



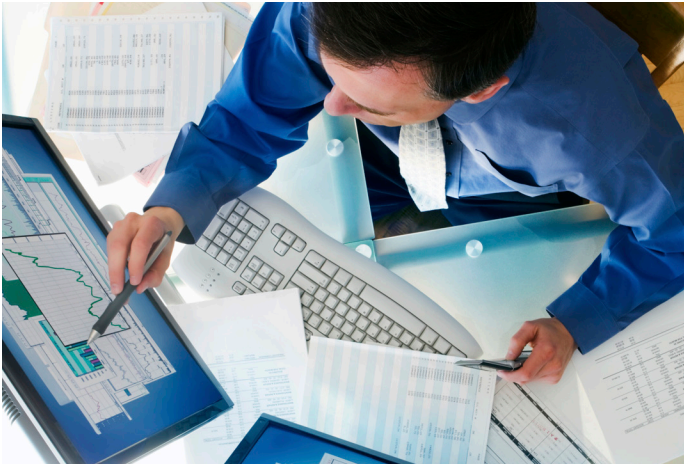
Advanced Transformer Load and Voltage Monitoring

Distributed Intelligence

Managing distribution transformer utilization has been a challenge to utilities for decades. Without the tools to monitor transformer load in real-time, you have to rely on offline, low-resolution load profiles to identify transformer loading and voltage issues, which can be highly inaccurate especially as the percentage of solar generation and electric vehicles (EVs) increases on the grid.

Many utilities currently lack real-time visibility into the secondary network of the grid. Having this visibility is critical as the grid gets more dynamic due to increasing penetration of EV charging and solar generation, and as you are asked to extract more out of existing grid assets. Distributed intelligence (DI) combines high-resolution data capture, edge computing and peer-to-peer capabilities to enable real-time monitoring and control at the edge of the grid. Advanced Transformer Load and Voltage Monitoring (ATLM/ATVM) utilizes data from service points using the

power of DI-enabled meters to calculate transformer loading and voltage statistics in real-time and relay that information to the backoffice. The backoffice stores and presents real-time data, historical data and threshold-based alarms to third-party utility systems, such as ADMS and DERMS, via API. DI provides unique peer-to-peer communications and edge-computing capability that, for the first time, allows real-time awareness of distribution transformer loading and voltage information at scale —all by leveraging existing smart meter deployments for enhanced grid intelligence.



With this application, all meters connected to the transformer share the required measurements (real power, reactive power, voltage, etc.) with each other in real-time via peer-to-peer communications. The collection of meters on the transformer then communicates results via a locally determined “spokesmeter” which acts as a single reporting point for the transformer. Results are transmitted by the spokesmeter to the backoffice on a configurable period in real-time. Additionally, when transformer loading and voltages downstream deviate from acceptable values, the application provides immediate alerts to users.

The loading and voltage information, which is aggregated to a service transformer level, is sent to your ADMS in real-time via API subscription or a DNP3 interface., which allows the ADMS to have a more accurate view of the grid that is based on full coverage of field measurements. The transformer monitoring data can be used as input to Power Flow and State Estimation applications to drive more informed decisions and optimal control, such as capacitor bank and load tap changer (LTC) control to optimize Volt/VAr or perform peak load reduction.

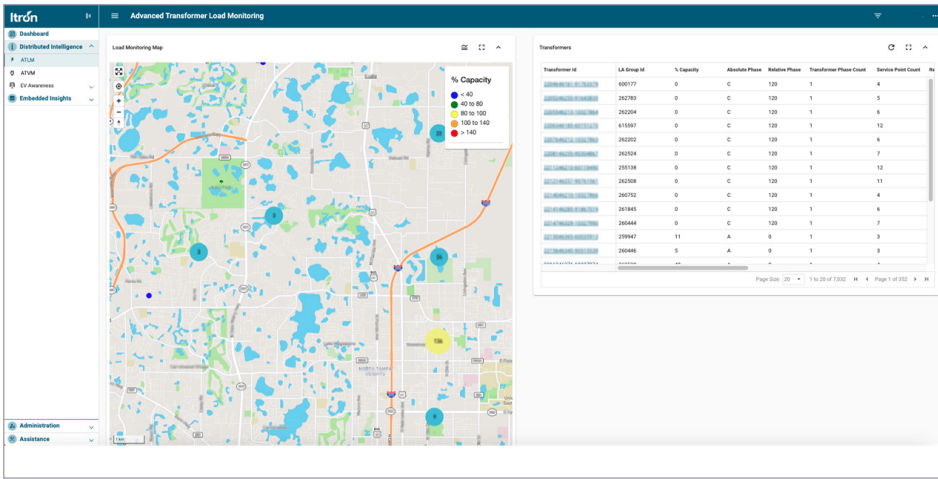
Along with having access to real-time stream of ATLM/ATVM data, you can access historical daily summary information such as overload, minimum/maximum/average voltage, load profiles and duration curves through an API. Having this first-of-its-kind capability enables you to obtain immediate awareness of transformer loading and voltage, which opens up several use cases as outlined below.

