



EtherCAT Series Products

**ECAT-2092T**

# EtherCAT Two-Channel Incremental Encoder Counter

with Latch and Compare Function



## 1.1 Introduction

The EtherCAT slave ECAT-2092T is an incremental encoder counter which provides two independent high-speed counter channels. It reads the pulse train generated by an incremental encoder and can be used in positioning feedback applications. Each channel has two counter (A, B) and one index inputs (C). The inputs can either be single-ended or differential signals. Three counting modes are supported: clockwise/counterclockwise, pulse/direction and quadrant counting mode. Each 32-bit counter and the trigger level (falling/rising edge) can be configured and set by software.

In addition to the encoder inputs A, B and C, a latch input I for each encoder channel allows the latching and clearing of each encoder counter. Encoder position are latched at rising and falling input signal and are recorded in two separate register.

The ECAT-2092T supports position compare: Each encoder channel is equipped with one 32-bit compare register which compares the counter position with the compare position and generates an output signal when the counter reaches or passes the compare position. The compare function supports single, auto incremental and array position compare. The pulse width of the compare output can be set.

Each channel has got an adjustable input signal filter for filtering out electrical noises.

## 1.2 Applications

- Position measurement
- Image capture
- Automated optical inspection
- Line-scan vision inspection
- Data acquisition

## 1.3 Features

Features:

- EtherCAT slave
- Two channels, 32-bit incremental encoder counters
- Encoder counting mode: CW/CCW , Pulse/Direction, A/B Phase
- Maximum counting rate: 4 MHz
- Encoder Input: A, B, C differential or single-ended signals
- Two digital input for counter latching
- Two digital output for position compare signal trigger: single and auto-increment compare

- Encoder digital input filter
- Input level: 5V, 12V/24V with internal resistor
- Polarity setting by software for active high or active low encoder input
- A/B/C signal isolation voltage: 2500V optical isolation

## 1.4 Hardware Specification

Item	Specification	
<b>Encoder Input</b>		
Number of encoder inputs	2x encoder counter (A, B, C), differential or single-ended	
Counter resolution	32 bit	
Encoder mode	A/B Phase, CW/CCW, Pulse/Dir	
Maximum input pulse frequency	A/B Phase	4 MHz
	CW/CCW	4 MHz
	Pulse/Dir	4 MHz
Programmable digital filter	1 ~ 250 $\mu$ s	
Input level	5V (default)	Logic high: 4 V ~ 5 V Logic low: 0 V ~ 2 V
	12 V (set by jumper)	Logic high: 5 V ~ 12 V Logic low: 0 V ~ 2 V
	24 V (set by jumper)	Logic high: 5 V ~ 24 V Logic low: 0 V ~ 2 V
A/B/C signal photo-isolation	2500 V <sub>DC</sub>	
<b>External Latch Input</b>		
Channel	2	
Input level	5V (default)	Logic high: 4 V ~ 5 V Logic low: 0 V ~ 2 V
	12 V (set by jumper)	Logic high: 5 V ~ 12 V Logic low: 0 V ~ 2 V
	24 V (set by jumper)	Logic high: 5 V ~ 24 V Logic low: 0 V ~ 2 V
<b>Compare Trigger Output</b>		
Channel	2	
Trigger pulse width	2 ~ 32,767 $\mu$ s	
Load voltage	5 ~ 48 V	
Max load current	100 mA	
<b>LED Indicators</b>		
Diagnostic LED	Power, EtherCAT status, signal status of each encoder input	
<b>Communication Interface</b>		
Connector	2 x RJ-45	

Item	Specification
Protocol	EtherCAT
Distance between stations	Max. 100 m (100BASE-TX)
Data transfer medium	Ethernet/EtherCAT Cable (Min. CAT 5), Shielded
<b>Power</b>	
Input voltage range	20 V <sub>DC</sub> ~ 30V <sub>DC</sub>
Power consumption	Maximum 4.5W
<b>EMS Protection</b>	
ESD (IEC 61000-4-2)	4 KV Contact for each channel
EFT (IEC 61000-4-4)	Signal: 1 KV Class A; Power: 1 KV Class A
Surge (IEC 61000-4-5)	1 KV Class A
<b>Mechanism</b>	
Installation	DIN-Rail
Dimensions (LxWxH) [mm]	110mm x 90mm x 33mm (without connectors)
Case material	UL 94V-0 housing
<b>Environment</b>	
Operating temperature	-25°C ~ 70°C
Storage temperature	-30°C ~ 80°C
Relative humidity	10 ~ 90%, No condensation

