PROJECT WORK

Dispersing Unit Design

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Subject Dispersing Unit Design

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ABSTRACT

Based on the P&I diagram which was given by the supervisor, the objective of the project is to identify the symbols of components in the drawing and select the most suitable devices for the system of the project. In addition, the purpose of the project was also to design the cabinet for the control room, the wiring system, cable connection and software for PLC.

In the beginning, this project was instructed by the supervisor with the explanation and the plan to do the project. There are the computer tools supporting the project work which were taught and applied by the supervisor and other HAMK teachers. These tools were mainly for designing the system and software for PLC. Furthermore, the questions emerging during working on the project were answered or suggested by the supervisor. Other sources were electrical and automation manufacturers' websites. These websites were used to choose the suitable devices and motors for the system.

In total, the project work was accomplished with fourteen types of documents such as the system drawings, cabinet layout, cable list, motor list, instruments list, etc. The design of the system met the requirement of the project and 95% of the project work could be used to build the real system in real life.

The project instructs and helps students to get familiar with real work in a professional environment and it is necessary to promote the students' skills. These skills are suggested to be reinforced and tested more exactly by adding one more part to the project. That is to have a sample of a real system to test the students' work in real life.

Keywords Dispersing Unit Design, P&I diagram, cabinet, system design.

Pages 37 pages including appendices 1 pages

CONTENTS

1 INTRODUCTION

The project work's purpose is to help students to get familiar and started with basic steps and ways of working in professional environment when implementing a small plant like an automation system and making its technical documentation. With the P&I diagram given from the supervisor, the project work was done with following documentation:

Hieu Nguyen:

- Motor list
- I/O list
- Circuit diagrams
- Cable list
- Description of circuit operation
- Definition of control circuit
- Cabinet layout

Duc Nguyen:

- Instrument list
- Loop Programming charts
- Description of Process operation
- Description of application software
- Hook-up drawings
- Table of name plates

2 TECHNICAL DOCUMENTATION

2.1 **Pipe and Instrumentation diagram**

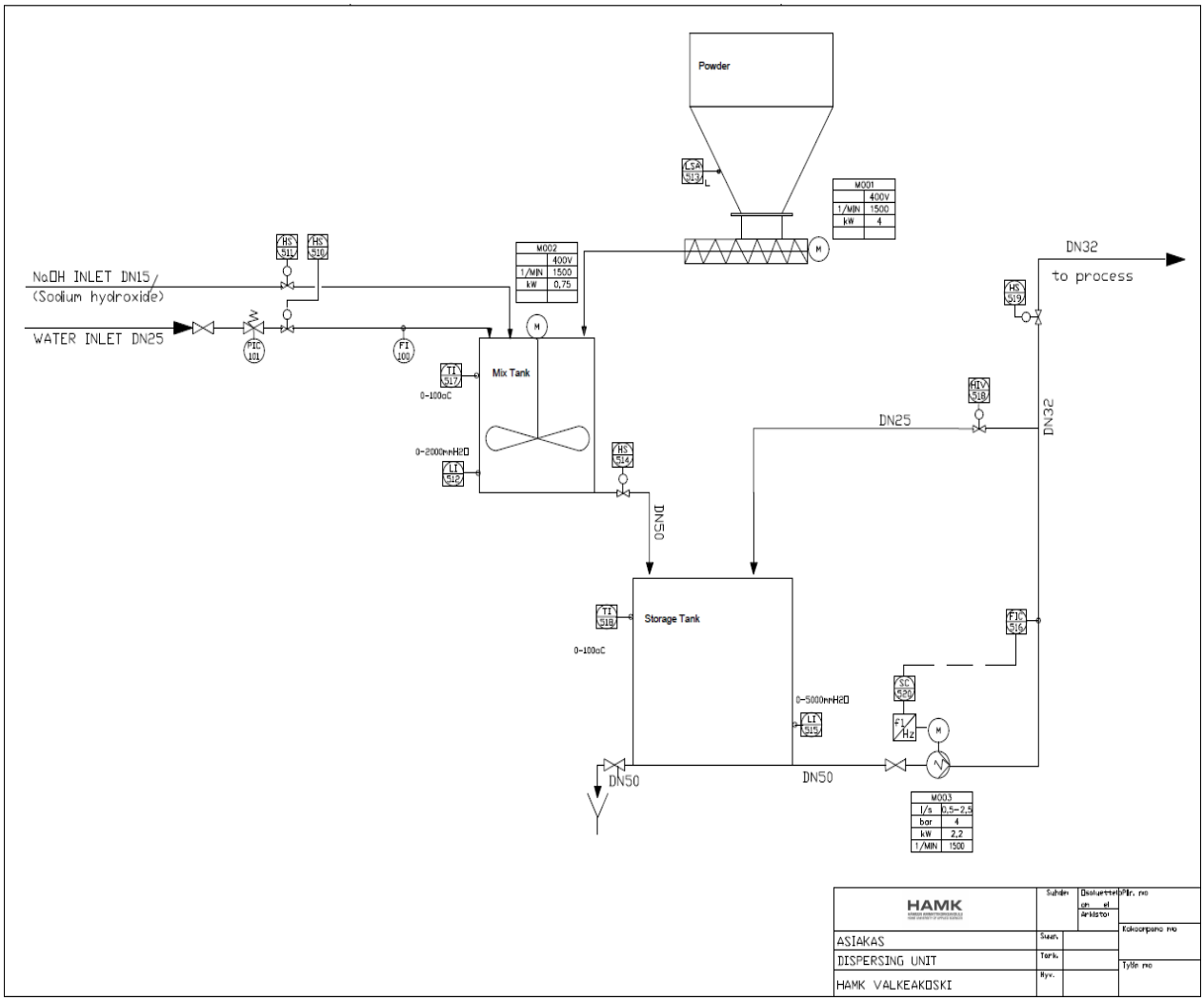


Figure 1. P&I diagram

2.2 **Description of process operation**

The operation of the dispersing unit process:
There are 4 main parts in this process:

- 1 powder distributing tank with the conveyor motor
- 1 mixing tank with the stirring motor
- 1 storage tank
- 1 pump with the speed drive

At the beginning, both the NaOH liquid and the water are conducted into the mixing tank simultaneously through the DN15 and DN25 alternately. To control the flow rate in each pipe, there are two hand valve HS-511 and HS-510 corresponded to DN15 and DN25 which are also managed in the control room. Besides that, the pressure relief valve with the pressure indicator PIC-101 and flow meter FI-100 are located on the pipe DN25 controlling on the field individually.

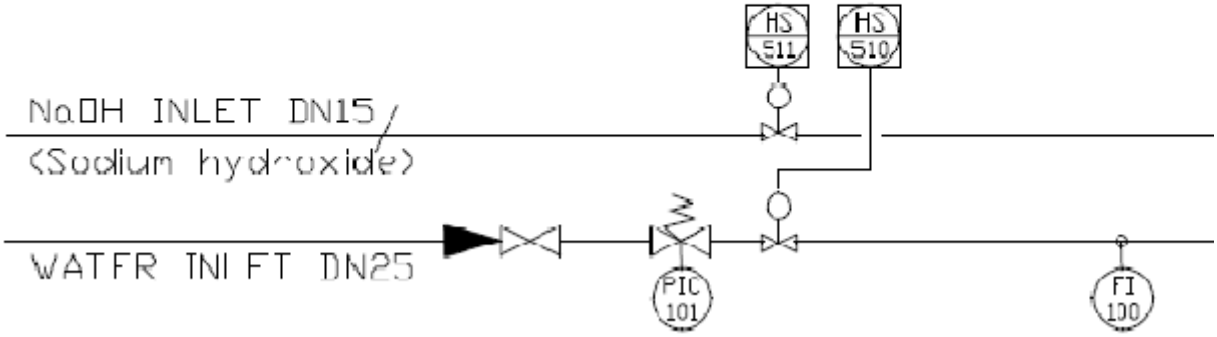


Figure 2. Beginning of the process

Concurrently the powder from the powder tank is dispatched by the conveyor motor MO-01 with the mixing liquid NaOH and water into the mixing tank. On the side of the power tank, the low-level switch alarm LSA-513 is adjusted for operating the powder level.

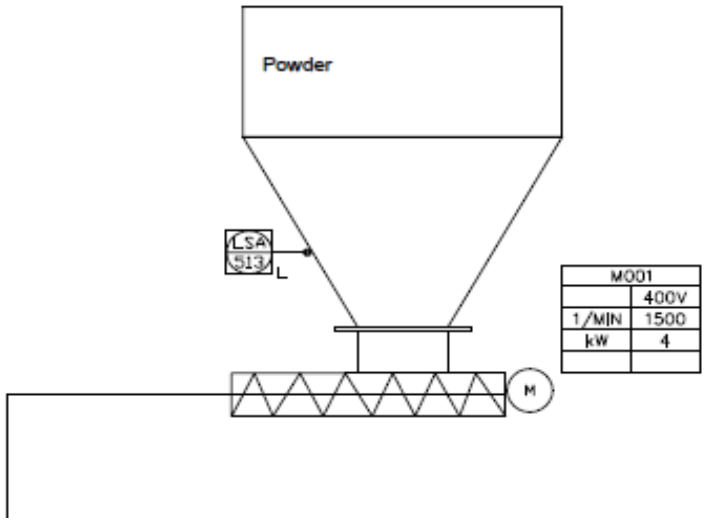


Figure 3. Powder tank with dispatching conveyor

The following stage of the process is all the materials is leaded into the mixing tank and stirred by the stirring motor MO-02. The temperature transmitter TI-517 for the set point range 0-100℃and the hydrostatic low-level transmitter LI-512 for the set point range 0-2000mmH_2O are merged on the side of the tank indicating the temperature and level of the mixed liquid to the control room.

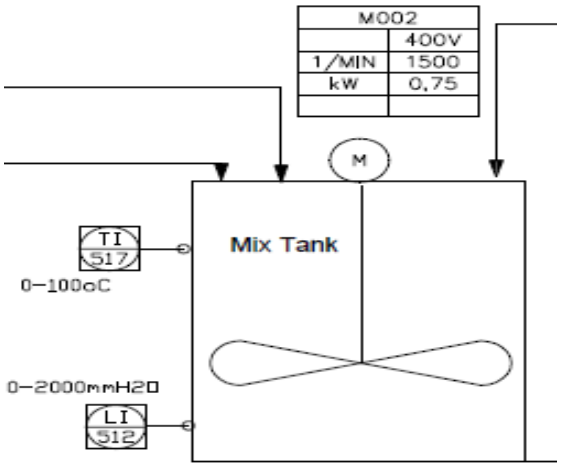


Figure 4. Mix tank with stirring motor

After the mixing stage, the result liquid is released into the storage tank via the pipe DN50 with the control of the hand valve HS-514. Concerning the storage tank, also the temperature transmitter for the set point range 0-100℃ TI-518 and hydrostatic low-level transmitter LI-515 for the set point range 0-5000mmH_2O are attached on the side of the tank indicating the temperature and level of the liquid mixture to the control room.

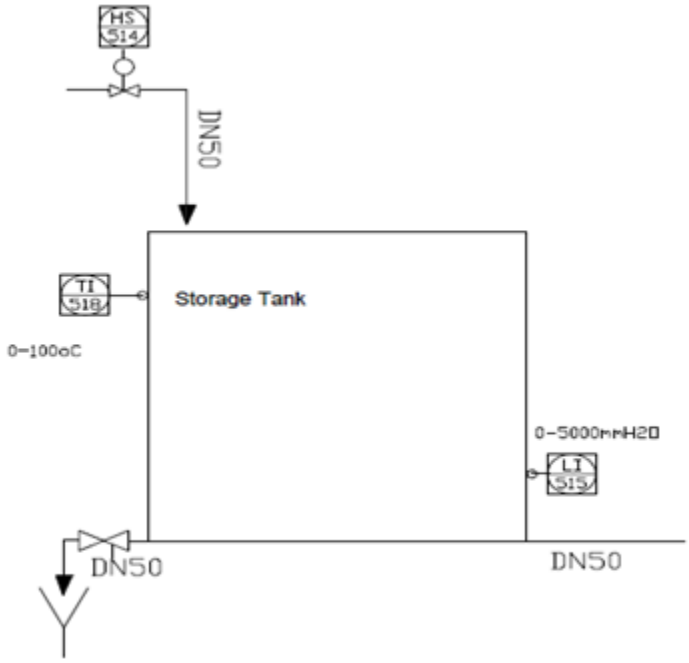


Figure 5. Storage tank

There is the pump motor MO-03 connected with the speed drive SC-520 drains the liquid mixture from the storage tank through the pipe DN50 to the pipe DN32. Based on the database signal from the FIC-516 flow transmitter measures the flow rate in the pipe DN32 indicating to the control room, the speed drive is adjusted to control the pump motor speed reasonably.

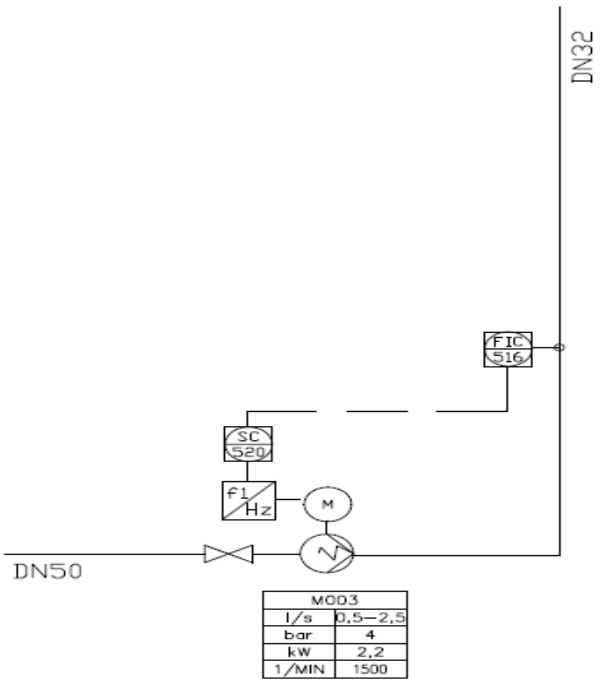


Figure 6. Pump motor with speed drive control

On the pipe DN32 to the next stage, the hand valve HS-519 commanded from the control room is combined. Another direction flow is the displacement of liquid back to the storage tank via the pipe DN25 and operated by the hand valve HIV-518.

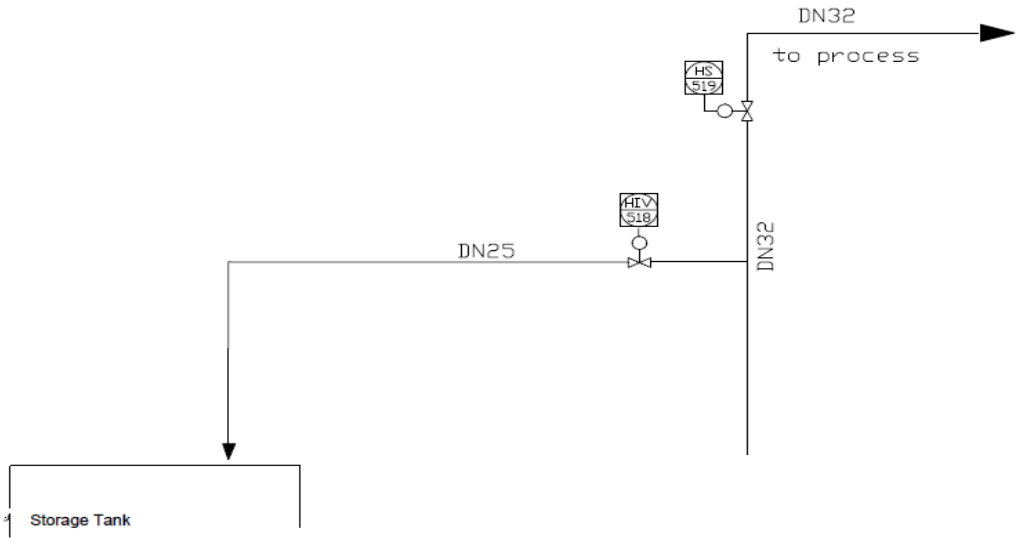


Figure 7. Mixture direction

2.3 **Description of circuit operation**

There are two main parts in the circuit operation: main power distribution circuit diagram (sheet 1, 2) and control circuit diagram (sheet 3, 4, 5). The first circuit supports power for the second circuit. The first circuit operates with a three-phase load with protection devices. Main power distribution circuit also has two power supply for 24VDC. The second circuit operates with 24VDC. The first 24VDC power supply gives power for PLC, all I/O cards and other instruments except sensors with the limit current not exceeding 5A. The other one gives power for all sensors.

