IDM

Catalog

Intelligent Electronic Device OLTC Torque Monitor

Because it has moving parts, which switch high voltages and currents, the on-load tap changer (OLTC) is, from the statistic point of view, a major source of faults in transformers. In order to detect these defects at an early stage and reduce the likelihood of unexpected downtime, the IDM monitors the OLTC torque online, alerting the operator for changes in its typical signature, which indicate developing failures.

The energy for the OLTC operation is supplied by a motorized mechanism, which applies more or less torque in each commutation stage, thus creating a typical "signature" typical which, under normal conditions, is repeated at each commutation. Mechanical problems in the OLTC change this signature, allowing their detection while they are still incipient.

Since the torque developed by the motor is proportional to the electrical power, the IDM monitors failures indirectly by measuring motor consumption with the purpose of detecting and issuing alarms in case this signature or the commutation time change. Therefore, the commutator mechanical failures may be detected while they are still incipient. For this purpose, the IDM Torque Monitor oversees several variables online:

- Current Oscillography, voltages (optional) and power consumed by the motor during operations, either in single or three-phase mode;
- OLTC tap position (optional), through potentiometric disc or current input (for instance, 4-20mA);
- Driving mechanism temperature (optional);
- Mechanism anti-condensation heater current (optional);
- Line Current interrupted by the commuter contacts (optional);
- Motor circuit breaker auxiliary alarm contact (optional).

In order to diagnose the OLTC, the IDM correlates these measurements in specialized engineering algorithms, obtaining useful information for the diagnosis and prognosis, as applicable:

- Power and energy signature spent by the motor during the operation;
- Motor starting current;
- Commuter operation time signature;
- Minimum and maximum voltages in the motor during operation;
- Number of OLTC operations and service time, total and after the last maintenance;
- Integration of the commuted current, indicating wear of the commuter contacts, total and after the most recent maintenance;
- Time remaining until the next service time maintenance, number of operations and integration of the commutated current;
- Heater mechanism operation, avoiding water condensation and oxidation;
- Too low or too high temperature of the operation mechanism;
- Motor power supply voltage too low or too high;

With the measurements and calculations through engineering algorithms, the IDM sounds an alarm in case of abnormalities, as well as notices of maintenance scheduled in advance by the user via a signaling system that allows you to quickly diagnose the OLTC state, with activation of output contacts:

- **Green** - Transformer is working correctly. No maintenance is needed;
- **Blue** - Transformer is working correctly. Maintenance reminder;
- **Yellow** - Minor abnormality;
- **Red** - Major abnormality.

IDM Optional Features

According to the order, IDMs can be delivered with one or more of the optional functions listed below.

Optional item 1 – DNP3 Protocol:

Level 1 DNP3 slave communication protocol, RTU, with support for timestamp with 1 ms accuracy. Through the DNP3 protocol, the user can access parameter query and programming, checking of analog and digital measurements, and alarm events.

Optional item 2 – Mass Memory:

Allows storage of data and past events in a log of up to 10,389 records in a circular memory, which can have its recording period adjusted according to the user's need. The information stored is:

- Date and time of the events;
- Alarms that occurred;
- Self-diagnoses that occurred;
- Measurements made;

Optional item 3 – Voltage Control and Heating Monitoring

Allows the heating system current and temperature monitoring; also allows program of conditions in which the heating system is turned on or off. The voltage control can also be monitored when this option is activated.

The good working of this function depends on the correct voltage control, CT current sensor and PT100Ω temperature sensor connection to device.

Optional item 4 - Position Measurement

An input to measure the position of the OLTC with a potentiometric transmitter, with compensation of cable resistance and error detection. Associated functions: Current output programming for TAP remote indication; OLTC local manual command (front panel) and through serial communication; Adds the measurement of the line current (IL).

