Approval

| Approval Controls Supplier | Department / Section / Loc. | Name | Date | Signature |
| --- | --- | --- | --- | --- |
| Edited | BE 1/0 (MCC) | Preiszig Jochen |  |  |
| Edited | BE 1/0 (SPS) | Ilia Bedniakov |  |  |
| Edited | BE 1/0 (BuB) | Ilia Bedniakov |  |  |
| Checked | HOA | Beulent Akguel |  |  |
| Approved | HOA | Buelent Akguel |  |  |
| Approval Equipment Supplier | Department / Section / Loc. | Name | Date | Signature |
| Checked | PP |  |  |  |
| Approved | VA |  |  |  |
| Approval Operating Company | Department / Section / Loc. | Name | Date | Signature |
| Checked |  |  |  |  |
| Approved |  |  |  |  |

Tab. 1 - Approval

Distribution List

| Company | Name | Media | Date |
| --- | --- | --- | --- |
| AZO CONTROLS |  |  |  |
| AZO SOLIDS |  |  |  |
| Operating Company |  |  |  |

Tab. 2 - Distribution List

Table of Contents

[Approval 1](#_Toc379383965)

[Distribution List 1](#_Toc379383966)

[Table of Contents 2](#_Toc379383967)

[1 Reference Information 5](#_Toc379383968)

[1.1 History 5](#_Toc379383969)

[1.2 Policies 5](#_Toc379383970)

[1.3 Cross References 5](#_Toc379383971)

[1.4 Reference Table User Requirement Specification vs. Functional Specification 5](#_Toc379383972)

[1.5 Differences to User Requirement Specification 6](#_Toc379383973)

[1.6 Status of Contract 6](#_Toc379383974)

[1.6.1 Functional Specification to be a central Part of the Contract 6](#_Toc379383975)

[1.6.2 Guidelines 6](#_Toc379383976)

[1.7 Guidelines for Development 6](#_Toc379383977)

[2 Overview 7](#_Toc379383978)

[2.1 Goals and Benefits 7](#_Toc379383979)

[2.2 Overview Details 7](#_Toc379383980)

[2.2.1 Main Components of the System 7](#_Toc379383981)

[2.2.2 Main Functions 7](#_Toc379383982)

[2.2.3 Main Interfaces 8](#_Toc379383983)

[2.2.4 Language 8](#_Toc379383984)

[2.3 Hardware 8](#_Toc379383985)

[2.3.1 Overview 8](#_Toc379383986)

[2.3.2 Location of the Control Panels 9](#_Toc379383987)

[2.4 Software 9](#_Toc379383988)

[2.5 Network 10](#_Toc379383989)

[2.5.1 Ethernet 10](#_Toc379383990)

[2.5.2 Field Bus 10](#_Toc379383991)

[2.6 Availability 10](#_Toc379383992)

[2.7 Emergency Stop Conception 11](#_Toc379383993)

[2.8 Backup Conception 11](#_Toc379383994)

[2.9 Equipment Structure 12](#_Toc379383995)

[2.9.1 Lines 12](#_Toc379383996)

[2.9.2 Scales 12](#_Toc379383997)

[2.9.2.1 Standard Scales 12](#_Toc379383998)

[2.9.2.2 Loss-in-weight Scales 12](#_Toc379383999)

[2.9.3 Storage Places 12](#_Toc379384000)

[2.9.4 Consumers 13](#_Toc379384001)

[2.10 Configuration of Scales 13](#_Toc379384002)

[2.10.1 Scale - Storage Place 13](#_Toc379384003)

[2.10.2 Scale - Consumer 13](#_Toc379384004)

[2.10.3 Scale - Line 14](#_Toc379384005)

[3 Functions 15](#_Toc379384006)

[3.1 Master Data Management 15](#_Toc379384007)

[3.2 ProdServer 16](#_Toc379384008)

[3.3 ManDos 17](#_Toc379384009)

[3.4 Visualisation 18](#_Toc379384010)

[3.5 Operation Terminals 19](#_Toc379384011)

[3.6 Operation Modes 20](#_Toc379384012)

[3.7 Production Sequence in Automatic Mode 21](#_Toc379384013)

[3.8 Production Sequence in Manual Mode 22](#_Toc379384014)

