



GROUP 1 :

Group Members 1) ชาญรังกฤต จารุอาง 63070501208
2) ชาญลักษณ์ วิยะสุข 63070501216
3) นางสาวตั้นกาสินี เมืองหมุน 63070501221

LABORATORY MANUAL

Control system and Department of Instrumentation
Engineering

Faculty of Engineering

King Mongkut's University of
Technology Thonburi



CONTENT

LABORATORY 1 :STAR-DELTA MOTOR STARTER.....	3
LABORATORY 2 :FORWARD-REVERSE MOTOR.....	12
LABORATORY 3 :PLC DIGITAL PRACTICES.....	21
LABORATORY 4 :PLC ANALOG PRACTICES	31
LABORATORY 5 :CABINET EQUIPMENTS PRACTICES.....	43



LABORATORY 1: Star-Delta Motor Starter

Objective

- 1) To understand the motor starter by Star-Delta method.
- 2) To learn about any diagram symbols.
- 3) To practice wiring skill and reading wiring diagram.

1) star & delta
↓
2) delta

Equipments

TAG NO.	DESCRIPTION.	TYPE	MODEL	BRAND
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AF 50kA,	GV2-L14	TELEMECANIQUE
FL1	CONTROL FUSE	1P 10x38,4A	Z-SH/1	MOELLER
K1,K2,K3	CONTACTOR	MAGNETIC CONTACTOR	LC1-D09M7	TELEMECANIQUE
F1	THERMAL OVERLOAD	THERMAL OVERLOAD 2.5-4A	LRD-08	TELEMECANIQUE
S1	PUSH BUTTON FOR STOP	22mm. 1NC CONTACT,RED COLOUR	XB7-EA42P	TELEMECANIQUE
S2	PUSH BUTTON FOR START	22mm. 1NO CONTACT, GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
KT1	TIMER RELAY FOR STAR/DELTA	220VAC 1 C/O CONTACT	RE8-YG31BUTQ	TELEMECANIQUE
H1	PILOT LAMP FOR START	GREEN COLOUR	XB7-EVO3MP	TELEMECANIQUE
H2	PILOT LAMP FOR STOP	RED COLOUR	XB7-EVO4MP	TELEMECANIQUE
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR	XB7-EVO5MP	TELEMECANIQUE



Test Procedure

[check ວ່າລາຍການຢູ່ຈະໄດ້ສັບສົນ ລາ] → test ພິມໄຟຟ້າ ແລະ ທີ່ສ່ວນໄຟຟ້າ ຈະຮັດຈຳໄຟຟ້າ ດັ່ງນີ້

1. Study the installation equipments ,drawing (panel, wire duct, din rail) and install all the equipments on the panel by mounting on the plate (follow by panel layout) as shown in figure 1.1

ສໍາເລັດ
star ແລະ neutron ຫຼື ມອງກາງ
delta ວະນຸ

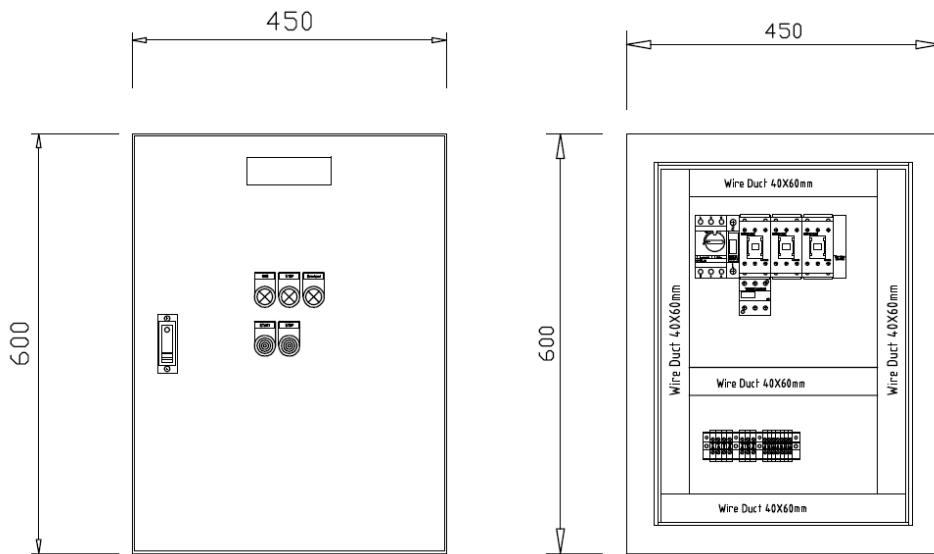


Figure 1.1 Front views and w/o front cover of Star-Delta motor starter.

2. Study the circuit diagram as shown in figure 1.2, 1.3; try to connect the cable.

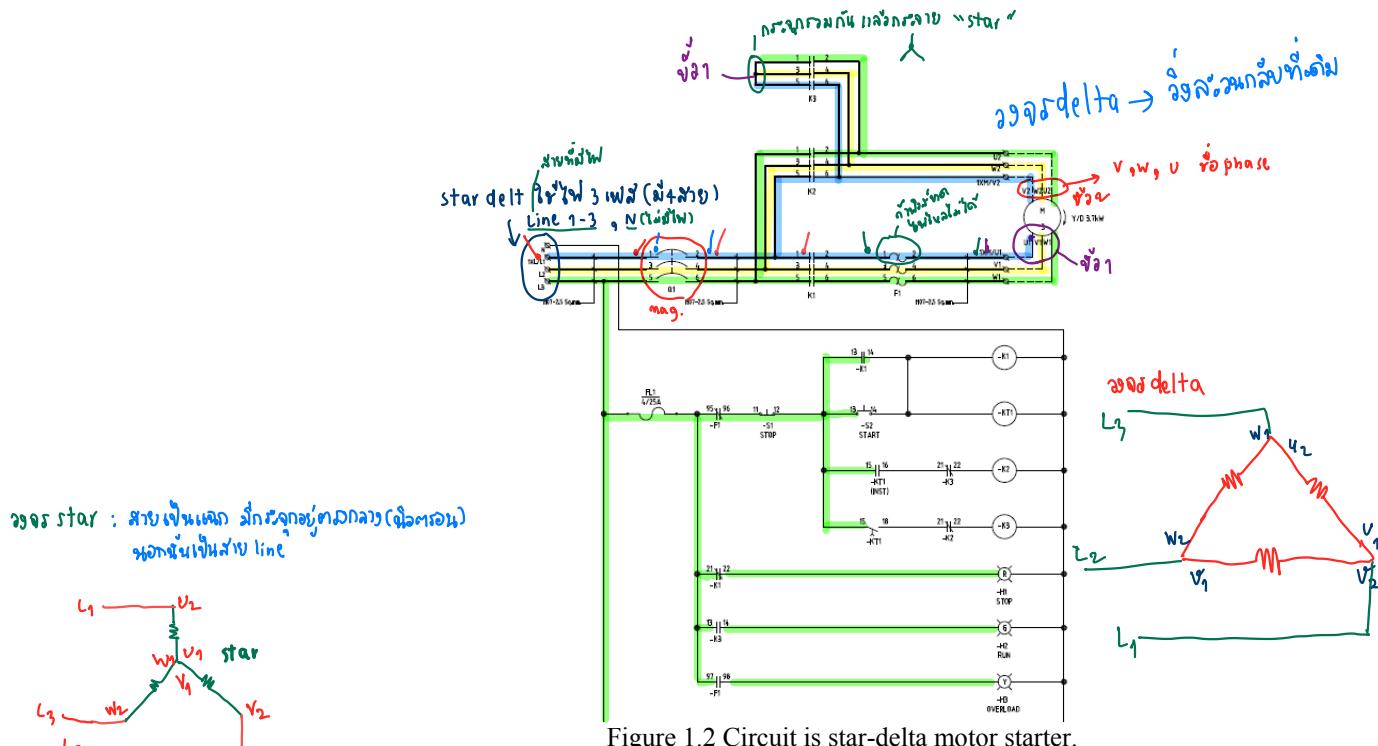


Figure 1.2 Circuit is star-delta motor starter.

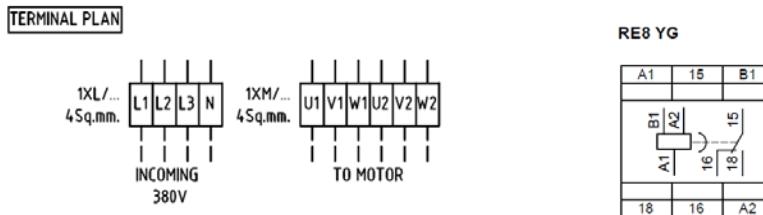
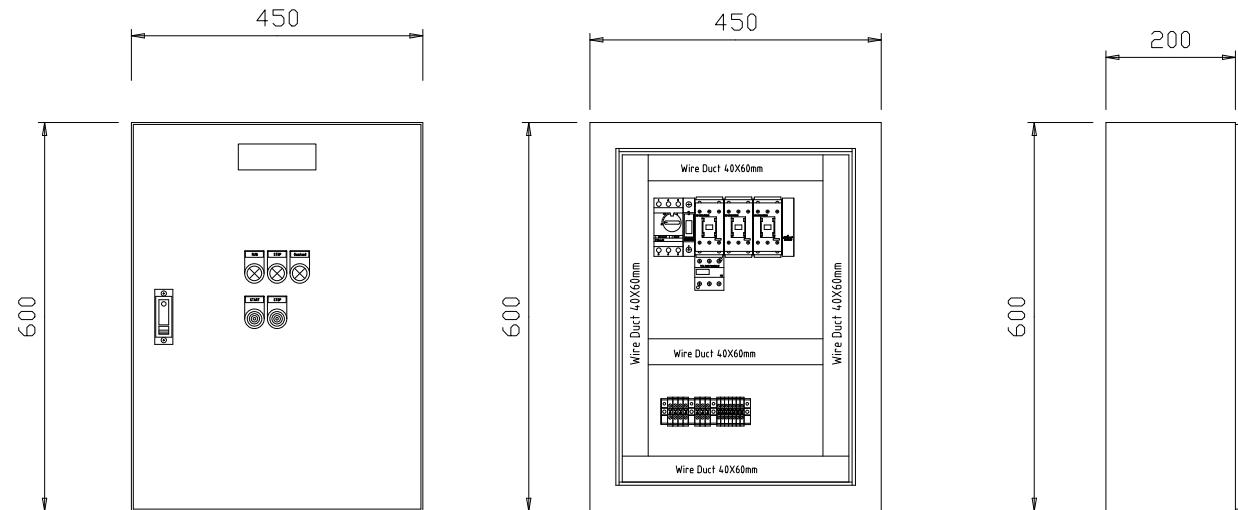


Figure 1.3 Terminal Plans and Block timer relay for star delta (KT1).

3. When you finish all connections, call instructor for checking.
4. Connect the circuit to the power source and push switch (S2) “ON” the auxiliary contact of the magnetic contactor (K1) which is connected in parallel across the “ON” push button will close thereby providing a latch to hold the magnetic contactor (K1) activated which eventually maintains the control circuit active even after releasing the “ON” push button switch.
5. Another the auxiliary contact of magnetic contactor (K1) placed on top of the magnetic contactor coil (K2) and the timer relay coil (KT1) initializes the control circuit which activates the star connection of the motor through the magnetic contactor star coil (Y) (K2), and while also awaiting to reach the specified time delay along with the activation of the timer contact during this initial sequence.
6. Once the time delay is reached, the timer's auxiliary contacts will change state opposite its normal condition which would become an open contact (instead of close) to release the magnetic contactor star coil (Y) (K2) while at the same time providing a close contact (instead of open) to activate the magnetic contactor delta coil (Δ) (K3) for the second sequence to reconfigure the motor terminal connection from star to delta connection, to place the motor in the run state from start state. Pilot lamp (H1) is “ON”.
7. Push stop switch (S1) then all magnetic contactor is open. And pilot lamp (H2) is “ON”.
8. Restart motor and simulate overload fault from thermal overload. Overload contact will cut the circuit to stop motor. And pilot lamp (H3) is “ON”.

