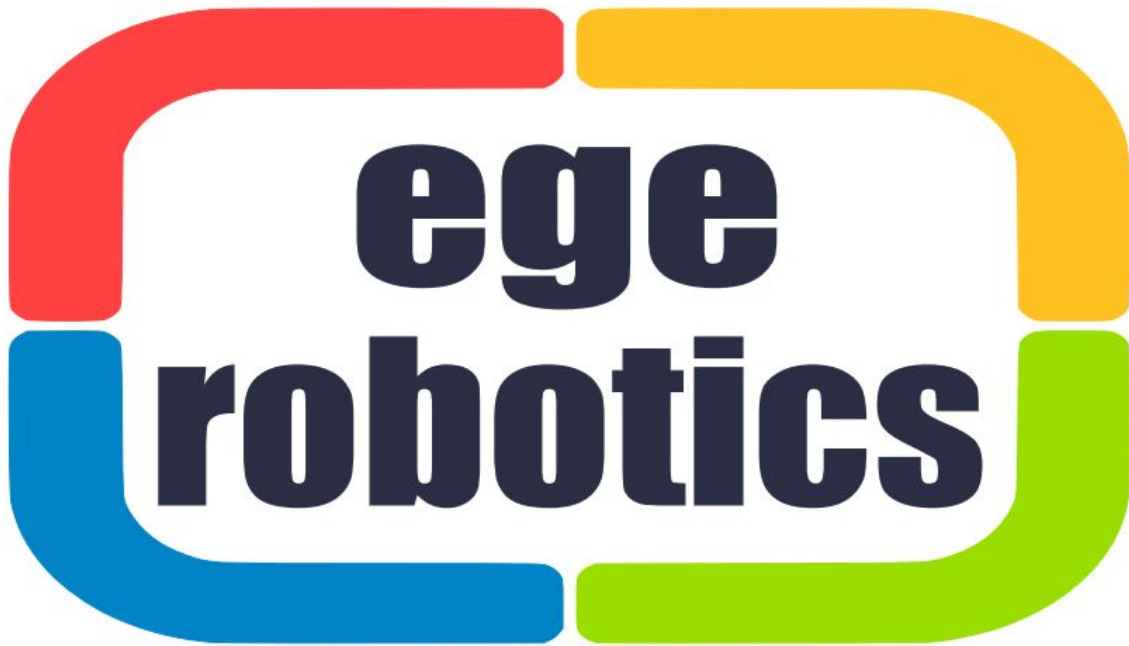




USER MANUAL

ETHERCAT DIGITAL & ANALOG INPUTS OUTPUTS

Document History

Version	Date	Author	Comment
V1.0	28.06.2025	Emre Şensoy	First Release.

