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- **Additional Organization Information**
  - Size :
    - Company: 100 employees; 30 researches
  - Years in operation: 25 years

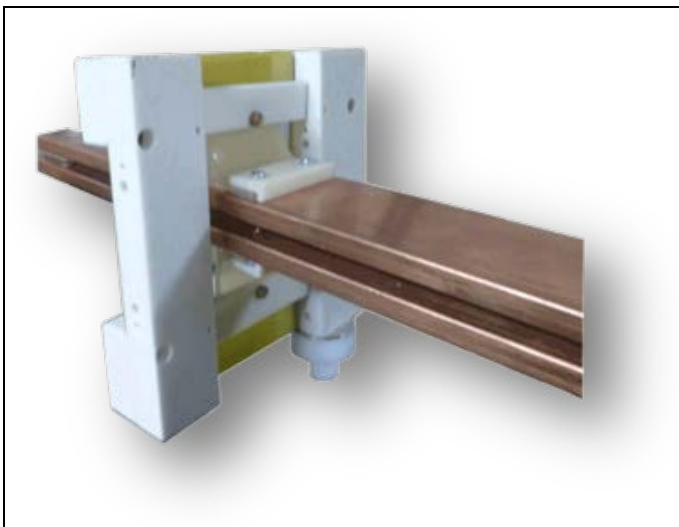
**Title of Proposal:** Magneto-optical current transducer with analogue or digital outputs

### **Proposed Technical Approach**

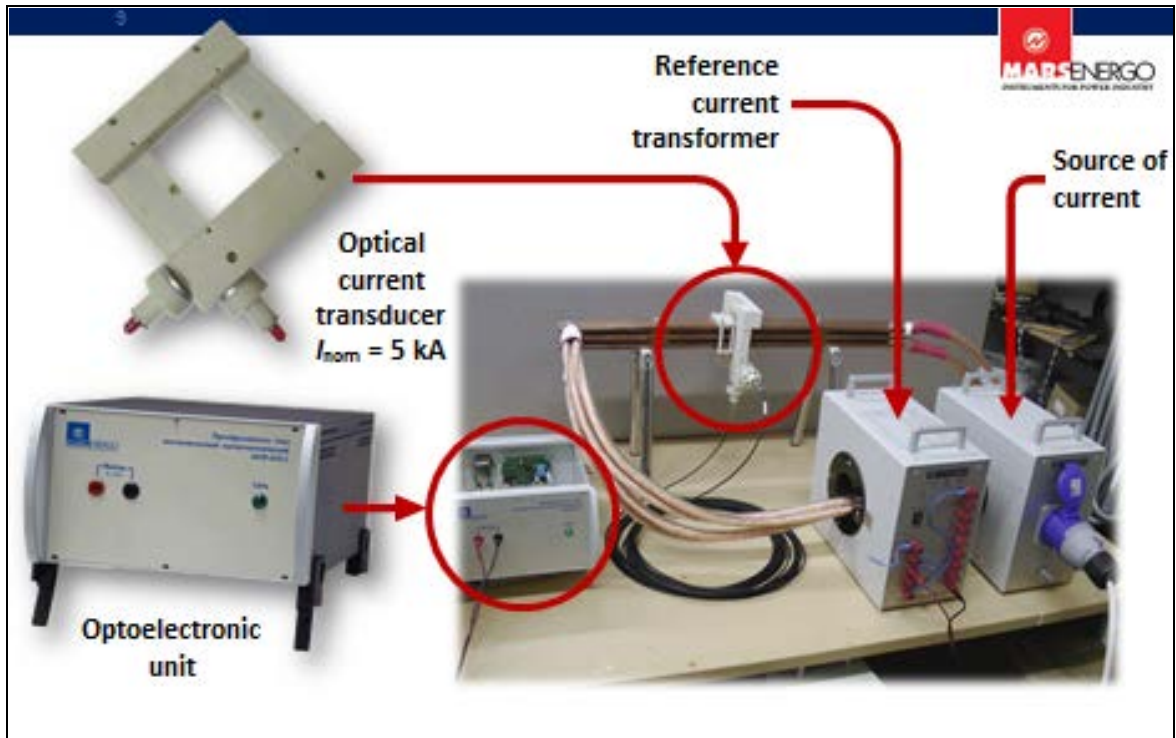
- **Magneto-optical Current Transducer used to convert instantaneous values of primary (high) AC or pulse current into the proportional values of secondary (low) current or into SV (Sampled value) data is based on magneto-optical (Faraday) effect. It consists of an optical sensor (Faraday cell) made of diamagnetic glass and opto-electronic unit.**

