LAMPIRAN

Lampiran 1 : Spesifikasi Umum VFD 3G3MX2-V1 *series*

Item		Specifications
Enclosure rating*1		Open type (IP20)
Control	Control method	Phase-to-phase sinusoidal modulation PWM
	Output frequency range*2	0.01 to 400 Hz
	Frequency precision*3	Digital command: ±0.01% of the maximum frequency, Analog command: ±0.2% of the maximum frequency (25±10°C)
	Frequency setting resolution	Digital setting: 0.01 Hz, Analog setting: Maximum frequency × 1/1000
	Voltage/Frequency characteristics	V/f characteristics (constant torque, reduced torque) Sensorless vector control, V/f control with speed feedback
	Overload current rating of inverter	Heavy load rating (CT): 150%/60 s Light load rating (VT): 120%/60 s
	Instantaneous overcurrent protection	200% of heavy load rating (CT) value
	Acceleration/ Deceleration time	0.00 to 3600 s (line/curve arbitrary setting), 2nd acceleration/deceleration setting provided
	Carrier frequency change range	2 to 15 kHz (Derating required)
	Starting torque	200%/0.5 Hz (Sensorless vector control)
	DC injection braking	Operates at operating frequency or less during deceleration via STOP command, at set frequency or less during operation, or via external input (level and time can be set).
Protective function		Overcurrent, Overvoltage, Undervoltage, Electronic thermal, Temperature error, Ground-fault current at power-on, Inrush current protection circuit, Overload limit, Incoming overvoltage, External trip, Memory error, CPU error, USP error, Communication error, Overvoltage suppression during deceleration, Power interruption protection, Emergency shutoff, etc.
Input signal	Frequency settings	Digital Operator External analog input signal (variable resistor/0 to 10 VDC/4 to 20 mA), Modbus communication
	RUN/STOP command	Digital Operator External digital input signal (3-wire input available), Modbus communication
	Multi-function Input*4	7 points (Functions can be selected from among 68)
	Analog input*5	2 points (FV terminal for voltage: 10 bits/0 to 10 V, FI terminal for current: 10 bits/4 to 20 mA)
	Pulse input	1 point (RP terminal: 32 kHz max., 5 to 24 VDC)
Output signal	Multi-function output*4	2 points (P1 and P2, Functions can be selected from among 47)
	Relay output*4	1 point (SPDT contact (MC, MA, MB), Functions can be selected from among 47)
	Analog output (Frequency monitor)*6	1 point (AM terminal: 10 bits for voltage, 0 to 10 V) (Frequency or current can be selected)
	Pulse output	1 point (MP terminal: 32 kHz max., 0 to 10 V)
Communications	RS-422	RJ45 connector (for Digital Operator)
	RS-485	Control circuit terminal, Modbus communication
	USB	USB1.1, mini-B connector

Lampiran 2: Spesifikasi Komunikasi Modbus VFD 3G3MX2-V1 *series*

Item	Description	Remarks
Protocol	Modbus communication (Slave)	
Transmission speed	2,400, 4,800, 9,600, 19.2 k, 38.4 k, 57.6 k, 76.8 k, 115.2 kbps	Selectable via parameter
Synchronous system	Start-stop synchronous system	
Transmission code	Binary	
Transmission mode	LSB first (Transmission starts with Least Significant Bit)	
Compatible interface	RS485	
Data bit length	8 bits	
Parity	No/Even/Odd	Selectable via parameter
Stop bit length	1 or 2 bits	Selectable via parameter
Startup method	One-side start by host command	-
Wait time	Silent Interval 0 to 1,000 [ms]	Selectable via parameter
Connection form	1: N (N = 247 max.) (32 units max. connectable without repeaters)	Selectable via parameter
Error check	Overrun/Framing/CRC-16/Horizontal parity	
Communications cable length	500 m	

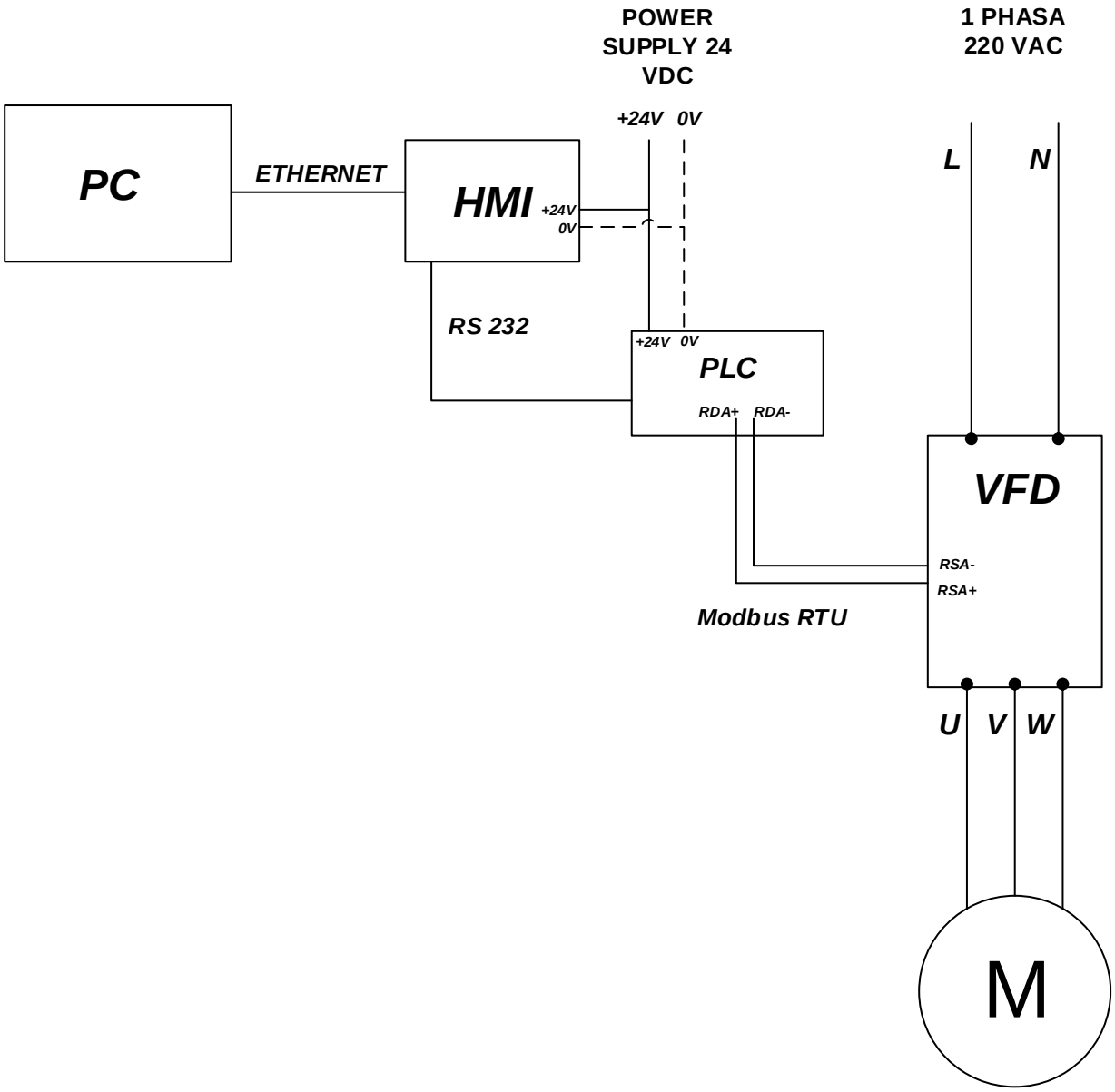
Lampiran 3 : Spesifikasi Umum CP1E-N30DT-D