2.4 **Definition of control system**

2.4.1 Transformer

These Schneider transformers (ABL8REM24030 and ABL8REM24050) from the manufacturer are designed for basic use in industrial applications. They provide a 24VDC power supply with different current (3A and 5A) for multiple purposes, especially when the PLC requires minimum 4A. With the input voltage from 100 to 240 V AC single phase, the transformers supply the output voltage 24VDC. Another advantage of these transformer is integrated fuse for more protection. Despite that advantage, two circuit breakers are also used to protect these transformers.

2.4.2 Protection circuit breaker

The Siemens protection devices (5SJ4108-7HG40) are miniature circuit breaker with current limiting. There are two different tripping mechanisms in these devices, the delayed thermal tripping mechanism for overload protection and the electro mechanic tripping mechanism for short circuit protection. The breaking capacity is up to 14kA at 230/400 VAC and rated currents up to 8A.

2.4.3 PLC CX5010

The PLC are Embedded PCs from the CX5000 series with Intel® Atom™ processors and differ only by the CPU version from Beckhoff manufacturer. With the installed TwinCAT runtime environment, the CX5010 can be programmed for implementation of PLC or Automation projects. With large program memory, the PLC satisfies demanding requirements:

1. For multisector automation tasks in the construction of series machines, special machines and plants.

2. Used as a central controller on production lines with central and distributed I/O.
3. High processing performance in binary and floating-point arithmetic.
4. PROFIBUS DP master/slave interface.
5. For extensive I/O configurations.
6. For setting up distributed I/O structures.
7. Comprehensive integrated system diagnosis.

2.4.4 Digital input EL1808

Manufacturer: Beckhoff

1. Digital input
2. 500V isolation
3. 8 inputs
4. 24VDC
5. Direct plug-in technique
6. IP20 protection class

2.4.5 Digital output EL2808

Manufacturer: Beckhoff

1. Digital output
2. 500V isolation
3. 8 outputs
4. 0.5 A max output current
5. 24VDC
6. Direct plug-in technique
7. IP20 protection class

2.4.6 Analog input EL3058

Manufacturer: Beckhoff

1. Analog input
2. 500V isolation
3. 8 inputs
4. 4…20 mA signal current
5. 24VDC
6. 1.25 ms
7. 12 bits resolution (16 bits including signal)
8. IP20 protection class

2.4.7 Analog Output EL4028

Manufacturer: Beckhoff

1. Analog output

2. 500V isolation
3. 8 outputs
4. 4…20 mA signal current
5. 24VDC
6. 400 µs
7. IP20 protection class

2.4.8 Motor 1: 3GAA112320-ADJ

Manufacturer: ABB

1. Power: 4kW at 400V/415V/690V 50 Hz
2. In: 8.6 A
3. Speed: 1451 rpm
4. Mounting: IM B3
5. Protection device Schneider: circuit breaker GV2-ME14, contactor LC1D09BD
    a. 4 kW at 440 V AC 50/60 Hz, 4...5.5 kW at 500 V AC 50/60 Hz, 3...4 kW at 400/415 V AC 50/60 Hz
    b. Magnetic Protection Adjustment Range (138 A).
    c. Thermal Protection Adjustment Range (6…10 A).
    d. Rated Breaking Capacity (Iq 50 kA at 400/415 V conforming to IEC60947-4-1, Iq 6 kA at 500 V conforming to IEC60947-4-1, Iq 15 kA at 440 V conforming to IEC60947-4-1).

2.4.9 Motor 2: 3GAA082614-BSJ

Manufacturer: ABB

1. Power: 0.75kW at 400V/415V/230V 50 Hz
2. In: 1.9 A
3. Speed: 1437 rpm
4. Mounting: IM V1
5. Protection device Schneider: circuit breaker GV2-ME10, contactor LC1D09BL
    a. 2.2…3 kW at 440 V AC 50/60 Hz, 3 kW at 500 V AC 50/60 Hz, 2.2 kW at 400/415 V AC 50/60 Hz
    b. Magnetic Protection Adjustment Range (78 A).
    c. Thermal Protection Adjustment Range (4…6.3 A).
    d. Rated Breaking Capacity (Iq 50 kA at 400/415 V conforming to IEC60947-4-1, Iq 50 kA at 500 V conforming to IEC60947-4-1, Iq 50 kA at 440 V conforming to IEC60947-4-1).

2.4.10 Motor 3: 3GAA102530-ASJ

Manufacturer: ABB

1. Power: 2.2kW at 400V/415V/230V 50 Hz

2. In: 4.6 A
3. Speed: 1455 rpm
4. Mounting: IM B3
5. Protection device Schneider: circuit breaker GV2-ME10, contactor LC1D09BL
    a. 2.2…3 kW at 440 V AC 50/60 Hz, 3 kW at 500 V AC 50/60 Hz, 2.2 kW at 400/415 V AC 50/60 Hz
    b. Magnetic Protection Adjustment Range (78 A).
    c. Thermal Protection Adjustment Range (4…6.3 A).
    d. Rated Breaking Capacity (Iq 50 kA at 400/415 V conforming to IEC60947-4-1, Iq 50 kA at 500 V conforming to IEC60947-4-1, Iq 50 kA at 440 V conforming to IEC60947-4-1).

2.4.11 Solenoid valve

NITRA pneumatic directional control solenoid valve, 5-port (4-way), 2-position, spool valve with aluminium body, optional manifold mounting, 1/8-inch NPT female ports, Cv=0.67, 24VDC double solenoid, 9.4mm DIN style wiring connector with LED indication

2.5 **Description of application software**

The process programs are designed for 2 level indicators, 2 temperature indicators, 1 flow indicator, 1 level switch alarm, 1 conveyor motor, 1 stirring motor, 1 pump motor, 1 speed drive and 4 hand valves.

Level indicators and temperature indicators measure the value via the hydrostatic level transmitter and the temperature transmitter thus shown on the screen in the control room. The program illustrates 1 analog input signal which is the measurement value.

The electro-magnetic flow transmitter adjusts the value which is also represented in the control room and simultaneously based on that to control speed drive. There is 1 analog input signal which is shown as the measurement value from the flow transmitter. Program gets 1 output into the speed drive and 1 output for the positioning state. Besides that, there is the binary signal for controlling mode.

The speed drive manages the pump motor frequency. It receives the binary input as the frequency unit on/off and another binary input is to set mode as manual/auto. The program obtains 1 binary output signal to adjust the start/stop of the speed drive.

The level switch alarm which has a level transmitter checks the level value inside the powder tank and alarm in case of lower level limit. The

input signal is as the level value, 1 output signal for setting alarm off whenever the switch alarm is triggered and 1 output signal for positioning state.

Each hand valve controls the flow rate in its pipe. The open limit state and close limit state are displayed in the control room. The program reads 2 binary input signals as the state being used and 1 output to control the valve.

The control valve has a sensor in the field for characterizing and representing the state position of the valve to the control room. There is 1 input signal into the program as the sensing value of position, 1 output for managing the valve and 1 output for the position feedback.

The conveyor motor shifts the powder from the powder tank to the mixing tank, otherwise the stirring motor blends the mixture. There is 1 input as the run state and 1 input as the electric centre fault. Program sets 1 output to control motor and 1 output for manual/auto mode.

The pump motor is governed by the motor drive. There is also 1 input as the run state and 1 input as the electric centre fault. The other is the input of frequency from motor drive for operating motor speed.

2.6 **Instrument list**

Table 1. Valve list

VALVE LIST

Tag numbe	Loop numbe	Service description	Production type	Location	I/O Type	Range or set point	Size (DN)	Manufacturer
HS-510	H 510	Ball valve with pneumatic actuator	K60D-25-DA52	Field		0 - 40 bar	25	AVS
		Limit switch	SB 01205	Field	BI	50mA - 3A		AVS
		Solenoid valve	AVS-5121-24D	Control Cabinet	BO	1.5 - 8.0 bar		AVS
HS-511	H 511	Ball valve with pneumatic actuator	K60D-15-DA32	Field		0 - 40 bar	15	AVS
		Limit switch	SB 01205	Field	BI	50mA - 3A		AVS
		Solenoid valve	AVS-5121-24D	Control Cabinet	BO	1.5- 8.0 bar		AVS
HS-514	H 514	Ball valve with pneumatic actuator	K60D-50-DA75	Field		0 - 40 bar	50	AVS
		Limit switch	SB 01205	Field	BI	50mA - 3A		AVS
		Solenoid valve	AVS-5121-24D	Control Cabinet	BO	1.5 - 8.0 bar		AVS
HS-519	H 519	Ball valve with pneumatic actuator	K60D-32-DA63	Field		0 - 40 bar	32	AVS
		Limit switch	SB 01205	Field	BI	50mA - 3A		AVS
		Solenoid valve	AVS-5121-24D	Control Cabinet	BO	1.5 - 8.0 bar		AVS
HIV-521	H 521	Control valve with pneumatic actuator	Axiom AX	Field	AO	4-20mA	25	Metso's Neles
		Limit switch	SB 01205	Field	BI	50mA - 3A		AVS
		Solenoid valve	AVS-5121-24D	Control Cabinet	BO	1.5 - 8.0 bar		AVS
LSA-513	L 513	Level switch alarm	Liquipoint FTW23	Field	BI	0 - 16 bar		Endress+Hauser

Table 2. Transmitter list

TRANSMITTER LIST

Tag numbe	Loop numbe	Service description	Production type	Location	I/O Type	Range or set point	Size (DN)	Manufacturer
LI-512	L 512	Level transmitter	Deltapilot FMB70	Field	AI/AO	4...20mA/ 0.1 - 10 bar/ 100m H2O		Endress+Hauser
LI-515	L 515	Level transmitter	Deltapilot FMB70	Field	AI/AO	4...20mA/ 0.1 - 10 bar/ 100m H2O		Endress+Hauser
TI-517	T 517	Temperature transmitter	iTHERM TrustSens TM372	Field	AI/AO	4...20mA/ 0 - 6.0 bar/ –40 to +160 °C		Endress+Hauser
TI-518	T 518	Temperature transmitter	iTHERM TrustSens TM372	Field	AI/AO	4...20mA/ 0 - 6.0 bar/ –40 to +160 °C		Endress+Hauser
FIC-516	F 516	Flow transmitter	Promag P 200	Field	AI/AO	4...20mA/ 0.01 - 10 m/s / –20 to +150 °C		Endress+Hauser

2.7 **Motor list**

Table 3. Motor list

Electrical position	Device description	Technical details						Manufacturer	Motor type	Production code	Control place	MCC- type	Protection device	Contactor	Attn!
		Department	P(kW)	r/min	U(V)	In(A)	Mounting code								
M001	POWDER CONVEYOR		4	1451	400	8,6	IM B3	ABB	M3AA 112MB 4	3GAA112320-ADJ	PLC	ND	GV2-ME14	LC1D09BD	GVAE11 ADD
M002	MIXING TANK MIXER		0,75	1437	400	1,9	IM V1	ABB	M3AA 80ME 4	3GAA082614-BSJ	PLC	RD	GV2-ME10	LC1D09BL	
M003	STORAGE TANK FEED		2,2	1455	400	4,6	IM B3	ABB	M3AA 100LC 4	3GAA102530-ASJ	PLC	SC	GV2-ME10	LC1D09BD	ACS355-03X-05A6-4

2.8 **IO list**

Table 4. I/O list

Loop Tag	Loop Desc 1	Loop Desc 2	#	Device Tag	DCS Range	DCS Unit	Device Name	FBC slot	Card	I/O Address	AA	AI	AO	BI	BO	Signal	Supply
HS-511	MIXING TANK	NaOH VALVE	1	ZSO_511	-		OPEN LIMIT	2	0	2.0.0.0				1		NO	
HS-511	MIXING TANK	NaOH VALVE	2	ZSC_511	-		CLOSED LIMIT	2	0	2.0.0.1				1		NO	
HS-511	MIXING TANK	NaOH VALVE	3	GSV_511	-		SOLENOID VALVE	2	3	2.0.3.0					1		6 Bar
HS-510	MIXING TANK	WATER VALVE	1	ZSO_510	-		OPEN LIMIT	2	0	2.0.0.2				1		NO	
HS-510	MIXING TANK	WATER VALVE	2	ZSC_510	-		CLOSED LIMIT	2	0	2.0.0.3				1		NO	
HS-510	MIXING TANK	WATER VALVE	3	GSV_510	-		SOLENOID VALVE	2	3	2.0.3.1					1		6 Bar
LI-512	MIXING TANK	LEVEL	1	LT-512	0-2000	mm	LEVEL SENSOR	3	0	3.0.0.0		1				4-20mA	
TI-517	MIXING TANK	TEMPERATURE	1	TT-517	0-100	°C	TEMPERATURE SENSOR	3	0	3.0.0.1		1				4-20mA	
HS-514	STORAGE TANK	MIXING TANK	1	ZSO_514	-		OPEN LIMIT	2	0	2.0.0.4				1		NO	
HS-514	STORAGE TANK	MIXING TANK	2	ZSC_514	-		CLOSED LIMIT	2	0	2.0.0.5				1		NO	
HS-514	STORAGE TANK	MIXING TANK	3	GSV_514	-		SOLENOID VALVE	2	3	2.0.3.2					1		6 Bar
TI-518	STORAGE TANK	TEMPERATURE	1	TT-518	0-100	°C	TEMPERATURE SENSOR	3	0	3.0.0.2		1				4-20mA	
LI-515	STORAGE TANK	LEVEL	1	LT-515	0-5000	mm	LEVEL SENSOR	3	0	3.0.0.3		1				4-20mA	
LSA-513	POWDER TANK	LEVEL	1	LT-513	0-100	%	LEVEL SENSOR	3	0	3.0.0.4		1				4-20mA	
LSA-513	POWDER TANK	LEVEL	2	LA-513	-	-	LOW LEVEL ALARM	2	2	2.0.2.0				1		NO	
HS-519	PROCESS	PUMP	1	ZSO_519	-		OPEN LIMIT	2	0	2.0.0.6				1		NO	
HS-519	PROCESS	PUMP	2	ZSC_519	-		CLOSED LIMIT	2	0	2.0.0.7				1		NO	
HS-519	PROCESS	PUMP	3	GSV_519	-		SOLENOID VALVE	2	3	2.0.3.3					1		6 Bar
FIC-516	PUMP	FLOW	1	FT-516	0.01-10	m/s	FLOW SENSOR	3	0	3.0.0.5		1				4-20mA	
HIV-521	STORAGE TANK	PUMP	1	CV_521	0-100	%	CONTROL VALVE	3	1	3.0.1.0			1			4-20mA	
HIV-521	STORAGE TANK	PUMP	2	PF_521	0-100	%	POSITION FEEDBACK	3	0	3.0.0.6		1				4-20mA	
HIV-521	STORAGE TANK	PUMP	3	ZSO_521	-		OPEN LIMIT	2	1	2.0.1.0				1		NO	
HIV-521	STORAGE TANK	PUMP	4	ZSC_521	-		CLOSED LIMIT	2	1	2.0.1.1				1		NO	
HIV-521	STORAGE TANK	PUMP	5	GSV_521	-		SOLENOID VALVE	2	3	2.0.3.4					1		6 Bar
M001	MIXING TANK	POWDER FEED	1	M001_ST			M001 START	2	3	2.0.3.6					1		
M001	MIXING TANK	POWDER FEED	2	M001_RUN			M001 RUNNING	2	1	2.0.1.4				1		NO	
M001	MIXING TANK	POWDER FEED	3	M001_FAULT			M001 FAULT	2	1	2.0.1.5				1		NO	
M002	MIXING TANK	MIXER	1	M002_ST			M002 START	2	3	2.0.3.7					1		
M002	MIXING TANK	MIXER	2	M002_RUN			M002 RUNNING	2	1	2.0.1.6				1		NO	
M002	MIXING TANK	MIXER	3	M002_FAULT			M002 FAULT	2	1	2.0.1.7				1		NO	
M003	STORAGE TANK	PUMP	1	M003_ST			M003 START	2	3	2.0.3.5					1		
M003	STORAGE TANK	PUMP	2	M003_RUN			M003 RUNNING	2	1	2.0.1.2				1		NO	
M003	STORAGE TANK	PUMP	3	M003_FAULT			M003 FAULT	2	1	2.0.1.3				1		NO	
												7	1	17	8		

