



Transformer Advantage 3

Transformer Temperature Monitoring and Control

- Single, Dual and Three RTD Units
- Calculated or Simulated Winding Temperatures
- LTC Temperature Difference (CT/LTC Model)
- Multi-Stage Fan/Pump Control with Readback
- Loss of Life (Insulation Aging) Option
- Auxiliary Analog & Digital Inputs
- SCADA Ready – DNP3.0 & Modbus Protocols Included
- Ethernet & USB Communications
- Weatherproof NEMA 4X Metal Case
- Expanded Wiring Compartment

NEW
NEW

- Extend Transformer Life
- Maximize Capacity
- Reduce Maintenance

The *Transformer Advantage 3* is a precision temperature monitor for liquid immersed power and distribution transformers. It is rugged, fully electronic and field configurable. With *Transformer Advantage 3*, users can extend transformer life, utilize maximum capacity and reduce maintenance costs.

- Up to 12 Setpoint Relays
- Fan Sequencing
- Fan Exercise Timer
- Seasonal Setback

Five models in the Advantage line offer a range of functions and configurations. All use an accurate and stable platinum temperature sensor (RTD) to precisely measure critical liquid temperatures. Setpoint relays can activate alarms or multiple stages of cooling at different temperatures. A sequencing function equalizes run time between cooling stages. The fan timer can exercise fans at a preset time each day. Seasonal setback is available on any setpoint relay. A front panel test mode quickly verifies cooling and alarm operation. The high current relay contacts can be configured for fail safe operation.

- Time Stamped Peak Storage
- Front Panel or Remote Setup
- Digital and Analog Outputs
- Wire or Fiber Communication

The large alphanumeric LED display continually shows the selected transformer parameter. Front panel buttons scroll the display through other parameters and relay/alarm status. Peak and valley values for each channel are time stamped and stored in non-volatile memory. These are easily checked and reset by the operator from the front panel or through digital communications. A password-protected supervisor mode accesses all setup parameters. Initial setup can be done from the front panel or through either isolated communication port (wire or fiber). Windows-based configuration software significantly speeds startup.

- Easy Upgrade
- EMI Hardened
- Direct Transformer Mounting
- Made in USA

The *Transformer Advantage 3* is a cost-effective upgrade from analog gauges and an easy upgrade from *Transformer Advantage II*. It is designed to mount on the transformer or in the control cabinet. Probe options fit most popular thermowells, or magnetically mount on units without wells. The *Advantage* has been conservatively designed and stress tested to provide years of trouble free service in the harshest environments. A wide variety of options tailor the *Transformer Advantage 3* to each application.

Simulated Winding Temperature

This is the traditional method for indicating transformer winding temperature. A heated thermowell, driven by a bushing CT, simulates the winding temperature rise above the oil temperature. This temperature rise is calibrated by the transformer manufacturer at full load. Performance is optimized for steady state or slowly changing loads. The simulated winding method is often used as a direct replacement for an analog winding gauge when higher accuracy, more configuration flexibility or a SCADA interface is required. Two and three channel Advantage models support this method on new or existing transformers.

Calculated Winding Temperature

A newer method uses oil temperature and load current to calculate winding temperature, based on IEEE guidelines. The Transformer Advantage analyzes transformer parameters to determine thermal time constants for the oil and windings. These time constants are changed dynamically based on load and cooling conditions. Rate of change information is also utilized in the Weschler algorithm to further improve the winding temperature accuracy. This is particularly important when operating above nameplate rating. Three Transformer Advantage models use the calculated winding method.



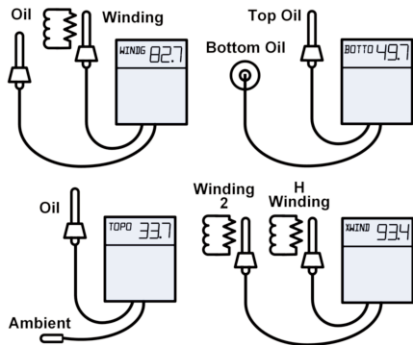
**WESCHLER
INSTRUMENTS**
DIVISION OF HUGHES CORPORATION

**16900 FOLTZ PARKWAY
CLEVELAND, OHIO 44149**
Phone: (440) 238-2550 Fax: (440) 238-0660
www.weschler.com Email: sales@weschler.com

