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cRIO ECAT - C SERIES EtherCAT Slave

Module Specification

V0.5/12.09.2017

Revision History

Version	Date	Description	Resp.
V0.5	12.09.2017	UL specific changes	RM, TD
V0.4	26.08.2017	Intermediate Version, UL specific changes	RM, TD, JKU
V0.3	15.05.2017	Minor changes	DW,JF,JKU
V0.2	10.05.2017	EtherCAT SYNC0 added, minor changes	DW,JKU
V0.1	05.05.2017	Initial Version	JKU

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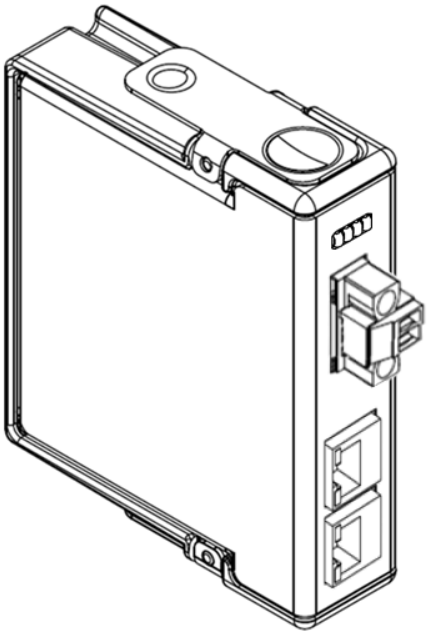
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KUNBUS cRIO ECAT

C Series EtherCAT Slave Module



- Operation as EtherCAT Slave
- 2 Ethernet ports for daisy chaining additional EtherCAT slaves
- Min cycle time 100µS
- EtherCAT SYNC0 supported
- Max. 1024 Bytes of Input Data
- Max. 1024 Bytes of Output data
- CANopen over EtherCAT (CoE)
- 24V ⎓ external power supply

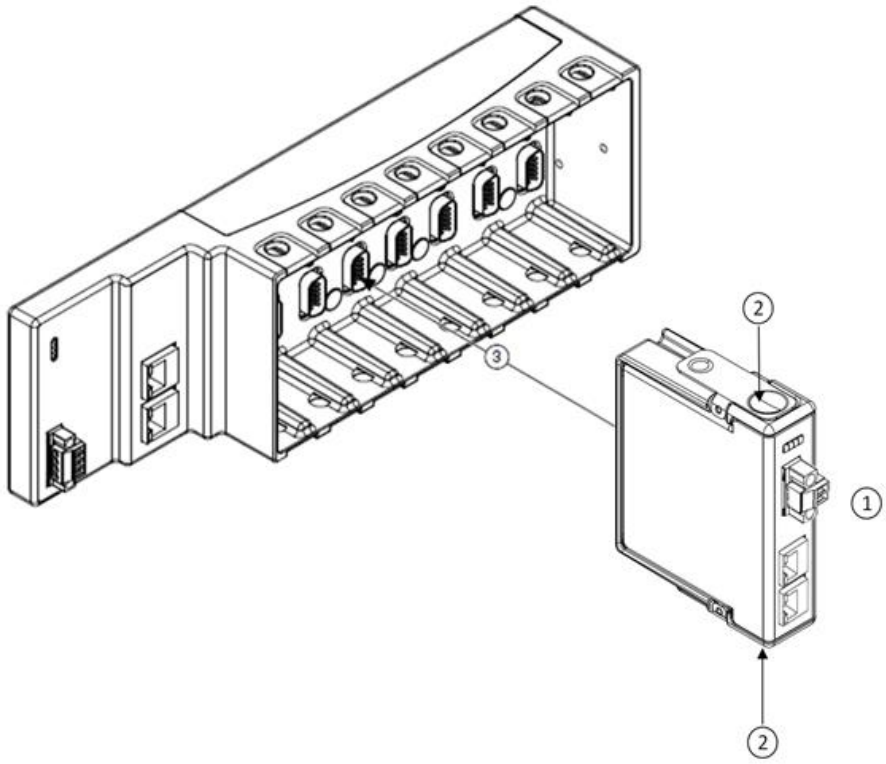
The KUNBUS cRIO ECAT is a C SERIES EtherCAT slave module which turns any NI compactRIO Controller into a deterministic EtherCAT slave. With standard CAT5 cabling the module communicates deterministically with any compliant EtherCAT Master.

