Contents

1 Subject of specification 2
2 Scope of validity 2
2.1 Deviations 2
3 Hierarchy of documents 2
4 Definitions and designations 2
5 Description 3
5.1 General requirements for computers operated in automatics systems 3
5.2 Functional division of computers working in automatics systems 4
5.3 Detailed requirements for computers working in automatics systems 6
5.4 Protection of computer software and data 7
5.4.1 Hardware protection in place of failure origin 8
5.4.2 Redundancy of computer equipment 8
5.4.3 Protection of software and data by means of administrative tools 8
5.4.4 Back-up copies of software and data on external carriers 8
5.4.5 Storage of back-up and safety copies 9
5.5 Proper installation of computer systems 9
5.6 Power supply of computers 10
6 Relevant documents 10
7 Codes and standards 10
7.1 Directives of European Union 10
7.2 Polish standards 10
7.3 Other standards 11
8 Record of changes 12

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1 Subject of specification

This specification used in conjunction with other technical specifications of LOTOS Group S.A., establishes minimal requirements constituting quality guide for preparation of Control and Instrumentation technical design, regarding selection of computers working in automatics systems. Some issues not covered by this specification will be subject of detailed standards, or will require specific independent considerations.

This specification determines technical guidelines for configuring computers working in automatics systems, used for acquisition, visualisation, control, processing and storage of process data. The specification determines basic requirements for installation, supply, service, and protection of software and data as well.

2 Scope of validity

This specification shall be used when preparing both quotations and Purchase Orders concerning planned LOTOS Group S.A. new investments and modernizations.

It shall also be a base for preparation of other detailed specifications and quotations relevant for package units or other equipment deliveries.

Therefore this specification concerns only computers working in automatics systems, and not those systems in whole, nor other elements such as, for example, I/O circuits, DCS and PLC controllers. The specification does not relate to computers and servers operating in refinery network of LOTOS Group S.A., either.

2.1 Deviations

Any deviation from this specification and the relevant specifications, standards and related documents including proposals, which the bidder claims to be economically and / or technically superior solutions, must be submitted in writing for review and approval by Grupa LOTOS SA. Non-approved exceptions are not acceptable by Grupa Lotos S.A.

The supplier must report in writing any ambiguity in this or any other specifications of Grupa LOTOS SA or non-compliance with the referred documents / standards and obtain a written explanation from Grupa Lotos SA.

3 Hierarchy of documents

In case of conflicts existing between this specification and other documents, the following order of precedence shall govern:

- The current Polish legislation
- Terms of purchase order / contract and other requirements agreed in writing with GLSA
- Data Sheets approved by GLSA
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Definitions and designations

GLSA – LOTOS Group S.A.

CR – Control Room

DCS – Distributed Control System

DDS – Digital Data Storage

DLT – Digital Linear Tape

ER – Engineering Room

ESD – Emergency Shut Down System

SIS -Safety Instrumented System

SIL - Safety Integrity Level

HMI – Human Machine Interface

IP – Ingress Protection

I/O – Input/Output

LCD – Liquid Crystal Display

MTBF – Mean Time Between Failures

PLC – Programmable Logic Controller

RAID – Redundant Array of Independent Disks

USB – Universal Serial Bus

TFT – Thin Film Transistor, type of liquid crystal colour display with active matrix

UPS – Uninterruptible Power Supply

5 Description

5.1 General requirements for computers operated in automatics systems

Computers working in automatics systems are elements of reliable and effective system of control and monitoring, and also process data storage and management in purposes of versatile analyses of GLSA production data. Industrial database is made available through extensive client network within refinery network.

Essential element characterizing computers working in automatics systems is their reliability, which has also its reflection in data safety and high comfort of personnel work as well. In relation to this assumption, supplier of automatics systems shall take into consideration design of the computers in respect of resistance to industrial conditions present in place of computer installation, specific requirements regarding performance, functions of operator and process interactions, and also selection of computer sub-assemblies and their possible redundancy. Elements of computers shall be high reliability components, manufactured by renowned producers.

Computers working in automatics systems shall feature possibility of easy repair, introduction of changes, extension (scaling ability) and operating system as well as software updates (patches, upgrades), accomplished by GLSA in course of production, also after expiration of guarantee period. In relation to this, hardware and software configuration shall comply with standards adopted in GLSA – standard computer technology present for instance in office applications is preferred – and subject to detailed agreement with GLSA each time. If there is a necessity to apply dedicated solutions it is required that comprehensive engineering trainings for GLSA employees are ensured at the contractual stage.

Another element that is important for usage of computers is short reaction and repair time required in case of failure. A repair shall be accomplished in place where computer is installed.

