Hardware Design Specification (HDS)

Type:	ZSE 12 HP-PH - 40D
Machine number:	06080
Order number:	N-40136146
Customer:	Next Pharma

Change history:

Date	Version	Description
29.10.2025	1.0	Final
18.05.2026	2.0	Correction of order number of Memory Card 24MByte in chapter 2.4.1 and correction of Object description of Christ Panel in chapter 2.4.4

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1. Purpose and scope

This document specifies the hardware components and technical features of the automation system based on the requirements for the system and and based on the HDS for the standard software ZSE12.

1.1 Standard software

The standard software was developed, programmed and qualified at ZSE18 machine #05937 regarding standard PID in his full expansion / full periphery scope of delivery. Functions, which are only relevant for ZSE12 software were tested at machine #06013.

All possible components are electrically prepared according to the standard PID up to ET200. If a device from this standard set is not used for the corresponding customer order, the wiring between the ET200 and the connector does not take place. However, if a device is required, it is wired up to the connector plate/plug.

The following equipment was connected and used for qualification of the standard software:

- RX9100 Heating cooling unit zones BR_018_H1_K12_AE_FDA_NET, EBraun
- RX3000 volumetric dosing unit MT-S HD with Congrav CM-E 3.0, Brabender
- RX4000 Liquid dosing Watson Marlow 120U/DV
- RX6000 Cooling belt MFB18-24VDC-BLE2-50.5-500, Fedotec
- RX7000 Pelletizer IPS-SG-E Mini Pharma, IPS
- RX13000 Drum cooler CCR-10/06, BBA

The extruder together with the additional (peripheral) equipment is called extrusion line.

The extruder itself was tested and qualified with a KS vario hardware temperature controller, max. 12 zones with a PT100 zone temperature sensor, one melt temperature sensor, one melt pressure sensor, 1 gear, 1 motor.

The following frequency converter were installed (provided and programmed by Leistritz):

- For main drive: KEB 00S6000-CMAT / 12S6A14
- For cooling belt: Oriental motor BLE2D30-C
- For drum cooler: Siemens PM240-2

1.2 Description project

The machine is controlled via an HMI. Standard software ZSE12 is installed on the HMI. The standard software is a qualified software and was qualified for a defined scope.
Whether the delivery scope of the present machine corresponds to the qualified scope was considered in a risk assessment (refer to RA_6080).

The following equipment is connected with the extruder:

- RX9100 Heating cooling unit zones BR-018-H1-K012-AE-FDA
- RX3000 Dosing unit MiniTwin MT-S-HD, Brabender
- RX4000 Liquid dosing Watson Marlow 120U/DV with pump head 114
- RX6000 Cooling belt MFB18-24VDC-BLE2-50.5-500, fedotec

The extruder itself is equipped with a KS vario hardware temperature controller, Zone 1-8 with a PT100 zone temperature sensor in each zone, one melt temperature sensor, one melt pressure sensor, 1 gear, 1 motor.

The material is outlet is defined as follows: in Zone 9 with die head LSK 12 (integrated material outlet) and die 1x0.8 mm/ 1x1.8 mm/ 1x3 mm.

The extruder together with the additional (peripheral) equipment is called extrusion line.