Table 1: Technical data

## 1.5 Dimensions

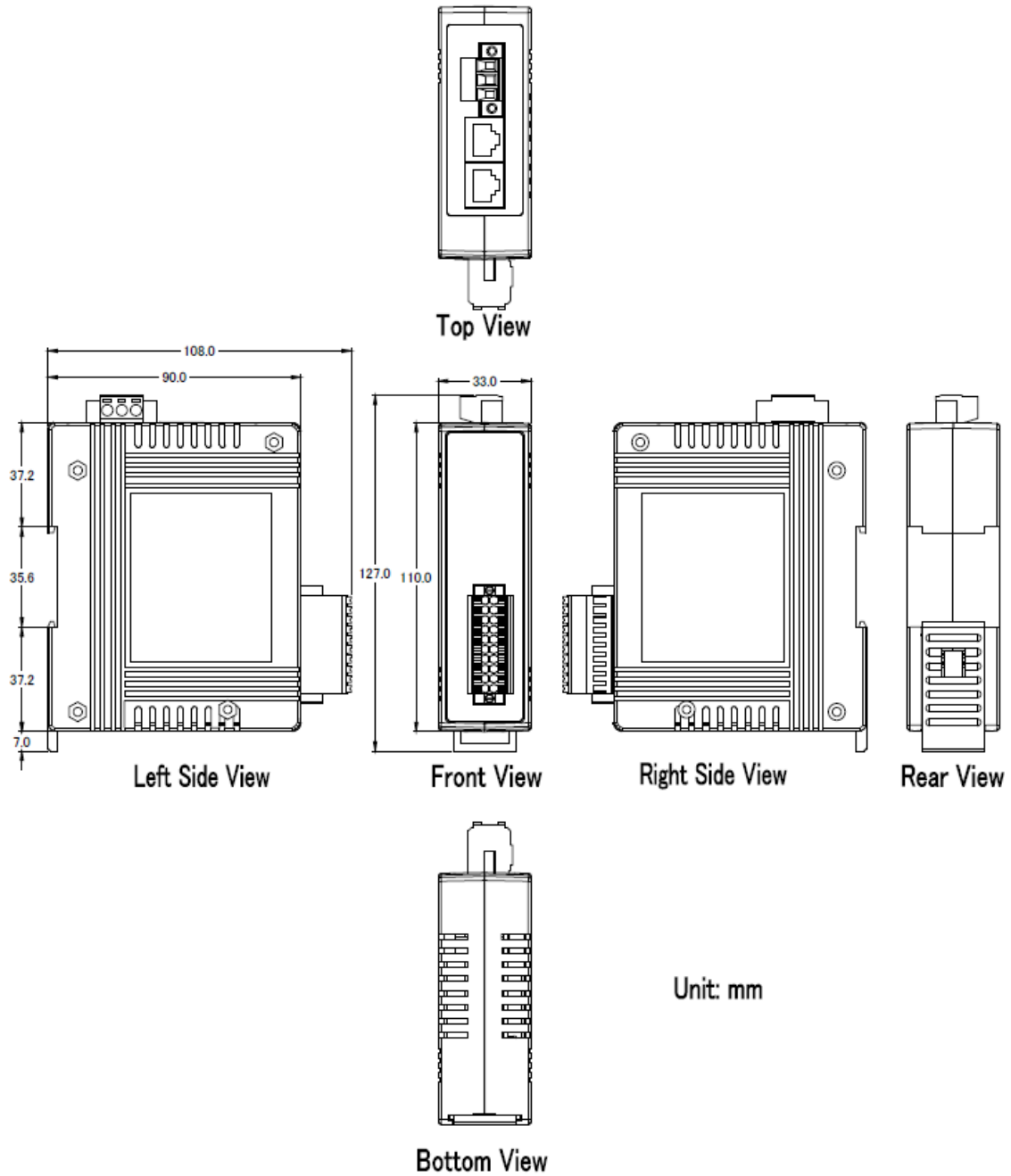


Figure 1: Dimensions of the ECAT-2092T

## 1.6 Connection Interfaces

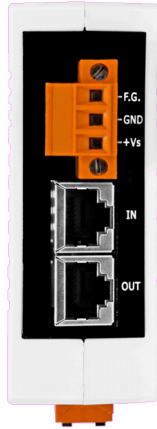


Figure 2: ECAT-2092T side view with power supply and EtherCAT connection

Name	Signal
F.G	Frame ground
GND	Power supply: Ground 0V (from negative power contact)
+Vs	Power supply: +24 V <sub>DC</sub> (from positive power contact)
IN	EtherCAT signal input
OUT	EtherCAT signal output