Optional item 5 – OLTC Maintenance

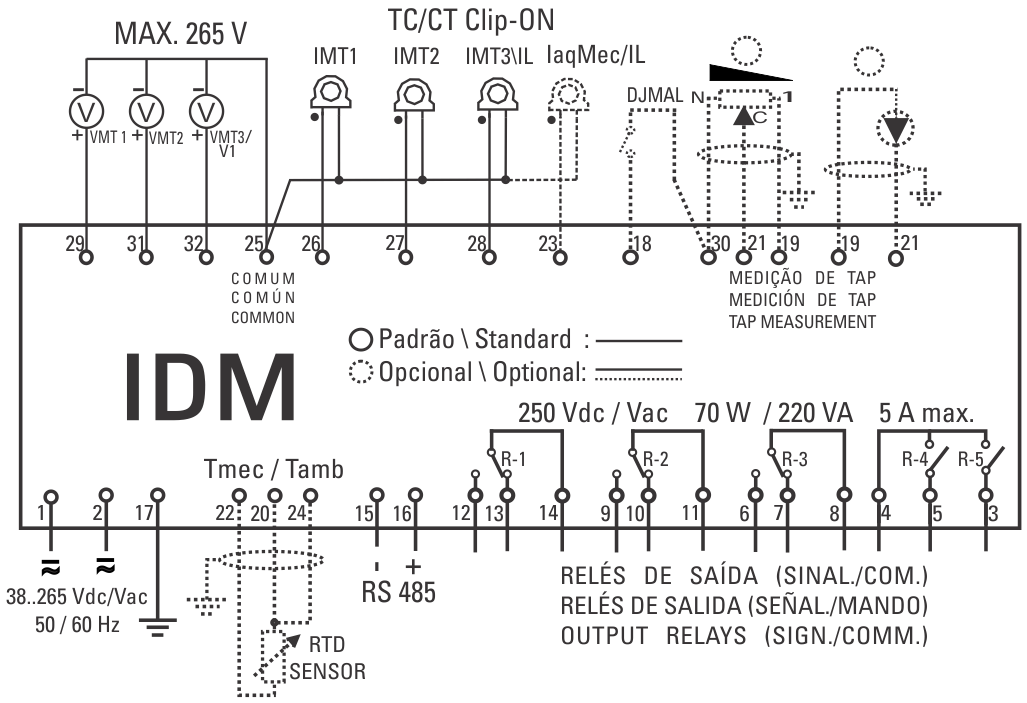
This optional item expands the IDM's functionalities, adding some information:

- OLTC operation counter, with maintenance reminder per number of operations;
- Integration of switching current squared, with a reminder of maintenance due to a high I2 sum total.
- Forecast of the remaining time before the next OLTC maintenance

Technical Specifications

Conditions	Interval / Description
Supply Voltage:	38 a 265 Vac/Vdc 50/60 Hz
Consumption:	≤13 W
Degree of Protection:	0.3 to 2.5mm^2, 22 to 12 AWG
Connections:	IP 20
Installation:	Embedded in panel
Measurement Inputs	
Currents:	4 External clip-on O...10 Aac rms / Other ranges by request
Voltages:	3 of 0...240 Vca F-T. Other ranges with external TP
Temperatures:	1 Pt-100 Ω at 0 ºC sensor / -55 to 200 °C range
Dry contacts:	1 potential free
Tap:	Potentiometric disc or current loop 0-5, 0-10, 0-20 or 4-20 mA range
Maximum errors	
Currents:	1% of measurement in the 80 ... 240 Vac / 100 ... 300 Vdc range
Voltages:	1% of measurement in the 0.5 ... 10 Aac range
Temperatures:	0.5% end of scale + sensor error
Exits to relays:	3 Reversible + 2 NO / NC
Maximum switching power:	70 W(dc) / 220 VA(ac)
Maximum switching voltage:	250 Vdc / 250 Vac
Maximum conduction current:	5 A
Serial Communication Ports:	1 RS485
Communication Protocols:	Modbus RTU / DNP3 (Optional)

Connection Diagram



In the picture, is remarkable the hardware difference between the IDM and the SDM: the communication ports. Just the IDM has Ethernet ports.

