TECHNICAL EQUIPMENT STANDARD SUT-C

Control & Instrumentation

Documentation number: SUT C

Status as of October 2019

PCC Rokita SA
ul. Sienkiewicza 4
56-120 Brzeg Dolny
kontakt@pcc.rokita.pl
www.pcc.rokita.pl

Brzeg Dolny 2019

Table of Contents

1. PURPOSE OF THE INSTRUCTION

The purpose of this instruction is to provide both, suitable reliability of work for technical installations and individual devices (minimizing of the number of failures and critical faults in a specified period of time and minimizing the time of their removal) and optimisation of maintenance and operation cost by

determining basic technical requirements in the C&I discipline (reducing the cost of inventory, reducing the time to remove failures or faults by applying standard solutions). Reaching the objective that is optimizing the costs of maintenance and operation of the installation can be done by ensuring standards of:

- skills and knowledge
- work.

In order to reach the standards mentioned above, this document standardizes devices, technical solutions and manufacturers, which will lead to unification and systemizing of the measurements and automation, which will consequently lead to reducing the cost of employee training in equipment operation, unifying the scope of employee work in the whole company, and better predictability of issues related to the operation of own installations.

Additionally, in connection with the conclusion of the grant agreement, it is necessary to apply in the selection procedures the rules resulting from the "*Guidelines for the principles of awarding public contracts and the selection of contractors in transactions not covered by the PZP Act (Public Procurement Act) under RPO WD*". This obliges our company to accept all technically equivalent solutions. However, there is a risk that the contracts will be won by offers with a low cost and low-quality devices, which cannot be verified at the stage of technical documentation examination but only later at the stage of operation.

Additionally, in the case of offers for services, the applicable regulations allow the contractor to issue a declaration of conformity for the solutions provided, which considerably limits of the possibility of assessing the offered devices in terms of the relevant technical tests that these devices have undergone. The only possible justification for reducing the scope of equivalent solutions in tenders is to refer to the standards used in the company (PCC Rokita Group), in order to maintain compatibility with existing solutions.

2. SCOPE OF INSTRUCTION

This document includes the general requirements for the design and selection of automation devices and control and visualisation systems. The instruction includes the guidelines for design and/or implementation binding in the PCC group that are compatible with the Technical Documentation Standard (SDT) which is also in force in PCC Rokita SA.

This document relates to companies of PCC Rokita S.A. group (in particular workers of department of GT, GTP, GTU, GTS, GTA, GI, GIP, GK, chief engineering), workers of LabMatic Sp. z o.o. and workers of third-party companies carrying out assembly works for technical devices and installations in the field of Control and Measurement Apparatus and Automation on behalf of the PCC group companies.

No.	Position (role)	Responsibilities	Authorizations
1.	Technical Director (GT)	Supervision over the implementation of the instructions.	Requesting for change of instruction.
2.	Technical Department Manager (GTP)	Supervision over the implementation of the instructions, abiding by the instruction.	Reporting the needs to change the instruction.
3.	Technical Specialist	Abiding by the instruction.	Reporting the needs to change the instruction.
4.	Maintenance Manager (GTU)	Abiding by the instruction	Reporting the needs to change the instruction.
5.	Project Manager (GI)	Supervision over the implementation of the instructions.	Reporting the needs to change the instruction.
6.	Chief Engineer	Supervision over the implementation of the instructions, abiding by the instruction.	Reporting the needs to change the instruction.

3. PRINCIPLES OF HOW TO PROCEED

3.1. Definitions and Abbreviations

3.1.1. Abbreviations

AKP – Measurement and Control Instrumentation

AKPiA – Control and Instrumentation

AMS – Alarm Management System

APL – Advanced Process Library

CPU – Central Processing Unit

CEO – General Director

DCS – Distributed Control System

DMZ – Demilitarized zone

EMC – Electromagnetic Compatibility

ESD – Emergency Shutdown System

EX – Explosionproof

HART – Highway Addressable Remote Transducer. Communication protocol.

HMI – Human-Machine Interface

MPI – Multi-Point Interface. Communication protocol.

MR – Matrix of risk

NTP – Network Time Protocol

P&ID - Piping and Instrumentation Diagram

PLC - Programmable Logic Controller

SCADA – Supervisory Control and Data Acquisition

SIL – Safety Integrity Level

SIS – Safety Instrumented System

TDS – Technical Documentation Standard

TES – Technical Equipment Standard

USB – Universal Serial Bus

VPN – Virtual Private Network

WAN - Wide Area Network

IQEMS - Integrated Quality and Environment Management System

3.1.2. Definitions

ATEX - (French. Atmospheres Explosibles) - EU directive (legal act) describing basic requirements which must be met by each product intended to be used in an environment with an explosive atmosphere.

CPU - Central Processing Unit – a sequential digital device executing orders on the basis of interpreted data taken from the memory.

Sensor – a device, physical system, which transforms its reaction to the physical stimulus into a measurable signal of other physical quantity to provide information about the physical quantity.

DCS - Distributed Control System, a system for control and visualization of the industrial process, which has a common database for control and visualization, as opposed to SCADA or PLC systems.

DMZ – Demilitarized zone. Special, dedicated configuration of local area network (LAN) to improve cybersecurity by sorting computers by each side of firewall.

Measuring accuracy – level of consistency between the measurement result and the factual value referenced to a specified master.

Emergency Shutdown System (ESD) – interlocks system ensuring safe process stoppage in case of a breakdown in industrial control process.

HART – Highway Addressable Remote Transducer. Communication protocol for industrial networks allowing the change of a range and C&I diagnostics. One of standard communication protocols for the C&M equipment in industry.

HAZOP – Hazard and Operability Study. Method of risk analysis.

HMI – Human-Machine Interface. The user interface in a manufacturing or process control system. It provides a graphics-based visualization of an industrial control and monitoring system.

Measuring instrument class – determines the maximum allowed measuring deviation. It is determined as a percent in relation to the entire measuring range. There are laboratory class (devices with 0.2 and 0.5 class) and technical class devices (instrument class equal or above 1).

Microswitch – electric switch operated with a small movement of its lever.

MPI - Multi-Point Interface. An industrial network for communication between PLCs, programming station, operator panels and other SIMATIC devices produced by Siemens**.**

NAMUR – technical standard adopted by the international association of automation users for industrial processes. NAMUR standard defines 2-wire proximity switches with switching parameters from 1.2 mA

do 2.1 mA at 8.2 VDC.

NTP – Network Time Protocol. A networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks.

PLC - Programmable Logic Controller – microprocessor device performing cyclic control algorithm, based on which it processes the statutes to corresponding output statuses.

PROFIBUS DP – Communication standard for industrial networks. One of standard communication protocols of C&I devices in the industry.

PROFInet – A modern industrial standard for building integrated and compact automation systems and distributed automation systems based on component model, which is based on industrial Ethernet.

Straight length section - straight section of pipe with an unchanged cross section and shape.

Transducer – A device that converts some value to other, according to a define rules and with some accuracy.

Smart transducers – transducers for measurement and signal processing, ensuring communication with the measuring or control system with a digital signal, based on the standard communication protocol.

Communication protocol – set of rules and steps performed by communication devices for data transmission and exchange.

SCADA – Supervisory Control And Data Acquisition – system for monitoring and acquisition of technology or production process, performing the following functions: acquisition of current process data (including measurements), visualisation of collected data, process control based on the data collected and proper control algorithm, alarms and measurement data archiving.

TDS – Technical Documentation Standard – standards developed by PCC Rokita SA for the technical documentation and system of process identification.

SIL – Safety Integrity Level – level of requirements, which should be fulfil (executed) by safety system.

SIS – **Safety Instrumented System –** Instrumented system used to implement one or more Safety Instrumented Functions (SIF). A SIS is composed of any combination of sensors, logic solvers and final control elements for the purpose of taking a process to a safe state when predetermined conditions are violated.

Controller - device supervising operation of an electrical apparatus. It can be a computer, electric, electronic or electromechanical device.

Signal – model of a measurable value varying in time, generated by physical phenomena or systems.

Analogue signal - signal which may have any value of a continuous range, and its values can be determined at any point of time by a mathematical function determining a given signal.

Digital signal - electrical or optical signal which, through proper coding (digital modulation) transmits digital data.

Measuring signal – signal with given parameters, known to the metrologist, for activating the measured system of device being verified.

Actuators - mechanical devices used in regulation and control systems, creating input signal to the regulation/control object on the basis of the control signal.

USB – Universal Serial Bus – is a hardware communication port used to connect various devices to the

computer, with automatic detection and recognition by the operating system. **VPN** – A virtual private network (VPN) is a communication channel used to ensure a better efficiency or greater security level of transmitted data, thorough which data is sent in a private network between end clients through the public network (Internet) in such a way that the nodes are transparent to the packages sent in this way.

Watchdog - is an electronic timer that is used to detect and recover from computer malfunctions.
Measuring range - range of the measured value or other values determining it, for which the measuring device can be used with accuracy permissible limits, with no harm to the device strength and without compromising safety.
Shutoff valve – a valve responsible for blocking the technological installation in the case of failure, thus plays an important role in safety systems ESD/SIS. It can be a ball valve, regulation valve or a butterfly valve.
Firewall – is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules. A firewall typically establishes a barrier between a trusted internal network and untrusted external network, such as the Internet.

3.2. General Guidelines

3.2.1. Scope

This document includes the general requirements for the design and selection of automation devices and control and visualisation systems as well as the Conditions of Acceptance for Devices and Automation systems. Before starting to prepare technical design or before selection of a device, all technical requirements, standards and guidelines specified in this document should be agreed.

Note: Any deviations from the technical guidelines contained herein should be agreed and accepted in writing by the Investor.

3.2.2. Exclusions

The following equipment is hereby excluded from the C&I discipline and detail engineering:

1. Sampling points at instruments and pipelines unless they are fitted with automation devices.
2. Nozzles for facility devices.
3. All check valves, hand valves, and on-off hand valves equipped with limit switches and drain valves except valves mounted on instrumentation pipes and valves mounted on air manifold drains.
4. All AC and DC power supply devices with cables to the distribution cabinets and all cables and intermediate cabinets supplying the control cabinets
5. A power supply devices of UPS type.
6. Electrical heating lines along with their control equipment.

3.3. Description how to proceed

3.3.1. General design requirements and acceptance conditions applicable in PCC Rokita S.A.

3.3.1.1. General design requirements

1. Automation equipment and control systems for new installations should be selected in such a manner as to comply with the standards and codes provided in section 6, and the requirements contained herein.
2. Automation equipment should be selected based on the HAZOP analysis taking into consideration SIL classification.
3. The adopted solutions should ensure safety, reliable operation and low cost of maintenance. Location of each device should ensure free access and safe operation.
4. Maximum standardization and unification of automation equipment and appliances in the control cabinets should be ensured.
5. All materials used in the automation equipment should be suitable for the conditions of process and ambient conditions.
6. For measurements the SI units (international system of units) should be mainly applied.
7. The measuring equipment mounted on process installations qualified as pressure systems should be commissioned according to the pressure directive referred to in section 6.
8. For automation equipment powered by air, air distributors with a reserve of additional drainage of 30% should be provided. Air distributors (manifolds) and valve islands (terminals) should be equipped in main filter regulator with pressure gauge. Each filter regulator equipped in a pressure gauge should be used but only when group use is not possible. Each outlet should be individually marked (with a tag number of a device, it is connected to).
9. For C&I devices, which are powered by air, there should be used such devices, which are able to work properly with the minimum of pressure 4,5 bar of power supply air.
10. Monitor the pressure of measuring air, which supplies automation devices for a given installation, taking into account an alarm signalization for the low pressure (less than or equal to 5 bar) and alarm with an interlock in the case of too low pressure (less than or equal to 4,5 bar – loss of measuring air).
11. All devices operating in safety and interlock loops should be equipped with a line damage detection system. Furthermore, an automation equipment within the ESD system should be connected directly to control systems.
12. All automation equipment within the ESD systems will be powered by a UPS. A UPS power supply is recommended for all measuring equipment and control cabinets.
13. In the event of power failure, the actuators have to switch to safe position automatically.

14. The detailed engineering design of C&I should include all signals connected to the control systems, which belong to other industries (mechanical, electrical, etc.).
15. Explosion proof equipment should have relevant certificates in Polish or English, issued by EU notified certification organs. The following explosion proof solutions for the automation and control equipment are preferred:
    - EEx (i) for measurement equipment and executive equipment of ESD integrated with DCS by means of dedicated devices ET200M Fail-safe or ET200iSP (If it is necessary to install distributed modules in explosive atmosphere) containing fail-safe modules.
    - EEx (d) For executive equipment of ESD independent of DCS.
16. Monitor and record values of filling and display appropriate levels in unpressurized and pressurized vessels in accordance with the guidelines of PBT. I04 - Technical Standards of mechanical equipment (SUT M).

3.3.1.2. Power supply systems of C&I

The power supply systems of C&I should be designed in accordance with applicable regulations and standards as well as the following requirements:

1. C&I equipment may not be damaged, turned off or impair the operation at:
   a. momentary voltage variations,
   b. momentary switching between different supply systems,
   c. supply voltage restored,
   d. switching on and disconnections.
2. The power supply circuits should be designed in order that the maximum voltage drop at the supply point does not exceed 5%.
3. Instruments should be powered by DCS. Local automation systems should be supplied with voltage guaranteed. The voltage guaranteed is the scope of work of electrical discipline.
4. Power supply system with guaranteed voltage for the protections, control and automation systems should be provided.
5. 230V AC guaranteed power supply system via an on-grid inverter supplied from the 24V DC guaranteed power supply system or in special cases via a UPS using its own local battery or cooperating with a separated battery, should be provided for 230V AC receivers.
6. The UPS systems should be avoided.
7. The basic emergency power supply system for the DCS control system, security and control systems as well as the C&I systems is a 24V DC guaranteed voltage supply system via a buffer power supply (rectifier) cooperating with the battery connected to them. Example is shown in the Figure 1. Example

of diagram of guaranteed 24VDC power supply for C&I. A converter 24V DC should be placed between a buffer power supply and a diode bridge.

8. Guaranteed power supply systems shall ensure power supply for the time required to stop control systems. However, for not less than 60 minutes.
9. A buffer power supply should be equipped with following systems:
   a. Contacts allowing operation with DCS.
   b. RS485 communication interface with software allowing for full remote control with a PC.
   c. RJ45 interface for digital communication with the Ethernet, with software allowing full remote control with a PC.
10. Accumulator batteries operating with buffer power supplies should be selected for the circuit rated voltage and operating conditions from 85% to 110% of the rated voltage.
11. In the case of power supply of PLC controller series S7-400 produced by SIEMENS, there have to be applied adequate power supply modules designed for connecting 24V DC providing the 5VDC/10A and 24VDC/1A on the secondary site. For non-redundant power supply use module of PS 405 10A (6ES7405-0KA020-0AA0). In order to increase availability of control system, especially If it is necessary to operate the control system from uncertain supply using two power supply modules type of PS 405 10 A (6ES7405-0KR020-0AA0) equipped in buffer batteries.