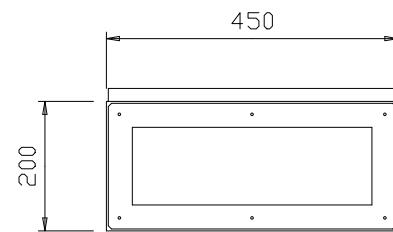
1 2 3 4 5 6 7 8



FRONT VIEW

W/O FRONT COVER

SIDE VIEW



TOP&BOTTOM VIEW

CUBICLE NOTE

CUBICLE CONSTRUCTION

- Frame : Folded Steel sheet 1.0 mm. Thk.
- Front cover ; Steel sheet 1.0 mm. Thk.
- Top and Bottom cover : Steel Sheet 1.0 mm. Thk.
- Mounting plate : Steel sheet 1.0 mm. Thk.
- Colour of painted part , Epoxy-Polyester Powder coating
White Gray (RAL-7032)

PANEL NOTE

- Indoor installation
- Wall mounting
- Degree of protection IP40

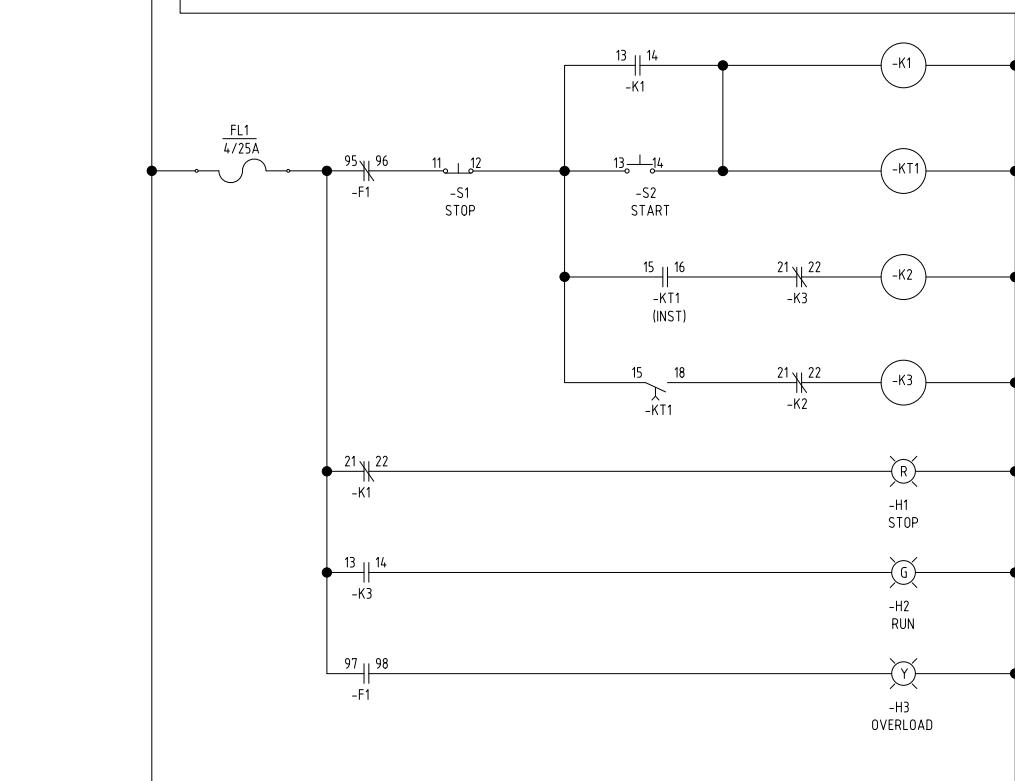
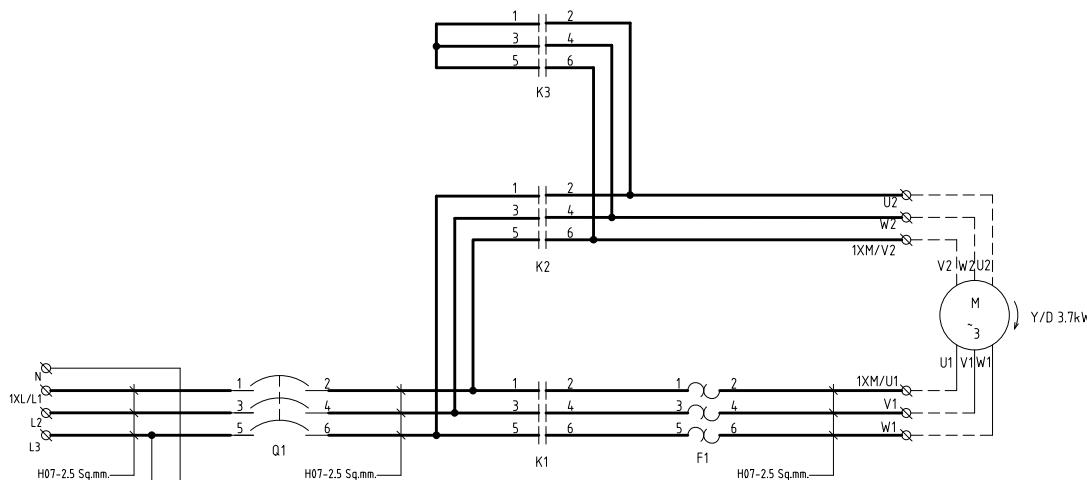
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OWNER : TROPICALTECH CO.,LTD. PLANT : LAB			
PROJECT : KMUTT			
TITLE : Panel Layout For STAR/DELTA 3.7kW			
ISO-E : Drawing No: Rev: Form: Rev: Name Date			
drawn: Rochan 1/10/2011 0 A4			
checked: Yongjet 1/10/2011 B -			
approved: - Project No: J11-10-001 Page no: C -			
D -			

1 2 3 4 5 6 7 8

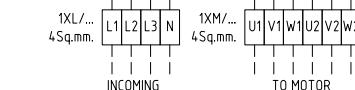
CABLE DESCRIPTION

- Power & Control Cable : H07 V-K TYPE
- Power Cable : Black Colour Mark : L1-Red , L2-Yellow, L3-Blue
- Control Cable : Black Colour Mark : Wire Marker White Colour

TAGNO	DESCRIPTION	TYPE	MODEL	BRAND
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AFC 50KA	GV2-L14	TELEMECANIQUE
FL1	CONTROL FUSE	1P FUSE 10x38 , 4A	Z-SH/1	MOELLER
K1,K2,K3	CONTRACTOR	MAGNETIC CONTACTOR 4KW 12A	LC1-D09M7	TELEMECANIQUE
F1	THERMAL OVERLOAD	THERMAL OVERLOAD 2.5-4A	LRD-08	TELEMECANIQUE
S1	PUSH BUTTON FOR STOP	22mm 1NC CONTACT , RED COLOUR	XBT-EA42P	TELEMECANIQUE
S2	PUSH BUTTON FOR START	22mm 1NO CONTACT , GREEN COLOUR	XBT-EA31P	TELEMECANIQUE
KT1	TIMER RELAY FOR STAR/DELTA	220VAC C/O CONTACT	REB-YG31BUQ	TELEMECANIQUE
H1	PILOT LAMP FOR START	GREEN COLOUR	XBT-EV03MP	TELEMECANIQUE
H2	PILOT LAMP FOR STOP	RED COLOUR	XBT-EV04MP	TELEMECANIQUE
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR	XBT-FV05MP	TELEMECANIQUE



TERMINAL PLATE



BRANIUM Co.,Ltd.

TROPICAL TECH CO., LTD. PLANT: LAB

PROJECT : KMITT

TITLE: Control Diagram for Star/Delta 3.7kW

ISO-E :		Scale : —	Weight : —	kg	Revise
drawn:	Rochan	1/10/2011	Drawing No:	Rev. 0	Name _____
checked:	Yongyot	1/12/2011	Format: A4	Rev. A	Date _____
approved:	Project-No: J11-10-001 Page no:			C	
				D	



Experiment Table

1. Equipment List Table

TAG NO.	DESCRIPTION.	TYPE	MODEL	DONE	REMARK
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AF 50kA,	GV2-L14	<input checked="" type="checkbox"/>
FL1	CONTROL FUSE	1P 10x38,4A	Z-SH/1	<input checked="" type="checkbox"/>
K1,K2, K3	CONTACTOR	MAGNETIC CONTACTOR	LC1-D09M7	<input checked="" type="checkbox"/>
F1	relay ຫຼັກອະຮັດໄສຕົວສັນ ^{ກຳເປົ່າຍຸດເລື່ອງກຳນົວອັນຈົກ} THERMAL OVERLOAD ກຳເປົ່າຍຸດເລື່ອງກຳນົວອັນຈົກ	THERMAL OVERLOAD 2.5-4A	LRD-08	<input checked="" type="checkbox"/>
S1	PUSH BUTTON FOR STOP	22mm. 1NC CONTACT,RED COLOUR	XB7-EA42P	<input checked="" type="checkbox"/>
S2	PUSH BUTTON FOR START	22mm. 1NO CONTACT, GREEN COLOUR	XB7-EA31P	<input checked="" type="checkbox"/>
KT1	TIMER RELAY FOR STAR/DELTA	220VAC 1 C/O CONTACT	RE8-YG31BUTQ	<input checked="" type="checkbox"/>
H1	PILOT LAMP FOR START	GREEN COLOUR	XB7-EVO3MP	<input checked="" type="checkbox"/>
H2	PILOT LAMP FOR STOP	RED COLOUR	XB7-EVO4MP	<input checked="" type="checkbox"/>
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR	XB7-EVO5MP	<input checked="" type="checkbox"/>



2. Tool List Table

NO.	DESCRIPTION.	DONE	REMARK
1	TOOL BOX	<input checked="" type="checkbox"/>
2	STRIPS & CUTTING TOOL	<input checked="" type="checkbox"/>
3	CRIMPING TOOL	<input checked="" type="checkbox"/>
4	SCREWDRIVER	<input checked="" type="checkbox"/>
5	SCREWDRIVER	<input checked="" type="checkbox"/>

3. Wiring Procedure Table

NO.	PROCEDURE WIRRING	DONE	REMARK
1	Install all equipments on the panel by mounting on the plate	<input checked="" type="checkbox"/>
2	Wiring cable to equipment follow circuit diagram	<input checked="" type="checkbox"/>
3	Check the result of the wiring.	<input checked="" type="checkbox"/>

4. Circuit Test Procedure Table

NO.	PROCEDURE TEST	CONTACTOR			PILOT LAMP			REMARK
		K1	K2	K3	GREEN	YELLOW	RED	
1	On circuit breaker.	<input type="checkbox"/>					
2	Push start switch (S2). Motor connect as star connection.	<input type="checkbox"/>					
3	When timer relay time out. It will change connection from star to delta.	<input type="checkbox"/>					
4	Push stop switch (S1).	<input type="checkbox"/>					
5	The overload testing.	<input type="checkbox"/>					



