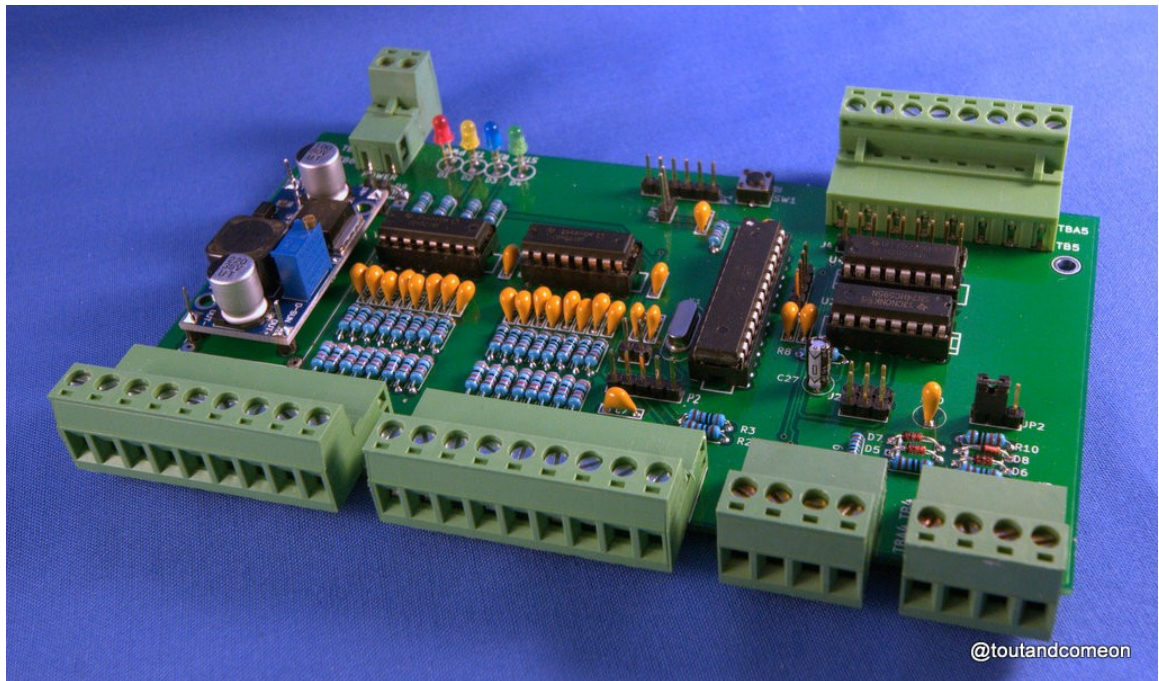


VM1AT-R1 INDUSTRIAL MICROCONTROLLER



WARNING

To avoid permanent damage to integrated circuits you may take precautions to discharge any static electricity from your body before handling them.

ASSEMBLY INSTRUCTIONS

- Before starting identify the components using the BOM and the pictures checking that you have all of them. The picture is also useful to solve any doubt about the orientation of components.
- Use a 20W soldering iron with small tip (1 to 1.5 mm) for all components with the exception of the big terminal blocks that will require 30-40W. Do not overheat the components.
- In general the components are installed beginning with the lower ones and continuing with the tallest. This helps the assembly by allowing the board to rest flat on the table.
- This is the recommended order:
 - Resistors R1 to R43
 - Diodes D5, D6, D7, D8 and D9
 - 16 pin sockets SK2, SK4, SK5 and SK6. Check correct orientation.
 - 28 pin sockets SK1. Check correct orientation.
 - Capacitors C1 to C26
 - Headers J1 to J4
 - Jumpers JP1 and JP2
 - Connectors P1 and P2

