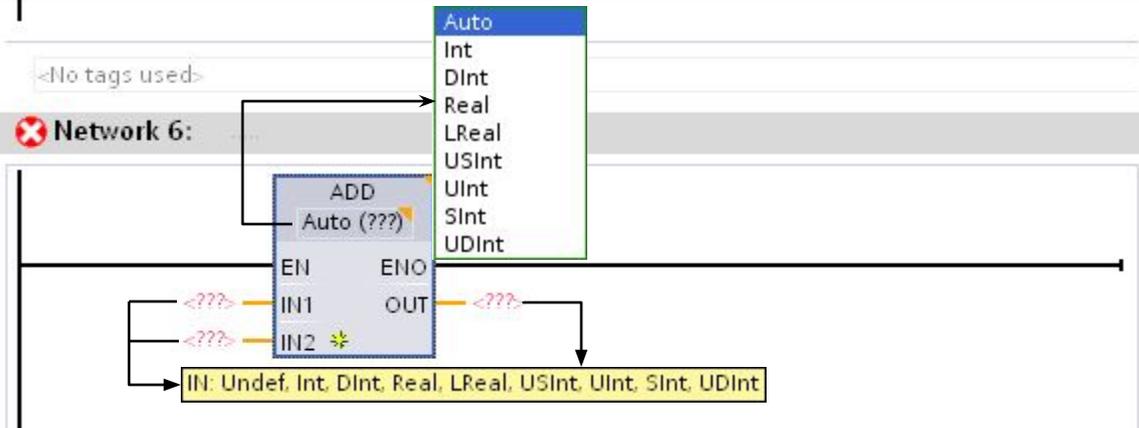
100%

# Определение типов переменных в инструкциях

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_2 [FB2]

PLC programming

Block interface

Network 6: 

Network 7: 

Network 8: 

Instructions

Options

Favorites

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
  - CALCULATE
  - ADD
  - SUB
  - MUL
  - DIV
  - MOD
  - NEG
  - INC
  - DEC
  - ABS
  - MIN
  - MAX
  - LIMIT

Extended instructions

Technology

Communication

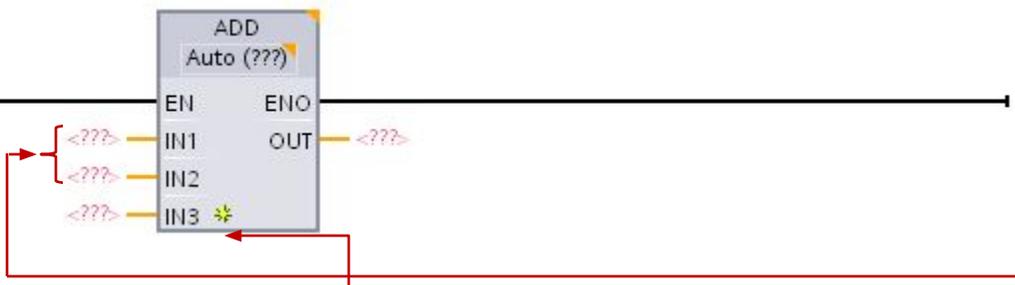
Properties Info Diagnostics

# Расширение зоны входов/выходов в ряде инструкций

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_2 [FB2]

Block interface

<No tags used>

**Network 6:** 

<No tags used> **Расширение возможно до IN100**

**Network 7:**

<No tags used>

**Network 8:**

Instructions

Options

Favorites

Basic instructions

Name

- General
  - New network
  - Empty box
  - Open branch
  - Close branch
  - Insert input
- Move operations
- Conversion operations
- Program control operations
- Word logic operations
- Shift and rotate

Extended instructions

Technology

Communication

Properties Info Diagnostics



# Команды проверки, является ли число вещественным

PLC programming

...t\_S7\_ALL\_CPU > Group\_PLG > PLC\_2 [CPU 1516-3 PN/DP] > Program blocks > Block\_2 [FC2]

Block interface

Network 3:

%MD100 "VAR\_1" (OK) — RLO=1, если число вещественное — %M10.0 "Tag\_6"

Network 4:

%MD100 "VAR\_1" (NOT\_OK) — RLO=0, если число вещественное — %M10.2 "Tag\_8"

Network 5:

%MD120 "VAR\_5" (OK) — %M10.1 "Tag\_7"

Instructions

Options

Favorites

Basic instructions

Comparator operations

- CMP ==
- CMP <
- CMP >=
- CMP <=
- CMP >
- CMP <
- IN\_Range
- OUT\_Range
- |-OK|**
- |-|NOT\_OK|**

Math functions

Move operations

Conversion operations

Program control operations

Extended instructions

Technology

Communication

Properties Info Diagnostics

100%



# Команды проверки, является ли число вещественным

...t\_S7\_ALL\_CPU > Group\_PLG > PLC\_2 [CPU 1516-3 PN/DP] > Program blocks > Block\_2 [FC2]

Block interface

No condition defined.