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1 - Product Overview

1-1 Dimensions

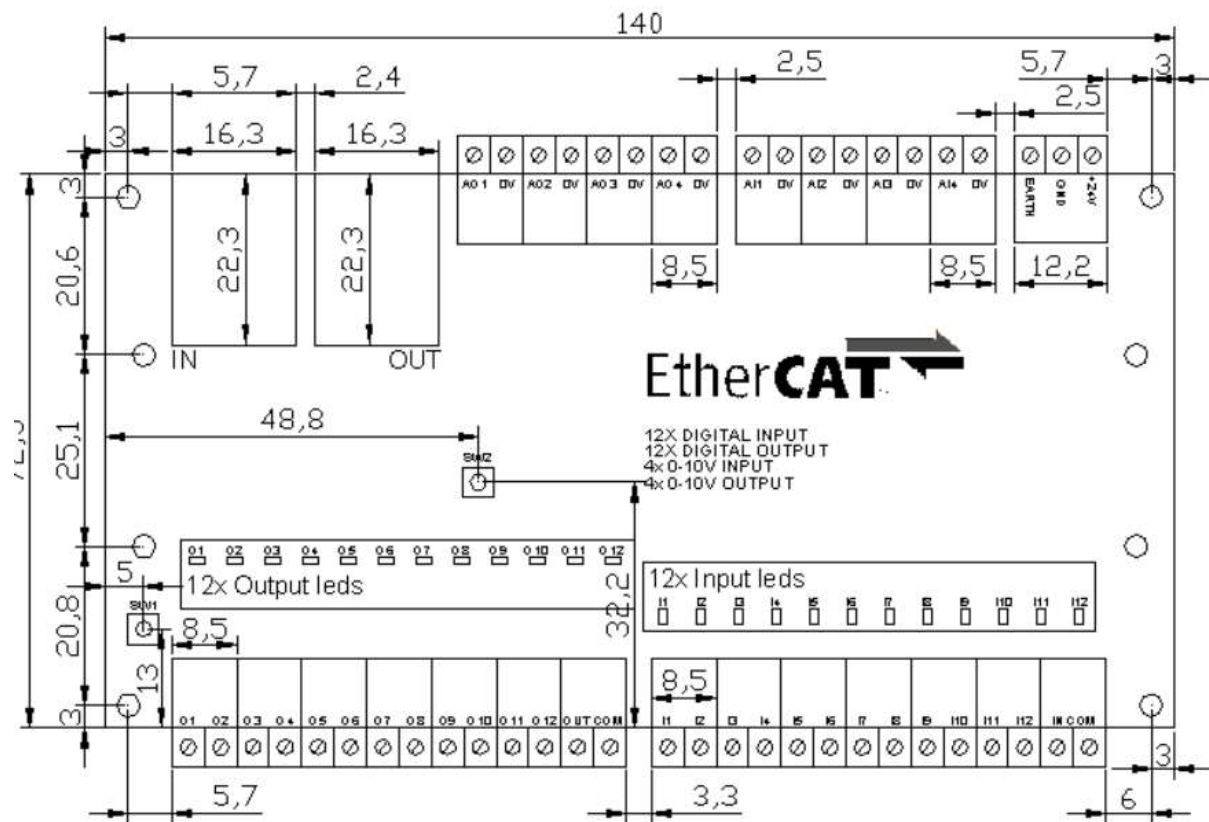


Figure 1 Outline dimensions in mm (all tolerances : $\pm 0.5\text{mm}$)

