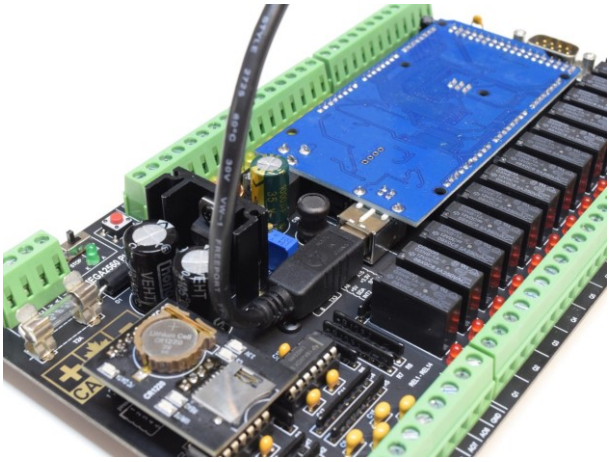
EAN 4260474039951
May 22, 2020
Document version 1.2

CANADUINO MEGA2560 300-24 DIY PLC Kit V1.3



This Kit offers a very affordable opportunity to add a programmable logic controller to many kinds of projects and machines like lighting, HVAC, greenhouses, water treatment or smoke houses. It can help you control your Halloween decoration or your manufacturing equipment.

CANADUINO MEGA2560 300-24 PLC is built around an Arduino MEGA2560 compatible module and can be programmed using Arduino IDE. We highly recommend Mitov's "Visuino" visual programming tool.

CANADUINO MEGA2560 300-24 PLC fits a small budget but delivers power and versatility equal to 10x more expensive professional process control devices.

MEGA2560 300-24 PLC basic features:

- ✓ 8 analog 0-10V inputs (10-bit res.)
- ✓ 8 analog inputs or GPIO (TTL level)
- ✓ 8 analog 0-10V outputs (8-bit res.)
- ✓ 2 interrupt inputs
- ✓ 16 digital 3.3-24V inputs
- ✓ 14 digital 250V/5A relay outputs
- ✓ 2 x RS232 (option), I2C Bus, SPI Bus

INTRODUCTION

MEGA2560 300-24 PLC is a Do-It-Yourself kit comprising only through-hole parts with a pin pitch of typically 2.5mm or more and is easy to build using basic electronic tools.

There are 16 opto-isolated digital inputs, typically recognizing any voltage 3.3V to 24V DC as HIGH level. This of course depends on the CTR of the opto-isolators and can be differ. The ones we ship with the kit have a typical CTR of 50-200 but can be replaced by a different type, for example with CTR of 400-800, to make the inputs work already with a voltage as low as about 2.5V.

The 14 digital outputs are fast acting relays OMRON G5NB-1A-E with about 10ms operate and release time, and high-capacity contacts. The maximum load can be 5A @ 250VAC or 30VDC.

Analog inputs and outputs on screw terminals are designed for 0-10V operation, typically used for light dimmers or motor drivers, for example.

Several 10V output terminals are available to deliver 10V level for example to a potentiometer, to generate the analog input signal. The 10V level is adjustable in a range of about 9-11V and is also used to drive the output relays. The 10V supply outputs in the analog input section are over current protected (trip point 200mA) by a self-resetting fuse.

Analog inputs and outputs are not electrically isolated. The impedance of the analog outputs is about 1k which limits the short circuit current to 10mA, while the inputs are protected against voltage of up to 28V. The 8 additional analog inputs on the AUX connector (2x8 pin header) are straight connected to the ATmega2560 MCU and do not have any kind of additional protection. These pins can also be defined as standard GPIO ports, if auxiliary TTL level digital ports are needed, for example to address multiple SPI devices.

I2C bus and SPI are exposed for an easy connection to auxiliary devices, for example the optional available RTC and micro-SD module. There are no pull-up resistors for the I2C bus on board; please make sure your external device has these resistors assembled. I2C and SPI data lines are direct connections to the MEGA2560, and do not have additional protection.

The 2 optional serial RS232 ports easily connect with machines, frequency motor drives, computers, or HMI devices, for example. Both ports are available on the same 9-pin male D-Sub port. Port COM2 is available on pins 2 and 3, while COM3 is available on pins 7 and 8. COM1 is the serial port used for programming and monitoring (RX/TX through USB).

