



Seat No.

King Mongkut's University of Technology Thonburi

Midterm examination, 1st Semester, Academic year 2018

Department of Control Systems and Instrumentation Engineering

INC 363 Industrial network and software

Automation Engineering

Date: Monday 8th, October 2018

Time: 13:00-16:00

Instructions:

1. There are 2 parts of examquestions in **18** pages.

Part 1: Industrial Automation	4 questions	30 points
Part 2: Industrial Network	6 questions	30 points
2. A P&ID (A3 size) is provided.
3. **Permitted:** 1 engineering calculator
4. **NOT Permitted:** Textbooks, or notes of any kind
5. Write all your answers in the **examination sheet**.

Students are not allowed to take examination scripts, answer booklets or any materials out of the examination room. Violation of the rule shall result in penalty of student receiving a zero in that examination.

Students who are caught cheating in the examination shall be penalized by receiving Fail grade (F) in that subject and is forced to withdraw (W) from all remaining subjects in the semester. The maximum penalty may include expulsion.

Diew Koolpiruck

(Asst.Prof.Dr. DiewKoolpiruck)

Examiner (02-470-9096)

This exam has been approved by department of Control system and instrumentation engineering.

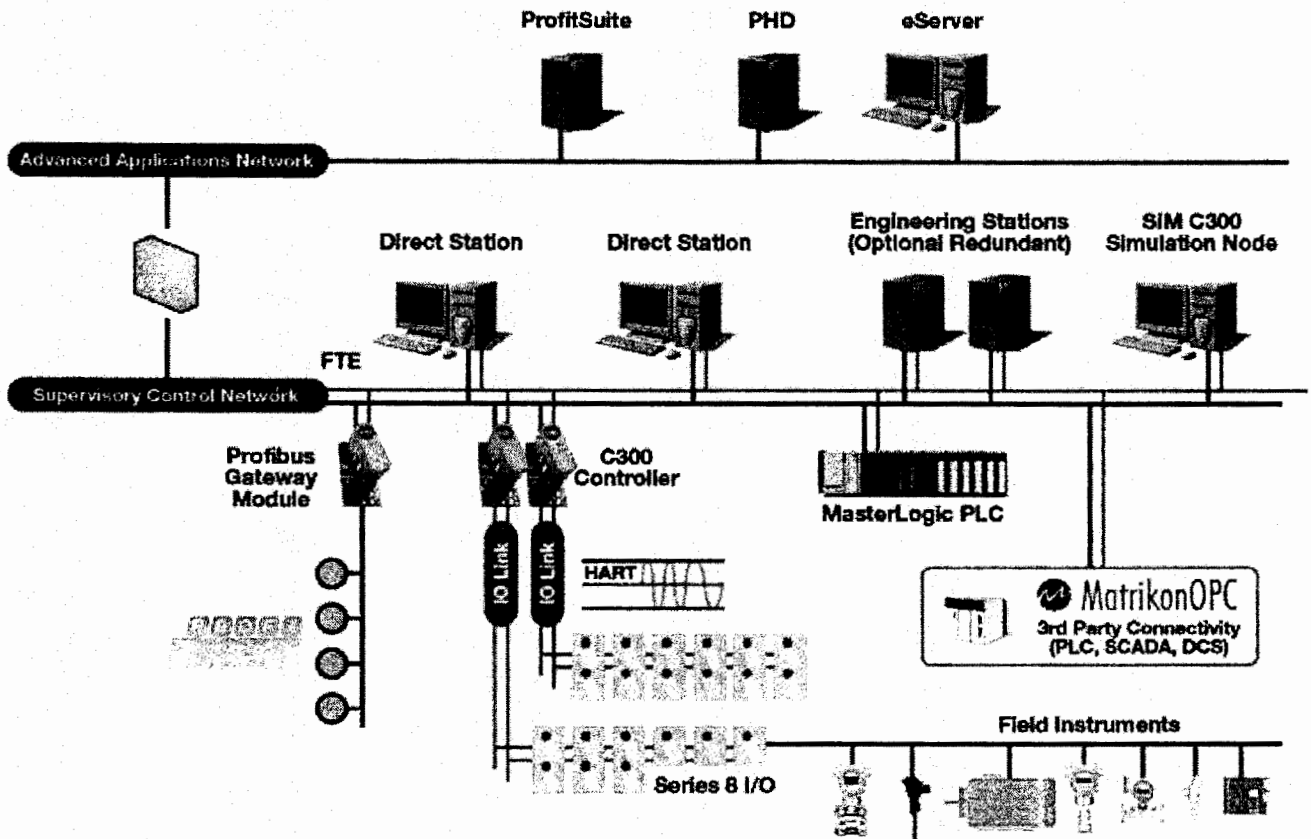
Sudchai Boonto

(Asst.Prof.Dr.Ing. SudchaiBoonto)

Head of department

Part 1: Industrial Automation System (30 points)

1) Answer the below questions:



Source <http://www.honeywell.com>

Figure 1.1 System architecture of automation

1.1 From a figure 1.1, identify major components of automation system on the diagram and explain their functions. (5 points)

Name - Surname:

Student Id:

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1.2 Analyze the block diagram and explain the control technique that given based on DCS programming below

(5 points)

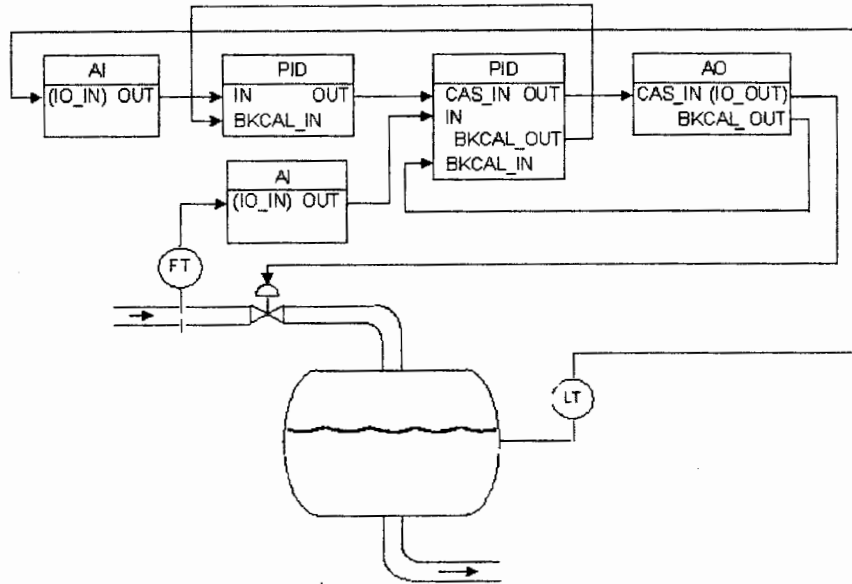


Figure 1.2 DCS programming and device interface

Manipulate variable = _____

Primary Process variable = _____

Secondary Process variable = _____

Disturbance = _____

Block Diagram

2. From a given P&ID representing the connection of field instruments and controllers, draw ILD (Instrumentation Loop Diagram) to complete wiring diagrams. (5 points)