Item		Description
Supply voltage		24 VDC
Operating voltage range		20.4 to 26.4 VDC
Power Consumption		20 W max
Power off detection		2 ms min
Ambient operating temperature		0 to 55 °C
Ambient humidity		10% to 90%
Ambient storage temperature		-20 to 75 °C (excluding battery)
Altitude		2,000 m max.
Pollution degree		2 or less: Conforms to JIS B3502 and IEC 61131-2.
Noise resistance		2 kV on power supply line (Conforms to IEC61000-4-4.)
Overvoltage category		Category II: Conforms to JIS B3502 and IEC 61131-2.
EMC immunity level		Zone B
Grounding method		Ground to 100 Ω or less.
Program capacity		8 K steps (32 Kbytes) including the symbol table,
		comments, and program indices of the CX-Programmer
Control method		Stored program method
I/O control method		Cyclic scan with immediate refreshing
Program language		Ladder diagram
Instructions		Approximately 200
Processing speed	**Overhead processing time**	0.4 ms
	instruction execution times	Basic instructions (LD): 1.19 μs min.
		Special instructions (MOV): 7.9 μs min.
Number of CP1W-series Expansion Units connected		3 units
Built-in RS-232C port		150 (30 built in, 40 × 3 expansion)
		30 (18 inputs, 12 outputs)
	Communications method	Half duplex
	synchronization	Start-stop
	Baud rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, or 115.2 kbps
	Supported rotocol	• Host Link
		• 1:N NT Link
		• No-protocol mode
		• Serial PLC Links (master, slave)
		• Modbus-RTU Easy Master
Serial Option port	**Mountable Option Boards**	• One RS-232C port: CP1W-CIF01
		• One RS-422A/485 port (not isolated): CP1W-CIF11
		• One RS-422A/485 port (isolated): CP1W-CIF12
		• One Ethernet port: CP1W-CIF41
Serial Option port	**Communications method**	Depends on Option Board.
	synchronization	Depends on Option Board.
	Baud rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, or 115.2 kbps
	Compatible protocols	• Host Link
		• 1:N NT Link
		• No-protocol mode
		• Serial PLC Links (master, slave)
		• Modbus-RTU Easy Master
Memory backup	**Built-in EEPROM**	Ladder programs and parameters are automatically saved to built-in EEPROM
		A section of the Data Memory Area can be saved to the built-in EEPROM.
Memory backup	**Battery backup With**	CP1W-BAT01 can be used.
	CP1W-BAT01 Battery	Maximum battery service life: 5 years
	(Sold separately)	Backup Time
CIO Area	**Input Bits**	1,600 bits (100 words): CIO 0.00 to CIO 99.15 (CIO 00 to CIO 99)
	Output Bits	1,600 bits (100 words): CIO 100.00 to CIO 199.15 (CIO 100 to CIO 199)
	Serial PLC Link Words	1,440 bits (90 words): CIO 200.00 to CIO 289.15 (words CIO 200 to CIO 289)
Work Area (W)		1,600 bits (100 words): W0.00 to W99.15 (W0 to W99)
Holding Area (H)		800 bits (50 words): H0.00 to H49.15 (H0 to H49)
Auxiliary Area (A)		Read-only: 7,168 bits (448 words) A0 to A447
		Read/write: 4,896 bits (306 words) in words A448 to A753
Temporary Relay Area (TR) (TR Area)		16 bits: TR0 to TR15
Timer Area (T)		256 timer numbers (T0 to T255 (separate from counters))
Counter Area (C)		256 counter numbers (C0 to C255 (separate from timers))
Data Memory Area (D)		8 Kwords: D0 to D8191 Of these, 7,000 words can be saved to the backup
		memory (built-in EEP-ROM) using settings in the
		Auxiliary Area

Lampiran 4 : Spesifikasi Umum HMI NB10W-TW01B

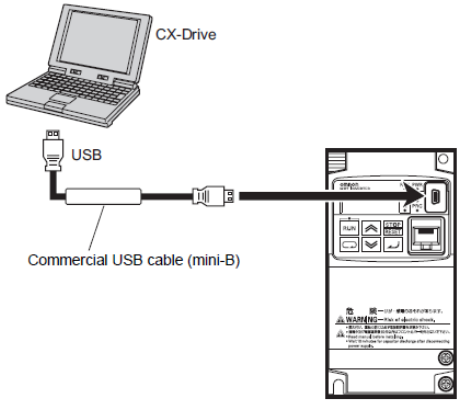
Item	Description
Display type	10.1" TFT LCD
Display resolution (H × V)	800 × 480
Number of colors	65536
Backlight	LED
Backlight lifetime	50,000 hours
Touch panel	1 million touch operations
Dimensions in mm (H × W × D)	210.8 × 268.8 × 54.0
Internal memory	128 MB (including system area)
Serial (COM1)	RS-232C,
	Transmission distance: 15 m Max.,
	Connector: D-Sub 9-pin
Serial (COM2)	RS-232C/422A/485 (not isolated),
	Transmission distance: 15 m Max. (RS-232C),
	500 m Max. (RS-422A/485),
	Connector: D-Sub 9-pin
USB Host	Equivalent to USB 2.0 full speed, type A, Output power 5 V, 150 mA
USB Slave	Equivalent to USB 2.0 full speed, type B, Transmission distance: 5 m
Printer connection	PictBridge support
Ethernet	10/100 base-T
Line voltage	20.4 to 27.6 VDC (24 VDC −15 to 15%)
Power consumption	14 W
Battery lifetime	5 years (at 25°C)

Lampiran 5 : Wiring Diagram



Lampiran 6 : Pengaturan VFD

Buka CX-Drive lalu klik *New*, pilih tipe VFD sesuai dengan tipe yang digunakan. Sambungkan PC dengan VFD, untuk koneksinya menggunakan kabel USB (*mini*-B). Terlihat seperti gambar berikut:

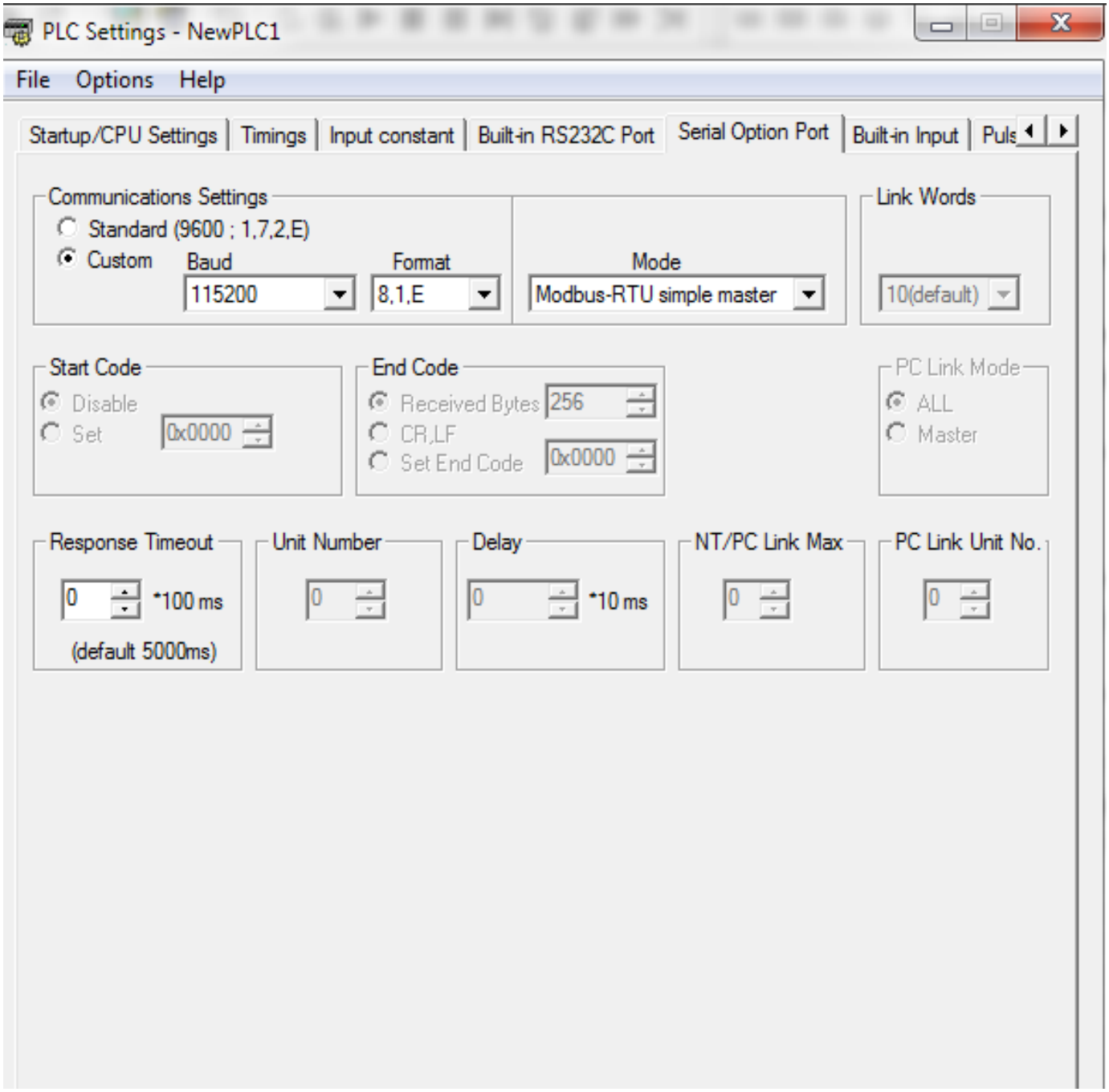


Parameter yang di atur untuk aplikasi ini adalah sebagai berikut:

No	Parameter	Setting
1	A001 (Frequency Reference Selection 1)	03 (Modbus Communication)
2	A002 (run command selection 1)	03 (Modbus Communication)
3	C071 (Communication Speed Selection / Baud Rate Selection)	10 (115200 bps)
4	C072 (Communication Station No. Selection)	1
5	C074 (Communication Parity Selection)	1 (Even Parity)

Dan untuk parameter yang lainnya sesuai dengan *Default* atau menurut pengaturan dari Omron. Simpan, klik ikon *Work Online*, lalu klik ikon *Transfer to Drive*.

