



VIRGINIA - GEORGIA TRANSFORMER
ONE SOURCE-ONE COMMITMENT

TRANSFORMER MONITORING – SECURE AND EXTEND TRANSFORMER LIFE

Comprehensive monitoring of transformers' key operating parameters provides control outputs and diagnostics for long life of the transformer. With integrated intelligence, and analysis of the transformer's condition from VT-GT, maintaining the transformer in prime operating condition is made easier and the life of the transformer is extended. This value added protection of the asset serves as an intelligent transformer physician.

VCM KEY BENEFITS:

While the VCM2 monitors all the essential operating parameters of the transformer, VCM3 adds additional protection by enabling:

- *Detects Moisture in Oil*
- *Evaluates Moisture in Insulation*
- *Loss of Life Algorithmic Projection*
- *Measures H₂ Dissolved Gas*
- *Records Short Circuit Occurrences*
- *SCADA compatible; DNP3 or Modbus Protocol*



VCM2

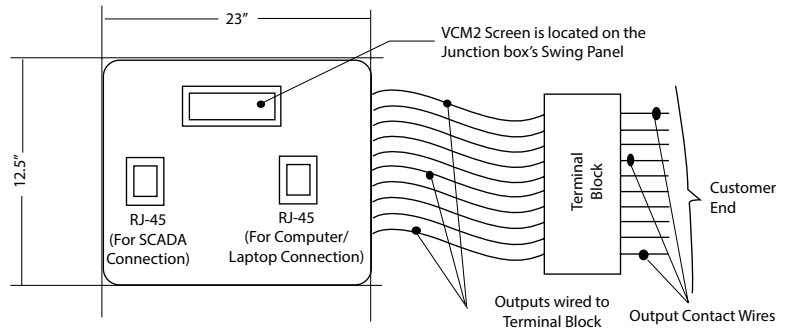
VCM 2 provides transformer monitoring and protection

The VCM-2 is an integrated module for all essential transformer parameters with accurate monitoring, control and data collection. Virginia Transformer Corp offers VCM2 state of the art technology to provide comprehensive monitoring and protection for Class I power transformers.

A Second Generation, PLC based Transformer Monitoring and Diagnostic Module developed by Virginia Transformer Corp. This device monitors all essential transformer operating parameters, providing actual and on-line diagnostics with SCADA output.

FEATURES

- ◆ VCM2 uses solid state devices for best reliability
- ◆ Unlike other ETM's, VCM doesn't require any external RTD's and other components. VCM2 includes sensors for measurement
- ◆ Sensors used in the VCM2 are more accurate compared to conventional mechanical gauges
- ◆ Contacts generate messages if exact set points are fixed, but the user can change the set points locally on the VCM2 screen or remotely from the customer's computer or laptop
- ◆ Set Points can be changed through the wired connection with a secure user ID and password
- ◆ Output Contacts can be tested (locally) in the field using the screen
- ◆ SCADA compatible: DNP3 or Modbus protocol
- ◆ Life time data is available for download anytime
- ◆ Analyze transformer performance based on saved measurements and data
- ◆ Capability to communicate the data between the VCM2 and the user through wired connection
- ◆ 110/ 220 VAC 50 /60 cycle power
- ◆ No maintenance required



Output Controls

Based on the measurements, the following set points are activated:

Winding Temperature

- Fanstage 1
- Fanstage 2
- Alarm
- Trip

Oil level

Low level, Low-low level, High level

Pressure

Hi tank pressure, Low Tank Pressure

Outputs and Measurements: Oil Temperature, Tank Oil Level, Tank Pressure, Winding Temperature, Ambient Temperature

Other controls and outputs:

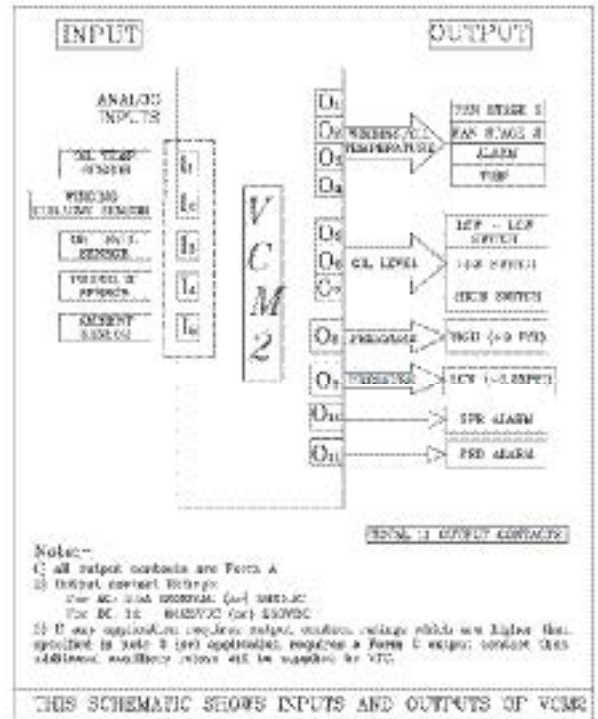
PRD activation, SPR activation, Fan Control Alarms

Display/Reporting:

All measurements and alarms are displayed locally on screen. Set points for fan operation and alarms can be changed locally for start up and testing. The measurements and historical data are available locally and through SCADA connection

VCM2 Package Components:

1. **Sensor box**
 - Top oil temperature sensor
 - Liquid level sensor
 - Pressure sensor
 - Ambient temperature
2. **Current Transmitter Sensor**
to measure the load current.
3. **SCADA Connection**
Modbus or DNP3 Protocol





VCM 3 provides the ultimate in transformer monitoring and protection

For the first time in the industry all the values of measurements can be charted and analyzed for abnormal heating and gassing condition to schedule maintenance and achieve an extended life of the transformer, providing an early warning of impending failure. When integrated into the smart grid intelligence, this feature will protect the transmission system against a brown out or a black out.

Only VTC transformers offer VCM3 state of the art technology to provide comprehensive monitoring and protection of Class II power transformers with or without LTC, essentially making an Intelligent Transformer. Service interruptions are avoided with status reports of operating parameters. In the event of a potential condition, the VCM3 displays a warning locally on screen and sends an alarm to the user's computer when connected.

Provides all the functions of VCM2 plus loss of life analysis, dissolved H₂ gas analysis, moisture in the oil, moisture in paper insulation, LTC Tap Position, LTC differential temperature, LTC Off-Tap, Low N₂ Pressure Alarm



FEATURES

Solid-state Sensors and Set Points, 25 Point Annunciator

- ◆ Moisture in Oil and Paper Insulation
- ◆ Measures H₂ Dissolved Gas
- ◆ Low nitrogen pressure alarm
- ◆ Loss of Life Evaluation
- ◆ LTC Monitoring
- ◆ Detects, displays and records the number of short circuit fault current events on the transformer, magnitude and time of occurrence
- ◆ Fast response pressure sensors sense the Rapid Pressure Rise to latch the rapid pressure relay contact
- ◆ Fail Safe Operation - fans will turn on
- ◆ All data is compatible to SCADA through Modbus/DNP3 protocols
- ◆ Solid-state sensors with analog outputs and comparator circuits replace the mechanical gauges
- ◆ Output Contacts can be tested (locally) in the field changing the set points on the screen
- ◆ Should any sensors become disabled, an alarm message is sent and displayed locally
- ◆ A touch screen annunciator provides a local display of all parameters

