Wx-M1616 â€" 16 In, 16 Out Expansion I/Os

Description

[vc_row row_content_display=â€in_gridâ€ row_content_display_align=â€leftâ€ row_type=â€rowâ€ stretch_row_type=â€yesâ€][vc_column css_animation=â€fadeInâ€]
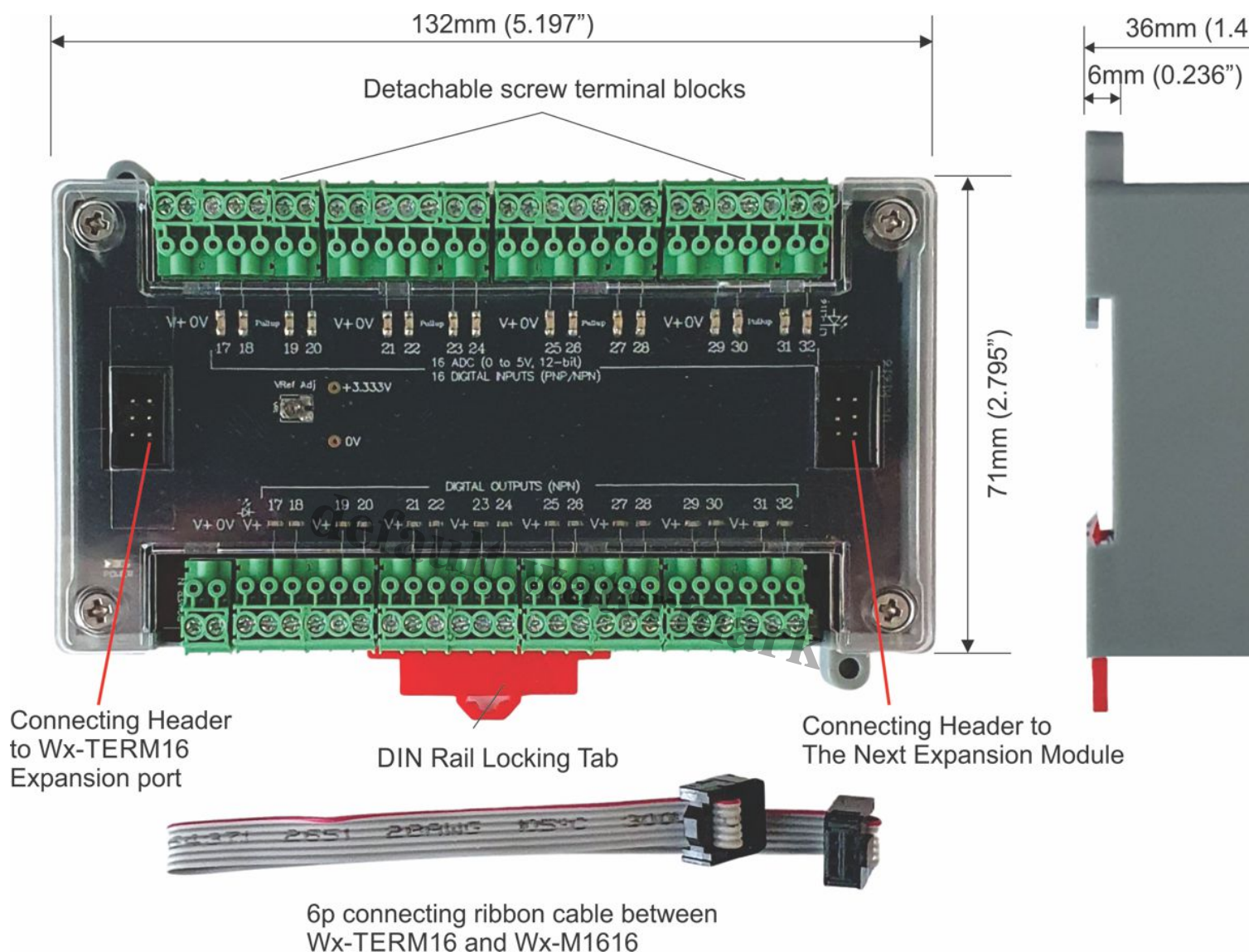
Wx-M1616 User's Manual#

1. Introduction#

Figure 1

A Wx-M1616 is a DIN-rail mountable expansion module that adds additional digital inputs, analog inputs and digital outputs to a Wx100 PLC system.

Wx-M1616 is meant to be connected to the 6p expansion headers located at the right-end of the Wx-TERM16 terminal module using the 6p connecting ribbon cable included with your new Wx-M1616 . Wx-M1616 deploys detachable screw terminals to enable quick field wiring. The following are the I/O specifications:

I/O Types:	Qty	Specifications
Digital Inputs:	16	12 to 24VDC, PNP or NPN
Analog Inputs:	16 (shared terminal with D.I.)	0V to 5V, 12-bit resolution
Digtal outputs:	16	12 to 24VDC, NPN. 2A continuous

a) Configuring Digital/Analog Inputs

Any or all of the 16 digital input terminals of a Wx-M1616 may also be used as 0-5V analog inputs, enabling highly flexible I/O configuration. To use an input terminal as an analog input you simply wire a 0-5V analog signal to it and the i-TRiLOGI TBASIC custom function simply call the function ADC(n) where n is the input number. The firmware will automatically configure these inputs to become analog inputs. For example, if you want to use input 17,18,19,20 as analog input then simply call the function ADC(17) to ADC(20) and the firmware will configure these 4 inputs as analog inputs.