Lampiran 7 : Pengaturan *Serial Option port*

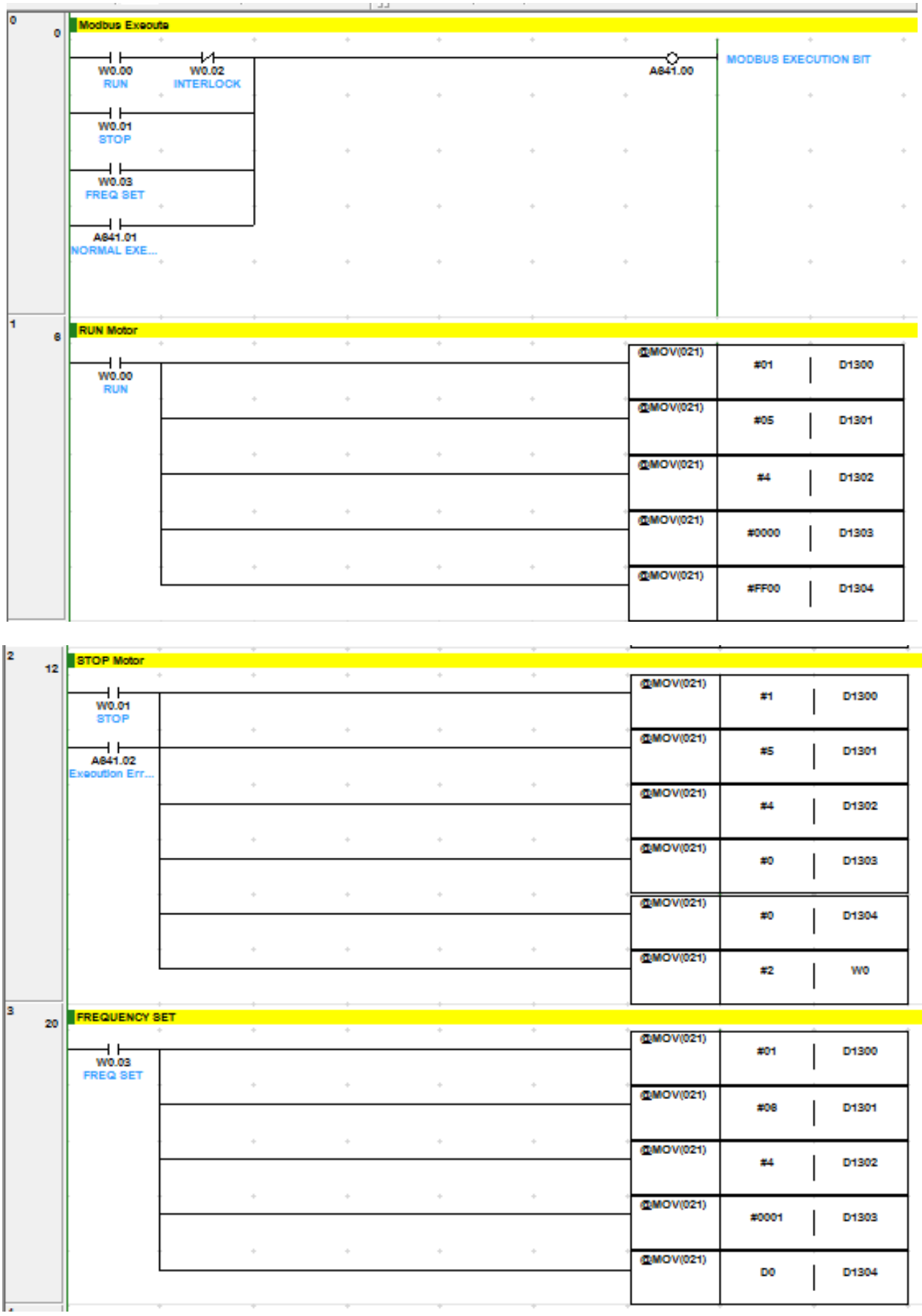


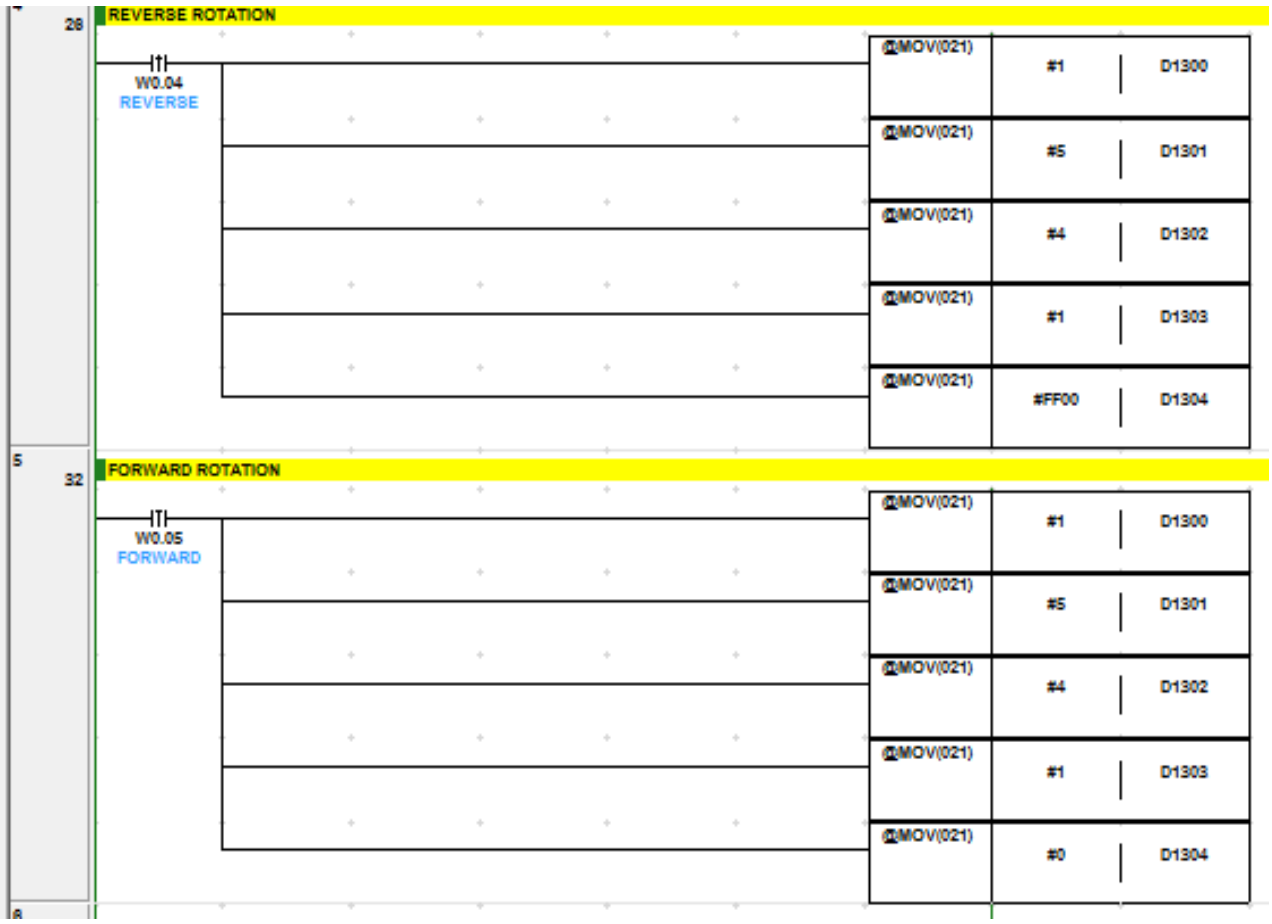
Lampiran 8 : *Error Code* pada *Response Message*