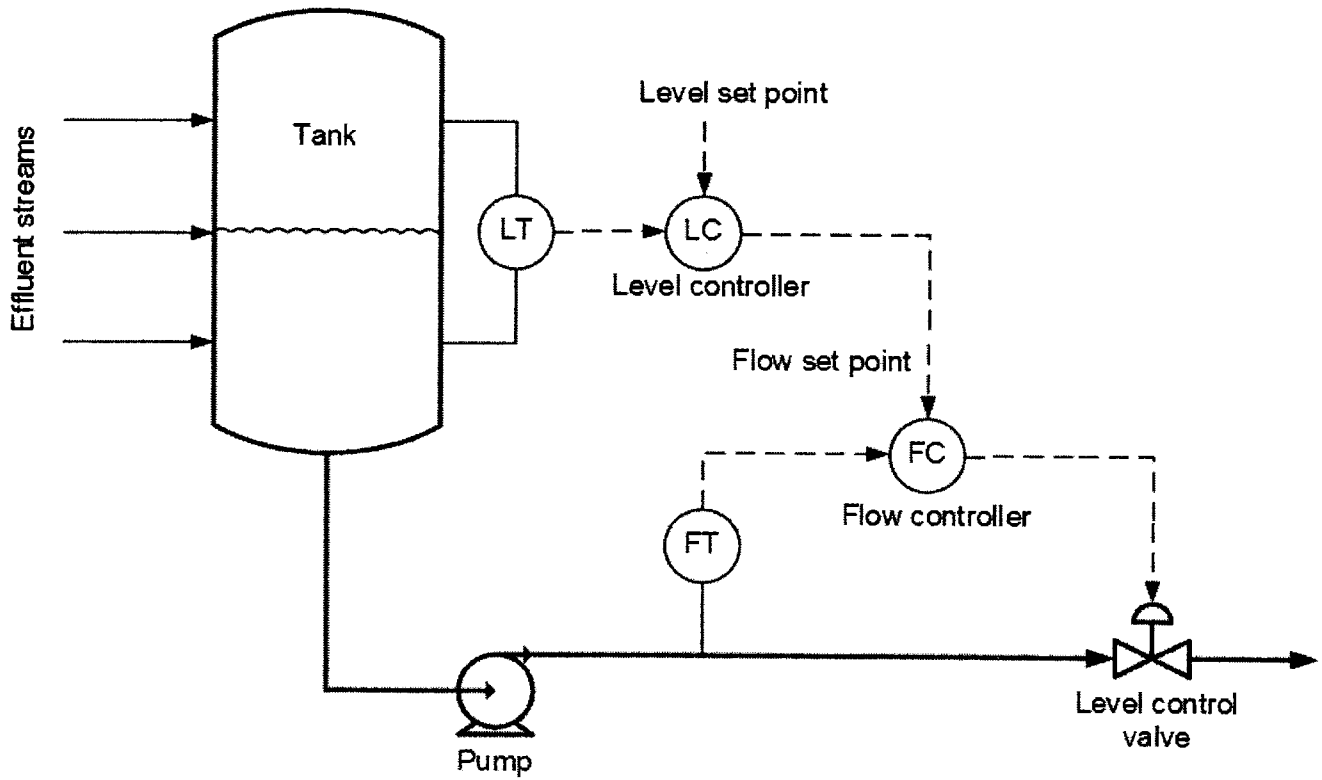