Software shall provide GLSA with possibility of introducing changes without loss of computer guarantee, as well as for whole automatics system. Actions of GLSA that may lead to invalidation of guarantees shall be minimised, and specified in detail on contractual stage.

Computers being delivered have to be models that are currently offered by a manufacturer. They cannot be computers originating from stock reserves, terminated production or models being currently withdrawn. Therefore the hardware specification shall be set within final stage of project preparation, if possible.

5.2 Functional division of computers working in automatics systems

Computers working in automatics systems can be functionally divided according to below given table.

Item	Computer function	Functional description and technical requirements for computer
1	**Operator's station**	**Functionality:** a computer intended for communication of process control and monitoring system with human (operator) (HMI), in order to present process data and entering of commands and control parameters by operator. **Basic technical requirements:** - possibility of two monitors connection (presenting independent displays) - at least 19" LCD monitor (active TFT matrix) with 1600x1200 resolution, angle of view exceeding 160º both vertically and horizontally, contrast 500:1 at least, brightness 250 cd/m^2 at least - keyboard and trackball (preferred) or optical mouse - double network interface – Fast Ethernet preferred (100Base-Tx) (or of higher speed), for redundant communication in automatics system - providing possibility of audible signals generation
2	**Engineering station**	**Functionality:** the same as for operator's station, additionally tools for system configuration, software modification, and also for parameterization and diagnostic of field equipment **Basic technical requirements:** - the same technical requirements as for operator's station - internal or external CD/DVD recorder
3	**Process station**	**Functionality:** a computer, or computer integrated in PLC/DCS intended for data acquisition from industrial automatics instruments, information processing and transmitting to other stations, control systems and servers. The station stores only current data;

Item	Computer function	Functional description and technical requirements for computer
		In quality of process station, industrial*) or compact**) computer can be used. **Basic technical requirements:** - compact computer: absence of rotating elements – passive cooling design (without fan), solution without mechanical disk is preferred, equipped with required communication interfaces - industrial computer: free PCI expansion slots, possibility of inserting full-size expansion card, RAID 1 controller (so-called hardware mirroring) or higher, equipped with required communication interfaces

Item	Computer function	Functional description and technical requirements for computer
4	**Automatics system server**	**Functionality:** server type computer, intended for gathering, archiving and serving data acquired from automatics instruments, or from process or operator's stations. In small systems***), functions of station and server can be accomplished by single physical computer, which fulfils requirements for all classes. **Basic technical requirements:** - double power supply, enabling replacement during operation (Hot Swap) - redundant fans, enabling replacement during operation (Hot Swap) - hardware RAID 5 controller, enabling replacement of disks during operation (Hot Swap) + hot stand-by disk – SCSI disks are preferred - tape memory - LCD 19" display
5	**History server**	**Functionality:** server type computer, intended for gathering, archiving and serving of data coming from other servers and stations, in long period of time (1 year minimum) **Basic technical requirements:** - the same technical requirements as for automatics system server

industrial computer*) – intended for use in industrial environment (on plant). It features higher resistance to ambient conditions and increased level of operating reliability

compact computer**) (barebone) – a computer with integrated elements, small casing, for installation on rail in cabinet

small system***) – control system for less than 1000 process variables

5.3 Detailed requirements for computers working in automatics systems

A computer and its elements intended for automatics systems must fulfil requirements of software, which will be installed and used on specific computer. Selection of computer elements shall be done on the grounds of software producer requirements. CPU speed, RAM memory size, capacity of hard disks (HDD), graphic accelerator power, shall substantially exceed software requirements for long-term operation period. In case of typical requirements, a computer shall meet them in excess of 20%, while if only minimum requirements are stated, then hardware of at least double capacity shall be used.

Furthermore, each computer must be furnished with:

- Ethernet interfaces (100 Mbps or more), and USB (2.0 or higher) or FireWire (IEEE 1394), where one of them enables system boot-up.
- redundant power supplies and fans, enabling their replacement during operation in case of important computer stations and servers, where failure of one of them does not influence equipment operation

- industrial casings, suitable for installation in standard 19" cabinets; deviation is only possible in case of compact type computers for special applications

Computers (also monitors and peripherals) must have CE mark, indicating manufacturer's declaration on fulfilling requirements of adequate European Directives regarding safety of use and environment protection. Possession of other safety marks (for example, TCO, UL, CSA, TUV-GS, SEMKO, GOST, FCC-B, TICK, VCCI-2, and MRP) is recommended as well.

Supplier shall specify MTBF value for computers, and in particular for their components such as: power supplies, hard drives, fans (value above 100,000 h is required).

Computers must have at least one-year guarantee running from installation commissioning, realized on site (shipping of equipment to supplier is not required), and at least 3-year supplier guarantee. Furthermore, in case of servers supplier must be able to provide 24-hour service at client facilities. Response time, along with definition of proceeding, as well as maximum repair time shall be specified by supplier and agreed with GLSA. Purchasing of hardware from local supplier that provides short response time and local service is recommended.