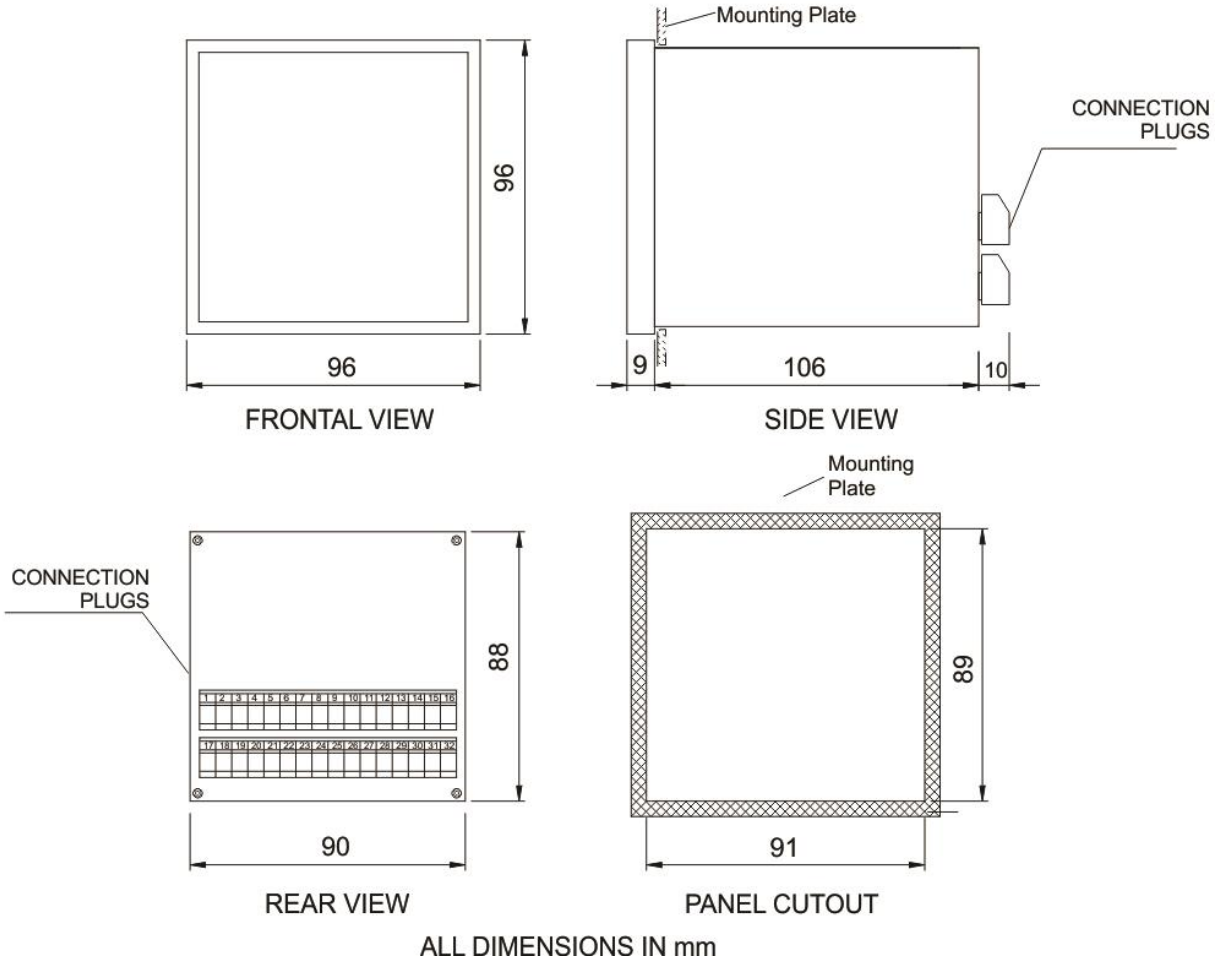
One of the hardware options is the choosing between two optical fiber ports or two RJ45 cable ports for the SDM.

Another hardware option is the Tap position measurement method. It can be done with a potentiometric transmitter or an analogic signal of current loop.

The choosing, in both situations, must be done during the order, considering they are options that change the product's hardware.

The green elements represent functions that can be selected through parameterization and sensors which are used only when some firmware options are available and activated.