1-2 Top view

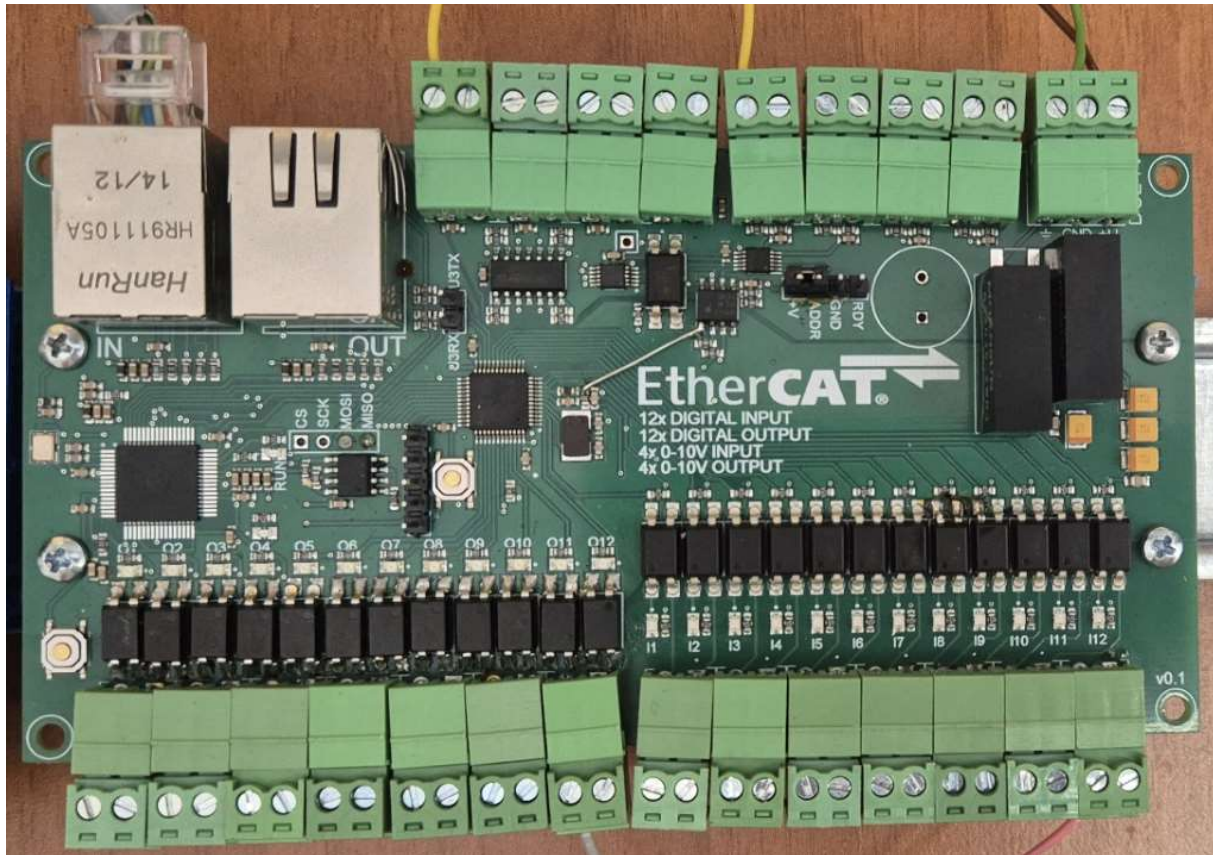


Figure 2 Top view of EtherCAT Encoder Interface

2 - Connections

2-1 IN & OUT ports

IN : A connection must be made to the IN port from the previous ethercat device. A standard Ethernet cable should be used.

OUT : If there is another EtherCAT device after this device, a connection must be made from the OUT port to the IN port of the other device. A standard Ethernet cable should be used.

2-1-1 Standart Ethernet Cable

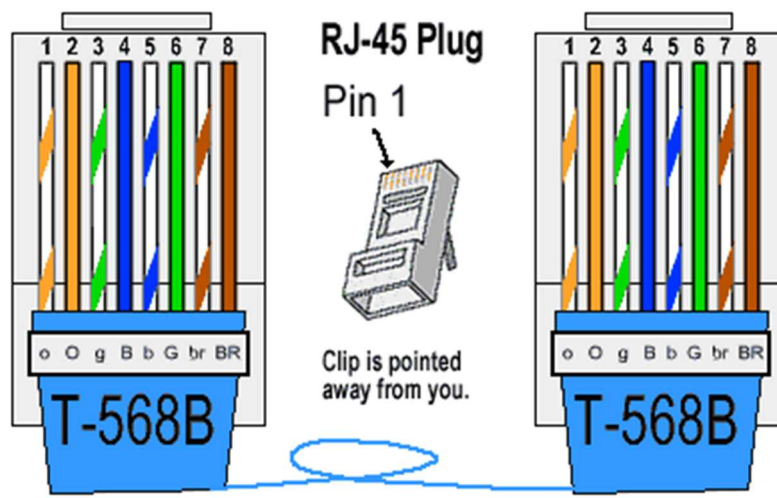


Figure 3 Standart ethernet cable pinout

2-2 12x DIGITAL OUTPUTS

This IO board has 12 isolated digital transistor optocoupler output (50mA) as shown in figure 4. Every optocoupler's 3. Pin collected and connected to OUT COM.

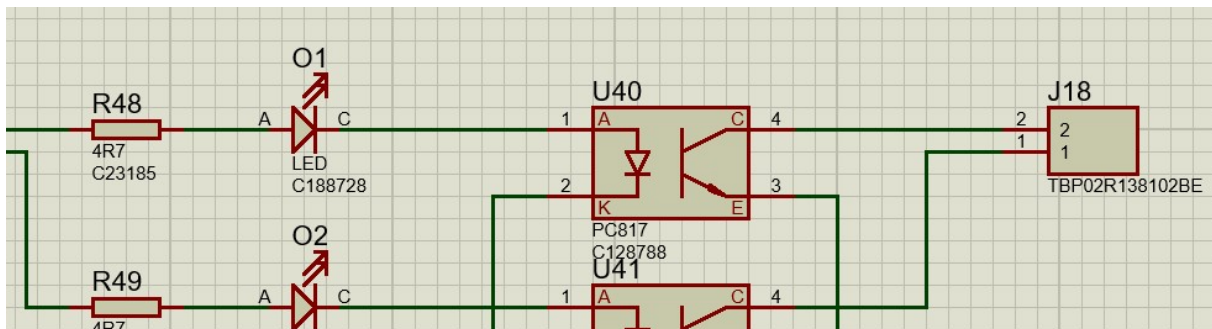


Figure 4 Digital Output schematics

To use an output you must connect as shown in figure 5.