2.9 **Circuits diagram**

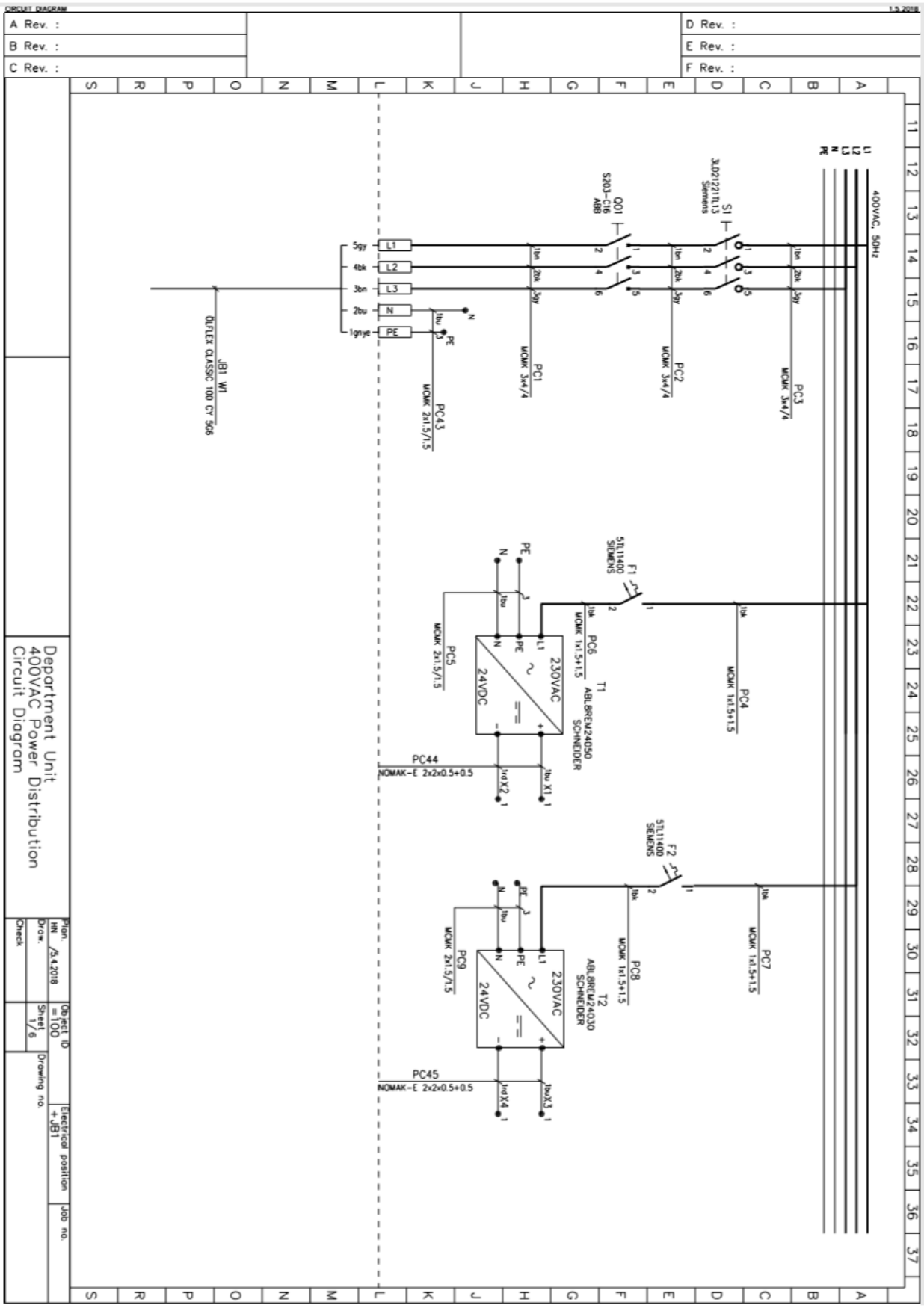


Figure 8. Sheet 1: Main power distribution and transformer

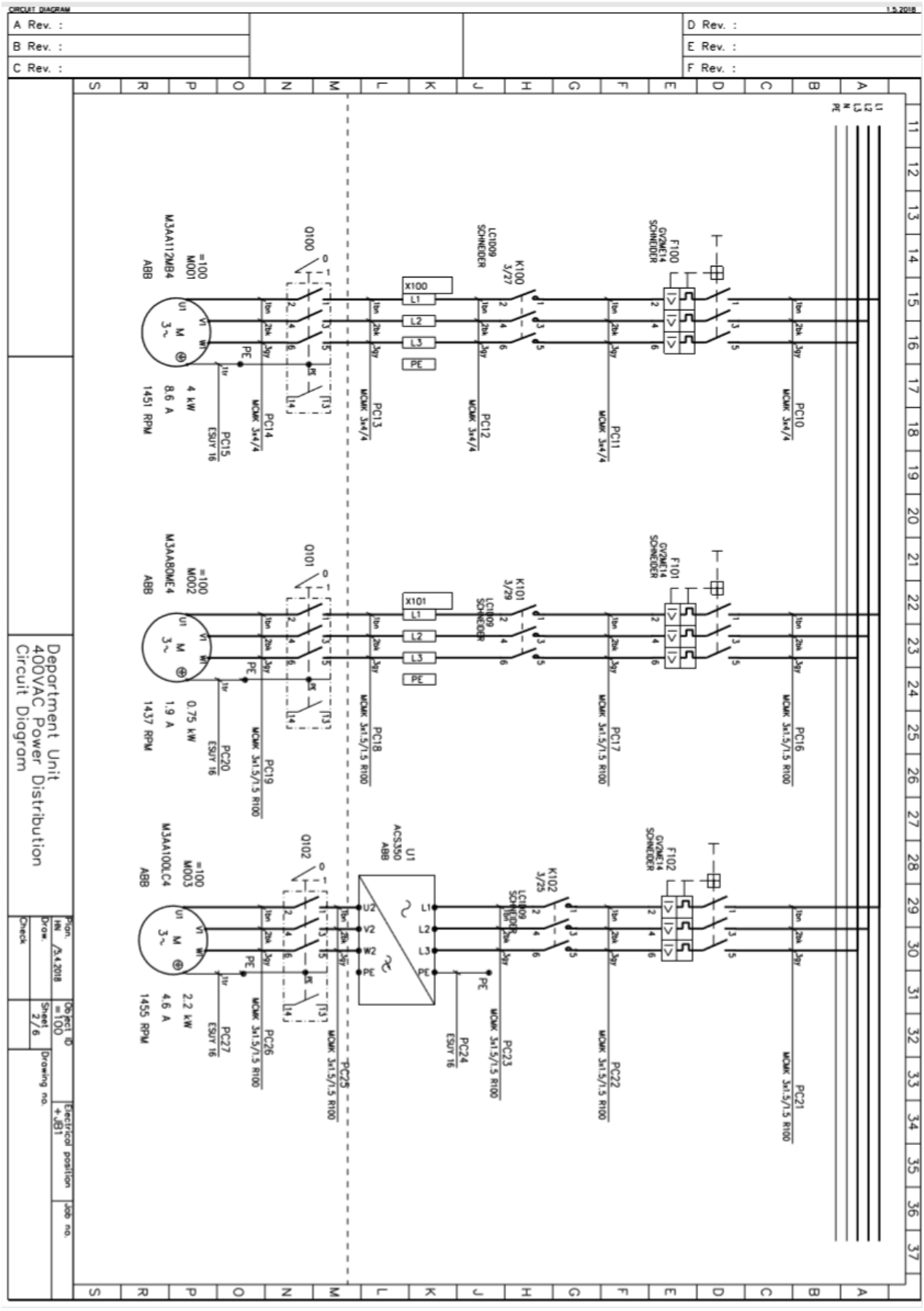


Figure 9. Sheet 2: Motors and their protection devices

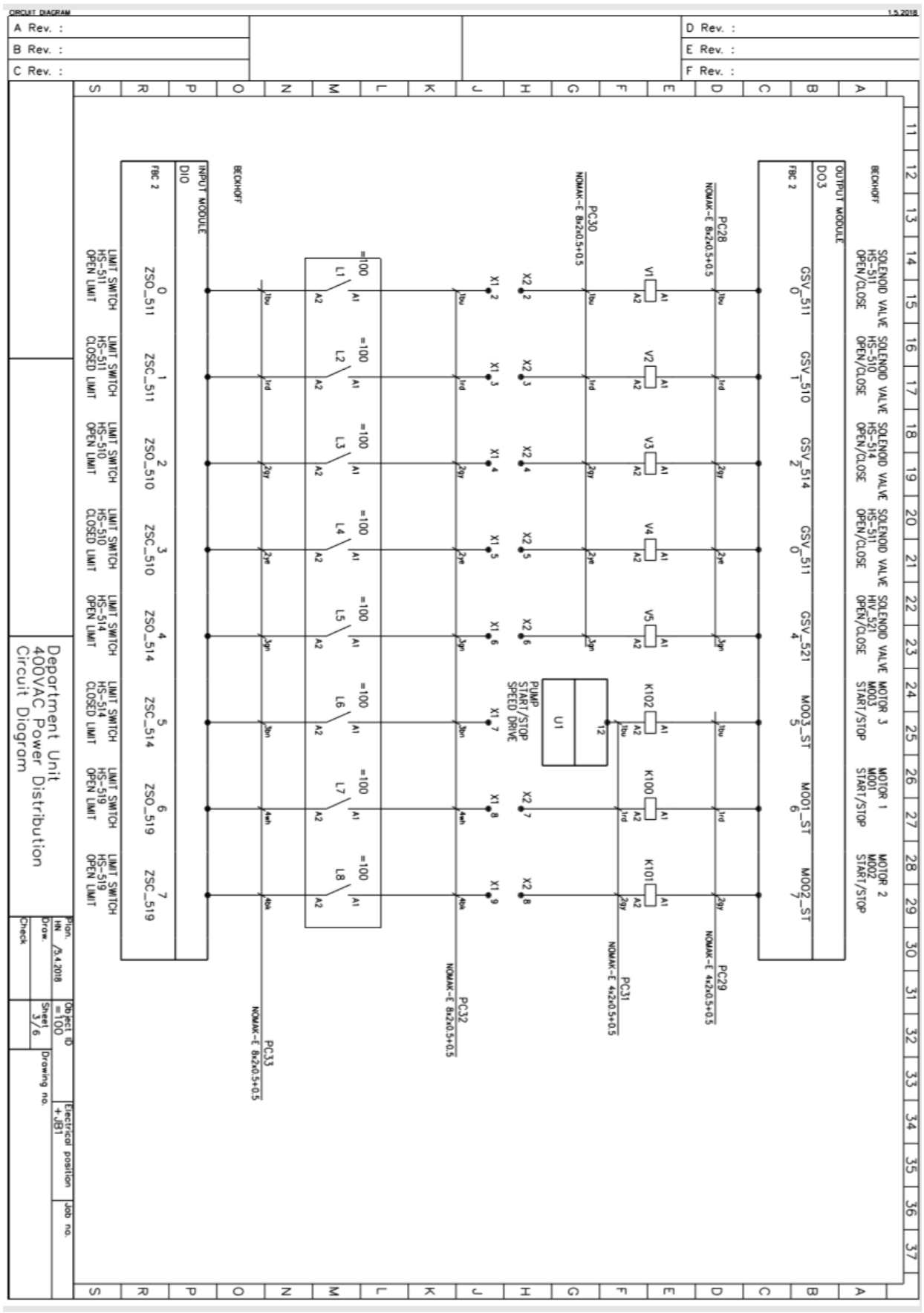


Figure 10. Control system

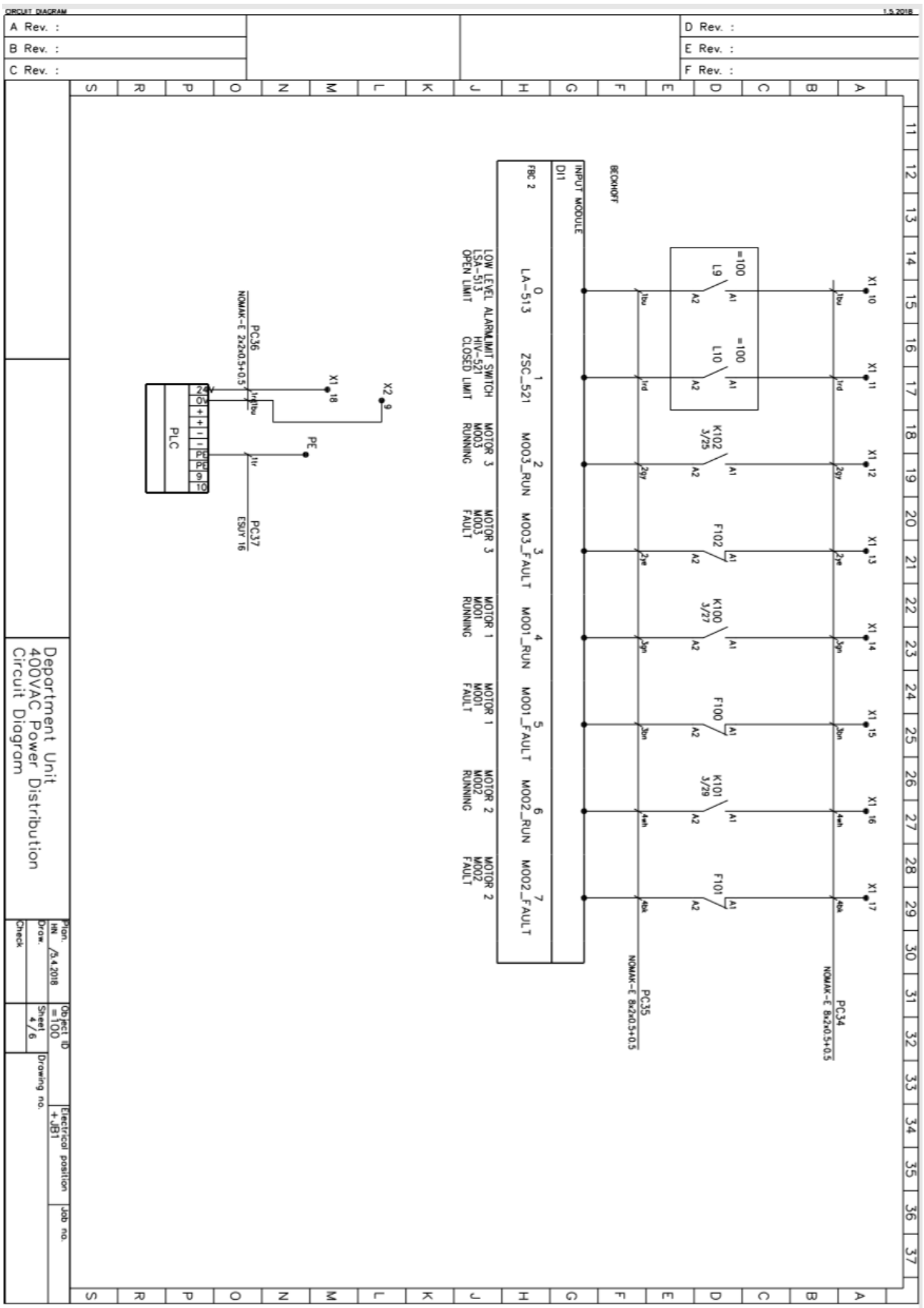


Figure 11. Control system

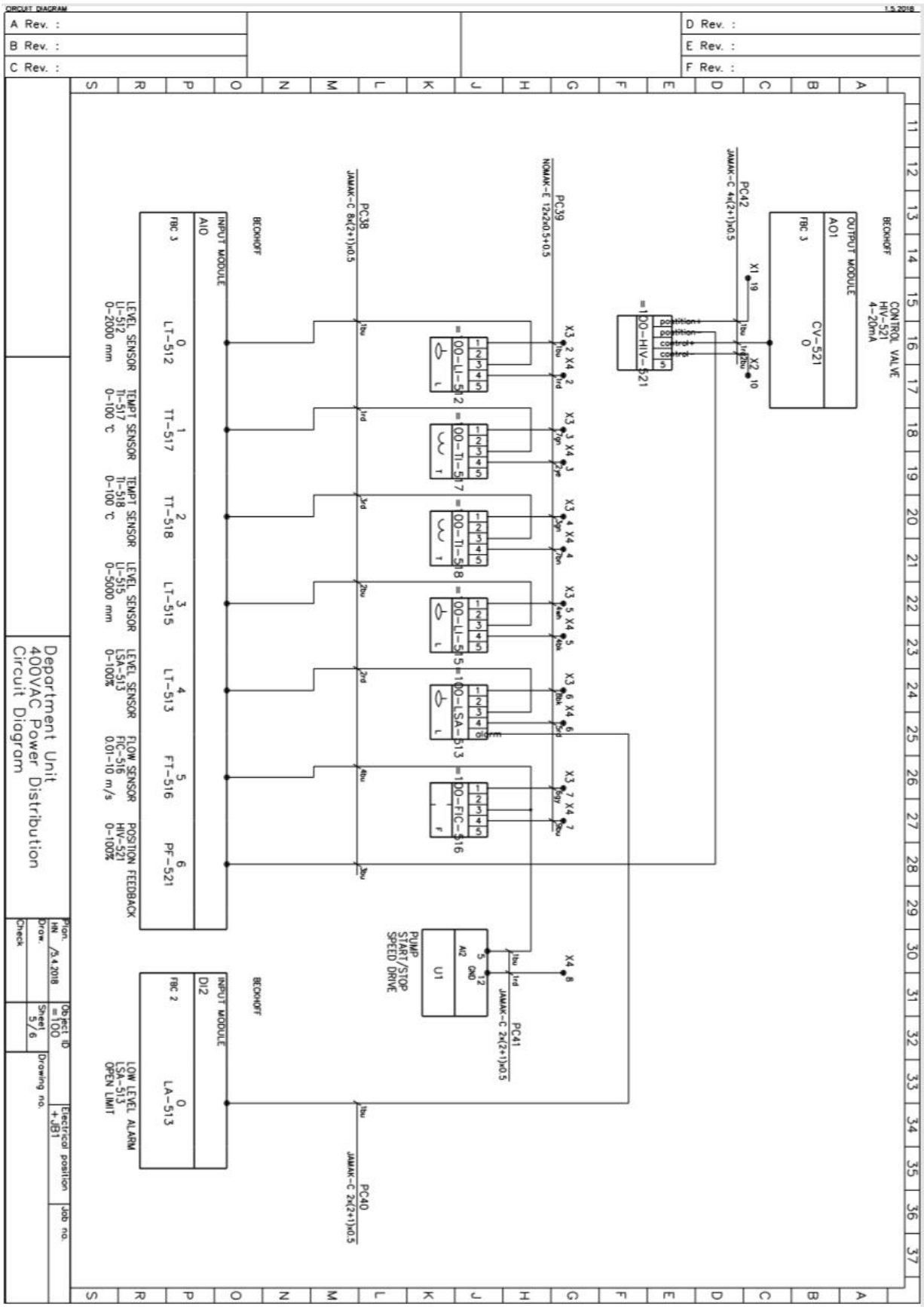


Figure 12. Sensors

2.10 **Loop programming charts**

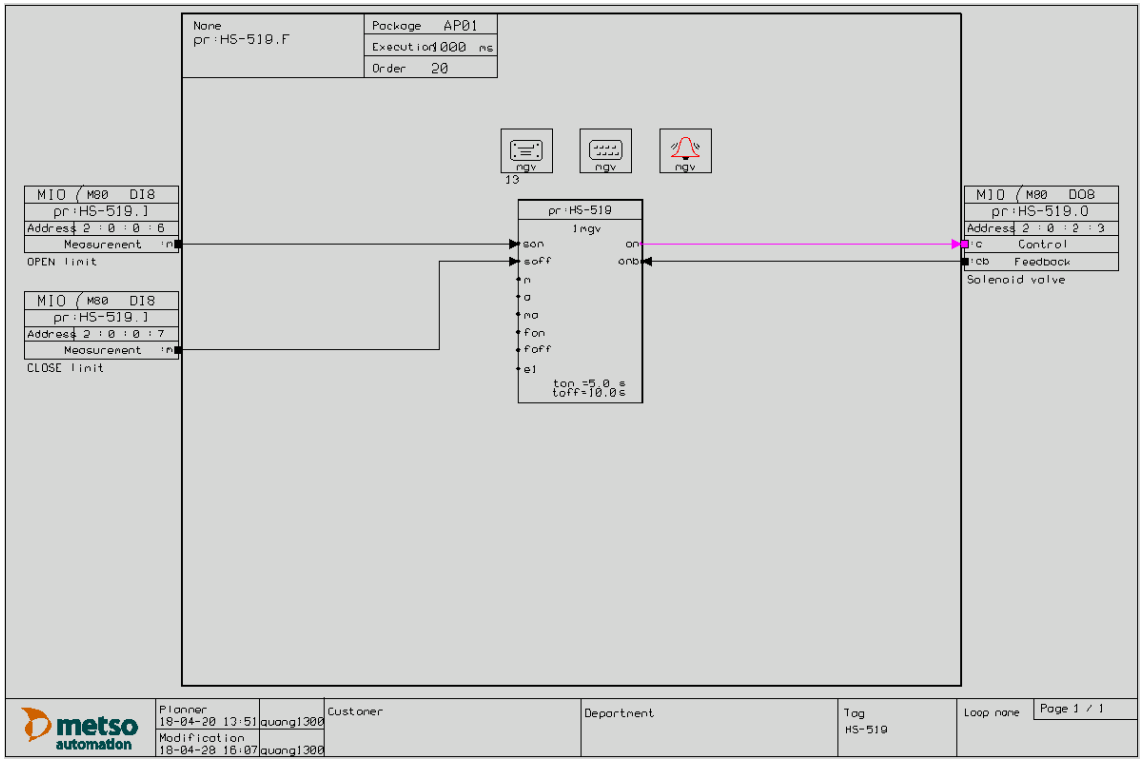


Figure 13. Hand valve control loop

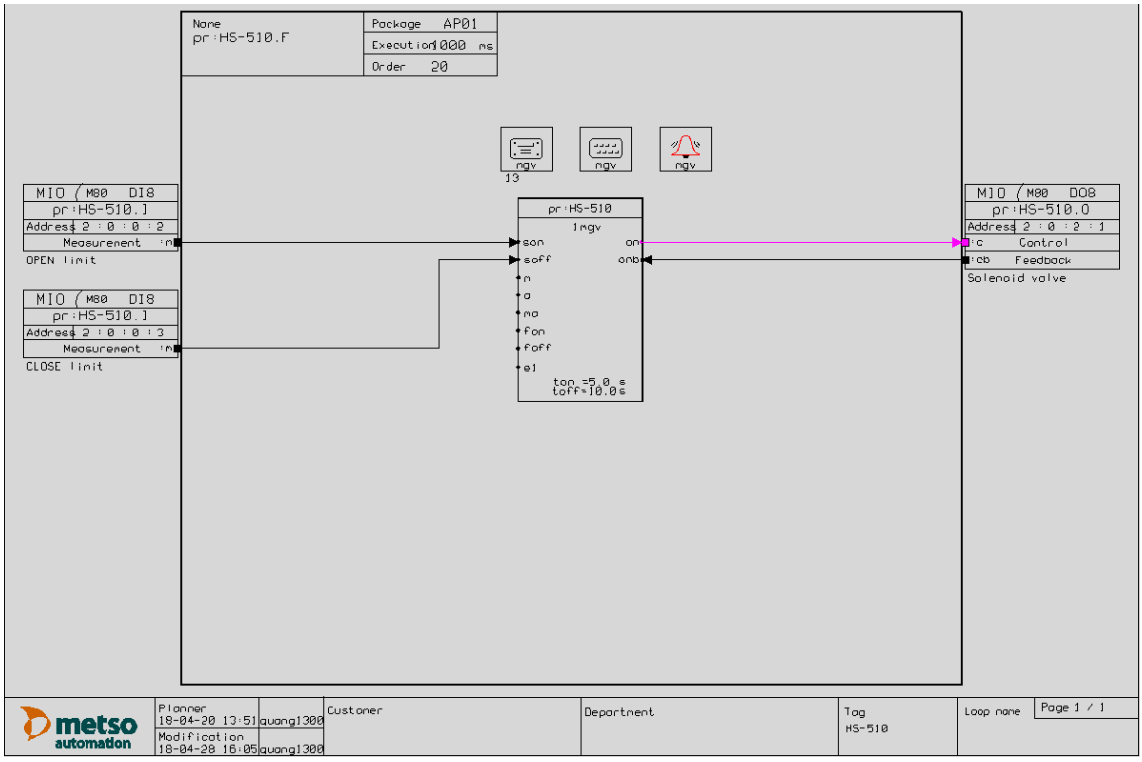


Figure 14. Hand valve control loop

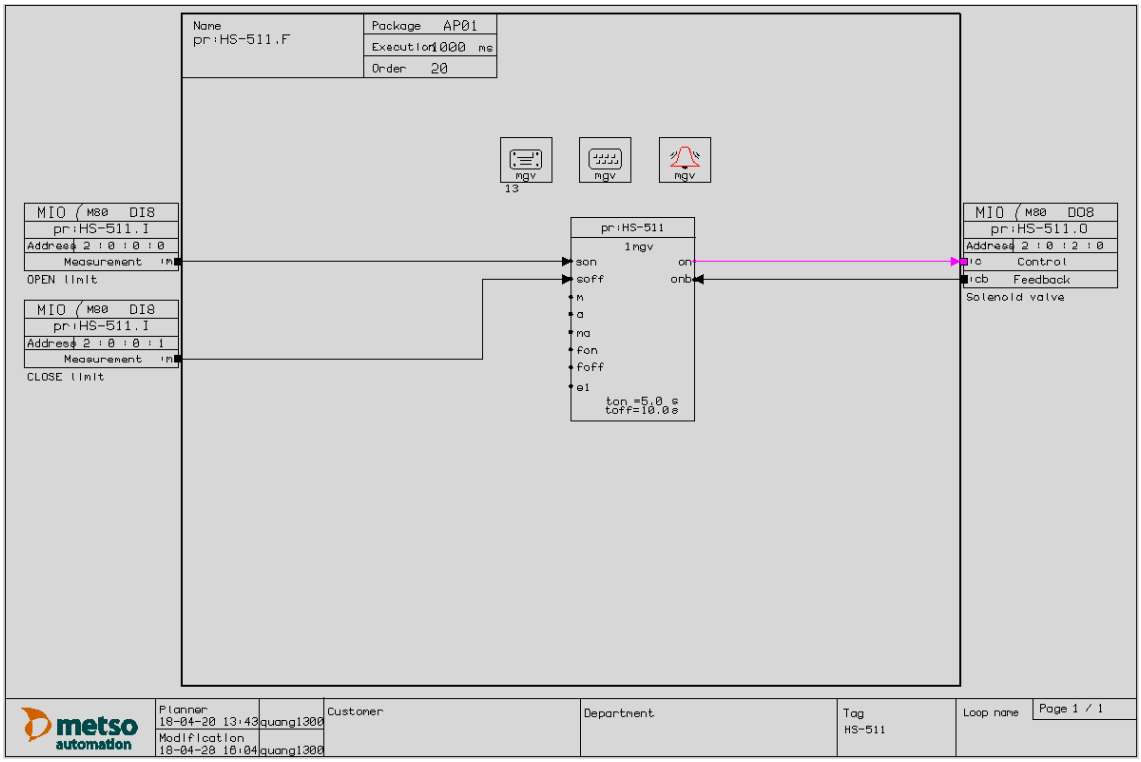


Figure 15. Hand valve control loop

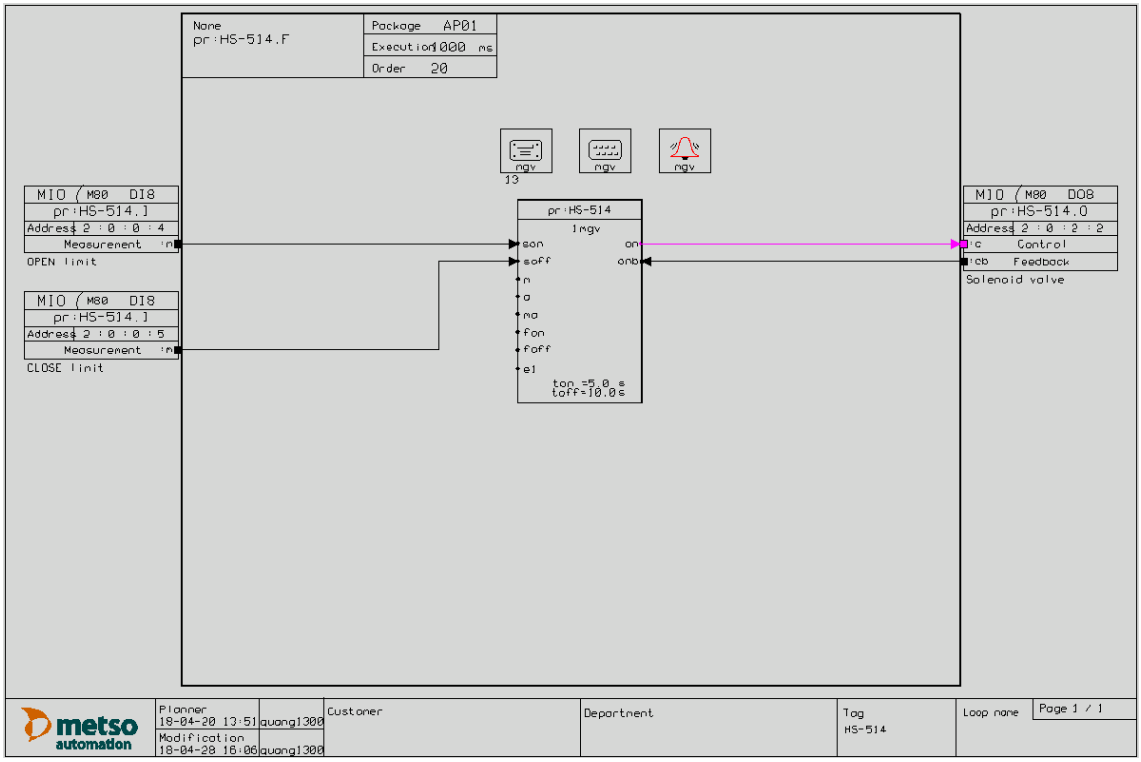


Figure 16. Hand valve control loop

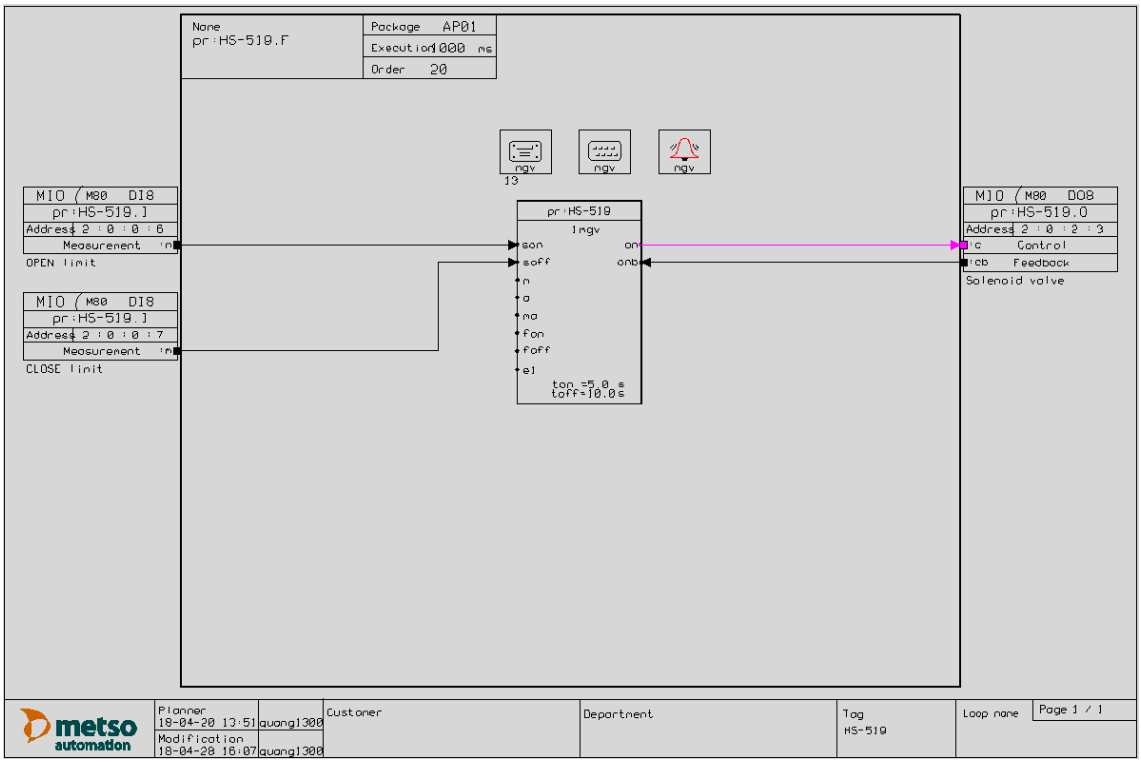


Figure 17. Hand valve control loop

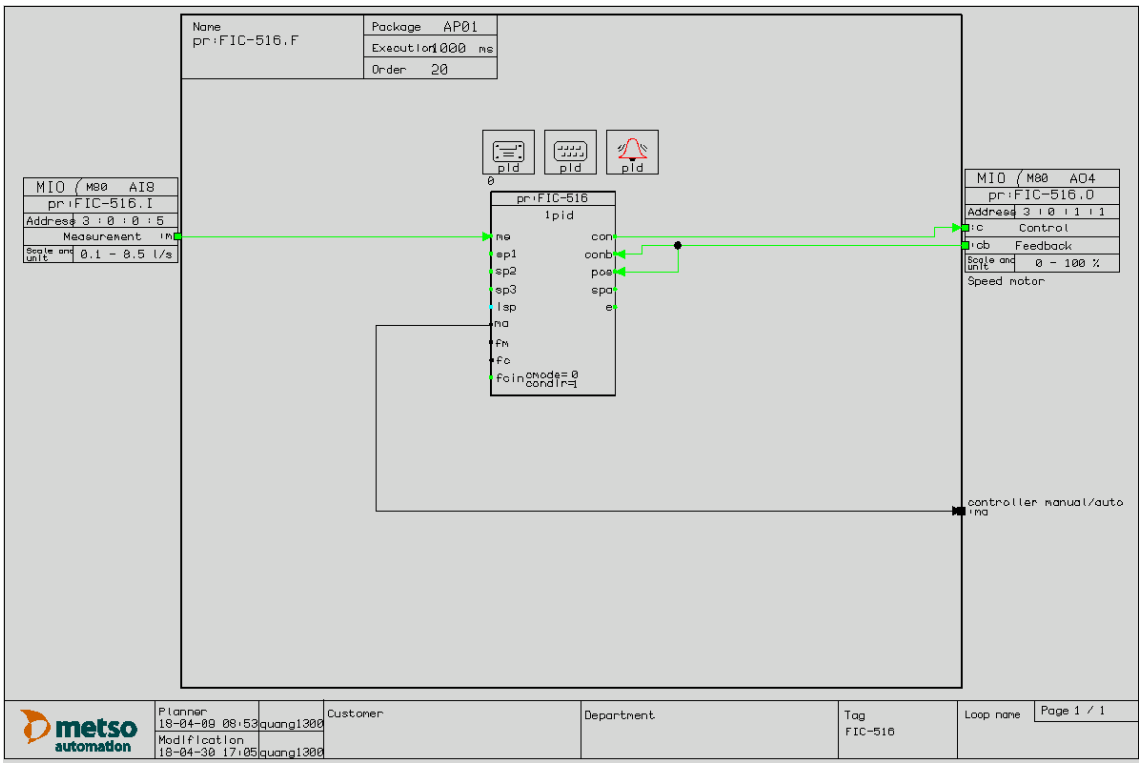


Figure 18. Flow indicating control loop