[3.9 Service Mode 23](#_Toc379384015)

[3.10 Fault Handling 24](#_Toc379384016)

[3.11 Silo Refill 25](#_Toc379384017)

[3.12 Weighing 26](#_Toc379384018)

[3.13 Mobile Units 27](#_Toc379384019)

[3.14 Mixing Sequence 28](#_Toc379384020)

[3.15 Central Filter 29](#_Toc379384021)

[4 Interfaces to other System Components 30](#_Toc379384022)

[4.1 PLC <=> Mixer 30](#_Toc379384023)

[5 System Security / Protection 31](#_Toc379384024)

[5.1 Actions on Fault 31](#_Toc379384025)

[5.1.1 Power Fault 31](#_Toc379384026)

[5.2 Data Recovery 32](#_Toc379384027)

[5.3 Access Protection 33](#_Toc379384028)

[5.3.1 Access Control 33](#_Toc379384029)

[5.3.1.1 Control System 33](#_Toc379384030)

[5.3.1.2 Visualisation System 33](#_Toc379384031)

[5.3.1.3 PLC System 34](#_Toc379384032)

[6 Data 35](#_Toc379384033)

[6.1 System Data 35](#_Toc379384034)

[6.2 Equipment Data 35](#_Toc379384035)

[6.3 Data Availability 35](#_Toc379384036)

[6.4 Data Integrity and Data Security 35](#_Toc379384037)

[7 Remote Diagnosis and Maintenance 36](#_Toc379384038)

[8 Glossary 37](#_Toc379384039)

[9 Contacts 38](#_Toc379384040)

[10 Due Dates 39](#_Toc379384041)

[11 Addendum 40](#_Toc379384042)

[11.1 List of Tables 40](#_Toc379384043)

[11.2 List of Figures 41](#_Toc379384044)

[11.3 Open Issues 42](#_Toc379384045)

1. Reference Information
   1. History

| No. | Date | Concerned Parts of Document | Reason of Change | Version | Responsible |
| --- | --- | --- | --- | --- | --- |
|  | 01.10.2018 | All | First draft | 0.1 | Ilia Bedniakov |

Tab. 3 - Document-History

* 1. Policies

| No. | Guidelines |
| --- | --- |
|  | — |

Tab. 4 - Guidelines

* 1. Cross References

| No. | Reference Number / Document Key / File Name | Title |
| --- | --- | --- |
|  | 3-119663-00-0 – V02 | P&ID |

Tab. 5 - Cross References

* 1. Reference Table User Requirement Specification vs. Functional Specification

| No. | User Requirement Specification | Functional Specification |
| --- | --- | --- |
|  | N.A. | — |

Tab. 6 - Reference Table URS vs. FS

* 1. Differences to User Requirement Specification

| No. | Concerned Parts of Document | Reason of Difference |
| --- | --- | --- |
|  | N.A. | — |

Tab. 7 - Differences to URS

* 1. Status of Contract
     1. Functional Specification to be a central Part of the Contract

The functional specification is obligatory for all contract partners. It describes all essential implementation features of the AZO Control System to be developed.

By approving this document, the customer accepts the proposed procedures. He especially accepts the functionality of the application explained in the chapters 3-6. The specified scope of functions and data totally describes the application

* + 1. Guidelines

The Functional Specification has to be kept current during the complete life cycle of the project.

* 1. Development Guidelines

|  |  |
| --- | --- |
|  | **Without written approval of the project manager, the equipment supplier and the operating company development and implementation cannot start!** |

1. Overview
   1. Goals and Benefits

Automatic feeding system for transport of product to the packing machine ROVE. The product is fed through the feeding hopper FHP01.