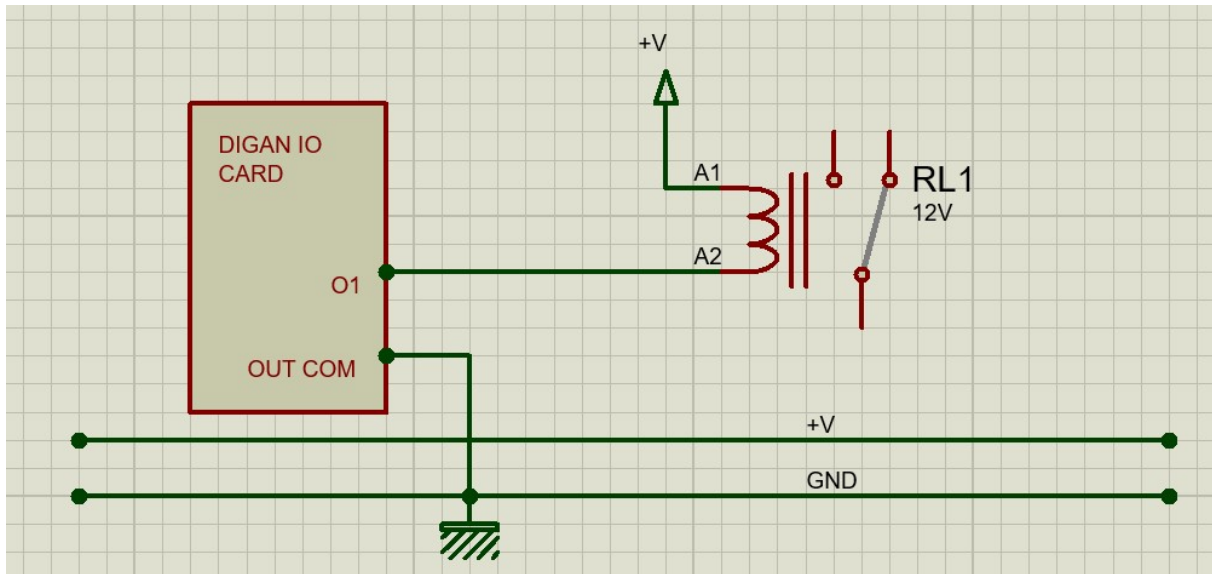


Figure 5 an output connection schematic

2-3 12x DIGITAL INPUTS

This IO board has 12 isolated digital transistor optocoupler input as shown in figure 6. Every optocoupler's 2. Pin collected and connected to IN COM.

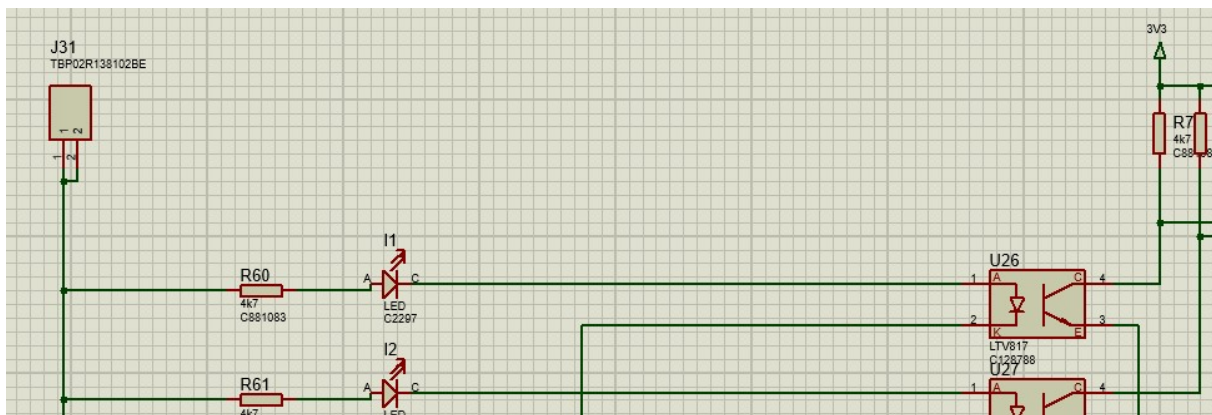


Figure 6 an input connection schematic

To use an output you must connect as shown in figure 7.