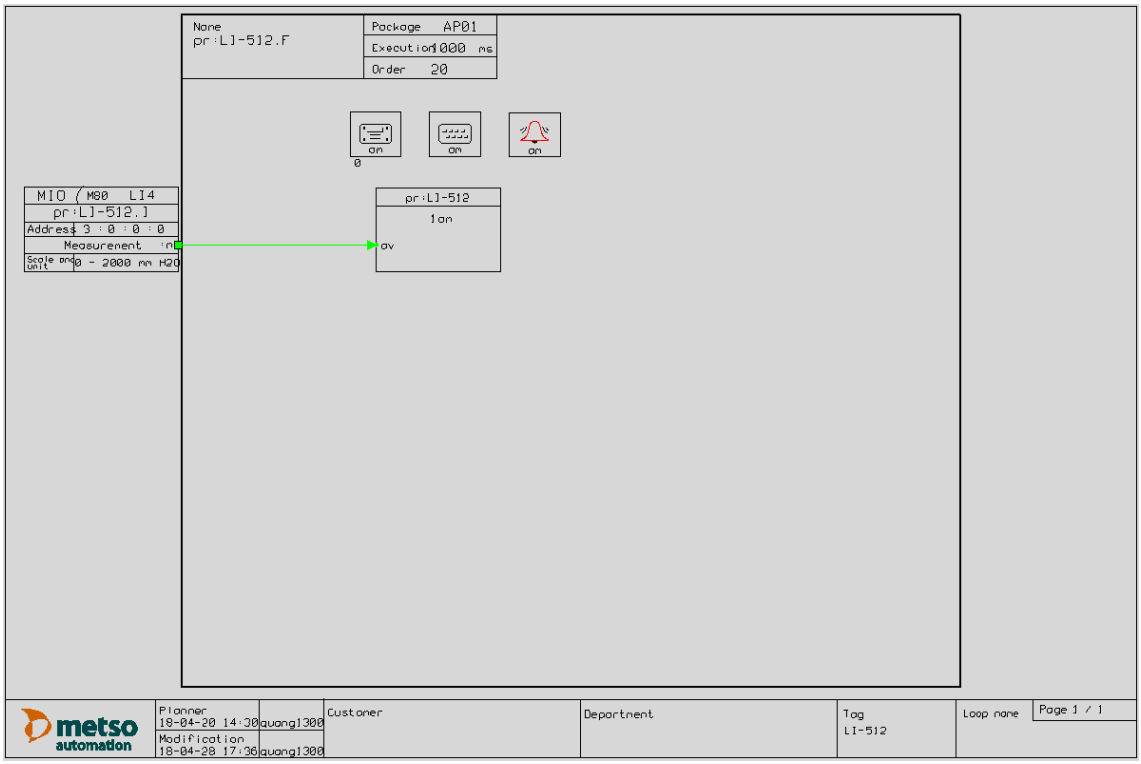


Figure 19. Level measurement in mixing tank

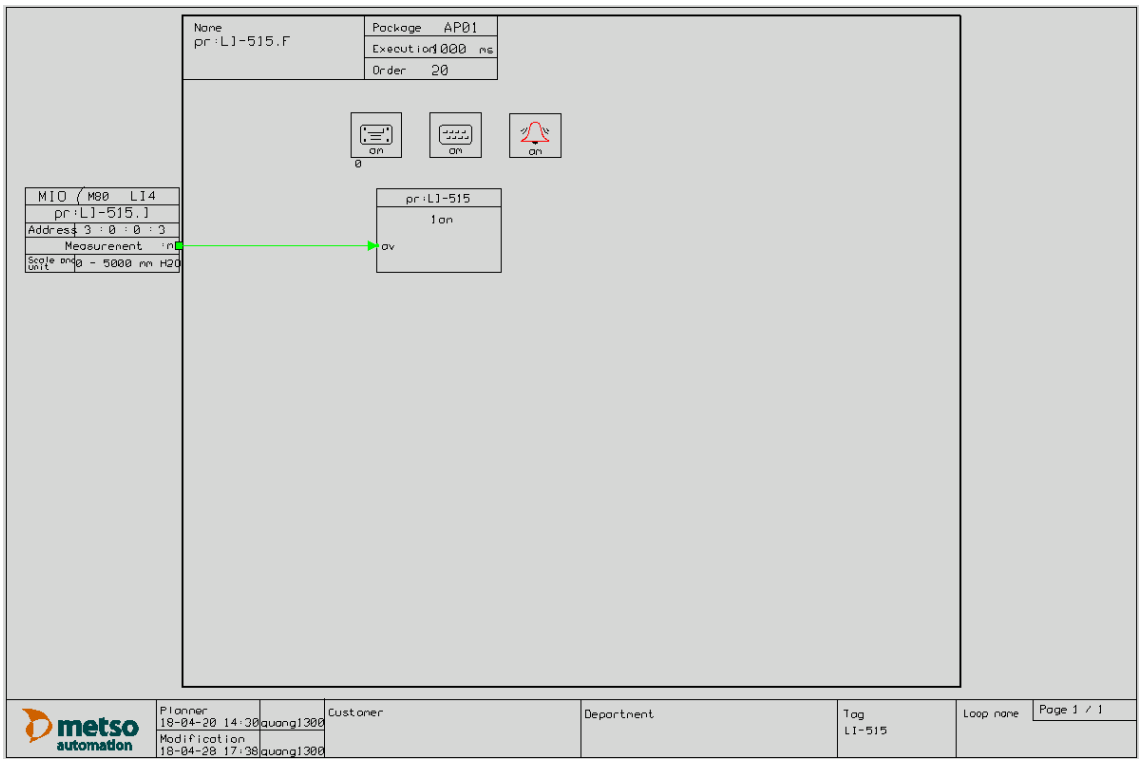


Figure 20. Level measurement in storage tank

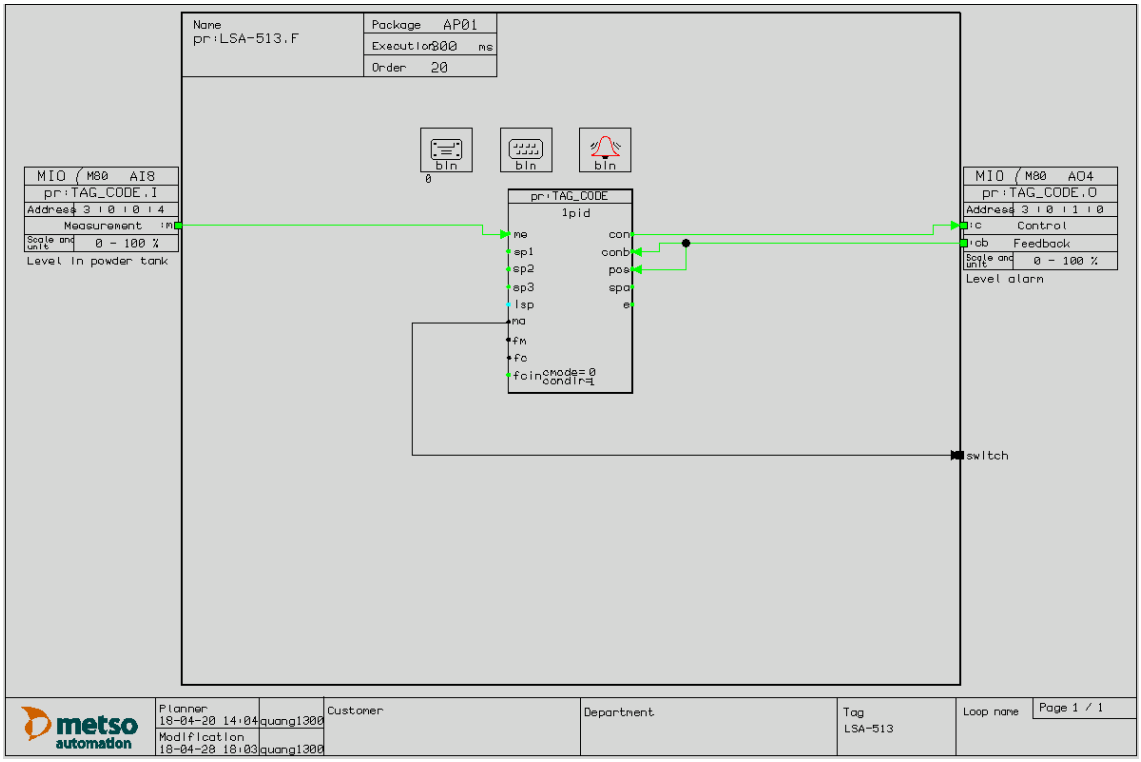


Figure 21. Level switch alarm in powder tank

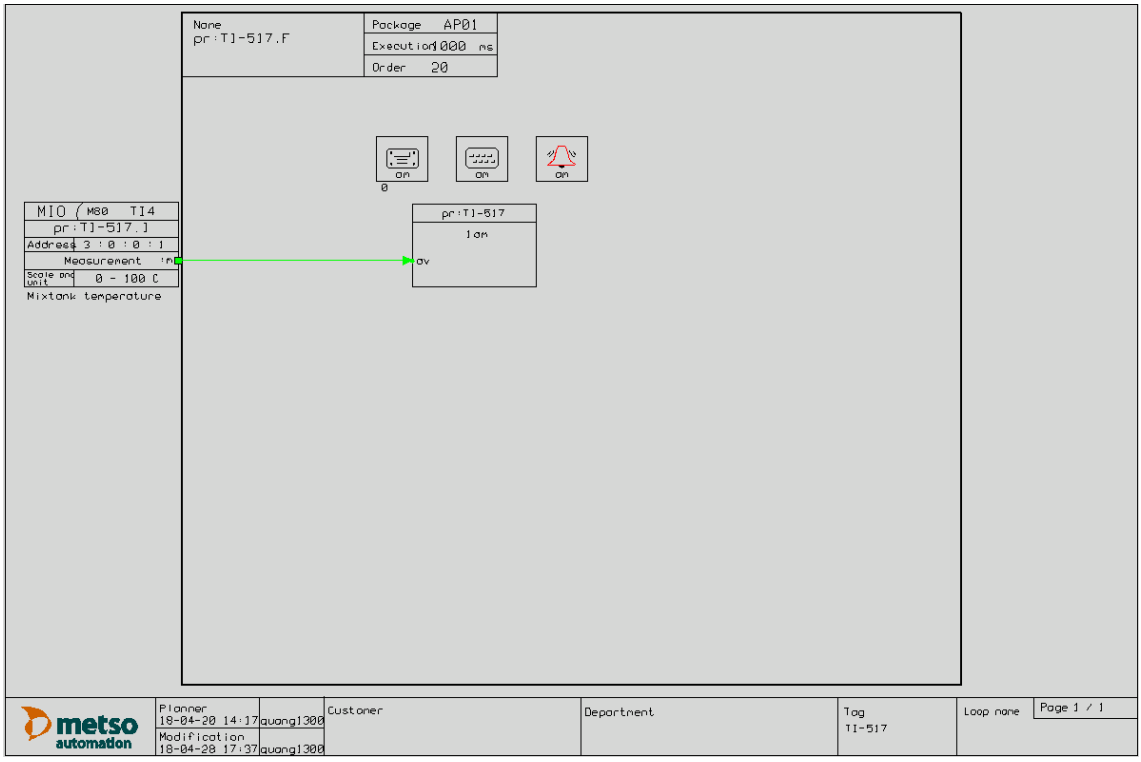


Figure 22. Temperature measurement in mixing tank

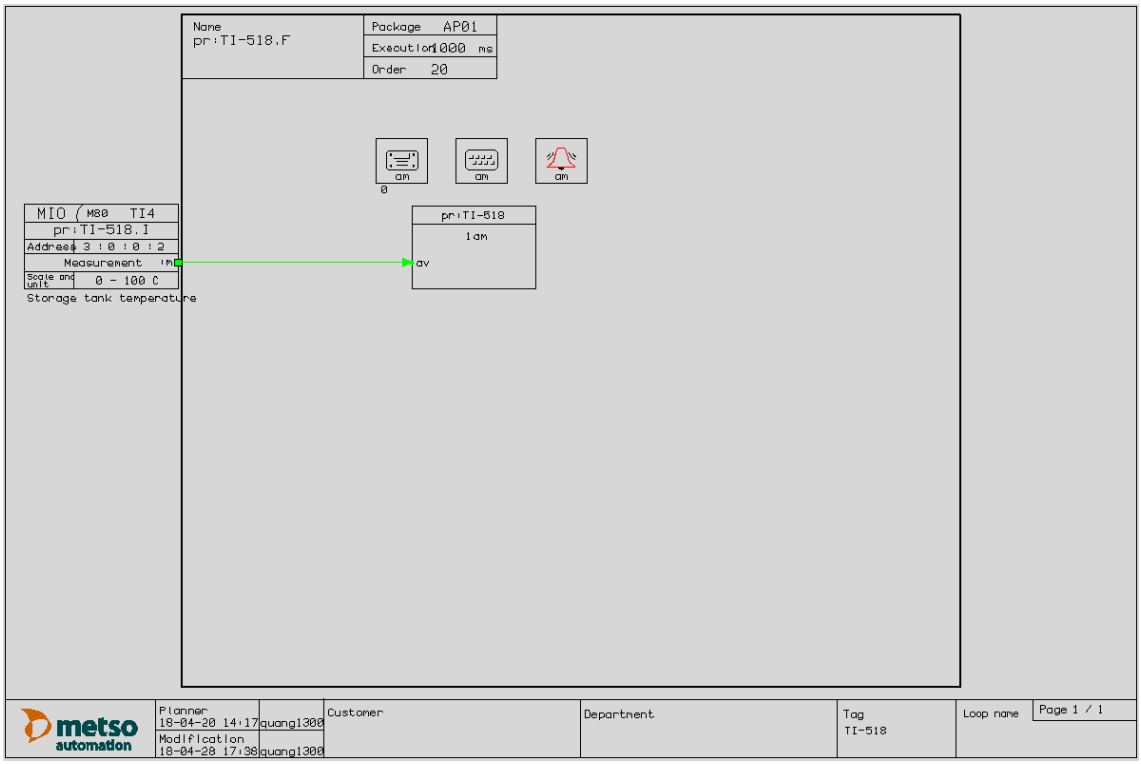


Figure 23. Temperature measurement in storage tank

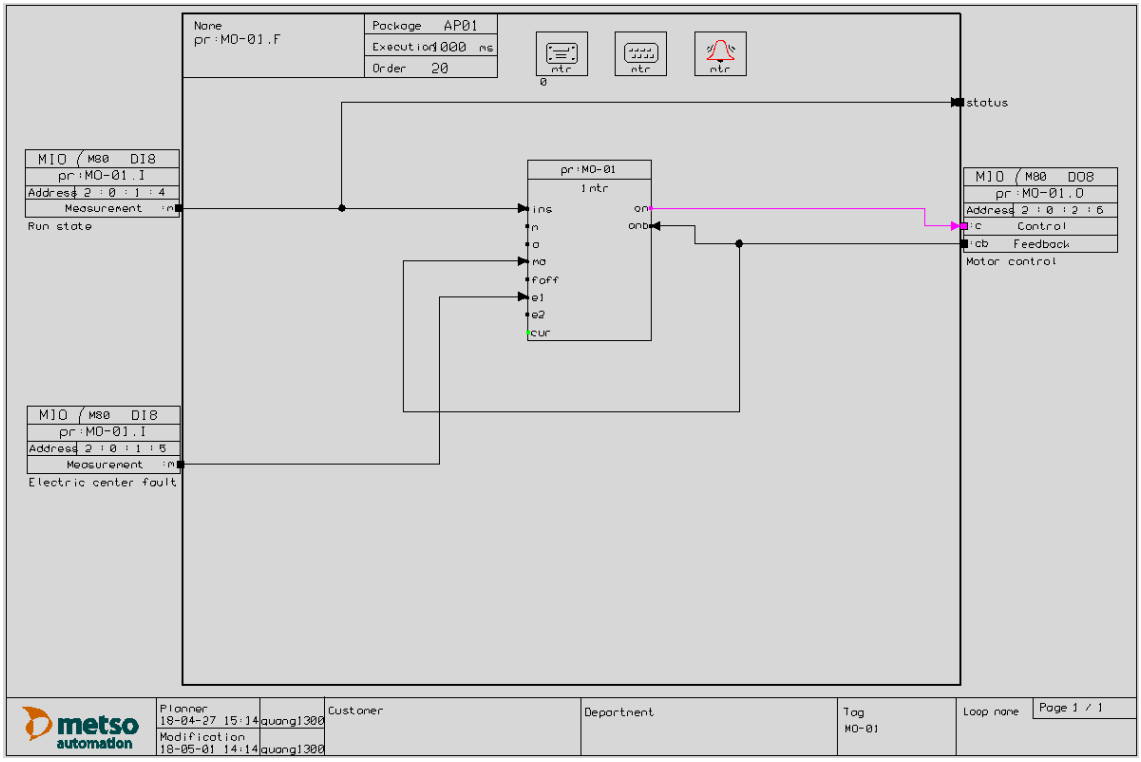


Figure 24. Powder conveyor motor loop

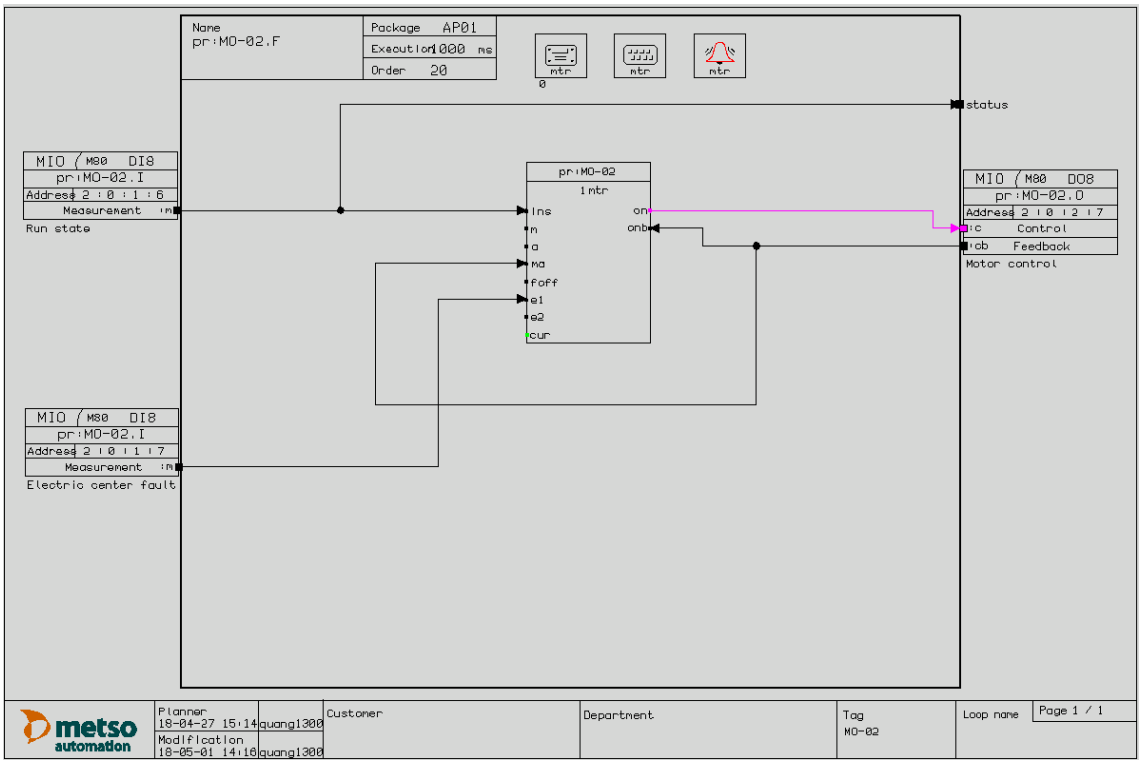


Figure 25. Mixing tank mixer motor loop

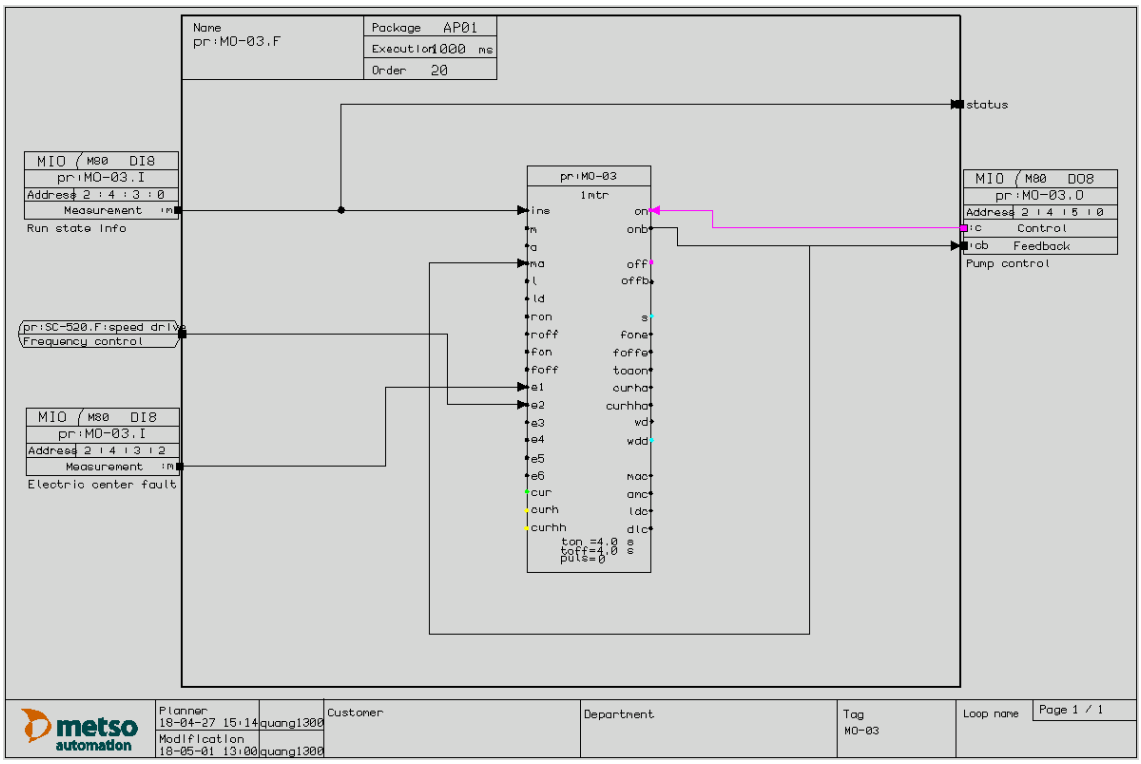


Figure 26. Storage tank feed motor loop

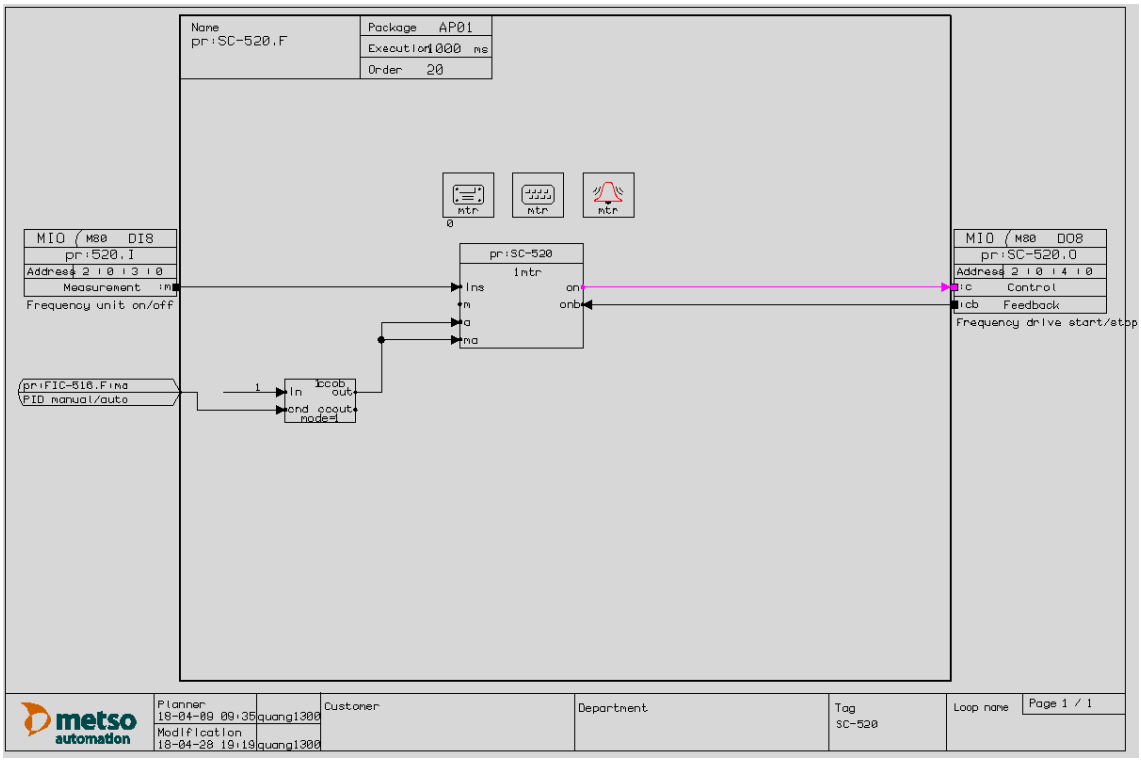


Figure 27. Speed drive loop

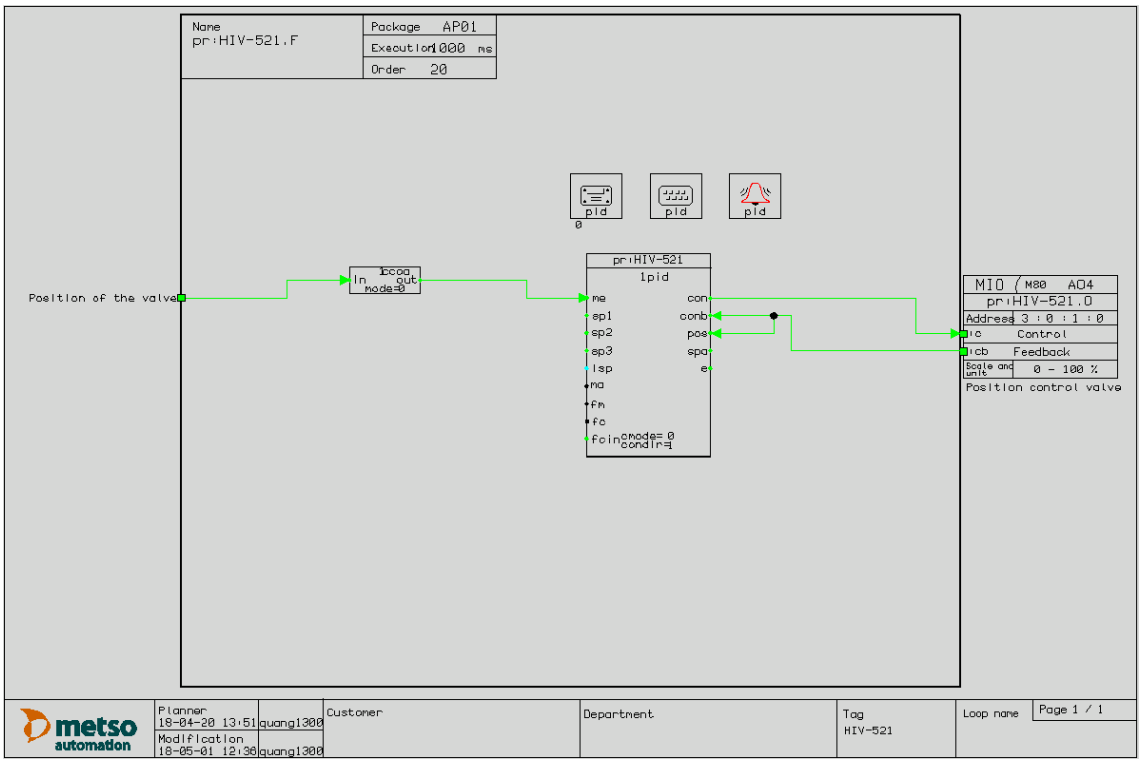


Figure 28. Control valve loop

2.11 **Cabinet layout image**

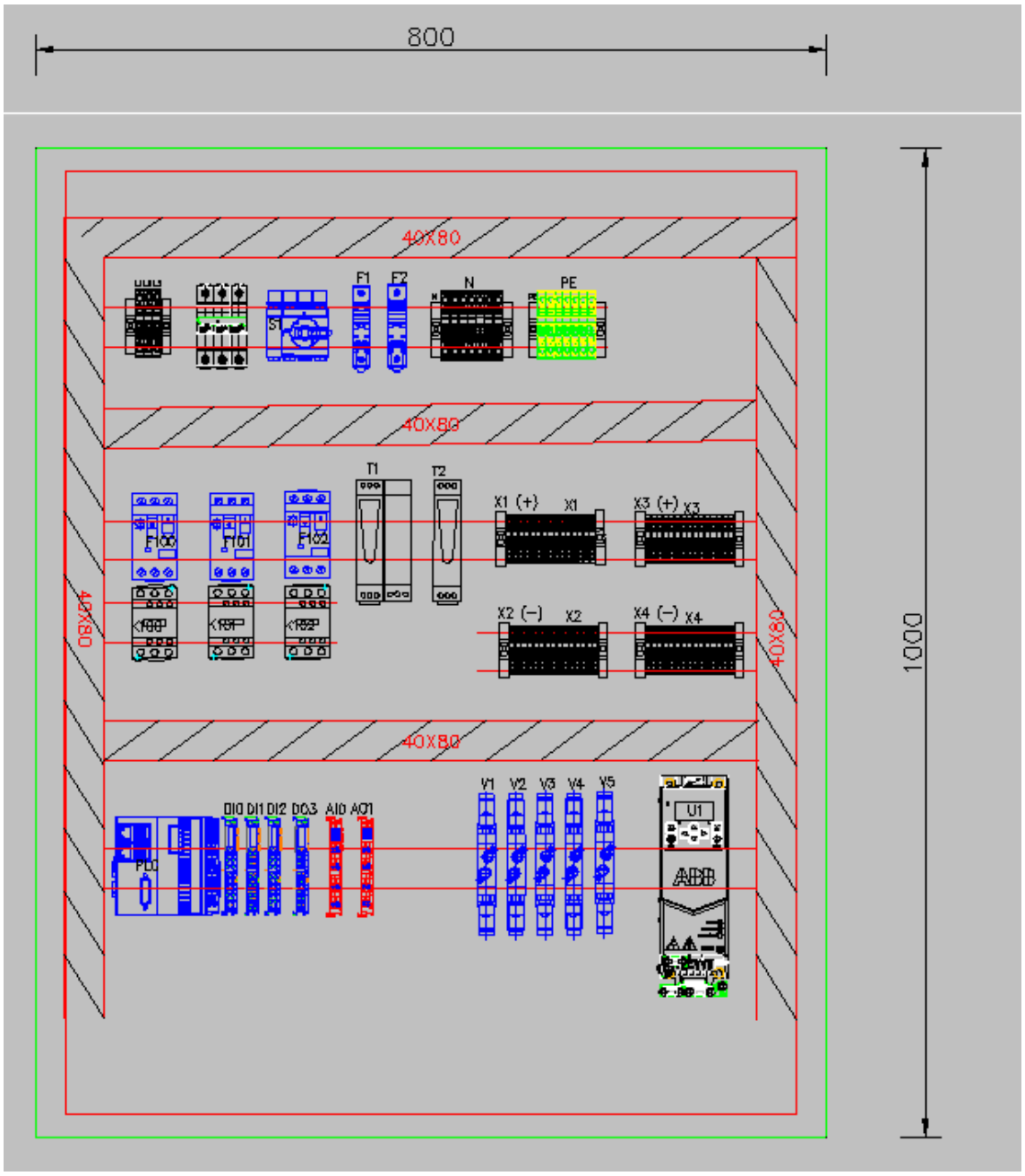
