# POLITECNICO DI TORINO

Master of Science in Mechatronic Engineering



# Automatic Control, PLC Programming and Simulation of Pneumatic Cylinders' Lifetime Testing

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## Abstract

In this thesis project, programming and simulating of the automatic testing process has been studied. The ambition is to develop an efficient test bench to determine the durability of pneumatic cylinders in working conditions.

Pneumatic cylinders have extensive application in different industries. For safety and financial reasons, just to name the most important, anticipation of their lifetime is crucial. To estimate the life service of a pneumatic cylinder, applying the progressive methods of testing and reliable mechanism is necessary.

The programmable logic controller (PLC) has a specific role in automation world. I have used Siemens' engineering framework, the TIA Portal, to control the test bench. Data acquisition is a key purpose in this project. Unlike previous studies related to the pneumatic cylinder lifetime testing, I have used a different way to record, save and analyze the data, namely by using the trace function in the TIA Portal. Previous solutions done by other students had some major limitations. One is in the ability to acquire and store the data. They needed to use an additional component like HMI or a PC that always had to be connected to the PLC CPU. Another limitation was the lack of analyzing tools. However, with the method used in this study there is no need to use any extra component to save the measured values. In addition, the trace function has the capability of creating the diagrams and analyzing the data.

There are some crucial measurements that can be achieved by two different tests; a wear test to measure the number of complete movements and a leak test to investigate any leakage inside the cylinder chambers. These two tests can be done either individually or successively one after another.

The outcome of this project is to learn how to assemble a test bench to perform different testing on pneumatic cylinders automatically and how to program and organize it in a proper manner for controlling the project. And finally, how to simulate the project, diagnose and develop the program virtually.

In this project I have used the TIA Portal V16, PLCSIM Advanced V3.0 and FluidSim Pneumatic for PLC programming and simulation of the test process. The program is developed in such a way that the major settings can be redefined by users according to the conditions and more cylinders can easily be added to the test bench.

And the results show that these programs and this setup are suited for this kind of testing and that a proper method can be found using it.

## Introduction

The project consists of two major parts: hardware, including the test bench that is a combination of pneumatic and electrical systems, and software which operates and controls the different test processes. In the first section I will look at the hardware part, the different components of the test bench and how they are working.

In the second section the software part will be explained in detail, starting with the FluidSim Pneumatic software that is used to design the electro-pneumatic circuit and simulate the test bench. Then there is an overview of the PLCSIM Advanced software and why it is necessary for this project. Then the TIA Selection Tool and the advantages of applying this software in the project will be clarified. And finally, the most important part of the project, programming in the TIA Portal engineering framework, will be described in detail. The procedure of creating the project in the TIA Portal and programming is illustrated step by step. Then a study of the data acquisition system has been made using "Trace function". The trace function is a dynamic capability of the TIA Portal to record, collect and analyze the data.

In the software section figures are used to help the reader better understand the explanations.

The test program has three modes. In the first mode the leak test is executed using high-pressure air. The next mode is the wear test which uses low pressure air. The third state is the full test mode in which both the wear and leak tests will be executed in succession. All these three test modes will be done automatically. It is crucial to predict possible faults that may happen during each test mode. For some errors it suffices to inform the operator, but in some cases the defective cylinder should be removed from test process. A function named Alarm Codes is defined for this purpose. In this function different errors and proper actions are considered. In this project the main language which is used in PLC programming is LAD. However, to simulate pressure dropping during the leak test SCL coding is used as well. For simulation of pressure decreasing, an exponential function is used. SCL coding is more suitable when using mathematical calculations.

In the third section the conclusions drawn from this project and its results are mentioned as well as their applicability in the industry. At the end the list of references which I used in my thesis is shown. The last section includes the complete program of the testing project in the TIA Portal.

## A. Hardware

## 1. Electro-Pneumatic Systems

## 1.1 Pneumatics in industries

Automatic systems have a key role in today's world and one of the technologies which is commonly used in this area is pneumatics. Electro-pneumatic systems consist of two main parts: power and control. The power section is driven by a pneumatic circuit and the control section is driven by an electric circuit.

A pneumatic system consists of interconnected components using compressed air to transmit and control energy in mechanical works and automated processes. The flexibility and efficiency of this system makes it very useful for a large range of industries and can be found in various places, such as train doors, dentist offices etc.

#### 1.2 Main and basic components

Some basic components are needed in pneumatic machines in order to make, control, store, move and use compressed air:

- A compressor which collects air.
- Receiver for storing air.
- Valves for controlling air.
- Some kind of circuit for moving air between the different parts of the system.
- An actuator which is activated by air to do requested job.

As the name indicates, pneumatic systems get their power from compressed air. In order for such a system to work two main parts are needed: something that compresses the air, called compressor, and something that can use the compressed air to hold, move or lift an object, called the actuator. Some kind of circuit, usually comprised of a network of pipes, is also needed in order to move the air from the compressor to the actuator. In order to control the system a valve is needed in order to switch the air on or off. In some cases, the valve should also be able to change directions, otherwise the machine is unable to lower something that it has lifted, or vice versa.

Another important part of a pneumatic system is the receiver where compressed air is stored under pressure, ready to be used instantly as soon as the operating valve is opened. Without this and because of compressibility of the air, it would take time for the compressor to achieve the pressure needed to make the actuator move.

#### Compressors

As mentioned above, the compressor is the starting point for any pneumatic circuit that compresses air, getting it to about seven to ten times the atmospheric pressure, 700-1,000 kPa, or 100-150 psi. This pressure is what generates the energy needed for the pneumatic system, and it is done by compressing air into a smaller space. However, energy does not come out of thin air, the compressor needs to be powered by a diesel or gasoline engine, thus converting one form of energy to another.

#### Actuators

An actuator is something that moves something else. It is the part of a pneumatic tool that does some kind of action by lifting or lowering an object, for instance a mechanical arm, a piston etc. They usually work in a straight line and they are often powered by pistons that slide in and out of cylinders as they are moved by compressed air, thus turning potential energy from the compressed air into kinetic energy and some kind of movement.

In order to get a rotating motion an air-powered motor can be used. This uses gas to make shafts rotate, in very much the same ways as a turbine which can be seen as a machine that uses an internal windmill. When the gas moves through this kind of air motor it pushes against vanes, thus making an axle spin in order to make a drilling motion, such as in a polishing machine.



Figure 1

#### Circuits

Above we have described how a pneumatic system works, but in most industrial contexts many circuits coexist and need to be able to work together. They consist of different kinds of valves and actuators, and in a large factory one large compressor could be the energy source for a large range of machines, meaning that there are many complex circuits. There are dozens of pneumatic symbols to help drawing circuits clearly on the engineering plans, such as symbols for electronic and hydraulic components. There is some engineering software to make very advanced logic circuits entirely from fluid-powered components in which fluidic components. Like electrical circuits, there are fluid equivalents of AND/OR logic gates, timer circuits, latching units, switches, amplifiers etc.



Figure 2

A pneumatic circuit can use many different components depending on the purpose. For instance:

- A timer drain valve drains the condensated water from the air tank when instructed to. But air alone cannot remove water and impurities from compressed air and therefore other components are also needed in order to increase the life span of the pneumatic components.
- A pre-filter is used to remove most water molecules as well as impurities and this filter is usually installed in the main line.
- An air dryer is installed in order to remove water vapor from compressed air. In order to dry compressed air, it is possible to lower the temperature and then increase it again, making condensation form at the lower temperature, allowing it

to be discharged. Re-heating dries the air. This process is particularly efficient in refrigerated compressed air dryers.

 Air filter, regulator, lubricator: These can be used together or separately. They contribute to different cleaning: air filters clean the air from dust and vapor, a regulator decreases the pressure and air lubricators ensure that oil is added into the compressor air.

#### Pneumatic valves

Pneumatic valves govern the pressure, direction or flow of compressed air and they are usually divided into directional control valves (distributors), pressure regulating valves, and auxiliary valves.

Their function is to operate actuators and distribute compressed air in the circuits. Power valves directly distribute the fluid used to operate pneumatic actuators while control valves govern the fluid that controls other valves. Different kinds of ports or openings allow air to pass.

There are several types of valves depending on their manner of operation, such as diaphragm valves, poppet valves, rotary distributor valves and slide valves. These can control the pressure, direction, and flow of air. These can further be categorized based on their function such as pressure regulating valves, auxiliary valves, and directional control valves.



Figure 3

1. Directional control valves can direct fluid along different paths by switching the connections of an actuator, reversing a motion and stopping it. These valves are categorized based on the number of ports and positions. Since they are digital valves, usually have discrete number (two or three) of positions.

2. Pressure regulating valves are mainly used to control and reduce air pressure to ensure that it is constant and safe for the circuit at the output of the valve.

3. Auxiliary valves perform various functions associated with other valves and they can consist of selector valves, sequence valves, nonreturn valves, flow control valves and time delay valves.

Valves are either monostable or bistable. A monostable valve needs a signal for switching and without a signal it will return to its previous position. A bistable valve has two operating positions, without having a preference. When the valve moves after having received a signal it will retain this position until another signal comes (memory function).

Some common types of valves which are named according to their number of ports and switching positions:

- 2 way / 2 position valves
- 3 way / 2 position valves
- 4 way / 2 position valves
- 5 way / 2 position valves
- 4 way / 3 position valves

### 1.3 Electrical

In the electric parts of electro-pneumatic systems various components can be used according to the required functions. Solenoid valves, Relays, Switches, different types of Sensors (mechanical limit switches, magnetic, inductive, capacitive, optical, ultrasonic, etc.), Programmable controllers and so on.

## 2. PLC

PLC (Programmable Logic Controller) is the heart of the automation section of this project. PLCs are industrial digital computers, which are designed to perform any process automatically and with high reliability. A PLC is equipped with a programmable microprocessor that receives electric signals in inputs and according to the user program, sends commands to the outputs. Inputs are connected to the sensors or transducers and outputs are connected to the actuators in the system which it controls. In this project I used a CPU from Siemens S7-1500 family.



Figure 4

#### **PLC Advantages**

The PLCs are compact and reliable as they have no moving parts, and this make them particularly suitable for use in the industry as they operate safely. They are also modular and can therefore be configured as needed and maintained easily. This makes them flexible and changes to the process cycle can be made instantly. Despite of their simplicity they are able to handle very complicated logical operations. They have the capability to program counter, timer, comparator etc. and they possess powerful facilities when it comes to fault finding, diagnostics and documentation. In addition, they can handle analog signals and close loop control programming and can be connected to printers, video terminals, computers, other PLCs, displays etc. Finally, they can be reused and have a low power consumption making them compatible with an equivalent hard-wired logic system.

In this section we have looked at the different parts of an electro-pneumatic system and in the next segment the test bench for this project will be presented.

## 3. Test bench

In the hardware part of the test bench used in this project two double acting cylinders are used. For each cylinder two blocking valves (one for each chamber) and one distribution valve are used. The type of the blocking valves and the distribution valve are 2/2 and 5/2. In both cases the valves are monostable. The distribution solenoid valve will be actuated electrically while the blocking valve can only be activated pneumatically. There is one auxiliary solenoid valve to control all posterior blocking valves and one for all anterior blocking valves in the system. In this system we need two air supplies; high-pressure supply to perform the leak test and low-pressure supply for the wear test and in each part one 3/2 monostable valve at the input of the system will control the supplied air. In figure 5 we can see the pneumatic circuit of the test bench in this project.





The power supply used in the electrical circuit is 24 volts. To send the commands and control the testing process, some detent switches, pushbuttons, and magnetic limit switches are used. The six modules as shown in figure 6 are related to the digital and analog input/output of the PLC.

Four pressure manometers show pressure inside the chambers and the supplies. Each limit switch is connected to a relay and a "normally opened" contact of the relay is an input signal to the PLC. All solenoid valves are connected to the output modules and receive commands from the PLC.

There are nine LEDs connected to the PLS' output and each of these are in their turn related to a different fault happens in the system.





In the first part and until here we have discussed the main components required in the hardware section. The electro-pneumatic circuits are designed, and the hardware configuration is completed. We now have the base for our project and in the next part we will look at the different kinds of software that are used in this project, and in the subsequent part we will be looking at the programming and simulation of the test bench.

## **B. Software**

## 4. FluidSim

Fluidsim is a robust software for simulating pneumatic, hydraulic, and electrical circuits. To simulate my project, I have used Fluidsim version 4. By means of the Fluidsim library, we can select our required components and create a project on the related window. There is also the possibility of simulating analog signals like pressure in this project. We can use the help section to find out the software possibility and its various functions.

My project in Fluidsim is a combination of pneumatics and electrical circuits. After designing the circuit, we can start the simulation. In fact, the Fluidsim plays the role of hardware in my project. When connecting my PLC program to Fluidsim I used OPC mode. In order to do so it was necessary to install an EzOPC file. I have used EzOPC V5.6 in my project.

There are different modules for digital and analog signals as inputs and outputs. In the following figure, we can see the project in Fluidsim. Analog out, Fluidsim In and Fluidsim out are three modules which I used to represent my PLC I/Os and its connection to the project hardware.



## 5. PLCSIM Advanced

In this project I have used PLCSIM Advanced V3.0 for simulation. In comparison with PLCSIM, PLCSIM Advanced has some important advantages. It tries to emulate CPU hardware behavior. In addition, it can communicate with other PCs and even with real PLC CPU.

After installing the PLCSIM Advanced, the first step is to check box the "Support simulation during block compilation" option in TIA Portal. It is placed on the "Protection" tab in the properties of the project. Otherwise the TIA Portal cannot connect to PLCSIM Advanced.

#### S7-PLCSIM Advanced Control Panel

At the top of the control panel, online access, we can switch to adopt the communication interface. If PLCSIM is selected, it can communicate with local via softbus. If PLCSIM virtual ethernet adapter is selected it communicates with the outside via TCP/IP and in the next section, TCP/IP communication will be activated. It is then possible to choose either local or ethernet network for distributed communication.

PLCSIM Advanced works only with CPU 1500 and ET 200SP CPU. To create a virtual controller, it is necessary to enter a unique name for the created "instance", otherwise the start button will not be enabled.

The retentive data in addition to the hardware configuration, and the user program, will be saved in a file in the local PC. The path can be selected in the virtual simatic memory card section.

After creating an instance, we can load the program from the TIA Portal to the device and start the simulation.

Figure 8 shows the PLCSIM Advanced control panel. To connect FluidSim to the TIA Portal via PLCSIM Advance, it is necessary to install the Festo Didactic EzOPC software. Then in its S7-PLCSIM tab select PLCSIM Advanced and define I/O range. In FluidSim software and in options we have to select OPC mode as well. In Figure 9 the overview tab, PLCSIM tab and the setting options are shown.

|          |                        |                            | _       |       | $\times$ |
|----------|------------------------|----------------------------|---------|-------|----------|
| PĽ<br>SI | S7-PLCSIM Ad           | vanced V3.0                | Control | Panel | Д<br>Д   |
|          | Online Access          |                            |         |       |          |
|          | PLCSIM                 | PLCSIM Virtual Eth. Adapte | er      |       |          |
| •        | TCP/IP communication   | with                       | $\sim$  |       |          |
| Ð        | Virtual Time Scaling   |                            |         |       |          |
|          | 0.01 Of                | f 100                      |         |       |          |
|          | Start Virtual S7-150   | 00 PLC                     |         |       |          |
| 185      | Instance name          |                            |         |       |          |
| <b>1</b> | PLC type               | Unspecified CPU 1500 🗸     | •       |       |          |
|          |                        | Start                      |         |       |          |
|          | MRES                   |                            |         |       |          |
|          | No Active PLC Instance |                            |         |       |          |
|          |                        |                            |         |       |          |
|          |                        |                            |         |       |          |
|          |                        |                            |         |       |          |
|          |                        | Drop Instances Here        |         |       |          |
|          |                        |                            |         |       |          |
|          |                        |                            |         |       |          |
|          |                        |                            |         |       |          |
| 2        | Runtime Manager Port   | 50000                      |         |       |          |
|          | Virtual SIMATIC Memor  | y Card                     |         |       |          |
| 1        | Show Notifications     | $\checkmark$               |         |       |          |
| r        | Function Manual        |                            |         |       |          |
| 8        | Exit                   |                            |         |       |          |

Figure 8



- 🗆 🗙 🐼 Overview 🗮 Virtual Controller 🗮 EasyPort 🕮 S7-PLCSIM 💊 CoDeSys PLCSIM Advanced Define IO range

Figure 9

## 6. TIA Portal

#### Introduction

With continued technological development, the world of automation is changing as well. Processes need to be faster, tasks are becoming more complex and more and more of operations are becoming digital. To handle these demands, Siemens introduced a very powerful and comprehensive approach. The totally integrated automation portal, or TIA Portal for short, is a modern engineering framework for all digitalized automation tasks. The TIA Portal integrates STEP 7, WinCC, Startdrive, SIMOTION SCOUT TIA, SINAMICS and SIMCODE ES software. Furthermore, TIA Portal contains new functionalities like the TIA Portal Multiuser Engineering and SIMATIC Energy Suite that are designed for energy management. Another important advantage of TIA is digital workflow where it is possible to use a virtual model of machines and simulate, test, and analyze every possible scenario before building the real systems.

## 6.1 TIA Selection Tool

#### Starting a project with TIA Portal

The first step to design an automation project is to choose and configure the right hardware. In order to be able to correctly choose the devices required for our project, we can use TIA Selection Tool software, which is independent from the TIA Portal. This software helps users to select and configure components without error in a fast and easy way. As it is shown in figure 10, in the Tia Selection Tool main tab, we select plant configuration and wizards. By using this function and simply enter the number of input/output signals and requested module type, TIA Selection Tool will automatically generate the required modules and devices, including accessories.

| TIA Selection Tool  |   |            |                                |    | Save 🖧 Log on to Siemens Indu       | 🗇<br>ustry Ma <b>li</b> | >    |
|---------------------|---|------------|--------------------------------|----|-------------------------------------|-------------------------|------|
| ≫ SIEMENS           | Search                                      |            |                                |    |                                     | 8                       | ٩    |
| Welcome             | Series                                      |            |                                |    | •                                   | Smart Assi              | stan |
| Rew Device 1        | Plant configuration and wizards 2           | <b>i</b>   | Mustry solutions               | i  | Ibrary                              | í                       |      |
| 🔀 Projects          |   | 03         |                                | 03 |                                     | 03                      |      |
| 😥 Configuration ( 3 | Controllers                                 |            | 10 systems                     | LY | Panels                              |                         |      |
| Order list          | Industrie PCs, Monitore und Thin<br>Clients | i          | Drive technology               | i  | Industrial controls                 | í                       |      |
|                     | Software                                    | í          | Industrial Communication       | i  | Connection system                   | í                       |      |
|                     | SITOP Power Supply and DC UPS               | í          | SIMATIC Ident                  | í  | Energy distribution and measurement | í                       |      |
|                     | Internet of Things                          | í          | * Condition Monitoring Systems | iP | Other devices                       | í                       |      |
|                     | Safety Evaluation                           | í          |                                |    |                                     |                         |      |
| Options             | A Selection Tool cloud                      |            |                                |    |                                     |                         | 1    |
|                     | Comparison of TIA Selection Tool versions   | Start dire | ctly in browser                |    |                                     |                         |      |

Figure 10

| TIA Selection Tool  |                                  |  | - 0 ×  | < |
|---------------------|----------------------------------|--|--|---|
|                     | Project > Group_1 > Plant config | uration (Plant configuration)  | Save 🕹 Log on to Siemens Industry Mall 🚥                                       |   |
| SIEMENS             | Search                           |  | ٥,   | • |
| Welcome             | Special product properties Confi | jure 4   |  |   |
| 🙀 New Device        | Systems                          | (i) Controller, distributed I/O and system settings  |  |   |
| 🔀 Projects          | Central modules                  | You can create a controller and multiple associated ET 200 devices with the system conf<br>include all possible versions. All devices created here can be edited manually and change | Iguration. It represents a quick and easy option but does not<br>ed afterward. |   |
| 😥 Configuration     | Distributed modules              | Central modules Advanced Controller & IO (S7-1500 & ET 200MP)  | •  |   |
| <b>↓</b> Order list |                                  | Distributed modules  |  |   |
|                     | ann Network                      | Distributed Controller & IO IP20 (ET 2005P)  | •  |   |
|                     | Power supply                     | Distributed modules outside the control cabinet None   | •  |   |
|                     | Software                         |  |  |   |
|                     | s Result                         | Actuators/sensors connection   |  |   |
| Options             |                                  | As-interface   |  |   |
| Project view        |                                  | Process fail-safe signals<br>• Yes O No  | ~  |   |
|                     |                                  | Figure 11  |  |   |

In the configuration section, we choose type of modules, communication system, software, and physical specifications of the required panel. According to our selection, this software gives us different options. In figure 11 we can see these options on the left side. It is possible to click on each of them one by one and set the required fields. For instance, by clicking on central and distributed module and then clicking on add module, a new tab will be opened. Here we can enter the type and number of signals which we want to use in our project, Figure 12. After completing the setting, we click on result. The

TIA Selection Tool computes and analyzes our requirement and shows the result, Figure 13.

| TIA Selection Tool   |   | – o ×   |
|--|---|---|
| ≫ siemens  | Project > Group_1 > Plant configuration_3 (Plant configuration) See | Save 🔔 Log on to Siemen's industry Mall 🚥   |
| Welcome         Welcome         New Device         Projects         Configuration         Order list | Select modules for central modules.                                 | Digital input, DI 32x24VDC HF<br>SIMATIC S7-1500, DIGITAL INPUT<br>MODULE DI32 X DC24V, 32 CHANNELS IN<br>GROUPS OF 16; INPUT DELAY 0.05<br>20MS; INPUT TYPE 3 (IEC 61131);<br>DIAGNOSIS, PROCESSALARMS<br>6ES7521-1BL00-0AB0 |
| I I I I I I I I I I I I I I I I I I I  |   |   |

Figure 12

In the last step, by clicking on create devices, the software will generate a list of devices which can fulfill the project requirements, Figure 14. We could also click on controllers in the main tab (Figure 10) and instead make some selection manually.



Number of devices Figure 13



Figure 14

6

Now we can export the project to the TIA Portal. To do so in the project view we click on project / export / TIA Portal or ECAD system. It is also possible to do exporting in the portal view by clicking on "..." in the top right corner and then select export / TIA Portal or ECAD system.

There are many other functions in the TIA Selection Tool that we can use for different purposes. For instance, when our TIA Selection Tool project is completed, in the Project / Export / EPLAN section the TIA Selection Tool can automatically generate the circuit diagram of our project in the EPLAN software.

#### **TIA Portal:**

After exporting the project from the TIA Selection Tool, we switch over to the TIA Portal to import the generated export file. To do so, we click on Tools in the main bar and select import CAx data. After the import, we can see the imported devices with full details in the project tree on the device view.



Figure 15

## 6.2 Data Types

After the device configuration, we are ready to start programming. But before that, I would like to add a short explanation on different data types in PLC programming.

