Verticross India Pvt. Ltd.

Data Concentrator Unit

VData -09

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INTRODUCTION

In a typical substation, there are two types of feeders, namely “Incoming Feeder” and “outgoing feeder”. It is very important for the DISCOM to analyse the power attributes of both incoming and outgoing feeder. All such feeders have energy meters interfaced to measure energy related parameters in a distribution substation.

A typical substation has at an average 6 to 8 such feeder meters and acquiring data from these meters is a challenge as these are of different makes, types and models. Moreover, the need to read the actual status of these feeders is necessary. Automation has helped mature the operations at a substation to a larger extent. Substation automation involves feeder management, especially the data which helps in final audit. 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.

Data Concentrator Unit (DCU) is one such product which has evolved over the years in acquiring data from various types and makes of feeder meters installed in a substation. . Standardisation in meter data and communication protocol has also evolved over the years.

Acquiring of Data from a feeder meter can also be done using an AMR but AMR cannot deduct the life status of the feeder. Hence the need for a device that has the capability to ready I/O inputs both digital and analog is required. DCU has the following various components that make it one of the most suitable product for substation feeder management.

Various components of a DCU

- I/O analog and digital card (Optional)
- GPRS Modem with RS 232/ RS485
- Power Supply
- CPU card with LAN

This document details about the DCU technology and its benefits. Verticross has designed and developed DCU (VData 09) in-house and have deployed the same in most of the states.

Feeder meters of different makes and models have their own communication protocol although most of them have now standardised to DLMS protocol. DCU acquires the feeder data and can also store the same locally. The data in the feeder 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 Feeder Energy meters and transmitting the same to HES. Most importantly availability of data on a real time basis makes the entire system challenging.

VData-09 is capable of reading multiple feeder energy meters (maximum of 16 meters) through a single RS-485 port, connected in Daisy Chain mode. VData-09 are used within

substations to concentrate data from different sources to one main source and transmit the collected data of each source to a central database at regular intervals, which is configurable.

Our DCU provides multiple communication interface options such as LAN, GSM/GPRS, RS-232 and RS-485 serial connectivity thus ensuring two-way meter data communication in a reliable, efficient, and cost-saving manner. A variety of protocol sets are also available to support different meter standards of various manufacturers.

