

LEM-CAB300-C USER MANUAL



AUTOMOTIVE CURRENT TRANSDUCER FLUXGATE TECHNOLOGY CAB 300-C/SP3-XXX

INTRODUCTION

This manual describes the use and operation of the LEM CAB 300-C automotive current transducer when used with the EVtv Motor Werks CAB300 software library for the Arduino Due microcontroller.

LEM Corporation provides innovative and high quality solutions for measuring electrical parameters. Its core products - current and voltage transducers - are used in drives & welding, renewable energies & power supplies, traction, high precision, and automotive applications.

The CAB family is for battery monitoring applications where high accuracy and very low offset are required. It uses a low frequency fluxgate transducer.

The low-frequency fluxgate transducer is made of a wound core which saturates under low induction. A current chopper switches the winding's current to saturate the magnetic core alternatively at $\pm B_{max}$ with a fixed frequency.

Fluxgate transducers use the change of the saturation's point symmetry to measure the primary current.

Due to this current switching principle, both electric and magnetic offsets are cancelled.

- Transducer using Fluxgate technology
- Zero offset
- Unlimited over-current capability
- Panel mounting
- Unipolar + 12 V battery power supply
- $T_A = -40\text{ }^{\circ}\text{C} \dots +105\text{ }^{\circ}\text{C}$
- Accuracy (over temperature range) - ε_G = Sensitivity error < 0.5 % - ε_L = Linearity error < 0.1 %
- Output signal: - CAN.C (500 kbps)
- Full galvanic isolation.

Mechanical characteristics

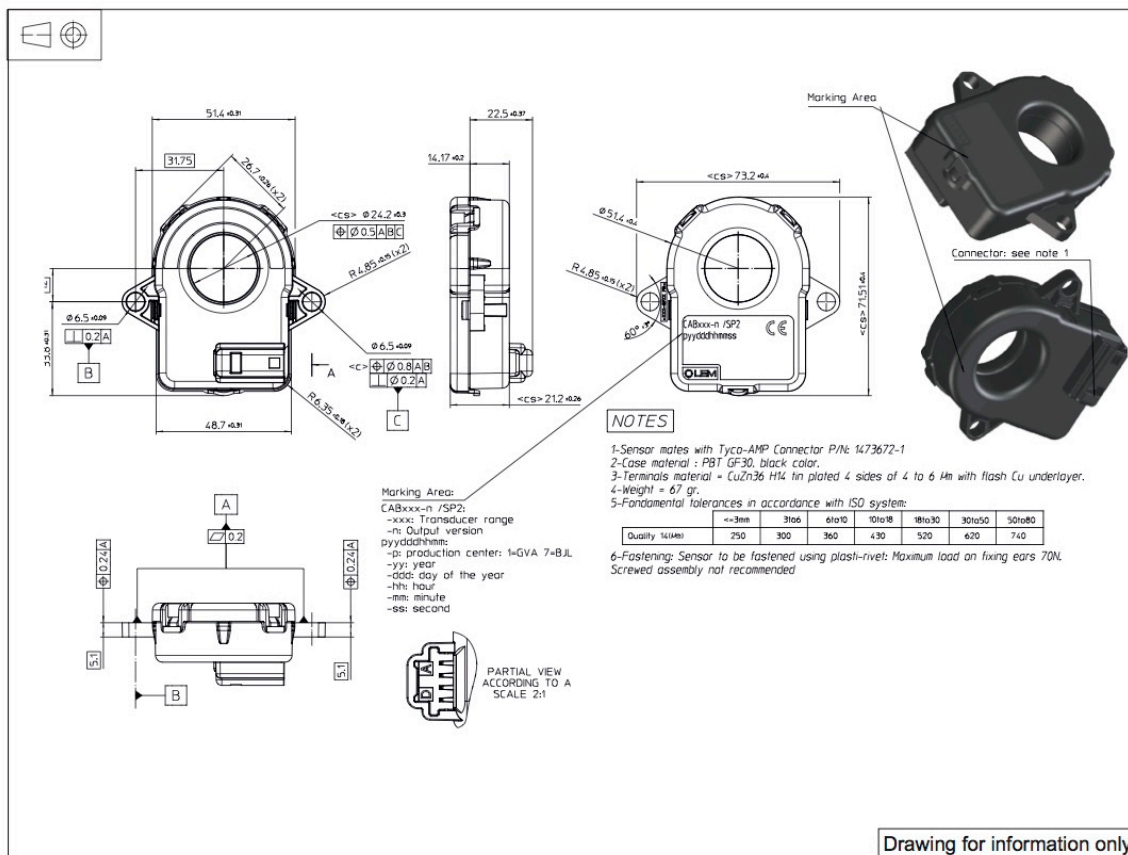
- Plastic case PBT GF 30

- Magnetic core nanocrystalline
- Mass 67g
- Electrical terminal coating Tin plated

