

FREQUENTLY ASKED QUESTIONS

Q.: Who installs the unit?

A.: An experienced Promethean™ Devices, LLC installation crew.

Q.: Is it a well-known contractor?

A.: Promethean Devices is the only contractor presently qualified to site, deploy, assemble, install, test, calibrate, and certify a Real-time Transmission Line Monitoring System (RT-TLMS). We have a master contract with Par Electric to install the RT-TLMS on the tower; calibration, test, and certification would be performed by Promethean Devices. Any customer approved contractor may be used to install the system. Promethean would then require a price estimate from the approved contractor. Only Promethean can then calibrate, test, and certify the system. Certification initiates the warranty period of five (5) years.

Q.: Can Promethean Devices meet safety requirements for contractors working in transmission line ROWs?

A.: To date, Promethean Devices has met field safety requirements at several large investor-owned utilities across a broad region of the U.S. For an "on Tower" installation, Par Electric is our preferred contractor, but a utility may specify any approved contractor. For "on Tower" installation, we feel our master contractor, Par Electric, can meet safety standards and approvals but we will work with any approved contractor and submit specifications for pricing.

Q.: What is the lead time for Promethean to provide real time data?

A.: Typically, it takes 90 days to have the Promethean RT-TLMS installed and providing secure data to a Utility specified static IP address. The "on Tower" installation is the most rapid to deploy, and presents a minimum of field labor and ROW disturbance. For the "On Tower" installation, three small sensors require direct burial (~30") at the low point of line sag, along with the trenching of conduit for the cables using 1.5" HDPE ducts.

Q.: What is needed to provide for installation (e.g. communications circuits)?

A.: Information and data on the line itself and an active cellular modem of the customer's choice (800 MHz, 1900, etc). Information on the ROW itself (topography), conductor type/specs, year of construction, tower/structure drawings, ROW/Tower/Line survey data, etc. Some recent CT data (one day to one week) is required to tune an RT-TLMS to the line it is intended to monitor. Knowing the typical and fully expected range of phase currents is important if maximum system accuracy is to be obtained. Data (PLS-CADD models, maximum operating line temperature, minimum clearance, etc.) for the expected current range and expected ambient temperature range provides information for the expected sag envelope.

Q.: What are the communications requirements?

A.: Establish and maintain an active cell modem and account (Sprint, Verizon, ATT, etc.).

Q.: Who provides system maintenance?

A.: Promethean Devices. Critical system parameters (e.g., battery voltage) are continuously monitored remotely. Any indicated or necessary maintenance will be reported to the customer by Promethean Devices.

Q.: At what cost?

A.: With the exception of system/component theft or vandalism, and system/component damage or alteration via the various acts of nature/God, none for the first two years.

Q.: Is there a warranty?

A.: Yes. There is a five (5) year warranty covering all system hardware and software. The only exclusions are system/component theft or vandalism, and system/component damage or alteration via the various acts of nature/God.

Q.: What equipment is required for installation and maintenance?

A.: No utility field crews or equipment are required. Promethean Devices may, at times, employ equipment such as a two-man auger, a one-man trencher, or small-profile earth-working equipment. For an "on Tower" installation a bucket truck is required to mount the enclosure and solar panels. Whenever possible, a small trencher will trench the cable conduit to the sensors located at the nadir of sag.

Q.: Are outages required for installation?

A.: No outages are required for installation, calibration, maintenance, data validation, etc.

Q.: Does the location affect cost, e.g. accessibility, distance from communications terminal?

A.: The location may impact our contractor price if it is extremely remote, access is very difficult (e.g., requires special vehicles), or terrain factors, such as water, sand, broken or solid rock complicate installation procedures.

Q.: How big is the footprint of the unit?

A.: Given a 138 kV H-frame construction, estimate a T-shaped footprint. The top of the T contains the three sensors; this would be a swath ~ 25 meters long by two meters wide running across the ROW (perpendicular to the overhead conductors) and located roughly mid-span. The other dimension of the T leads to the solar panels and the electronics/communications/

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battery enclosure; this is approximately 10 meters in length by two meters wide. The electronic equipment occupies a ~ 3 x 3m ground area. If desired, the electronics, communications, and solar panels can be mounted directly on the tower structure.

- Above Ground on ROW: Electronics and solar panel above ground; sensors above or below ground
- Above Ground on Tower: Electronics and solar panels on tower; sensors and batteries buried 30".

Q.: Do solar panels need full sunlight or is partial shade adequate?

A.: Full sunlight is best. Partial shade would be evaluated once the sites/spans are chosen. If needed, we will recommend and discuss adjusting the necessary solar panel number/wattage and/or battery back-up capacity to suit end-user requirements.

Q.: Can distribution power be used if it is available?

A.: Yes.

Q.: Does that change the cost?

A.: The change in cost would be very small, unless we have to buy, trench, and bury a significant length of power cable and conduit to convey, protect, and ensure the safe operation of the distribution power.

Q.: Does that improve the reliability?

A.: No. This would not improve the overall system reliability. However, one could virtually guarantee 100% up-time. With distribution power, the solar/battery power system is relegated solely to back-up power supply function, which presents no issues. The entire system runs on 12V DC, so a standard direct bury cable would need to be run from the distribution source to a high-efficiency AC-DC converter.

Q.: How long do the solar-battery power supply last?

A.: The backup power is from sealed 12V DC lead acid deep cycle marine batteries. The batteries last ~ 21 days before they completely discharge. A small 400 watt wind microturbine is also available as an option; this would augment the solar power, charging the batteries at night and/or on very cloudy days.

Q.: What if more than one circuit exists in the ROW?