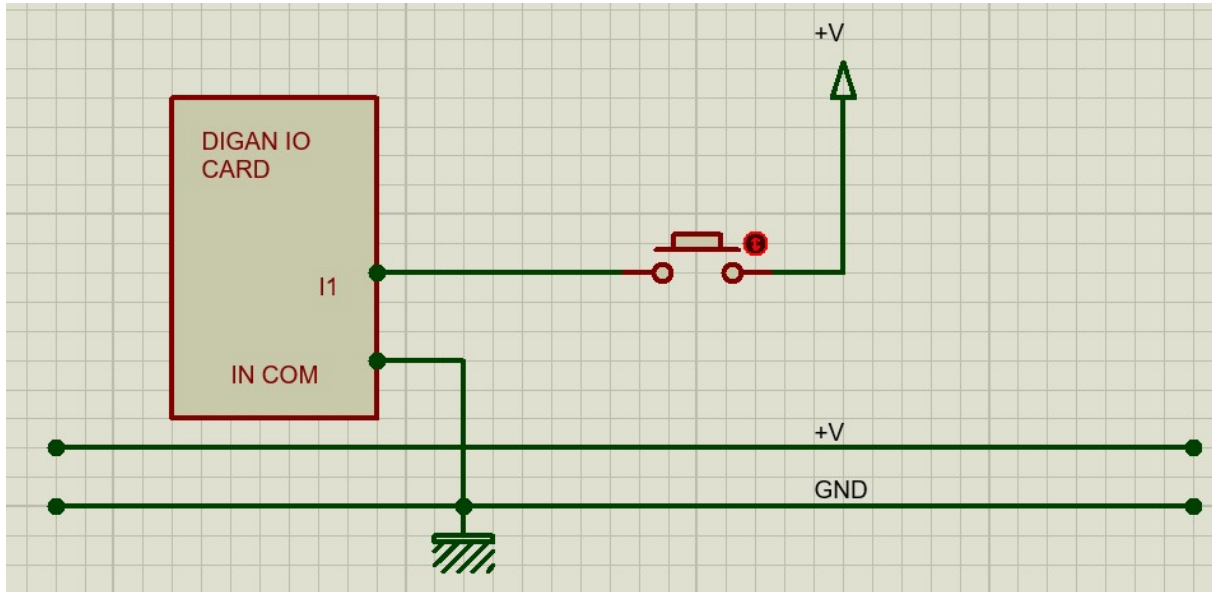


Figure 7 an output connection schematic

2-3 4x ANALOG 0-10V INPUTS

Analog input schematics as shown in figure 8. Every input has a voltage divider circuit with Gain = 1/3 and a filter capacitor 100n. All analog inputs isolated from MCU.

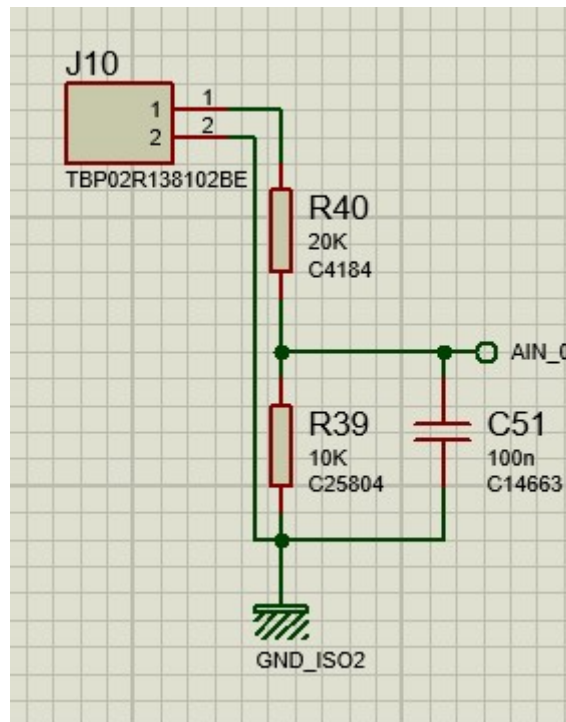


Figure 8 an analog input schematic

2-4 4x ANALOG 0-10V OUTPUTS

The board has a MCP4728 DAC IC. Every output of the DAC connected to one of 4 channel of LM324 NON-INVERTING Amp. Input. Gain of opamp circuit is 3. There is a filter capacitor (470p) at the end. All analog outputs isolated from MCU.

