

*FULTEK*

**FOCUS HMI PLC USER MANUAL**

## A. GENERAL FEATURES

Focus HMI is a touch operator panel of domestic production. All models have Ethernet and a RS485. Some models have two RS485s. You can add multiple serial ports by USB port. In addition, You can use many devices with USB port, it will automatically recognize it. Focus HMI program is used for programming. Focus HMI has Linux (Armbian) operating system. You can use it as a touch panel PC without the Focus HMI program.

There are three basic models of Focus HMI: Basic, Plus and Professional. All models have support for Modbus RTU, Modbus TCP/IP, Profinet(Siemens), Hostlink(Omron), Fins Ethernet(Omron) and Fulmatic 7 PLC communication. Focus HMI can share all values in the tag table with third devices with the Modbus TCP / IP Slave feature. Bidirectional read-write can be done. If the number of serial ports is not enough, you can expand it with a USB serial port. Focus HMI is one of the very few HMIs with quad-core. Page transitions and communication are extremely fast with a 1.2 GHz processor.

Specifications	Basic	Plus	Professional
MCU	ARM Cortex A7, 4 Core 1,2 GHz	ARM Cortex A7, 4 Core 1,2 GHz	ARM Cortex A7, 4 Core 1,3 GHz
Ram 7"	512 MB DDR3	512 MB DDR3	1 GB DDR3
10.1"	1 GB DDR3	1 GB DDR3	
Graphics Processor (GPU)	Mali400MP2 @600 MHz	Mali400MP2 @600 MHz	Mali400MP2 @600 MHz
Storage Capacity 7"	8 GB SD	16 GB SD	16 GB SD
10.1"	16 GB SD		
Screen type	TFT	TFT	TFT
Resolution 7"	800 x 480	800 x 480	800 x 480
10.1"	1024 x 600	1024 x 600	1024 x 600
Color	16.7 Million	16.7 Million	16.7 Million
Brightness 7"	350 cd/m <sup>2</sup>	600 cd/m <sup>2</sup>	600 cd/m <sup>2</sup>
10.1"	450 cd/m <sup>2</sup>	1000 cd/m <sup>2</sup>	1000 cd/m <sup>2</sup>
Back Light	Led / 30000 h>	Led / 30000 h>	Led / 30000 h>
Touch 7"	Resistive	Resistive or Capacitive	Resistive or Capacitive
10.1"			
Ethernet	10/100 Full	10/100 Full	10/100 Full
Wifi	No, with the USB dongle.	No, with the USB dongle.	Realtek RTL8189ETV, 802.11 b/g/n
RS485 7"	1	2	2
10.1"	2		
USB 2.0	1	1	3
RTC 7"	No	Yes	Yes
10.1"	Yes		
RTC Backup Super Capacitor	30 Days	30 Days	30 Days
Buzzer 7"	No	80 dB	80 dB
10.1"	80 dB		
VNC Server	Yes	Yes	Yes
FTP	Yes	Yes	Yes
Web Server	Yes	Yes	Yes
Power	20-28 VDC	20-28 VDC	20-28 VDC
Current 7"	0,25 A	0,30 A	0,30 A
10.1"	0,40 A	0,50 A	0,50 A
Power consumption 7"	6W	7,2W	7,2W
10.1"	9,6W	12W	12W
Storage Temperature	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C
Operating Temperature	0 °C to +50 °C	0 °C to +50 °C	0 °C to +50 °C
Humidity	0..90 %RH	0..90 %RH	0..90 %RH
Size 7"	209 x 159 x 40 mm	209 x 159 x 40 mm	209 x 159 x 40 mm
10.1"	295 x 208 x 43 mm	295 x 208 x 43 mm	295 x 208 x 43 mm
Cut Size 7"	192 x 142 mm	192 x 142 mm	192 x 142 mm
10.1"	279 x 191 mm	279 x 191 mm	279 x 191 mm
Weight 7"	550 gr	560 gr	610 gr
10.1"	1130 gr	1130 gr	1130 gr



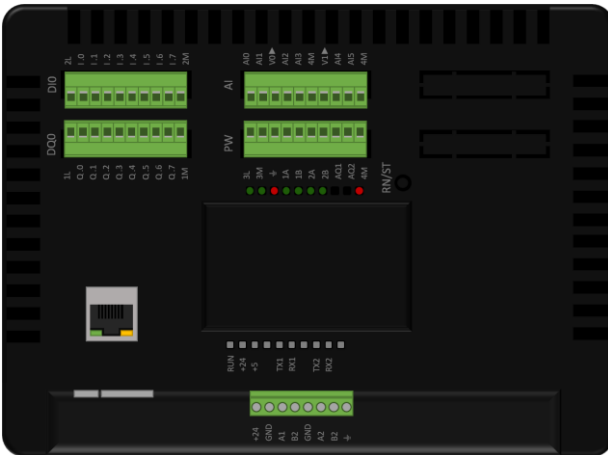


There are also models of the Focus HMI with integrated Fulmatic 7 PLC. The integrated PLC has a maximum of 40 IO. It can be expanded up to 16384 IO capacity with Fulmatic 7 Remote IO modules. The integrated PLC is programmed with the Speed PLC program. PLC and HMI are completely electrically independent.



**PN-XXXXXX-XX**

It is the model without integrated PLC.



**PB-XXXXXX-XX**

It is the model including the Integrated Basic PLC.



**PP-XXXXXX-XX**

It is the model including the Integrated Plus PLC.



**B. USAGE AND SAFETY**

STANDARD FEATURES FOR ALL MODELS WITH PLC	
Power	24 V DC %15 tolerance band 2,4 W Power Consumption (standby)
Digital Input / Output	8 x 200 kHz Digital Input 8 x 655 kHz 0,1 A Digital Input
Analog Input / Output	2 x 0-10 V / 0-20 mA selectable 12 bit Analog Input and 4 x 16 bit selectable Analog Input, 1 x 0-10 V and 1 x 0-20 mA Analog Output
2x Serial Port	It is selected according to the model. RS485 / RS232
Ethernet	10/100 MBit Full duplex, DHCP support, Web Server support (10 socket), TCP Modbus support (5 socket)
Web Server	512 KB File space for Web Server
Program Cycle Time	Max loop speed 65 kHz
I/O Capacity	512 Analog Input and 512 Analog Output or, 8192 Digital Input ve 8192 Digital Output
RTC	Real Time Clock (It works 30 days without electricity.) Accuracy temperature 25 °C ±100 Ms./Day
Working Conditions	-20 +60 °C / 5-95% Humidity



### Security Notes



PLC must be de-energized before wiring. Wiring must be done in accordance with the connection diagram.