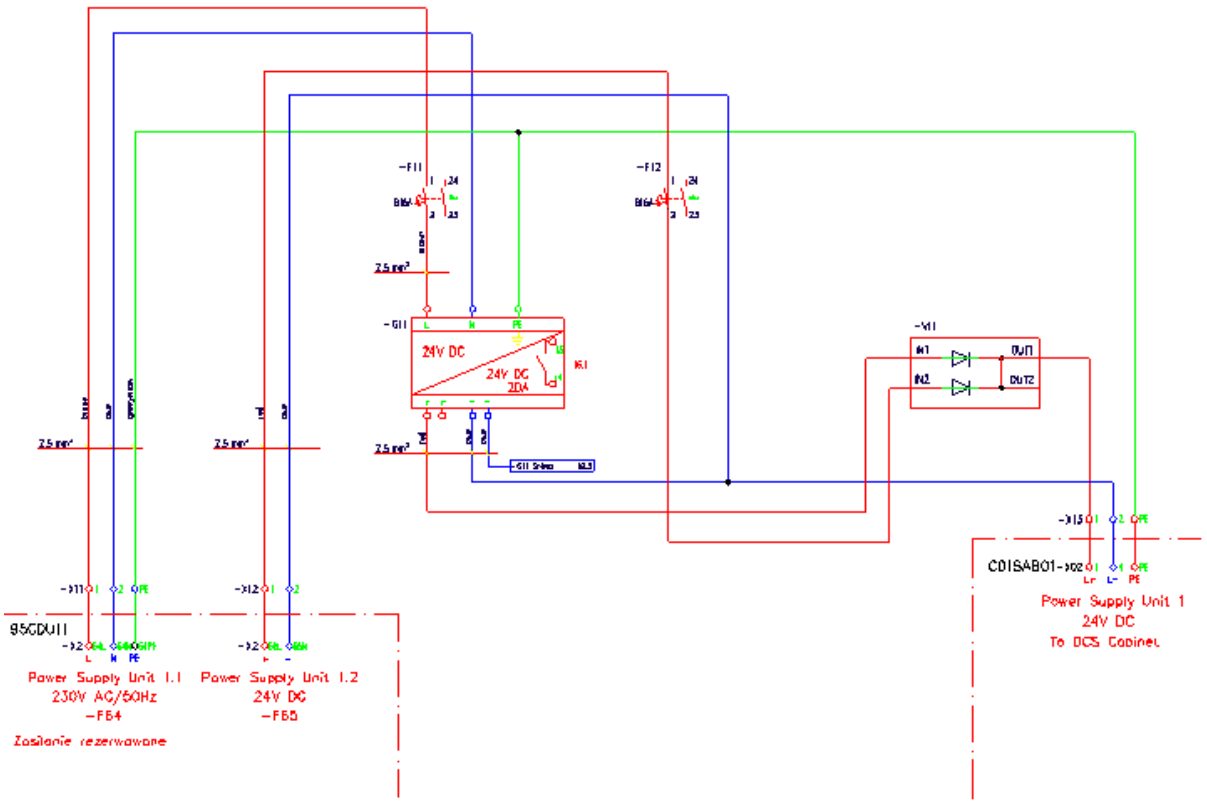


Figure 1. Example of guaranteed power supply diagram 24V DC for C&I

12. UPS units used in power supply systems for DCS and interlock systems for control and measuring automation should meet the following requirements:

a. UPS should have the minimum overload for power factor (power factor, PF=0.8 ≤125% for 10 minutes, ≤150% for 1 minute).

b. The UPS should have a double conversion mode (double Energy process).

c. The UPS units should have a high current overload of inverters installed in the system, allowing to correct selective protection on the rail receivers.

d. UPS should provide the time of switching to battery operation of 0 s (zero seconds). The ON-LINE mode.

e. The UPS should be equipped with overvoltage protection, overcurrent protection and short circuit protection.

f. The UPS should be equipped with protection against excessive battery discharge.

g. The UPS unit should have a bypass circuit equipped with a static switch and service bypass activated manually.

h. The UPS should be equipped with microprocessor electronic bypass.

i. The UPS units should have possibility to work with DCS to the extent necessary e.g. via contacts or Ethernet communication protocol.

j. UPS should transfer the following signals to the superior system:

- battery operation,
- guaranteed power supply failure
- battery discharge;

k. The UPS should have the required rated power based on the C&I and IT or electrical detail engineering documentation, for application assumed + 50% reserve.

3.3.1.3. Measurement and control instrumentation

1. Smart measuring transmitters and positioners should be used.
2. An equipment and interface software for diagnostics and communication with the site equipment should be provided.
3. An overvoltage protection should be provided everywhere it is necessary or as preventive measure to increase the protection of devices.
4. Equipment in metallic enclosures should be suitable for connection to the main ground system
5. All measuring devices installed on site should be marked and labelled.
6. All measurement devices mounted on a plant, should be furnished with stainless steel nameplates. The nameplates should specify all important information such as: e.g. instrument TAG number, type of device, serial number, crucial parameters, EX information, etc.

3.3.1.4. Standard of measurement and instrumentation signals.

1. Pneumatic signal: 20 to 100 kPa.
2. Signal 4-20mA with HART protocol in two wire 24VDC line as an output signal from electronic transducer as well as an output control signal.
3. 24VDC binary signal, NAMUR standard, potential-free contact.
4. 24VDC binary control signals
5. Profibus DP serial communication.

3.3.1.5. Mounting and Installation of the automation equipment.

1. The housing of the apparatus should be suitable to the atmosphere and process conditions
2. The housing should be equipped with sight glass if the display is installed
3. The cable glands should be tight and prevent the ingress of water and solid impurities to the equipment.
4. Locations subjected to vibration and high temperatures should be avoided.
5. It is prohibited to mount the equipment under drains and above vents.
6. Clamps, holders and supports should be mounted to fixed parts of structures, avoiding barriers and other parts provided for user safety. The equipment may not be mounted directly on concrete walls.
7. All devices to which electrical signals supplied should be grounded or shielded according to the recommendation by the producer.
8. The junction boxes should be installed in places with easy access, about 1.5 m above the platform. Each junction box should be labelled on the outside of the cover. The same marking shall be used on the multi-core cable outgoing of them.
9. Where it is necessary, electric heat cable for the automation equipment and instrumentation pipes should be ensured. The heating cables should be arranged to ensure easy dismantling and assembly of the heated devices. The electric heat cables should be installed according to the recommendation by the producer.
10. Components of measuring systems should be equipped with suitable fixtures and shut-off elements to ensure its safe dismantling and replacement while the system is running.
11. Cables connecting executing devices with the computer systems should be led into devices separately.
12. Communications cables (e.g. fibre optic ring) should be laid separately.
13. All cables and cables trays including communications cables should be protected against damage as well as impact of an external electromagnetic field.

14. Cable trays and their support elements should be protected against corrosion (e.g. by galvanic coat or painting).
15. Equipment requiring access (for regular checks, maintenance or replacement) should not be installed higher than 1.8 m above the service level. Permanent or movable platforms should be used for components installed higher.
16. All devices with flange or wafer should be equipped with seals dedicated to the process conditions.

3.3.1.6. Cable lines and cable routes.

The cable lines and routes should be designed in accordance with applicable regulations and standards, as well as the following requirements:

1. Requirements for components of cable trays.
   a. designed with at least 20 % reserve.
   b. Made of hot dip galvanised sheet metal (according to PN-EN ISO 1461:2011P Hot dip galvanised coatings on fabricated steel articles). The acid resistant steel or plastic (according to the local conditions) should be provided for cable trays for aggressive environment areas.
2. The system solutions for cable routes should be used.
3. The digital communication and telecommunication cables should be laid on separate cable trays than power cables.
4. Cables and conductors in cable trays or ladders should be protected with special guards against ambient conditions, such as: rainfall, sunlight, mechanical or heat exposures.
5. Cables should be protected against incidental damage.
6. The Adaptalok fittings should be used on electrical conduit to protect the ends of cables entering to the devices.
7. Electric continuity for cable routes and mounting accessories should be provided, as well as grounded every 15-20m.
8. C&I wiring for voltage of 230V AC or 24V DC should be made of multi-core cables and meet the following requirements:
   a. construction – cord of thin wires made of electrolytic copper,
   b. the same cross section area of current carrying conductors and protective conductor.
   c. Self-extinguishing according to PN-EN 60332-1-2:2010 Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
   d. with high chemical resistance (depending on the installation place);
   e. with numbered or colour-coded conductors;

f. with halogen-free or PVC insulation; in special cases, cables with additional protection (steel wire braid) should be provided.

g. for use in industrial conditions as well as in external wiring, UV and weather resistant.

9. The cross-sectional area of the signal cable (conductor) shall be at least 0.5 mm^2

10. The cross-sectional area of the power supply cable which powered C&I devices shall be at least 1.5 mm^2.

11. Cables placed entirely or partially in explosive atmospheres should have the following minimum cross-sectional area of conductors:

a. signal and control cables – 0,75mm^2,

b. Telecommunications cables – 0,75mm2.

12. An increased level of insulation of cables should be provided, as follow:

a. 0.3/0.5 kV insulation for signal cables with stranded conductors.

b. 0,6/1kV insulation for power supply cables

13. Signal cables should have at least 15 % reserve conductor pairs and not less than 2 reserve conductors

14. Optical fibre cables should have at least 30 % reserve, at least 4 fibres – 2 pairs

15. The maximum number of conductors in each single cable should not be more then 48.

16. The multi-cores cables shall be used for signals with the same voltage levels.

17. Signals for special measurements should be transferred with shielded cables, in accordance with requirements of devices' manufacturers (e.g. shielding in pairs).

18. The signal and power supply (pulse, digital data transmission etc.) cables should be installed in accordance with the requirements of the DCS system applied as well as harmonised standard PN-EN 50575 – Power, control and communication cables - Cables for general applications in construction works subject to reaction to fire requirements Power, control and communication cables - Cables for general applications in construction works subject to reaction to fire requirements.

19. The type, number of pairs and routes of the telecommunications cables should be agreed with the PCC IT S.A.

20. In closed rooms, the cables shall be routed under the floor or in special ducting.

21. In open spaces, make proper cable support structures, starting from the main cable routes to individual C&I devices (junction boxes, sensors and transducers etc.).

22. For outdoors installations, the cables should be laid underground in shield tubing, cable ducts, or on support structures. Cables laid underground, where they are exposed to damage, should be additionally protected with e.g.: steel tubes, concrete sleeves etc.

23. Different categories of the cables should be placed on separate cable trays and ladders in the following order from the top: HV power supply cables, LV power supply cables, signal cables.
24. All cables should be permanently marked on the both ends and on the crossing points. The type of marking should be suitable to the ambient conditions, according to the guidelines of the Investor.
25. Electrical and C&I cabling should be laid after carrying out of assembly of the process equipment, structures, pipelines and particularly welding works. If it necessary to take welding works close to existing electric and signals cables, it will be done under electrician supervisor and using shields to preventing against damage of the cables and conductors.
26. All cables/conductors and equipment of junction boxes such as: connectors, terminal blocks, control devices, equipment locations, buttons, indicators, relays, contactors, wire harnesses, rating plates should be labelled by markers.
27. The conductor marking methods are described in the Technical Equipment Standard SUT E-1 Guidelines for technical equipment. ELECTRICAL DISCIPLINE: A decision of DG PCC Rokita SA Z 2013/14 of 10.04.2013 on introducing Technical Equipment Standard in PCC Rokita SA, Electrical Discipline; PW.C 15.I02 Technical Equipment Standard SUT E- Electrical Discipline.
28. Suitable colours of sleeves should be provided for different nominal cross sections of cables, according to German colour coding system (N), described in the Figure 2.
29. When all works related to installation of network are finished make measurements according to the standard **PN-IEC 60364-6-61 standard withdrawn**.

Cable cross section	System	
[mm]	German (N)	
0,14		Gray
0,25		Blue
0,34		Turquoise
0,5		Orange
0,75		White
1		Yellow
1,5		Red
2,5		Blue
4		Gray
6		Black
10		Ivory
16		Green
25		Brown
35		Beige

50		Olive
70		Yellow
95		Red
120		Blue
150		Yellow

Figure 2 Colours of cables sleeves.

3.3.1.7. C&I cabinets and junction boxes.

All C&I cabinets and junctions boxes should be designed/selected in accordance with electrical regulations, standards, as well as in accordance with mentioned bellow requirements:

1. The international protection rating suitable for ambient conditions, at least IP65.
2. Should be made of the material suitable for the environment and exposure levels to chemical substances of a process unit as well as adequately protected from corrosion.
3. All junction boxes based on outdoor as well as on high atmospheric humidity should be equipped with heaters.
4. Should be equipped with ventilation system if they give off considerable amount of heat, and if it is necessary to ensure special conditions of work for instrumentation installed in them, they should be equipped with air-conditioning.
5. A reserve unit should be ensured for cabinets with mechanical ventilation.
6. The sizing of the C&I cabinets should ensure ca. 30 % reserve space for the possible future extension.
7. Circuits with different voltage levels should be properly installed, separated and marked according to the applicable standards and regulations, this applies particularly to the Ex systems.
8. The installation height of the cabinets should ensure that the lowest height of the terminals or equipment be not lower than 250 mm from the floor.
9. Use terminal blocks with screwed or spring-loaded connectors (terminals) which should be maintenance-free for at least 10 years, except for the Ex systems which are verified according to separate legislation.
10. The equipment of cabinets should be located in the following order:

- power supply and distribution components including the protections;
- components of control system and communication modules;
- terminal blocks and relays.

Example of layout of components in a control cabinet is shown in Figure 3 - Sample layout of a DCS control cabinet.

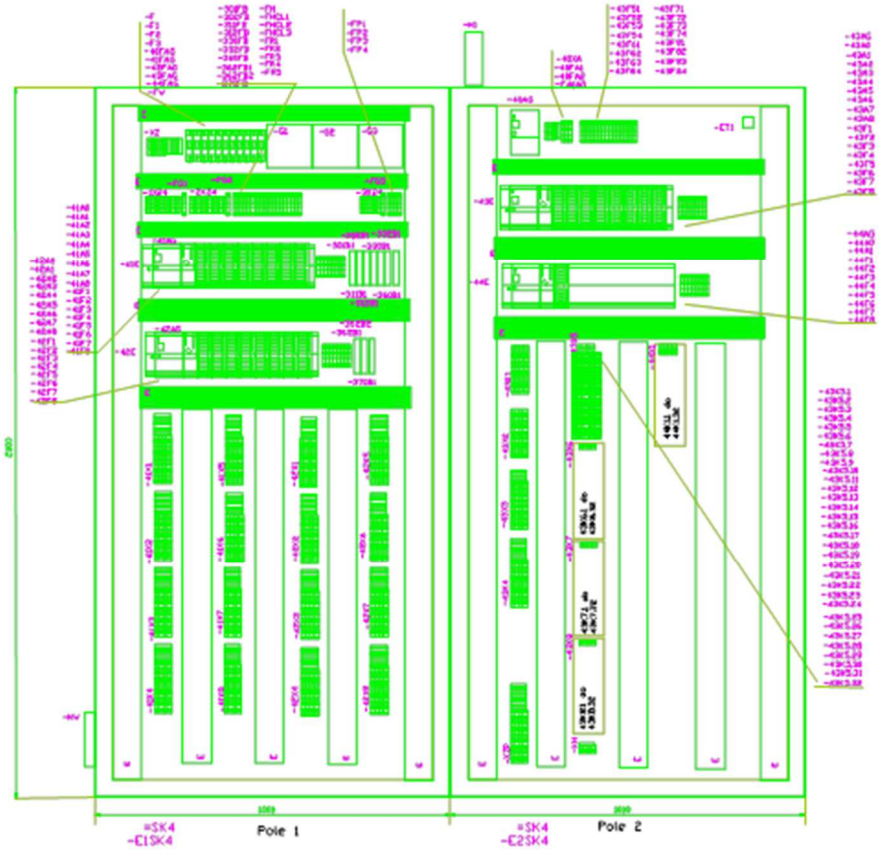


Figure 3 Sample of layout of a DCS cabinet.

3.3.1.8. Operator panels

1. The operator panels should be powered by the guaranteed power supply.
2. Operator panels should be delivered with:
   a. touchscreen display
   b. colour TFT display
   c. 15" display
   d. Display resolution not less than 1280x800.
3. Operator panels should be capable of being used in PROFIBUS DP and PROFINET communication protocol. The PROFIBUS DP protocol is preferred for communication with DCS and MPI protocol is preferred for communication with local PLC.
4. The operator panels besides standard visualization functions should allow archiving variables on memory cards or network drivers, furthermore alarms handling, recipes, scripts VB, allow running programs such as runtime (driver Soft PLC, IE).
5. The SIMATIC WinCC Comfort (TIA Portal) or WinCC flexible software is required for configuration and programming the operator panels.

6. The International Protection Rating (IP) for the operator panels should be not less than:
   a. IP 65 – front side
   b. IP 20 - back side
7. Protective film is required for display of operator panels (For SIMATIC HMI TP1500 COMFORT the order number for Protective film 15" widescreen: 6AV2124-6QJ00-0AX1).
8. The operator panels, which are mounted outdoor and in unheated buildings and other constructions should be protected by additional opening, viewing window e.g. type of NSYCW55, lockable, IP55, manufactured by Schneider Electric.

9. Preferred model of operator panel: SIMATIC HMI TP1500 COMFORT (6AV2124-0QC02-0AX1). In case of application outdoor and in unheated buildings and other constructions and in potentially explosive atmosphere: SIMATIC HMI TP1500 Comfort Outdoor (6AV2124-0QC13-0AX0).
10. For local installations and devices such as chillers, compressors, load/unload stations it is acceptable to use operator panels with size of 7", but according to requirements mentioned below:
   a) There is no requirement for permanent operation of visualization on HMI panel.
   b) There is no possibility to install 15" operator panels.
   c) The control system consists of no more than 40 signals.

   In that case, operator panels of type TP700 Comfort (6AV2124-0GC01-0AX0) with protective film are preferred. In case of application outdoor and in unheated buildings and other constructions and in potentially explosive atmosphere: SIMATIC HMI TP700 Comfort Outdoor (6AV2124-0GC13-0AX0) is preferred.
11. RFID readers and identifiers are the preferred method of logging to the operator panels. In particular the following readers should be used: SIMATIC RF1000 ACCESS CONTROL READER RF1060R (6GT2831-6AA50) with assembly kit SIMATIC RF1000 CARD HOLDER FOR RF1060R AND RF1070R (6GT2890-0CA00).