The auxiliary connector with its 8 additional analog inputs, 5V and 3.3V supply voltage and I2C bus, can perfectly be used to connect any kind of graphic or character display, like for example UNIVERSAL-SOLDER's 1602 (2x16) or 2004 (4x20) character displays, or 128x64 graphic display, due to the fact that these 8 ports can become GPIO by declaration in your Arduino sketch.

The operation voltage for the PLC is 12-24V AC/DC (absolute limits 9-24VAC or 12V-35VDC). The on-board power supply consists of a step-down switching converter for the 10V rail (adjustable between about 9 and 11 Volt with a trim potentiometer), capable of a maximum output current of 3A to operate the relays, and generate the 10V level for the analog section and the input of the following 5V linear voltage regulator for the logic part. A fuse with a breaking capacity of 2A(T) limits the current for the entire device to a safe maximum.

The kit comes with sturdy screw terminals with rising cage clamp contacts, to insure best connectivity to solid and flex wires 22-12AWG. Mounting holes with 3.2mm diameter are available in all 4 corners and 2 more in the middle of the board. They can take 3mm standoffs or spacers if desirable.

A DIN rail mount (tray) with outer dimensions of 212 x 128mm is available as option and snaps on standard 35mm DIN rails.

ASSEMBLING

Assembling this kit is no challenge. We expect you to have some soldering experience with thru-hole electronic components, and of course basic knowledge in analog and digital electronics, to proceed with commissioning and troubleshooting after assembling. To support your work and to make some steps easier to understand, please see the pictures on UNIVERSAL-SOLDER.com

The following order is recommended for flawless and easy assembling:

1. Start with the lowest profile parts, which are the 3 resistors R9, R10, R18

2. Proceed with the next thicker parts, which are the 100nF capacitors C2, 3, 6, 7, 10, 11, 16, 17 and 2.2µF capacitors C1, 4, 5, 8, 9, 12, 15, 18.

3. Now install all the resistor networks and arrays. There are 19 of them on board. Please refer to the schematic and make sure to install the right part in every position. The dot on the resistor marks pin 1. All pins #1 have a square on the silk screen. Markings:
   R1, R4 = B223
   R2, R5 = B561
   R3, R6 = A223
   R7, R8 = B103
   R19, R20, R22, R23 = B273
   R13, R16 = A102
   B15, B17 = A392
   R14, R21 = A272
   R12 = A223

   Hint: *Attach ALL parts only on 1 lead, IC sockets and pin headers maybe on 2 leads. Then turn the board over, adjust the alignment, and finally solder all remaining pins and contacts before you proceed with the next step.*

4. The IC sockets have about the same height as the resistor arrays and should be assembled next. There are 2 x DIP14, 6 x DIP16 and 1 x DIP20 to assemble. Make sure lining up the notch in the sockets with the printed notch on the silk screen.

5. Now the LEDs. We marked [A] and [K] on one of the LEDs in every group, also on the RUN LED. The long lead on LEDs is anode [A]. Insert 16 yellow LEDs for the inputs (D4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25, 26), one green LED for RUN (D2 has no name on the silk screen) and 14 red LEDs for the outputs (D6, 9, 12, 15, 18, 21, 24, 27-33).

6. Time for the headers. Please install all headers, for the Arduino, the optional RTC.SD module, and the auxiliary 2x8 connector.

7. Proceed with the remaining parts, starting with the smaller parts like the RUN switch, inductivities, diodes, trim pot, fuse clips and the 3 small electrolytic capacitors. Watch the polarity of the capacitors!! [+] is marked on the PCB, but [-] typically on the capacitors.

   Hint: *Solder the fuse clips with a fuse inserted – it is a lot easier.*

8. Next taller parts are the terminal connectors. You will easily find out how to make them all happen by interlocking the available 2 and 3 pole modules. Then assemble the relays.