Question

1. What is the different between star connection and delta connection?

- star connection ម៉ែគ្រាមនៃវរូបុន្ថែលទៅវា តាមពីរប៊ូលអំពីរករណ៍លើលក្ខណៈ delta
- star connection ស្រួល . 3.phase & wires . សំខាន់ delta connection
- .. ស្រួល 3.phase 3.wires (មិនមែនសាយ neutral)
- star connection មិនមែនតាម . នៅ delta connection មិនមែនឡើ
- star connection និង delta connection នូវប្រព័ន្ធលាកសម្រាប់ការចាន់ចាយក្នុង .
.. នូវឃើញតាមការចាន់ចាយនៅលើលំដោនុយការ start នូវលទ្ធផលតាមក្នុង នៅក្នុង ..
- ► star connection: $V_{line} = \sqrt{3} V_{phase}$... , $I_{line} = I_{phase}$
- ► delta connection: $V_{line} = V_{phase}$... , $I_{line} = \sqrt{3} I_{phase}$

2. What is the advantage of using Star Delta starting?

- ភាពពីរការចាន់ចាយលើលក្ខណៈ star delta . នឹងប្រើប្រាស់លទ្ធផលតាមក្នុងការចាន់ចាយ start ។
 - គុណភាពនៃសំខាន់ស្រួលលើលក្ខណៈ star delta នឹងប្រើប្រាស់លទ្ធផលតាមក្នុងការចាន់ចាយ . ឧប្បជ្ជ ..
.. នឹងប្រើប្រាស់លទ្ធផលតាមក្នុងការចាន់ចាយ . នឹងប្រើប្រាស់លទ្ធផលតាមក្នុងការចាន់ចាយ .
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Comment

..... ການຮັດລອງໜ້າ ເຮົາໄລ້ຕຳການຕາງວົດສ່ອບອງຈຽດໂຄບໃໝ່ digital meter ມີການ check ອອງຮັກໜ້າ node ວ່າສ່າຍໄຟກ້ອນມານີ້ລວງຈຽດຕ່ອງດີນກັນຄູກຕ້ອງຫາວ່າ wiring-diagram ຂີ່ສ້ອນໄມ້

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Summary

..... ກວດຕ່າວສອນເຫຼວດ້ວຍອງຈຽດ star delta ທີ່ໃຫ້ start ມອເຕොວ໌ໄດ້ຢ່າງສີ່-
ຢຸ່າຍສີ່ກົງລາຍພ. ເຊິ່ງອຸດຖາກາຫຼັກຫຼັກສົມບູນທີ່ກົດ ຈຸ່ນທີ່ກົດໃໝ່ວິທີ່ວິທີ່ກົດກົງລາຍພ. ເພື່ອຮັບຮັດກົດກົງລາຍພ.
..... ດັບຕຸ້ນຮັດກົດກົງລາຍພ. ເຊິ່ງອຸດຖາກາຫຼັກຫຼັກສົມບູນທີ່ກົດ ສົມບູນທີ່ກົດກົງລາຍພ.
..... ກວດຕ່າວສອນເຫຼວດ້ວຍອງຈຽດ star delta ທີ່ຈະຫຼັງຕ່າງໆ ເພື່ອຮັບຮັດກົດກົງລາຍພ.
..... ກວດຕ່າວສອນເຫຼວດ້ວຍອງຈຽດ star delta ທີ່ຈະຫຼັງຕ່າງໆ ເພື່ອຮັບຮັດກົດກົງລາຍພ.
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LABORATORY 2: Forward-Reverse Motor

Objective

- 1) To understand the motor direction control concept by basic device.
- 2) To learn about diagram symbols.
- 3) To practice wiring skill and reading wiring diagram.

Equipment

TAG NO.	DESCRIPTION.	TYPE	MODEL	BRAND
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AF 50kA	GV2-L14	TELEMECANIQUE
FL1	CONTROL FUSE	1P 10x38,4A	Z-SH/1	MOELLER
K1	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	TELEMECANIQUE
	AUX.CONTACT 1NO+1NC	-	LA-DN11	TELEMECANIQUE
K2	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	TELEMECANIQUE
	AUX.CONTACT 1NO+1NC	-	LA-DN11	TELEMECANIQUE
F1	THERMAL OVERLOAD	THERMAL OVERLOAD 7-110A	LRD-14	TELEMECANIQUE
S1	PUSH BUTTON FOR STOP	22mm. 1NC CONTACT, RED COLOUR	XB7-EA42P	TELEMECANIQUE
S2	PUSH BUTTON FOR START FORWARD	22mm. 1NO CONTACT, GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
S3	PUSH BUTTON FOR START REVERSE	22mm. 1NO CONTACT, GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
H1	PILOT LAMP FOR FORWARD	GREEN COLOUR	XB7-EVO3MP	TELEMECANIQUE
H2	PILOT LAMP FOR REVERSE	GREEN COLOUR	XB7-EVO3MP	TELEMECANIQUE
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR	XB7-EVO5MP	TELEMECANIQUE



Test Procedure

1. Study the installation equipments, drawing (panel, wire duct, din rail) and install all the equipments on the panel by mounting on the plate (follow by panel layout) as shown in figure 2.1.

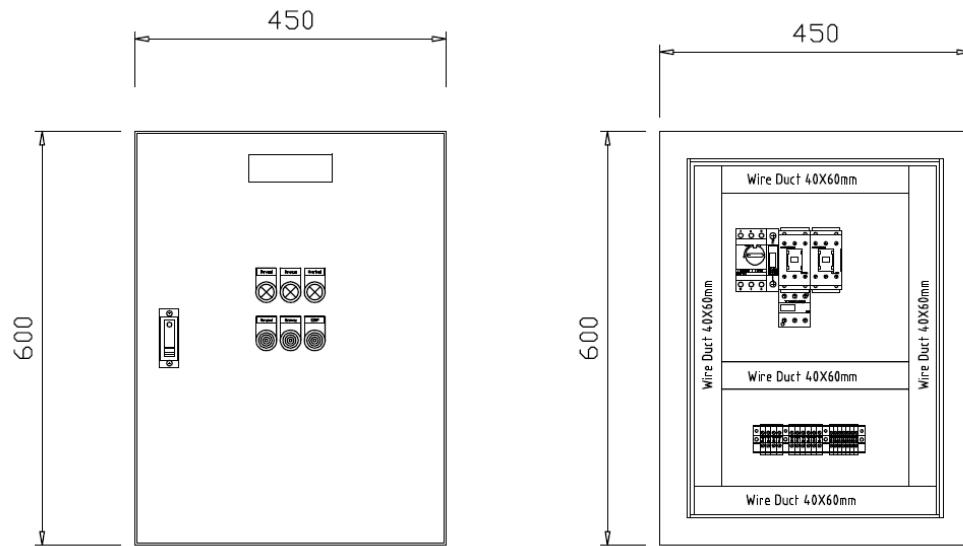


Figure 2.1 Front views and w/o front cover of Forward-Reverse motor.

2. Study the circuit diagram as shown in figure 2.2; try to connect the cable.

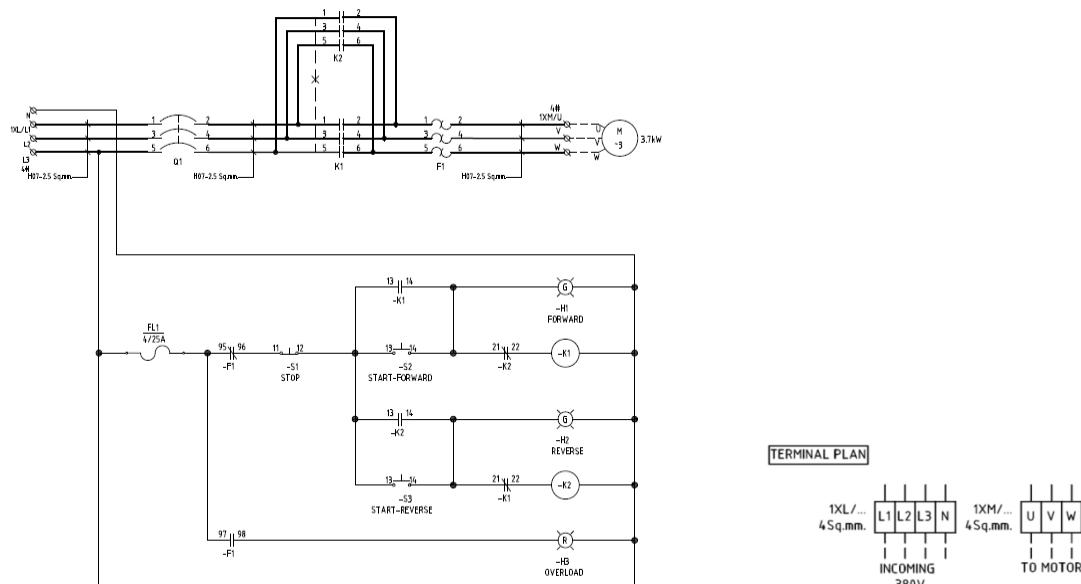


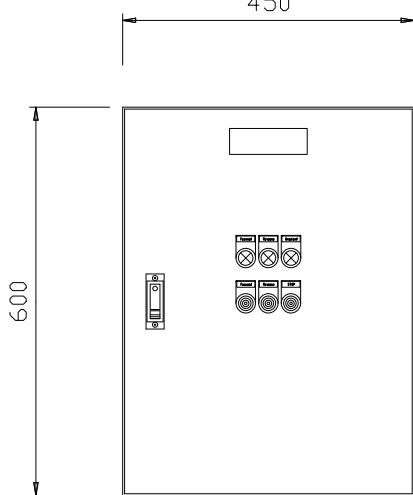
Figure 2.2 Circuit is Forward-Reverse motor and terminal plans

3. When you finish all connections, call instructor for checking.
4. Connect the circuit to the power source and press the forward push button (S2). The magnetic contactor (K1) will close a corresponding contact connected across the forward push button switch (S2). The motor will rotate in forward direction.

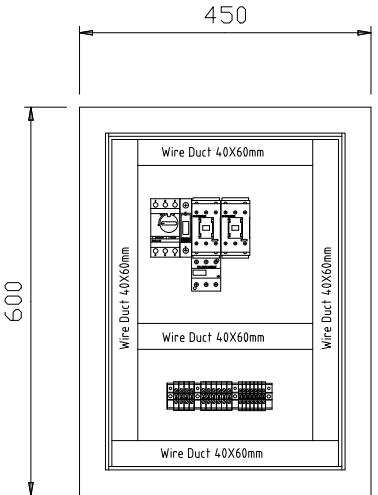
Note. The activation of the magnetic contactor (K1) would also open the interlock contact connected before the magnetic contactor (K2), which provides a safety measure that prevents electricity to pass through to the magnetic contactor (K2), in case of an unintentional switching of the reverse push button switch (S3) while the magnetic contactor (K1) is energized.

5. Press the “STOP” push button switch (S1) to release the locked status of any energized contact for returning all contacts to their initial ready state.
6. Press the reverse push button (S3). The magnetic contactor (K2) will close a corresponding contact connected across the reverse push button switch (S3). The motor will rotate in reverse direction.
7. Simulate overload fault by pressing thermal overload switch. Overload contact will cut the circuit to stop motor. And pilot lamp (H3) is “ON”.