The system primarily consists of the following parts:

* 1 feeding hopper, equipped with vibrator, vibration feeder, and metal separator
* 1 receiver for source hopper, equipped with rotary feeder
* 1 vacuum pump station VP for receiver (consist of 2 pumps)
* 1 buffer hopper HP01 before the packing machine
* 1 secondary filter SF01 between vacuum station and receiver



Figure 1 - Overview

* 1. Overview Details
     1. **Main Components of the System**

1. Operating terminal (WinCC TIA Portal Comfort TP9000)
2. PLC software application (Siemens Simatic S7-300)
3. Electric documentation (circuit diagrams, etc.)
4. Hardware for the different areas
   * 1. **Main Functions**
5. Visualization System (Visu Panel) provides the following functions
6. Visualization and controlling the plant
7. Manual control and service functions
8. Parameter input
9. Fault indication
10. PLC control system provides the following functions
11. Control and monitoring of actors and sensors
12. Data exchange with Visualization panel terminal
13. Data exchange with Rovema packing machine
    * 1. **Main Interfaces**
14. PFC (dry contacts) with ROVEMA packing machine
15. Ethernet connection with visualization Panel
    * 1. **Language**
16. Visualization System Terminal – operator manual: English and Russian.
17. PLC-System: project specific parts are documented in English, the standard modules are created in German.
18. Electric diagrams: the documents are created in English.  
    1. Hardware
       1. **Overview**

1. 1 x PLC Siemens CPU 314C-2 PN/DP
2. Central I/O on board, communication processor on board
3. Central periphery
4. 1 x Siemens SIMATIC TP900
5. TP900 (touch panel) for operating and monitoring the plant equipment
   * 1. **Location of the Control Panels**

Following operating elements are installed in main control cabinet

1. Emergency stop button
2. TP900

**Attention!:** The T9700 and operating elements are not for EX-Zones. Therefore the main control cabinet to be installed away from EX-Zones and not to be used in EX-Zones.

* 1. Software

1. Control system
2. Production PC
3. Third party software
4. Operating system Windows 2003 Server
5. SQL Server 2005
6. AZO CONTROLS software:
7. Master data management
8. Production server
9. Hostlink
10. ManDos PC
11. Third party software
12. Operating system Windows XP
13. AZO CONTROLS software:
14. ManDos
15. Visualisation system
16. Visualisation PC
17. Third party software
18. Operating system Windows XP
19. Visualisation software iFix
20. Operation terminal (WinCC flexible 2007 + HF4)
21. PLC system
22. PLC program (Simatic Manager V5.4 + SP3 + HF1)  
    The PLC program is coded in IL (instruction list).  
    1. Network
       1. Ethernet

| No. | Description | PC Name | Network Name | IP Address | Subnet |
| --- | --- | --- | --- | --- | --- |
|  | Server | SERV-PC | AZO CONTROLS network  Customer network | 192.168.1.11  10.0.30.1 | 255.255.255.0  255.0.0.0 |
|  | Production PC | PROD-PC | AZO CONTROLS network | 192.168.1.12 | 255.255.255.0 |
|  | Visualisation | VISU-PC | AZO CONTROLS network | 192.168.1.13 | 255.255.255.0 |
|  | PLC |  | AZO CONTROLS network | 192.168.1.1 | 255.255.255.0 |

Tab. 8 - IP Addresses

* + 1. Field Bus

1. Profibus DP (decentralised periphery + scales)
2. MPI (terminals)
   1. Availability
3. Control system:  
   The control system is used to operate and monitor the plant automatically. In case of a breakdown of the system the equipment can be controlled manually using the visualisation.
4. Visualisation system:  
   The visualisation system is used for equipment visualisation and monitoring as well as for controlling the plant. In that this system is production relevant, because in case of a breakdown the operator cannot use it e.g. for emergency operation and monitoring purposes.
5. PLC system:  
   The PLC system is controlling and monitoring the actors and sensors of the equipment and therefore it is absolutely production relevant. If one of the components of the PLC system is not available (e.g. because of a hardware fault) all production areas which are controlled by this component are affected. Such a component has to be exchanged as soon as possible.
   1. Emergency Stop Conception
6. The system in total is consisting out of one emergency stop circuit. The emergency stop switch is located in the switching cabinet door of the main cabinet. After usage the control voltage has to be powered on again before the system can be started again.
   1. Backup Conception
7. Control system (Server)
8. PC hardware fault  
   The backup PC is configured to be able to start using an additional partition as an alternative system for the server PC. The SQL server periodically performs backups to the P: partition of the server PC. In case of exchanging the server by the alternative PC the current backup can be restored to the database of the replacement system.
9. Fault of a hard disk  
   The PC system is based in a RAID system. This is mirroring the data onto a second hard disk, so in case of a hard disk problem of the primary disk the saved data of the second hard disk can be used further. The damaged hard disk has to be replaced as soon as possible to get back again to a status of breakdown protection. After implementation of a new hard disk the RAID software automatically synchronises the data within the RAID disks.
10. Control system (Production PC)
11. PC hardware fault  
    The backup PC is configured to be able to start using an additional partition as an alternative system for the server PC. Because the data and the programs are located on the server the PC can be started immediately in its current state.
12. Fault of a hard disk  
    The PC system is based in a RAID system. This is mirroring the data onto a second hard disk, so in case of a hard disk problem of the primary disk the saved data of the second hard disk can be used further. The damaged hard disk has to be replaced as soon as possible to get back again to a status of breakdown protection. After implementation of a new hard disk the RAID software automatically synchronises the data within the RAID disks.