50.0  
%MD100  
"VAR\_1"

OK

%M10.0  
"Tag\_6"

Число вещественное (REAL)

Network 4:

50.0  
%MD100  
"VAR\_1"

NOT\_OK

%M10.2  
"Tag\_8"

Число целое (DWORD)

Network 5:

50  
%MD120  
"VAR\_5"

OK

%M10.1  
"Tag\_7"

Testing

Options

CPU operator panel

PLC\_2 [CPU 1516-3 PN/DP]

RUN / STOP

ERROR

MAINT

Mode selector: RUN

Call environment

Breakpoints

Call hierarchy

Properties Info Diagnostics

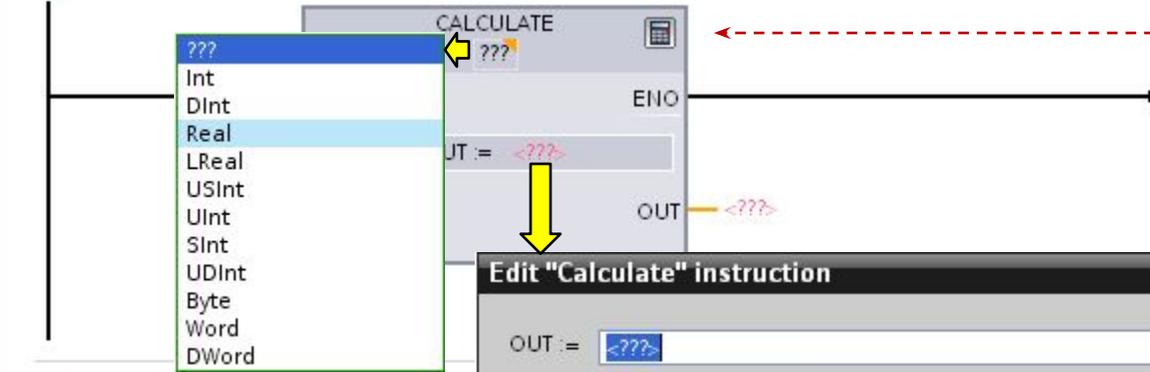


## Инструкция CALCULATE

Project\_1200 > PLC\_1 [CPU 1214C DC/DC/DC] > Program blocks > Block\_2 [FB2]

Block interface

<No tags used>

Network 6: 

Network 7: 

Network 8: 

Instructions

Options

Favorites

Basic instructions

Math functions

CALCULATE

Extended instructions

Technology

Communication

PLC programming

Testing

Tasks

Libraries

100%

Properties Info Diagnostics

OK Cancel

Example:  
 $(IN1 + IN2) * (IN1 - IN2)$

Possible instructions:  
 And, Or, XOR, Swap, Not / Inv, +, -, \*, /, Mod, Abs, Neg, Exp, \*\*, Frac, Ln, Sin, ASin, Cos, ACos, Tan, ATan, Sqr, Sqrt, Round, Ceil, Floor, Trunc

OUT := <???

# Пример работы инструкции CALCULATE в режиме On-Line

The screenshot displays the SIMATIC TIA-portal interface in On-Line mode. The left pane shows the Project tree with the following structure:

- Project\_1200\_1500
  - Add new device
  - Devices & networks
  - PLC\_1 [CPU 1214C DC/D...]
  - PLC\_2 [CPU 1516-3 PN...]
    - Device configuration
    - Online & diagnostics
    - Program blocks
      - Add new block
      - Main [OB1]
      - Block\_1 [FC1]
      - Data\_block\_1 [DB1]
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Traces
    - Program info
    - PLC alarms
    - Text lists
    - Local modules
    - Common data

The main workspace shows the Block interface for Block\_1 [FC1]. The network configuration is as follows:

- Network 1:**
  - Instruction: **CALCULATE** (Real)
  - Equation:  $OUT = (IN1 + IN2) / (IN3 - IN4)$
  - Inputs:
    - IN1: 21.0 (%MD100) "VAR\_1"
    - IN2: 32.0 (%MD104) "VAR\_2"
    - IN3: 25.0 (%MD108) "VAR\_3"
    - IN4: 11.0 (%MD112) "VAR\_4"
  - Output:
    - OUT: 3.785714 (%MD116) "RESULT"

The bottom status bar shows the zoom level at 100% and active toolbars for Properties, Info, and Diagnostics.

# Инструкция «чтение переменной из заданной области»

PLC programming

Block interface

Block title: .....

Comment

Network 1: .....

Порядковый номер переменной в области Static\_1 Array [0..4]

FieldRead  
Real

EN

ENO

INDEX

VALUE

"Data\_block\_1".VAR\_5

"Data\_block\_1".Static\_1[0]

"Data\_block\_1".VAR\_1

MEMBER

"Data\_block\_1".VAR\_1

Network 2: .....

Data_block_1			
	Name	Data type	Start value
1	▼ Static		
2	■ VAR_1	Real	0.0
3	■ VAR_2	Real	0.0
4	■ VAR_3	Real	0.0
5	■ VAR_4	Real	0.0
6	■ RESULT	Real	0.0
7	▼ Static_1	Array [0..4] of Real	
8	■ Static_1[0]	Real	10.0
9	■ Static_1[1]	Real	20.0
10	■ Static_1[2]	Real	30.0
11	■ Static_1[3]	Real	40.0
12	■ Static_1[4]	Real	50.0
13	<Add new>		

100%

Properties Info Diagnostics

Favorites

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
- Move operations
  - MOVE
  - FieldRead
  - FieldWrite
  - MOVE\_BLK
  - MOVE\_BLK\_VARIANT
  - UMOVE\_BLK
  - FILL\_BLK
  - UFILL\_BLK
  - SWAP
- ARRAY DB instructions
  - ReadFromArrayDB
  - WriteToArrayDB
  - ReadFromArrayDBL
  - WriteToArrayDBL
- Others
- Conversion operations

Extended instructions

Technology

Communication

# Чтение переменной из заданной области OnLine

Block interface

No condition defined.

