

History of the Electric Kilowatt Hour Meter RF Implant Module Used for Walk-by, Drive-by and Pole-Top Collection AMR

In 1988 Mr. Tom Tamarkin and Mr. Gene Starkey conceived of an electronic circuit module to be mounted inside an electric utility single phase Kilowatt Hour meter which would transmit the accumulated KWH readings to a portable receiver within a few thousand feet. The device worked by counting the revolutions of the meter's Eddy current disk using an infrared light emitting diode and phototransistor. The electronically processed signals representing revolutions were stored in the memory of an on-board microprocessor and compared to a real time clock. Arithmetically this was converted to current Kilowatt usage and accumulated KWH. This KW and KWH information was then transmitted using a 902-928 MHz semi-spread spectrum modulation technique developed by a wireless security company. Using technology supplied by a leading innovator in the field of wireless home security prototypes were built and successfully tested.

In 1990, Mr. Tamarkin formed the Tamar Corporation in Richardson, Texas and in the summer of 1990 the company successfully tested a mid-sized preproduction run of fifty implants. Over the course of the next eighteen months Tamar Corporation developed receiving software for hand held data terminals used in utility routes and the Tamar 2000 in-home display device. Tamar contracted with the original developer of the wireless security equipment to manufacture sufficient quantities of the implant boards for trade show exhibits and field trials.

On June 17, 1992 Tamar Corporation introduced the first Electric, Gas and Water meter AMR product line using the 902-928 MHz RF wireless approach at the NMRC (National Meter Readers Conference) in Atlanta, Georgia where Mr. Tamarkin also presented the key note presentation on the Future of AMR. Tamar Corporation was the only exhibitor at the 1992 NMRC and the 1992 AMRA (Automatic Meter Reading Association) show in Los Angeles, California to demonstrate this type of working wireless AMR technology for electric, gas and water meters.

In August 1992, Tamar Corporation successfully installed the first utility company pilot project with the City of Garland Municipal Electric Company in Garland, Texas.

Several years later various companies came out with copies of the Tamar implant modules and integrated the receivers in proprietary hand held data terminals and mobile PC based receivers.

Today all the major U. S. manufacturers of electro-mechanical Kilowatt Hour meters offer their meters with an optional RF implant module based on the initial design of Messieurs Tamarkin and Starkey and supported by such major meter reading EMR companies as Itron in Spokane, Washington.



Tamar Corporation introduced prototypes of its 902-928 MHz, RF KWH meter implants at the 1992 Rural Electric Expo in Anaheim, California.

Tom Tamarkin (center left) is flanked by Tamar's engineering team.

Tamar Corporation had the largest single exhibit at the 13th annual NMRC (National Meter Reader's Conference) held in Atlanta, Georgia June 17, 18 and 19, 1992. The company displayed fully working electric, gas, and water meter 902-928 MHz RF devices. Tamar fortold the future of meter reading and AMR by introducing "walk by/drive by AMR" three years before other vendors such as Itron and Cell Net.





One section of Tamar's booth displayed 20 electric meters, 3 gas meters and 3 water meters. Note that the exhibits were fully functional with the gas meters connected to an air pump and the water meters connected to a water tank and pump system. The electric meters were connected in series to a 200 amp, 1 volt "phantom load."

Tamar's staff was seen walking the hall floors with hand held data terminals and 902-928 MHz receivers collecting live data.





Tamar Corporation offered its SAMREIM (Software for Automatic Meter Reading Economic Impact Modeling) and “The Complete Handbook of AMR” at its smaller booth at the 1992 NMRC (National Meter Readers Conference).

At the left of the exhibit are two electric KWH meters outfitted with the Tamar implant and a PC at the right of the exhibit displays meter readouts.

Emily Tamarkin manned the booth and referred attendees to Tamar Corporation’s much larger exhibit at the NMRC.

Municipal Utilities

City of Garland becomes TAMAR's first Beta Site.

The City of Garland has formally agreed to become the first Beta site location for TAMAR Corporation's integrated Automatic Meter Reading/Route Management system. TAMAR will provide and implant Rf modules into 25 of the City of Garland's electric meters at the Towngate Townhomes in Garland, Texas.

This test site was chosen because of the number of inaccessible meters due to the building structure of the townhomes. This condition has served as a continual irritation to consumers as well as carried the associated burdens of high meter reading costs for the utility.

The implanted Rf modules will transmit the individual electric meter information to a Hand-Held Data Terminal used by a meter reader. TAMAR Corporation will also supply compatible hand-held units which will interface easily with the City of Garland's current meter reading system.

The installation of the implanted meters will take place the end of June, 1992 with the Beta test continuing for a six month period.

Rural Electric Cooperatives

Erath Electric Cooperative participates in product interest survey.

Erath Electric Cooperative of Stephenville, Texas will be participating in a mail-out home security survey to its members.

TAMAR's marketing department provided General Manager, Zeb Deck, with 14,000 four-color informational brochure/questionnaires for distribution. The survey will be used to determine interest in an introductory security program for Erath's cooperative members.

The survey will be included in the cooperative's July statement with the opportunity for members to respond by sending in a tear-away response card with their remittance or calling TAMAR's toll free number.



Mr. Garrett Moynihan of the City of Garland receives 25 electric meters with TAMAR Rf module implants from Engineer, Ray Sadler.

TAMAR Beta Test Goals are to:

- Demonstrate meter reading accuracy and system functionality
- Compare the TAMAR Hand-Held Data Terminal system vs. presently used system
- Prove ease of use for meter readers
- Review billing structure
- Reduce customer inconvenience and complaints
- Provide cost savings for meter reading



Home security survey to be received by Erath cooperative members in July.

SAMREIM®

Now available from Tamar Corporation

Software for Automatic Meter Reading
Economic Impact Modeling

SAMREIM® PC software program provides utilities with a low cost tool to accurately and independently determine viable AMR system cost parameters and optimal system configuration based on the utility's specific structure and needs. Implementation strategies for maximum cost effectiveness and greatest rate of return on invested capital are also suggested.

SAMREIM® allows the utility to calculate acceptable AMR system costs, including installation, training, operations, and maintenance expenses as a function of selected return on investment (ROI) terms and internal rate of return (IRR) percentages on invested capital. This data is critical and indispensable in analyzing and auditing vendor proposals and RFQ responses. Budgets may be proved-up quickly and efficiently for internal use as well as that of regulatory agencies.

SAMREIM® accomplishes these objectives by accurately determining present meter reading costs to a high level of detail and then calculating the per meter break-even price point for AMR system implementation. These calculations may be resolved to the system-wide average, regional, or individual route level.

Profit Line - Winter 1992

Tamar Corporation Acquires Omnidata Company

Tamar Corporation recently announced its acquisition of the Omnidata Corporation. Omnidata, located in Richardson, Texas was formed in 1989 by Gene R. Starkey and Tom D. Tamarkin. In December, 1989, Omnidata published its first edition of "The Complete Handbook of AMR". Since the handbook's publication, it has become the utilities most quoted and most read reference document in the field of Automatic Meter Reading. Omnidata's customer list for the handbook starts with AT&T, ends with Westinghouse, and includes such companies as General Electric, Motorola, Panasonic, Ameritech, Schumberger, Osaki and over 100 utility companies world-wide.