It is crucial to have good knowledge about various data types and their usage in programming. In the S7-1500 series we can use 64 different data types. Every single data or variable is defined by two major specifications. First is data type and the second is address. In fact, data type specifies what we can do with this variable. For instance, Boolean data type can accept two values (0/1 or On/Off or True/False). Or Integer data type can accept any number without a fractional component. The second characteristic of a variable is the size and the place that variable is stored in memory. The address can show both. The size of a variable can be in range of bits, byte (8 bits), word (16 bits), double word (32 bits) and long word (64 bits). Long word is only supported by S7-1500. When we are defining a variable in the PLC tags table, we have to determine its data type as well. Figure 16

| UA Si | emens - C:\Users\hamgha0625\D | eskto | op\Proje | t8_V16\Project8_V1 | 6                         |           |         |       |            |               |       |           |            |              | -        | ×٦  |
|-------|-------------------------------|-------|----------|--------------------|---------------------------|-----------|---------|-------|------------|---------------|-------|-----------|------------|--------------|----------|-----|
| Proje | ct Edit View Insert Online    | Opt   | tions To | ols Window Help    |                           |           |         |       |            |               |       |           | Totally    | ntograted Au | tomation |     |
| -     | Save project 📃 🗶 🗐            | 1     | × •• •   |                    | 🗉 🖾 💋 Go online 🧭 Go offi | ine &2 18 | II X -  |       | -Search in | n project>    | 1 124 |           | Totally I  | ntegrated Au | PORTAL   |     |
| Ī,    | roject tree                   | P     | roject8  | V16 > PLC 2 [CPU   | 1515F-2 PN] > PLC tags    |           |         |       |            | -projecto     |       |           |            |              | _ = = ×  | i.  |
|       |                               |       |          |                    |                           |           |         |       |            |               |       |           |            |              |          |     |
|       | Devices                       |       |          |                    |                           |           |         |       |            | a lags        |       | User con  | stants     | System co    | onstants | 2   |
| 3     | 8 🔟 🖬                         |       | 9 🥐 🛛    | 🕀 🛍 😤 🛨 🗲          |                           |           |         |       |            |               |       |           |            |              | -4       | as  |
| 2     |                               |       | PLC ta   | gs                 |                           |           |         |       |            |               |       |           |            |              |          | Ś   |
| i -   | 🖀 Cyclic interrupt [          | ~     | 1        | Vame               | Tag table                 | Data type | Address |       | Retain     | Acces         | Writa | Visibl    | Supervis   | Comment      |          |     |
| E I   | Main [OB1]                    | 1     | -0       | Leak Test          | Default tag table         | Bool      | %10.0   | -     | -          |               |       |           |            |              | ^        |     |
| b.    | Alarm Codes [FC               | 2     | -        | Sensor.out 1       | Default tag table         | Aom_Ident |         | ^     |            |               |       |           |            |              |          | ib  |
| 2     | Trace Codes [FC1]             | 3     | -00      | Sensor.in 1        | Default tag table         | Bool      |         | =     |            |               |       |           |            |              |          | ari |
| 2     | 🔹 Test Program (F             | ≡ 4   | -00      | Wear Test          | Default tag table         | Byte      |         |       |            |               |       |           |            |              | =        | es  |
| Ĩ.    | Cylinder 1 [DB8]              | 5     | -01      | Full Test          | Default tag table         | Char      |         |       |            |               |       |           |            |              |          |     |
|       | Cylinder 2 [DB9]              | 6     | -        | Emergency.Stop     | Default tag table         | Conn_Any  |         |       |            |               |       |           |            |              |          | 2   |
|       | Trace.Codes [DB1]             | 7     | -00      | Reset              | Default tag table         | Conn_Ouc  |         |       |            |               |       |           |            |              |          | dd  |
|       | Technology objects            | 8     | -00      | Start              | Default tag table         | Conn Prg  |         |       |            |               |       |           |            |              |          | ÷   |
|       | External source files         | 9     | -00      | Sensor.out 2       | Default tag table         | Conn_R_Id |         | ~     |            |               |       |           |            |              |          | ~   |
|       | 🔻 🔚 PLC tags                  | 10    | 0 🕣      | Sensor.in 2        | Default tag table         | Bool      | %11.4   |       |            |               |       |           |            |              |          |     |
|       | a Show all tags               | 11    | 1 📲      | Manometer 1        | Default tag table         | Int       | %IW2    |       |            |               |       |           |            |              |          |     |
|       | Add new tag table             | 12    | 2 📲      | Manometer 2        | Default tag table         | Int       | %IW4    |       |            |               |       |           |            |              |          |     |
|       | 🜿 Default tag table           | 13    | 3 💶      | Manometer.LPS      | Default tag table         | Int       | %IW6    |       |            |               |       |           |            |              |          |     |
|       | Cell PLC data types           | 14    | 4 🕣      | Manometer.HPS      | Default tag table         | Int       | %IW8    |       |            |               |       |           |            |              |          |     |
|       | Watch and force ta            | 15    | 5 📶      | HPV                | Default tag table         | Bool      | %Q0.0   |       |            |               |       |           |            |              |          |     |
| <     |                               | 16    | 6 🕣      | DV 1               | Default tag table         | Bool      | %Q0.1   |       |            |               |       |           |            |              |          |     |
| ~     | Details view                  | 17    | 7 📲      | AAV                | Default tag table         | Bool      | %Q0.2   |       |            |               |       |           |            |              |          |     |
|       |                               | 18    | 8 🕣      | PAV                | Default tag table         | Bool      | %Q0.3   |       |            |               |       |           |            |              |          |     |
|       |                               | 15    | 9 🕣      | LPV                | Default tag table         | Bool      | %Q0.4   |       |            |               |       |           |            |              |          |     |
|       | lane and land                 | - 20  | 0 📲      | DV 2               | Default tag table         | Bool      | %Q0.5   |       |            |               |       |           |            |              |          |     |
|       | Name                          | 21    | 1 📲      | LPS.PressureAlarm  | Default tag table         | Bool      | %Q0.6   |       |            |               |       |           |            |              |          | 4   |
|       |                               | 25    | 2 📶      | HPS PressureAlarm  | Default tag table         | Bool      | %00.7   |       | 0          |               |       |           |            |              | ~        | 4   |
|       |                               |       | <        |                    |                           |           | - 101   | _     |            |               | _     |           |            |              | >        | 4   |
|       |                               |       |          |                    |                           |           |         |       |            | <b>Proper</b> | ties  | 1 Info    | s 🔝 😨 🛙    | Diagnostics  | ■ B ▲    |     |
|       | Portal view 🔛 Over            |       | Main     | 🄹 Cycli 🔹 Traci    | e 🔹 Test 🌇 Trace 📲        | Alar      | Trace 🧉 | Cylin | PLC        | t             | 2     | Connectio | n to PLC_2 | terminated.  |          | 8   |

Figure 16

## 6.3 Programming blocks

I have structured the automation tasks in my program in order to increase the transparency of the project. This helps the maintainability of the plant and programming becomes easier. There are four different programming blocks in the TIA Portal. Organization block (OB), Function block (FB), Function (FC), and Data block (DB). The organization block has different types. I used "program cycle" as a main block of my program.

A "program cycle" OB is executed cyclically. In this block we place the instructions that control our application and call additional user blocks.

As I have two cylinders in my project, I wrote my code in a function block and then called it for each cylinder in the main block. We can add more cylinders to this project simply by calling the function block for each of them without needing to repeat the coding.

So, let's start programming in the function block. Function blocks are code blocks that store their values permanently in the instance data blocks, so that they remain available after the block has been executed. In fact, a function block is a combination of a function (FC) with its own data block.

In the project view and from project tree, we click on "add new block". A new tab will be opened where we can create a new function block. I renamed it "Test Program", Figure 17.



Figure 17

## 6.4 Test Program (Function Block)

#### 6.4.1 Network 1

The code in this network prepares the leak test starting conditions, both in the leak test and full test modes. Full test mode is when both wear and leak tests are executed successively. As we can see in the Figure 18, after emergency a "normally closed" contact, there are two parallel lines. In the first line by selecting leak test mode with selector switch and then pushing start button, the leakage testing process will be started. By executing network 1, high pressure valve, distribution valve, anterior and posterior auxiliary valves, and a memory bit (M1) will be set. Then the piston rod moves to out. The second line is related to the leak test when the test bench is in full test mode. The low-pressure valve must not be energized during the leak test. In the leak test program, I have used a memory bit in each network which is set when the execution of the network's code is finished. By setting this memory bit the next network can be executed. Using the "normally closed" contact of M1 in the start path guaranties that there be no disturbance in the testing process if before test completion the start button is activated again.



Figure 18

#### 6.4.2 Network 2

When the cylinder reaches plus end-position, this network will be activated by a sensor out signal. When the timer is activated, the cylinder will be under high pressure for some seconds. Here the timer is set on 10 seconds, Figure 19. Then air paths from both back and front sides will be blocked for 5 seconds by the timer that is placed in the third network.

#### 6.4.3 Network 3

By executing the code in this network, the high-pressure supply will be disconnected. The anterior auxiliary valve will be energized to open the front path. However, the posterior air path will remain in blocked position. The rear chamber memory bit will be set to activate measurements recording in trace function, Figure 20. This step lasts for 30 minutes. The timer that is in charge for doing so is placed in the next network, number 4.



Figure 19



Figure 20

#### 6.4.4 Network 4

The main step for the leakage test last for 30 minutes. When this step is finished, the high pressure and posterior auxiliary valves will be energized, and the distribution valve will be reset. Now the piston rod moves inside. The rear chamber memory bit will be reset to pause the recording, Figure 21.



Figure 21

#### 6.4.5 Network 5

When the piston rod moves inside the cylinder, the timer in network 5 will be activated by a sensor in signal. When the timer is activated, the cylinder will be under high pressure for some seconds. Here the timer is set to 10 seconds, Figure 22. Then the air paths from both back and front sides will be blocked for 5 seconds by the timer that is placed in the next network.





#### 6.4.6 Network 6

By executing the code of this network, the high-pressure supply will be disconnected. The posterior auxiliary valve will be energized to open the backside path. However, the anterior air path will remain in a blocked position. The front chamber memory bit will be set to reactivate the measurements recording in trace function, Figure 23. These are the conditions required to test the leakage in the front chamber.



#### 6.4.7 Network 7

By activating the timer on this network, the main leakage test will start and last for 30 minutes. During this period, the pressure changes will be monitored by the trace function. When the leakage monitoring is finished, all valves and memory bits will be reset at the output of the timer, and the data recording will be stopped by resetting the front chamber memory bit, Figure 24.

#### 6.4.8 Network 8

Network 8 is in charge to execute the wear test and the first step of the full test. By using a selector switch we select wear or full test mode and then by switching the start button, the test process will be started. Using a memory bit M10 helps to make a supporting line to keep the circuit connected after releasing the start button. When the wear sequences reach to the setpoint of the counter, M13 will be set. Then by returning the piston inside the cylinder and setting M7, the wear test process will be terminated, Figure 25.



Figure 24





#### 6.4.9 Network 9

When the test bench is in full test mode, the wear test is started by pressing the start button. The counter in network 9 counts the wear sequences in the full test mode. At the end of wear test, when the test bench switches to the leak test, air supply must be changed from low to high pressure. So, it is necessary that all cylinders finish their wear test first. Then the system is able to change the air supply and move to the leak test. As the movements of two cylinders are not synchronized, they may not finish their wear test process at the same time. Therefore, I defined the conditions in network 9 to guarantee this requirement. The lower parallel line will be activated in case of removing any defective cylinder from test process. This parallel line can bypass the condition in absence of the defective cylinder in the test process. By activating M8 and M14 and their contacts in networks 1 and 8, switching from wear to leak test process will be done automatically, Figure 26.









#### Figure 27

#### 6.4.10 Network 10

In this network there are two counters. The first one counting the wear sequences during wear test and the second one counting the number of complete wear cycles. Each wear cycle is equal to the setpoint of the first counter. In this project each wear cycle contains 30,000 complete wear sequences. The wear cycle counter is set on 32,000, Figure 27.

#### 6.4.11 Network 11

In this network the total number of wear sequences either in wear or full test mode will be shown through the use of the "calculate" function and a mathematical formula, Figure 28.



#### 6.4.12 Network 12

The analog signal which is receiving from the digital manometer is in the form of voltage. We create this network to normalize and scale this analog signal. The minimum and maximum value is depending on the system air pressure, Figure 29.

| • | Network 12: Normalizing & S | caling Analog Pressure S | ignal        |                |                        |                   |
|---|-----------------------------|--------------------------|--------------|----------------|------------------------|-------------------|
|   | Comment                     |                          |              |                |                        |                   |
|   |                             | NORM_X<br>Int to Real    |              |                | SCALE_X<br>Real to Int |                   |
|   | EN                          | ENO -                    |              | EN             | ENO                    |                   |
|   | 0.0 - C MIN                 |                          | #"Normalized | 0.0 - MIN      | TUO                    | — #"Scaled value" |
|   | #Manometer — VALUE          | OUT -                    | value"       | #"Normalized   |                        |                   |
|   | 27648 — MAX                 |                          |              | value" — VALUE |                        |                   |
|   |                             |                          |              | 10.0 - MAX     |                        |                   |
|   |                             |                          |              |                |                        |                   |
|   |                             |                          |              |                |                        |                   |
|   |                             |                          |              |                |                        |                   |
|   |                             |                          | Figure 29    |                |                        |                   |

#### 6.4.13 Network 13

If a piston stuck inside a cylinder or each of sensors is not working properly or if there is any other defect that causes the piston movement to last more than the predefined time, it can be detected in this network. By activating M206 the defective cylinder will be removed from the testing process. Figure 30





#### 6.4.14 Network 14

Network 14 is created to provide safety during all testing modes. If in each step of any testing modes the emergency stop switch is pushed, the working process will be stopped immediately, Figure 31. To resume the test process the emergency stop switch should be released and the reset push button should be pressed. If the piston is stopped in the middle of its path, you should first select the wear test mode switch and then press the reset button.





#### 6.4.15 Network 15

Whenever it is required to reset the testing system, which can be done by pressing the reset push button, the code in network 15 will be executed, Figure 32.

#### Network 15: Reset

Comment

| #Reset |             | #HPV   |
|--------|-------------|--------|
|        |             | (R)    |
|        |             | ()     |
|        |             | #DV    |
|        |             | (R)    |
|        |             | ( )    |
|        |             | #PAV   |
|        |             | (s )   |
|        |             |        |
|        |             | #AAV   |
|        |             | (s )   |
|        |             |        |
|        |             | #M1    |
|        |             | (R)    |
|        |             |        |
|        |             | # M2   |
|        |             | (R)    |
|        |             |        |
|        |             | # M3   |
|        |             | (R)    |
|        |             |        |
|        |             | # M4   |
|        |             | (R)    |
|        |             |        |
|        |             | # M5   |
|        |             | (R)    |
|        |             |        |
|        |             | #M6    |
|        |             | (R)    |
|        |             |        |
|        |             | #M7    |
|        |             | (R)    |
|        |             |        |
|        |             | #MIU   |
|        |             |        |
|        | #"WearTest" | #1 P\/ |
|        |             | #LTV   |
|        |             |        |
|        |             | #M13   |
|        |             |        |
|        |             |        |

Figure 32
## 6.5 Main Block (Organization Block)

The main block in the PLC programming is an organization block which, as I mentioned before, the selected subsection is "program cycle". The first and second networks are in charge to call cylinders function blocks. Network 1 is related to cylinder 1 and the network 2 to the second cylinder.

## 6.5.1 Network 1 & 2

As a way of not having to repeat the programming for each cylinder, we have an option in TIA Portal. We write the main program in a function block and we call this FB for each cylinder in the main block. As seen in Figure 33, there are two types of inputs and outputs. Some of them are common between the two cylinders and some must be used independently. The uncommon I/O comes from different physical addresses. For example, the start switch is common for all cylinders and we use only one start switch that occupies just one physical address. However, we use one manometer for each cylinder individually, so they are uncommon I/O and occupy different physical addresses. For each uncommon signal, we use an independent global tag from the tag table. There is no need to use a physical address tag for common I/O in the first and second networks. However, we create a specific network to define them. In the following pictures, Figures 33 and 34, the first and second networks with all common and uncommon I/O are shown.

#### Network 1: Calling Cylinder 1

Comment



Figure 33





Figure 34

## 6.5.2 Network 3 to 8

In these networks, I have defined the common inputs for all cylinders. Physical selector switch and pushbuttons: Leak test, wear test, full test, start, reset and emergency stop. (Figure 35 and Figure 36)

#### ▼ Network 3: Activating Leak Test Switch For All Cylinders



#### Network 4: Activating Wear Test Switch For All Cylinders



Figure 35



Network 6: Activating Start Switch For All Cylinders



Network 7: Activating Reset Switch For All Cylinders



Network 8: Activating Emergency Stop Switch For All Cylinders







#### 6.5.3 Network 9 to 12

In these networks, I have defined all common outputs to be valid for all cylinders. Highand low-pressure valves, anterior and posterior auxiliary valves, Figure 37.

#### 6.5.4 Network 13

I have created a FC to write codes in order to simulate pressure dropping during the leak test. In network 13 this FC is called. To enable FC1 the test bench has to be in leak or full test modes, Figure 38.



#### 6.5.5 Network 14

During the execution of tests, various errors may occur. There is a specific function in main block which is in charge to detect any possible errors. FC2 is called in this network, Figure 39.

#### Network 14: Alarms

Comment





#### 6.5.6 Network 15

When the piston movement limitation time error occurs, the defective cylinder will be removed from test process by disabling its function block in main OB. To reset this fault, it is essential to execute the related code in the main block because there is no access to the defective cylinder FB as it is disabled, Figure 40.



#### 6.5.7 Network 16

This network provides the required conditions to trigger trace function recording during the leak test. Whenever the individual chambers of the cylinders are under leakage test, its related memory bit is activated. This changes the state of "M0", and data recording starts, Figure 41.



#### 6.5.8 Network 17

This network provides the required conditions to trigger the trace function recording during the wear test in both "wear and full" modes. As shown in figure 42, when we are either in wear or full mode, as soon as pushing the start button, the recording will be started.



#### Figure 42

## 6.6 Alarm Codes (Function 2)

As I mentioned in introduction It is essential to predict possible faults that may occur during each test mode. In this section I used a function named Alarm Codes for this purpose where different errors and proper actions are considered. FCs in comparison with FBs do not occupy the memory for cyclic data storages. So, when it is possible it is better to use the FC instead of a FB to increase the performance speed. As the alarm system is common between all cylinders and have to be provided with actual parameters when called, it can be defined in a FC. To create a new function we use project tree to add a new block, Figure 17. Then in the new function header, we should define the local tags.

#### 6.6.1 Network 1

The first network of this function is related to the air supply pressure. The practical air pressure in this project is 6 bar for low and 10 bar for high pressure. Two digital manometers sense the pressure of both supplies. When the low-pressure air used in the wear test drops from 4 bar and the high-pressure air used in the leak test drops from 8 bar an alarm will be activated in each case, Figure 43.



#### 6.6.2 Network 2

As I explained in previous sections, when a cylinder is removed from the test process due to a defect an alarm will inform operator as well, Figure 44.



#### 6.6.3 Network 3

Monitoring the pressure during leak test is very important because we consider any possible leakage in the cylinders' chambers. If the pressure drops below 8 bar during the leakage test for each chamber, an alarm will be activated for each individually, Figure 45.

## 6.6.4 Network 4

The output in this network will be activated if the emergency stop switch is pressed and an alarm will inform the operator, Figure 46.



Comment



Figure 45





# 6.7 Trace Codes (Function 1)

## 6.7.1 Global data blocks

In order to simulate pressure dropping during the leak test and applying it in the trace function, I have used a function to create the required codes. I could use a function block as well. However, I used a function just to show how we can use it with a global data block. To create a global data block like other programming blocks, double click on "add new block" in the project tree, Figure 17. Variables which are located in global data blocks can be used by all other programming blocks (OB, FB, FC), Figure 47. As I need to use static variables in FC1, first I defined them in the global data block and then I used them in the function codes.



Figure 47

Some advantages of global data blocks are that they allow high-speed access and have a well-structured memory area. In addition, global DBs can be accessed by all other blocks in the user program and the structure of the global DBs can be composed of all data types.

#### 6.7.2 Network 1 to 5

In the first network's code, (U) and (V) are two static variables which are called from Trace.Codes [DB1]. In this code, (V) is a constant that adjusts the rate of pressure dropping. I selected V=0.00001 which can be defined by the user.

I used in the calculation block in the second network and exponential function formula  $y=e^x$ , as I wanted to generate 10 bar as starting pressure in the chamber. To have 10 in output (y),  $y=10=e^x$  so x=ln(y)=ln(10)=2.3025... I used x=2.308 as a start value to have y=10.05 bar inside the chamber.

Network 1: Codes to Generate Pressure Drop Over Time

```
Comment
  1 F "MO" THEN
 2
         // Statement section IF
         "Trace.Codes".U += "Trace.Codes".V ;
 3
    ELSE
 4
         "Cyll.RearChamber.Pressure" := 0 ;
 5
         "Cyl2.RearChamber.Pressure" := 0 ;
 6
         "Cyll.FrontChamber.Pressure" := 0 ;
 7
 8
         "Cyl2.FrontChamber.Pressure" := 0 ;
         "Trace.Codes".U := -2.308 ;
  9
 10 END IF ;
 11
```

Figure 48

When the code: "Trace.Codes".U += "Trace.Codes".V is executed, (U) will be incremented by rate of (V). As a result, the output of the calculation block which simulates the pressure dropping in the chamber, will be decreased by an exponential rate due to the formula output= $\exp(u)=e^{(u)}$ . I need to have a negative value of x=U=-2.308 as a start value and execute y=output= $e^{(-x)}$  to have the decreasing form of an exponential function.



Figure 49

Networks 2 to 5 generate exponential pressure dropping simulation in the rear chamber of cylinder 1, the front chamber of cylinder 1, the rear chamber of cylinder 2 and the front chamber of cylinder 2.

Using SCL for mathematical calculations is very useful, but another possibility is to use the math functions "calculate". I have used both in the trace codes function.

## 6.7.3 Trace Function and Data Recording

In the pneumatic cylinder's lifetime testing, it is crucial to record the data and analyze them. And since the duration of this test may be weeks and months, the importance of storing information becomes much greater. The TIA Portal has a powerful capability for recording and analyzing measurements. In my project I have used trace function for this purpose. These measurements are saved to the device and can then be read and saved permanently. This ability to trace and make logical analysis makes this system well-adapted to monitoring highly dynamic processes. It is also possible to combine signal waves from several measurements and make an overlay measurement. These can then be compared and synchronized. In a last step the measurements on the memory card can also be used in the diagnostic interface on the web server.

In this project the total number of wear sequence during the wear test and the pressure value inside the cylinder's both chambers during the leak test are recorded. For this purpose, I created two separate "traces". "Trace\_Wear.Test" and "Trace\_Leak.Test". Here I will explain how to create and configure the trace function to record and save the measurements for the leakage testing. Tracing process in the wear test including the steps and settings are the same.

To create this part of the program it is necessary to call the trace and logic analyzer function from project tree. By double clicking on the project tree, the section "add new trace", the trace configuration tab will be opened. These settings are important and determine how data is stored. In the trace project tree and under configuration, the signals which need to be recorded are selected. To do so we can call signals from the tag table or the cylinders' data block(s), Figure 50. It is possible to record tags from the different operand areas including process image input, process image output, bit memory, data blocks and I/O devices.

| oject tree 🛛 🕮               | ✓ Project8_V16 	→ PLC_2 [CPU 1           | 515F-2 P   | 'N]  | Traces F Trace               |                  |           |          | _ # =×    | Trace         | <b>n</b> 10   |
|------------------------------|--|------------|------|------------------------------|------------------|-----------|----------|-----------|---------------|---------------|
| Devices                      |  |            |      |                              |                  | Confi     | guration | 🔀 Diagram | Options       |               |
|                              | 1 4 4 8 8 8 8 8 9 9                      | <b>3</b> 3 |      |                              |                  |           |          |           |               |               |
|                              |  |            |      |                              |                  |           |          |           | ✓ Measurer    | ment curso    |
| Cylinder 1 [DB8]             | ▲ Configuration                          | 1          |      |                              |                  |           |          |           | Haritanta     | measuranu     |
| Cylinder 2 [DB9]             | Signals                                  | Signa      | ls _ |                              |                  |           |          |           | Honzoman      | measurenn     |
| Trace.Codes [DB1]            | <ul> <li>Recording conditions</li> </ul> |            |      |                              |                  |           |          |           | ¥1:           |               |
| Technology objects           | Sampling                                 |            |      | Name                         |                  | Data type | Address  | Comment   | Y2:           |               |
| External source files        | Trigger                                  | 1          | -    | "Cyl1.RearChamber.Pressure"  |                  | Real      | %MD18    |           | ΔY: 0.00      | 0             |
| PLC tags                     | Measurements on devic                    | 2          | -    | *Cyl2.RearChamber.Pressure*  |                  | Real      | %MD26    |           |               |               |
| Cell PLC data types          |  | 3          | -0   | *Cyl1.FrontChamber.Pressure* |                  | Real      | %MD22    |           | Vertical m    | easuremen     |
| Watch and force ta           | -  | 4          | -    | "Cyl2.FrontChamber.Pressure" |                  | Real      | %MD30    |           | t1:           |               |
| Online backups               |  | 5          |      | *Cyl2.FrontChamber.Pressure* | Real             | %MD30     |          | ^         | +2.           |               |
| Traces                       |  |            |      | *Cyl2.RearCham.LeakageAlarm* | Bool             | %Q1.3     |          |           |               |               |
| Add new trace                |  |            |      | Cyl2.RearChamber.Pressure*   | Real             | %MD26     |          |           | Δt: 0.00      | 0             |
| Trace                        |  |            |      | Cylinder 1*                  | Instance DB of T | DB8       |          | >> 1      | Intersections | with select   |
| Measurements                 |  |            |      | Cylinder 2*                  | Instance DB of T | DB9       |          | >>        | menseedons    | morseleet     |
| Combined meas                |  |            |      | *DiagStatusUpdate*           | Bool             | %M1.1     |          |           | Y(t1):        |               |
| OPC UA communic              | ~  |            |      | 1 *DV 1*                     | Bool             | %Q0.1     |          |           | Y(t2):        |               |
| Device provideta             |  |            |      | • *DV 2*                     | Bool             | %Q0.5     |          | *         | ΔΥ:           |               |
| Details view                 |  |            |      |                              |                  |           |          |           |               |               |
|                              |  |            |      |                              |                  |           |          |           | Mathematica   | el evaluation |
|                              |  |            |      |                              |                  |           |          |           | AM(Y): 0.00   |               |
|                              |  |            |      |                              |                  |           |          |           | INT(Y): 0.00  | 0             |
| Name Ad                      |  |            | <    |                              |                  | 101       |          |           | BM5(Y)- 0.00  |               |
| *Cyl1.RearChamber.Pressure % | ^  |            |      |                              |                  |           |          |           | 1.0.00        | ~             |

Figure 50

If the main [OB1] is selected under recording conditions for sampling, the program will record the data whenever the main [OB1] is executed. Here the problem is that the duration of the main [OB1] execution is not always the same and will vary in length. To solve this issue, I created another organization block with subsection "cyclic interrupt". By sampling the data with cyclic interrupt, it is possible to record in a time frame. Now we have two options to select time instead of cycle. I set to record every 1 second. This can be further defined by the user according to the specific requirements. By selecting "max recording duration", the program will record continuously to use all memory space. I set recording duration to cover only the leakage testing duration and when each chamber is under high pressure.