- Reset push button SW1
- 16 MHz cristal X1.
- Electrolytic capacitors C10 and C27.
- Power converter U3. First solder copper leads (approx. 1cm long) to the 4 holes of the converter leaving the long end in the bottom side. Then insert the leads into the main board, checking the orientation of the converter with the input terminals closer to diode D9, and solder them. Note that there are holes for two diferent sizes of converter but some models are slightly smaller requiring a little bending of the leads.
- Terminal blocks TB1 to TB6 (plug-in type) or TBA1 to TB6 (standard type). Plug-in type terminals must be installed in the inner row of mounting holes while standar terminals are intended to be installed in the outer row (although they can use either one). Use the 30-40W soldering iron.
- Led diodes D1 to D4. The recommended colors are only a suggestion. You may prefer other combination.
- DO NOT INSTALL THE INTEGRATED CIRCUITS YET.
- Connect the power supply (24Vdc) to TB6 (or TBA6). Negative pin is the one closer to the edge of the board. If the polarity is reversed the board will not work but no damage will happed (diode D9 protects the board against reverse polarity).
- Connect a voltmeter between 0V and +5V (i.e. pins 1 and 4 of TB3 (or TBA3).
- Adjust the trimpot in the power converter until the voltage reads +5V +/-5% (4.75 to 5.25V). It is recommended to seal the trimpot in the adjusted position applying a tiny drop of glue into the adjusting screw.
- Disconnect the power.
- Plug integrated circuits U1 (ATMEGA 328P), U2 (74HC595), U4 (ULN2003), U5 and U6 (CD4021). Note that U4 and U2 are pointing in opposite directions.
- Apply power again. If everything is OK the PWR indiator (RED) will turn on steady and the STAT indicator (GREEN) will blink once per second, indicating that the processor is running.
- Remember that this test does not verify the operation of the input/output pins. To test the full operation of the board you may use the pre-loaded program and a MODBUS MASTER application in order to read inputs and write outputs from an external device. Check the support documentation for help.

INSTALLATION AND USAGE

The VM1AT-R1 controller can be connected in several ways depending on the specific application, but the basic ideas are as follows:

- Digital Inputs (TB1, TB2) will be ACTIVE when +24V are applied to them and INACTIVE when 0V are applied or the input left open.
- Digital Outputs (TB5) will SINK up to 500 mA from a load connected to +24V when ACTIVE and open when INACTIVE. Typically this load will be the coil of a relay or contactor, but lamps, resistors and other devices can also be driven.
- Analog Inputs (TB4) can be used individually to measure analog voltages up to 5V or as a pair to use a TWO-WIRE (I2C) bus to connect several input/output devices (i.e. sensors, actuators, etc.).
- Serial connection (TB3) is intended to be used as a MODBUS RTU SLAVE communication link but can be used as a general purpose serial channel too. The terminal block can supply +5V to power external devices with up to 2A (i.e. a touch screen monitor).
- The user must develop the software for the intended use of the controller. Basic support libraries and examples are supplied to assist.
- Applications can be developed using various free of charge IDE platforms (AVR, Eclipse, Netbeans, Codeblocks, Arduino, etc.). There is an extensive community of users of boards based on the ATMEL ATMEGA328P microcontroller, specially the Arduino community, where all class of support, including forums, libraries and example applications can be found.

TEST PROGRAM

The processor comes with a small test program installed (VMbasic) that uses the debug serial channel (connector P1) to monitor the state of all digital and analogue inputs and control the state of the digital outputs. The program is part of the software support package that can be downloaded at:

<http://www.tutanautomation.com/wp-content/uploads/2015/05/VM1ATR1.zip>

To use the program you will need:

- A computer with a serial terminal program (i.e. the Arduino IDE serial console)
- One standard USB-Serial adapter (FTDI). This adapter will be required to download programs to the board too.

