Substation Data Concentrator Unit
Technical Specifications

1. Objective:

1.1 The main objective Substation Data Concentrator Unit (DCU) is to acquire Feeder meter data and breaker status from all such entities within a substation, without any human intervention. The data thus collected is transmitted out to a data centre located at Sub-Division office using Communication Technologies like GSM/ GPRS/ EDGE.

1.2 At the Sub-Division office, the data collected from all the DCUs (each DCU representing one substation) is colleted and organized as per electrical hierarchical structure. The compiled data is used to generate localized reports. Also, the data is further transmitted to a DISCOM data centre, for use at a higher level of distribution system management.

1.3 The data is used to generate exceptions and MIS reports for proper load planning and monitoring, which are essential for effective management of substation as cost-centre and thereby manage energy and demand of a Distribution Company. The data is also used to estimate performance indices and quality of supply, as required by regulatory bodies.iec-60870-5-101-104

2.0 DCU – Module level Features

2.1 DCU shall acquire data from the existing Feeder Meters, which are MODBUS compliant using either RS-232 / RS-485 / TCP connectivity. To achieve this function, the DCU will have requisite data collection software, with configurable MODBUS tables and corresponding slave address.

2.2 In case the meters are IEC-62056 (DLMS / COSEM) compliant, the requisite data collection Client software will be provided at the DCU. This software will support both IEC-62056-21 over RS-232 and IEC-62056-47 over Ethernet.

2.3 DCU shall acquire Breaker ON/OFF status using potential free contact multipliers available in the Breakers. These signals will be optically isolated at the Digital Input module of DCU.

2.4 DCU shall acquire various Analog Signals like Transformer Oil temperature and Winding temperature using 4-20 mA signals using Analog Input module.

2.5 DCU shall control the opening or closing of Breakers using high-current control signals generated by Digital Output module.

2.6 DCU shall collect all the Feeder Meter data, from various makes of meters, and convert the same into a common format data for storage and outbound transmission.

2.7 DCU shall collect the Breaker status and Analog parameters from the respective devices, and store the same in the format as per …… This would enable the use of data for integration with SCADA applications, in future.

2.8 DCU shall support both Pull-type and Push-type of communication modes. The type of data that needs to be sent on either mode can be determined by the user.

2.9 DCU shall provide a TCP/IP connectivity for a local PC, which can be used as substation HMI for monitoring and control functions. The data connectivity between DCU and HMI will conform to IEC-…. Standard.

2.10 Observation / Caution: DCU design assumes that the feeder meters provided in all substations are MODBUS or IEC-62056 (DLMS) compliant. In case, the feeder meters are neither MODBUS or IEC-62056, the Utility has to provide the required details of the protocol to develop suitable data collection software in DCU. Even in case of MODBUS meters, the mapping table for such meters will have to be provided by the utility, as different meter manufacturers use different mapping tables.

3.0 Functional Specifications:

3.1 The DCU will provide continuous on line monitoring and logging of the following parameters in respect of all incoming and outgoing feeders on real time basis:

a) Voltage, Phase to Phase and Phase to Neutral
b) Current on each phase
c) Power factor

d) Frequency
e) Power - Active / reactive / Apparent
f) Energy – Active, Reactive and Apparent
g) Breaker ON/OFF status
h) Analog parameters like Transformer Oil temperature, winding temperature etc.

3.2 The above parameters collected from each substation, via DCU, are used to generate MIS Reports, Spread Sheets, Executive dashboards and Alarms. Some of the typical reports are:

a) System outage / downtime feeder wise.
b) Energy balancing at sub stations.
c) Daily peak loads feeder
d) Peak Load of the Station.
e) Bus bar profile.
f) Daily Log sheets & any other forms / reports as required by the Utility

4. Features of Data logging system at Sub station (Das 4.0):-

4.1 Data collection on a common data structure (Das 4.1): The data collection software, resident in DCU, will collect the data from Feeder meters, which are either MODBUS or IEC-62056 compliant. The software would convert the data collected to a common data format structure, as the format from Feeder meters of various manufacturers would generally differ.