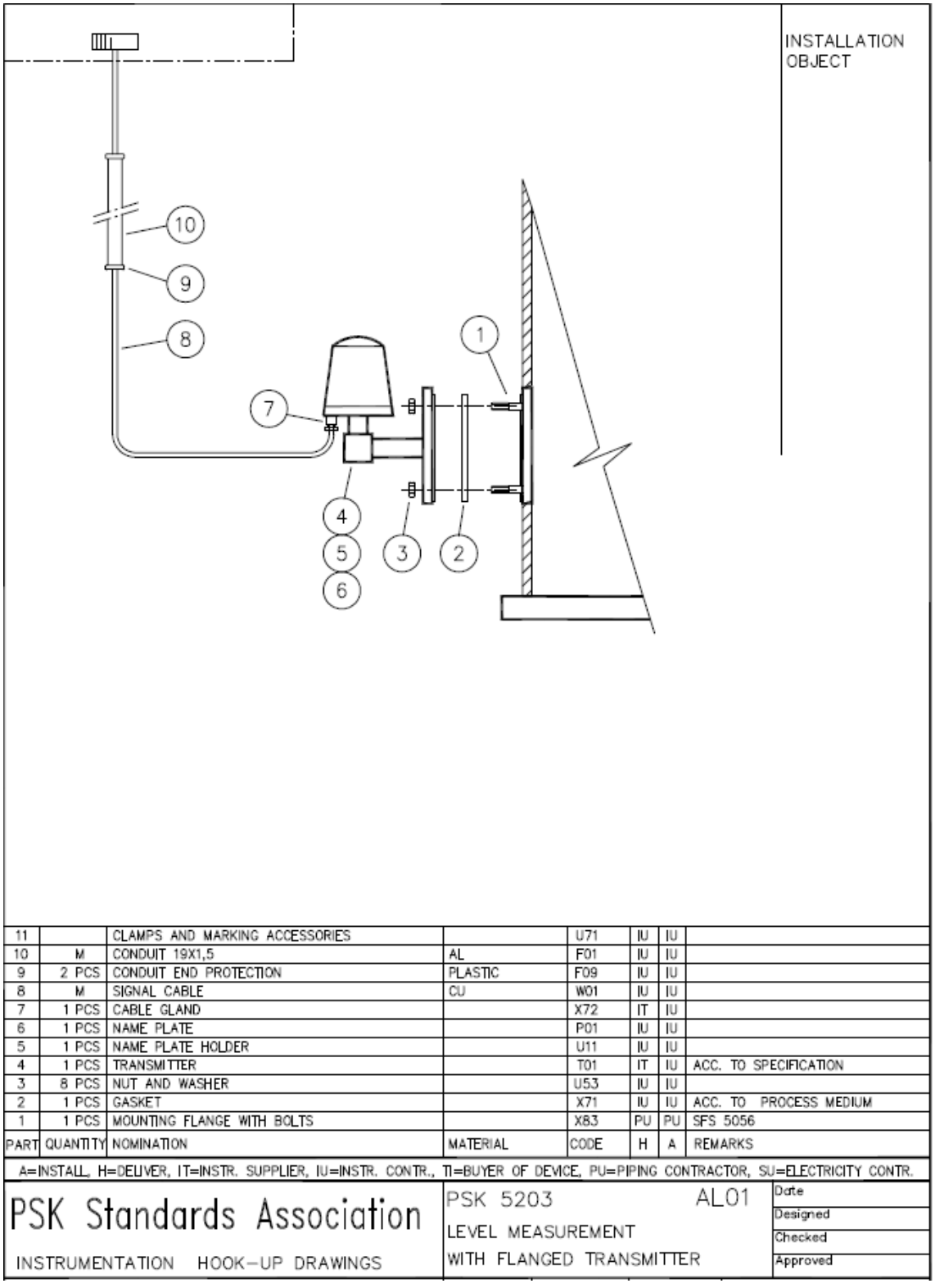


Figure 29. Cabinet layout

2.12 **Hook up drawings**



PART	QUANTITY	NOMINATION	MATERIAL	CODE	H	A	REMARKS
11		CLAMPS AND MARKING ACCESSORIES		U71	IU	IU	
10	M	CONDUIT 19X1,5	AL	F01	IU	IU	
9	2 PCS	CONDUIT END PROTECTION	PLASTIC	F09	IU	IU	
8	M	SIGNAL CABLE	CU	W01	IU	IU	
7	1 PCS	CABLE GLAND		X72	IT	IU	
6	1 PCS	NAME PLATE		P01	IU	IU	
5	1 PCS	NAME PLATE HOLDER		U11	IU	IU	
4	1 PCS	TRANSMITTER		T01	IT	IU	ACC. TO SPECIFICATION
3	8 PCS	NUT AND WASHER		U53	IU	IU	
2	1 PCS	GASKET		X71	IU	IU	ACC. TO PROCESS MEDIUM
1	1 PCS	MOUNTING FLANGE WITH BOLTS		X83	PU	PU	SFS 5056

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PSK Standards Association

INSTRUMENTATION HOOK-UP DRAWINGS

PSK 5203 AL01

LEVEL MEASUREMENT WITH FLANGED TRANSMITTER

Date
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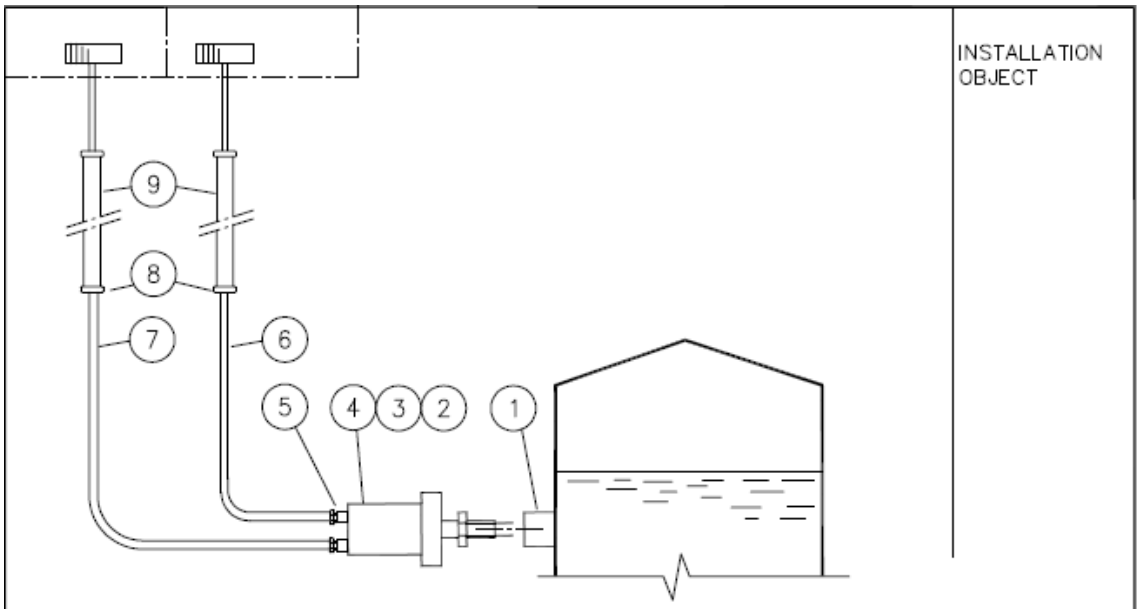
Figure 30. Level measurement with flanged transmitter