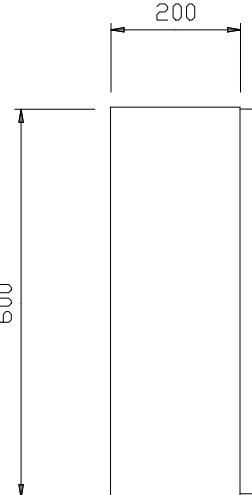
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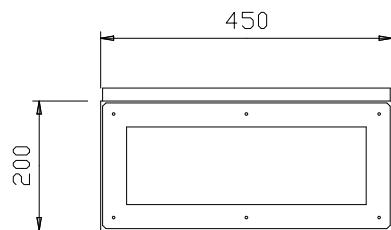
FRONT VIEW



W/O FRONT COVER



SIDE VIEW



TOP&BOTTOM VIEW

CUBICLE NOTE

CUBICLE CONSTRUCTION

- Frame : Folded Steel sheet 1.0 mm. Thk.
- Front cover ; Steel sheet 1.0 mm. Thk.
- Top and Bottom cover : Steel Sheet 1.0 mm. Thk.
- Mounting plate : Steel sheet 1.0 mm. Thk.
- Colour of painted part , Epoxy-Polyester Powder coating
White Gray (RAL-7032)

PANEL NOTE

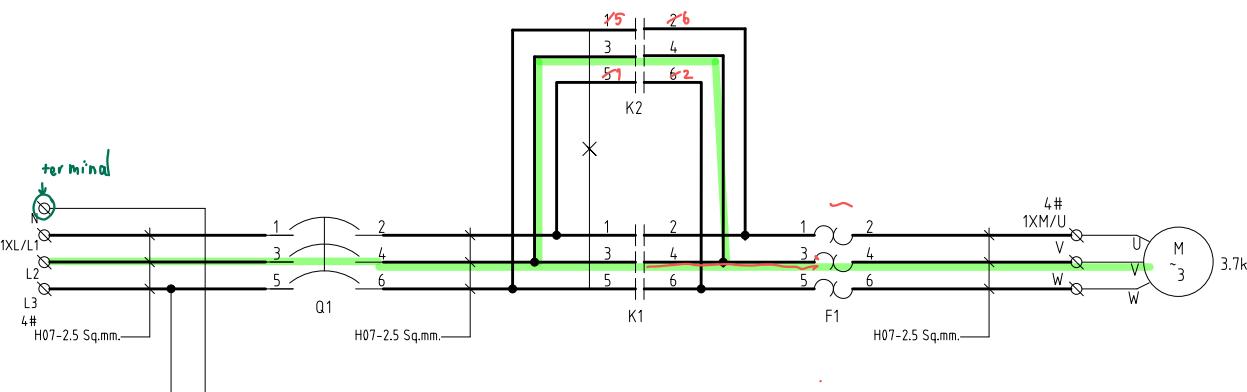
- Indoor installation
- Wall mounting
- Degree of protection IP40

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OWNER: TROPICALTECH CO.,LTD. PLANT: LAB										
PROJECT: KMUTT										
TITLE: Panel Layout for DOL 3.7kW										
ISO-E:	Scale:	Weight:	-	Kg	Rev:	Name:	Date:			
	-	-	-	-	0	A4				
drawn:	Rochan	1/10/2011	checked:	Yongjet	1/10/2011	Project No:	J11-10-001	Page no:		
approved:	-								D	

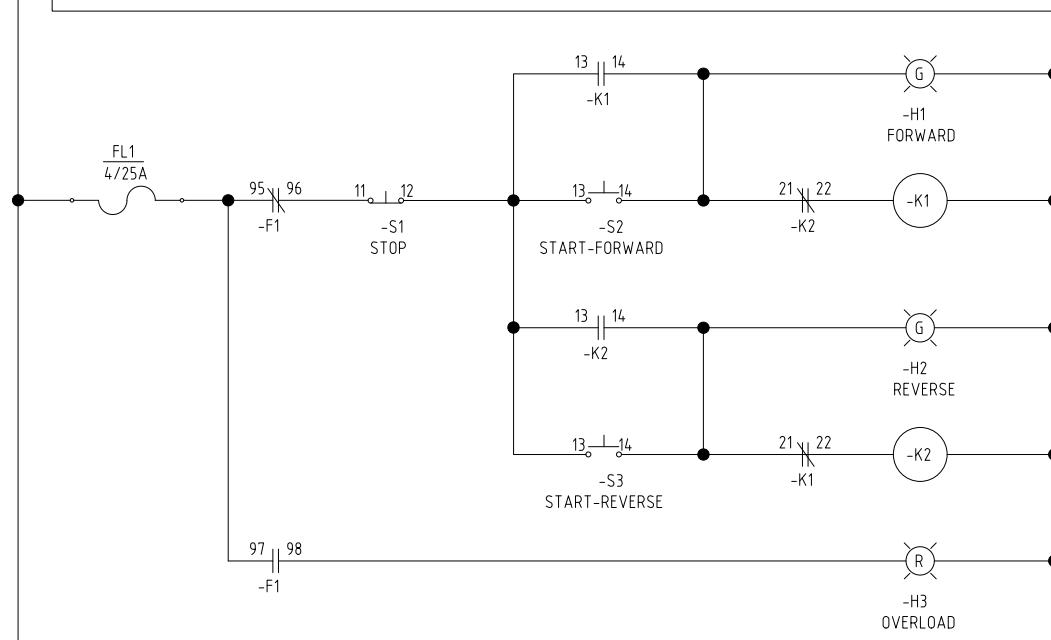
1 2 3 4 5 6 7 8

CABLE DESCRIPTION

-Power & Control Cable : H07 V-K TYPE



TAG NO	DESCRIPTION	TYPE	MODEL	BRAND
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AF 50KA	GV2-L14	TELEMECANIQUE
FL1	CONTROL FUSE	1P FUSE 10x38 , 4A	Z-SH/1	MOELLER
K1	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	TELEMECANIQUE
AUX	CONTACT 1NO+1NC	-	LA1-DN11	TELEMECANIQUE
K2	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	TELEMECANIQUE
AUX	CONTACT 1NO+1NC	-	LA1-DN11	TELEMECANIQUE
F1	THERMAL OVERLOAD	THERMAL OVERLOAD 7-10A	LRD-14	TELEMECANIQUE
S1	PUSH BUTTON FOR STOP	22mm 1NC , RED COLOUR	XB7-EA42P	TELEMECANIQUE
S2	PUSH BUTTON FOR START	22mm 1NO , GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
S3	PUSH BUTTON FOR START	22mm 1NO , GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
H1	PILOT LAMP FOR FORWARD	GREEN COLOUR 220VAC	XB7-EV03MP	TELEMECANIQUE
H2	PILOT LAMP FOR REVERSE	GREEN COLOUR 220VAC	XB7-EV04MP	TELEMECANIQUE
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR 220VAC	XB7-EV05MP	TELEMECANIQUE



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OWNER: PLANT: TROPICALTECH CO.,LTD. LAB									
PROJECT: KMUTT									
TITLE: Control Diagram for F/R 3.7kW									
ISO-E:		Scale: -	Weight: -	Rev. A	Rev. B	Rev. C	Rev. D	Name	Date
drawn: Rochan		1/10/2011	Drawing No: 0	A4					
checked: Yongjet		1/10/2011	Project No: J11-10-001		B-	C-	D-		
approved: -			Page no:						



Experiment Table

1. Equipment List Table

TAG NO.	DESCRITION.	TYPE	MODEL	DONE	REMARK
Q1	CIRCUIT BREAKER	3P MCCB 10AT/32AF 50kA,	GV2-L14	<input checked="" type="checkbox"/>
FL1	CONTROL FUSE	1P 10x38,4A	Z-SH/1	<input checked="" type="checkbox"/>
K1	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	<input checked="" type="checkbox"/>
	AUX.CONTACT 1NO+1NC	-	LA-DN11	<input type="checkbox"/>
K2	CONTACTOR	MAGNETIC CONTACTOR 4KW	LC1-D09M7	<input checked="" type="checkbox"/>
	AUX.CONTACT 1NO+1NC	-	LA-DN11	<input checked="" type="checkbox"/>
F1	THERMAL OVERLOAD	THERMAL OVERLOAD 7-110A	LRD-14	<input checked="" type="checkbox"/>
S1	PUSH BUTTON FOR STOP	22mm. 1NC CONTACT RED COLOUR	XB7-EA42P	<input checked="" type="checkbox"/>
S2	PUSH BUTTON FOR START FORWARD	22mm. 1NO CONTACT GREEN COLOUR	XB7-EA31P	<input checked="" type="checkbox"/>
S3	PUSH BUTTON FOR START REVERSE	22mm. 1NO CONTACT GREEN COLOUR	XB7-EA31P	<input checked="" type="checkbox"/>
H1	PILOT LAMP FOR FORWARD	GREEN COLOUR	XB7-EVO3MP	<input checked="" type="checkbox"/>
H2	PILOT LAMP FOR REVERSE	GREEN COLOUR	XB7-EVO3MP	<input checked="" type="checkbox"/>
H3	PILOT LAMP FOR OVERLOAD	YELLOW COLOUR	XB7-EVO5MP	<input checked="" type="checkbox"/>



2. Tool List Table

NO.	DESCRIPTION.	DONE	REMARK
1	TOOL BOX	<input checked="" type="checkbox"/>
2	STRIPS & CUTTING TOOL	<input checked="" type="checkbox"/>
3	CRIMPING TOOL	<input checked="" type="checkbox"/>
4	SCREWDRIVER	<input checked="" type="checkbox"/>
5	SCREWDRIVER	<input checked="" type="checkbox"/>

3. Wiring Procedure Table

NO.	PROCEDURE WIRRING	DONE	REMARK
1	Install all equipments on the panel by mounting on the plate.	<input checked="" type="checkbox"/>
2	Wiring to equipment follow circuit diagram.	<input checked="" type="checkbox"/>
3	Check the result of the wiring.	<input checked="" type="checkbox"/>

4. Circuit Test Procedure Table

NO.	PROCEDURE TEST	CONTACTOR			PILOT LAMP			REMARK
		K1	K2	K3	GREEN FORWARD	GREEN REVERSE	YELLOW	
1	On circuit breaker.	<input type="checkbox"/>					
2	Push forward switch (S2)	<input type="checkbox"/>					
3	Push stop switch (S1) and then push reverse switch (S3)	<input type="checkbox"/>					
4	Press thermal overload switch.	<input type="checkbox"/>					



Question

- How to convert the direction of motor by hardware configuration?

.....ການໃຊ້ hardware ໃໝ່ການສໍາລັບທີ່ກາງກາຮ່າມໜູນຂອງມອນຕອນກໍໄດ້ໂດຍ.
ການສໍາລັບທີ່ກາງກາຮ່າມໜູນຂອງມອນຕອນກໍໄດ້ໂດຍ. ອ້າງກາຮ່າມໜູນ
ເຈົ້າມຕ່ວາລອງສໍາຫຼິຟ່າມໜູນຂອງມອນຕອນກໍໄດ້ໂດຍ. ອ້າງກາຮ່າມໜູນ
1. ດີວຸນກິໂລກິໂຕ໌ ພົມຈະສໍາລັບທີ່ T1, T2, T3. ກິໂຕ໌ເຫັນກຳ.....
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- Why we have to stop the motor before we change direction?