The next section is related to the trigger setting. In the trigger mode I select "trigger on tag" and choose a memory bit "M0" from the tag table. This memory bit is placed on network 16 in the main block. "M0" will be activated whenever in leak test mode and when one of the cylinder chambers is under pressure. As I defined the Event equals to True, recording will be started by activating "M0". If it is required to start recording earlier than trigger, it can be set in pre-trigger section by entering the duration time before the trigger as well.

One of the advantages of the trace function in the TIA Portal is its capability of repeating measurements automatically and storing the recorded value in the device retentively. This can be the internal memory of CPU or a memory card. In this case even when there is no connected PC or HMI to the CPU, the trace function is able to record and save the data on the memory card. In the configuration tab, the last part is related to the setting of "Measurements on device (memory card)". There is one important point here. Only when "trigger on tag" is selected in the previous section, is there the possibility to check the

box "save measurements on device", otherwise it is not possible to activate this function. Then we choose the number of measurements and the variety of response when the number of measurements is reached. It can be selected to deactivate recording or to overwrite starting from the oldest recording.

After setting is finished, it is necessary to transfer the trace configuration to the device by clicking on the related icon in the trace toolbar.

The diagram tab displays the selected signals of a recording. Under the curve diagram there is signal table with its setting options.

During the leak test and when the trigger tag becomes active, recording is started. It lasts until the leakage test of first chamber is finished. Then the recording is paused until the next chamber is tested for leakage. By reactivating "M0" for the next chamber, recording resumes immediately. Figure 51

Recordings can be added to the measurements folder on the project tree. This folder can be accessible in both offline and online modes.

When we set the trace configuration to record and save the data on the device memory, this will be done when CPU is in run mode and the program is executing. The big advantage is that the recording function is active in offline mode as well and measurements will be saved on device (memory card). These recorded measurements are accessible on the "Measurements on device (memory card)" folder. This folder is displayed when there is an online connection to the CPU.



Figure 51

In figure 52 the configuration and recording tabs for the wear test is shown. One of the advantages of using the trace function is that even if there is no physical counter in the system, it is possible to count wear cycle and store it in the memory. By switching from online to offline mode, disconnecting the PC from CPU or switching the CPU to the stop mode, these stored measurements will be retained.



Figure 52

#### 6.7.4 Exporting the measurements

When it is required to export the recorded data from the measurements folder in the project or from the device (memory card), it is possible to transfer the measurements as a file with the file extension "\*.ttrecx" or "\*.csv". If we need to export a file which is compatible with Excel, we have to select the "csv" format, Figure 53.

| Save project 📑 🔏 💷 💷 🗙 🌖 🛎 (*                                    |                    | ダ Go online 🚀 Go d | iffline      | X         |              | ch in project> | 1        |               | PORT            |
|--|--------------------|--------------------|--------------|-----------|--------------|----------------|----------|---------------|-----------------|
| ject8_V16 → PLC_2 [CPU 1515F-2 PN] → Tra                         | ces I Measurements | Trace_001 2021     | -03-22 17.2  | 3.38.342  |              |                |          |               | _ • •           |
| 1 * and  |                    |                    |              |           |              |                | <b>1</b> | Configuration | 🔀 Diagram       |
| 3  |                    |                    |              |           |              |                |          |               | E               |
| tus: Recording completed   |                    |                    | _            |           |              |                |          |               |                 |
| Save As  |                    | 3                  | × .          |           |              |                |          |               |                 |
| → 🐘 📩 « Doku → Automation  | ר א Searc          | h Automation       | 2 17.23.38   | .342 [Mea | surements]   |                |          |               |                 |
| Irdna 🔻 Ny mapp  |                    | BE • (             |              |           |              |                |          | Cyl1.RearC    | hamber.Pressure |
| A Name   | Date modified      | Туре               | S            |           |              |                |          |               |                 |
| Trace_001 2021-03-22 17.23.38.342.csv                            | 3/22/2021 6:40 PM  | Microsoft Excel C  |              |           |              |                |          | Cyl2.RearC    | hamber.Pressur  |
| 2  |                    |                    |              |           |              |                |          |               |                 |
| 1  |                    |                    |              |           |              |                |          | Cyl1.FrontC   | hamber.Pressur  |
| e  |                    |                    |              |           |              |                |          |               |                 |
| v <  |                    |                    | >            |           |              |                |          | Cyl2.FrontC   | hamber.Pressur  |
| File name: Trace_001 2021-03-22 17.23.38.342.c                   | sv                 | 5                  |              |           |              |                |          |               |                 |
| Save as type: CSV (comma separated value) (*.csv                 | )                  |                    | 0.667        | 0.75      | 0.833        | 0.917 1        | 1.083    | 1.167         | 1.25            |
| Measurement (*.ttrecx)   |                    |                    | frond        |           |              |                |          | Automatic     |                 |
| CSV (comma separated value) (*.csv<br>Hide Folders               | )                  | Cancer             |              |           |              |                |          |               |                 |
|  |                    |                    |              |           | I I          | 1              | tv       | 1             |                 |
| Signal r Name Data type Disp<br>Data type Disp<br>Data type Disp | ating poi          | Formula            | Color Scalin | ggroup    | Min. Y scale | Max. Y scale   |          | Comment       |                 |
| G ≪ \$4 °Cvl2.RearC Real Flor                                    | ating point %MD26  |                    |              |           | 0            | 10.02504       |          |               |                 |
|  |                    |                    |              |           |              | 10.01017       |          |               |                 |

Figure 53

# Conclusion

In this thesis project a test bench is designed in order to measure the pneumatic cylinders' lifetime. The main objective of the project is programming, data acquisition and automatic control of the entire process.

Siemens' PLC and the TIA Portal are the major cores of the project. I used the TIA Selection Tool to select the required hardware precisely. The main programming language used in the project is LAD, although SCL language is also used for simulating pressure dropping.

During the project I studied how to organize the program, the application of various programming blocks, how to use different data types, diagnostic and troubleshooting.

A new approach is applied in this project for data acquisition, storing and analyzing the test measurement. By using the trace function, it is possible to save the data without needing an additional device. In this way the data is stored in the CPU itself.

With simulation of the program and whole testing process, it is possible to develop the program at low cost and with little effort. In this project FluidSim and PLCSIM Advanced are used to simulate the test bench and control the program. Festo didactic EzOPC software is also used to help to connect FluidSim and TIA Portal. A good program is one that meets all necessary safety conditions and provides easy way for diagnostic and maintenance. It should be as well constructed and understandable as possible. The software used in this project met all these requirements and will become useful for developing and improving the project in the future.

# References

- Siemens Programming Guideline for S7-1200/1500
- Siemens function manual, Simatic/Sinamics using the trace and logic analyzer function Edition 12/2019
- Siemens function manual, Simatic S7-1500 and PLCSIM Advanced Edition 11/2019.
- L. Mazza, "Mechatronic Engineering: Fluid Automation-unit4-Pneumatic Actuators Valves".
- **L**. Mazza, "Mechatronic Engineering: Fluid Automation-unit12
- www.xpneumatic.com/what-are-pneumatic-components
- **www.explainthatstuff.com/pneumatics.html**

# Appendix and Full PLC Codes

In the following section the complete codes and the project data in the TIA Portal are attached.

| Totally Integ<br>Automation | grated<br>Portal        |             |                              |                    |                  |                   |                  |           |   |  |
|-----------------------------|-------------------------|-------------|------------------------------|--------------------|------------------|-------------------|------------------|-----------|---|--|
| Main [OB1                   | ]                       |             |                              |                    |                  |                   |                  |           |   |  |
| Main Propertie              | s                       |             |                              |                    |                  |                   |                  |           |   |  |
| General                     | <u> </u>                |             |                              |                    |                  |                   |                  |           |   |  |
| Name                        | Main                    |             |                              | Numbe              | ٩r               | 1                 |                  |           | Type                                    | OB   |
|                             | LAD                     |             |                              | Numbe              | erina            | Automatic         |                  |           | .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |  |
| Information                 | 2.10                    |             |                              | rtanno             | ling             | ratomatic         |                  |           |   |  |
| Title                       | "Main Progi<br>(Cycle)" | ram Swe     | еер                          | Author             |                  | Alireza.Qao       | diri             |           | Comment                                 | The main OB is executed<br>cyclically. In this block we<br>place the instructions<br>that control our applica-<br>tion and call additional<br>user blocks. |
| Family                      |                         |             |                              | Versio             | n                | 0.1               |                  |           | User-defined<br>ID                      |  |
| Namo                        |                         |             | Data ti                      | (00                | Default          | value             |                  | Comm      | ont                                     |  |
|                             |                         |             | Data ty                      | he                 | Delault          | value             |                  | Commo     | ent                                     |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
| Initial_Ca                  | ll                      |             | Bool                         |                    |                  |                   |                  | Initial c | all of this OB                          |  |
| Remaner                     | ice                     |             | Bool                         |                    |                  |                   |                  | =True,    | if remanent dat                         | a are available  |
| Temp                        |                         |             |                              |                    |                  |                   |                  |           |   |  |
| Constant                    |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    | %DB8<br>"Cylinde | <b>3</b><br>ır 1" |                  |           |   |  |
|                             |                         |             |                              |                    | %FB1             |                   |                  |           |   |  |
|                             |                         | "Cylinder 1 | ".M206                       |                    | "Test Prog       | gram"             |                  |           |   |  |
|                             | -                       |             | false -                      | — EN<br>— Leak Tes | +                | ENO<br>HPV        | false            |           |   | -  |
|                             |                         |             | false -                      | - Wear Te          | st               | LPV               | false            |           |   |  |
|                             |                         |             | false -                      | Full Test          | :                | AAV               | false            |           |   |  |
|                             |                         | "Ser        | % <b>IO.2</b><br>sor in 1" - | - Sonsor i         | n                | PAV               | -talse           |           |   |  |
|                             |                         | 501         | %IO.1                        | Sensor.            |                  | DV                | %Q0.1<br>→"DV 1" |           |   |  |
|                             |                         | "Sens       | or.out 1" -                  | - Sensor.c         | out              |                   |                  |           |   |  |
|                             |                         |             | false -                      | Reset              |                  |                   |                  |           |   |  |
|                             |                         |             | talse -                      | Start<br>Emerge    | ıcv              |                   |                  |           |   |  |
|                             |                         |             | false -                      | Stop               | ,                |                   |                  |           |   |  |
|                             |                         | "Mano       | %IW2                         | Manana             |                  |                   |                  |           |   |  |
|                             |                         | wanto       |                              | IVIAIIUIN          |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
| Network 2:                  | Calling Cy              | linde       | r 2                          |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |
|                             |                         |             |                              |                    |                  |                   |                  |           |   |  |









| Totally Integrated<br>Automation Portal |  |                        |                                 |   |
|---|--|------------------------|---------------------------------|---|
| Network 17: Trace_                      | Near.Test Trigger                                    |                        |                                 |   |
|   | %I0.3 %I<br>"Wear Test" "Sta<br>%I0.6<br>"Full Test" | <b>1.2</b><br>art"<br> | %M8.0<br>"Wear.Counting"<br>{ } | 4 |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |
|   |  |                        |                                 |   |

# Cyclic interrupt [OB30]

| Cyclic interru | pt Properties    |         |        |         |                 |           |                    |   |
|----------------|------------------|---------|--------|---------|-----------------|-----------|--------------------|---|
| General        |                  |         |        |         |                 |           |                    |   |
| Name           | Cyclic interrupt |         | Numb   | er      | 30              |           | Туре               | OB  |
| Language       | LAD              |         | Numb   | ering   | Automatic       |           |                    |   |
| Information    |                  |         |        |         |                 |           |                    |   |
| Title          | Cyclic interrupt |         | Autho  | r       | Alireza. Qadiri |           | Comment            | This Cyclic interrupt OB is<br>created to be used in<br>trace function. No need<br>to write any codes here. |
| Family         |                  |         | Versio | on      | 0.1             |           | User-defined<br>ID |   |
| Name           |                  | Data ty | ype    | Default | t value         | Comm      | ent                |   |
| 🛨 Input        |                  |         |        |         |                 |           |                    |   |
| Initial_C      | Call             | Bool    |        |         |                 | Initial c | all of this OB     |   |
| Event_C        | Count            | Int     |        |         |                 | Events    | discarded          |   |
| Temp           |                  |         |        |         |                 |           |                    |   |
| Constant       |                  |         |        |         |                 |           |                    |   |

| Totally Integ<br>Automation | grated<br>Portal |            |       |            |        |          |  |   |  |               |                            |  |
|-----------------------------|------------------|------------|-------|------------|--------|----------|--|---|--|---------------|----------------------------|--|
| Test Progra                 | am [FI           | 31]        |       |            |        |          |  |   |  | <b>L</b>      |                            |  |
| Test Program P              | roperties        | 5          |       |            |        |          |  |   |  |               |                            |  |
| General                     | T at Droo        |            |       | steensk av | 1      |          |  |   |  |               | 50                         |  |
| Name                        | Iest Prog        | Jram       |       | Number     |        | matic    |  |   | туре                                       |               | FB                         |  |
| Information                 | LAD              |            |       | Numbering  | Auto   | matic    |  |   |  |               |                            |  |
| Title                       | Test Ben         | ch Program |       | Author     | Alire  | za.Qadir | i  |   | Comm                                       | ent           | In this<br>main p<br>bench | Function block the<br>program of the test<br>is written. |
| Family                      |                  |            |       | Version    | 0.1    |          |  |   | User-d<br>ID                               | efined        |                            |  |
| Name                        |                  | Data type  | Defa  | ult value  | Retain |          | Acces-<br>sible<br>from<br>HMI/OP<br>C<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision           | Comment  |
| ✓ Input                     |                  |            |       |            |        |          |  |   |  |               |                            |  |
| Leak Test                   | t                | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| Wear Tes                    | t                | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True<br>_                                  | False         |                            |  |
| Full Test                   |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| Sensor.in                   | 1                | BOOI       | false |            | Non-re | etain    | True   | e<br>Tru  | True                                       | False         |                            |  |
| Sensor.or                   | ut               | ROOI       | Taise |            | Non-re |          | True   | iru<br>e<br>T   | True                                       | Faise         |                            |  |
| Reset                       |                  | BOOI       | false |            | Non-re | etain    | Irue   | l ru<br>e   | Irue                                       | False         |                            |  |
| Start                       |                  | Bool       | false |            | Non-re | etain    | Irue   | l ru<br>e   | Irue                                       | False         |                            |  |
| Emergen                     | cy Stop          | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| Manome                      | ter              | Int        | 0     |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
|                             |                  |            |       |            |        |          |  |   |  |               |                            |  |
| HPV                         |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| LPV                         |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| AAV                         |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| PAV                         |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| DV                          |                  | Bool       | false |            | Non-re | etain    | True   | Tru<br>e  | True                                       | False         |                            |  |
| InOut                       |                  |            |       |            |        |          |  |   |  |               |                            |  |
|                             |                  |            |       |            |        |          |  |   |  |               |                            |  |
|                             |                  |            |       |            |        |          |  |   |  |               |                            |  |

| Totally Integrated<br>Automation Portal |           |               |            |  |   |  |               |                  |         |
|---|-----------|---------------|------------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Default value | Retain     | Acces-<br>sible<br>from<br>HMI/OP<br>C<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| M1                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| M2                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| M3                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| M4                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| M5                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| M6                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| M7                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M8                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M9                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M10                                     | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M11                                     | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M12                                     | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M13                                     | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M14                                     | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| RearChamber                             | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| FrontChamber                            | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| M206                                    | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| Normalized value                        | Real      | 0.0           | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| Scaled value                            | Int       | 0             | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| ➡ Full Test Counter                     | CTU_DINT  |               | Non-retain | True   | e<br>Tru  | True                                       | True          |                  |         |
| CU                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| CD                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| R                                       | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| LD                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
| QU                                      | Bool      | false         | Non-retain | True   | e<br>Tru  | True                                       | False         |                  |         |
|   |           |               |            |  | e   |  |               |                  |         |
|   |           |               |            |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |               |            |  |   |  |               |                  |         |
|---|-----------|---------------|------------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Default value | Retain     | Acces-<br>sible<br>from<br>HMI/OP<br>C<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| QD                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| PV                                      | DInt      | 0             | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| CV                                      | DInt      | 0             | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
|   | CTU_DINT  |               | Non-retain | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| CD                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| R                                       | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| LD                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| QU                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| QD                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| PV                                      | DInt      | 0             | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| CV                                      | DInt      | 0             | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| ✓ Wear Test Cycle<br>Counter            | CTU_DINT  |               | Retain     | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false         | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| CD                                      | Bool      | false         | Retain     | True   | Tru   | True                                       | False         |                  |         |
| R                                       | Bool      | false         | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| LD                                      | Bool      | false         | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| QU                                      | Bool      | false         | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| QD                                      | Bool      | false         | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| PV                                      | DInt      | 0             | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| CV                                      | DInt      | 0             | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| Total Number of<br>Wear Sequence        | DInt      | 0             | Retain     | True   | Tru<br>e  | True                                       | False         |                  |         |
| ▼ Timer 1                               | TON_TIME  |               | Non-retain | True   | Tru<br>e  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | Fals<br>e   | True                                       | False         |                  |         |
|   | !         | 1             | 1          |  | 1   | 1  | 1             |                  |         |
|   |           |               |            |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |               |            |  |   |  |               |                  |         |
|---|-----------|---------------|------------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Default value | Retain     | Acces-<br>sible<br>from<br>HMI/OP<br>C<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| IN                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| Q                                       | Bool      | false         | Non-retain | True   | Fals<br>e   | True                                       | False         |                  |         |
| ▼ Timer 2                               | TON_TIME  |               | Non-retain | True   | Tru<br>e  | True                                       | True          |                  |         |
| РТ                                      | Time      | T#0ms         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 3                               | TON_TIME  |               | Non-retain | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
|   | TON_TIME  |               | Non-retain | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 5                               | TON_TIME  |               | Non-retain | True   | Tru<br>e  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms         | Non-retain | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false         | Non-retain | True   | Tru<br>e  | True                                       | False         |                  |         |
| Q                                       | Bool      | false         | Non-retain | True   | Fals  | True                                       | False         |                  |         |
| ➡ Timer 6                               | TON_TIME  |               | Non-retain | True   | -<br>Tru<br>e   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms         | Non-retain | True   | C<br>Tru<br>e   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms         | Non-retain | True   | -<br>Fals<br>e  | True                                       | False         |                  |         |
|   | ······    | !             | 1          |  | ļ   |  |               |                  | 1       |
|   |           |               |            |  |   |  |               |                  |         |

| IN       Bool       false       Non-retain       True       True       True       False         Q       Bool       false       Non-retain       True       False       Image: Second seco  | IN         Bool         false         Non-retain         True         Fru         True         False         Image: Constant         Image: Constant </th <th></th> <th>Data type</th> <th>Default value</th> <th>Retain</th> <th>Acces-<br/>sible<br/>from<br/>HMI/OP<br/>C<br/>UA/We<br/>b API</th> <th>Wri<br/>ta-<br/>ble<br/>fro<br/>m<br/>HM<br/>I/O<br/>PC<br/>UA/<br/>We<br/>b</th> <th>Visible<br/>in HMI<br/>engi-<br/>neer-<br/>ing</th> <th>Set-<br/>point</th> <th>Super-<br/>vision</th> <th>Comment</th>  |                             | Data type       | Default value | Retain       | Acces-<br>sible<br>from<br>HMI/OP<br>C<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point   | Super-<br>vision | Comment           |
|---|--|-----------------------------|-----------------|---------------|--------------|--|--|--|-----------------|------------------|-------------------|
| Q       Bool       false       Non-retain       True       False       Image: False         r Timer 7       TON_TIME       Non-retain       True       True       True       False       Image:   | Q       Bool       false       Non-retain       True       False       Image: Constant         PT       Time       T#Oms       Non-retain       True       True       True       False       Image: Constant         PT       Time       T#Oms       Non-retain       True       True       False       Image: Constant         ET       Time       T#Oms       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant       Im  | IN                          | Bool            | false         | Non-retain   | True   | Tru  | True                                       | False           |                  |                   |
| Timer 7       TON_TIME       Non-retain       True       False       Image: Constant in the image: Consta  | Timer 7       TON_TIME       Non-retain       True       True       True       True         PT       Time       T#0ms       Non-retain       True       True       False       Image: Second sec | Q                           | Bool            | false         | Non-retain   | True   | e<br>Fals  | True                                       | False           |                  |                   |
| PT       Time       T#0ms       Non-retain       True       False         ET       Time       T#0ms       Non-retain       True       False       Image: Constant         IN       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         work 1: Starting Leak Test       #Start       #M1       #"Wear Test"       #"Full Test"       #HPV         \$Stop?       #'Leak Test"       #Start       #M1       #'Full Test"       #DV       \$Stop?         #M14       #M1       #'Full Test"       #DV       \$Stop?       #M1       #Full Test"       #DV         #M14       #M1       #'Full Test"       #DV       \$Stop?       #M1       #Full         #M14       #M1       #'Full Test"       #DV       \$Stop?       #M1       \$Stop?       #M1         #DV       \$Stop?       \$Stop?       \$Stop?       \$Stop?       \$Stop?       #AV       \$Stop?       \$Stop?         Bool       \$Stop?       \$Stop?  | PT       Time       T#0ms       Non-retain       True       True       False         ET       Time       T#0ms       Non-retain       True       False   | <ul> <li>Timer 7</li> </ul> | TON_TIME        |               | Non-retain   | True   | e<br>Tru   | True                                       | True            |                  |                   |
| ET       Time       T#0ms       Non-retain       True       Fals       True       False         IN       Bool       false       Non-retain       True       Fals       True       False       Image: Constant         Q       Bool       false       Non-retain       True       Fals       True       False       Image: Constant         Q       Bool       false       Non-retain       True       Fals       True       False       Image: Constant         ionstant       Image: Constant       Image: Consta  | ET       Time       T#Oms       Non-retain       True       False       Image: Constant         IN       Bool       false       Non-retain       True       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant         Image: Constant       Image: Constant       Image: Constant       Image: Constant       Image: Constant       Image: Constant         work 1: Starting Leak Test       #Start       #M1       #"Wear Test"       #"Full Test"       #HPV         Image: Constant       Image: Constant       Image: Constant       Image: Constant       Image: Constant       Image: Constant         Image: Constant  | РТ                          | Time            | T#0ms         | Non-retain   | True   | e<br>Tru   | True                                       | False           |                  |                   |
| IN       Bool       false       Non-retain       True       False       Image: Constant         Q       Bool       false       Non-retain       True       False       Image: Constant       Image: Co  | IN         Bool         false         Non-retain         True         True         True         False         Image: Constant         False         Image: Constant         False         Image: Constant         False         Image: Constant  | ET                          | Time            | T#0ms         | Non-retain   | True   | e<br>Fals  | True                                       | False           |                  |                   |
| Q         Bool         false         Non-retain         True         False         Image: Constant           emp         Image: Constant         Image: Constant <t< td=""><td>Q     Bool     false     Non-retain     True     Fals     True     False       emp     Image: Start ing Leak Test     Image: Start ing Leak Test     Image: Start ing Leak Test     #M1     #"Emergency       #"Emergency     #"Leak Test"     #Start     #M1     #"Wear Test"     #HPV       Image: Start ing Leak Test     Image: Start ing Leak Test     Image: Start ing Leak Test     #M1     #"Full Test"     #HPV       Image: Start ing Leak Test     Image: Start ing Leak Test ing Leak Test     Image: Start ing Leak Test ing</td><td>IN</td><td>Bool</td><td>false</td><td>Non-retain</td><td>True</td><td>e<br/>Tru</td><td>True</td><td>False</td><td></td><td></td></t<> | Q     Bool     false     Non-retain     True     Fals     True     False       emp     Image: Start ing Leak Test     Image: Start ing Leak Test     Image: Start ing Leak Test     #M1     #"Emergency       #"Emergency     #"Leak Test"     #Start     #M1     #"Wear Test"     #HPV       Image: Start ing Leak Test     Image: Start ing Leak Test     Image: Start ing Leak Test     #M1     #"Full Test"     #HPV       Image: Start ing Leak Test     Image: Start ing Leak Test ing Leak Test     Image: Start ing Leak Test ing  | IN                          | Bool            | false         | Non-retain   | True   | e<br>Tru   | True                                       | False           |                  |                   |
| remp     remp       Constant     Image: Constant       work 1: Starting Leak Test       #"Emergency       Stop"       #"Leak Test"       #Stop"       #"Leak Test"       #M1       #Wear Test"       #M14       #M14       #"Full Test"       #AAV       (S)       #AAV       (S)       #PAV       (S)       #M1       #PAV       (S)       #ILPV       (R)   | Femp         Image: Constant   | Q                           | Bool            | false         | Non-retain   | True   | e<br>Fals  | True                                       | False           |                  |                   |
| Constant       work 1: Starting Leak Test         #"Emergency       #"Leak Test"         Stop"       #"Leak Test"         #Wild       #M1         #Wild       #M1         #Wild       #Waar Test"         #Waar Test"       #"Full Test"         #M14       #M1         #W14       #M1         #PAV       {\$\$}         #PAV       {\$\$}         #W1       #"Full Test"         #UPV       {\$\$}         #W1       #"Full Test"         #PAV       {\$\$}         #UPV       {\$\$}         #W1       #UPV         #R)       #UPV         #R)       #UPV   | Constant     work 1: Starting Leak Test       #"Emergency<br>Stop"     #"Leak Test"       #"Leak Test"     #Start       #M14     #M1       #"Full Test"       #M14       #M14       #M14       #G       #M14       #M14       #G       #HPV       #AAV       #AAV       #G       #HPV  | emp                         |                 |               |              |  | C  |  |                 |                  |                   |
| #M14 #M1 #"Full Test"<br>#DV<br>(S)<br>#AAV<br>(S)<br>#AAV<br>(S)<br>#PAV<br>(S)<br>#M1<br>(S)<br>#M1<br>(S)<br>#M1<br>(R)<br>#LPV<br>(R)   | #M14 #M1 #"Full Test" #DV<br>+ + + + + + + + + + + + + + + + + + +   | # Emergen<br>Stop"          | =y<br>#"Leak Te | st" #Start    | #M1          | #"Wear 1   | Fest"  | #"Fi                                       | ull Test"<br>VI |                  | €HPV<br>(S}———■   |
| #AAV<br>#PAV<br>#PAV<br>(S)<br>#M1<br>(S)<br>#LPV<br>#LPV<br>(R)  | #AAV<br>(S)<br>#PAV<br>(S)<br>#M1<br>(S)<br>#LPV   |                             | #M14            | #M1           | #"Full Test" |  |  |  |                 |                  | #DV<br>(s)———     |
| #PAV<br>(S)<br>#M1<br>(S)<br>#LPV<br>(R)<br>(R)   | #PAV<br>(S)<br>#M1<br>(S)<br>#LPV  |                             |                 |               |              |  |  |  |                 |                  | (s)——             |
| #M1<br>(S)<br>#LPV<br>(R)<br>   | #M1<br>{(s)<br>#LPV  |                             |                 |               |              |  |  |  |                 | #                | ŧΡΑV<br>( S )──── |
| #LPV<br>{ R }   | #LPV   |                             |                 |               |              |  |  |  |                 |                  | #M1<br>(s)        |
| , K ,   |  |                             |                 |               |              |  |  |  |                 | #                | #LPV              |
|   | ·  |                             |                 |               |              |  |  |  |                 |                  |                   |