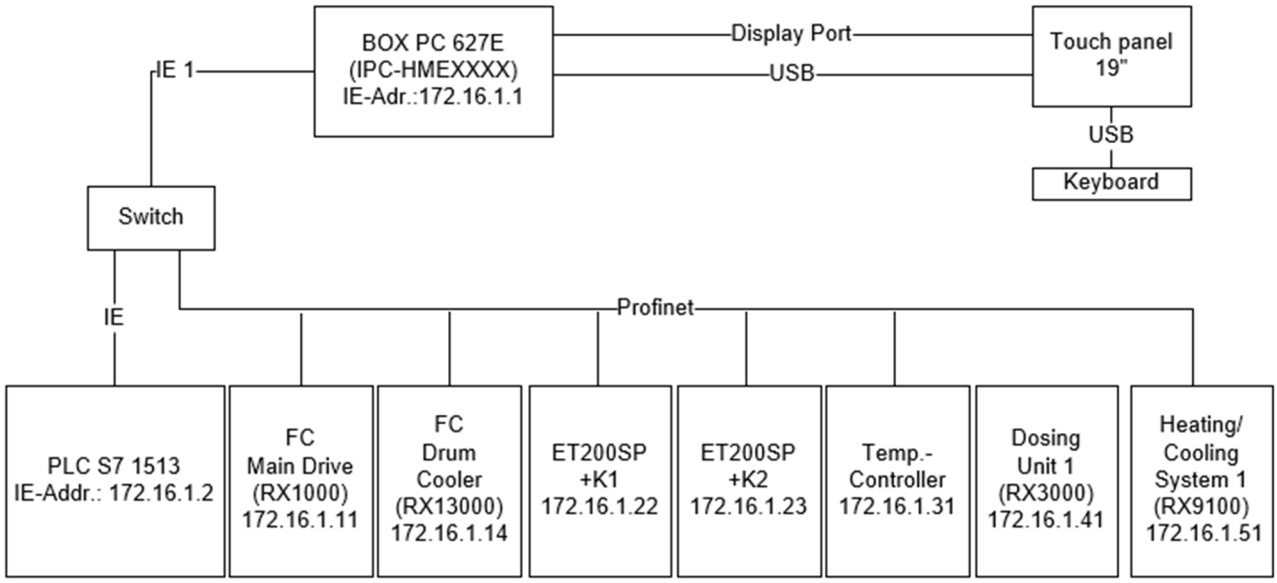
2. Description of the automation system

2.1 Package units

The units described below will be considered as package units in the scope of this project. Hardware components of package units are not part of the HDS. For more information see the corresponding manufacturer's documentation. The manufacturer documents are in the documentation by Leistritz.

Unit	Manufacturer	Communication Protocol
Dosing Unit 1 (RX3000)	Brabender	Profinet
Liquid Dosing Unit (RX4000)	Watson Marlow	Remote I/O
Cooling Belt (RX6000)	FEDOTEC	Remote I/O
Heat Exchanger 1 (RX9100)	EBraun	Profinet

2.2 Automation system structure



Please note: This picture shows the full periphery scope of delivery. Please refer to chapter 1.2 regarding the installed units for this project.

2.3 Hardware components

The hardware-related realization of the system is carried out with the SIMATIC S7 automation system from Siemens. The SCADA-System is realized on a Box IPC and a panel from Siemens.
The SIMATIC S7-1513 programmable logic controller (PLC) serves as the basis for the operation of the process-related components.

2.4 Main Components of the Controller

The SIMATIC S7-1513 with 24 MB RAM on memory card is the main unit of the automation system. It provides an Industrial Ethernet interface. ET200SP modules are installed to build a connection to the I/O hardware layer.

A frequency converter (FC) for the main drive, ET200SP stations for the hardware I/O, a Congrav-Controller (Brabender) for the dosing unit and a heat exchanger from EBraun are connected to the automation system via Profinet. A temperature controller from PMA is connected to the automation system via Profinet, too. In addition, some other peripheral devices are connected to the system.
The SCADA-System is coupled to the PLC via Industrial Ethernet.

2.4.1 List of control components

Item No.	Order Number	Object	Qty.	Supplier	Bus Address
1	6ES7513-1AM03-0AB0	CPU S7-1513-1PN	1	Siemens	IE IP: 172.16.1.2
2	6ES7954-8LF04-0AA0	Memory Card 24MByte	1	Siemens	