| Parameter | Symbol | Unit | Specification | Conditions |
|--|-----------|------|---------------|-------------------|
| Load dump over-voltage | U_c | V | 32 | 400 ms |
| Over-voltage | U_c | V | 24 | 1 minute |
| Reverse polarity | U_c | V | -50 | |
| Minimum supply voltage | U_c | V | 6 | Continuous |
| Maximum supply voltage | U_c | V | 18 | Continuous |
| Electrostatic discharge voltage | U_{ESD} | KV | 4 | Pins |
| Insulation resistance | R_{is} | MΩ | 500 | 500 V-ISO 16750-2 |
| Rms voltage for AC insulation test, 50 Hz, 1 min | U_d | KV | 2.5 | 50 Hz, 1 min |
| Creepage distance | d_{cp} | mm | 7.2 | |
| Clearance | d_{cl} | mm | 6.95 | |

| Parameter | Symbol | Unit | Specification | | | Conditions |
|--------------------------------------|-----------------|------|---------------|---------|------|--|
| | | | Min | Typical | Max | |
| Electrical Data | | | | | | |
| Primary current, measuring range | I_{PM} | A | -350 | | 350 | |
| Supply voltage | U_C | V | 8 | 13.5 | 16 | full accuracy |
| Current consumption @ $I_p = 0$ A | I_C | mA | | 30 | | @ $U_c = 13.5$ V @ 25 °C |
| Current consumption @ $I_p = 350$ A | I_C | mA | | 80 | | I_C is a function of I_p ; @ $U_c = 13.5$ V @ 25 °C |
| Performance Data | | | | | | |
| Linearity error | ε_L | % | -0.1 | | 0.1 | in temperature range |
| Offset current @ $I_p = 0$ A | I_o | mA | -10 | | 10 | min/max values @ 3 sigma; 8 V to 16 V; from -40 °C to 105 °C |
| Overall accuracy @ $I_p = \pm 350$ A | X_G | mA | -1750 | | 1750 | min/max values @ 3 sigma; 8 V to 16 V; from -40 °C to 105 °C |
| Phase shift | $\Delta\phi$ | ms | | 1.5 | | without digital filtering |
| Ambient operating temperature | T_A | C | -40 | | 105 | |

Dimensions CAB 300-C/SP3-XXX (in mm)



Mechanical characteristics

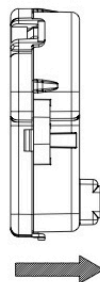
- Plastic case PBT GF 30
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- Mass 67 g
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Mounting recommendation

- Connector type Tyco-AMP P/N: 1 473672-1

Connection

| Pin Out | |
|---------|-------|
| A | CAN-L |
| B | CAN-H |
| C | GND |
| D | 12vdc |



I_p (positive primary current direction)