In August of 1990, Omnidata contracted with the Ameritech Company, the Regional Bell Operating Company in the Midwest, to develop a computer aided software engineering and economic modeling software package to be distributed throughout Ameritech's seven state territory. In January of 1991, Omnidata introduced its SAMREIM® software package to the utility industry. SAMREIM, or Software for Automatic Meter Reading Economic Impact Modeling, is currently being used by dozens of the country's largest investor-owned utilities, as well as, Rural Electric Cooperatives, municipalities, cities and gas utilities.

Tamar Corporation plans to continue to market the Omnidata products to the utility industry world-wide. Tamar also plans to use the SAMREIM software package as a key component in its sales and marketing program. SAMREIM allows the utility to do a complete cost analysis, payback determination and system design based on the specific needs of that utility. Given SAMREIM's recognized status as the premier economic modeling tool and its third party vendor origin, great creditability will be given to Tamar's sales presentations to utilities

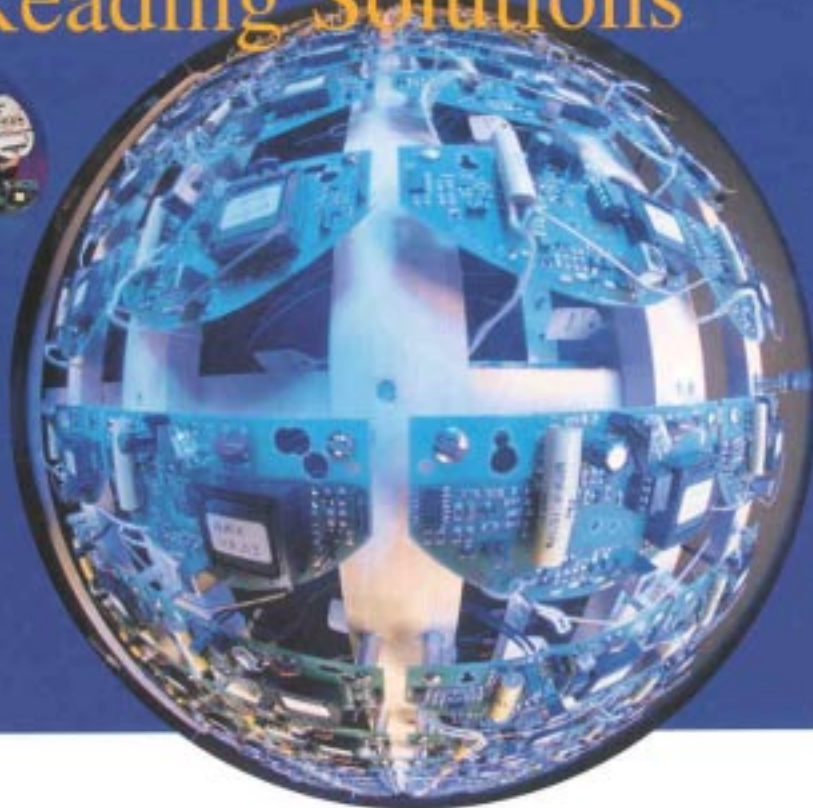
based on the computer generated analysis made with SAMREIM. Tamar plans to offer a new release of SAMREIM which will allow the utility to analyze the economics associated with a utilities entry into the security products and services market. This release is scheduled for March 1992.

In this transaction, Tamar Corporation also acquired the intellectual property rights held by Omnidata to technology conceived of and developed by Starkey and Tamarkin including the utility power meter encoder module. Additionally, Tamar acquired all company assets in the form of equipment, furniture, fixtures and computer software.



Mr. Gene Starkey
principal author of
"The Complete
Handbook of AMR"

A New World of Meter Reading Solutions



With the growing demands of meter reading and account management in the utility industry, new, accurate, and cost-effective solutions are essential to save you money and keep pace with the expectations and needs of your customers.

- TAMAR Corporation provides integrated meter reading and billing systems for gas, water, and electric utility services.

- We offer a wide range of options from automatic meter reading to off-site, remote, hand-held route management.

- Any single phase electric meter can be converted to monitor and apply Time-of-Use and/or Peak Power Demand rates.

- We can provide integrated security and energy management systems.

The future of AMR is TAMAR.

