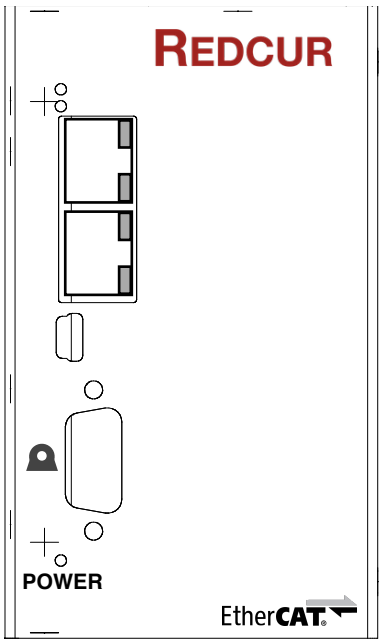
REDCUR

EtherCAT Current Converter Manual

Brings LEM High Precision Current Transducers to EtherCAT.



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General Information

This document is exclusively meant for experts in automation engineering. Please use this document for installation and taking the device into service.

EtherCAT®

EtherCAT® is a registered trade mark and patented technology licensed by Beckhoff Automation GmbH, Germany.

Redcur GmbH is a member of the EtherCAT Technology Group (ETG) (vendor id Vendor ID 0x00000B19). The conformance of the ECC with the EtherCAT protocol was verified with the EtherCAT Conformance Test Tool (CTT) of Beckhoff.

Variants of the ECC to fit LEM transducers

Redcurs EtherCAT Current Converter (ECC) is a DC measurement tool, dedicated for LEMs IT, IN and ITN series of high precision current transducers.

Variants of the ECC exists to cope the different specifications of LEM transducers. Please check if your ECC fits the transducer you are using. Improper combination of transducer and ECC may seriously damage both components. The following table shows the dependencies:

Variant	Suitable Transducer
ECC-IT60	IT 60-S
ECC-IT200	IT 200-S
ECC-IT400	IT 400-S
ECC-IN500	IN 500-S
ECC-ITN600	ITN 600-S
ECC-IT700	IT 700-S
ECC-IT1000	IT 1000-S
ECC-IN1000	IN 1000-S
ECC-IN2000	IN 2000-S

In the ECC-xxxx notation the “xxx” stands for the maximum current that can be handled by the ECC. For example the **ECC-400** handles a maximum of +/-400mA.

Highlights

- 24-Bit A/D conversion
- Power Supply for Transducer
- Metal housing for high EMC immunity
- Configurable through CoE
- Calibration Service (optional)
- Supports LEM IT, IN and ITN series
- Transducer Overload Protection

Standards/Compliance

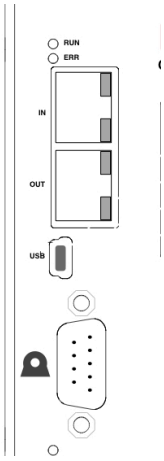
- EtherCAT®

- Implemented according to EN61010-1: 2010

Specification

AC Line Input	100-240V AC, 50/60Hz
Power Consumption	2,5W + LEM Sensor (see www.lem.com)
Mounting	DIN Rail
Weight	0,85kg
Dimensions (HxWxD) in mm	103x67x113
EtherCAT Cycle Time	100µs -100 Milliseconds
EtherCAT Data Transfer	Single, Bulk transfer up to 16 Measurements
Resolution	24 Bit
ADC Technology	$\Delta\Sigma$ (Delta-Sigma)
Filtering	Lowpass ~0.5 x ADC Data Rate (Anti Aliasing)
Accuracy	0,005% of Measuring Range
Maintenance Interface	USB
Sensor Interface	LEM proprietary D-SUB9 Pin

Hardware Installation



RJ45 connectors (IN/OUT)
- IN Connect to the EtherCAT master or previous EtherCAT slave
- OUT Connect to the next EtherCAT slave

Through these connectors only EtherCAT traffic can be handled
To connect use a standard Ethernet cable.