H₂ Gas, Moisture, Loss of Life Monitoring

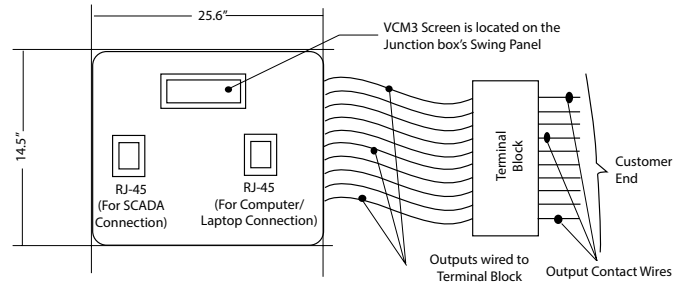
- ◆ VCM3 performs on-line Dissolved Gas Analysis (DGA) for Hydrogen utilizing a state-of-the-art gas detector module. It measures the moisture in oil in PPM, evaluates % moisture in paper insulation using a VTC proprietary algorithm. This combines to evaluate Loss-of-Life in the transformer

LTC Monitoring

- ◆ For transformers with an On-load Tap Changer, VCM3 includes the feature of monitoring LTC position, number of operations, LTC Differential temperature, and provides contacts for 16L, 16R, N and Off-Tap position indication

Display/Reporting

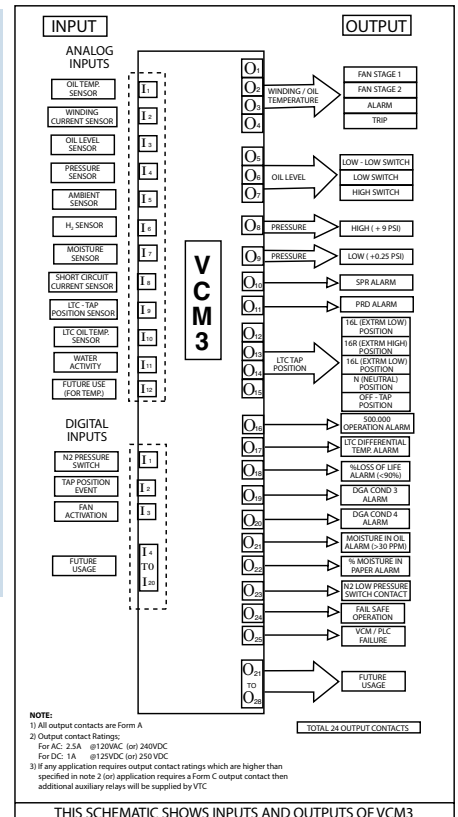
- ◆ All measurements and alarms are displayed locally on a touch screen monitor. Set points for all monitored parameters and alarms can be changed locally or from a connected laptop/computer. The measurements and lifetime historical data are available locally and downloadable to a computer; SCADA compatible, DNP3 or Modbus options.



VCM3 Package

Components:

1. **Sensor box**
 - Top oil temperature sensor
 - Liquid level sensor
 - Pressure sensor
 - Ambient temperature
2. **Current Transmitter Sensor** to measure the load current.
3. **Short Circuit Fault Current Detector.**
4. **Gas & Moisture Sensor.**
5. **LTC Oil Temperature Sensor.**
6. **LTC Tap Position Sensor Assembly.**
7. **N₂ Pressure Switch**
8. **SCADA Connection** Modbus or DNP3 Protocol