Table 2: ECAT-2092T power supply and EtherCAT interfaces



Figure 3: ECAT-2092T front view with encoder inputs

Name	Signal	Signal Description	
A0+	Input	Encoder input A0+	Encoder Channel 0
A0-	Input	Encoder input A0-	
B0+	Input	Encoder input B0+	
B0-	Input	Encoder input B0-	
C0+	Input	Encoder input C0+	
C0-	Input	Encoder input C0-	
I0+	Input	Latch input I0+	
I0-	Input	Latch input I0-	
T0+	Output	Compare trigger DO0	
T0-		External ground for DO0	
A1+	Input	Encoder input A1+	Encoder Channel 1
A1-	Input	Encoder input A1-	
B1+	Input	Encoder input B1+	
B1-	Input	Encoder input B1-	
C1+	Input	Encoder input C1+	
C1-	Input	Encoder input C1-	
I1+	Input	Latch input I0+	
I1-	Input	Latch input I0-	
T1+	Output	Compare trigger DO1	
T1-		External ground for DO1	

Table 3: Connection interfaces of the encoder counter

## 1.7 Internal I/O Structure

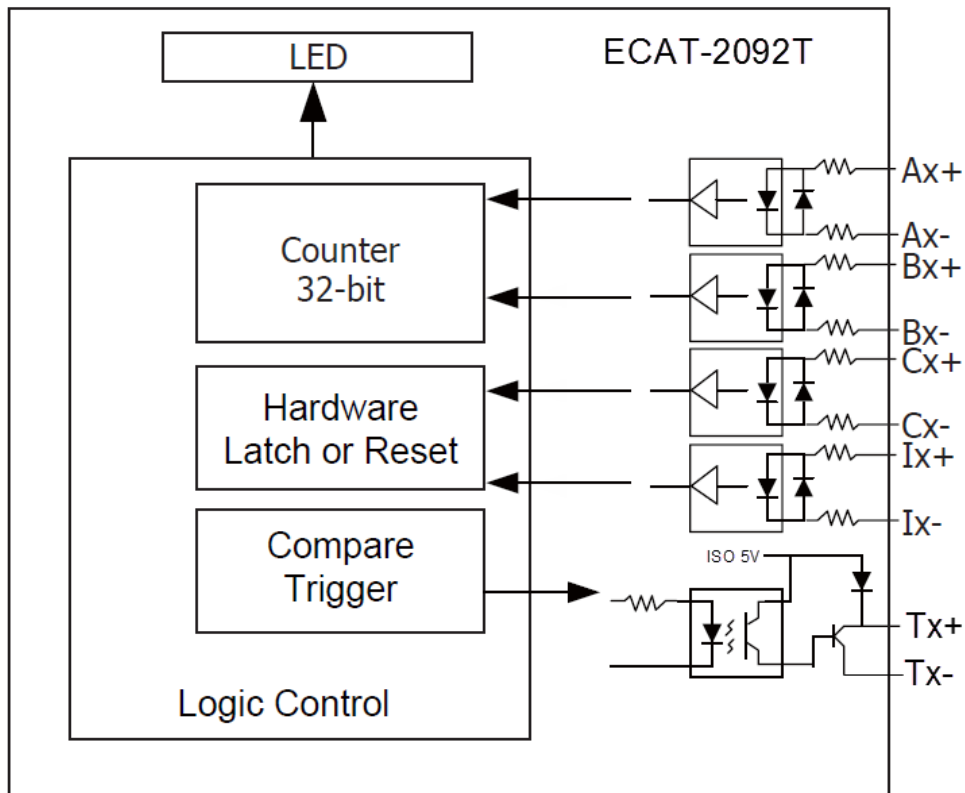


Figure 4: DIO circuit

## 1.8 Digital Input Wiring



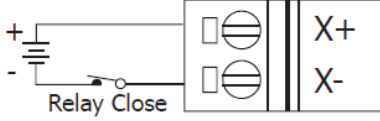
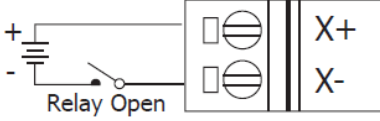
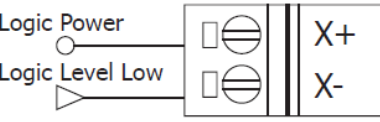