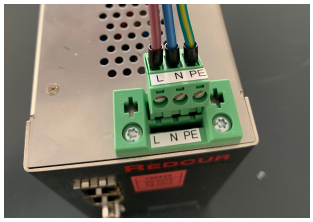
USB Mini Type B
For maintenance only - not a end user interface

9-pin DSUB female connector
- Power Supply to the LEM transducer
- Overload Indication/Protection
- Secondary Current Sink Circuitry

To connect use the proprietary D-SUB9 cable delivered with the transducer.
The following restrictions apply to the cable length:

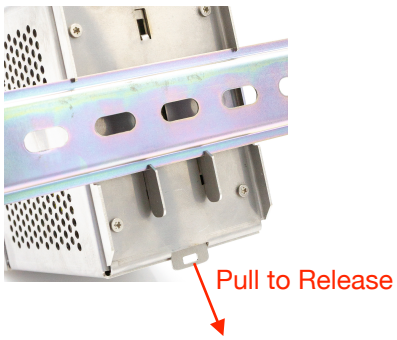
Length	Wire Cross Section (minimum)
≤ 5 m	0,34 mm²
> 5m ≤ 10m	0,75 mm²
> 10m	**Not supported!**

Power Supply 100-240V AC (50/60Hz)
Screw fixed connections for L/N/PE.
To be installed by authorised and educated personnel only!



After powering on the mains power supply the system is active.
For analysis of the ECC state please refer to the section “Meaning of LEDs” below.

DIN-Rail Installation
The ECC chassis provides a DIN-rail adapter on the rear side to easily snap-on the device.



CAUTION: To allow free convection free space of at least 20mm on the right side of device is required. Otherwise the accuracy to the device might be impacted.

LEM Transducer
Please refer to the documentation of LEM for the proper installation process.

Warning
Primary current in an unpowered LEM transducer can lead to destruction of the transducer!

The LEM transducer is to be connected with the ECC by the delivered proprietary D-SUB9 cable.

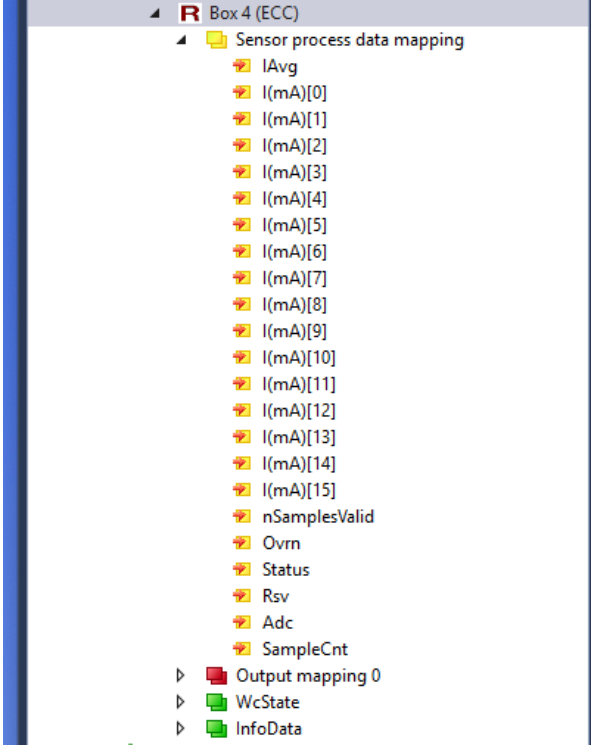
Meaning of LEDs

The ECC front has three LEDs and they have the following meaning:

LED	Color	Status	Meaning
RUN	green	off	INIT*
		blinking	PREOP*
		single flash	SAFEOP*
		solid	OP*
ERR	red	off	No Error
		blinking	Configuration Error
		single flash	Runtime Error
		double flash	Watchdog Error
POWER	green	solid	AC powered
		blinking	Error indication for either • No LEM transducer connected • LEM transducer in overload status • ADC overrun
		off	No AC power

*)State of EtherCAT State Machine

Bringing into Service



The EtherCAT Current Converter implements an EtherCAT slave device and has no proprietary front end software. For integration into an EtherCAT system a EtherCAT Slave Information (ESI) file is provided by Redcur. The following screenshots are taken from a TwinCAT 3.1 Master system.

After the proper detection in the device should up as depicted below.