b) Cascading Wx-M1616 Modules

As shown in Figure 1, the Wx-M1616 module also has an expansion header to the right of the module which allows it to be cascaded to another Wx-M1616. In fact, up to 4 pieces of Wx-M1616 can be cascaded in a chain. **Note:** Each Wx-M1616 must be configured for a different address using DIP switches as explained in the Section 8 in this manual.
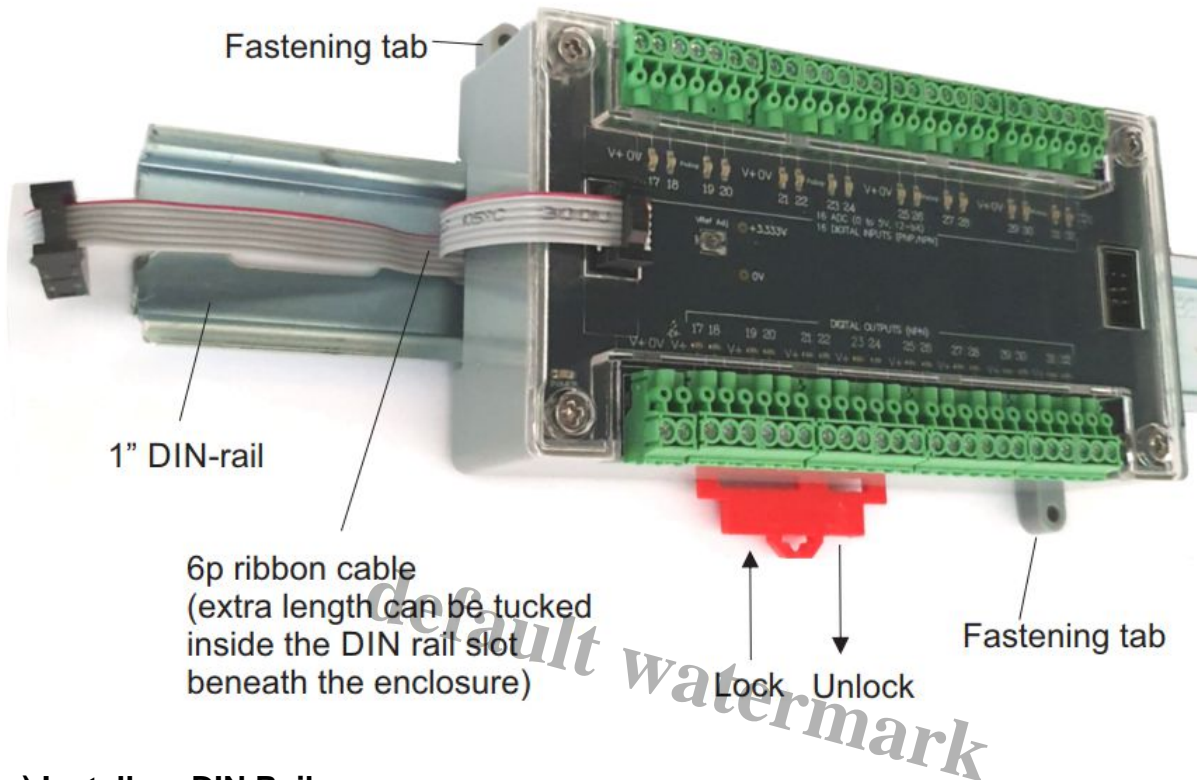
Hence Wx-M1616 may add up to a maximum of 16 x 4 = 64 digital/analog inputs and 16 x 4 = 64 digital outputs to the I/Os on the Wx100+Wx-TERM16.

c) Protective Transparent Sticker On Top Cover

After you have completed wiring to the Wx-M1616, you may like to peel off the transparent protective sticker over the transparent top cover for better visibility of the printed text on the Wx-M1616 PCB.

2. Installation#

There are two ways to install the Wx-M1616.

Fastening tab

1" DIN-rail

6p ribbon cable
(extra length can be tucked
inside the DIN rail slot
beneath the enclosure)

Lock   Unlock

Fastening tab

a) Install on DIN Rail

It is really simple to mount the Wx-M1616 on a DIN-rail â€" simply pull down the â€œDIN-Rail Locking Tabâ€ down until it clicks and stay in place. Next hook the Wx-M1616 over a 1â€³ DIN rail, and push the locking tab back into its original position and the enclosure will stay in place on the DIN rail.