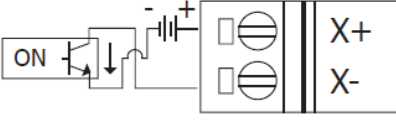
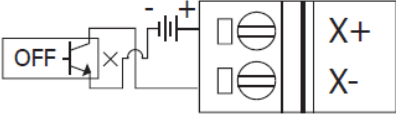
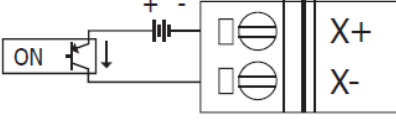
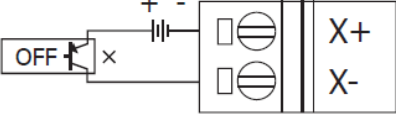
Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Relay Contact	Relay ON 	Relay OFF 
	Voltage > 4 V	Voltage < 0.8 V
TTL/CMOS Logic	Logic Power Logic Level Low 	Logic Power Logic Level High 
	Open Collector ON	Open Collector OFF
NPN Output	ON 	OFF 
	Open Collector ON	Open Collector OFF
PNP Output	ON 	OFF 

Figure 5: Encoder counter (A/B), index (C) and external latch (I) input wiring

## 1.9 Compare Trigger Output Wiring

Output Type	ON State Readback as 1	OFF State Readback as 0
Drive Relay	Relay ON 	Relay OFF 
	Resistance Load 	Resistance Load OFF 

Figure 6: Compare trigger output wiring

## 1.10 Digital Input Channel

The ECAT-2092T can accept encoder inputs from either differential or single-ended signals.

By default it is set to support differential encoder signals as they are preferred due to their excellent noise immunity. For single-ended encoder connection the ECAT-2092T provides an internal 1k Ohm resistor for each signal input. The internal resistor can be selected via jumper setting.

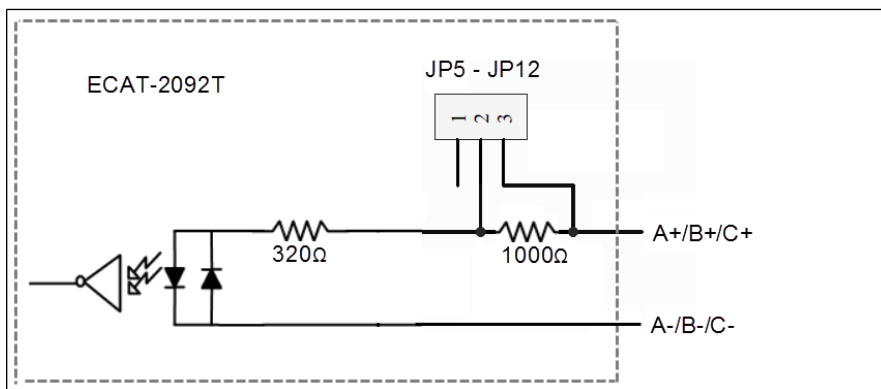


Figure 7: Encoder input channel circuit

## 1.11 Counting Modes

The ECAT-2092T encoder counter supports three modes:

- Pulse/Direction counting mode
- Clockwise/Counterclockwise mode
- Quadrant counting mode