4.2 Data collection at sub station via RS485/ RS232 data converters (Das 4.2): The software in the DCU is capable of collecting the data from Feeder meters using either RS485 / RS232. In case of Rs-485 meter, the meters would be daisy-chained and get connected to DCU via a RS-485 to RS-232 Converter. This is an integral part of DCU design.

4.3 Main areas of data collection (Das 4.3): The software is capable of collecting the following data from the feeder meter and store the same with date and time stamp:

a) Billing Data
b) Load survey profiles
c) Tamper data
d) Instantaneous parameters (at the time of collection)

4.4 Typical list of data acquisition from the Meters (Das 4.4): The following parameters from the feeder meters can be acquired and stored by the DCU:

a) All instantaneous values like voltage, current, frequency, power factor, active power, reactive power etc. can be acquired on demand or at pre-set intervals – ranging from 15 minutes to 30 minutes).

b) Instantaneous values can be acquired at higher speed, to meet the requirements of on-line monitoring at substation level in local HMI.

c) The historical values like power consumptions, accumulated energy, accumulated power, maximum demand etc. can be collected, which are in general a part of Load Survey data.

d) Any parameter from any of the feeder can be either acquired locally or from remote locations (through communication channel) on demand.

e) The Feeder meters can be synchronized to a common time datum, as available from a remote server or local GPS clock. However, the protocol to adjust the Real-Time Clock of the feeder meter has to be a part of MODBUS documentation. In case of IEC-62056 compliant meters, RTC corrections can be made using the DLMS client software resident in DCU.

4.5 Provision of generating critical events (Das 4.5): The DCU software, is capable of monitoring and reporting details of critical events, such as No communication with Meter, Power interruptions etc. In order to meet certain operations of DCU, even during power-fail conditions, it is desired that DCU is connected to substation battery. The battery can in turn be on floating charge on the substation auxiliary supply.

4.6 Provision of manual entry of meter change (Das 4.6): The DCU Software has the facility to configure the feeder meters manually. The possible parameters that can be configured include change in meter type, CT ratios, associated MODBUS tables etc. However, any such in configuration can be carried out only with proper user identification, security and audit trail.

4.7 Seamless transfer of data even in case of meter change (Das 4.7): The DCU Software will collect the data from the changed Feeder meters, after the changes and corresponding configuration tables are

updated, as defined in Section 4.6. Reconfiguration is essential in case the meter of one make is replaced with some other make, and both are MODBUS compliant with differing mapping tables. On the other hand, if the meters are IEC-62056 compliant, the meter change will not affect reading of data. However, the meter change being a local activity, confined to the substation and its connected DCU, the outbound data is independent of these local changes, as the data is transmitted in a pre-defined common data format. At the sub-division level, any change in the feeder meter or its configuration will be reported.

4.8 Storage of meter data at substation (Das 4.8): The DCU Software will acquire and store the Feeder Meter data in its database. The data can be collected by the Subdivision server for its data processing and report generation, by polling the DCU, at any time.

4.9 Mode of data transfer from Sub-station to Sub-division office (Das 4.9): The data transfer from DCU to the Sub-division server will be over the GSM/ GPRS/ EDGE channel. The Master /Slave configuration of the end-points (DCU at Substation and Server at subdivision office) and the interval period for data transfer can be configured by the user.

4.10 Facility for back up and restoration of data (Das 4.10): The DCU is built using Single Board Computer with Linux OS. Thus, managing the data in a secured form using standard database is possible. Also, database archival, backup and restore functions area available in this DCU software.

4.11 Administrator facility (Das 4.11): The DCU software provides administrator facility to manage the database with various levels of security. The DCU comes with a standard mass storage deveice of 2 GB, which can easily store all Feeder meter and breaker status information for more than 90 days.