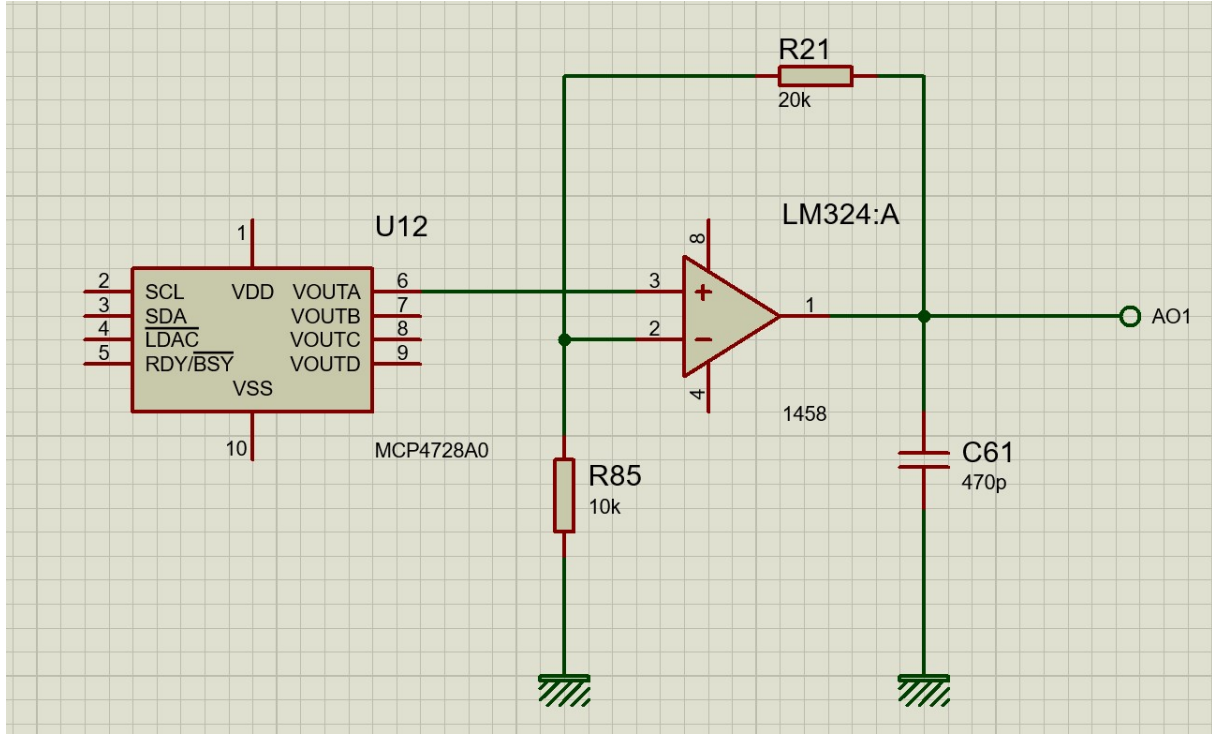


Figure 9 output schematic of every AOx

2-5 +24V GND EARTH INPUTS

This device must supply with DC 24V. You must connect +24V to port's +24V input. GND to port's GND input. Also you must connect system's EARTH GROUND to EARTH input.

2-6 SW1 AND SW2 BUTTONS

This buttons are for debugging purpose. You don't need to use them anytime.

3 TWINCAT INSTALLATION

Copy ER-ADIO-4-12.xml file, provided by us, to TwinCAT\3.1\Config\Io\EtherCAT directory.

Make all connections. Run Twincat. Open or create a new Project and do a right click to Ethercat device and click to SCAN as in the screen shot.