¶ **Overview of the proposed technology**

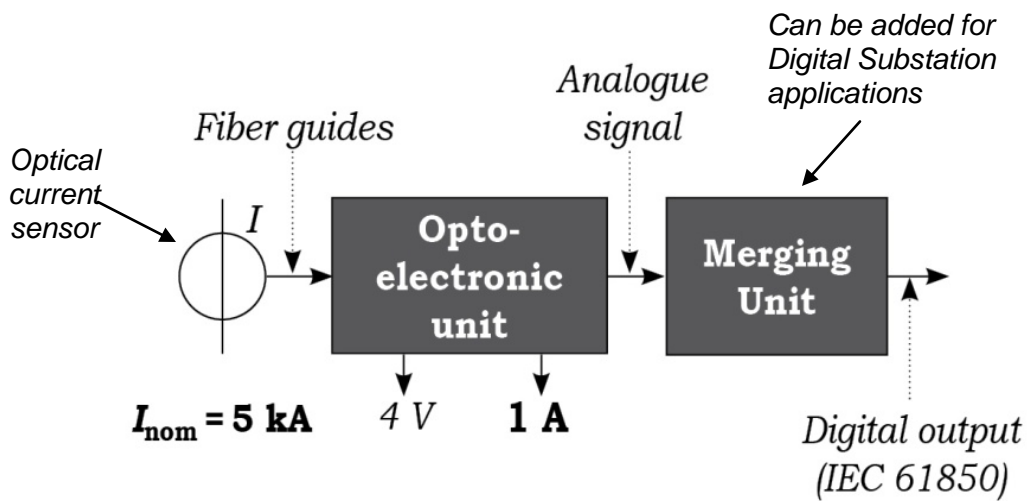
¶ **[Photo of the prototype:](#)**



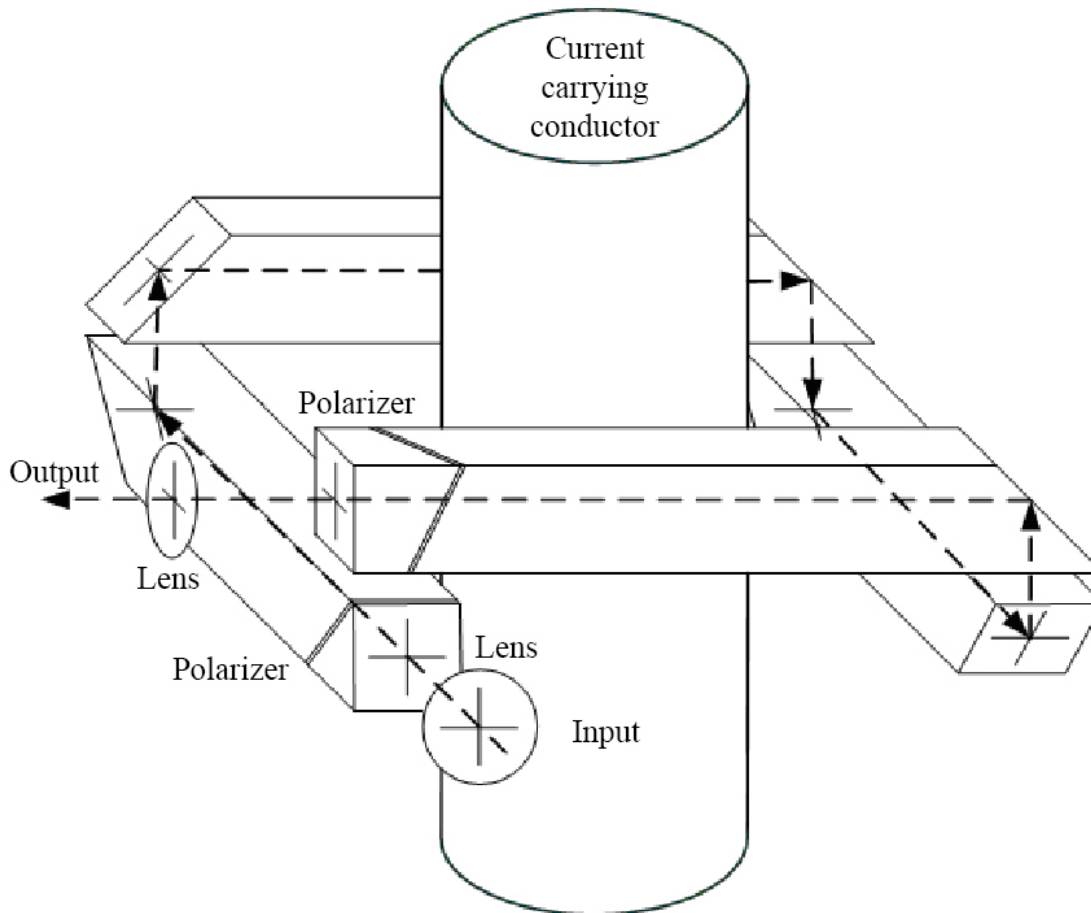
Testing of the prototype:



Block diagram:



**Design of optical current sensor (optical cell):**



Four prisms made of diamagnetic glass located in sequence along the optical path of the light make up an optical sensor. The prisms made of conventional diamagnetic glass form a close loop around the current carrying conductor. Polarizers are integrated in the prisms.

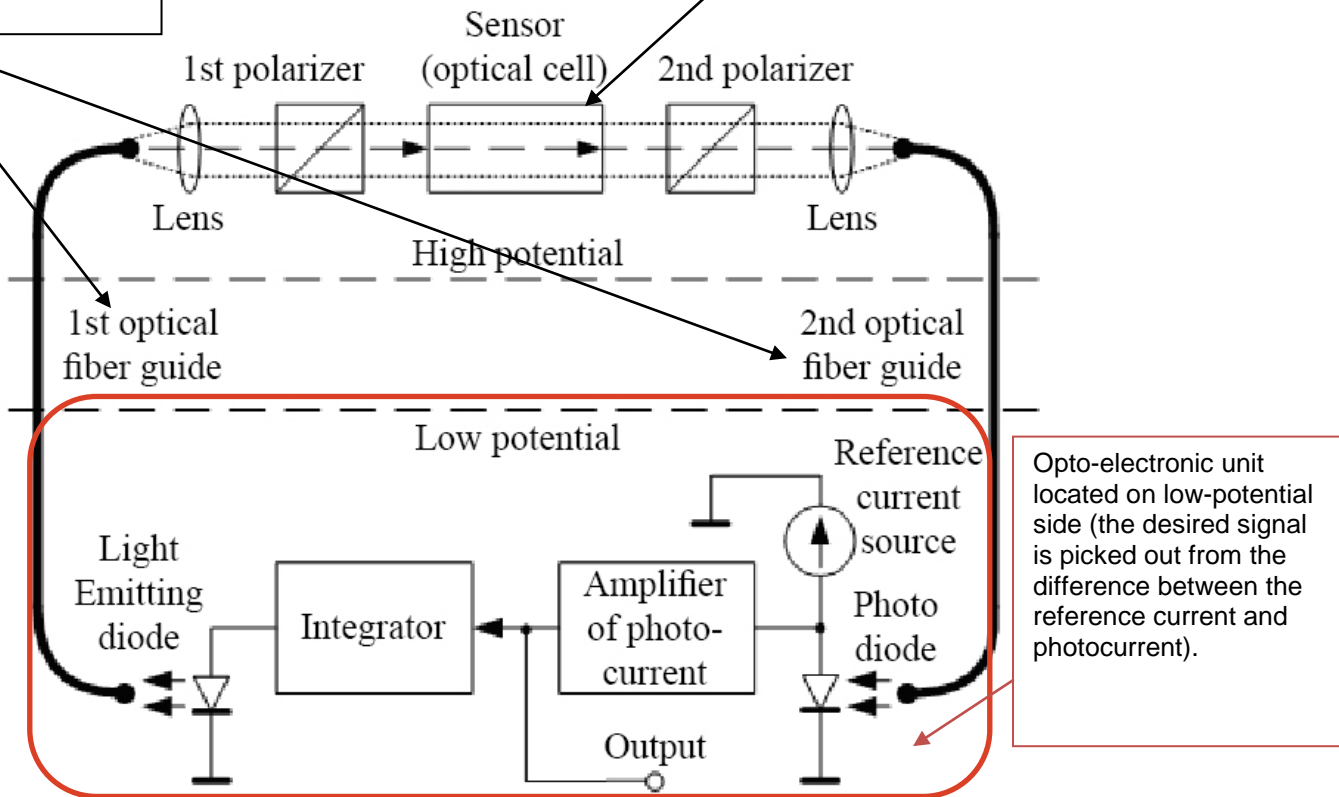
The existing prototype is designed for current carrying lines of up to 80 mm.

The optical sensor is designed for mounting/dismounting from the line without breaking into current circuits.