Computers performing functions of operator's or engineering stations, as well as servers, shall be located in central control room (CR), engineering room (ER), or possibly in other, air-conditioned room.

Process stations (compact computers, or industrial – special ones), located in industrial premises (without air-conditioning), such as production halls, shall feature design intended for typical industrial applications, where features of key significance are:

- reliability, small dimensions and low power consumption
- resistance to heat, vibrations and solvents dissipated in air (for example, use of gold plated contacts resistant to corrosive atmosphere)
- protection class for cabinet where computer is installed, shall be at least IP65
- protection standard for usage in explosion hazardous area, if operated in such zone
- cooling system of high capacity and reliability (redundancy of fans), if cooling is required
- use of displays intended for applications where electromagnetic interferences are present, and in harsh environmental conditions (dust and humidity)

Recommendations for computers located in industrial premises include application of:

- computers without rotating devices, for example hard disks
- membrane type keyboards and touch type LCD screens, adapted for operating them in gloves,
- 24V DC supply.

5.4 Protection of computer software and data

Protection of computer software and data concerns operating system and device drivers, system software, application software, utility and diagnostic software, process data of controlled plant.

In order to protect computer software and data against hardware failures, accidental deletion or virus infection, actions related to four scopes shall be determined: 4.4.1 and 4.4.2 scopes shall be adapted to required level of protections, while 4.4.3 and 4.4.4 scopes shall be employed in every case for all systems.

5.4.1 Hardware protection in place of failure origin

Protection of computer data by means of redundant disks usage configured according to adequate level of protection (RAID1, RAID5), redundancy of power supply or communication links. This method of protection is employed in case of servers and important computer stations, particularly if they are single.

5.4.2 Redundancy of computer equipment

For computer stations and servers, where high level of reliability is required, redundancy, i.e. multiplication (usually doubling) of functionally identical units is employed, and failure of one computer unit does not influence the other. For example, system of two (or more) independent, functionally identical operator's stations, servers, connected to the same segment of automatics system computer network.

5.4.3 Protection of software and data by means of administrative tools

Multi-level protection of access to computer system for users and administrator is always required. Structure of access rights shall be presented by supplier and agreed with GLSA.

5.4.4 Back-up copies of software and data on external carriers

The following activities related to coping data can be distinguished:

Archiving – after completion of given work stage, data of that stage are being archived – this applies to projects, analyses, reports and serves for easy searching of protected information, however not necessarily for these data recovering in case of computer failure. Archiving is rarely performed and data are stored for long period of time (for example, several years).

Back-up (safety copy) – daily back-up copy, which is used to fully recover of computer functionality after its failure – it does not directly serve protecting of information. The following types of copies can be distinguished here:

- normal copy – it contains all files subject to copying; is characterized by long copying time, large carrier space being occupied by stored data, high reliability of data restoring from carrier
- differential back-up copy – in order to restore full data, last normal back-up copy data shall be first restored, then the data from last differential copy
- incremental back-up copy – in order to restore full data, last normal back-up copy data shall be first restored, and then the data from all incremental copies sequentially, in chronological order.

Recommended method of back-up copies preparation, considering carrier occupancy and relatively easy data recovery, is to make normal copy once a week and differential copies each remaining weekday.

Contractor of automatics system where computers are used, have to present procedure of back-up copy preparation for current state of computer, data copy, and restoring procedure. Essential condition for data back-up procedure reliability is periodical (for example, twice a year) restoring of data on reserve computer, and their superficial checking.

Beside computer data back-up copy, it is necessary to have copies of whole computer disk (image), as well as carriers for operating system and all applications installed on specific computer in set-up versions.

Contractor of automatics system must provide procedure of software installation and configuration on automatics system computers. Installed software shall correspond to licence connected with it in terms of number as well as method of its installation and usage. Licence conditions must enable making at least one software back-up copy.

In order to accelerate service actions in case of failure, it is necessary to keep history of computers' repairs, as well as current specifications of hardware and software installed on each computer.

5.4.5 Storage of back-up and safety copies

It is recommended that software installation carriers, back-up and safety copies are stored in safe place, possibly in room different than that of computers for which such copies have been prepared.

It is also recommended that daily safety copies of important data are made on separate carriers, in order to prevent damage (for example, in result of mechanical or thermal damage) of copies from several days. Daily exchange of back-up carrier shall be connected with checking of messages regarding completion of safety copies a day before.

It is required for safety copy to be made automatically each day/night, and carriers for less important data shall be exchanged at least once a week.