A.: The Promethean™ RT-TLMS is designed to accurately monitor a single circuit, 3 phase AC transmission line. If there are close (< 500 m) parallel (or otherwise) HV overhead transmission and/or distribution circuits, the EM environment created by multiple proximal circuits becomes much more complex (i.e., noisy); in this case, more than 3 sensors are needed to discriminate the signals generated by the three overhead target phases. Presently, Promethean RT-TLMS technology

exists that can simultaneously monitor 2 transmission circuits, and we will discuss this option with end-users when appropriate.

Q.: Does the unit need to be at mid-span or anywhere in the span?

A.: Testing has shown that mid-span is ideal, but +/- 100' from the line's nadir presents no issue. Basically, at mid-span the (delta sag)/(delta temperature) is greatest. The more movement there is, the higher the accuracy of our Conductor Temperature vs. Clearance calibration. Better conductor temperature accuracy translates into a higher accuracy Ampacity/Rating estimate. We have a survey methodology to calculate the low point of sag (the nadir) even when the towers are at different elevations.

Q.: Does the RT-TLMS need to be in a suspension span?

A.: No. It can monitor a span terminated with a dead-end. In general (for the reasons listed above), the longer the span, and the closer the installation is to the line's nadir, the better.

Q.: Who provides the conductor sag information?

A.: Our team will meet with your Line Design Engineers to review available Fli-Map, LIDAR, survey, SAG10, and/or PLS-CADD information/models that they have on the target lines/conductors. Your team has all the necessary experience, knowledge, and information. This information and close collaboration is a critical part of the system site selection/identification process and the system software configuration. Frequently, there is knowledge of, or consensus regarding, a single critical span or a few critical spans. Absent this, we will review all available line/ROW data and, if necessary, conduct a vehicle- or on-foot-based ground/line 'survey' in order to ensure that target spans are correctly identified. We will work closely with your Line Design Engineers on such 'surveys' as experience shows that they always benefit from such participation.

Q.: Who verifies the conductor position?

A.: Promethean Devices verifies the conductor position via high resolution, high accuracy, and laser rangefinder measurements. These measurements are fed directly into the RT-TLMS while in operation and become a permanent part of the secure data set.

Q.: Who performs the calculations on Sag10?

A.: At this time, Alcan Cable does not own a copy of the Sag10 Sag and Tension software, but it can be made available upon request. Even so, we have not found its use necessary to the siting, installation, calibration, and operational accuracy of the RT-TLMS, or to the verification of accuracy.

Q.: Is there any operational hazard to the public or to utility workers?

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A.: No.

Q.: **Does the RT-TLMS unit need to be fenced for security and liability?**

A.: A simple aluminum or wooden fence, approximately 3 x 3 m, can be installed around the electronics, communications, battery, and solar panel section. Everything is 12V DC and all metallic components are grounded; there is no AC or HV hazard. The sensors can be mounted just above or just below ground. In both cases, they present no operational or electrical hazards.

Q.: **Is vandalism a concern?**

A.: We employ a very common – almost ubiquitous these days – light green communications enclosure that is quite recognizable as a vented cable TV enclosure. The solar panels are mounted in a pre-fabricated, rigid aluminum frame in a manner that makes their removal very difficult. Even with the correct tools, panel removal would be quite time consuming. The “on Tower” installation option minimizes the potential for vandalism because the electronics, communications, and solar panels are mounted up on the tower. Sensors buried in the ROW are practically invisible. In both cases, the batteries are housed in a direct-buried Quazite vault.

Q.: **Does vegetation and vegetation growth around the unit affect the operation?**

A.: No. However, the solar panels should be kept free from the shadows cast by proximate vegetation.

Q.: **Will normal VM mowing or cutting operations potentially damage the units?**

A.: No, as long as the mowing or cutting operations give the above ground equipment a small berth.

Q.: **What information is provided to the utility operations group?**

A.: Time of day (GMT or GPS), conductor clearance, conductor phase currents, conductor temperature, instantaneous Ampacity/Rating, ambient temperature, wind-speed, and direction.

Q.: **What is the data format?**

A.: The data is designed to be as simple and easy to work with as possible. Upon request, Promethean™ Devices will customize system data to any and all end-user specifications.

Q.: **Can the data be sent to a private information (PI) server?**

A.: Yes. This is the preferred arrangement.

Q.: **Is it a trended prediction or a snapshot of current position?**

A.: Presently, all data is real-time, provided in 10 second increments. Pricing includes two full years of unlimited 24/7/365 technical support, data customization, algorithm development, testing, and implementation, monthly/quarterly data analytics, and reporting with data-driven recommendations. Alarms can be set; trends can be determined; time-to-event/limit can be implemented; cell phones, PDAs, and e-mail can be specified and alerts/information communicated as per customer requirements and specifications.

Q.: **What about predicting near-future line transfer capability?**

A.: An "operator" window is available that will show the present MVA and the real time MVA available on the line. An average of the last 30 minutes MVA rating of the line is also shown. You know what you can handle now and what the capability was over the last 30 minutes. You can then make a reasonable assumption about the next 30 minutes. To be conservative, you may want to use 80% of the present (real time) MVA or the average of the last 30 minutes and real time values.

Q.: **What is the economic payback for Promethean RT TLMS?**

A.: Alcan Cable and Promethean Devices have developed software to analyze and determine the IRR for a Promethean RT-TLMS deployment. The IRR depends on the line voltage, length, Locality Marginal Price (LMP), the amount of time the line can be operated above the present static rating, and the average % loading above the present static rating. In the case of a typical 230 kv line, it usually only takes an MVA gain of 2% above the static rating, over the course of a year, to produce an IRR of 50%+.

For more information on **Alcan Cable** or **Promethean Devices**, go to www.cable.alcan.com or call (800) 347-0571.

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#UT-0022F
8/2010

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