Sections of the cables that connect to terminals should be taken into consideration. The cables to be connected must be used by stripping them to the point where they can enter into the terminal. It should be noted that excessively stripped cables may come into contact with cables in other terminals.

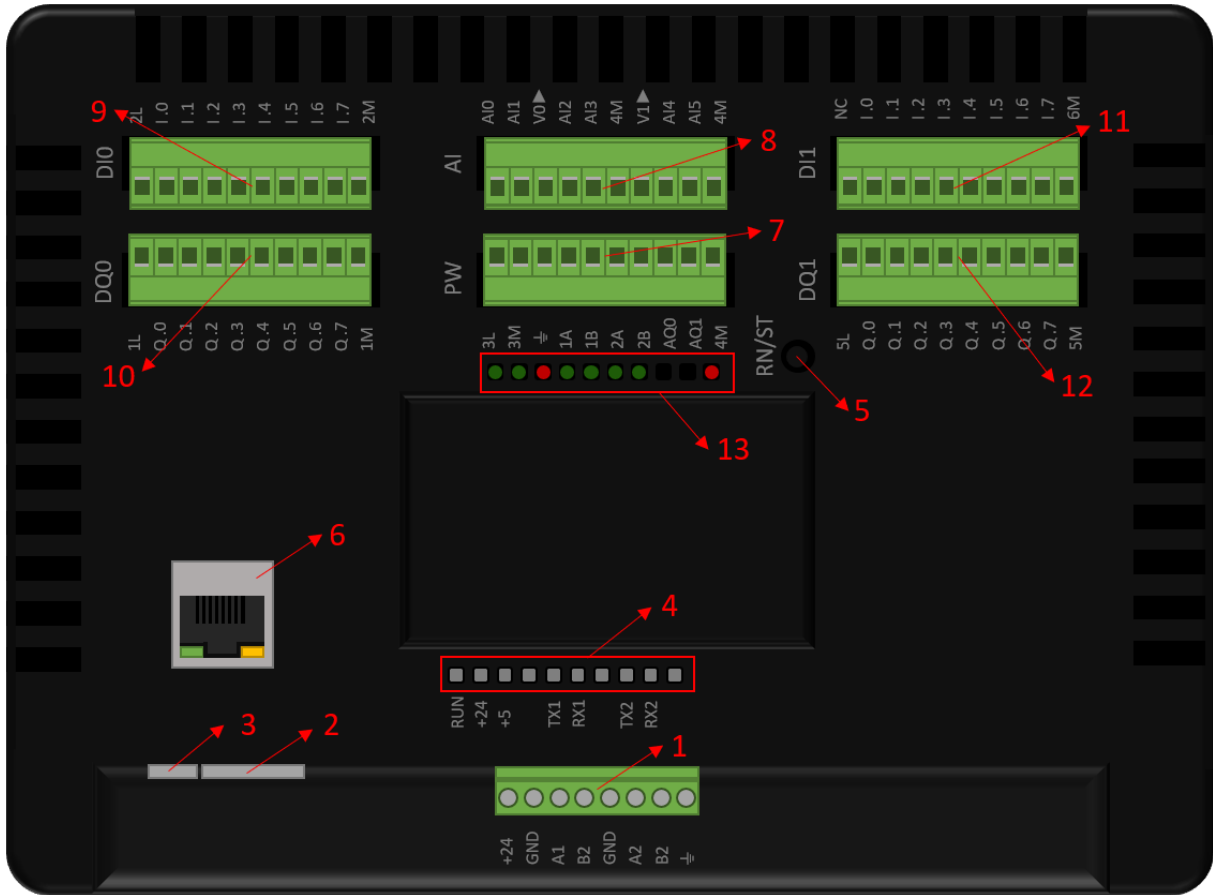


When the power is on, removing and installing the cables in the terminal, adding and removing the expansion modules can cause damage to the PLC.



Please read the instructions in the manual before energizing the device.

**C. BACK VIEW AND TERMINAL DESCRIPTIONS**



No	Connection Point	PX-XXXX01-XX Description	PX-XXXX02-XX Description	
1	HMI Connection Terminal	1	+24 V Terminal Supply	+24 V Terminal Supply
		2	0 V Terminal Supply	0 V Terminal Supply
		3	COM0 A Endpoint	COM0 A Endpoint
		4	COM0 B Endpoint	COM0 B Endpoint
		5	0 V Terminal Supply	0 V Terminal Supply
		6	----	COM1 A Endpoint
		7	----	COM1 B Endpoint
		8	Ground Endpoint	Ground Endpoint
2	HMI Ethernet	Socket	PLC 10/100M Full Duplex Ethernet Connection Point	PLC 10/100M Full Duplex Ethernet Connection Point
		Green LED	Ethernet Link LED	Ethernet Link LED
		Yellow LED	Ethernet Communication LED	Ethernet Communication LED
3	HMI USB	Socket	USB 2.0	USB 2.0



No	Connection Point		Description
5			PLC Run/Stop Button
6	PLC Ethernet	Socket	PLC 10/100M Full Duplex Ethernet Connection Point
		Green LED	Ethernet Link LED
		Yellow LED	Ethernet Communication LED
7	PW Connection Terminal	1	+24 V Terminal Supply
		2	0 V Terminal Supply
		3	Ground Endpoint
		4	COM0 A1 / TX1 Endpoint
		5	COM0 B1 / RX1 Endpoint
		6	COM1 A2 / TX2 Endpoint
		7	COM1 B2 / RX2 Endpoint
		8	0-10 V Analog Output
		9	0-20 mA Analog Output
		10	0 V Terminal Supply
9	DIO Connection Terminal	1	+24 V Terminal Supply
		2	I 0.0 Input
		3	I 0.1 Input
		4	I 0.2 Input
		5	I 0.3 Input
		6	I 0.4 Input
		7	I 0.5 Input
		8	I 0.6 Input
		9	I 0.7 Input
		10	0 V Terminal Supply
10	DQ0 Connection Terminal	1	+24 V Terminal Supply
		2	Q 0.0 Output
		3	Q 0.1 Output
		4	Q 0.2 Output
		5	Q 0.3 Output
		6	Q 0.4 Output
		7	Q 0.5 Output
		8	Q 0.6 Output
		9	Q 0.7 Output
		10	0 V Terminal Supply

