Verticross India Pvt. Ltd.

Automated Meter Readers

Vlink-09

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INTRODUCTION

Measurement of utilization of energy especially in the distribution sector has always remained a challenge. Automation has helped mature the operations to a larger extent. The capability and ability to control distribution losses have helped evolve technological solutions over the last few years. The need to acquire valid data and analyse the usage pattern is very critical in nature. Acquiring data from Energy meters is complex and more due to involvement of various agencies.

Automated Meter Reader (AMR) is one such product which has evolved over the years in acquiring data from various types and makes of meters. Standardisation in meter data and communication protocol has also evolved over the years. Monitoring consumer usage and generating bills based on peak and no-peak periods is essential.

Following are various types of consumers:

- DTR (Distribution Transformer)
- HT (High Tension)
- LT (Low Tension)
- Feeders

From visiting each consumer location and reading the meter data manually using MRI (Meter Reader Interface), which is a laborious task, the system has moved ahead by acquiring meter data using GPRS technology which is more reliable.

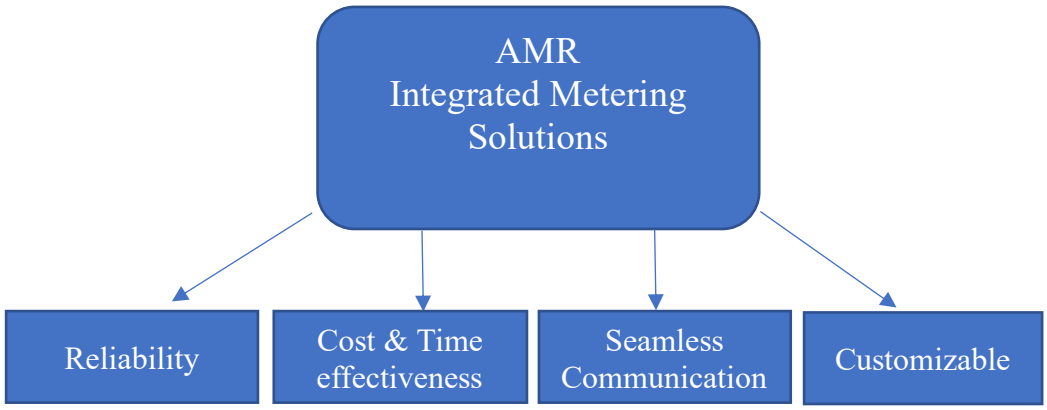
This document details about the AMR technology and its benefits. Verticross has designed and developed AMR (2G/ 3G/ NB-IoT /4G) in-house and have deployed the same across 12 states in India. Over 150,000 units have been deployed and are consistently transmitting data every 15 mins of interval to various data centres.

Data acquired by AMR is transmitted through GPRS to the HES (Head End System). Meters of different makes and models have their own communication protocol although most of them have now standardised to DLMS protocol. The data stored in the Meter is in encrypted form (Raw) and the HES helps to convert the Raw data to meaningful readable information.

Meter Data Acquisition (MDAS) is the software that is used to collect data from HES and generate various analytical reports and integrate key information with the MDMS (Meter Data Management System). The complexity of the entire system is limited to acquiring data from Energy meters and transmitting the same to HES. Most importantly availability of data on a real time basis makes the entire system challenging.

Features like data on-demand helps in monitoring and validation of data which is crucial. POTA (Programming Over The Air) can be used in upgrading the firmware and configuring the AMR remotely. AMR ensures seamless data acquisition from energy meters and hence this product is a critical entity.

The Value deliverables



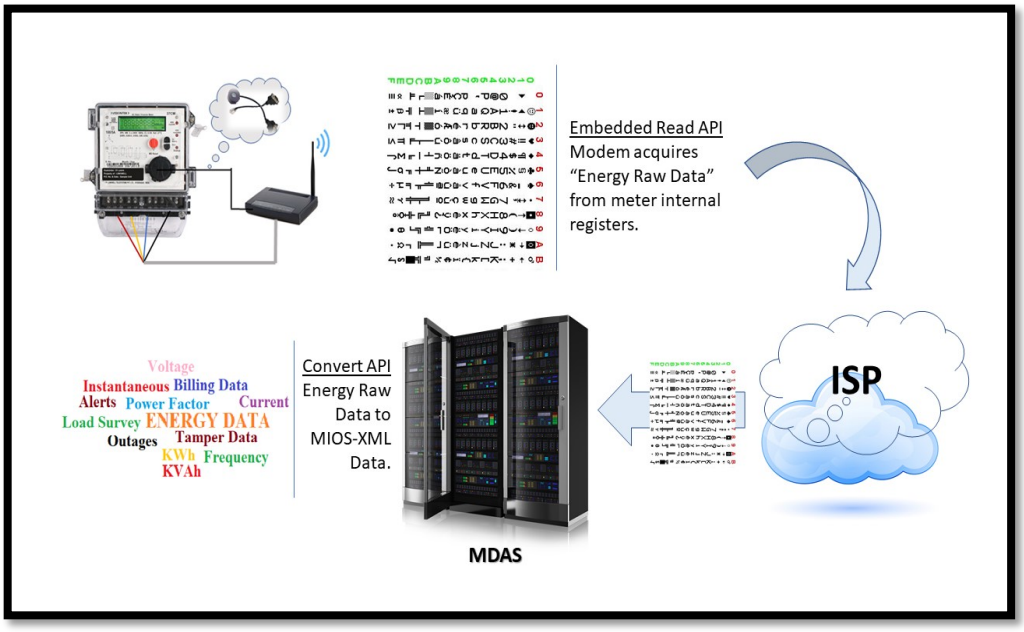
The Automatic Meter Reading (AMR) Modems manufactured by Verticross India Private Limited (VIPL), (VLink-09) provides an effective cutting-edge integral 360° energy management technology solution. It is available in various versions which is based on the type of communication….

- VLink-09 2G
- VLink-09 4G
- VLink -09 NB-IoT

VIPL AMR also called as "**VLink 09"** is an intelligent GPRS Modem for Energy Smart Meter is a kind of cellular terminal device that provides data acquiring and transfer function. It adopts high-powered industrial 16/32 bits CPU and embedded real time operating system (RTOS). It supports RS232 and RS485 (or RS422) port that can seamlessly and transparently connect one device to a cellular network, making it possible to connect to consumers existing serial devices with only basic configuration.

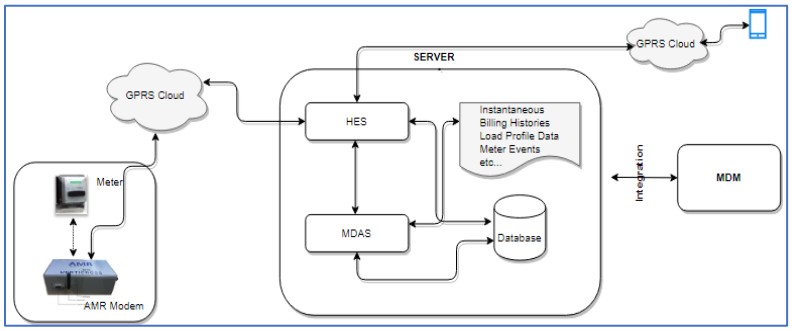
It has been widely used on M2M fields, such as intelligent transportation, smart grid, industrial automation, telemetry, finance, POS, water supply, environment protection, post, weather, and so on. Capable of communicating the readings of various parameters in real-time mode to the utilizing entity, AMR modems aid streamlining the complete energy audit of large, complex systems. The product adheres to the international standards and offers coherency with the legacy systems.

ARCHITECTURE



VLink-09 is an intelligent modem (AMR) that is supplied with 5dBi antenna, optical / serial communication cable and 4 wire power cable.
The Energy meter is connected to the AMR along with all accessories in the meter box. Based on the type and make of meter, either an optical cable or a serial cable is connected to the meter communication port.

After a successful installation, when powered-on, the AMR reads the data using appropriate communication protocol, which is in encrypted form. Data is transferred over GPRS to the HES server at the Data Centre. The conversion APP in the HES system converts the encrypted data or Raw data to readable form. MDAS (Meter Data Acquisition System) and MDMS (Meter Data Management System) uses these data to generate various reports.



Meters are of different makes, models and types and hence the challenge is in reading the data. Most of the meters follow DLMS communication protocol, while there are meters with legacy / proprietary communication protocol. VLink-09 has the capability to identify the type of meter and read data as it complies to all types of protocol.

Moreover different meters transmit data at different baud rate and the need to standardisation is essential. VLink-09 has the capability to configures locally and remotely based on the meter type.
Following are some of the meters whose data is acquired successfully…

- L&T
- Secure
- L&G
- Genus
- Elster
- Holly
- HPL
- Others (local make)

Following are various communication protocols we support

- MODBUS
- DLMS
- IEC protocols
- SPORT
- PACT
- Non-DLMS (legacy)
- Checksum based socket level protocol

Various components of VLink-09 are

- Logic board with SIM module, SIM tray, Serial ports, and controller
- Power supply card
- Battery
- Antenna
- Communication cable
- IP55 Enclosure

Firmware of VLink-09

- Proprietary embedded OS
- Communication protocol
- POTA (Programming Over The Air) – Remote operations.
- Energy data reading algorithm
- I/O operations
- Auto latching to network
- Watchdog to ensure system does not get interrupted