3.3.1.9. PLCs

1. PLCs should have guaranteed power supply.

In case of application of local control and visualization, use PLC S7-300 with adequate operator panel as HMI. In particular, the following modules of SIMATICS S7 should be used:

- POWER SUPPLY PS307 24 V/5 A (6ES7307-1EA01-0AA0) or PS307 24 V/10 A (6ES7307-1KA02-0AA0) depending on the required power demand.
- central processing unit CPU315-2 DP, 256 KB (6ES7315-2AH14-0AB0),
- interface module IM 365 FOR CONNECTING AN EXPANSION RACK, W/O K-BUS, 2 MODULES + CONNECTING CABLE 1M (6ES7365-0BA01-0AA0),
- digital input module SM 321, DI 32xDC24V (6ES7321-1BL00-0AA0),

- digital output module SM 322, DO 32x DC24V/0,5A (6ES7322-1BL00-0AA0),
- analog input module SM 331, 8AI, 9/12/14BIT (6ES7331-7KF02-0AB0),
- analog output module SM 332 8 AO, U/I, 11/12 BITS (6ES7332-5HF00-0AB0),

If it is necessary to use technological functions such as motion control or high-speed counters, use: counters input module FM350-2, COUNTER MOD., 8 CHANNELS, 20KHZ (6ES7350-2AH01-0AE0).
If it is necessary to connect an existing PLC with CPU314 to PROFIBUS DP use COMMUNICATION PROCESSOR CP 342-5 (6GK7342-5DA03-0XE0).
If it is necessary to connect an existing PLC S7-300 to ETHERNET use communication processor Industrial Ethernet CP343-1 LEAN (6GK7343-1CX10-0XE0).
If it is necessary to connect an existing PLC S7-300 to Profinet use central unit module CPU315-2 PN/DP, 384 KB (6ES7315-2EH14-0AB0).
If it is necessary to use SIWAREX weighing systems (e.g. for gravimetric measurements in silos and carriages, and weighting measurements in dangerous zones (in combination with module Ex SIWAREX IS), use technological module of electronic measurement SIWAREX FTA (7MH4900-2AA01). For measurements in explosive atmospheres use intrinsically safe module ES SIWAREX IS SYSTEM INTERMEDIATE (7MH4710-5BA)
- If it is necessary to extend PROFIBUS DP in explosive atmosphere use RS485-IS COUPLER (6ES7972-0AC80-0XA0) in front of the explosive zone to obtain spark proof atmosphere.
In the case of long distances between nodes on the PROFIBUS DP network, use as the transmission medium – multi mode optical fibre with the relevant elements of network OLM/G12 PROFIBUS V 4.0 OPTICAL LINK MODULE (6GK1503-3CB00), and for very long distances, use as transmission medium - single mode optical fibre with the relevant elements of network PROFIBUS OLM/G11 V4.0 OPTICAL LINK MODULE (6GK1503-2CC00).

2. The systems with PLCs should have a reserve in quantity of free channels in I/O modules as well as the computational power and the license for level at least 25%.
3. The standard libraries of control system of PLC should be used.
4. Provide source codes necessary to use the software as per its intended use, as used by the application provider, including open source software, as well as source projects (logic) of regulation, control, visualization, configuration, reporting, settings together with descriptions and comments enabling the Customer their review, change, extension and other operations necessary for the proper operation and optimization of the operation of devices or installations, in particular for all used PLCs and operator panels, with the exception of tool software such as PCS7, step7, WinCC flexible, etc., in which the above-mentioned designs are created.
5. Copies of applications should be delivered on suitable media, which allow reloading and modifications.

3.3.1.10. Programmable relays.

1. In economically justified cases, for flexible automation on a small scale, it is acceptable to use programmable relays.
2. 24V DC programmable relays should be used.
3. Programmable relays with relay outputs should be used.
4. For relays such as LOGO, use the following modules:

- LOGO! 12/24RCE logical module with display and ETHERNET interface, power supply 12/24VDC, 8 digital inputs 12/24VDC (4 inputs can work as analogue inputs 0-10V) / 4 relay outputs, memory if 400 blocks, possibility to expand by additional modules; ETHERNET BUILD IN WEB-SERVER; DATALOG STANDARD MICRO SD CARD FOR LOGO! SOFT COMFORT V8PREVIOS PROJECT USABEL (6ED1052-1MD08-0BA0),
- LOGO! DM16 24R, expand module, power supply 24VDC/8 digital inputs 24VDC/8 relay outputs, 4 TE FOR LOGO! 8 (6ED1055-1NB10-0BA2),
- LOGO! AM2, expand module, power supply 12/24VDC, 2 analog inputs 0-10V or 0-20mA FOR LOGO! 8 (6ED1055-1MA00-0BA2),
- LOGO! AM2 AQ expansion module, power supply 24DC, 2 analog inputs 0/4-20mA or 0-10V FOR LOGO! 8 (6ED1055-1MM00-0BA2),
- LOGO! TD TEXT DISPLAY, 6 LINES, 3 BACKGROUND COLORS 2 ETHERNET PORTS ACCESSORIES, FOR LOGO! 8,
- LOGO! POWER 24 V, universal stabilized power supply input voltage 100-240V AC, output voltage: 24V DC / 4A.

5. For EASY type relays, use following type:

- EASY719-DC-RC – controller relay, power supply of 24 V DC, 12 digital inputs, 4 of them can be used as analog inputs. 6 relay outputs 10A.

3.3.1.11. Control and visualization systems.

1. Control and visualization system - The Distributed Control System (DCS) is the preferred system for control and visualization.
2. Control and visualization systems can be connected with internal internet network only when a teleservice is necessary and via encrypted VPN connection using router/modem as well as software's firewall on PC.
3. Access to DCS should be provided via DMZ server (demilitarized zone) for the system components used for data collection with double-checking (surveillance) used via hardware devices such as firewall using the separate sign into via VPN of internal PCC IT network, according to recommendations for

building DCS network, which is described in "RECOMMENDATION, Guidelines for structure of DCS industrial network DCS v100" (file located in confidential data base at PCC Rokita S.A.).

4. To provide connection for the control and visualization system, it should be equipped with power supply control system (ON/OFF of power supply by "click" by authorized person) of a router/modem. The power supply control system should be made by use a relay with simultaneously monitoring and alarm during turn on. Turning on the power supply of the router/modem should be done only for specified time (e.g. 2.5h), after that a period alarm should be triggered every 30 minutes.
5. Time of remote works must be absolutely recorded in DCS.
6. The control and visualization systems should be equipped with an anti-virus security system and the routers filtering access for connecting to the internal network. Control and visualization systems should have safeguarded access to external mass storages and internal devices connected via USB port (e.g. Function of blocking which is available in a manager of local group rules, Option – permission for using USB devices with defined identifier). All USB ports which are generally available should be permanently protected against plug in of external devices.

3.3.1.11.1. DCS system.

1. The DCS systems must have a guaranteed power supply. This applies to both I/O modules, power supplies of controllers, controllers and engineering workplaces, application servers, and operator station, including peripherals.

2. The DCS systems should ensure safety of the basic control and measurement functions via an appropriate level of hardware and software redundancy.

3. The hardware redundancy is achieved through the use of dual operator stations, redundant communication bus, redundant controller processors unit and redundant power supply.

4. The detail engineering project should take into consideration below mentioned data and parameters of control and visualization system:

   a. CPU computational capability,
   b. information of the PLC memory
   c. version of DCS software.
   d. size of current licenses. Additionally, the number of variables which are used should be given.
   e. number of PO points. Additionally, the number of used ones should be given.
   f. number of variables for archiving. Additionally, the number of used ones should be given.
   g. Topology of industrial and DCS network.

5. As a minimum, the DCS system should ensure:

   a. Measurements, status monitoring, alarm handling;
   b. Continuous and discrete controls

c. Binary control.
d. Sequential control
e. Complex mathematical calculations
f. Recording all events, values and states.
g. Archiving recorded data with possibility to its future retrieval;
h. Possibility of hardware and software expansion in online mode.
i. Possibility of modification.
j. Internal diagnostic.

6. DCS systems should have a reserve in both the number of free I/O module channels, computing power and license of at least 25%.

7. Only standard libraries for the DCS system should be used. For PCS7 at least v7.1 Advanced Process Library (APL) should be used.

8. The DCS systems should be supplied with all required licenses, including those for the software to perform data backups and recovery, antivirus software, spreadsheet software, operating system etc.

9. DCS should be provided with the operating system Windows 7.

10. Microsoft Windows operating system required for a given DCS should be provided only in a version that allows transfer of the license to another computer - boxed edition (BOX license).

11. Application of software must be provided in the source version.

12. Provide source codes necessary to use the software as per its intended use, as used by the application provider, including open source software, as well as source projects (logic) of regulation, control, visualization, configuration, reporting, settings together with descriptions and comments enabling the Customer their review, change, extension and other operations necessary for the proper operation and optimization of the operation of devices or installations, in particular for all used PLCs and operator panels, with the exception of tool software such as PCS7, step7, WinCC flexible, etc., in which the above-mentioned designs are created.

13. Copies of the software's applications created by tool software should be delivered on media allowing its re-loading and modifications.

14. The DCS should be equipped with antivirus protection system and router for filtering access to the internal network.

15. The DCS system should have the architecture allowing communication via the communication interfaces based on open standards such as OPC, ODBC, DDE, DD, DA.

16. The DCS should communicate with own individual parts via a redundant data bus.

17. The DCS should provide a system or method for user login and identification.

18. The DCS should synchronise the applications (designs) of all OS stations with the ES stations.

19. DCS should be provided the time synchronization of all its components:
    a. Directly from the use of hardware real-time clock, in case of no access to the WAN.
    b. indirectly via NTP server, in case of access to the WAN.
20. The DCS should allow printing of reports, trends and synoptics.
21. The DCS should generate following reports:

a) cyclic e.g. daily or shift reports.

b) The reports including all operators activities.

c) Event reports with information about breakdowns, switch-offs etc. With giving the reason of event, its duration time and activities undertaken.

22. The visualization systems should be made in accordance with the VDI/VDE 3699 Control Using Display Screens (a set of recommendations for visualization systems in the control rooms of chemical and petrochemical plants).

23. The control and visualisation system should take into account the visualisation of matrix of interlocks and alarms. The samples are showed in the Figure 5. Screen of image selection with the alarms and interlocks matrix and Figure 6. Sample of visualization of the alarms and interlocks matrix in DCS system and Figure 7. Sample of visualization of interlocks in Delta V DCS system. These screens should contain tables of alarms, which include all measurements on a given synoptics and ranges of alarms for each of the measurements. The yellow colour indicates active warnings lower/upper. The red colour indicates active alarms lower/upper. A second table should be the table of interlocks, which includes all regulations elements such as on/off valves and control valves, as well as all causes/ alarms/ warnings, which cause the blocking of the other elements as well as electrical and C&I devices. On the display, there should be no possibility to do any actions such as confirmations or change of the alarm threshold. The displays should be used only to preview settings of alarm thresholds and also preview configuration and status of interlocks.

24. Control and visualization system should take into account the heating circuit control faceplate (interface on the display of operator), which allows the user to select manual or automatic control. In manual mode an operator should be able to turn on/off the heating circuit by on/off buttons, independently of temperature. In automatic mode, if the temperature of a pipeline will increase or decrease, below a set level, the circuit should be automatically turned off/on. Each circuit should have possibility to set alarms exceeding the high and low temperature as well as hysteresis and temperature kept on constant level. There should be possibility to enter these settings through a screen of electric heating (sample screen is shown in Figure 8. Screen of electric heating), where in a table should collect all new heating circuits or through a faceplate of a circuit. The screen should be adapted to the regulation VDI/VDE 3699 Control Using Display Screens.

25. The faceplate of the circuit should be opened by switch, which is placed on the screen, e.g.: 

. Colour of a button should inform the operator about circuit automatic or manual work mode. Green colour of the button means automatic mode, gray colour of the button means manual mode. Colour of text is additional information. Black colour means circuit off, red colour means circuit on. A sample of faceplate of circuit is shown in Figure 9 The faceplate of heating circuit., in the top bar is the number and description of the circuit. The controls icons and buttons of control the circuit are located on the left side. The windows which allow to enter the parameters of circuit are located on the right side. A sample of description of the faceplate of heating circuit is shown in Figure 10 Legend of the faceplate of heating circuit.

26. The DCS cabinets must be equipped with lighting, pocket for documents, thermostat, exhaust fans, screen and earthing terminals, cable trays, cable ladders, socles and a diagnostic socket.

27. The DCS cabinets should be placed in air-conditioned rooms. In the absence of such facilities, adequate working conditions should be provided, i.e. suitable temperature and ventilation in the cabinet.

28. The DCS cabinets should be grounded and equipped with the necessary protection against electric shock and overvoltages.

29. Each cabinet should be marked with an individual number.

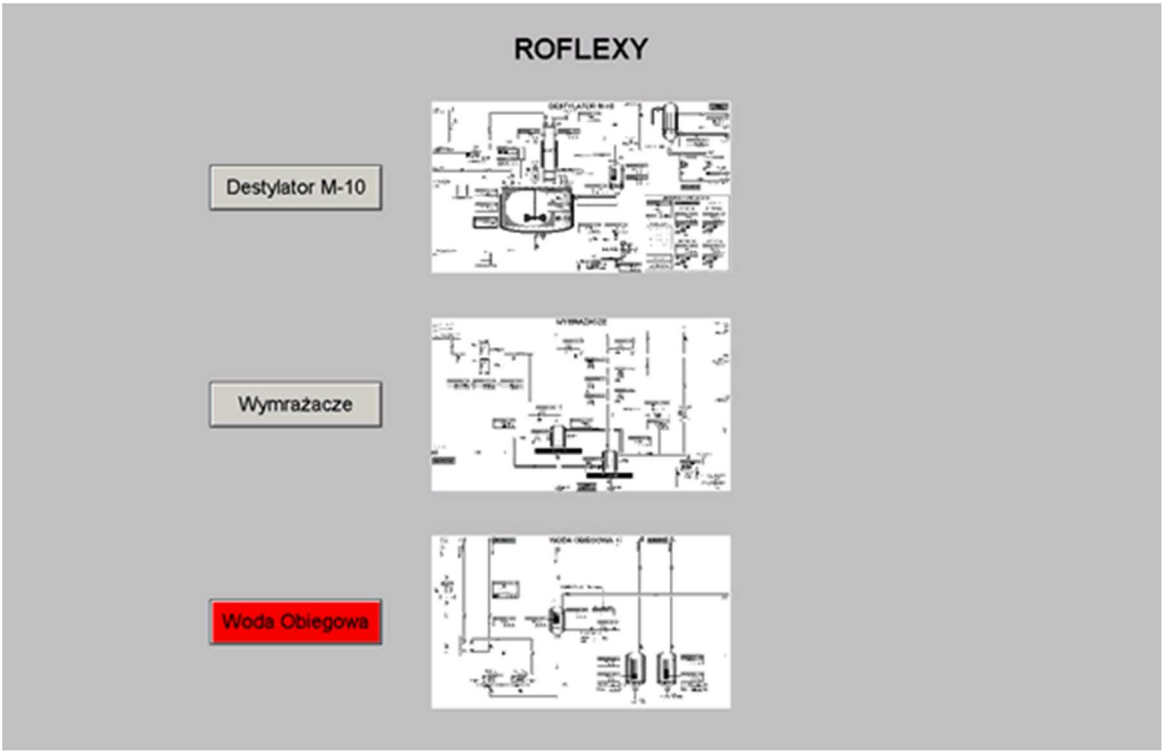
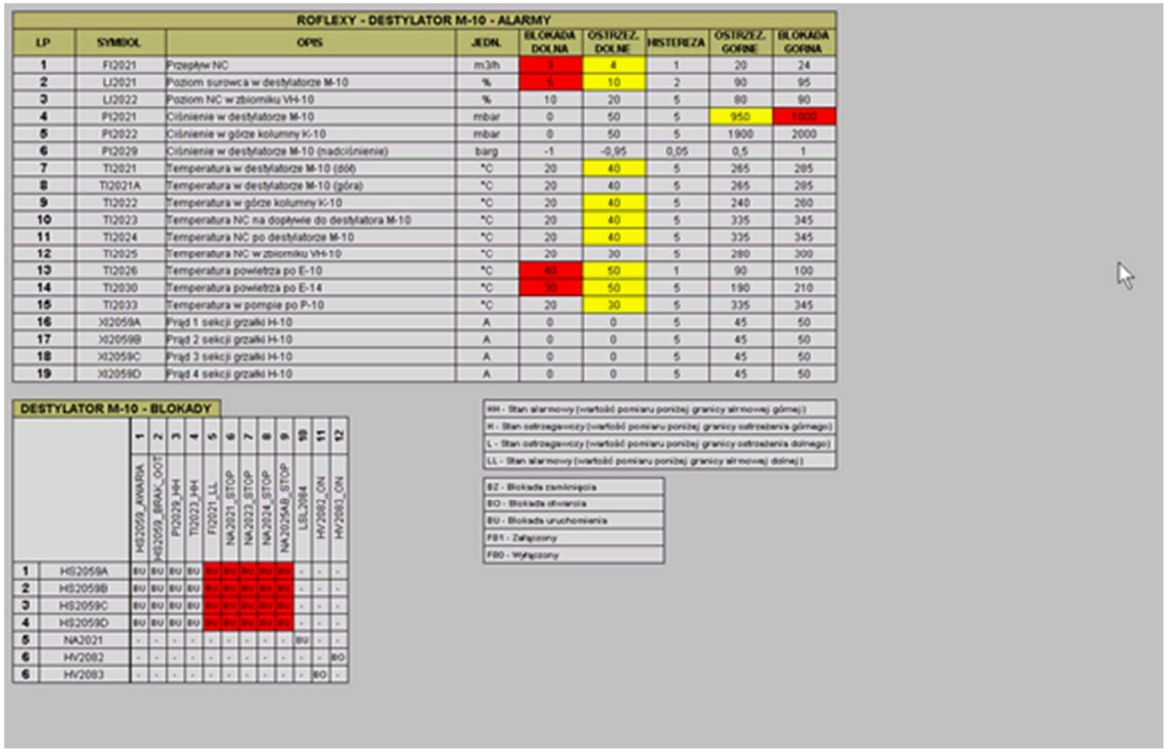


Figure 5 Screen of image selection with the alarms and interlocks matrix.