Dimensions



Order Specification

The OLTC Torque Monitor - IDM is a universal device, with characteristics selected on its programming menus through its front panel or communication ports.
Universal power supply (38 ~ 265 VDC / VAC, 50/60 Hz).
Therefore, when issuing a purchase order for this device, the buyer just needs to specify:

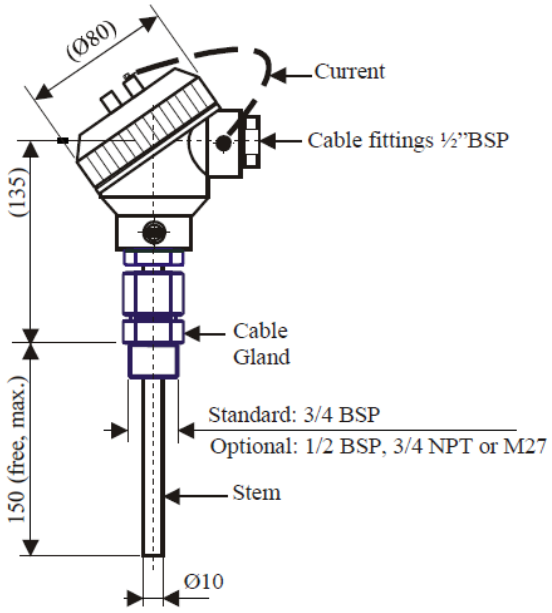
- OLTC Torque Monitor - IDM:
  - ✓ Quantity;
  - ✓ Required amount of Clip-on CTs (DC, single phase or three phase application);
  - ✓ Optional: DNP3 Protocol.
  - ✓ Required amount of PTs;
  - ✓ PT100Ω temperature sensor or not;
  - ✓ Optional items selected;
  - ✓ If the optional item 4 (Position Measurement) is selected, choose between potentiometric transmitter or analogic signal mA for measurement.

Optional Accessories

- **PT100ΩW Temperature Sensor at 0ºC**

Top oil temperature in power transformers is usually taken by a temperature sensor installed in a thermowell on the transformer's cover. The sensors used with the IDM must be of the Pt100W kind at 0ºC. If needed, Treetech has a sensor that is appropriate to be installed in a thermowell, as per the drawing below (special sizes on demand), supplied as optional accessory. Contact us also on thermal shelters for ambient temperature measurement and thermowells for installation.

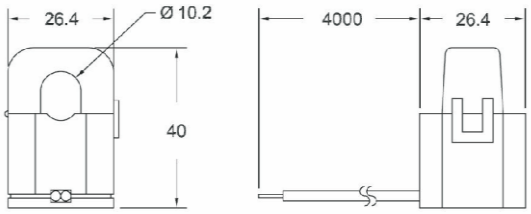
Características	
Standard:	ASTM E1137, class B
Alpha Coefficient:	0,003850 / ºC
Measurement Range:	-100 a +300ºC
Head:	Cast Aluminum, yellow coating
Stem:	Stainless Steel
Cable gland:	Nickel-plated Tin
Chain:	Nickel-plated Tin
Screws:	Stainless Steel
Adapter:	Stainless Steel
Insulation:	2kV, 50/60 Hz, 1min.



- **External Clip-on CTs (Split Core)**

The use of external clip-on CTs with a split core window allows the installation of the temperature monitors without directly connecting the bushing CT secondary to the IDM, which eliminates the risk of accidentally opening the secondary and allows installation during transformer operation.

Operating Temperature: -40...+85°C. Size (mm):