| Totally Integ       | prated      |                              |                       |                |                             |                |                    |  |
|---------------------|-------------|------------------------------|-----------------------|----------------|-----------------------------|----------------|--------------------|--|
| Automation          | Portal      |                              |                       |                |                             |                |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |
| Trace Cod           | es [FC1]    |                              |                       |                |                             |                |                    |  |
| Trace Codes Pr      | operties    |                              |                       |                |                             |                |                    |  |
| General             | operties    |                              |                       |                |                             |                |                    |  |
| Name                | Trace Codes |                              | Numbe                 | r              | 1                           |                | Туре               | FC   |
| Language            | LAD         |                              | Numbe                 | ring           | Automatic                   |                |                    |  |
| Information         |             | f                            | Andhan                |                |                             |                | <b>C</b>           | Leaders for all and a  |
| Litle               | dropping    | of pressure                  | Author Alireza.Qadiri |                |                             |                | Comment            | In this function the codes<br>needed to simulate pres-<br>sure dropping during the<br>leak test is written. The<br>value of the pressure will<br>be recorded by "Trace<br>Function". |
| Family              |             |                              | Version               |                | 0.1                         |                | User-defined<br>ID |  |
| Name                |             | Data ty                      | /pe l                 | Default        | t value                     | Comme          | ent                |  |
| Input               |             |                              |                       |                |                             |                |                    |  |
| Output              |             |                              |                       |                |                             |                |                    |  |
| InOut               |             |                              |                       |                |                             |                |                    |  |
| Temp                |             |                              |                       |                |                             |                |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |
|                     |             | ) / a : al                   |                       |                |                             |                |                    |  |
| Network 1:          | Codes to (  | Generate P                   | ressure               | Drop           | Over Time                   |                |                    |  |
| 0001 IF "M          | O" THEN     |                              |                       |                |                             |                |                    |  |
| 0002 /              | / Stateme   | ent sectio                   | on IF                 | ~              |                             |                |                    |  |
| 0003 "<br>0004 ELSE | Trace.Co    | des".U +=                    | = "Tra                | ce.Cc          | des".V ;                    |                |                    |  |
| 0005 "              | Cyl1.Rea:   | rChamber.                    | Pressu                | re" :          | = 0 ;                       |                |                    |  |
| 0006 "              | Cyl2.Rea:   | rChamber.                    | Pressu                | re" :          | = 0 ;                       |                |                    |  |
| 0007 "              | Cyll.From   | ntChamber                    | .Press                | ure"           | := 0 ;                      |                |                    |  |
| 0008 "              | Trace.Co    | des".U :=                    | -2.30                 | ure"<br>8 :    | := 0 ;                      |                |                    |  |
| 0010 END_I          | F ;         |                              | 2.00                  | <b>°</b> ,     |                             |                |                    |  |
| 0011                |             |                              |                       |                |                             |                |                    |  |
| Network 2:          | Exponenti   | ial Pressure                 | Drop S                | Simul          | ationCyl1.Rea               | arCham         | ıber               |  |
|                     |             |                              |                       |                |                             |                |                    |  |
|                     |             | "Cylinder 1".<br>RearChamber |                       | CALCUI<br>Real | ATE                         |                |                    |  |
|                     | -           |                              | EN                    |                | ENO                         |                |                    |  |
|                     |             |                              | C                     | )UT := E)      | (P(-IN1)                    |                |                    |  |
|                     |             | "Trace.Codes".U -            | IN1 👍                 |                | <mark>%MD1</mark><br>"Cyl1. | 8              |                    |  |
|                     |             |                              |                       |                | OUT -Pressu                 | namber.<br>re" |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |
|                     | I           |                              |                       |                |                             |                |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |
|                     |             |                              |                       |                |                             |                |                    |  |



| Totally Integ     | Jrated                    |         |         |         |                 |       |                    |  |
|-------------------|---------------------------|---------|---------|---------|-----------------|-------|--------------------|--|
| Automation        | Portal                    |         |         |         |                 |       |                    |  |
|                   | I                         |         |         |         |                 |       | I                  |  |
|                   |                           |         |         |         |                 |       |                    |  |
| Alarm Cod         | es [FC2]                  |         |         |         |                 |       |                    |  |
| Alarm Codos B     | roportios                 |         |         |         |                 |       |                    |  |
| General           | operties                  |         |         |         |                 |       |                    |  |
| Name              | Alarm Codes               |         | Numbe   | er      | 2               |       | Туре               | FC   |
| Language          | LAD                       |         | Numbe   | ering   | Automatic       |       |                    |  |
| Information       |                           |         |         |         |                 |       |                    |  |
| Title             | Alarms                    |         | Author  |         | Alireza. Qadiri |       | Comment            | The instruction related to<br>the different errors and<br>system failure is written<br>in this function. |
| Family            |                           |         | Version | n       | 0.1             |       | User-defined<br>ID |  |
| Name              |                           | Data ty | /ne     | Default | value           | Comme | ant                |  |
| ✓ Input           |                           | Dutaty  | μς      | Derdalt | Vilac           |       |                    |  |
| Leak Test         |                           | Bool    |         |         |                 |       |                    |  |
| Wear Tes          | :<br>:t                   | Bool    |         |         |                 |       |                    |  |
| Emergen           | cv.Stop                   | Bool    |         |         |                 |       |                    |  |
| Manome            | ter.HPS                   | Int     |         |         |                 | _     |                    |  |
| Manome            | anometer.LPS Int          |         |         |         |                 |       |                    |  |
| Cyl1.Rear         | Cyl1.RearChamber.Pressure |         |         |         |                 |       |                    |  |
| Cyl1.Fror<br>sure | 1tChamber.Pres-           | Real    |         |         |                 |       |                    |  |
| Cyl2.Rear         | r Chamber. Pressure       | Real    |         |         |                 |       |                    |  |
| Cyl2.Fror         | itChamber.Pres-           | Real    |         |         |                 |       |                    |  |
| sure              |                           |         |         |         |                 |       |                    |  |
| ✓ Output          |                           |         |         |         |                 |       |                    |  |
| LPS.Press         | ureAlarm                  | Bool    |         |         |                 |       |                    |  |
| HPS.Press         | sureAlarm                 | Bool    |         |         |                 |       |                    |  |
| Cyl1.Dete         | ectAlarm                  | Bool    |         |         |                 |       |                    |  |
| Cyl2.Dete         |                           | BOOI    |         |         |                 |       |                    |  |
| larm              |                           | BUUI    |         |         |                 |       |                    |  |
| Cyl2.Reai<br>larm | rCham.LeakageA-           | BOOI    |         |         |                 |       |                    |  |
| Cyl1.Fror<br>larm | 1tCham.LeakageA-          | Bool    |         |         |                 |       |                    |  |
| Cyl2.Fror<br>larm | 1tCham.LeakageA-          | Bool    |         |         |                 |       |                    |  |
| Emergen           | cy.StopAlarm              | Bool    |         |         |                 |       |                    |  |
| InOut             |                           |         |         |         |                 |       |                    |  |
| Temp              |                           |         |         |         |                 |       |                    |  |
| Constant          |                           |         |         |         |                 |       |                    |  |
| ➡ Return          |                           |         |         |         |                 |       |                    |  |
| Alarm Co          | des                       | Void    |         |         |                 |       |                    |  |
| Network 1: 9      | Supply Pressur            | e Alar  | ms      |         |                 |       |                    |  |



| Totally Integrated<br>Automation Portal |                                       |                      |
|---|---------------------------------------|----------------------|
| Network 4: Emergen                      | cy Stop Alarm                         |                      |
|   | #"Emergency. #"Emerg<br>Stop" StopAla | jency.<br>arm"<br>}f |
|   |                                       | ]                    |
|   |                                       |                      |
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|   | Т                                     |                      |

|                             |                  | _         |                     |         |                 |  |   |  |               |                  |   |  |
|-----------------------------|------------------|-----------|---------------------|---------|-----------------|--|---|--|---------------|------------------|---|--|
| Totally Integ<br>Automation | grated<br>Portal |           |                     |         |                 |  |   |  |               |                  |   |  |
| Trace.Codes [DB1]           |                  |           |                     |         |                 |  |   |  |               |                  |   |  |
| Trace.Codes Pr              | operties         |           |                     |         |                 |  |   |  |               |                  |   |  |
| General                     |                  |           |                     |         |                 |  |   |  |               |                  |   |  |
| Name                        | Trace.Cod        | es        |                     | Number  | 1               |  |   |  | Туре          |                  | DB  |  |
| Language                    | DB Numbering     |           |                     |         | Autor           | natic  |   |  |               |                  |   |  |
| Information                 |                  |           |                     |         |                 |  |   |  |               |                  |   |  |
| Title                       | Global Da        | ta Block  |                     | Author  | Alireza. Qadiri |  |   |  | Comment       |                  | This global data block is<br>ceated to provide static<br>variables which is used in<br>FC1. |  |
| Family                      |                  |           |                     | Version | 0.1             |  |   |  | User-de<br>ID | fined            |   |  |
| Name                        |                  | Data type | ta type Start value |         |                 | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment   |  |
| ✓ Static                    |                  |           |                     |         |                 |  |   |  |               |                  |   |  |
| U                           |                  | Real      | -2.30               | 8       | False           | True   | Tru   | True                                       | False         |                  |   |  |

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Tru True

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Real

1.0E-05

| Totally Integrated<br>Automation Portal |                       |           |       |            |        |  |   |  |               |                  |         |  |
|---|-----------------------|-----------|-------|------------|--------|--|---|--|---------------|------------------|---------|--|
| Cylinder 1                              | [DB8]                 |           |       |            |        |  |   |  |               |                  |         |  |
| Cylinder 1 Prop                         | erties                |           |       |            |        |  |   |  |               |                  |         |  |
| General                                 | Culindan              | 1         |       | Numer      |        |  |   |  |               |                  |         |  |
| Name                                    | Cylinder<br>DB        | 1         |       | Number 8 I |        |  |   |  |               | Туре DB          |         |  |
| Information                             | 00                    |           |       | Rumbering  | rator  | nutie  |   |  |               |                  |         |  |
| Title                                   | Cylinder <sup>-</sup> | 1         |       | Author     | Alirez | a.Qadiri   |   |  | Comme         | ent              |         |  |
| Family                                  |                       |           |       | Version    | 0.1    |  |   |  | User-de<br>ID | efined           |         |  |
| Name                                    |                       | Data type | Start | value      | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |  |
| 🛨 Input                                 |                       |           |       |            |        |  |   |  |               |                  |         |  |
| Leak Test                               | :                     | Bool      | false |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| Wear Tes                                | t                     | Bool      | false |            | False  | True   | e<br>Tru<br>e   | True                                       | False         |                  |         |  |
| Full Test                               |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| Sensor.in                               |                       | Bool      | false |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| Sensor.ou                               | ut                    | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| Reset                                   |                       | Bool      | false |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| Start                                   |                       | Bool      | false |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| Emergen                                 | cy Stop               | Bool      | false |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| Manome                                  | ter                   | Int       | 0     |            | False  | True   | Tru   | True                                       | False         |                  |         |  |
| ▼ Output                                |                       |           |       |            |        |  |   |  |               |                  |         |  |
| HPV                                     |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| LPV                                     |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| AAV                                     |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| PAV                                     |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| DV                                      |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
| InOut                                   |                       |           |       |            |        |  |   |  |               |                  |         |  |
| ▼ Static                                |                       |           |       |            |        |  |   |  |               |                  |         |  |
| M1                                      |                       | Bool      | false |            | False  | True   | Tru<br>e  | True                                       | False         |                  |         |  |
|   |                       | 1         | ļ     |            | !      |  | 1   | 1  | 1             |                  | 1       |  |
|   |                       |           |       |            |        |  |   |  |               |                  |         |  |
|   |                       |           |       |            |        |  |   |  |               |                  |         |  |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| M2                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M3                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M4                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M5                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M6                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M7                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M8                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M9                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M10                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M11                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M12                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M13                                     | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M14                                     | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| RearChamber                             | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| FrontChamber                            | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M206                                    | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| Normalized value                        | Real      | 0.0         | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| Scaled value                            | Int       | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ✓ Full Test Counter                     | CTU_DINT  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| R                                       | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
|   |           |             |        | !  |   | !  | !             | ·<br>            | ·       |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| PV                                      | DInt      | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ✓ Wear Test Counter                     | CTU_DINT  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| R                                       | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| PV                                      | DInt      | 0           | False  | True   | Tru   | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | False  | True   | Tru   | True                                       | False         |                  |         |
| ✓ Wear Test Cycle<br>Counter            | CTU_DINT  |             | True   | True   | Tru   | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| R                                       | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| PV                                      | DInt      | 0           | True   | True   | Tru   | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| Total Number of                         | DInt      | 0           | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| Timer 1                                 | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
|   |           |             |        |  | е   |  |               | <b> </b>         |         |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |         |
| ➡ Timer 2                               | TON_TIME  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 3                               | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| ▼ Timer 4                               | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 5                               | TON_TIME  |             | False  | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ➡ Timer 6                               | TON_TIME  |             | False  | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
|   |           |             |        |  | e   |  |               | <br>             |         |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |           |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|-----------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | · Comment |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |
| ▼ Timer 7                               | TON_TIME  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |           |
| PT                                      | Time      | T#0ms       | False  | True   | Tru<br>e  | True                                       | False         |                  |           |
| ET                                      | Time      | T#0ms       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |
| IN                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |           |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |

| Totally Integrated<br>Automation Portal |          |           |       |           |            |  |   |  |               |                  |         |
|---|----------|-----------|-------|-----------|------------|--|---|--|---------------|------------------|---------|
| Cylinder 2                              | [DB9]    |           |       |           |            |  |   |  |               |                  |         |
| Cylinder 2 Prop                         | perties  |           |       |           |            |  |   |  |               |                  |         |
| General                                 | Culinder | า         |       | Number    | 0          |  |   |  | Turne         |                  | DR      |
| Name                                    |          | Ζ         |       | Number    | 9<br>Autor | natic  |   |  | туре          |                  | DR      |
| Information                             | DB       |           |       | Numbering | Autor      | natic  |   |  |               |                  |         |
| Title                                   | Cylinder | 2         |       | Author    | Alirez     | a.Oadiri   |   |  | Comme         | ent              |         |
| Family                                  |          |           |       | Version   | 0.1        |  |   |  | User-de<br>ID | efined           |         |
| Name                                    |          | Data type | Start | value     | Retain     | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
|   |          |           |       |           |            |  |   |  |               |                  |         |
| Leak Test                               | t        | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Wear Tes                                | st       | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Full Test                               |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Sensor.ir                               | ١        | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Sensor.o                                | ut       | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Reset                                   |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Start                                   |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Emergen                                 | icy Stop | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| Manome                                  | ter      | Int       | 0     |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
|   |          |           |       |           |            |  |   |  |               |                  |         |
| HPV                                     |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| LPV                                     |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| AAV                                     |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| PAV                                     |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| DV                                      |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
| InOut                                   |          |           |       |           |            |  | -   |  |               |                  |         |
| ▼ Static                                |          |           |       |           |            |  |   |  |               |                  |         |
| M1                                      |          | Bool      | false |           | False      | True   | Tru<br>e  | True                                       | False         |                  |         |
|   |          | 1         | 1     |           | <u> </u>   | 1  | 1-  | <u> </u>                                   | <u> </u>      |                  |         |
|   |          |           |       |           |            |  |   |  |               | Г                |         |
|   |          |           |       |           |            |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| M2                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M3                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M4                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M5                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M6                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M7                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M8                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M9                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M10                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M11                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M12                                     | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| M13                                     | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M14                                     | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| RearChamber                             | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| FrontChamber                            | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| M206                                    | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| Normalized value                        | Real      | 0.0         | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| Scaled value                            | Int       | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ✓ Full Test Counter                     | CTU_DINT  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| R                                       | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
|   |           |             |        | !  |   | !  | !             | ·<br>            | ·       |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| PV                                      | DInt      | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ✓ Wear Test Counter                     | CTU_DINT  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| R                                       | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| PV                                      | DInt      | 0           | False  | True   | Tru   | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | False  | True   | Tru   | True                                       | False         |                  |         |
| ✓ Wear Test Cycle<br>Counter            | CTU_DINT  |             | True   | True   | Tru   | True                                       | True          |                  |         |
| CU                                      | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| CD                                      | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| R                                       | Bool      | false       | True   | True   | Tru   | True                                       | False         |                  |         |
| LD                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| QU                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| QD                                      | Bool      | false       | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| PV                                      | DInt      | 0           | True   | True   | Tru   | True                                       | False         |                  |         |
| CV                                      | DInt      | 0           | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| Total Number of                         | DInt      | 0           | True   | True   | e<br>Tru  | True                                       | False         |                  |         |
| Timer 1                                 | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
|   |           |             |        |  | е   |  |               | <b> </b>         |         |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |         |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|---------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | Comment |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |         |
| ➡ Timer 2                               | TON_TIME  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 3                               | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | e<br>Tru  | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | e<br>Fals   | True                                       | False         |                  |         |
| ▼ Timer 4                               | TON_TIME  |             | False  | True   | e<br>Tru  | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ▼ Timer 5                               | TON_TIME  |             | False  | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru<br>e  | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
| Q                                       | Bool      | false       | False  | True   | Fals  | True                                       | False         |                  |         |
| ➡ Timer 6                               | TON_TIME  |             | False  | True   | Tru   | True                                       | True          |                  |         |
| PT                                      | Time      | T#0ms       | False  | True   | Tru   | True                                       | False         |                  |         |
| ET                                      | Time      | T#0ms       | False  | True   | Fals  | True                                       | False         |                  |         |
| IN                                      | Bool      | false       | False  | True   | Tru   | True                                       | False         |                  |         |
|   |           |             |        |  | e   |  |               | <br>             |         |
|   |           |             |        |  |   |  |               |                  |         |

| Totally Integrated<br>Automation Portal |           |             |        |  |   |  |               |                  |           |
|---|-----------|-------------|--------|--|---|--|---------------|------------------|-----------|
| Name                                    | Data type | Start value | Retain | Acces-<br>sible<br>from<br>HMI/O<br>PC<br>UA/We<br>b API | Wri<br>ta-<br>ble<br>fro<br>m<br>HM<br>I/O<br>PC<br>UA/<br>We<br>b<br>API | Visible<br>in HMI<br>engi-<br>neer-<br>ing | Set-<br>point | Super-<br>vision | · Comment |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |
| ▼ Timer 7                               | TON_TIME  |             | False  | True   | Tru<br>e  | True                                       | True          |                  |           |
| PT                                      | Time      | T#0ms       | False  | True   | Tru<br>e  | True                                       | False         |                  |           |
| ET                                      | Time      | T#0ms       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |
| IN                                      | Bool      | false       | False  | True   | Tru<br>e  | True                                       | False         |                  |           |
| Q                                       | Bool      | false       | False  | True   | Fals<br>e   | True                                       | False         |                  |           |