WITH ADVANCED TRANSFORMER LOAD AND VOLTAGE MONITORING, YOU BENEFIT BY:

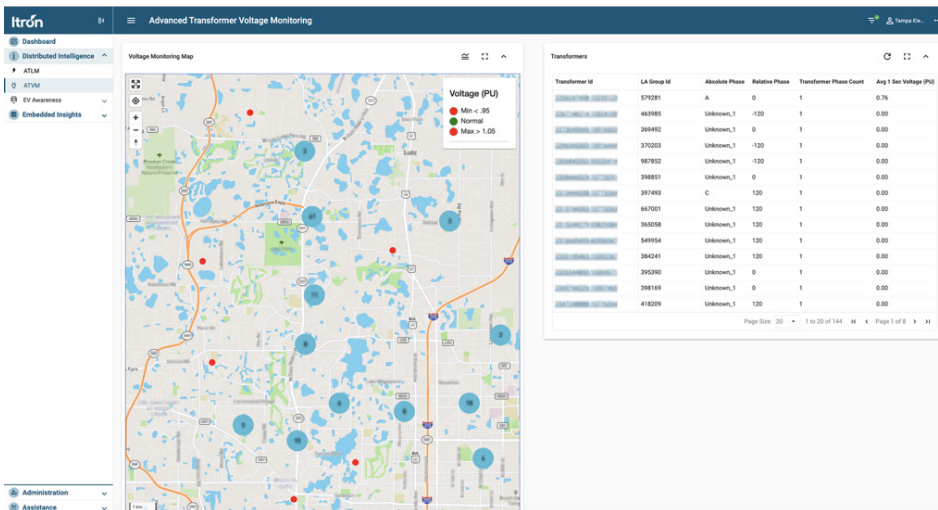
- » Estimating load flow/state more accurately and optimizing voltage (VVO/CVR), resulting in improved operational efficiency and utilization capacity
- » Planning for EV and solar generation hosting capacity on the grid
- » Obtaining desired transformer life through reduction of failures due to overloading
- » Gaining awareness of DER impacts and feedback for load shed or grid-services events in near real-time
- » Reducing technical losses through optimal power flow
- » Reducing unplanned outages through preventative maintenance of transformers that are consistently stressed
- » Reducing the number of truck rolls/analysis through proactive identification of problems
- » Improving planning studies through better modeling of distribution transformers

FEATURES

Along with the capability to stream ATLM/ATVM results to utility operational systems such as ADMS and DERMS in real-time, the application also includes an intuitive and thoughtful user interface that helps you see the current and historic conditions and issues in your area. The summary pages below include a map view that can be expanded to show the locations of transformers along with color codes to represent their loading and voltage statistics information. The pages also include high-level statistics of each of the transformers such as their percentage loading relative to capacity, min and max voltages.



Active Transformer Load Monitoring: Summary page that shows transformer loading according to nameplate rating.



Active Transformer Voltage Monitoring: Summary page showing which transformers are over or under voltage according to nameplate rating.

Transformer ID	Transformer Group ID	Normal Voltage (V)	Absolute Phase	Relative Phase	Transformer Phase Count	Max 1 Sec Voltage (PU)	Min 1 Sec Voltage (PU)	Avg 1 Sec Voltage (PU)	Std Dev 1 Sec Voltage (PU)	Service Point Count	Reporting Meters Count	Nameplate (kW)	Total kW	Power Factor	% Phase Capacity
F10	1	480	B	0	1	0.96	0.83	0.23	31	60	40	55.12	0.98	138	
F10	10	220	0C	30	1	1.08	0.89	1.00	0.12	9	431	100	268.10	1.00	358
F100	100	480	Unknown	90	1	1.13	0.85	0.88	0.19	3	299	90	15.74	1.00	17
F1000	1000	240	-4B	-90	1	1.01	0.89	1.00	0.11	11	252	126	-40.83	0.92	32
F10000	10000	220	C	60	1	1.05	1.05	1.05	0.17	85	424	126	122.35	0.94	97
F100000	100000	240	A	120	1	1.18	0.87	1.15	0.04	91	115	77	73.52	0.95	95
F1000000	1000000	240	0C	30	1	0.96	0.91	0.95	0.35	57	246	68	175.49	0.94	258
F10000001	110	CA	120	1	1.03	0.94	1.02	0.26	42	191	60	186.83	1.00	312	
F10000002	240	B	90	1	1.08	0.80	0.97	0.31	30	29	67	158.39	0.97	228	
F10000003	480	Unknown	0	1	1.10	0.82	0.84	0.34	87	442	77	225.02	0.98	292	
F10000004	208	B	90	1	1.05	0.88	0.98	0.21	29	427	58	46.94	0.96	81	
F10000005	480	R	90	1	1.04	0.89	0.99	0.39	42	379	58	222.49	0.99	384	
F10000006	220	C	30	1	1.04	0.91	0.94	0.02	22	110	111	315.19	0.98	324	
F10000007	120	-CA	0	1	1.19	1.12	1.14	0.13	28	266	63	278.38	0.99	442	
F10000008	480	B	0	1	1.18	1.01	1.14	0.38	42	488	90	256.26	0.99	385	
F10000009	110	Total	-150	1	0.97	0.95	0.95	0.28	36	60	87	280.05	1.00	322	
F1000001	110	B	90	1	0.99	0.80	0.96	0.08	31	282	53	53.43	0.97	101	

Tabular view provides the user with detailed information about the transformer loading and voltage statistics at each time stamp over the past few hours

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