ROFLEXY - DESTYLATOR M-10 - ALARMY

LP	SYMBOL	OPIS	JEDN.	BLOKADA DOLNA	OSTRZEŻ. DOLNE	HISTEREZA	OSTRZEŻ. GÓRNE	BLOKADA GÓRNA
1	FI2021	Przepływ NC	m3/h	3	4	1	20	24
2	LI2021	Poziom surowca w destylatorze M-10	%	5	10	2	90	95
3	LI2022	Poziom NC w zbiorniku VH-10	%	10	20	5	80	90
4	PI2021	Ciśnienie w destylatorze M-10	mbar	0	50	5	950	1000
5	PI2022	Ciśnienie w górze kolumny K-10	mbar	0	50	5	1900	2000
6	PI2029	Ciśnienie w destylatorze M-10 (nadciśnienie)	barg	-1	-0,95	0,05	0,5	1
7	TI2021	Temperatura w destylatorze M-10 (dół)	°C	20	40	5	265	285
8	TI2021A	Temperatura w destylatorze M-10 (góra)	°C	20	40	5	265	285
9	TI2022	Temperatura w górze kolumny K-10	°C	20	40	5	240	260
10	TI2023	Temperatura NC na dopływie do destylatora M-10	°C	20	40	5	335	345
11	TI2024	Temperatura NC po destylatorze M-10	°C	20	40	5	335	345
12	TI2025	Temperatura NC w zbiorniku VH-10	°C	20	30	5	280	300
13	TI2026	Temperatura powietrza po E-10	°C	40	50	1	90	100
14	TI2030	Temperatura powietrza po E-14	°C	30	50	5	190	210
15	TI2033	Temperatura w pompie po P-10	°C	20	30	5	335	345
16	XI2059A	Prąd 1 sekcji grzałki H-10	A	0	0	5	45	50
17	XI2059B	Prąd 2 sekcji grzałki H-10	A	0	0	5	45	50
18	XI2059C	Prąd 3 sekcji grzałki H-10	A	0	0	5	45	50
19	XI2059D	Prąd 4 sekcji grzałki H-10	A	0	0	5	45	50

DESTYLATOR M-10 - BLOKADY

		1 HS2059_AWARIA	2 HS2059_BRAK_OOT	3 PI2029_HH	4 TI2023_HH	5 FI2021_LL	6 NA2021_STOP	7 NA2023_STOP	8 NA2024_STOP	9 NA3025AB_STOP	10 LSL2084	11 HV2082_ON	12 HV2083_ON
1	HS2059A	BU	BU	BU	BU	BU	BU	BU	BU	BU	-	-	-
2	HS2059B	BU	BU	BU	BU	BU	BU	BU	BU	BU	-	-	-
3	HS2059C	BU	BU	BU	BU	BU	BU	BU	BU	BU	-	-	-
4	HS2059D	BU	BU	BU	BU	BU	BU	BU	BU	BU	-	-	-
5	NA2021	-	-	-	-	-	-	-	-	-	BU	-	-
6	HV2082	-	-	-	-	-	-	-	-	-	-	BO	-
6	HV2083	-	-	-	-	-	-	-	-	-	BO	-	

HH - Stan alarmowy (=wartość pomiaru poniżej granicy alrmowej górnej)
H - Stan ostrzegawczy (=wartość pomiaru poniżej granicy ostrzeżenia górnego)
L - Stan ostrzegawczy (=wartość pomiaru poniżej granicy ostrzeżenia dolnego)
LL - Stan alarmowy (=wartość pomiaru poniżej granicy alrmowej dolnej)

BZ - Blokada zamknięcia
BO - Blokada otwarcia
BU - Blokada uruchomienia
FB1 - Załączony
FB0 - Wyłączony

Figure 6 Sample of visualization of the alarms and interlocks matrix in DCS system

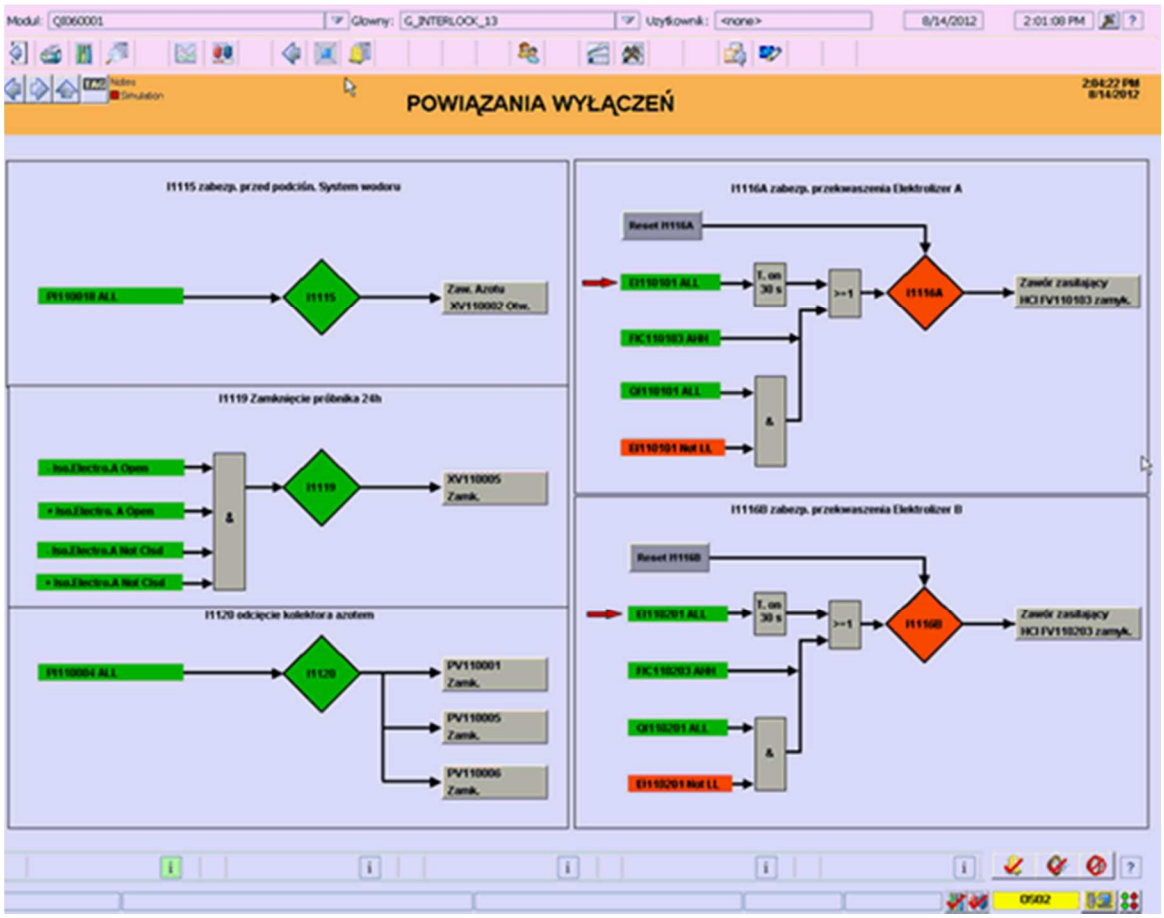
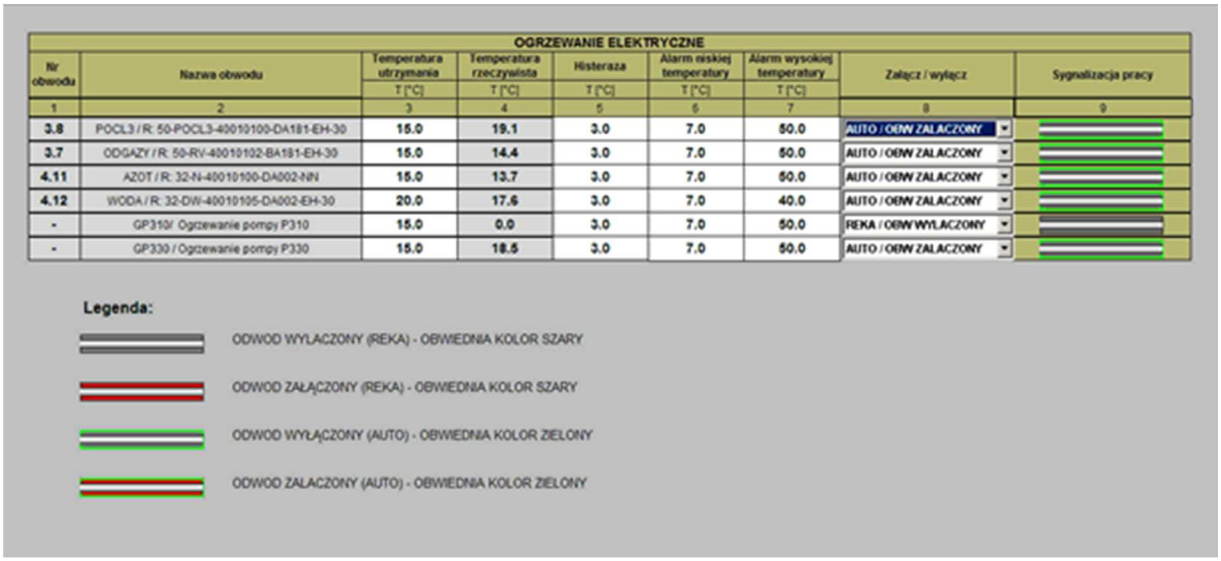


Figure 7 Sample of visualization of interlocks in Delta V DCS system



OGRZEWANIE ELEKTRYCZNE

Nr obwodu	Nazwa obwodu	Temperatura utrzymania T [°C]	Temperatura rzeczywista T [°C]	Histeraza T [°C]	Alarm niskiej temperatury T [°C]	Alarm wysokiej temperatury T [°C]	Załącz / wyłącz	Sygnalizacja pracy
1	2	3	4	5	6	7	8	9
3.8	POCL3 / R: 50-POCL3-40010100-DA181-EH-30	15.0	19.1	3.0	7.0	50.0	AUTO / OBW ZALACZONY	
3.7	ODGAZY / R: 50-RV-40010102-BA181-EH-30	15.0	14.4	3.0	7.0	50.0	AUTO / OBW ZALACZONY	
4.11	AZOT / R: 32-N-40010100-DA002-NN	15.0	13.7	3.0	7.0	50.0	AUTO / OBW ZALACZONY	
4.12	WODA / R: 32-DW-40010105-DA002-EH-30	20.0	17.6	3.0	7.0	40.0	AUTO / OBW ZALACZONY	
-	GP310/ Ogrzewanie pompy P310	15.0	0.0	3.0	7.0	50.0	REKA / OBW WYLACZONY	
-	GP330 / Ogrzewanie pompy P330	15.0	18.5	3.0	7.0	50.0	AUTO / OBW ZALACZONY	

Legenda:

ODWOD WYLACZONY (REKA) - OBWIEDNIA KOLOR SZARY

ODWOD ZAŁĄCZONY (REKA) - OBWIEDNIA KOLOR SZARY

ODWOD WYŁĄCZONY (AUTO) - OBWIEDNIA KOLOR ZIELONY

ODWOD ZALACZONY (AUTO) - OBWIEDNIA KOLOR ZIELONY

Figure 8 Screen of electric heating

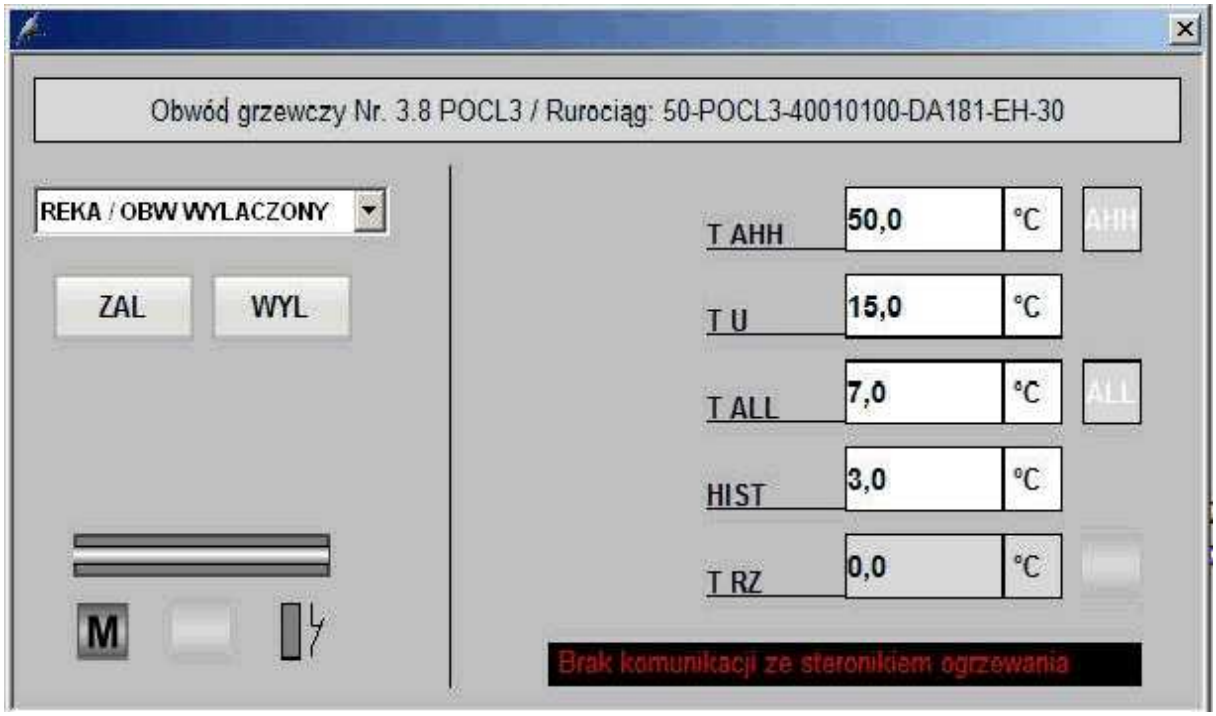


Figure 9 The faceplate of heating circuit.

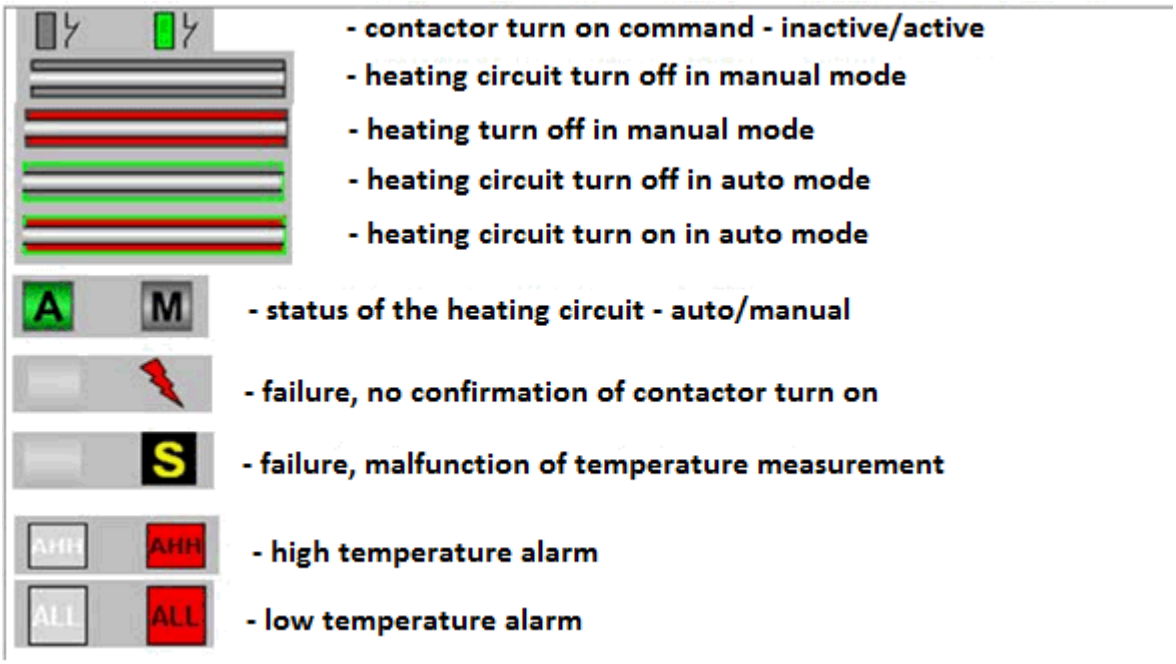


Figure 10 Legend of the faceplate of heating circuit.