10		CLAMPS AND MARKING ACCESSORIES		U71	IU	IU	
9	M	CONDUIT 19X1,5	AL	F01	IU	IU	
8	4 PCS	CONDUIT END PROTECTION	PLASTIC	F09	IU	IU	
7	M	POWER CABLE	CU	W11	IU	IU	
6	M	SIGNAL CABLE	CU	W01	IU	IU	
5	1 PCS	CABLE GLAND		X72	IT	IU	
4	1 PCS	NAME PLATE HOLDER		U11	IU	IU	
3	1 PCS	NAME PLATE		P01	IU	IU	
2	1 PCS	LEVEL SWITCH		T04	IT	IU	
1	1 PCS	PROCESS CONNECTION		X80	PU	PU	
PART	QUANTITY	NOMINATION	MATERIAL	CODE	H	A	REMARKS

A=INSTALL, H=DELIVER, IT=INSTR. SUPPLIER, IU=INSTR. CONTR., TI=BUYER OF DEVICE, PU=PIPING CONTRACTOR, SU=ELECTRICITY CONTR.

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INSTRUMENTATION HOOK-UP DRAWINGS

PSK 5203 AL30

LEVEL MEASUREMENT,
LEVEL SWITCH

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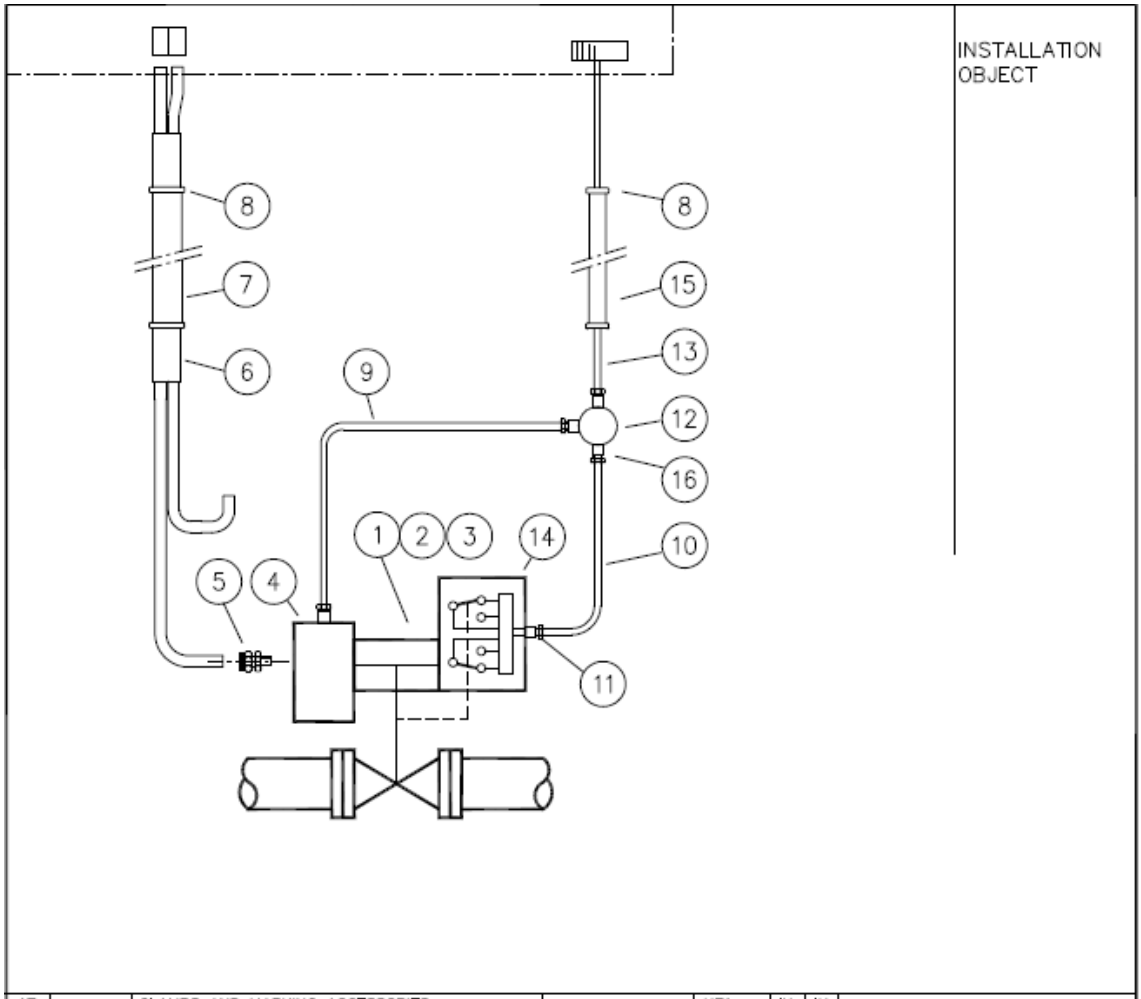
Figure 31. Level measurement, level switch



PART	QUANTITY	NOMINATION	MATERIAL	CODE	H	A	REMARKS
17		CLAMPS AND MARKING ACCESSORIES		U71	IU	IU	