The enclosure may still slide along the DIN rail to make it easy to adjust its location. If you need to lock the enclosure in place you can add a 6-32 x 1â€³ (or M3.5 x 25mm) screw to one of the fastening tabs to add some friction against the back wall of the control panel.

b) Fasten with Screws

There are two fastening tabs on the upper and lower side of the Wx-M1616 body enclosure. Simply drill a pilot hole through the fastening tab and use two pieces of M3 or 1/8â€³ diameter self-tapping screws to fasten the Wx-M1616 enclosure to the control panel.
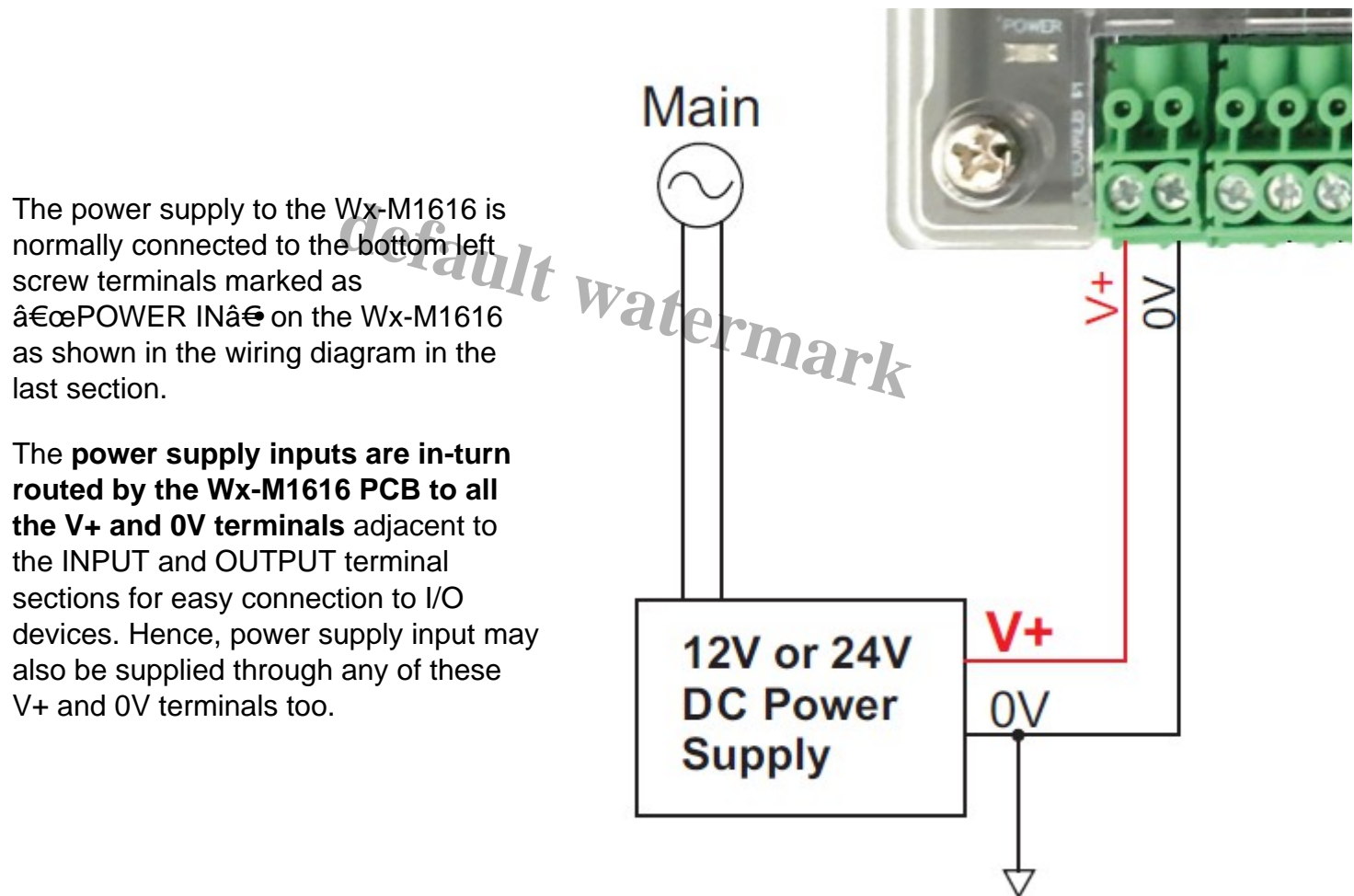
3. Physical Wirings#
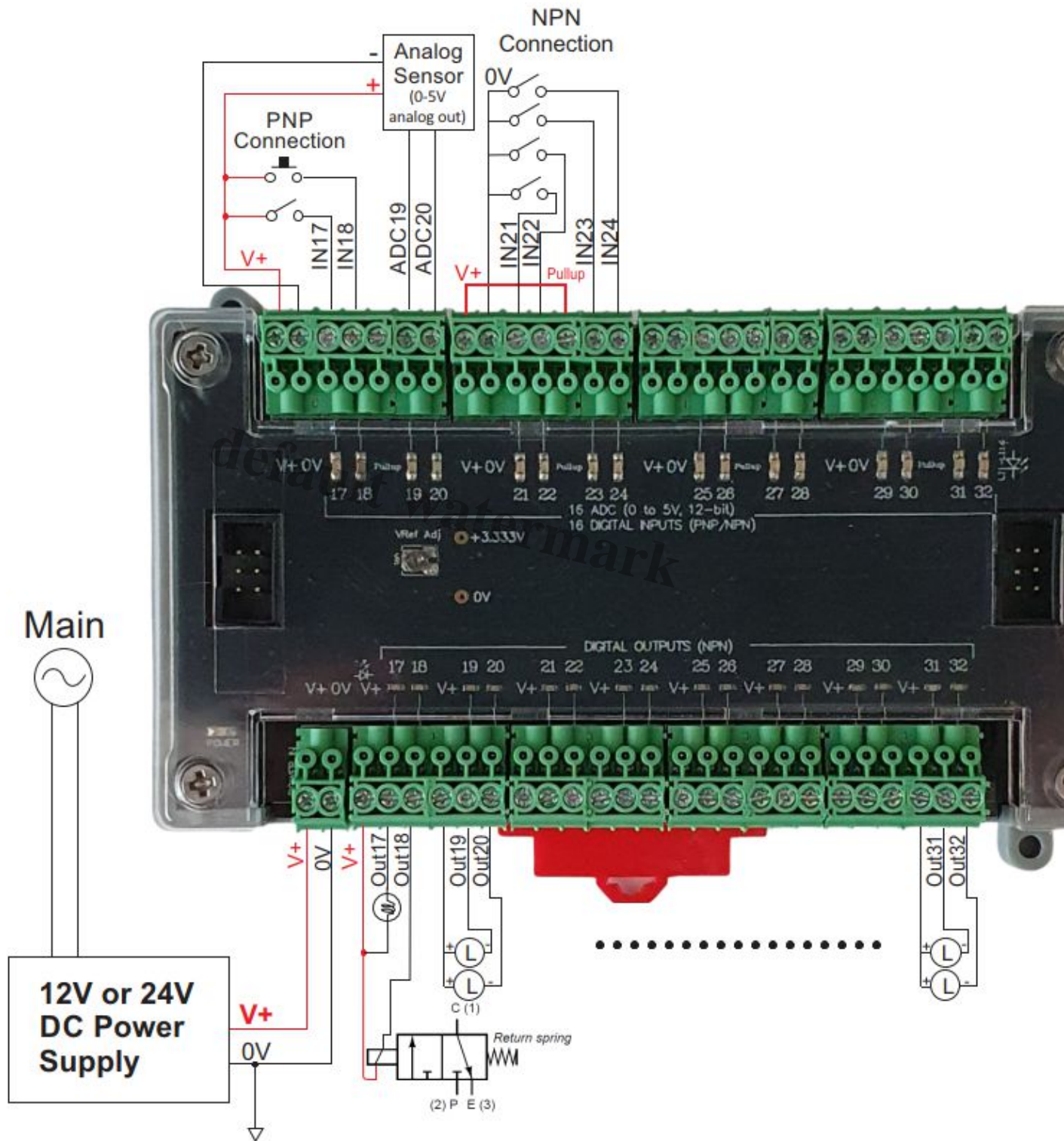
Note:

- In the next few sections we will describe in greater details how the power supply, the digital inputs and digital outputs should be wired to the Wx-TERM8 board.
- The specifications and programming methods for the analog I/Os are detailed in Chapter 5 and Chapter 6 in the Wx100 User's Manual.

4. Power Supply Wiring#

Wx-M1616 can be powered by the same 12 to 24V DC power supply that is powering the Wx100 PLC and the Wx-TERM16 module. Alternatively, choose a regulated switching or linear power supply between 12V to 24VDC (+/- 5% ripple) and 2A to 5A current capacity.

The power supply to the Wx-M1616 is normally connected to the bottom left screw terminals marked as "POWER IN" on the Wx-M1616 as shown in the wiring diagram in the last section.

The **power supply inputs are in-turn routed by the Wx-M1616 PCB to all the V+ and 0V terminals** adjacent to the INPUT and OUTPUT terminal sections for easy connection to I/O devices. Hence, power supply input may also be supplied through any of these V+ and 0V terminals too.

5. Digital Inputs Wiring#

Each module of Wx-M1616 adds 16 digital/Analog inputs to the Wx100 PLC.

To simplify field wiring, the power input (V+ and 0V) that Wx-M1616 receives via its "POWER IN" connectors are routed by the Wx-M1616 PCB to the entire input terminal section.

a) PNP Connection

All Wx-M1616 PLC's digital inputs are PNP (current sink) by default. This means that to turn ON the digital input you need to supply it a high positive voltage >=+8V. To turn off the digital input you need to supply it <= +3V.

Input Voltage for **Logic 0:**	Open Circuit or 0 to 3VDC
Input Voltage for **Logic 1:**	+8V to +30VDC

Each digital input has a green LED indicator which lights up when the input is turned ON. Connecting to a mechanical switch or push button is extremely simple – it only needs to short the V+ to the IN terminal as shown in (a) below. PNP sensors that are powered from 12 to 24V DC is just as easily connected as shown as (b) in Figure 1.5
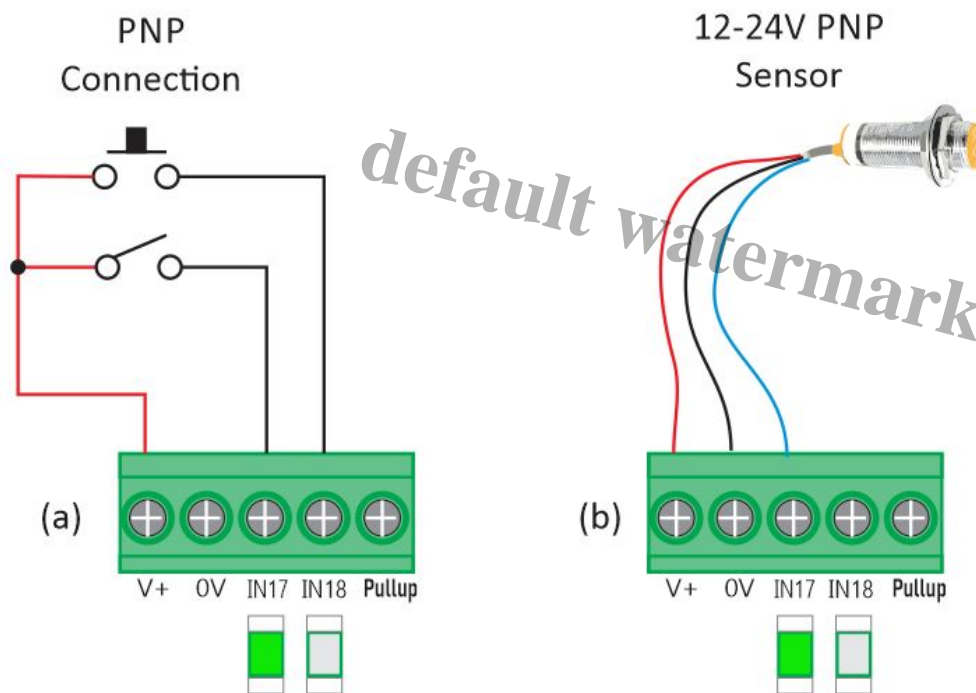