VLink -09 Hardware

- 32-bit high speed M0+ ARM cortex core with dual UART for communications
- CMOS circuitry for low power consumption and high noise immunity
- Three phase supply 70V AC to 480V AC at 50Hz ± 5Hz
- Single phase 230V, 50Hz ± 5Hz supply
- Operating range: 70 V AC P-P to 480 V AC P-P, for both HT and LT tri-vector meters
- Quad band GSM/ GPRS/ 2G/4G/ LTE communication module
- In-built AC/DC power supply
- Built-in overload, short-circuit and surge protection
- EMI and RFI protection
- Polarised connectors for reverse polarity protection
- Leakage current protection through use of high-quality glass epoxy PCB
- Power-on LED indicator
- Supports SIM cards of 1.8V and 3V
- Battery backup for transmitting alerts and alarms during power outages
- RS-232/RS-485 communication port
- On-board flash for data-storage

DATESHEET

LTE Module

- M0+ ARM Core based design
- SIM 7600E / SIM7672 / SIM800C
- Fall back to 3G and 2G networks
- Supports Voice, SMS, Data and Fax
- Low Power Consumption
- Echo Cancellation
- Embedded Powerful TCP/IP Protocol Stack
- UL MAX 5.76Mbps /UL MAX 10Mbps
- LTE - FDD:B1, B3, B5, B7, B8, B20
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- Supply Voltage: 3.4 ~ 4.5 V
- Approvals: FTA, CE, FCC and PTCRB
- Two UART Interfaces

Sim Holder

- External push SIM holder
- 3V/1.8V SIM interfaces with sealing arrangement

Data Transmission

- LTE: UL 5Mbps / DL 10Mbps
- HSPA+: L MAX 5.76Mbps /UL MAX 10Mbps
- UMTS: UL 384kbps/DL 384kbps
- Edge: UL 236.8kbps/DL 236.8kbps

FTP, SMTP

- Point-to-Point MO and MT
- SMS cell broadcast and Text and PDU mode

Control / Logic Card

- Arm Cortex M0+
- 32 Bit Micro Controller
- 128 KB Flash
- 8 KB RAM
- Dual UART

Interface:

- RS232 Port 9-pin D type connector for meter interfacing through RS232 or through optical port
- Power supply card 4 core, 3 phase 4-wire

- SMA connector Antenna interface

Power Supply

- 80 V A/C to 480 V A/C or 230 V A/C @ 50Hz

Internal Backup Battery:

- 3.7 V / 500mAh Rechargeable Li-Ion battery

Environment Parameters

- Storage temperature: -25° C to +70° C
- Operating temperature: -10° C to +60° C
- Operating Humidity up to 95% RH (Non-condensing)

Enclosure

- Engineering plastic housing (ABS plastic)
- With sealing arrangement for Enclosure

Dimensions

- 190mm (L) x 110mm (W) x 45mm (H)

LED Indications

- Transmit indicator
- Receive indicator
- Network Status indicator
- Power supply indicator

LED Type & Color	Functionality	Remarks
LED1 (Green)	Network Status LED	**Continuously ON :** - Searching Network Signal **Flashes at every 0.2 Seconds:** **-** 4G Network Registered, Data transmit **Flashing at Every 0.8Second:** **-** 2G/3G Network not Registered **Continuously Off :** - Sleep

LED2 & LED3 (Yellow & Green)	TX/RX status	**Red LED Flashing:** - Transmission of data with Meter / Modem **Red LED Glowing continuously:** - Modem is restarting - Data is being transmitted continuously **Green LED Flashing:** - Receiving data from the Meter / Modem **Green LED Glowing continuously:** - Modem is restarting - Data is being received continuously
LED4 (Red)	Power Status	**Red LED Continuously ON:** - Input Mains power present **Red LED Continuously OFF:** - Input mains power off / beyond the range

FEATURES & FUNCTIONALITIES

Data Acquiring

VLink-09 comes in various models which is based on the type of communication module. AMR (VLine-09) has the capability to acquire following energy data from various makes and models of meter.