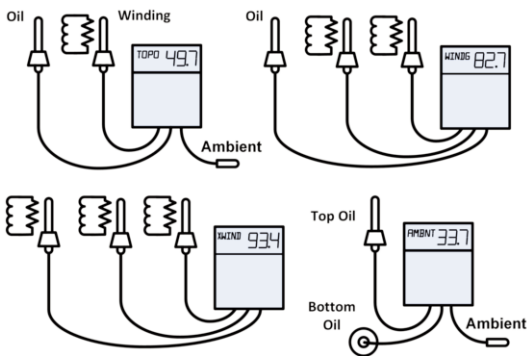
Transformer Advantage 3

Typical Configurations

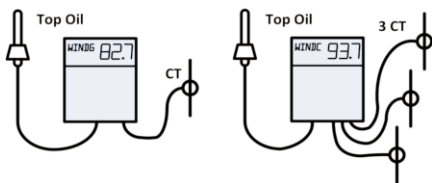
Advantage DC



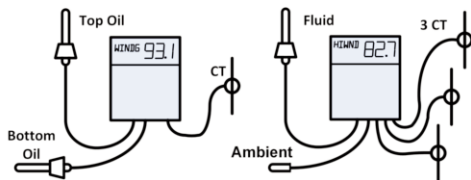
Advantage TC



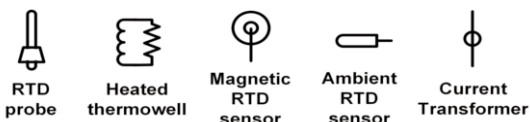
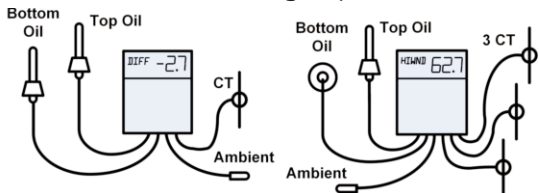
Advantage CT



Advantage CTX



Advantage CT/LTC



Simulated Winding Models

Advantage DC

The Advantage DC provides two channels of temperature monitoring in a single unit. Any mix of thermowell, magnetic and ambient probes can be used. Liquid temperature is directly measured using either an RTD probe installed in a thermowell or a magnetic RTD probe mounted on the side of the main or LTC tank. Winding temperature is simulated with an RTD probe in a heated thermowell.

Up to 12 setpoint relays are available in every Advantage model. In the Advantage DC, each setpoint relay can be configured to trigger on channel 1 or channel 2 temperature, any auxiliary input, day/date or a remote command. Hysteresis, non-alarm state and sensor fail response are individually settable.

Both channels can be retransmitted using the analog output option. Other devices on the transformer can be monitored through the auxiliary input option (not shown in diagrams). One Advantage DC easily replaces the oil and winding gauges on an existing transformer.

Advantage TC

The Advantage TC provides three identical channels to measure any combination of top oil, bottom oil, winding, LTC and ambient temperature. For example, one Advantage TC will monitor oil temperature using either a thermowell or magnetic probe and two winding temperatures from probes in heated wells. An ambient probe coupled to a setpoint relay can be used for a low temperature alarm or pump lockout. Up to four channels of analog output, with adjustable span, are available.

Calculated Winding Models

Advantage CT

The Advantage CT directly measures transformer oil temperature and transformer load current in one phase. Winding temperature is calculated from the measured current, liquid temperature and key transformer parameters. This calculation uses a proprietary algorithm based on IEEE C57.91. The sophisticated algorithm also provides different thermal profiles for natural, forced or directed oil cooling. An existing current transformer can be wired directly to the Advantage CT, or the clamp-on option can be ordered to avoid CT loop rewiring. The 3 winding option displays individual temperatures, based on each winding's characteristics. Two or four channels of analog output readback oil temperature, winding temperatures and/or load currents. Auxiliary analog/digital inputs allow the Advantage CT to monitor cooling circuits and adjust the winding temperature calculation based on the cooling equipment actually operating. Other transformer devices can also be monitored for transmission to a SCADA system or to activate alarms.