It is recommended to use tape memory of DDS type (Digital Data Storage) – width 4 mm, and for bigger capacities (in excess of 10 GB), tape memory of DLT type (Digital Linear Tape). Capacity of tape must be greater than volume of data being copied to it (with/without data compression) during single back-up session (daily back-up copy).

Safety copies storage system shall enable restoring of data from each of recent 7 days at least, i.e. from one day of each week, recent month and from one day of each month (so-called Grandfather-Father-Son procedure). Tapes from which data are already not needed will be used as data carriers for back-up copies in next days.

Licence certificate or other document, constituting base for specific software installation and usage, shall also be stored in secured place, separate from computers working in automatics system. Administrator passwords shall be protected (for example, in locked cabinet and sealed envelope), however accessible at each time.

5.5 Proper installation of computer systems

Operator's station shall be furnished with ergonomic interface (HMI) for comfortable and safe operating of manufacturing process, i.e. display enabling positioning it at various angles with adjustment of panel position: rotation to left, to right, vertical inclination, adjustment of height, as well as ergonomic keyboard and manipulator (a trackball is preferred).

Workplace with installed operator's station shall be made according to human-factor engineering for computer stands (ergonomic table, seat). Furthermore, all cables leading from computer cabinets to operator's stands shall be adequately protected. The cables shall be routed in cable trays; exposing them to easy damage or disconnection is inadmissible.

Casings of central units shall be mounted in standard 19" cabinets, intended for use in industrial environment (resistant to dustiness). Compact computers, which can be mounted directly in automatics system cabinets, constitute an exception here.

Cabinets and method of assembly have to provide proper heat dissipation (forced by fans or thanks to natural convection). Key-locked doors shall protect access to computers. A cabinet shall be additionally equipped with easily accessible and removable back or side panel, for servicing purposes.

Routing of cables inside a cabinet cannot hinder assembly or disassembly of computers or other elements that require maintenance. As far as possible, power supply cables shall be separated from signal cables (they shall be routed in separate ducts). All cables shall be unequivocally labelled or marked, thus enabling easy identification.

Requirements regarding location and installation of computers shall be submitted to GLSA. Installation of computers must be safe in respect of human work, operation of automatics systems and data being stored in them.

5.6 Power supply of computers

Computers working in automatics systems are supplied from uninterruptible supply system (UPS).

In cases where high reliability of computer unit is of key importance, redundant power supply shall be provided from two UPS units, or, if only one UPS unit is available, by means of two power supply cables routed separately and secured with two independent protections in power supply cabinet of automatics system (downstream the UPS). It is required that redundant power supplies have independent supply sockets, for supplying them from two independent sources.

6 Relevant documents

Any "Technical Specification" issued by GRUPA LOTOS S.A. listed in Contract Files.

7 Codes and standards

In each case it is assumed that standards, regulations, directives and orders called are of their latest editions along with amendments, annexes and supplements in force.

Standards that are specifically connected with computers are principally listed here. Remaining standards related to Control and Instrumentation, are given in specification GLSA 3010 – Instrumentation general Requirements.

7.1 Directives of European Union

2006/95/WE Electrical equipment designed for use within certain voltage limits

89/336/EEC	Electromagnetic compatibility (EMC)
2004/108/EC	Electromagnetic compatibility and repealing Directive 89/336/EEC
93/68/EEC	CE marking
94/9/EEC	Equipment explosive atmospheres (ATEX)

7.2 Polish standards

PN-EN 60950	Safety of information technology equipment
PN-EN 55022	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement
PN-EN 55024	Information technology equipment. Immunity characteristics. Limits and methods of measurement
PN-EN 61000	Electromagnetic compatibility (EMC)
PN-EN ISO 9241 Part 302	Ergonomics of human-system interaction -- Terminology for electronic visual displays
PN-EN ISO 9241 Part 302	Ergonomics of human-system interaction -- Requirements for electronic visual displays

PN-EN ISO 9241 Part 304 Ergonomics of human-system interaction -- User performance test methods for electronic visual displays

PN-EN ISO 9241 Part 305 Ergonomics of human-system interaction -- Optical laboratory test methods for electronic visual displays

PN-EN ISO 9241 Part 306 Ergonomics of human-system interaction -- Field assessment methods for electronic visual displays

PN-EN ISO 9241 Part 307 Ergonomics of human-system interaction -- Analysis and compliance test methods for electronic visual displays

7.3 Other standards

TCO, UL, CSA, TUV-GS, SEMKO, GOST, FCC-B, TICK, VCCI-2, MRP – other national safety standards for computer and electric equipment

EPA Energy Star – Equipment of low energy consumption.

8 Record of changes

No.	Date	Description	Introduced by
1		This specification entirely replaces the former LOTOS Group S.A. standard No. PR 07 374 with the same title.	M. Domaniewski
2	30-11-2013 (rev. 1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel