Planning and Installing the EnergyAxis® System Starter Kit

Introduction

This instructional leaflet provides guidelines for installing the EnergyAxis System starter kit, composed of REX meters and A3 ALPHA® meter/collectors (A3 ALPHA meters with ITM3[1] and ILC1[2] option boards). Both the REX meters and the A3 ALPHA meter/collectors use 900 MHz radios to communicate with each other in a wireless local area network (LAN). The collector's ITM3 can be used in conjunction with Elster Electricity's Metercat™ meter support software to remotely read billing data for a collector as well as billing data for all REX meters that are registered to the collector.

The starter kit is intended to demonstrate the following characteristics:

- The system is easy to install and does not require any additional infrastructure other than the meters.
- Planning the system is relatively easy.
- The system provides reliable meter readings.

A typical starter system consists of the following:

- up to three Form 2S A3 ALPHA meter/collectors
- up to 500 Form 2S REX meters
- Metercat Release 1.4 or above
- a marriage file used to associate a REX meter serial number with a REX meter LAN identification number

Related Documents

The following documents provide details on using the various components necessary for operating the system:

- *Elster Electricity Modems Product Guide* (PG42-1006A)
- *A3 ALPHA Meter/Collector Product Guide* (PG42-1005A)
- *EnergyAxis® System Starter Kit Software User Guide*
- *Metercat Quick Start Guide*

Refer to the respective technical manuals and instructional leaflets (IL) for details on the A3 ALPHA meter and the REX meter.

[1] internal telephone modem
[2] internal LAN controller

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LAN Overview

The collector contains most of the network intelligence required to register REX meters and operate the LAN. Specifically, the collector is responsible for the following:

- determining an optimal communications path for each REX meter and registering a REX meter to this communications path
- reading and storing billing data from each REX meter on a periodic basis (the evaluation collectors will be configured to read billing data from each REX meter every four hours)
- synchronizing the REX meters to the system time
- distributing TOU schedule information to each REX meter (allowing the REX meters to perform TOU metering)

Note: TOU schedules must be programmed in the collector at time of manufacture.

Each REX meter will be registered to only one collector at a time. Once registered, REX meters may change their registration to a different collector if a shorter, reliable communications path is found to the different collector.

The 900 MHz network can be described as a mesh network because any REX meter is allowed to communicate with any other REX meter to route communications to and from the collector (Figure 1). The 900 MHz network can function out to eight levels (seven levels of repeaters) as illustrated in Figure 1. A meter that communicates directly to the collector is referred to as a level 1 meter; a meter that communicates to the collector through one repeater is a level 2 meter, and so on.

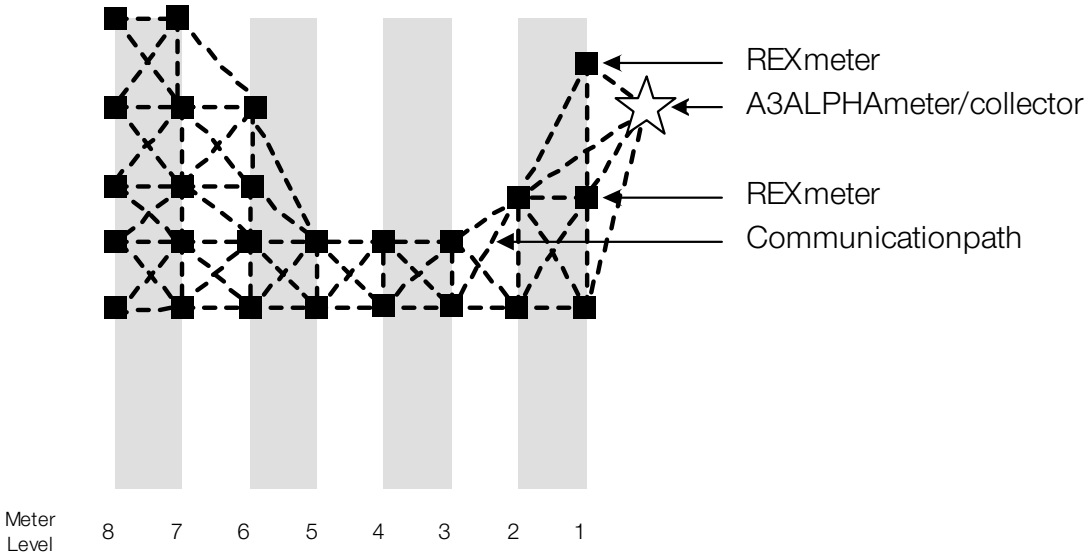

Figure 1 REX network showing all possible communications paths

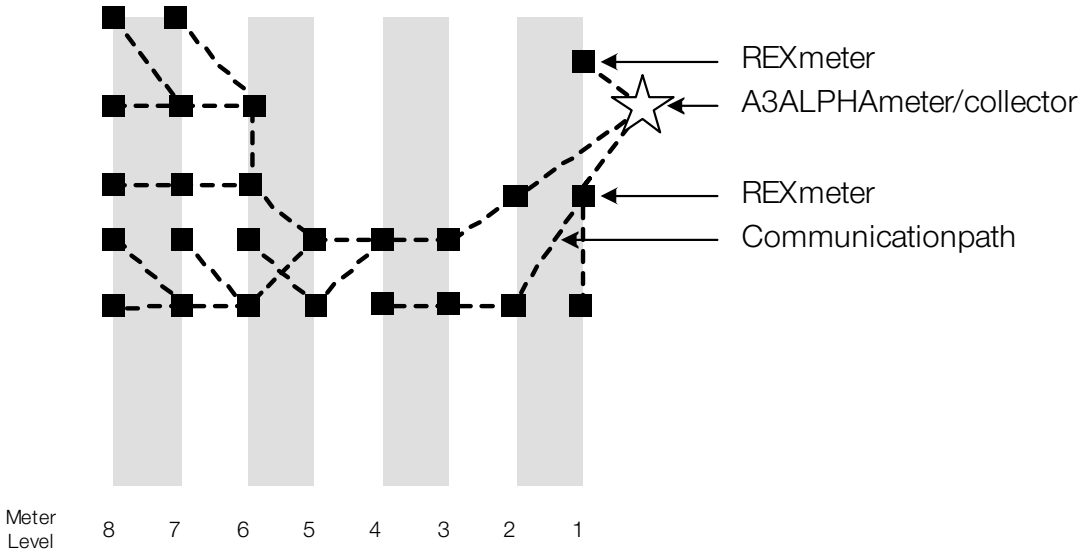

Figure 2 REX network showing registered communications paths

As the density of meters in an area is increased, each meter will have an increased number of possible communications paths to the collector. When installed, the collector qualifies and selects a communications path for each REX meter (Figure 2). The collector monitors the communications performance of each meter and will change the communications paths for meters that fall below a required performance threshold.

The radio frequency (RF) signals transmitted and received by a meter are directly affected by the meter socket and the building structure. As a result, communication from the face of the meter tend to be better than communication through the back of the meter.

Elster Electricity field testing indicates that meters facing away from each other can reliably communicate if they are within 400 feet of each other (Figure 3). In the optimal case where meters are on residences facing each other, meters can typically communicate reliably if they are within 1500 feet of each other. In general, as the distance between these devices increases, the communications performance between the two decreases. Although not typical, field testing has shown reliable communications performance between devices that are 2000 or more feet apart.

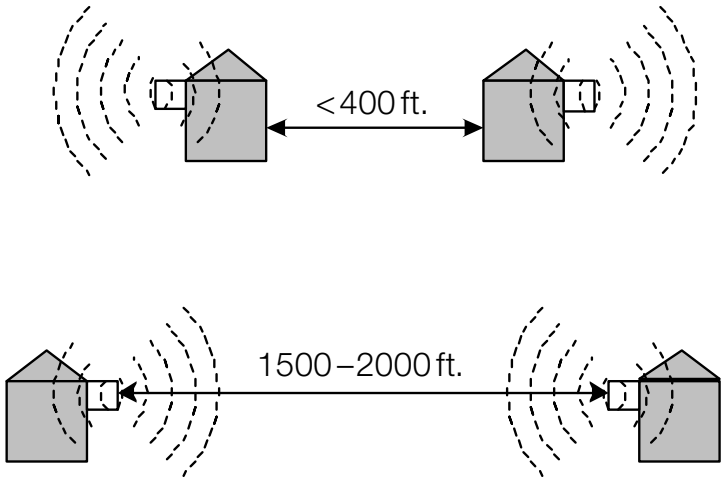

Figure 3 Meter orientation, distance and RF performance

Note: An increased communications distance between meters does not necessarily mean that the system will not work. It means that more communications attempts may be required to obtain a given reading.

Installation of the Starter Kit

Selecting a Site

When selecting a site for the system, consideration should be given to the density of meters within the area. As described above, the network will work best if each meter has multiple meters within communications range. With this in mind, Elster Electricity recommends the following guidelines when selecting an area for the system:

- apartment complexes, town houses, and other densely populated areas should work very well
- areas with single-family homes with lot sizes smaller than 0.35 acres should work very well (REX meters do not need to be installed at every possible location for the system to work well)
- when the lot size is above 0.5 acres (or where the typical distance between meters is greater than 500 feet) it is more critical that REX meters be installed at all possible meter locations thereby giving each meter as many communications paths as possible

Collector Coverage Area

For planning purposes, Elster Electricity recommends using a 2500-foot diameter circle to represent the collector coverage area. With a collector centrally located in the center of this circle, the collector should be able to register all REX meters inside the circle to a meter repeater level of four or less. With a total of eight levels available, there should be ample margin for signal overlap between collector cells. This guideline is consistent with the planning philosophy of providing multiple paths to each meter.

Collector Location (General)

After selecting a site for the network, the next step is to select the locations for the collectors. Using a detailed map of the area, use a compass to draw 2500-foot diameter circles to indicate the collector coverage area. If one collector is used, the collector should be in the center of the area of the selected site.

If multiple collectors are used, the edges of the first collector circle (or cell) should touch on natural boundaries of the selected site (such as major roads or open areas) or should touch the boundaries of the selected site. After locating the first collector, additional collector cells can be drawn such that neighboring cells touch one point of the first collector cell (Figure 4).

Figure 4 Collector cell coverage (3 cells)

Collector Location (Specific)

After selecting a general location for the collector, the actual location will need to be selected. An ideal collector site will have:

- access to a dedicated phone line (required)
- houses on all four sides
- reasonable maintenance access

Installation Sequence

For the starter system, Elster Electricity recommends the following process:

1 Install all of the REX meters that are part of the system.

2 Install the collectors that are part of the system.

Once installed, the collector will begin the process of finding and registering REX meters. By installing all of the REX meters first, the collector will be able to select communications paths based on all REX meter combinations and will therefore build the most reliable communications network.

Example System Installation: Elster Electricity Field Trial

A 227–point 900 MHz network field trial (see Figure 5) has been operating in a residential neighborhood since August 2002. This field trial of collectors and meters was used to test the network and equipment in an actual working environment. All meters were installed using dual socket adapters with a standard electromechanical meter at the top for manual reading and a REX meter at the bottom for testing purposes. Not every home in the area had a REX meter installed; several of the planned sites would not accommodate dual adapter arrangements and had to be eliminated from the test.

The test environment is a residential neighborhood with lot sizes of approximately 0.25-0.5 acre (373–746 sq. ft.). The total area of the test site is about half a square mile. The neighborhood is 10-15 years old and characterized by long established trees, shrubs and other foliage. Home construction is conventional wood frame housing with a variety of exterior finishes (for example, brick, vinyl, aluminum and cedar siding).

Test Site Specifications

The REX field test layout is 0.5 miles by 0.6 miles and the individual lots are approximately 125 feet square on average. That corresponds to a lot size of approximately 0.35 acres and means the distance between meters on adjacent lots typically ranges from 50-250 feet. The 50–foot distance results when meters are on the closest sides of two houses and the 250–foot distance results when meters are on the far sides of two houses, on the front of one house and back of another or on houses that are across the street from each other.

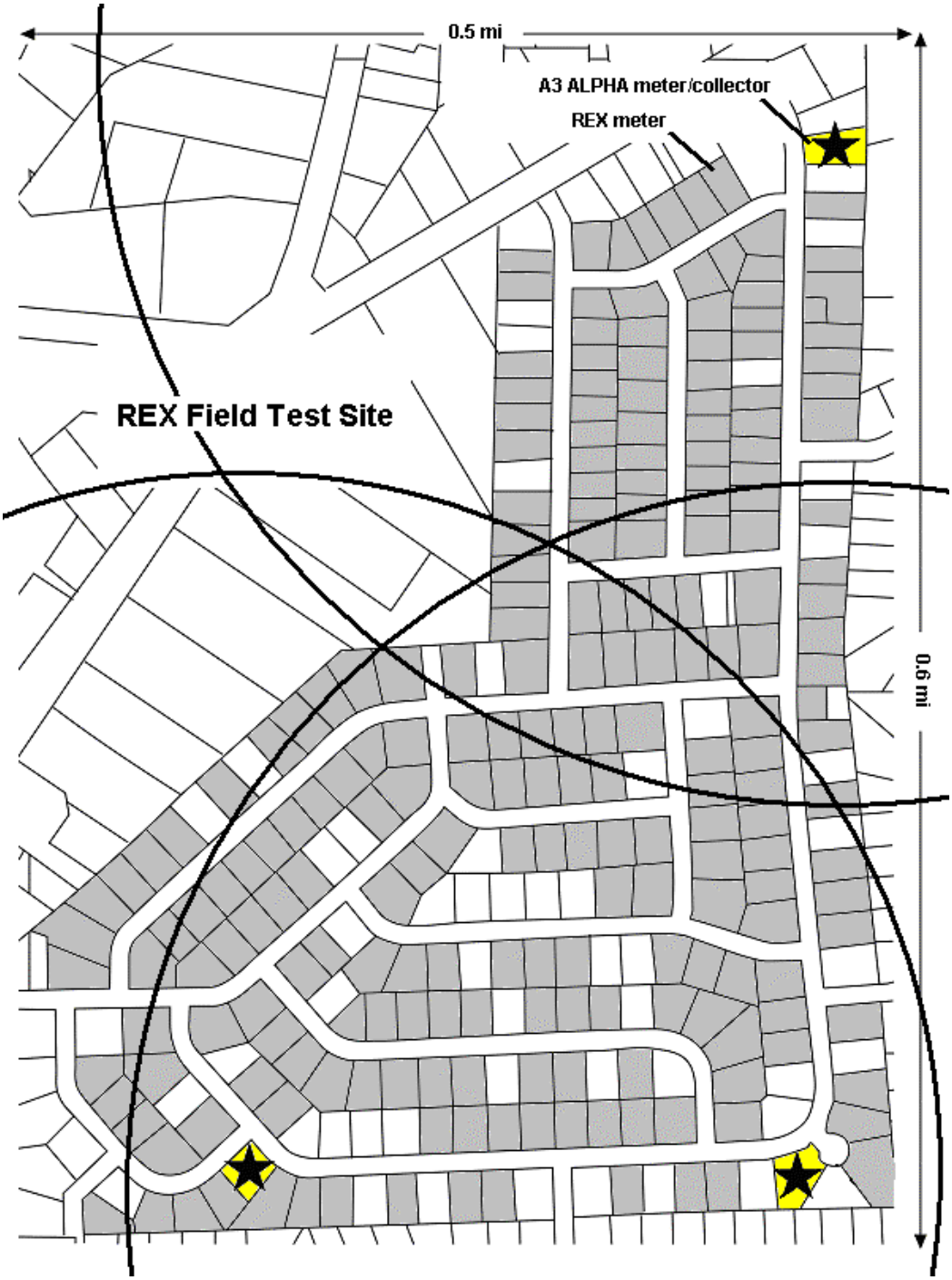

Figure 5 900 MHz network field test site

The field trial installation was made with three collectors at different extremes of the neighborhood (represented by stars in Figure 5) with REX meters located throughout the neighborhood (represented by the dark gray shaded locations in Figure 5). This allowed the system to be operated with one, two or three collectors active at any one time and was used to investigate a variety of operating scenarios. All these test conditions have been exercised thoroughly since the system was first installed.

The entire 227–meter site has been successfully operated as a single cell from each of the individual collectors. These tests confirmed the multi-level repeater concept, the collector's network algorithms and the ability of the mesh concept to reach every device in the neighborhood from the diverse collectors. The site has also been operated with two collectors active (two cells) and with all three collectors (three cells) active at one time. In these tests, each of the collectors claimed a segment of the total population with the cells overlapping in several areas (represented by arcs in Figure 5). Communications testing verified that system performance was equally successful for the one, two, and three collector configurations.

Additional Meter Information

A3 ALPHA meter/collectors are available as Form 1S, 2S, 3S, 4S, 5S, 9S, 12S, 16S and 35S meters.

REX meters are available for residential sites that require Form 1S, 2S, 3S and 4S devices.

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