16	3 PCS	CABLE GLAND		X72	IU	IU	
15	M	CONDUIT 19X1,5	AL	F01	IU	IU	
14	1 PCS	LIMIT SWITCH		S05	IT	IT	
13	M	SIGNAL CABLE	CU	W01	IU	IU	
12	1 PCS	CONNECTION BOX		F31	IU	IU	
11	2 PCS	CABLE GLAND		X72	IT	IU	
10	M	SIGNAL CABLE	CU	W01	IU	IU	
9	M	SIGNAL CABLE	CU	W01	IU	IU	
8	4 PCS	CONDUIT END PROTECTION	PLASTIC	F09	IU	IU	
7	M	CONDUIT 25X1,5	AL	F03	IU	IU	
6	M	PNEUM CABLE	PLASTIC	W21	IU	IU	
5	1 PCS	MALE CONNECTOR	SFS-EN 10088-2	X08	IU	IU	ACC. TO EQUIPMENT
4	1 PCS	SOLENOID VALVE		Q51	IT	IT	
3	1 PCS	NAME PLATE		P01	IU	IU	
2	1 PCS	NAME PLATE HOLDER		U11	IU	IU	
1	1 PCS	VALVE		Q62	IT	PU	ACC. TO SPECIFICATION

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INSTRUMENTATION HOOK-UP DRAWINGS

PSK 5207 AV10

ON-OFF VALVE WITH SOLENOID VALVE AND LIMIT SWITCH

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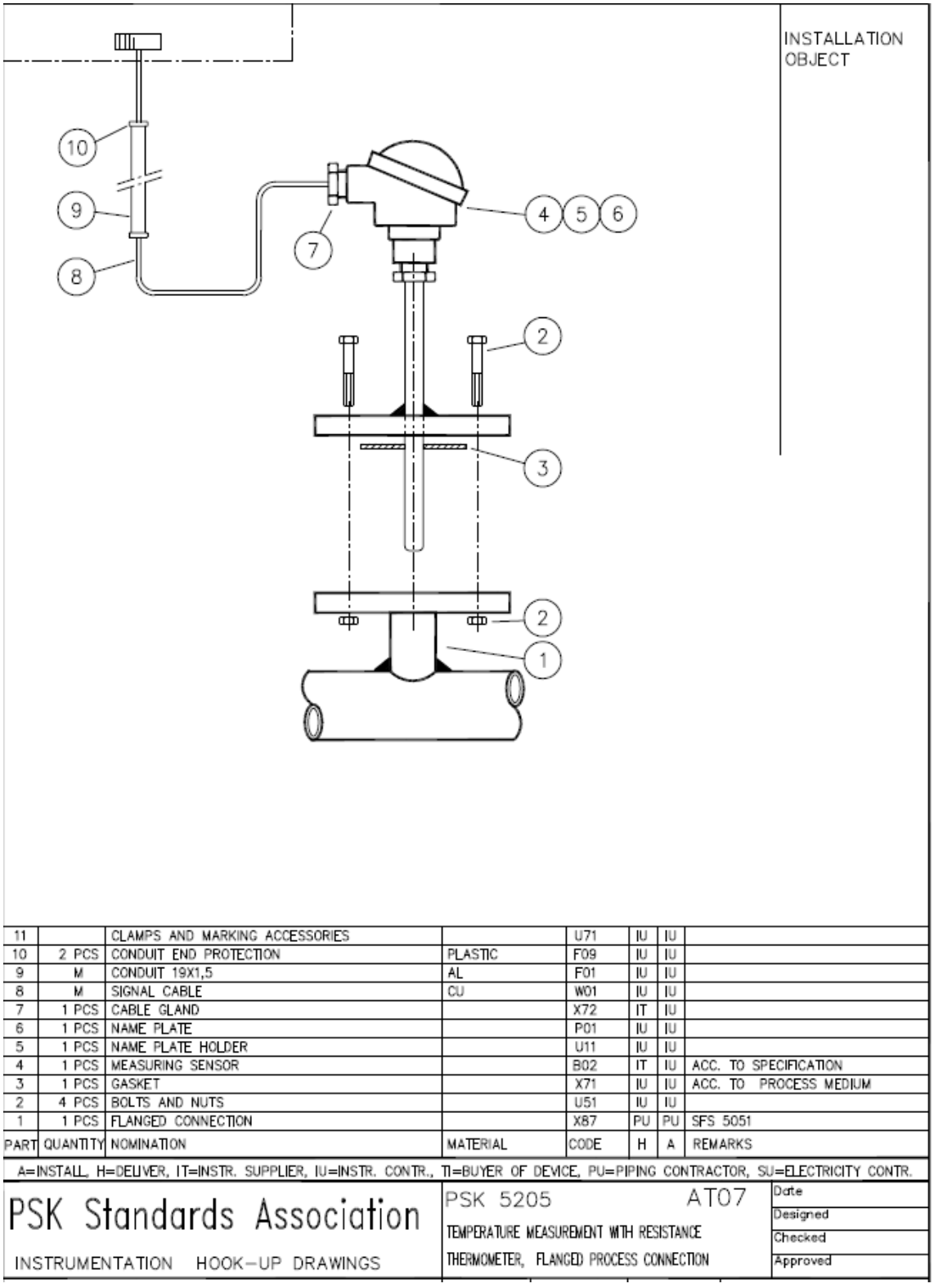
Figure 32. On/off valve with solenoid valve and limit switch