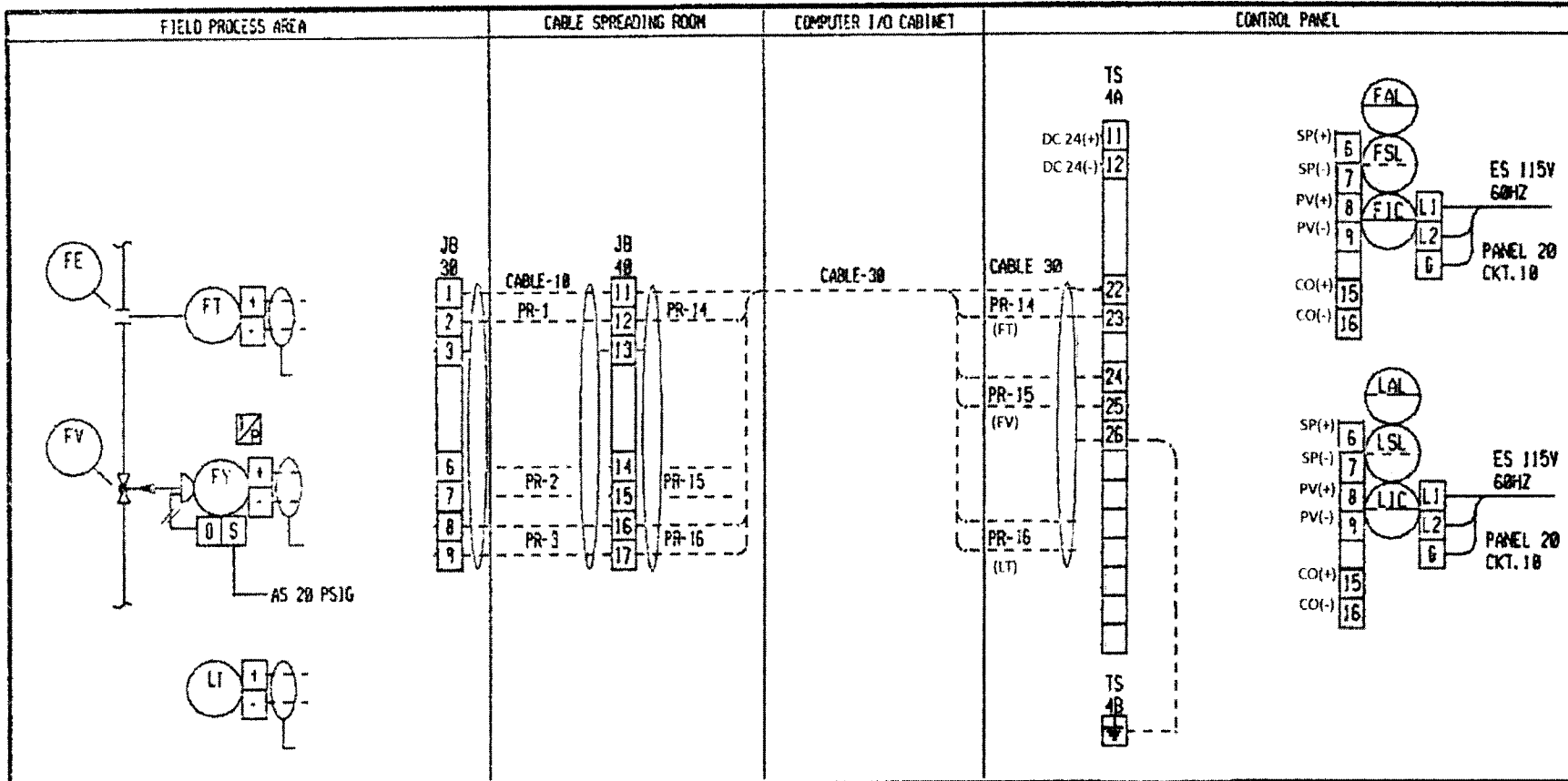