30. A power supply units of large DCS systems should be placed in the other (separate) cabinets.

31. Format 16:9 LCD and size at least 24" should be used.

32. In creating DCS system based on SIEMENS PCS7 software tool, apply a family of redundant (Dual Controller), fault-tolerant or safety related module systems of automation AS410 with 2 central control units CPU410-5H F. S7-400/S7-400H/F/FH (6ES7410-5HX08-0AB0) with suitable EXPANSION CARD PO with communication processor CP 443-1. The AS central process unit via communication module CP443-1 should be connected to the system bus (via the Industrial Ethernet network) as a single or a double ring with a single operator stations (OS) and a single engineering stations (ES As a OS and ES should use predefined PCS 7 INDUSTRIAL WORKSTATION IPC547E computers with a speakers and 4-monitor card installed in a dedicated industrial cabinet as well as with the 4-monitor terminals connected to them. The monitors of terminals shall be mounted on dedicated racks fixed to the desks. At the site bus level, to the central control unit AS via the PROFIBUS-DP network, distributed ET200M stations with the SIMATIC DP ET 200M, INTERFACE MODULE IM153-2 (6ES7153-1AA03-0XB0) should be connected, based on the SIMATIC S7-300 modules. In particular, the following modules should be used:

- binary input module SM 321, 32 DI DC24V (6ES7321-1BL00-0AA0),
- binary output module SM 322, 32 DO DC24V/0,5A (6ES7322-1BL00-0AA0),
- analog input module SM 331, 8AI, 9/12/14BIT (6ES7331-7KF02-0AB0),
- analog output module SM 332 8 AO, U/I, 11/12 BITS (6ES7332-5HF00-0AB0),

- counter input module FM350-2, COUNTER MOD., 8 CHANNELS, 20KHZ (6ES7350-2AH01-0AE0).

In case of application of SIWAREX weighing systems, use SIWAREX FTA (7MH4900-2AA01). For measurements in explosive atmospheres use intrinsically safe module ES SIWAREX IS SYSTEM INTERMEDIATE (7MH4710-5BA).

If it is necessary to extend PROFIBUS DP, use repeater RS485 PROFIBUS/MPI (6ES7972-0AA02-0XA0).

If it is necessary to lay PROFIBUS DP cables in hazardous explosion area, use RS485-IS COUPLER (6ES7972-0AC80-0XA0) in front of hazardous explosion area to provide spark proof atmosphere.

For long distances between nodes on the PROFIBUS DP network, use as the transmission medium – multi mode optical fibre with the relevant elements of network OLM/G12 PROFIBUS V 4.0 OPTICAL LINK MODULE (6GK1503-3CB00) and for very long distances, should use as transmission medium - single mode optical fibre with the relevant elements of network PROFIBUS OLM/G11 V4.0 OPTICAL LINK MODULE (6GK1503-2CC00).

In case of application of distributed I/O modules in explosive atmosphere the ET 200iSP with DP/DP COUPLER (6ES7158-0AD01-0XA0) on PROFIBUS DP network should be used. As communications modules use redundancy modules of IM 152 (6ES7152-1AA00-0AB0) with power supply unit 24V (6ES7138-7EA01-0AA0).

For distributed I/O ET200iSP use the following modules:

- digital input module 8 DI NAMUR (6ES7131-7RF00-0AB0),
- digital output module 4DO (6ES7132-7RD01-0AB0),
- analog input module 4AI (6ES7134-7TD00-0AB0),
- analog output module 4AO (6ES7135-7TD00-0AB0),

Standard library PCS7 v 6.1 should be used for control software created in system SIMATIC PCS7 version 6.1, however extended library should be used for higher version PCS7 at least 7.1 (free of charge, added to PCS7 v7.1). In case of applying own blocks of control, it should have attached detailed description of how they work and description of I/O etc.

DCS systems should provide licenses to enable collection of data on OPC server.

In case of creating recipes in DCS system, for PCS7 use licensed WinCC / User Archives 6AV6371-1CB07-0AX0.

33. In case of creating DCS system based on DeltaV system manufactured by Emerson, the CPUs and single operating and engineering stations of the control system should be connected with the system bus via a dedicated Ethernet network (DeltaV Control Network). As the OS stations, use predefined VE-2550 or VE-2552 PCs (preferred rack-mounted version) made by DELL with a 2-monitor card, mounted in a dedicated industrial cabinet with 2-minitor terminals connected. Each station should be

equipped with the following peripherals: mouse, keyboard, speakers. The dedicated DELL servers for the ES and AS stations should be used.

M series

As central unit, use the redundant CPU MQ Plus DeltaV VE 3008 with power supply unit VE5009. As distributed I/O stations use the following M series cards:

- analog input card 8AI 4-20mA, HART, VE4003S2B4
- analog output card 8AO 4-20mA, HART, VE4005S2B3
- digital input card 8DI 24VDC, Dry Contact, VE4001S2T2B3
- digital output card 8DO 24VDC, High Side, VE4002S1T2B3
- Profibus card DP I/O VE4014

– fast counters card VE4015

In case of application of remote I/O stations, use the S series system. In case of application of S series, the software tool of DeltaV has to comply with M and S series.

For equipment mentioned above, use a following cables:

- FLK 16/EZ-DR/…/KONFEK - cable length has to be adapted to design of cabinet, e.g. FLK 16/EZ-DR/300/KONFEK – 2299330 – for 3m cable;

Interface modules mounted on a cross terminals:

- Digital DI/O – FLKM 16/DV – 2304432
- Digital DO – PLC-V8/FLK14/OUT – 2295554
- Analog AI/O - FLKM 16/AI/DV – 2304429
- Analog AO – FLKM 16/DV – 2304432

and terminal block UDMTK 5-P/P Phoenix Contact 3101087.

Wiring and modules should be delivered and installed by the supplier (contractor) of cabinets.

S series

As central unit, use the redundant CPU SQ SE3008.

Use the following cards:

- analog input card AI 4-20mA, HART, SE4303T01
- analog output card AO 4-20mA, HART, SE4304T01
- digital input card DI 24VDC, Dry Contact, SE4301T02
- digital output card DO 24VDC, High Side, SE4302T01
- Profibus card DP I/O SE4022
- Discrete Input Charm Namur SE4301T01

The configuration DeltaV standard valid for the modules and graphic components is PCSD version 5.0. If components not available in the library are required, prepare documentation for the modules and graphic components cooperating with it (faceplates and other interface parts).

34. In case of creating DCS system based on 800xA software tool, equipment mentioned below should be used:

- The redundant CPU PM866, if it is necessary to use no more than 1000 I/O. The redundant CPU PM862, if it is necessary to use no more than 500 I/O
- analog input module: AI815, 8AI, 4-20mA, HART
- analog output module AO815, 8AO, 4-20mA, HART
- digital input module: DI810, 16DI, 24VDC
- digital output module: DO810, 16DO, 24VDC
- communication processor PROFIBUS: CI854
- For OS and ES stations as well as servers there should be used dedicated computers manufactured by DELL. OS station should be equipped with graphics card to connect 4 LCD monitors. ES station and servers should be equipped with graphics card to connect 2 LCD monitors.
- fast counter module: DP840 pulse counter, 8ch

For devices working in an explosive atmosphere, use following I/O modules:

- analog input module AI895, 8AI, 4-20mA, Intrinsic Safety + HART
- analog output module: AO895, 8AO, 4-20mA, Intrinsic Safety + HART
- digital input module DI890, 8DI, 24VDC, Individually galvanic isolated channels
- digital output module DO890, 4DO, 24VDC, Individually galvanic isolated channels

3.3.1.12 Emergency Shutdown System (ESD) /SIS

1. The ESD/SIS systems should ensure the safety of installations and equipment.
2. ESD/SIS systems should be supplied by guaranteed power supply voltage only.
3. The ESD/SIS systems should be integrated with DCS system by use of dedicated distributed stations. For PCS7 use ET200M Fail-safe or ET200iSP (for explosive atmosphere) with the following fail-safe modules:

- SM 326, F-DI 24 (6ES7326-1BK02-0AB0),
- SM 326, F-DO 10 (6ES7326-2BF10-0AB0),
- SM 336, F-AI 6 (6ES7336-4GE00-0AB0),
- 8F-DI (6ES7138-7FN00-0AB0),
- 4F-DO (6ES7138-7FD00-0AB0),
- 4F-AI (6ES7138-7FA00-0AB0).

In that case, application of software of ESD/SIS systems should be created by the use of dedicated software's blocks which are certified for applications of ESD/SIS.

For software application of DCS DeltaV use modules of Simplex Logic Solver VS3202 (redundant version). Software of system interlocks should be created with dedicated and certified function blocks of software. Interlocks system software should be created with dedicated and certified function blocks of software.

In case of application ESD/SIS systems produced by ABB, the following devices should be used:

- The redundant central process unit type of PM863, if it is necessary to use no more than 1000 I/O
- analog output module AI880A, 8AI, 4-20mA, HART
- digital input module: DI880, 16DI, 24VDC
- digital output module DO880, 16DO, 24VDC.

4. The ESD/SIS system should have separate inputs and outputs in relation to inputs and outputs of the DCS control system.

5. It is recommended that devices which are connected to the ESD/SIS (which are not integrated with DCS system by fail-safe modules) and placed in explosion atmospheres should use EEx (d) version. If fulfilment of this condition is difficult, the EEx (i) device and separators equipped with line continuity diagnostics should be used, if the ESD/SIS modules do not have the diagnostic.

6. Visualization of ESD/SIS systems should be based on visualization of DCS system.

7. The 10 % reserve of inputs/outputs and licenses for the ESD/SIS modules should be ensured.

3.3.1.13. Guidelines for HMI.

1. Design and programming work of HMI must be implemented in accordance with VDI / VDE 3699 (a set of recommendations for visualization systems in the control room of chemical and petrochemical plants).

Example of screen in accordance with the VDI/VDE 3699 - Control Using Display Screens is shown in Figure 11 - Sample screen of distillation process in accordance with VDI/VDE 3699 - Control Using Display Screens.

There is a conception of showing information for operators as a lot of information in the form of compact by using so-called hybrid analog - digital indicator of process values. In the next Figure 12 – Example of hybrid indicator, Figure 12 – Example of hybrid process value indicator , there is an example of a hybrid analog - digital indicator of process values.

In the Figure 13 View of distillation column with vertical temperature curve. - there is a next example of hybrid indicator which has been implemented on the view of distillation column.

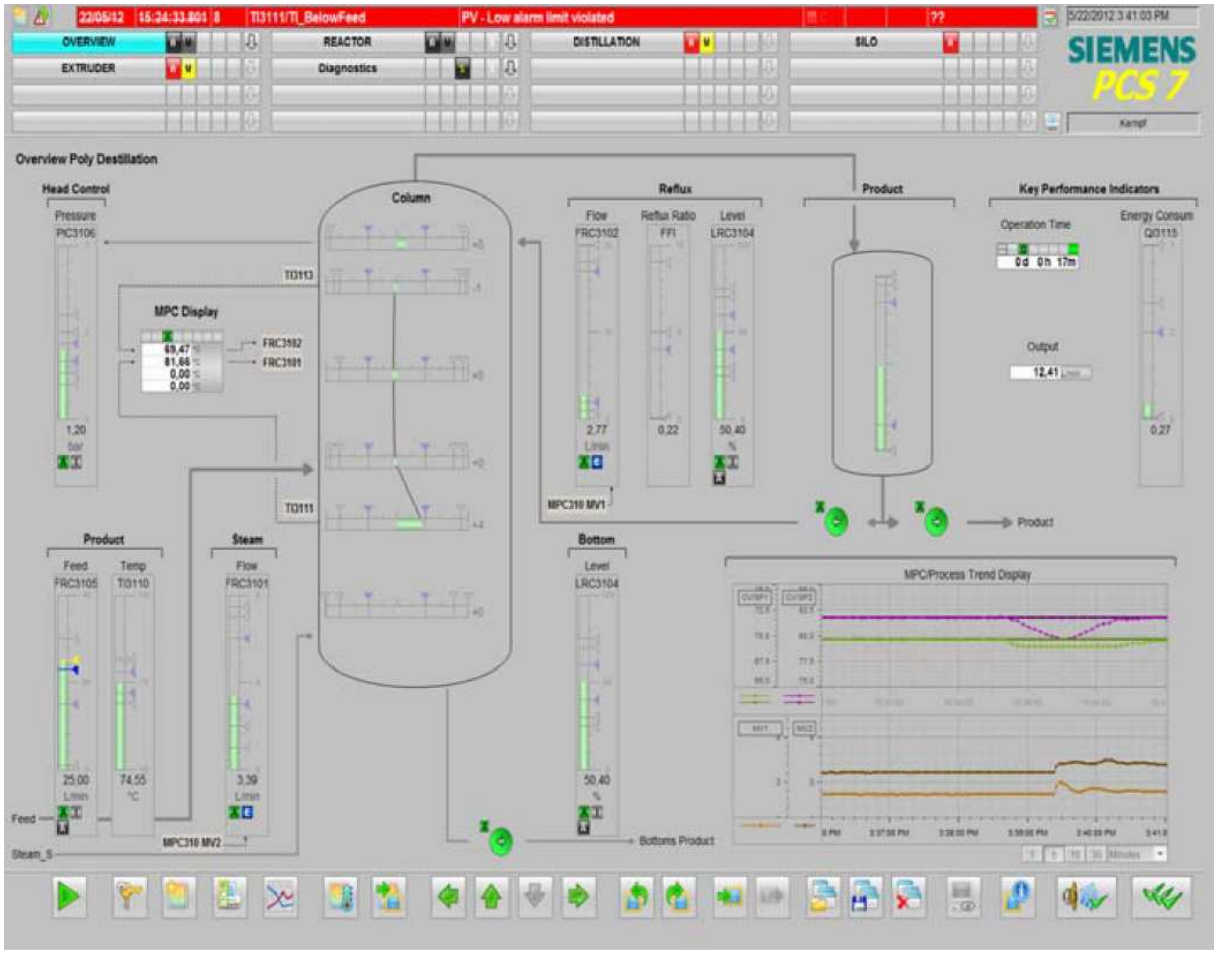


Figure 11 - Sample screen of distillation process in accordance with VDI/VDE 3699 - Control Using Display Screens.

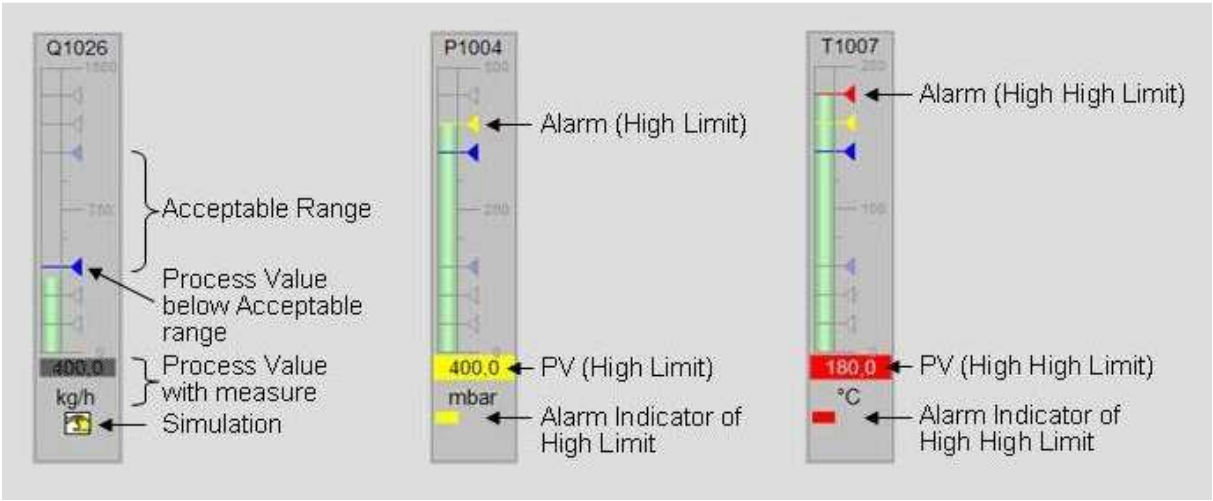


Figure 12 – Example of hybrid process value indicator

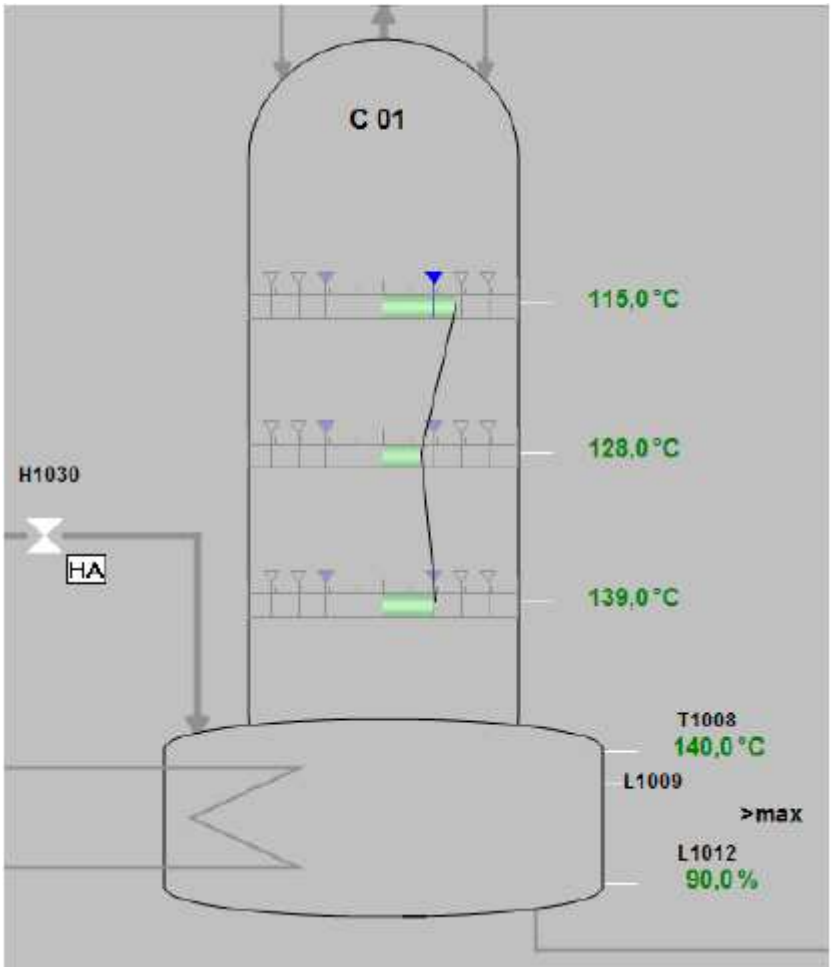


Figure 13 View of distillation column with a vertical temperature curve.