2.4.2 List of ET200SP components ZSE12

Item No.	Order Number	Object	Type	Supplier	Bus Address
+K1 switch cabinet					
0	6ES7193-6AR00-0AA0	Bus adapter		Siemens	172.16.1.22
1	6ES7155-6AU02-0BN0	Interface Module IM155-6 PN ST incl. Server Modul for ET200SP	IM	Siemens	
2	6ES7134-6GD01-0BA1	Electronic Module for ET200SP, AI 4xI 2-/4-wire ST	AI	Siemens	
3	6ES7134-6GD01-0BA1	Electronic Module for ET200SP, AI 4xI 2-/4-wire ST	AI	Siemens	
4	6ES7135-6HD00-0BA1	Electronic Module for ET200SP, AQ 4xU/I ST	AQ	Siemens	
5	6ES7131-6BF01-0BA0	Electronic Module for ET200SP, DI 8x24VDC ST	DI	Siemens	
6	6ES7131-6BF01-0BA0	Electronic Module for ET200SP, DI 8x24VDC ST	DI	Siemens	
7	6ES7131-6BF01-0BA0	Electronic Module for ET200SP, DI 8x24VDC ST	DI	Siemens	
8	6ES7131-6BF01-0BA0	Electronic Module for ET200SP, DI 8x24VDC ST	DI	Siemens	

Item No.	Order Number	Object	Type	Supplier	Bus Address
9	6ES7132-6BF01-0BA0	Electronic Module for ET200SP, DQ 8x24VDC/0,5A ST	DQ	Siemens	
10	6ES7132-6BD21-0BA0	Electronic Module for ET200SP, DQ 4x24VDC/2A ST	DQ	Siemens	
11	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
12	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
13	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
14	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
15	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
16	6ES7193-6PA00-0AA0	Server Module		Siemens	
+K2 Extruder					
0	6ES7193-6AR00-0AA0	Bus adapter		Siemens	172.16.1.23
1	6ES7155-6AU02-0BN0	Interface Module IM155-6 PN ST incl. Server Modul for ET200SP	IM	Siemens	
2	6ES7134-6GD01-0BA1	Electronic Module for ET200SP, AI 4xI 2-/4-wire ST	AI	Siemens	
3	6ES7134-6JD00-0CA1	Electronic Module (ET200SP), AI 4xRTD/TC HF	AI	Siemens	
4	6ES7135-6HD00-0BA1	Electronic Module for ET200SP, AQ 4xU/I ST	AO	Siemens	
5	6ES7138-6AA01-0BA0	Electronic Module for ET200SP, TM Count 1x24V ST	TM Count	Siemens	
6	6ES7131-6BF01-0BA0	Electronic Module for ET200SP, DI 8x24VDC ST	DI	Siemens	
7	6ES7132-6BD21-0BA0	Electronic Module for ET200SP, DQ 4x24VDC/2A ST	DQ	Siemens	
8	6ES7132-6HD01-0BB1	Electronic Module for ET200SP, RQ NO 4x120VDC.230VAC/5A ST	RQ	Siemens	
9	6ES7132-6BD21-0BA0	Electronic Module for ET200SP, DQ 4x24VDC/2A ST	DQ	Siemens	
10	6ES7132-6BD21-0BA0	Electronic Module for ET200SP, DQ 4x24VDC/2A ST	DQ	Siemens	
11	6ES7132-6BD21-0BA0	Electronic Module for ET200SP, DQ 4x24VDC/2A ST	DQ	Siemens	
12	6ES7193-6PA00-0AA0	Server Module		Siemens	

2.4.3 List of Profinet Nodes

Item No.	Order Number	Object	Qty.	Supplier	Bus address
1	6ES7193-6AR00-0AA0	K1 Interface Module ET200SP	1	Siemens	172.16.1.22
2	6ES7193-6AR00-0AA0	K2 Interface Module ET200SP	1	Siemens	172.16.1.23
3	00S6000-CMAT/ 12S6A14-1100 (2Y)	Main drive Frequency converter	1	KEB	172.16.1.11
5	MT-S HD	Dosing Unit 1 Congrav Controller	1	Braben-der	172.16.1.41
6	BR_18_H1_K12_AE_FDA_NET	Heat exchanger 1	1	EBraun	172.16.1.51
7	KSVC-101-00171-100	Temperature controller KS Vario Bus adapter	1	PMA	172.16.1.31
8	6AG4131-3CK20-2AA1	SIMATIC IPC627E	1	Siemens	172.16.1.1