5.0 Features of Data logging system at Sub-division office (Das 5.0):

5.1 Periodicity of data collection (Das 5.1). The periodicity of data collection at the Sub-division from its connected DCUs is dependent only on the time taken to establish communication link connectivity and the available bandwidth. At each DCU, a Single Board Computer operating at 800 MHz is provided. Thus, load of data acquisition from feeder meters and breakers is not high. Therefore,

the limitations of getting real-time data from DCU will come from the limitations at the Sub-Division server end only.

6.0 Meter Data Acquisition Software Requirements at the Sub-station: (Das 6.0)

6.1 Configurable data collection engine for meters of different makes (Das 6.1): The Data collection engine in the DCU is configurable for different makes of meters. The configuration includes mapping tables for MODBUS compliant meters, since different meter manufacturers use different mapping tables. However, in case the meters are IEC-62056 compliant, the configuration would be simple to include such parameters as Logical Name (LN) or Short Name (SN) referencing.

Restructured Accelerated Power Development and Reforms Programme
(R-APDRP) of Govt. of India
REQUEST FOR PROPOSAL (RFP)
for selection of 'IT Implementation Agency' to assist the Rajasthan Discoms
for implementation of IT infrastructure

JVVNL IT/RAPDRP/33

Substation Data Concentrator Unit

Compliance Statement

4.5	**Substation Data Concentrator Unit**	**TN- 33: Page 22 of 1255 onwards**
	The DCU should have real time processor (min 266 MHZ) for reliable stand-alone operation, signal processing, control, acquisition and Real Time Deterministic Control with following capabilities	Complied Single Board Computer with Linux OS operating at CPU frequency of 800 MHz. Memory Capacity of 1 GB USB – 2 Ports Complied Single Board Computer with CPU frequency of 800 MHz. Memory Capacity of 1 GB USB – 2 Ports SDRAM – 1 GB
4.5.1	Memory: It should have Minimum of 128 MB Non Volatile Storage and 64 MB DRAM in built memory.	Compact Flash – 2 GB SDRAM - 1 GB
4.5.2	Network Connectivity: DCU must have inbuilt support built-in TCP/IP 10/100 Mb/s Ethernet port to conduct programmatic communication over the network and host built-in Web (HTTP) and file (FTP) servers Compatibility to IEEE 802.3 with communication rates 10 Mb/s, 100 Mb/s .	Complied
4.5.3	DCU must have RS232 serial port to communicate with peripheral devices	USB – 2 Ports; RS-232 – 2 Ports

4.5.4	Communication Protocol: The DCU must support the MODBUS protocol to communicate with modbus enable peripheral devices.	Complied: Can support both RS-232 and TCP/IP MODBUS protocol
4.5.5	Analog Inputs: DCU should have inbuilt analog input from power system devices and scalable for future expansion	Complied - 4-20mA inputs as per substation standard
4.5.6	Status input: DCU should have inbuilt digital Input to monitor the status of power system devices and scalable for future expansion.	Complied: Potential free contacts for Single ended and Double ended Status Inputs; Potential free contacts support 24-60V / 60V – 110 V DC loop voltage
4.5.7	Control Outputs: The DCU shall Digital output to provide the capability of controlling the Power system devices and scalable for future expansion	Complied: Potential free contacts with MOSFET switches. Current rating can be customised
4.5.8	Power Requirements	
	Power supply voltage range 19 to 30 V DC/110-120V DC	Complied; Selectable Voltage band either 19V to 30VDC or 110V-120V DC
	Power consumption (internal, driving no loads)	Less than 50W
	Low Power Consumption	Complied
4.5.9	Environment: -5 to 60 °C temperature range	Complied
4.5.10	Alarming & Scheduling: The alarms and schedules can be preset or customized as per the requirements of the utility. There should not be limitations on the number of alarms and schedules as per setting requirements.	Complied
4.5.11	Data Logging & File Compression	
	Real-Time high speed data logging should be possible. The files shall be stored in various formats like text, CSV, Spreadsheet, ASCII, binary etc.	Complied
	It should be possible to implement various kinds of file compression techniques.	Complied
4.5.12	Inbuilt Clock on Real Time Controller: The real-time controller should have a very stable inbuilt clock with a battery backup	Complied; upto 100 year calender