Advantage CTX

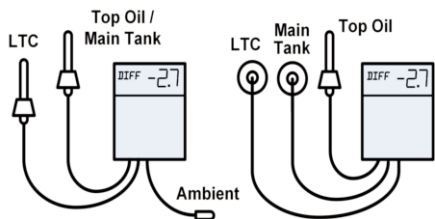
The Advantage CTX adds an extra temperature channel to the capabilities of the Advantage CT. This channel is typically used to monitor ambient, LTC or bottom oil. Many control and alarm schemes are possible with up to 12 setpoint relays.

Advantage CT/LTC

The Advantage CT/LTC has three RTD inputs and one or three winding current inputs. This top end model in the Advantage line combines transformer and advanced load tap changer monitoring in a single unit. For transformer monitoring, the Advantage CT/LTC replaces up to 6 analog gauges. In the basic configuration, a single CT input monitors one winding. The first RTD input monitors top oil. The other two can be used for bottom oil, LTC or ambient using a thermowell, magnetic or air sensor. The three winding option adds two CT inputs. The analog output option retransmits up to 4 parameters. These are typically oil, winding and ambient temperature plus load current. Hottest winding and highest current can be transmitted with the three CT option.

Transformer Temperature Monitoring & Control

Advantage CT/LTC



1 or 3 CT inputs available in either configuration.

LTC Monitoring

A single RTD input can be used to monitor LTC temperature. However, closer monitoring requires tracking the difference between the main tank and LTC tank temperature. The Advantage CT/LTC is optimized to perform this function. Both a difference and deviation (difference trend) are calculated to detect contact wear, misalignment, coking, overloading, locked rotor and other heat generating conditions. Because LTC degradation is a long-term effect, sophisticated digital filtering and a proprietary LTC tailoring function are used to avoid false alarms from cooling stage operation and other short-term changes. Two configurations are possible with the Advantage CT/LTC. Best accuracy is achieved with thermowell probes in both the main and LTC tanks. The third RTD input can then be used to monitor bottom oil or ambient. For LTCs without a thermowell, the third RTD input is used for an additional magnetic probe mounted on the main tank.

Specifications

Temperature Inputs:

Sensor: 3 or 4 wire, 100Ω Platinum RTD, $\alpha=0.385$;
4 wire Class A probes supplied.
Range: -70.0 to 250.0°C
Display Resolution: 0.1°C
Display Accuracy: $\pm 0.5\%$ of full scale with thermowell probe,
 $\pm 1.0\%$ with magnetic probe

Current Inputs:

Direct CT Input: 1-10A full scale, 50/60Hz, burden <0.1Ω
Clamp-on CT Input: 1-10A full scale, 50/60Hz
Display Resolution: 1A of load current
Display Accuracy: 1% of full scale

Auxiliary Analog/Digital Inputs:

Configuration: Up to 8 differential inputs with 1000V AC
channel to channel isolation
Input Ranges: 5/150/300V AC or DC, 1/20ma DC
24VDC for dry contacts
Display Resolution: 4 digits

LED Displays:

Prompt: 5 digit, 14 segment red alphanumeric,
0.5" (13mm) height
Value: 5 digit, 14 segment red alphanumeric,
0.8" (20mm) height

Setpoint Alarms & Relays (individually settable):

Setpoint Range: -40.0 to 250.0°C
Hysteresis: 0-20°C
Non-Alarm State: User selectable energized or de-energized
Alarm Source:
DC Ch1, Ch2, Aux1-8, Time/Date, Remote
TC Ch1-3, Aux1-8, Time/Date, Remote
CT Oil, Winding1-3, Hottest Winding, Load1-3,
Highest Load, Aux2-8, Time/Date, Remote
CTX Oil, Ch2, Winding1-3, Hottest Winding, Load1-3,
Highest Load, Aux2-8, Time/Date, Remote
CT/LTC Oil, Winding1-3, Hottest Winding, LTC, Diff, Dev, Ch3,
Load1-3, Highest Load, Aux2-8, Time/Date, Remote

Sensor Failure:

Detection: Open probe, shorted probe or internal failure
Operation: Any setpoint relay can be used as a sensor fail relay
Sensor Fail Response: Energize, De-energize

Contact Ratings: 10A @ 125Vac
(all relays) 10A @ 240Vac
½HP @120/240Vac
10A @ 30Vdc, 1A@125Vdc
Contact Protection: MOV (250V, 6500A)

Power Requirements:

90V AC 30VA 90V DC 0.3A
250V AC 40VA 250V DC 0.1A

Peak / Valley:

Stores min & max reading for each measured or
calculated channel. Data stored with time stamp
in non-volatile memory (>30 day capacity in hourly
mode).