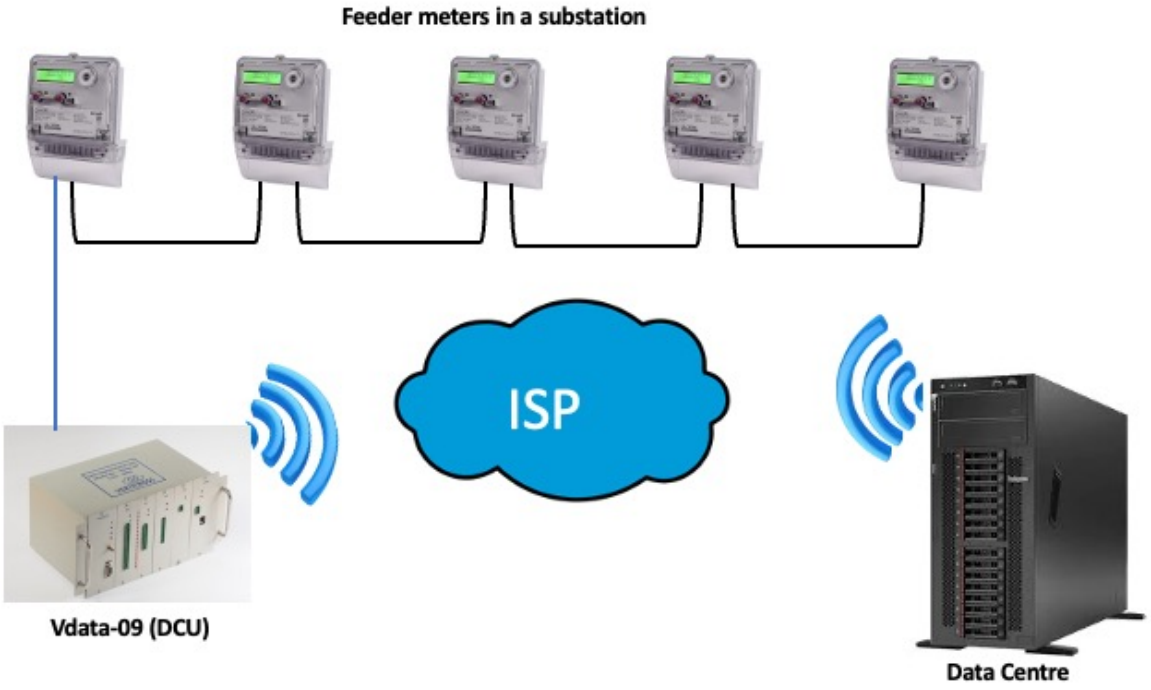
ARCHITECTURE

In a typical substation, all feeder meters are connected in a daisy chain pattern and interfaced to the DCU. Most of the meters in the substation have RS485 port and hence we use the daisy chain pattern for connectivity. The DCU has the capability to ready data from meter one after the other and the data is stored in locally. Data from DCU is transmitted through GPRS to the HES (Head End System) server installed at the Data Centre.

It is possible to find RS232 enabled feeder meters and in such case, an MIU (Machine Interface Unit) is used to convert RS 232 to RS 485 and also provide an ID which is then becomes part of the connectivity. The challenge to read these meters persist as feeder meters are of different make, model and type. We have come across feeder meters that can be interfaced with MIU in a WIFI network and DCU can read all data through LAN. Such instances are rare although the VData-09 has the capability to handle such scenario.

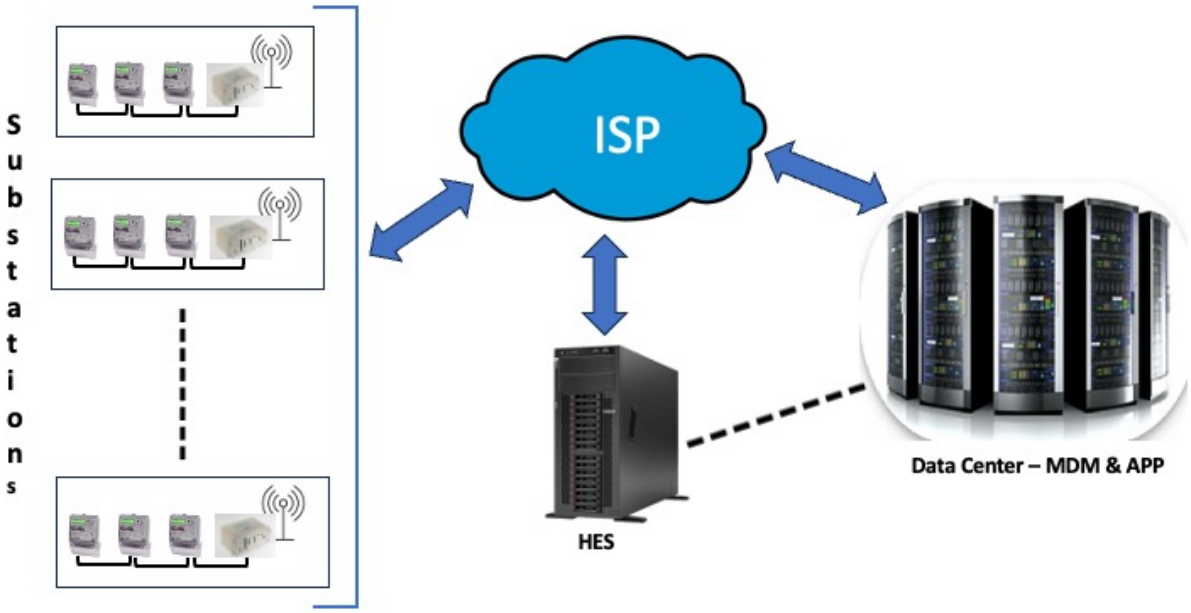
RF based feeder meters can also be interfaced with the DCU. However, DCU would transmit data to the data centre through GPRS although the LAN option is available and depends upon the infrastructure in the substation.

In most cases the DCU is powered-on using the 110 V battery provided in the substation. It is advisable to use the station power only iof proper earthing is available.



All substations installed with the DCU are interfaced to a common HES through the internet cloud. Data from HES is made available to the MDM (Meter Data Management System) in the Data Centre. MDM integrates the Data to the GIS, Asset management system, Substation feeder monitoring system, etc..