9. Now you can assemble all remaining parts (3 big capacitors – watch polarity, 2 voltage regulators, the heat sink, the RS232 port). It can be necessary to bend the leads of the switching voltage regulator (TO-220 5-pin package) depending on the type in your kit. Please refer to the pictures, how to bend its leads. It is recommended to assemble the heat sink with the 2 ICs before adding these parts to the PCB but completely tighten the screw only after all soldering on these parts is done.

   Do NOT install any ICs or the Arduino module at this time.

COMMISSIONING

After performing visual testing for shorts or bad solder joints, apply a voltage of 12-24VDC, limited to 30mA, to GND and IN 12-24V terminal. Check if 5V on the IC sockets and the adjustable 10V is available, without exceeding the current limit. If this looks good, install the ICs. Make sure the correct position of pin 1 (notch or dot on package, socket, and PCB print).

Check again just as you did before. You should measure a total current of about 30mA at 12V, and just about 20mA at 24V. This is a good sign for the switching regulator to work as expected.

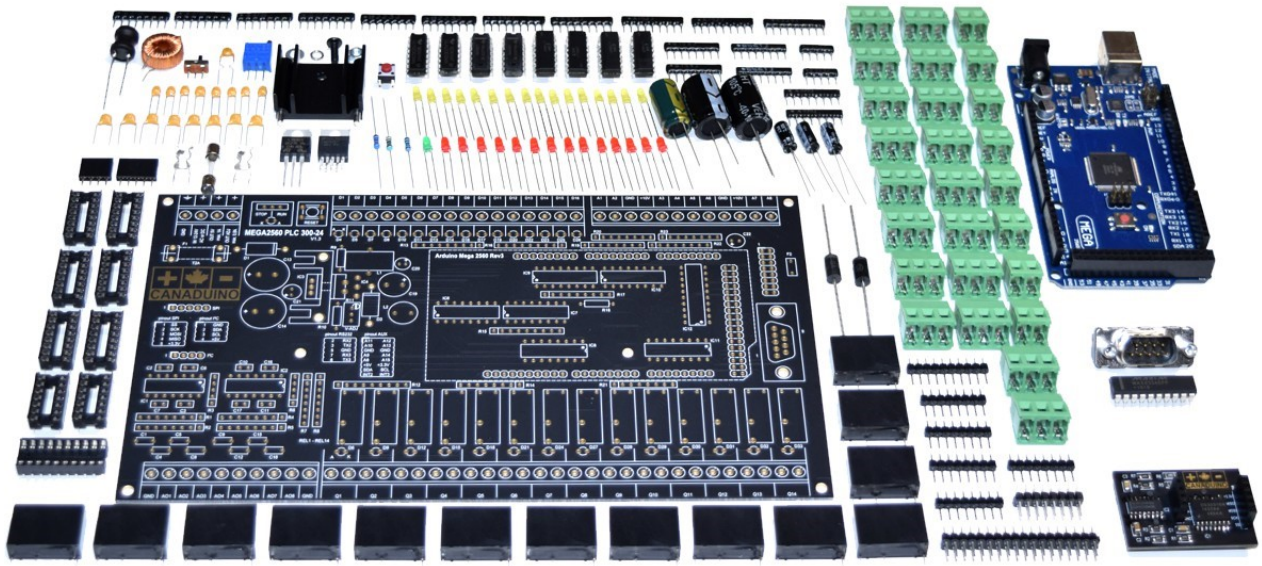
Now you can proceed with the Arduino board. The total current should be about 150mA at 24V or 250mA at 12V, with the Arduino installed.

We recommend you check every input and the analog outputs with a voltmeter, to confirm the expected voltage levels. Connect every input D1 - D16 with a jumper wire to either the 5V or 10V supply output and see if the corresponding input LED will light up.

Please see the schematic for details about the function, and the ports assignment.

ORDER INFORMATION

Basic PLC kit:	EAN 4260474039951 (Arduino MEGA2560 sold separately)
DIN rail kit:	EAN 4260474033997 (see picture on our website)
SD-Card + RTC:	EAN 4260474034413 (Backup battery CR1220 not included)
MEGA2560:	EAN 4260474030736 (100% compatible Arduino board)
MAX233CPP:	EAN 4260474034406 (2 serial ports RS232)



DIY Kit with all included parts. Arduino module, SD-Card + RTC module, and MAX233CPP serial chip are sold separately.