● Error Codes

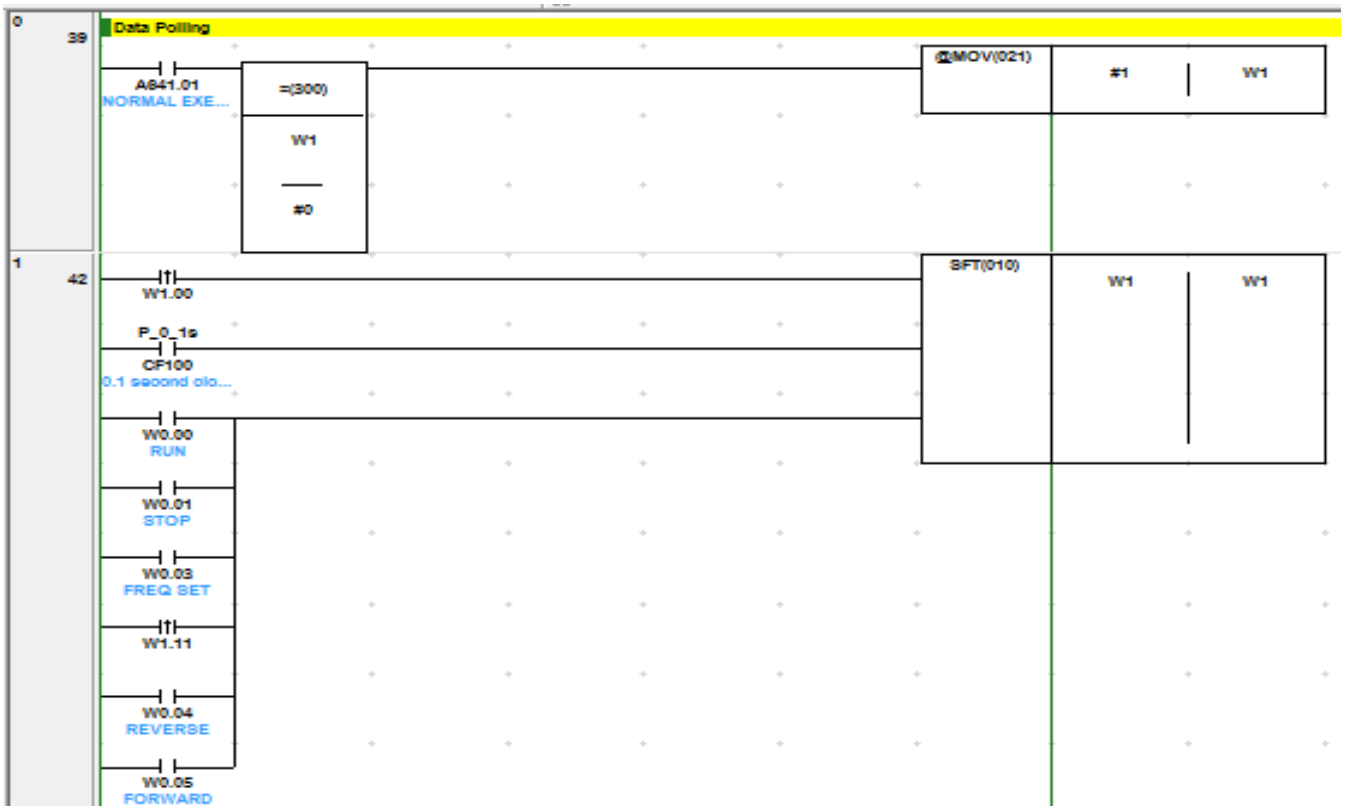
Code	Description	Description
00 hex	Normal end	–
01 hex	Illegal address	The slave address specified in the parameter is illegal (248 or higher).
02 hex	Illegal function code	The function code specified in the parameter is illegal.
03 hex	Data length overflow	There are more than 94 data bytes.
04 hex	Serial communications mode error	The Modbus-RTU Easy Master function was executed when the serial communications mode was not the Modbus-RTU Easy Master Mode or when the option board is not equipped.
80 hex	Response timeout	A response was not received from the slave.
81 hex	Parity error	A parity error occurred.
82 hex	Framing error	A framing error occurred.
83 hex	Overrun error	An overrun error occurred.
84 hex	CRC error	A CRC error occurred.
85 hex	Incorrect confirmation address	The slave address in the response is different from the one in the request.
86 hex	Incorrect confirmation function code	The function code in the response is different from the one in the request.
87 hex	Response size overflow	The response frame is larger than the storage area (92 bytes).
88 hex	Exception response	An exception response was received from the slave.
89 hex	Service being executed	A service is already being executed (reception traffic congestion).
8A hex	Execution canceled	Executing the service has been canceled.
8F hex	Other error	Other FINS response code was received.