No	Connection Point	Description for Model PX-XXXXXX-0X	Description for Model PX-XXXXXX-1X	Description for Model PX-XXXXXX-2X
8	AI Connection Terminal	1	Analog Input 0	Analog Input 0
		2	Analog Input 1	Analog Input 1
		3	----	----
		4	Analog Input 2	Analog Input 2
		5	Analog Input 3	Analog Input 3
		6	0 V Supply	0 V Supply
		7	----	V1 Endpoint
		8	Analog Input 4	Loadcell 0
		9	Analog Input 5	Loadcell 0
		10	0 V Supply	0 V Supply



No	Connection Point	Description	
4	HMI LED Block	1	Run LED
		2	+24V LED
		3	+5V LED
		4	----
		5	COM0 A LED
		6	COM0 B LED
		7	----
		8	COM1 A LED
		9	COM1 B LED
		10	----
13	PLC LED Block	1	Power on LED
		2	Run LED
		3	Fault LED
		4	COM0 A1 / TX1 LED
		5	COM0 B1 / RX1 LED
		6	COM1 A2 / TX2 LED
		7	COM1 B2 / RX2 LED
		8	----
		9	----
		10	Stop LED

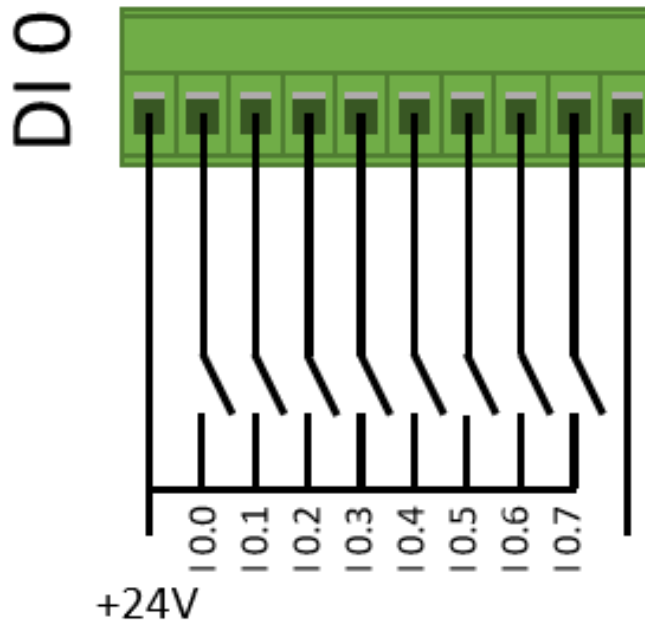
No	Connection Point	Description for model PP-XXXXXX-XX	
1	DI1 Connection Terminal	1	----
		2	I 1.0 Input
		3	I 1.1 Input
		4	I 1.2 Input
		5	I 1.3 Input
		6	I 1.4 Input
		7	I 1.5 Input
		8	I 1.6 Input
		9	I 1.7 Input
		10	0 V Terminal Supply
12	DQ1 Connection Terminal	1	+24 V Terminal Supply
		2	Q 1.0 Output
		3	Q 1.1 Output
		4	Q 1.2 Output
		5	Q 1.3 Output
		6	Q 1.4 Output
		7	Q 1.5 Output
		8	Q 1.6 Output
		9	Q 1.7 Output
		10	0 V Terminal Supply



## D. TECHNICAL SPECIFICATIONS

**Scanning Time:** The scanning time varies according to the size of the program, the blocks and functions used in the program, the input-output types and operations used. You can see the real time and maximum scan times in the Speed PLC program's PLC Status section. The maximum scanning speed is 65 kHz.

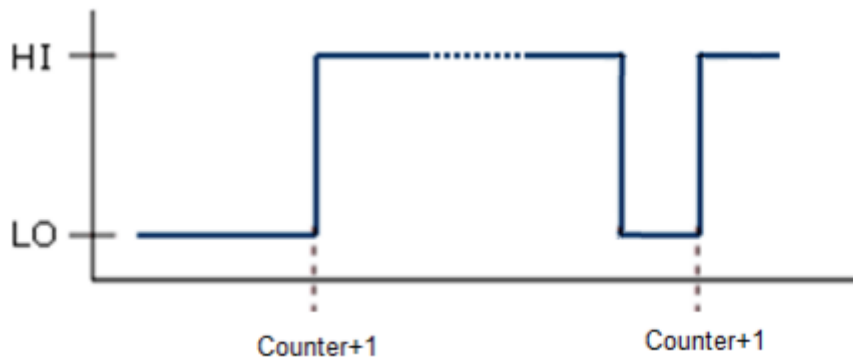
**Digital Inputs:** There are 8 x 200 kHz and 8 x 50 kHz inputs on the module. The sampling frequency is the speed at which the signal from the input is detected by the PLC. When defined as normal digital input, it is read once in each PLC cycle.



Use of Digital Inputs

Digital inputs may be used as digital inputs or It can also be used as Rising Edge Counter, Rising Edge Directional Counter, Falling Edge Counter, Falling Edge Directional Counter, AB Encoder 2X, ABZ Encoder 2X, AB Encoder 4X, ABZ Encoder 4X, Frequency 1000ms, Period Rising Edge, Period Falling Edge, Period Rising and Falling Edge, Interrupt Block Rising Edge, Interrupt Block Falling Edge, Interrupt Block Rising and Falling Edge.

**Rising Edge Counter:** It is a type of digital input that increments the counter specified on the rising edge of the signal applied to the input. The value in the counter is 1 when the signal applied to the input rises to the logical 1 level. The value in the counter does not change until the signal goes fall back to the logic 0 and the logic goes rises back to logic 1.