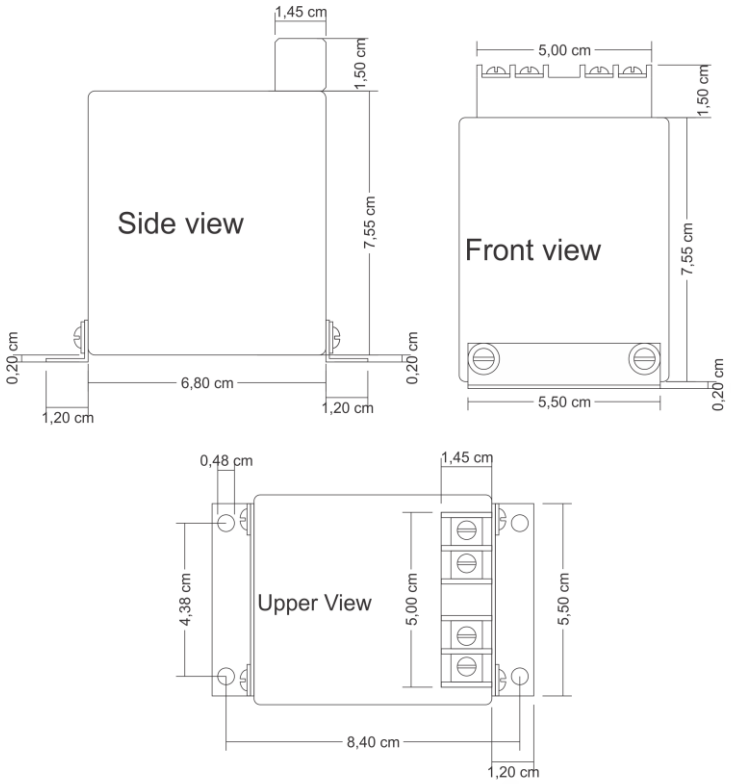


- **Voltage measurement Transformer model EI 22x22**

The auxiliary PT must be used if the motor is supplied with AC voltage higher than the IDM's measurement inputs (265Vac) can support or for motor voltage isolation in the relative control voltage. The supply attends to the needs of the application and the quantity must be requested in the acquisition order.

The PT will have the following features:

- ✓ Dry isolation;
- ✓ Power: 15VA;
- ✓ Primary Voltage: 550V;
- ✓ Secondary Voltage: 220V;
- ✓ Isolating material: "F" class (155°);
- ✓ Frequency: 50/60Hz;
- ✓ Isolation Class: 1,2 kV (T.A.D: 4kV);
- ✓ Winding in Electrolytic copper, encapsulated with epoxy resin;
- ✓ Cooling: air circulation (AN)
- ✓ Open mounting for indoor installation;
- ✓ Approximate dimensions (AXLXP) 85 x 75 x 55



- **Outdoor cabinets**

The OLTC Torque Monitor must be always installed in a shelter against bad weather. The IDM OLTC Torque Monitor must be installed in a weatherproof area, usually inside the control panel of the transformer. When this is inconvenient, such as, for example, when old transformers are refurbished, the IDM can be supplied in a weatherproof cabinet, easy to be installed.

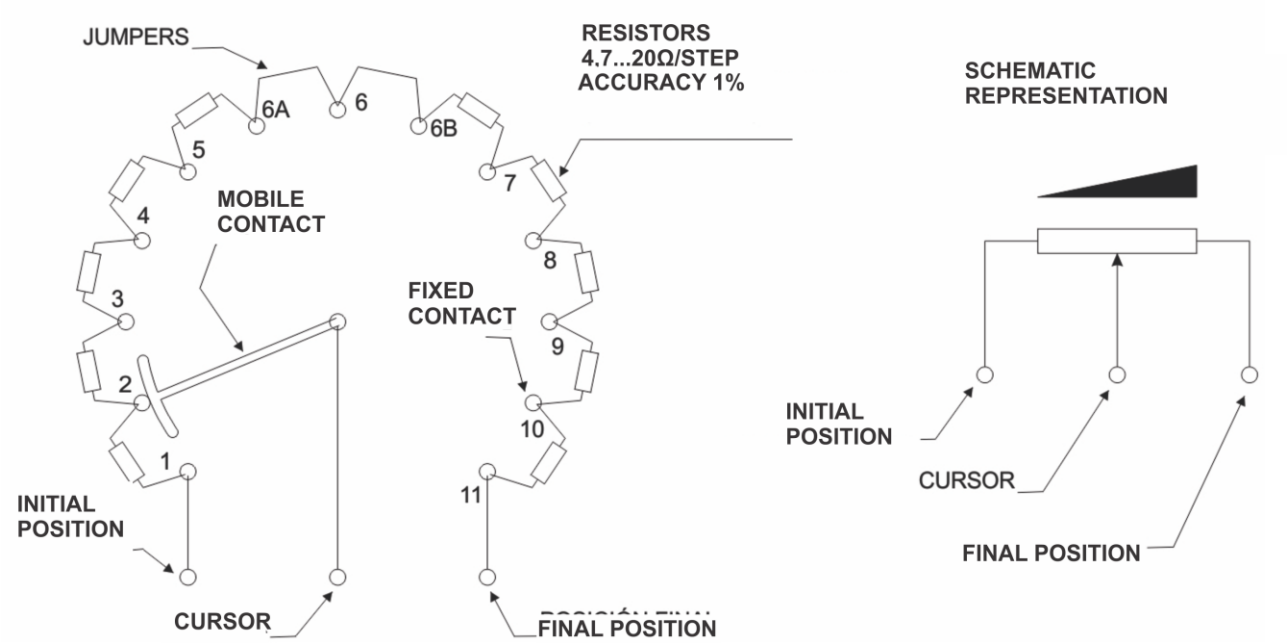
Characteristics:	
Mounting:	Bolted or with high load capacity magnets.
IDM Anchoring	On a sliding rack
Wiring connection	Multi-polar removable plugs at the bottom of the cabinet.
Degree of Protection:	IP55
Insulation test:	2kV, 50/60 Hz, 1 min.