## Default tag table [108]

| con | Name                                  | Data type | Address | Visible in HMI en-<br>gineering | Accessible from<br>HMI/OPC UA/Web<br>API | Comment |
|-----|---------------------------------------|-----------|---------|---------------------------------|--|---------|
| •   | AAV                                   | Bool      | %Q0.2   | True                            | True                                     |         |
|     | AlwaysFALSE                           | Bool      | %M1.3   | True                            | True                                     |         |
|     | AlwaysTRUE                            | Bool      | %M1.2   | True                            | True                                     |         |
|     | Clock_0.5Hz                           | Bool      | %M0.7   | True                            | True                                     |         |
|     | Clock_0.625Hz                         | Bool      | %M0.6   | True                            | True                                     |         |
| E.  | Clock_1.25Hz                          | Bool      | %M0.4   | True                            | True                                     |         |
| E.  | Clock_1Hz                             | Bool      | %M0.5   | True                            | True                                     |         |
|     | Clock_2.5Hz                           | Bool      | %M0.2   | True                            | True                                     |         |
| E.  | Clock_2Hz                             | Bool      | %M0.3   | True                            | True                                     |         |
| E.  | Clock_5Hz                             | Bool      | %M0.1   | True                            | True                                     |         |
|     | Clock_10Hz                            | Bool      | %M0.0   | True                            | True                                     |         |
| E.  | Clock_Byte                            | Byte      | %MB0    | True                            | True                                     |         |
| E   | Cyl1.DefectA-<br>larm                 | Bool      | %Q1.0   | True                            | True                                     |         |
|     | Cyl1.Front-<br>Cham.Leaka-<br>geAlarm | Bool      | %Q1.4   | True                            | True                                     |         |
|     | Cyl1.FrontCh-<br>amber.Pres-<br>sure  | Real      | %MD22   | True                            | True                                     |         |
| •   | Cyl1.Rear-<br>Cham.Leaka-<br>geAlarm  | Bool      | %Q1.2   | True                            | True                                     |         |
| œ   | Cyl1.Rear-<br>Chamber.Pres-<br>sure   | Real      | %MD18   | True                            | True                                     |         |
|     | Cyl2.DefectA-<br>larm                 | Bool      | %Q1.1   | True                            | True                                     |         |
|     | Cyl2.Front-<br>Cham.Leaka-<br>geAlarm | Bool      | %Q1.5   | True                            | True                                     |         |
| ••• | Cyl2.FrontCh-<br>amber.Pres-<br>sure  | Real      | %MD30   | True                            | True                                     |         |
| •   | Cyl2.Rear-<br>Cham.Leaka-<br>geAlarm  | Bool      | %Q1.3   | True                            | True                                     |         |
| •   | Cyl2.Rear-<br>Chamber.Pres-<br>sure   | Real      | %MD26   | True                            | True                                     |         |
| Œ   | DiagStatusUp-<br>date                 | Bool      | %M1.1   | True                            | True                                     |         |
|     | DV 1                                  | Bool      | %Q0.1   | True                            | True                                     |         |
|     | DV 2                                  | Bool      | %Q0.5   | True                            | True                                     |         |
| (T) | Emergen-<br>cy.Stop                   | Bool      | %10.7   | True                            | True                                     |         |

| Totall<br>Auton | y Integrated<br>nation Portal |           |         |                                 |  |         |
|-----------------|-------------------------------|-----------|---------|---------------------------------|--|---------|
| lcon            | Name                          | Data type | Address | Visible in HMI en-<br>gineering | Accessible from<br>HMI/OPC UA/Web<br>API | Comment |
| -00             | Emergen-<br>cy.StopAlarm      | Bool      | %Q1.6   | True                            | True                                     |         |
|                 | FirstScan                     | Bool      | %M1.0   | True                            | True                                     |         |
|                 | Full Test                     | Bool      | %I0.6   | True                            | True                                     |         |
| -11             | Full Test Coun-<br>ter Reset  | Bool      | %M10.6  | True                            | True                                     |         |
| -0              | HPS.PressureA-<br>larm        | Bool      | %Q0.7   | True                            | True                                     |         |
|                 | HPV                           | Bool      | %Q0.0   | True                            | True                                     |         |
| -01             | Leak Test                     | Bool      | %I0.0   | True                            | True                                     |         |
| -               | LPS.PressureA-<br>larm        | Bool      | %Q0.6   | True                            | True                                     |         |
|                 | LPV                           | Bool      | %Q0.4   | True                            | True                                     |         |
|                 | MO                            | Bool      | %M1.4   | True                            | True                                     |         |
| -0              | M206                          | Bool      | %M1.5   | True                            | True                                     |         |
| -0              | Manometer 1                   | Int       | %IW2    | True                            | True                                     |         |
|                 | Manometer 2                   | Int       | %IW4    | True                            | True                                     |         |
| -0              | Manome-<br>ter.HPS            | Int       | %IW8    | True                            | True                                     |         |
| -0              | Manome-<br>ter.LPS            | Int       | %IW6    | True                            | True                                     |         |
| -0              | Normalized<br>value 1         | Real      | %MD0    | True                            | True                                     |         |
| -00             | Normalized value 2            | Real      | %MD12   | True                            | True                                     |         |
| -00             | PAV                           | Bool      | %Q0.3   | True                            | True                                     |         |
| -0              | Reset                         | Bool      | %I1.1   | True                            | True                                     |         |
| -01             | Scaled value 1                | Int       | %MW1    | True                            | True                                     |         |
| -00             | Scaled value 2                | Int       | %MW6    | True                            | True                                     |         |
| -00             | Sensor.in 1                   | Bool      | %10.2   | True                            | True                                     |         |
|                 | Sensor.in 2                   | Bool      | %I1.4   | True                            | True                                     |         |
| -83             | Sensor.out 1                  | Bool      | %I0.1   | True                            | True                                     |         |
| -               | Sensor.out 2                  | Bool      | %I1.3   | True                            | True                                     |         |
|                 | Start                         | Bool      | %I1.2   | True                            | True                                     |         |
| -83             | System_Byte                   | Byte      | %MB1    | True                            | True                                     |         |
| -0              | Wear Test                     | Bool      | %10.3   | True                            | True                                     |         |
| -0              | Wear.Counting                 | Bool      | %M8.0   | True                            | True                                     |         |

| Totally Integrated<br>Automation Portal                                 |  |                             |  |
|---|--|-----------------------------|--|
| Local module<br>PLC_2 [CPU 151  | s<br>5F-2 PN]                          |                             |  |
| PLC_2   |  |                             |  |
| General\Project inform  | nation                                 |                             |  |
| Name  | PLC_2                                  | Author                      | Alireza.Qadiri   |
| Comment   |  | Rack                        | 0  |
| Slot  | 1                                      |                             |  |
| Short designation   | CPU 1515F-2 PN                         | Description                 | Fail-safe CPU with display; work mem-<br>ory 750 KB code and 3 MB data; can<br>be used for safety applications; sup-<br>ports consistent safety upload; sup-   |
|   |  |                             | ports consistent safety upload, sup-<br>ports PROFIsafe V2; 30 ns bit opera-<br>tion time; 5-stage protection concept,<br>technology functions: motion control,<br>closed-loop control, counting and<br>measuring; tracing; Runtime options;<br>isochronous mode (central); for all<br>PROFINET interfaces: transport proto-<br>col TCP/IP, secure Open User Commu-<br>nication, S7 communication, S7 rout-<br>ing, IP forwarding, Web server, DNS<br>client, OPC UA: Server DA, Client DA,<br>methods, companion specifications;<br>1st interface: PROFINET IO controller,<br>supports RT/IRT, performance upgrade<br>PROFINET V2.3, 2 ports, I-Device, MRP,<br>MRPD, isochronous mode; 2nd inter-<br>face: PROFINET IO controller, supports<br>RT, I-Device; firmware V2.8 |
| Article number  | 6ES7 515-2FM02-0AB0                    | Firmware version            | V2.8   |
| <b>General</b> \Identification  | & Maintenance                          |                             |  |
| Plant designation   |  | Location identifier         |  |
| Installation date   | 2020-12-12 12:56:51.087                | Additional informa-<br>tion |  |
| General\Checksums   |  | c. ()                       |  |
| Text lists  | FA 70 E8 75 1D 5A 8E 29                | Software                    | Not available (compile necessary)  |
| Fail-safe F-activation  | 0                                      |                             |  |
|   |  |                             |  |
| Central F-source ad-  | 1                                      | Default F-monitoring        | 150ms  |
| Fail-safe\F-narameters  |  | ROElsafe address type 1     |  |
| Low limit for F-desti-  | 1                                      | High limit for F-desti-     | 99   |
| nation addresses  |  | nation addresses            |  |
| PROFINET interface [X   | 1]\General                             |                             |  |
| Name  | PROFINET interface_1                   | Author                      | hamgha0625   |
| Comment   |  |                             |  |
| PROFINET interface [X<br>Default F-monitoring<br>time for F-I/O of this | 1 J\F-parameters<br>150ms              |                             |  |
| interface   |  |                             |  |
| PROFINET interface [X   | 1]\Ethernet addresses\Interface n      | etworked with               |  |
| Subnet:   | PN/IE_1                                |                             |  |
| PROFINET interface [X   | 1]\Ethernet addresses\IP protocol      |                             |  |
| IP configuration  | IF address is set directly at the devi | ce                          |  |
|   |  |                             |  |

| Automation Portai   |   |   |                                   |  |  |  |
|---|---|---|-----------------------------------|--|--|--|
| PROFINET interface [X   | 1]\Ethernet addresses\PROFINET  |   |                                   |  |  |  |
| PROFINET device<br>name is set directly at<br>the device            | False   | Generate PROFINET<br>device name auto-<br>matically                 | True                              |  |  |  |
| PROFINET device<br>name:  | plc_2.profinet interface_1  | Converted name:   | plcxb2.profinetxainterfacexb1fc88 |  |  |  |
| Device number:  | 0   |   |                                   |  |  |  |
| PROFINET interface [X   | 1]\Time-of-day synchronization\NTP n  | node  |                                   |  |  |  |
| Note  | Time synchronization for all PROFINET<br>interfaces take place within the set-<br>tings for time synchronization of the<br>PROFINET interface [X1]. | Enable time synchro-<br>nization via NTP serv-<br>er                | False                             |  |  |  |
|   | IP addresses  | Server 1  | 0.0.0.0                           |  |  |  |
| Server 2  | 0.0.0.0   | Server 3  | 0.0.0.0                           |  |  |  |
| Server 4  | 0.0.0.0   | Update interval   | 10s                               |  |  |  |
| PROFINET interface [X]  | 1)\Operating mode   | <b></b>   |                                   |  |  |  |
| 1 Nor inter interface [X  |   | IO system   |                                   |  |  |  |
|   |   |   |                                   |  |  |  |
| Device number   | 0   | IO device   | Faise                             |  |  |  |
| PROFINET interface [X   | 1]\Advanced options\Interface option  | S   |                                   |  |  |  |
| Call the user program<br>if communication er-<br>rors occur         | False   | Support device re-<br>placement without<br>exchangeable medi-<br>um | True                              |  |  |  |
| Permit overwriting of<br>device names of all<br>assigned IO devices | False   | Limit data infeed into the network                                  | True                              |  |  |  |
| Use IEC V2.2 LLDP<br>mode   | False   | Keep-Alive connec-<br>tion monitoring:                              | 30s                               |  |  |  |
| PROFINET interface [X   | 1]\Advanced options\Media redundar  | псу   |                                   |  |  |  |
| MRP domain  | mrpdomain-1   | Media redundancy role:  | Not device in the ring            |  |  |  |
| PROFINET interface [X   | 1]\Advanced options\Real time settin  | gs\IO communication   |                                   |  |  |  |
| Send clock:   | 1.000ms   |   |                                   |  |  |  |
| PROFINET interface [X   | 1]\Advanced options\Real time settin  | gs\Synchronization  |                                   |  |  |  |
| Svnc domain:  | Sync-Domain 1   | Synchronization role:   | Unsynchronized                    |  |  |  |
| RT class:   |   |   |                                   |  |  |  |
| DDOFINET interface [V   | 1) Advenced entione) Deal time cottin   | a) Deal time antions  |                                   |  |  |  |
| PROFINET Interface [X   | I JAdvanced options\keal time setting   | gs\keal time options  |                                   |  |  |  |
| Calculated bandwidth  | 0.000ms   | Calculated bandwidth  | 0.000%                            |  |  |  |
| for cyclic IO data:   |   | for cyclic IO data:   |                                   |  |  |  |
| PROFINET interface [X   | 1]\Advanced options\Port [X1 P1 R]\G  | eneral  |                                   |  |  |  |
| Name  | Port 1  | Author  | hamgha0625                        |  |  |  |
| Comment   |   | -   | <b>_</b>                          |  |  |  |
| PROFINET interface [X]  | 1)\Advanced ontions\Port [X1 P1 R]\P  | ort interconnection\l oc  | al nort:                          |  |  |  |
| Local port:   | PLC_2\PROFINET interface_1<br>[X1]\Port_1 [X1 P1 R]   | Medium:   | Copper                            |  |  |  |
| Cable name:   |   |   |                                   |  |  |  |
| PROFINET interface IV   | 1)\Advanced ontions\Port [¥1 P1 P]\P/   | ort interconnection\Part  | tner port:                        |  |  |  |
|   | Monitoring of partner port is not possi-<br>ble   | Alternative partners  | False                             |  |  |  |
| Partner port:   | Any partner   |   |                                   |  |  |  |
|   |   |   |                                   |  |  |  |

| Totally Integrated                    |  |                          |            |
|---------------------------------------|--|--------------------------|------------|
| Automation Portal                     |  |                          |            |
|                                       |  |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P1 R]\Po    | ort options\Activate     |            |
| Activate this port for                | True                                     |                          |            |
| USE<br>DROEINET interface [V          | 1) Advanced entions Dert [V1 D1 D] D     | art antianal Connection  |            |
| Transmission rate /                   |  | Monitor                  | False      |
| duplex:                               |  |                          |            |
| Enable autonegotia-                   | True                                     |                          | 1          |
| tion                                  |  |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P1 R]\Po    | ort options\Boundaries   |            |
| End of detection of                   | False                                    | End of topology dis-     | False      |
| End of the sync do-                   | Falco                                    | covery                   |            |
| main                                  |  |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P2 R]\G     | eneral                   |            |
| Name                                  | Port_2                                   | Author                   | hamgha0625 |
| Comment                               |  |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P2 R]\Po    | ort interconnection\Loca | al port:   |
| Local port:                           | PLC_2\PROFINET interface_1               | Medium:                  | Copper     |
| Cable name:                           | [X1]\Port_2 [X1 P2 R]                    |                          |            |
| Cable name:                           |  |                          |            |
| 120.00                                |  |                          |            |
| L L L L L L L L L L L L L L L L L L L |  |                          |            |
|                                       |  |                          |            |
|                                       |  |                          |            |
|                                       | • · · · ·                                |                          |            |
|                                       |  |                          |            |
|                                       | 24                                       |                          |            |
| PROFINET interface [X                 | 1)\Advanced ontions\Port [X1 P2 R]\Pr    | ort interconnection\Part | ther port. |
| I NOI INET IIIteriace [X              | Monitoring of partner port is not possi- | Alternative partners     | False      |
|                                       | ble                                      | I I                      |            |
| Partner port:                         | Any partner                              |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P2 R]\Po    | ort options\Activate     |            |
| Activate this port for                | True                                     |                          |            |
| USE<br>DROEINET interface [V          | 1) Advanced entions Dert [V1 D2 D] D     | art antianal Connection  |            |
| Transmission rate /                   | Automatic                                | Monitor                  | Falso      |
| duplex:                               | Automatic                                | Monitor                  | laise      |
| Enable autonegotia-                   | True                                     |                          |            |
| tion                                  |  |                          |            |
| PROFINET interface [X                 | 1]\Advanced options\Port [X1 P2 R]\Po    | ort options\Boundaries   |            |
| End of detection of                   | False                                    | End of topology dis-     | False      |
| accessible devices                    | <b>F</b> _l                              | covery                   |            |
| End of the sync do-                   | Faise                                    |                          |            |
| PROFINET interface [X                 | 1]\Web server access                     |                          |            |
| Note                                  | The Web server must also be activated    | Enable Web server via    | True       |
|                                       | in the properties of the PLC.            | IP address of this in-   |            |
|                                       |  | terface                  |            |
| PROFINET interface [X                 | 2]\General                               |                          |            |
| Name                                  | PROFINET interface_2                     | Author                   | hamgha0625 |
| Comment                               | 21)E parameters                          |                          |            |
| Default E-monitoring                  |  | ĺ                        |            |
| time for F-I/O of this                |  |                          |            |
| interface                             |  |                          |            |
| PROFINET interface [X                 | 2]\Ethernet addresses\Interface netw     | orked with               |            |
| Subnet:                               | Not connected                            |                          |            |
|                                       |  |                          |            |
|                                       |  |                          |            |
|                                       |  |                          |            |

| Automation Portal   |  |  |  |  |  |  |
|---|--|--|--|--|--|--|
| PROFINET interface [X   | ]\Ethernet addresses\IP protocol   |  |  |  |  |  |
| IP configuration  | IP address is set directly at the device   |  |  |  |  |  |
| PROFINET interface [X   | 2]\Ethernet addresses\PROFINET   |  |  |  |  |  |
| PROFINET device<br>name is set directly at<br>the device  | False  | Generate PROFINET<br>device name auto-<br>matically  | True   |  |  |  |
| PROFINET device   | plc_2.profinet interface_2   | Converted name:  | plcxb2.profinetxainterfacexb2fdc8              |  |  |  |
| Device number:  | 0  |  |  |  |  |  |
| PROFINET interface [X]  | ?<br>]\Time-of-day synchronization\NTP n   | node   |  |  |  |  |
| Note  | Time synchronization for all PROFINET<br>interfaces take place within the set-<br>tings for time synchronization of the<br>PROFINET interface [X1].  | Enable time synchro-<br>nization via NTP serv-<br>er   | False  |  |  |  |
|   | IP addresses   | Server 1   | 0.0.0.0  |  |  |  |
| Server 2  | 0.0.0.0  | Server 3   | 0.0.0.0  |  |  |  |
| Server 4  | 0.0.0.0  | Update interval  | 10s  |  |  |  |
| PROFINET interface [X   | 2]\Operating mode  |  |  |  |  |  |
| IO controller   | Irue   | IO system  |  |  |  |  |
| Device number   | 0  | IO device  | False  |  |  |  |
| PROFINET interface [X<br>Call the user program<br>if communication er-<br>rors occur  | J\Advanced options\Interface option<br>False   | s<br>Support device re-<br>placement without<br>exchangeable medi-<br>um   | True   |  |  |  |
| Permit overwriting of<br>device names of all<br>assigned IO devices   | False  | Limit data infeed into<br>the network  | False  |  |  |  |
| Use IEC V2.2 LLDP<br>mode   | False  | Keep-Alive connec-<br>tion monitoring:   | 30s  |  |  |  |
| PROFINET interface [X   | 2]\Advanced options\Real time setting  | gs\IO communication  |  |  |  |  |
| Send clock:   | 1.000ms  |  |  |  |  |  |
| Send Clock: 1.000ms   |  |  |  |  |  |  |
| PROFINET interface [X   | 2]\Advanced options\Real time setting  | gs\Real time options   |  |  |  |  |
| PROFINET interface [X<br>Calculated bandwidth<br>for cyclic IO data:  | 2]\Advanced options\Real time settin<br>0.000ms  | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:  | 0.000%   |  |  |  |
| PROFINET interface [X<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X   | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger  | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>neral   | 0.000%   |  |  |  |
| PROFINET interface [X<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X<br>Name   | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger<br>Port_1  | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>eral<br>Author  | 0.000%<br>hamgha0625                           |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment  | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger<br>Port_1  | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>eral<br>Author  | 0.000%<br>hamgha0625                           |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.  | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger<br>Port_1<br>2]\Advanced options\Port [X2 P1]\Por  | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>weral<br>Author   | 0.000%<br>hamgha0625<br>port:                  |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:   | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger<br>Port_1<br>2]\Advanced options\Port [X2 P1]\Por<br>PLC_2\PROFINET interface_2<br>[X2]\Port_1 [X2 P1]   | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>meral<br>Author<br>t interconnection\Local<br>Medium:   | 0.000%<br>hamgha0625<br><b>port:</b><br>Copper |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:  | 2]\Advanced options\Real time settin<br>0.000ms<br>2]\Advanced options\Port [X2 P1]\Ger<br>Port_1<br>2]\Advanced options\Port [X2 P1]\Por<br>PLC_2\PROFINET interface_2<br>[X2]\Port_1 [X2 P1]<br>   | gs\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>heral<br>Author<br>tinterconnection\Local<br>Medium:  | 0.000%<br>hamgha0625<br>port:<br>Copper        |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:  | 2]\Advanced options\Real time setting 0.000ms 2]\Advanced options\Port [X2 P1]\Ger Port_1 2]\Advanced options\Port [X2 P1]\Por PLC_2\PROFINET interface_2 [X2]\Port_1 [X2 P1] 2]\Advanced options\Port [X2 P1]\Por Monitoring of partner port is not possible  | ss\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>meral<br>Author<br>t interconnection\Local<br>Medium:<br>t interconnection\Partne<br>Alternative partners   | 0.000%<br>hamgha0625<br>port:<br>Copper        |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:  | 2]\Advanced options\Real time setting 0.000ms 2]\Advanced options\Port [X2 P1]\Ger Port_1 2]\Advanced options\Port [X2 P1]\Por PLC_2\PROFINET interface_2 [X2]\Port_1 [X2 P1] 2]\Advanced options\Port [X2 P1]\Por Monitoring of partner port is not possible Any partner  | ss\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>neral<br>Author<br>t interconnection\Local<br>Medium:   | 0.000%<br>hamgha0625<br>port:<br>Copper        |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:<br>Cable name:   | 2]\Advanced options\Real time settine 0.000ms 2]\Advanced options\Port [X2 P1]\Ger Port_1 2]\Advanced options\Port [X2 P1]\Por PLC_2\PROFINET interface_2 [X2]\Port_1 [X2 P1] 2]\Advanced options\Port [X2 P1]\Por Monitoring of partner port is not possible Any partner 2]\Advanced options\Port [X2 P1]\Por                           | ss\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>meral<br>Author<br>t interconnection\Local<br>Medium:<br>t interconnection\Partners<br>Alternative partners | 0.000% hamgha0625 port: Copper                 |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:<br>Cable name:<br>PROFINET interface [X.<br>Partner port:<br>PROFINET interface [X.<br>Activate this port for        | 2]\Advanced options\Real time settine<br>0.000ms 2]\Advanced options\Port [X2 P1]\Ger<br>Port_1 2]\Advanced options\Port [X2 P1]\Por<br>PLC_2\PROFINET interface_2<br>[X2]\Port_1 [X2 P1] 2]\Advanced options\Port [X2 P1]\Por<br>Monitoring of partner port is not possible<br>Any partner 2]\Advanced options\Port [X2 P1]\Por<br>True | ss\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>eeral<br>Author<br>t interconnection\Local<br>Medium:<br>t interconnection\Partners<br>Alternative partners | 0.000%<br>hamgha0625<br>port:<br>Copper        |  |  |  |
| PROFINET interface [X.<br>Calculated bandwidth<br>for cyclic IO data:<br>PROFINET interface [X.<br>Name<br>Comment<br>PROFINET interface [X.<br>Local port:<br>Cable name:<br>Cable name:<br>PROFINET interface [X.<br>Partner port:<br>PROFINET interface [X.<br>Activate this port for<br>use | 2]\Advanced options\Real time settine 0.000ms 2]\Advanced options\Port [X2 P1]\Ger Port_1 2]\Advanced options\Port [X2 P1]\Por PLC_2\PROFINET interface_2 [X2]\Port_1 [X2 P1] 2]\Advanced options\Port [X2 P1]\Por Monitoring of partner port is not possible Any partner 2]\Advanced options\Port [X2 P1]\Por True                      | ss\Real time options<br>Calculated bandwidth<br>for cyclic IO data:<br>heral<br>Author<br>t interconnection\Local<br>Medium:<br>t interconnection\Partners<br>Alternative partners | 0.000% hamgha0625 port: Copper er port: False  |  |  |  |

| Totally Integrated                               |   |   |                              |
|--|---|---|------------------------------|
| Automation Fortur                                |   |   |                              |
| PROFINET interface [X                            | 2]\Advanced options\Port [X2 P1]\Port                               | options\Connection  |                              |
| Transmission rate /<br>duplex:                   | Automatic   | Monitor   | False                        |
| Enable autonegotia-<br>tion                      | True  |   |                              |
| PROFINET interface [X                            | 2]\Advanced options\Port [X2 P1]\Port                               | options\Boundaries  |                              |
| End of detection of<br>accessible devices        | False   | End of topology dis-<br>covery                                | False                        |
| End of the sync do-<br>main                      | False   |   |                              |
| PROFINET interface [X                            | 2]\Web server access  |   |                              |
| Note   | The Web server must also be activated in the properties of the PLC. | Enable Web server via<br>IP address of this in-<br>terface    | False                        |
| Startup  |   |   |                              |
| Startup after POWER<br>ON                        | Warm restart - Operating mode before<br>POWER OFF                   | Comparison preset to<br>actual configuration                  | Startup CPU even if mismatch |
| Configuration time                               | 60000ms   |   |                              |
| Cycle  | 150   |   |                              |
| Maximum cycle time                               | T50ms   | Minimum avala tima  | 1                            |
| cle time for cyclic OBs                          | Irue  | Minimum cycle time  | ims                          |
| Communication load                               |   |   |                              |
| Cycle load due to                                | 50%   |   |                              |
| communication                                    |   |   |                              |
| System and clock mem                             | nory\System memory bits   |   |                              |
| Enable the use of sys-                           | False   | Address of system   | 1                            |
| tem memory byte                                  |   | memory byte (MBx)   |                              |
| First cycle                                      |   | Diagnostic status<br>changed                                  |                              |
| Always 1 (high)                                  |   | Always 0 (low)  |                              |
| System and clock mem                             | lory/Clock memory bits  | Address of clock  | 0                            |
| clock memory byte                                | Faise   | Address of Clock  | 0                            |
| 10 Hz clock                                      |   | 5 Hz clock  |                              |
| 2.5 Hz clock                                     |   | 2 Hz clock  |                              |
| 1.25 Hz clock                                    |   | 1 Hz clock  |                              |
| 0.625 Hz clock                                   |   | 0.5 Hz clock  |                              |
| SIMATIC Memory Card                              | \Diagnostics  |   |                              |
| Aging of the SIMATIC<br>memory card              | False   | Threshold value   | 80%                          |
| System diagnostics\Ge                            | neral   |   |                              |
| Activate system diag-<br>nostics for this device | True  | Report network faults<br>as maintenance in-<br>stead of fault | False                        |
| PLC alarms\General                               |   |   |                              |
| Central alarm man-                               | True  |   |                              |
| agement in the PLC                               |   |   |                              |
| Web server\General                               | -   |   |                              |
| Activate web server<br>on this module            | Irue  | Permit access only<br>with HTTPS                              | False                        |
| Web server(Automatic                             |   | Undata interval   | 10c                          |
| date   | True  | Opdate interval   | 105                          |
| Web server\User mana                             | gement  |   |                              |
| User name  |   | User rights   |                              |
| Everybody  |   |   |                              |
|  |   |   |                              |