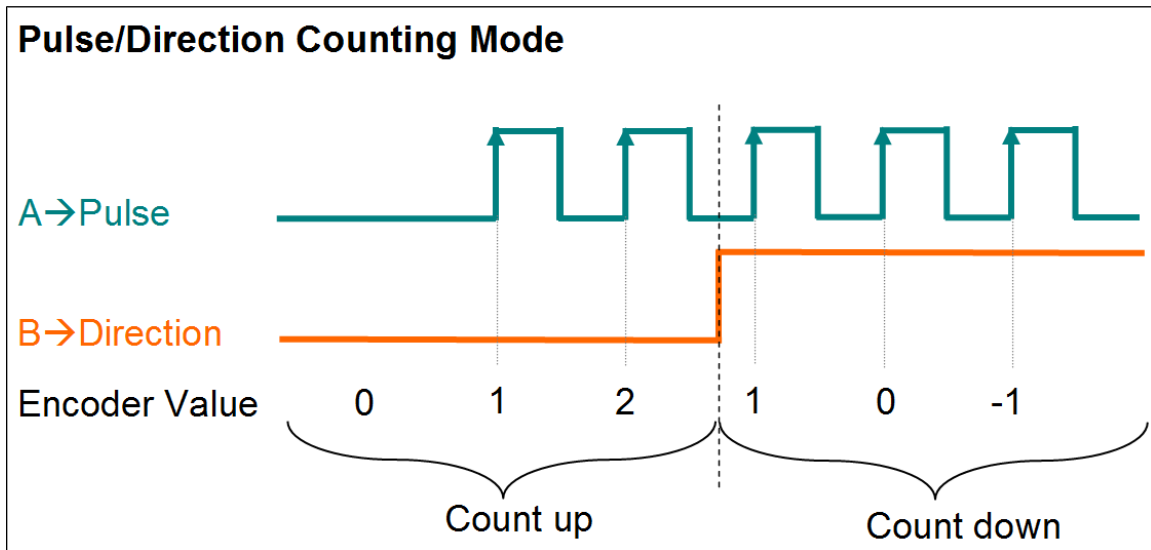


Figure 8: Pulse/Direction counting mode

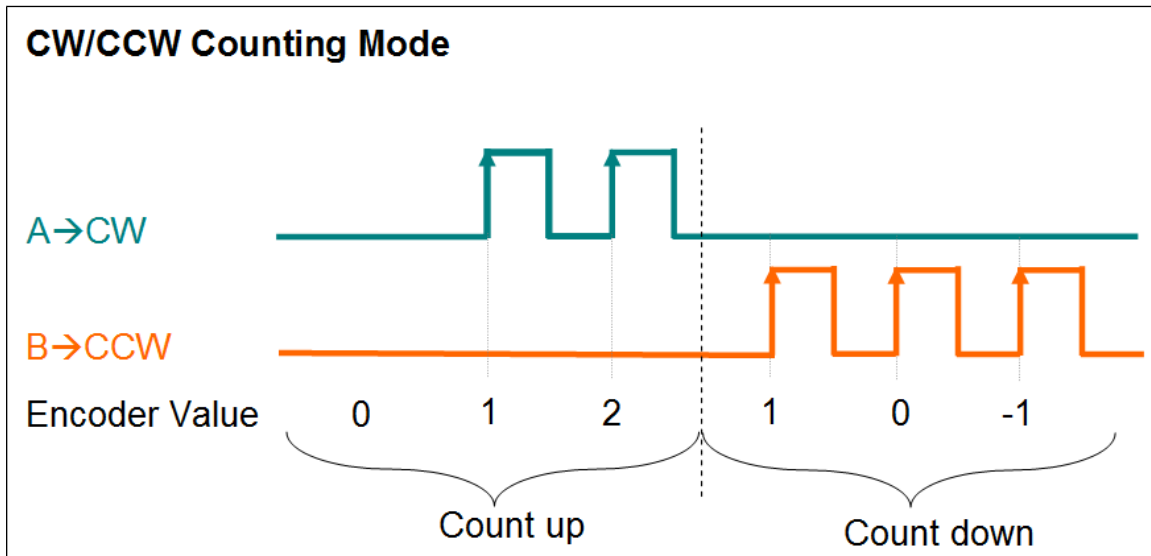


Figure 9: Clockwise/ Counterclockwise counting mode

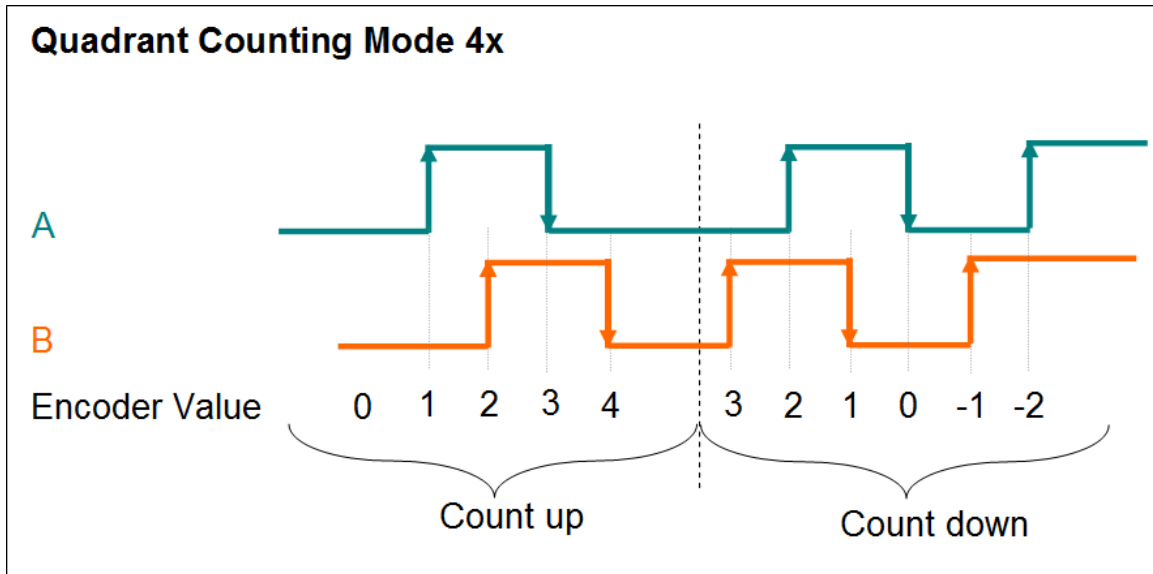


Figure 10: Quadrant counting mode

## 1.12 Position Compare Trigger Types

1. Single position compare (Figure 11): The user has to set one compare position at which a digital output signal will be triggered. The DO trigger will always be generated once the encoder counter reaches this position, regardless from which direction.

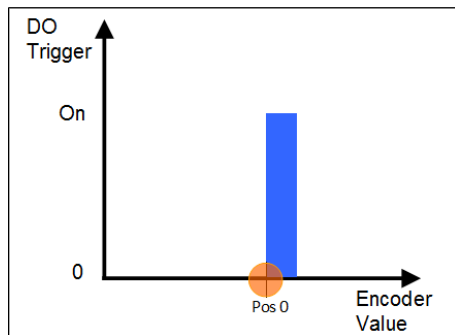


Figure 11: Single position compare

2. Fixed distance auto-increment compare (Figure 12): In a unidirectional movement the next compare position will be