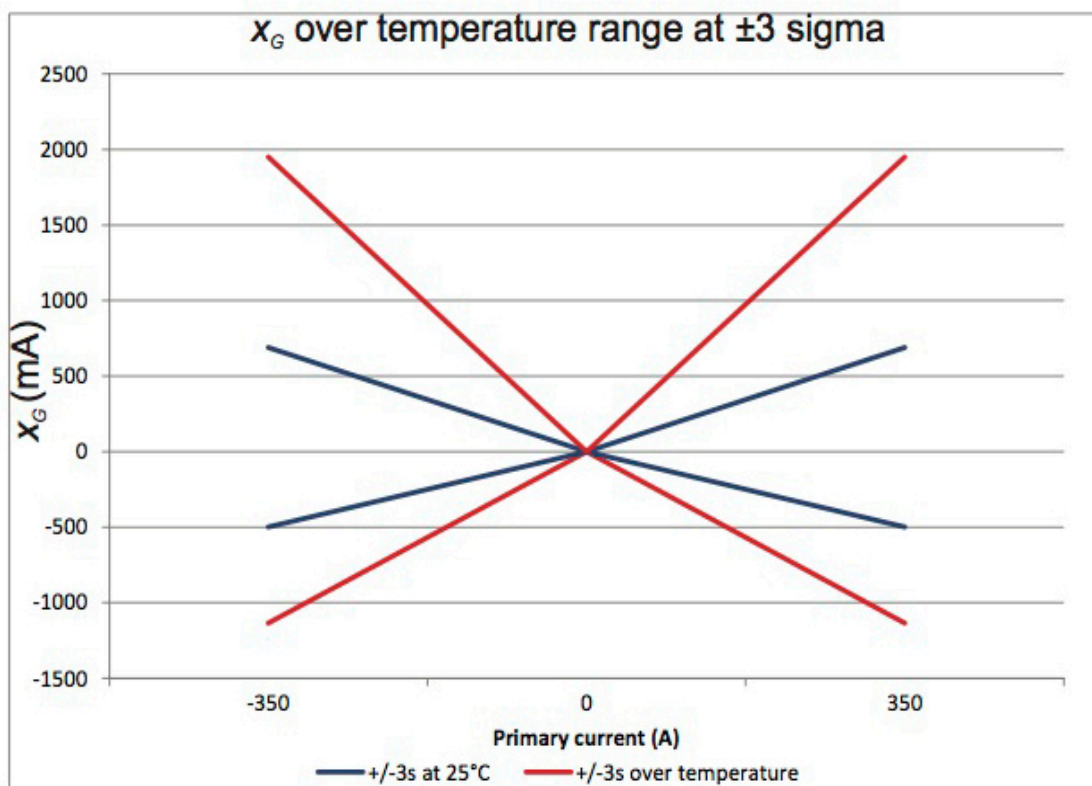
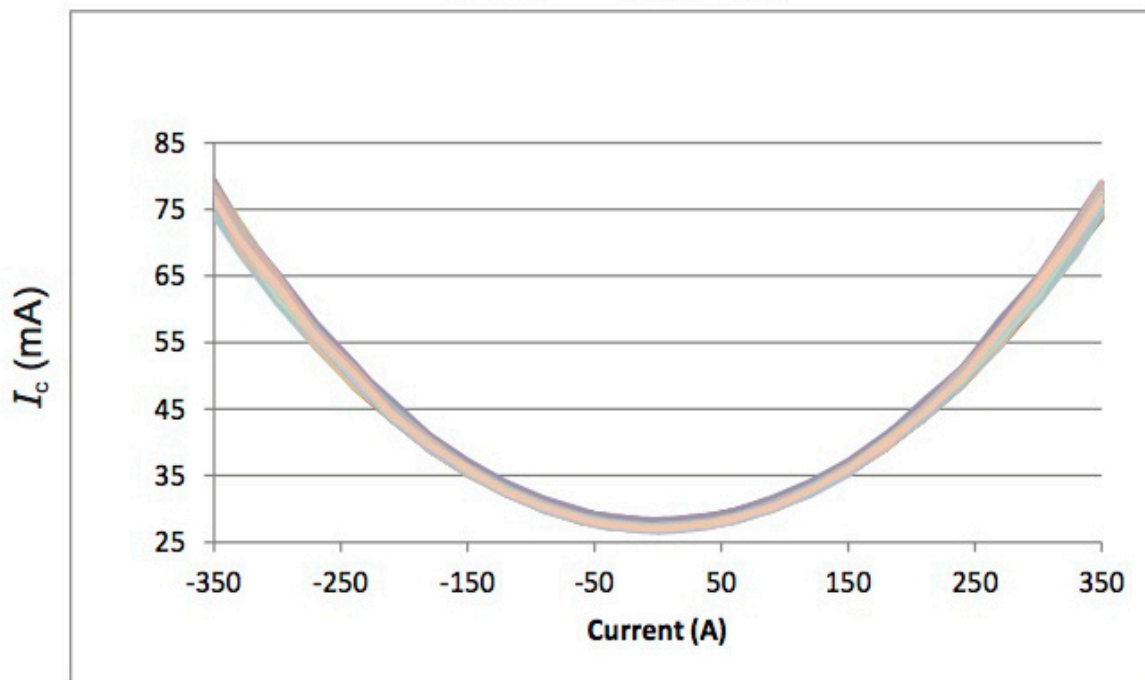
| PRODUCT NAME | PART NUMBER | CAN ID | CAN SPEED (kbps) |
|---------------------------|----------------|--------|------------------|
| CAB 300-C/SP3- 000 | 90.H5.46.003.P | 0x3C0 | 500 |
| CAB 300-C/SP3- 002 | 90.H5.46.023.P | 0x3C2 | 500 |

EVTV Motor Werks routinely stocks three versions of the CAB300-C/SP3 current sensor, identified by the three digit dash number suffix of the LEM part number.

Surprisingly, LEM does not provision for changing message IDs or bus speeds. The CAB300-C comes from the factory with a fixed CAN message ID. In applications where you are measuring TWO currents, it would be impossible to tell which transmission represented which current.

The -000 uses message ID 0x3C0 while -002 uses message ID 0x3C2. By using both, you can have two current sensors reporting current by message ID. Both operate at a fixed 500 kbps. Additional addresses are not stocked but ARE available by special order.

The -010 dash number provides a single sensor capability on a 250kbps bus.

Accuracy curves I_c @ 25 °C at 13.5 V

SOFTWARE

EVTV has developed software to read current levels from the CAB 300 device and keep a rolling value of Ampere-Hours measured by the device. This software is not designed for any particular purpose, but rather to illustrate how to access the CAB 300 data on the CAN bus for use in your own applications.

This software is written in a C++ variant for the Arduino Due controller board with a CAN shield. EVTV offers several CAN bus shields for the Arduino DUE.

The software consists of a library (CAB300) and several example programs which can be found in the EXAMPLES subdirectory inside the CAB300 library folder.

To use these, place the CAB300 folder in your Arduino/libraries folder and extract the examples into your base /Arduino folder. You can then load and compile these programs onto an Arduino Due board with CAN shield.

The CAB 300 library and the example programs require other libraries for the Arduino.

These include:

```
#include <SPI.h>
```

```
#include <due_can.h>
```

```
#include <due_wire.h>
```

```
#include "variant.h"
```

```
#include <Wire_EEPROM.h>
```

We have included all these in the CAB300.zip file.