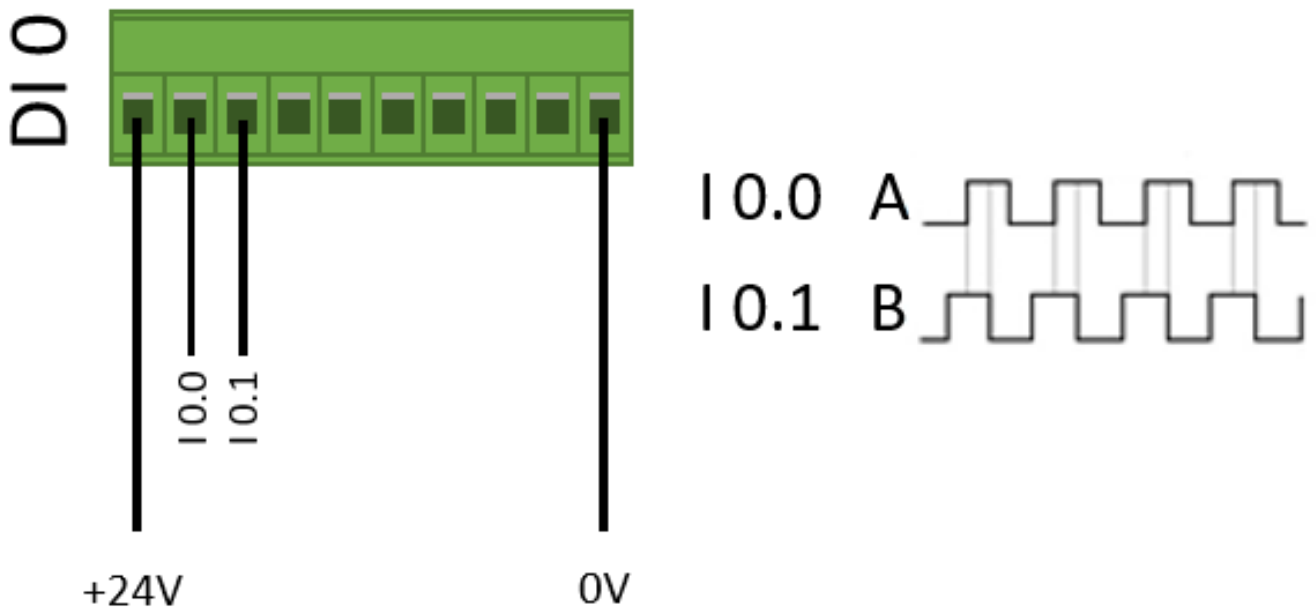


**Rising Edge Directional Counter:** When this type is selected, the next input is automatically assigned as the direction identifier. When logic 0 is applied to the direction identifier input, the counter moves in the negative direction, and when the logic 1 is applied, it moves in the positive direction. Signals are detected on the rising edge.

**Falling Edge Counter:** It is a digital input type that increases the counter specified on the falling edge of the signal applied to the input. The value in the counter becomes 1 when the signal applied to the input drops to the logic 0 level after logic 1, and the value in the counter does not change until the signal rises to logic 1 again and falls back to logic 0.

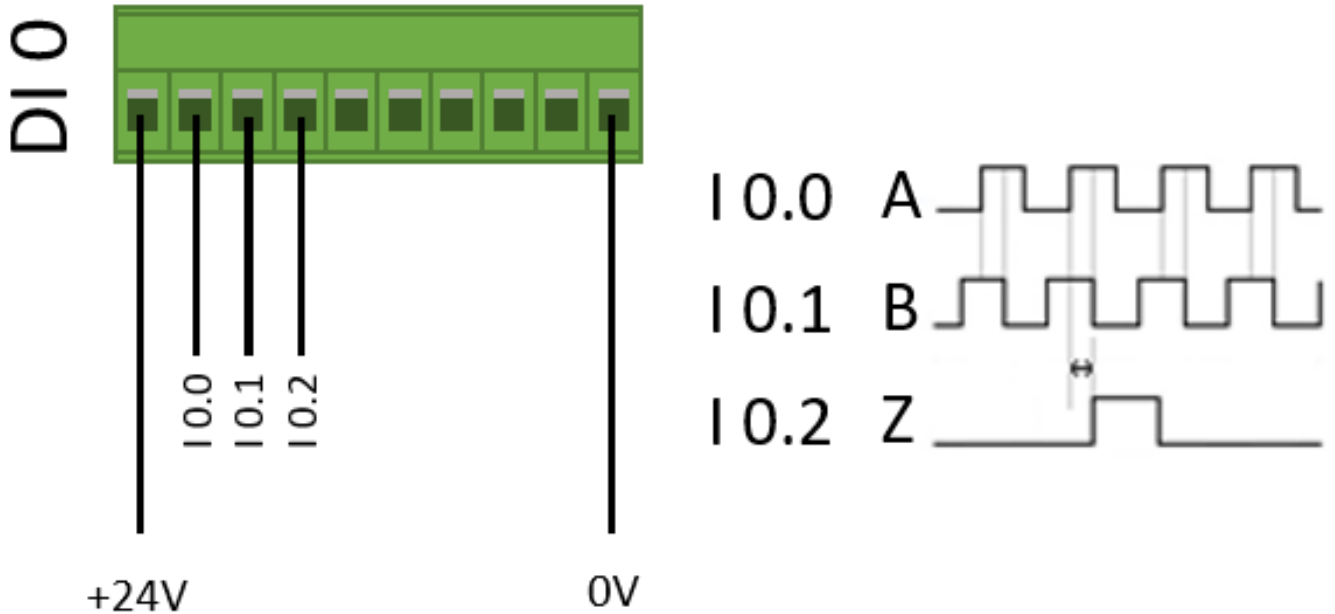
**Falling Edge Directional Counter:** When this type is selected, the next entry is automatically assigned as a direction navigator. When logic 0 is applied to the direction identifier input, the counter moves in the negative direction, and when the logic 1 is applied, it moves in the positive direction. The signals are detected on the falling edge.

**AB Encoder 2x:** When the AB type 2x Encoder is selected, the A endpoint of the Encoder should be connected into the pin where the selection was made and the B endpoint should be connected in the next input.