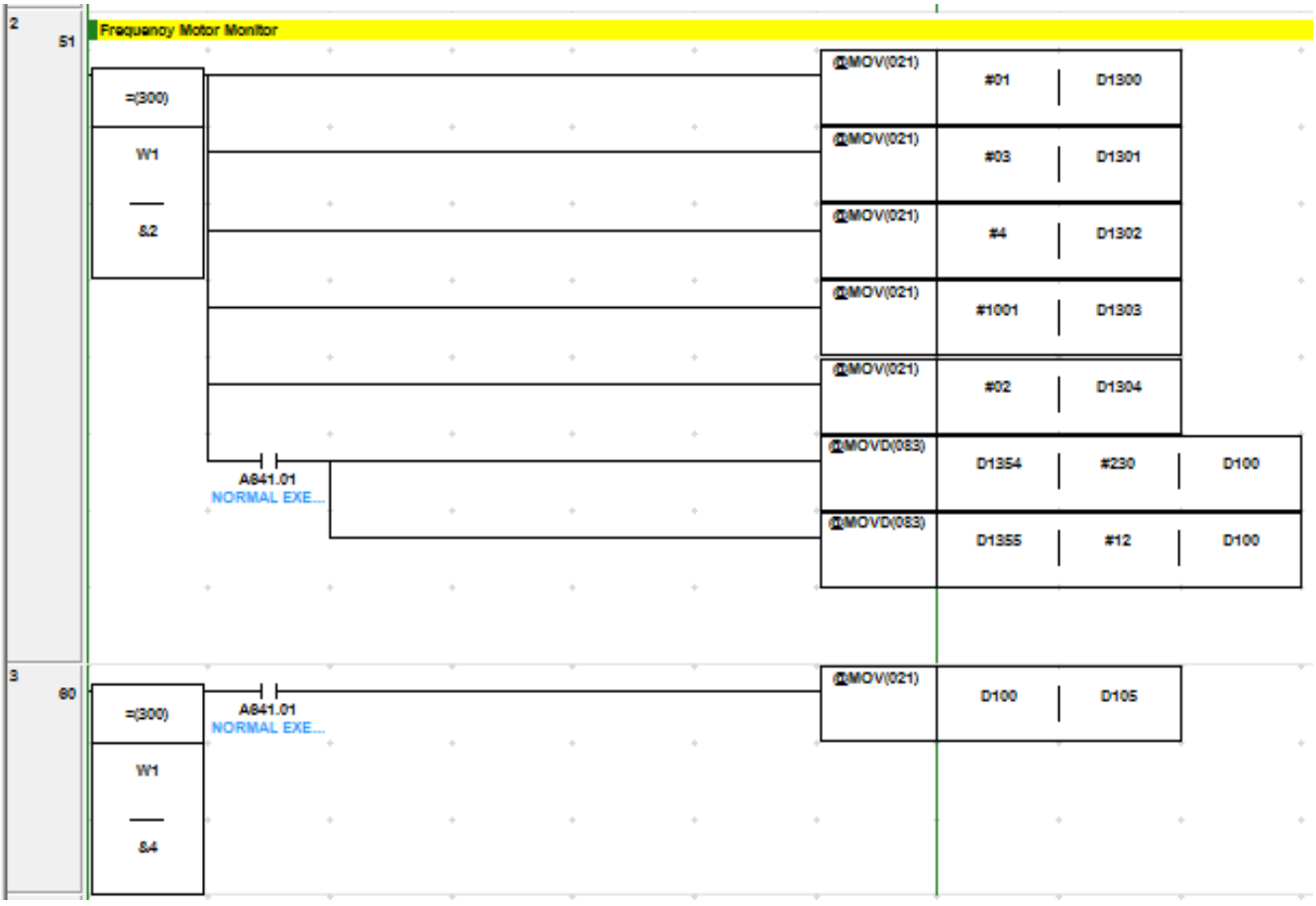
Lampiran 9 : *Operation Program* PLC

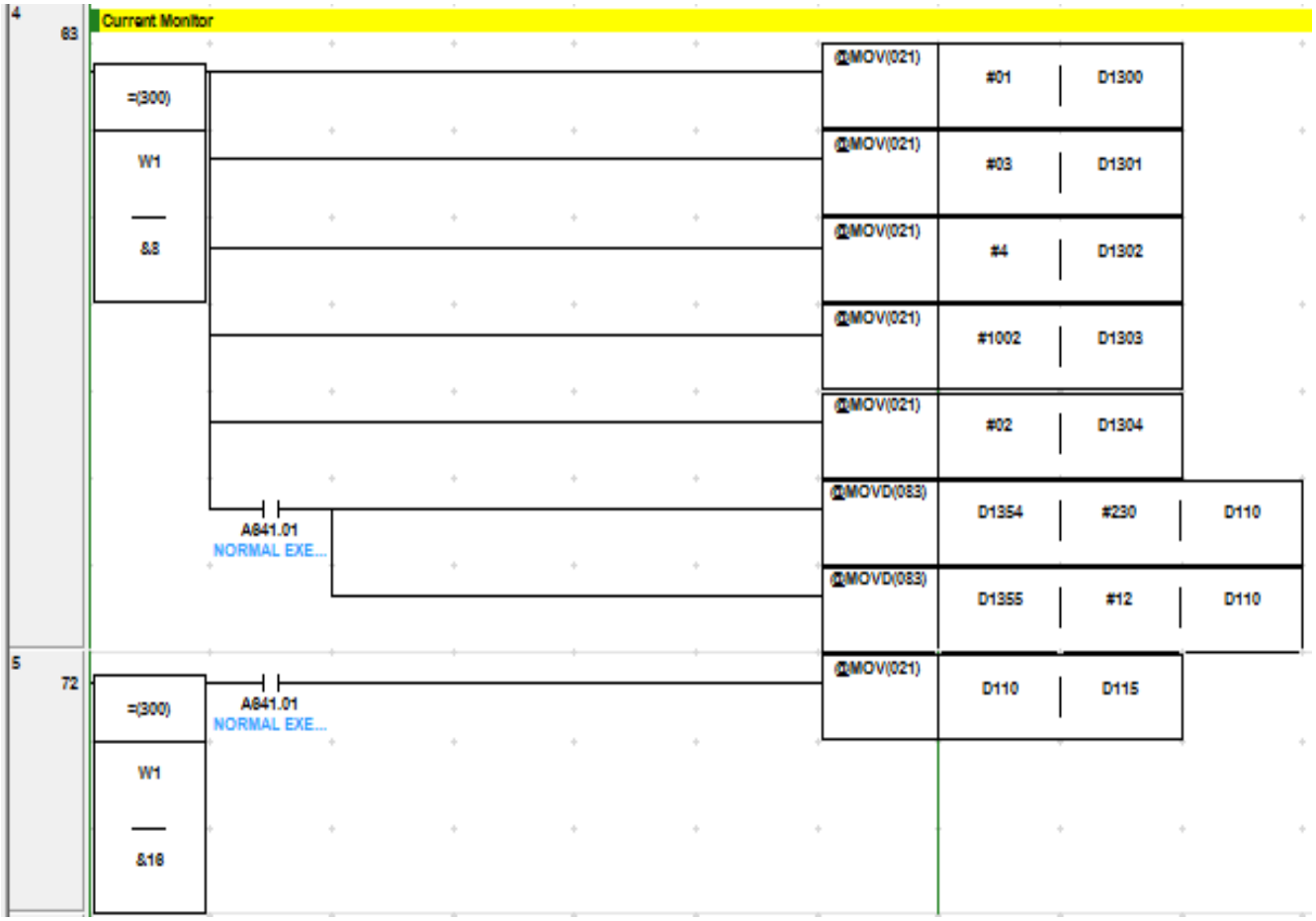


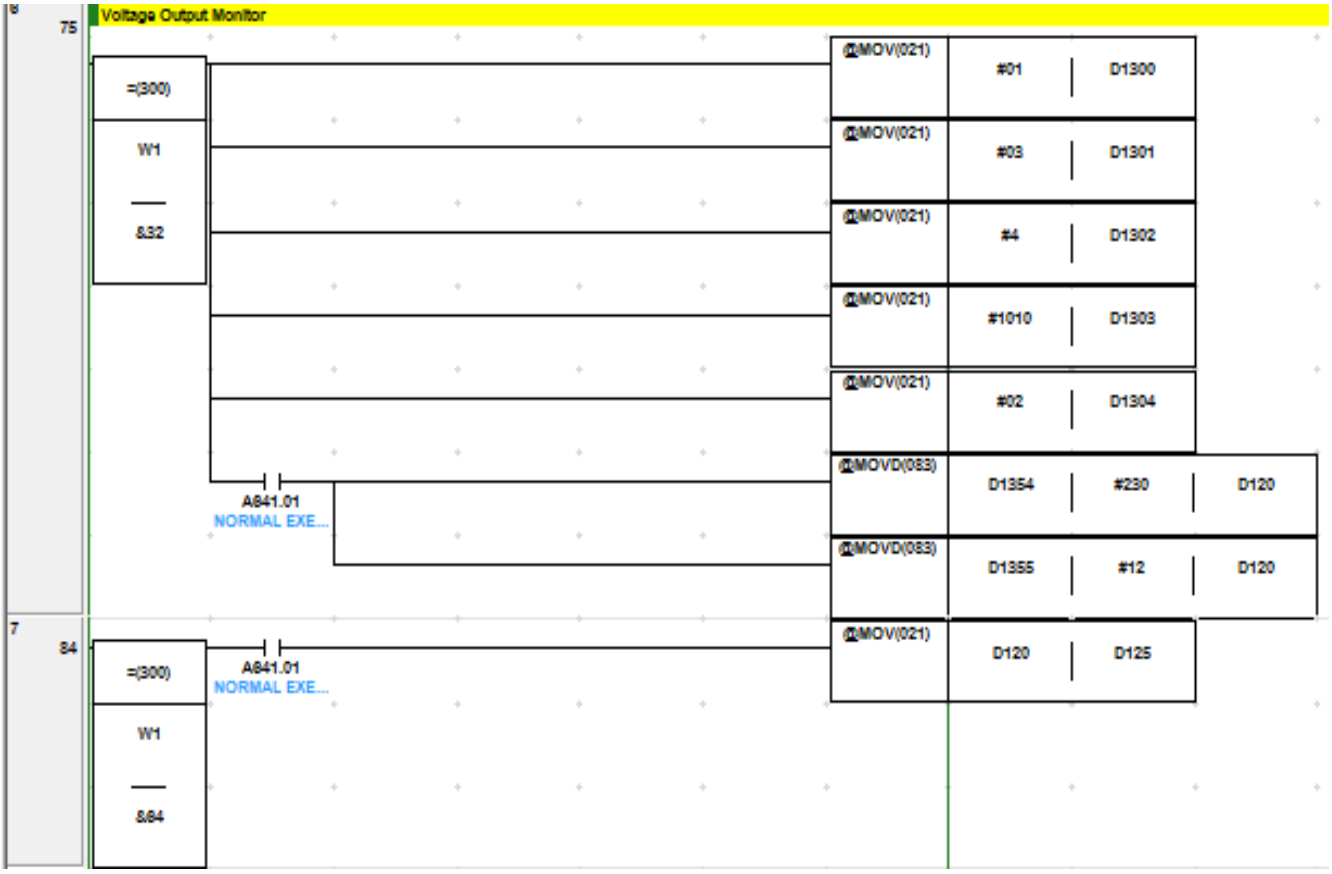

28
REVERSE ROTATION
W0.04
REVERSE
@MOV(021)
#1
D1300
@MOV(021)
#5
D1301
@MOV(021)
#4
D1302
@MOV(021)
#1
D1303
@MOV(021)
#FF00
D1304
5
32
FORWARD ROTATION
W0.05
FORWARD
@MOV(021)
#1
D1300
@MOV(021)
#5
D1301
@MOV(021)
#4
D1302
@MOV(021)
#1
D1303
@MOV(021)
#0
D1304