2. In order to avoid appearance of unnecessary alarms, during the design phase, predict other (separate) data sheet for each alarm in the context of AMS system, which include the following information.

a. instrument name
b. measurement range
c. limit values
d. range of hysteresis
e. cause of alarm
f. comment of alarm
g. addressee of alarm (e.g. operator, maintenance worker)
h. priority of alarm
i. alarm masking by other alarms and events
j. alarm influence on masking other messages
k. recommended actions for the operator ("knowledge base"),
l. effect of wrong actions/decisions made by operator.

m. way of alarm signalling on synoptics
n. alarm effect on automatic control systems
o. alarm effect on ESD/SIS/

3. In case of creating the HMI, the AMS system should be implemented or expanded on the basis of the information included in data sheets of alarms.

3.3.1.14. Acceptance conditions for the C&I.

1. As-built documentation should be delivered with:
   a. corrected drawings (plans and diagrams),
   b. written arrangements for deviations from the project with the signatures of the supervisor and the designer,
   c. documentations delivered by the producer of apparatus and equipment,
   d. guarantees, approvals, certificates, declarations of conformity, cards (protocols) of transferring arising waste for disposal.
   e. as-built protocols of tests and measurements:
      - protocols of testing and commissioning of the industrial network,
      - protocols of testing and commissioning control and visualization system, which containing inter alia confirmation of carry out functional checks off all interlocks and control algorithms (including sequence),
      - protocols of testing and commissioning measuring and control circuits,
      - protocols of research of initial inspection of electrical equipment and protective systems dedicated for use in potentially explosive zones according to regulation of **Procedure ZEST PBT.PR.01 network operation and** maintenance
      - certificate of calibration/verification C&I equipment.
   f. list of specifications of C&I (Excel file containing inter alia the following details: technological symbol, description, location, type, producer, serial number, set range (measuring or action) the range of factory, the characteristic data (e.g. the length of the probe, process connections, accuracy, characteristic of the device EX, etc. appropriate for the types of equipment, cost)),
   g. a list of recommended spare parts for C&I equipment
   h. user manual (operation and exploitation) and user training protocols,
   i. current software for the control system and visualization/source codes (e.g. complete controllers and operator panels project),
   j. export of interlocks and thresholds,
   k. a list of regulator settings,

l. graphic files of synopsis

m. drawing of the structure of the industrial network and DCS system with marking the all network addresses.

n. data concerning the control and visualization system such as:

- computational capabilities of the CPU,
- information about PLC controllers memory,
- the software version of the control and visualization system,
- the size of the current software license with the number of variables which are used,
- number of PO points (Process Objects points) with the number of used ones,
- number of archiving variables with the number of used ones,

2. The source codes of application made in the software tool should be supplied.

3. All measuring devices installed on the facility should be checked and calibrated in laboratories of company LabMatic Sp. z o.o. or under the supervision of a representative of PCC Rokita SA.

4. All measuring devices should be marked in accordance with the regulations of PCC Rokita S.A., particularly with:

Procedure **PUR.PR.02 Supervision of the equipment for monitoring and measurements** in accordance with procedure of **PUR.PR.02.I01 Marking**.

5. Detailed acceptance conditions including the factory acceptance tests (FAT), site acceptance tests (SAT) and site integrity tests (SIT) of the automation systems should be in accordance with **PN-EN 62381:2012 – English version** Automation systems in the process industry. Factory acceptance test (FAT), site acceptance test (SAT) and site integration test (SIT) **Automation systems in the process industry**. Factory acceptance test (FAT), site acceptance test (SAT) and site integration test (SIT). In particular, the following steps should be made:

- check wiring (input cable, clamps cable, glands),
- check TAGs designation,
- check the assembly of measuring devices and control,
- check the condition of screw connectors and terminals,
- check the condition of earthing and equipotential
- check the condition of protection against electric shock, short circuit and overload.
- check the condition of the cables insulation,
- check the lay of cables,
- check possibility of maintenance (exploitation, e.g. possibility exchanging fans, etc.),
- check connection of plugs of system cables
- check possibility of reserves (expansion of spaces in the closets and cabinets C&I),
- check the effectiveness of signalling circuits and control systems.

- check the system load (memory, CPU, cycle time, refresh time process value, etc.),
- check of monitoring of power failure (UPS monitoring , redundant power supply),
- check the fuse breaker monitoring,
- check the cooling systems (fans, air conditioning e.g. in cabinets C&I),
- check the communication in a control system - network monitoring system,
- check faults of control and measuring circuits (short circuit, wire break, out of range, earth fault),
- check the Watchdog if it is.
- check the synopsis (e.g. compatibility with P&ID, colours, symbols, static and dynamic texts, organization: links, tree),
- check and test of start-up, run the control system, check compatibility of inputs I/O with indicators, indications from the alarm system, warnings, TAG trends archiving system, event, refresh on the graphic and faceplates,
- check and test run of interlocks system,
- scaling of tanks

3.3.2. Requirements for C&I

3.3.2.1. Pressure measurements

3.3.2.1.1 Electronic pressure and differential pressure transducers (PT)&(PDT)

1. Electronic pressure and differential pressure transducers should be selected in accordance with the applicable regulations and standards, as well as the following requirements: Smart transducers should be applied.
2. The transducer connected only to the DCS/PLC system should be supplied from its input modules.
3. Standard output signal: 4 … 20 mA, 2-wire 24V DC line.
4. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
5. The overall measuring accuracy (measuring device class) should be above ± 0.1%.
6. ø12 mm impulse tubes should be used. The material should be selected to the process conditions and the environment, according to the mechanical classification of pipeline, included in the document MS-06 PIPELINE LIST. MS-06 PIPELINE LIST included in decision of General Director No. 2010/46 of 20.12.2010 - regarding to the Technical Documentation Standard in PCC Rokita SA. Welded and bolted ERMETO connections are preferred.
7. The heating or insulation of impulse tubes should be provided where it is required by the process or ambient conditions.
8. Pressure transducers should be equipped with individual sets of 2 valves as well as separate drain valves should be installed on impulse tubes. Example is shown in Figure 14 – Example of connection on-off valve

and drain valve to a pressure transducer. Note! There is only example of application of pressure transducer equipped with diaphragm seal for viscous, abrasive and high temperature media, where is not recommended by virtue of process conditions connections transducer with impulse tube by gauge valves M20x1,5. Finally the connection way should be agreed with the Investor.

9. Differential pressure transducers should be equipped with 3-valve sets, as in the case of pressure transducers. This includes one drain valve and one for the chamber of the device. 5-valve sets shall be allowed for measuring the differential pressure.

10. Drains and exhaust media which are hazardous to people and environment should be directed by tube to safe locations.

11. M20x1.5 threaded process connection is recommended.

12. Should it be necessary to use pressure transducers with separators (e.g. abrasive media, high temperatures etc.), should be provided DN50 separators in accordance with Błąd! Nie można odnaleźć źródła odwołania. **- Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN - Part 1: Steel flanges.**

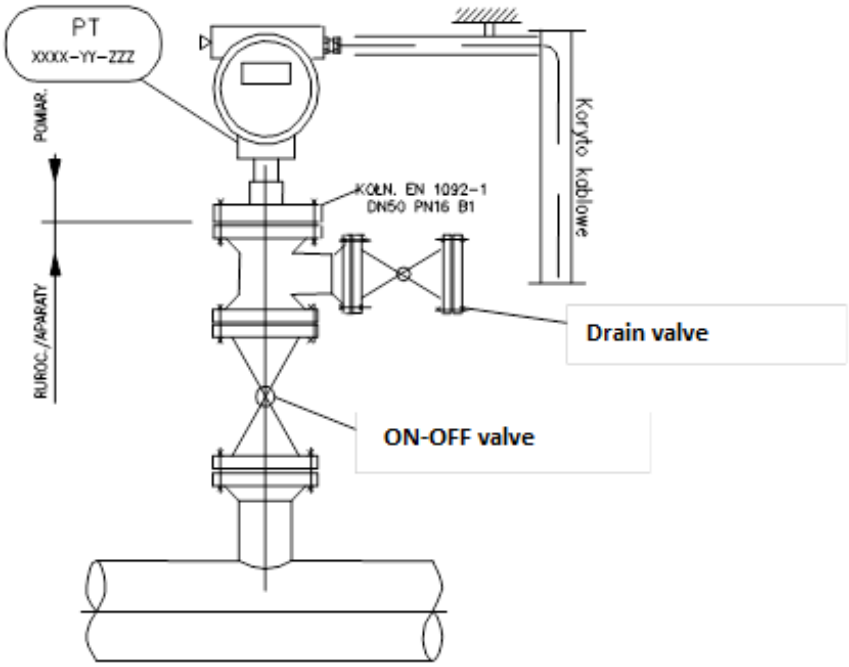


Figure 14 Example of connection on-off valve and drain valve to a pressure transducer.

13. If the equipment will be used in explosive atmospheres, comply with valid standards and regulations (see chapter 6). Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.
14. Pneumatic pressure and differential pressure transducers are not recommended.

3.3.2.1.2. Pressure gauges (PG)

The pressure gauges should be selected in accordance with the valid standards, regulations and the document **PBT.PR.01.I07 technical inspection** Pressure gauges should also meet the following requirements**:**

1. Minimum measuring accuracy of pressure gauges should be 1.6 %.
2. The gauges should have enclosures of at least painted carbon steel (recommended ANSI 316 stainless steel), with the recommended diameter 100 or 160 mm with a break resistant glass.
3. M20x1.5 connection is recommended.
4. The pressure gauges should have overload diaphragms.
5. Overload protection should be 130 % of the measuring range.
6. Pressure measuring devices should be equipped with a cut-off and drain valve as in the case pressure transducers. An example is shown in – Figure 15 - Example connection of the valves to the pressure indicators.

Note! There is only example of application of pressure gauge equipped with diaphragm seal for viscous, abrasive and high temperature media, where is not recommended by virtue of process conditions connections transducer with impulse tube by gauge valves M20x1,5. Finally the connection way should be agreed with the Investor.

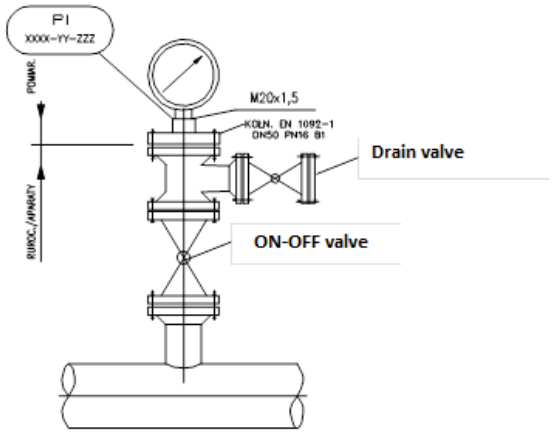


Figure 15 - Example connection of the valves to the pressure indicators.

7. The maximum allowable pressure of device should be red line marked in factory on the gauge face.
8. For viscous, abrasive and high temperature media, should be used pressure gauges with flange separators and capillaries with connection diameter DN50 in accordance with **PN-EN 1092-1–A1:2013-07 Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN - Part 1: Steel flanges.**
9. Liquid filled pressure gauges should be used in locations exposed to shock and vibration.
10. If dampeners and over range protection measures are required, they should be made of at least stainless-steel ANSI 316 and allow setting change from the outside.

3.3.2.1.3. Pressure switches (PS)

Pressure switches should be selected in accordance with the valid standards and codes and the following requirements:
1. The pressure switches should be equipped with microswitch or NAMUR type 24 VDC 0.5 A contacts, protected against weather conditions.
2. The pressure switches used in the ESD system should be provided with a system for detecting continuity of the measuring circuit. If they are mounted in potentially explosive atmospheres, should be made in explosion proof and non-intrinsically safe version.
3. The trigger point should be adjustable in the whole operating range.
4. M20x1.5 connection is recommended.
5. For viscous, abrasive and high temperature media, use pressure switches with flange separators and capillaries with connection diameter DN50 in accordance with the **PN-EN 1092-1–A1:2013-07 Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN - Part 1: Steel flanges**.

3.3.2.2. Level measurements

3.3.2.2.1. Level transducers (LT)

Level transducers should be selected in accordance with the valid standards, regulations and the following requirements:
1. The smart transducers should be used.
2. In case of hydrostatic transducers, for viscous, abrasive or aggressive and high temperature media, use pressure gauges with flange separators with connection diameter DN50 or DN80 in accordance with **PN-EN 1092-1–A1:2013-07 – English version. Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN - Part 1: Steel flanges.**
3. Exhausts and drains should be led out via a tube to safe places or to the drainage systems, except for instruments installed on no hazardous media e.g. low pressure, non-toxic and non-flammable liquids.

4. A transducer connected to DCS system/PLC only should be supplied from its input modules.
5. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line.
6. The total accuracy should be above ± 1 %.
7. The transducers should be equipped with HART communication protocol and directly connected to the DCS input cards.
8. M20x1.5 gland should be used for electrical connections.
9. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.

3.3.2.2.2. Level switches (LS)

The level switches should be selected in accordance with the valid standards, regulations and the following requirements:

1. Minimum dimensions of connection stubs should be DN50. Other sizes can be used in case of special requirements.
2. The level switches should be equipped with microswitch or NAMUR type 24 VDC 0.5 A contacts, protected against weather conditions.
3. Level switches which are used in the ESD system should be equipped with a system for detecting continuity of the measuring circuit. If they are mounted in potentially explosive atmospheres, should be made as explosion proof and non-intrinsically safe version.

3.3.2.3. Temperature measurements

3.3.2.3.1. Temperature transducers (TT)

The temperature transducers should be selected in accordance with the valid standards, regulations and the following requirements:

1. The smart transducers should be used.
2. The transducers connected only to the DCS/PLC system should be supplied from its input modules.
3. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line.
4. Total accuracy should be above ± 0.5%.
5. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
6. The transducers should be mounted in thermocouple heads or located in a separate flame-proof enclosure, if it is necessary (e.g. measuring temperature of bearings in an electric motor).
7. The resistive sensors (RTD) are preferred to cooperate with the temperature transducers.

8. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.

3.3.2.3.2. Temperature sensors (TE)

The temperature sensors should be selected in accordance with the valid standards, regulations and the following requirements:

1. Resistance sensors (RTD) with a 3-wire configuration and "A" class are preferred in connection layout (measuring circuit).
2. Should it be necessary to use thermocouples, should be used thermocouples with an unearthed joint.
3. The M20x1.5 threaded connection is recommended.
4. All temperature sensors should be installed in shields to allow removal without shutting down the system.

Temperature sensors should be mounted at an angle of 45 ° from the horizontal so that to provide a higher process connection than the point of entry of the sensor to the device or pipeline. An example is shown in Figure 16 Example connection of temperature sensors and thermometers.

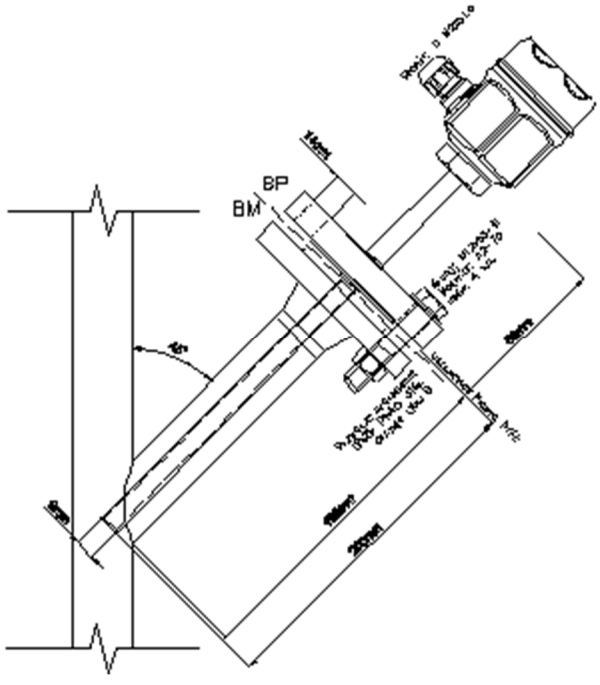


Figure 16. Example connection of temperature sensors and thermometers.

5. The selection of flange connection of thermowell, type and flange facing should be comply with the mechanical classification of pipeline or technological equipment included in decision of General Director No. 2010/46 of 20.12.2010 - regarding to the Technical Documentation Standard in PCC Rokita SA

3.3.2.3.3. Local thermometers (TI)

Local thermometers should be selected in accordance with the valid standards, regulations and the document **PBT.PR.01.I07 technical inspection .** Local thermometers should also comply with the following requirements:

1. The preferred local temperature measurement should be done with bimetallic or manometric thermometers filled by gas or liquid.
2. Minimum measuring accuracy for local thermometers should be 1.6 %.
3. Diameter of the measuring surface should be min. 100 mm.
4. The unit of measure: °C.
5. Maximum design temperature of the thermometer or process should be permanently marked by the manufacturer as a red line on the thermometer scale or enclosure.
6. M20x1.5 threaded connection is recommended.
7. Thermometers should be installed in shields/thermowell to allow their removal without shutting down the system.

Thermometers should be mounted at an angle of 45 ° from the horizontal so that to provide a higher process connection than the point of entry of the sensor to the device or pipeline. An example is shown in Figure 18 – Example connection of local thermometers.

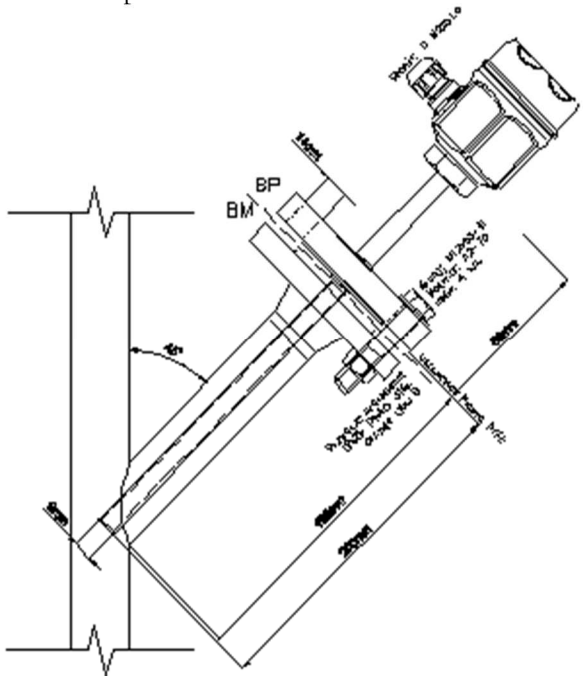


Figure 18 – Example connection of local thermometers.

8. Bimetallic thermometers should be used for measuring temperatures above 0°C.

9. Mercury thermometers are not allowed.

3.3.2.4. Flow measurements

For flow measurements, unless below specified otherwise, it is recommended to use connections with recommended diameters specified in the document **PBT.I04 Technical Equipment Standard SUT M Mechanical Discipline**. In justified cases, deviations from this rule are possible, though they have to be consulted with relevant PCC Rokita personnel on a case-by-case basis.

3.3.2.4.1. Orifice/venturi flowmeters (FT)

Orifice/venturi flowmeters should be selected in accordance with the valid standards, regulations and the following requirements:

1. Orifice/venturi flowmeters for pipelines above DN50 should be selected according to **PN-EN ISO 5167-1:2005 Measurement of fluid flow through the measuring orifice built completely in filled pipes of circular cross section. Part 1: Principles and general requirements**.
2. A compact orifice/venturi flowmeter should be used for process pipelines below DN50. In the case, a construction according to the supplier's standard should be used. The delivery should be complete with an orifice/venturi. Flanges should be delivered with straight sections before and after the orifice/venturi, and together with joints and gaskets.
3. A compact orifice/venturi flowmeter should be equipped with a mesh filter on the inlet side as well as shut off and by-pass function.
4. For flow rates with Reynolds number below 4000, highly contaminated or viscous liquids, the possibility to use an accumulating device depends on the pressure drops allowed by the process.
5. Venturi nozzles should be used when low pressure drop is required. A complete delivery should include gaskets, bolts, nuts and cut off valves.
6. In case of clean gases and low-density liquids, if pressure drops are not allowed, ANNUBAR tubes, in a version allowing replacement under pressure, should be installed.
7. Drain valves should be used for measuring flow of steam and gas, and where is the risk of condensation occurs.
8. Venting holes are recommended while measuring flow of gassed or steaming liquids.
9. Impulse tubes should be equipped with cut off valves.
10. Straight sections both in the outlet and inlet should be provided in accordance with **PN-EN ISO 5167-1:2005Measurement of fluid flow through the measuring orifice built completely in filled pipes of circular cross section. Part 1: Principles and general requirements**.
11. The material should be selected to the process conditions and the environment, according to the mechanical classification of pipeline, included in the document MS-06 PIPELINE LIST. MS-06

PIPELINE LIST is included in decision of General Director No. 2010/46 of 20.12.2010 - regarding to the Technical Documentation Standard in PCC Rokita SA

12. Requirements regarding pressure transducers are listed in chapter 3.3.2.1.1
13. If required range exceeds 5:1, two transducers with the ranges selected so as to ensure full measuring range should be used.

3.3.2.4.2. Electromagnetic flowmeters (FT)

Electromagnetic flowmeters should be selected in accordance with the valid standards, regulations and the following requirements:

1. A smart transducer should be used.
2. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line and pulse output.
3. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
4. Power supply voltage: 24V DC.
5. Total accuracy should be above ± 1%.
6. Material should be properly selected to the process, environment and measured medium.
7. A cut off and bypass function of the flow meter on a pipeline should be provided.
8. Straight sections both in the outlet and inlet should be provided in accordance with recommendation of a manufacturer.
9. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.
10. At least IP 65 for protection against dust and water.
11. The flowmeters should be equipped with integral LCD or LED displays.
12. The flowmeters should be calibrated by the supplier for the specified range.

3.3.2.4.3. Vortex centrifugal flowmeters.

Centrifugal flow meters are preferred for measuring flow rates of steam and measurement in a wide range. The flowmeters should be selected in accordance with the valid standards, regulations and the following requirements:

1. A smart transducer should be used.
2. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line and pulse output.
3. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
4. Power supply voltage: 24V DC
5. Total accuracy should be above ± 1,5%.

6. The flow meters should be selected with 30 % reserve of the measuring range.
7. Materials the flowmeters are built should be properly selected to the process, environment and measured medium.
8. A cut off and bypass function of the flow meter on a pipeline should be provided.
9. Straight sections both in the outlet and inlet should be provided in accordance with recommendation of a manufacturer.
10. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.
11. At least IP 65 for protection against dust and water.
12. The flowmeters should be equipped with integral LCD or LED displays.
13. The flowmeters should be calibrated by the supplier for the specified range.

3.3.2.4.4. Coriolis mass flow meters (FT)

The coriolis mass flow meters should be selected in accordance with the valid standards, regulations and the following requirements:

1. A smart transducer should be used.
2. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line and a pulse output.
3. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
4. Power supply voltage: 24V DC
5. Total accuracy should be above ± 0,5%.
6. Materials the flowmeters are built of should be properly selected to the process, environment and measured medium.
7. A cut off and bypass function of the flow meters on a pipeline should be provided.
8. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.
9. At least IP 65 for protection against dust and water.
10. The flow meters should be equipped with integral LCD or LED displays.
11. The flowmeters should be calibrated by the supplier for the specified range.

3.3.2.4.5. Thermal mass flow meters (FT)

Thermal mass flow meters should be selected in accordance with the valid standards, regulations and the following requirements

1. A smart transducer should be used.
2. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line and a pulse output.
3. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
4. Power supply voltage: 24V DC
5. Total accuracy should be above ± 0,5%.
6. Materials the flow meters are built of should be properly selected to the process, environment and measured medium.
7. A cut off and bypass function of the flowmeters on a pipeline should be provided.
8. Straight sections both in the outlet and inlet should be provided in accordance with recommendation of a manufacturer.
9. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.
10. At least IP 65 for protection against dust and water.
11. The flow meters should be equipped with integral LCD or LED displays.
12. The flow meters should be calibrated by the supplier for the specified range.

3.3.2.4.6. Ultrasonic flow meters (FT)

Ultrasonic flow meters should be selected in accordance with the valid standards, regulations and the following requirements

1. A smart transducer should be used.
2. Standard output signal: 4 … 20 mA, 2-wire 24 VDC line and a pulse output.
3. The transducers should be equipped with HART communication protocol, and directly connected to the DCS input cards.
4. Power supply voltage: 24V DC
5. The total accuracy should be above ± 2,5%.
6. Materials the flow meters are built of should be properly selected to the process, environment and measured medium.
7. In case of flange connections, a cut off and bypass function of the flowmeters on a pipeline should be provided.
8. Straight sections both in the outlet and inlet should be provided in accordance with recommendation of a manufacturer.
9. If the equipment will be used in explosive atmospheres, the valid standards and regulations (see chapter 6) should be comply. Intrinsically safe version for the control and monitoring purposes is

preferred and explosion-proof not intrinsically safe version should be used at the ESD protection input.

10. At least IP 65 for protection against dust and water.
11. The flow meters should be equipped with integral LCD or LED displays.
12. The flow meters should be calibrated by the supplier for the specified range.

3.3.2.4.7. Rotameters (FI)

Rotameters should be used mainly for local measurements. Rotameters should be used mainly for local measurements. Rotameters should be used mainly for local measurements.

Rotameters should be selected in accordance with the valid standards, regulations and the following requirements

1. Total accuracy should be above ± 2,5%.
2. Rotameter should be equipped with steel enclosure. Materials the flow meters are built should be properly selected to the process, environment and measured medium.
3. Rotameter should be equipped with the scale covered with sealed and safety glass.
4. Rotameters should be equipped with cut off valves at the outlet and inlet.
5. At least IP 65 for protection against dust and water.
6. Rotameters should be calibrated by the supplier for the specified range.

3.3.2.4.8. Turbine flow meters (FI)

Turbine flow meters should be used mainly for local measurements.

Turbine flow meters should be selected in accordance with the valid standards, regulations and the following requirements

1. A smart transducer should be used.
2. Output impulse signal as an option.
3. Total accuracy should be above ± 1,0%.
4. Materials the flow meters are built of should be properly selected to the process, environment and measured medium.
5. The flow meters should be calibrated by the supplier for the specified range.

3.3.2.4.9. Oval flow meters (FI)

Oval flow meters should be used mainly for local measurements and dosing systems.

Oval flow meters should be selected in accordance with the valid standards, regulations and the following requirements

1. The total accuracy should be above ± 2,5%.
2. The flow meter should have a pulse output.
3. Materials the flow meters are built of should be properly selected to the process, environment and measured medium.

4. Anti-contamination filter should be installed upstream the oval flow meter.
5. Oval flow meters should be equipped with cut off valves at the outlet and inlet.
6. The flow meters should be calibrated by the supplier for the specified range.

3.3.2.4.10. Flow switches (FS)

Flow switches should be selected in accordance with the valid standards and codes and the following requirements:

1. The flow switches should have microswitch or NAMUR type 24 VDC 0.5 A contacts, protected from weather conditions.
2. At least IP 65 for protection against dust and water.
3. The Flow switches used in the ESD system should be provided with a system for detecting continuity of the measuring circuit. If they are mounted in potentially explosive atmospheres, should be made in explosion proof and non-intrinsically safe version.

3.3.2.5. Analysers

Analysers should be selected in accordance with the valid standards, regulations and the following requirements:

1. They should be provided with appropriate sampling system.
2. The sample, which has been taken, should be returned to the process or, if it is not possible, should be drained through a pipeline to a discharge system.
3. Response time of an analyser may not exceed the required time resulting from the process needs.
4. All analysers, if possible, should be provided with a self-diagnostic function. An alarm signal, in case of emergency should be transmitted to the DCS system.
5. PH and conductivity sensors should be designed in a manner allowing removal for inspection, cleaning or calibration during normal operation. It is preferred to install such sensors directly in process pipelines, without sampling.
6. Analysers located in local cabinets should be electrically heated.
7. The measurement signals from analysers to DCS should be transmitted with standard and galvanically isolated analogue signals 4… 20 mA. Serial transmission signal can be used for monitoring the analyser operation.
8. For detectors of explosive, flammable and toxic substances should not be used semiconductor sensors. For non-production areas should not be used optic sensors.

3.3.2.6. Weighing systems

Weighing systems should be selected in accordance with the valid standards, regulations and the following requirements:

1. Weighing systems should be designed to allow communication with DCS via 4…20 mA 24V DC output signal.
2. Measuring elements have to be suitable to the conditions in a given system.

3.3.2.7. Cut-off/on-off valves (XV)

Cut-off/on-off valves with actuators should be selected in accordance with the valid standards, regulations and the following requirements:

1. For typical solutions, ball cut-off/on-off valves are preferred (or other if required), with asbestos-free seals.
2. In general, all cut-off/on-off valves should have 6th tightness class in accordance with regulation PN-EN 60534-4 or for others class A in accordance with PN-EN 12266-1. Exception from this rule is possible only in justified cases and requires confirmation in HAZOP analysis. Fire safety certificate for the valves is required only when the technology requires so.
3. Tightness of the body of automatic valves (gland of valve) should have class A and category at least accordance with C02 (1500 cycles), in accordance with PN-EN IOS15848 (TA LUFT).
4. Material of the pressure part of the body should be selected according to the pipeline list. The manufacturer should certify that the materials used are suitable for a given application and comply with the design parameters set out in the technical specification.
5. Material of the external valve parts should be selected individually for each valve, depending on the medium and required parameters.
6. Quarter turn ball valves should be equipped with pneumatic actuators with return spring or two-way (double acting) piston actuators. The two-way (double acting) piston actuators should be used if due to the force, closing speed required or other process requirements, the pneumatic actuators with return spring cannot be used.
7. Closing time of a pneumatic actuator should be comply with the manufacturer's standards, requirements of the safety standards, process requirements and HAZOP analysis.
8. The actuators should be equipped with electromagnetic valves, unless the valve islands are applied.
9. In case of solenoid valves controlled from I/O module type of ET200iSP (in EX areas) a piezoelectric valve, control by continuous signal (current of switching max 19mA) should be used. The piezoelectric valves should be made in explosion proof (Ex ia) and non-intrinsically safe version.
10. Supply tubes for valves should be made of material resistant to process and weather conditions. In most cases, diameter of 8 mm acid-resistant steel tubes is used.
11. In case of a short distance from the valve, if the process conditions and the weather are suitable should be used pneumatic lines with PVC shields that are resistant to welding sparks.
12. Position switches should be used for indicating the open/close state.

3.3.2.8. Solenoid valves (XY)

1. Solenoid valve coil should be supplied with 24V DC.
2. The cable glands should have M20x1.5 thread.
3. The solenoid valves should be equipped with silencer.
4. Solenoid valves should be made of material suitable to the conditions and medium of technological processes.
5. Solenoid valves located in explosion hazard zones, have to be in explosion proof version EEx (d) or EEx (me).
6. In case of solenoid valves controlled from I/O module type of ET200iSP (in EX areas) a piezoelectric valve, control by continuous signal (current of switching max 19mA) should be used. The piezoelectric valves should be made in explosion proof (Ex ia) and non-intrinsically safe version.
7. It is necessary to use plates (throttle valves), hydraulic modules or other technical solutions for reducing operating speed of actuators, if it is a requirement of technological process, or if there are other reasons (e.g. to eliminate of a water hammer).

3.3.2.9. Control valves

Control valves should be selected in accordance with the valid standards, regulations and the following requirements

1. In general, globe, ball or membrane valves as well as control butterfly valves (dampers) should be used. The seals should be asbestos-free.
2. Material of the pressure part of the body should be selected according to the pipeline list. The manufacturer should certify that the materials used are suitable for a given application and comply with the design parameters set out in the technical specification.
3. Valves should be equipped with pneumatic membrane actuators with spring to set the valve in safe position on power failure. The actuators should be equipped with smart electro-pneumatic positioners with pressure gauges, controlled with 4-20 mA signal and HART communication protocol, as well as with 4-20 mA feedback signal. The actuators should be current loop powered.
4. Safe position of a control valve should be indicated in P&ID. The valve should be set in safe position in case of control signal failure or pneumatic supply failure.
5. Piston actuators should be used, if long valve stroke, high force or speed is required. Rotary and piston actuators can be used for control ball and butterfly valves (dampers).
6. Control valve actuator should be able to handle at least 125 % of the maximum foreseeable load and have stroke reserve.

7. Valve size should be selected in accordance with **PN-IEC 60534 Part 1-4**. Valve calculation sheet should be attached to the detail engineering. Kvs ratio of a valve should be selected in such a manner so as the nominal flow falls within the range of 70 to 80 % of the maximum flow.
8. In general, unless otherwise specified and including fact that control valves must not work as cut-off valve, (see section 2 of chapter 3.3.2.7), then the regulation valves should have 4th tightness class, according to according to PN-EN 60534-4, unless:
9. A valve should be complete with pneumatic tubing. Pneumatic tubing should be made of cooper or acid resistant steel. The cable glands should have M20x1.5 thread.
10. In case of a short distance from the valve, if the process conditions and the weather are suitable should be used pneumatic lines with PVC shields that are resistant to welding sparks.
11. Each valve should be equipped with a stainless steel, permanently fixed identification plate. The identification plate should specify all valve parameters.
12. Each individual electro-pneumatic positioner should be equipped with a filter reducer with a pressure gauge.
13. It is not recommended to use control valves as cut- off devices.

3.3.3. Requirements for cybersecurity of control systems.

The requirements for cybernetic control systems are to be found in attached document: „SUT C-2 Cyber Security Procurement Language for Control Systems"

3.3.4. List of standardisations of C&I equipment in PCC Rokita

Equipment group	Type of equipment	Device	Selected manufacturers for standardization
Pressure measurement	Electronic pressure and pressure difference transducers (PT)&(PDT)		Aplisens
			Emerson
			Yokogawa
	Pressure gauge (PI)		Badotherm
			Baumer

			WIKA
	Pressure switch (PS)		Danfoss
			Trafag
			GEORGIN
Level measurement	Level transducer (LT)	Magnetostrictive	Emerson
			Kübler
			Nivelco
		Radar	Nivelco
			VEGA
		Ultrasonic	Nivelco
			VEGA
			Aplisens
			Emerson
			Yokogawa
	Level switch (LS)		Emerson
			Kübler
			VEGA
Temperature measurement	Temperature transducer (TT)		Baumer
			WIKA
			ABB
	Temperature sensor (TE)		Limatherm
			Termoprecyzja
			Termoaparatura
			ABB
			GEORGIN dla sygnalizatorów temperatury TS
	Local thermometer (TI)		Badotherm
			Baumer
			WIKA
Flow measurement	Flow meter (FT)	Orifice/venturi	Emerson
		Electromagnetic	ABB

			KROHNE
			Yokogawa
		Centrifugal (Vortex)	Emerson
			KROHNE
			Yokogawa
		Corolis mass	Emerson
			KROHNE
			Yokogawa
		Mass thermal	Emerson
		Ultrasonic	Emerson
			KROHNE
	Rotameter (FI)		ABB
			KROHNE
			ZA „ROTAMETR ” Sp. Z o.o.
			Yokogawa
	Flow meter(FI)	Turbine	ABB
			TECFLUID
		Oval	Bopp&Reuther
			Macnaught
			TECFLUID
	Flow switch (FS)		Honsberg
			Kübler
			Turck
Measurement of physical and chemical properties	pH-Meter		METTLER TOLEDO
			Yokogawa
		Zirconia probe	ABB
Weight measurement	Weighting system	Platform	METTLER TOLEDO
			Radwag
		Tank	Sartorius
			Siemens

Actuators	Cut-off valve/on-off valve (XV)		ADLER
			Ebro (tylko przepustnice)
			Richter
			Kingdom
	Actuator	Pneumatic	Air Torque
			InterApp
			Pentair
			Rotork
		Electricial	AUMA
			Siemens
	Position sensor (sensor boxes)		Pepperl+Fuchs
			Rotech
			Soldo controls
	Solenoid valve (XY)		Asco
			Norgren
			Parker
			Rexroth
	control valve		ARCA
			ARI Armaturen
			Descote (dla instalacji chlorowych)
			Polna
			Richter
			Samson
	Positioner		ABB
			Flowserve PMV
			Samson
			Siemens
Control system components	DCS control system		Emerson
			Siemens
			ABB
	Programmable Logic Controller - PLC		Siemens
	Programmable Control Relay		Siemens

			EATON (Moeller)
	ESD protection system		Emerson
			Siemens
			ABB
HMI	Operator device - control panel		Siemens
	Engineering station (ES), Operator Station (OS)	System PCS7	Siemens
		System DeltaV	DELL
Electrical components	Wire		Bitner
			Lappkabel
			Helukabel
			Technokabel
	Electrical accessory		Wago
			ETI
			PHOENIX CONTACT
	Isolating relay		PHOENIX CONTACT
			Finder
			Relpol
	Intrinsic safety (IS) isolators for hazardous area/ safety barriers		Phoenix
			MEAN WELL
			SIEMENS
			Turck
			PEPERL FUCHS
	Ex power supply		PHOENIX CONTACT
			PEPERL FUCHS
			Aplisens
			Turck
	Power Supply/Buffered power supply		PHOENIX CONTACT
			SIEMENS
			MEAN WELL

	Cable route,		Baks
			Ebo System
Pneumatic components	Pneumatic leads		Parker Legris
			CAMOZZI
			ABB
	Pneumatic accessory		Parker Legris
			FESTO
			PREMA
			Rexroth
			SMC

3.3.5. List of figures

4. LIST OF DOCUMENTED INFORMATION

No. [1cm]	Type [1,5cm]	Communication scope [5cm]	Provider [3cm]	Recipient [3cm]	Providing frequency [3cm]	Form of provided information [3cm]	Storing person [3cm]	Storing period [3cm]	Archiving period [3cm]
	in/ out								

5. LIST OF FORMS

No. [1cm]	Link [5cm]	Form name [22cm]

6. LIST OF DOCUMENTS.

No.	Link	Title of document
1.	http://nuxeo.rokita.com.pl/nuxeo/nxdoc/default/caf987f0-6244-4363-980e-1d7365f0d5a1/view_documents	CSUT01 List of C&I equipment subject to PCC Rokita standardisation
2.		SUT C-2 Cyber Security Procurement Language for Control Systems.
3.		List of legal requirements for the H&S and technical safety of processes
4.		List of legal requirements for the environmental protection
5.		Act of 11 May 2001, Measures law.
6.		Act of 21 December 2000, Technical Supervision
7.		Act of 30 August 2002, on compliance assessment system,
8.		Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments.

No.	Link	Title of document
9.		Machinery Directive 2006/42/WE
10.		ATEX directive 2014/34/UE and 1999/92/WE
11.		NAWI directive 2009/23/WE
12.		Pressure Equipment Directive PED 2014/68/UE
13.		Regulation of the Minister of Development of 2 June 2016. on the requirements to be met by measuring instruments.
14.		Regulation of the Minister of Economy of 31 January 2008 on the requirements to be met by non-automatic weighing instruments, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
15.		Regulation of the Minister of Economy of 31 March 2008 amending the regulation on technical inspection of technical conditions to be met by non-pressure and low-pressure tanks for the storage of flammable liquids.
16.		Regulation of the Minister of Economy of 19 April 2007 on the requirements to be met by oscillating densimeters to measure the density of the liquid, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
17.		Regulation of the Minister of Economy of 23 October 2007 on the requirements to be met by water meters, and a detailed scope of checks carried out during legal metrological control of measuring instruments.
18.		Regulation of the Minister of Economy of 22 January 2008 on the requirements to be met by measuring tanks, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
19.		Regulation of the Minister of Economy of 27 December 2007 on the types of measuring instruments subject to legal metrological control and the scope of this inspection.
20.		Regulation of the Minister of Economy of 7 January 2008 on legal metrological control of measuring instruments.
21.		Regulation of the Minister of Economy of 2 June 2010 amending the regulation on legal metrological control of measuring instruments.

No.	Link	Title of document
22.		Regulation of the Minister of Economy of 27 December 2007 on the requirements to be met by measuring systems for continuous and dynamic measurement of quantities of liquids other than water, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
23.		Regulation of the Minister of Economy of 16 June 2010 amending the regulation on the requirements to be met by measuring systems for continuous and dynamic measurement of quantities of liquids other than water, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
24.		Regulation of the Minister of Economy of 13 September 2011 amending the regulation on amending the regulation on the requirements to be met by measuring systems for continuous and dynamic measurement of quantities of liquids other than water, and the detailed scope of examinations and checks carried out during legal metrological control of measuring instruments.
25.		IEC 60332-3-10 Test for Electric Cables Under Fire Condition – Part 3-10: Test for Vertical Flame Spread of Vertically-Mounted Bunched Wires or Cables – Apparatus – Fire Edition
26.		IEC 60364 Electrical Installation for Buildings Requirements – For Special Installation or Location
27.		IEC 92-3 Electrical installation in skips, part 3, cables (construction and testing)
28.		PN–76 E 05125 – ELECTRO ENERGETIC AND SIGNALING CABLE LINES (standard withdrawn)
29.		PN-EN 1092-1–A1:2013-07 – English version, Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN - Part 1: Steel flanges.
30.		PN-EN ISO 80079–36:2016-07 – English version, Non-electrical equipment for explosive atmospheres – Part 1: Basic method and requirements
31.		PN-EN 1349:2010 Industrial process control valves

No.	Link	Title of document
32.		PN-EN 161–A3:2013-06 – English version, Automatic shut-off valves for gas burners and gas appliances
33.		PN-EN 298:2012 Automatic burner control systems for burners and appliances burning gaseous or liquid fuels
34.		PN-EN ISO 2355–-1:2014-07 – English version, Safety and control devices for oil burners and oil-burning appliances -- Particular requirements -- Part 1: Automatic and semi-automatic valves
35.		PN-EN 6007–-6:2016-02 – English version Explosive atmospheres - Part 6: Equipment protection by liquid immersion "o"
36.		PN-EN 61–41-14:2005 – English version Electrical apparatus for use in the presence of combustible dust - Part 14: Selection and installation
37.		PN-EN 60079–26:2015-04 – Explosive atmospheres - Part 26: Equipment with Equipment Protection Level (EPL) Ga
38.		PN-EN 60079-0:2013-03 Explosive atmospheres - Part 0: Equipment - General requirements
39.		PN-EN 6007–-1:2014-12 – English version, Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
40.		PN-EN 60079-1–-1:2016-02 – English version – Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres
41.		PN-EN 60–79-11:2012 – English version Explosive atmospheres. Equipment protection by intrinsic safety "i"
42.		PN-EN 60079–14:2014-06 – c Explosive atmospheres - Part 14: Electrical installations design, selection and erection.
43.		PN-EN 60079–17:2014-05 – English version Explosive atmospheres - Part 17: Electrical installations inspection and maintenance
44.		PN-EN 60079–18:2015-06 – English version Explosive atmospheres. Equipment protection by encapsulation “m”
45.		PN-EN 60079-2:2015-02 – English version, Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure “p”
46.		PN-EN 60079-25:2011 Explosive atmospheres - Part 25: Intrinsically safe electrical systems
47.		PN-EN 60079-26:2015-04 – Explosive atmospheres - Part 26: Equipment with Equipment Protection Level (EPL) Ga

No.	Link	Title of document
48.		PN-EN 60079-5:2015-08 – English version Explosive atmospheres. Equipment protection by powder filling "q"
49.		PN-EN 60079-7:2016-02 – English version Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
50.		PN-EN 60529:2003 Protection degrees ensured by housing (IP code).
51.		PN-EN 60584-1:2014-04 – English version Thermocouples - Part 1: EMF specifications and tolerances EMF
52.		PN-EN 60751:2009 Platinum sensors of industrial resistance thermocouples.
53		PN-EN 6–534-4:2006 – English version, industrial control valves – Part 4: examinations and checks
54.		PN-EN 60947-5-6:2002 Low voltage distribution and control equipment. Part 5-6: Control apparatus and switches. Proximity switch interfaces and connection amplifiers (NAMUR).
55.		PN-EN 61000-4-2:2011 Electromagnetic compatibility (EMC). Part 4-2: Testing and measurement techniques-Electrostatic discharge immunity test
56.		PN-EN 61000-4-3:2007/IS1:2009 Electromagnetic compatibility (EMC). Part 4-3: Testing and measurement techniques. Testing resistance to electromagnetic field of radio frequency * Interpretation of Section 5 (originally).
57.		PN-EN 61000-6-2:2008 Electromagnetic compatibility (EMC). Part 4-3: General requirements. Immunity for industrial environments.
58.		PN-EN 61131-3:2013-10 – Programmable controllers - Part 3 of Programming Languages.
59.		PN-EN 61285:2015-06 – Industrial-process control. Safety of analyser houses.
60.		PN-EN 61340-5-1:2009 Static Electricity - Part 5-1: Protection of electronic devices from static electricity. General requirements.
61.		PN-EN 61508 Part 1-7:2010 Functional safety of electrical / electronic / programmable electronic safety related systems Part 1-7.
62.		PN-EN 61511 1-3:2009 Functional safety. Apparatus safety systems for the industrial process sector. Part 1-3.

No.	Link	Title of document
63.		PN-EN 62381:2012 – English version Automation systems in the process industry. Factory acceptance test (FAT), site acceptance test (SAT) and site integration test (SIT)
64.		PN-EN 676+A2:2008 – English version Automatic forced draft burners for gaseous fuels
65.		PN-EN 746-1+A1:2012 Industrial thermoprocessing equipment-Part1: Common safety requirements for industrial thermoprocessing equipment
66.		PN-EN 746-2:2010 – English version Industrial equipment for thermal processes - Safety requirements for combustion and fuel systems.
67.		PN-EN 746-3+A1:2012 Industrial equipment for thermal processes -– Part 3 -Safety requirements for the generation and use of gaseous atmospheres.
68.		PN-EN ISO 5167-1:2005 Measurement of fluid flow through the measuring orifice built completely in filled pipes of circular cross section. Part 1: Principles and general requirements.
69.		PN-EN 60332-1-2:2010 Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
70.		PN-IEC 60364-6-61 Electrical installations in buildings. Commissioning tests - withdrawn standard.
71.		PN-IEC 60534 Part 1-4 Industrial control valves.
72.		PN-EN ISO 1461:2011P Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods
73.		PN-ISO 5725-1:2002 Accuracy (trueness and precision) of measurement methods and results.
74.		PN-EN 1092-1+A1:2013-07 – English version Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges
75		PN-EN 1–266-1:2012 – English version Industrial–Instrumentation– Metal instrumentation tests – Part1: Pressure tests, testing procedures and acceptance criteria– Obligatory requirements
76		PN-EN 50575 – Power, control and communication cables - Cables for general applications in construction works subject to reaction to fire requirements

No.	Link	Title of document
77.		PN-ISO 724:1995 ISO Metric threads for general use. The nominal dimensions
78		PN-EN ISO 15848-1:2015-10/A1:2017-06 Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 1: Classification system and qualification procedures for type testing of valves
79.		WUDT-UC WO-A/01 Pressure Equipment General requirements. Fittings. Safety devices for protection against excessive pressure.
80.		WUDT-UC WO-A/02 Pressure Equipment General requirements. Fittings. Protective automation.
81.		WUDT-UC WO-A/03 Pressure Equipment General requirements. Fittings. Control and instrumentation.
82.		WUDT-UC WO-A/04 Pressure Equipment General requirements. Fittings.
83.		VDI/VDE 3699 Control Using Display Screens
84		CHEMICAL ENGINEERING TRANSACTIONS VO–. 31, 2013 – A publication of AIDIC The Italian Association of Chemical Engineering "Efficient Plant Operation in Process Industries Using a User-Centric Design" Lutz Glathe*, Sven Kempf
85		AUTOMATICS, ELECTROTECHNICS, DISTURBANCES No. 9/2012 Alarm management system: the chance for man among automation
86		Modern plant control centers and operator control concepts February 10, 2012 SIEMENS HMI+ supports operative process control of industrial production processes by means of visualization
87.		PBT.PR.01.I07 technical inspection
88.		Regulation no. 25/2013 of the General Manager of PCC Rokita SA dated June 26, 2013, on the introduction of the instructions for use and testing effectiveness of the protections from static electricity in PCC Rokita S.A.
89.		Regulation no. 46/2010 of the General Manager of PCC Rokita SA dated December 20, 2010, on the standard for technical documentation in PCC Rokita S.A.

No.	Link	Title of document
90.		Regulation no. 18/2011 of the General Director of PCC Rokita SA dated May 11, 2011 on the minimum requirements for the occupational health&safety, related to the risk of occurrence of explosive atmosphere at the workplace.
91.		Regulation no. 2018/28 of the General Director of PCC Rokita SA dated September 20,2018r. on the introduction of the General Sales Conditions of the companies of PCC group.
92.		Regulation no. 2016/29 of the General Director of PCC Rokita SA dated December 7, 2016 on the general specification of execution and acceptance of design works, technical and design documentation, rules of organization and supervision of proceedings of the companies of PCC group.
93.		Procedure ZEST PZM ZEST Purchase of technical products and services
94.		Procedure PUR.PR.02 Supervision of the equipment for monitoring and measurements in accordance with procedure of PUR.PR.02.I01 Marking
95.		Procedure ZEST PBT.PR.01 network operation and maintenance
96.		Technical standard of electrical equipment.
97.		PBT.I04 Technical standard of mechanical equipment.
98.		Related documents 1. Technical documentation PCC Rokita SA 2. Data base PCT-Tools. 3. Technical documentation standard (SDT) 4. Matrix of risk (MR)