AB Encoder Connection

**ABZ Encoder 2x:** When ABZ type 2x Encoder is selected, the A endpoint of the Encoder should be connected to the pin where the selection was made, B endpoint should be connected to the next input and Z pin should be connected to the next input.



ABZ Encoder Connection

**AB Encoder 4x:** When AB type 4x Encoder is selected, the A endpoint of the Encoder should be connected to the pin where the selection was made, and the B endpoint should be connected to the next input.

**ABZ Encoder 4x:** When ABZ type 4x Encoder is selected, A endpoint of the Encoder should be connected to the pin where the selection is made, B endpoint should be connected to the next input and Z pin should be connected to the next input.

**Frequency 1000ms:** It is the input type which counts the pulses applied to the input within 1000 ms. The count is repeated every 1000ms and the value in the counter is updated.

**Period Rising Edge:** It is an input type that is used to measure the time difference between periods. The measurement is found by calculating the time difference between the rising edge of the first signal and the rising edge of the subsequent signal. The measurement is made in microseconds. The measurement resolution is 1 microsecond. The minimum continuous measurement period is 10 microseconds.

**Period Falling Edge:** It is an input type that is used to measure the time difference between periods. The measurement is found by calculating the time difference between the falling edge of the first signal and the falling edge of the subsequent signal. The measurement is made in microseconds. The measurement resolution is 1 microsecond. The minimum continuous measurement period is 10 microseconds.

**Period Rising and Falling Edge:** It is the input type for measuring the period length. The measurement is found by calculating the time difference between the rising edge or falling edge and the subsequent falling or rising edge in the signal. The measurement is made in microseconds. The measurement resolution is 1 microsecond. The minimum continuous measurement period is 10 microseconds.

**Interrupt Block Rising Edge:** The interrupt block works by detecting the rising edge of the signal applied to the input.

**Interrupt Block Falling Edge:** The interrupt block works by detecting the falling edge of the signal applied to the input.

**Interrupt Block Rising and Falling Edge:** The interrupt block works by detecting both the rising edge and the falling edge of the signal applied to the input.

**Fast Counter:** When the inputs are used as a fast counter, it reads 1 channel at 200 kHz, 3 channels at 150 kHz, or 8 channels at 100 kHz.

**Analog Inputs:** Reading the values of analog inputs; The period of writing the value to the relevant variable is called the sampling time. The total sampling frequency of the analog inputs is 66.5 kHz. The sampling frequency of the analog inputs used is the total sampling frequency divided by the number of analog inputs used.

$$f_{\text{analogue channel sample freq}} = \frac{\text{Total sampling frequency}}{\text{Number of analog channels using}}$$

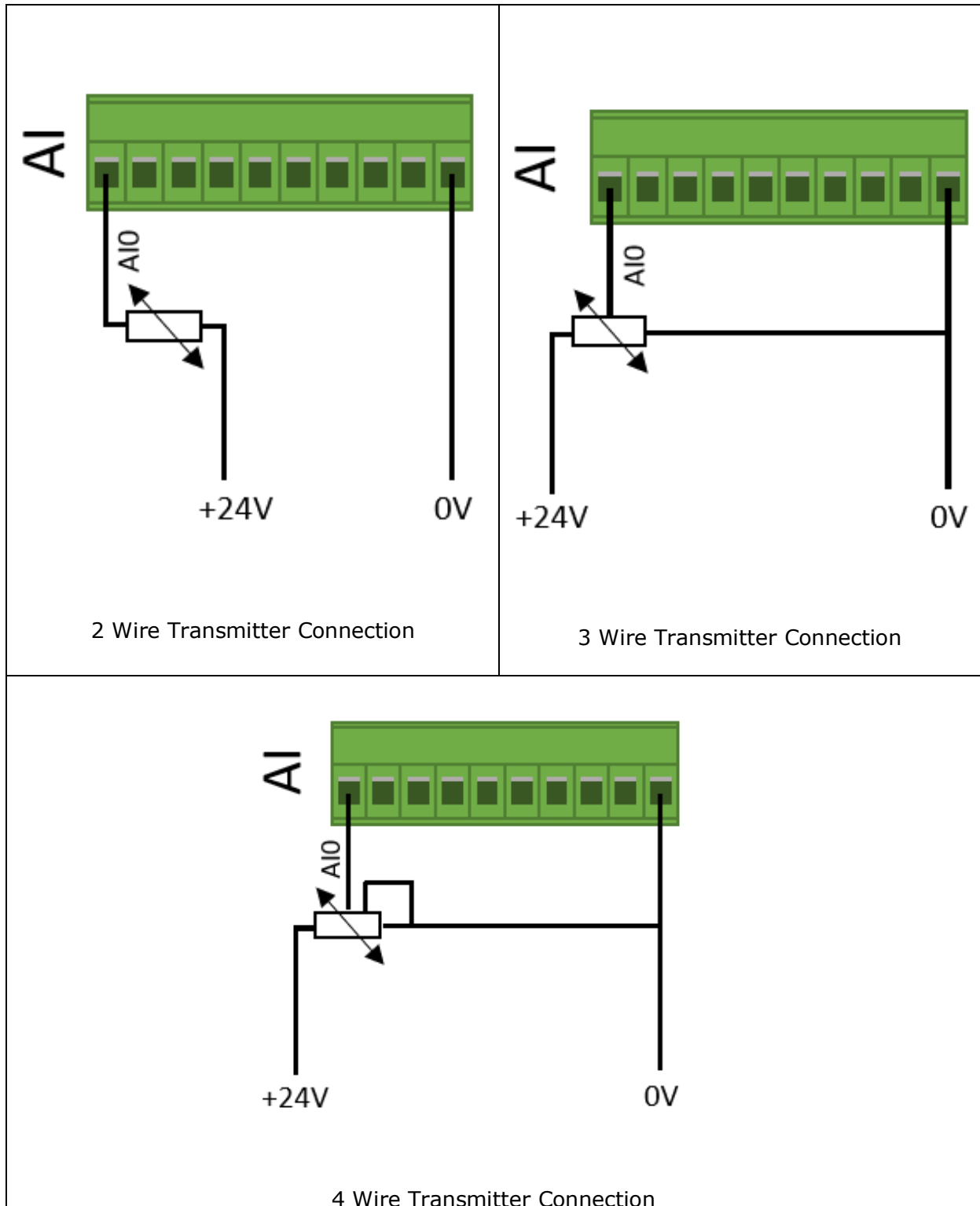
Analog inputs AI0 and AI1 are 12 bit resolution. The value that can be read is between 0-4095 values. Analog inputs can be used as 0-10 V input and/or 0-20 mA.