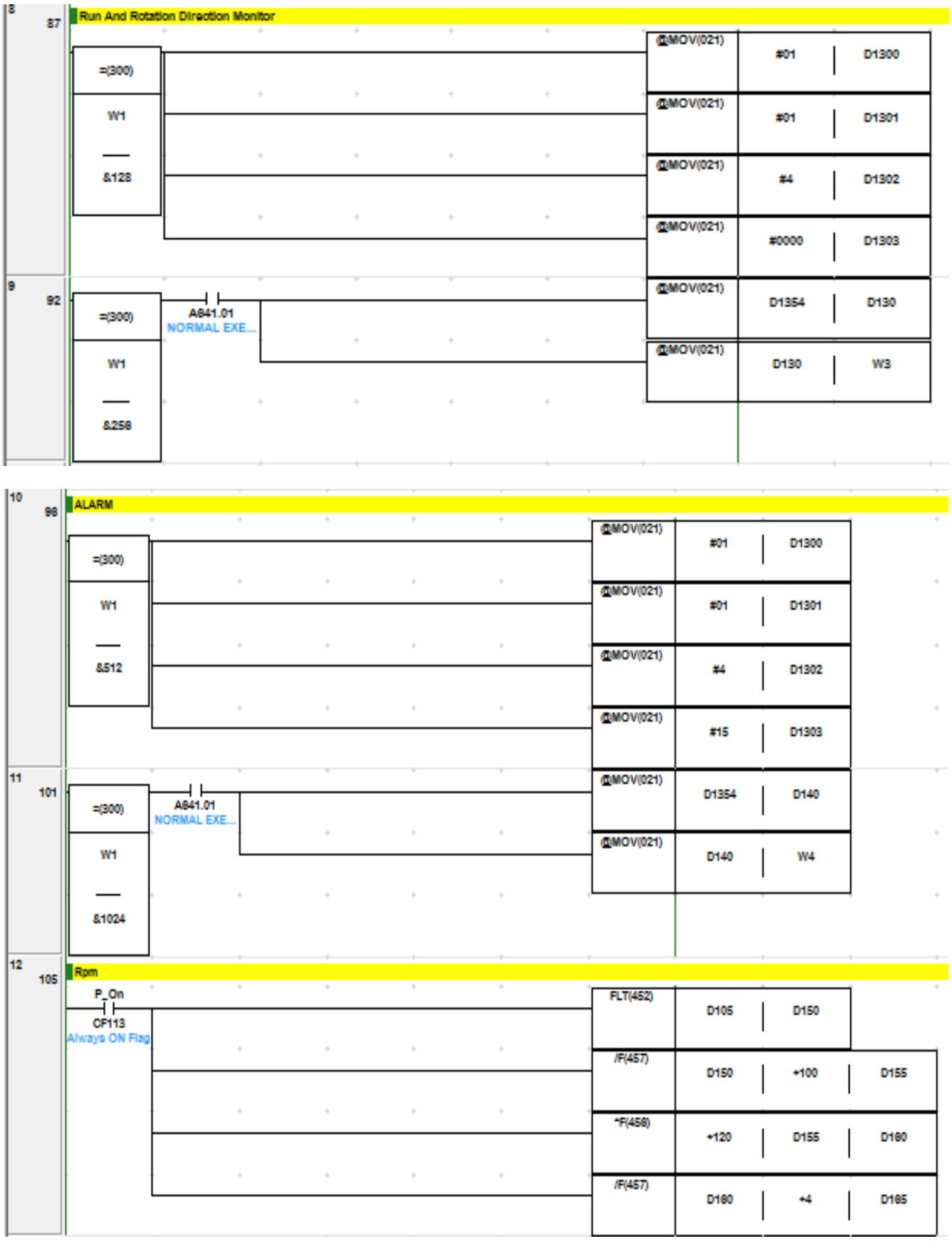
Lampiran 10 : *Monitoring Program* PLC



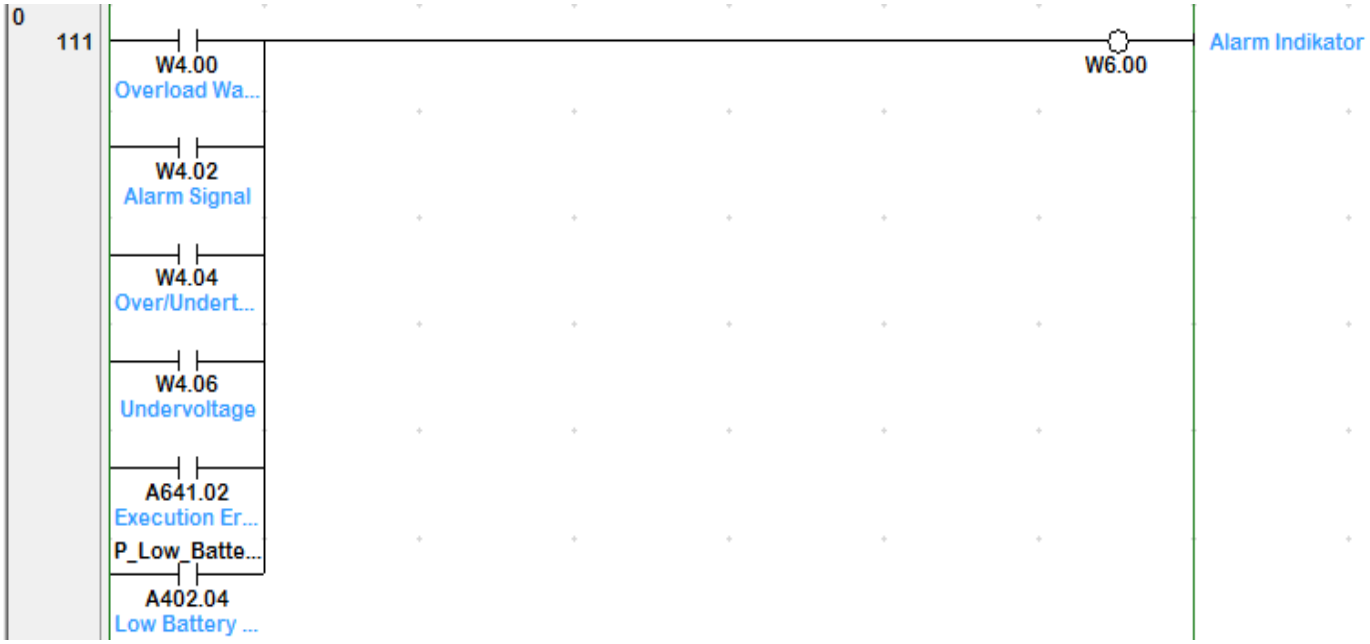



4
63
Current Monitor
=(300)
W1
&8
@MOV(021)
#01
D1300
@MOV(021)
#03
D1301
@MOV(021)
#4
D1302
@MOV(021)
#1002
D1303
@MOV(021)
#02
D1304
@MOVD(083)
D1354
#230
D110
@MOVD(083)
D1355
#12
D110
A841.01
NORMAL EXE...
5
72
=(300)
W1
&16
A841.01
NORMAL EXE...
@MOV(021)
D110
D115

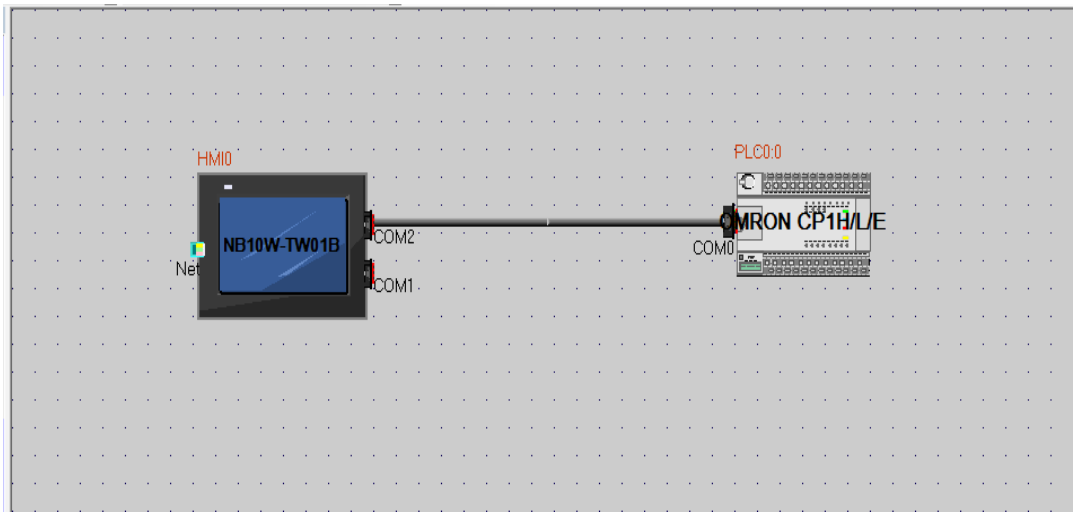

6
75
Voltage Output Monitor
=(300)
W1
&32
@MOV(021)
#01
D1300
@MOV(021)
#03
D1301
@MOV(021)
#4
D1302
@MOV(021)
#1010
D1303
@MOV(021)
#02
D1304
@MOVD(083)
D1354
#230
D120
@MOVD(083)
D1355
#12
D120
A841.01
NORMAL EXE...
7
84
=(300)
W1
&64
A841.01
NORMAL EXE...
@MOV(021)
D120
D125