THIS SCHEMATIC SHOWS INPUTS AND OUTPUTS OF VCM3

VCM Comparison to other monitoring devices

FEATURES	VCM2	VCM3	Qualitrol ETM 509	Dynamic Rating ETM	SEL 2414	Advanced TTC 1000
Pressure Transducer	Yes (j)	Yes (j)	No	No	No	No
Ambient Temperature Transducer	Yes (j)	Yes (j)	No	No	No	No
Level Transducer	Yes (j)	Yes (j)	No	No	No	No
Top Oil Temperature Transducer	Yes (j)	Yes (j)	No	No	No	No
LTC Temperature Transducer	No	Yes (j)	No	No	No	No
Load Current Monitoring Sensor	Yes (j)	Yes (j)	No	No	No	No
Short Circuit Fault Current Sensor	No	Yes (j)	No	No	No	No
LTC Position Sensor	No	Yes (j)	No	No	No	No
Oil Temperature Monitoring	Yes	Yes	Yes – Optional			
Winding Temperature Monitoring	Yes	Yes	Yes – Optional			
Load Current Monitoring	Yes	Yes	Yes – Optional			
Ambient Temperature Measurement	Yes	Yes	Yes – Optional			
Pressure Monitoring	Yes	Yes	Yes-Optional		No	No
Liquid Level Monitoring	Yes	Yes	Yes-Optional		No	No
Periodic Fan Bank Exercise	No	Yes	Yes	Yes	Yes	Yes
LTC Differential Temperature	No	Yes	Yes – Optional			
LTC Tap Position Display	No	Yes	Yes – Optional			
LTC (Off-Tap)	No	Yes	Yes – Optional			
(16L, 16R, Neutral)	No	Yes*	No	No	No	No
LTC Operation Position Counter	No	Yes	Yes – Optional			
Output Contacts	11	25	8	5	8	8
# Annunciation	Yes (11 Point)	Yes (25 Point)	Yes (8 Point)	Yes (5 Point)	Yes (8 Point)	Yes (8 Point)
Fan Failure Detection	No	Yes	No	No	No	No
Dissolved Gas in Oil - Measurement	No	Yes (H ₂ Only)	No	Yes (H ₂ Only)	No	No
Transformer Loss of Life Tracking	No	Yes	Yes	Yes	Yes	Yes
Measurement of Moisture in Oil (in PPM)	No	Yes	No	Yes - Optional	No	No
Moisture in Insulation (%)	No	Yes	No	No	No	No
Duration and Magnitude of Short Circuit Fault Current	No	Yes	No	No	No	No
Nitrogen Cylinder Low Pressure Switch	No	Yes	Yes – Optional			
SCADA Protocol: Modbus, DNP3	Yes	Yes	Yes	Yes	Yes	Yes
Supports Ethernet Connection	Yes	Yes	Yes	Yes	Yes	Yes
Supports Fiber Optic Connection	No	No	Yes	No	No	Yes
Historical Data Storage and Download Available	Yes 60 Years	Yes 60 Years	Yes 2 Years	Yes 2 Years	Yes 2 Years	Yes 2 Years

j = All sensors/transducers included, No other hardware required

* Additional auxiliary relays will be supplied with VCM3, if FORM C contacts are required

The **VCM** is a proprietary PLC based monitoring and diagnostic module developed by Virginia Transformer Corporation, fitted exclusively on VTC Transformers and a single point service provided by VTC.

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Information included in this manual was correct at the time of printing.
Virginia -Georgia Transformer reserves the right to discontinue products or
change specifications without prior notification.

VCM FREQUENTLY ASKED QUESTIONS

Q: How is the transformer protected in case the SRI function is not operating due to failure of the pressure sensor?

A: There are four levels of protection provided in VCM3:

1. The Solid-State sensors used are the finest quality. These sensors are made with a semiconductor quality control system similar to phones and TV's
2. If the PLC is not receiving a signal from any sensor for any reason, the VCM3 displays an error message on the local screen and on the remote monitoring that the sensor is disconnected. An inactive sensor alarm is also activated. (All sensors can be changed without draining oil)
3. In the event the VCM3 fails to show the Sensor Failed Alarm, the transformer is still protected by the mechanical Pressure Relief Device (PRD) set to open at 10 PSI.
4. In the event of a sudden pressure build up from gas generation, the sudden pressure relay will latch. This event will be registered by the Dissolved Gas Sensor and an alarm condition 1, 2, 3, 4 (depending on the amount of gasses) is displayed on the monitor via SCADA.

Q: Can VCM3 be used when a UL rated transformer is requested?

A: Yes, All components in VCM3 are UL listed.