automatically set by incrementing the current compare position with a fixed distance. This means the position compare output is generated at a fixed pitch.

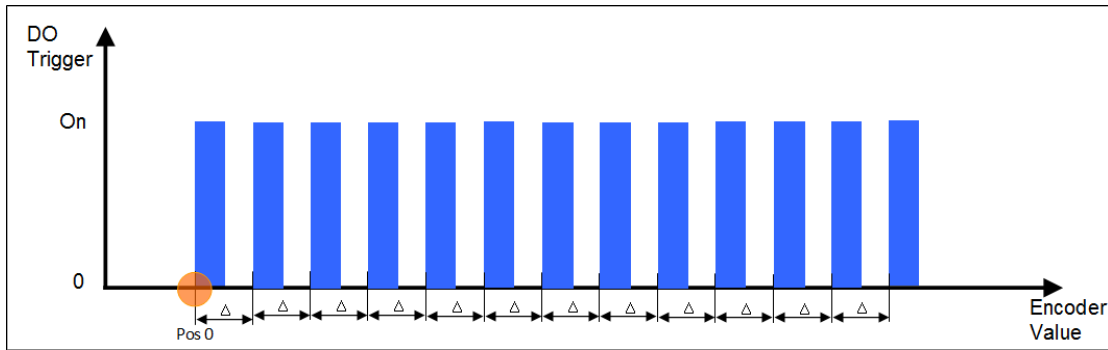


Figure 12: Auto-increment compare

3. Position compare array (Figure 13): A sequential compare which triggers a position compare output according to a set number of positions stored in the hardware registers. Up to 200 compare values are supported for each encoder channel. Each individual position in the array can be set whether to trigger an output when its position has been reached.

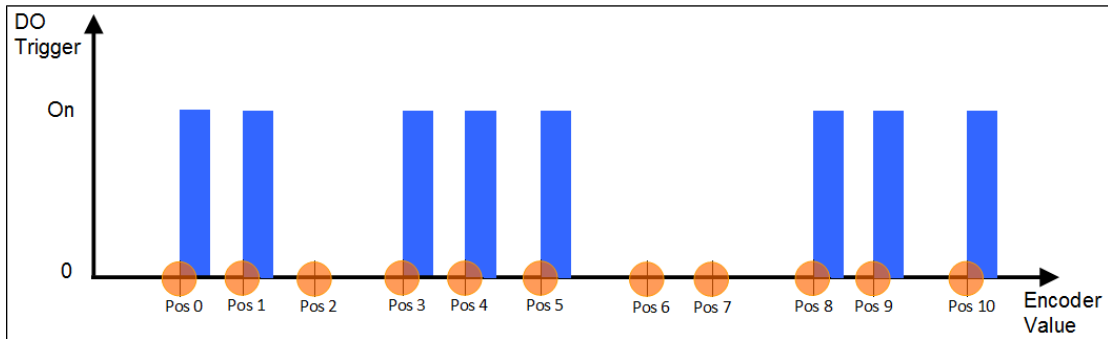


Figure 13: Position array compare

The position compare function can be either be enabled via software or a dedicated DI.