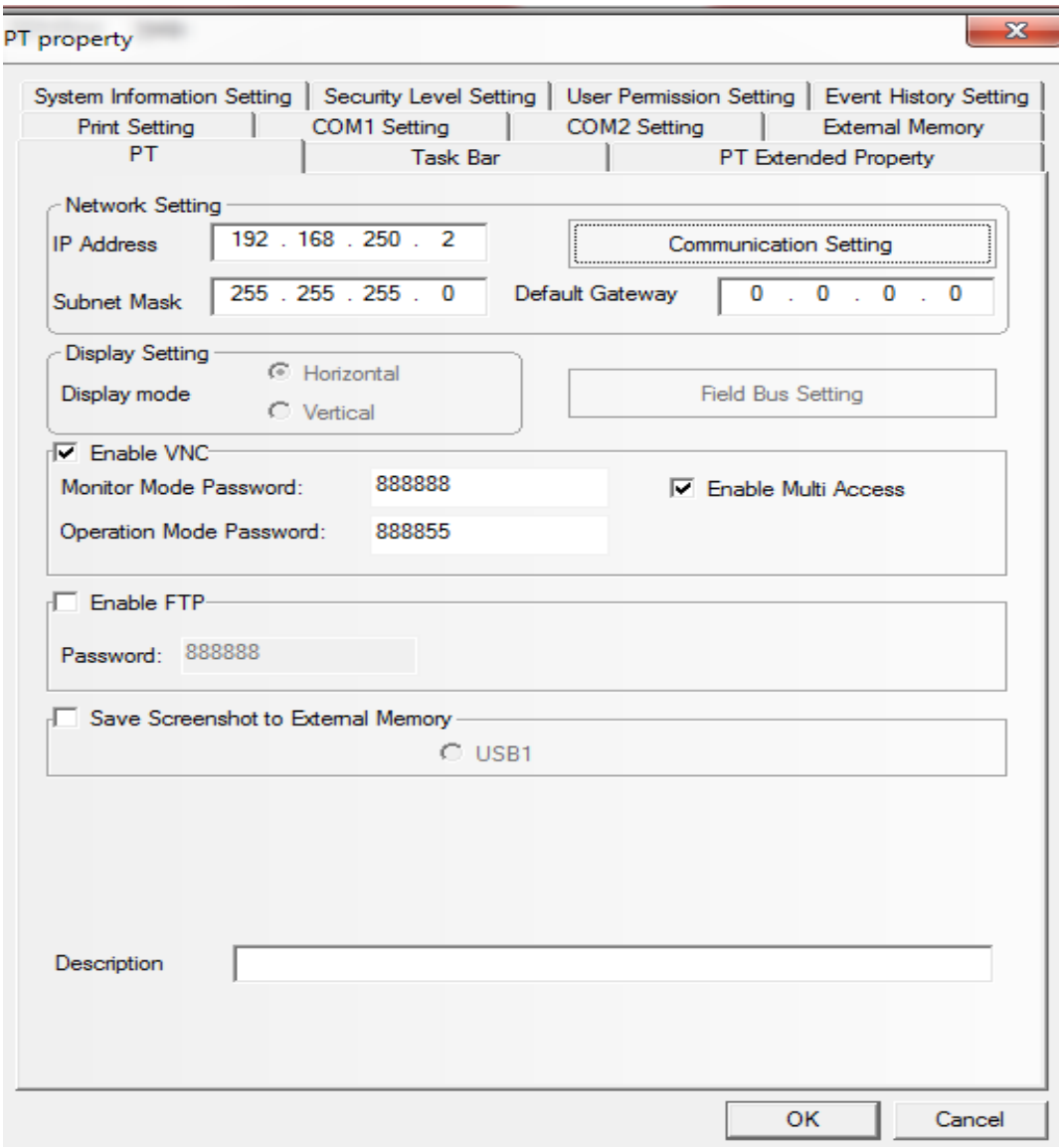

8
87
Run And Rotation Direction Monitor
=(300)
W1
&128
@MOV(021)
#01
D1300
@MOV(021)
#01
D1301
@MOV(021)
#4
D1302
@MOV(021)
#0000
D1303
9
92
=(300)
W1
&256
A841.01
NORMAL EXE...
@MOV(021)
D1354
D130
@MOV(021)
D130
W3
10
98
ALARM
=(300)
W1
&512
@MOV(021)
#01
D1300
@MOV(021)
#01
D1301
@MOV(021)
#4
D1302
@MOV(021)
#15
D1303
11
101
=(300)
W1
&1024
A841.01
NORMAL EXE...
@MOV(021)
D1354
D140
@MOV(021)
D140
W4
12
105
Rpm
P_On
CF113
Always ON Flag
FLT(452)
D105
D150
/F(457)
D150
+100
D155
*F(456)
+120
D155
D160
/F(457)
D160
+4
D165