In voltage measurement, The internal resistance is 14.3 kΩ. The value 0 V corresponds to 0 and The value 10 V corresponds to 3925. Max readable voltage (4095 value) is 10.47 V.

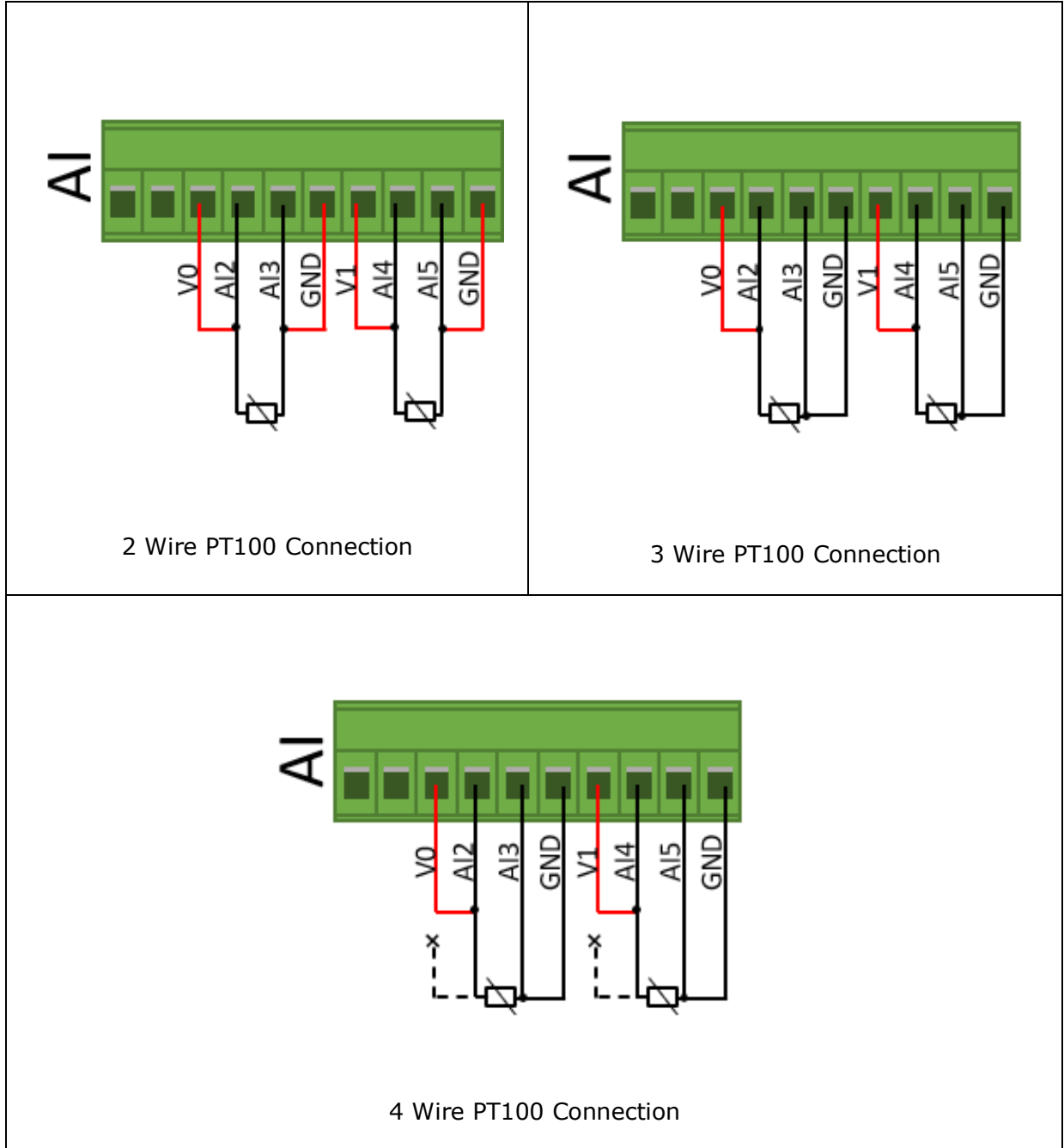
In current measurement, the internal resistance is 150Ω. The value 0 mA corresponds to 0 and The value 20 mA corresponds to 3930. The maximum readable current (4095 value) is 20,8 mA.

AI2, AI3, AI4 and AI5 are 16 bit resolution. Channels can be used as 0-10 V / 0-20 mA / PT100 / PT1000 / Resistor / Thermocouple B, E, J, K, N, R, S, T.