OR

1. PC hardware fault  
   The system can be operated in manual mode.
2. Fault of a hard disk  
   The system can be operated in manual mode.
3. Visualisation system (Visu PC)
4. PC hardware fault  
   The backup PC is configured to be able to start using an additional partition as an alternative system for the server PC. Because the data and the programs are located on the server the PC can be started immediately in its current state.
5. Fault of a hard disk  
   The PC system is based in a RAID system. This is mirroring the data onto a second hard disk, so in case of a hard disk problem of the primary disk the saved data of the second hard disk can be used further. The damaged hard disk has to be replaced as soon as possible to get back again to a status of breakdown protection. After implementation of a new hard disk the RAID software automatically synchronises the data within the RAID disks.
6. Visualisation system (Terminal)
7. The valid program version of the visualisation system is located on the visualisation main system. After installation has finished the program is handed over to the customer on a CD ROM.
8. SPS-Syste
9. The valid program version of the PLC system is located on the CPU device. After installation has finished the program is handed over to the customer on a CD ROM. Backup of temporary data is in the responsibility of the customer.
   1. Equipment Structure
      1. Lines

| No. | Line Descriptions | Comments |
| --- | --- | --- |
|  | Production line 1 | — |

Tab. 9 - Linen Overview

* + 1. Scales
       1. Standard Scales

| No. | Description | Weighing Range  [kg] | Volume  [l] | Type | Comments |
| --- | --- | --- | --- | --- | --- |
|  | Wa1 | 0 - 1500 | 0 - 2000 | Siwarex U | — |
|  | Wa5 | 0 - 500 | — | Mettler IND690 | Floor scale |

Tab. 10 - Scale Overview

* + - 1. Loss-in-weight Scales

| No. | Description | Weighing Range  [kg] | Volume  [l] | Conveying Capacity  [kg/h] | Type | Comments |
| --- | --- | --- | --- | --- | --- | --- |
|  | WA11 | 0 - 1500 | 0 - 2000 | 32 - 600 | Siwarex FTC | — |

Tab. 11 - Overview Loss-in-weight Scales

* + 1. Storage Places

| No. | Silo | Comments |
| --- | --- | --- |
|  | Silo301 | Outdoor silo |
|  | Silo510 | Indoor silo |
|  | ET 101 | Feeding hopper |
|  | HZ Mi 1 | Manual addition mixer |

Tab. 12 - Overview Storage Places

* + 1. Consumers

| No. | Consumer | Comments |
| --- | --- | --- |
|  | Silo 1 | Target silo |
|  | Container 1 | — |
|  | Extruder 2 | — |
|  | Bag discharge station 3 | — |

Tab. 13 - Overview Consumers

* 1. Configuration of Scales
     1. Scale - Storage Place

| Storage Place | Wa1 | Wa2 | Wa3 | Wa4 | Wa5 | Wa6 | Wa7 | Wa8 | Wa9 | Wa10 | Wa11 | Wa12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Silo 1 | X | — | — | — | — | — | — | — | — | — | — | — |
| Silo 2 | — | X | — | — | — | — | — | — | — | — | — | — |
| Silo 3 | — | X | — | — | — | — | — | — | — | — | — | — |