| Totally Integrated<br>Automation Porta      | d<br>al                       |                          |                                    |                                       |                              |  |  |
|---|-------------------------------|--------------------------|------------------------------------|---------------------------------------|------------------------------|--|--|
|   |                               |                          |                                    |                                       |                              |  |  |
| Web server\User-def                         | fined web pages               |                          |                                    |                                       |                              |  |  |
| Application name                            | HTML source path              | Default HTML page        | Files with dynamic<br>content      | Web DB numb                           | mber Fragment DB num-<br>ber |  |  |
|   |                               | index.htm                | .htm;.html                         | 333                                   | 334                          |  |  |
| Web server\Overvie                          | w of interfaces               |                          |                                    |                                       |                              |  |  |
| Device                                      |                               | Interface                |                                    | Enabled web                           | server access                |  |  |
| PLC_2                                       |                               | PROFINET interface_      | 1                                  | True                                  |                              |  |  |
| PLC_2                                       |                               | PROFINET interface_      | 2                                  | False                                 |                              |  |  |
| Display\General\Disp                        | olay standby mode             | 9                        |                                    |                                       |                              |  |  |
| Time to standby                             | 30 minutes                    |                          |                                    |                                       |                              |  |  |
| mode  |                               |                          |                                    |                                       |                              |  |  |
| Display\General\Ene                         | ergy saving mode              |                          |                                    |                                       |                              |  |  |
| Time to energy savi                         | <b>ng</b> 15 minutes          |                          |                                    |                                       |                              |  |  |
| mode<br>Disale: 4C sus and 1Disa            |                               |                          |                                    |                                       |                              |  |  |
| Display\General\Display                     | play language                 |                          |                                    |                                       |                              |  |  |
| display                                     | n English                     |                          |                                    |                                       |                              |  |  |
| Display/Automatic u                         | Indate                        |                          |                                    |                                       |                              |  |  |
| Time to undate                              | 5 seconds                     |                          |                                    |                                       |                              |  |  |
| Display/Password/Di                         | splay protection              |                          |                                    |                                       |                              |  |  |
| Enable write access                         | True                          |                          | Enable display prot                | <b>ec-</b> True                       |                              |  |  |
| Password                                    | ••••                          |                          | Confirm password                   | •••••                                 |                              |  |  |
| Time until automati                         | c 15 minutes                  |                          | commi pussivoru                    |                                       |                              |  |  |
| logoff                                      |                               |                          |                                    |                                       |                              |  |  |
| Display\User-defined                        | d logo                        |                          |                                    |                                       |                              |  |  |
| User logo activated                         | False                         |                          | Adapt logo                         | False                                 | alse                         |  |  |
| Resolution                                  | 240x260                       |                          | Company logo                       |                                       |                              |  |  |
|   |                               |                          |                                    |                                       |                              |  |  |
| User interface langu                        | lages                         |                          |                                    |                                       |                              |  |  |
| Assign project langu                        | Jage                          |                          | User interface lang                | Jages                                 |                              |  |  |
| English (United State                       | s)                            |                          | German                             |                                       |                              |  |  |
| English (United State                       | s)                            |                          | English                            |                                       |                              |  |  |
| English (United State                       | s)                            |                          | French                             |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Spanish                            |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Italian                            |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Japanese                           |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Chinese (simplified)               |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Korean                             |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Russian                            |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Turkish                            |                                       |                              |  |  |
| English (United State                       | s)                            |                          | Portuguese (Brazil)                |                                       |                              |  |  |
| Time of day\Local tin                       | me                            |                          |                                    |                                       |                              |  |  |
| Time zone                                   | (UTC) Dublin, Ec<br>don       | linburgh, Lisbon, Lon-   |                                    |                                       |                              |  |  |
| Time of day\Dayligh                         | t saving time                 |                          |                                    |                                       |                              |  |  |
| Activate daylight sa                        | <b>v-</b> True                |                          | Difference betweer                 | n 60 mins                             |                              |  |  |
| ing time                                    |                               |                          | standard and daylig<br>saving time | ght                                   |                              |  |  |
| Time of day\Dayligh<br>Selection of the wee | t saving time\Star<br>ek Last | t of daylight saving tir | ne<br>Selection of the we<br>day   | <b>ek-</b> Sunday                     |                              |  |  |
| of  | March                         |                          | at                                 | 01:00 a.m.                            |                              |  |  |
| Time of day\Dayligh                         | t saving time\Star            | t of standard time       | ···                                | · · · · · · · · · · · · · · · · · · · |                              |  |  |
| Selection of the wee                        | ek Last                       |                          | Selection of the we<br>day         | <b>ek-</b> Sunday                     |                              |  |  |
| of  | October                       |                          | at                                 | 02:00 a.m.                            |                              |  |  |
|   |                               |                          |                                    |                                       |                              |  |  |
|   |                               |                          |                                    |                                       |                              |  |  |

| Totally Integrated                       |   |                              |                         |                           |                         |  |
|--|---|------------------------------|-------------------------|---------------------------|-------------------------|--|
| Automation Portal                        |   |                              |                         |                           |                         |  |
|  |   |                              |                         |                           |                         |  |
| Protection                               |   |                              |                         |                           |                         |  |
| level of protection                      | Full access (no protection)                 | )                            | Password                |                           | ••••                    |  |
|  |   |                              |                         |                           |                         |  |
| Confirm password                         |   |                              |                         |                           |                         |  |
| Protection\Connection                    | mechanisms                                  |                              |                         |                           |                         |  |
| Permit access with                       | False                                       |                              |                         |                           |                         |  |
| tion from remote                         |   |                              |                         |                           |                         |  |
| partner                                  |   |                              |                         |                           |                         |  |
| Protection\Security even                 | ent   |                              |                         |                           |                         |  |
| Summarize security                       | True  |                              | Length of a             | an interval               | 20                      |  |
| events in case of high                   |   |                              | -                       |                           |                         |  |
| message volume                           |   |                              |                         |                           |                         |  |
| Unit                                     | seconds                                     |                              |                         |                           |                         |  |
| OPC UA\Accessibility of                  | f the server                                |                              |                         |                           |                         |  |
| Activate OPC UA serv-                    | False                                       |                              |                         |                           |                         |  |
| er                                       |   |                              |                         |                           |                         |  |
| System power supply(C                    | seneral                                     |                              |                         |                           |                         |  |
| General                                  | Connection to supply volta                  | age L+                       |                         |                           |                         |  |
| System power supply\P                    | ower segment overview                       | '                            |                         | -                         |                         |  |
| Module                                   | Slot  |                              |                         | Su                        | pply/consu              | nption   |
| PLC_2                                    | 1   |                              |                         | 12                        | .00W                    |  |
| DI 16x24VDC HF_1                         | 2   |                              |                         | -1.                       | 10W                     |  |
| DQ 16x24VDC/0.5A HF_                     | 3   |                              |                         | -1.                       | 10W                     |  |
| AI 4xU/I/RTD/TC ST_T                     | 4   |                              |                         | -0.                       | 70W                     |  |
|  | Summa                                       | ry                           |                         | 9.                        | IOW                     |  |
| Advanced configuratio                    | n\DNS configuration                         |                              |                         |                           |                         |  |
| No DNS server ad-<br>dross is configured |   |                              |                         |                           |                         |  |
| Advanced configuratio                    | n/IP Eorwording/Configu                     | ration IDv/ E                | anwarding               |                           |                         |  |
| Enable IPv4 forward-                     | Falso                                       |                              | Jiwarung                |                           |                         |  |
| ing for interfaces of                    |   |                              |                         |                           |                         |  |
| this PLC                                 |   |                              |                         |                           |                         |  |
| Advanced configuratio                    | n\Configuration control\(                   | Configuration                | n control fo            | r central co              | nfiguration             |  |
| Allow reconfiguration                    | False                                       | _                            |                         |                           | _                       |  |
| of device via the user                   |   |                              |                         |                           |                         |  |
| program                                  |   |                              |                         |                           |                         |  |
| Connection resources\                    |   |                              |                         | -                         |                         |  |
|  | Station resources - Re-<br>served - Maximum | Station reso<br>served - Cor | urces - Re-<br>Ifigured | Station res<br>namic - Co | ources - Dy<br>nfigured | <ul> <li>Module resources -<br/>PLC_2 [CPU 1515F-2<br/>PN] - Configured</li> </ul> |
| Maximum number of re-                    | -   | 10                           |                         | 98                        |                         | 108  |
| sources:                                 |   |                              |                         |                           |                         |  |
|  | Maximum                                     | Configured                   |                         | Configured                |                         | Configured   |
| PG communication:                        | 4   | -                            |                         | -                         |                         | -  |
| HMI communication:                       | 4   | 0                            |                         | 0                         |                         | 0  |
| S7 communication:                        | 0   | -                            |                         | 0                         |                         | 0  |
| Open user communica-<br>tion:            | 0   | -                            |                         | 0                         |                         | 0  |
| Web communication:                       | 2   | -                            |                         | -                         |                         | -  |
| OPC UA client/server                     | 0   | -                            |                         | -                         |                         | -  |
| communication:                           |   |                              |                         |                           |                         |  |
| Other communication:                     | -   | -                            |                         | 0                         |                         | 0  |
| Total resources used:                    |   | 0                            |                         | 0                         |                         | 0  |
| Available resources:                     |   | 10                           |                         | 98                        |                         | 108  |
| Overview of addresses                    | \Overview of addresses\0                    | Overview of a                | ddresses                |                           |                         |  |
| Inputs                                   | True  |                              | Outputs                 |                           | True                    |  |
| Address gaps                             | False                                       |                              | Slot                    |                           | True                    |  |
|  |   |                              |                         |                           |                         |  |
|  |   |                              |                         |                           |                         |  |
|  |   |                              |                         |                           |                         |  |
|  |   |                              |                         |                           |                         |  |

| Totally<br>Autom     | y Integrated<br>nation Portal |                     |                       |                  |                     |                           |             |           |                           |
|----------------------|-------------------------------|---------------------|-----------------------|------------------|---------------------|---------------------------|-------------|-----------|---------------------------|
| -                    |                               |                     |                       | •                |                     | 4                         | L           |           |                           |
| Туре<br>РІР          | Automaticu                    | Indate              | Addr. from            | -                | Addr. to            |                           | Mod         | ule       | DI 16x24VDC HF_1          |
|                      | / atomatic t                  | ipuate              | 00                    |                  | name                | 1515F-2 PN]               | num         | ber       |                           |
| Size                 | 2 Bytes                       |                     | Master / IO<br>system | -                | Rack                | 0                         | Slot        |           | 2                         |
| Туре                 | 0                             |                     | Addr. from            | 0                | Addr. to            | 1                         | Mod         | ule       | DQ 16x24VDC/<br>0.5A HF_1 |
| PIP                  | Automatic ı                   | update              | OB                    | -                | Device<br>name      | PLC_2 [CPU<br>1515F-2 PN] | Devi<br>num | ce<br>ber | -                         |
| Size                 | 2 Bytes                       |                     | Master / IO<br>system | -                | Rack                | 0                         | Slot        |           | 3                         |
| Туре                 | I                             |                     | Addr. from            | 2                | Addr. to            | 9                         | Mod         | ule       | AI 4xU/I/RTD/TC           |
| PIP                  | Automatic u                   | update              | ОВ                    | -                | Device              | PLC_2 [CPU                | Devi        | ce<br>ber | -                         |
| Size                 | 8 Bytes                       |                     | Master / IO<br>svstem | -                | Rack                | 0                         | Slot        |           | 4                         |
| Runtime              | licenses\OPC                  | UA\Run              | itime license         | S                |                     |                           |             |           |                           |
| Type of r<br>cense   | required li-                  | None                |                       |                  | Type of pu<br>cense | Irchased li-              | No license  |           |                           |
| Runtime              | licenses\ProD                 | iag\Sup             | pervisions            |                  |                     |                           |             |           |                           |
| Number               | of used su-                   | 0                   |                       |                  |                     |                           |             |           |                           |
| Runtime              | licenses\ProD                 | iag\Rur             | ntime license         | 25               |                     |                           |             |           |                           |
| Number<br>censes     | of required li-               | None (·             | <= 25 superv          | isions)          | Used ProD           | iag licenses              | No license  |           |                           |
| Runtime              | licenses\Ener                 | gy Suite            | e\Energy obj          | ects             |                     |                           |             |           |                           |
| Number               | of configured                 | 0                   |                       |                  |                     |                           |             |           |                           |
| energy o             | bjects<br>liconsos\Enor       | av Suit             | o\Puntimo lia         | CONSOS           |                     |                           |             |           |                           |
| Total nu             | mber of li-                   | 9 <b>y</b> 3un<br>0 | ekkuntine ik          | Lenses           |                     |                           |             |           |                           |
| censed e             | energy ob-                    |                     |                       |                  |                     |                           |             |           |                           |
| jects<br>Buntime     | licences) Ener                | an e Cruite         | a).Durativa a lie     | an a c Number of | nurshaad            | liconcos                  |             |           |                           |
| kuntime<br>License t | licenses\Ener                 | No lice             | e\kuntime iid<br>nse  | censes Number of | license tv          | ncenses                   | lo license  |           |                           |
| gy objec             | ts'                           | NO IICCI            | iii)C                 |                  | gy objects          |                           | NO ILCENSE  |           |                           |
|                      |                               |                     |                       |                  |                     |                           |             |           |                           |
|                      |                               |                     |                       |                  |                     |                           | T           |           |                           |

| Totally Integrated<br>Automation Portal   |                                       |                             |  |
|---|---------------------------------------|-----------------------------|--|
|   |                                       |                             |  |
| Local module                              | S                                     |                             |  |
| DI 16x24VDC H                             | F_1                                   |                             |  |
| DI 16x24VDC HF_1                          |                                       |                             |  |
| General\Project inform                    | nation                                |                             |  |
| Name                                      | DI 16X24VDC HF_1                      | Author                      | Allreza.Qadiri   |
| Comment                                   | 2                                     | каск                        | 0  |
| Slot<br>Comonall Cotolon inform           |                                       |                             |  |
| General/Catalog Inform                    |                                       | Description                 | Digital input module DI16 x DC24)/   |
| Short designation                         |                                       | Description                 | grouping 16; input delay 0.0520ms;<br>input type 3 (IEC 61131); configurable<br>diagnostics; hardware interrupts; val-<br>ue status; integrated counter for chan-<br>nel 0 and 1; isochronous mode |
| Article number                            | 6ES7 521-1BH00-0AB0                   | Firmware version            | V2.2   |
| <b>General</b> \Identification            | & Maintenance                         |                             |  |
| Plant designation                         |                                       | Location identifier         |  |
| Installation date                         | 2020-12-15 12:07:43.631               | Additional informa-<br>tion |  |
| Module parameters\Ge                      | eneral\Startup                        |                             |  |
| Comparison preset to<br>actual module     | From CPU                              |                             |  |
| Module parameters\Ch                      | nannel template\Inputs\Apply to all c | hannels that use the ter    | mplate\Diagnostics   |
| No supply voltage L+                      | False                                 | Wire break                  | False  |
| Module parameters\Ch                      | nannel template\Inputs\Apply to all c | hannels that use the ter    | mplate\Input parameters  |
| Input delay                               | 3.2ms                                 |                             |  |
| Module parameters\DI                      | Configuration\Configuration of subr   | nodules                     |  |
| Module distribution                       | None                                  |                             |  |
| Module parameters\DI                      | Configuration\Value status (Quality   | Information)                |  |
| Value status                              | False                                 |                             |  |
| Module parameters\DI                      | Configuration\Copy of module for SI   | nared Device (MSI)          |  |
| Copy of module:                           | None                                  |                             |  |
| Module parameters\DI                      | Configuration\Counter configuration   | n\Counter configuration     | on channel 0 and channel 1 enabled   |
| Counter configuration<br>on channel 0 and | False                                 |                             |  |
| channel 1 enabled                         |                                       |                             |  |
| Input 0 - 15\General                      |                                       |                             |  |
| Name                                      | DI 16x24VDC HF_1                      | Comment                     |  |
| Input 0 - 15\Inputs\Ger                   | neral\Module failure                  |                             |  |
| Input values with                         | Input value 0                         |                             |  |
| Inodule failure                           | annal 0 7)Channal 0                   |                             |  |
| Parameter settings                        | From tomplato                         |                             |  |
| Input 0 - 15\Inputs\Cha                   | annel 0-7)Channel 0)Diagnostics       |                             |  |
| No supply voltage L+                      | Falso                                 | Wire break                  | Falso  |
| Input 0 - 15\Inputs\Cha                   | nnel 0-7\Channel 0\Innut parameter    |                             |  |
| Input delay                               | 3 2ms                                 |                             |  |
| Input 0 - 15\Inputs\Cha                   | annel 0-7\Channel 0\Counter configu   | ration                      |  |
| Reaction to violation                     |                                       | Edge selection              |  |
| of a counting limit                       |                                       |                             |  |
| Set output DQ                             |                                       | High counting limit         |  |
| Low counting limit                        |                                       | Start value                 |  |
| Comparison value                          |                                       |                             |  |
| Input 0 - 15\Inputs\Cha                   | annel 0-7\Channel 0\Hardware interru  | ıpts\                       |  |
| Comparison event for<br>DQ has occurred   | 0                                     | CountRidPrefixEvent         | 49248  |
|   |                                       |                             |  |

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| Automation Portal       |                                       |                                  |        |  |
|                         |                                       |                                  |        |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
| Rising edge0            | Count0                                | Channel number                   | 0      |  |
| CountHwEventType        | 5                                     |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 0\Hardware interru  | ots\                             |        |  |
| Enable rising edge de-  | 0                                     | RidPrefixRisingEdgeE-            | 49152  |  |
| tection                 |                                       | vent                             | -      |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
| Rising edge0            | Rising edge0                          | Channel number                   | 0      |  |
| HWEVENT I YPERISIN-     | 1                                     |                                  |        |  |
| Junut 0 - 15\lunuts\Cha | annel 0-7\Channel 0\Hardware interru  | ots)                             |        |  |
| Enable falling edge     |                                       | RidPrefixFallingEdg-             | 49280  |  |
| detection               | 5                                     | eEvent                           | 19200  |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
| Falling edge0           | Falling edge0                         | Channel number                   | 0      |  |
| HwEventTypeFallin-      | 2                                     |                                  |        |  |
| gEdge                   |                                       |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1                   |                                  |        |  |
| Parameter settings      | From template                         |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Diagnostics       |                                  |        |  |
| No supply voltage L+    | False                                 | Wire break                       | False  |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Input parameters  |                                  |        |  |
| Input delay             | 3.2ms                                 |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Counter configura | ation                            |        |  |
| Reaction to violation   |                                       | Edge selection                   |        |  |
| of a counting limit     |                                       |                                  |        |  |
| Set output DQ           |                                       | High counting limit              |        |  |
| Low counting limit      |                                       | Start value                      |        |  |
| Comparison value        |                                       |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Hardware interruj | ots\<br>Count Did Des fin From t | 10240  |  |
| Comparison event for    | 0                                     | CountRidPrefixEvent              | 49249  |  |
| Event name:             |                                       | Hardware interrunt               | 0      |  |
| Rising edge1            | Count1                                | Channel number                   | 1      |  |
|                         | 5                                     | channel humber                   | •      |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Hardware interru  | ots\                             |        |  |
| Enable rising edge de-  | -0                                    | RidPrefixRisingEdgeE-            | 49153  |  |
| tection                 |                                       | vent                             |        |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
| Rising edge1            | Rising edge1                          | Channel number                   | 1      |  |
| HwEventTypeRisin-       | 1                                     |                                  | 1      |  |
| gEdge                   |                                       |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 1\Hardware interru  | ots\                             | 1      |  |
| Enable falling edge     | 0                                     | RidPrefixFallingEdg-             | 49281  |  |
| detection               |                                       | eEvent                           | -      |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
| Falling edge1           | Falling edge1                         | Channel number                   | 1      |  |
| HwEvent I ypeFallin-    | 2                                     |                                  |        |  |
| geage                   | annal 0 7\Channal 2                   |                                  |        |  |
| Parameter sottings      | From tomplate                         |                                  |        |  |
| Input 0 - 15\Inputs\Cha | appel 0-7)Chappel 2)Diagnostics       |                                  |        |  |
| No supply voltage L+    | Falso                                 | Wire break                       | Falso  |  |
| Input 0 - 15\Inputs\Cha | annel 0-7/Channel 2/Input parameters  | Wife bleak                       | i dise |  |
| Input delay 3 2ms       |                                       |                                  |        |  |
| Input 0 - 15\Inputs\Cha | annel 0-7\Channel 2\Hardware interru  | ntsl                             |        |  |
| Enable rising edge de-  |                                       | RidPrefixRisingEdgeE-            | 49154  |  |
| tection                 | <b>`</b>                              | vent                             | 19191  |  |
| Event name:             |                                       | Hardware interrupt               | 0      |  |
|                         |                                       | •                                | !      |  |
|                         |                                       |                                  |        |  |
|                         |                                       |                                  |        |  |

| Totally Integrated               |  |                             |            |  |
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| Automation Portal                |  |                             |            |  |
|                                  |  |                             |            |  |
| Risina edae2                     | Rising edge2                           | Channel number              | 2          |  |
| HwEventTypeRisin-                | 1                                      |                             |            |  |
| gEdge                            |  |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 2\Hardware interru   | pts\                        |            |  |
| Enable falling edge              | 0                                      | RidPrefixFallingEdg-        | 49282      |  |
| detection                        |  | eEvent                      |            |  |
| Event name:                      |  | Hardware interrupt          | 0          |  |
| Falling edge2                    | Falling edge2                          | Channel number              | 2          |  |
| HwEventTypeFallin-               | 2                                      |                             |            |  |
| geuge<br>Input 0 - 15\Inputs\Cha | annol 0-7\Channol 3                    |                             |            |  |
| Parameter settings               | From template                          |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 3\Diagnostics        |                             |            |  |
| No supply voltage L+             | False                                  | Wire break                  | False      |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 3\Input parameters   |                             |            |  |
| Input delay                      | 3.2ms                                  |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 3\Hardware interru   | pts\                        |            |  |
| Enable rising edge de-           | 0                                      | RidPrefixRisingEdgeE-       | 49155      |  |
| tection                          |  | vent                        |            |  |
| Event name:                      |  | Hardware interrupt          | 0          |  |
| Rising edge3                     | Rising edge3                           | Channel number              | 3          |  |
| HwEventTypeRisin-                | 1                                      |                             |            |  |
| gEdge                            |  |                             |            |  |
| Input 0 - 15\Inputs\Cna          | Annei 0-7 (Channei 3 (Hardware Interru | pts\<br>BidBrofixEollingEdg | 40202      |  |
| detection                        | 0                                      | eFvent                      | 49205      |  |
| Event name:                      |  | Hardware interrupt          | 0          |  |
| Falling edge3                    | Falling edge3                          | Channel number              | 3          |  |
| HwEventTypeFallin-               | 2                                      |                             |            |  |
| gEdge                            |  |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 4                    |                             |            |  |
| Parameter settings               | From template                          |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 4\Diagnostics        |                             | <b>F</b> 1 |  |
| No supply voltage L+             |  | Wire break                  | False      |  |
|                                  | annei 0-7 (Channei 4 (Input parameters |                             |            |  |
| Input delay                      | 3.21115                                | ntal                        |            |  |
| Enable rising edge de-           |  | RidProfixRisingEdgeE-       | 49156      |  |
| tection                          | Ŭ                                      | vent                        | 19150      |  |
| Event name:                      |  | Hardware interrupt          | 0          |  |
| Rising edge4                     | Rising edge4                           | Channel number              | 4          |  |
| HwEventTypeRisin-                | 1                                      |                             |            |  |
| gEdge                            |  |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 4\Hardware interru   | pts\                        | 1          |  |
| Enable falling edge              | 0                                      | RidPrefixFallingEdg-        | 49284      |  |
| detection                        |  | eEvent                      | 0          |  |
| Event name:                      | Falling adged                          | Hardware Interrupt          | 0          |  |
| HwEvontTypoEallin                | 2                                      |                             | 4          |  |
| aEdae                            | 2                                      |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 5                    |                             |            |  |
| Parameter settings               | From template                          |                             |            |  |
| Input 0 - 15\Inputs\Cha          | nnel 0-7\Channel 5\Diagnostics         |                             |            |  |
| No supply voltage L+             | False                                  | Wire break                  | False      |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 5\Input parameters   |                             |            |  |
| Input delay                      | 3.2ms                                  |                             |            |  |
| Input 0 - 15\Inputs\Cha          | annel 0-7\Channel 5\Hardware interru   | pts\                        |            |  |
| Enable rising edge de-           | 0                                      | RidPrefixRisingEdgeE-       | 49157      |  |
| tection                          |  | vent                        |            |  |
|                                  |  |                             |            |  |
|                                  |  |                             |            |  |