VData-09 has an option of interfacing with the feeder lines directly to provide the live status of power availability. This life status is published on the DISCOM site for consumers to be aware of power cuts.



VData-09 is installed in a substation and is supplied with AMR Modem (4G), Power supply (redundancy - optional), CPU Card, Analog Input and output card (Optional), Digital Input and output card (Optional), Antenna, Power cable, communication cables, and other accessories.

After a successful installation, when powered-on, the DCU (VData-09) reads the data using appropriate communication protocol, which is in encrypted form, from feeder meter simultaneously or concurrently. Data is transferred over GPRS to the HES server at the Data Centre. The conversion API in the HES system converts the encrypted data or Raw data to readable form. MDMS (Meter Data Management System) uses these data to generate various reports and also interfaces other systems like SCADA, Asset management system, etc..

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. VData-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. VData-09 has the capability to configures locally and remotely based on the meter type.
Following are some of the feedervmeters whose data is acquired successfully…

- L&T
- Secure
- L&G
- Genus
- HPL

Following are various communication protocols we support

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

Firmware of VData-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

DATESHEET

Processer Card

- CPU - 4xARM Cortex -A53
- CPU speed - 1.2GHz
- Number of Ports: 5 ports (4 X RS-485, 1 X Ethernet)
- Ethernet speed: 10/100 Base-T
- Ethernet protocols: TCP/IP, FTP
- Protocols: DLMS, Non-DLMS(Secure and L&T)
- OS support - Linux 2.6
- Operates on both AC and DC power supply
- On-board SD card for backup data storage
- 16GB flash expendable up to 256 GB
- 1GB RAM
- Meter interface baud rate: 300 bps to 115K bps

- RS485 DLMS Communication (Up to 16 meters per one port)

Communication Interface

- RS232, RS485
- LAN

Power Supply card

- Operating voltage: 230V AC.
- Voltage range: 90V ~ 440V AC.
- Output Voltage : 5 V DC
- Output current : 2.5 Amps
- Frequency: 50 Hz.
- Max 100 mA

Modem Card

- Quad band GSM/GPRS/2G/3G/4G modem

LED Indications

1. Power - 1
2. Network status - 1
3. TX and Rx LED's for each port
4. Health LED on each card

Standards

Electro Static Discharge (ESD) as per IEC61000-4-2
Electrical Fast Transient Burst Immunity Test as per IEC61000-4-4
Surge IEC61000-4-5 - 6KV
Conducted emission CISPR22 (Class B)

Environmental

Operating Temp: -25 degrees C to +60 degrees C
Limit Temp. range for storage: -40 degrees C to +65 degrees C
Relative Humidity: Up to 95% non-condensing

I/O Cards

- 16 channel Optically isolated Digital input
- 8 channel digital output with 2 Amps current carrying capacity potential free contact
- 8 channel Analog inputs with 24 bit ADC resolution
- 8 channel analog output with 16 bit DAC solution

FEATURES & FUNCTIONALITIES

Following are few key attributes of the DCU.

- Compatible with multiple operating systems including Raspbian, Windows 10 IoT Core, Linux, OSMC and RetroPie
- Ethernet protocols: TCP/IP, UDP, DHCP, Modbus, DNP3 TCP
- Serial protocols: Modbus RTU Master, Modbus RTU Slave, Modbus ASCII Master, Modbus ASCII Slave, DNP3 Slave
- On-board 16GB SD card for backup data storage
- Supports IEC61870-5-101, IEC61870-5-104, IEC61850-3, DNP3
- RS232/RS485 Modbus communication
- Redundant power supply
- Communication - GSM/GPRS/4G and RF (Optional)
- GSM/GPRS/4G Communication interface
- Protection: IP51
- Built-in overload, short-circuit and surge protection
- Interface with feeder meters, transformers, transducers, breakers, etc.

Data Acquiring

VData-09 comes in various models with options. VData-09 has the capability to acquire following energy data from various makes and models of meter.

- Meter data
- Energy snapshot data
- Instantaneous parameters data
- Load profile data
- Meter setting data
- Tamper data:
- Abnormal event data

Configuration and Diagnostics

The inbuilt process in the DCU 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
- VData -09 internal logic program
- HES system

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.