Tab. 14 - Configuration Scale - Storage Place

* + 1. Scale - Consumer

| Consumer | Wa1 | Wa2 | Wa3 | Wa4 | Wa5 | Wa6 | Wa7 | Wa8 | Wa9 | Wa10 | Wa11 | Wa12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Extruder 1 | X | — | — | — | — | — | — | — | — | — | — | — |
| Extruder 2 | — | X | — | — | — | — | — | — | — | — | — | — |
| Rollers | — | X | — | X | — | — | — | — | — | — | — | — |
| Bigbag | — | — | X | — | — | — | — | — | — | — | — | — |

Tab. 15 - Configuration Scale - Consumer

* + 1. Scale - Line

| Line | Wa1 | Wa2 | Wa3 | Wa4 | Wa5 | Wa6 | Wa7 | Wa8 | Wa9 | Wa10 | Wa11 | Wa12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Linie 1 | X | — | — | — | — | — | — | — | — | — | — | — |
| Linie 2 | — | X | — | — | — | — | — | — | — | — | — | — |

Tab. 16 - Configuration Scale - Line

1. Functions
   1. Master Data Management
2. xxx
   1. ProdServer
3. xxx
   1. ManDos
4. xxx
   1. Visualisation
5. xxx
   1. Operation Terminals
6. Controls (lights, buttons) are described in the various chapters.
   1. Operation Modes
7. (Automatic, manual, service)
   1. Production Sequence in Automatic Mode
8. (production description, project specific)
   1. Production Sequence in Manual Mode
9. (Visu, operation terminals)
   1. Service Mode
10. xxx
    1. Fault Handling
11. (how are faults displayed and how are they acknowledged? Visu, OP, light, buzzer)
12. Visualisation PC
13. Occurring faults within the equipment, scale faults and violated monitoring intervals are displayed on a separate window. Additionally the last fault messages are displayed in the header area of each visualisation window. In order to ensure a controlled start of the motors after correction of a fault each assigned motor alarm has to be acknowledged one by one. In this way it will vanish from the fault / alarm list. Scale faults have to be acknowledged at the control system after elimination. They then disappear from the fault / alarm list as well. Other faults are deleted from the fault list when they no longer are signalised.
14. Operator Terminal
15. Occurring faults within the equipment, scale faults and violated monitoring intervals are displayed on a separate window. Additionally the faults appear in a popup window in the screen foreground. In every case the have to be acknowledged. In order to ensure a controlled start of the motors after correction of a fault each motor alarm has to be acknowledged one by one. In this way it will vanish from the fault / alarm list. Scale faults have to be acknowledged at the terminal after elimination. They then disappear from the fault / alarm list as well. Other faults are deleted from the fault list when they no longer are signalised.
    1. Silo Refill
16. (Refill, Visu bottom area: key switch)
    1. Weighing
17. Weighing mode (control, positive, negative)
18. Weighing operation (filling, discharging)
19. Sharing of production equipment (Silo, blower, FU)
20. Special function (pre-aeration, lifting function)
    1. Mobile Units
21. (Componenter, Dosibox, Shuttle)
    1. Mixing Sequence
22. (Mixing recipes, static mixing sequence)
    1. Central Filter
23. (Cleaning)
24. Interfaces to other System Components
    1. PLC <=> Mixer
25. Coupling type (DP/DP, PFK, Ethernet, Profibus)

| Signals from the Mixer | Type | Range of Values | Unit |
| --- | --- | --- | --- |
| Automatic | Boolean | — | — |
| Fault | Boolean | — | — |
| Control voltage on | Boolean | — | — |
| Inlet valve open | Boolean | — | — |
| Inlet valve closed | Boolean | — | — |
| Temperature | Real | 0-200 | °C |
| Mixer speed | Real | 300-1400 | rpm |

Tab. 17 - Signals from the Mixer

| Signals to the Mixer | Type | Range of Values | Unit |
| --- | --- | --- | --- |
| Acknowledge fault | Boolean | — | — |
| Open inlet valve | Boolean | — | — |
| Discharge mixer | Boolean | — | — |
| Set point mixer speed | Real | 300-1400 | rpm |