The RIO field-programmable gate array (FPGA) acts as the module interface, handling I/O reads and writes in a cyclic fashion based on instructions and timing from the module's FPGA driver. The FPGA can be programmed using the NI LabVIEW FPGA Module to embed EtherCAT based high-speed logic, such as I/O timing, triggering, and closed-loop control in combination with the module's FPGA driver interface.

Installing Module

This section explains how to install and remove the cRIO ECAT module from a cRIO chassis.

Figure 1: Installing Module



Complete the following steps to install the cRIO ECAT module in a cRIO chassis.

1. Make sure no external power supply is connected to the module. The chassis can be powered on when you install module(s).
2. Align the module (1) with an I/O module slot (3) in the chassis as shown in Figure 1. The module slots are labeled beginning from 1, left to right. The number of module slots depends on the cRIO chassis type.
3. Squeeze the latches (2) and insert the module into the module slot.
4. Press firmly on the front side of the module until the latches (2) lock the module into place.

EtherCAT Configuration

The module has to be configured for a specific PDO configuration offline by using the PDO configuration tool. The Tool creates a .pdo file that must be downloaded and stored to the module.
The module can store up to 320 different PDO variables permanently which can be mapped as EtherCAT input- and/or output data.

EtherCAT Communication

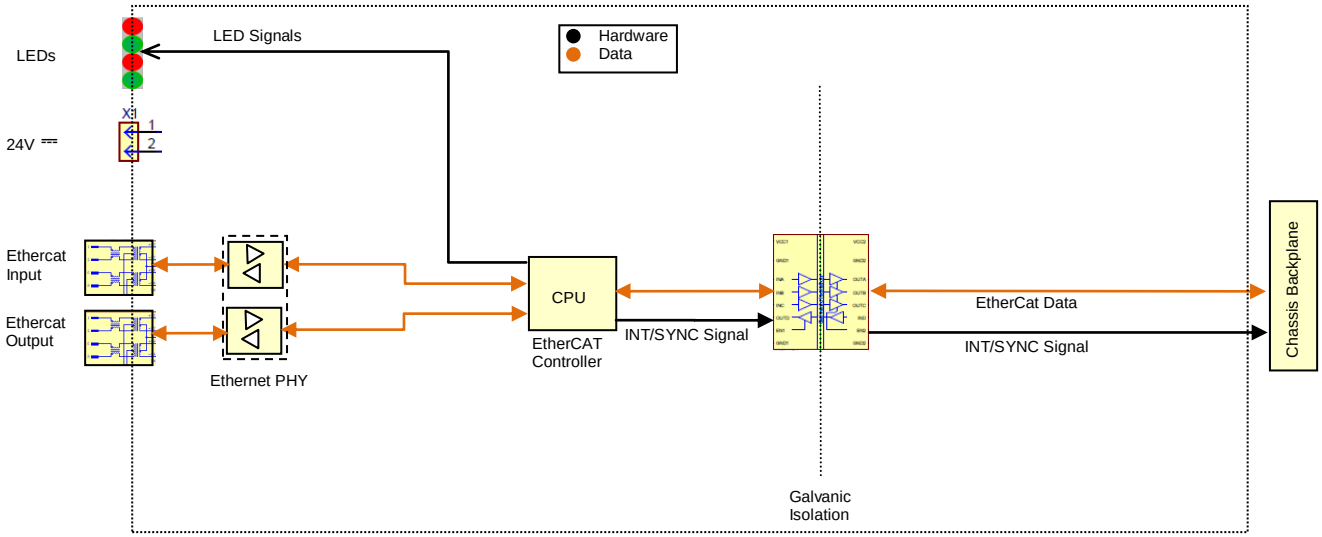
The module supports non-synchronized as well as synchronized EtherCAT SYNC0 communication.
In synchronized mode the module provides the digital SYNC signal to the FPGA API. To synchronize the module based inputs and outputs with the EtherCAT Master Sync 0 requests the module can detect Sync 0 timing signals.

The following system specific parameter must be configured using the PDO configuration tool:

- *Min Cycle time*
  Time value in nanoseconds, the FPGA application needs at least to process all input- and output data

For non-synchronized mode, no additional configuration is required.