“Transducer +Sensor” Assembly

Two fiber optic guides provide:  
-Optical connection between optical sensors and opto-electronic unit;  
-Galvanic isolation between high-potential and low-potential sides.

Magneto-optical (Faraday) cell for current measurements or Electro-optical (electro-gyration) cell for voltage measurements – depending on the optical cell in use the module can be used either for current or voltage measurements

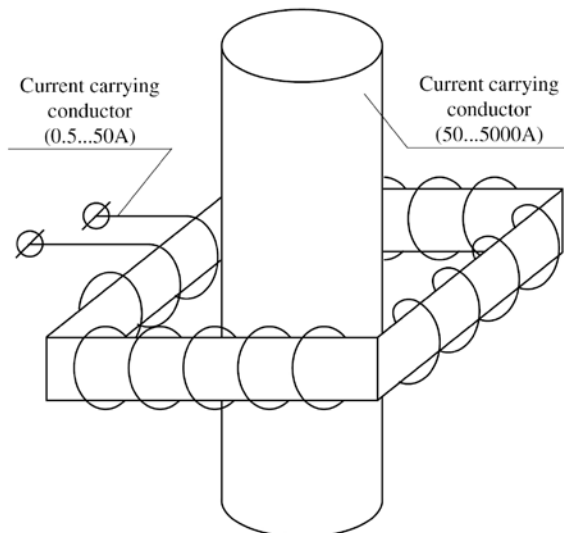


Opto-electronic unit located on low-potential side (the desired signal is picked out from the difference between the reference current and photocurrent).

**Basic specifications**

	Existing prototype	To be achieved
Operating voltage range	0.4...35 kV	0.4...35 kV
Frequency range	1Hz ~ 10 kHz	1Hz ~ 10 kHz
Nominal primary current	50...5000A	50...5000A 0.5A...50A
Accuracy class;	0.5S	0.2S
Thermal and electrodynamic withstand	100; 150 kA	100; 150 kA
Output signal <ul style="list-style-type: none"> <li>• Analogue</li> <li>• Digital</li> </ul>	1A; 4 V According to IEC 61850-9-2LE	1A; 4 V According to IEC 61850-9-2LE
Fiber guide length between the optical sensor and opto-electronic unit	Up to 200 m	Up to 200 m
Size	Optical sensor: 162 × 162 mm Opto-electronic unit (W × D × H): 134 × 215 × 450 mm	Optical sensor: 162 × 162 mm Opto-electronic unit (W × D × H): 134 × 215 × 450 mm
Weight	Optical sensor: 1 kg; Optoelectronic unit: 3 kg	Optical sensor: 1 kg; Optoelectronic unit: 3 kg

**Outline of a dual range optical current sensor (0.5 to 50A; 50 to 5000A)**



### **Unique Selling Point**

- ¶ 1. Unlike widely spread fiber optic current sensors, an optical current sensor made of standard diamagnetic glass has a number of advantages:
  - ¶ - While passing through the glass, a light beam behaves according to the laws of classic optics (no multireflections; no influence of material strains etc.), therefore the required measurement accuracy can be achieved using an optoelectronic unit of considerably simpler design;
  - ¶ - Substantial temperature independence owing to diamagnetic glass selected for the independence of its Verdet constant from temperature changes;
  - ¶ - Better time stability.
- ¶ 2. Advantage of Mars-Energy prototype – the transducer can also be used for voltage measurements – the only thing to do is to replace the current (Faraday) optical cell with the voltage (electro-rotation) one.

### **Development level**

- ¶ Applied research or development]

### **Development plan**

- ¶ The prototype has just been successfully tested on the customer's site (in Cheboksary city, Russia) being installed in the protection relay cabinet instead of a conventional transformer.
- ¶ Further steps:
  - ¶ 1. Design of a dual range transducer (0.5 to 50A; 50 to 5000A);
  - ¶ 2. Adaptation of the design and output signal level to transformer applications according to IEC 60044-8;
  - 3. Improving measurement accuracy characteristics;
  - 4. Testing of the transducer and preparation for serial production.

### **Conditions to submit sample**

The sample can be provided according to the agreement signed by the parties.

### **Desired form of collaboration**

Cooperation in bringing up the transducer to serial production.



## OOO NPP MARS-ENERGO

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### **Intellectual property conditions**

To be negotiated.

### **Patents**

Utility model patent N 149253 granted by FIPS (Federal Institute of Industrial Property, Russia); registered in State Registry of Utility Models on 26 November 2014.

[http://www1.fips.ru/wps/wcm/connect/content\\_en/en/main+](http://www1.fips.ru/wps/wcm/connect/content_en/en/main+)