Meter data

- Serial No.
- Time of Reading (Meter)
- Time of Data Dump on PC
- Meter Program
- Meter Scaling
- Meter C.T. Primary Rating
- Meter P.T. Rating
- Meter C.T. Secondary Rating
- Previous Tariff
- Present Tariff
- Meter Reading Count
- MD Reset Count
- Meter Class
- Meter Rating
- Meter Type
- Common Format Version
- Generated

Energy snapshot data:

- Start Date/Time
- Active Import Total
- Active Export Voltage
- Reactive Import Not Applicable
- Reactive Export Not Applicable
- Active Forwarded
- Apparent Forwarded
- Active Import Voltage
- Apparent Active Import Voltage

Billing data:

- Active Import Voltage
- Active Import Total
- Active Export Voltage
- Reactive Import Not Applicable
- Reactive Export Not Applicable
- Active Forwarded
- Apparent Forwarded
- Start Date/Time
- Apparent Active Import Voltage
- Reactive Import Energy
- Reactive Export Energy
- Active Forwarded Energy
- Apparent Forwarded Energy

Instantaneous parameters data:

- R-Phase Voltage
- Y-Phase Voltage
- B-Phase Voltage
- R-Phase Line Current
- Y-Phase Line Current
- B-Phase Line Current
- R-Phase Active Current
- Y-Phase Active Current
- B-Phase Active Current
- R- Phase Reactive Current
- Y-Phase Reactive Current
- B-Phase Reactive Current
- Active Power (sys)
- Reactive Power (sys)
- Apparent Power (sys)
- R-Phase Power Factor
- Y-Phase Power Factor
- B-Phase Power Factor
- R- Phase Voltage Angle
- Y-Phase Voltage Angle
- B-Phase Voltage Angle
- Phase Sequence
- Current Frequency

Load profile data:

- Date & Time and Interval Period
- Voltage (Sys) Average for Defined duration
- Line Current (Sys) Average for Defined duration
- Active Forwarded Ener

Meter setting data:

- Load Survey Setting Interval Period Energy
- MD Setting Interval Period Line Current (Sys)
- Average for Defined Duration
- duration
- Active Demand forwarded Energy
- Active forward Energy
- Apparent Demand forwarded Energy
- Reactive Demand Export Energy
- Defined duration

  Active Demand Forwarded
- Voltage (Sys) Average for Defined

Tamper data:

- R Phase PT Missing/Failure
- Y Phase PT Missing/Failure
- B Phase PT Missing/Failure
- Y Phase PT Unbalance
- B Phase PT Unbalance
- R Phase PT Unbalance
- R Phase PT Missing/Failure
- Y Phase PT Missing/Failure
- B Phase PT Missing/Failure
- R Phase PT Unbalance
- Y Phase PT Unbalance
- B Phase PT Unbalance
- R Phase CT Reversal
- Y Phase CT Reversal
- B Phase CT Reversal
- R Phase Current Bypass
- Y Phase Current Bypass
- B Phase Current Bypass
- R Phase Low PF
- Y Phase Low PF
- B Phase Low PF
- Neutral Imbalance
- Power Failure
- Service Voltage event
- High Voltage event
- PF event
- Harmonic event
- THD Current event

Abnormal event data:

- R-Phase Voltage
- Y-Phase Voltage
- B-Phase Voltage
- R-Phase Active Current
- Y-Phase Active Current
- B-Phase Active Current
- R-Phase Power Factor
- Y-Phase Power Factor
- B-Phase Power Factor
- R-Phase Line Current
- Y-Phase Line Current
- B-Phase Line Current
- Active Forwarded Energy Code
- Date & Time

Configuration and Diagnostics

The inbuilt process in the AMR can do a self-diagnostic check to report any fault deduction and data integrity checks.
Following are the parameters that are configured ..

- Network setting
- Registration process of modem
- Data baud rate

Both configuration and diagnostic check can be done locally or through remote using POTA feature.

Data Validation

Acquired data is validated using the following tools.

- CMRI equipment
- VLink -09 internal logic program
- Mobile APP

VLink-09 transmits data which is validated with internal logical calculation to ensure the data and its parameters are correct.

Remote Programming

Programming Over The Air (POTA) is an important functionality. Following the various use of this..

- Update the device firmware remotely
- Read data as and when required (On-Demand) for audit or other purpose.
- Configuration and self-diagnostic check.

Alerts and alarms

Various alerts and alarms are generated and transmitted to the Data centre. An inbuilt battery is provided to transmit data pertaining to power failure at the consumer location to the data centre.

MCF

Meter communication failure is identified and this alarm is sent to the data centre for rectification. MCF indicates, disconnection of communication cable between the meter and AMR.

Time Synchronization

Meter, AMR and Server time have to be in synchronized mode. This helps in generating validated reports. This

Signal strength

VLink-09 measures the signal strength and the same is transmitted to the Data Centre. This process ensures that data availability is taken care as data completeness is an issue with lower signal strength.

Data transfer scheduling

We can schedule reading and transmitting of data every 15 mins, 30 mins, 45 mins, 60 mins, etc.. based on the customer requirement.

BENIFITS

- No manual interference in reading energy meters
- Avert misuse or tamper of meters due to periodic monitoring
- Accurate and validated data
- Read data remotely without visiting the location
- Improves billing
- This data can be used for data analytics and proper forecasting
- Maintenance of electrical equipment’s.
- Reducing distribution losses
- Enhance customer service