| Totally Integrated      |                                      |                                      |       |  |
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| Automation Portal       |                                      |                                      |       |  |
|                         |                                      |                                      |       |  |
| Event name:             |                                      | Hardware interrunt                   | ٥     |  |
| Pising odgo5            | Picing adge5                         | Channel number                       | 5     |  |
|                         |                                      | Channel number                       | 5     |  |
| HWEVENTT yperisin-      |                                      |                                      |       |  |
| geuge                   | anal 0.7 Channel El Hardware interru | ntal                                 |       |  |
| Input 0 - 15\inputs\cha | nnei 0-7 Channei 5 Hardware Interru  | pist<br>Did Des fisses Illie and des | 40205 |  |
| enable failing edge     | 0                                    | RidPrefixFallingEdg-                 | 49285 |  |
| Event name              |                                      | Hardware interrupt                   | 0     |  |
|                         | Falling adgeE                        | Channel number                       | F     |  |
|                         |                                      | Channel number                       | S     |  |
| aEdao                   | 2                                    |                                      |       |  |
| gruge                   | unnal 0 7\Channal 6                  |                                      |       |  |
| Barameter settings      |                                      |                                      |       |  |
| Parameter settings      |                                      |                                      |       |  |
| Input 0 - 15\inputs\Cha | Inner 0-7 (Channer 6) Diagnostics    | Marine have b                        | E. L. |  |
| No supply voltage L+    | False                                | Wire break                           | False |  |
| Input 0 - 15\Inputs\Cha | Innel 0-7\Channel 6\Input parameters |                                      |       |  |
| Input delay             | 3.2ms                                |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 6\Hardware interru  | pts\                                 |       |  |
| Enable rising edge de-  | 0                                    | RidPrefixRisingEdgeE-                | 49158 |  |
| tection                 |                                      | vent                                 | -     |  |
| Event name:             |                                      | Hardware interrupt                   | 0     |  |
| Rising edge6            | Rising edge6                         | Channel number                       | 6     |  |
| HwEventTypeRisin-       | 1                                    |                                      |       |  |
| gEdge                   |                                      |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 6\Hardware interru  | pts\                                 |       |  |
| Enable falling edge     | 0                                    | RidPrefixFallingEdg-                 | 49286 |  |
| detection               |                                      | eEvent                               |       |  |
| Event name:             |                                      | Hardware interrupt                   | 0     |  |
| Falling edge6           | Falling edge6                        | Channel number                       | 6     |  |
| HwEventTypeFallin-      | 2                                    |                                      |       |  |
| gEdge                   |                                      |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 7                   | 1                                    |       |  |
| Parameter settings      | From template                        |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 7\Diagnostics       |                                      |       |  |
| No supply voltage L+    | False                                | Wire break                           | False |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 7\Input parameters  |                                      |       |  |
| Input delay             | 3.2ms                                |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 7\Hardware interru  | pts\                                 |       |  |
| Enable rising edge de-  | 0                                    | RidPrefixRisingEdgeE-                | 49159 |  |
| tection                 |                                      | vent                                 |       |  |
| Event name:             |                                      | Hardware interrupt                   | 0     |  |
| Rising edge7            | Rising edge7                         | Channel number                       | 7     |  |
| HwEventTypeRisin-       | 1                                    |                                      | -     |  |
| gEdge                   |                                      |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 0-7\Channel 7\Hardware interru  | pts\                                 |       |  |
| Enable falling edge     | 0                                    | RidPrefixFallingEdg-                 | 49287 |  |
| detection               |                                      | eEvent                               |       |  |
| Event name:             |                                      | Hardware interrupt                   | 0     |  |
| Falling edge7           | Falling edge7                        | Channel number                       | 7     |  |
| HwEventTypeFallin-      | 2                                    |                                      |       |  |
| gEdge                   |                                      |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 8                  |                                      |       |  |
| Parameter settings      | From template                        |                                      |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 8\Diagnostics      |                                      |       |  |
| No supply voltage L+    | False                                | Wire break                           | False |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 8\Input parameter  | rs                                   |       |  |
| Input delay             | 3.2ms                                |                                      |       |  |
|                         |                                      | 1                                    |       |  |
|                         |                                      |                                      |       |  |
|                         |                                      |                                      |       |  |
|                         |                                      |                                      |       |  |
|                         |                                      |                                      |       |  |

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| Automation Portal                                       |                                      |                               |        |  |
|   |                                      |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 8\Hardware interr  | unts\                         |        |  |
| Enable rising edge de-                                  |                                      | RidPrefixRisingEdgeE-         | 49160  |  |
| tection   |                                      | vent                          | 19100  |  |
| Event name:   |                                      | Hardware interrupt            | 0      |  |
| Rising edge8  | Rising edge8                         | Channel number                | 8      |  |
| HwEventTypeRisin-                                       | 1                                    |                               | 0      |  |
| gEdge   |                                      |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 8\Hardware interr  | upts\                         |        |  |
| Enable falling edge                                     | 0                                    | RidPrefixFallingEdg-          | 49288  |  |
| detection   |                                      | eEvent                        |        |  |
| Event name:   |                                      | Hardware interrupt            | 0      |  |
| Falling edge8   | Falling edge8                        | Channel number                | 8      |  |
| HwEventTypeFallin-                                      | 2                                    |                               |        |  |
| gEdge   |                                      |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 9                  |                               |        |  |
| Parameter settings                                      | From template                        |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 9\Diagnostics      |                               |        |  |
| No supply voltage L+                                    | False                                | Wire break                    | False  |  |
| Input 0 - 15\Inputs\Cha                                 | innel 8-15\Channel 9\Input parameter | s                             |        |  |
| Input delay   | 3.2ms                                |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 9\Hardware interr  | upts\                         |        |  |
| Enable rising edge de-                                  | 0                                    | RidPrefixRisingEdgeE-         | 49161  |  |
| tection   |                                      | vent                          |        |  |
| Event name:   |                                      | Hardware interrupt            | 0      |  |
| Rising edge9  | Rising edge9                         | Channel number                | 9      |  |
| HwEventTypeRisin-                                       | 1                                    |                               |        |  |
| gEdge   |                                      |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | nnel 8-15\Channel 9\Hardware interr  | upts\                         |        |  |
| Enable falling edge                                     | 0                                    | RidPrefixFallingEdg-          | 49289  |  |
| detection   |                                      | eEvent                        |        |  |
| Event name:   |                                      | Hardware interrupt            | 0      |  |
| Falling edge9   | Falling edge9                        | Channel number                | 9      |  |
| HwEventTypeFallin-                                      | 2                                    |                               |        |  |
| gEdge   |                                      |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | innel 8-15\Channel 10                |                               |        |  |
| Parameter settings                                      | From template                        |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | Innel 8-15\Channel 10\Diagnostics    | I                             |        |  |
| No supply voltage L+                                    | False                                | Wire break                    | False  |  |
| Input 0 - 15\Inputs\Cha                                 | innel 8-15\Channel 10\Input paramete | ers                           |        |  |
| Input delay   | 3.2ms                                |                               |        |  |
| Input 0 - 15\Inputs\Cha                                 | innel 8-15\Channel 10\Hardware inter | rupts\                        |        |  |
| Enable rising edge de-                                  | U                                    | RidPrefixRisingEdgeE-         | 49162  |  |
|   |                                      | vent                          | 0      |  |
| Event name:   |                                      | Hardware Interrupt            | 0      |  |
| Rising edge10   | Rising edge10                        | Channel number                | 10     |  |
| HwEvent I ypeRisin-                                     | 1                                    |                               |        |  |
| geuge   | anal 9 15/Channel 10/Hardware inter  | ruptal                        |        |  |
| Input 0 - 15\inputs\Cha                                 |                                      | rupts\<br>DidDrofixCollingCdg | 40200  |  |
| detection   | 0                                    | oEvont                        | 49290  |  |
| Event name:   |                                      | Hardware interrunt            | 0      |  |
| Event name.   | Falling edge10                       | Channel number                | 10     |  |
| HwEventTypeEallin                                       | 2                                    |                               | 10     |  |
| aEdae   | 2                                    |                               |        |  |
| Input 0 - 15\Ipputs\Cha                                 | nnel 8-15\Channel 11                 |                               |        |  |
| Parameter settings                                      | From template                        |                               |        |  |
| Input 0 - 15\Inputs\Channel 8-15\Channel 11\Diagnostics |                                      |                               |        |  |
| No supply voltage L±                                    | False                                | Wire break                    | False  |  |
| to supply voltage LT                                    |                                      |                               | , uise |  |
|   |                                      |                               |        |  |
|   |                                      |                               |        |  |
|   | 1                                    |                               |        |  |
| Totally Integrated   |   |  |   |  |
|--|---|--|---|--|
| Automation Portal  |   |  |   |  |
|  |   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 11\Input paramete  | ers  |   |  |
| Input delay  | 3.2ms   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 11\Hardware inter  | rupts\   |   |  |
| Enable rising edge de  | - 0   | RidPrefixRisingEdgeE-  | 49163   |  |
| tection  |   | vent   |   |  |
| Event name:  |   | Hardware interrupt   | 0   |  |
| Rising edge11  | Rising edge11   | Channel number   | 11  |  |
| HwEventTypeRisin-  | 1   |  |   |  |
| gEdge  |   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 11\Hardware inter  | rupts\   |   |  |
| Enable falling edge  | 0   | RidPrefixFallingEdg-   | 49291   |  |
| detection  |   | eEvent   |   |  |
| Event name:  |   | Hardware interrupt   | 0   |  |
| Falling edge11   | Falling edge11  | Channel number   | 11  |  |
| HwEventTypeFallin-   | 2   |  |   |  |
| gEdge  |   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 12   |  |   |  |
| Parameter settings   | From template   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 12\Diagnostics   | II   |   |  |
| No supply voltage L+   | False   | Wire break   | False   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 12\Input paramete  | ers  |   |  |
| Input delay  | 3.2ms   |  |   |  |
| Input 0 - 15\Inputs\Cha  | annel 8-15\Channel 12\Hardware inter  | rupts\   |   |  |
| Enable rising edge de  | -0  | RidPrefixRisingEdgeE-  | 49164   |  |
| tection  |   | vent   | 0   |  |
| Event name:  | Dising adapt 2  | Hardware Interrupt   | 12  |  |
| Rising edge 12   | Rising edge i 2   | Channel number   | IZ  |  |
| HWEVENTT yperisin-   | 1   |  |   |  |
| gruge  |   |  |   |  |
| Input () - 15\Ipputs\(`h;  | annel 8-15\Channel 12\Hardware inter  | runts)   |   |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge   | annel 8-15\Channel 12\Hardware inter  | rupts\<br>RidPrefixEallingEdg-   | 49292   |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection  | annel 8-15\Channel 12\Hardware inter<br>0   | rupts\<br>RidPrefixFallingEdg-<br>eEvent   | 49292   |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:   | annel 8-15\Channel 12\Hardware inter<br>0   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt   | 49292<br>0  |  |
| Input 0 - 15(Inputs)Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12   | annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15(Inputs)Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-   | Falling edge12  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15(Inputs)Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge  | annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Cha   | Annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12<br>2<br>Annel 8-15\Channel 13   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Cha<br>Parameter settings   | Annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12<br>2<br>Annel 8-15\Channel 13<br>From template  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi  | Annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12<br>2<br>Annel 8-15\Channel 13<br>From template<br>Annel 8-15\Channel 13\Diagnostics   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12  |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Cha<br>Parameter settings<br>Input 0 - 15\Inputs\Cha<br>No supply voltage L+  | annel 8-15\Channel 12\Hardware inter<br>0<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break   | 49292<br>0<br>12<br>False   |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi   | Falling edge12<br>2<br>Falling edge12<br>2<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break   | 49292<br>0<br>12<br>False   |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Cha<br>Parameter settings<br>Input 0 - 15\Inputs\Cha<br>No supply voltage L+<br>Input 0 - 15\Inputs\Cha<br>Input delay  | Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break   | 49292<br>0<br>12<br>False   |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi   | Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers  | 49292<br>0<br>12<br>False   |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge de  | Falling edge12<br>2<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-   | 49292<br>0<br>12<br>False<br>49165                                |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection  | Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent   | 49292<br>0<br>12<br>False   |  |
| Input 0 - 15\Inputs\Cha<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Cha<br>Parameter settings<br>Input 0 - 15\Inputs\Cha<br>No supply voltage L+<br>Input 0 - 15\Inputs\Cha<br>Input delay<br>Input 0 - 15\Inputs\Cha<br>Enable rising edge det<br>tection<br>Event name:   | Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Input paramete<br>- 0   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt   | 49292<br>0<br>12<br>False<br>49165<br>0                           |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13   | Falling edge12<br>2<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-  | Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13<br>1  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge  | Falling edge12<br>2<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13<br>1  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi   | Falling edge12<br>Falling edge12<br>2<br>Annel 8-15\Channel 13<br>From template<br>Annel 8-15\Channel 13\Diagnostics<br>False<br>Annel 8-15\Channel 13\Input paramete<br>3.2ms<br>Annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13<br>1<br>Annel 8-15\Channel 13\Hardware inter   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge  | Falling edge12<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13<br>1<br>annel 8-15\Channel 13\Hardware inter<br>0  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection   | Falling edge12<br>Falling edge12<br>2<br>annel 8-15\Channel 13<br>From template<br>annel 8-15\Channel 13\Diagnostics<br>False<br>annel 8-15\Channel 13\Input paramete<br>3.2ms<br>annel 8-15\Channel 13\Hardware inter<br>0<br>Rising edge13<br>1<br>annel 8-15\Channel 13\Hardware inter<br>0  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13                     |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:  | annel 8-15\Channel 12\Hardware inter         Falling edge12         2         annel 8-15\Channel 13         From template         annel 8-15\Channel 13\Diagnostics         False         annel 8-15\Channel 13\Input parameter         3.2ms         annel 8-15\Channel 13\Hardware inter         0         Rising edge13         1         annel 8-15\Channel 13\Hardware inter | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt                   | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0       |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13  | Falling edge12   2   Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number           | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-  | Falling edge12   2   Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter   0   Falling edge13   2   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number           | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Input delay<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge detection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge  | Falling edge12   2   Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   Falling edge13   2  | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>No supply voltage L+<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection  | Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input parameter   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter   0   Falling edge13   1   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings | Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter   0   Falling edge13   2   annel 8-15\Channel 13\Hardware inter   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings   | Falling edge12   2   Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter   0   Falling edge13   2   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |
| Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge12<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings<br>Input 0 - 15\Inputs\Chi<br>Input 0 - 15\Inputs\Chi<br>Enable rising edge det<br>tection<br>Event name:<br>Rising edge13<br>HwEventTypeRisin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Enable falling edge<br>detection<br>Event name:<br>Falling edge13<br>HwEventTypeFallin-<br>gEdge<br>Input 0 - 15\Inputs\Chi<br>Parameter settings   | Falling edge12   2   Falling edge12   2   annel 8-15\Channel 13   From template   annel 8-15\Channel 13\Diagnostics   False   annel 8-15\Channel 13\Input paramete   3.2ms   annel 8-15\Channel 13\Hardware inter   0   Rising edge13   1   annel 8-15\Channel 13\Hardware inter   0   Falling edge13   2   | rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number<br>Wire break<br>ers<br>rupts\<br>RidPrefixRisingEdgeE-<br>vent<br>Hardware interrupt<br>Channel number<br>rupts\<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt<br>Channel number | 49292<br>0<br>12<br>False<br>49165<br>0<br>13<br>49293<br>0<br>13 |  |

| Totally Integrated      |                                     |                       |       |  |
|-------------------------|-------------------------------------|-----------------------|-------|--|
| Automation Portal       |                                     |                       |       |  |
|                         |                                     |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 14\Diagnostics    |                       |       |  |
| No supply voltage L+    | False                               | Wire break            | False |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 14\Input paramete | ers                   |       |  |
| Input delay             | 3.2ms                               |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 14\Hardware inter | rupts\                |       |  |
| Enable rising edge de-  | 0                                   | RidPrefixRisingEdgeE- | 49166 |  |
| Event name:             |                                     | Hardware interrunt    | 0     |  |
| Rising edge14           | Rising edge14                       |                       | 14    |  |
| HwEventTypeRisin-       | 1                                   | chamernamber          |       |  |
| gEdge                   |                                     |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 14\Hardware inter | rupts\                |       |  |
| Enable falling edge     | 0                                   | RidPrefixFallingEdg-  | 49294 |  |
| detection               |                                     | eEvent                |       |  |
| Event name:             |                                     | Hardware interrupt    | 0     |  |
| Falling edge14          | Falling edge14                      | Channel number        | 14    |  |
| HWEVent lypeFallin-     | 2                                   |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 15                |                       |       |  |
| Parameter settings      | From template                       |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 15\Diagnostics    |                       |       |  |
| No supply voltage L+    | False                               | Wire break            | False |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 15\Input paramete | ers                   |       |  |
| Input delay             | 3.2ms                               |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 15\Hardware inter | rupts\                |       |  |
| Enable rising edge de-  | 0                                   | RidPrefixRisingEdgeE- | 49167 |  |
| tection                 |                                     | vent                  | -     |  |
| Event name:             |                                     | Hardware interrupt    | 0     |  |
| Rising edge 15          | Rising edge 15                      | Channel number        | 15    |  |
| aEdae                   |                                     |                       |       |  |
| Input 0 - 15\Inputs\Cha | nnel 8-15\Channel 15\Hardware inter | rupts\                |       |  |
| Enable falling edge     | 0                                   | RidPrefixFallingEdg-  | 49295 |  |
| detection               |                                     | eEvent                |       |  |
| Event name:             |                                     | Hardware interrupt    | 0     |  |
| Falling edge15          | Falling edge15                      | Channel number        | 15    |  |
| HwEventTypeFallin-      | 2                                   |                       |       |  |
| gEdge                   |                                     |                       |       |  |
| Start address           | o o                                 | End address           | 17    |  |
| Isochronous mode        | 5.0<br>Falco                        | Organization block    | 0     |  |
| Process image           | 0                                   | organization block    | 0     |  |
| i rocess initige        | 0                                   |                       |       |  |
|                         |                                     |                       |       |  |
|                         |                                     |                       |       |  |
|                         |                                     |                       |       |  |
|                         |                                     |                       |       |  |
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|                         |                                     |                       |       |  |
|                         |                                     |                       |       |  |
|                         |                                     |                       |       |  |

## Local modules

## DQ 16x24VDC/0.5A HF\_1

| DQ 16x24VDC/0.5A HF                   | _1                                    |                                   |  |
|---------------------------------------|---------------------------------------|-----------------------------------|--|
| General\Project inform                | nation                                |                                   |  |
| Name                                  | DQ 16x24VDC/0.5A HF_1                 | Author                            | Alireza. Qadiri  |
| Comment                               |                                       | Rack                              | 0  |
| Slot                                  | 3                                     |                                   |  |
| General\Catalog inform                | mation                                |                                   |  |
| Short designation                     | DQ 16x24VDC/0.5A HF                   | Description                       | Digital output module DQ16 x DC24V /<br>0,5A; grouping 8; 4A per group; con-<br>figurable diagnostics; configurable<br>substitute value for output; isochro-<br>nous mode; switching cycle counter |
| Article number                        | 6ES7 522-1BH01-0AB0                   | Firmware version                  | V1.1   |
| <b>General</b> \Identification        | & Maintenance                         |                                   |  |
| Plant designation                     |                                       | Location identifier               |  |
| Installation date                     | 2020-12-15 12:08:13.527               | Additional informa-<br>tion       |  |
| Module parameters\G                   | eneral\Startup                        |                                   |  |
| Comparison preset to<br>actual module | From CPU                              |                                   |  |
| Module parameters\Cl                  | hannel template\Outputs\Apply to all  | channels that use the t           | emplate\Diagnostics  |
| No supply voltage L+                  | False                                 | Wire break                        | False  |
| Short circuit to<br>ground            | False                                 | Maintenance switch-<br>ing cycles | False  |
| Module parameters\Cl                  | hannel template\Outputs\Apply to all  | channels that use the t           | emplate\Output parameters  |
| Reaction to CPU STOP                  | Shutdown                              | Switching cycle coun-<br>ter      | False  |
| Switching cycle limit                 |                                       |                                   |  |
| Module parameters\D                   | Q configuration\Configuration of subr | nodules                           |  |
| Module distribution                   | None                                  |                                   |  |
| Module parameters\D                   | Q configuration\Value status (Quality | Information)                      |  |
| Value status                          | False                                 |                                   |  |
| Module parameters\D                   | Q configuration\Copy of module for sh | nared device (MSO)                |  |
| Copy of module:                       | None                                  |                                   |  |
| Output 0 - 15\General                 |                                       |                                   |  |
| Name                                  | DQ 16x24VDC/0.5A HF_1                 | Comment                           |  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 0               |                                   |  |
| Parameter settings                    | From template                         |                                   |  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 0\Diagnostics   |                                   |  |
| No supply voltage L+                  | False                                 | Wire break                        | False  |
| Short circuit to<br>ground            | False                                 | Maintenance switch-<br>ing cycles | False  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 0\Output parar  | neters                            |  |
| Reaction to CPU STOP                  | Shutdown                              | Switching cycle coun-<br>ter      | False  |
| Switching cycle limit                 |                                       |                                   |  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 1               |                                   |  |
| Parameter settings                    | From template                         |                                   |  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 1\Diagnostics   |                                   |  |
| No supply voltage L+                  | False                                 | Wire break                        | False  |
| Short circuit to<br>ground            | False                                 | Maintenance switch-<br>ing cycles | False  |
| Output 0 - 15\Outputs                 | Channel 0 - 7\Channel 1\Output parar  | neters                            |  |
| Reaction to CPU STOP                  | Shutdown                              | Switching cycle coun-<br>ter      | False  |
|                                       |                                       |                                   |  |
|                                       |                                       |                                   |  |

| Totally Integrated<br>Automation Portal |                                      |                              |        |  |
|---|--------------------------------------|------------------------------|--------|--|
| Switching cycle limit                   |                                      | ]                            |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 2              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 2\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| ground                                  |                                      | ing cycles                   |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 2\Output parar | neters                       |        |  |
| Reaction to CPU STOP                    | Shutdown                             | Switching cycle coun-<br>ter | False  |  |
| Switching cycle limit                   |                                      |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 3              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 3\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| ground                                  |                                      | ing cycles                   |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 3\Output parar | neters                       |        |  |
| Reaction to CPU STOP                    | Shutdown                             | Switching cycle coun-        | False  |  |
|   |                                      | ter                          |        |  |
| Switching cycle limit                   |                                      |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 4              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 4\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| ground                                  |                                      | ing cycles                   | -      |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 4\Output parar | neters                       |        |  |
| Reaction to CPU STOP                    | Shutdown                             | Switching cycle coun-        | False  |  |
|   |                                      | ter                          |        |  |
| Switching cycle limit                   |                                      |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 5              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 5\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| ground                                  |                                      | ing cycles                   |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 5\Output parar | neters                       |        |  |
| Reaction to CPU STOP                    | Shutdown                             | Switching cycle coun-<br>ter | False  |  |
| Switching cycle limit                   |                                      |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 6              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 6\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| ground                                  |                                      | ing cycles                   |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 6\Output parar | neters                       |        |  |
| Reaction to CPU STOP                    | Shutdown                             | Switching cycle coun-<br>ter | False  |  |
| Switching cycle limit                   |                                      |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 7              |                              |        |  |
| Parameter settings                      | From template                        |                              |        |  |
| Output 0 - 15\Outputs\                  | Channel 0 - 7\Channel 7\Diagnostics  |                              |        |  |
| No supply voltage L+                    | False                                | Wire break                   | False  |  |
| Short circuit to                        | False                                | Maintenance switch-          | False  |  |
| around                                  |                                      | ing cycles                   | i disc |  |
| 5                                       |                                      | J                            |        |  |
|   |                                      |                              |        |  |
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|   |                                      |                              |        |  |