Circuitry



- The module GND is not connected to chassis GND
- The module is galvanically isolated from the chassis backplane
- The cRIO ECAT integrates an intelligent EtherCAT controller performing the complete EtherCAT state machine
- The module receives the EtherCAT output data from the chassis and transmits the EtherCAT input data to the chassis
- The EtherCAT controller provides 2 digital signals INT and SYNC to the chassis for EtherCAT synchronized operation mode (SYNC0)
- The Ethernet Phys and the EtherCAT controller are thermally coupled to the module shell

NOTICE

Device must be supplied with limited energy according to UL61010-1 3rd edition, section 9.4 or LPS in conformance with UL60950-1 or Class 2 in accordance with UL 1310 or UL 1585.

cRIO ECAT Specifications

Input/Output Characteristics	
EtherCAT	
Operation Mode	EtherCAT Slave
Synchronization	SYNC0
Max. Input Data	1024 Bytes
Max. Output Data	1024 Bytes
Min. Cycle Time	100 µS
Ethernet	
Ethernet Connections	2 (1 EtherCAT Input, 1 EtherCAT Output)
Ethernet Connection Format	RJ45
Ethernet Connection medium	CAT5
Max. cable length	100 m
Ethernet Function	100 Base-T(X)
Ethernet Port Isolation	$1500V_{rms}$
External power supply	
Nominal Voltage Input	24V ⎓
Voltage Input Range	Min.18V to max. 30 V ⎓
Power requirements	
Power consumed from chassis at 70°C (measured)	
Active mode	31 mW
Sleep mode	31 mW
Power consumed from external power supply (measured at 24 V ⎓)	
Active mode	1.297 W (receiving and transmitting)
Sleep mode	0.9 W
Power supply requirements	
Device must be supplied with limited energy according to UL61010-1 3rd edition, section 9.4 or LPS in conformance with UL60950-1 or Class 2 in accordance with UL 1310 or UL 1585.	
Safety Voltages	
Connect only voltages that are within the following limits.	
+24V Terminal to -24V Terminal	60V
-24V Terminal to +24V Terminal	60V
+24V Terminal to chassis GND	60V
-24V Terminal to Chassis GND	60V

Shock and Vibration	
Operating vibration	
Random (IEC 60068-2-64)	5 $g_{rms,}$ 10 Hz to 500Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500Hz
Operating shock	
Shock (IEC 60068-2-27)	30 g 11 ms half sine, 50 g, 11ms half sine, 18 shocks at 6 orientations
Environemental	
Refer to the manual for the chassis you are using for more information about meeting these specifications.	
Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40°F to +158°F
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40°F to +185°F
Ingress protection	NEMA Class 1 IP 40 (not evaluated by UL)
Maximum altitude	2,000 m
Operating humidity (IEC 60068-2-56)	10 to 95% RH noncondensing
Storage humidity (IEC 60068-2-56)	5 to 95% RH noncondensing
Pollution degree (IEC 60664)	2
Indoor use only	
Physical	
If you need to clean the module, wipe it with a dry towel.	
Spring terminal	
Gauge	0.14 mm² to 1.5 mm² (26 AWG to 16 AWG) copper conductor wire
Wire strip lenght	9 mm
Wires per spring terminal	One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule
Ferrule	0.25 mm² to 1.5 mm²
Temperature rating	194°F minimum
Connector securement	
Securement type	Screw flanges provided
Weight	
KUNBUS cRIO ECAT with spring terminal	178 g
CE Compliance	
This product meets the essential requirements of applicable European directives as follows:	
2014/35/EU	Low-Voltage Directive (safety)
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2011/65/EU	ROHS Directive

2012/19/EU	WEEE Directive

Electromagnetic Compatibility	
Emission	
EN 61000-6-4: 01.2014	Interference field strength (radiated emission)
Immunity	
EN 61000-4-6: 03.2009	Conducted disturbances induced by RF
EN 61000-4-3: 05.2006	Electromagnetic RF fields
EN 61000-4-4: 12.2012	Fast transients, burst
EN 61000-4-5:2014	High energy surge voltages
EN 61000-4-2: 2014	Electrostatic discharge, ESD
Safety and Hazardous Location Standards	
This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:	
IEC 61010-1	
EN 61010-1	
UL 61010-1	
Safety Guidelines	
Caution Do not operate the cRIO ECAT in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way.	

Table 1: cRIO ECAT Specifications

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