11		CLAMPS AND MARKING ACCESSORIES		U71	IU	IU	
10	2 PCS	CONDUIT END PROTECTION	PLASTIC	F09	IU	IU	
9	M	CONDUIT 19X1,5	AL	F01	IU	IU	
8	M	SIGNAL CABLE	CU	W01	IU	IU	
7	1 PCS	CABLE GLAND		X72	IT	IU	
6	1 PCS	NAME PLATE		P01	IU	IU	
5	1 PCS	NAME PLATE HOLDER		U11	IU	IU	
4	1 PCS	MEASURING SENSOR		B02	IT	IU	ACC. TO SPECIFICATION
3	1 PCS	GASKET		X71	IU	IU	ACC. TO PROCESS MEDIUM
2	4 PCS	BOLTS AND NUTS		U51	IU	IU	
1	1 PCS	FLANGED CONNECTION		X87	PU	PU	SFS 5051
PART	QUANTITY	NOMINATION	MATERIAL	CODE	H	A	REMARKS

A=INSTALL, H=DELIVER, IT=INSTR. SUPPLIER, IU=INSTR. CONTR., TI=BUYER OF DEVICE, PU=PIPING CONTRACTOR, SU=ELECTRICITY CONTR.

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INSTRUMENTATION HOOK-UP DRAWINGS

PSK 5205 AT07

TEMPERATURE MEASUREMENT WITH RESISTANCE THERMOMETER, FLANGED PROCESS CONNECTION

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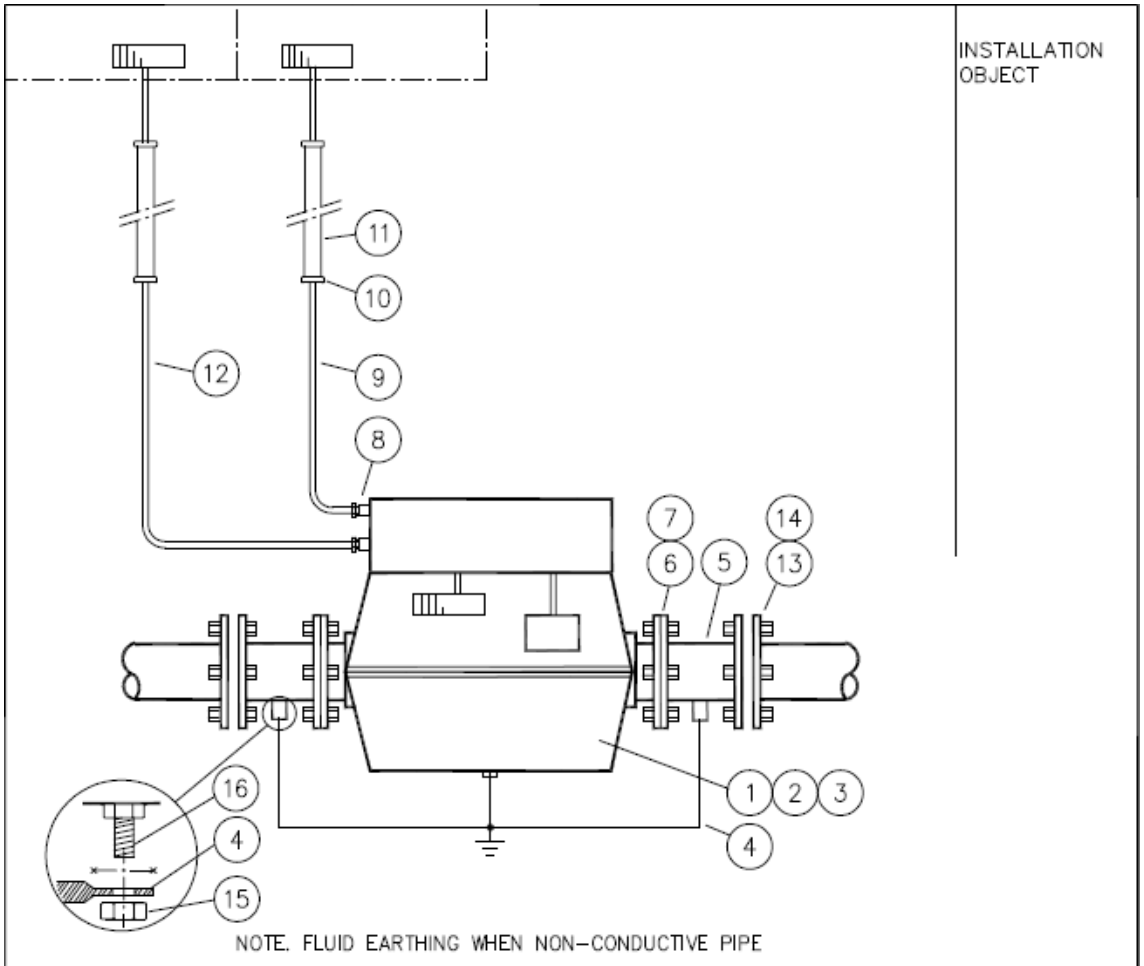
Figure 33. Temperature measurement flanged process connection



NOTE. FLUID EARTHING WHEN NON-CONDUCTIVE PIPE

PART	QUANTITY	NOMINATION	MATERIAL	CODE	H	A	REMARKS
18		PART COMBINATION (1+5) INSTALLATION		X111		PU	
17		CLAMPS AND MARKING ACCESSORIES		U71	IU	IU	
16	2 PCS	SCREW M6		U54	PU	PU	
15	2 PCS	NUT AND WASHER		U53	IT	IT	
14	2 PCS	GASKET		X71	PU	PU	ACC. TO PROCESS MEDIUM
13	PCS	BOLTS AND NUTS		U51	PU	PU	
12	M	SIGNAL CABLE	CU	W01	IU	IU	
11	M	CONDUIT 19X1,5	AL	F01	IU	IU	
10	4 PCS	CONDUIT END PROTECTION	PLASTIC	F09	IU	IU	
9	M	POWER CABLE	CU	W11	IU	IU	
8	2 PCS	CABLE GLAND		X72	IT	IU	
7	2 PCS	GASKET		X71	IU	IU	ACC. TO PROCESS MEDIUM
6	PCS	BOLTS AND NUTS		U51	IU	IU	
5	2 PCS	SPOOL PIECES FOR MAGNETIC FLOW TUPE		W81	IT	IU	
4	M	EARTHING CABLE		W45	IU	IU	
3	2 PCS	NAME PLATE		P01	IU	IU	
2	1 PCS	NAME PLATE HOLDER		U11	IU	IU	
1	1 PCS	MEASURING SENSOR		B02	IT	IU	ACC. TO SPECIFICATION

A=INSTALL, H=DELIVER, IT=INSTR. SUPPLIER, IU=INSTR. CONTR., TI=BUYER OF DEVICE, PU=PIPING CONTRACTOR, SU=ELECTRICITY CONTR.

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INSTRUMENTATION HOOK-UP DRAWINGS

PSK 5202 AF14

FLOW MEASUREMENT, MAGNETIC FLOW TUBE WITH INTEGRAL TRANSMITTER

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Figure 34. Flow measurement electro-magnetic flow transmitter

2.13 **Table of name plates**

Table 5. Hydrostatic level transmitter

Hydrostatic Level Transmitter		
Tag number	**Manufacturer**	**Spec**
LT-512	Endress+Hauser	Deltapilot FMB70
Measuring ranges		**Output**
0,1 - 10 bar		4 - 20 mA

Table 6. Hydrostatic level transmitter

Hydrostatic Level Transmitter		
Tag number	**Manufacturer**	**Spec**
LT-515	Endress+Hauser	Deltapilot FMB70
Measuring ranges		**Output**
0,1 - 10 bar		4 - 20 mA

Table 7. Temperature transmitter

Temperature Transmitter		
Tag number	**Manufacturer**	**Spec**
TT-518	Endress+Hauser	iTHERM TrustSens TM372
Measuring ranges		**Output**
0 - 6.0 bar		4 - 20 mA

Table 8. Temperature transmitter

Temperature Transmitter		
Tag number	**Manufacturer**	**Spec**
TT-518	Endress+Hauser	iTHERM TrustSens TM372
Measuring ranges		**Output**
0 - 6.0 bar		4 - 20 mA

Table 9. Flow transmitter

Flow Transmitter		
Tag number	**Manufacturer**	**Spec**
FT-516	Endress+Hauser	Promag P 200
Measuring ranges	**Pressure rating**	**Output**
0.01 to 10 m/s	100 mbar	4 - 20 mA

Table 10. Powder conveyor motor

Powder Conveyor Motor		
Tag number	**Manufacturer**	**Spec**
M-001	ABB	M3AA 112MB 4
Operating voltage	**AMPS**	**R.P.M**
400V	8.6	1451
Power		
4 kW		

Table 11. Mixing tank mixer motor

MIXING TANK MIXER MOTOR		
Tag number	**Manufacturer**	**Spec**
M-002	ABB	M3AA 80ME 4
Operating voltage	**AMPS**	**R.P.M**
400V	1.9	1437
Power		
0.75 kW		

Table 12. Storage tank feed motor

STORAGE TANK FEED MOTOR		
Tag number	**Manufacturer**	**Spec**
M-003	ABB	M3AA 100LC 4
Operating voltage	**AMPS**	**R.P.M**
400V	4.6	1455
Power		
2.2 kW		

Table 13. Hand valve

HAND VALVE		
Tag position	**Manufacturer**	**Type**
HV-510	AVS	K60D-25-DA52
Operating ranges	**Size**	
0 - 40 bar	25 DN	

Table 14. Hand valve

HAND VALVE		
Tag position	**Manufacturer**	**Type**
HV-511	AVS	K60D-15-DA32
Operating ranges	**Size**	
0 - 40 bar	15 DN	

Table 15. Hand valve

HAND VALVE		
Tag position	**Manufacturer**	**Type**
HV-514	AVS	K60D-50-DA75
Operating ranges	**Size**	
0 - 40 bar	50 DN	

Table 16. Hand valve

HAND VALVE		
Tag position	**Manufacturer**	**Type**
HV-519	AVS	K60D-32-DA63
Operating ranges	**Size**	
0 - 40 bar	32 DN	

Table 17. Control valve

CONTROL VALVE		
Tag position	**Manufacturer**	**Type**
HV-521	Metso's Neles	Axiom AX
Operating ranges	**Size**	
2.7 - 7.5 bar	25 DN	

Table 18. Level switch

LEVEL SWITCH		
Tag number	**Manufacturer**	**Spec**
LS-513	Endress+Hauser	Liquipoint FTW23
Measuring ranges		**Output**
0 - 16 bar		4 - 20 mA

2.14 **Cable list**

Table 19. Cable list

NUMBER	TYPE	FROM	TO
JB1 W1	ÖLFLEX CLASSIC 100 CY 5G6	=100+JB1	
PC1	MCMK 3x4/4	=100+JB1-X0	=100+JB1-Q01
PC10	MCMK 3x4/4	=100+JB1-<SUPPLY>	=100+JB1-F100
PC11	MCMK 3x4/4	=100+JB1-F100	=100+JB1-K100
PC12	MCMK 3x4/4	=100+JB1-K100	=100+JB1-X100
PC13	MCMK 3x4/4	=100+JB1-X100	=100+JB1-Q100
PC14	MCMK 3x4/4	=100+JB1-Q100	=100-M001
PC15	ESUY 16	=100+JB1-<SUPPLY>	=100-M001
PC16	MCMK 3x1.5/1.5 R100	=100+JB1-<SUPPLY>	=100+JB1-F101
PC17	MCMK 3x1.5/1.5 R100	=100+JB1-F101	=100+JB1-K101
PC18	MCMK 3x1.5/1.5 R100	=100+JB1-K101	=100+JB1-X101
PC19	MCMK 3x1.5/1.5 R100	=100+JB1-X101	=100+JB1-Q101
PC2	MCMK 3x4/4	=100+JB1-S1	=100+JB1-Q01
PC20	ESUY 16	=100+JB1-<SUPPLY>	=100-M002
PC21	MCMK 3x1.5/1.5 R100	=100+JB1-<SUPPLY>	=100+JB1-F102
PC22	MCMK 3x1.5/1.5 R100	=100+JB1-F102	=100+JB1-K102
PC23	MCMK 3x1.5/1.5 R100	=100+JB1-K102	=100+JB1-U1
PC24	ESUY 16	=100+JB1-<SUPPLY>	=100+JB1-U1
PC25	MCMK 3x1.5/1.5 R100	=100+JB1-U1	=100+JB1-Q102
PC26	MCMK 3x1.5/1.5 R100	=100+JB1-Q102	=100-M003
PC27	ESUY 16	=100+JB1-<SUPPLY>	=100-M003
PC28	NOMAK-E 8x2x0.5+0.5	=100+JB1-DO3	
PC29	NOMAK-E 4x2x0.5+0.5	=100+JB1-DO3	=100+JB1-V2
PC3	MCMK 3x4/4	=100+JB1-<SUPPLY>	=100+JB1-Q01
PC30	NOMAK-E 8x2x0.5+0.5	=100+JB1-DO3	=100+JB1-V3
PC31	NOMAK-E 4x2x0.5+0.5	=100+JB1-DO3	=100+JB1-V4
PC32	NOMAK-E 8x2x0.5+0.5	=100+JB1-DO3	=100+JB1-V5
PC33	NOMAK-E 8x2x0.5+0.5	=100+JB1-DO3	=100-M001
PC34	NOMAK-E 8x2x0.5+0.5	=100+JB1-DO3	=100-M001
PC35	NOMAK-E 8x2x0.5+0.5		=100+JB1-DI1
PC36	NOMAK-E 2x2x0.5+0.5		=100+JB1-PLC
PC37	ESUY 16	=100+JB1-<SUPPLY>	=100+JB1-PLC
PC38	JAMAK-C 8x(2+1)x0.5		=100+JB1-AI0
PC39	NOMAK-E 12x2x0.5+0.5		
PC4	MCMK 1x1.5+1.5	=100+JB1-<SUPPLY>	=100+JB1-F1
PC40	JAMAK-C 2x(2+1)x0.5	=100-LSA-513	=100+JB1-DI2
PC41	JAMAK-C 2x(2+1)x0.5		=100+JB1-U1
PC42	JAMAK-C 4x(2+1)x0.5		=100-HIV-521
PC43	MCMK 2x1.5/1.5	=100+JB1-X0	=100+JB1-<SUPPLY>
PC44	NOMAK-E 2x2x0.5+0.5	=100+JB1-T1	
PC45	NOMAK-E 2x2x0.5+0.5	=100+JB1-T2	
PC5	MCMK 2x1.5/1.5	=100+JB1-<SUPPLY>	=100+JB1-T1
PC6	MCMK 1x1.5+1.5	=100+JB1-F1	=100+JB1-T1
PC7	MCMK 1x1.5+1.5	=100+JB1-<SUPPLY>	=100+JB1-F2
PC8	MCMK 1x1.5+1.5	=100+JB1-F2	=100+JB1-T2
PC9	MCMK 2x1.5/1.5	=100+JB1-<SUPPLY>	=100+JB1-T2

3 CONCLUSION

In conclusion, the project work prepares students skills and knowledges for doing a plant in real world. From understanding the requirement of the plant to searching for suitable instruments and devices makes students to know more intimately and how the process works. With all documentations from hardware selection to software programming, the project is like an assignment for an engineering in professional environment.

Appendix 1

APPENDIX HEADING