| Totally Integrated     |                                      |                                    |       |  |  |  |
|------------------------|--------------------------------------|------------------------------------|-------|--|--|--|
| Automation Portal      |                                      |                                    |       |  |  |  |
|                        |                                      |                                    |       |  |  |  |
|                        |                                      |                                    |       |  |  |  |
|                        | Channel 0 - AChannel AOutput parar   | neters<br>Coult de la manda accord |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coun-              | Faise |  |  |  |
| <u> </u>               |                                      | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 8             |                                    |       |  |  |  |
| Parameter settings     | From template                        |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 8\Diagnostics |                                    |       |  |  |  |
| No supply voltage L+   | False                                | Wire break                         | False |  |  |  |
| Short circuit to       | False                                | Maintenance switch-                | False |  |  |  |
| ground                 |                                      | ing cycles                         |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 8\Output para | ameters                            |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coun-              | False |  |  |  |
|                        |                                      | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 9             |                                    |       |  |  |  |
| Parameter settings     | From template                        |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 9\Diagnostics |                                    |       |  |  |  |
| No supply voltage L+   | False                                | Wire break                         | False |  |  |  |
| Short circuit to       | False                                | Maintenance switch-                | False |  |  |  |
| ground                 |                                      | ing cycles                         |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 9\Output para | ameters                            |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coun-              | False |  |  |  |
|                        |                                      | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 10            |                                    |       |  |  |  |
| Parameter settings     | From template                        |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 10\Diagnostic | S                                  |       |  |  |  |
| No supply voltage L+   | False                                | Wire break                         | False |  |  |  |
| Short circuit to       | False                                | Maintenance switch-                | False |  |  |  |
| ground                 |                                      | ing cycles                         |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 10\Output par | rameters                           |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coun-              | False |  |  |  |
|                        |                                      | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 11            |                                    |       |  |  |  |
| Parameter settings     | From template                        |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 11\Diagnostic | s                                  |       |  |  |  |
| No supply voltage L+   | False                                | Wire break                         | False |  |  |  |
| Short circuit to       | False                                | Maintenance switch-                | False |  |  |  |
| ground                 |                                      | ing cycles                         |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 11\Output par | rameters                           |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coun-              | False |  |  |  |
|                        |                                      | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    | ]     |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 12            |                                    |       |  |  |  |
| Parameter settings     | From template                        |                                    |       |  |  |  |
| Output 0 - 15\Outputs\ | Channel 8 - 15\Channel 12\Diagnostic | S                                  |       |  |  |  |
|                        | False                                | Wire break                         | False |  |  |  |
| Short circuit to       | False                                | Maintenance switch                 | False |  |  |  |
| around                 |                                      | ing cycles                         |       |  |  |  |
| Output 0 - 15\Outpute  | Channel 8 - 15\Channel 12\Output par | rameters                           |       |  |  |  |
| Reaction to CPU STOP   | Shutdown                             | Switching cycle coup               | False |  |  |  |
|                        | Shataowii                            | ter                                |       |  |  |  |
| Switching cycle limit  |                                      |                                    |       |  |  |  |
| Output 0 - 15\Outputo  | Channel 8 - 15\Channel 12            |                                    |       |  |  |  |
| Parameter settings     |                                      |                                    |       |  |  |  |
| Parameter settings     | Channel 9. 15 Channel 10 Diaman      |                                    |       |  |  |  |
|                        | Chaimer & - 15/Channel 13/Diagnostic | Mine hus - la                      | C-la- |  |  |  |
| No supply voltage L+   | Faise                                | wire break                         | Faise |  |  |  |
|                        |                                      |                                    |       |  |  |  |
|                        |                                      |                                    |       |  |  |  |
|                        |                                      |                                    |       |  |  |  |
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| l otally integrated  |   |                                   |          |
| Automation Portai  |   |                                   |          |
|  |   |                                   |          |
| Short circuit to   | False                                       | Maintenance switch-               | False    |
| ground   |   | ing cycles                        |          |
| Output 0 - 15\Outputs\   | Channel 8 - 15\Channel 13\Output par        | rameters                          |          |
| Reaction to CPU STOP   | Shutdown                                    | Switching cycle coun-             | False    |
| Cuvitabing avala limit   |   | ler                               |          |
| Switching cycle limit  | Channel 9, 15) Channel 14                   |                                   |          |
| Dulpul 0 - 15(Oulpuls)   |   |                                   |          |
| Parameter settings   | From template                               |                                   |          |
| No supply voltage L  |   | .s<br>Wire brook                  | Falco    |
| Short circuit to   |   | Maintonanco gwitch                |          |
| around   | raise                                       | ing cycles                        | Faise    |
| Output 0 - 15\Outputs\   | Channel 8 - 15\Channel 14\Output par        | rameters                          |          |
| Reaction to CPU STOP   | Shutdown                                    | Switching cycle coun-             | False    |
|  | Shutdown                                    | ter                               |          |
| Switchina cvcle limit  |   |                                   |          |
| Output 0 - 15\Outputs\   | Channel 8 - 15\Channel 15                   |                                   |          |
| Parameter settings   | From template                               |                                   |          |
| Output 0 - 15\Outputs  | Channel 8 - 15\Channel 15\Diagnostic        | S                                 |          |
| No supply voltage L+   | False                                       | Wire break                        | False    |
| Short circuit to   | False                                       | Maintenance switch-               | False    |
| ground   |   | ing cycles                        |          |
| Output 0 - 15\Outputs\   | Channel 8 - 15\Channel 15\Output pa         | rameters                          |          |
| Reaction to CPU STOP   | Shutdown                                    | Switching cycle coun-             | False    |
|  |   | ter                               |          |
| Switching cyclo limit  |   |                                   |          |
| Switching Cycle Innit  |   |                                   |          |
| Output 0 - 15\I/O addre  | esses\Output addresses                      |                                   |          |
| Output 0 - 15\I/O addre<br>Start address                                       | esses\Output addresses<br>0.0               | End address                       | 1.7      |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode                  | esses\Output addresses<br>0.0<br>False      | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addre<br>Start address<br>Isochronous mode<br>Process image  | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | o.o<br>False<br>O                           | End address<br>Organization block | 1.7<br>0 |
| Output 0 - 15\I/O addres<br>Start address<br>Isochronous mode<br>Process image | esses\Output addresses<br>0.0<br>False<br>0 | End address<br>Organization block | 1.7<br>0 |

| Totally Integrated<br>Automation Portal |                                       |                          |   |
|---|---------------------------------------|--------------------------|---|
| Local module                            | S                                     |                          |   |
| AI 4xU/I/RTD/TC                         | ST_1                                  |                          |   |
| AI 4xU/I/RTD/TC ST_1                    | ation                                 |                          |   |
| Name                                    |                                       | Author                   | Alireza Oadiri  |
| Comment                                 |                                       | Rack                     | 0   |
| Slot                                    | 4                                     |                          | -   |
| General\Catalog inform                  | nation                                |                          |   |
| Short designation                       | AI 4xU/I/RTD/TC ST                    | Description              | Analog input module AI4 x U/I/RTD/TC<br>16-bit; grouping 4; 2 channels with<br>RTD measurement; common mode<br>voltage 10 V; configurable diagnostics;<br>hardware interrupts |
| Article number                          | 6ES7 531-7QD00-0AB0                   | Firmware version         | V1.0  |
| General\Identification                  | & Maintenance                         | <b></b>                  |   |
| Plant designation                       | 2021 01 00 22 42 10 112               | Location identifier      |   |
| Installation date                       | 2021-01-08 22:42:10.113               | Additional Informa-      |   |
| Module parameters\Ge                    | eneral\Startup                        |                          |   |
| Comparison preset to actual module      | From CPU                              |                          |   |
| Module parameters\Ch                    | nannel template\Inputs\Apply to all c | hannels that use the ter | mplate\Diagnostics  |
| No supply voltage L+                    | False                                 | Overflow                 | False   |
| Underflow                               | False                                 | Common mode error        | False   |
| Reference junction                      | False                                 | Wire break               | False   |
| Current limit for wire                  |                                       |                          |   |
| break diagnostics                       |                                       |                          |   |
| Moasurement type                        | Voltage                               | Moasuring range          |   |
| Temperature coeffi-                     | Voltage                               | Temperature unit         | +/- 100   |
| cient                                   |                                       | Eixed reference tem-     |   |
|   | 5047                                  | perature                 | Nono  |
| cy suppression                          | 50HZ                                  | Shibothing               | None  |
| Module parameters\Al                    | configuration\Configuration of subn   | nodules                  |   |
| Module distribution                     | None                                  |                          |   |
| Module parameters\Al                    | configuration\Value status (Quality   | Information)             |   |
| Value status                            | False                                 |                          |   |
| Module parameters\AI                    | configuration\Copy of module for Sh   | nared Device (MSI)       |   |
| Copy of module:                         | None                                  |                          |   |
| Input 0 - 3\General                     |                                       | Commont                  |   |
| Input 0 - 3\Inputs\Char                 |                                       | comment                  |   |
| Parameter settings                      | From template                         |                          |   |
| Input 0 - 3\Inputs\Char                 | nel 0\Diagnostics                     |                          |   |
| No supply voltage L+                    | False                                 | Overflow                 | False   |
| Underflow                               | False                                 | Common mode error        | False   |
| Reference junction                      | False                                 | Wire break               | False   |
| Current limit for wire                  |                                       |                          |   |
| break diagnostics                       |                                       |                          |   |
| Moosurement type                        |                                       | Moocuring range          | 101   |
| Temperature coeffi                      | vollage                               | Temperature unit         |   |
| cient                                   |                                       |                          |   |
|   |                                       |                          |   |
|   |                                       |                          |   |

|                                    |                         |                                  | I       |  |
|------------------------------------|-------------------------|----------------------------------|---------|--|
| Totally Integrated                 |                         |                                  |         |  |
| Automation Portal                  |                         |                                  |         |  |
|                                    |                         |                                  |         |  |
| Reference junction                 |                         | Fixed reference tem-<br>perature |         |  |
| Interference frequen-              | 50Hz                    | Smoothing                        | None    |  |
| cy suppression                     |                         |                                  |         |  |
| Input 0 - 3\Inputs\Char            | inel 0\Hardware interru | ipts                             |         |  |
| High limit 1                       |                         | Low limit 1                      |         |  |
| High limit 2                       |                         | LOW limit 2                      |         |  |
|                                    | inei U\Hardware interru | pts\                             | 40272   |  |
| Hardware Interrupt<br>high limit 1 | 0                       | eEvent                           | 49272   |  |
| Event name:                        |                         | Hardware interrupt:              | 0       |  |
| UpperLimitOne0                     | UpperLimitOne0          | Channel number                   | 0       |  |
| HwEventTypeLi-                     | 4                       |                                  |         |  |
| mit 10 verrun                      |                         |                                  |         |  |
| Input 0 - 3\Inputs\Char            | inel 0\Hardware interru | ipts\                            |         |  |
| Hardware interrupt<br>low limit 1  | 0                       | RidPrefixFallingEdg-<br>eEvent   | 49288   |  |
| Event name:                        |                         | Hardware interrupt:              | 0       |  |
| LowerLimitOne0                     | LowerLimitOne0          | Channel number                   | 0       |  |
| HwEventTypeLi-                     | 3                       |                                  |         |  |
| mit1Underrun                       |                         |                                  |         |  |
| Input 0 - 3\Inputs\Char            | nel 0\Hardware interru  | ipts\                            |         |  |
| Hardware interrupt                 | 0                       | RidPrefixFallingEdg-             | 49264   |  |
| high limit 2                       |                         | eEvent                           |         |  |
| Event name:                        |                         | Hardware interrupt:              | 0       |  |
| UpperLimitTwo0                     | UpperLimitTwo0          | Channel number                   | 0       |  |
| HwEventTypeLi-<br>mit2Overrun      | 6                       |                                  |         |  |
| Input 0 - 3\Inputs\Char            | nel 0\Hardware interru  | ipts\                            |         |  |
| Hardware interrupt                 | 0                       | RidPrefixFallingEdg-             | 49280   |  |
| Event name:                        |                         | Hardware interrupt:              | 0       |  |
| Lowerl imitTwo0                    | Lowerl imitTwo0         | Channel number                   | 0       |  |
| HwEventTypel i-                    | 5                       |                                  | 0       |  |
| mit2Underrun                       | 5                       |                                  |         |  |
| Input 0 - 3\Inputs\Char            | inel 1                  |                                  |         |  |
| Parameter settings                 | From template           |                                  |         |  |
| Input 0 - 3\Inputs\Char            | nel 1\Diagnostics       |                                  |         |  |
| No supply voltage L+               | False                   | Overflow                         | False   |  |
| Underflow                          | False                   | Common mode error                | False   |  |
| Reference junction                 | False                   | Wire break                       | False   |  |
| Current limit for wire             |                         |                                  | 1       |  |
| break diagnostics                  |                         |                                  |         |  |
| Input 0 - 3\Inputs\Char            | nel 1\Measuring         |                                  |         |  |
| Measurement type                   | Voltage                 | Measuring range                  | +/- 10V |  |
| Temperature coeffi-<br>cient       |                         | Temperature unit                 |         |  |
| Reference junction                 |                         | Fixed reference tem-             |         |  |
|                                    |                         | perature                         |         |  |
| Interference frequen-              | 50Hz                    | Smoothing                        | None    |  |
| cy suppression                     |                         |                                  |         |  |
| Input 0 - 3\Inputs\Char            | nel 1\Hardware interru  | ipts                             | 1       |  |
| High limit 1                       |                         | Low limit 1                      |         |  |
| High limit 2                       |                         | Low limit 2                      |         |  |
| Input 0 - 3\Inputs\Char            | nel 1\Hardware interru  | ipts\                            |         |  |
| Hardware interrupt                 | 0                       | RidPrefixFallingEdg-             | 49273   |  |
| Event name                         |                         | Hardware interrupt:              | 0       |  |
| Upperl imitOne1                    | Upperl imitOne1         | Channel number                   | 1       |  |
| - ppsi zinitone i                  | -pper Linitorie I       | chamer humber                    | · ·     |  |
|                                    |                         |                                  |         |  |
|                                    |                         |                                  |         |  |

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| Automation Portal   |   |  |   |
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| HwEventTypeLi-  | 4   |  | •   |
| mit10verrun   |   |  |   |
| Input 0 - 3\Inputs\Char   | nnel 1\Hardware interrupts\   |  |   |
| Hardware interrupt  | 0   | RidPrefixFallingEdg-   | 49289   |
| low limit 1   |   | eEvent   | -   |
| Event name:   |   | Hardware interrupt:  | 0   |
| LowerLimitOne1  | LowerLimitOne1  | Channel number   | 1   |
| HWEVENTTypeLI-  | 3   |  |   |
| Input 0 - 3\Inputs\Char   | nel 1\Hardware interrunts\  |  |   |
| Hardware interrupt  | 0   | RidPrefixFallingEdg-   | 49265   |
| high limit 2  |   | eEvent   |   |
| Event name:   |   | Hardware interrupt:  | 0   |
| UpperLimitTwo1  | UpperLimitTwo1  | Channel number   | 1   |
| HwEventTypeLi-  | 6   |  | · · · · · · · · · · · · · · · · · · ·                             |
| mit2Overrun   |   |  |   |
| Input 0 - 3\Inputs\Char   | nel 1\Hardware interrupts\  |  |   |
| Hardware interrupt  | 0   | RidPrefixFallingEdg-   | 49281   |
| IOW IIMIT 2   |   |  | 0   |
| Event name:   | LowertimitTwo1  | Channel number   | 1   |
| HwEventTypel i-   | 5   |  | 1   |
| mit2Underrun  |   |  |   |
| Input 0 - 3\Inputs\Char   | nnel 2  |  |   |
| Parameter settings  | From template   |  |   |
| Input 0 - 3\Inputs\Char   | nnel 2\Diagnostics  |  |   |
| No supply voltage L+  | False   | Overflow   | False   |
| Underflow   | False   | Common mode error  | False   |
| <b>Reference</b> junction   | False   | Wire break   | False   |
|   |   |  |   |
| Current limit for wire  |   |  |   |
| Current limit for wire<br>break diagnostics   |   |  |   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char  | nnel 2\Measuring  | Moosuring range  | ./ 101/   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-   | n <mark>nel 2\Measuring</mark><br>Voltage   | Measuring range  | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient  | n <b>el 2\Measuring</b><br>Voltage  | Measuring range<br>Temperature unit  | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction  | n <b>nel 2\Measuring</b><br>Voltage   | Measuring range<br>Temperature unit<br>Fixed reference tem-  | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction  | n <b>nel 2\Measuring</b><br>Voltage   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature  | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-   | nnel 2\Measuring<br>Voltage<br>50Hz   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression   | onel 2\Measuring<br>Voltage<br>50Hz   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1  | Voltage<br>50Hz<br><b>1 Nel 2\Hardware interrupts</b>   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2  | voltage<br>50Hz<br><b>1nel 2\Hardware interrupts</b>  | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1  | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char   | Voltage<br>50Hz<br><b>1nel 2\Hardware interrupts</b>  | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt   | Voltage<br>50Hz<br><b>nnel 2\Hardware interrupts</b>  | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1   | Innel 2\Measuring         Voltage         50Hz         Innel 2\Hardware interrupts         Innel 2\Hardware interrupts\   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-<br>eEvent   | +/- 10V<br>None   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:  | Innel 2\Measuring   Voltage   50Hz   nnel 2\Hardware interrupts   nnel 2\Hardware interrupts\   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt:  | +/- 10V<br>None<br>49274  |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2  | Innel 2\Measuring   Voltage   50Hz   Innel 2\Hardware interrupts   0   UpperLimitOne2   | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt:<br>Channel number  | +/- 10V<br>None<br>49274<br>0                                     |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-  | Voltage<br>50Hz<br>nel 2\Hardware interrupts<br>nel 2\Hardware interrupts<br>0<br>UpperLimitOne2<br>4   | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overun  | Voltage Voltage 50Hz nnel 2\Hardware interrupts 0 UpperLimitOne2 4  | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt:<br>Channel number  | +/- 10V<br>None<br>49274<br>0                                     |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char  | Image   Voltage   50Hz   Image   S0Hz   Image   Image   Image   UpperLimitOne2   4  | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1   | Voltage<br>Voltage<br>50Hz<br><b>inel 2\Hardware interrupts</b><br>UpperLimitOne2<br>4<br><b>inel 2\Hardware interrupts</b><br>0                                  | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent  | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:  | Innel 2\Measuring   Voltage   50Hz   Innel 2\Hardware interrupts   0   UpperLimitOne2   4   Innel 2\Hardware interrupts\   0                                      | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Hardware interrupt:         Hardware interrupt:  | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2  | Innel 2\Measuring   Voltage   50Hz   50Hz   Innel 2\Hardware interrupts   0   UpperLimitOne2   4   Innel 2\Hardware interrupts\   0   LowerLimitOne2              | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V   |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-  | Voltage<br>Voltage<br>50Hz<br><b>Innel 2\Hardware interrupts</b><br>0<br>UpperLimitOne2<br>4<br>LowerLimitOne2<br>3   | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V  None  49274  0  2  49290  0  2                           |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underun   | Voltage<br>Voltage<br>50Hz<br>nel 2\Hardware interrupts<br>0<br>UpperLimitOne2<br>4<br>LowerLimitOne2<br>3  | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char   | Voltage   Voltage   50Hz   50Hz   nel 2\Hardware interrupts   0   UpperLimitOne2   4   0   LowerLimitOne2   3   | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number   | +/- 10V<br>None<br>49274<br>0<br>2<br>49290<br>0<br>2             |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>bigh limit 2                | Voltage   Voltage   50Hz   50Hz   nel 2\Hardware interrupts   0   UpperLimitOne2   4   0   LowerLimitOne2   3   nel 2\Hardware interrupts\   0                    | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number | +/- 10V<br>None<br>49274<br>0<br>2                                |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 2<br>Event name: | Voltage   50Hz   50Hz   nel 2\Hardware interrupts   0   UpperLimitOne2   4   nel 2\Hardware interrupts\   0   LowerLimitOne2   3   nel 2\Hardware interrupts\   0 | Measuring range         Temperature unit         Fixed reference temperature         Smoothing         Low limit 1         Low limit 2         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number         RidPrefixFallingEdg-<br>eEvent         Hardware interrupt:         Channel number | +/- 10V<br>None<br>49274<br>0<br>2<br>49290<br>0<br>2             |
| Current limit for wire<br>break diagnostics<br>Input 0 - 3\Inputs\Char<br>Measurement type<br>Temperature coeffi-<br>cient<br>Reference junction<br>Interference frequen-<br>cy suppression<br>Input 0 - 3\Inputs\Char<br>High limit 1<br>High limit 2<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 1<br>Event name:<br>UpperLimitOne2<br>HwEventTypeLi-<br>mit1Overrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>low limit 1<br>Event name:<br>LowerLimitOne2<br>HwEventTypeLi-<br>mit1Underrun<br>Input 0 - 3\Inputs\Char<br>Hardware interrupt<br>high limit 2<br>Event name: | Voltage<br>Voltage<br>50Hz<br>nel 2\Hardware interrupts<br>0<br>UpperLimitOne2<br>4<br>LowerLimitOne2<br>3<br>nel 2\Hardware interrupts<br>0                      | Measuring range<br>Temperature unit<br>Fixed reference tem-<br>perature<br>Smoothing<br>Low limit 1<br>Low limit 2<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt:<br>Channel number<br>RidPrefixFallingEdg-<br>eEvent<br>Hardware interrupt:<br>Channel number   | +/- 10V  None  49274  0  2  49274  0  2  49290  0  2  49290  0  2 |

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|---|--------------------|---------------|----------------------------------|---------|--|
| UpperLimitTwo2                              | UpperLimitTwo      | 02            | Channel number                   | 2       |  |
| HwEventTypeLi-                              | 6                  |               |                                  |         |  |
| mit2Overrun                                 |                    | - interrepted |                                  |         |  |
| Input 0 - 3\inputs\Chan                     |                    | e Interrupts  | PidProfixEallingEdg-             | 10787   |  |
| low limit 2                                 | 0                  |               | eEvent                           | 49202   |  |
| Event name:                                 |                    |               | Hardware interrupt:              | 0       |  |
| LowerLimitTwo2                              | LowerLimitTwo      | )2            | Channel number                   | 2       |  |
| HwEventTypeLi-                              | 5                  |               |                                  |         |  |
| Input 0 - 3\Inputs\Char                     | inel 3             |               |                                  |         |  |
| Parameter settings                          | From template      |               |                                  |         |  |
| Input 0 - 3\Inputs\Chan                     | nel 3\Diagnost     | ics           |                                  |         |  |
| No supply voltage L+                        | False              |               | Overflow                         | False   |  |
| Underflow                                   | False              |               | Common mode error                | False   |  |
| Reference junction                          | False              |               | Wire break                       | False   |  |
| Current limit for wire<br>break diagnostics |                    |               |                                  |         |  |
| Input 0 - 3\Inputs\Chan                     | inel 3\Measurin    | ng            |                                  |         |  |
| Measurement type                            | Voltage            |               | Measuring range                  | +/- 10V |  |
| Temperature coeffi-<br>cient                |                    |               | Temperature unit                 |         |  |
| Reference junction                          |                    |               | Fixed reference tem-<br>perature |         |  |
| Interference frequen-                       | 50Hz               |               | Smoothing                        | None    |  |
| cy suppression                              | and 2\Uardwar      | - intorrupto  |                                  |         |  |
| linput 0 - 3\inputs\Chan                    | inel 3\Haruwar     | e interrupts  | Low limit 1                      |         |  |
| High limit 2                                |                    |               | Low limit 2                      |         |  |
| Input 0 - 3\Inputs\Char                     | nel 3\Hardwar      | e interrupts\ |                                  |         |  |
| Hardware interrupt<br>high limit 1          | 0                  |               | RidPrefixFallingEdg-<br>eEvent   | 49275   |  |
| Event name:                                 |                    |               | Hardware interrupt:              | 0       |  |
| UpperLimitOne3                              | UpperLimitOne      | :3            | Channel number                   | 3       |  |
| HwEventTypeLi-                              | 4                  |               |                                  |         |  |
| mit10verrun                                 | and 2\Hardwar      | a interrupte) |                                  |         |  |
| Input 0 - 5\inputs\Chan                     |                    | e Interrupts  | PidProfixFallingEdg-             | 10701   |  |
| low limit 1                                 |                    |               | eEvent                           | 47271   |  |
| Event name:                                 | LowerLimitOne      |               | Hardware mierrupi.               | 0       |  |
| HwFventTvpeLi-                              | R                  | .5            |                                  | 3       |  |
| mit1Underrun                                |                    |               |                                  |         |  |
| Input 0 - 3\Inputs\Char                     | nel 3\Hardwar      | e interrupts\ |                                  |         |  |
| Hardware interrupt<br>high limit 2          | 0                  |               | RidPrefixFallingEdg-<br>eEvent   | 49267   |  |
| Event name:                                 |                    |               | Hardware interrupt:              | 0       |  |
| UpperLimitTwo3<br>HwEventTvpeLi-            | UpperLimitTwo<br>6 | 13            | Channel number                   | 3       |  |
| mit2Overrun                                 |                    |               |                                  |         |  |
| Input 0 - 3\Inputs\Char                     | inel 3\Hardwar     | e interrupts\ |                                  |         |  |
| Hardware interrupt<br>low limit 2           | 0                  |               | RidPrefixFallingEdg-<br>eEvent   | 49283   |  |
| Event name:                                 |                    |               | Hardware interrupt:              | 0       |  |
| LowerLimitTwo3                              | LowerLimitTwo      | J3            | Channel number                   | 3       |  |
| HwEventTypeLi-<br>mit2Underrun              | 5                  |               |                                  |         |  |
| Input 0 - 3\I/O addresse                    | es\Input addres    | ses           |                                  |         |  |
| Start address                               | 2                  |               | End address                      | 9       |  |
|   | <u> </u>           |               |                                  |         |  |

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|---|---------------|---|--|
| Organization block 0                    | Process image | 0 |  |