b) NPN Connection

NPN (current sink) sensors work in reverse to PNP sensors in that when it turns ON it will want to pull the input to low voltage, whereas when it turns 'OFF' it will either leave the input floating or pull it up to the power supply voltage level.

By connecting the "Pullup" terminal to V+, each digital input in the group (e.g. IN17,IN18,IN19 & IN20 are in one group, IN21 to IN24 are in another group, and so on) will be pulled up to V+ via its individual internal 3.3K 0.5W pullup resistor.

This means that by default the digital input is turned ON (the green LED will light up) even if the sensor is not connected or sensor output an OFF state. When the NPN sensor turns ON it will pull the input to low, essentially turning OFF the PLC digital input. This means that the NPN sensor behaves in negative logic to the PLC.

When Pullup is connected to V+:

Input Voltage for **Inverted Logic 0:**	Open Circuit or +8V to +30V
Input Voltage for **Inverted Logic 1:**	0V to +3V
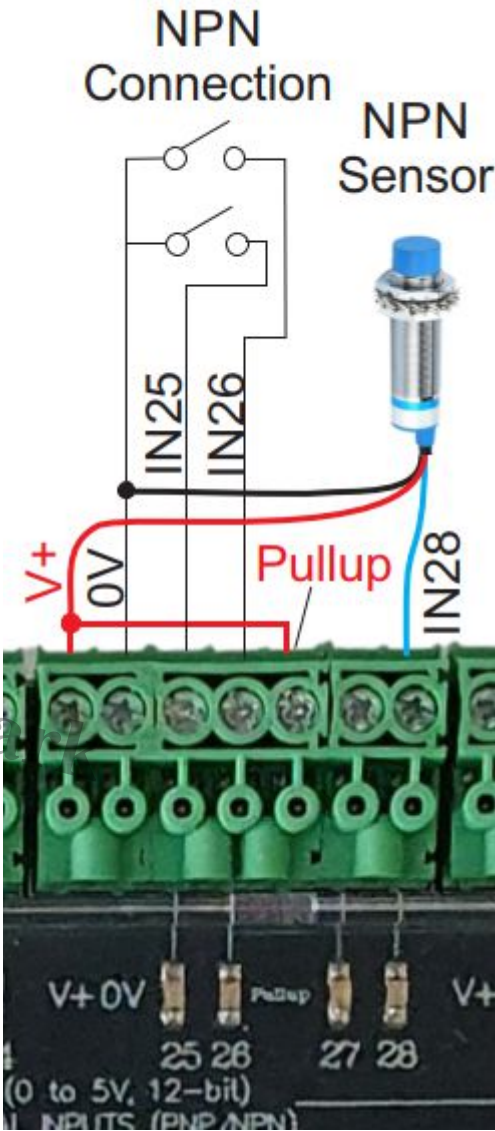
Fortunately, you don't have to think in term of negative logic when you write the PLC program. By running the special **INVERT_INPUTS** command once during initialization of the PLC program, you can force the PLC firmware to invert the logic of specified inputs before processing. This includes the digital I/O scan as well as all interrupt-based input functions such as pulse monitoring and high-speed counter operation:

INVERT_INPUTS *ch, n*

Every 16 digital inputs are grouped into 1 channel the same way as is defined by the system variable INPUT[ch]. Wx supports up to 5 digital inputs channel = 16 x 5 = 80 digital inputs.

ch
ch = 1: Input #1 to #16
ch = 2: Input #17 to #32
ch = 3: Input #33 to #48
ch = 4: Input #49 to #64
ch = 5: Input #65 to #80

n
bit within the channel to be inverted. Any bit that is a â€˜1â€™ in *n* will signal to the firmware that the corresponding physical input bit is to be inverted during I/O scan or when it is processed by an interrupt service routine.

E.g. If you are connecting only IN17 to IN20 to NPN sensors and the rest to PNP, that means you should set bit 0,1,2 & 3 to â€˜1â€™ and the rest to â€˜0â€™. So you should run this command:

INVERT_INPUTS 2, &H000F â€˜ Only inputs 17 to 20 are inverted

If you are connecting first 8 Wx-M1616 inputs (IN17 to 24) to NPN sensors, then run this command:

INVERT_INPUTS 2, &H00FF â€˜ Inputs 17 to 24 are all inverted. Inputs 25 to 32 are not inverted.