Figure 2 P&ID of Cascade control



No.	Date	Revisions	By	Apr
LOOP DIAGRAM				
JOB No.	DRAWING No.	REV.		

3. From the previous question (No. 2), if an engineer changes the wiring technology by FF-H1 and replaces controllers by DCS. Draw a new ILD(Instrumentation Loop Diagram) to complete wiring diagrams. (5 points)

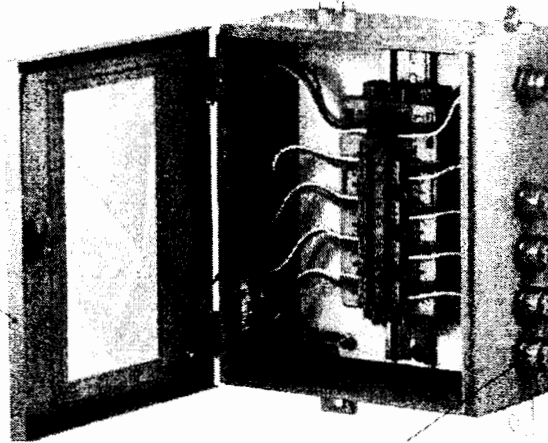
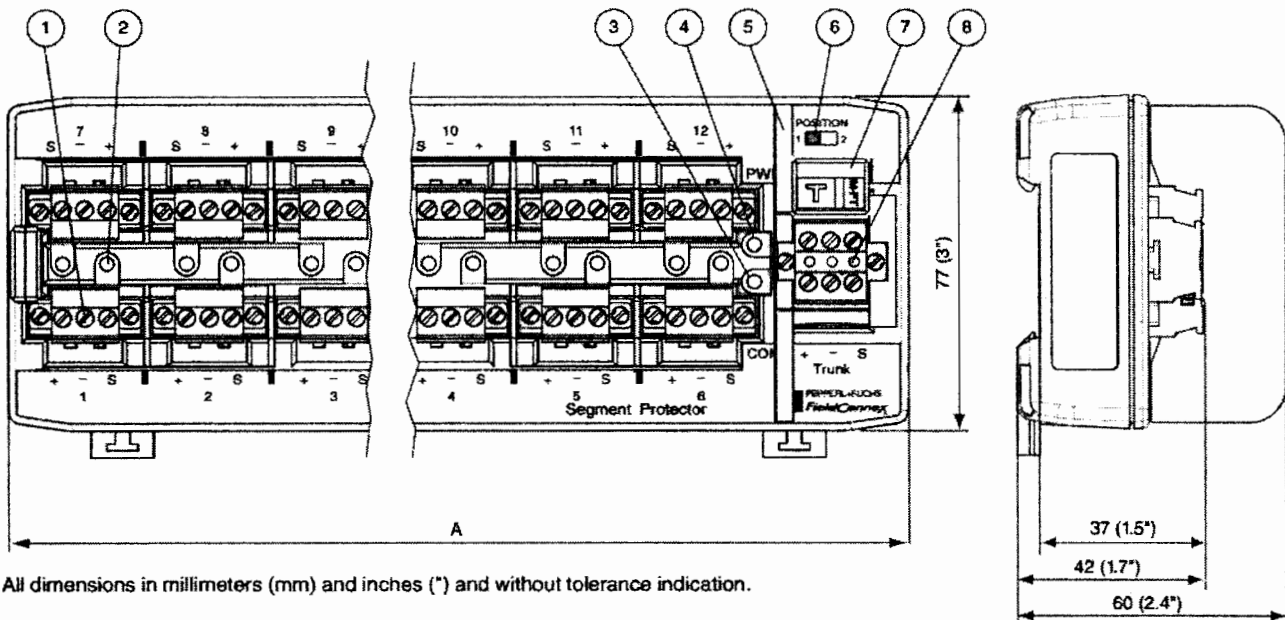
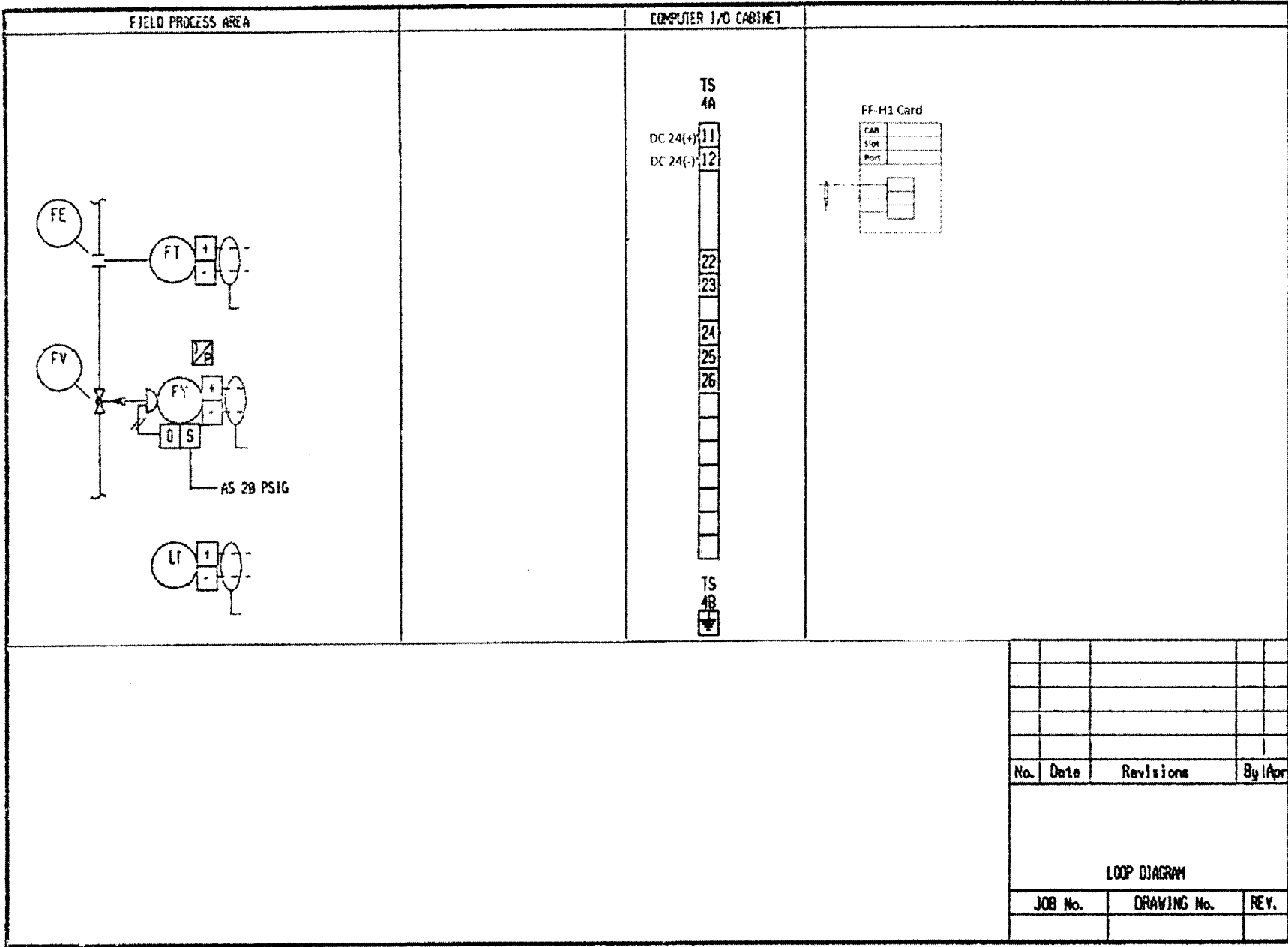