Sensor process data mapping

Data Field	Description
I(mA)[x]	A list of 16 current measurements. **nSamplesValid** tells how many of them are valid and usable.
IAvg	Averaged current measurement - primary measurement value.
Ovrn	Indicator to if measured current is above limits.
Status	Indicates the health of the ECC and LEM transducer **0x00**: Busy - ECC is initialising, booting or calibrating; no measurement data is produced; this state should be non-permanent **0x01**: OK - normal operation mode **0x02**: Transducer offline - LEM transducer not connected or shows error on status pins (see LEM documentation for details) **0x03**: Out of range - AD converter overrun, i.e. the input current on the ECC is too high; *Potential root cause: wrong LEM transducer type is connected*
RSV	Used for data alignment - not to be used
Adc	Raw value delivered from the 24-Bit ADC
SampleCnt	Number of samples since device start

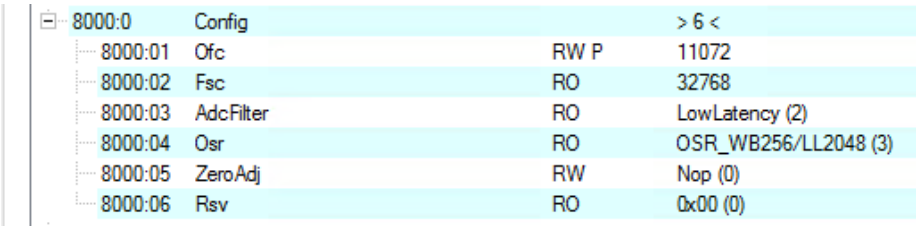
Output mapping 0 - reserved for future use

NOTE:
All current measurement values are given in Milliampere (mA) and show the primary current measured by the LEM transducer.

CoE Parameters

Below the meaning of the ECC specific CoE parameters are explained. Where possible the values of the parameters and variables are defined in ENUM types and relevant information can be obtained on the graphical user interface.

Config Parameters



8000:0	Config		> 6 <
8000:01	Ofc	RW P	11072
8000:02	Fsc	RO	32768
8000:03	AdcFilter	RO	LowLatency (2)
8000:04	Osr	RO	OSR_WB256/LL2048 (3)
8000:05	ZeroAdj	RW	Nop (0)
8000:06	Rsv	RO	0x00 (0)

Parameter	Description
Ofc	Offset of the measured current. The unit is in ADC values (see **Adc** measurement above). This value can be edited by the user. Changing this value takes immediate effect. See “Adjusting the offset” for details.
Fsc	Gain setting. This value is set properly upon manufacturing to calibrate the device for the shunt resistor, operational amplifiers etc..
AdcFilter	Shows the activated filter in the circuitry. This value is set during manufacturing. In the case shown above the “Low Latency” Filter is used.
Osr	Oversampling Rate of the ADC. In the given case we use a 2048 oversampling rate as the Low Latency (LL) filter is active
ZeroAdj	Trigger for automated offset setting. User should use this parameter to adjust the offset instead of the **Ofc** parameter. See “Adjusting the offset” for details.

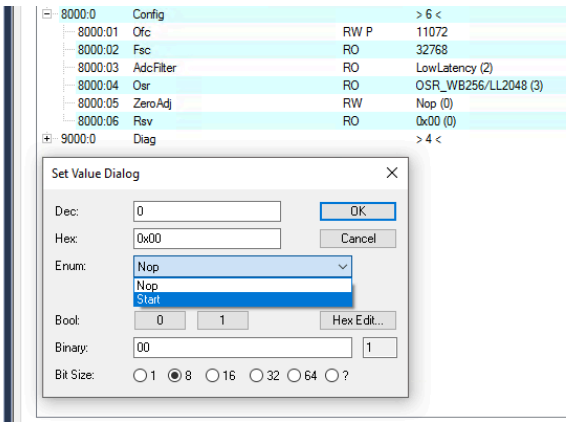
Adjusting the offset
Over time or when changing the LEM transducer it might be necessary to adjust the offset. In principal there are two ways to do that.

1. Editing the CoE parameter **Ofc.**
2. Using the Automated offset setting capability of the ECC, using the **ZeroAdj** parameter.

For both ways it is important to prepare the system by a) attaching the LEM transducer and check that it is properly powered on and b) to make sure there primary current is 0.

For method 1 observe the **Adc** measurement and find an averaged value of it. Add this value to the existing **Ofc** parameter.

For method 2 double click on **ZeroAdj** and set the value in the Enum field to “Start”.



The ECC will basically do what is described as method 1 in the background.

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