.....ມີຫຼຸດຈຸກປະກຸບທີ່ມີມອນຕອນກໍໄດ້ສໍາລັບມູນຄູນໜູນ. ຊຶ່ງຄອງເຫັນກຳກຳລູ່ທີ່
ມອນຕອນກໍໄດ້ເພື່ອຈຳກັດການກາງດູ່ມ ຮັດ. ດັລັກໆຕາມ ດ້ວຍການຮັບສໍານັກ
ທີ່ກາງກຳລູ່ທີ່ມີມອນຕອນກໍໄດ້. ລະຫວ່າງໃໝ່ເກີດກາວສ່ວນກາງກຳລູ່ທີ່ມີມອນຕອນ
ເດີດກາວກິນການຂຶ້ນທີ່ສູ່ມາກຳນົດມອນຕອນກໍໄດ້ດ້ວຍເຫັນໄດ້.....
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Comment

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Summary

..... ການຄອບດຸມຂອງເຕວີ່ແມ່ງນີ້ 3. ພົບດຽວ ໂື້ງສ່າມາຮັດໝູນຕາມເງື່ອນໝາກີ້ກາງເຊື່ອ. ນຸ້າຫາກຈຸດເຖິງຫຼາກີ້ກາງໄດ້ໃຫ້ນ. ເຮົາຈະຕ້ອງຈຳກັງຮັດສ່ານຫື່ມີຂະໜາດໂທລະວົບ ເປົ້ນຍັນທີ່ກົດຕໍ່ການຮັດຊຸມ ຂຶ້ນກາງໂຮງໝໍ relay. ເຫັນມາຫຼືໃຫ້ການຮັດງານ ຫຼື ດັບສົ່ງອານຸທັກ ປຸ່ນ forward ແລະ reverse ຮັມດີ້ໃຫ້ອະດີ interlock ເຫັນຈາກວຸບແຜ່ວ່າປ້ອກກັນການ ກາດຢູ່ໜົມພ່ອມກົນ ອີກທີ່ພື້ນຢູ່ໜົມ ຮັດງານ ແລ້ວສົ່ງໃຫ້ມີເຕວີ່ຂະໜາດກາງຮັດຊຸມ ທີ່ເຮົາຄວກ ຮອໃຫ້ມີເຕວີ່ຂະໜາດຮັດຊຸມທີ່ໜົມກົນກີ່ຈຳກັງການ ແລ້ວສົ່ງໃຫ້ມີເຕວີ່ກາງຮັດຊຸມຈົບງານກົດເຕົອຮົ່ງເພື່ອ ບຸດອົງກົດຄວາມເລື່ອງໄຫຍ້ທີ່ວ່າຈະເກີດໃຈໆໃນກ່ຽວຂ້ອງເຕວີ່.....

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LABORATORY 3: PLC Digital Practices

Objective

- 1) To understand wiring of digital device to PLC.
- 2) To learn about diagram symbols.
- 3) To practice of wiring skill and reading wiring diagram.
- 4) To practice the process of PLC I/O test.

Equipment

TAG NO.	DESCRIPTION.	TYPE	MODEL	BRAND
F01,F02	CIRCUIT BREAKER	2P MCCB 10AT/32AF 50kA	C60a	SCHNEIDER
U1	POWER SUPPLY	220VAC/24VDC 2A	-	CONNECTWELL
S1,S2,S3S4	PUSH BUTTON	22mm. 1NO CONTACT, GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
S5,S6	SELECTOR SWITCH	2 NO	XB7-ED33P	TELEMECANIQUE
K1-K8	CONTROL RELAY	24VDC 1C/O	-	RELEQUICK
H1-H8	PILOT LAMP	GREEN COLOUR 24V	XB7-EV03BP	TELEMECANIQUE
PLC	PLC	16DI 8DO	114-6BJ02	VIPA

Test Procedure

1. Study the equipment manuals of PLC (VIPA 114-6BJ02).
2. Study the installation equipment, drawing (panel, wire duct and din rail) and install all the equipments on the panel by mounting on the plate (follow by panel layout) as show in figure 3.1.

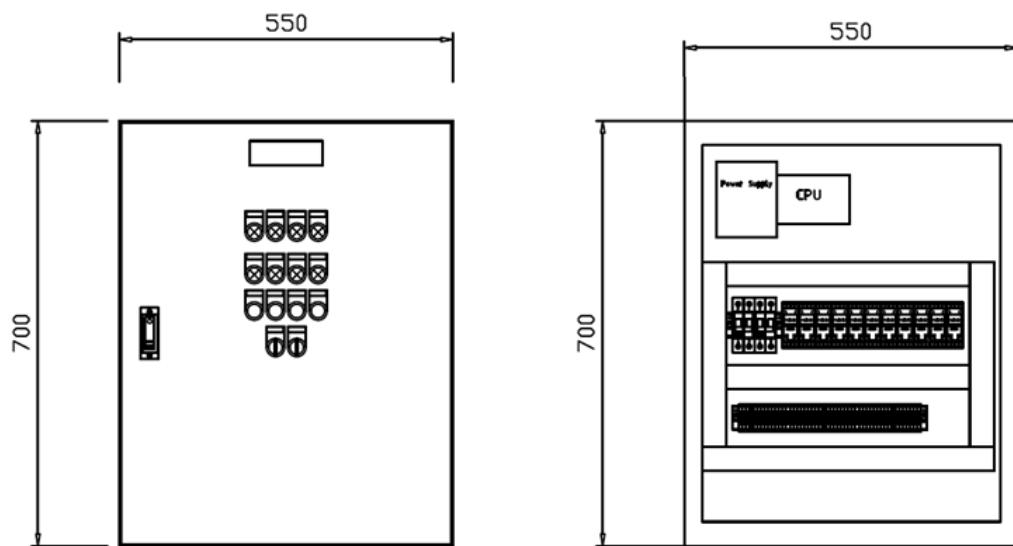


Figure 3.1 Front views and w/o front cover of PLC digital practices



3. Study the circuit diagram as shown in figure 3.2; try to connect the cable.

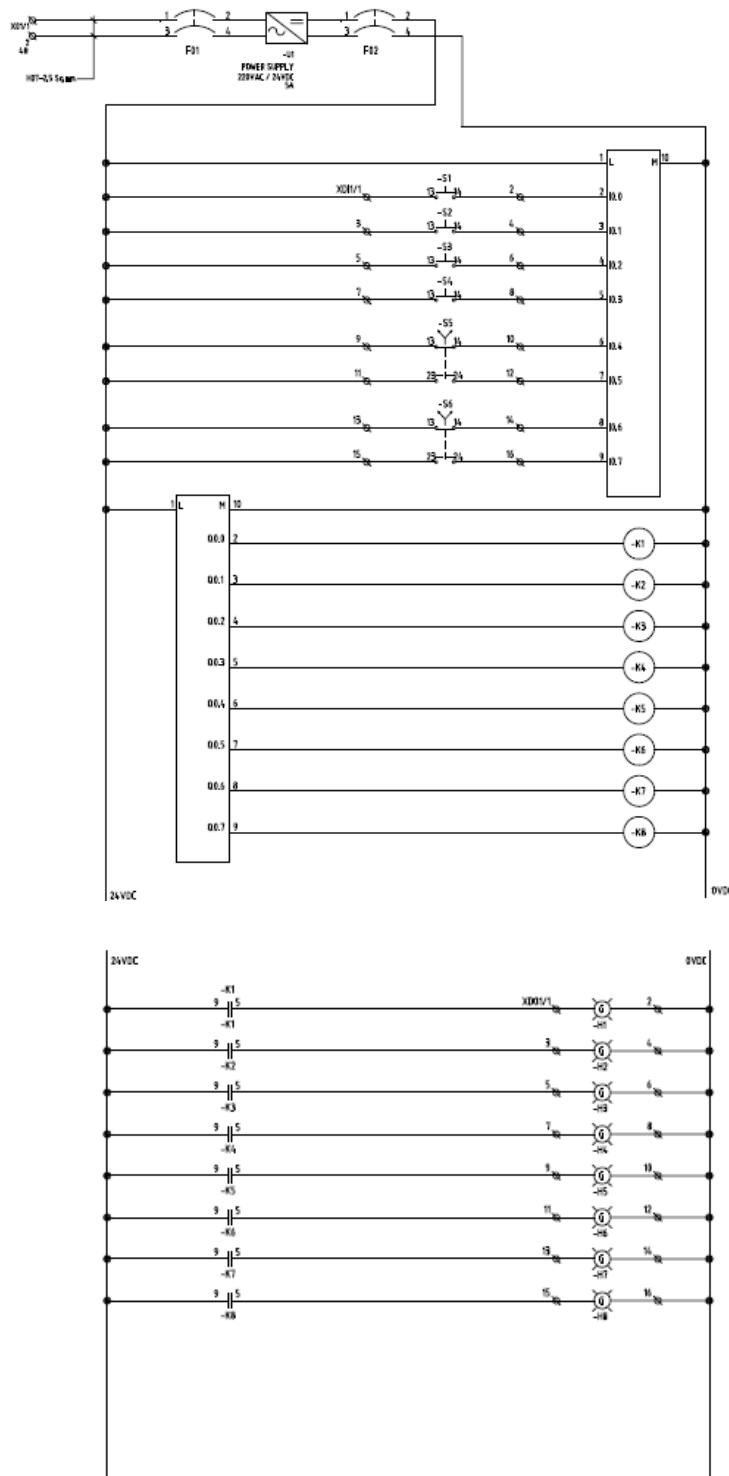


Figure 3.2 Circuit is PLC digital practices.



4. When you finish all connections, call instructor for checking.
5. Study the software manual. Set hardware configuration of PLC (VIPA CPU114-6BJ02) follows manual or instructor. (VIPA PLC can use with Siemens SIMATIC manager)
6. Create ladder program for testing circuit as shown in figure 3.3. (or create ladder program follow by your instructor recommendation)

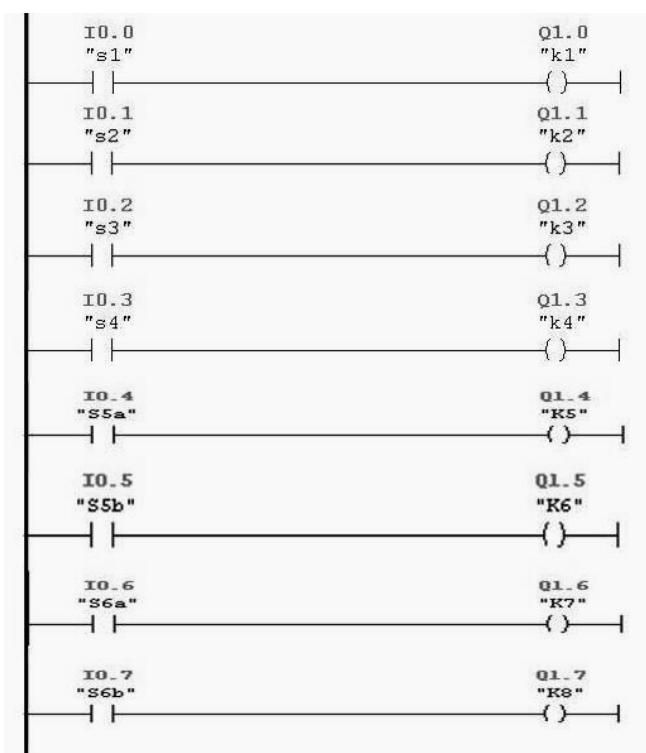
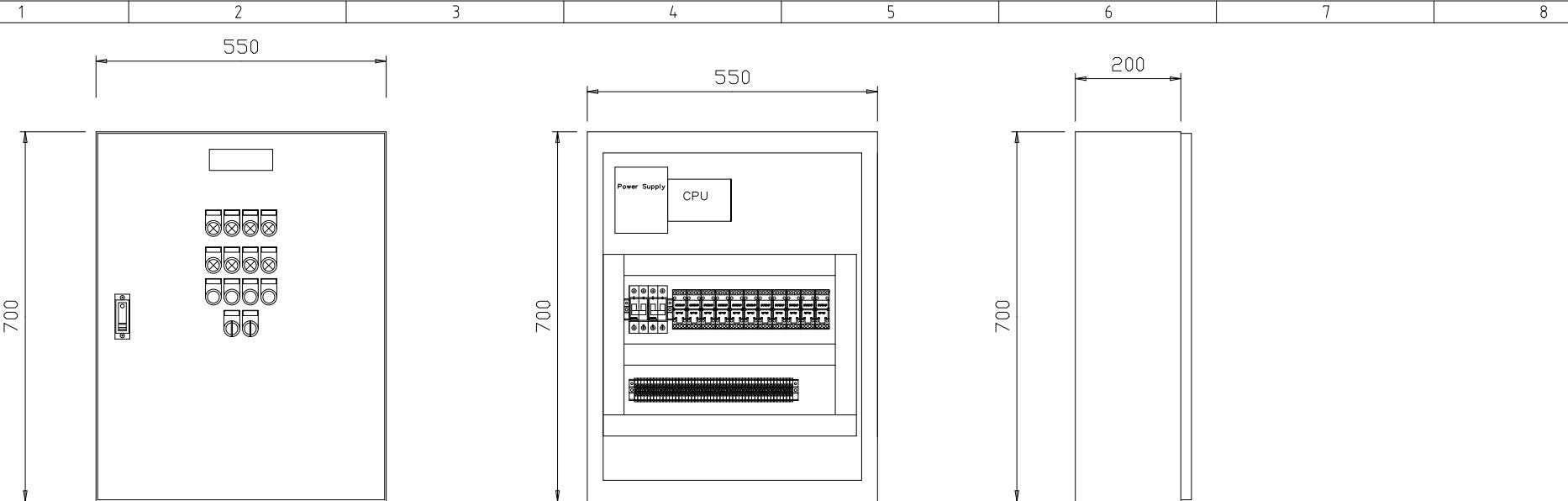


Figure 3.3 Ladder program for test circuit.