Figure 3 Junction box for Fieldbus connection



Description:

- 1 Connection spur 1
- 2 LED ERR spur 1 (red, short circuit)
- 3 LED COM/ERR (communication/diagnostics)
- 4 LED PWR (power)
- 5 Separation wall ACC-R2-SW.3
- 6 Switch, short circuit current selection
- 7 Terminator M-FT, removable
- 8 T-connector T-CON.3



No.	Date	Revisions	By/Apr
LOOP DIAGRAM			
JOB No.	DRAWING No.	REV.	

Name - Surname:

Student Id:

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4. From the given P&ID (A3), identify Input-Output for conventional I/O (4-20 mA) by adding tagname into the table. (10 points)

Analog input					
Analog output					
Digital input					
Digital output					

Part 2: Industrial network (30 points)

5. Explain 7 Layers of OSI in data communication and their examples.

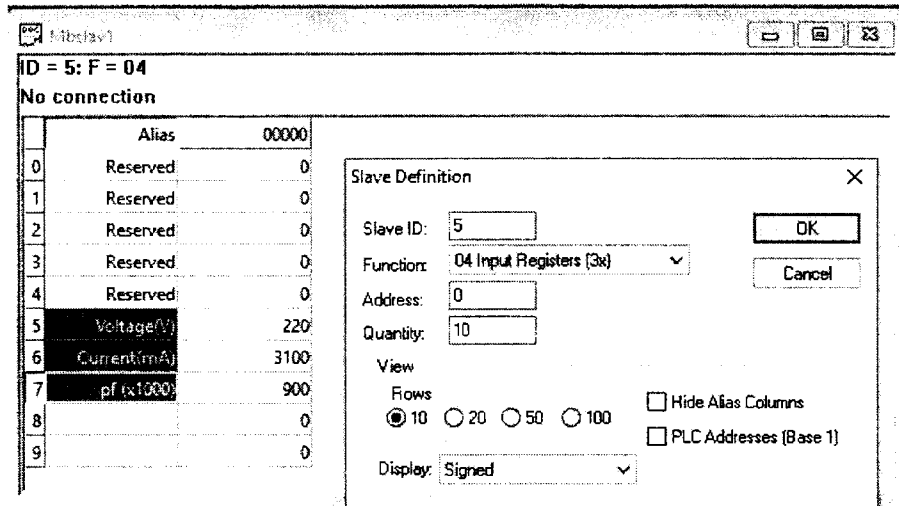
(3 points)

Layer	Layer name	examples
7		
6		
5		
4		
3		
2		
1		

6. Ethernet TCP/IP protocols are often used in Control Level Network. Explain how connection-oriented and connectionless services (in Layer 4) work and give examples of their applications. (3 points)

7. Explain the medium Access Control mechanism of Producer-Consumer. (4 points)

8. A power meter is connected to the automation network with Modbus ASCII protocol. Measuring variables are stored in Input Register shown in the below figure with Modbus address ID=5. If a master device is designed to read all variables with the single command, what is a data frame of command? (5 points)



Function 03 (03hex) Read Holding Registers: Read the binary contents of holding registers in the slave.

Query:The query message specifies the starting register and quantity of registers to be read. Example of a request to read 0...1 (register 40001 to 40002) from slave device 1:













Field Name	RTU (hex)	ASCII Characters
Header	None	: (Colon)
Slave Address	01	0 1
Function	03	0 3
Starting Address HI	00	0 0
Starting Address LO	00	0 0
No of Registers Hi	00	0 0
No of Registers Lo	02	0 2
Error Check Lo	C4	LRC (F A)
Error Check Hi	0B	
Trailer	None	CR LF
Total Bytes	8	17

Function 04 (04hex) Read Input Registers: Read the binary contents of input registers in the slave.

Query: The query message specifies the starting register and quantity of registers to be read. Example of a request to read 0...1 (register 30001 to 30002) from slave device 1:

Field Name	RTU (hex)	ASCII Characters
Header	None	:(Colon)
Slave Address	01	0 1
Function	04	0
Starting Address HI	00	0 0
Starting Address LO	00	0 0
No of Registers HI	00	0 0
No of Registers Lo	02	0 2
Error Check Lo	71	LRC (F 9)
Error Check Hi	CB	
Trailer	None	CR LF
Total Bytes	8	17

10. The below table displays industrial protocol logos with various applications. Answer the questions by filling the alphabet (a)-(l) with briefly comments only if it is required. (10 points)

 (a)	 (b)	 (c)	 (d)
 (e)	 (f)	 (g)	 (h)
 (i)	 (j)	 (k)	 (l)

Questions	Answers	
	1 st Answer	2 nd Answer
10.1) Which protocol is often used in Building Automation? (1 points)		
10.2) Which protocols support for working in <u>Intrinsic Safety</u> Area? (2 points)		
10.3) Which protocols include Common Industrial Protocol (CIP) in their protocol? (2 points)		
10.4) Which protocol is used based on Peer to Peer network? (1 points)		
10.5) Which protocol is utilized TCP/IP for realtime data by hardware bypass in level 2 of the OSI reference model? (1 points)		
10.6) Which protocols are designed for control network? (2 points)		
10.7) Which protocol is often designed for automotive industry? (1 points)		