2.4.4 List of SCADA-System Components

Item No.	Order Number	Object	Qty.	Supplier	Bus Address
1	6AG4131-3CK20-2AA1	SIMATIC IPC627E	1	Siemens	172.16.1.1
2	PA10015996	Touch Hygienics Monitor 18,5" Stainless Steel IP67	1	Christ	
3	1085255	Industrial Ethernet Switch (FL SWITCH 1016N)	1	PHOENIX CONTACT	
4	WDBUZG0010BBK-EB	1TB external Hard Drive	1	WD Elements	

2.5 Communication

2.5.1 Bus Systems

The communication concept of SIMATIC S7 is based on standards established worldwide and enables a reliable data exchange between all levels and components of a technical system. Powerful, rugged network components from SIMATIC NET are used for communication. All SIMATIC NET products have been specially developed for industrial use. The buses of the SIMATIC NET family ensure continuous, smooth communication between all system components: operator stations, automation systems, peripheral devices and field components.

2.5.2 Industrial Ethernet

INDUSTRIAL ETHERNET is used as the system bus. Industrial Ethernet functions according to the access method standardized in IEEE 802.3.

2.5.3 I/O-Level

Signals are exchanged between components via hardwired cables according to standard signal types.

2.5.4 Communication Interfaces

The controller is equipped with the following interfaces:
Internal Communication of the system:

Communication Partners:		**Connection Type:**
Extruder Controller (S7)	SCADA-System	Industrial Ethernet (IE)
Extruder Controller (S7)	Heating Controller (via KS Vario)	Profinet
Extruder Controller (S7)	Main Drive (via FC)	Profinet
Extruder Controller (S7)	Cooling Belt (via FC)	Profinet
Extruder Controller (S7)	ET200SP	Profinet

Communication to supplied Components / Package Units:

Communication Partners:		**Connection Type:**
Extruder-Controller (S7)	Dosing Unit 1	Profinet
Extruder-Controller (S7)	Heat Exchanger 1	Profinet

2.6 Electrical engineering

2.6.1 Cabinets

The electrical components are installed in an external cabinet and in the base frame of the extruder. The build of the control cabinets for the automation will be done in accordance with actual guidelines and specifications (see declaration of conformation).
The entire electrically components, consisting of control components, measuring technology, frequency converters, power supply and PLC is installed in the cabinets. The cabinets are located in a non-explosive environment and are built for IP52. The customer provides the electrical supply. The transfer point is the switch cabinet. In the switch cabinet, the UPS is provided for the supply of the SCADA computer.

2.6.2 Environmental conditions

The following data are used:

- Maximum humidity: 95 %
- Maximum ambient temperature: 40 °C
- Maximum installation elevation: under 1000 m altitude
- Explosive environment: no

2.6.3 Electrical Supply

The following data are used:

- Mains designation: TN-S 400V / 3 / N / PE / 50 Hz
- Mains connections voltage: 400V
- Control voltage: 24V
- No. of phases: 3
- Rotating field: clockwise
- PEN conductor or loadable neutral conductor: N
- Protective conductor: PE
- Line frequency: 50Hz +/- 5%
- Permissible voltage fluctuations: -+10% of nominal voltage
- Protective measure: as per local PSU or VDE regulations

2.6.4 Signal Types

The following SIMATIC S7 signal types are used:

- Digital Inputs: 24 VDC
- Digital Outputs 24 VDC / 0.2 A
- Analogue Inputs 0 - 10V or 4 - 20 mA signal by PLC
- Analogue Outputs 0 - 10V or 4 - 20 mA signal by PLC

3. Abbreviation

Abbreviation	Description
DC	Direct Current
DP	Decentralized Peripherals
I/O-Level	In- Output level of the PLC
FC	Frequency Converter
IE	Industrial Ethernet
IEC	International Engineering Consortium
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
PE	Protection Earth
PC	Personal Computer
PLC	Programmable Logic Controller

4. Applicable Documents

Document Number	Version	Title
BZ 40136146PI010	A	PID Extruder
N 40136146-01	01	Order confirmation
N/A	Actual	Wiring diagram machine 06080

5. Attachments

none

6. Appendix

none