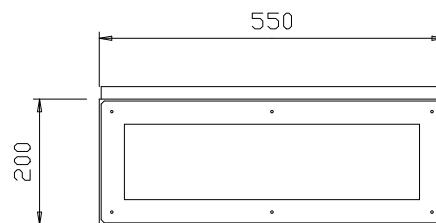
7. Connect the PC to PLC and download program. Turn on to RUN mode.
8. Test program by pushing switch (S1:I0.0) relay coil (K1:Q1.0) is “ON”. Then, check the result at output monitor, pilot lamp (H1) of circuit and output display lamp PLC is “ON”. Change to other push switch and retest (S2, S3, S4, S5a, S5b, S6a, and S6b).



FRONT VIEW

W/O FRONT COVER

SIDE VIEW



TOP&BOTTOM VIEW

CUBICLE NOTE

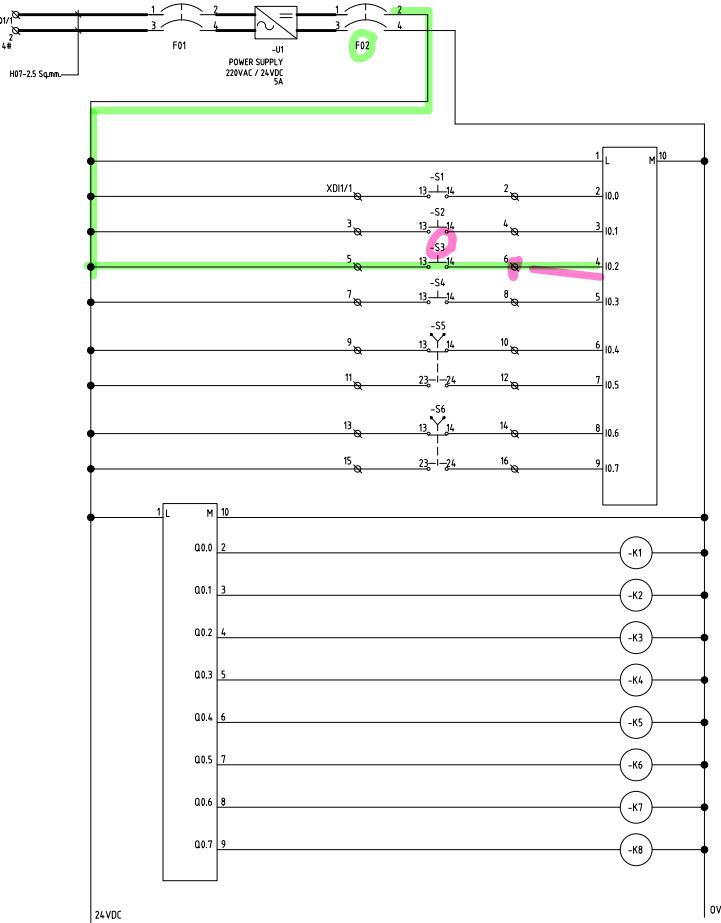
CUBICLE CONSTRUCTION

- Frame : Folded Steel sheet 1.0 mm. Thk.
- Front cover ; Steel sheet 1.0 mm. Thk.
- Top and Bottom cover : Steel Sheet 1.0 mm. Thk.
- Mounting plate : Steel sheet 1.0 mm. Thk.
- Colour of painted part , Epoxy-Polyester Powder coating
White Gray (RAL-7032)

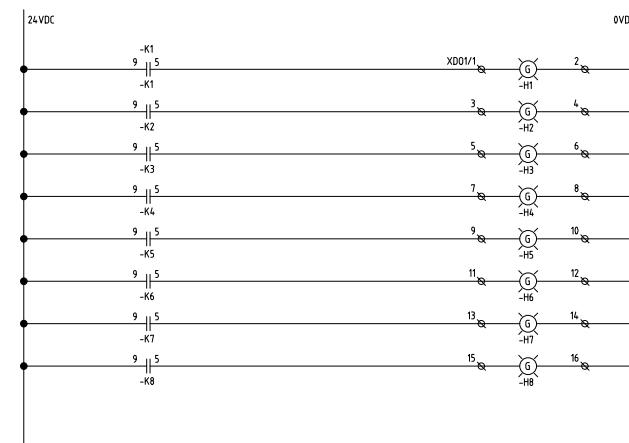
PANEL NOTE

- Indoor installation
- Wall mounting
- Degree of protection IP40

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PROJECT:	KMUTT								
TITLE:	Panel Layout for PLC Digital								
ISD-E:	Scale:	Weight:	-	Kg	Rev.	Rev.	Rev.	Rev.	Date
					A	B	C	D	
Drawn:	Rachan	1/10/2011			0	A4			
Checked:	Yongol	1/10/2011							
Approved:	-								
Project No: J11-10-001 Page No:									



TAG NO.	DESCRIPTION	TYPE	MODEL	BRAND
F01,F02	CIRCUIT BREAKER	2P MCB 6A/32AF	C60a	SCHNEIDER
U1	POWER SUPPLY	220VAC/24VDC 5A	-	CONNECTWELL
S1...S4	PUSH BUTTON	22mm 1NO CONTACT , GREEN COLOUR	XB7-EA31P	TELEMECANIQUE
S5,S6	SELECTOR SWITCH	2NO	XB7-ED33P	TELEMECANIQUE
K1..K8	CONTROL RELAY	24VDC 1C/O	-	RELEQUICK
H1..H8	PILOT LAMP	GREEN COLOUR 24V	XB7-EV03BP	TELEMECANIQUE
PLC	PLC	16DI 8DO	CPU114	VIPA



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PROJECT : KMUTT									
TITLE : Control Diagram for PLC Digital									
ISD-E :	Scale : -	Weight : -	Kg	Rev. No.	Date	Rev. A	Rev. B	Rev. C	Rev. D
Drawn : Rachan	1/10/2011			0	A4				
Checked : Yongol	1/10/2011								
Approved : -									
Project No.: J11-10-001 Page No.: 7									



Experiment Table

1. Equipment List Table

TAG NO.	DESCRITION.	TYPE	MODEL	DONE	REMARK
F01,F02	CIRCUIT BREAKER	2P MCCB 10AT/32AF 50kA	C60a	<input checked="" type="checkbox"/>
U1	POWER SUPPLY	220VAC/24VDC 2A	-	<input checked="" type="checkbox"/>
S1,S2,S3,S4	PUSH BUTTON	22mm. 1NO CONTACT GREEN COLOUR	XB7-EA31P	<input checked="" type="checkbox"/>
S5,S6	SELECTOR SWITCH	2 NO	XB7-ED33P	<input checked="" type="checkbox"/>
K1-K8	CONTROL RELAY	24VDC 1C/O	-	<input checked="" type="checkbox"/>
H1-H8	PILOT LAMP	GREEN COLOUR 24V	XB7-EV03BP	<input checked="" type="checkbox"/>
PLC	PLC	16DI 8DO	114-6BJ02	<input checked="" type="checkbox"/>

2. Tool List Table

NO	DESCRITION.	DONE	REMARK
1	TOOL BOX	<input checked="" type="checkbox"/>
2	STRIPS & CUTTING TOOL	<input checked="" type="checkbox"/>
3	CRIMPING TOOL	<input checked="" type="checkbox"/>
4	SCREWDRIVER	<input checked="" type="checkbox"/>
5	SCREWDRIVER	<input checked="" type="checkbox"/>



3. Wiring Procedure Table

NO.	PROCEDURE WIRRING	DONE	REMARK
1	Install all equipments on the panel by mounting on the plate.	<input checked="" type="checkbox"/>
2	Wiring to equipment follows circuit diagram.	<input checked="" type="checkbox"/>
3	Check the result of the wiring.	<input checked="" type="checkbox"/>

4. Circuit Test Procedure Table

NO.	PROCEDURE TEST	DONE	PILOT LAMP		REMARK
			ON	OFF	
1	Set hardware configuration of PLC (VIPA CPU114-6BJ02)	<input type="checkbox"/>		
2	Create ladder program for testing circuit	<input type="checkbox"/>		
3	Connect the PC to PLC and download program. Then turn on to RUN mode	<input type="checkbox"/>		
4	Test program by :			
	• Push switch 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 5a	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 5b	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 6a	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Push switch 6b	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Question

1. What is the specification of PLC in this LAB?

..... PLC 's type: 16DI8DO

..... model: VIPA 114~6BJ02

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2. What is the different between sourcing element and sinking element?

• Sourcing element នឹង transistor នាយក PNP ចុះវីដីអារាបេល់លាយ

..... នូវតម្លៃជាន់ដីនូវ load នៅលើ PLC

• Sinking element នឹង transistor នាយក NPN ចុះវីដីអារាបេល់លាយ

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Comment

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Summary

..... จากการทดลอง จึงได้สรุปว่า PLC จะมีวิธีการมาต้องการควบคุม -
 การห้องโถง ไม่จะรับ input digital ผ่าน sensor หรืออุปกรณ์ต่างๆ แต่จะต้อง
 • Sinking element ; ตัว transistor เป็น NPN ในการต่อวงจร
 อยู่กานต์ในตัวต่อไปนี้จะเป็นจุด load หรือ PLC ให้ต่อจังหวะ ground
 • sourcing element ; ตัว transistor เป็น PNP ในการต่อวงจร
 อยู่กานต์ที่ต้องต่อจุดที่ต้องบีบไฟจากเบลนเดอร์จ่ายไฟให้ load หรือ PLC

..... สำหรับการทดลองนี้ เราจะเรียกว่าตัวนำเข้าบากต่อ ปล่อยตัว คือ digital-
 input ไม่เชื่อมต่อ PLC มาก่อน แต่ PLC จะส่ง output ผ่านตัวต่อ digital output
 ไปยัง relay ที่ต่อไปดูแล้วมีการติดต่อ รีเลย์ lamp ให้ลักษณะตัวต่อตัวกันตัว
 หรือต่อตัวกันตัวกัน ตามที่ผู้ใช้งานจะต้องการจะเข้าไป



LABORATORY 4: PLC Analog Practices.