4.5.13	Web Page Creation and Access	
	The real-time controller should have an inbuilt web server to help to create web pages of the front panel of the code running in the controller. The access to the web page should be given to everyone or restricted to certain IP address only.	Complied; Linux OS supports
4.5.14	Web File Attachment: The real-time controller should allow to send email with web files as attachments.	Complied
4.5.15	DNS Support: The real-Time controllers supports DNS configuration.	Complied
4.5.16	Dynamic and Static IP addressing: It should be possible to access the real-time controller from any location by configuring it on a public / Static IP address. It should also be configured with a dynamic IP address.	Complied
4.5.17	Remote Network Interface: By configuring the controller with a public IP, it should be possible to interface to any remote networks. In this state it should be possible for controller to be programmed and debugged remotely.	Complied
4.5.18	Day/Time Determination: The date and time of the controller should be possible to set remotely. At the same time it should be possible to configure to acquire the local date and time from the internet / GPRS network or using the GPS modem	Complied
4.5.19	GSM / GPRS Features	
	Supported GSM bands Quad GSM band: 800/900/1800/1900 MHz	Complied; Supports TCP/IP and FTP
	GSM standard SMS, Fax, CSD (circuit), GPRS	Complied
	Cellular Data class 10	Complied
	SIM card reader Tray Push Type	Complied
	SIM lock function Yes	Complied
4.5.20	Onboard Stack	Complied: Using Single Board Computer with Linux OS, supports these requirements.
	UDP Upto 8 Sockets	Complied
	TCP/IP (Client) Upto 8 Sockets	Complied
	TCP/IP (Server) Upto 4 Sockets	Complied
	FTP, HTTP, SMTP, POP3	Complied

4.5.21	The DCU should have inbuilt converter unit for facilitating data conversion from RS 485 to RS 232.	Complied
4.5.22	LED Indicators: LEDs to display various status information.	Complied
4.5.23	DI & DOs and analog input	
	DCU shall have inbuilt Digital Output / Input for controlling & monitoring (Digital input 24 and Digital output 24).	Complied: DI - Potential Free contacts; DO - MOSFET Switch based
	DCU shall have the expandability to add Digital input & output channels to cater the future need.	Expandable in multiples of 8 DI and 8 DO modules
	DCU shall have inbuilt Analog Input 8 Nos and should have the expandability to add Analog input card to cater the future need.	Complied: Expandable in multiples of 8 Analog Channels
4.5.24	The proposed DCU at 33kV Sub Stations shall have provisions to install a PC for local monitoring.	Complied: Standard Ethernet connectivity ensures any PC / Server can be connected to DCU

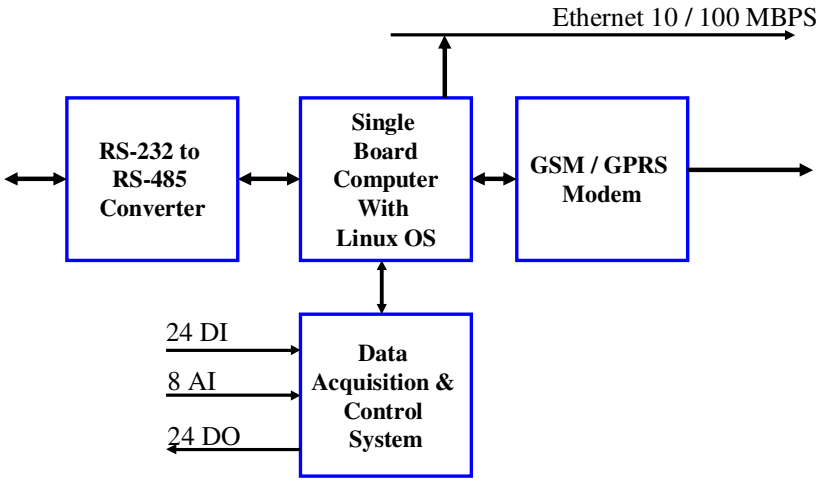

Fig. Data Concentrator Unit – Internal Architecture