SCADA Communications:

Digital:
Port 1: Concurrent port 1 & port 2 operation
Isolated USB 2.0 via internal USB B connector
Port 2: Isolated RS-232, RS-422, or RS-485 (2 or 4 wire)
via plug-in screw terminal connector on I/O module
Analog Retransmit: 2 or 4 channels with 1000V ch-ch isolation
Range: User settable zero and full scale between 0 and
24ma dc
Span: User adjustable from -40 to 250°C
Accuracy: $\pm 0.5\%$ of Display
Source: Any temperature or winding current reading
Voltage: 24V max.
Ethernet (option*): 10/100 BaseT, isolated, RJ45 connector
Fiber (option*): 850 nm LED drives multimode fiber at up to 57600
baud. ST connector;
Protocol: DNP3 Level 1 slave, ASCII, Modbus RTU, Modbus TCP
*Use of Ethernet or Fiber disables Port 2 on I/O module

Environment:

Operating Temperature: -40 to 70°C (-55°C with heater)
Storage Temperature: -40 to 85°C
Memory Retention: Setup parameters - indefinite
Clock - 5 days
Enclosure Protection: NEMA 4X (IP66 dust & water)
EMC: EN 61326:1997
Surge: IEEE C37.90.1-1989

Enclosure: Powder coated aluminum, 16lbs (7.3kg)
Surface Mount: 8.3"W x 17.2"H x 7.6"D (211x435x193mm)
Thru Panel Mount: 8.0"W x 13.2"H x 6.5" behind panel
(204x335x165mm)

Fittings: 1, 2 or 3 RTD grips; three 1" conduit holes
Optional SO cable fittings available

Supplied Accessories: 10' (3m) USB cable; USB memory stick with manuals
& Windows setup/monitoring software.

Warranty: 5 years

Transformer Advantage 3 is Weschler's newest electronic temperature monitor for power plant and substation applications. Since the first model was introduced in 1996, we have continually enhanced the features and the performance of our IED line. The new **Transformer Advantage 3** builds on this experience to offer more standard features, more configuration options, and Ethernet communications. With field reliability proven in thousands of installations worldwide, we confidently offer a five year warranty.

Subject to change without notice. See product manual for detailed specifications and notes.

Transformer Advantage 3

The **Transformer Advantage 3** has the flexibility to support a large number of installation variations.

Alarms & Relays

Each Advantage has 24 alarms that can be assigned to any relay. One relay can be linked to multiple alarms, so fewer relays are needed and field wiring is simplified. For example, three alarms and one relay can be used to activate a cooling stage from top oil temperature, winding temperature & winding current.

To control the timing of relay operation, each alarm includes adjustable pickup and dropout delays (1 sec to 27 hrs). This feature reduces momentary equipment activation or false alarms due to transient conditions. Each alarm still has adjustable setpoint and hysteresis. The alarm source can be any measured or calculated channel, a digital command, time of day or calendar trigger.

Relay operation also includes the ability to 1) sequence fan operation to equalize run time and equipment wear, 2) select the non-alarm relay state [coil on or coil off], 3) define relay action when a sensor or equipment failure is detected.

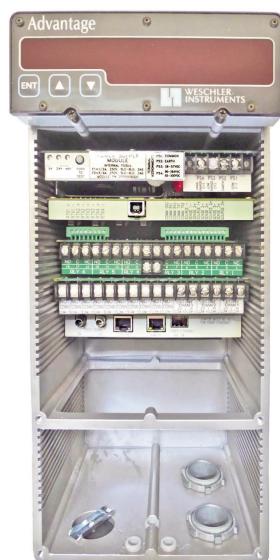
Any alarm can be assigned to activate on sensor failure or internal circuit failure. This alarm then operates a sense fail relay and any other relay that has its sense fail function enabled. More than one relay can be designated as a sensor fail relay to provide redundancy or additional control capability.

