

## EBOX software programming

E/BOX

EtherCAT Measurement Box

Programming instructions

Software version : 0.9.3

Output structure

```
uint8    control
uint8    digital outputs
int16    analog output 1
int16    analog output 2
uint16   pwm output 1
uint16   pwm output 2
```

Input structure

```
uint8    status
uint8    counter
uint8    digital inputs
int32    analog input 1
int32    analog input 1
uint32   time stamp analog inputs
int32    encoder position 1
int32    encoder position 1
```

Outputs are synchronous with data frame, inputs are free running at approximately 11KHz.

Outputs:

Control

The control register is used for trigger functions and mode settings.

Bit 0 : Arms the index trigger for encoder 1. The first index pulse resets the encoder

and sets bit 0 in the status register. To retrigger write 0 and then 1 again.

Bit 1 : Arms the index trigger for encoder 2.

Digital outputs

Bit 0..7 enable the corresponding output. The voltage is equal to the supply voltage.

Each output is short circuit proof, and thermal and overcurrent protected.

Analog outputs

The output range of +-10V is mapped to +-32767 counts. Zero counts equals 0 volts.

Each output is overcurrent protected (20mA). The outputs are however not protected

against external voltages. Output impedance 0.50hm.

PWM outputs

The output range of 0-100% duty cycle is mapped to 2000 counts.

Repetition frequency

is 25Khz or 40usec. Values over 2000 are clipped. Each output has an open collector

transistor stage with over current protection.

Inputs:

Status

The status register is used for signalling the current state.

Bit 0 : Encoder 1 index pulse triggered.

Bit 1 : Encoder 2 index pulse triggered.

Counter

The counter register increments at each internal cycle. After 255 -> 0.

Digital inputs

Bit 0..7 correspond to each input signal. Voltage levels of 4 to 30V are

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acceptable.

Input impedance is 10Kohm.

### Analog inputs

The input range of +/-10V is mapped to +/-100000 counts. When the filter parameter  $n > 1$  then

the range will be  $n * 100000$ . The input range extends to approximately +/-11V but gets

increasingly non-linear. Input impedance is 1Mohm, or 2Mohm differential. The common mode

input range is +/-11V. The inputs withstand voltages to +/-24V.

### Time stamp analog inputs

32 LSB of the EtherCAT time for the last ADC trigger.

### Encoder positions

Encoder input signals are RS422 compatible, A+ A- B+ B- I+ I-. Using only A+ B+ I+ is also

acceptable (with loss of signal quality). Maximum input frequency 10Mhz. The input signals

are quadrature decoded, so one cycle counts 4 pulses. The count range is +/-2147483648.

The counter overflows in both directions. Other software must take this into account.

When the encoder mode is set to time stamping encoder position 2 is swapped with the

time stamp. The time stamp is a free running counter at 50Mhz (or 20ns) that gets latched

at each low to high transition of the B channel.

### CoE parameters

For calibration and mode setting purposes there are parameters available with following descriptions.

Index	Subindex	Name	Function
0x8000	0x01	ADC1 zero offset	Zero calibration of
analog input 1. Stored in eeprom.			
0x8000	0x02	ADC1 gain	Gain calibration
of analog input 1. Stored in eeprom.			
Fixed point 0x80000000 == 1.0			
0x8000	0x03	ADC2 zero offset	Zero calibration of
analog input 2. Stored in eeprom.			
0x8000	0x04	ADC2 gain	Gain calibration
of analog input 2. Stored in eeprom.			
Fixed point 0x80000000 == 1.0			
0x8000	0x05	DAC1 zero offset	Zero calibration of
analog output 1. Stored in eeprom.			
0x8000	0x06	DAC2 zero offset	Zero calibration of
analog output 2. Stored in eeprom.			
0x8001	0x01	Filter Ain1	Analog capture
multiplier. Values n between 2 and 255			
will trigger the ADC n times at 250Khz. The resulting			
value is the sum off n captures.			
0x8001	0x02	Filter Ain2	Analog capture
multiplier. Values n between 2 and 255			
will trigger the ADC n times at 250Khz. The resulting			
value is the sum off n captures.			
0x8001	0x03	Encoder mode	Bit 0 will enable the

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time stamp mode of encoder 1.

0x8001 0x04 ADC mode

Currently not

0x8001 0x05 DAC mode

Currently not

used.