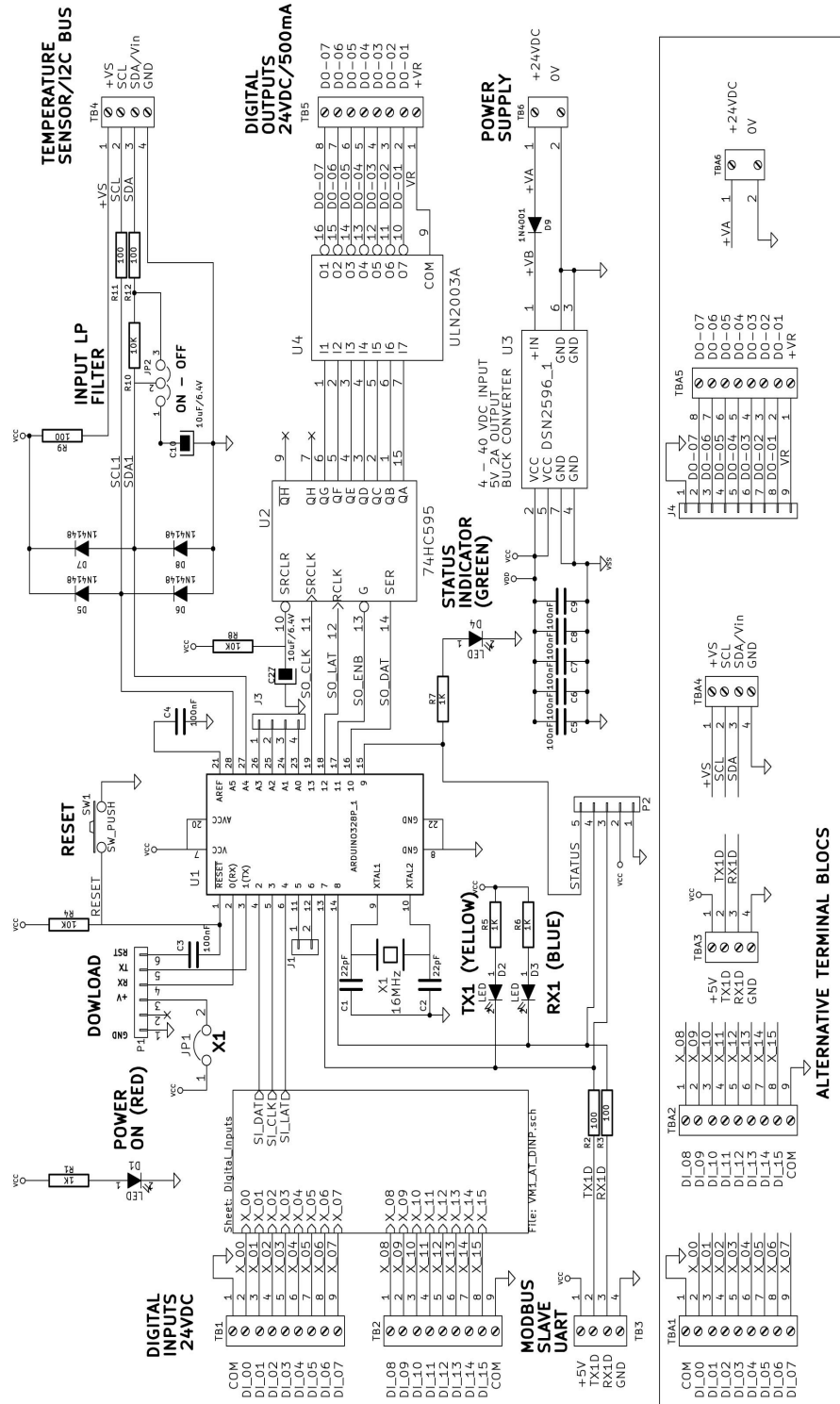
Operation:

- Connect the power to the board and the FTDI adapter to connector P1 (Check that the DTR pin in the adapter is close to the RESET push button).
- Start the serial console at 9600 baud. Every second the board will send a line containing all the input and output values.
- Enter a single number from "0" to "7" and press SEND to toggle the corresponding output. The new value will be displayed in the console.