Objective

- 1) To understand wiring of analog device to PLC.
- 2) To understand the wiring of 2-wires, 4-wires transmitter and RTD.
- 3) To learn about diagram symbols.
- 4) To practice of wiring skill and reading wiring diagram.
- 5) To assembly loop current Calibrator.

Equipment

TAG NO.	DESCRIPTION.	TYPE	MODEL	BRAND
F01,F02	CIRCUIT BREAKER	2P MCCB 10AT/32AF 50kA,	C60a	SCHNEIDER
U1	POWER SUPPLY	220VAC/24VDC 2A	-	CONNECTWELL
P1,P2	transmitter LOOP CURRENT CALIBRATOR	LOOP CURRENT CALIBRATOR	LC-95	WISCO
PLC	PLC: WITH SHARE LAB 3 DIGITAL PRACTICE	16DI 8DO	114-6BJ02	VIPA
ANALOG EXPANSION	VIPA ANALOG EXPANSION MODULE EM134	ANALOG EXPANSION MODULE EM134	134-4EE00	VIPA
B1	RTD : Sensor à temp.	-	-	-



Test Procedure

1. Study the equipments manual of PLC (VIPA 114-6BJ02), VIPA ANALOG EXPANSION MODULE (EM134-4EE00), Loop current calibrator (LC-95) and RTD.
2. Study the installation equipments, drawing (panel, wire duct and din rail) and install all the equipments on the panel by mounting on the plate (follow by panel layout) as shown in figure 4.1.

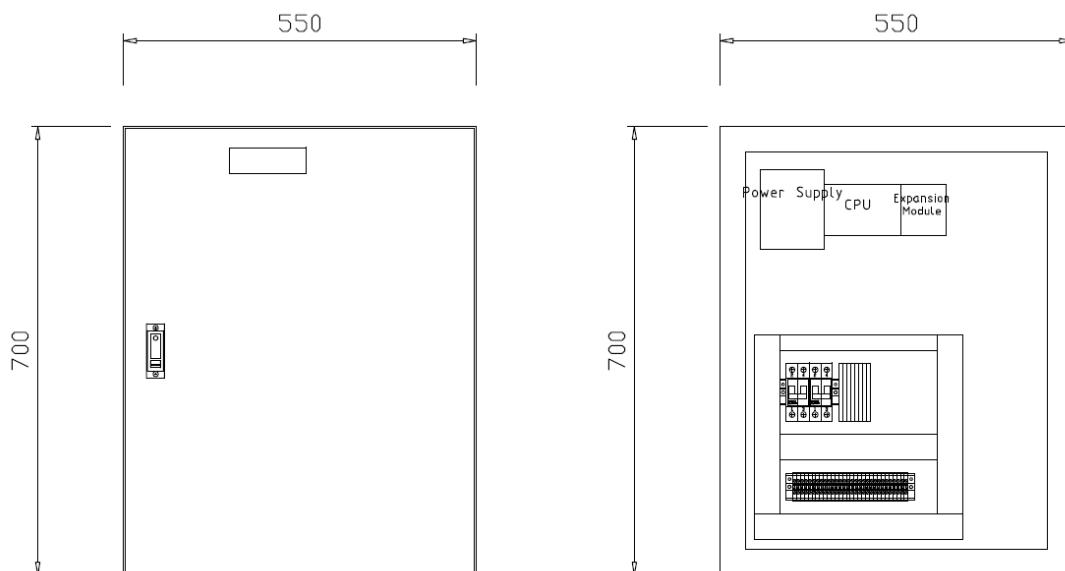


Figure 4.1 Front views and w/o front cover of PLC analog practices



3. Study the circuit diagram as shown in figure 4.2; try to connect the cable.

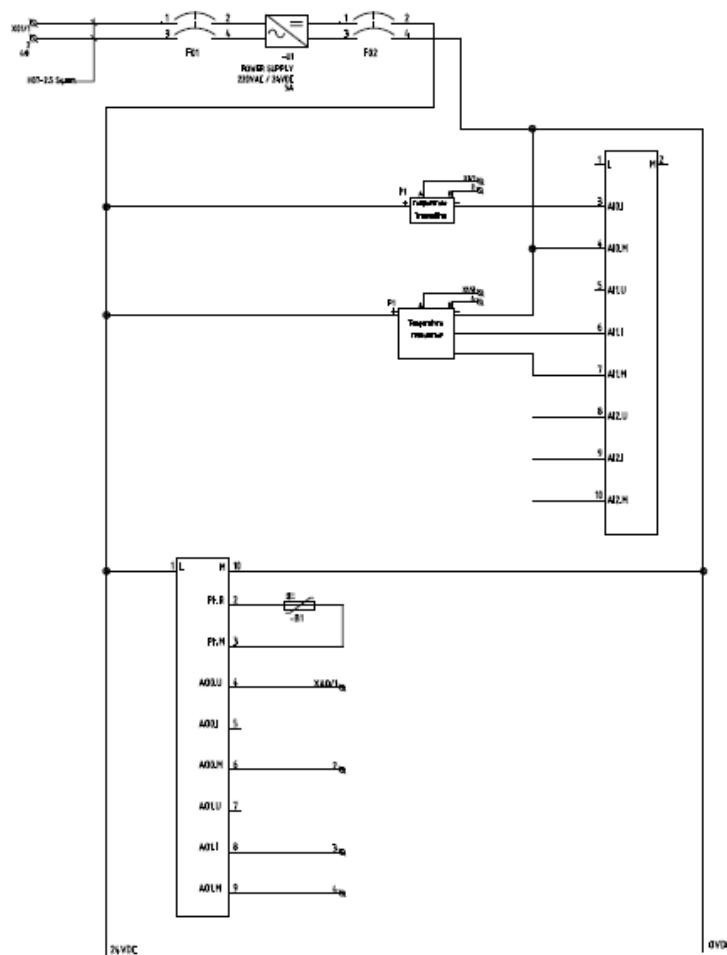


Figure 4.2 Circuit is analog practices.

4. When you finish all connections, call instructor for checking.
5. Study the software manual. Set hardware configuration of PLC VIPA ANALOG EXPANSION MODULE (EM134-4EE00) follows manual or your instructor. (VIPA PLC can use with Siemens SIMATIC manager)



6. Create ladder program for testing circuit as shown in figure 4.3. (or create ladder program follow by your instructor recommendation)

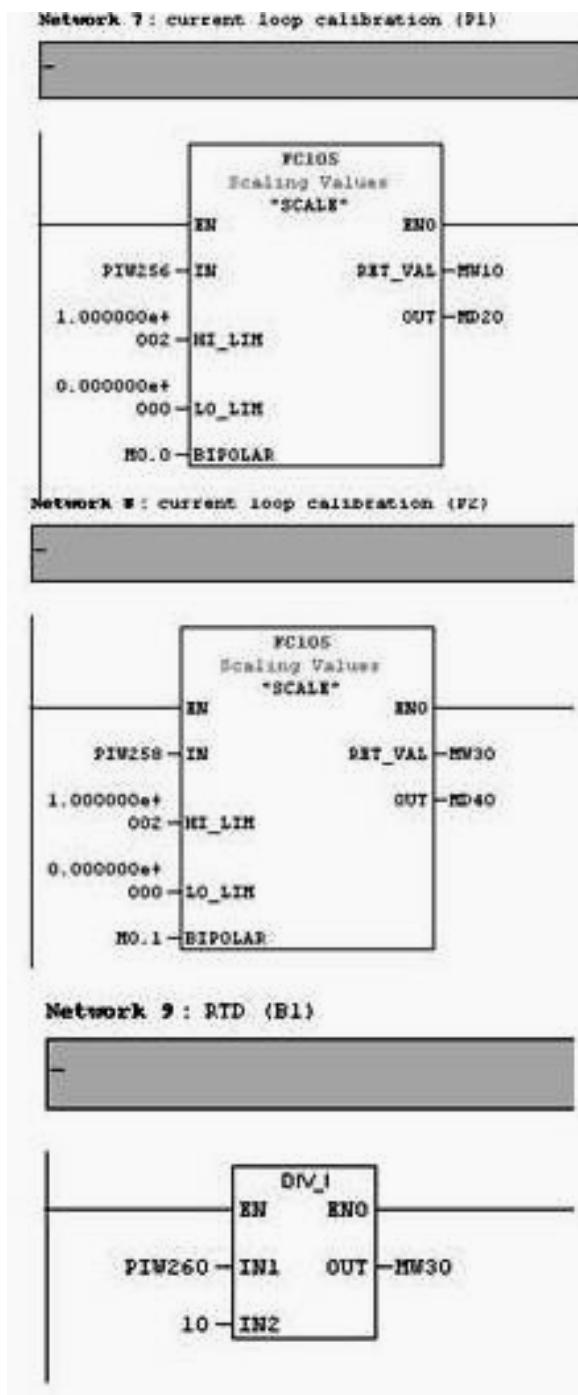


Figure 4.3 Ladder program for test circuit.



7. Conversions current table measuring range 4-20 mA as shown in figure 4.4, table conversions voltage measuring (1-5 V) as shown in figure 4.5 and table conversions resistance as show in figure 4.6.

Formulas for the conversion:

$$Value = 27648 \cdot \frac{I - 4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4 \quad I: \text{current, Value: decimal value}$$

4...20mA	dez.	hex.	Range
> 22.81mA	32767	7FFFh	Overflow
22.81mA	32511	7EFFh	Overdrive range
:	:	:	
20mA	27648	6C00h	Nominal range
:	:	:	
4mA	0	0	
:	:	:	Underdrive range
1.185mA	-4864	ED00h	
< 1.185mA	-32768	8000h	Underflow

Figure 4.4 Table conversions current measuring rang 4...20 mA.

Formulas for the conversion:

$$Value = 27648 \cdot \frac{U - 1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1 \quad U: \text{voltage, Value: decimal value}$$

1...5V	dez.	hex.	Range
> 5,704V	32767	7FFFh	Overflow
5,704V	32511	7EFFh	Overdrive range
:	:	:	
5V	27648	6C00h	Nominal range
:	:	:	
1V	0	0	
:	:	:	Nominal range
-0,296V	-4864	ED00h	
< -0,296V	-32768	8000h	Underflow

Figure 4.5 Table conversions voltage measuring 1-5 V

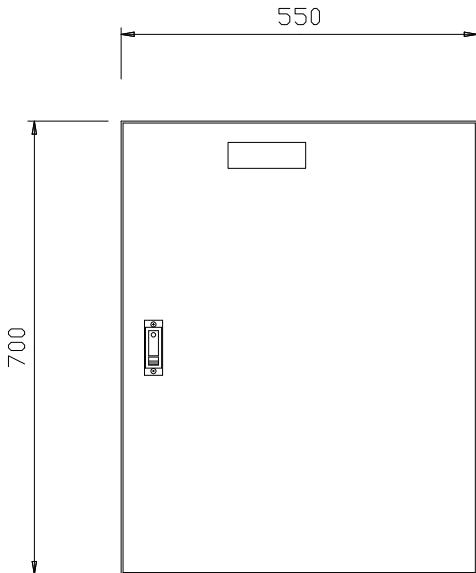


Resistance thermometer	With Pt100, Pt1000 or Ni100, Ni1000 the temperature is directly shown with the adjusted unit. Here applies: 1 Digit = 0.1 temperature unit.			
Measuring range	in °C (1digit=0,1°C)	Unit		Range
		dez.	hex.	
	>1000,0	32767	7FFFh	Overflow
	1000,0	10000	2710h	Overdrive range
	.	.	.	
	.	.	.	
Pt100, Pt1000 standard	850,0	8500	2134h	Nominal range
	
	-200,0	-2000	F830h	
	.	.	.	Underdrive range
	.	.	.	
	-243,0	-2430	F682h	
	< -243,0	-32768	8000h	Underflow

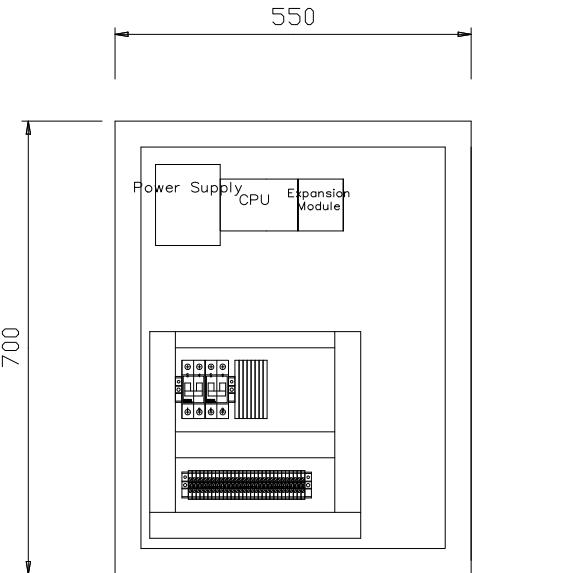
Figure 4.6 Table conversions resistance thermometer.