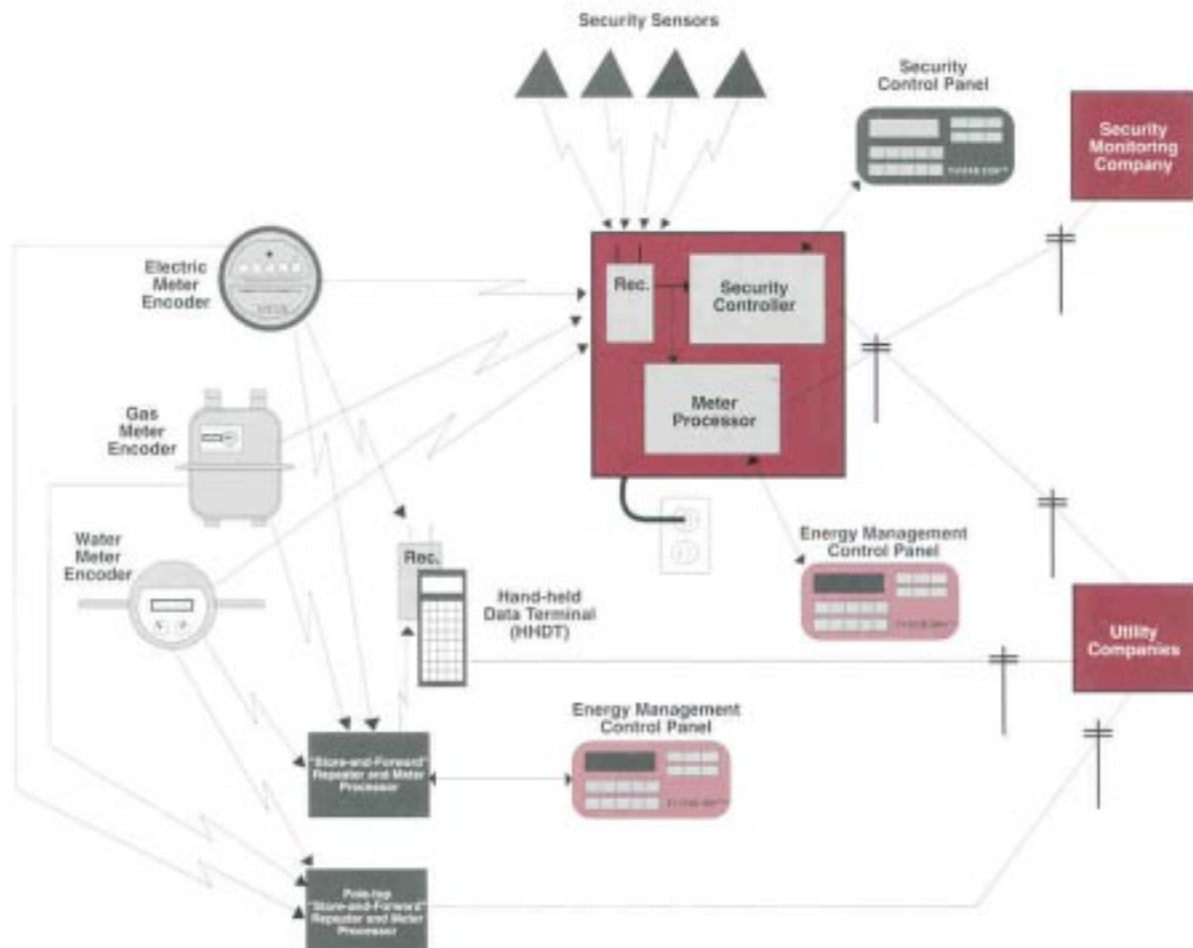
TAMAR
CORPORATION

1710 Firman Drive, Suite 300 • Richardson, Texas 75081 • Phone (214) 234-1800 • Fax (214) 234-1880 • Toll Free Number 1-800-237-1801

TAMAR Integrated Systems

Includes:

- Automatic Meter Reading
- Security and Alarm Services
- Energy Management
- Off-Site Remote Meter Reading using a Hand-Held Data Transmitter system



"Providing more than just electricity, gas, or water to each customer."

Benefits of TAMAR Integrated Products

Security

- Generates additional strong re-occurring revenues for utilities
- Easy and quick installation
- Protection from break-ins, fire, or medical emergencies
- Protection for other special emergencies
- Selectable level of desired security
- Selectable supervision
- Tamper-proof protection
- Long-range coverage

Energy Management

- Monitor long and short-term energy usage
- View billing history
- Establish an energy budget

Automatic Meter Reading

- Accelerates cash flow
- Reduces operating expenses required to read meters
- Gives better service to your members
- Reduce inaccuracy of improperly read meters
- Virtually eliminate theft of service

Off-Site Meter Reading

- Today's most cost-effective solution
- Greater distance for accurate readings
- Time Savings/Cost Savings
- Retrofit for current Hand-Held Data Terminal (HHDT) Meter Reading Systems



the user to enter a budget and monitor the progress of their budget. The information used by the energy management control panel is bi-directional and allows the utility to download the latest rate structure information.

Your utility may also use this information to set up variable rate structures based on peak power demand and/or time-of-use schedules. As much as 20% may be reduced from a bill with good judgment and persistent budgeting by the consumer. The console offers consumers and the utility the advantage of future cost savings now! Additional benefits include:

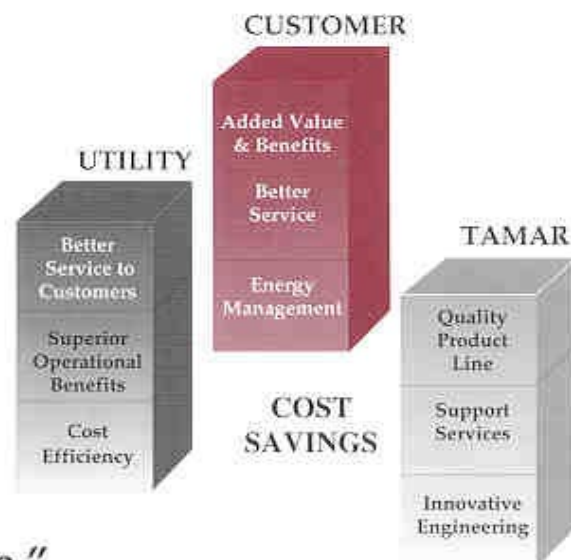
- Set up and monitor an energy budget
- View up-to-the-minute usage in Kwh, dollars and cents per day, and real-time consumption (burn rate)
- Review 12 month billing history
- Monitor long and short-term usage
- The utility may set up variable rate structures or residential accounts.
- In cases where gas and/or water meters are monitored, the energy management control panel will also display accumulated usage of these services as well.

To introduce and utilize the products and fully realize the greatest amount of re-occurring revenue, TIPS has an integrated sales, marketing, training, and service strategy. As your marketing partner — we are fully prepared to offer:

- Product Demonstration Kit
- Resident Marketing Video
- Training Videos
- Group Presentations
- Telemarketing Services
- System Instructions
- Warning Decals and Property Signs
- Marketing Brochures
- Press Release and Advertising Assistance

Contact us at (214) 234-1800 now, and let TIPS provide the building blocks for a strong foundation between utilities, their customers, and TAMAR Corporation.

What we can build from TIPS...



Together we will
"Build into the Future."

TAMAR Integrated Products

Introducing the TAMAR Integrated Product line

Includes Systems:

- Automatic Meter Reading
- Off-Site Remote Meter Reading
- Energy Management
- Security and Alarm Services

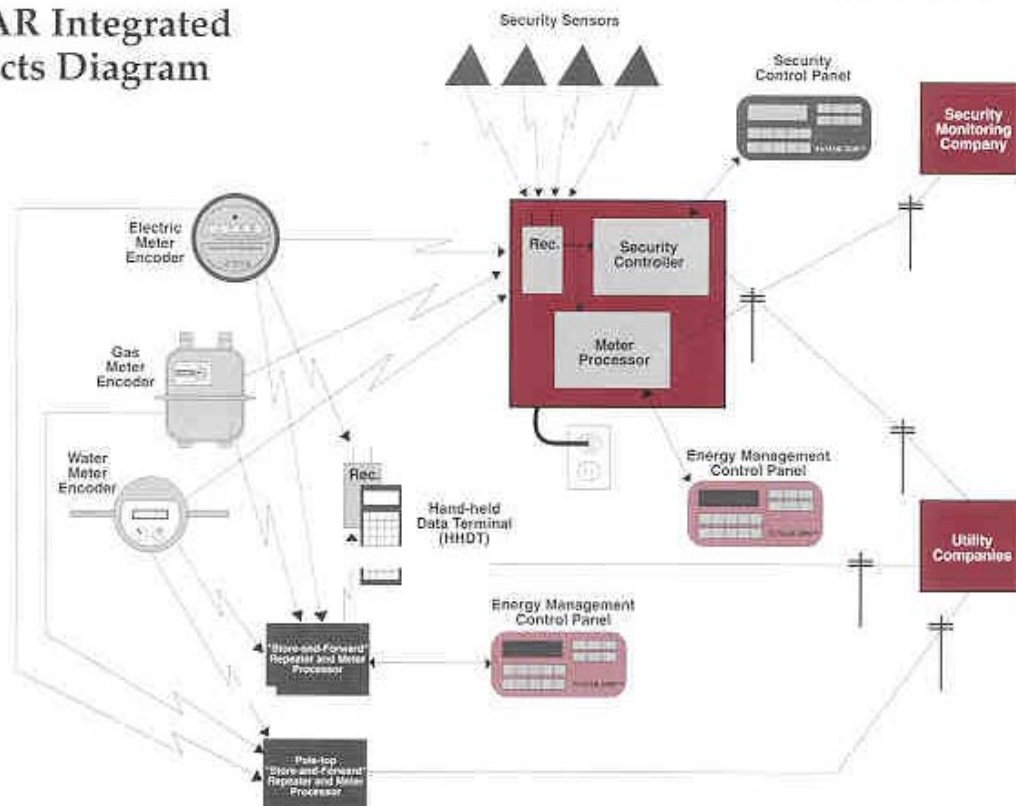
Automatic Meter Reading

We have developed an Automatic Meter Reading system which includes a meter encoder that "reads" the electric, gas, or water meter, and sends the data to a receiver where it is processed and sent to the utility using a bi-directional telephone interface, or to a "store-and-forward" repeater and processor module. This module re-broadcasts processed signals which are received by a portable receiver used with a hand-held data terminal and/or the energy management control panel. The system is wireless, easy to install and allows greater transmission range for receiving the meter information. Gas and water meter modules are battery powered.

Benefits to the utility are:

- Accelerates cash flow
- Reduces operating expense
- Virtually eliminates improperly read meters
- Reduces inaccuracy of theft of service

TAMAR Integrated Products Diagram



Alone, AMR may not be cost-effective to install on a mass development basis. However, with the integration of AMR and the security system, it quickly becomes affordable by generating a monthly revenue source while offering an excellent service to utility consumers. Also, AMR may be cost-effective when selectively used to solve the "inaccessible meter" problem. Additionally, the TAMAR system may be shared by two or more utility services, thus, reducing the costs to each individual utility.

Security System

A residential burglary occurs every 10 seconds in this country. Protection from break-ins, fire, or medical emergencies is something all people need. An integral part of everyday life is the requirement for "peace of mind." It is essential that your customer's homes and families be safe and secure.

Now, your utility may offer the latest in wireless security systems, 24-hour monitoring, . . . and install AMR at the residence at the same time.

The TAMAR 2020 security system includes a control console, keypads, motion detection sensors, smoke detectors, transmitters for door/window contacts, glass break devices, panic buttons, and a remote transmitter. The receiving component used in AMR is the same receiving unit within the security system. This saves on installation costs and provides a short-term Return on Investment.

Security much like the utility industry is a monitored business that is maintained 365 days-a-year, 24 hours-a-day. Billing occurs on a monthly basis for usage and service. Security has a proven investment track record and generates a cash revenue stream which may be used to purchase additional AMR stand alone systems. Benefits include:

- "Peace of mind" to your customers
- A new re-occurring revenue source
- New service to your customers

Off-Site Remote Meter Reading System

If your utility is using or intends to use a hand-held data terminal meter reading system, **TAMAR offers a solution to further automate your route management system.** We offer a new and unique concept of off-site remote, technology.

Accurately and swiftly from distances of up to 1500 feet, the off-site remote, HHDT system gives access to hard-to-read meters. This is a time and labor saver. The Off-Site Remote Meter Reading system can be used in route management retrofit applications as well. The benefits of this TAMAR system are:

- Accurate readings over greater distances
- Time and labor cost savings
- Inaccessible meter solution

Energy Management System

Creating systems that offer solutions are all a part of TIPS, and wise energy usage by your customers is an area that positively affects the future of all utilities.

The time has arrived where consumers are interested in taking an active role in budgeting their energy usage along with their checkbook. The TAMAR AMR system using the energy management control panel is an excellent avenue to provide customers a tool to continually monitor their usage.

The energy management control panel is a countertop or wall mounted unit which displays up-to-the-minute electricity usage in Kwh, and both accumulated and real-time dollars. It will give a 12 month billing history to better estimate a long and short-term budget strategy, and allow

the user to enter a budget and monitor the progress of their budget. The information used by the energy management control panel is bi-directional and allows the utility to download the latest rate structure information.

Your utility may also use this information to set up variable rate structures based on peak power demand and/or time-of-use schedules. As much as 20% may be reduced from a bill with good judgment and persistent budgeting by the consumer. The console offers consumers and the utility the advantage of future cost savings now! Additional benefits include:

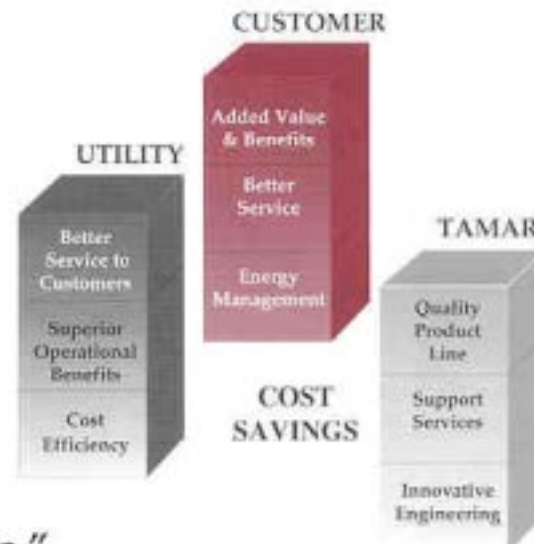
- Set up and monitor an energy budget
- View up-to-the-minute usage in Kwh, dollars and cents per day, and real-time consumption (burn rate)
- Review 12 month billing history
- Monitor long and short-term usage
- The utility may set up variable rate structures or residential accounts.
- In cases where gas and/or water meters are monitored, the energy management control panel will also display accumulated usage of these services as well.

To introduce and utilize the products and fully realize the greatest amount of re-occurring revenue, TIPS has an integrated sales, marketing, training, and service strategy. As your marketing partner — we are fully prepared to offer:

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Benefits of TAMAR Integrated Products

Security

- Generates additional strong re-occurring revenues for utilities
- Easy and quick installation
- Protection from break-ins, fire, or medical emergencies
- Protection for other special emergencies
- Selectable level of desired security
- Selectable supervision
- Tamper-proof protection
- Long-range coverage

Energy Management

- Monitor long and short-term energy usage
- View billing history
- Establish an energy budget

Automatic Meter Reading

- Accelerates cash flow
- Reduces operating expenses required to read meters
- Gives better service to your members
- Reduce inaccuracy of improperly read meters
- Virtually eliminate theft of service

Off-Site Meter Reading

- Today's most cost-effective solution
- Greater distance for accurate readings
- Time Savings/Cost Savings
- Retrofit for current Hand-Held Data Terminal (HHDT) Meter Reading Systems

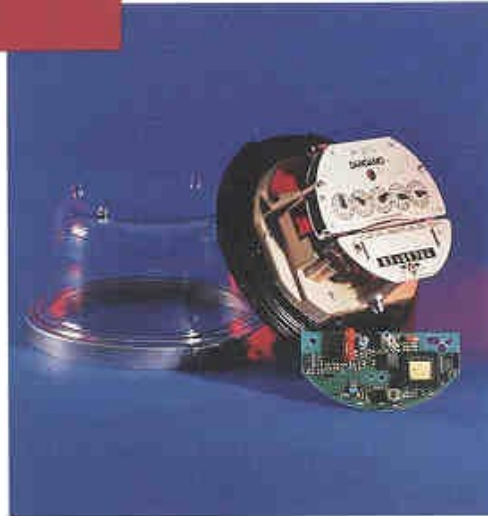
Automatic Meter Reading (AMR) System - Electric

Utility companies providing electricity to their customers have a need for a low-cost method of automatically receiving accurate, timely meter information. The TAMAR 2000 product line is the state-of-the-art technological advancement in Automatic Meter Reading (AMR) that addresses these requirements.

TMS200E - METER ENCODER and TRANSMITTER

TAMAR has developed a unique, proprietary technological approach which incorporates micro-electronics and radio frequency transmission at the 920 MHz frequency range. Although the frequency and power level of transmission allow for unlicensed use, transmission ranges are extremely high due to TAMAR'S unique and highly proprietary modulation and demodulation techniques employing spread spectrum, coupled with the unusually high sensitivity of TAMAR'S receiver.

The TMS200E is a meter encoder and transmitter which works by measuring the rotational velocity of the electric meter's Eddy current disk using a miniature laser beam source and optical detector. The data collected is converted into accumulative power consumption information which represents a "mirror image" of the electric meter's dial. The encoder and transmitter unit has been designed using (SMT) Surface Mount Technology to be efficiently and rapidly installed under glass in all clock face and cyclometer meters currently in use. By being wireless, they eliminate code, safety, and certification problems.



TMS200E

TMM20 - METER PROCESSOR

The TMM20 meter processor, located in the control console, receiver, or Store and Forward Repeater, may be programmed by the utility to automatically call (via telephone line) the utility's central billing office computer to transfer billing data. Another communication option uses licensed 928-952 MHz radio which forms the backbone of TAMAR'S SCADA product line. Due to the integrated technology, the meter may be read "on demand" and allows for remote disconnect of service (with optional power control module) along with the implementation of peak power demand and/or time of use rate structures.

Yet another cost-effective means to read meters equipped with the TAMAR TMS200E is to use the TAMAR Portable Reader TPR-2 and Hand-Held Data Terminal Meter Reading System. With this system, meters may be read from distances of up to 2,000 feet as a meter reader walks, drives, or flies his route.

As a neighborhood becomes saturated with gas, water, and/or electric meters utilizing the TAMAR Meter Encoder and transmitter units, TAMAR'S Pole-Top Data Concentrator and Repeater may be installed to collect data from up to 512 local meters (2,000 to 4,000 foot radius) and relay it directly to one or more utilities using bi-directional telephone



Receiver



Store and Forward Repeater

communications or optional licensed 928-952 MHz Rf transceiver as used in TAMAR'S SCADA product line.

Benefits:

- Accelerates cash flow
- Reduces operating expenses required to read meters
- Reduce inaccuracy of improperly read meters
- Virtually eliminates theft of service
- Allows implementation of Variable Rate Structures by converting a standard Kwh meter into a Peak Power Demand and Time-of-Use meter

Automatic Meter Reading (AMR) System - Gas

Utility companies providing natural gas to their customers have a need for a low-cost method of automatically receiving accurate, timely meter information. The TAMAR 2000 product line is the state-of-the-art technological advancement in Automatic Meter Reading (AMR) that addresses these requirements.

TMS200G - Gas Meter Encoder and Transmitter

TAMAR has developed a unique, proprietary technological approach which incorporates micro-electronics and radio frequency transmission at the 920 MHz frequency range. Although the frequency and power level of transmission allow for unlicensed use, transmission ranges are extremely high due to TAMAR'S unique and highly proprietary modulation and demodulation techniques employing spread spectrum, coupled with the unusually high sensitivity of TAMAR'S receiver.

The TMS200G is battery operated using a proven and highly reliable battery technology providing upward of ten years of trouble-free operation between battery changes.

The TMS200G is a gas meter encoder and transmitter unit which works by measuring the rotational velocity of the gas meter's proving dial. The data collected is converted into accumulative energy consumption information which represents a "mirror image" of all the gas meter dials.

The TMS200G has been designed and manufactured using SMT (Surface Mount Technology) to be efficiently and rapidly installed on virtually any gas meter currently in use. By being wireless, battery operated, and intrinsically safe, code, safety, and certification problems have been eliminated.



TMS200G

TMM20 Meter Processor

The TMM20 meter processor, located in the control console, receiver, or Store and Forward Receiver, may be programmed by the utility to automatically call (via telephone line) the utility's central billing office computer to transfer billing data. As the unit is bi-directional, the utility may dial out to the unit as well, to take a reading on demand. Another communication option uses licensed 928-952 MHz radio which forms the backbone of TAMAR'S SCADA product line.

Yet Another cost-effective means to read gas meters equipped with the TAMAR TMS200G is to use the TAMAR local area Store and Forward Repeater in conjunction with the TAMAR Portable Receiver and Hand-Held Data Terminal System. In this fashion, gas meters may be read from distances of up to 4000 feet from the meter as a meter reader walks, drives, or flies the route.

As a neighborhood becomes saturated with gas, water, and/or electric meters utilizing the TAMAR Meter Encoder and transmitter units; TAMAR'S Pole-Top Data Concentrator and Repeater may be installed to collect data from up to 512 local meters (2,000 to 4,000 foot radius) and relay it directly to one or more utilities using bi-directional telephone communications or optional licensed 928-952 MHz Rf transceiver as used in TAMAR'S SCADA product line.



Receiver



Store and Forward Repeater

Benefits:

- Helps pinpoint leaks and other service related problems including tamper and theft of service.
- Accelerates cash flow
- Reduces operating expenses required to read meters
- Reduce inaccuracy of billings due to improperly read meters.
- Virtually eliminates theft of service

Automatic Meter Reading (AMR) System - Water

Utility companies providing water service to their customers have a need for a low cost method of automatically receiving accurate, timely meter information. The TAMAR 2000 product line is the state-of-the-art technological advancement in Automatic Meter Reading (AMR) which fully addresses these requirements.

TMS200W Water Meter Encoder and Transmitter

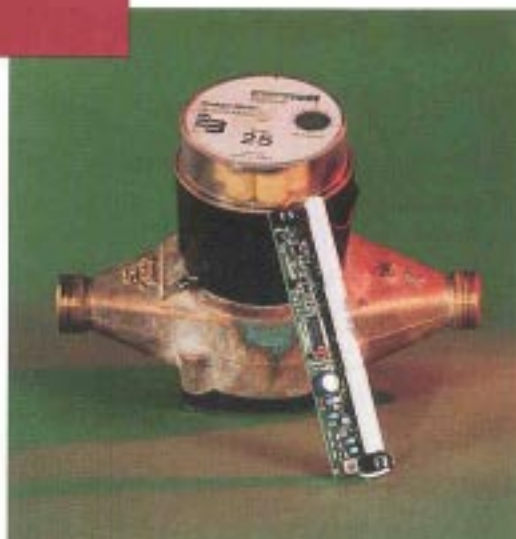
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The TMS200W is battery operated using a field proven and highly reliable battery technology providing upwards of ten years of trouble-free operation between battery changes.

The TMS200W is housed in a hermetically sealed, plastic case which is fully submersible in water for indefinite periods, thus, facilitating the device's use in water meter pits.

The TMS200W is a water meter encoder and transmitter unit. Data collected by the encoder is converted into accumulative water consumption information representing a 100% accurate "mirror image" of the water meter's mechanical dials or index register.

The TMS200W has been designed and manufactured using SMT (Surface Mount



TMS200W

Technology) to be efficiently and rapidly installed on virtually any water meter currently in use. By being wireless and battery operated, the TMS200W can be used on any water meter whether it is mounted in a pit, above ground, or indoors.

TMM20 Meter Processor

The TMM20 meter processor, located in the control console, receiver, or Store and Forward Repeater, may be programmed by the utility to automatically call (via telephone line) the utility's central billing office computer to transfer billing data. As the unit is bi-directional, the utility may dial out to the unit as well, to take a reading on demand. Another communication option uses licensed 928-952 MHz radio which forms the backbone of TAMAR'S SCADA product line.

Yet another cost-effective means to read water meters equipped with the TAMAR TMS200W is to use the TAMAR local area Store and Forward Repeater in conjunction with the TAMAR Portable Receiver and Hand-Held Data Terminal System. In this fashion, water meters may be read from distances of up to 4,000 feet from the meter as a meter reader walks, drives, or flies the route.

As a neighborhood becomes saturated with water, gas, and/or electric meters utilizing the TAMAR Meter Encoder and transmitter units, TAMAR'S Pole-Top Data Concentrator and



Receiver



Store and Forward Repeater

repeater may be installed to collect data from up to 512 local meters (2,000-4,000 foot radius) and relay it directly to one or more utilities using bi-directional telephone communications or an optional licensed 928-952 MHz Rf transceiver as used in TAMAR'S SCADA product line.

Benefits:

- Pin-points leaks and other service related problems including tamper and theft of service
- Accelerates cash flow
- Reduces operating expenses required to read meters
- Reduces inaccuracy of billings due to improperly read meters
- Virtually eliminates theft of service

Automatic Meter Reading (AMR) System Electric - Gas - Water

- Store and Forward Repeater
- Pole-Top Data Concentrator and Repeater

TSF 200R - Store and Forward Repeater

The TAMAR TSF200R has been designed to be used with the TAMAR TMS200 series of electric, gas, and water meter encoder and transmitter units. The TSF200R Store and Forward Repeater serves three purposes:

Firstly, the effective transmission range between an inaccessible electric, gas or water meter and meter reader's portable receiver and hand-held data terminal ... or TAMAR'S Pole-Top Data Concentrator and Repeater ... can be increased up to 2,000 feet beyond the 2,000 foot range of the meters' encoder and transmitter.

Secondly, the TSF200R is used to receive, process and update the data transmission originating from TAMAR'S TMS200G and TMS200W Gas and Water Meter Encoder and Transmitter units.

Thirdly, the TSF200R is used to receive, process and update the data transmissions originating from TAMAR'S TMS200E Electric Meter Encoder and Transmitter unit. This information may be re-transmitted to a meter reader's portable receiver and hand-held data terminal ... or TAMAR'S Pole-Top Data Concentrator and Repeater. Additionally, the electric utility's information is processed and re-transmitted to the TAMAR TIRC-2 Intelligent Resource Console which may be located inside many customers' homes or buildings. The TIRC-2 is an information display panel which enables consumers to monitor their energy usage and to interactively set-up and control monthly utility budgets.



The TAMAR Pole-Top Data Concentrator and Repeater (background)

The TAMAR Store and Forward Repeater (foreground)

TDC200R - Pole-Top Data Concentrator and Repeater

The TAMAR TDC200R is used to receive signals from up to 512 local meters within a 2,000-4,000 foot radius. Any combination of electric, gas, or water meters may be accommodated by the TDC200R. The TDC200R also contains a low power (unlicensed) 920 MHz transmitter which is able to direct control signals to local TSF200R Store and Forward Repeaters, local TIRC-2 Information Display Panels, or local remote TAMAR Service Connect/Disconnect Power Control Modules used to remotely turn-on and turn-off a customer's electric service.

The TDC200R can communicate with the utility in two optional ways. Option BTL is a bi-directional telephone interface which is capable of initiating in-bound communication sessions on a preprogrammed basis for up to 16 different offices outfitted with Tamar's network data receiving and processing equipment. Thus, as an example, electric billing data is sent to one utility's billing processing station, while gas utility information is sent to another utility's billing information station and water information to yet another. Service outage or tampering information may be routed to different incoming stations. As the TDC200R supports bi-directional communications and session commencement events, outbound transmissions from a given utility may be

generated at any time to take an electric, gas or water meter reading on demand, download new rate structure information to local TIRC-2 Information Display Panels, perform various reset functions, issue energy management control commands or perform remote service turn-on or turn-offs. The BTL interface has been designed to be used with a standard voice grade telephone line.

The RFL option allows the TDC200R to be integrated into the TAMAR 928-952 MHz licensed Rf communications network as used by the TAMAR SCADA product line.

Time-of-Use (TOU) and Peak Power Demand Rate Structures

Many utilities are currently in need of a means to inexpensively implement variable rate structures on a mass deployment basis due to the ever-growing demand on their generating, transmission, and distribution systems.

The result of this strain requires either significant investment in additional generating and transmission distribution capabilities or load leveling and stabilization through demand-side management. This is accomplished in conjunction with special service rate structures such as seasonal, demand, and time-of-use billing.

The use of the TAMAR TMS200E Electric Meter Encoder and Transmitter unit not only provides automatic and remote meter reading capabilities, but can be used to convert every standard residential meter and account to both a Time-of-Use and Peak Power Demand meter along with implementation of TOU and Peak Power Demand rates.

Time-of-Use (TOU)

Time-of-Use (TOU) provides the ability to monitor energy usage and apply changing rates for any particular time of day, for each day of the week or holidays. TAMAR TOU offers 16 independent Time-of-Use periods. A perpetual calendar and a 4 year programmable task calendar allow an unlimited number of programmable dates to accommodate holidays, seasonal schedule changes, and changes to and from daylight savings time.

There are 4 different weekly schedules that are selected at the calendar level. Each weekly schedule offers 9 days (7 days of the week, plus 2 holidays) of independent variable rate schedules.

Each daily schedule contains up to 8 daily



Data Screen for TOU and Peak Power Usage



TOU Daily Power Usage Graph

setpoints at 15 minute intervals. Each of these setpoints may be used to select a different Time-of-Use period, allowing for a progressive billing structure.

Peak Power Demand

Peak Power Demand offers the capability to monitor the highest Kw load used during a set time period, usually defined as the previous billing period. With this function a utility can manage peak loads, distribute cost, and lower the cost of energy purchased by the utility.

Levels of energy usage are read at rolling intervals of 15, 30, or 60 minutes. The system will track the highest demand level accumulated during a billing period. If, for example, a higher reading is accumulated at any time interval during a set billing period, the higher number will automatically be saved. Billing is set at established rate segments of Kwh used.

Pre-set load research may be available to analyze load profiles for 36 day time periods at 15, 30, or 60 minute intervals or a 60 day rolling time period at 2 hour intervals.

Benefits:

- Establish variable rate structures
- Unlimited programmable dates to accommodate holidays, time, and season changes.
- Control peak loads
- Reduce cost of energy purchased by utility

Energy Management System

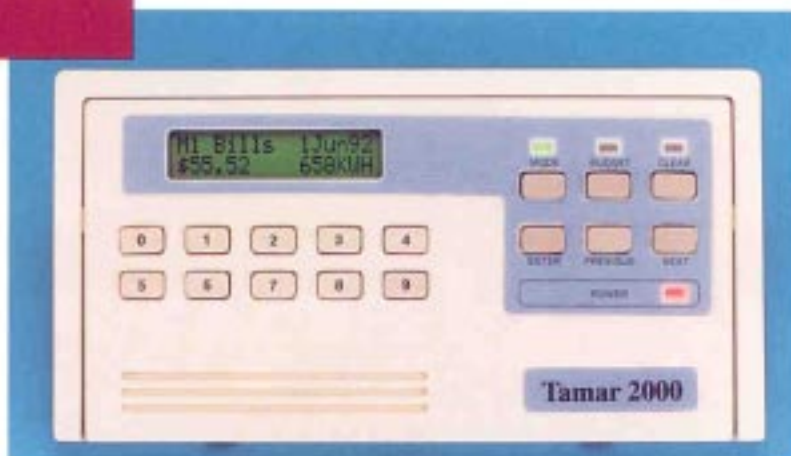
Wise energy usage is important for the utility and the paying consumer.

The **TIRC-2** (TAMAR Intelligent Resource Console) is a small, attractive display and function control console which may be wall mounted. Integrated with the **TMM20** meter processing module, the **TIRC-2** is a bi-directional interface between the homeowner and their energy information.

This panel will enable the consumer to monitor their energy usage for long and short-term budgeting by providing the last 12 months billing history. Displayed in both cost per Kwh and dollars and cents, the user can determine and maintain their own budget of energy usage. Every 15 seconds, the panel will update automatically, allowing for better than up-to-the-minute statistics.

The **TIRC-2** contains an alpha-numeric LCD display, a multi-color status LED display, and various touch sensitive switches used for function selection, set-up, and data entry. The **TIRC-2's** receiver receives the energy consumption data as stored and re-transmitted by the **TMM20** control console. All arithmetic and functionality is controlled locally by the **TIRC-2's** micro processor and associated electronics.

A utility may offer this as a bonus or incentive product to their customers



TIRC-2

to begin more prudent energy usage. A utility may also wish to sell the **TIRC-2** and **TM200E** to the consumer, thereby passing on the cost of AMR to the consumer.

The consumer will receive a payback on the purchase price of the **TIRC-2** in the form of reduced electric bills. The average monthly savings will, of course, depend on the customer's discipline as measured by the ability to keep to a budget. It should be noted that it has been proven in numerous field tests that, on average, there is a considerable reduction of power consumption (up to 20%) when consumers are continually made aware of their usage. Implementation of various variable rate structures by the utility may significantly increase expected savings.

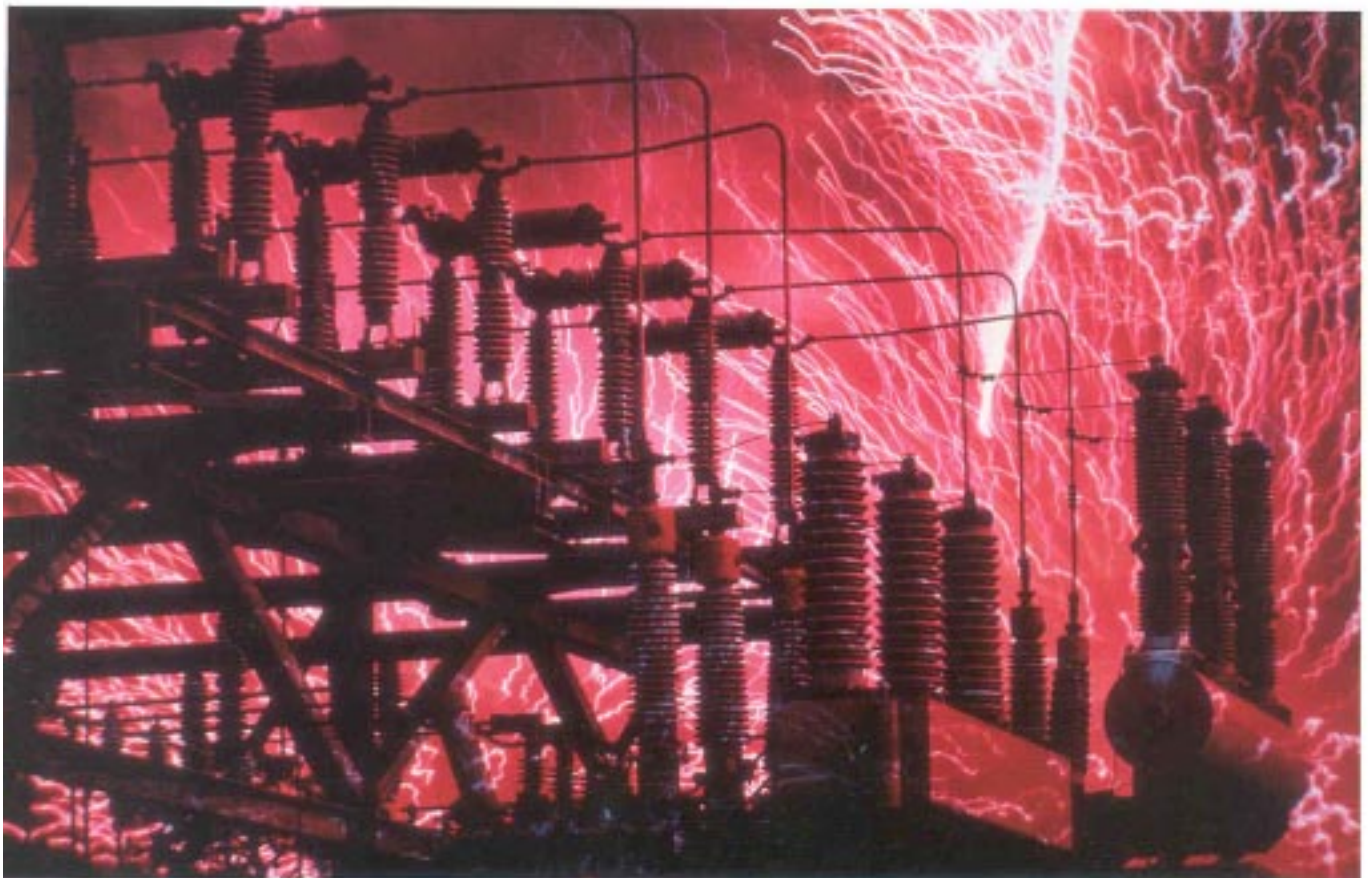
Many utilities are experimenting with novel and complex rate structures. They may take full advantage of the rate information provided by the **TIRC-2** to establish Time-of-Use and Peak Power Demand variable rate structures. Rate structures may be downloaded automatically by the utility to the customers via phone line connection or through TAMAR'S radio frequency link.

Benefits:

- Display current burn rate in \$\$\$ per day and Kwh per day
- Display usage of electric power to date since last reading by the utility in \$\$\$
- Display previous monthly billings for the previous twelve months
- Ability to enter a budget and monitor costs to date versus budget amount
- Display accurate electric meter dial readings
- TOU and Peak Power Demand - Variable Rate Structures

SCADA

TAMAR CORPORATION



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SCADA

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OVERVIEW

The TAMAR SCADA System has been specifically designed for electric utilities and offers a high-tech, versatile approach to data gathering, control, and communications. This is a PC/AT based system, usually consisting of a Process and Control Center and several Remote Terminal Units located in substations or various metering points.

TAMAR RTUs use wave form analysis algorithms to derive all pertinent electrical parameters avoiding the use of multiple transducers. This affords considerable space and cost efficiency while achieving excellent accuracy.

Distributed Intelligence is one of the major advantages inherent in the TAMAR SCADA System because it allows quicker access and response times at the Central Base, as well as offering greater overall system reliability.



A TAMAR SCADA System can help you and the people you serve by -

Giving you the tools and data you need to analyze and improve your system efficiency:

- Historical and cumulative electrical data retention
- Maintenance of sequence of events
- Peak load profile information capture
- Report and graph formatting according to your individual needs
- Automatic capacitor bank control

Putting up to the minute status and load information at your finger tips:

- Observe the performance of your whole system on one screen
- Window in on one substation
- Window in on one point
- Spot problems with equipment before they become serious

Alerting you to alarm conditions immediately when they happen:

- Automatic map board update
- Automatic status change report
- Audible alarm requiring acknowledgement
- Alarm on
 - Breaker trip
 - Transformer problems
 - Gate or door open
 - Voltage out of limits
 - Excessive current
 - Poor power factor
 - Other alarms

Allowing you to control equipment remotely:

- Modify regulator settings under extreme load conditions
- Aid linemen in power outage trouble shooting
- Reclose breakers from the office
- Place recloser in one shot mode

Maintaining a log of SCADA operations:

- Date and Time of log on and log off
- Personnel
- Operations
- Resulting status

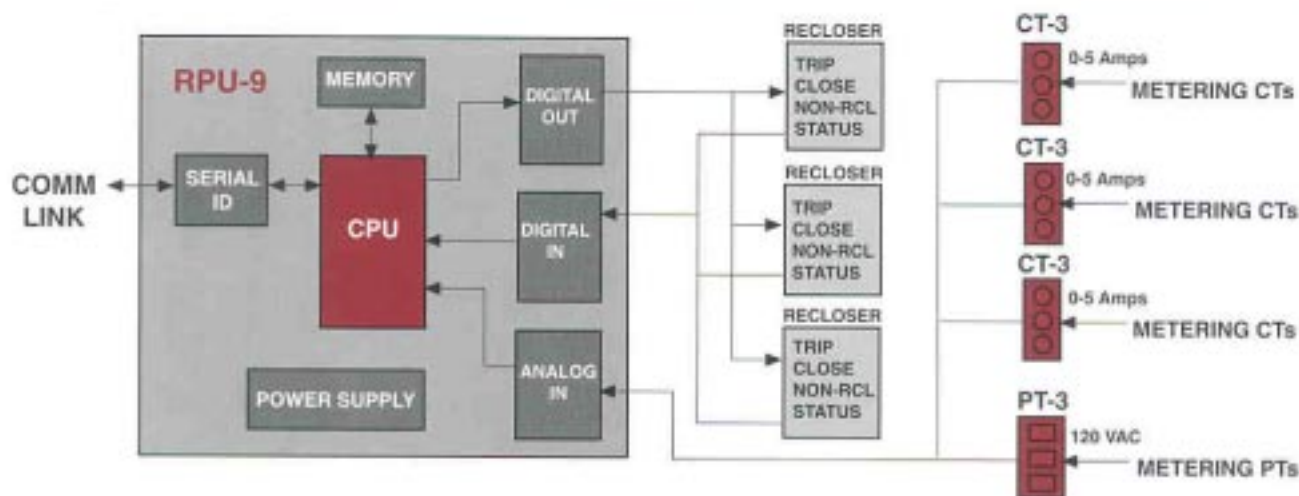
Remote Terminal Unit

Installation of the TAMAR RTU equipment in the substation is simple and straight forward. Addition of a substation to the SCADA system is summarized by the following:

1. Hold preconstruction meeting.
2. Trench and run signal wires in substation.
3. Mount RTU (including PT-3s) and CT-3s.
4. Make connections from RTU to control, status and metering points.
5. Check-out supervisory and calibrate analogs.
6. Add personality files at the PCC.

All of TAMAR'S RTUs use wave-form analysis algorithms for derivation of electrical parameters. Waveform analysis, simply put, makes use of raw voltage and current signals with the classical equations for power and RMS values to calculate voltage, current and phase angle for each phase to be monitored. From these quantities all other parameters including summations and averages are calculated. This significantly reduces the amount of equipment necessary to gather information while maintaining a high level of accuracy.

Configuration



Specifications

Electrical Measurements

Voltage	RMS Volts	+/-0.5%	From 120:8 PTs
Current	RMS Amps	+/-0.5%	From 500:1 CTs
Power	Kilowatts	+/-0.5%	Calculated
Reactive VA	KVARs	+/-0.5%	Calculated
Power Factor	Percent	+/-0.5%	Calculated
Phase Angle	Degrees	+/-0.3	Calculated

Supervisory

Status Inputs	15-120V AC or DC	Max 256
Momentary Control	Contacts or Drive	Max 256
Latching Control	Dry Contacts	Max 256

Environmental

Operating Temperature	-15 to 70 Celsius	Card Cage & Breakouts
Storage Temperature	-40 to 125 Celsius	20 Watts (Max)
Humidity	95% Non-condensing	
RPU Configuration	19" Rack Mount	
Power Requirements	120 Volts AC or DC	