Digital Communications

Every Advantage digital interface includes two ports on the I/O module: a hard-wired RS-232/422/485 port and a plug-in USB port for field service. Enabling the Ethernet and/or fiber communication option will disable the I/O module's serial port. Parameters for all ports are set via the front panel. The supplied ASCII, DNP3 & Modbus protocols can be used over wire or fiber connections.

Connections

The Transformer Advantage 3 is available in two case styles: a surface-mount case for mounting on a transformer and a thru-panel case for mounting inside a control cabinet. The modular construction separates circuitry by function on six plug-in modules. Screw terminal connections are used for high current and high voltage lines. Analog and digital signals use modular, plug-in screw terminal connectors. Communication signals terminate in industry-standard connectors (USB, Ethernet, fiber). The rugged metal case of The Advantage 3 includes an expanded lower compartment to facilitate field wiring. Three conduit holes provide space for power, signal and communication lines.



Surface-Mount Case

CT Ratio Entry

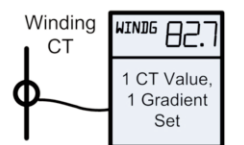
Two methods are provided to set up a CT input on the CT, CTX and CT/LTC models. If the transformer's CT ratio is known (e.g. 2000:5), this can be directly entered into the Advantage during initial configuration. For situations where the CT ratio is not known, or the ratio accuracy is suspect, the CT input can be calibrated precisely using a DMM.

Three Winding Temperatures

The calculated winding models (CT, CTX, CT/LTC) are available with either one or three winding temperatures. Each winding temperature is calculated and displayed using the maximum winding current, gradient and CT ratio values entered for that winding.

In addition to displaying individual winding values, the Advantage with a three winding option also displays the highest winding current and highest winding temperature. These parameters can be used as alarm sources. This reduces the number of alarms needed to control for typical configurations, such as 'activate fans when any winding reaches 80°C'. Highest winding current and highest winding temperature are remotely readable through the digital and analog outputs.

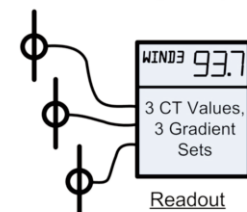
One Winding Temperature



Readout
Winding Current
Winding Temperature

Typical Use
Single phase transformer
Center winding of 3 ϕ transformer

Three Winding Temperatures



Readout
3 Winding Currents
3 Winding Temperatures
Highest Winding Current
Highest Winding Temperature

Typical Use
Transformer with tertiary winding
Unbalanced 3 ϕ transformer

Loss of Life

The calculated winding Loss of Life (Insulation Aging) option tracks the cumulative effect of loading and winding temperature on the transformer's life. Expended hours, remaining hours and present rate of insulation aging are displayed. On three winding units, these values are shown for each winding. Loss of Life can be utilized on both new and existing transformers. For a new transformer, the expected life (usually 180000 hours) is entered during commissioning. For an existing transformer, the number of life hours already used is also entered.

The Monitor software reports the life and rate for each winding. This program also includes a Loss of Life estimator. Enter the hottest spot winding temperature and the number of hours the transformer will run at this temperature. The program shows the hourly and cumulative loss of insulation life for these conditions.

Transformer Advantage - Monitoring & Control

Auxiliary Inputs

Additional analog/digital inputs are available on any Transformer Advantage. These inputs handle AC or DC voltages from 5 to 300V full scale, DC current of 1 to 20mA full scale and dry or wet switch contacts. Each input is separately adjusted for function and range. One alarm is provided with each auxiliary input. This is in addition to the 24 general setpoint alarms. Each auxiliary alarm has programmable high and low limits, hysteresis, pickup delay and dropout delay. The alarm can be linked to any setpoint relay for control of external equipment. It can also be configured to enable its operation only when another relay is activated. This allows more complex control schemes (see fan current monitor example).