### 1.13 Extern Latch

Two registers are reserved for each encoder channel: One register stores the encoder value latched by an rising and the other the value latched by an falling input signal edge.

Application for the latch function:

- Position capture
- Position measurement: the value difference between the rising and falling latched position indicates the distance the encoder counter moved between the rising and falling input signal.
- Homing

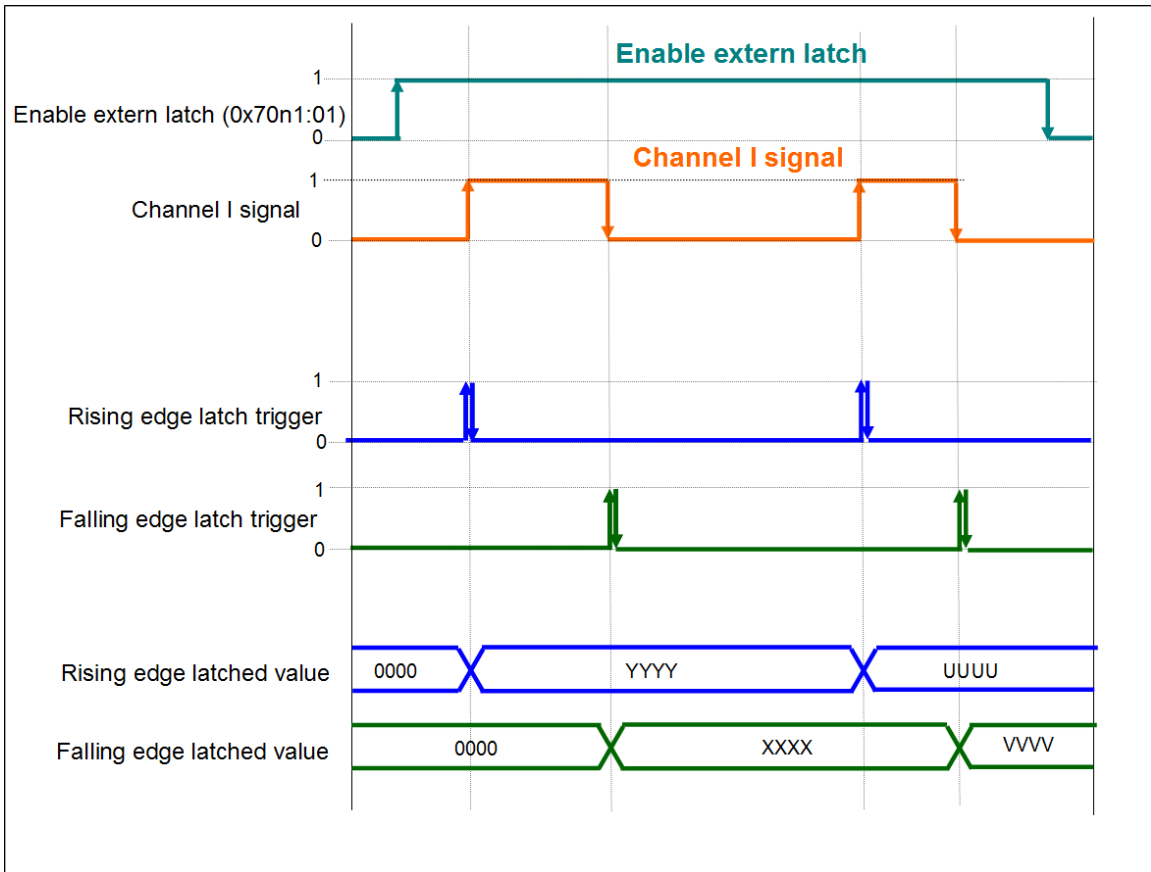
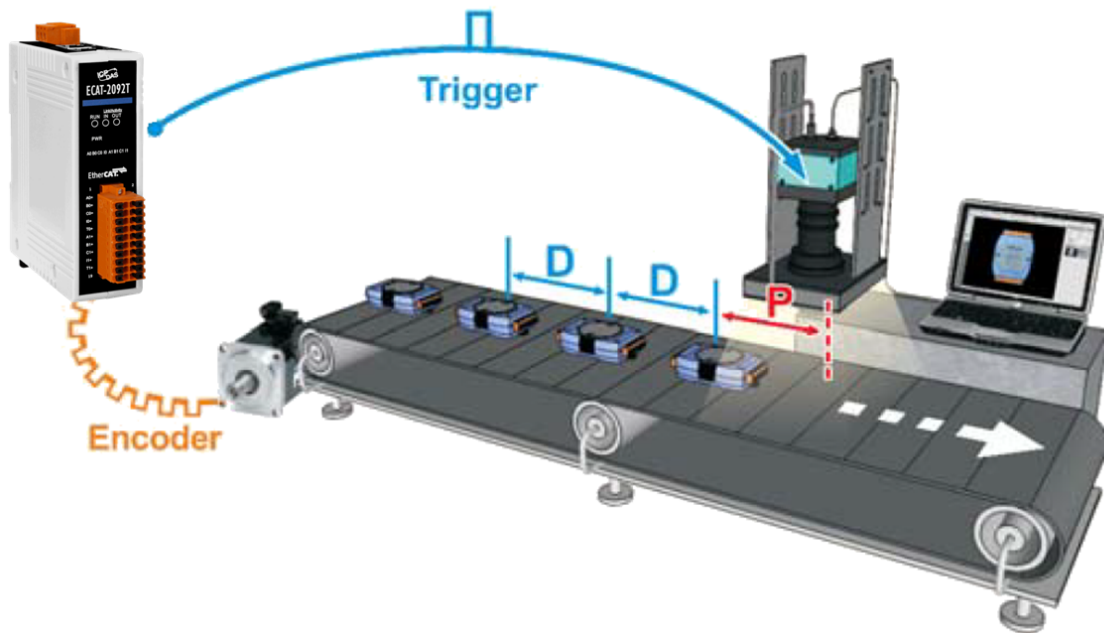
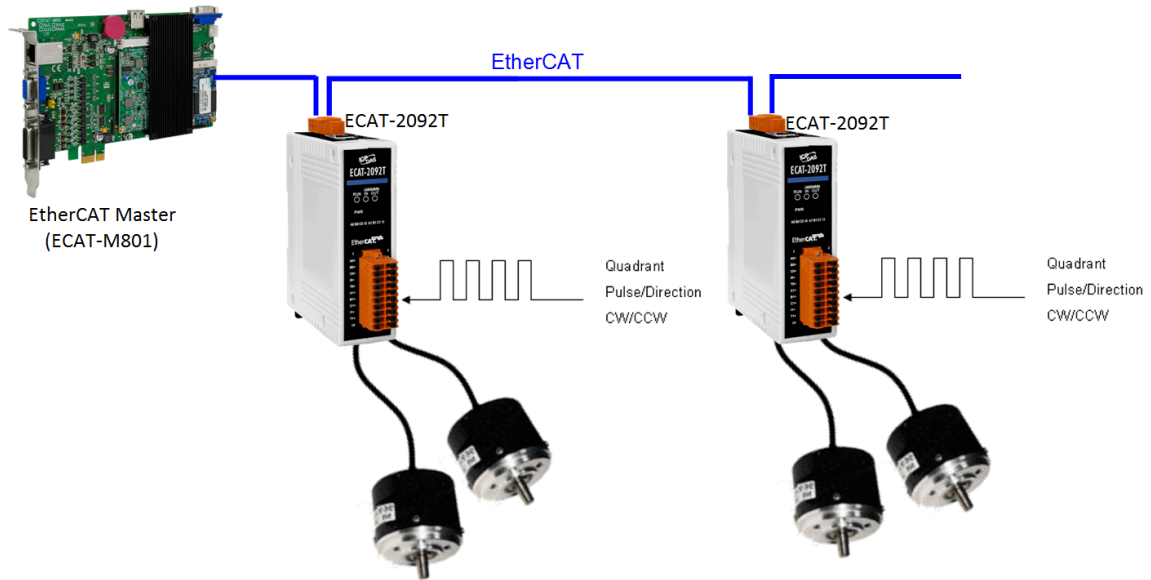


Figure 14: Rising and falling edge latch

## 1.14 Application



## 1.15 Ordering Information

ECAT-2092T	EtherCAT two-channel incremental encoder counter with compare trigger output
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