► **Block title:** .....

▼ **Network 1:** .....

FieldRead  
Real

EN ENO

INDEX VALUE

MEMBER

0  
%MD120  
"VAR\_5"

10.0  
"Data\_block\_1".Static\_1[0]

10.0  
"Data\_block\_1".VAR\_1

Static_1[0]	Real	10.0
Static_1[1]	Real	20.0
Static_1[2]	Real	30.0
Static_1[3]	Real	40.0
Static_1[4]	Real	50.0

3  
%MD120  
"VAR\_5"

10.0  
"Data\_block\_1".Static\_1[0]

40.0  
"Data\_block\_1".VAR\_1

▼ **Network 1:** .....

FieldRead  
Real

EN ENO

INDEX VALUE

MEMBER

3  
%MD120  
"VAR\_5"

10.0  
"Data\_block\_1".Static\_1[0]

40.0  
"Data\_block\_1".VAR\_1

▼ **CPU operator panel**

PLC\_2 [CPU 1516-3 PM/DP]

RUN / STOP    RUN

ERROR    STOP

MAINT    MRES

Mode selector: RUN

Properties    Info    Diagnostics

Call environment

Breakpoints

Call hierarchy

# Инструкция «запись переменной в заданную область»

PLC programming

Block interface

Block title: .....

Network 1: .....

Network 2: .....

FieldWrite  
Real

EN

ENO

INDEX

MEMBER

VALUE

"Data\_block\_1".VAR\_1

"Data\_block\_1".Static\_1[0]

%MD120

"VAR\_5"

Порядковый номер переменной в области Static\_1 Array [0..4]

**Data\_block\_1**

	Name	Data type	Start value
1	Static		
2	VAR_1	Real	0.0
3	VAR_2	Real	0.0
4	VAR_3	Real	0.0
5	VAR_4	Real	0.0
6	RESULT	Real	0.0
7	Static_1	Array [0..4] of Real	
8	Static_1[0]	Real	0.0
9	Static_1[1]	Real	0.0
10	Static_1[2]	Real	0.0
11	Static_1[3]	Real	0.0
12	Static_1[4]	Real	0.0

100%

Properties Info Diagnostics

**Favorites**

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
- Move operations
  - MOVE
  - FieldRead
  - FieldWrite**
  - MOVE\_BLK
  - MOVE\_BLK\_VARIANT
  - UMOVE\_BLK
  - FILL\_BLK
  - UFILL\_BLK
  - SWAP
- ARRAY DB instructions
  - ReadFromArrayDB
  - WriteToArrayDB
  - ReadFromArrayDBL
  - WriteToArrayDBL
- Others
- Conversion operations

Extended instructions

Technology

Communication

# Инструкция копирования из одной области данных в другую

Block interface

Block title: .....

Comment

Network 1: **Количество переносимых элементов**

MOVE\_BLK

ENI — ENO

IN — "Data\_block\_1".Static\_2[5]

OUT — "Data\_block\_1".Static\_1[0]

COUNT — 5

Static_1	Static_2
Static_1[0]	Static_2[0]
Static_1[1]	Static_2[1]
Static_1[2]	Static_2[2]
Static_1[3]	Static_2[3]
Static_1[4]	Static_2[4]
Static_2[5]	Static_2[5]
Static_2[6]	Static_2[6]
Static_2[7]	Static_2[7]
Static_2[8]	Static_2[8]
Static_2[9]	Static_2[9]
Static_2[10]	Static_2[10]

Static\_1 Array [0..4] of Real

Static\_2 Array [0..10] of Real

Properties Info Diagnostics

Favorites

Basic instructions

Name

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
- Move operations
  - MOVE
  - FieldRead
  - FieldWrite
  - MOVE\_BLK**
  - MOVE\_BLK\_VARIANT
  - UMOVE\_BLK
  - FILL\_BLK
  - UFILL\_BLK
  - SWAP
- ARRAY DB instructions
  - ReadFromArrayDB
  - WriteToArrayDB
  - ReadFromArrayDBL
  - WriteToArrayDBL
- Others
- Conversion operations

Extended instructions

Technology

Communication

# Инструкция «переход по номеру в списке»

PLC progr

Comment

**Network 1:**

EN DEST0 LABEL\_0  
%MW10 K DEST1 LABEL\_1

Количество переходов можно увеличить

Если значение  $\%MW10 = 0$ , переходим на LABEL\_0, если значение  $\%MW10 = 1$ , переходим на LABEL\_1. Далее по списку.

**Network 2:**

LABEL\_0

ADD Real  
EN EIO  
%MD100 IN1 OUT %MD104  
10.0 IN2

Выход из блока. (Или, если необходимо, переход в другую точку).