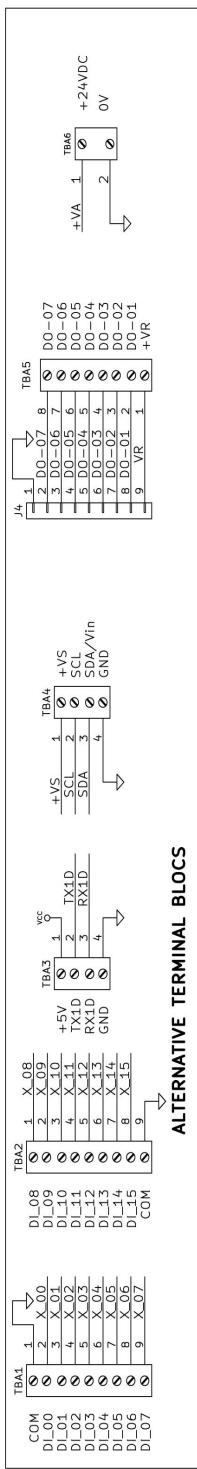
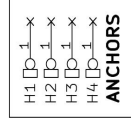
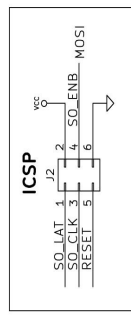
VM1ATR1- BOM

Pos	Qty	Value	Ref
1	2	22pF	C1 C2
2	23	100nF	C3 C4 C5 C6 C7 C8 C9 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26
3	2	10uF/6.4V	C10 C27
4	4	1N4148	D5 D6 D7 D8
5	1	1N4001	D9
6	4	LED	D1 D2 D3 D4
7	1	HEADER 1 X 2p	J1
8	1	HEADER 2 x 3p	J2
9	1	HEADER 1 x 4p	J3
10	1	HEADER 1 x 9p	J4
11	1	HEADER 1 x 2p	JP1
12	1	HEADER 1 x 3p	JP2
13	1	HEADER 1 x 5p	P2
14	1	HEADER 1 x 6p 90D	P1
15	5	100	R2 R3 R9 R11 R12
16	4	1K	R1 R5 R6 R7
17	19	10K	R4 R8 R10 R14 R16 R18 R20 R22 R24 R26 R28 R30 R32 R34 R36 R38 R40 R42 R44
18	16	39K	R13 R15 R17 R19 R21 R23 R25 R27 R29 R31 R33 R35 R37 R39 R41 R43
19	1	SW_PUSH	SW1
20	1	CONN_2_V	TB6 TBA6
21	2	CONN_4_V	TB3 TB4 TBA3 TBA4
22	2	CONN_9_V	TB1 TB2 TBA1 TBA2
23	1	CONN_8_V	TB5 TBA5
24	2	CD4021	U5 U6
25	1	ULN2003A	U4
26	1	ATMEGA328P	U1
27	1	74HC595	U2
28	1	DSN2596_1	U3
29	1	16MHz	X1
30	1	DIP28_300	SK1
31	4	DIP16_300	SK2 SK4 SK5 SK6
32	1	VM1AT_R1	PCB1