8. Connect the PC to PLC and download program. Then turn on to RUN mode.
9. Test program by simulating (P1) current loop calibration (LC-95) 2 wire type with standard scaling block (FC105) of step7 program. Input signal (PIW256) will convert current value (4-20 mA) to decimal value as shown in figure 4.4. Check output (MD20). The voltage measuring also use by converting voltage value (step 1-5 V) to decimal value as shown in figure 4.5
10. Simulate RTD (B1:Pt.R) signal input (PIW260) to standard integer function block (DIV_I) of step7 program. It will convert temperature value to decimal value as show in figure 4.6. Check output (MW30).
11. Retest step 9 and step 10 by using current loop calibration (LC-95) 4 wire type and RTD.

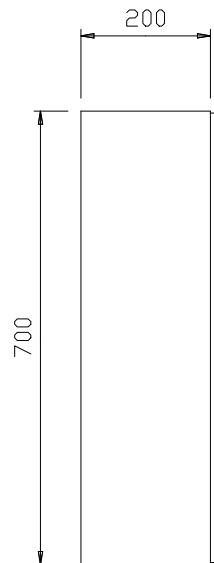
1 2 3 4 5 6 7 8



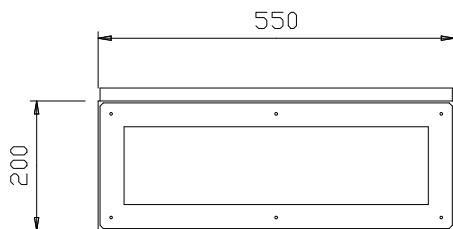
FRONT VIEW



W/O FRONT COVER



SIDE VIEW



TOP&BOTTOM VIEW

CUBICLE NOTE

CUBICLE CONSTRUCTION

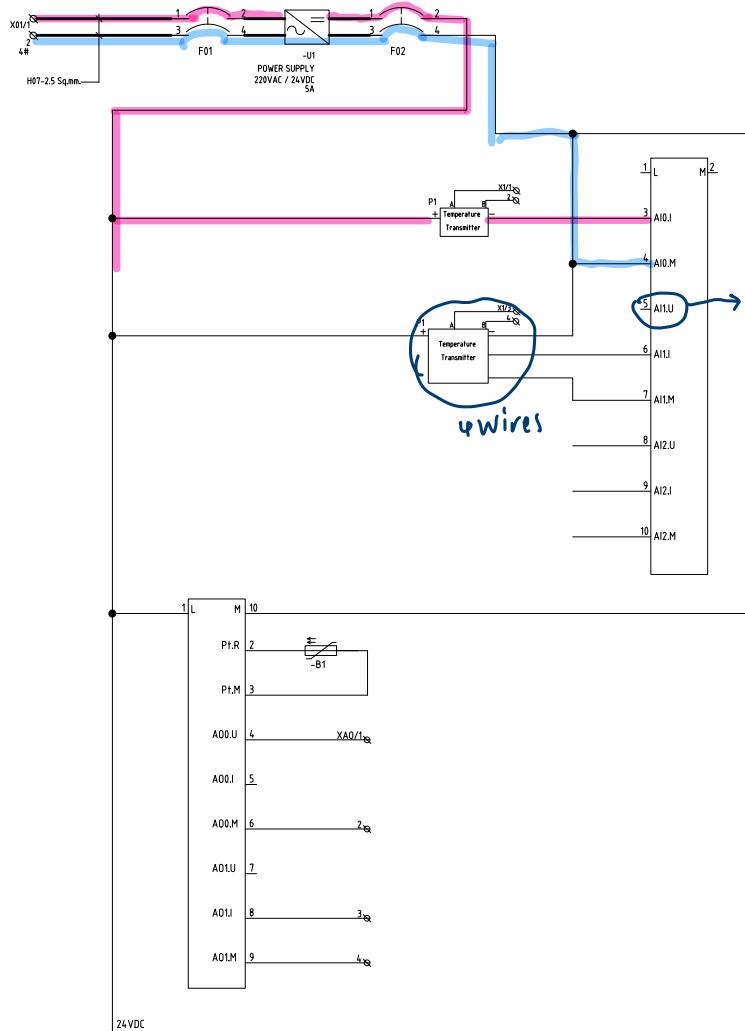
- Frame : Folded Steel sheet 1.0 mm. Thk.
- Front cover ; Steel sheet 1.0 mm. Thk.
- Top and Bottom cover : Steel Sheet 1.0 mm. Thk.
- Mounting plate : Steel sheet 1.0 mm. Thk.
- Colour of painted part , Epoxy-Polyester Powder coating
White Gray (RAL-7032)

PANEL NOTE

- Indoor installation
- Wall mounting
- Degree of protection IP40

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OWNER: TROPICALTECH CO.,LTD. PLANT: KMUTT										
PROJECT: KMUTT										
TITLE: Panel Layout for PLC Analog										
ISO-E:	Scale:	Weight:	kg	Rev:	Name:	Date:				
	-	-	-	A						
drawn:	Rochan	1/10/2011	0	A4						
checked:	Yongjet	1/10/2011	B							
approved:	-	-	C							
			D							
Project No.: J11-10-001 Page no:										

1 2 3 4 5 6 7 8



TAG NO.	DESCRIPTION	TYPE	MODEL	BRAND
F01,F02	CIRCUIT BREAKER	2P MCB 6A/32AF	C60a	SCHNEIDER
U1	POWER SUPPLY	220VAC/24VDC 5A	-	CONNECTWELL
P1,P2	TRANSMITTER	TEMPERATURE	-	-
PLC	PLC	16DI 8DO	CPU114	VIPA

1074-57899
(4-20mA)

ມໍານວຍກ່າງ
(4 wires)

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OWNER: PLANT:									
PROJECT: TROPICALTECH CO.,LTD. LAB									
TITLE: Control Diagram for PLC Analog									
ISO-E:		Scale:	Weight:	kg	Rev:	Form:	Rev:	Name:	Date:
		—	—	—	0	A4	—	—	—
drawn:	Rochan	1/10/2011	checked:	Yongset	1/10/2011	Project No.:	J11-10-001	Page no:	—
approved:	—	—	—	—	—	C	—	—	
—	—	—	—	—	D	—	—	—	



Experiment Table

1. Equipment List Table

TAG NO.	DESCRITION.	TYPE	MODEL	DONE	REMARK
F01,F02	CIRCUIT BREAKER	2P MCCB 10AT/32AF 50kA,	C60a	<input checked="" type="checkbox"/>
U1	POWER SUPPLY	220VAC/24VDC 2A	-	<input checked="" type="checkbox"/>
P1,P2	LOOP CURRENT CALIBRATOR	LOOP CURRENT CALIBRATOR	LC-95	<input checked="" type="checkbox"/>
PLC	PLC: WITH SHARE LAB 3 DIGITAL PRACTICE	16DI 8DO	114-6BJ02	<input checked="" type="checkbox"/>
ANALOG EXPANSION	VIPA ANALOG EXPANSION MODULE EM134	ANALOG EXPANSION MODULE EM134	134-4EE00	<input checked="" type="checkbox"/>
B1	RTD	-	-	<input checked="" type="checkbox"/>

2. Tool List Table

NO	DESCRITION.	DONE	REMARK
1	TOOL BOX	<input checked="" type="checkbox"/>
2	STRIPS & CUTTING TOOL	<input checked="" type="checkbox"/>
3	CRIMPING TOOL	<input checked="" type="checkbox"/>
4	SCREWDRIVER	<input checked="" type="checkbox"/>
5	SCREWDRIVER	<input checked="" type="checkbox"/>



3. Wiring Procedure Table

NO.	PROCEDURE WIRRING	DONE	REMARK
1	Install all equipments on the panel by mounting on the plate	<input checked="" type="checkbox"/>
2	Wiring to equipment follow circuit diagram.	<input checked="" type="checkbox"/>
3	Check the result of the wiring	<input checked="" type="checkbox"/>

4. Procedure Test Circuit

NO.	PROCEDURE TEST	DONE	RESULT	REMARK
1	Set hardware configuration of PLC (VIPA CPU114-6BJ02) and Analog expansion module (EM134-4EE00)	<input type="checkbox"/>
2	Create ladder program for test circuit	<input type="checkbox"/>
3	Connect the PC to PLC and download program, then turn on to RUN mode	<input type="checkbox"/>
4	Test program by simulate step current loop calibrator and use standard scaling block FC105 for scaling signal to 0-100 and write the result.	<input type="checkbox"/>
	• Step 0%	<input type="checkbox"/>
	• Step 25%	<input type="checkbox"/>
	• Step 50%	<input type="checkbox"/>
	• Step 75%	<input type="checkbox"/>
	• Step 100%	<input type="checkbox"/>
5	Test program by RTD	<input type="checkbox"/>



Question

1. What is the specification of expansion module in this LAB?

.....specification >> VIPA 134-4FF00 .
 • 3xAI / 1xAI Pt, Ni, R / 2xAD with 12 bit

.....

2. What different of signal between 4 wire connection and 2 wire connection?

..... • 4.wire.connection តួនាទីទូទៅ supply នៅរាជ. ហើយខ្លួនឯងត្រូវបាន transmitter
 • 2.wire.connection តួនាទីទូទៅ ត្រូវបាន ប្រើប្រាស់លើទូទៅ ដូចជាកំណើនព័ត៌មានទូទៅ supply ឬផ្លូវ.

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Comment

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Summary

..... រាយការណ៍គម្រើនទិន្នន័យ PLC analog . នាំវាទីនុញ្ញនៃអេន្វោល . Sensor រីល breaker ..
..... និង transmitter . និងចូលរឿងក្នុងអេន្វោល ដើម្បីអាជីវកិច្ចការប្រព័ន្ធផែនក្នុងក្រុងផ្លូវ ..
..... និងតាមការប្រើប្រាស់ក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .
..... ស្តីពីការប្រើប្រាស់ក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .
..... ស្តីពីការប្រើប្រាស់ក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .
..... និងក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .
..... និងក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .
..... និងក្នុងក្រុងផ្លូវ . និងក្នុងក្រុងផ្លូវ .