Lampiran 11 : *Alarm Program* PLC

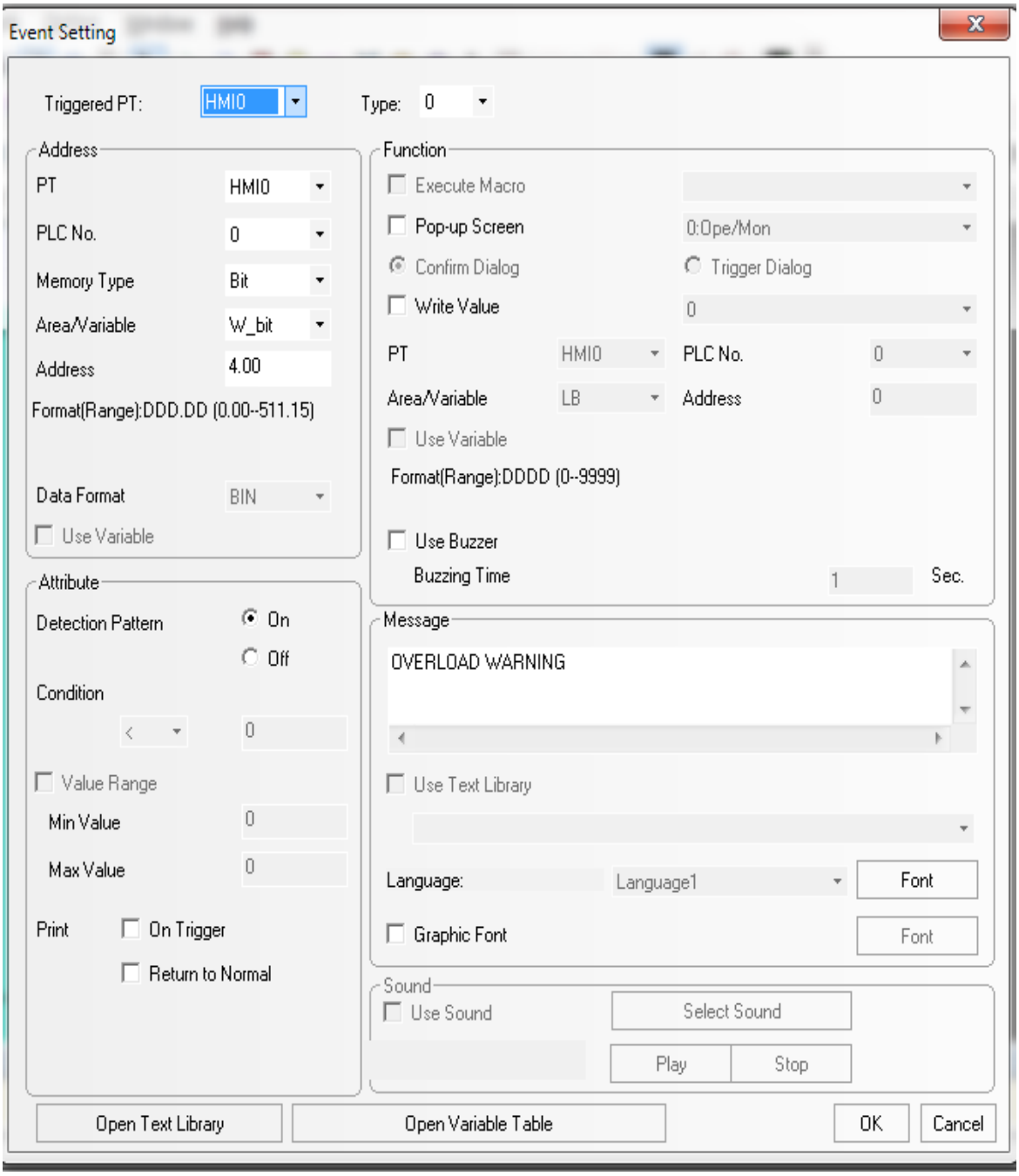


Lampiran 12 : Konfigurasi dan Pengaturan HMI

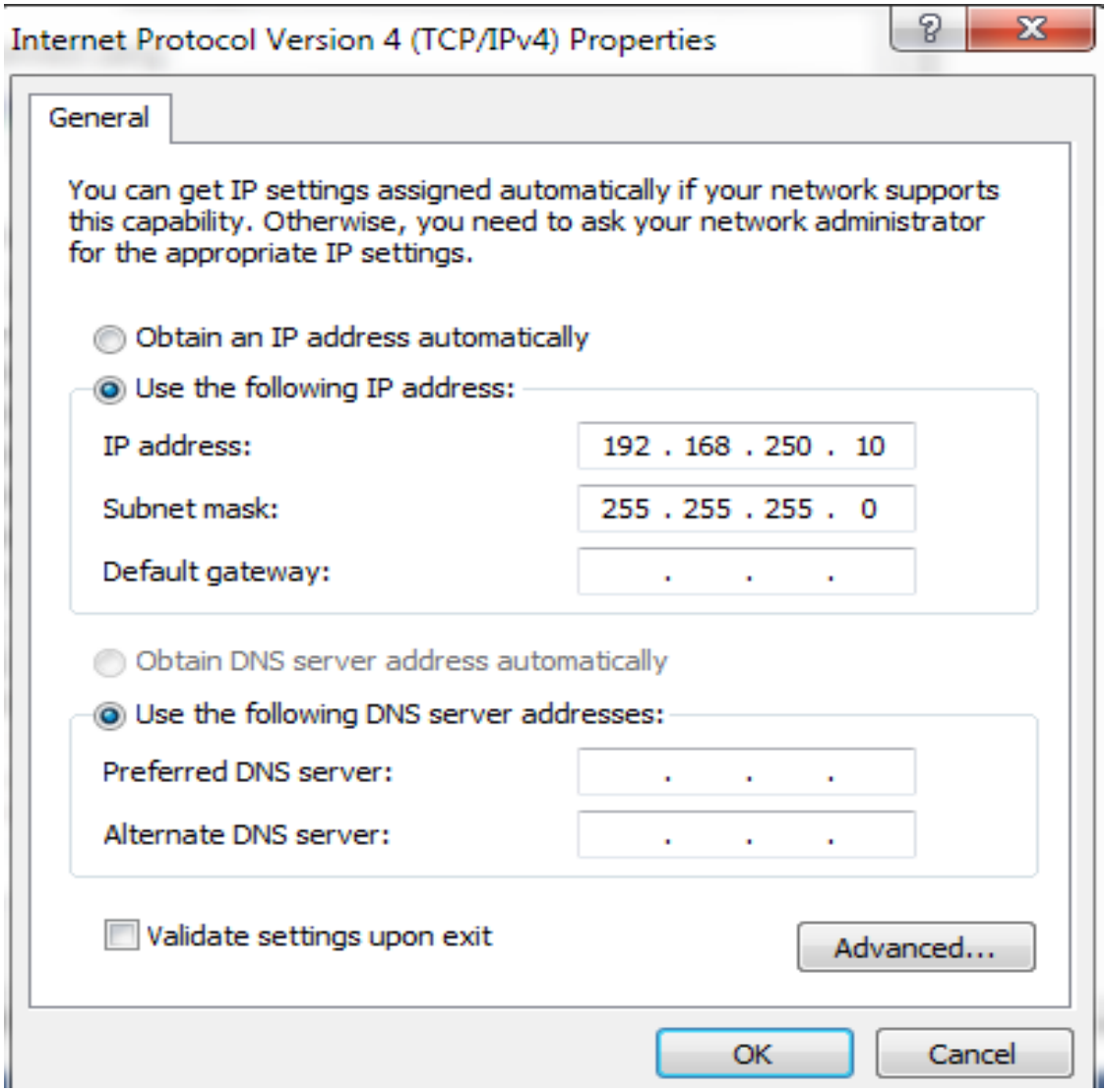




Lampiran 13 : Even Setting



Lampiran 14 : Internet Protocol Version 4 (TCP/IPv4) Properties



Lampiran 15 : Hasil *Turn It In*

Implementasi komunikasi data pada sistem kendali motor induksi tiga phasa

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Lampiran 16 : Lembar Revisi dan Tugas Ujian Sarjana

FAKULTAS TEKNOLOGI INDUSTRI
Universitas Islam Sultan Agung (UNISSULA)
Jl. Raya Kaligawe Km.4 Telp. 024-6583584 Psw. 340 Faks. 024-6582455
Semarang 50112 http://www.unissula.ac.id

LEMBAR REVISI dan TUGAS UJIAN SARJANA

Berdasarkan Rapat Tim Penguji Ujian Sarjana

Hari	:	Rabu
Tanggal	:	21 Agustus 2019
Tempat	:	R. Sidang

Memutuskan bahwa mahasiswa :

Nama	:	Muchamad Rifai
NIM	:	30601501796
Judul TA	:	Implementasi Komunikasi Data Pada Sistem Kendali Motor Induksi Tiga Fhasa

wajib melakukan perbaikan dan membuat tugas seperti tercantum dibawah ini:

NO	REVISI	BATAS REVISI
	Flowchart kerja alat / Alur input – output.	Segera! ✓ 30 Agust '19.

NO	TUGAS

Mengetahui,
Ketua Tim Penguji

Jenny Putri Hapsari, ST, MT
NIDN. 0607018501

Semarang, 21 Agustus 2019
Penguji 1,

Jenny Putri Hapsari, ST, MT
NIDN. 0607018501

FAKULTAS TEKNOLOGI INDUSTRI
Universitas Islam Sultan Agung (UNISSULA)
Jl. Raya Kaligawe Km.4 Telp. 024-6583584 Psw. 340 Faks. 024-6582455
Semarang 50112 http://www.unissula.ac.id

LEMBAR REVISI dan TUGAS UJIAN SARJANA

Berdasarkan Rapat Tim Penguji Ujian Sarjana

Hari	:	Rabu
Tanggal	:	21 Agustus 2019
Tempat	:	R. Sidang

Memutuskan bahwa mahasiswa :

Nama	:	Muchamad Rifai
NIM	:	30601501796
Judul TA	:	Implementasi Komunikasi Data Pada Sistem Kendali Motor Induksi Tiga Fhasa

wajib melakukan perbaikan dan membuat tugas seperti tercantum dibawah ini:

NO	REVISI	BATAS REVISI
	- konsisten numbering + bullet. - Blok Diagram - flowchart → Algoritma. - bahasa laporan	① 30/9

6/19.
6/09

NO	TUGAS
-	Mendeley → Ref manager. ? 6

Mengetahui,
Ketua Tim Penguji

Jenny Putri Hapsari, ST, MT
NIDN. 0607018501

Semarang, 21 Agustus 2019
Penguji 2,

M. Khosyi'in, ST, MT
NIDN. 0602077901

FAKULTAS TEKNOLOGI INDUSTRI
Universitas Islam Sultan Agung (UNISSULA)
Jl. Raya Kaligawe Km.4 Telp. 024-6583584 Psw. 340 Faks. 024-6582455
Semarang 50112 http://www.unissula.ac.id

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Berdasarkan Rapat Tim Penguji Ujian Sarjana

Hari	:	Rabu
Tanggal	:	21 Agustus 2019
Tempat	:	R. Sidang

Memutuskan bahwa mahasiswa :

Nama	:	Muchamad Rifai
NIM	:	30601501796
Judul TA	:	Implementasi Komunikasi Data Pada Sistem Kendali Motor Induksi Tiga Fhasa

wajib melakukan perbaikan dan membuat tugas seperti tercantum dibawah ini:

NO	REVISI	BATAS REVISI
	- buat flow chart sebelum ladder ✓ - Bab 3 buat instalasi → pemasangan → lampiran ✓ - Bagaimana menghitung daya listrik motor ✓ - tes. - " - " - " - energi pada motor tes ✓	

NO	TUGAS

Mengetahui,
Ketua Tim Penguji

Jenny Putri Hapsari, ST, MT
NIDN. 0607018501

Semarang, 21 Agustus 2019
Penguji 3,

Ir. Agus Adhi Nugroho, MT
NIDN. 0628086501