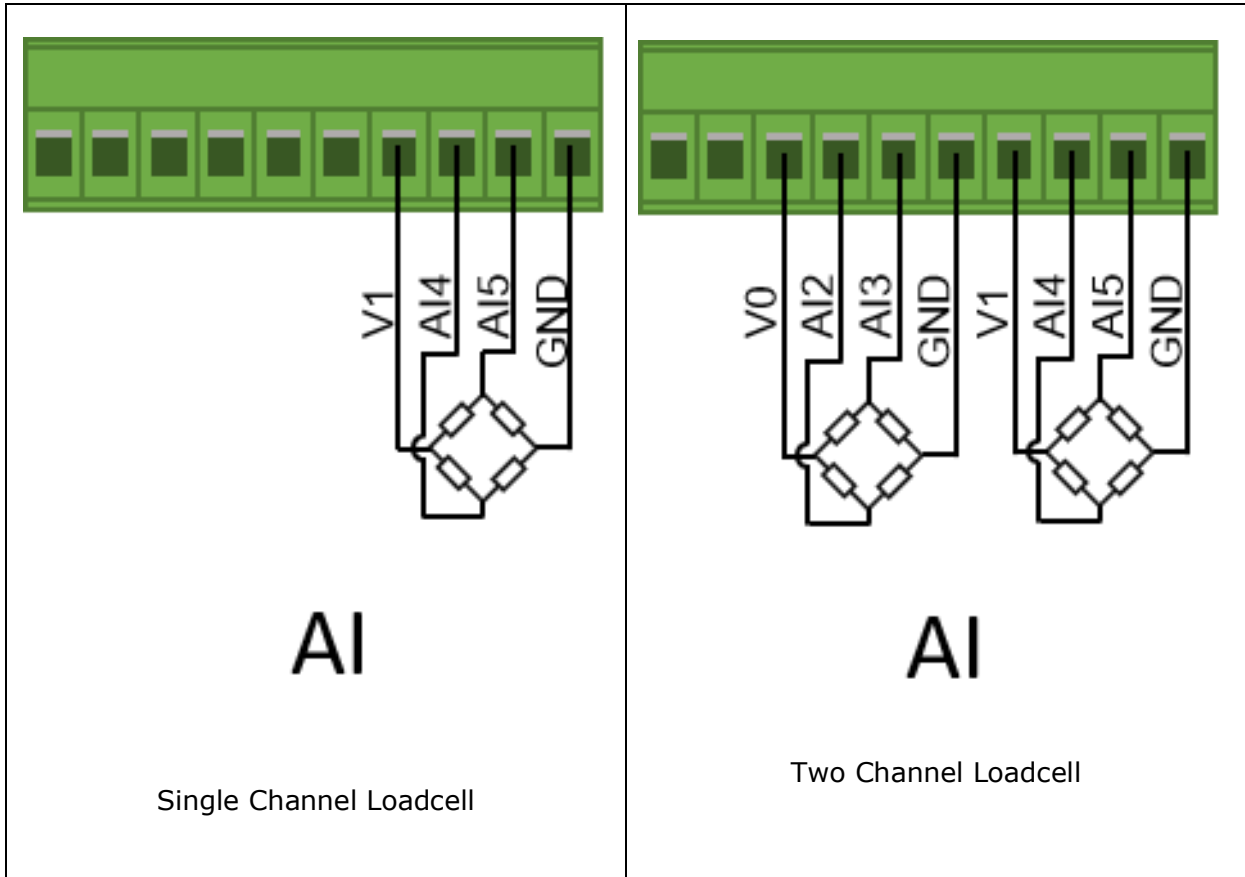


Use of Analog Inputs



Use of Analog Inputs





Use of Analog Inputs

Single Channel Loadcell Connection:

- + Excitation -- V1
- + Signal -- AI4
- Signal -- AI5
- Excitation -- GND

Two Channel Loadcell Connection:

1. Loadcell

- + Excitation -- V0
- + Signal -- AI2
- Signal -- AI3
- Excitation -- GND

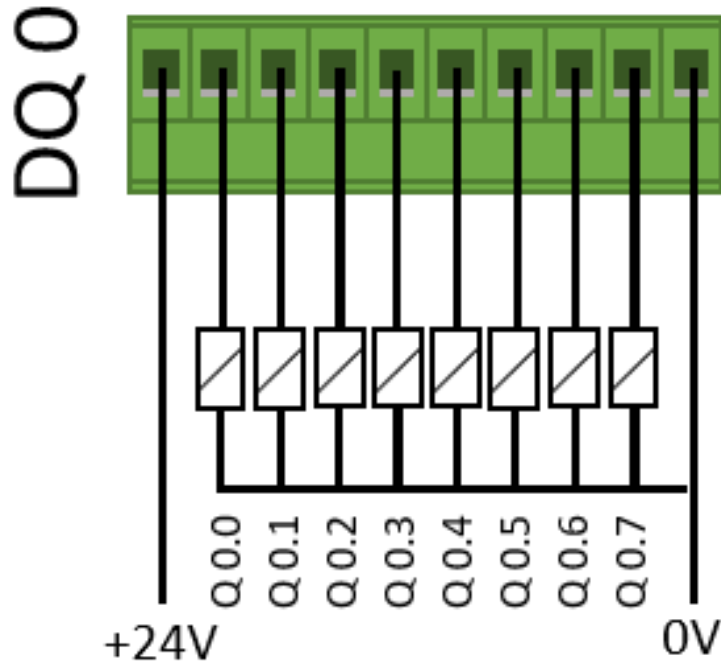
2. Loadcell

- + Excitation -- V1
- + Signal -- AI4
- Signal -- AI5
- Excitation -- GND



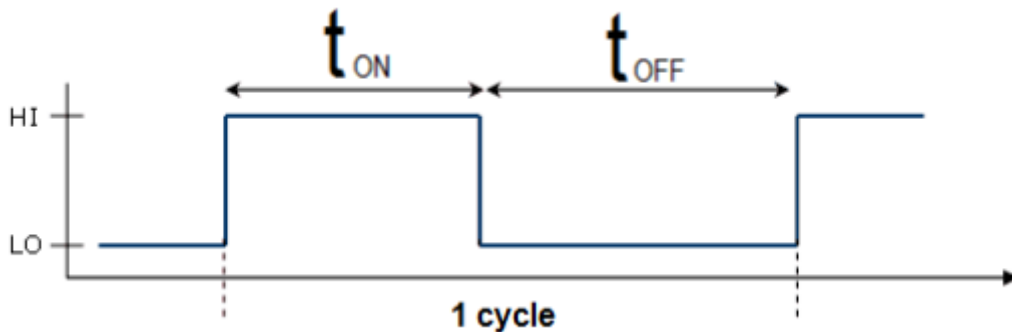
**Digital Outputs:**

There are 8 x 655 kHz 0.1 A and 8 x 20 kHz 0.5 A Digital Outputs.



Use of Digital Outputs

**PWM Output:** Hardware PWM (Pulse Width Modulation) is a function that allows to control the supplied electricity by changing the logic 1 residence times of generated square wave a certain frequency.



PWM control is done by checking period length and activity status. The period length is controlled by the PWM frequency. The maximum output frequency on the PLC is 655 kHz. PWM channels are grouped in pairs. There are different frequency variables for each group. This variable value can range from 0 to 65535.