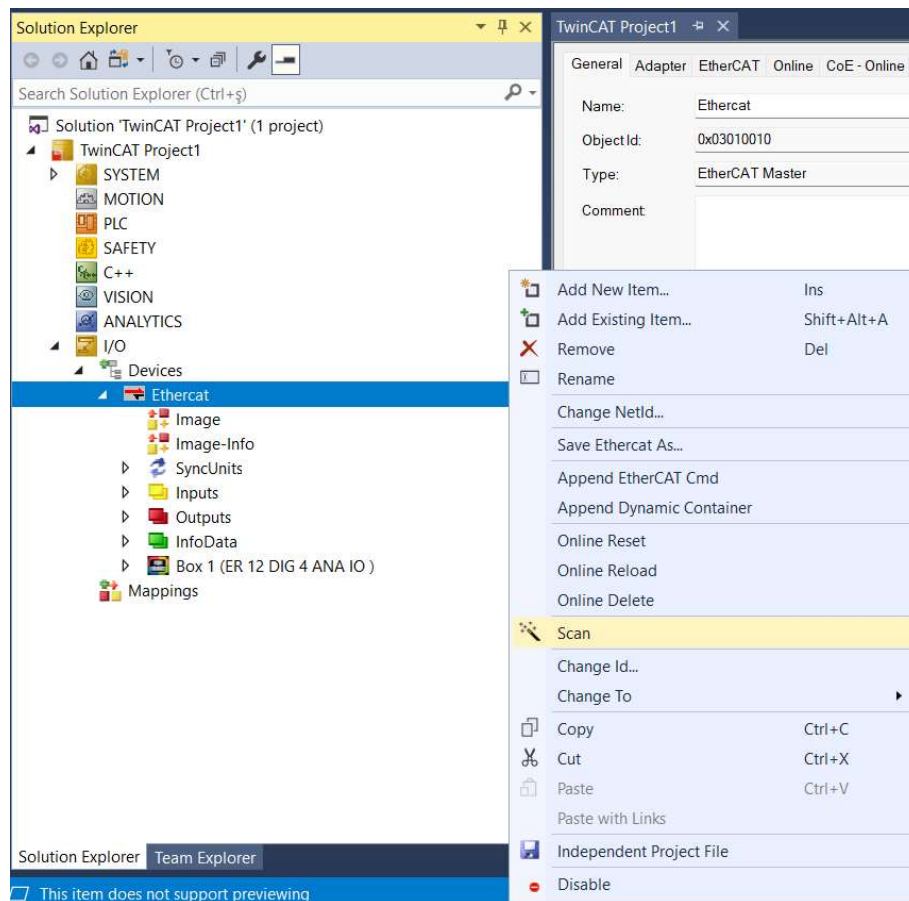


Figure 10 Twincat project tree screen shot

It will scan the network and add connected devices to tree. As you can see there is a BOX 1(ER 12 DIG 4 ANA IO).

Click on the right-pointing triangle to the left of BOX1. And you will see this screen.