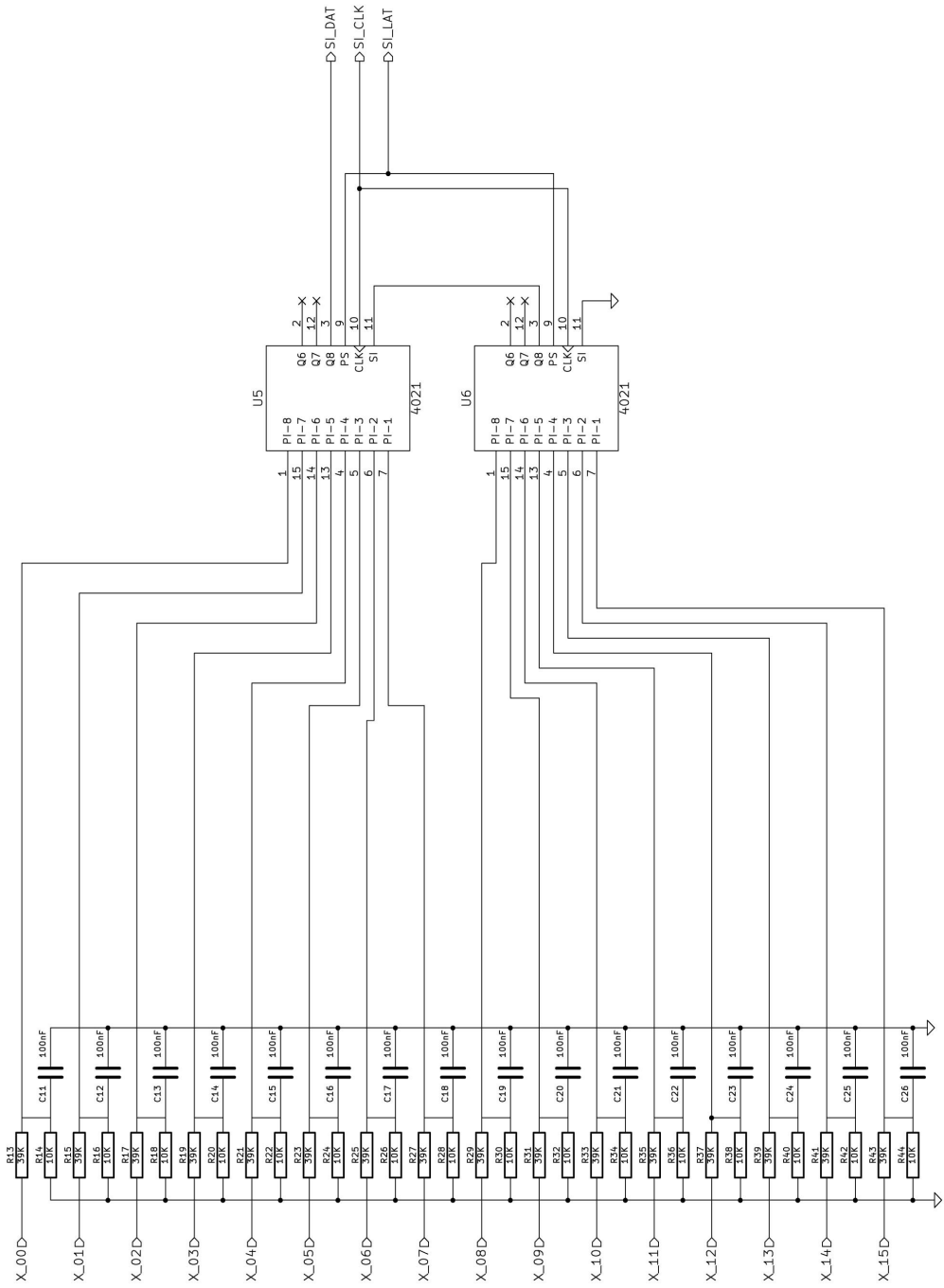
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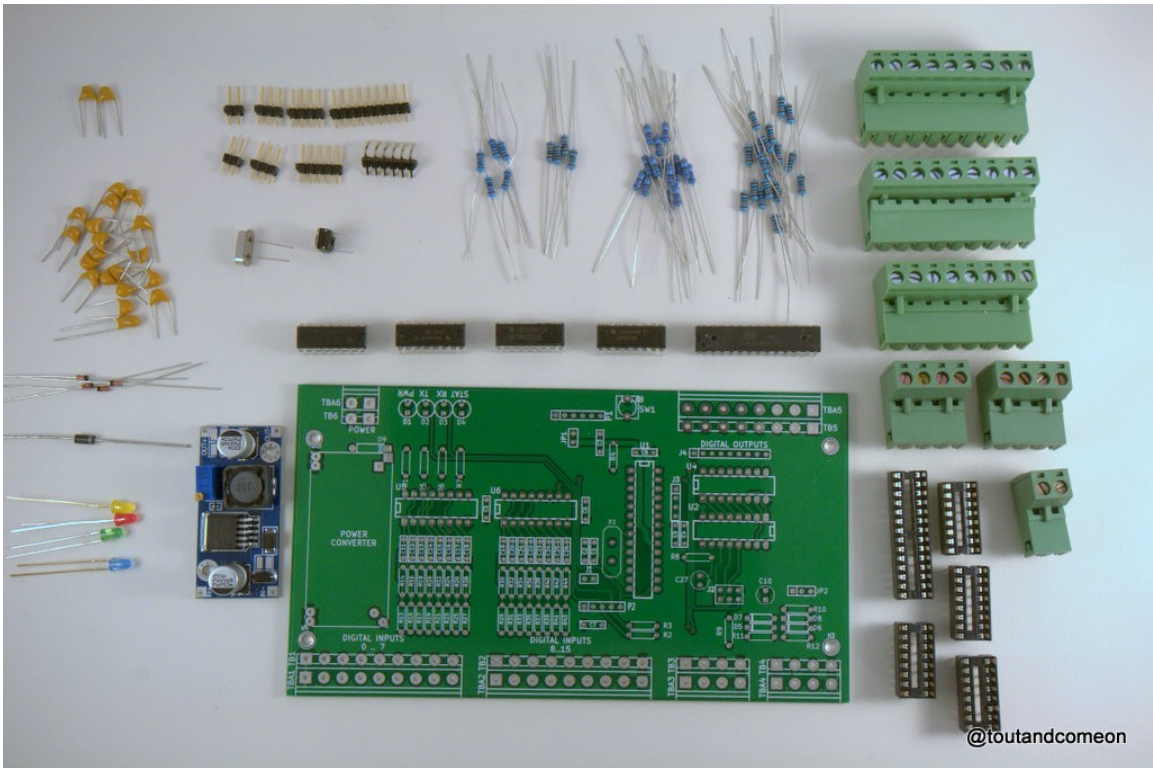