Tab. 18 - Signals to the Mixer

1. System Security / Protection
   1. Actions on Fault
      1. Power Fault
2. Control system  
   After a power fault the control system can be started in a secure restart mode (a data recovery mode). In this case the system status must not be changed manually (e.g. discharging of scales, etc.).
3. Visualisation System  
   In the visualisation system no data are stored. Therefore the PC simply has to be started again. After the startup sequence has finished the system synchronises automatically with the connected partners (PLC, control system).
4. PLC System  
   The PLC memory resident program and data is protected by a backup battery or an appropriate storage board. On return of the voltage and switching on of the control voltage the sequence is continued at the point of the interrupt.
   1. Data Recovery
5. Control System  
   The SQL server database backup will periodically be created and will be stored on the production PC. From here it should be saved periodically onto an external medium..
6. SPS-System  
   At the end of the installation a copy of the final PLC program version will be created and it will be saved within the OLC project. Further backups are in the responsibility of the customer. If necessary a backup can be restored in the CPU device via programming device or remote access.
   1. Access Protection
      1. Access Control
         1. Control System

Content: Listing of user groups. Reference to related chapters if necessary (PWDS).

Each function in the control system can be monitored on customer's request by the access control system.

The following user groups are defined by default:

| User Groups | Range of Values |
| --- | --- |
| User | Operating personnel  ordinary login required.  Detailed function scope freely configurable. |
| SuperUser | Specialists  ordinary login required.  Detailed function scope freely configurable. |
| Administrator: | Administrator  ordinary login required.  System administration, password administration  +  all rights of the groups User and SuperUser  Detailed function scope freely configurable. |

Tab. 19 - Access Control of the Control System (LT)

Further groups are freely definable (30 groups at maximum).

* + - 1. Visualisation System

The users identify themselves by a combination of a unique user ID, a user name (login) and a password.   
Each process critical action can only be executed after an ordinary login.

The following user groups are defined by default:

| User Groups | Range of Values |
| --- | --- |
| Group 1 | General issues, watching only  without login |
| Group 2 | Operators all rights of group 1 + all switching and parameterising actions necessary for the operation of the equipment like set value modifications, manual / auto status changes, alarm, message and dialog confirmations  ordinary login required. |
| Group 3 | Shift supervisor or special operators all rights of groups 1 - 2 + modification of process specific parameters like limit and alarm values or delay times, tipping mode within process sequences (if available)  ordinary login required. |
| Group 4 | Specialists all rights of groups 1 - 3 + Modification of control parameters, equipment specific parameters like machine limit values or bridging times, temporary bridging of interlocks, configuration and installation of new / changed software  ordinary login required. |
| Group 5: | Administrator all rights of groups 1 - 4 + system administration, password administration  ordinary login required. |

Tab. 20 - Access Control of the Visualisation System (BuB)

* + - 1. PLC System

In the PLC no access control is enabled. No AZO CONTROLS module has any password protection.

1. Data
   1. System Data
2. Control System
3. The configuration of the control system is stored in the SQL server database.
4. PLC System
5. The configuration of the PLC system is stored in the PLC.
   1. Equipment Data
6. Control System
7. The configuration of the equipment related to the control system is stored in the SQL server database.
8. PLC System
9. The configuration of the equipment related to the PLC system is stored in the PLC.
   1. Data Availability
10. Control System
    1. Data Integrity and Data Security
11. Control System
12. Remote Diagnosis and Maintenance
13. Control System
14. Remote services are executed with the agreed remote access tools using an analogue modem at the dedicated PC

OR

1. Remote services are executed with the agreed remote access tools using a VPN connection to the dedicated PC.
2. Prerequisites
3. PC is configured with an IP address of the customer network
4. Customer has set up and drives a VPN-Server
5. Customer provides VPN client software
6. Visualisation System
7. Remote services are executed with the agreed remote access tools using an analogue modem at the dedicated PC

OR

1. Remote services are executed with the agreed remote access tools using a VPN connection to the dedicated PC.
2. Prerequisites
3. PC is configured with an IP address of the customer network
4. Customer has set up and drives a VPN-Server
5. Customer provides VPN client software
6. PLC System:
7. Remote services are executed using an analogue modem and the teleservice adaptor of the CPU.
8. Current software version is in the responsibility of AZO CONTROLS.