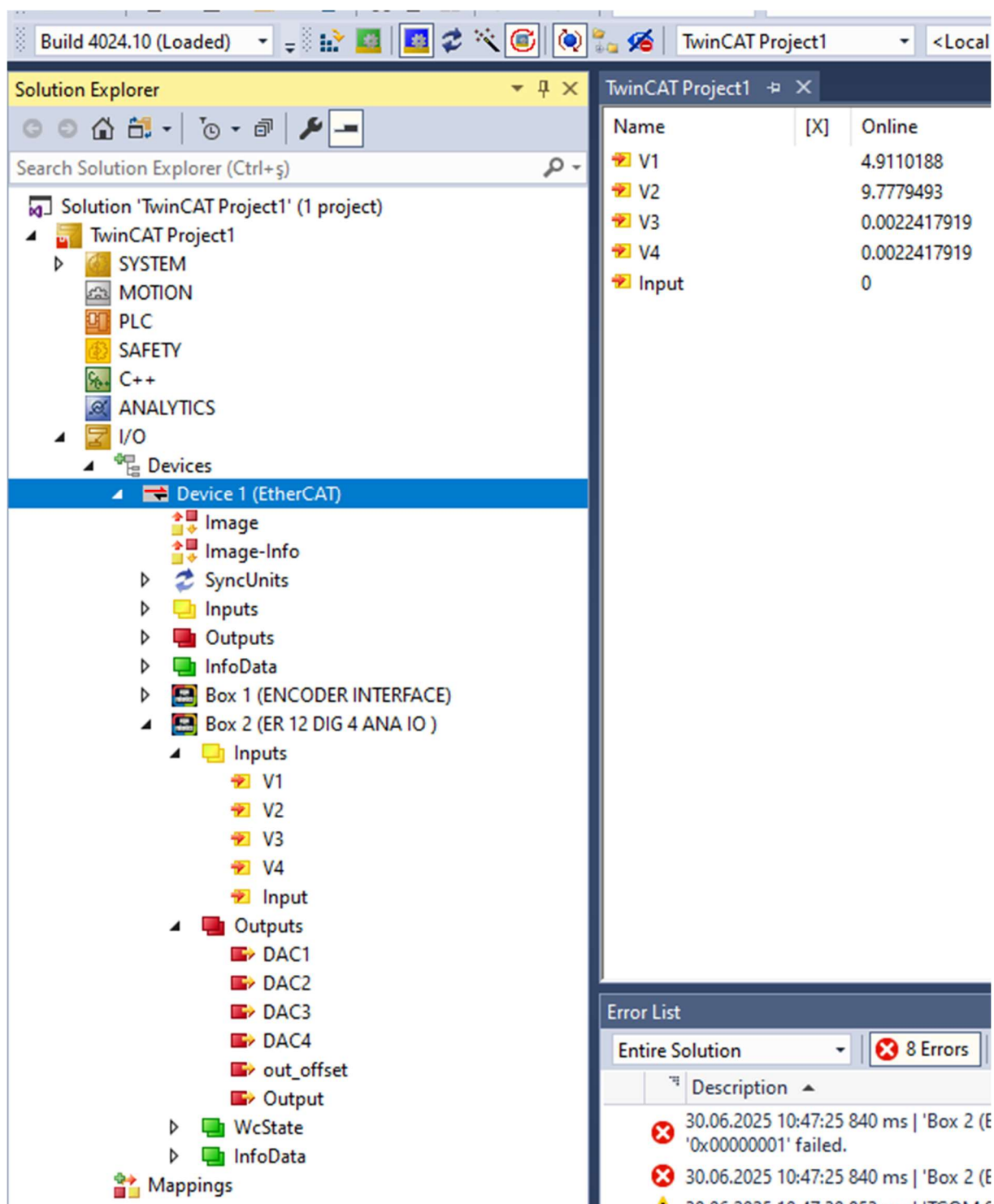


Figure 11 Twincat screenshot of DIG AN Inputs & Outputs

3-1 INPUTS

V1 to V4 registers related with analog inputs. Input register is related with digital inputs.

3-1-1 V1 TO V4 ANALOG INPUTS

You will get voltage value of every analog input.

3-1-2 INPUT

You can get $2^{(n-1)}$ value from every input. For example if 1. input has a high state we will get $2^{(1-1)} = 1$ from this register. If 2. input has a high state we will get $2^{(2-1)} = 2$ from this register. If both 1 & 2 input has high state same time we will get $1+2 = 3$ from this register.

Below you can see adding value of each input

Input Number	1	2	3	4	5	6	7	8	9	10	11	12
Adding Value	1	2	4	8	16	32	64	128	256	512	1024	2048

3-2 OUTPUTS

DAC1 to DAC4 registers are related with analog outputs. Output register related with digital outputs.

3-2-1DAC1 TO DAC4 ANALOG OUTPUTS

You must 0xFFFF for max analog value and 0x0 for min analog value. When you write 0xFFFF to one of DACx register, if the output is greater than 10V, you can compensate the output with out_offset register.

3-2-2out_offset REGISTER

If you write 0xFFFF to any of DACx register, and the corresponding analog voltage is greater than 10V, you can compensate this voltage value by writing the max voltage value to out_offset register.

For example you wrote 0xFFFF to DAC1 and you measured 11.2V from DAC1 output, if you write 11.2 to out_offset register, card will change the analog output to 10V.

After this if you write 0x7FFF any DACx, you will get 5V, if you write 0x0 to any DACx you will get 0V from corresponding analog output.

3-2-3OUTPUT REGISTER

To activate an output you must add corresponding value and write it to Output Register ($2^{(n-1)}$). For example to activate 1. Output write 1 to Output register. In the same way, to activate 2. Output you must write 2 to Output Register.

To activate 2 or more output simply add them all and write to Output Register. For example, to activate 4,7 and 9 outputs, simply write $8+64+256=328$ to Output Register

Output Number	1	2	3	4	5	6	7	8	9	10	11	12
Adding Value	1	2	4	8	16	32	64	128	256	512	1024	2048

4 MORE DETAILED VIDEO

<https://youtu.be/WotxXeQrlHM>