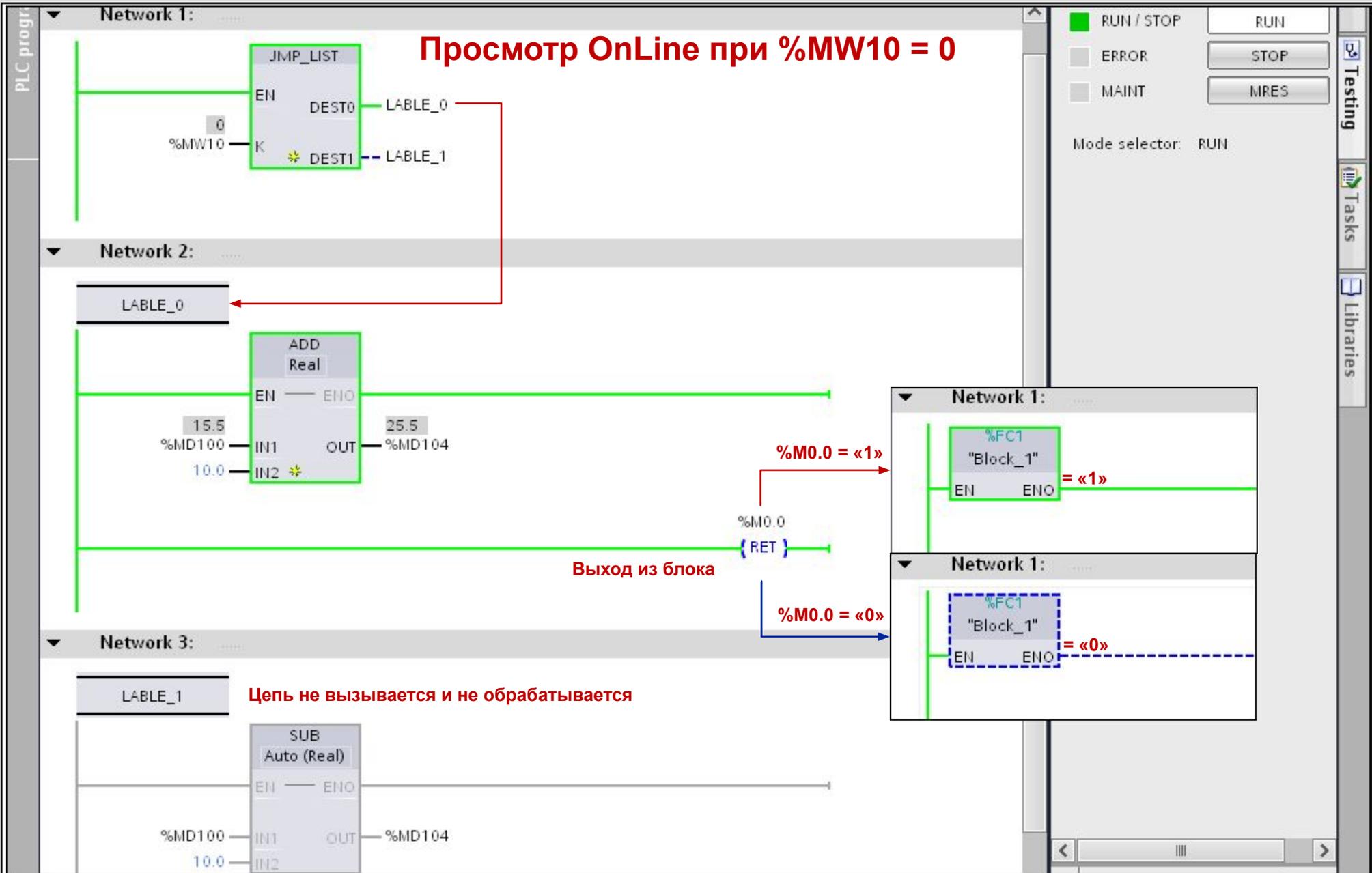
**Network 3:**

LABEL\_1

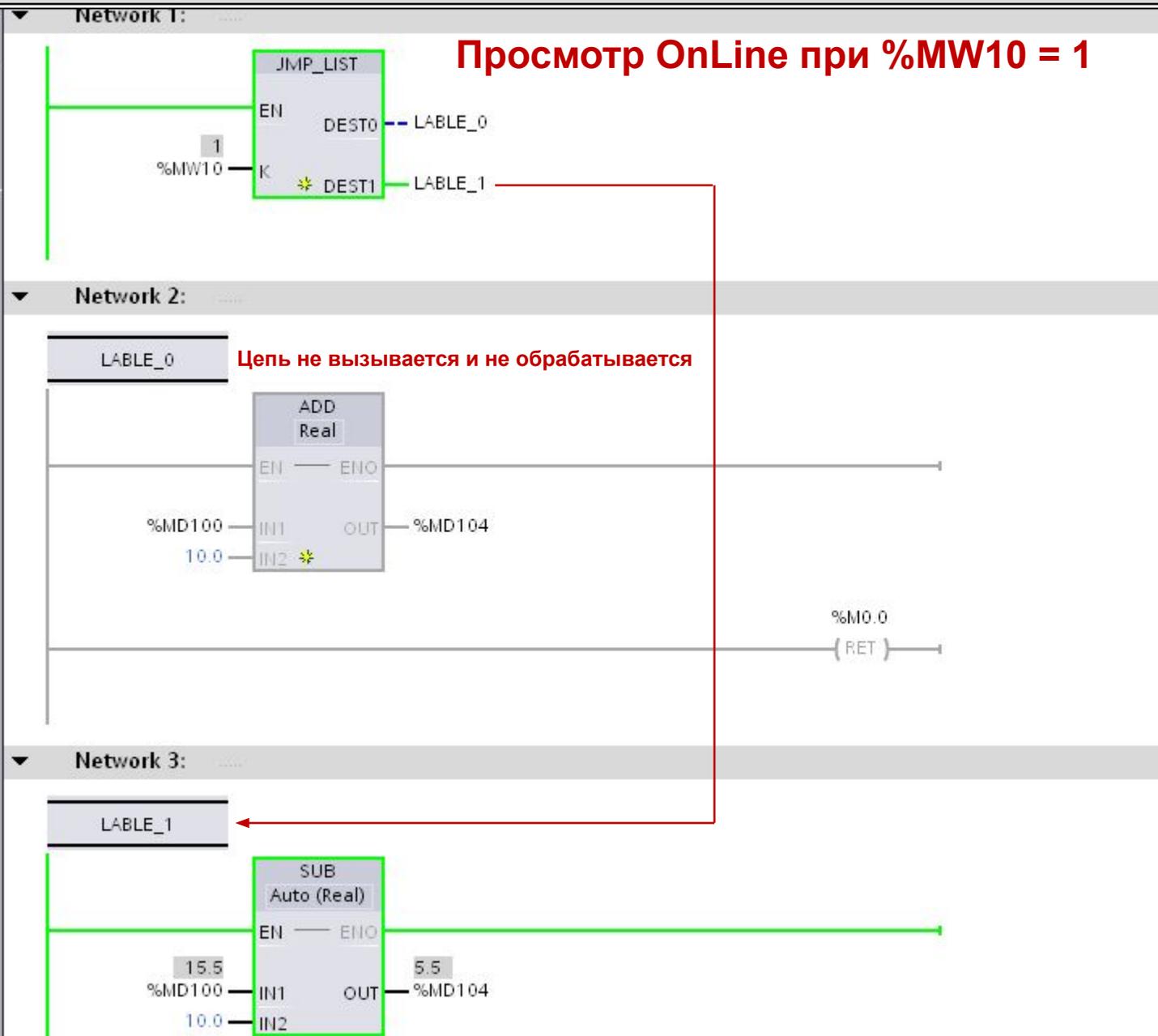
SUB Auto (Real)  
EN EIO  
%MD100 IN1 OUT %MD104  
10.0 IN2

**Right Panel (Libraries):**

- General
- Bit logic operations
- Timer operations
- Counter operations
- Comparator operations
- Math functions
- Move operations
- Conversion operations
- Program control operations
  - (JMP)
  - (JMPN)
  - Label
  - JMP\_LIST**
  - SWITCH
  - (RET)
- Runtime control
  - ENDIS\_PW
  - RE\_TRIGR
  - STP
  - GET\_ERROR
  - GET\_ERR\_ID
  - INIT\_RD
  - WAIT
- Word logic operations
- Shift and rotate
- Additional instructions



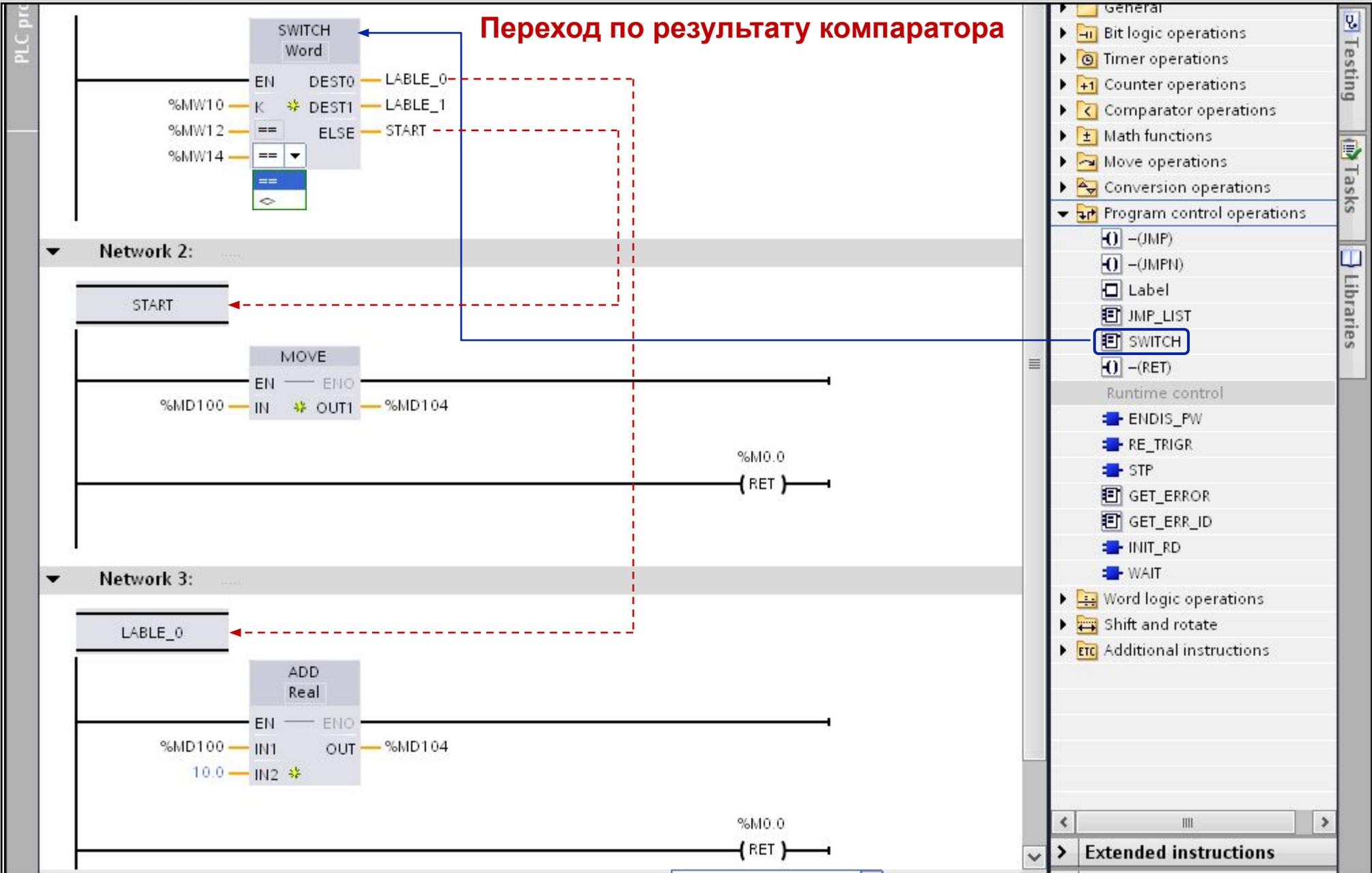
# Просмотр OnLine при %MW10 = 1



Mode selector: RUN

Buttons: RUN, STOP, MRES

Testing, Tasks, Libraries



# Строковые команды. Перенос строки из одной области в другую

Block interface

Block title: ...

Comment

Network 1:

..Group\_PLC > PLC\_2 [CPU 1516-3 PN/DP] > Watch and force tables > Watch table\_2

	i	Name	Address	Display format	Monitor value	Modify value
1		"Data_block_2".Static_1		String	'START'	'START'
2		"Data_block_2".Static_2		String	'START'	
3		"Tag_18"	%MD124	Floating-point number	0.0	0.0
4			<Add new>			

100%

Properties Info Diagnostics

Favorites

Basic instructions

Extended instructions

Name

- Date and time-of-day
- String + Char
  - S\_MOVE
  - S\_COMP
  - S\_CONV
  - STRG\_VAL
  - VAL\_STRG
  - Strg\_TO\_Chars
  - Chars\_TO\_Strg
  - MAX\_LEN
  - ATH
  - HTA
- Instructions
  - LEN
  - CONCAT
  - LEFT
  - RIGHT
  - MID
  - DELETE
  - INSERT
  - REPLACE
  - FIND
- Process image

Technology

Communication

# Строковые команды. Сравнение областей, содержащих строки

PLC programming

Block interface

Block title: .....

Network 1: .....

Network 2: .....

Network 3: .....

100%

Properties Info Diagnostics

Favorites

Basic instructions

Extended instructions

Name

- Date and time-of-day
- String + Char
  - S\_MOVE
  - S\_COMP**
  - S\_CONV
  - STRG\_VAL
  - VAL\_STRG
  - Strg\_TO\_Chars
  - Chars\_TO\_Strg
  - MAX\_LEN
  - ATH
  - HTA
- Instructions
  - LEN
  - CONCAT
  - LEFT
  - RIGHT
  - MID
  - DELETE
  - INSERT
  - REPLACE
  - FIIND
- Process image

Technology

Communication

# Сравнение областей, содержащих строки, в режиме OnLine

Block interface

No condition defined.

► **Block title:** .....

▼ **Network 1:** .....

Network 2:

► **Network 3:** .....

100%

Properties Info Diagnostics

▼ **CPU operator panel**

PLC\_2 [CPU 1516-3 PN/DP]

RUN / STOP

ERROR

MAINT

Mode selector: RUN

Testing Tasks Libraries

Call environment

Breakpoints

Call hierarchy



# Создание нескольких ОБ типа "Main Program Sweep (Cycle)"

**Project tree**

**Devices**

- Project\_1200\_1500
  - PLC\_1 [CPU 1214C DC/DC/DC]
  - PLC\_2 [CPU 1516-3 PN/DP]
    - Program blocks
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Local modules
  - Unassigned devices
  - Common data
  - Documentation settings
  - Languages & resources
  - Online access
  - Card Reader/USB memory

**Add new block**

Name: Main\_1

Language: LAD

Number: 123

manual  
 automatic

Description:  
 A "Program cycle" OB is executed cyclically and is the main block of the program. This is where you place the instructions that control your application, and call additional user blocks.

[more...](#)

**Additional information**

Add new and open

OK Cancel

**Project tree**

Start

OB  
Organization block

FB  
Function block

FC  
Function

DB  
Data block

Tasks

Libraries

OB  
DB  
FC  
FC



# Создание нескольких ОБ типа "Main Program Sweep (Cycle)"

Project tree: Project\_1200\_1500 > PLC\_2 [CPU 1516-3 PN/DP] > Program blocks

Name	Modified	Remark	Title	Address	Type	Language	Opt
Add new block							
Main_1 [OB123]	8/24/2014 - 5:05:39 PM		"Main Program Sweep (Cycle)"	OB123	OB	LAD	<input type="checkbox"/>
Main [OB1]	8/23/2014 - 3:32:18 PM		"Main Program Sweep (Cycle)"	OB1	OB	LAD	<input type="checkbox"/>
Data_block_1 [D...	8/23/2014 - 4:57:31 PM			DB1	DB	DB	<input type="checkbox"/>
Block_2 [FC2]	8/24/2014 - 12:34:33 PM			FC2	FC	LAD	<input type="checkbox"/>
Block_1 [FC1]	8/24/2014 - 12:41:47 PM			FC1	FC	LAD	<input type="checkbox"/>

Приоритет у OB1 и у OB123 одинаков. выполняются они друг за другом, по возрастанию номера

Reference projects

Details view

Properties Info Diagnostics

## Вызов программных блоков из OB1 "Main Program Sweep (Cycle)"

The screenshot displays the SIMATIC TIA-portal interface for configuring a program block call. The left pane shows the project tree with the following structure:

- Project\_1200\_1500
  - Add new device
  - Devices & networks
  - PLC\_1 [CPU 1214C DC/DC...]
  - PLC\_2 [CPU 1516-3 PN/DP]
    - Device configuration
    - Online & diagnostics
    - Program blocks
      - Add new block
      - Main [OB1]
      - Main\_1 [OB123]
      - Block\_1 [FC1]
      - Block\_2 [FC2]
    - Data\_block\_1 [DB1]
  - Technology objects
  - External source files
  - PLC tags
  - PLC data types
  - Watch and force tables
  - Traces
  - Program info
  - PLC alarms
  - Text lists

The right pane shows the configuration for the selected block, "Main Program Sweep (Cycle)". The "Block title" is "Main Program Sweep (Cycle)". The "Network 1" section shows a call to the block "Block\_1" (FC1) with the EN (Enable) input and ENO (Enable Out) output. The "Network 2" section is empty, showing "<No tags used>".

The bottom of the interface includes a zoom level of 100% and buttons for Properties, Info, and Diagnostics.

## Вызов программных блоков из OB123 "Main Program Sweep (Cycle)"

The screenshot displays the SIMATIC Manager interface for configuring a program block call. The left pane shows the project tree with the following structure:

- Project\_1200\_1500
  - Add new device
  - Devices & networks
  - PLC\_1 [CPU 1214C DC/DC...]
  - PLC\_2 [CPU 1516-3 PN/DP]
    - Device configuration
    - Online & diagnostics
    - Program blocks
      - Add new block
      - Main [OB1]
      - Main\_1 [OB123]
      - Block\_1 [FC1]
      - Block\_2 [FC2]
      - Data\_block\_1 [DB1]
    - Technology objects
    - External source files
    - PLC tags
    - PLC data types
    - Watch and force tables
    - Traces
    - Program info
    - PLC alarms
    - Text lists

The right pane shows the 'Block interface' for 'Main Program Sweep (Cycle)'. It contains the following elements:

- Block title:** "Main Program Sweep (Cycle)"
- Comment:** (empty text field)
- Network 1:** A network diagram showing a call to block "Block\_2". The call is represented by a vertical line on the left with an EN (Enable) input and an ENO (Enable Out) output. A horizontal line connects the ENO output to the EN input of the "Block\_2" block. Below the network, a table lists the call parameters: "Block\_2" and "%FC2".
- Network 2:** A network diagram showing a call to block "Block\_2". The call is represented by a vertical line on the left. Below the network, a text field contains "<No tags used>".

The bottom status bar includes the following elements:

- Reference projects
- Details view
- 100% zoom level
- Properties, Info, and Diagnostics buttons

# Функция отслеживания значений переменных во времени

Project tree

Project\_S7\_ALL\_CPU > Group\_PLC > PLC\_2 [CPU 1516-3 PN/DP]

Devices

Project\_S7\_ALL\_CPU

Group\_PLC

PLC\_1 [CPU 1214C DC/D...]

PLC\_2 [CPU 1516-3 PN/DP]

Program blocks

Technology objects

External source files

PLC tags

PLC data types

Watch and force ta...

Local modules

PLC\_3 [CPU 314C-2 P...]

PLC\_4 [CPU 414-3 PN/DP]

PLC\_5 [IM151-8 CPU]

Common data

Documentation settings

Languages & resources

Online access

Card Reader/USB memory

Reference projects

Details view

Details List Thumbnails

Name	Modified	Remark	Type
Device configuration			
Online & diagnostics			
Program blocks	8/31/2014 5:21 PM	(none)	
Technology objects	8/23/2014 12:59 PM	(none)	
External source files	8/23/2014 12:59 PM	(none)	
Watch and force tables	8/23/2014 3:16 PM	(none)	
Traces			
Program info			
PLC alarms			
Text lists			
Local modules			

Только для S7-1500

Двойной щелчок

Properties Info Diagnostics

# Функция отслеживания значений переменных во времени

Project\_S7\_ALL\_CPU > Group\_PLG > PLC\_2 [CPU 1516-3 PN/DP]

Trace handling

Trace [Trace configuration] Properties Info Diagnostics

General

General

Configuration

Signals

Recording conditions

Sampling

Trigger

Signals

	Name	Data type	Address	Color	Comment
1	"Tag_3"	Bool	%I0.0	Blue	
2	"Tag_4"	Bool	%I0.1	Red	
3	"Tag_5"	Bool	%Q0.0	Pure Red	
4			<Add new>		



# Функция отслеживания значений переменных во времени

Project\_S7\_ALL\_CPU > Group\_PLC > PLC\_2 [CPU 1516-3 PN/DP]

Trace handling

Trace [Trace configuration] Properties Info Diagnostics

Devices & networks

Tasks

Libraries

**General**

General

Configuration

Signals

Recording conditions

Sampling

**Trigger**

Trigger mode: Trigger on tag

Trigger tag: "Tag\_3" %I0.0

Event: = TRUE

Value:

Pre-trigger (b): 0 Samples



# Функция отслеживания значений переменных во времени OnLine

Project\_S7\_ALL\_CPU > Group\_PLG > PLC\_2 [CPU 1516-3 PN/DP]

Show trace data: Trace [Installed traces]

Devices & networks | Tasks | Libraries

Name | Data t... | Addre... | Color | Min. Y scale | Max. Y scale | Unit | Comment

### Trace handling

Configured traces		Comment
1	Trace	
2	<Add new>	

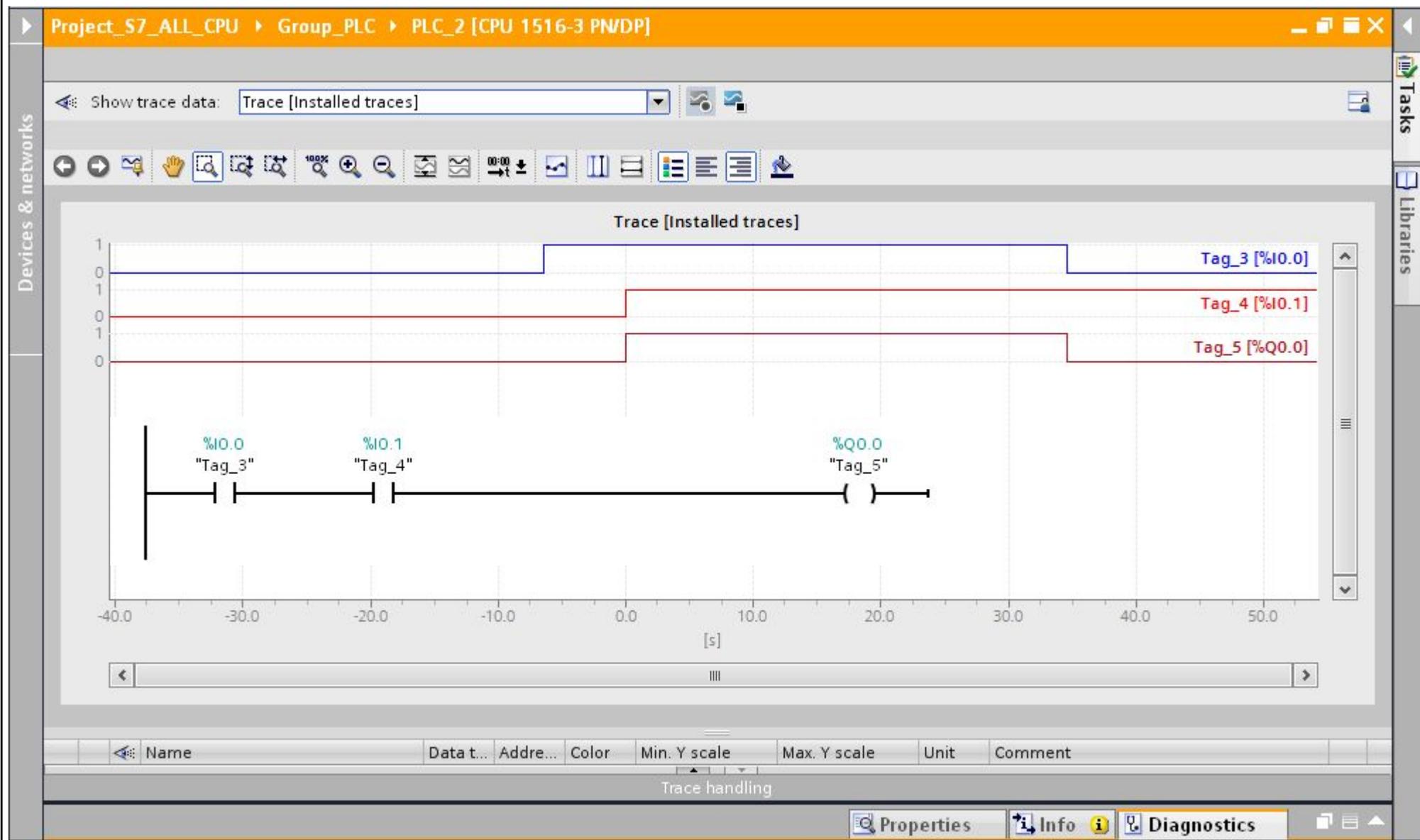
Installed traces		Active	Status
1	Trace	<input checked="" type="checkbox"/>	Waiting for trigger

Recorded traces		Time stamp

Properties | Info | Diagnostics



# Функция отслеживания значений переменных во времени OnLine



## Конец раздела 11. Окно навигации

- ▶ Основы алгебры логики
- ▶ Общие сведения, создание проекта.  
Конфигурирование станции
- ▶ Программные блоки (FC/FB)
- ▶ Блоки данных (DB)
- ▶ Регистры, служебные флаги.  
Библиотека программных инструкций.
- ▶ Организационные блоки (OB)
- ▶ Модули обработки аналоговых сигналов
- ▶ Программирование на языках SCL, GRAPH
- ▶ Тестирование и отладка
- ▶ Системы с сетевой конфигурацией  
Конфигурирование ПЛК S7-1200, S7-1500