Note:

1. Run the **INVERT_INPUTS** *ch*, *n* command as early as possible in your PLC program. Ideally it should be the first statement inside an INIT custom function triggered by a **SCAN** contact at the first rung of the ladder logic.
2. An input that belongs to the input group where the â€œPullupâ€ signal is connected to V+ **can no longer be configured as an analog input**. Thus, if you have a system that needs to connect to analog, PNP and NPN sensors we recommend that you configure all NPN sensors to one or more groups that are pulled up.
3. Although the ON/OFF input indicators on the i-TRiLOGI online monitoring screen will show correctly the input state of the input corresponding to its defined logic type (either positive or negative logic), the actual green LEDs of the digital inputs will continue to only light up in positive logic mode (i.e. when the input voltage is > 8V) even if an input has already been configured as an NPN input. This should be clearly stated in the service manual for your maintenance technicians to avoid confusion.

c) Programming Digital Inputs

All digital outputs are directly programmable in Ladder Logic as well as in TBASIC custom functions. Some **programming examples** are detailed in the manual:

â€œWx100 PLCâ€™s User Manual â€“ Chapter 3 â€“ Programming The I/Oâ€œ

6. Digital Outputs Wiring#

Each Wx-M1616 adds 16 digital outputs to the Wx100 PLC. All digital outputs on the Wx-M1616 are **NPN output type** â€" meaning that when an output is turned ON it will sink current from the load (i.e. connecting the load to the 0V). The correct way to wire the load to the PLCâ€™s digital output is to connect the high side voltage (either the V+ or another positive voltage from the loadâ€™s power supply) to â€œ+â€ input lead of the load, and connect the â€œ-â€ input lead of the load to the PLCâ€™s digital output.

To simplify field wiring, the V+ power input that Wx-M1616 receives via its â€œPOWER INâ€ connector is routed by the Wx-M1616 PCB to the output terminal section. This allows user to very easily wire to a typical output load. For example, the following shows how to easily use it to turn on a 12V lamp load.

The load can really be any kind of DC load as long as the working load voltage is <= 30VDC and the load current is < 2A continuous. It could be as small as a LED indicator lamp, a solenoid valve, the coil of a 12 or 24V relay or contactor, or a DC motor.

Output Driver	Voltage	Current
OFF	Internally pulled up to V+ via a 20K ohm resistor	Leakage < 0.1mA
ON	< 0.3V	4A peak, 2A continuous

Programming Digital Outputs

All digital outputs are directly programmable in Ladder Logic as well as in TBASIC custom functions. Some **programming examples** are detailed in the manual:

â€œWx100 PLCâ€™s User Manual â€" Chapter 3 â€" Programming The I/Oâ€œ

7. Analog Inputs Wiring#

Any or all of the 16 digital input terminals of a Wx-M1616 may also be used as high precision, 0-5V analog inputs, enabling highly flexible I/O configuration. To use an input terminal as an analog input you simply wire a 0-5V analog signal to it directly as shown below:
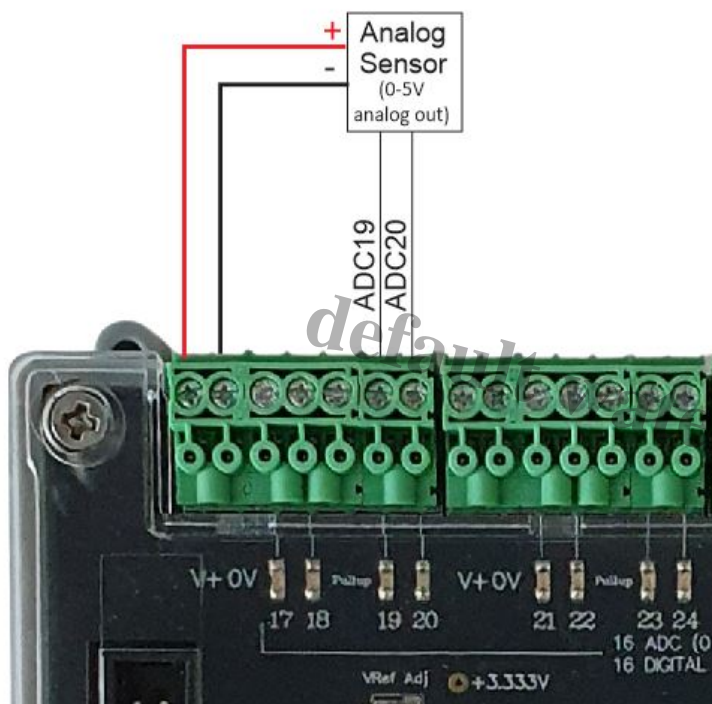
Specifications

Analog Inputs #	17 to 32
Measurable Analog Voltage Range	0 to 5V
Analog Resolution	12 bit (0 to 4095)
Input Impedance	60 KΩ
Non-linearity	+/- 0.5 LSB
Absolute maximum input voltage Range	-5V to +30V

a) Programming Analog Inputs

Upon power on or after a software reset, all input on an Wx-M1616 are configured as digital inputs by default.