The frequency is 10 times the value written to this variable.

$$f_{\text{PWM output freq}} = \text{Set. value} \times 10$$

The period is a cycle of frequency.

$$t_{\text{Period Duration (sec.)}} = \frac{1}{f_{\text{PWM output freq.}}}$$

The %tON setpoint that controls the PWM logic high state can be at a maximum resolution of 16 bits (between 0-65535) depending on the frequency. When the frequency increases, the resolution decreases. The set value %tON must be 65535 in order to get 100% output even if the resolution decreases.

$$\text{Resolution} = \frac{84000000}{f_{\text{PWM Output freq.}}}$$



*Note:* In Speed PLC program, apart from hardware PWM, software PWM is also available. Hardware PWM described in this section. For software PWM, you can refer to the help pages of the Speed PLC program.

**PTO Outputs:** PTO (pulse train output); It is a function that outputs a certain number of square waves. After the set number of square wave outputs is operated, output logic will be 0. The process frequency is found by multiplying the value written to the frequency variable of the square wave by 10. In the first cycle of the process frequency, output is logic 1 and in the other cycle output is logic 0. Thus, the PTO output frequency is half of the process frequency.

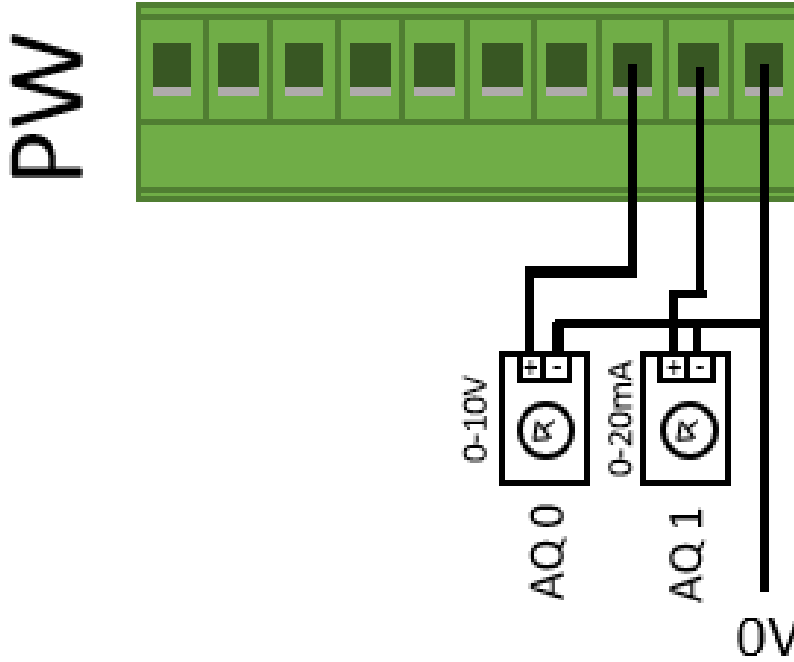
$$f_{\text{PTO Output freq}} = \frac{\text{Set. value}}{2} \times 10$$



When multiple PTO channels are used at a very high frequency at the same time, the PLC may switch the PLC stop mode because the PLC cycle time will increase. There is no such risk below 100 kHz.

**Analog Outputs:** There are two outputs, 0-10V from the AQ0 analog output channel and 0-20mA from the AQ1 analog output channel.

The analog output refreshing period is equal to the operation cycle of the PLC module. Maximum current of 20mA can be obtained from 0-10V output.



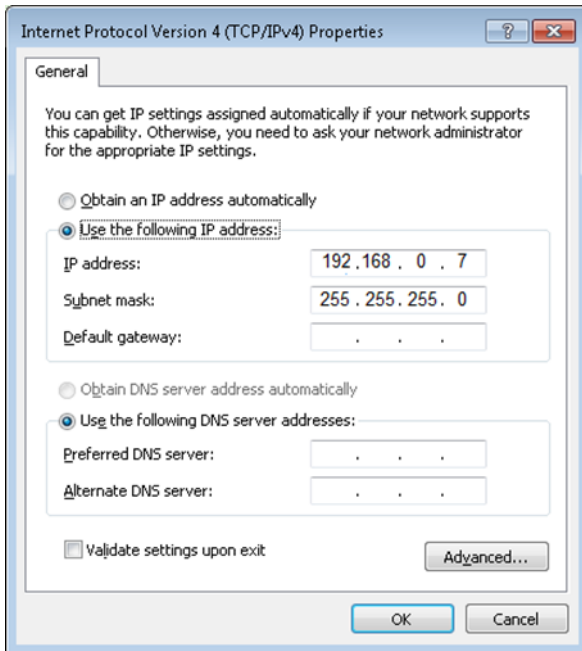
Use of Analog Outputs

## E. OTHER FEATURES

**Modbus Communication:** Modbus RTU ve Modbus TCP ile haberleşmeyi desteklemektedir. 5 connections can be provided simultaneously with Modbus TCP. Up to 32 devices can be connected with the Modbus RTU from each serial port.

**Speed PLC BUS:** With the Speed PLC BUS communication protocol which developed by Fultek Control Systems, intelligent read and the ability to write different data fields features provides faster communication. You can find detailed information in the help section of the Speed PLC program.

**MAC Address:** The MAC address of the integrated PLC module is located on the product label. If you wish, you can change the MAC address in the DB0 data block with the Speed PLC program. When changing the MAC address, check that the same MAC address is not on the network. Do not forget that communication problems with the PLC may occur in case of conflicting MAC addresses.



**Ethernet Connection:** If you wish, you can connect the integrated PLC module on your local network or connect it directly on your computer without cross cable. To make a direct connection to your computer, you must set settings of your network adapter, as shown in the figure and then connect the Ethernet cable.

**Factory Settings:** Off the power of integrated PLC module. Supply the integrated PLC module while pressing and holding the PLC Run/Stop button. Release the button when the Run LED is turned on, the PLC will return to the factory settings. COM0 Serial port at factory settings: 115200 bps, none parity, 1 stop bit, 8 data bit. IP address factory setting: 192.168.0.10. Modbus PLC address factory setting: 0.

**RTC:** Real Time Clock life is 30 days, during this time if the PLC is not energized, System Fault LED lights on. You can remove this warning when you update the system time in Speed PLC DB0.