- **Weather instrument shelter to measure outside temperature**

To measure outside temperature a Pt100Ω at 0ºC sensor must be installed in a weather instrument shelter which minimizes the effect sun and rain have on the measurement.

- **Potentiometric Transmitter**

The IDM admits the potentiometric transmitter resistance by step in the range 4,7 to 20Ω; the total resistance, 9,4 to 1000Ω. The value of each resistor is shown in the picture below. The potentiometric transmitter mobile contact (cursor) can be “closes before opens” or “opens before closes”, without losses. The potentiometric transmitter resistance must be accurate, with error range of 1% maximum. The transmitter can read until 35 taps.



Type Testing

Immunity to Surges (IEC 60255-22-5 and IEC 61000-4-5):	
Differential mode:	1kV, 5 per polarity (+/-)
Common Mode:	2kV, 5 per polarity (+/-)
Immunity to Electric Transients (IEC 60255-22-1, IEC 61000-4-12 and IEEE C37-90-1):	
Peak value of 1st cycle, Frequency, Time and repetition rate, Decay to 50%:	2.5 kV common mode, 1 kV dif. mode, 1 MHz, 2 sec; 200 surge/s, 5 cycles
Voltage pulse (IEC 60255-5):	
Waveform, Amplitude, Pulse Number:	1.2/50 µs, 5 kV, 3 negative and 3 positive, 5s interval
Applied Voltage (IEC 60255-5):	
Bearable voltage at the industrial frequency:	2 kV 60Hz 1 min. against ground
Immunity to Irradiated Electromagnetic Fields (IEC 60255-22-3 and IEC 61000-4-3):	
Frequency, field intensity:	80 a 2500 Mhz, 10V/m
Immunity to conducted electromagnetic disturbances (IEC 60255-22-6 and IEC 61000-4-6):	
Frequency, field intensity:	0,15 a 80 MHz, 10V/m
Industrial Frequency Magnetic Field Immunity (IEC 61000-4-8)	
Magnetic Field Intensity and Direction:	30 A/m, 3 orthogonal axes
Electrostatic Discharges (IEC 60255-22-2, IEC 61000-4-2 and IEEE C37-90-3):	
Intensity and repetitions:	Air mode, 15 kV, ten discharges per polarity;
Immunity to Rapid Electric Transients (IEC 60255-2-4, IEC 61000-4-4 and IEEE C37-90-1):	
Power supply, inputs and outputs:	4kV
Power supply failure (IEC 60255-22-11 AND IEC 61000-4-11):	
Voltage Drops:	0-80% of U, 1/2 to 300 cycles, 85 V and 265 V, 50/60 Hz
Short interruptions:	5sec., 85 V and 265 V, 50...60 Hz.
Cold test (IEC 60068-2-1):	
Temperature, test duration:	-40°C, 16 hours
Dry heat test (IEC 60068-2-2):	
Temperature, test duration	+85ºC, 16 hours

Moist heat test (IEC 60068-2-78)	
Temperature and humidity, test duration	+40°C, 85% RH, 24 hours
Damp heat, cyclic (IEC 60068-2-14)	
Temperature range, total test duration:	-40 to +85ºC, 96 hours
Vibration response: (IEC 60255-21-1)	
Application, Duration, Amplitude, Intensity:	3axes, sinusoidal 160 min/axis, 10 a 150 Hz, 2G
Electric safety standards (EN 61010-1)	
Protections against electric shock, mechanical damage, liquid damage and flame propagation Heat resistance and protection devices	

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