As soon as the TBASIC command ADC(n) is run, the input channel #n would be configured by the PLC's firmware as an analog input. For example, if you call the function ADC(17), ADC(23) then

input terminal #17 and #23 will automatically becomes analog input and return an analog reading between 0-4095 corresponding to input voltage of 0 to 5VDC.

Note: An input that has been configured as an analog input is still able to correctly report logic â€˜1â€™ to the CPU if the input voltage >+ +8V and logic â€˜0â€™ if input voltage <= +3V, but the input response time may be slower than when it is not configured as analog input.

More programming and application examples on using the analog input with Wx100 can be found in Chapter 5 of Wx100 Userâ€™s Manual.

b) Interfacing to 0-20mA and 0-10V Analog Signals

With addition of simple resistors you can easily convert 0-20mA or 0-10V signal to 0 to 5V which can then be measured by the Wx-M1616 analog inputs. Please refer to the following diagrams:

Converting 20mA current-loop to 0-5V   *Converting 0-10V input to 0-5V*
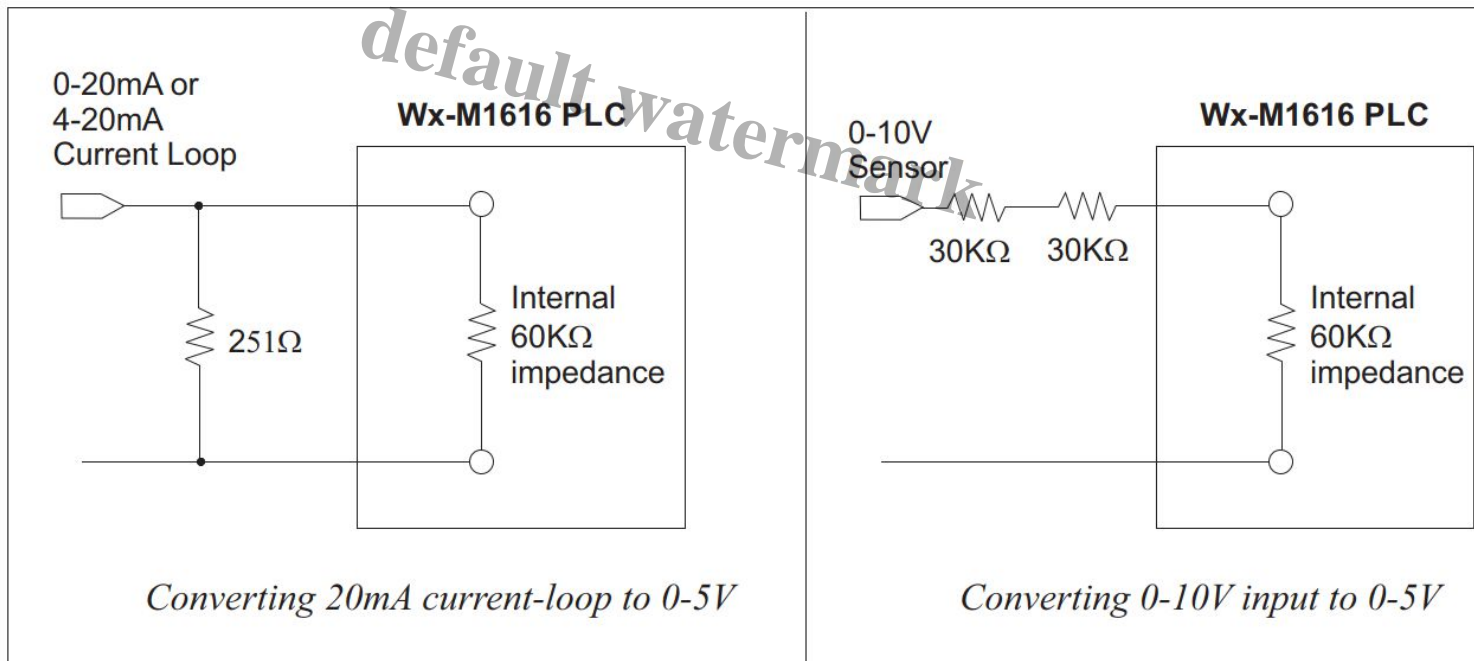
Note: The parallel resistance of the (249+1.37=250.37 ohm) and the internal 164.2K impedance of the Wx-TERM8+Wx100 PLC yields 250 ohm, which is then used to convert 20mA current to 5V.

c) Interfacing to Two-Wire 0-20mA Analog Signals

Many 4-20mA analog sensors only have two wire connections and are designed to be powered by the 4-20mA output current that flows through it. These types of sensors can be interfaced easily to the 0-5V analog inputs of the PLC as shown in the following diagram:

The sensor output will be converted to a 1-5V analog voltage and can be read by the PLC using the ADC(n) statement, which will return readings of between 820 and 4092.
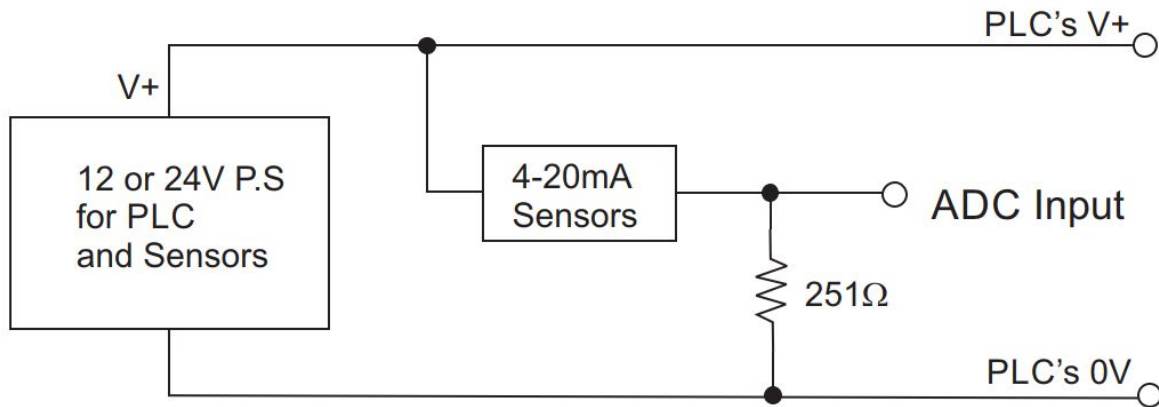
8. Adding More Wx-M1616#

As mentioned in the introduction section, up to four Wx-M1616 can be cascaded in a chain and add a total of 64 DI/AI and 64 DO to the Wx100 + Wx-TERM16.

However, the additional Wx-M1616 must be configured to occupy higher I/Os numbers. A new Wx-M1616 shipped from the factory are always configured to occupy the lowest I/O number, which is #17 to #32 for both the input and outputs.

1. Remove the 4 screws from the Wx-M1616 enclosure. Open the top cover and retrieve the PCB from within the enclosure.
2. Flip over the PCB and notice the 3 DIP switches as shown in the diagram below:
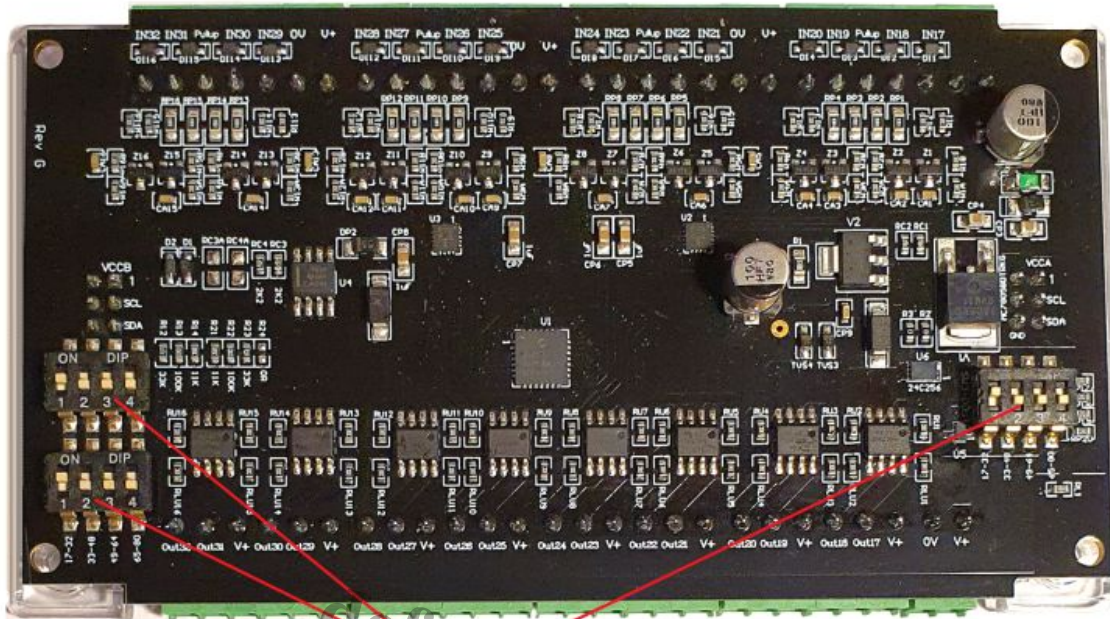
3 DIP switches for setting
address for Wx-M1616

3. **All 3 DIP switches should be set the same**. At any one time only one of the 4 switches on the DIP-switch should be turned ON as shown in the following diagram:
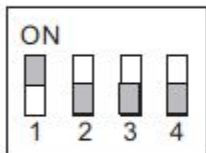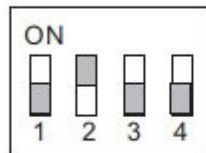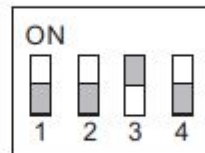

| I/O #17 to 32 | I/O #33 to 48 | I/O #49 to 64 | I/O #65 to 80 |
| 1=ON | 2=ON | 3=ON | 4=ON |

Once you have set the DIP switches, peel from the I/O label sheet (included in the Wx-M1616 package as shown below) the I/O number labels that correspond to the DIP switches setting and paste over the default I/O numbers (17 to 32) on the PCB so that the correct I/O number is visible on the PCB once they are assembled back to the enclosure. We provide 2 sets of I/O labels so you will have a spare set of I/O for flexibility.

4. After setting the DIP switch and pasting the I/o labels, re-assemble the PCB onto the enclosure and fasten the top cover back to the bottom enclosure with the 4 original screws.

[/vc_column][/vc_row]

Date Created
2021/06/11
Author
administrator