ALTERNATIVE TERMINAL BLOCS

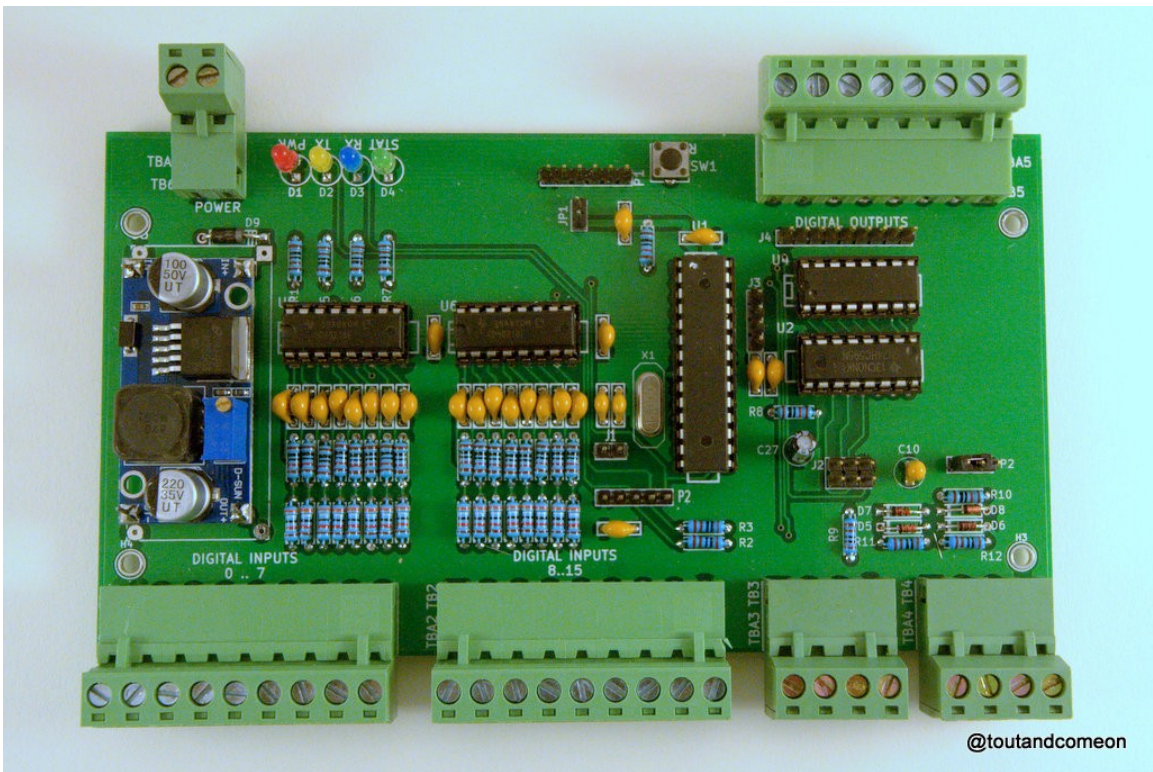


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