AC voltage inputs can be used to confirm that fans and pumps are running normally. A current transducer (ACA to ACV) provides isolated sensing of the motor current. High and low alarm limits on each channel are adjustable to distinguish a tripped breaker, freewheeling blade or overloaded motor. A relay can be activated for remote monitoring or control. The operating value and alarm status are sent to the substation network through the digital interface.

Auxiliary DC inputs allow the Advantage to monitor the output from legacy analog gauges on the transformer. These typically have low voltage or current loop (mA) outputs. The Advantage acts as a data concentrator, sending their values through the digital interface to the substation network. The Advantage will also activate alarms and relays from these signals.

External switches or on/off signals can also be read through the auxiliary inputs. Either dry or wetted switch contacts are compatible. For dry (unpowered) contacts, the Advantage supplies 24V DC power.

Up to eight auxiliary inputs can be ordered on the DC and TC models. This is reduced on the Calculated Winding models by the number of winding current inputs. Seven auxiliary inputs are available with a single winding input and five are available with three winding inputs. Auxiliary inputs have 1000V channel-channel isolation.

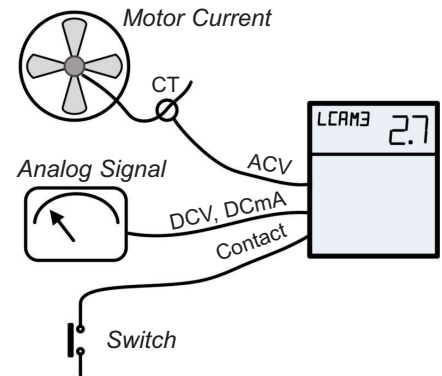
Software Support

All Transformer Advantage 3 models, as well as earlier Transformer Advantage 2 models, are supported by a single software program that is supplied with each unit (and available for download from the Weschler website). This software speeds installation and simplifies field maintenance. It is compatible with Windows XP, Vista & Windows 7-11. The software works through the Advantage's USB port for walk-up service or through the network port for remote operation.

A Launch Pad window is used to access Configuration, Monitor, Logged Data and Firmware Update applications. The Configuration application displays the present settings of a connected unit. Changes can be made by clicking various menu items. The resulting configuration file is then downloaded to the Advantage or saved for later use. The Configuration application can also be used to build and save a setup file without connecting to the Advantage. This reduces the field installation time. Weschler will also, at no charge, review a configuration file and pre-load it to an Advantage before shipment.

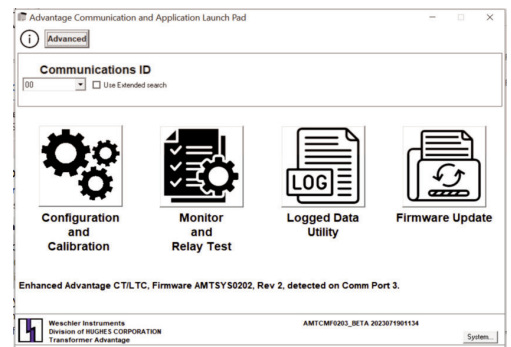
The Monitor application provides a quick snapshot of measured values, alarm settings and relay status. Data is shown in both tabular & graph formats. Users can also view peak and valley values for each parameter, and test the operation of each relay.

The Logged Data Utility extracts stored hourly peak/valley data from an Advantage. It can then be displayed or exported to Excel for analysis.



Example: Fan Current Monitor

Connect a clamp-on current transducer (50A AC input, 5V AC output) to the fan motor activated by an Advantage setpoint relay (e.g. relay 1). Wire the transducer to an auxiliary input channel. Set the channel hardware to 5V full scale. Configure the corresponding auxiliary input alarm to 50A AC full scale. Set the low and high alarm limits to accommodate the normal running current of the fan motor. Associate this alarm with relay 1, so it is enabled only when the fan relay is activated. Use a 10 second pickup delay to inhibit false alarms due to motor starting current. Link the fan alarm to another Advantage relay to activate a remote warning indicator.



16900 Foltz Parkway
Cleveland OH 44149 USA
Phone: (440) 238-2550 Fax: (440) 238-0660
Email: sales@weschler.com
www.weschler.com