OR

1. Remote services are executed with the agreed remote access tools using VPN and direct access to the CPU of the PLC.
2. Current software version is in the responsibility of AZO CONTROLS.
3. Prerequisites
4. PLC is configured with an IP address of the customer network
5. Customer has set up and drives a VPN-Server
6. Customer provides VPN client software

OR

1. Remote services are executed with the agreed remote access tools using VPN and direct access to a programming device with its own access to the PLC.
2. Current software version is laying at customer's side.
3. Prerequisites
4. PLC is configured with an IP address of the customer network
5. Customer has set up and drives a VPN-Server
6. Customer provides connection between programming device and PLC.
7. Glossary

| Begriff | Beschreibung |
| --- | --- |
| BE 1/0 | Department (area) engineering level 1 and 0  (PLCs and actuators/sensors, SCADA) |
| BE 3/2 | Department (area) engineering level 3 and 2  (control systems and MES functionality) |
| L-BE | Management of department (area leading) |
| MCC | Motor Control Center,  switch cabinet and electric planning |
| PLC | Programmable Logic Control,  programming of level 1 control systems |
| Visualisation (BuB) | Visualisation systems / operating and monitoring  Visualisation and SCADA configuration resp. programming |
| LT | Control systems level 2 and 3,  control systems and MES configuration resp. programming |
| PL | Project management |
| Kastor | Batch oriented control system (an AZO CONTROLS System) |
| ManDos | Manual Dosing Station (an AZO CONTROLS System) |
| Wa | Scale |

Tab. 21 - Glossary

1. Contacts

| Name | Company | Department | Phone Number | Email |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Tab. 22 - Contacts

1. Due Dates

| Due Date | Description | Responsible |
| --- | --- | --- |
|  | Quotes provided | AZO CONTROLS / equipment supplier |
|  | Start software development | AZO CONTROLS |
|  | Shipping MCC | AZO CONTROLS |
|  | Shipping equipment supplier | AZO CONTROLS / equipment supplier |
|  | FAT at equipment supplier | AZO CONTROLS / equipment supplier |
|  | Installation and startup | AZO CONTROLS / equipment supplier / operating company |
|  | Ready for production | AZO CONTROLS / equipment supplier / operating company |

Tab. 23 - Due Dates

1. Addendum
   1. List of Tables

[Tab. 1 - Approval 1](#_Toc379384046)

[Tab. 2 - Distribution List 1](#_Toc379384047)

[Tab. 3 - Document-History 5](#_Toc379384048)

[Tab. 4 - Guidelines 5](#_Toc379384049)

[Tab. 5 - Cross References 5](#_Toc379384050)

[Tab. 6 - Reference Table URS vs. FS 5](#_Toc379384051)

[Tab. 7 - Differences to URS 6](#_Toc379384052)

[Tab. 8 - IPAddresses 10](#_Toc379384053)

[Tab. 9 - Linen Overview 12](#_Toc379384054)

[Tab. 10 - Scale Overview 12](#_Toc379384055)

[Tab. 11 - Overview Loss-in-weight Scales 12](#_Toc379384056)

[Tab. 12 - Overview Storage Places 13](#_Toc379384057)

[Tab. 13 - Overview Consumers 13](#_Toc379384058)

[Tab. 14 - Configuration Scale - Storage Place 13](#_Toc379384059)

[Tab. 15 - Configuration Scale - Consumer 13](#_Toc379384060)

[Tab. 16 - Configuration Scale - Line 14](#_Toc379384061)

[Tab. 17 - Signals from the Mixer 30](#_Toc379384062)

[Tab. 18 - Signals to the Mixer 30](#_Toc379384063)

[Tab. 19 - Access Control of the Control System (LT) 33](#_Toc379384064)

[Tab. 20 - Access Control of the Visualisation System (BuB) 34](#_Toc379384065)

[Tab. 21 - Glossary 37](#_Toc379384066)

[Tab. 22 - Contacts 38](#_Toc379384067)

[Tab. 23 - Due Dates 39](#_Toc379384068)

[Tab. 24 - List of Open Issues 42](#_Toc379384069)

* 1. List of Figures

[Fig. 1 - Overview 7](#_Toc379384070)

* 1. Open Issues

| No. | Date | Description | Responsible | Due Date | Finished |
| --- | --- | --- | --- | --- | --- |
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Tab. 24 - List of Open Issues